May 14, 1940. T. F. CROCKER 2,200,593

TELEPHONE SYSTEM

Filed July 28, 1938 11 Sheets-Sheet 1

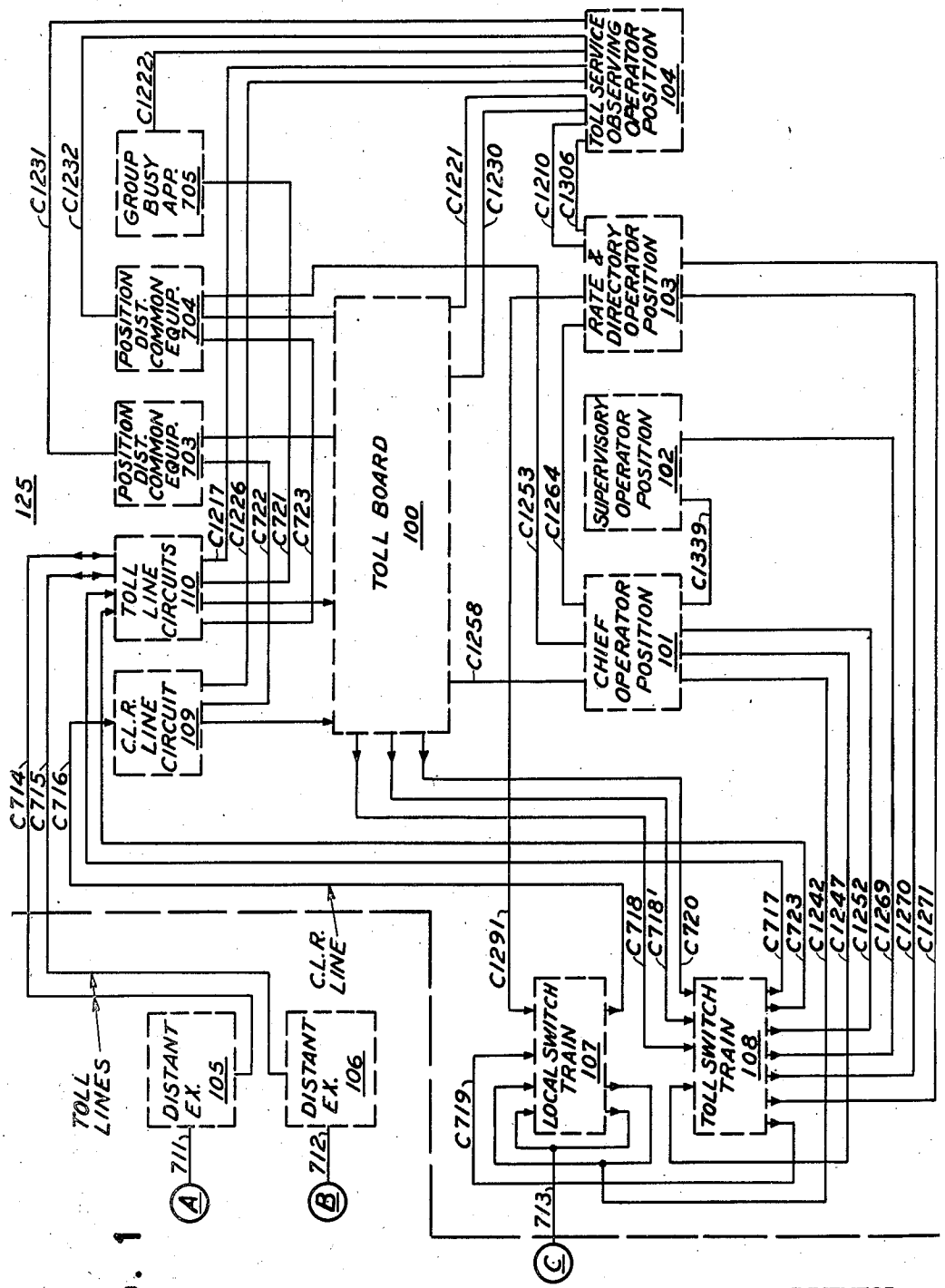


FIG. 1

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TELEPHONE SYSTEM

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FIG. 2

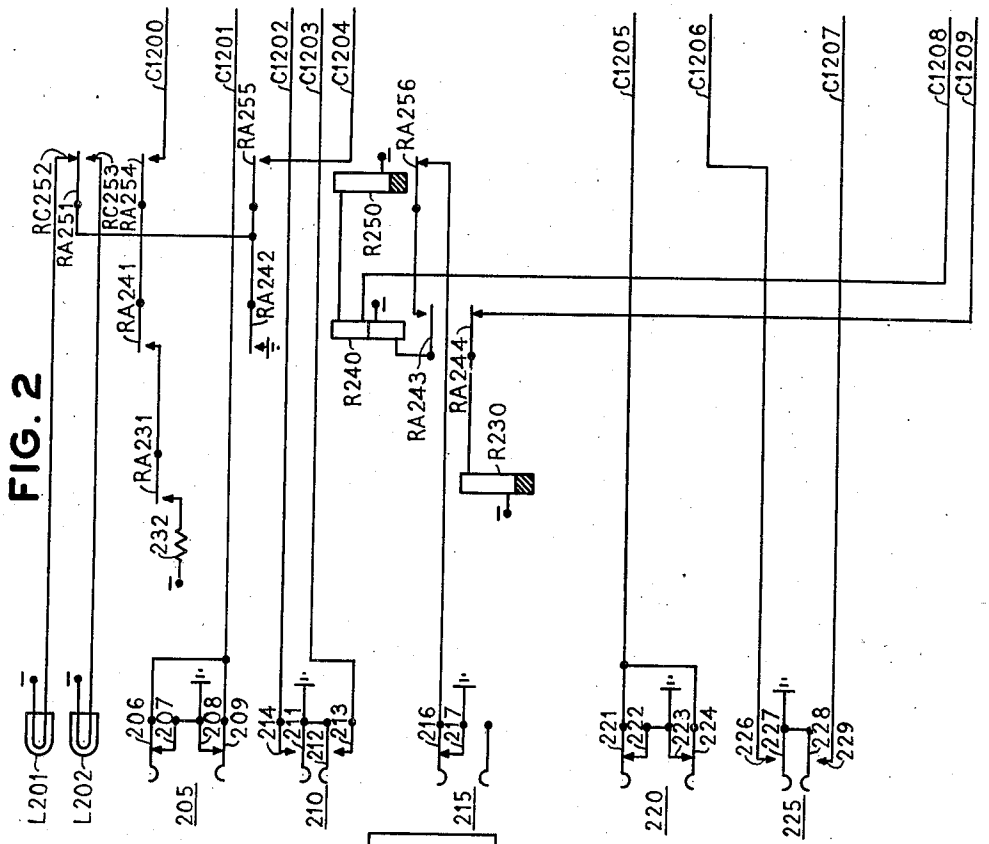
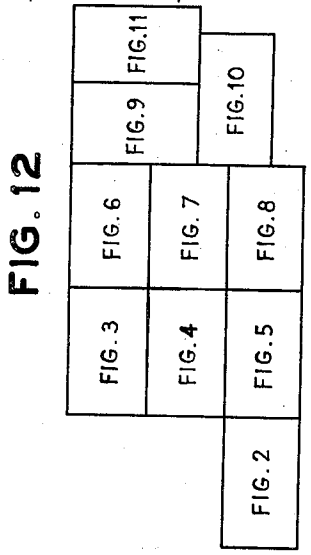


FIG. 12



104

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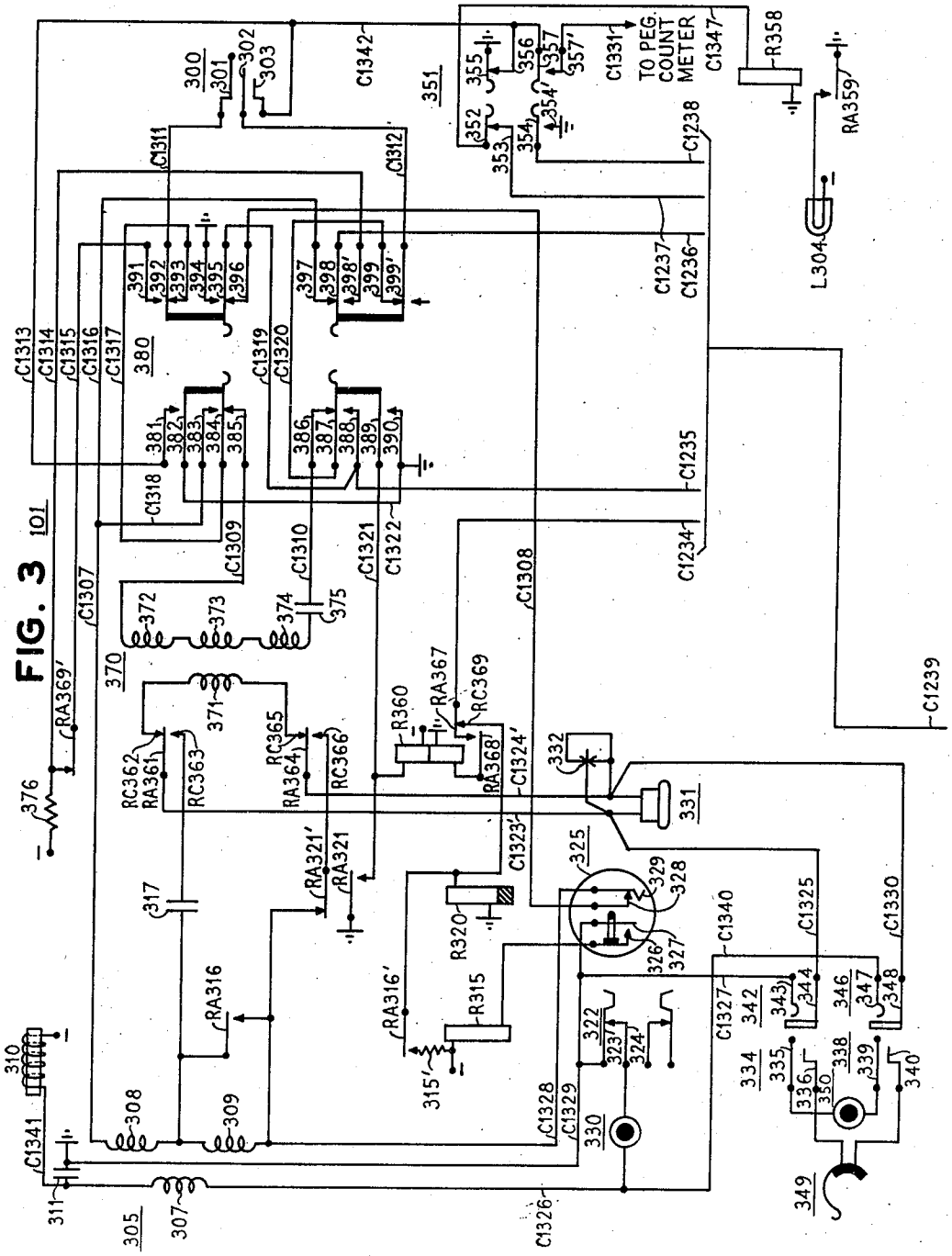


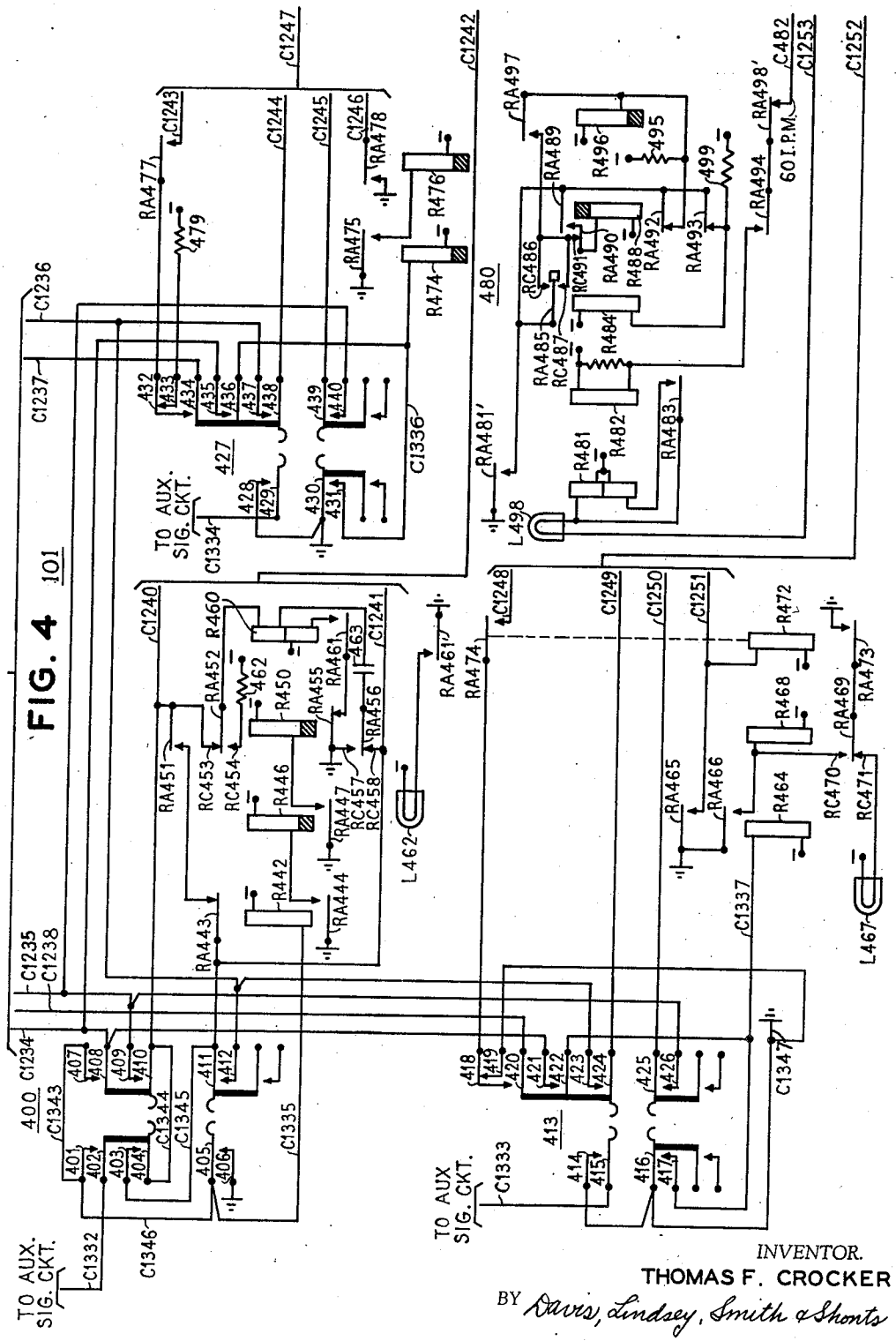
FIG. 3

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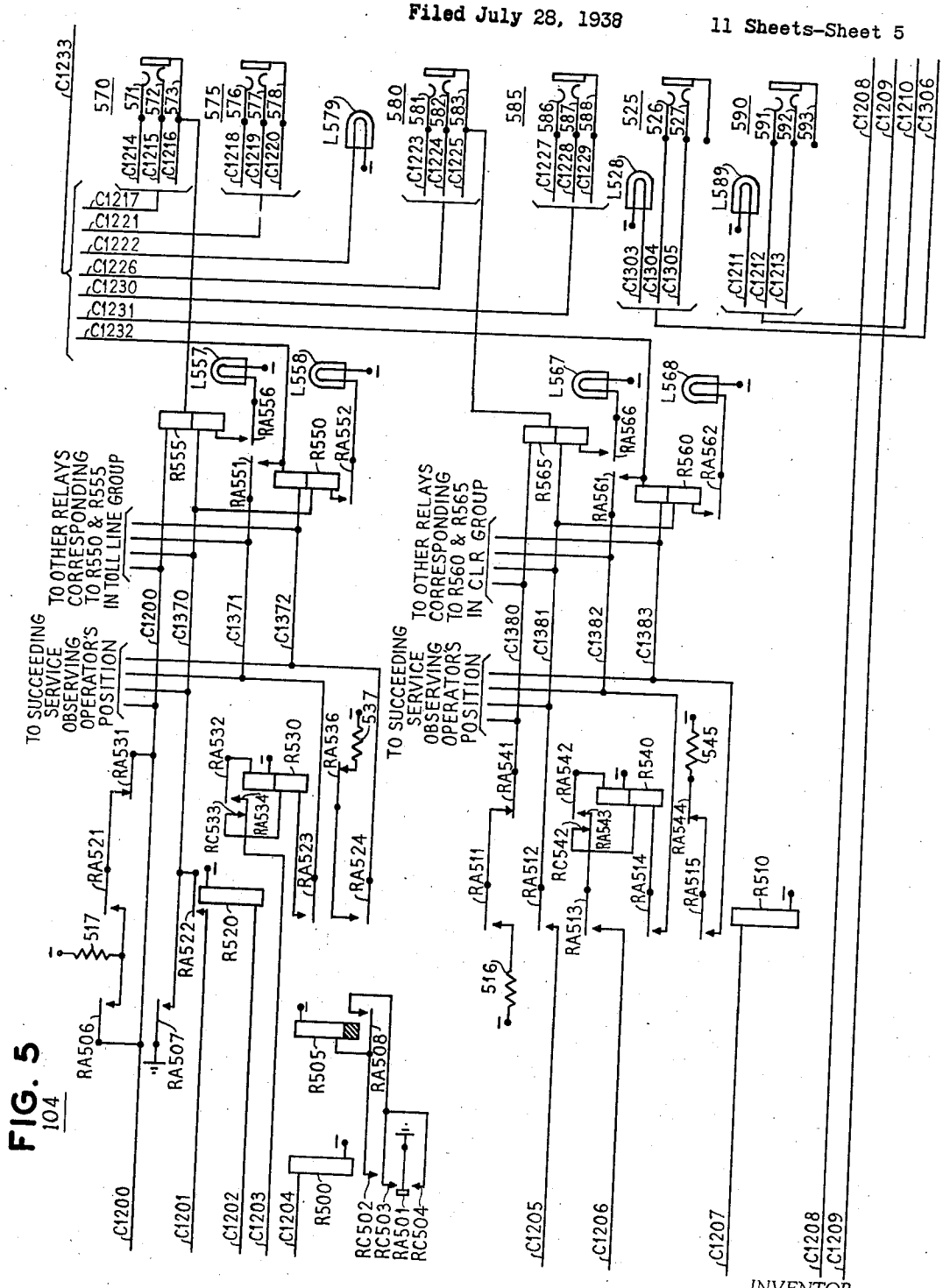


FIG. 5

104

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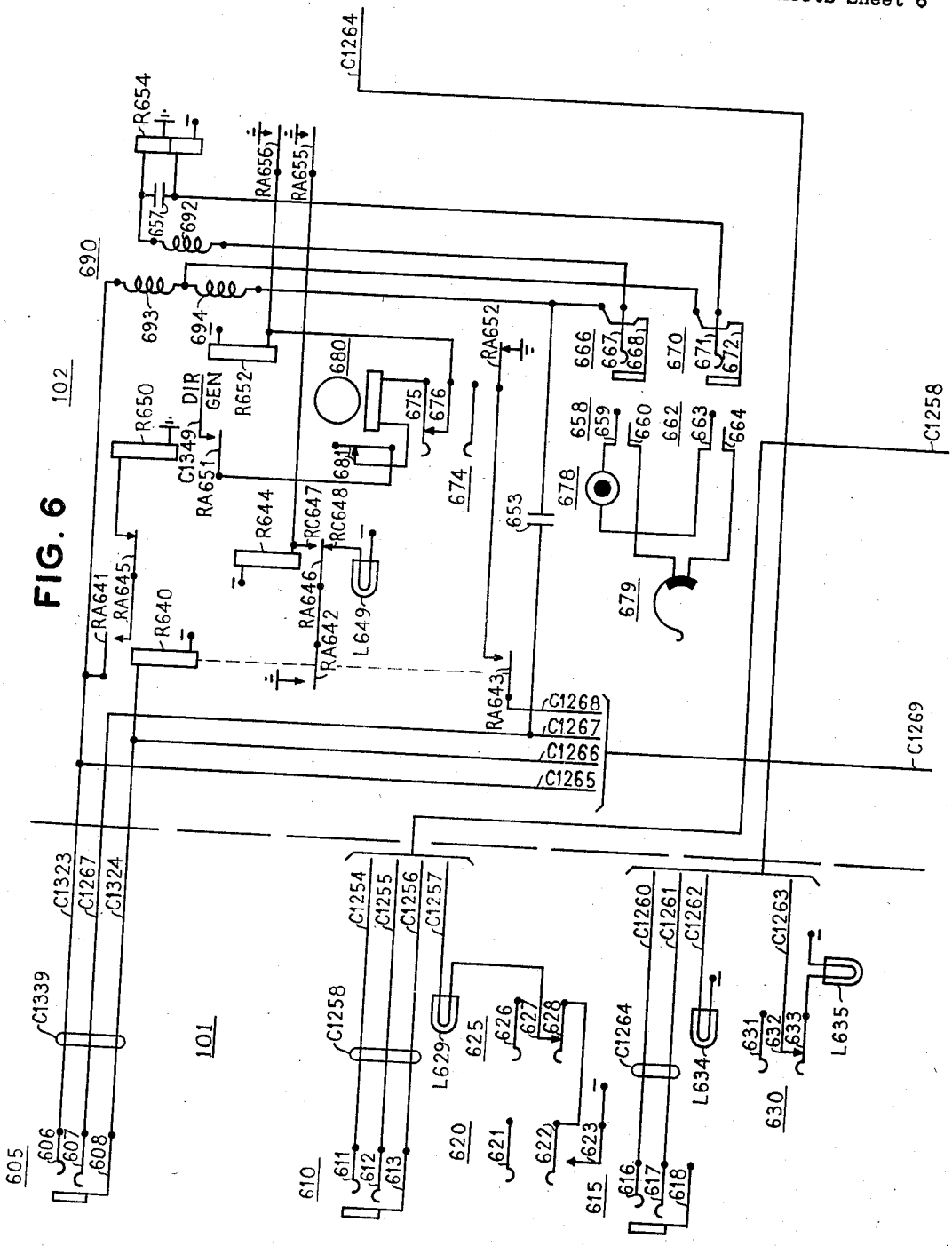


FIG. 6

102

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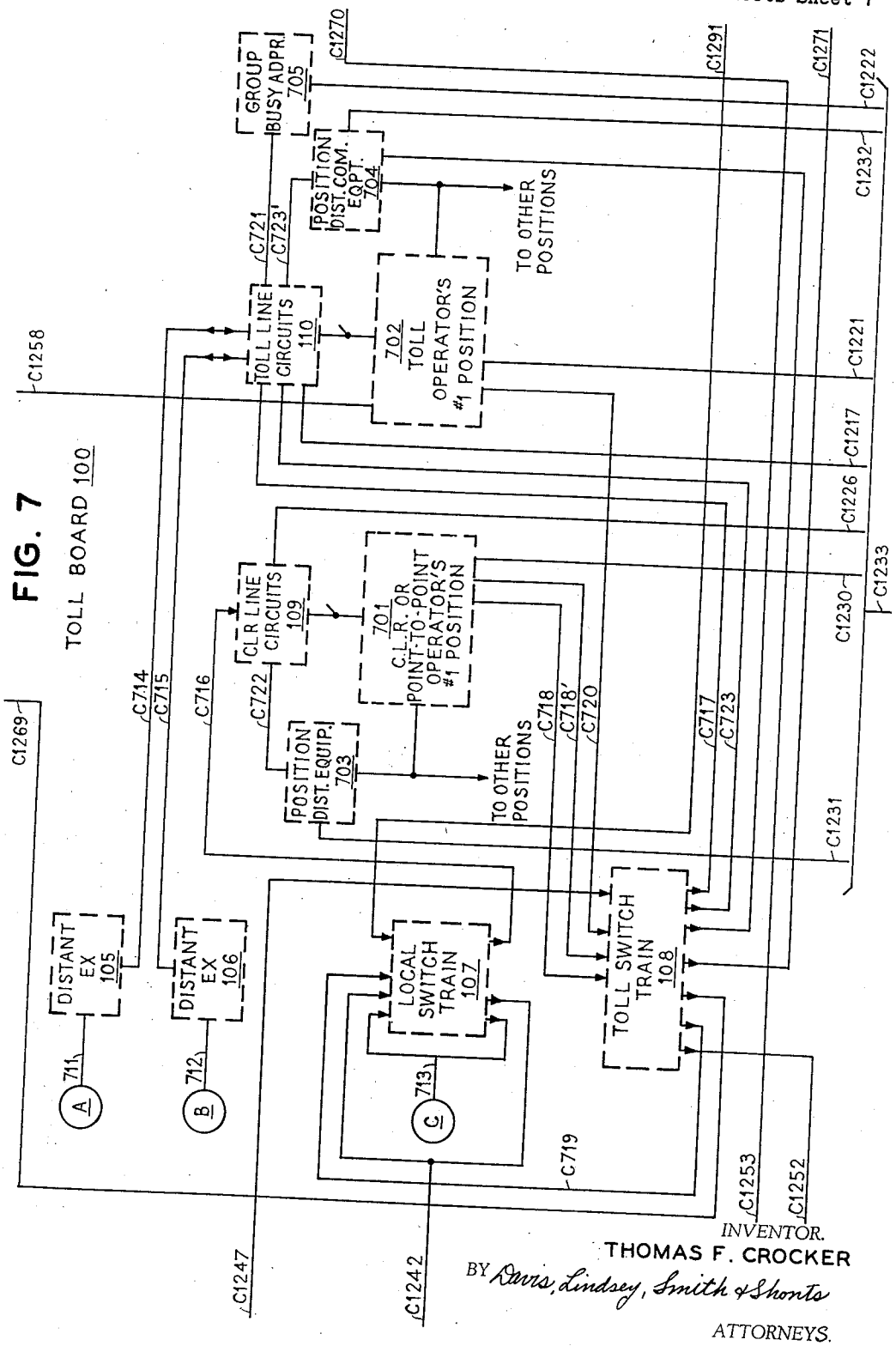


FIG. 7

TOLL BOARD 100

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2,200,593

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Filed July 28, 1938

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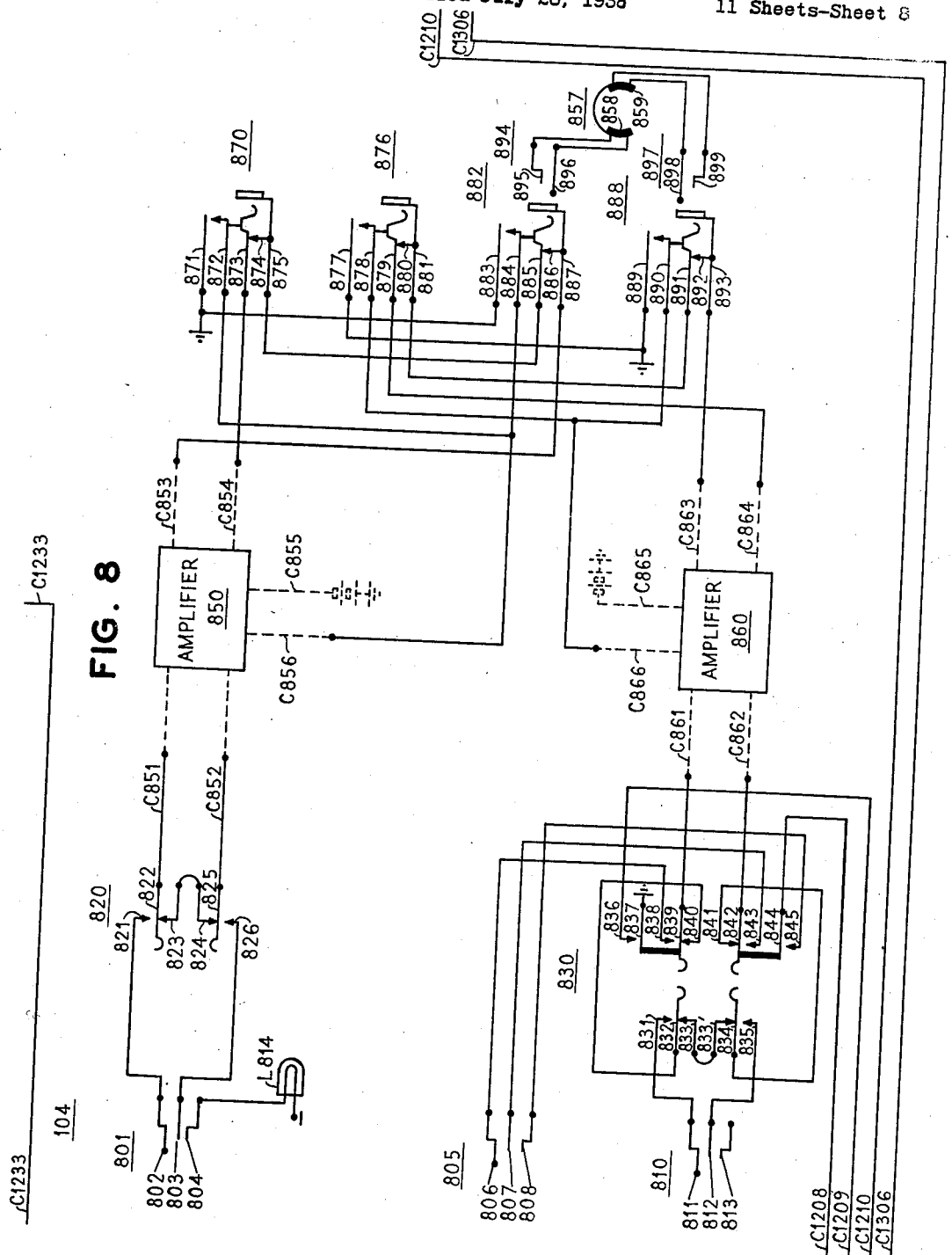


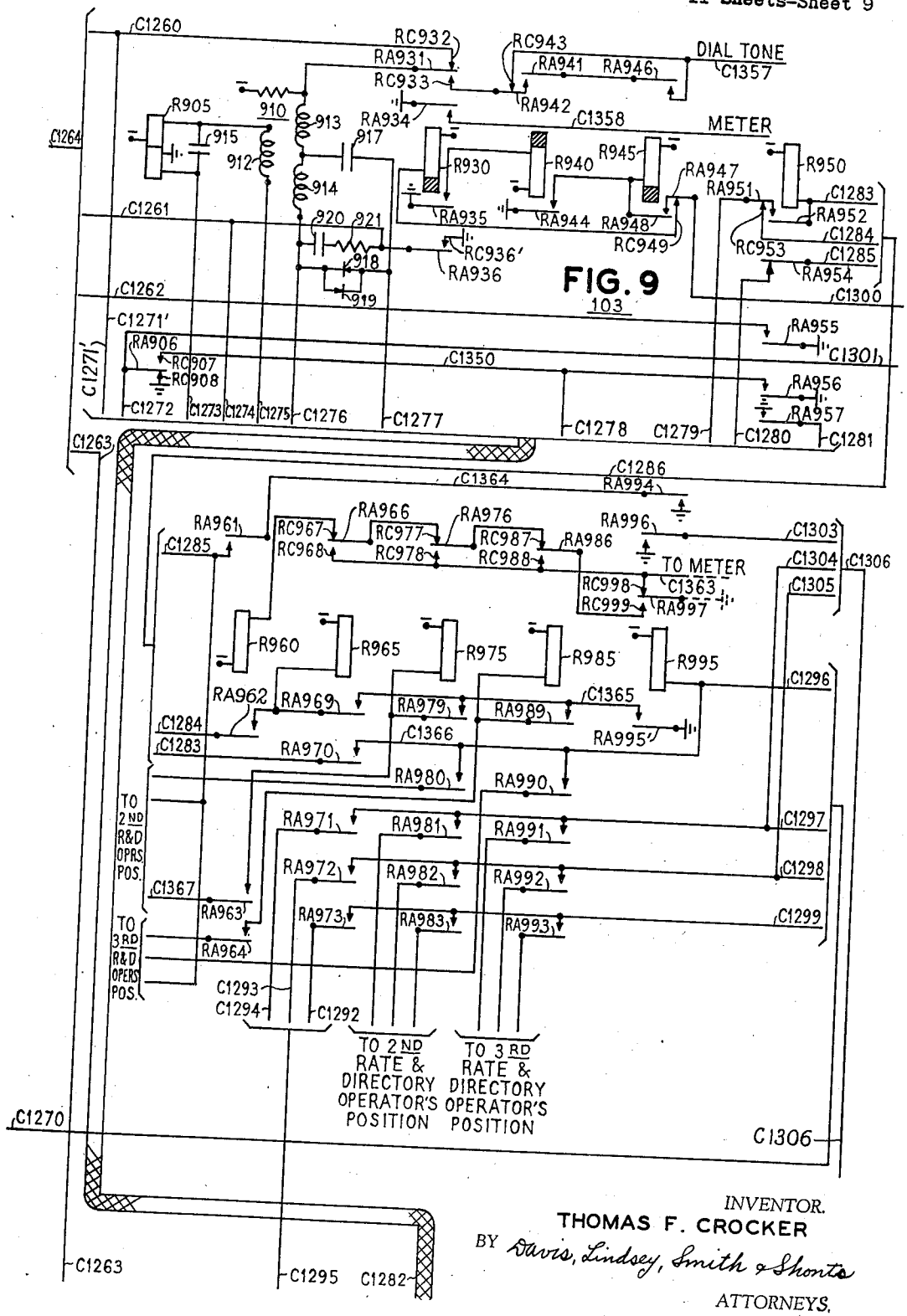
FIG. 8

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TELEPHONE SYSTEM

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TELEPHONE SYSTEM

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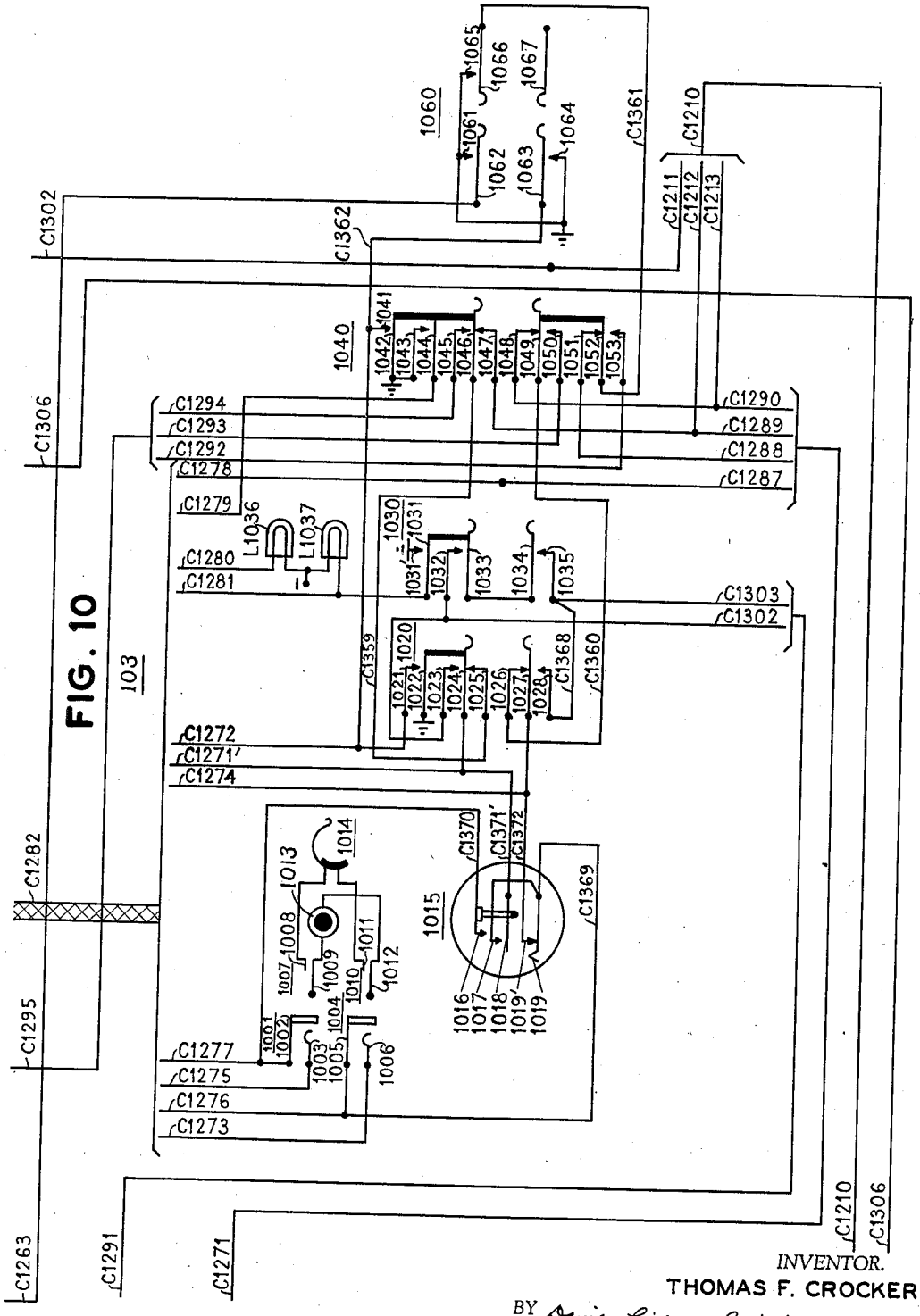


FIG. 10

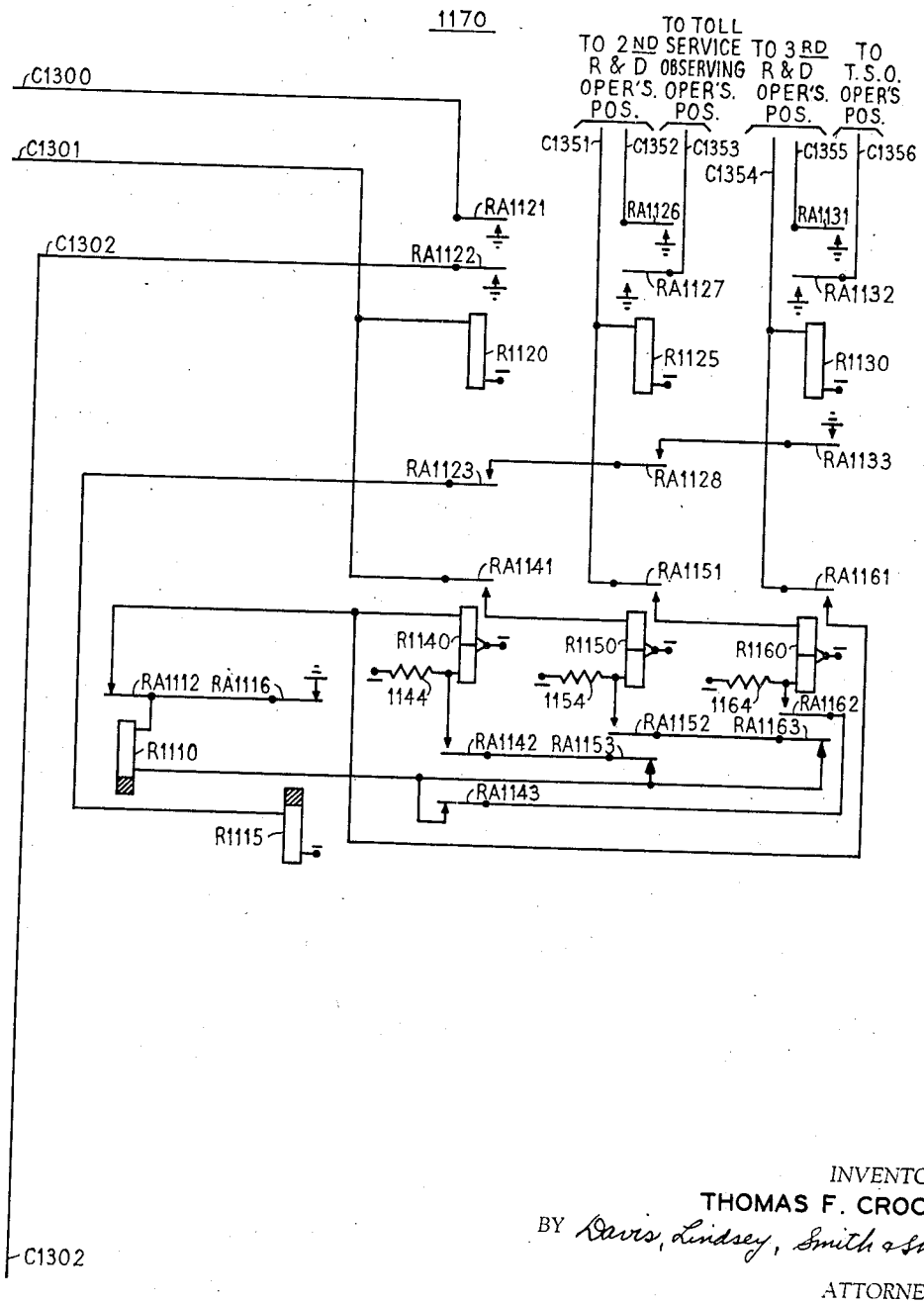
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TELEPHONE SYSTEM

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FIG. 11



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Patented May 14, 1940

2,200,593

UNITED STATES PATENT OFFICE

2,200,593

TELEPHONE SYSTEM

Thomas Frederick Crocker, Chicago, Ill., assignor to Associated Electric Laboratories, Inc., Chicago, Ill., a corporation of Delaware

Application July 28, 1938, Serial No. 221,700

85 Claims. (Cl. 179—27)

The present invention relates to telephone systems and has for one of its objects the provision of improved apparatus for rendering and supervising toll services in such systems.

In a telephone system adapted to handle toll traffic, an exchange is provided which includes a toll board comprising a number of groups of operator's positions and at which the various groups of combined line and recording or C. L. R. and toll lines terminate. Usually the toll board comprises a group of C. L. R. operator's positions, a group of toll operator's positions and a group of point-to-point operator's positions, these groups of operator's positions being adapted to handle the respective types of toll services to be rendered. A local switch train and a toll switch train are provided in the exchange, each being accessible to each operator's position at the toll board. In order to supervise and coordinate the work of the operators at the various operator's positions at the toll board and to advise the operators in regard to the services to be rendered, a plurality of auxiliary operator's positions are associated with the toll board. These auxiliary operator's positions usually comprise a chief operator's position, a group of supervisory operator's positions, a group of rate and directory operator's positions and a group of toll service observing operator's positions. These auxiliary operator's positions must also be coordinated with respect to each other in order to insure that prompt and efficient toll services are rendered at the toll board. In order to accomplish these ends, certain of the auxiliary operator's positions have access to other of the auxiliary operator's positions, to the local and toll switch trains in the exchange and to the various C. L. R. and toll lines terminating at the toll board, in addition to access to each of the operator's positions at the toll board. Also, signal arrangements are provided at the toll board and at the auxiliary operator's positions in order further to coordinate the work of the operators at the operator's positions at the toll board and the operators at the auxiliary operator's positions.

It is an object of the present invention to provide, in a telephone system of the character noted including a toll board and a plurality of auxiliary operator's positions, improved apparatus for supervising and coordinating the work of the operators at the operator's positions at the toll board in an efficient manner which comprises a minimum amount of equipment.

Another object of the invention is to provide, in a telephone system of the character noted and including at least two auxiliary operator's positions, an improved arrangement for selectively establishing a monitoring connection and a two-way communication connection between the two operator's positions.

Another object of the invention is to provide, in a telephone system of the type described, a switch having access to a plurality of groups of lines, an operator's position provided with apparatus successively operative to perform successive control functions to cause the switch to select a line in a particular group of lines, and an improved arrangement for indicating to an operator at the operator's position when the apparatus may be effectively operated to perform the successive control functions.

It is another object of the invention to provide, in a telephone system, a switchboard comprising a plurality of operator's switchboard positions and an arrangement for assigning calls to the operator's switchboard positions in a predetermined order to be answered, another operator's position, and an improved arrangement for indicating to an operator at the other operator's position a predetermined time interval delay in answering a call.

It is another object of the invention to provide, in a telephone system, a plurality of operator's positions, a distributor for assigning calls to be answered by particular idle ones of the operator's positions in a predetermined order, and an arrangement controlled when all of the operator's positions are busy for assigning calls to be answered by any one of the operator's positions.

A further object of the invention is to provide, in a telephone system, a plurality of operator's positions, and an improved distributor for assigning calls to the operator's positions to be answered which is preselective and fully directive in character.

It is a further object of the invention to provide, in a telephone system, a plurality of operator's positions, an arrangement for assigning incoming calls to be answered to idle ones of the operator's positions in a predetermined order, apparatus at each operator's position operative to initiate an outgoing call therefrom, and an arrangement controlled by the operation of the apparatus at each operator's position for preventing incoming calls from being assigned to the operator's position.

It is a further object of the invention to provide, in a telephone system, a switchboard including a plurality of operator's switchboard

positions, an arrangement operative to select idle ones of the operator's switchboard positions in a predetermined order and to assign an incoming call to a selected operator's switchboard position, an arrangement for routing a call from the operator's switchboard position over an outgoing line, another operator's position, and arrangements controlled by the selection of a particular operator's switchboard position, by the assignment of a call on a particular incoming line thereto, and by the routing of the call over a particular outgoing line for transmitting corresponding signals to the other operator's position.

It is a further object of the invention to provide, in a telephone system, a switchboard including an operator's switchboard position adapted to route a call therethrough on a particular incoming line over a particular outgoing line, and another operator's position provided with improved apparatus for selectively monitoring a connection including the particular operator's switchboard position, a connection including the particular incoming line and a connection including the particular outgoing line.

The features of the present invention are illustrated as being incorporated in a telephone system including an exchange provided with a toll board having groups of C. L. R. and toll lines terminating thereat, and a plurality of auxiliary operator's positions associated with the toll board and with each other in such a manner that the operators at the operator's positions at the toll board may be adequately advised and supervised in order to insure that prompt and efficient toll services are rendered. The toll board includes a group of C. L. R. operator's positions, a group of toll operator's positions and a group of point-to-point operator's positions, a position distributor for assigning incoming C. L. R. calls to idle ones of the C. L. R. operator's positions in a predetermined order and a position distributor for assigning incoming toll calls to idle ones of the toll operator's positions in a predetermined order. The auxiliary operator's positions associated with the toll board comprise a chief operator's position, a group of supervisory operator's positions, a group of rate and directory operator's positions and a group of toll service observing operator's positions.

In accordance with one feature of the invention, one of the supervisory operator's positions is provided with a line extending thereto over which a call is adapted to be routed. The chief operator's position comprises a telephone instrument including a receiver and a transmitter, first and second repeaters being associated with the chief operator's position, means for connecting the transmitter to the first repeater, means for selectively connecting the first and second repeaters to the line extending to the supervisory operator's position and automatic means controlled by the last-mentioned means for connecting the receiver to the first repeater when the first repeater is connected to the line, thereby to complete a two-way communication connection between the chief operator's position and the line, and for connecting the receiver to the second repeater when the second repeater is connected to the line, thereby to complete a monitoring connection between the chief operator's position and the line.

In accordance with another feature of the invention, the telephone system includes an exchange having a plurality of groups of lines associated therewith and extending to different distant exchanges and a switch having access to the lines. Control apparatus is associated with the switch and operative in response to a first control function to perform an intermediate operation which consumes an interval of time and operative in response to at least one additional control function subsequent to the performance of the intermediate operation for causing the switch to select a line in a particular one of the groups of lines. The chief operator's position is provided with a signal and apparatus for performing the control functions to which the control apparatus is responsive. An arrangement is associated with the switch and the chief operator's position for controlling the operation of the signal at the chief operator's position during the interval of time the control apparatus is performing the intermediate operation.

In accordance with another feature of the invention, a switchboard is provided which comprises a plurality of operator's switchboard positions and has a plurality of lines associated therewith and extending to a distant exchange. A position distributor is associated with the switchboard and is operative to assign a call on one of the lines to an idle one of the operator's switchboard positions to be answered. A timer and a signal are associated with the chief operator's position; and an arrangement is provided which is controlled by the presence of a call on one of the lines when all of the operator's switchboard positions are busy for causing operation of the timer, the timer being effective after the operation thereof for a predetermined time interval to cause operation of the signal at the chief operator's position.

In accordance with a further feature of the invention, the telephone system includes a plurality of rate and directory operator's positions, a plurality of trunk lines individually extending to the operator's positions, an auxiliary trunk line commonly associated with the operator's positions and to which each operator's position has access, a switch having access to the trunk lines and operative to seize one of the trunk lines, and a distributor associated with the rate and directory operator's position for causing the switch to seize idle ones of the first-mentioned trunk lines in a predetermined order. Also an arrangement is provided which is controlled when all of the operator's positions are busy for causing the switch to seize the auxiliary trunk line. In accordance with a further feature of the invention, the distributor associated with the rate and directory operator's positions is operative to assign one of the first-mentioned trunk lines extending to an idle one of the operator's positions to be seized by the switch and operative in response to the seizure of the assigned trunk line by the switch to assign another one of the first-mentioned trunk lines extending to an idle one of the operator's positions to be seized by the switch. In accordance with a further feature of the invention, a trunk line individually associated with each rate and directory operator's position extends to a second switch, and each operator's position is provided with means operative to seize the trunk line individually associated therewith. Also, an arrangement is provided which is controlled when the trunk line individually associated with a particular operator's position is seized for rendering busy the one of the trunk lines individually extending to the particular operator's position.

In accordance with a further feature of the invention, the service observing operator's position

is associated with the toll board, and an arrangement is provided which is controlled by the operation of the distributor to select a particular operator's switchboard position for transmitting to the service observing operator's position a signal characteristic to the particular operator's switchboard position. Also an arrangement is provided which is controlled by the operation of the distributor to assign a call on a particular one of the lines to the selected particular operator's switchboard position for transmitting to the service observing operator's position a signal characteristic to the particular line.

In accordance with a further feature of the invention, the lines associated with the switchboard are divided into a group of incoming lines and a group of outgoing lines, and a switch is provided which is operative to route a call between a line in the incoming group and a line in the outgoing group, each operator's switchboard position being provided with apparatus for controlling the operation of the switch. A signal characteristic to a particular operator's switchboard position is transmitted to the toll service observing operator's position when the particular operator's position is selected by the distributor; a signal characteristic to a particular incoming line having a call thereon is transmitted to the toll service observing operator's position when the particular incoming line is assigned to the particular operator's switchboard position; and a signal characteristic to a particular outgoing line over which the call is to be routed is transmitted to the toll service observing operator's position after the switch seizes the particular outgoing line. In accordance with a further feature of the invention, equipment is provided at the service observing operator's position for selectively monitoring a connection including the particular operator's switchboard position, a connection including the particular incoming line and a connection including the particular outgoing line.

Further features of the invention pertain to the particular arrangement of the circuit elements whereby the above-outlined and additional operating features are attained.

The novel features believed to be characteristic of the invention are set forth in the appended claims. The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawings in which Figure 1 illustrates the general arrangement of a telephone system embodying the present invention; Figs. 2 to 11, inclusive, illustrate the details of a system having incorporated therein the features of the invention as briefly outlined above; and Fig. 12 illustrates the mode of combining Figs. 2 to 11, inclusive, of the drawings to form a unified system.

Description of the Apparatus Incorporated in the Telephone System

Referring now more particularly to Fig. 1 of the drawings, the telephone system there illustrated comprises a local automatic exchange 125 and two distant automatic exchanges 105 and 106. The local exchange 125 serves a number of local subscriber substations including the subscriber substation indicated at C and associated with a subscriber line 713 extending to the local exchange. Similarly, the distant exchanges 105 and 106 each serve a number of local subscriber substations including the subscriber substation indicated at A and associated with the subscriber line 711 extending to the distant exchange 105 and the subscriber substation indicated at B associated with the subscriber line 712 extending to the distant exchange 106. The distant exchanges 105 and 106 are respectively connected to the local exchange 125 by first and second groups of two-way toll lines respectively including the toll lines indicated at C714 and C715. Each end of each of the toll lines terminates in a toll line circuit individual thereto, the toll line circuits terminating the ends of the toll lines C714 and C715 at the local exchange 125 being indicated in the group of toll line circuits 110.

The local exchange 125 includes a local switch train 107 having access to each of the local subscriber lines and which preferably comprises a plurality of groups of selector and connector switches of the Strowger type arranged in the usual manner. The local switch train 107 may be controlled by an impulsing apparatus disposed at each subscriber substation in order to set up the various connections between the local subscriber lines in the usual manner. Similarly, the distant exchanges 105 and 106 are provided with local switch trains which may be controlled by impulsing apparatus disposed at the local subscriber substations in order to set up the various connections between the local subscriber lines in the usual manner. Also the local exchange 125 includes a toll switch train 108 which preferably comprises a plurality of groups of selector and connector switches of the Strowger type arranged in the usual manner, and which is utilized in a manner more fully described subsequently in setting up the various toll connections. Similarly, the distant exchanges 105 and 106 are provided with toll switch trains which are utilized in setting up the various toll connections.

An automatic toll board 100 is arranged in the local exchange 125 and comprises a group of C. L. R. operator's positions, a group of point-to-point operator's positions and a group of toll operator's positions, each operator's position having access to both the local and the toll switch trains 107 and 108, respectively. Associated with the toll board 100 is a group of C. L. R. lines accessible to the local switch train 107, one of the C. L. R. lines being indicated at C716 and provided with a C. L. R. line circuit 109. Position distributor and common equipment 703 is associated with the C. L. R. line circuits and the C. L. R. operator's positions in order to assign incoming C. L. R. calls to the C. L. R. operator's positions in a predetermined order. Position distributor and common equipment 704 is associated with the toll line circuits and the toll operator's positions in order to assign incoming toll calls to the toll operator's positions in a predetermined order. The toll switch train 108 has access to the local switch train 107 and to the toll line circuits in order to enable an operator at a point-to-point operator's position to render point-to-point service and to enable an operator at a toll operator's position to render inward and through service in a manner more fully described subsequently.

Associated with the toll board 100, the local switch train 107 and the toll switch train 108 is a plurality of auxiliary operator's positions including a chief operator's position, a number of supervisory operator's positions, a number of rate and directory operator's positions, and a

number of toll service observing operator's positions. In the system illustrated, the chief operator's position is indicated at 101; one of the supervisory operator's positions is indicated at 102; one of the rate and directory operator's positions is indicated at 103; and one of the toll service observing operator's positions is indicated at 104. The chief operator's position 101 has access to and is accessible to the local switch train 107 by way of a trunk line C1242, has access by way of the trunk line C1247 to the toll switch train 108 and is accessible by way of a trunk line C1252 to the toll switch train 108. The chief operator's position 101 has access to the supervisory operator's position 102 by way of a trunk line C1339 and has access to the rate and directory operator's position 103 by way of a trunk line C1264. Furthermore, the chief operator's position 101 has access to each operator's position at the toll board 100 by way of a trunk line individual thereto, access being had to the first toll operator's position at the toll board by way of the trunk line C1258. Finally the position distributor and common equipment 704 is associated, by way of the trunk line C1253, with the chief operator's position 101 for a purpose more fully described subsequently. The supervisory operator's position 102 is accessible to the toll switch train 108 by way of the trunk line C1269. The rate and directory operator's position 103 has access to the local switch train 107 by way of a trunk line C1291, is accessible to the toll switch train 108 by way of a trunk line C1271 individual thereto and an auxiliary trunk line C1270 commonly associated with each rate and directory operator's position. The toll service observing operator's position 104 is associated with the position distributor and common equipment 703 and with the position distributor and common equipment 704 by way of the trunk line C1231 and C1232, respectively, for a purpose more fully described subsequently. Also the toll service observing operator's position 104 is associated with a group busy apparatus 705 by way of a trunk line C1222, while the group busy apparatus 705 is associated with the toll line circuits 110 of a particular group of toll lines by way of a trunk line C721 for a purpose more fully described subsequently. Furthermore, the toll service observing operator's position 104 has access to each operator's position at the toll board 100 by way of a trunk line individual thereto, access to the first C. L. R. operator's position at the toll board being had by way of the trunk line C1230, and access to the first toll operator's position at the toll board being had by way of the trunk line C1221. Moreover, the toll service observing operator's position 104 has access to each C. L. R. and each toll line circuit, access to one of the C. L. R. line circuits being had by way of the trunk line C1226, and access to one of the toll line circuits being had by way of the trunk line C1217. Finally, the toll service observing operator's position 104 has access to each rate and directory operator's position and access to each auxiliary trunk line associated with the rate and directory operator's positions, access being had to the rate and directory operator's position 103 by way of the trunk line C1210, and access being had to the auxiliary trunk line C1270 associated with the rate and directory operator's positions by way of the trunk line C1306.

Preferably, the toll board 100, the position distributor and common equipment 703 and the position distributor and common equipment 704, associated therewith, are of the construction and arrangement of that described and claimed in the copending application of Thomas F. Crocker, Serial No. 142,558, filed May 14, 1937 now Patent No. 2,167,710, issued Aug. 1, 1939. Briefly, the toll board 100, as best shown in Fig. 7, comprises a first group of operator's positions which are utilized as toll operator's positions and a second group of operator's positions which may be utilized, either as C. L. R. operator's positions or as point-to-point operator's positions, each of the operator's positions of the second group being capable of being converted from one type of operator's position to the other merely by operating a key thereat. Accordingly the toll board 100 comprises a plural of toll operator's positions, a plurality of C. L. R. operator's positions and a plurality of point-to-point operator's positions. In the system illustrated, the first C. L. R. operator's position is indicated at 701 and the first toll operator's position is indicated at 702. The position distributor and common equipment 703 is so connected and arranged that it selects the C. L. R. operator's positions in a predetermined order and assigns an incoming C. L. R. call to a selected C. L. R. operator's position. Each C. L. R. operator's position is provided with a link-listening key which is operable to one position to cause the position distributor and common equipment 703 to select the corresponding C. L. R. operator's position in the course of operation thereof and operable to another position after the position distributor and common equipment 703 assigns an incoming C. L. R. call thereto. The position distributor and common equipment 703 is preselective and fully directive in that it selects an idle C. L. R. operator's position having the link-listening key thereat occupying the one position, and subsequently assigns automatically a call on one of the C. L. R. lines thereto in response to the creation of a calling condition on the one C. L. R. line. After the link-listening key at the one C. L. R. operator's position is operated to the other position, the position distributor and common equipment 703 operates automatically to select another idle C. L. R. operator's position having the link-listening key thereat operated to the one position. Also, each C. L. R. operator's position is provided with an answer key which is operated to a predetermined position in order to answer a call on the one C. L. R. line assigned thereto and a ringing key which is operated to a predetermined position in order to cause ringing current to be projected over an outgoing toll line over which a call is to be routed. Finally, each C. L. R. operator's position is provided with a telephone instrument and an impulsing apparatus thereat in order to control the operations of the local and the toll switch trains 107 and 108, respectively.

Similarly, each toll operator's position is provided with a link-listening key which is operable to one position to cause the position distributor and common equipment 704 to select the corresponding toll operator's position in the course of operation thereof, and operable to another position after the position distributor and common equipment 704 assigns an incoming toll call thereto. The position distributor and common equipment 704 is preselective and fully directive in that it selects an idle toll operator's position having the link-listening key thereat occupying the one position, and subsequently assigns automatically a call on one of the toll lines thereto in response

to the creation of a calling condition on the one toll line. After the link-listening key at the one toll operator's position is operated to the other position, the position distributor and common equipment 704 operates automatically to select another idle toll operator's position having the link-listening key thereat operated to the one position. Also, each toll operator's position is provided with an answer key which is operated to a predetermined position in order to answer a call on the one toll line assigned thereto and a ringing key which is operated to a predetermined position in order to cause ringing current to be projected over an outgoing toll line, over which a call is to be routed. Finally, each toll operator's position is provided with a telephone instrument and an impulsing apparatus thereat in order to control the operations of the local and toll switch trains 107 and 108, respectively. Group busy apparatus 705 is associated with the toll line circuits of the group of toll lines extending to the distant exchange 105 and is operable to transmit a signal to the toll service observing operator's position 104 when all of the lines in the group extending to the distant exchange 105 are busy.

The chief operator's position 101, as best shown in Figs. 3, 4 and the portion of Fig. 6 to the left of the dashed line, comprises a primary telephone instrument including a transmitter 330 and a receiver 331, a secondary telephone instrument including a transmitter 350 and a receiver 349, and an impulsing apparatus 325, the secondary telephone instrument being adapted to be connected by way of the plugs 334 and 338 associated with the jacks 342 and 346, respectively, across the respective terminals of the primary telephone instrument. Associated with the primary telephone instrument are a first repeater 305 and a second repeater 370. A trunk line C1239 and a monitoring plug 300 are provided at the chief operator's position 101 and an arrangement including a switch 380 is provided for controlling the association of the repeaters 305 and 370 with the trunk line C1239 and the monitoring plug 300. A control relay R360 is provided for selectively connecting the receiver 331 of the primary telephone instrument to the repeaters 305 and 370. Two control relays R315 and R320 are associated with the impulsing apparatus 325 for the purpose of completing a bridge path around at least a portion of the repeater 305, and for interrupting the connection of the receiver 331 to the repeater 305 when the impulsing apparatus 325 is operated, thereby respectively to establish a low impedance impulsing circuit between the impulsing apparatus 325 and the trunk line C1339, and to prevent clicks in the receiver 331. The switch 380 is provided with a normal position, a right-hand or ring position and a left-hand or talk position. When the switch 380 occupies its normal position, the repeater 370 is connected to the monitoring plug 300 and the repeater 305 is connected to the trunk line C1239; when the switch 380 occupies its ring position, a source of ringing current is connected to the monitoring plug 300 and the trunk line C1239; and when the switch 380 occupies its talk position, the monitoring plug 300 is connected to the repeater 305 and the trunk line C1239 is connected to the repeater 305.

The chief operator's position 101 has access to and is accessible to the local switch train 107 by way of the trunk line C1242 and a switch 400 associated therewith. The switch 400 has a normal position, a right-hand or talk position and a left-hand or hold position. When the switch 400 is operated to its talk position, the trunk line C1239 is connected to the trunk line C1242, and when the switch 400 is operated to its hold position a bridge is connected to the trunk line C1242, thereby to retain the local switch train 107 in operated position. A ring-up relay R460 is associated with the trunk line C1242 and is adapted to illuminate a lamp L462 at the chief operator's position in order to indicate to an operator thereat a calling condition of the trunk line C1242. Associated with the switch 400 and the ring-up relay R460 is a plurality of control relays R442, R446 and R450. These control relays are so connected and arranged that an auxiliary bridge is connected to the trunk line C1242 when the switch 400 is operated from its talk position or its hold position, thereby to prevent the release of the local switch train 107, these relays further interrupting the auxiliary bridge after a predetermined time interval in the event the switch 400 is operated to its normal position, thereby to release the local switch train 107. Further, these control relays control the disconnection of the ring-up relay R460 from the trunk line C1242 and, consequently, the illumination of the lamp L462. Finally, these control relays control a charging circuit for the ring-up relay R460 which is provided for the purpose of preventing false operation of the ring-up relay R460 by the switching surges of current projected over the trunk line C1242 incident to the release of the local switch train 107.

The chief operator's position 101 has access to the toll switch train 108 by way of the trunk line C1247 and a switch 427 associated therewith. The switch 427 has a normal position, a right-hand or talk position and a left-hand or hold position. When the switch 427 is operated to its talk position, the trunk line C1239 is connected to the trunk line C1247 and, when the switch 427 is operated to its hold position, two control relays R474 and R476 are operated. The control relay R476 controls the release of the toll switch train 108 and the operation of a signal at the toll board 100. Also, an arrangement including a control relay R358 and a lamp L304 is provided for the purpose of indicating to an operator at the chief operator's position 101 the time interval during which a selector switch in the toll switch train is hunting for a trunk line extending to a connector switch having access to the desired toll line.

The chief operator's position 101 is accessible to the toll switch train 108 by way of the trunk line C1252 and a switch 413 associated therewith. The switch 413 has a normal position, a right-hand or talk position and a left-hand or hold position. When the switch 413 occupies its talk position, the trunk line C1239 is connected to the trunk line C1252, and when the switch 413 occupies its hold position the operation of a control relay R464 is controlled in order to retain the toll switch train 108 in operated position. A control relay R472 is associated with the trunk line C1252 for the purpose of operating a signal lamp L467 when a calling condition is created on the trunk line C1252. Also, a control relay R468 is provided for the purpose of extinguishing the lamp L467, the operation of the last-mentioned control relay being under the joint control of the control relays R464 and R472.

The chief operator's position 101 also embodies signaling apparatus 480 associated with the toll board 100. More particularly, the signaling apparatus 480 is associated with the position distributor and common equipment 704 at the toll

board and is so connected and arranged that an indication is given to an operator at the chief operator's position when a toll call in the inward group of toll trunks at the toll board has a predetermined delayed answering time. More specifically, the signaling apparatus 680 comprises a lamp L498, a plurality of control relays R481, R482, R484, R488 and R496 and a trunk line C1253 associated with apparatus in the position distributor and common equipment 704. The arrangement is such that operations of these control relays are initiated in the event that all of the toll operator's positions are busy and there is no toll operator's position to which an incoming toll call may be assigned by the position distributor and common equipment 704. These control relays constitute a timer and, after operating a predetermined time interval, cause the lamp L498 to be illuminated intermittently.

The monitoring plug 300 is associated with first, second and third groups of jacks, the first group of jacks being connected to trunk lines extending to the respective supervisory operator's positions, the second group of jacks being connected to trunk lines extending to the respective operator's positions at the toll board 100 and the third group of jacks being connected to trunk lines extending to the respective rate and directory operator's positions. In the arrangement illustrated, the jack 605 included in the first group is connected by way of a trunk line C1339 to the supervisory operator's position 102; the jack 610 included in the second group is connected to a trunk line C1258 extending to the first toll operator's position 702 at the toll board 100; and the jack 615 is connected to a trunk line C1264 extending to the first rate and directory operator's position 103. When the monitoring plug 300 is inserted into the jack 605, a monitoring connection is automatically established from the chief operator's position 101 to the supervisory operator's position 102, and this connection may be automatically converted into a two-way communication connection therebetween by operating the switch 380 to its talk position. When the monitoring plug 300 is inserted into the jack 610, a monitoring connection is automatically established from the chief operator's position 101 to the first toll operator's position 702 at the toll board 100, and this connection may be automatically converted into a two-way communication connection therebetween by operating the switch 380 to its talk position. When the monitoring plug 300 is inserted into the jack 615, a monitoring connection is automatically established from the chief operator's position 101 to the first rate and directory operator's position 103, and this connection may be automatically converted into a two-way communication connection therebetween by operating the switch 380 to its talk position.

The jack 610 has a lamp L629 individually associated therewith which is controlled jointly by the busy or idle condition of the first toll operator's position 702 at the toll board and a master switch 620 at the chief operator's position 101, the master switch 620 being connected and arranged in the circuits for illuminating the lamp L629 and the other lamps individually associated with the other jacks corresponding to the jack 610 and extending to the other operator's positions at the toll board.

Two lamps L634 and L635 are individually associated with the jack 615, the lamp L634 being connected and arranged to be illuminated when the first rate and directory operator's position 103 answers a call on the first auxiliary trunk line C1270, and the lamp L635 being connected and arranged to be illuminated when the first rate and directory operator's position 103 is rendered busy by operating a switch 1060 thereat.

The supervisory operator's position 102, as best shown in Fig. 6 to the right of the dashed line, comprises a telephone instrument including a transmitter 678 and a receiver 679, a repeater 690, a signal lamp L649, an alarm 680, and an arrangement comprising two plugs 658 and 662 and two jacks 666 and 670 for connecting the telephone instrument to the repeater 690. The supervisory operator's position 102 is accessible by way of the trunk line C1339 to the chief operator's position 101 and accessible by way of the trunk line C1269 to the toll switch train 108. The supervisory operator's position 102 also includes a plurality of control relays R640, R644, R652 and R654 and a ring-up relay R650 for controlling the illumination of the lamp L649, for controlling the operation of the alarm 680 and for controlling the marking of the trunk line C1263 as busy to the toll switch train 108.

Associated with the rate and directory operator's positions, as best shown in Figs. 9 to 11, inclusive, is a position distributor 1170 which comprises a plurality of control relays R1110, R1115, R1120, R1125, R1130, R1140, R1150 and R1160. This position distributor 1170 is connected and arranged to assign three rate and directory operator's positions in a predetermined order to the use of the operators at the toll board 100. The first rate and directory operator's position 103 comprises a telephone instrument including a transmitter 1013 and a receiver 1014, an impulsing apparatus 1015, a repeater 910 and a plurality of control switches 1020, 1030, 1040 and 1050. The first rate and directory operator's position 103 is accessible by way of the trunk line C1271 individual thereto to the toll switch train 108 and accessible by way of the trunk line C1270 commonly associated with each rate and directory operator's position to the toll switch train 108. An arrangement including two plugs 1007 and 1010 and two jacks 1001 and 1004 is provided for connecting the telephone instrument at the rate and directory operator's position 103 to the repeater 910. The switch 1040 is operable between two positions to selectively connect the rate and directory operator's position 103 to the trunk line C1271 and the auxiliary trunk line C1270. A plurality of control relays R930, R940 and R945 are associated with the rate and directory operator's position 103, and so connected and arranged that a zip-zip tone is produced in the receiver 1014 when the toll switch train 108 seizes the trunk line C1271 assigned to be seized by the distributor 1170. Also, a control relay R935 is associated with the rate and directory operator's position 103 in order to control the marking of this position as busy to the toll switch train 108 under the control of the telephone instrument thereat. The switch 1060 has a normal position, right-hand and left-hand positions. When the switch 1060 occupies a right-hand position a signal is operated at the toll board 100, and when the switch 1060 occupies a left-hand position the rate and directory operator's position 103 is rendered busy to the toll switch train 108 and a signal is operated at the chief operator's position 101. Further a control relay R950 is associated with the rate and directory operator's position 103 which is connected

and arranged to control a signal at the chief operator's position 101 to control the operations of the lamps L1036 and L1037 at the rate and directory operator's position 103, and to control the marking of the trunk line C1271 as busy to the toll switch train 108 when the rate and directory operator's position 103 is connected to the auxiliary trunk line C1270.

Associated with the auxiliary trunk line C1270 are a plurality of control relays R960, R965, R975, R985 and R995, the control relays R965, R975 and R985 also being respectively associated with the first, second and third rate and directory operator's positions. The control relay R995 is connected and arranged to control the operation of the control relay R960, which latter relay controls the operations of the signals at each rate and directory operator's position when the toll switch train 108 seizes the auxiliary trunk line C1270. The control relay R965 is connected and arranged to be controlled at the first rate and directory operator's position 103 and is effective to control the operation of the control relay R950. In a similar manner, the control relays R975 and R985 are connected and arranged to be controlled at the second and third rate and directory operator's positions, respectively.

The first rate and directory operator's position 103 has access by way of a trunk line C1291 individual thereto to the local switch train 107, and the impulsing apparatus 1015 and the repeater 910 thereat are connected to the trunk line C1291 when the switch 1020 is operated from its right-hand position to its left-hand position. Also an arrangement including the switch 1030 is provided for holding the local switch train 107 in operated position independently of the impulsing apparatus 1015 and the repeater 910.

The service observing operator's position 104, as best shown in Figs. 2, 5 and 8, comprises a receiver set 857 including two receivers 858 and 859 individually associated with two plugs 894 and 897, respectively, and two signal current amplifiers 850 and 860 which are respectively associated with two pairs of jacks 870, 882, and 876, 888. The amplifier 850 is associated with a switch 820 connected to a monitoring plug 801 and the amplifier 860 is associated with the switch 830 having a normal position and right-hand and left-hand positions. When the switch 830 occupies a right-hand position, the amplifier 860 is connected to a monitoring plug 805, and when the switch 830 occupies a left-hand position the amplifier 860 is connected to a monitoring plug 810. The toll service observing operator's position 104 is also provided with a plurality of jacks individually associated with the toll line circuits, a plurality of jacks individually associated with the toll operator's positions, a plurality of jacks individually associated with the C. L. R. line circuits, a plurality of jacks individually associated with the C. L. R. operator's positions, a plurality of jacks individually associated with the rate and directory operator's positions, and a plurality of jacks individually associated with the auxiliary trunk lines commonly associated with the rate and directory operator's positions. In the arrangement illustrated, the jack 570 is individually associated with one of the toll line circuits 110; the jack 575 is individually associated with the first toll operator's position 702; the jack 580 is individually associated with one of the C. L. R. line circuits 109; the jack 585 is individually associated with the first C. L. R. operator's position 701; the jack 590 is individually associated with the first rate and directory operator's position 103; and the jack 525 is individually associated with the first auxiliary trunk line C1270 commonly associated with the rate and directory operator's positions. A group of control relays is individually associated with the jacks associated with the toll line circuits, and a group of control relays is individually associated with the jacks associated with the C. L. R. line circuits. In the arrangement illustrated, a control relay R555 is associated with the jack 570 and a control relay R565 is associated with the jack 580. Further, a control relay R560 is associated with the position distributor 703 and a control relay R550 is associated with the position distributor 704. A number of lamps L557, L558, L567 and L568 are respectively associated with the control relays R555, R550, R565 and R560. The operation of the control relays R550 and R560 are under the control of the position distributors 704 and 703, respectively, and the operation of the control relays R555 and R565 are under the control of one of the toll line circuits 110 and one of the C. L. R. line circuits 109, respectively. Also, two control relays R520 and R530 are provided in order to control the operation of the control relays R550 and R555 and two control relays R510 and R540 are provided in order to control the operation of the control relays R560 and R565. A control relay R230 is provided which is controlled by the operation of the switch 830, and two control relays R240 and R250 are provided which are controlled by the operation of the ringing keys at the operator's positions at the toll board 100. Two control relays R500 and R505 are provided in order to control the operation of a control relay corresponding to the control relay R555. Further the control relays R240 and R250 control the illumination of a supervisory disconnect lamp L201 and a supervisory ringing lamp L202 at the toll service observing operator's position 104. The operation of the various control relays are controlled by a plurality of switches 205, 210, 215, 220 and 225 at the toll service observing operator's position 104. By utilizing the equipment at the toll service observing operator's position 104, in a manner more fully described subsequently, all of the services rendered by the operators at the various operator's positions at the toll board 100 may be monitored. Furthermore, the arrangement of the control relays and the lamps at the toll service observing operator's position 104 is such that an operator at the toll service observing operator's position 104 is adequately advised as to which operator's position at the toll board the service is to be performed at and which C. L. R. and toll lines are involved in the various connections.

Operation of the apparatus at the toll board

The toll board 100 comprises a plurality of combined line and recording or C. L. R. operator's positions and a position distributor 703 associated therewith for the purpose of selecting the positions and assigning incoming C. L. R. calls thereto as previously noted. More particularly, the position distributor 703 selects sequentially the C. L. R. operator's positions having operated link-listening keys and assigns an incoming C. L. R. call to the selected C. L. R operator's position When the position distributor 703 operates to select a particular C. L. R. operator's position, it applies ground potential to the control conductor individual to the position

and extending to the toll service observing operator's position 104. For example, when the position distributor 703 operates to select the first C. L. R. operator's position 701, ground potential in the position distributor 703 is applied to the control conductor C1231 individual to this position and extending to the toll service observing operator's position 104. This application of ground potential to the control conductor C1231 causes the position lamp L568 at the toll service observing operator's position 104 and individual to the first C. L. R. operator's position 701 to be illuminated under certain operating conditions, in order to assist the operator at this position in observing the service rendered by the operator at the first C. L. R. operator's position 701, in a manner more fully explained subsequently. When the operator at the first C. L. R. operator's position 701 answers an incoming C. L. R. call assigned thereto by the position distributor 703, the link-listening key thereat is returned to its busy position and the position distributor 703 operates automatically to select another C. L. R. operator's position to receive the next incoming C. L. R. call. The position distributor 703 also operates at this time to remove ground potential from the control conductor C1231, thereby to perform, under the operating conditions noted, a function at the service observing operator's position 104, as is more fully explained subsequently.

The operator at the first C. L. R. operator's position 701 may seize the toll switch train 108 and dial a series of digits thereinto to cause it to seize an idle toll line in a particular group of toll lines. When the toll switch train 108 is operated to seize an outgoing toll line, ground potential in the toll switch train is applied to the control conductor of the trunk line. For example, when the toll switch train 108 seizes the outgoing toll line C714, ground potential in the toll switch train is applied to the control conductor thereof, which ground potential is conducted by way of the toll line circuit individual to the toll line C714 to the control conductor C1216 of the trunk line C1217 extending to the service observing operator's position 104, thereby to cause, under the operating conditions noted, the toll line lamp L557 individual to the toll line C714 to be illuminated.

After an outgoing toll line has been seized by the toll switch train 108, the operator at the first C. L. R. operator's position operates the ringing key at this position, thereby to cause ringing current to be projected over the outgoing toll line and to cause ground potential at this position to be applied to the control conductor C1229 of the trunk line C1230 individually associated with the first C. L. R. operator's position. This application of ground potential to the control conductor C1229 of the trunk line C1230 causes, under the operating conditions noted, the ringing supervisory lamp L202 at the toll service observing operator's position 104 to be illuminated. When the toll operator in the distant exchange answers the toll call extending thereto, the operator at the first C. L. R. operator's position 701 operates the ringing key at her position to arrest the application of ringing current to the outgoing toll line extending to the distant exchange. When this ringing key is thus operated, ground potential is removed from the control conductor C1229 of the trunk line C1230, thereby to cause, under the operating conditions noted, the ringing supervisory lamp L202 to be extinguished. In order to release the established connection extending to the distant exchange, the operator at the first C. L. R. operator's position 701 operates a release key at her position, causing ground potential to be applied through a resistor to the control conductor C1229 of the trunk line C1230, thereby to cause, under the operating conditions noted, the disconnect supervisory lamp L201 at the toll service observing operator's position 104 to be illuminated.

The toll board also comprises a plurality of toll operator's positions and a position distributor 704 associated therewith for the purpose of selecting the positions and assigning incoming toll calls thereto. More particularly, the position distributor 704 selects sequentially the toll operator's positions having operated link-listening keys and assigns an incoming toll call to the selected toll operator's position. When the position distributor 704 operates to select a particular toll operator's position, it applies ground potential to the control conductor individual to the position and extending to the toll service observing operator's position 104. For example, when the position distributor 704 operates to select the first toll operator's position 702, ground potential in the position distributor 704 is applied to the control conductor C1232 individual to this position and extending to the toll service observing operator's position 104. This application of ground potential to the control conductor C1232 causes the position lamp L559 at the toll service observing operator's position 104 and individual to the first toll operator's position 702 to be illuminated, under certain operating conditions, in order to assist the operator at this position in observing the service rendered by the operator at the first toll operator's position 702, in a manner more fully explained subsequently. When the operator at the first toll operator's position 702 answers an incoming toll call assigned thereto by the position distributor 704, the link-listening key thereat is returned to its busy position and the position distributor 704 operates automatically to select another toll operator's position to receive the next incoming toll call. The position distributor 704 also operates at this time to remove ground potential from the control conductor C1232, thereby to perform, under the operating conditions noted, a function at the service observing operator's position 104, as is more fully explained subsequently.

The operator at the first toll operator's position 702 may seize the toll switch train 108 and dial a series of digits thereinto to cause the toll switch to seize an idle toll line in a particular group of toll lines, thereby to cause, under the operating conditions noted, the toll line lamp individual thereto at the toll service observing operator's position 104 to be illuminated as previously explained.

After an outgoing toll line has been seized by the toll switch train 108, the operator at the first toll operator's position operates the ringing key at this position, thereby to cause ringing current to be projected over the outgoing toll line and to cause ground potential at this position to be applied to the control conductor C1229 of the trunk line C1221 individually associated with the first toll operator's position. This application of ground potential to the control conductor C1229 of the trunk line C1221 causes, under the operating conditions noted, the ringing supervisory lamp L202 at the toll service observing operator's position 104 to be illuminated. When the toll oper-

ator in the distant exchange answers the toll call extending thereto, the operator at the first toll operator's position 102 operates the ringing key at her position to arrest the application of ringing current to the outgoing toll line extending to the distant exchange. When this ringing key is thus operated, ground potential is removed from the control conductor C1220 of the trunk line C1221, thereby to cause, under the operating conditions noted, the ringing supervisory lamp L202 to be extinguished. In order to release the established connection extending to the distant exchange, the operator at the first toll operator's position 102 operates a release key at her position, causing ground potential to be applied through a resistor to the control conductor C1220 of the trunk line C1221, thereby to cause, under the operating conditions noted, the disconnect supervisory lamp L201 at the toll service observing operator's position 104 to be illuminated.

An arrangement is provided at the toll board 100 in order to indicate to the toll service observing operator's position 104 when all of the toll lines in a particular group at the toll board are busy. For example, an arrangement is provided for indicating when all of the outgoing toll lines extending to the distant exchange 105 are busy, which comprises a group busy apparatus 705 individually associated by way of the trunk line C721 with the line circuits of the group of outgoing trunk lines extending to the distant exchange 105, a control conductor C1222 and a lamp L579 located at the toll service observing operator's position 104. When all of the outgoing toll lines extending from the toll board 100 to the distant exchange 105 are busy, the group busy apparatus 705 individually associated therewith by way of the trunk line C721 is operated, to apply ground potential to the control conductor C1222, thereby to cause the lamp L579 to be illuminated.

The position distributor 704 is so connected and arranged that ground potential is applied therein to the control conductor C1253 extending to the chief operator's position 101 when the position distributor may not operate to assign an incoming toll call to one of the toll operator's positions due to the fact that none of the link-listening keys at the toll operator's positions are operated to cause the position distributor to operate to select the corresponding toll operator's position. The application of ground potential to the control conductor C1253 causes the lamp L498 at the chief operator's position 101 to flash after a time interval of approximately four seconds, thereby to indicate to the operator at the chief operator's position that an incoming toll call has had a delayed answering time of approximately four seconds.

Each of the C. L. R. operator's positions and each of the toll operator's positions has access to the toll switch train 108. More specifically, the first C. L. R. operator's position 701 has access to the toll switch train 108 by way of a group of trunk lines including the trunk lines C718 and C718', and the first toll operator's position 702 has access to the toll switch train by way of a group of trunk lines including the trunk line C720. Also, the toll switch train 108 is accessible to the chief operator's position 101 by way of the trunk line C1247. The toll switch train 108 has access by way of the trunk line C1252 to the chief operator's position 101, access by way of the trunk line C1269 to the supervisory operator's position 102, access by way of the trunk line C1271 to the rate and directory operator's position 103, and access by way of the first auxiliary trunk line C1270 to each of the rate and directory operator's positions. The toll switch train 108 also has access by way of a group of trunk lines including the trunk line C719 to the local switch train 107, and access by way of the trunk lines C717 and C723 to the toll line circuits individual to the toll lines C714 and C715, respectively, included in groups of toll lines extending to the distant exchanges 105 and 106, respectively. The local switch train 107 is accessible by way of the trunk line C1242 to the chief operator's position 101, and accessible by way of the trunk line C1291 to the rate and directory operator's position 103. Also, the local switch train is accessible to the subscriber's station C by way of the subscriber line 713. The local switch train 107 has access by way of the subscriber line 713 to the subscriber's substation C, and access by way of the trunk line C1242 to the chief operator's position 101. Further, the local switch train 107 has access by way of a group of C. L. R. lines including the C. L. R. line C716, the line circuits individual thereto, and the trunk line C722 to the position distributor 703. Each incoming toll line, including the toll lines C714 and C715, has access by way of the toll line circuits individual thereto and the trunk line C723 to the position distributor 704.

In order to extend a call initiated at the substation A associated with the distant exchange 105 to the substation B associated with the distant exchange 106 and routed by way of the toll board 100, the subscriber at the substation A removes the receiver of the telephone instrument thereat from its hook and dials a proper series of digits into the local switch train in the distant exchange 105 in order to establish a connection to a C. L. R. operator's position thereat. The operator at the C. L. R. operator's position in the distant exchange 105 answers the call and, after receiving the information concerning the called substation B, dials a proper series of digits into the toll switch train therein in order to cause the toll switch train to seize an idle toll line, such, for example, as the toll line C714 extending to the toll board 100. The incoming toll call on the toll line C714 is routed by way of the toll line circuit individual thereto, the trunk line 723', and the position distributor 704 to one of the toll operator's positions. Assuming that the call is routed to the first toll operator's position 702, the operator at this position answers the call and receives the information concerning the called substation B. The operator at the toll operator's position 702 then seizes the toll switch train 108 by way of the trunk line C720 and dials a proper series of digits thereinto to cause the toll switch train to seize the trunk line C723 extending by way of the toll line circuit individual to the toll line C715 to the toll line C715. The operator at the first toll operator's position 702 then operates the ringing key thereat to project ringing current over the outgoing toll line C715, causing the toll call to be answered at the distant exchange 106 by a toll operator thereat. The toll operator in the distant exchange 106 then receives the information concerning the called substation B and dials a proper series of digits into the switch train therein to cause the subscriber line 712 to be seized. Ringing current is then projected over the subscriber line 712 extending to the substation B. When the subscriber at the substation B answers the call, the toll operator in the distant

exchange 106 connects the subscriber line 712 to the toll line C715. The operator at the first toll operator's position 702 then connects the toll lines C715 and C714 together. Finally, the C. L. R. operator at the distant exchange 105 connects the toll line C714 to the subscriber line 711, thereby to complete an established connection between the substations A and B. The release of this established connection is under the control of the C. L. R. operator in the distant exchange 105.

In order to extend a call initiated at the substation A associated with the distant exchange 105 to the substation C associated with the local switch train 107 and routed by way of the first toll operator's position at the toll board 100, the call is initiated and extended to the first toll operator's position 702, as previously explained. The operator at the first toll operator's position then seizes, by way of the trunk line C720, the toll switch train 108 and dials a proper series of digits thereinto to cause the toll switch train to seize the trunk line C719 extending to the local switch train 107. The operator at the first toll operator's position then dials a further series of digits into the local switch train 107 to cause the local switch train to seize the subscriber line 713 extending to the substation C. The operator at the first toll operator's position then operates the ringing key thereat to project ringing current over the subscriber line 713 extending to the substation C. When the subscriber at the substation C answers the call, the operator at the first toll operator's position 702 connects the trunk line C720 to the toll line C714. Finally, the C. L. R. operator in the distant exchange 105 then connects the toll line C714 to the subscriber line 711, thereby to complete an established connection between the substations A and C. The release of this established connection is under the control of the C. L. R. operator in the distant exchange 105.

In order to extend a call initiated at the substation C associated with the local switch train 107 to the substation A associated with the distant exchange 105, the subscriber at the substation C removes the receiver of the telephone instrument thereat from its hook in order to seize the local switch train 107 and dials a proper series of digits into the local switch train, thereby to cause the local switch train 107 to seize the C. L. R. line 716 and to extend the call by way of the line circuit individual thereto, the trunk line C722 and the position distributor 703 to one of the C. L. R. operator's positions. Assuming that the call is assigned to the first C. L. R. operator's position 701 by the position distributor 703, the operator thereat answers the call and receives the information concerning the substation A. The operator at the first C. L. R. operator's position 701 then seizes the toll switch train by way of the trunk line C718 and dials a proper series of digits thereinto to cause the toll switch train to seize the trunk line C717 and to route the call by way of the line circuit individual to the toll line C714 to the toll line C714. The operator at the first C. L. R. operator's position then operates the ringing key thereat to project ringing current over the toll line C714. The toll operator in the distant exchange 105 then answers the call and receives the information concerning the called substation A. The toll operator in the distant exchange then dials a proper series of digits into the switch train thereat to cause the switch train to seize the subscriber line 711. Ringing current is then projected over the subscriber line 711 extending to the substation A. When the subscriber at the substation A answers the call, the toll operator in the distant exchange 105 connects the subscriber line 711 to the toll line C714. The operator at the first C. L. R. operator's position then connects the C. L. R. line C716 to the trunk line C718, thereby to complete the established connection between the substations C and A. The release of this established connection is under the control of the operator at the first C. L. R. operator's position 701.

The operator's position 701 may be utilized as a C. L. R. operator's position, as previously described, or as a point-to-point operator's position, this conversion being effected by operating a key at this position. In order to establish a connection between the substation C and the substation B routed by way of the operator's position 701 at the toll board 100, the operator's position 701 being utilized as a point-to-point operator's position, the operator at the point-to-point position 701 seizes, by way of the trunk line C718, the toll switch train 108. The operator at the point-to-point operator's position 701 then dials a proper series of digits into the toll switch train to cause the toll switch train to seize the local switch train 107, and then dials a further series of digits into the local switch train 107 to cause the local switch train to seize the subscriber line 713 extending to the substation C. The operator at the point-to-point operator's position then operates the ringing key thereat to project ringing current over the subscriber line 713 to the substation C; and after the subscriber at the substation C answers the call, the operator at the point-to-point operator's position 701 holds the call extending to the substation C and seizes, by way of the trunk line C718', the toll switch train 108 and dials a proper series of digits into the toll switch train to cause the toll switch train to seize the trunk line 723, which connection is extended by way of the toll line circuit individual to the toll line C715 to the toll line C715. The operator at the point-to-point operator's position 701 operates the ringing key thereat to project ringing current over the toll line C715. The toll operator in the distant exchange 106 then answers the call and receives the information concerning the called substation B. The toll operator in the distant exchange 106 then dials a proper series of digits into the switch train thereat to cause the switch train to seize the subscriber line 712 extending to the substation B. Ringing current is then projected over the subscriber line 712 to the substation B. When the subscriber at the substation B answers the call, the toll operator in the distant exchange 106 connects the subscriber line 712 to the toll line C715. Finally, the operator at the point-to-point operator's position 701 connects the trunk line C718 to the trunk line C718', thereby to complete an established connection between the substations C and B. The release of this established connection is under the control of the operator at the point-to-point operator's position 701.

Operation of the apparatus at the chief operator's position

The chief operator's position 101 has access to each supervisory operator's position and, in order to monitor an established connection between a particular supervisory operator's position and a toll operator's position, it is only necessary for the chief operator to insert the moni-

toring plug 300 into the particular jack associated therewith which is connected to a trunk line extending to the particular supervisory operator's position. For example, in order to monitor an established connection between the supervisory operator's position 102 and the first toll operator's position 702, the monitoring plug 300 is inserted into the jack 605 which is connected to the trunk line C1339 extending to the supervisory operator's position 102, the established connection between the first toll operator's position 702 and the supervisory operator's position 102 being routed by way of the trunk line C720, the toll switch train 108 and the trunk line C1269. When the monitoring plug 300 is inserted into the jack 605, a connection is established between the trunk line C1339 extending to the supervisory operator's position 102 and the repeater transformer 370, this connection extending from the line conductor C1323 of the trunk line C1339 by way of the jack tip 606, the plug tip 301, the conductor C1311, the switch springs 392 and 393, C1317, the switch springs 384 and 385, C1309, the primary windings 372, 373 and 374 of the transformer 370, the condenser 375, C1310, the switch springs 386 and 387, C1320, the switch springs 399 and 399', the conductor C1312, the plug ring 302 and the jack ring 607 to the line conductor C1267 of the trunk line C1339. Also, ground on the switch spring 355 of the switch 351 is extended by way of the switch spring 356, C1342, the plug sleeve 303 and the jack sleeve 608 to the control conductor C1324 of the trunk line C1339, thereby to cause operation of the apparatus at the supervisory operator's position 102 in a manner more fully described subsequently. The receiver 331 of the primary telephone instrument at the chief operator's position is connected across the secondary winding 371 of the transformer 370, this circuit extending from the upper terminal of the winding 371 by way of RC362, RA361, C1323', the receiver 331 bridged across C1323' and C1324', C1324', RA364 and RC365 to the lower terminal of the winding 371. Thus, the receiver 331 is associated by way of the transformer 370 with the trunk line C1339, and the chief operator may readily monitor the established connection between the first toll operator's position 702 and the supervisory operator's position 102. The operation of the apparatus at the supervisory operator's position 102, when the monitoring plug 300 is inserted into the jack 605, is described subsequently.

Also it is noted that the receiver 349 of the secondary telephone instrument at the chief operator's position may be bridged across the secondary winding 371 of the transformer 370 by inserting the plugs 334 and 338 into the jacks 342 and 346, respectively. At this time, one terminal of the receiver 349 is connected by way of the plug sleeve 336, the jack sleeve 344 and C1325 to C1323', and the other terminal of the receiver 349 is connected by way of the plug sleeve 340, the jack sleeve 348 and C1330 to C1324'. Also it is noted that a uni-directional conducting device in the form of a copper oxide rectifier 332 is bridged across C1323' and C1324' in order to minimize disturbances in the receivers 331 and 349.

Should the chief operator desire to cut into the established connection between the first toll operator's position 702 and the supervisory operator's position 102 in order to converse with the operators thereat, it is only necessary to operate the switch 380 to its left-hand or talk position. When the switch 380 is operated to its talk position the conductors C1311 and C1312 are respectively connected to the conductors C1307 and C1308, and a circuit for energizing the switching relay R360 is completed. This circuit extends from ground at the switch spring 390 by way of the switch spring 389, C1321 and the upper winding of R360 to battery. When energized over the above-traced circuit the switching relay R360 operates to interrupt at RA361, RC362 and RA364, RC365, the connection of the receiver 331 across the secondary winidng 371 of the transformer 370, and connects at RA361, RC363 and RA364, RC366, the receiver 331 across the secondary winding 309 of the transformer 305. At this time, one terminal of the receiver 331 is connected by way of C1323', RA361, RC363 and the condenser 317 to one terminal of the winding 309, and the other terminal of the receiver 331 is connected by way of C1324', RA364, RC366 and RA321' to the other terminal of the winding 309. Also the line conductors C1323 and C1267 of the trunk line C1339 extending to the supervisory operator's position 102 are connected across the secondary windings 308 and 309 of the transformer 305, the line conductor C1323 being connected by way of the jack tip 606, the plug tip 301, C1311, the switch springs 392 and 393, C1317, thme switch springs 384 and 383, C1318 and the conductor 1307 to the upper terminal of the secondary winding 308, the line conductor C1267 being connected by way of the jack ring 607, the plug ring 302, C1312, the switch springs 399' and 399, C1320, the switch springs 387 and 388. C1319, the switch springs 395 and 396, C1308, the impulse springs 328 and 329 of the dialing mechanism 325 and C1328 to the lower terminal of the secondary winding 309, and the upper terminal of the secondary winding 309 being connected to the lower terminal of the secondary winding 308. Also, the transmitter 330 of the primary telephone instrument at the chief operator's position is included in an energizing circuit extending from ground on C1329 by way of the switch springs 323 and 324, the transmitter 330, C1326, the primary winding 307 of the transformer 305, C1341 and the winding of the choke coil 310 to battery. It is noted that the energizing circuit of the transmitter 330 may be interrupted by operating the switch 322, thereby to move the switch springs 323 and 324 into disengagement. Also, the transmitter 350 of the secondary telephone instrument at the chief operator's position 101 may be connected across C1326 and C1329 by inserting the plugs 334 and 338 into the jacks 342 and 346, respectively. At this time, one terminal of the transmitter 350 is connected by way of the plug tip 335, the jack tip 343 and C1327 to C1329, and the other terminal of the transmitter 350 is connected by way of the plug tip 339, the jack tip 347 and C1340 to C1326. By talking into either of the transmitters 330 or 350, signal currents are generated in the primary winding 307 of the transformer 305, causing corresponding signal currents to be induced in the secondary windings 308 and 309 of the transformer 305. The circuit for the signal currents extends from one terminal of the transmitter 330 by way of the switch springs 324 and 323, C1329, the condenser 311 bridged across C1329 and C1341, C1341, the primary winding 307 of the transformer 305 and C1326 to the other terminal of the transmitter 330. The signal currents induced in the secondary windings 308 and 309 of the transformer 305 are impressed upon the line conductors C1323 and

C1267 of the trunk line C1339 by way of the above-traced circuit, and are conducted therefrom to the telephone instrument at the supervisory operator's position 102 in a manner more fully described subsequently.

The release of the cut-in connection between the chief operator's position 101 and the trunk line C1339 may be effected by returning the switch 380 to its normal position. When the switch 380 is returned to its normal position the circuit for energizing the switching relay R360 is interrupted at the switch springs 389 and 390, causing this relay to restore. Upon restoring, the switching relay R360 disconnects at RA361, RC363 and RA364, RC366 the receiver 331 from across the secondary winding 309 of the transformer 305, and connects at RA361, RC362 and RA364, RC365 the receiver 331 across the secondary winding 371 of the transformer 370. When the monitoring plug 300 is withdrawn from the associated jack 605, ground potential is removed from the control conductor C1324 of the trunk line C1339, causing the apparatus at the supervisory operator's position 102 to be released in a manner more fully described subsequently.

The chief operator has access to each toll operator's position and, in order to monitor the setting up of a toll connection by a particular operator, it is only necessary for the chief operator to insert the monitoring plug 300 into the particular jack associated therewith which is connected to a trunk line extending to the particular toll operator's position. For example, in order to monitor the setting up of a toll connection by the operator at the first toll operator's position 702, the monitoring plug 300 is inserted into the jack 610 which is connected to the trunk line C1258 extending to the first toll operator's position 702. When the monitoring plug 300 is inserted into the jack 610 a connection is established between the trunk line C1258 extending to the first toll operator's position 702 and the transformer 370, this connection extending from the line conductor C1254 of the trunk line C1258 by way of the jack tip 611, the plug tip 301, C1311, the switch springs 392 and 393, C1317, the switch springs 384 and 385, C1309, the primary windings 372, 373 and 374 of the transformer 370, the condenser 375, C1310, the switch springs 386 and 387, C1320, the switch springs 399 and 399', C1312, the plug ring 302 and the jack ring 612 to the line conductor C1255 of the trunk line C1258. Also, ground on the switch spring 355 of the switch 351 is extended by way of the switch spring 356, C1342, the plug sleeve 303 and the pack sleeve 613 to the control conductor C1256 of the trunk line C1258. The presence of ground potential upon the control conductor C1256 of the trunk line C1258 causes a relay, not shown, included in the apparatus at the first toll operator's position 702, to operate and connect the line conductors C1254 and C1255 of the trunk line C1258 to the trunk line across which the toll operator's telephone instrument is connected. As the receiver 331 of the primary telephone instrument at the chief operator's position is connected across the secondary winding 371 of the transformer 370, the chief operator may monitor the setting up of a toll connection by the operator at the first toll operator's position 702.

Should the chief operator desire to cut into the toll connection being set up, it is only necessary to operate the switch 380 to its talk position, as previously explained. The operation of the apparatus at the chief operator's position, incident to the operation of the switch 380 to its talk position, is the same as that previously explained. Also, the release of the cut-in connection between the chief operator's position and the trunk line C1258 may be effected by returning the switch 380 to its normal position. When the cut-in connection is released the apparatus at the chief operator's position is released, as previously explained. When the monitoring plug 300 is withdrawn from the associated jack 610, the relay included in the apparatus at the first toll operator's position 702 restores to disconnect the trunk line C1258 from the trunk line across which the telephone instrument at the first toll operator's position 702 is connected, thereby to release the apparatus at the first toll operator's position.

Also it is noted that a lamp and a switch are associated with each jack connected to a trunk line extending to a corresponding toll operator's position. For example, a lamp L629 and a switch 625 are associated with the jack 610. When the operator at the first toll operator's position 702 operates the link-listening key thereat in order to condition the distributor equipment 704 to assign an incoming toll call to the first toll operator's position 702, ground is removed from the control conductor C1257. Also, when the operator at the first toll operator's position 702 receives a toll call to be set up, she immediately operates the link-listening key at this position to its busy position, thereby placing ground potential upon the control conductor C1257. Thus, no ground potential appears upon the control conductor C1257 when the operator at the first toll operator's position 702 is waiting for an incoming toll call to be assigned to her to be set up and ground potential appears upon the control conductor C1257 while the operator at the first toll operator's position 702 is setting up a toll connection. Also, a common switch 620 is provided at the chief operator's position which, when operated, applies battery potential to one terminal of each of the lamps associated with the jacks connected to the trunk lines extending to the toll operator's positions. Hence, when the common switch 620 is operated, battery potential is applied to one terminal of the lamp L629, this path extending from battery at the switch spring 623, by way of the switch spring 622 and the switch springs 626 and 627 to one terminal of the lamp L629, the other terminal of the lamp L629 being connected to the control conductor C1257. At this time, if the operator at the first toll operator's position 702 is waiting for an incoming toll call to be assigned to her position no ground potential appears upon the control conductor C1257, and the lamp L629 is not illuminated. On the other hand, if the operator at the first toll operator's position 702 is setting up a toll connection, ground potential appears upon the control conductor C1257, and the lamp L629 is illuminated. Thus, by operating the common switch 629, the chief operator can readily ascertain whether the operators at the particular toll operator's positions are waiting for incoming toll calls to be assigned to the corresponding toll operator's positions, or setting up toll connections at the corresponding toll operator's positions.

The chief operator has access to each rate and directory operator's position and, in order to monitor an established connection between a particular toll operator's position and a particular rate and directory operator's position, it is only necessary for the chief operator to insert the

monitoring plug 300 into the particular jack associated therewith which is connected to a trunk line extending to the particular rate and directory operator's position. For example, in order to monitor an established connection between the rate and directory operator's position 103 and any one of the toll operator's positions, the monitoring plug 300 is inserted into the jack 615 which is connected to the trunk line C1264 extending to the rate and directory operator's position 103. When the monitoring plug 300 is inserted into the jack 615 a connection is established between the trunk line C1264 extending to the rate and directory operator's position 103 and the transformer 370, this connection extending from the line conductor C1260 of the trunk line C1264 by way of the jack tip 616, the plug tip 301, C1311, the switch springs 392 and 393, C1317, the switch springs 384 and 385, C1309, the primary windings 372, 373 and 374 of the transformer 370, the condenser 375, C1310, the switch springs 386 and 387, C1320, the switch springs 399 and 399', C1312, the plug ring 302, the jack ring 617 to the line conductor C1261 of the trunk line C1264. As the receiver 331 of the primary telephone instrument at the chief operator's position is connected across the secondary winding 371 of the repeater 370, the chief operator may monitor the established connection between the particular toll operator's position and the rate and directory operator's position 103.

Should the chief operator desire to cut into the established connection between the particular toll operator's position and the rate and directory operator's position 103, it is only necessary to operate the switch 380 to its talk position, as previously explained. The operation of the apparatus at the chief operator's position, incident to the operation of the switch 300 to its talk position, is the same as that previously explained. Also, the release of the cut-in connection between the chief operator's position and the trunk line C1264 may be effected by returning the switch 380 to its normal position. When the cut-in connection is released the apparatus at the chief operator's position is released, as previously explained.

Also it is noted that two lamps and a switch are associated with each jack connected to a trunk line extending to a corresponding rate and directory operator's position. For example, two lamps L634 and L635 and a switch 630 are associated with the jack 615. One terminal of the lamp L635 is connected to battery and the other terminal thereof is connected by way of the switch springs 633 and 632 of the switch 630 to a control conductor C1263 included in the trunk line C1264 extending to the rate and directory operator's position 1003. When the operator at the rate and directory operator's position 103 wishes to signal the chief operator, she merely operates a switch to apply ground potential to the control conductor C1263, causing the lamp L635 to be illuminated, whereupon the chief operator may insert the monitoring plug 300 into the associated jack 615 and converse with the operator at the rate and directory operator's position 103. The lamp L635 may be extinguished by the chief operator by operating the switch 630 to move the switch springs 632 and 633 into disengagement. One terminal of the lamp L634 is connected to battery and the other terminal thereof is connected to a control conductor C1262 included in the trunk line C1264 extending to the rate and directory operator's position 103. When the apparatus at the rate and directory operator's position 103 is operated in order to establish a connection between the telephone instrument at this position and the particular toll operator's position by way of the auxiliary trunk line C1270, ground potential is applied to the control conductor C1262 by the operation of the control relay R950, thereby to cause the lamp L634 to be illuminated. The illumination of the lamp L634 indicates to the chief operator that the operator at the rate and directory operator's position 103 is to perform a service by way of the auxiliary trunk line C1270 for an operator at one of the toll operator's positions.

The local switch train 107 has access to the chief operator's position 101 and, in order to establish a connection between a subscriber's substation having access to the local switch train and the chief operator's position, it is only necessary to dial a proper series of digits at the substation after the local switch train has been seized in order to extend a connection from the substation to the chief operator's position. For example, in extending a connection from the subscriber's substation C to the chief operator's position 101, the receiver of the telephone instrument at the substation C is removed from its associated hook, causing the local switch train 107 to seize the subscriber line 713 extending between the local switch train 107 and the substation C. After the subscriber line 713 is seized by the local switch train, a proper series of digits is dialed at the dialing mechanism at the substation C to cause the local switch train to seize the trunk line C1242 extending to the chief operator's position and to apply ringing current to the line conductors C1240 and C1241 of the trunk line C1242. The application of ringing current to the line conductors C1240 and C1241 energizes the ring-up relay R460. The circuit for energizing the ring-up relay R460 extends from one terminal of an A. C. source of supply, not shown, by way of the line conductor C1240, RC453, RA452, the upper winding of R460, the condenser 463, RA456, RC458 and the line conductor C1241 to the other terminal of the A. C. source of supply. When energized over the above-traced circuit the ring-up relay R460 operates to complete at RA461 a holding circuit for itself extending from ground at RA455 by way of RA461 and the lower winding of R460 to battery, and completes at RA461' an obvious circuit for illuminating the lamp L462. In order to answer the call the chief operator at the chief operator's position 101 operates the switch 400 to its right-hand or talk position. When the switch 400 is operated to its talk position the line conductors C1235 and C1236 of the trunk line C1239 are connected to the line conductors C1240 and C1241, respectively, of the trunk line C1242, the line conductor C1235 being connected by way of the switch springs 409 and 410 to the line conductor C1240, and the line conductor C1236 being connected by way of the switch springs 412 and 411 to the line conductor C1241. Also, the control conductor C1234 of the trunk line C1239 is connected by way of the switch springs 408 and 407, C1343 and C1346 to the conductor C1335, thereby completing a circuit for energizing the control relays R320 and R442. This circuit extends from ground at the lower terminal of the winding of R320 by way of the winding of R320, RC369, RA367, C1234, the contact springs 408 and 407, C1343, C1346, C1335 and the winding of R442 to battery at the upper terminal of the winding of R442. When

energized over the above-traced circuit the control relays R320 and R442 operate, and upon operating, the control relay R320 interrupts at RA321' a point in the circuit for connecting the receiver 331 across the secondary winding 309 of the transformer 305 and completes at RA321 a circuit for energizing the switching relay R360. The circuit for energizing the switching relay R360 extends from ground at RA321 by way of the upper winding of R360 to battery. When energized over the above-traced circuit the switching relay R360 operates to interrupt at RA361, RC362 and RA364, RC365, the connection of the receiver 331 across the secondary winding 371 of the transformer 370, and to prepare at RA361, RC363 and RA364, RC366 a circuit for connecting the receiver 331 across the secondary winding 389 of the transformer 385, this circuit being open at RA321' at this time. Also, upon operating, the switching relay R360 interrupts at RA367 and RC369 the circuit for energizing the control relay R320, and completes at RA367 and RA368 a holding circuit for itself, the latter circuit extending from ground at the upper terminal of the lower winding of R360 by way of the lower winding of R360, RA368 and RA367 to the control conductor C1236. Shortly after the circuit for energizing the control relay R320 is interrupted, the control relay R320, being of the slow-to-release type, restores to complete at RA321' the circuit for connecting the receiver 331 across the secondary winding 309 of the transformer 305, and to interrupt at RA321 the original circuit for operating the switching relay R360. At this time the receiver 331 is connected across the secondary winding 389 of the transformer 385, which secondary winding 309 is included in a connection bridged across the line conductors C1235 and C1236 of the trunk line C1239, this path extending from the line conductor C1235 by way of the switch spring 393, C1319, the switch springs 395 and 396, C1306, the impulse springs 328 and 329 of the dialing mechanism 325, C1328, the secondary windings 309 and 308 of the transformer 305, C1307, C1316 and the switch springs 397 and 398 to the line conductor C1236. Also the transmitter 330 is included in the previously traced circuit including the primary winding 307 of the transformer 305. Thus, transmitter 330 and the receiver 331 of the primary telephone instrument at the chief operator's position 101 are connected by way of the trunk line C1239, the trunk line C1242, the local switch train 107 and the subscriber line 713 to the substation C for two-way communication therebetween.

Upon operating, the control relay R442 interrupts at RA443 a point in a bridge connection across the line conductor C1240 and C1241 of the trunk line C1242, and completes at RA444 an obvious circuit for energizing the control relay R446. When energized, the control relay R446 operates to complete at RA447 an obvious circuit for energizing the control relay R450. Upon operating, the control relay R450 prepares at RA451 a point in the previously mentioned bridge connection across the line conductors C1240 and C1241 of the trunk line C1242, interrupts at RA452, RC453 and RA456, RC458, points in the original operating circuit of the ring-up relay R460. Also, the control relay R450 interrupts at RA455 a point in the holding circuit of the ring-up relay R460, and completes at RA452, RC454 and RA456, RC457, a circuit for charging the condenser 463 in series with the upper winding of the ring-up relay R460. This charging circuit extends from ground at RC457 by way of RA456, the condenser 463, the upper winding of R460, RA452, RC454 and the resistor 462 to battery. The condenser 463 is charged by way of the above-traced circuit in order to prevent reoperation of the ring-up relay R460 from switching surges on the line conductors C1240 and C1241 of the trunk line C1242 incident to the release of the established connection between the chief operator's position 101 and the substation C in a manner more fully explained subsequently. When the original operating and holding circuits of the ring-up relay R460 are interrupted, this relay restores to interrupt at RA461 a further point in its holding circuit and to interrupt at RA461' the circuit for illuminating the lamp L462, thereby to cause the lamp L462 to be extinguished.

Should the chief operator desire to hold the connection to the substation C and free the primary telephone instrument at the chief operator's position 101 for other use, she may operate the switch 400 to its left-hand or hold position. When the switch 400 is operated from its talk position the trunk line C1239 is disconnected thereat from the trunk line C1242 in an obvious manner, causing the control relay R442 and the switching relay R360 to restore. When the switching relay R360 restores the receiver 331 is disconnected from across the secondary winding 309 of the transformer 305 and is connected across the secondary winding 371 of the transformer 370 as previously explained. Upon restoring, the control relay R442 completes at RA443 the previously mentioned bridge connection across the line conductors C1240 and C1241 of the trunk line C1242, thereby to retain the local switch train 107 in operated position. This bridge connection extends from the line conductor C1240 by way of RA451 and RA443 to the line conductor C1241. Also, upon restoring, the control relay R442 interrupts at RA444 the circuit for energizing the control relay R446, which relay, being of the slow-to-release type, does not immediately restore. Moreover, the control relay R450 is of the slow-to-release type and does not restore until a time interval after the control relay R446 restores. Consequently, there is sufficient time for the switch 400 to be operated from its talk position to its hold position before the control relay R450 restores to interrupt at RA451 the bridge connection across the line conductors C1240 and C1241 of the trunk line C1242. When the switch 400 is operated to its hold position, ground potential is applied to the conductor C1335, causing the control relay R442 to be reenergized. This circuit extends from ground at the switch spring 405 by way of the switch spring 405, C1235 and the winding of R442 to battery. When energized over the above-traced circuit the control relay R442 reoperates to interrupt at RA443 the bridge connection across the line conductor C1240 and C1241 of the trunk line C1242, and to complete at RA444 the circuit for energizing the control relay R446. Also, when the switch 400 is operated to its hold position an alternative bridge connection is completed in the switch 400 across the line conductors C1240 and C1241 of the trunk line C1242. This last-mentioned bridge connection extends from the line conductor C1240 by way of C1344, the switch springs 404 and 406 and C1345 to the line conductor C1241. Further, ground potential is applied to the control conductor C1332 when the switch 400 is operated to

its hold position, thereby to operate an auxiliary signal device to indicate to the chief operator that the switch 400 occupies its hold position, the path for applying ground potential to the control conductor C1332 extending from ground at the switch spring 406 by way of the switch spring 405, C1346 and the switch springs 401 and 402 to the control conductor C1332.

Should the chief operator desire to recomplete the connection between the primary telephone instrument at the chief operator's position 101 and the substation C, the switch 400 is operated from its hold position to its talk position. When the switch 400 is operated from its hold position, the path for applying ground potential to the control conductor C1332 and the circuit for energizing the control relay R442 are interrupted, due to the disengagement between the switch springs 406 and 405, thereby to cause the operation of the auxiliary signal device to be arrested and the control relay R442 to restore. Upon restoring, the control relay R442 recompletes the first-mentioned bridge connection across the line conductors C1240 and C1241 of the trunk line C1242, which connection is maintained due to the slow-to-release characteristics of the control relays R446 and R450 until the trunk line C1242 is reconnected to the trunk line C1239, thereby to recomplete the circuit for energizing the control relay R442 in series with the control relay R320. The subsequent operation of the control relays R320 and R442 is the same as that previously described, thereby to cause a two-way communication connection to be established between the primary telephone instrument at the chief operator's position 101 and the substation C.

In order to release the established connection between the primary telephone instrument at the chief operator's position 101 and the substation C the switch 400 is operated to its normal position, causing the trunk line C1239 to be disconnected from the trunk line C1242, and the switching relay R360 and the control relay R442 to restore. Upon restoring, the control relay R442 recompletes the first-mentioned bridge connection across the line conductors C1240 and C1241 of the trunk line C1242, and interrupts the circuit for energizing the control relay R446 as previously explained. Shortly thereafter, the control relay R446 restores and interrupts at RA447 the circuit for energizing the control relay R450. Shortly thereafter, the control relay R450 restores to interrupt at RA451 the first-mentioned bridge connection across the line conductors C1240 and C1241. Upon restoring, the control relay R450 also interrupts at RA452, RC454 and RA456, RC457, the circuit for charging the condenser 463, and connects at RA452, RC453 and RA456, RC458, the upper winding of the ring-up relay R460 across the line conductors C1240 and C1241. When the first-mentioned bridge connection across the line conductors C1240 and C1241 is interrupted the local switch train 107 begins to be released, causing switching surges to be impressed upon the line conductors C1240 and C1241 of the trunk line C1242. However, these switching surges do not cause the false operation of the ring-up relay R460 due to the charge upon the condenser 463. At this time the apparatus involved in the established connection between the primary telephone instrument at the chief operator's position 101 and the substation C is completely released for further use.

The chief operator's position 101 has access to the local switch train 107 and, in order to establish a connection between the chief operator's position and a substation to which the local switch train 107 has access, it is only necessary for the chief operator to operate the switch 400 to its talk position and then dial at the dialing mechanism 325 a proper series of digits into the local switch train 107, thereby to cause the local switch train 107 to select the subscriber line to which the desired substation is connected. For example, in extending a connection from the chief operator's position to the substation C, the switch 400 is operated to its talk position, the trunk line C1239 being connected to the trunk line C1242 by way of the switch 400 as previously explained. Also, the control conductor C1234 of the trunk line C1239 is connected by way of the switch 400 to the conductor C1335, thereby to cause the control relays R320 and R442 to be operated. Upon operating, the control relay R320 causes the primary telephone instrument at the chief operator's position to be connected to the trunk line C1239, and by way of the switch 400 to the trunk line C1242 extending to the local switch train 107 as previously explained. Upon operating, the control relay R442 causes the operation of the control relays R446 and R450 as previously explained. Upon operating, the control relay R450 prepares the primary bridge connection across the line conductors C1240 and C1241, and completes the circuit for charging the condenser 463 in series with the upper winding of the ring-up relay R460 in a manner similar to that previously explained. At this time, the primary telephone instrument at the chief operator's position is connected by way of the trunk line C1242 to the local switch train 107 whereupon the local switch train 107 is operated, thereby to condition the same to be responsive to series of digits dialed at the dialing mechanism 325. When the dialing mechanism 325 is operated to its off-normal position in order to transmit a series of impulses by way of the trunk line C1242 to the local switch train 107, the impulse springs 328 and 329 thereof are moved into disengagement and the contact springs 326 and 327 thereof are moved into engagement. The disengagement of the contact springs 328 and 329 interrupts the loop circuit between the secondary windings 308 and 309 of the transformer 305 and the impulse-responsive apparatus in the local switch train 107, thereby to transmit a first pulse to the impulse-responsive apparatus in the local switch train 107. When the contact springs 326 and 327 are moved into engagement an obvious circuit for energizing the control relay R315 is completed, this circuit extending from the grounded conductor C1329 by way of the contact springs 327 and 326, and the winding of R315 to battery. When energized over the above-traced circuit, the control relay R315 operates to complete at RA316 an obvious path for short-circuiting the secondary winding 309 of the transformer 305, thereby to minimize the impedance of the loop circuit extending to the impulse-responsive apparatus in the local switch train 107 so that distinct impulses are transmitted thereto. Upon operating, the control relay R315 also completes at RA316' an obvious circuit for energizing the control relay R320, this circuit extending from ground at the lower terminal of the winding of R320 by way of the winding of R320, RA316' and the resistor 315' to battery at the upper terminal of the winding of R315. When energized over the above-traced circuit

the control relay R320 operates to interrupt at RA321' a point in the circuit for connecting the receiver 331 across the secondary winding 309 of the transformer 305, thereby to prevent clicks in the receiver 331 corresponding to the impulses being transmitted from the dialing mechanism 325 by way of the trunk line C1242 to the impulse-responsive apparatus in the local switch train 107. The dialing mechanism 325 operates to move the impulse springs 328 and 329 into alternate engagement and disengagement, thereby to transmit a first series of impulses from the dialing mechanism by way of the trunk line C1242 to the impulse-responsive apparatus in the local switch train 107. At the end of the first series of impulses the contact springs 326 and 327 are moved into disengagement, thereby to interrupt the circuit for energizing the control relay R315, causing the latter relay to restore. Upon restoring, the control relay R315 interrupts at RA316 the path for short-circuiting the secondary winding 309 of the transformer 305, and interrupts at RA316' the circuit for energizing the control relay R320. The control relay R320, being of the slow-to-release type, does not immediately restore and is again energized before it restores upon the reoperation of the control relay R315, in the event the dialing mechanism 325 is again operated to transmit a second series of impulses by way of the trunk line C1242 to the impulse-responsive apparatus in the local switch train 107. The dialing mechanism 325 is operated to transmit a plurality of series of impulses by way of the trunk line C1242 to the local switch train 107 in order to cause the local switch train 107 to select the subscriber line 713 connected to the substation C. At the conclusion of the last series of impulses transmitted from the dialing mechanism 325, the impulse springs 328 and 329 are moved into engagement, thereby to establish a connection between the primary telephone instrument at the chief operator's position and the local switch train 107, and the contact springs 326 and 327 are moved into disengagement, thereby to interrupt the circuit for energizing the control relay R315, causing this relay to restore. Upon restoring, the control relay R315 interrupts at RA316 the path for short-circuiting the secondary winding 309 of the transformer 305, and interrupts at RA316' the circuit for energizing the control relay R320. Shortly thereafter, the control relay R320 restores to complete the circuit for connecting the receiver 331 across the secondary winding 309 of the transformer 305. After the called party at the substation C answers the call thereat, the primary telephone instrument at the chief operator's position is connected for two-way communication to the substation C.

Should the chief operator wish to hold the connection extending by way of the local switch train 107 to the substation C and free the primary telephone instrument at the chief operator's position 101 for other use, the switch 400 is operated to its hold position, as previously explained. The operation of the switching relay R360 and the operations of the control relays R442, R446 and R450, when the switch 400 is operated from its talk position to its hold position, are the same as previously described. As previously noted, the control relays R442, R446 and R450 operate to prevent the release of the local switch train 107 when the switch 400 is operated from its talk position, and the alternative bridge in the switch 400 is completed across the line conductors C1240 and C1241 of the trunk line C1242 when the switch 400 is operated to its hold position as previously noted. The chief operator may reestablish the connection between the primary telephone instrument at the chief operator's position and the substation C by operating the switch 400 from its hold position to its talk position. The release of the apparatus involved in the established connection between the primary telephone instrument at the chief operator's position and the substation C is under the control of the chief operator and may be effected by operating the switch 400 to its normal position, thereby to cause the apparatus to be released in the manner previously described.

The chief operator's position 101 has access to the toll switch train 108 and, in order to establish a connection between the chief operator's position and a distant exchange, to which the toll switch train 108 has access, it is only necessary for the chief operator to operate the switch 427 to its talk position and then dial at the dialing mechanism 325 a proper series of digits into the toll switch train 108, thereby to cause the toll switch train 108 to select an idle trunk line extending to the desired distant exchange. For example, in extending a connection from the chief operator's position to the distant exchange 105, the switch 427 is first operated to its right-hand or talk position. When the switch 427 is operated to its talk position, the trunk line C1239 is connected to the trunk line C1247 by way of the switch 427, the line conductors C1235 and C1236 of the trunk line C1239 being respectively connected to the line conductors C1245 and C1244 of the trunk line C1247. More particularly, the line conductor C1235 is connected by way of the switch springs 440 and 439 to the line conductor C1245, and the line conductor C1236 is connected by way of the switch springs 437 and 438 to the line conductor C1244. Also the control conductor C1234 of the trunk line C1239 is connected by way of the switch springs 435 and 436 to the conductor C1336, thereby to complete an obvious circuit for energizing in series the control relays R320 and R474, this circuit extending from ground at the lower terminal of the winding of R320 by way of the winding R320, RC369, RA367, C1234, the switch springs 435 and 436, C1336 and the winding of R474 to battery. When energized over the above-traced circuit the control relays R320 and R474 operate, the control relay R320 operating to cause operation of the switching relay R360, which latter relay operates as previously explained. Upon operating, the control relay R474 completes at RA475 an obvious circuit for energizing the control relay R476. When energized, the control relay R476 operates to complete at RA477 a connection between the control conductor C1243 of the trunk line C1247 and the control conductor C1237 of the trunk line C1239, thereby to prepare a circuit, traced hereinafter, for energizing the control relay R358. The control relay R476 also completes at RA478 a path for applying ground potential to the control conductor C1246 of the trunk line C1247, thereby to mark the trunk line C1247 in the toll switch train 108 as a calling line. The toll switch train 108 then operates to find the calling trunk line C1247, at which time the impulsing apparatus in the toll switch train 108 is conditioned to be responsive to a series of digits dialed at the dialing mechanism 325. The dialing mechanism 325 is then operated to transmit by way of the trunk line C1247 a first series of impulses to the toll

switch train 108 in a manner similar to that previously explained. When the dialing mechanism 325 is operated the control relays R315 and R320 operate, as previously described. In response to the first series of impulses transmitted to the impuse-responsive apparatus in the toll switch train 108, a selector switch therein operates to select a group of trunk lines extending to a connector switch having access to the toll line C714 extending to the distant exchange 105. At the conclusion of the first series of impulses this selector switch in the toll switch train 108 operates automatically to find an idle trunk line extending to the connector switch noted. During the time the selector switch is operating to find an idle trunk line extending to the connector switch noted, a series of impulses are transmitted by way of the control conductor C1243 of the trunk line C1247 to energize the control relay R358, thereby to cause intermittent operation thereof. This circuit for intermittently energizing the control relay R358 extends from pulsating battery in the toll switch train 108 by way of the control conductor C1243, RA477, the switch springs 432 and 434, the control conductor C1237, the switch springs 353 and 352 of the switch 351, C1347 and the winding of R358 to ground. When intermittently energized over the above-traced circuit, the control relay R350 intermittently operates to intermittently complete at RA359 an obvious circuit for illuminating the lamp L304, thereby to cause the lamp L304 to flash. This flashing of the lamp L304 indicates to the chief operator that the toll switch train 108 is operating in response to the last digit dialed and that no further digit should be dialed at this time. When the selector switch in the toll switch train 108 finds an idle trunk line extending to the connector switch noted, the circuit for transmitting impulses by way of the control conductor C1243 to energize intermittently the control relay R358 is interrupted in the toll switch train 108. When the circuit for intermittently energizing the control relay R358 is interrupted, operation of the control relay R358 is arrested. Flashing of the lamp L304 is then arrested, thereby to indicate to the chief operator that the next digit may be dialed at the dialing mechanism 325. The chief operator then dials one or more successive digits, thereby to transmit one or more series of impulses to the toll switch train 108 in order to cause the connector switch mentioned to select an idle toll line extending to the distant exchange 105. Assuming that the toll line C714 is the toll line selected by the connector switch mentioned, the connection between the toll switch train 108 and the distant exchange 105 extends from the toll switch train 108 by way of the trunk line C717, the toll line circuit individual to the toll line C714 in the group of toll line circuits 110 and the toll line C714 to the distant exchange 105. At this time the call from the toll operator's position is extended by way of the trunk line C1239, the switch 427, the trunk line C1247, the toll switch train 108, the trunk line C717, the toll line circuit individual to the toll line C714 and the toll line C714 to the distant exchange 105. In order to advice the toll operator at the distant exchange 105 that a toll call is incoming thereto, the chief operator causes ringing current to be projected over the toll line C714 to the toll operator's position at the distant exchange 105. This is accomplished by operating the switch 380 to its right-hand or ring position. When the switch 380 is operated to its ring position, ground at the switch spring 394 is connected by way of the switch spring 395, C1319 and the switch spring 388 to the line conductor C1235 of the trunk line C1239, and battery is connected by way of the resistor 376 and the contact springs 398' and 398 to the line conductor C1236 of the trunk line C1239. This causes a ringing current to be projected by way of the toll switch train 108 and the toll line C714 to the toll operator's position in the distant exchange 105. The toll operator in the distant exchange 105 then answers the toll call, thereby to complete a connection between the primary telephone instrument at the chief operator's position and the telephone instrument of the toll operator in the distant exchange 105 for two-way communication therebetween. The switch 380 is then returned to its normal position to interrupt the projection of ringing current to the toll operator's position in the distant exchange 105.

Should the chief operator desire to hold the connection extending by way of the toll switch train 108 and the toll line C714 to the distant exchange 105 and free the primary telephone instrument at the chief operator's position for other use, the switch 427 is operated to its left-hand or hold position. When the switch 427 is operated from its talk position, the trunk line C1239 is disconnected from the trunk line C1247 and th circuit for energizing in series the switching relay R360 and the control relay R474 is interrupted. The switching relay R360 then restores, as previously explained, and the control relay R474, being of the slow-to-release type, does not immediately restore to interrupt at RA475 the circuit for energizing the control relay R476. Due to the fact that both of the control relays R474 and R476 are of the slow-to-release type, there is ample time for the switch 427 to be operated from its talk position to its hold position before the control relay R476 restores to interrupt at RA478 the path for applying ground potential to the control conductor C1246 of the trunk line C1247. Thus, the control relay R476 remains in its operated position to retain ground potential at RA478 upon the control conductor C1246, thereby to retain the toll switch train 108 in its operated position. When the switch 427 is operated to its hold position an obvious circuit for energizing the control relay R474 is completed, this circuit extending from ground at the switch spring 430 by way of the switch spring 431, C1336 and the winding of R474 to battery, thereby to retain the control relay R474 in its operated position while the switch 427 occupies its hold position. Also, when the switch 427 is operated to its hold position, the switch springs 428 and 429 are moved into engagement, thereby to apply ground at the switch spring 430 by way of the switch springs 428 and 429 to the control conductor C1334. The application of ground potential to the control conductor C1334 causes an auxiliary signal device to be operated, thereby to indicate to the chief operator that the switch 427 occupies its hold position. Furthermore, when the switch 427 is operated from its talk position the switch springs 432 and 433 are moved into engagement, thereby to complete a path for applying battery potential to the control conductor C1243 of the trunk line C1247. The application of battery potential to the control conductor C1243 completes a circuit for energizing a signal device at the toll board 100, thereby to indicate

at the toll board that the chief operator is holding a toll connection. This circuit extends from battery by way of the resistor 479, the switch springs 433 and 432, RA477, the control conductor C1243 of the trunk line C1247, the toll switch train 108, and the signal device at the toll board 100 to ground.

Should the chief operator desire to reconnect the primary telephone instrument at the chief operator's position to the telephone instrument at the toll operator's position in the distant exchange 105, the switch 427 is operated from its hold position to its talk position. When the switch 427 is operated from its hold position the path for applying ground potential to the control conductor C1334 is interrupted, due to the disengagement of the switch springs 428 and 429, thereby to arrest operation of the auxiliary signal device. Operation of the switch 427 from its hold position also interrupts the circuit for energizing the control relay R474. However, this relay does not immediately restore, due to its slow-to-release characteristic, as previously pointed out. When the switch 427 is operated to its talk position, the circuit for energizing in series the control relays R320 and R474 is recompleted, thereby to cause reoperation of the control relay R320 as previously explained and to retain the control relay R474 in its operated position. Also, the operation of the switch 427 to its talk position causes the switch springs 432 and 433 to be moved into disengagement, thereby to interrupt the circuit for operating the signal device at the toll board 100 in order to indicate at the toll board that the chief operator is no longer holding a toll connection.

In order to release the established connection between the primary telephone instrument at the chief operator's position and the toll operator's position in the distant exchange 105, the switch 427 is returned to its normal position, thereby to disconnect the trunk line C1239 from the trunk line C1247, and to interrupt the circuit for energizing in series the switching relay R360 and the control relay R474. The switching relay R360 then restores to release the apparatus at the chief operator's position as previously explained, and the control relay R474 restores shortly thereafter to interrupt at RA475 the circuit for energizing the control relay R476. Shortly thereafter, the control relay R476 restores to interrupt at RA477 the circuit for energizing the signal device at the toll board 100 and to remove the application of ground potential is RA478 to the control conductor C1246 of the trunk line C1247. When ground potential is removed from the control conductor C1246, the toll switch train 108 is released and the line circuit individual to the toll line C714 is released. At this time the apparatus involved in the established connection between the chief operator's position and the toll operator in the distant exchange 105 is completely released for further use.

The toll switch train 108 has access to the chief operator's position 101 and, in order to establish a connection between a toll line incoming to the toll board 100 and the chief operator's position, it is only necessary for the toll operator at the toll operator's position at the toll board 100 answering the toll call on the incoming toll line first to dial a proper series of digits into the toll switch train 103 in order to cause the toll switch train to seize the trunk line C1252 extending to the chief operator's position, and after the call is answered by the chief operator at the chief operator's position, to connect the incoming toll line through to the toll switch train 108. For example, in extending a connection from the toll line C715 incoming to the toll board 100 and extending to the distant exchange 106 to the chief operator's position and routed by way of the first toll operator's position 702 at the toll board 100, the toll operator at the first toll operator's position 702, after answering the toll call on the toll line C715, dials a proper series of digits by way of the trunk line C720 into the toll switch train 108, thereby to cause the toll switch train to seize the trunk line C1252 extending to the chief operator's position. When the trunk line C1252 is seized by the toll switch train 108, ground potential in the toll switch train is applied to the control conductor C1251 of the trunk line C1252, thereby to complete an obvious circuit for energizing the control relay R472. This circuit extends from the grounded control conductor C1251 by way of the winding of R472 to battery. When energized over the above-traced circuit, the control relay R472 operates to ground at RA474 the control conductor C1248 in order to operate a signal device at the toll board 100. This path for grounding the control conductor C1248 extends from the grounded conductor C1347 by way of the switch springs 419 and 418 and RA474 to the control conductor C1248. Also, the control relay R472 completes at RA473 a circuit for illuminating the lamp L467, this circuit extending from ground at RA473 by way of RA469 and RC471 to one terminal of the lamp, and from the other terminal of the lamp to battery. The illumination of the lamp L467 indicates to the chief operator that a toll operator at one of the toll operator's positions at the toll board 100 is extending a toll call to the chief operator's position 101. In order to answer the call, the chief operator operates the switch 413 to its right-hand or talk position. When the switch is operated to its talk position, the line conductors C1235 and C1236 of the trunk line C1239 are connected to the line conductors C1250 and C1249, respectively, of the trunk line C1252, the line conductor C1235 being connected by way of the switch springs 426 and 425 to the line conductor C1250, and the line conductor C1236 being connected by way of the switch springs 423 and 424 to the line conductor C1249. Also, the control conductor C1234 is connected by way of the switch springs 421 and 422 to the conductor C1237, thereby completing an obvious circuit for energizing the control relays R320 and R464. This circuit extends from ground at the lower terminal of the winding of R320 by way of the winding of R320, RC369, RA367, C1234, the switch springs 421 and 422, C1337 and the winding of R464 to battery. When energized over the above-traced circuit, the control relays R320 and R464 operate, the control relay R320 operating to cause operation of the switching relay R360, which latter relay operates as previously explained. Upon operating, the control relay R464 completes at RA465 an obvious path for applying multiple ground potential at RA465 to the control conductor C1251 of the trunk line C1252, and completes at RA466 a circuit for energizing the control relay R468. The latter circuit extends from ground at RA466 by way of the winding of R468 to battery. When energized over the above-traced circuit the control relay R468 operates to interrupt at RA469 and RC471 a point in the circuit for illuminating the lamp L467, and completes at RA469 and

RC470 a holding circuit for itself extending from ground at RA473 by way of RA469, RC470 and the winding of R468 to battery. Also, when the switch 413 is operated to its talk position, the switch springs 418 and 419 are moved into disengagement, thereby to interrupt the path for applying ground potential to the control conductor C1248 of the trunk line C1252. When ground potential is removed from the control conductor C1248, the operation of the signal device at the toll board is interrupted, thereby to indicate to the operator at the first toll operator's position that the chief operator has answered the call. Also, when the switch 413 is operated to its talk position, the switch springs 416 and 420 are moved into engagement, thereby to connect the control conductor C1248 of the trunk line C1252 to the control conductor C1238 of the trunk line C1239. The connection of the control conductor C1248 to the control conductor C1238 prepares an alternative path for applying ground potential at the switch 351 to the control conductor C1248, thereby to operate the signal device at the toll board. This path may be completed by operating the switch 351 to its left-hand position, thereby to move the grounded switch spring 354' into engagement with the switch spring 354 connected to the control conductor C1238. Preferably, the switch 351 is operated intermittently between its normal and left-hand position, thereby to intermittently complete the path for applying ground potential to the control conductor C1248. This operation of the switch 351 causes the signal device at the toll board to operate intermittently, thereby to indicate to the operator at the first toll operator's position 702 that the chief operator wishes to communicate with her, whereupon the operator at the first toll operator's position connects the telephone instrument at her position to the trunk line C720 connected by way of the toll switch train 108 to the trunk line C1252. At this time the primary telephone instrument at the chief operator's position is connected by way of the trunk line C1239, the switch 413, the trunk line C1252, the toll switch train 108 and the trunk line C720 to the telephone instrument at the first toll operator's position 702. The operator at the first toll operator's position 702 may then connect the trunk line C720 to the toll line C715, thereby to complete a connection between the chief operator's position 101 and the toll operator's position in the distant exchange 106 for two-way communication between the primary telephone instrument at the chief operator's position and the telephone instrument at the toll operator's position in the distant exchange 106.

Should the chief operator desire to hold the connection extending by way of the toll switch train 108 and the toll line C715 to the distant exchange 106 and free the primary telephone instrument at the chief operator's position for other use, the switch 413 is operated to its left-hand or hold position. When the switch 413 is operated from its talk position, the trunk line C1239 is disconnected from the trunk line C1252, and the circuit for energizing in series the switching relay R360 and the control relay R464 is interrupted. The switching relay R360 then restores as previously explained, and the control relay R464 restores to interrupt at RA465 the path for applying multiple ground potential to the control conductor C1251 and to interrupt at RA466 the original circuit for operating the control relay R468. The toll switch train 108 is not released, however, as the release thereof is under the control of the toll operator in the distant exchange 106. Thus, ground potential remains upon the control conductor C1251 of the trunk line C1252. Thus, the control relay R472 remains in its operated position to maintain the holding circuit of the control relay R468 completed. Accordingly, the control relay R468 remains in its operated position to prevent the completion of the circuit for illuminating the lamp L467. Also, when the switch 413 is operated from its talk position, the switch springs 418 and 419 are again moved into engagement, thereby to complete the path for applying ground potential to the control conductor C1248. The application of ground potential to the control conductor C1248 at this time indicates to the toll operator at the first toll operator's position 702 that the chief operator has operated the switch 413 from its talk position. When the switch 413 is operated to its hold position, an obvious circuit for engaging the control relay R464 is completed, this circuit extending from the ground conductor C1347 by way of the switch springs 416 and 417, C1337 and the winding of R464 to battery. The control relay R464 then reoperates to again apply multiple ground potential at RA465 to the control conductor C1251 and to recomplete at RA466 the original circuit for operating the control relay R468. Also, when the switch 413 is operated to its hold position, the switch springs 414 and 415 are moved into engagement, thereby to apply ground potential from the grounded conductor C1347 by way of the switch springs 414 and 415 to the control conductor C1333. The application of ground potential to the control conductor C1333 causes an auxiliary signal device to be operated, thereby to indicate to the chief operator that the switch 413 occupies its hold position.

Should the chief operator desire to reconnect the primary telephone instrument at the chief operator's position to the telephone instrument at the toll operator's position in the distant exchange 106, the switch 413 is operated from its hold position to its talk position. When the switch 413 is operated from its hold position, the path for applying ground potential to the control conductor C1333 is interrupted, due to the disengagement of the switch springs 414 and 415, thereby to arrest operation of the auxiliary signal device. Operation of the switch 413 from its hold position also interrupts the circuit for energizing the control relay R464, causing this relay to restore, as previously explained. When the switch 413 is operated to its talk position, the circuit for energizing in series the control relays R320 and R464 is recompleted, thereby to cause reoperation of these control relays as previously explained. Also, the operation of the switch 413 to its talk position causes the switch springs 418 and 419 to be moved into disengagement, thereby to interrupt the circuit for operating the signal device at the toll board.

In order to release the established connection between the primary telephone instrument at the chief operator's position and the telephone instrument at the toll operator's position in the distant exchange 106, and to release the apparatus involved in establishing this connection, it is necessary for the chief operator to operate the switch 413 to its normal position and the toll operator in the distant exchange 106 to interrupt the loop extending from the telephone instrument at the toll operator's position in the

distant exchange 106 to the toll switch train 103. When the switch 413 is operated to its normal position, the trunk line C1239 is disconnected from the trunk line C1252 and the circuit for energizing the control relay R464 is interrupted, causing this relay to restore. However, the control relays R468 and R472 remain in their operated positions until the toll switch train 103 is released by the toll operator at the toll operator's position in the distant exchange 106. When the toll operator at the toll operator's position in the distant exchange 106 interrupts the loop extending to the toll switch train 103, the toll switch train is released, thereby to remove ground potential from the control conductor C1251 of the trunk line C1252. When the ground potential is removed from the control conductor C1251, the circuit for energizing the control relay R472 and the holding circuit of the control relay R468 are interrupted, thereby to cause these control relays to restore. At this time, the apparatus involved in the established connection between the chief operator's position and the toll operator's position in the distant exchange 106 is completely released for further use.

Signal apparatus common to the toll operator's positions at the toll board 100 is provided at the chief operator's position in order to indicate to the chief operator a delayed time interval in answering an incoming toll call. The illustrated signal apparatus 400 is associated with the inward group of toll lines at the toll board 100 and includes a control conductor C1253 connected to the position distributor 704. The position distributor 704 is so constructed and arranged that ground potential is applied to the control conductor C1253 when the position distributor 704 may not operate to assign an incoming toll call to one of the toll operator's positions, due to the fact that all of the toll operator's positions are busy and none of the link-listening keys thereat are operated to cause the position distributor 704 to operate to select the corresponding toll operator's position. When ground potential is applied to the control conductor C1253, a circuit is completed for energizing the control relay R481, this circuit extending from the grounded control conductor C1253 by way of the lamp L498 and the upper winding of R481 to battery. The resistance of this circuit is too high to cause the lamp L498 to be illuminated, although the control relay R481 is operated. Upon operating, the control relay R481 completes at RA481' circuits for energizing the control relays R484 and R496, the circuit for energizing the control relay R496 extending from ground at RA481' by way of RA493 and the winding of R484 to battery, and the circuit for energizing the control relay R499 extending from ground at RA481' by way of RA492 and the winding of R496 to battery. When energized over the above-traced circuit, the control relay R484 operates to move its weighted armature RA485 into engagement with the contact RC487, thereby to complete a circuit for energizing the control relay R488, this circuit extending from ground at RA481' by way of RA485, RC487, RC491, RA490 and the winding of R488 to battery. Simultaneously, the control relay R496 operates to complete at RA497 a holding circuit for itself extending from ground at RA481' by way of RA485, RC487, RA497 and the winding of R496 to battery, and interrupts at RA498' a point in a circuit traced hereinafter for energizing the control relay R482. Shortly after the control relay R488 is energized over the above-traced circuit, it operates as it is of the slow-to-operate type. Upon operating, the control relay R488 completes at RA489 and RA490 a holding circuit for itself extending from ground at RA481' by way of RA489, RA490 and the winding of R488 to battery, interrupts at RA490 and RC491 its original operating circuit, and prepares at RA494 a point in the circuit for energizing the control relay R482. Also upon operating, the control relay R488 interrupts at RA492 the original circuit for operating the control relay R496, and interrupts at RA493 the circuit for operating the control relay R484. When the operating circuit of the control relay R484 is interrupted, this relay restores to cause its weighted armature RA485 to vibrate into alternate engagements with the contacts RC486 and RC487 for a predetermined interval of time. As the weighted armature RA485 alternately engages the contacts RC486 and RC487, the holding circuit for the control relay R499 is alternately completed and the latter relay, being of the slow-to-release type, does not restore so long as the weighted armature RA485 alternately engages the contacts RC486 and RC487. After a predetermined time interval, however, the weighted armature RA485 assumes an intermediate position between the contacts RC486 and RC487, thereby completely interrupting the holding circuit of the control relay R496. Shortly thereafter, the control relay R596 restores to interrupt at RA497 a further point in its holding circuit and to complete at RA498' the circuit for energizing the control relay R482. The circuit for energizing the control relay R482 extends from pulsating ground potential upon the control conductor C482 by way of RA498', RA494 and the winding of R482 to battery. Preferably, the pulsating ground potential upon the control conductor C482 is at the rate of sixty impulses per minute, thereby to cause the relay R482 to operate and restore sixty times per minute. Each time the control relay R482 is operated, it completes at RA483 a circuit for energizing the lower winding of the control relay R481 in multiple with the upper winding thereof. This circuit extends from the grounded control conductor C1253 by way of the lamp L498, RA483 and the lower winding of R481 to battery. When the lower winding of the relay R481 is energized in multiple with the upper winding thereof, the lamp L498 is illuminated, due to the relatively low resistance of the lower winding of the control relay R481. On the other hand, when the control relay R482 restores, it interrupts at RA483 the circuit for energizing the lower winding of R481 in multiple with the upper winding thereof, and the lamp L498 is extinguished, due to the high resistance of the upper winding of R481, as previously noted. Thus, the lamp L498 flashes at a rate of sixty times per minute, indicating to the chief operator that an incoming toll call at the toll board 100 has not been answered in a given time interval. Preferably, this time interval comprises four seconds and is determined by the characteristics of the vibratory control relay R484, the slow-to-operate control relay R488 and the slow-to-release control relay R496. In the event that the operator at the first toll operator's position 702 answers the incoming toll call after a four-second delay, ground potential is removed from the control conductor C1253, causing the control relay R481 to be deenergized. When the control relay R481 is deenergized it restores to interrupt

at RA481' the holding circuit of the control relay R488, which latter relay restores. Upon restoring, the control relay R488 interrupts at RA494 the circuit for energizing the control relay R482. At this time, the lamp L498 is extinguished and the apparatus 480 is released for further use.

Operation of the apparatus at the supervisory operator's position

The toll switch train 108 has access to each supervisory operator's position and, in order to establish a connection between a toll operator's position having access to the toll switch train 108 and a particular supervisory operator's position, it is only necessary for the operator at the toll operator's position to dial a proper series of digits into the toll switch train 108 in order to cause the toll switch train 108 to seize the trunk line extending to the particular supervisory operator's position. For example, in extending a connection from the first toll operator's position 702 to the supervisory operator's position 102, the operator at the first toll operator's position 702 seizes the toll switch train 108 and dials a proper series of digits thereinto to cause the toll switch train 108 to seize the trunk line C1269 extending to the supervisory operator's position 102. When the toll switch train 108 seizes the trunk line C1269, ground potential in the toll switch train 108 is applied to the control conductor C1266 of the trunk line C1269. The application of ground potential to the control conductor C1269 completes an obvious circuit for energizing the control relay R640, thereby to cause this relay to operate. Upon operating, the control relay R640 prepares at RA641 a point in a circuit traced hereinafter for energizing the ring-up relay R650, completes at RA642 a circuit extending from ground at RA642 by way of RA646, RC648 and the lamp L649 to battery for illuminating the lamp L649, and completes at RA643 an obvious path for applying ground potential at RA652 to the control conductor C1268 of the trunk line C1269. The application of ground potential to the control conductor C1268 causes a signal device at the toll board to be operated, thereby to indicate to the operator at the first toll operator's position 702 that the call has not been answered by the operator at the supervisory operator's position 102. The illumination of the lamp L649 indicates to the operator at the supervisory operator's position 102 that a call is being extended thereto.

The operator at the first toll operator's position 702 applies ringing current extending from battery to the line conductor C1265 of the trunk line C1269, thereby to cause the ring-up relay R650 to be energized. The circuit for energizing the ring-up relay R650 extends from battery by way of the line conductor C1265, RA641, RA645 and the winding of R650 to ground. When energized over the above-traced circuit, the ring-up relay R650 operates to complete at RA651 a circuit for operating the audible alarm device 680 at the supervisory operator's position 102, this circuit extending from the ungrounded terminal of a grounded alternating current generator, not shown, by way of the conductor C1349, RA651, the self-interrupting contacts 681 of the alarm device 680, the winding of the alarm device 680, the switch springs 675 and 676 of the switch 674 and the winding of the control relay R652 to grounded battery. The alarm device 680 operates in an obvious manner to indicate to the supervisory operator at the supervisory operator's position 102 that a call is being extended thereto. It is noted that when the control relay R652 is energized over the above-traced circuit it does not operate due to the high series resistance of the winding of the alarm device 680. The supervisory operator may immediately answer the call extending thereto or arrest the operation of the alarm device 680 by operating the switch 674 to move the switch springs 675 and 676 into disengagement, thereby to interrupt the circuit for operating the alarm device 680.

In answering the call, the operator at the supervisory operator's position 102 inserts the plugs 658 and 662 into the jacks 666 and 670, respectively. At this time the transmitter 678 of the telephone instrument at the supervisory operator's position 102 is connected in series with the answer relay R654 and the primary winding 692 of the transformer 690, this circuit extending from ground at the lower terminal of the upper winding of R654 by way of the upper winding of R654, the primary winding 692 of the transformer 690, the jack tip 667 and the plug tip 659 to one terminal of the transmitter 678, and from the other terminal of the transmitter 678 by way of the plug tip 663, the jack tip 671 and the lower winding of R654 to battery. Also, the receiver 679 of the telephone instrument at the supervisory operator's position 102 is connected across the secondary winding 694 of the transformer 690, one terminal of the receiver 679 being connected by way of the plug ring 660 and the jack ring 668 to the lower terminal of the secondary winding 694 and the other terminal of the receiver 679 being connected by way of the plug ring 664 and the jack ring 672 to the upper terminal of the secondary winding 694. At this time the telephone instrument at the supervisory operator's position 102 is connected by way of the transformer 690 to the trunk line C1269 for two-way communication thereover. The signal currents generated in the transmitter 678 traverse a circuit extending from one terminal of the transmitter by way of the plug tip 659, the jack tip 667, the primary winding 692 of the transformer 690, the condenser 657, the jack tip 671 and the plug tip 663 to the other terminal of the transmitter. The secondary windings 693 and 694 of the transformer 690 are connected across the line conductors C1265 and C1267 of the trunk line C1269, this connection extending from the line conductor C1265 by way of the secondary windings 693 and 694 and the condenser 653 to the line conductor C1267. When the transmitter is connected in the above-traced series circuit, the answer relay R654 is operated to complete at RA655 an obvious circuit for energizing the control relay R644 and to complete at RA656 an obvious circuit for energizing the control relay R652. When the control relay R644 is energized, it operates to interrupt at RA645 the circuit for energizing the ring-up relay R650, to interrupt at RA646 and RC648 the circuit for illuminating the lamp L649 and to complete at RA646 and RC647 a holding circuit for itself. The holding circuit of the control relay R644 extends from ground at RA642 by way of RA646, RC647 and the winding of R644 to battery. When the ring-up relay R650 restores, it interrupts at RA651 the circuit for operating the alarm device 680, thereby to arrest further operation thereof. When energized over the above-traced circuit, the control relay R652 operates to interrupt at RA652 the path for applying ground potential to the control conductor C1268 of the trunk line C1269, thereby to interrupt the circuit for

operating the signal device at the toll board 100. When the circuit for energizing the signal device at the toll board is interrupted, further operation of the signal device is arrested, thereby to indicate to the operator at the first toll operator's position 702 that the operator at the supervisory operator's position 102 has answered the call extending thereto.

In order to release the established connection between the first toll operator's position 702 and the telephone instrument at the supervisory operator's position 102, the supervisory operator withdraws the plugs 658 and 662, respectively, from the jacks 666 and 670, and the toll operator at the first toll operator's position 702 releases the toll switch train 108. When the plugs 658 and 662 are withdrawn from the jacks 666 and 670, the circuit for energizing the answer relay R654 is interrupted, causing this relay to restore. When the answer relay R654 restores, it interrupts at RA655 the original circuit for operating the control relay R644, and interrupts at RA656 the operating circuit of the control relay R652, causing this relay to restore. Upon restoring, the control relay R652 prepares at RA652 a point in the path for applying ground potential to the control conductor C1268 of the trunk line C1269. When the toll switch train 108 is released, ground potential is removed from the control conductor C1266, thereby to interrupt the operating circuit of the control relay R640, causing this relay to restore. Upon restoring, the control relay R640 interrupts at RA641 a point in the operating circuit of the ring-up relay R650, interrupts at RA642 the holding circuit of the control relay R644, causing this relay to restore, and interrupts at RA643 a point in the path for applying ground potential to the control conductor C1268 of the trunk line C1269. Upon restoring, the control relay R644 prepares at RA645 a point in the operating circuit of the ring-up relay R650, interrupts at RA646 and RC647 a further point in its holding circuit, and prepares at RA646 and RC648 a point in the circuit for illuminating the lamp L649. At this time the apparatus involved in establishing the connection between the first toll operator's position 702 and the telephone instrument at the supervisory operator's position 102 is released for further use.

The chief operator's position 101 has access to the supervisory operator's position 102, and a monitoring connection therebetween may be established by inserting the monitoring plug 300 into the jack 605 connected to the trunk line C1339 extending to the supervisory operator's position 102, as previously noted. When the monitoring plug 300 is inserted in the jack 605, a loop circuit is completed between the primary windings 372, 373 and 374 of the transformer 370 and the secondary windings 693 and 694 of the transformer 690, this circuit extending from the upper terminal of the primary winding 372 by way of the secondary windings 372, 373 and 374, the condenser 375, C1310, the switch springs 386 and 387, C1320, the switch springs 399 and 399', C1312, the plug ring 302, the jack ring 607, C1267, the condenser 653, the secondary windings 694 and 693, C1323, the jack tip 606, the plug tip 301, C1311, the switch springs 392 and 393, C1317, the switch springs 384 and 385, and C1309 to the upper terminal of the primary winding 372. At this time the receiver 331 at the primary telephone instrument at the chief operator's position 101 is connected across the secondary winding 371 of the transformer 370, thereby to complete a monitoring connection between the receiver 331 and the telephone instrument at the supervisory operator's position 102.

In order for the chief operator at the chief operator's position 101 to establish a connection between the chief operator's position 101 and the supervisory operator's position 102, when the supervisory operator's position 102 is idle, the switch 380 is operated to its ring position after the monitoring plug 300 is inserted into the jack 605. When the monitoring plug 300 is inserted into the jack 605, ground potential upon the switch spring 355 is applied by way of the switch spring 356, C1342, the plug sleeve 303 and the jack sleeve 608 to the control conductor C1224 of the trunk line C1339 extending to the supervisory operator's position 102, thereby to complete a circuit for energizing the control relay R640, the upper terminal of the winding of R640 being connected to the control conductor C1324 and the lower terminal thereof being connected to battery. When energized over the above-traced circuit, the control relay R640 operates to prepare at RA641 a circuit for energizing the ring-up relay R650, and to complete at RA642 the circuit for illuminating the lamp L649. When the switch 380 is operated to its ring position, battery at the resistor 376 is applied by way of RA369', C1315, the switch springs 391 and 392, C1311, the plug tip 301 and the jack tip 606 to the line conductor C1323 of the trunk line C1339, thereby to complete a circuit for energizing the ring-up relay R650, the upper terminal of the winding of R650 being connected by way of RA645 and RA641 to the line conductor C1323 and the lower terminal of the winding of R650 being connected to ground. When energized over the above-traced circuit, the ring-up relay R650 operates as previously explained to cause operation of the signal device 680. The call at the supervisory operator's position 102 is answered by inserting the plugs 658 and 662 into the jacks 666 and 670, thereby to cause operation of the remainder of the apparatus at the supervisory operator's position 102 in the manner previously explained. The chief operator retains the switch 380 in its ring position a sufficient length of time to permit the operator at the supervisory operator's position 102 to answer the call, at which time she operates the switch 380 to its talk position. The operation of the apparatus at the chief operator's position 101 in response to the operation of the switch 380 to its talk position is the same as that previously described, thereby to complete a connection for two-way communication between the primary telephone instrument at the chief operator's position 101 and the telephone instrument at the supervisory operator's position 102. At this time the control relay R640 is held in operated position by way of an energizing circuit extending from the grounded switch spring 390 by way of C1322, the switch springs 382 and 381, C1313, the plug sleeve 303, the jack sleeve 608, the control conductor C1324 and the winding of R640 to battery.

In order to release the established connection between the chief operator's position 101 and the supervisory operator's position 102, the chief operator returns the switch 380 to its normal position, thereby to move the switch springs 381 and 382 into disengagement in order to interrupt the circuit for energizing the control relay R640, causing this relay to restore. The restoration of the control relay R640 effects a partial release of the apparatus at the supervisory operator's

position 102, as previously explained, the remainder of the apparatus at the supervisory operator's position 102 being released when the plugs 658 and 662 are withdrawn from the jacks 666 and 670, respectively, as previously explained. Also, the operation of the switch 380 to its normal position effects the release of the apparatus at the chief operator's position 101 in the manner previously explained. At this time the apparatus involved in establishing the connection between the chief operator's position 101 and the supervisory operator's position 102 is completely released for further use.

Operation of the apparatus at the rate and directory operator's position

The toll switch train 108 has access to each rate and directory operator's position; and in order to establish a connection between a toll operator's position having access to the toll switch train 108 and an idle rate and directory operator's position, it is only necessary for the operator at the toll operator's position to dial a proper series of digits into the toll switch train 108 in order to cause the toll switch train to seize a trunk line extending to an idle rate and directory operator's position. For example, in extending a connection from the first toll operator's position 702 to an idle rate and directory operator's position, the toll operator at the first toll operator's position seizes the toll switch train 108 and dials a proper series of digits thereinto to cause the toll switch train 108 to seize a trunk line extending to an idle rate and directory operator's position. The trunk lines extending to the rate and directory operators' positions are assigned by the distributor apparatus 1170 to be seized by the toll switch train 108 in a predetermined order. More specifically, the trunk lines extending to the rate and directory operators' positions are seized sequentially. And when all of the trunk lines extending to the rate and directory operators' positions are busy, the toll switch train 108 automatically seizes an auxiliary trunk line to which each of the rate and directory operators' positions have access in a manner more fully explained subsequently. Assuming that the first rate and directory operator's position is idle when the call is initiated at the first toll operator's position 702, the toll switch train 108 seizes the trunk line C1271 extending thereto. At this time the plugs 1007 and 1010 associated with the telephone instrument at the first rate and directory operator's position 103 are inserted, respectively, into the jacks 1001 and 1004, thereby to complete an energizing circuit for the transmitter 1013 thereof and to complete a bridge connection between the receiver 1014 thereof and the secondary winding 914 of the transformer 910. The circuit for energizing the transmitter 1013 extends from ground at the upper terminal of the lower winding of the control relay R905 by way of the lower winding thereof, C1273, the cable C1282, C1273, the jack tip 1006, the plug tip 1012, the transmitter 1013, the plug tip 1009, the jack tip 1003, C1275, the cable C1282, C1275, the primary winding 912 of the transformer 910 and the upper winding of R905 to battery. When energized over the above-traced circuit, the transmitter 1013 is conditioned to transmit signalling currents to the primary winding 912 of the transformer 910; and when the control relay R905 is energized over this circuit, it operates. Upon operating, the control relay R905 interrupts, at RA906 and RC908, a point in a circuit, traced hereinafter, for operating the control relays R1120 and R1150, thereby to render the first rate and directory operator's position busy. Further, the control relay R905 completes, at RA906 and RC907, a point in a circuit, traced hereinafter, for energizing the control relays R1120 and R1150 when the trunk line C1271 is seized by the toll switch train 108. The signalling currents generated at the transmitter 1013 traverse a circuit extending from one terminal of the transmitter by way of the plug tip 1009, the jack tip 1003, C1275, the cable C1282, C1275, the primary winding 912, the condenser 915, C1273, the cable C1282, C1273, the jack tip 1006 and the plug tip 1012 to the other terminal of the transmitter. The bridge connection between the receiver 1014 and the secondary winding 914 of the transformer 910 extends from one terminal of the receiver 1014 by way of the plug ring 1008, the jack ring 1002, C1277, the cable C1282, C1277, the condenser 917, the secondary winding 914 of the transformer 910, C1276, the cable C1282, C1276, the jack ring 1005 and the plug ring 1011 to the other terminal of the receiver 1014. Also, it is noted that two oppositely connected unidirectional devices in the form of copper oxide rectifiers 918 and 919 are bridged across the conductors C1276 and C1277 and consequently across the terminals of the receiver 1014, thereby to minimize clicks in the receiver 1014 when the dialing apparatus 1015 associated with the telephone instrument at the first rate and directory operator's position 103 is operated.

When the first rate and directory operator's position 103 is idle, a circuit is first completed for energizing the control relay R1140 in the distributor apparatus 1170, this circuit extending from ground at RA1116 by way of RA1112 and the upper winding of R1140 to battery. When energized over the above-traced circuit, the control relay R1140 operates to connect the upper winding of the control relay R1150 in multiple with the winding of the control relay R1120, this connection extending from the upper terminal of the winding R1120 by way of RA1141 and the upper winding of R1150 to battery. Upon operating, the control relay R1140 also completes, at RA1142, a holding circuit for itself extending from the ground at RA1116 by way of the winding of the control relay R1110, RA1153, RA1142 and the lower winding of R1140 to battery. Further, the control relay R1140 interrupts, at RA1143, a point in a holding circuit, traced hereinafter, for the control relay R1150. When the lower winding of the control relay R1140 and the winding of the control relay R1110 are energized in series, the control relay R1140 is held in its operating position and the control relay R1110 is operated. Upon operating, the control relay R1110 interrupts, at RA1112, the original circuit for operating the control relay R1140. At this time the windings of the control relays R1120 and R1150 are connected in multiple to the control conductor C1301. Thus, the trunk line C1271 extending to the first rate and directory operator's position is assigned by the distributor apparatus 1170 to be seized by the toll switch train 108.

Accordingly, the toll switch train 108 seizes the trunk line C1271 as previously noted, the trunk line C1271 being marked for seizure by the toll switch train 108 by the application of battery at the upper winding of the control relay R1150 to the control conductor C1301. This path for

applying battery to the control conductor C1301 extends from battery at the upper terminal of the upper winding of R1150 by way of the winding of R1150 and RA1141, to the control conductor C1301. The resistance of the upper winding of the control relay R1150 is sufficiently low that the control relay in the toll switch train 108 is energized and operates when the trunk line C1271 is seized, thereby to arrest further operation of the toll switch train. The path for energizing the control relay in the toll switch train 108 extends from battery potential as applied to the control conductor C1301, as previously noted, by way of C1272, RA906, RC907, C1350, C1278, the cable C1282, C1278, the control conductor C1287 of the trunk line C1271, the toll switch train 108 and the winding of the control relay in the toll switch train 108 to ground. After the toll switch train 108 seizes the trunk line C1271, ground potential is applied to the control conductor C1287 thereof in the toll switch train. This application of ground potential to the control conductor C1287 completes a circuit for energizing the control relays R1120 and R1150, this circuit extending from the grounded control conductor C1287 of the trunk line C1271 by way of C1278, the cable C1282, C1278, C1350, RC907, RA906 and C1272 to C1301, one branch extending from C1301 by way of the winding of R1120 to battery, and the other branch extending from C1301 by way of RA1141 and the upper winding of R1150 to battery. When energized over the above-traced circuit, the control relay R1120 operates to apply ground potential at RA1121 to the control conductor C1300, thereby to cause a zip-zip tone to be transmitted to the receiver 1014 of the telephone instrument at the first rate and directory operator's position 103, in a manner more fully described subsequently. Also, upon operating, the control relay R1120 completes, at RA1122, a circuit for illuminating the lamp L589 associated with first rate and directory operator's position at the toll service observing operator's position 104. This circuit extends from ground at RA1122 by way of C1302, the control conductor C1211, the cable C1210, C1211 and the lamp L589 to battery. The illumination of the lamp L589 at the toll service observing operator's position 104 indicates to the operator at this position that the toll switch train 108 has seized the trunk line C1271 extending to the first rate and directory operator's position 103 and that shortly thereafter the operator at this position will render a service for a toll operator. Further, the control relay R1120 prepares at RA1123, a point in a chain ground circuit for energizing the control relay R1115 in a manner more fully described subsequently.

When energized over the above-traced circuit, the control relay R1150 operates to connect the upper winding of the control relay R1160 in multiple with the winding of the control relay R1125, these windings being connected to the control conductor C1351 of a trunk line extending to the toll switch train 108 and associated with the second rate and directory operator's position. Also, the control relay R1150 completes, at RA1152, a holding circuit for itself extending from battery at the upper terminal of the lower winding of R1150 by way of the lower winding of R1150, RA1152, RA1163, the winding of R1110 and RA1116 to ground. Further, the control relay R1150 interrupts, at RA1153, a point in the holding circuit of the control relay R1140, causing the latter relay to restore. Upon restoring, the control relay R1140 interrupts, at RA1141, a point in the original operating circuit of the control relay R1150; interrupts, at RA1142, a further point in its own holding circuit; and prepares, at RA1143, a point in the holding circuit of the control relay R1160. At this time the trunk line extending to the toll switch train 108 and associated with the second rate and directory operator's position is assigned by the distributor apparatus 1170 to be seized by the toll switch train when the next call is initiated to be extended to a rate and directory operator's position.

When the trunk line extending to the toll switch train 108 and associated with the second rate and directory operator's position is seized by the toll switch train, ground is applied in the toll switch train to the control conductor C1351, thereby to complete an obvious circuit for energizing the control relays R1125 and R1160. When energized, the control relay R1125 operates to apply, at RA1126, ground potential to the control conductor C1352, thereby to cause a zip-zip tone to be transmitted to the receiver of the telephone instrument at the second rate and directory operator's position. Also, the control relay R1125 applies ground potential at RA1127 to the control conductor C1353, thereby to cause the lamp at the toll service observing operator's position 104 associated with the second rate and directory operator's position to be illuminated for the purpose previously explained. Further, the control relay R1125 prepares at RA1128 a point in the chain ground circuit for energizing the control relay R1115.

When energized, the control relay R1150 operates to connect, at RA1161, the upper winding of the control relay R1140 in multiple with the winding of R1130, these windings being connected to a control conductor C1354. Also, the control relay R1160 completes, at RA1162, a holding circuit for itself extending from ground at RA1116 by way of the winding of R1110, RA1143, RA1162 and the lower winding of R1160 to battery. Further, the control relay R1160 interrupts, at RA1163, a point in the holding circuit of the control relay R1150, and the latter relay restores. Upon restoring, the control relay R1150 interrupts, at RA1151, a point in the original operating circuit of the control relay R1160; interrupts at RA1152, a further point in its own holding circuit; and prepares, at RA1153, a point in the holding circuit of the control relay R1140.

When the trunk line extending to the toll switch train 108 and associated with the third rate and directry operator's position is seized by the toll switch train, ground is applied in the toll switch train to the control conductor C1354, thereby to complete an obvious circuit for energizing the control relays R1130 and R1140. When energized, the control relay R1130 operates to apply, at RA1131, ground potential to the control conductor C1355, thereby to cause a zip-zip tone to be transmitted to the receiver of the telephone instrument at the third rate and directory operator's position. Also, the control relay R1130 applies ground potential at RA1132 to the control conductor C1356, thereby to cause the lamp at the toll service observing operator's position 104 associated with the third rate and directory operator's position to be illuminated for the purpose previously explained. Further, the control relay R1130 prepares at RA1133 a point in the chain ground circuit for energizing the control relay R1115.

When energized, the control relay R1140 operates to connect, at RA1141, the upper winding of the control relay R1150 in multiple with the winding of R1120, these windings being connected to the control conductor C1301. Assuming that the first rate and directory operator's position is idle at this time, no ground potential appears on the control conductor C1301, and the control relay R1150 is not reoperated. Also, the control relay R1140 completes, at RA1142, its holding circuit; and interrupts, at RA1143, the holding circuit of the control relay R1160, causing the latter relay to restore. Upon restoring, the control relay R1160 interrupts, at RA1161, the original circuit for operating the control relay R1140; interrupts, at RA1162, a further point in its own holding circuit; and prepares, at RA1163, a point in the holding circuit of the control relay R1150.

On the other hand, assuming that the first rate and directory operator's position is busy and that the second rate and directory operator's position is idle when the trunk line associated with the third rate and directory operator's position is seized by the toll switch train 108, upon operating, the control reday R1160 completes, at RA1161, the circuit for operating the control relay R1140, which latter relay operates as noted above. However, at this time, when the upper winding of the control relay R1150 is connected at RA1141 in multiple with the winding of the control relay R1120, the control relay R1150 is energized as ground potential appears upon the control conductor C1301. When energized, the control relay R1150 operates to connect, at RA1151, the upper winding of the control relay R1160 in multiple with the winding of the control relay R1125, these windings being connected to the control conductor C1351, as previously noted. Also, the control relay R1150 completes, at RA1152, its holding circuit and interrupts, at RA1153, the holding circuit of the control relay R1140, causing the latter relay to restore. Upon restoring, the control relay R1140 interrupts, at RA1141, the original operating circuit of the control relay R1150; interrupts, at RA1142, a further point in its own holding circuit; and prepares, at RA1143, a point in the holding circuit of the control relay R1160. At this time, the trunk line associated with the second rate and directory operator's position is assigned by the distributor apparatus 1170 to be seized by the toll switch train 108 when the next call is initiated, which is to be extended to a rate and directory operator's position.

When the toll switch train 108 seizes the trunk line associated with the third rate and directory operator's position, if both the first and second rate and directory operators' positions are busy, the chain ground circuit for energizing the control relay R1115 is completed when the control relay R1130 operates. This circuit extends from ground at RA1133 by way of RA1128, RA1123 and the winding of R1115 to battery. Shortly after the relay R1115 is energized over the above-traced chain ground circuit, this relay, being of the slow-to-operate type, operates to interrupt at RA1116 the circuit for energizing the control relay R1110 in series with the control relays R1140, R1150 and R1160, thereby to interrupt a point in the holding circuit of the control relays R1140, R1150 and R1160 and to cause the slow-to-release relay R1110 to restore shortly thereafter. Upon restoring, the slow-to-release relay R1110, prepares, at RA1112, a point in the original circuit for operating the control relay R1140.

At this time, the control relay R1140 is energized and operates to complete, at RA1141, the original operating circuit of the control relay R1150, which latter relay operates to complete, at RA1151, the original operating circuit of the control relay R1160. The control relays R1140, R1150 and R1160 remain in their operated positions so long as ground potential is applied to the control conductors C1354, C1301, C1351, respectively, of the trunk lines associated with the first, second and third rate and directory operators' positions, respectively. The control relays R1140, R1150 and R1160 remain in their operated positions until one of the rate and directory operators' positions becomes idle, at which time ground potential is removed from the control conductor of the trunk line associated therewith, thereby to cause the control relays connected to this control conductor to restore and interrupt the chain ground circuit for energizing the control relay R1115 and to cause the distributor apparatus 1170 to operate in the manner previously explained to assign the rate and directory operators' positions sequentially to be seized to the toll switch train 108.

Continuing with the operation of the apparatus at the first rate and directory operator's position 103, when the toll switch train 108 seizes the trunk line C1271 individually associated therewith to cause the control relay R1120 to operate and apply ground potential to the control conductor C1300, the circuit for energizing the control relay R930 is completed. This circuit extends from ground at RA1121 by way of C1300, RA947, RC949 and the winding of R930 to battery. When energized over the above-traced circuit, the control relay R930 operates to disconnect, at RA931 and RC932, the upper terminal of the secondary winding 913 of the transformer 910 from the line conductor C1260 of the trunk line C1264 extending to the chief operator's position 101, to connect, at RA931 and RC933, the upper terminal of the secondary winding 913 of the transformer 910 to the dial tone conductor C1357 and to connect, at RA936 and RC936', the lower terminal of the secondary winding 914 of the transformer 910 to ground, thereby to complete a circuit for energizing the receiver 1014 of the telephone instrument at the first rate and directory operator's position with dial tone current. This circuit extends from the ungrounded terminal of a grounded dial tone transformer winding, not shown, by way of the dial tone conductor C1357, RC943, RA942, RC933, RA931, the secondary winding 913, the condenser 917, C1277, the cable C1282, C1277, the jack ring 1002, the plug ring 1008, the receiver 1014, the plug ring 1011, the jack ring 1005, C1276, the cable C1282, C1276, the condenser 920, the resistor 921, RA936 and RC936' to ground. Upon operating, the control relay R930 also applies, at RA934, ground potential to the meter lead C1358, thereby to operate a meter in the form of a peg counter associated with the first rate and directory operator's position. This peg counter registers the number of services rendered by the first rate and directory operator. Further, the control relay R930 completes, at RA935, an obvious circuit for energizing the control relay R940. Shortly after being energized, the control relay R940, being of the slow-to-operate type, operates to interrupt, at RC943 and RA942, a point in the circuit for energizing the receiver 1014 with dial tone cur-

rent; prepares, at RA941 and RA942, an alternative circuit, traced hereinafter, for energizing the receiver 1014 with dial tone current; and completes, at RA944, an obvious circuit for energizing the control relay R945. When energized, the control relay R945 completes, at RA946, the alternative circuit for energizing the receiver 1014 with dial tone current, this circuit extending from the ungrounded terminal of the grounded dial tone transformer winding by way of the dial tone lead C1357, RA945, RA941, RA942, RC933 and RA931 to the upper terminal of the secondary winding and therefrom through the receiver 1014 to ground at RC936', as previously traced. Also, the control relay R945 completes, at RA948 and RA947, a holding circuit for itself extending from ground at RA1121 by way of C1300, RA947, RA948 and the winding of R945 to battery. Further, the control relay R945 interrupts, at RA947 and RC949, a point in the operating circuit of the control relay R930, which latter relay, being of the slow-to-release type, restores shortly thereafter. Upon restoring, the control relay R930 connects, at RA931 and RC932, the upper terminal of the secondary winding 913 of the transformer 910 to the line conductor C1260 of the trunk line C1264 extending to the chief operator's position 101. Also, the control relay R930 interrupts, at RA931, RC933 and RA936, RC936', points in the alternative circuit for energizing the receiver 1014 with dial tone current by way of the dial tone lead C1357. Further, the control relay R930 interrupts, at RA934, the path for applying ground potential to the meter lead C1358; and interrupts, at RA935, the operating circuit of the control relay R940, causing the latter relay to restore. Upon restoring, the control relay R940 interrupts, at RA941 and RA942, a further point in the alternative circuit for energizing the receiver 1014 with dial tone current by way of the dial tone lead C1357; prepares, at RA942 and RC943, a point in the original circuit for energizing the receiver 1014 with dial tone current by way of the dial tone lead C1357; and interrupts, at RA944, a point in the original operating circuit of the control relay R945. The above-described interaction of the control relays R930, R940 and R945 causes a zip-zip tone to be transmitted by way of the dial tone lead C1357 to the receiver 1014 in an obvious manner.

At this time a loop circuit is completed between the first toll operator's position 702 and the transformer 910 at the first rate and directory operator's position 103. This circuit extends from the first toll operator's position 702 by way of the trunk line C720, the toll switch train 108, the trunk line C1271 and the switches 1040 and 1020 to the transformer 910 at the first rate and directory operator's position 103, the line conductor C1289 of the trunk line C1271 being connected by way of the switch springs 1047 and 1046, C1359, the switch springs 1025 and 1024, C1271', the cable C1262, C1271', C1260, RC932, RA931, the secondary windings 913 and 914 of the transformer 910, the condenser 920, the resistor 921, C1261, C1274, the cable C1282, C1274, C1372, the switch springs 1027 and 2026, C1360 and the switch springs 1049 and 1048 to the line conductor C1290 of the trunk line C1271. The telephone instrument at the first rate and directory operator's position is associated with the transformer 910 in the manner previously described, thereby completing a connection for two-way communication between the first rate and directory operator's position 103 and the first toll operator's position 702. Also, at this time, the control conductor C1298 of the trunk line C1271 is connected by way of the switch springs 1051 and 1052 and C1361 to the switch spring 1066 of the switch 1060. By operating the switch 1060 to its right-hand position, ground potential at the switch spring 1064 may be connected by way of the switch spring 1065 to the switch spring 1066, thereby to complete an obvious path for applying ground to the control conductor C1288 extending by way of the trunk line C1271 to the first toll operator's position 702. This application of ground to the control conductor C1288 causes a signal device at the toll board to be operated, thereby to indicate to the operator at the first toll operator's position 702 that the operator at the first rate and directory operator's position 103 wishes to communicate with her. Preferably, the switch 1060 is operated intermittently from its normal to its right-hand position, thereby to complete intermittently the path for applying ground to the control conductor C1288 and to cause intermittent operation of the signal device at the toll board.

The release of the established connection between the first toll operator's position 702 and the telephone instrument at the first rate and directory operator's position 103 is under the control of the operator at the first toll operator's position; and in order to effect the release of this established connection, the operator at the first toll operator's position releases the toll switch train 108 in the usual manner. When the toll switch train 108 is released, ground potential is removed therein from the control conductor C1287, thereby to interrupt the previously traced circuit for energizing the control relay R1120, causing this relay to restore. Upon restoring, the control relay R1120 interrupts, at RA1121, the holding circuit of the control relay R945, causing the latter relay to restore shortly thereafter, the latter relay being of the slow-to-release type. Upon restoring, the control relay R945 interrupts, at RA946, a further point in the alternative circuit for energizing the receiver 1014 with dial tone current by way of the dial tone lead C1357; interrupts, at RA948 and RA947, a further point in its holding circuit; and prepares, at RA947 and RC949, a point in the operating circuit of the control relay R930. The control relay R1120 also interrupts, at RA1122, the path for applying ground potential to the control conductor C1302, thereby to cause the lamp L589 at the service observing operator's position 104 to be extinguished. Further, the control relay R1120 interrupts, at RA1123, a point in the chain ground circuit for energizing the control relay R1115. At this time the apparatus involved in the established connection between the first toll operator's position 702 and the first rate and directory operator's position 103 is completely released for further use.

In order for the rate and directory operator at the first rate and directory operator's position 103 to vacate her position for an off-duty period, the plugs 1007 and 1010 associated with the telephone instrument at this position are withdrawn from the associated jacks 1001 and 1004, respectively, thereby to interrupt the circuit for energizing in series the control relay R905 and the transmitter 1013, and to interrupt the bridge connection between the receiver 1014 and the secondary winding 914 of the transformer 910. When the circuit for energizing in series the

control relay R905 and the transmitter 1013 is interrupted, the control relay R905 restores. Upon restoring, the control relay R905 interrupts, at RA906 and RC907, a point in the circuit for energizing in multiple the control relays R1120 and R1150 by way of the control conductor C1287 of the trunk line C1271 extending to the toll switch train 108, when the toll switch train seizes the trunk line C1271, as previously explained. Also, at RA906 and RC907, there is interrupted a point in the path for applying battery potential at the upper winding of R1150 to the control conductor C1287 of the trunk line C1271. The removal of battery potential from the control conductor C1287 of the trunk line C1271 prevents the toll switch train 108 from seizing the trunk line C1271 extending to the first rate and directory operator's position 103. Thus, the first rate and directory operator's position 103 is rendered busy by withdrawing the plugs 1007 and 1010 from the jacks 1001 and 1004, respectively. Also, upon restoring, the control relay R905 completes, at RA906 and RC908, a circuit for energizing in multiple the control relays R1120 and R1150, this circuit extending from ground at RC908 by way of RA906 and C1272 to C1301, one branch extending from C1301 by way of the winding of R1120 to battery, and the other branch extending from C1301 by way of RA1141 and the upper winding of R1150 to battery. When energized over the above-traced circuit, the control relays R1120 and R1150 operate as previously explained, thereby to cause the distributor apparatus 1170 to assign a trunk line associated with the next idle rate and directory operator's position to the use of the next call initiated at one of the toll operators' positions to be extended by way of the toll switch train 108 to a rate and directory operator's position.

When the operator at the first rate and directory operator's position 103 renders the position busy, as explained above, the key 1060 is operated from its normal to its left-hand position, thereby to complete a circuit for applying ground potential to the control conductor C1263 extending by way of the trunk line C1264 to the chief operator's position 101. This path for applying ground potential to the control conductor C1263 extends from ground at the switch spring 1064 by way of the switch springs 1061 and 1062 to the control conductor C1263. The application of ground potential to the control conductor C1263 causes the lamp L635 at the chief operator's position 101 to be illuminated, this circuit for illuminating the lamp L635 extending from the grounded control conductor C1263 of the trunk line C1264 by way of the switch springs 632 and 633 of the switch 630 and the lamp L635 to battery. The illumination of the lamp L635 indicates to the chief operator at the chief operator's position 101 that the operator at the first rate and directory operator's position 103 has vacated her position. Also, it is noted that the operation of the switch 1060 to its left-hand position renders the first rate and directory operator's position 103 busy, regardless of whether the plugs 1007 and 1010 associated with the telephone instrument at this position are withdrawn from the associated jacks 1001 and 1004. This is accomplished by the application of ground potential to the control conductor C1362 in the switch 1060. The circuit for applying ground potential to the control conductor C1362 extends from ground at the switch spring 1064 by way of the switch spring 1063 to the control conductor C1362. This application of ground potential to the control conductor C1362 energizes in multiple the control relays R1120 and R1150 and marks the trunk line C1271 associated with the first rate and directory operator's position 103 as busy in the toll switch train 108. The circuit for energizing in multiple the control relays R1120 and R1150 extends from ground at the switch spring 1064 by way of the switch spring 1063, C1362, C1272, the cable C1282 and C1272 to C1301, one branch extending from C1301 by way of the winding of R1120 to battery, and the other branch extending from C1301 by way of RA1141 and the upper winding of R1150 to battery. When energized over the above-traced circuit, the control relays R1120 and R1150 operate as previously explained. The path for marking the trunk line C1271 associated with the first rate and directory operator's position 103 as busy in the toll switch train 108 extends from ground at the switch spring 1064 by way of the switch spring 1063, C1362, C1272, the cable C1282, C1272, RA906, RC907, C1350, C1278, the cable C1282, C1278 and the control conductor C1287 of the trunk line C1271 to the toll switch train 108.

When all of the individual trunk lines extending from the toll switch train 108 to the rate and directory operators' positions are busy, the toll switch train 108 is automatically conditioned to seize the first auxiliary trunk line C1270 extending to the rate and directory operators' positions, when the next call is initiated at one of the toll operators' positions, which call is to be routed to one of the rate and directory operators' positions. Under this condition, when the toll switch train 108 seizes the first auxiliary trunk line C1270, ground in the toll switch train 108 is applied to the control conductor C1296 thereof, thereby to complete a circuit for energizing the control relay R995, this circuit extending from the grounded control conductor C1296 by way of the winding of R995 to battery. When energized over the above-traced circuit. the control relay R995 operates to complete, at RA996, a circuit for illuminating the lamp L528 at the service observing operator's position, thereby to indicate to the operator at this position that a call has been extended from one of the toll operators' positions by way of the first auxiliary trunk C1270 to the rate and directory operators' positions and that shortly thereafter an operator on one of the rate and directory operators' positions will perform a service for the toll operator initiating the call. The control relay R995 also prepares, at RA994, a point in a circuit for illuminating in multiple the lamp at each rate and directory operator's position; interrupts, at RA997 and RC998, a point in a path for applying ground potential to the control conductor C1363 extending to a meter or the like; prepares, at RA995', a point in a holding circuit for one of the control relays R965, R975 or R985; and completes, at RA997 and RC999, a chain circuit for energizing the control relay R960. The chain circuit for energizing the control relay R960 extends from ground at RA997 by way of RC999, RA986, RC987, RA976, RC977, RA966, RC967 and the winding of R960 to battery. When energized over the above-traced circuit, the control relay R960 operates to complete, at RA961, the circuit for illuminating in multiple the lamp at each rate and directory operator's position. For example, the lamp L1036 at the first rate and directory operator's position is illuminated at this time. The circuit for illuminating the lamp L1036 extends

from ground at RA994 by way of C1364, RA991, C1285, the cable C1283, C1285, RA954, C1280, the cable C1282, C1286, and the lamp L1036 to battery. The lamp L1036 at the first rate and directory operator's position 103 is illuminated, and in a similar manner the lamp at each rate and directory operator's position is illuminated, thereby to indicate to each rate and directory operator that a call upon the first auxiliary trunk line C1270 is awaiting an answer. Upon operating, the control relay R960 also prepares, at RA962, RA963 and RA964, respectively, points in the circuits for operating the control relays R965, R975 and R985.

As soon as one of the rate and directory operators is available, she operates an auxiliary trunk answer switch at her position in order to answer the call. Assume that the operator at the first rate and directory operator's position 103 operates the auxiliary trunk answer switch 1040 at her position from its normal to its left-hand position in order to answer the call. When the switch 1040 is operated to its left-hand position, ground potential at the switch spring 1043 is applied by way of the switch spring 1044 to the control conductor C1279, thereby to complete a circuit for energizing the control relay R965. This circuit extends from ground at the switch spring 1043 by way of the switch spring 1044, C1279, the cable C1282, C1279, RA951, RC953, C1284, C1286, C1284, RA962 and the winding of R965 to battery. When energized over the above-traced circuit, the control relay R965 operates to complete at RA969 its holding circuit extending from ground at RA995' by way of C1365, RA969 and the winding of R965 to battery. The control relay R965 also interrupts at RA966 and RC967 a point in the chain ground circuit for operating the control relay R960, causing the latter relay to restore; and completes at RA966 and RC968 a path for applying ground potential to the meter lead C1363, this path extending from ground at RA997 by way of RC999, RA983, RC987, RA976, RC977, RA966 and RC968 to the meter lead C1363. Further, the control relay R965 completes at RA970 a circuit for energizing the control relay R950, this circuit extending from the grounded control conductor C1296 of the first auxiliary trunk line C1270 by way of C1366, RA970, C1283, C1286, C1283 and the winding of R950 to battery. Further, the control relay R965 connects at RA971 and RA972 the secondary windings 913 and 914 of the repeater 910 across the line conductors C1297 and C1298 of the first auxiliary trunk line C1270, the line conductor C1297 being connected by way of RA971, C1294, C1295, C1296, the switch springs 1045 and 1046, C1359, the switch springs 1025 and 1024, C1271', the cable C1282, C1271', C1260, RC932, RA931, the secondary windings 913 and 914, the condenser 920, the resistor 921, C1261, C1274, the cable C1282, C1274, C1372, the switch springs 1027 and 1026, C1360, the switch springs 1049 and 1050, C1293, C1295, C1293, RA972, to the line conductor C1298. The control relay R965 also connects at RA973 the control conductor C1299 of the first auxiliary trunk line C1270 to the control conductor C1361, thereby to permit the operator at the first rate and directory operator's position 103 to apply ground potential at the switch 1060 to the control conductor C1299 by operating the switch 1060 to its right-hand position. When the switch 1060 is operated to its right-hand position, a path for applying ground potential to the control conductor C1299 is completed, this path extending from ground at the switch spring 1064 by way of the switch springs 1065 and 1066, C1361, the switch springs 1052 and 1053, C1292, C1295, C1252 and RA973 to the control conductor C1299. The application of ground potential to the control conductor C1299 completes a circuit for operating a signal device at the toll board 101, thereby to indicate to the operator at the toll operator's position that an operator at one of the rate and directory operators' positions wishes to communicate with her, as previously explained.

Upon restoring, the control relay R960 interrupts at RA991 the circuit for illuminating in multiple the lamp at each rate and directory operator's position including the lamp L1036 at the first rate and directory operator's position 103, and interrupts at RA962 a point in the original operating circuit of the control relay R965. Upon operating, the control relay R950 completes at RA952 and RA951 a holding circuit for itself extending from ground at the switch spring 1043 by way of the switch spring 1044, C1279, the cable C1282, C1279, RA951, RA952 and the winding of R950 to battery. The control relay R950 also interrupts at RA951 and RC953 a further point in the original operating circuit of the control relay R965, interrupts at RA954 a further point in the circuit for illuminating the lamp L1036, and completes at RA955 a path for applying ground potential to the control conductor C1262 extending by way of the trunk line C1264 to the chief operator's position 101. The application of ground potential to the control conductor C1262 completes a circuit for illuminating the lamp L634 at the chief operator's position, this circuit extending from ground at RA955 by way of the control conductor C1262 of the trunk line C1264, C1262 and the lamp L634 to battery. The illumination of the lamp L634 at the chief operator's position indicates to the chief operator that the operator at the first rate and directory operator's position 103 has answered a call initiated by one of the toll operators and routed by way of the first auxiliary trunk line C1270 to the first rate and directory operator's position and that shortly thereafter the operator at this position will perform a service for the toll operator. Further the control relay R950 applies ground potential at RA956 to the control conductor C1301, thereby to complete a circuit for energizing in multiple the control relays R1120 and R1150. This circuit extends from ground at RA956 by way of C1350, RC907, RA906 and C1272 to C1301, one branch extending from C1301 by way of the upper winding of R1120 to battery, and the other branch extending from C1301 by way of R1141 and the upper winding of R1150 to battery. When energized over the above-traced circuits, the control relays R1120 and R1150 operate as previously explained. Also, the control relay completes at RA956 the previously traced path for applying ground potential to the control conductor C1287 of the trunk line C1271, thereby to mark the first rate and directory operator's position as busy in the toll switch train 108. Finally, the control relay R950 completes at RA957 a circuit for illuminating the lamp L1037 at the first rate and directory operator's position 103, this circuit extending from ground at RA957 by way of C1281, the cable C1282, C1281 and the lamp L1037 to battery. The illumination of the lamp L1037 reminds the operator at the first rate and directory operator's position 103 that the auxiliary trunk

line answer switch 1040 occupies its left-hand position. At this time a loop circuit is completed between the toll operator's position by way of the toll switch train 108 and the first auxiliary trunk line C1270 to the transformer 910. The telephone instrument at the first rate and directory operator's position is associated with the transformer 910 as previously explained. Thus, a connection is established between the toll operator's position and the telephone instrument at the first rate and directory operator's position for two-way communication therebetween.

The release of the established connection between the toll operator's position and the first rate and directory operator's position 103 is effected under the joint control of the toll operator and the rate and directory operator at these positions. First, the toll operator disconnects her position from the trunk line extending between her position and the toll switch train 108, the toll switch train being retained in operated position at this time due to the application of ground potential at the auxiliary trunk line answer switch 1040 at the first rate and directory operator's position 103 to the control conductor C1296 of the trunk line C1270. When the switch 1040 is returned to its normal position, the switch springs 1043 and 1044 are moved into disengagement, thereby to remove the application of ground potential to the control conductor C1279. When ground potential is removed from the control conductor C1279, the holding circuit of the control relay R950 and the path for applying ground potential to the control conductor C1296 of the trunk line C1270 are interrupted, thereby to cause the control relay R950 to restore and the toll switch train 108 to be released. Upon restoring, the control relay R950 interrupts at RA951 and RA952 a further point in its holding circuit, prepares at RA951 and RC953 a point in the operating circuit of the control relay R965, prepares at RA954 a point in the circuit for illuminating the lamp L1036, interrupts at RA955 a point in the circuit for illuminating the lamp L634 at the chief operator's position, interrupts at RA956 a point in the operating circuit of the control relay R1120, and interrupts at RA957 a point in the circuit for illuminating the lamp L1037. When the lamp L1037 at the first rate and directory operator's position is extinguished, the rate and directory operator at this position is reminded that the switch 1040 has been returned to its normal position. Also, when the lamp L634 at the chief operator's position is extinguished, the chief operator is advised that the connection between the first rate and directory operator's position and a toll operator's position has been released. At this time the apparatus involved in the established connection between the toll operator's position and the first rate and directory operator's position 103 is released for further use.

From the foregoing description it will be apparent that, had the operator at second rate and directory operator's position answered the call extending from the toll operator's position by way of the toll switch train 108 and the first auxiliary trunk line C1270 to the rate and directory operators' positions, the control relay R975 individual to the second rate and directory operator's position would have been operated when the operator at the second rate and directory operator's position operated the auxiliary trunk line answer switch thereat, corresponding to the switch 1040 at the first rate and directory operator's position. The control relay R975 would have been energized over a circuit extending from ground at the auxiliary trunk line answer switch by way of the control conductor C1367, RA963 and the winding of R975 to battery. The circuit controlling functions of the control relay R975 are similar to those of the control relay R965 described above. Also, attention is directed to the fact that, if the operator at the third rate and directory operator's position had answered the call extending to the rate and directory operators' positions by way of the first auxiliary trunk line C1270, the control relay R985 individual to the third rate and directory operator's position would have been operated in a manner similar to the operation of the control relays R965 and R975.

The chief operator's position 101 has access to the first rate and directory operator's position 103 and a monitoring connection therebetween may be established by inserting the monitoring plug 300 into the jack 615 connected to the trunk line C1264 extending to the first rate and directory operator's position 103, as previously noted. When the monitoring plug 300 is inserted into the jack 615, a loop circuit is completed between the primary windings 372, 373 and 374 of the transformer 370 and the secondary windings 913 and 914 of the transformer 910, this circuit extending from the upper terminal of the primary winding 372 by way of the primary windings 372, 373 and 374, the condenser 375, C1310, the switch springs 386 and 387, C1320, the switch springs 399 and 399', C1312, the plug ring 302, the jack ring 617, the line conductor C1261 of the trunk line C1264, C1261, the resistor 921, the condenser 920, the secondary windings 914 and 913 of the transformer 910, RA931, RC932, the line conductor C1260 of the trunk line C1264, C1260, the jack tip 616, the plug tip 301, C1311, the switch springs 392 and 393, C1317, the switch springs 384 and 385 and C1309 to the upper terminal of the primary winding 372. At this time the receiver 331 of the primary telephone instrument at the chief operator's position 101 is connected across the secondary winding 371 of the transformer 370, thereby to complete a monitoring connection between the receiver 331 and the telephone instrument at the first rate and directory operator's position.

Each rate and directory operator's position has access to the local switch train 107 and, in order to establish a connection between a particular rate and directory operator's position and a subscriber substation accessible to the local switch train 107, it is only necessary for the rate and directory operator at the particular rate and directory operator's position to operate the dial switch at this position to its left-hand position, thereby to seize the local switch train 107 and then dial a proper series of digits into the local switch train to cause it to seize the subscriber line to which the subscriber substation is connected. For example, in order to establish a connection between the first rate and directory operator's position 103 and the subscriber substation C, the operator at the first rate and directory operator's position 103 first operates the dial switch 1020 to its left-hand position. When the dial switch 1020 is operated to its left-hand position, the line conductors C1302 and C1303 of the trunk line C1291, extending to the local switch train 107, are connected to the transformer 910, the line conductor C1302 being connected by way of

the switch springs 1023 and 1024, C1271', the cable C1282, C1271', C1260, RC932, RA931, the secondary windings 913 and 914 of the transformer 910, C1276, the cable C1282, C1276, the contact springs 1019 and 1019' of the dialing apparatus 1015, C1372, the switch springs 1027 and 1028, and C1368 to the line conductor C1303. Thus, a bridge circuit is completed across the line conductors C1302 and C1303 of the trunk line C1291 extending to the local switch train 107 which causes the local switch train to be seized. When the dial switch 1020 is operated to its left-hand position, ground potential at the switch spring 1022 is applied to the control conductor C1301, thereby to complete a circuit for energizing in multiple the control relays R1120 and R1150. This circuit extends from ground at the switch spring 1022 by way of the switch spring 1021, C1272, the cable C1282 and C1272 to C1301, one branch extending from C1301 by way of the winding of R1120 to battery, and the other branch extending from C1301 by way of RA1141 and the upper winding of R1150 to battery. When energized over the above-traced circuit the control relays R1120 and R1150 operate, as previously explained. Also, ground potential at the switch spring 1022 is applied by way of the switch spring 1021, C1272, the cable C1282, C1272, RA906, RC907, C1359, C1276, the cable C1282 and C1276 to the control conductor C1287 of the trunk line C1271, this trunk line being individual to the first rate and directory operator's position and extending to the toll switch train 108. This application of ground potential to the control conductor C1287 of the trunk line C1271 marks the first rate and directory operator's position 103 as busy in the toll switch train 108.

After the local switch train 107 has been seized, the operator at the first rate and directory operator's position operates the dialing apparatus 1015 thereat, thereby to transmit a first series of impulses to the local switch train. The dialing apparatus 1015 is operated to its off-normal position and released in order to cause the impulse contacts 1019 and 1019' to be moved intermittently into disengagement, thereby to cause a series of impulses to be transmitted to the local switch train 107 by way of the trunk line C1291. When the dialing apparatus 1015 is operated to its off-normal position, the contact springs 1016, 1017 and 1018 are moved into engagement with each other and remain in this position throughout the impulsing period. The engagement between the contact springs 1016 and 1017 completes a path for short-circuiting the receiver 1014 of the telephone instrument at the first rate and directory operator's position, thereby to prevent click produced by the dialing apparatus 1015 from being transmitted thereto. This circuit extends from one terminal of the receiver 1014 by way of the plug ring 1008, the jack ring 1002, C1370, the contact springs 1016 and 1017, C1369, the jack ring 1005 and the plug ring 1011 to the other terminal of the receiver 1014. The engagement between the contact springs 1017 and 1018 completes a bridge connection across the line conductors C1302 and C1303 of the trunk line C1291 including the impulse springs 1019 and 1019', thereby short-circuiting the secondary windings 913 and 914 of the transformer 910 in order to exclude these windings from the impulsing circuit. This bridge connection across the line conductors C1302 and C1303 extends from the line conductor C1302 by way of the switch springs 1023 and 1024, C1371', the contact springs 1018 and 1017, the impulse springs 1019 and 1019', C1372, the switch springs 1027 and 1028 and C1368 to the line conductor C1303. At the end of the first series of impulses, the contact springs 1016, 1017 and 1018 are moved into disengagement, thereby to interrupt the path for short-circuiting the receiver 1014 and the path for short-circuiting the secondary windings 913 and 914 of the transformer 910. The dialing apparatus 1015 is operated a number of times, as described above, in order to cause a series of digits to be dialed into the local switch train 107, thereby to cause the local switch train to seize the subscriber line 713 extending to the substation C in the usual manner. After the subscriber line 713 is seized by the local switch train 107, it is tested in accordance with conventional practice and busy tone is returned to the telephone instrument at the first rate and directory operator's position in the event it is busy and ringing current projected thereover to the substation C in the event that it is idle. After the subscriber at the substation C answers the call, a loop is completed therefrom by way of the subscriber line 713, the local switch train 107 and the trunk line C1291 to the transformer 910, thereby to complete a circuit for two-way communication between the substation C and the first rate and directory operator's position.

Should the operator at the first rate and directory operator's position 103 desire to hold the established connection to the substation C, and free the telephone instrument at the first rate and directory operator's position for other use, the hold switch 1030 is operated to its left-hand position, thereby to complete a bridge connection across the line conductors C1302 and C1303 of the trunk line C1291. This bridge connection extends from the line conductor C1302 by way of the switch springs 1032, 1033, 1034 and 1035 to the line conductor C1303. After the hold switch 1030 is operated to its left-hand position, the dial switch 1020 may be returned to its normal position, thereby to disconnect the transformer 910 from the trunk line C1291 and to remove at the switch springs 1022 and 1021 ground potential from the control conductors C1301 and C1287. The removal of ground potential from the control conductor C1301 causes the control relay R1120 to restore, as previously explained, thereby to cause the distributor apparatus 1170 to operate as previously explained. In the course of operation of the distributor apparatus 1170 the trunk line C1271 individual to the first rate and directory operator's position and extending to the toll switch train 108 will be assigned to be seized by the toll switch train. Also, when the hold switch 1030 is operated to its left-hand position, ground potential is applied to the switch spring 1031, thereby to complete a circuit for illuminating the lamp L1037, this circuit extending from the grounded switch spring 1031' by way of the switch spring 1031 and the lamp L1037 to battery. The illumination of the lamp L1037 reminds the operator at the first rate and directory operator's position 103 that the hold switch 1030 occupies its left-hand position.

Should the operator at the first rate and directory operator's position wish to reconnect the transformer 910 to the trunk line C1291, the dial switch 1020 is operated to its left-hand position and then the hold switch 1030 is operated to its normal position. At this time the repeater 910 is connected to the trunk line C1291 and the trunk line C1271 individual to the first rate and

directory operator's position, and extending to the toll switch train 108 is rendered busy as previously explained. Further the first rate and directory operator's position is marked as busy in the distributor apparatus 1170 in the manner previously described.

The release of the established connection between the first rate and directory operator's position 103 and the substation C is under the control of the operator at the first rate and directory operator's position. In order to release the established connection the operator at the first rate and directory operator's position returns the dial switch 1020 to its normal position, thereby to disconnect the transformer 910 from the trunk line C1291. When the transformer 910 is disconnected from the trunk line C1291, the loop circuit between the transformer 910 and the local switch train 107 is interrupted, thereby to cause the local switch train to be released. When the local switch train 107 is released, the connection to the subscriber line 713 extending to the substation C is released. At this time the apparatus involved in the established connection between the first rate and directory operator's position and the substation C is completely released for further use.

The rate and directory operators' positions are accessible to the toll service observing operator's position 104. For example, the first rate and directory operator's position 103 is accessible to the toll service observing operator's position 104 by way of the trunk line C1210 and each of the rate and directory operator's positions is accessible by way of the trunk line C1306 to the toll service observing operator's position 104. As previously noted, when the trunk line C1271 individual to the first rate and directory operator's position is seized by the toll switch train 108, the control relay R1120 is operated. Upon operating, the control relay R1120 applies at RA1122 ground potential to the control conductor C1302 which is extended by way of the control conductor C1211 of the trunk line C1210 to the lamp L589 at the toll service observing operator's position 104, thereby to cause this lamp to be illuminated. Also, when the first auxiliary trunk line C1270 is seized by the toll switch train 108, the control relay R995 operates to apply at RA996 ground potential to the control conductor C1303 of the trunk line C1306 which is extended by way of the trunk line C1306 to the lamp L528 at the toll service observing operator's position 104, thereby to cause illumination of the lamp L528. Thus, the illumination of the lamp L589 indicates to the operator at the toll service observing operator's position 104 that the trunk line C1271 individual to the first rate and directory operator's position has been seized by the toll switch train 108, and that shortly thereafter the operator at the first rate and directory operator's position will render a service to one of the toll operators. In a similar manner the illumination of the lamp L528 indicates to the operator at the toll service observing operator's position 104 that the first auxiliary trunk line C1270 has been seized by the toll switch train 108, and that shortly thereafter an operator at one of the rate and directory operators' positions will render a service to one of the toll operators.

When the lamp L589 is illuminated, should the operator at the toll service observing operator's position 104 desire to monitor the service rendered by the operator at the first rate and directory operator's position, she inserts a proper one of the plugs 801, 805 or 810 in a manner more fully described subsequently into the jack 590, thereby to complete a connection between the plug inserted into the jack 590 and the trunk line C1271. It is noted that the jack tip 591 is connected by way of the conductor C1212 of the trunk line C1210 to the line conductor C1289 of the trunk line C1271 and the jack ring 592 is connected by way of the conductor C1213 of the trunk line C1210 to the line conductor C1290 of the trunk line C1271.

When the lamp L528 is illuminated, should the operator at the toll service observing operator's position 104 desire to monitor the service rendered by the operator at the rate and directory operator's position answering the call on the first auxiliary trunk line C1270, she inserts a proper one of the plugs mentioned into the jack 525, thereby to complete a connection between the plug inserted into the jack 525 and the first auxiliary trunk line C1270. It is noted that the jack tip 526 is connected by way of the conductor C1304 of the trunk line C1306 to the line conductor C1297 of the first auxiliary trunk line C1270, and the jack ring 527 is connected by way of the conductor C1305 of the trunk line C1306 to the line conductor C1298 of the first auxiliary trunk line C1270.

Operation of the apparatus at the toll service observing operator's position

The service observing operator's position 104 is provided with a receiver set 857 associated with an amplifying arrangement at this position including two vacuum tube amplifiers 850 and 860. The vacuum tube amplifiers 850 and 860 are associated with three monitoring plugs 801, 805 and 810 which are adapted to be inserted into associated jacks connected to trunk lines which are connected to established toll connections, thereby to allow the operator at the service observing operator's position 104 to monitor the established toll connection. The amplifying arrangement including the vacuum tube amplifiers 850 and 860 is utilized in order to prevent an appreciable amount of voice current from being shunted from the established toll connection to the receiver set 857 and the consequent disturbance of repeater balances and reduction in transmission. More specifically, the receiver set 857 is of the head type including two receivers 858 and 859 which are adapted to be respectively associated with the ears of the operator. The receivers 858 and 859 are connected respectively to two plugs 894 and 897. The plug 894 is associated with two multiple connected jacks 870 and 882 while the plug 897 is associated with two multiple connected jacks 876 and 888. When the plugs 894 and 897 are inserted into the jacks 882 and 888, respectively, the receiver 858 is connected to the amplifier 850 and the receiver 859 is connected to the amplifier 860. More particularly, one terminal of the receiver 858 is connected by way of the plug ring 895 and the jack ring 887 to the conductor C853, and the other terminal of the receiver 858 is connected by way of the plug tip 896, the jack tip 885, the jack contact 874 and the jack tip 873 to the conductor C954, the conductors C853 and C954 being connected to the output terminals of the amplifier 850. One terminal of the receiver 859 is connected by way of the plug ring 899 and the jack ring 893 to the conductor C863, and the other terminal of the receiver 859 is connected by way of the plug tip 898, the jack tip 891, the jack contact 880 and

the jack tip 879 to the conductor C864, the conductors C863 and C864 being connected to the output terminals of the amplifier 860. Also, when the plug 894 is inserted into the jack 892 the power input circuit of the amplifier 850 is completed due to the movement of the jack springs 883 and 884 into engagement. This circuit extends from the grounded jack spring 883 by way of the jack spring 884, C856, the positive power input terminal of the amplifier 850 through the apparatus in the amplifier, the negative power input terminal of the amplifier and C855 to the negative terminal of grounded battery. In a similar manner, when the plug 897 is inserted into the jack 888 the power input circuit of the amplifier 860 is completed due to the movement of the jack springs 889 and 890 into engagement. This circuit extends from the grounded jack spring 889 by way of the jack spring 890, C866, the positive power input terminal of the amplifier 860 through the apparatus in the amplifier, the negative power input terminal of the amplifier and C865 to the negative terminal of grounded battery.

The control input circuit of the amplifier 850 is adapted to be connected by way of the switch 820 to the monitoring plug 801. The control input circuit of the amplifier 850 is short-circuited when the switch 820 occupies its normal position, the conductor C851 being connected by way of the switch springs 822, 823, 824 and 825 to the conductor C852. When the switch 820 is operated to its right-hand position the switch springs 822 and 825 are respectively moved into disengagement with the switch springs 823 and 824 and into engagement with the switch springs 821 and 826. At this time the conductor C851 is connected by way of the switch springs 822 and 821 to the plug tip 802, and the conductor C852 is connected by way of the switch springs 825 and 826 to the plug ring 803. The control input circuit of the amplifier 860 is adapted to be selectvely connected by way of the switch 830 to the monitoring plugs 805 and 810. The control input circuit of the amplifier 860 is short-circuited when the switch 830 occupies its normal position, the conductor C861 being connected by way of the switch springs 839, 840, 832, 833, 833', 834, 841 and 842 to the conductor C862. When the switch 830 is operated to its right-hand position, the control input circuit of the amplifier 860 is connected to the monitoring plug 805, the conductor C861 being connected by way of the switch springs 839 and 838 to the plug tip 806 and the conductor C862 being connected by way of the switch springs 842 and 843 to the plug ring 807. On the other hand, when the switch 830 is operated to its left-hand position the control input circuit of the amplifier 860 is connected to the monitoring plug 810, the conductor C861 being connected by way of the switch springs 839, 840, 832 and 831 to the plug tip 811, and the conductor C862 being connected by way of the switch springs 842, 841, 834 and 835 to the plug ring 812.

The service observing operator's position 104 has access to each toll line incoming to the toll board 100 and to each toll operator's position at the toll board. When the operator at the toll service observing operator's position 104 desires to observe inward and through toll service at the toll board 100 the switch 210 is operated to its right-hand position, thereby to apply ground potential to the control conductors C1202 and C1203. The application of ground potential to the control conductor C1202 completes an obvious circuit for energizing the control relay R520, and the application of ground potential to the control conductor C1203 prepares a circuit traced hereinafter for energizing the control relay R530. When energized, the control relay R520 operates to connect at RA521 battery potential by way of the resistor 517, RA521 and RA531 to the control conductor C1200, thereby to prepare a circuit traced hereinafter for energizing the control relay R555. The control relay R520 also applies at RA522 ground potential by way of the switch springs 208, 209 and 207, 206, C1201 and RA522 to the control conductor C1370, thereby to prepare holding circuits traced hereinafter for the control relays R550 and R555. Further the control relay R520 applies, at RA523, ground potential by way of the switch springs 212 and 213, C1203, RA534, RC533, the lower winding of R530 and RA523 to the control conductor C1371, thereby to prepare a circuit traced hereinafter for operating the control relay R530. Finally, the control relay R520 applies at RA524 battery potential by way of the resistor 537, RA536 and RA524 to the control conductor C1372, thereby to prepare a circuit traced hereinafter for operating the control relay R550.

Each toll operator's position at the toll board 100 is provided with a link-listening key which is operative to cause the position distributor 704 to select the toll operator's position as the position to which the next incoming toll call is to be assigned. As previously noted, the position distributor 704 selects sequentially the toll operator's positions having operated link-listening keys and assigns an incoming toll call to the selected toll operator's position. When the position distributor 704 operates to select a particular toll operator's position, ground potential in the position distributor 704 is applied to the control conductor individual to the toll operator's position extending to the toll service observing operator's position 104. For example, when the position distributor 704 operates to select the first toll operator's position 702, ground potential in the position distributor 704 is applied to the control conductor C1232 individual to the first toll operator's position extending to the toll service observing operator's position 104. This application of ground potential to the control conductor C1232 completes a circuit for energizing the control relay R550, this circuit extending from the grounded control conductor C1232 by way of the upper winding of R550, C1372, RA524, RA536 and the resistor 537 to battery. When energized over the above-traced circuit the control relay R550 operates to complete at RA552 a circuit for illuminating the position lamp L558 and for holding itself in its operated position, this circuit extending from ground at the switch spring 208 by way of the switch spring 209, C1201, RA522, C1370, the lower winding of R550, RA552 and L558 to battery. The illumination of the position lamp L558 indicates to the operator at the toll service observing operator's position that the first toll operator's position 702 has been selected by the position distributor 704 to receive the next incoming toll call. The control relay R550 also completes at RA551 a path for short-circuiting the lower winding of the control relay R530, this circuit extending from the grounded control conductor C1232 by way of RA551, C1371, RA523, the lower

winding of R530, RC533, RA534, C1203 and the switch springs 213 and 212 to ground.

The operator at the toll service observing operator's position inserts the monitoring plug 805 into the jack 575 and operates the switch 830 to its right-hand position in the event she wishes to monitor the inward and through toll service to be rendered by the operator at the first toll operator's position 702 when the next incoming toll call is assigned to the first toll operator's position. At this time the input circuit of the amplifier 860 is connected across the line conductors of the trunk line at the first toll operator's position 702. More specifically, one control input terminal of the amplifier 860 is connected by way of C861, the switch springs 839 and 838, the plug tip 806, the jack tip 576, and the conductor C1218 of the cable C1221 to one of the line conductors of the trunk line incoming to the first toll operator's position. The other control input terminal of the amplifier 860 is connected by way of C862, the switch springs 842 and 843, the plug ring 807, the jack ring 577 and the conductor C1219 of the cable C1221 to the other line conductor of the trunk line incoming to the first toll operator's position. Also, the control conductor of the trunk line incoming to the first toll operator's position is connected by way of the control conductor C1220 of the cable C1221, the jack sleeve 578, the plug sleeve 808 and the switch springs 845 and 844 to the control conductor C1208, thereby to prepare a circuit traced hereinafter for energizing in series the control relays R240 and R250. Furthermore, operation of the switch 830 to its right-hand position completes a circuit for energizing the control relay R230, this circuit extending from the grounded switch spring 837 by way of the switch spring 836, C1209, RA244 and the winding of R230 to battery. When energized over the above-traced circuit the control relay R230 operates to prepare a circuit traced hereinafter for applying battery potential to the control conductor C1200.

When the next toll call is extended to the toll board 100 it will be assigned by the position distributor 704 to the first toll operator's position 702 to be answered. Assuming that the toll call is extended to the toll board 100 by way of a toll line associated with the trunk line C1217 individual thereto, as soon as the toll call is assigned to the first toll operator's position ground potential is applied in the line circuit of the toll line to the control conductor C1216 of the trunk line C1217. This application of ground potential to the control conductor C1216 completes a circuit for energizing the control relay R555, this circuit extending from the grounded control conductor C1216 by way of the upper winding of R555, C1200, RA531, RA521 and the resistor 517 to battery. When energized over the above-traced circuit the control relay R555 operates to complete at RA556 a circuit for illuminating the toll line lamp L557 and for holding R555 in its operated position. This circuit extends from ground at the switch springs 207 and 208 by way of the switch springs 206 and 209, C1201, RA522, C1370, the lower winding of R555, RA556 and L557 to battery. The illumination of the toll line lamp L557 indicates to the operator at the toll service observing operator's position 104 that the toll call assigned to the first toll operator's position 702 is routed thereto by way of the toll line with which the trunk line C1217 is individually associated. Due to the fact that the trunk line C1221 is connected across the trunk line at the first toll operator's position 702, the operator at the toll service observing operator's position may monitor the connection. This monitoring connection includes the trunk line C1221, the jack 575, the plug 805, the switch 830, the amplifier 860, the jack 888, the plug 897 and the receiver 859.

When the operator at the first toll operator's position 702 answers the toll call, the link-listening key is returned to its busy position and the position distributor 704 operates automatically to select another toll operator's position to receive the next incoming toll call. The position distributor 704 also operates to remove ground potential from the control conductor C1232, thereby to interrupt a point in the path for short-circuiting the lower winding of the control relay R530. At this time a circuit for energizing the control relay R530 is completed, this circuit extending from the grounded switch spring 212 by way of the switch spring 213, C1203, RA534, RC533, the lower winding of R530, RA523, C1371, the upper winding of R550, C1372, RA524, RA536 and the resistor 537 to battery. When energized over the above-traced circuit, the control relay R530 operates to complete at RA532 and RA534 a holding circuit for itself extending from the grounded control conductor C1203 by way of RA534, RA532 and the upper winding of R530 to battery. The control relay R530 also interrupts at RA534 and RC533 a point in its original operating circuit, interrupts at RA531 a point in the path for applying battery potential to the control conductor C1200, and interrupts at RA536 a point in the path for applying battery potential to the control conductor C1372. The removal of battery potential from the control conductor C1200 prevents any of the other control relays corresponding to the control relay R555 and associated with the other trunk lines corresponding to the trunk line C1217 from being operated when the next toll call on an incoming toll line is assigned to a toll operator's position while the operator at the toll service observing operator's position 104 is monitoring the toll service being rendered by the operator at the first toll operator's position 702. Also, the removal of battery potential from the control conductor C1372 prevents any of the other relays corresponding to the relay R550 and associated with the other trunk lines corresponding to the trunk line C1232 from being operated when the position distributor 704 selects the next toll operator's position to assign the next incoming toll call thereto, while the operator at the toll service observing operator's position 104 is monitoring the toll service being rendered by the toll operator at the first toll operator's position 702.

The control relays R550 and R555 remain in their operated positions and the lamps L557 and L558 remain illuminated until the switch 205 is operated to its right-hand position, thereby to remove ground potential from the control conductor C1201. The removal of ground potential from the control conductor C1201 causes the control relays R550 and R555 to restore. Upon restoring, the control relay R550 interrupts at RA551 a further point in the original circuit for operating the control relay R530, and interrupts at RA552 a further point in the circuit for illuminating the lamp L558. Upon restoring, the control relay R555 interrupts at RA556 a further point in the circuit for illuminating the lamp L557. At this time the control relays R550 and R555, and the other control relays corresponding

thereto, occupy their restored positions and remain in these positions until the switch 210 is operated to its normal position to cause the control relays R520 and R530 to restore in a manner more fully described subsequently.

The operator at the first toll operator's position 702 extends the toll call to an outgoing toll line by dialing a proper series of digits into the toll switch train 108, thereby to cause the toll switch train to seize an outgoing trunk line extending to the desired distant exchange. When the toll switch train 108 seizes the outgoing trunk line, ground potential is applied to the control conductor of the trunk line individually associated therewith, thereby to prepare a circuit for operating the relay corresponding to the relay R555 associated with the trunk line. For example, assume that the trunk line C1217 is individually associated with the outgoing trunk line seized by the toll switch train 108 at this time, instead of being individually associated with the incoming toll line to the first toll operator's position 702, as previously assumed. In this event, when the toll switch train 108 seizes the outgoing trunk line, ground potential is applied therein to the control conductor C1216 of the trunk line C1217, thereby to prepare a circuit traced hereinafter for operating the control relay R555. The operator at the first toll operator's position 702 then operates the ringing key at this position, thereby to cause ground potential to be applied to the control conductor C1220 of the trunk line C1221 associated with the first toll operator's position. The application of ground potential to the control conductor C1220 completes a circuit for energizing in series the control relays R249 and R250, thereby to cause these relays to operate. This circuit extends from the grounded control conductor C1220 by way of the jack sleeve 578, the plug sleeve 808, the contact springs 845 and 844, C1208, the upper winding of R240 and the winding of R250 to battery. Upon operating, the control relay R250 interrupts at RA251 and RC252 a point in a circuit traced hereinafter for illuminating the disconnect supervisory lamp L201, prepares at RA251 and RC253 a point in a circuit traced hereinafter for illuminating the ringing supervisory lamp L202, prepares at RA254 a point in a circuit traced hereinafter for applying battery potential to the control conductor C1200, prepares at RA255 a point in a circuit traced hereinafter for energizing the control relay R500, and interrupts at RA256 a point in the holding circuit of the control relay R240. Upon operating, the control relay R240 completes at RA241 a point in a path for applying battery potential to the control conductor C1200, this path extending from battery at the resistor 232 by way of RA231, RA241 and RA254 to the control conductor C1200. This application of battery potential to the control conductor C1200 completes a circuit for operating the control relay R555, this circuit extending from battery potential on the control conductor C1200 by way of the upper winding of R555 to ground potential on the control conductor C1216 of the trunk line C1217 individually associated with the seized outgoing trunk line as just assumed. When energized over the above-traced circuit, the relay R555 operates to prepare at RA556 a point in the circuit for illuminating the toll line lamp L557 and for holding the control relay R555 in its operated position. The control relay R240 also completes at RA242 a point in a circuit for illuminating the ringing supervisory lamp L202, this circuit extending from ground at RA242 by way of RA251, RC253 and L202 to battery. The illumination of the lamp L202 advises the operator at the toll service observing operator's position that ringing current is being projected over the outgoing toll line. The control relay R240 also completes at RA242 a circuit for energizing the control relay R500, this circuit extending from ground at RA242 by way of RA255, C1204 and the winding of R500 to battery. When energized over the above-traced circuit, the control relay R500 operates to move the weighted armature RA501 into engagement with the contact RC503, the latter contact being moved into engagement with the contact RC502, thereby to complete a circuit for energizing the control relay R505 and to prepare a point in a circuit for holding the control relay R505 in its operated position. The circuit for energizing the control relay R505 extends from the grounded armature RA501 by way of RC503, RC502 and the winding of R505 to battery. When energized over the above-traced circuit, the control relay R505 operates to complete at RA508 a point in its holding circuit, this holding circuit extending from ground at RA501 by way of RC503, RA508 and the winding of R505 to battery. Further, the control relay R505 applies at RA506 multiple battery potential to the control conductor C1200, thereby to complete a multiple circuit for energizing the control relay R555. This circuit extends from battery by way of the resistor 517, RA506, C1200 and the upper winding of R555 to the grounded control conductor C1216 of the trunk line C1217. Finally the control relay R505 completes at RA507 the circuit for holding the control relay R555 operated and for illuminating the toll line lamp L557, this circuit extending from ground at RA507 by way of C1370, the lower winding of R555, RA556 and L557 to battery. The illumination of the toll line lamp L557 indicates to the operator at the toll service observing operator's position 104 that the outgoing toll line, with which the trunk line C1217 is individually associated, is the toll line over which the outgoing toll call is being extended. Further, the control relay R240 prepares at RA243 a point in its own holding circuit and interrupts at RA244 a point in the operating circuit of the control relay R230. The control relay R230, being of the slow-to-release type, restores shortly thereafter to interrupt at RA231 a point in the original circuit for operating the control relay R555, the latter control relay being retained in its operated position at this time by the operater control relay R505.

When the toll operator in the distant exchange answers the toll call extending thereto, the operator at the first toll operator's position 702 operates the ringing key at her position to arrest the application of ringing current to the outgoing toll line extending to the distant exchange. When this ringing key is thus operated ground potential is removed from the control conductor C1220 of the trunk line C1221 extending to the first toll operator's position 702, thereby to interrupt the circuit for energizing in series the control relays R240 and R250, causing the control relay R240 to restore immediately. Upon restoring, the control relay R240 interrupts at RA241 a further point in the original path for applying battery potential to the control conductor C1200, and interrupts at RA242 a point in the circuits for illuminating the ringing supervisory lamp L202 and for operating the control relay R500. Further, the control relay R240 interrupts at

RA243 a point in its own holding circuit and completes at RA244 a point in the operating circuit of the control relay R230. When the ringing supervisory lamp L202 is extinguished, the operator at the toll service observing operator's position 104 is advised that the projection of ringing current over the outgoing toll line has been arrested. The control relay R230 reoperates to prepare at RA231 a point in the original path for applying battery potential to the control conductor C1200. Shortly after the circuit for energizing the control relay R250 is interrupted, the latter control relay, being of the slow-to-release type, restores. Upon restoring, the control relay R250 prepares at RA251 and RC252 a point in the circuit for illuminating the disconnect supervisory lamp L201, interrupts at RA251 and RC253 a further point in the circuit for illuminating the ringing supervisory lamp L202, interrupts at RA254 a further point in the path for applying battery potential to the control conductor C1200, interrupts at RA255 a further point in the operating circuit of the control relay R500 and prepares at RA256 a point in the holding circuit of the control relay R240.

When the operating circuit of the control relay R500 is interrupted, this control relay restores, thereby to release its weighted armature RA501 and to interrupt at RC502 and RC503 a point in the original operating circuit of the control relay R505. The weighted armature RA501 vibrates between the contacts RC503 and RC504 and into alternate engagement therewith, thereby to intermittently complete the holding circuit of the control relay R505. After a predetermined time interval, the weighted armature RA501 assumes an intermediate position between the contacts RC503 and RC504, thereby to completely interrupt the holding circuit of the control relay R505. Shortly thereafter, the control relay R505, being of the slow-to-release type, restores to interrupt at RA506 a point in the path for applying battery potential to the control conductor C1200, thereby to interrupt the operating circuit of the control relay R555. The control relay R505 also interrupts at RA507 a point in the circuit for illuminating the toll line lamp L557 and for holding the control relay R555 in its operated position, causing the latter control relay to restore, and interrupts at RA508 a further point in its own holding circuit. Upon restoring, the control relay R555 interrupts at RA556 a further point in the circuit for illuminating the toll line lamp L557. The weighted armature RA501 of the control relay R500 and the slow-to-release relay R505 have suitable characteristics such that the toll line lamp L557 is extinguished approximately ten seconds after the projection of ringing current over the outgoing toll line is arrested. When the toll line lamp L557 is extinguished, the operator at the toll service observing operator's position is advised that approximately ten seconds have elapsed since the projection of ringing current over the outgoing toll line was arrested.

The operator at the toll service observing operator's position then inserts the monitoring plug 801 into the jack 570 and operates the switch 820 to its right-hand position, thereby to connect the receiver 858 by way of the amplifier 850 to the outgoing toll line, the receiver 859 being connected at this time by way of the amplifier 860, the switch 830, the plug 805 and the jack 575 to the trunk line C1221 extending to the first toll operator's position 702. More particularly, one control input terminal of the amplifier 850 is connected by way of C851, the switch springs 822 and 821, the plug tip 802, the jack tip 571 and the line conductor C1214 of the trunk line C1217 to one line conductor of the outgoing trunk line and the other control input terminal of the amplifier 850 is connected by way of C852, the switch springs 825 and 826, the plug ring 803, the jack ring 572 and the line conductor C1215 of the trunk line C1217 to the other line conductor of the outgoing trunk line. Also, a circuit is completed for illuminating the lamp L814, this circuit extending from the grounded control conductor C1216 of the trunk line C1217 by way of the jack sleeve 573, the plug sleeve 804 and L814 to battery. The illumination of the lamp L814 indicates to the operator at this position that the outgoing toll line with which the trunk line C1217 is individually associated is a busy toll line. At this time, if the outgoing toll line, with which the trunk line C1217 is individually associated, is the outgoing toll line to which the first toll operator's position 702 is connected, then the operator at the toll service observing operator's position will hear in the receivers 858 and 859 one conversation. On the other hand, if the outgoing toll line, with which the trunk line C1217 is individually associated, is not the outgoing toll line to which the first toll operator's position 702 is connected, then the operator at the toll service observing operator's position will hear in the receivers 858 and 859 two conversations. Thus, the outgoing toll line, to which the first toll operator's position 702 is connected, is verified. After verifying the outgoing toll line to which the first toll operator's position 702 is connected, the operator at the toll service observing operator's position 104 withdraws the plug 801 from the jack 570 and inserts the plug 810 into the jack 570. The switch 820 is then returned to its normal position and the switch 830 is operated to its left-hand position, thereby to connect the receiver 859 by way of the amplifier 860, the switch 830, the plug 810, the jack 570 and the trunk line C1217 to the outgoing toll line extending to the distant exchange.

When the operator at the toll service observing operator's position 104 observes that the connection between the first toll operator's position 702 and the distant exchange is to be released, she operates the switch 830 from its left-hand position to its right-hand position, thereby to connect the receiver 859 by way of the amplifier 860, the switch 830, the plug 805, the jack 575 and the trunk line C1221 to the trunk line at the first toll operator's position. When the operator at the first toll operator's position releases the connection by operating a release key at her position, ground potential through a resistor is applied thereat to the control conductor C1220 of the trunk line C1221 extending to the toll service observing operator's position 104, thereby to complete a circuit for energizing the control relay R240. This circuit extends from the grounded control conductor C1220 by way of the jack sleeve 578, the plug sleeve 808, the switch springs 845 and 844, C1208, the upper winding of R240 and the winding of R250 to battery. When energized over the above-traced circuit, the control relay R240 operates. However, the control relay R250 does not operate due to the high series resistance of this circuit. Upon operating, the control relay R240 completes at RA242 a circuit for illuminating the disconnect supervisory lamp L201, this circuit extending from ground at RA242 by way of

RA251, RC252 and L201 to battery. The illumination of the disconnect supervisory lamp L201 indicates to the operator at the toll service observing operator's position 104 that the established connection between the first toll operator's position 702 and the distant exchange has been released. The control relay R240 also completes at RA243 a holding circuit for itself extending from ground at the switch spring 217 by way of the switch spring 216, RA256, RA243 and the lower winding of R240 to battery.

In order to completely release the apparatus at the toll service observing operator's position 104, the switch 830 is returned to its normal position. The switch 210 is operated to its left-hand position and the switch 215 is operated to its right-hand position. When the switch 230 is operated to its normal position, the switch springs 844 and 845 are moved into disengagement, thereby to interrupt a point in the circuit for operating the control relay R240, this control relay being retained in its operated position at this time due to its completed holding circuit. When the switch 210 is operated to its left-hand position, the operating circuit of the control relay R520 and the holding circuit of the control relay R530 are interrupted, causing these relays to restore. Upon restoring, the control relay R520 interrupts at RA521 a point in the path for applying battery potential to the control conductor C1209, interrupts at RA522 a point in the path for applying ground potential to the control conductor C1370, interrupts at RA523 a point in the path for applying ground potential to the control conductor C1371 and interrupts at RA524 a point in the path for applying battery potential to the control conductor C1372. Upon restoring, the control relay R530 prepares at RA531 a point in the path for applying battery potential to the control conductor C1209, interrupts at RA532 and RA534 a further point in its own holding circuit, prepares at RA534 and RC533 a point in the path for applying ground potential to the control conductor C1371 and prepares at RA536 a point in the path for applying battery potential to the control conductor C1372. When the switch 215 is operated to its right-hand position, the holding circuit of the control relay R240 is interrupted, causing this relay to restore. Upon restoring, the control relay R240 interrupts at RA241 a point in the path for applying battery potential to the control conductor C1209, interrupts at RA242 the circuit for illuminating the disconnect supervisory lamp L201, interrupts at RA243 a further point in its own holding circuit and prepares at RA244 a point in the operating circuit of the control relay R239. When the disconnect supervisory lamp L201 is extinguished, the operator at the toll service observing operator's position operates the switch 205 to its left-hand position, thereby to apply ground potential to the control conductor C1201. At this time, the apparatus at the toll service observing operator's position 104 is completely released for further use.

From the foregoing description it was assumed that a toll call routed by way of an incoming toll line was assigned by the position distributor 704 to the first toll operator's position 702 and that shortly thereafter the operator at the first toll operator's position operated her link-listening key to cause ground potential to be removed from the control conductor S1232, thereby to cause the control relay R539 to be operated, as previously explained. Upon operating, the control relay R539 interrupts at RA531 a point in the path for applying ground potential to the control conductor C1209, thereby to prevent the operation of other control relays corresponding to the control relay R555. Also it was noted that the control relay R555 was operated when ground potential was applied in the line circuit of the incoming toll line to the control conductor C1216 of the trunk line C1217 individually associated with the incoming toll line. It may happen that an operator at another toll operator's position at the toll board 100 has the link-listening key at her position operated to cause the position distributor 704 to assign the next incoming toll call to her position after the incoming toll call is assigned to the first toll operator's position 702. At this time, should a second toll call come into the toll board 100 immediately after the first toll call is assigned by the position distributor 704 to the first toll operator's position 702, the position distributor 704 would assign the second toll call to the other toll operator's position. When the second toll call is assigned to the other toll operator's position, ground potential is applied in the line circuit of the second incoming toll line to the control conductor of the trunk line individually associated with the second toll line and corresponding to the control conductor C1216 of the trunk line C1217 associated with the first toll line. Thus, a relay corresponding to the relay R555 would operate shortly after the operation of the control relay R555, thereby to cause the toll line lamp L557 and another toll line lamp corresponding thereto and individual to the second toll line to be illuminated. Due to the illumination of these two toll line lamps, it is impossible for the operator at the toll service observing operator's position 104 to know which of the toll calls the operator at the first toll operator's position 702 is answering. In order to verify the call which the operator at the first toll operator's position is answering, the operator at the toll service observing operator's position 104 operates the switch 829 to its right-hand position and inserts the monitoring plug 801 into the jack 570. If the operator at the first toll operator's position 702 is answering the toll call on the first toll line, the operator at the toll service observing operator's position hears one conversation in the receivers 858 and 859, thereby verifying the toll call which the operator at the first toll operator's position is answering. On the other hand, should the operator at the toll service observing operator's position 702 hear two conversations at this time, she would know that the toll operator at the first toll operator's position is answering the toll call on the second toll line and not the toll call on the first toll line. Following this verification, the operator at the toll service observing operator's position inserts the monitoring jack 810 into the jack connected to the trunk line individual to the toll line to which the first toll operator's position 702 is connected, and operates the switch 830 to its left-hand position, thereby to monitor the established connection between the first toll operator's position and the distant exchange, as previously explained.

The toll service observing operator's position 104 has access to each C. L. R. line incoming to the toll board 100 and to each C. L. R. operator's position at the toll board. When the operator at the toll service observing operator's position 104 desires to observe recording and paystation service at the toll board 100, the switch 225 is operated to its right-hand position, thereby to apply ground potential to the control conductors

C1206 and C1207. The application of ground potential to the control conductor C1207 completes an obvious circuit for energizing the control relay R510 and the application of ground potential to the control conductor C1206 prepares a circuit traced hereinafter for energizing the control relay R540. When energized, the control relay R510 operates to connect at RA511 battery potential by way of the resistor 516, RA511 and RA541 to the control conductor C1380, thereby to prepare a circuit traced hereinafter for energizing the control relay R565. The control relay R510 also connects at RA512 ground potential by way of the switch springs 222, 221 and 223, 224, C1205 and RA512 to the control conductor C1381, thereby to prepare holding circuits traced hereinafter for the control relays R560 and R565. Further, the control relay R510 connects at RA513 and RA514 ground potential by way of the switch springs 227 and 226, C1206, RA513, RA543, RC542, the lower winding of R540 and RA514 to the control conductor C1382, thereby to prepare a circuit traced hereinafter for operating the control relay R540. Finally, the control relay R510 connects at RA515 battery potential by way of the resistor 545, RA544 and RA515 to the control conductor C1383, thereby to prepare a circuit traced hereinafter for energizing the control relay R560.

Each C. L. R. operator's position at the toll board 100 is provided with a link-listening key which is operated to cause the position distributor 703 to select the C. L. R. operator's position as the position to which the next incoming C. L. R. call is to be assigned. As previously noted, the position distributor 703 selects sequentially the C. L. R. operators' positions having operated link-listening keys and assigns an incoming C. L. R. call to the selected C. L. R. operator's position. When the position distributor 703 operates to select a particular C. L. R. operator's position, ground potential in the position distributor 703 is applied to the control conductor individual to the C. L. R. operator's position extending to the toll service observing operator's position 104. For example, when the position distributor 703 operates to select the first C. L. R. operator's position 701, ground potential in the position distributor 703 is applied to the control conductor C1231 individual to the first C. L. R. operator's position extending to the toll service observing operator's position 104. This application of ground potential to the control conductor C1231 completes a circuit for energizing the control relay R560, this circuit extending from the grounded control conductor C1231 by way of the upper winding of R560, C1383, RA515, RA544 and the resistor 545 to battery. When energized over the above-traced circuit, the control relay R560 operates to complete at RA562 the circuit for illuminating the position lamp L568 and for holding itself in its operated position, this circuit extending from ground at the switch spring 222 by way of the switch spring 221, C1205, RA512, C1381, the lower winding of R560, RA562 and L568 to battery. The illumination of the position lamp L568 indicates to the operator at the toll service observing operator's position that the first C. L. R. operator's position 701 has been selected by the position distributor 703 to receive the next incoming C. L. R. call. The control relay R560 also completes at RA561 a path for short-circuiting the lower winding of the control relay R540, this circuit extending from the grounded control conductor C1231 by way of RA561, C1382, RA514, the lower winding of R540, RC542, RA543, RA513, C1206 and the switch springs 226 and 227 to ground.

The operator at the toll service observing operator's position inserts the monitoring plug 805 into the jack 585 and operates the switch 830 to its right-hand position in the event she wishes to monitor the C. L. R. service to be rendered by the operator at the first C. L. R. operator's position 701 when the next incoming C. L. R. call is assigned to the first C. L. R. operator's position 701. At this time the input circuit of the amplifier 860 is connected by way of the switch 830, the plug 805, the jack 585 and the trunk line C1230 across the line conductors of the trunk line at the first C. L. R. operator's position 701.

When the next C. L. R. call is extended to the toll board 100 it will be assigned by the position distributor 703 to the first C. L. R. operator's position 701 to be answered. Assuming that the C. L. R. call is extended to the toll board 100 by way of a toll line associated with the trunk line C1226 individual thereto, as soon as the C. L. R. call is assigned to the first C. L. R. operator's position, ground potential is applied in the line circuit of the C. L. R. line to the control conductor C1225 of the trunk line C1226. This application of ground potential to the control conductor C1225 completes a circuit for energizing the control relay R565, this circuit extending from the grounded control conductor C1225 by way of the upper winding of R565, C1380, RA541, RA511 and the resistor 516 to battery. When energized over the above-traced circuit, the control relay R565 operates to complete at RA566 a circuit for illuminating the C. L. R. line lamp L567 and for holding R565 in its operated position. This circuit extends from ground at the switch springs 222 and 221 by way of C1205, RA512, C1381, the lower winding of R565, RA566 and L567 to battery. The illumination of the C. L. R. line lamp L567 indicates to the operator at the toll service observing operator's position 104 that the C. L. R. line assigned to the first C. L. R. operator's position 701 is routed thereto by way of the C. L. R. line with which the trunk line C1226 is individually associated. Due to the fact that the trunk line C1230 is connected across the trunk line at the first C. L. R. operator's position 701, the operator at the toll service observing operator's position may monitor the connection. This monitoring connection includes the trunk line C1230, the jack 585, the plug 805, the switch 830, the amplifier 860 and the receiver 859.

When the operator at the first C. L. R. operator's position 701 answers the C. L. R. call, the link-listening key is returned to its busy position and the position distributor 703 operates automatically to select another C. L. R. operator's position to receive the next incoming C. L. R. call. The position distributor 703 also operates to remove ground potential from the control conductor C1231, thereby to interrupt a point in the path for short-circuiting the lower winding of the control relay R450. At this time a circuit for energizing the control relay R540 is completed, this circuit extending from the grounded switch spring 227 by way of the switch spring 226, C1206, RA513, RA543, RC542, the lower winding of R540, RA514, C1382, RA561, the upper winding of R560, C1383, RA515, RA544 and the resistor 545 to battery. When energized over the above-traced circuit, the control relay R540 operates to complete at RA542 and RA543 a holding circuit

for itself extending from the grounded control conductor C1206 by way of RA543, RA543, RA542 and the upper winding of R540 to battery. The control relay R540 also interrupts at RA543 and RC542 a point in its original operating circuit, interrupts at RA541 a point in the path for applying battery potential to the control conductor C1380, and interrupts at RA544 a point in the path for applying battery potential to the control conductor C1383. The removal of battery potential from the control conductor C1380 prevents any of the other control relays corresponding to the control relay R565, and associated with the other trunk lines corresponding to the trunk line C1226, from being operated when the next C. L. R. call is assigned to a C. L. R. operator's position while the operator at the toll service observing operator's position 104 is monitoring the C. L. R. service being rendered by the operator at the first C. L. R. operator's position 701. Also, the removal of battery potential from the control conductor C1383 prevents any of the other relays corresponding to the relay R560, and associated with the other trunk lines corresponding to the trunk line C1234, from being operated when the position distributor selects the next C. L. R. operator's position to assign the next incoming C. L. R. call thereto while the operator at the toll service observing operator's position 104 is monitoring the C. L. R. service being rendered by the C. L. R. operator at the first C. L. R. operator's position 701.

The control relays R560 and R565 remain in their operated positions and the lamps L567 and L568 remain illuminated until the switch 220 is operated to its right-hand position, thereby to remove ground potential from the control conductor C1205. The removal of ground potential from the control conductor C1205 causes the control relays R560 and R565 to restore. Upon restoring, the control relay R560 interrupts at RA561 a further point in the original circuit for operating the control relay R540, and interrupts at RA562 a further point in the circuit for illuminating the lamp L568. Upon restoring, the control relay R565 interrupts at RA566 a further point in the circuit for illuminating the lamp L567. At this time the control relays R560 and R565, and the other control relays corresponding thereto, occupy their restored positions and remain in these positions until the switch 225 is operated to its normal position to cause the control relays R510 and R540 to restore in a manner more fully described subsequently.

The operator at the first C. L. R. operator's position 701 extends the C. L. R. call to an outgoing toll line by dialing a proper series of digits into the toll switch train 108, thereby to cause the toll switch train to seize an outgoing trunk line extending to the desired distant exchange. When the toll switch train 108 seizes the outgoing trunk line, ground potential is applied to the control conductor of the trunk line individually associated therewith. For example, assume that the trunk line C1217 is individually associated with the outgoing trunk line seized by the toll switch train 108 at this time instead of being individually associated with an incoming toll line to the toll board 100, as previously assumed. In this event, when the toll switch train 108 seizes the outgoing trunk line, ground potential is applied therein to the control conductor C1216 of the trunk line C1217, thereby to prepare a circuit traced hereinafter for operating the control relay R555. The operator at the first C. L. R. operator's position 701 then operates the ringing key at this position, thereby to cause ground potential to be applied to the control conductor C1229 of the trunk line C1230 associated with the first C. L. R. operator's position. The application of ground potential to the control conductor C1229 completes a circuit for energizing in series the control relays R240 and R250, thereby to cause these relays to operate. This circuit extends from the grounded control conductor C1229 by way of the jack sleeve 508, the plug sleeve 808, the contact springs 845 and 844, C1298, the upper winding of R240 and the winding of R250 to battery. The control relays R240 and R250 operate to cause the control relay R230 to restore, to cause the ringing supervisory lamp L202 to be illuminated, to cause the control relay R500 to operate and to cause the control relay R555 to be operated in the manner previously described. Also, the control relay R500 causes the control relay R505 to be operated, which latter relay causes the toll line lamp L557 to be illuminated as previously explained. The illumination of the toll line lamp L557 indicates to the operator at the toll service observing operator's position 104 that the C. L. R. call is being extended by way of the toll line with which the trunk line C1217 is individually associated and the illumination of the ringing supervisory lamp L202 indicates to the operator at this position that ringing current is being projected over the outgoing toll line as previously explained.

When the toll operator in the distant exchange answers the toll call extending thereto, the operator at the first C. L. R. operator's position 701 operates the ringing key at her position to arrest the application of ringing current to the outgoing toll line extending to the distant exchange. When this ringing key is thus operated, ground potential is removed from the control conductor C1229 of the trunk line C1230 extending to the toll service observing operator's position, thereby to interrupt the circuit for energizing in series the control relays R240 and R250, causing the control relay R240 to restore immediately, and the control relay R250 to restore shortly thereafter. The restorations of the control relays R240 and R250 are effective to cause the control relay R230 to reoperate, to cause the ringing supervisory lamp L202 to be extinguished and to cause the control relay R500 to restore in the manner previously described. Upon restoring, the control relay R500 causes the control relay R505 to restore approximately ten seconds thereafter, thereby to cause the control relay R555 to restore and the toll line lamp L557 to be extinguished as previously explained. When the ringing supervisory lamp L202 is extinguished, the operator at the toll service observing operator's position is advised that the projection of ringing current over the outgoing toll line has been arrested, and when the toll line lamp L557 is extinguished, the operator at this position is advised that approximately ten seconds have elapsed since the projection of ringing current over the outgoing toll line was arrested.

The operator at the toll service observing operator's position then inserts the monitoring plug 801 into the jack 570 and operates the switch 820 to its right-hand position, thereby to connect the receiver 858 by way of the amplifier 850, the switch 820, the plug 801, the jack 570 and the trunk line C1217 to the outgoing trunk line, the receiver 859 being connected at this time by way

of the amplifier 860, the switch 830, the plug 805 and the jack 585 to the trunk line C1230 extending to the first C. L. R. operator's position 701. Also, the previously-traced circuit for illuminating the lamp L814 is completed when the plug 801 is inserted into the jack 570, thereby to indicate to the operator at the toll service observing operator's position that the outgoing toll line with which the trunk line C1217 is individually associated is a busy toll line. At this time, if the outgoing toll line with which the trunk line C1217 is individually associated is the outgoing toll line to which the first C. L. R. operator's position 701 is connected, then the operator at the toll service observing operator's position will hear in the receivers 858 and 859 one conversation. On the other hand, if the outgoing toll line with which the trunk line C1217 is individually associated is not the outgoing toll line to which the first C. L. R. operator's position 701 is connected, then the operator at the toll service observing operator's position will hear in the receivers 858 and 859 two conversations. Thus, the outgoing toll line, to which the first C. L. R. operator's position 701 is connected, is verified. After verifying the outgoing toll line to which the first C. L. R. operator's position 701 is connected, the operator at the toll service observing operator's position 104 withdraws the plug 801 from the jack 570 and inserts the plug 810 into the jack 570. The switch 820 is then returned to its normal position and the switch 830 is operated to its left-hand position, thereby to connect the receiver 859 by way of the amplifier 860, the switch 830, the plug 810, the jack 570 and the trunk line C1217 to the outgoing toll line extending to the distant exchange.

When the operator at the toll service observing operator's position 104 observes that the connection between the first C. L. R. operator's position 701 and the distant exchange is to be released, she operates the switch 830 from its left-hand position to its right-hand position, thereby to connect the receiver 859 by way of the amplifier 860, the switch 830, the plug 805, the jack 585 and the trunk line C1230 to the trunk line at the first C. L. R. operator's position. When the operator at the first C. L. R. operator's position releases the connection by operating a release key at her position, ground potential through a resistor is applied to the control conductor C1229 of the trunk line C1230 extending to the first C. L. R. operator's position, thereby to complete a circuit for energizing the control relay R240. This circuit extends from the grounded control conductor C1229 by way of the jack sleeve 588, the plug sleeve 808, the switch springs 845 and 844, C1208, the upper winding of R240 and the winding of R250 to battery. When energized over the above-traced circuit, the control relay R240 operates. However, the control relay R250 does not operate due to the high series resistance of this circuit. Upon operating, the control relay R240 completes the circuit for illuminating the disconnect supervisory lamp L201, thereby to indicate that the established connection between the first C. L. R. operator's position and the distant exchange has been released and completes its own holding circuit as previously explained.

In order to completely release the apparatus at the toll service observing operator's position 104, the switch 830 is returned to its normal position, the switch 225 is operated to its left-hand position and the switch 215 is operated to its right-hand position. When the switch 830 is operated to its normal position, the switch springs 844 and 845 are moved into disengagement, thereby to interrupt a point in the circuit for operating the control relay R240, this control relay being retained in its operated position at this time due to its completed holding circuit. When the switch 225 is operated to its left-hand position, the operating circuit of the control relay R510 and the holding circuit of the control relay R540 are interrupted, causing these relays to restore. Upon restoring, the control relay R510 interrupts at RA511 a point in the path for applying battery potential to the control conductor C1380, interrupts at RA512 a point in the path for applying ground potential to the control conductor C1381, interrupts at RA513 and RA514 points in the path for applying ground potential to the control conductor C1382, and interrupts at RA515 a point in the path for applying battery potential to the control conductor C1383. Upon restoring, the control relay R540 prepares at RA541 a point in the path for applying battery potential to the control conductor C1380, interrupts at RA542 and RA543 a further point in its own holding circuit, prepares at RA543 and RC542 a point in the path for applying ground potential to the control conductor C1382 and prepares at RA544 a point in the path for applying battery potential to the control conductor C1383. When the switch 215 is operated to its right-hand position, the holding circuit of the control relay R240 is interrupted, causing this relay to restore. Upon restoring, the control relay R240 interrupts at RA241 a point in the path for applying battery potential to the control conductor C1200, interrupts at RA242 the circuit for illuminating the disconnect supervisory lamp L201, interrupts at RA243 a further point in its own holding circuit and prepares at RA244 a point in the holding circuit of the control relay R230. When the disconnect supervisory lamp L201 is extinguished, the operator at the toll service observing operator's position operates the switch 220 to its left-hand position, thereby to apply ground potential to the control conductor C1205. At this time the apparatus at the toll service observing operator's position 104 is completely released for further use.

In the event that two incoming C. L. R. calls are assigned by the position distributor 703 to the first and another C. L. R. operator's positions in rapid succession, and before the operator at the first C. L. R. operator's position may operate her link-listening key to cause the control relay R540 to operate as previously explained, the control relay R565 associated with the trunk line C1226 individual to the C. L. R. line assigned by the position distributor 703 to the first C. L. R. operator's position operates to cause the C. L. R. line lamp L567 to be illuminated. Also, a control relay corresponding to the control relay R565 and associated with a trunk line which is individual to the C. L. R. line assigned by the position distributor 703 to the other C. L. R. operator's position is operated to cause the C. L. R. line lamp associated therewith to be illuminated. In order to ascertain which of the C. L. R. lines is assigned by the position distributor 703 to the first C. L. R. operator's position 701, the operator at the toll service observing operator's position 104 inserts the plug 801 into the jack 580 and operates the switch 820 to its right-hand position as previously explained. If the C. L. R. line with which the trunk line C1226 is associated is the

C. L. R. line assigned by the position distributor 703 to the first C. L. R. operator's position 701, the operator at the toll service observing operator's position 104 hears one conversation in the receivers 858 and 859, as previously explained. Thus, the operator at the toll service observing operator's position verifies the C. L. R. line assigned by the position distributor 703 to the first C. L. R. operator's position 701 in this event.

In order to observe the point-to-point service rendered by an operator at any one of the point-to-point operator's positions, the operator at the toll service observing operator's position 104 inserts the monitoring plug 810 into the jack connected by a trunk line to the desired C. L. R. operator's position and operates the switch 830 to its left-hand position. For example, in order to monitor the point-to-point service being rendered by the operator at the point-to-point operator's position 701, the plug 810 is inserted into the jack 585 connected by way of the trunk line C1230 to the point-to-point operator's position 701 and the switch 830 is operated to its left-hand position. At this time, the receiver 859 is connected by way of the amplifier 860, the switch 830, the plug 810, the jack 585 and the trunk line C1230 across the trunk line at the point-to-point operator's position 701. Thus, the operator at the toll service observing operator's position 104 may monitor every service rendered by the operator at the point-to-point operator's position 701. For example, an established connection extending between the point-to-point operator's position 701 and the subscriber substation C, and routed therebetween by way of the trunk line C718, the toll switch train 108, the trunk line C719, the local switch train 107 and the subscriber line 713, may be readily monitored by the operator at the toll service observing operator's position 104. Also, an established connection extending between the point-to-point operator's position 701 and a toll operator's position at the distant exchange 105, and routed therebetween by way of the trunk line C718, the toll switch train 108, the trunk line C717 and the toll line C714, may be readily monitored by the operator at the toll service observing operator's position 701.

The toll service observing operator's position 104 has access to each rate and directory operator's position and access to each auxiliary trunk line associated with the rate and directory operator's positions as previously noted. More specifically, the toll service observing operator's position 104 has access to the rate and directory operator's position 103 by way of the trunk line C1210 and access to the first auxiliary trunk line associated with the rate and directory operator's positions by way of the trunk line C1306. As previously noted, when the distributor apparatus 1170 assigns a call from one of the toll operator's positions to the rate and directory operator's position 103, the control relay R1120 operates to apply ground potential to the control conductor C1302 which is connected to the control conductor C1211 of the trunk line C1210, thereby to cause the lamp L589 to be illuminated. In a similar manner, when the operator at the rate and directory operator's position 103 answers a call from one of the toll operator's positions extending by way of the first auxiliary trunk line C1270 to the rate and directory operator's positions, the control relay R995 operates to apply ground potential to the control conductor C1303 of the trunk line C1306, thereby to cause the lamp L528 to be illuminated. The illumination of the lamp L589 indicates to the operator at the toll service observing operator's position 104 that the operator at the rate and directory operator's position 103 has answered a call extending thereto by way of the trunk line C1271 from one of the toll operator's positions and will shortly thereafter render a service in connection therewith. Similarly, the illumination of the lamp L528 indicates to the operator at the toll service observing operator's position 104 that an operator at one of the rate and directory operator's positions has answered a call extending thereto by way of the first auxiliary trunk line C1270 from one of the toll operator's positions, and will shortly thereafter render a service in connection therewith. Should the operator at the toll service observing operator's position desire to monitor the established connection extending by way of the trunk line C1271 between the toll operator's position and the rate and directory operator's position 103, the monitoring plug 810 is inserted into the jack 590 and the switch 830 is operated to its left-hand position, thereby to complete a monitoring connection extending from the trunk line C1271 by way of the trunk line C1210, the jack 590, the plug 810, the switch 830 and the amplifier 860 to the receiver 859. Similarly, should the operator at the toll service observing operator's position desire to monitor the established connection extending by way of the first auxiliary trunk line C1270 between the toll operator's position and the rate and directory operator's position, the monitoring plug 810 is iserted into the jack 525 and the switch 830 is operated to its left-hand position, thereby to complete a monitoring connection extending from the first auxiliary trunk line C1270 by way of the trunk line C1306, the jack 525, the plug 810, the switch 830 and the amplifier 860 to the receiver 859.

An arrangement is provided at the toll service observing operator's position 104 in order to indicate when all of the toll lines in a particular group at the toll board 100 are busy. For example, an arrangement is provided for indicating when all of the outgoing toll lines from the toll board 100 extending to the distant exchange 105 are busy, which comprises a group busy apparatus 705 individually associated by way of the trunk line C721 with the line circuits of the group of outgoing trunk lines extending to the distant exchange 105, a control conductor C1222 and a lamp L579 located at the toll service observing operator's position 104. When all of the toll lines extending from the toll board 100 to the distant exchange 105 are busy, the group busy apparatus 705 individually associated therewith by way of the trunk line C721 is operated to apply ground potential to the control conductor C1222. The application of ground potential to the control conductor C1222 completes an obvious circuit for illuminating the lamp L579. The illumination of the lamp L579 indicates to the operator at the toll service observing operator's position 104 that the condition mentioned above prevails. Other arrangements of this character may be associated with the other groups of toll lines at the toll board 100 in order to indicate to the operator at the toll service observing operator's position an all-busy condition of these groups of toll lines.

Conclusions

From the foregoing it is apparent that a telephone system is provided which comprises an au-

tomatic toll board including a number of operators' positions of the usual types for performing the various toll services in an efficient manner, and a number of auxiliary operators' positions associated with the toll board in such a manner that the operators at the toll board may be adequately advised and supervised in order to insure that prompt and efficient toll services are rendered.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a telephone system, a first operator's position having a line extending thereto, means for routing a call by way of said line to said first operator's position, a second operator's position having a receiver and a transmitter thereat, first and second repeaters, means for associating said transmitter with said first repeater, means under the control of an operator at said second operator's position for associating said first repeater with said line and for associating said receiver with said first repeater, thereby to complete a two-way communication connection between said second operator's position and said line, and means under the control of an operator at said second operator's position for associating said second repeater with said line and for associating said receiver with said second repeater, thereby to complete a monitoring connection between said second operator's position and said line.

2. In a telephone system, a first operator's position having a line extending thereto, means for routing a call by way of said line to said first operator's position, a second operator's position having a receiver and a transmitter thereat, first and second repeaters, means for associating said transmitter with said first repeater, an operator controlled switch at said second operator's position and having a plurality of operating positions, means controlled by the operation of said switch to one position for associating said first repeater with said line and for associating said receiver with said first repeater, thereby to complete a two-way communication connection between said second operator's position and said line, and means controlled by the operation of said switch to another position for associating said second repeater with said line and for associating said receiver with second repeater, thereby to complete a monitoring connection between said second operator's position and said line.

3. In a telephone system, a first operator's position having a line extending thereto, means for routing a call by way of said line to said first operator's position, a second operator's position having a receiver and a transmitter thereat, first and second repeaters, means for connecting said transmitter to said first repeater, means including a relay for selectively connecting said receiver to said first and second repeaters, an operator controlled switch at said second operator's position and having a plurality of operating positions, means controlled by the operation of said switch to one position for connecting said first repeater to said line and for controlling the operation of said relay to cause said relay to connect said receiver to said first repeater, thereby to complete a two-way communication connection between said second operator's position and said line, and means controlled by the operation of said switch to another position for connecting said second repeater to said line and for controlling the operation of said relay to cause said relay to connect said receiver to said second repeater, thereby to complete a monitoring connection between said second operator's position and said line.

4. In a telephone system, a first operator's position having a line extending thereto, means for routing a call by way of said line to said first operator's position, a second operator's position having a receiver and a transmitter thereat, first and second repeaters, means for connecting said transmitter to said first repeater, means for selectively connecting said first and second repeaters to said line, means operative to connect said receiver to said first repeater when said first repeater is connected to said line, thereby to complete a two-way communication connection between said second operator's position and said line, and means operative to connect said receiver to said second repeater when said second repeater is connected to said line, thereby to complete a monitoring connection between said second operator's position and said line.

5. In a telephone system, a first operator's position having a line extending thereto, means for routing a call by way of said line to said first operator's position, a second operator's position having a receiver and a transmitter thereat, first and second repeaters, means for connecting said transmitter to said first repeater, means for selectively connecting said first and second repeaters to said line, and automatic means controlled by said last-mentioned means for connecting said receiver to said first repeater when said first repeater is connected to said line, thereby to complete a two-way communication connection between said second operator's position and said line, and for connecting said receiver to said second repeater when said second repeater is connected to said line, thereby to complete a monitoring connection between said second operator's position and said line.

6. In a telephone system, a switchboard, a plurality of lines associated with said switchboard, an operator's switchboard position for setting up and routing connections between said lines, a second operator's position having a receiver and a transmitter thereat, a trunk line extending between said positions, first and second repeaters, means for associating said transmitter with said first repeater, means under the control of an operator at said second operator's position for associating said first repeater with said trunk line and for associating said receiver with said first repeater, thereby to complete a two-way communication connection between said second operator's position and a connection routed over any one of said first-mentioned lines by way of said operator's switchboard position, means under the control of an operator at said second operator's position for associating said second repeater with said trunk line and for associating said receiver with said second repeater, thereby to complete a monitoring connection between said second operator's position and a connection routed over any one of said first-mentioned lines by way of said operator's switchboard position.

7. In a telephone system, a first operator's position having a line extending thereto, a switchboard, an operator's switchboard position, a switch having access to said line and operative

to seize said line, means at said operator's switchboard position for controlling the operation of said switch, a second operator's position having a receiver and a transmitter thereat, first and second repeaters, means for connecting said transmitter to said first repeater, means for selectively connecting said first and second repeaters to said line, means operative to connect said receiver to said first repeater when said first repeater is connected to said line, thereby to complete a two-way communication connection between said second operator's position and a connection between said first operator's position and said operator's switchboard position, and means operative to connect said receiver to said second repeater when said second repeater is connected to said line, thereby to complete a monitoring connection between said second operator's position and a connection between said first operator's position and said operator's switchboard position.

8. In a telephone system, a first operator's position having a telephone instrument thereat, first and second signal devices at said first operator's position, a second operator's position, a trunk line extending between said positions, means at said second operator's position for seizing said trunk line, means responsive to the seizure of said trunk line for operating said first signal device, means at said second operator's position for projecting ringing current over said trunk line, means responsive to the projection of ringing current over said trunk line for operating said second signal device, means at said first operator's position for connecting the telephone instrument thereat to said trunk line, means responsive to the connection of said telephone instrument to said trunk line for arresting the operations of said signal devices and for rendering said signal devices inoperative, means at said second operator's position for releasing said trunk line, and means jointly responsive to the release of said trunk line and to the disconnection of said telephone instrument from said trunk line for rendering said signal devices operative.

9. In a telephone system, a first operator's position having a telephone instrument thereat, first and second signal devices at said first operator's position, a second operator's position, a trunk line extending between said positions, means at said second operator's position for seizing said trunk line, means responsive to the seizure of said trunk line for operating said first signal device, means at said second operator's position for projecting ringing current over said trunk line, means responsive to the projection of ringing current over said trunk line for operating said second signal device, means at said first operator's position for connecting the telephone instrument thereat to said trunk line, a relay, means responsive to the connection of said telephone instrument to said trunk line for causing operation of said relay, means controlled by the operation of said relay for arresting the operations of said signal devices and for rendering said signal devices inoperative, means at said second operator's position for releasing said trunk line, means jointly responsive to the release of said trunk line and to the disconnection of said telephone instrument from said trunk line for causing said relay to restore, and means controlled by the restoration of said relay for rendering said signal devices operative.

10. In a telephone system, a first operator's position having a telephone instrument thereat, first and second signal devices at said first operator's position, a second operator's position, a trunk line extending between said positions, means at said second operator's position for seizing said trunk line, means responsive to the seizure of said trunk line for operating said first signal device, means at said second operator's position for projecting ringing current over said trunk line, means responsive to the projection of ringing current over said trunk line for operating said second signal device, means at said first operator's position for connecting the telephone instrument thereat to said trunk line, a relay, operating and holding circuits for said relay, means controlled by the connection of said telephone instrument to said trunk line for completing said operating circuit, means controlled by the operation of said relay for arresting the operations of said signal devices, for rendering said signal devices inoperative and for completing said holding circuit, means at said second operator's position for releasing said trunk line, means responsive to the release of said trunk line for interrupting said holding circuit, means responsive to the disconnection of said telephone instrument from said trunk line for interrupting said operating circuit, and means controlled by the restoration of said relay for rendering said signal devices operative.

11. In a telephone system, a first operator's position having a telephone instrument thereat, a line extending to said first operator's position, an automatic switch having access to said line and operative to route a call by way of said line to said first operator's position, first and second signal devices at said first operator's position, a second operator's position, a trunk line extending between said positions and connected to said first-mentioned line, means at said second operator's position for seizing said trunk line, means responsive to the seizure of said trunk line for marking said first-mentioned line as busy to said switch and for operating said first signal device, means at said second operator's position for projecting ringing current over said trunk line, means responsive to the projection of ringing current over said trunk line for operating said second signal device, means at said first operator's position for connecting the telephone instrument thereat to said trunk line, means responsive to the connection of said telephone instrument to said trunk line for arresting the operations of said signal devices and for rendering said signal devices inoperative, means at said second operator's position for releasing said trunk line, means responsive to the release of said trunk line for marking said first-mentioned line as idle to said switch, and means jointly responsive to the release of said trunk line and to the disconnection of said telephone instrument from said trunk line for rendering said signal devices operative.

12. In a telephone system, a switchboard having a signal thereat, an operator's switchboard position, a second operator's position having a telephone instrument thereat, a trunk line extending to said second operator's position, a switch having access to said trunk line, means at said operator's switchboard position for causing said switch to seize said trunk line, means controlled by the seizure of said trunk line for operating said signal, means at said second operator's position for connecting the telephone instrument thereat to said trunk line, and means

controlled by the connection of said telephone instrument to said trunk line for arresting the operation of said signal.

13. In a telephone system, a switchboard having a signal thereat, an operator's switchboard position, a second operator's position having a signal thereat, a trunk line extending to said second operator's position, a switch having access to said trunk line, means at said operator's switchboard position for causing said switch to seize said trunk line, means controlled by the seizure of said trunk line for operating said signals, a telephone instrument at said second operator's position, means at said second operator's position for connecting the telephone instrument thereat to said trunk line, and means controlled by the connection of said telephone instrument to said trunk line for arresting the operations of said signals.

14. In a telephone system, a switchboard having a plurality of lines associated therewith, an operator's switchboard position, means operative to assign a call on one of said lines to said operator's switchboard position to be answered, a device at said operator's switchboard position operable to one position to cause said assigning means to operate to assign a call on one of said lines thereto and operable to another position after said assigning means has assigned a call on one of said lines thereto, a second operator's position having a signal thereat, a device at said second operator's position, and means under the joint control of said devices for controlling the operation of said signal.

15. In a telephone system, a switchboard having a plurality of lines associated therewith, an operator's switchboard position, means operative to assign a call on one of said lines to said operator's switchboard position to be answered, a device at said operator's switchboard position operable to one position to cause said assigning means to operate to assign a call on one of said lines thereto and operable to another position after said assigning means has assigned a call on one of said lines thereto, a second operator's position having a signal thereat, means responsive to the operation of said device to said other position for conditioning said signal to be operated, and means at said second operator's position for operating said signal in the event that said signal has been previously conditioned to be operated, thereby to indicate to an operator at said second operator's position that said assigning means has operated to assign a call to said operator's switchboard position.

16. In a telephone system, a switchboard having a plurality of lines associated therewith, an operator's switchboard position, means operative to route a call on one of said lines to said operator's switchboard position, a device at said operator's switchboard position and having a plurality of operating positions, means responsive to the operation of said device to one position for conditioning said routing means to be operative, means responsive to the initiation of a call on one of said lines for causing said routing means to operate and route the call on the one line to said operator's switchboard position, a second operator's position having a signal thereat, means at said second operator's position adapted to operate said signal, and means responsive to the operation of said device to said one position for rendering said last-mentioned means ineffective to operate said signal, thereby to indicate to an operator at said second operator's position that said routing means is conditioned to route a call to said operator's switchboard position.

17. In a telephone system, a switchboard having a plurality of lines associated therewith, an operator's switchboard position, means operative to route a call on one of said lines to said operator's switchboard position, a device at said operator's switchboard position and having a plurality of operating positions, means responsive to the operation of said device to one position for conditioning said routing means to be operative, means responsive to the initiation of a call on one of said lines for causing said routing means to operate and route the call on the one line to said operator's switchboard position, said device being operated to another position after said routing means has operated to route a call on the one line to said operator's switchboard position, a second operator's position having a signal thereat, and means at said second operator's position adapted to operate said signal, said last-mentioned means being ineffective to operate said signal in the event said device occupies said one position, thereby to indicate to an operator at said second operator's position that said routing means is conditioned to route a call to said operator's switchboard position, and being effective to operate said signal in the event said device occupies said other position, thereby to indicate to an operator at said second operator's position that a call is routed to said operator's switchboard position.

18. In a telephone system, a switchboard having a plurality of lines associated therewith, a plurality of operator's switchboard positions, means operative to assign calling ones of said lines to said operator's switchboard positions in a predetermined order, a device at each operator's switchboard position, means controlled by the operation of each of said devices for controlling the operation of said assigning means to assign a calling one of said lines to the corresponding operator's switchboard position, a second operator's position having a plurality of signals thereat individually corresponding to said operator's switchboard positions, a device at said second operator's position, and means under the joint control of said last-mentioned device and corresponding ones of said first-mentioned devices for controlling the operations of corresponding ones of said signals.

19. In a telephone system, a switchboard having a plurality of lines associated therewith, a plurality of operator's switchboard positions, means for routing calls on said lines to said operator's switchboard positions, a device at each operator's switchboard position having a plurality of operating positions, each of said devices being operative to a first position to render idle the associated operator's switchboard position and operative to a second position to render busy the associated operator's switchboard position, a second operator's position, a plurality of signal devices at said second operator's position individually corresponding to said operator's switchboard positions, an operating circuit for each of said signals, means responsive to the operation of each of said devices to a predetermined one of said positions for preparing a point in the operating circuit of the corresponding signal, and operator controlled means at said second operator's position operative to prepare another point in the operating circuit of each of said signals, whereby the signals associated with operator's switchboard positions having devices occupying said predetermined one

positions are operated in order to indicate to an operator at said second operator's position the conditions of said operator's switchboard positions.

20. In a telephone system, an operator's position having a telephone instrument thereat, a trunk line at said operator's position, a second line extending to said operator's position, an automatic switch having access to said second line, means for operating said switch to cause said switch to seize said second line, a bridge, means for selectively connecting and disconnecting said trunk line and said bridge to said second line, automatic means for connecting said telephone instrument to said trunk line when said trunk line is connected to said second line and for disconnecting said telephone instrument from said trunk line when said trunk line is disconnected from said second line, said second line being rendered busy when said trunk line or said bridge is connected thereto, and means responsive to a busy condition of said second line for retaining said switch in operated position.

21. In a telephone system, an operator's position having a telephone instrument thereat, a trunk line at said operator's position, a second line extending to said operator's position, an automatic switch having access to said second line, means for operating said switch to cause said switch to seize said second line, a bridge, means for selectively connecting and disconnecting said trunk line and said bridge to said second line, automatic means for connecting said telephone instrument to said trunk line when said trunk line is connected to said second line and for disconnecting said telephone instrument from said trunk line when said trunk line is disconnected from said second line, said second line being rendered busy when said trunk line or said bridge is connected thereto, additional means for rendering said second line busy for a predetermined time interval after said trunk line or said bridge is disconnected from said second line, and means responsive to a busy condition of said second line for retaining said switch in operated position.

22. In a telephone system, an operator's position having a telephone instrument thereat, a trunk line at said operator's position, a second line extending to said operator's position, an automatic switch having access to said second line, means for operating said switch to cause said switch to seize said second line, first and second bridges, means for selectively connecting and disconnecting said trunk line and said first bridge to said second line, automatic means for connecting said telephone instrument to said trunk line when said trunk line is connected to said second line and for disconnecting said telephone instrument from said trunk line when said trunk line is disconnected from said second line, means responsive to the disconnection of said trunk line or said first bridge from said second line for connecting said second bridge to said second line, means responsive to the connection of said trunk line or said first bridge to said second line for disconnecting said second bridge from said second line, additional means for disconnecting said second bridge from said second line after a predetermined time interval, said second line being rendered busy when said trunk line or one of said bridges is connected thereto, and means responsive to a busy condition of said second line for retaining said switch in operated position.

23. In a telephone system, an operator's position having a telephone instrument thereat, a trunk line at said operator's position, a second line extending to said operator's position, an automatic switch having access to said second line, means for operating said switch to cause said switch to seize said second line, first and second bridges, a device for selectively connecting and disconnecting said trunk line and said first bridge to said second line, means including a first relay operative to control the connection of said telephone instrument to said trunk line, means controlled by said device for controlling the operation of said first relay to cause said first relay to connect said telephone instrument to said trunk line when said trunk line is connected to said second line and to cause said first relay to disconnect said telephone instrument from said trunk line when said trunk line is disconnected from said second line, a slow-acting relay, means controlled by said device for connecting said second bridge to said second line when said trunk line or said first bridge is disconnected from said second line and for controlling said slow-acting relay, means controlled by said slow-acting relay for disconnecting said second bridge from said second line, said second line being rendered busy when said trunk line or one of said bridges is connected thereto, and means responsive to a busy condition of said second line for retaining said switch in operated position.

24. In a telephone system, an operator's position having a telephone instrument thereat, a trunk line at said operator's position, a second line extending to said operator's position, an automatic switch having access to said second line, means for operating said switch to cause said switch to sieze said second line and to project A. C. ringing current thereover, a ring-up relay, said ring-up relay being operated when the ringing current is projected over said second line, a signal at said operator's position, means responsive to the operation of said ring-up relay for operating said signal, a device for connecting and disconnecting said trunk line to said second line, means controlled by said device for causing said ring-up relay to restore when said trunk line is connected to said second line, thereby to cause the operation of said signal to be arrested, said second line being rendered busy when said trunk line is connected thereto, means responsive to a busy condition of said second line for retaining said switch in operated position, and means for preventing the switching surges of current projected over said second line by said switch incident to the release thereof from causing reoperation of said ring-up relay.

25. In a telephone system, an operator's position having a telephone instrument thereat, a trunk line at said operator's position, a second line extending to said operator's position, an automatic switch having access to said second line, means for operating said switch to cause said switch to seize said second line and to project A. C. ringing current thereover, a ring-up relay having a winding, a bridge including said winding and a condenser, said bridge being normally connected to said second line, whereby said ring-up relay is energized and operated when the ringing current is projected over said second line, a signal at said operator's position, means responsive to the operation of said ring-up relay for operating said signal, a device for connecting and disconnecting said trunk line to said second line, automatic means for connecting said telephone instrument to said trunk line when said trunk line is connected to said second line and

for disconnecting said telephone instrument from said trunk line when said trunk line is disconnected from said second line, a source of D. C. supply, means controlled by said device for disconnecting said bridge from said second line and for connecting said bridge to said source of D. C. supply when said trunk line is connected to said second line, thereby to charge said condenser, said ring-up relay restoring after said bridge is disconnected from said second line, thereby to cause the operation of said signal to be arrested, said second line being rendered busy when said trunk line is connected thereto, means responsive to a busy condition of said second line for retaining said switch in operated position, and means controlled by said device for disconnecting said bridge from said D. C. source of supply and for connecting said bridge to said second line when said trunk line is disconnected from said second line, said condenser being so connected and arranged that the charge thereon prevents the switching surges of current projected over said second line by said switch incident to the release thereof from causing reoperation of said ring-up relay.

26. In a telephone system, an operator's position having a telephone instrument thereat, a trunk line at said operator's position, a second line extending to said operator's position, an automatic switch having access to said second line, means for operating said switch to cause said switch to seize said second line and to project A. C. ringing current thereover, a ring-up relay having a winding, a bridge including said winding and a condenser, said bridge being normally connected to said second line, whereby said ring-up relay is energized and operated when the ringing current is projected over said second line, a holding circuit for said ring-up relay, a signal at said operator's position, means responsive to the operation of said ring-up relay for completing said holding circuit and for operating said signal, a device for connecting and disconnecting said trunk line to said second line, automatic means for connecting said telephone instrument to said trunk line when said trunk line is connected to said second line and for disconnecting said telephone instrument from said trunk line when said trunk line is disconnected from said second line, a source of D. C. supply, means controlled by said device for interrupting said holding circuit, for disconnecting said bridge from said second line and for connecting said bridge to said source of D. C. supply when said trunk line is connected to said second line, thereby to charge said condenser, said ring-up relay restoring after said bridge is disconnected from said second line, thereby to cause the operation of said signal to be arrested, said second line being rendered busy when said trunk line is connected thereto, means responsive to a busy condition of said second line for retaining said switch in operated position, and means controlled by said device for disconnecting said bridge from said D. C. source of supply and for connecting said bridge to said second line when said trunk line is disconnected from said second line, said condenser being so connected and arranged that the charge thereon prevents the switching surges of current projected over said second line by said switch incident to the release thereof from causing reoperation of said ring-up relay.

27. In a telephone system, an operator's position having a telephone instrument thereat, a trunk line at said operator's position, a second line extending to said operator's position, an automatic switch having access to said second line, means for operating said switch to cause said switch to seize said second line and to project A. C. ringing current thereover, a ring-up relay, said ring-up relay being operated when the ringing current is projected over said second line, a signal at said operator's position, means responsive to the operation of said ring-up relay for operating said signal, a bridge, a device for selectively connecting and disconnecting said trunk line and said bridge to said second line, automatic means for connecting said telephone instrument to said trunk line when said trunk line is connected to said second line and for disconnecting said telephone instrument from said trunk line when said trunk line is disconnected from said second line, means controlled by said device for causing said ring-up relay to restore when said trunk line is connected to said second line, thereby to cause the operation of said signal to be arrested, said second line being rendered busy when said trunk line is connected thereto, means responsive to a busy condition of said second line for retaining said switch in operated position, and means for preventing the switching surges of current projected over said second line by said switch incident to the release thereof from causing reoperation of said ring-up relay.

28. In a telephone system, an operator's position having a telephone instrument and impulsing apparatus thereat, an impulse responsive switch, a line extending between said operator's position and said switch, a repeater, means operative to connect said impulsing apparatus and said repeater to said line, thereby to seize said switch, automatic means controlled by said last-mentioned means for connecting said telephone instrument to said repeater, and means controlled by the operation of said impulsing apparatus for completing a bridge path around at least a portion of said repeater, whereby a low impedance impulsing circuit is established by way of said line between said impulsing apparatus and said switch, said last-mentioned means being controlled after the operation of said impulsing apparatus is arrested to interrupt said bridge path.

29. In a telephone system, an operator's position having a telephone instrument and impulsing apparatus thereat, an impulse responsive switch, a line extending between said operator's position and said switch, a repeater, means operative to connect said impulsing apparatus and said repeater to said line, thereby to seize said switch, automatic means controlled by said last-mentioned means for connecting said telephone instrument to said repeater, and means controlled by the operation of said impulsing apparatus for completing a bridge path around at least a portion of said repeater, whereby a low impedance impulsing circuit is established by way of said line between said impulsing apparatus and said switch, and for disconnecting the receiver of said telephone instrument from said repeater, thereby to eliminate clicks in the receiver incident to the operation of said impulsing apparatus, said last-mentioned means being controlled after the operation of said impulsing apparatus is arrested to interrupt said bridge path and to reconnect the receiver of said telephone instrument to said repeater.

30. In a telephone system, an operator's posi-

tion having a telephone instrument and impulsing apparatus thereat, an impulse responsive switch, a line extending between said operator's position and said switch, a repeater, means operative to connect said impulsing apparatus and said repeater to said line, thereby to seize said switch, automatic means controlled by said last-mentioned means for connecting said telephone instrument to said repeater, a first relay, means controlled by the operation of said impulsing apparatus for operating said first relay, a slow-acting relay, means controlled by the operation of said first relay for completing a bridge path around at least a portion of said repeater, whereby a low impedance impulsing circuit is established by way of said line between said impulsing apparatus and said switch, and for operating said slow-acting relay, and means responsive to the operation of said slow-acting relay for disconnecting the receiver of said telephone instrument from said repeater, thereby to eliminate clicks in the receiver incident to the operation of said impulsing apparatus, the operation of said first relay being controlled after the operation of said impulsing apparatus is arrested to cause said bridge path to be interrupted, the operation of said slow-acting relay being controlled by the last-mentioned operation of said first relay to reconnect the receiver of said telephone instrument to said repeater subsequent to the interruption of said bridge path.

31. In a telephone system, an operator's position having a telephone instrument and impulsing apparatus thereat, an impulse responsive switch, a line extending between said operator's position and said switch, a repeater, a device at said operator's position having a plurality of operating positions, means controlled by the operation of said device to one position for connecting said impulsing apparatus and said repeater to said line, thereby to seize said switch, automatic means controlled by said last-mentioned operation of said device for connecting said telephone instrument to said repeater, means controlled by the operation of said impulsing apparatus for completing a bridge path around at least a portion of said repeater, whereby a low impedance impulsing circuit is established by way of said line between said impulsing apparatus and said switch, said last-mentioned means being controlled after the operation of said impulsing apparatus is arrested to interrupt said bridge path, a bridge, and means controlled by the operation of said device to another position for disconnecting said impulse apparatus and said repeater from said line and for connecting said bridge to said line, thereby to retain said switch in operated position.

32. In a telephone system, an operator's position having a telephone instrument and impulsing apparatus thereat, an impulse responsive switch, a line extending between said oprator's position and said switch, a repeater, a device for establishing a monitoring connection between the receiver of said telephone instrument and a circuit, means for connecting the receiver of said telephone instrument to said device, means for connecting the transmitter of said telephone instrument to said repeater, means operative to connect said impulsing apparatus and said repeater to said line, thereby to seize said switch, automatic means controlled by said last-mentioned means for disconnecting the receiver of said telephone instrument from said device and for connecting it to said repeater, and means controlled by the operation of said impulsing apparatus for completing a bridge path around at least a portion of said repeater, whereby a low impedance impulsing circuit is established by way of said line between said impulsing apparatus and said switch, and for disconnecting the receiver of said telephone instrument from said repeater, thereby to eliminate clicks in the receiver incident to the operation of said impulsing apparatus, said last-mentioned means being controlled after the operation of said impulsing apparatus is arrested to interrupt said bridge path and to reconnect the receiver of said telephone instrument to said repeater.

33. In a telephone system, an exchange having a plurality of groups of lines associated therewith and extending to different distant exchanges, a switch having access to said lines, control apparatus operative in response to a first control function to perform an intermediate operation which consumes an interval of time and operative in response to at least one additional control function subsequent to the performance of said intermediate operation for causing said switch to select a line in a particular one of said groups of lines, an operator's position having a signal thereat, apparatus at said operator's position for performing said control functions, and means for controlling the operation of said signal during the interval of time said control apparatus is performing said intermediate operation.

34. In a telephone system, an exchange having a plurality of groups of lines associated therewith and extending to different distant exchanges, a switch having access to said lines, control apparatus operative in response to a first series of impulses to perform an intermediate operation which consumes an interval of time and operative in response to at least one additional series of impulses subsequent to the performance of said intermediate operation for causing said switch to select a particular one of said groups of lines and then to select an idle line in the selected group of lines, an operator's position having a signal thereat, an impulsing apparatus at said operator's position operative to transmit a series of impulses to said control apparatus, and means for controlling the operation of said signal during the interval of time said control apparatus is performing said intermediate operation.

35. In a telephone system, an exchange having a plurality of groups of lines associated therewith and extending to different distant exchanges, a switch having access to said lines, control apparatus operative in response to a first control function to perform an intermediate operation which consumes an interval of time and operative in response to at least one additional control function subsequent to the performance of said intermediate operation for causing said switch to select a line in a particular one of said groups of lines, an operator's position, apparatus at said operator's position for performing said control functions, and means controlled during the interval of time said control apparatus is performing said intermediate operation for indicating to an operator at said operator's position that said additional control function should not be performed until a later time.

36. In a telephone system, an exchange having a plurality of groups of lines associated therewith and extending to different distant exchanges, a switch having access to said lines, con-

trol apparatus operative in response to a first control function to perform an intermediate operation which consumes an interval of time and operative in response to at least one additional control function subsequent to the performance of said intermediate operation for causing said switch to select a line in a particular one of said groups of lines, an operator's position having a signal thereat, apparatus at said operator's position for performing said control functions, and means for operating said signal during the interval of time said control apparatus is performing said intermediate operation, thereby to indicate to an operator at said operator's position that said additional control function should not be performed until a later time.

37. In a telephone system, a switchboard having a plurality of lines associated therewith, a signal at said switchboard, a switch having access to said lines, an operator's position having a telephone instrument thereat, a trunk line extending between said operator's position and said switch, a device at said operator's position and having a plurality of operating positions, a slow-acting relay, means responsive to the operation of said device to one position for associating said telephone instrument with said trunk line and for operating said relay, means responsive to the association of said telephone instrument with said trunk line for seizing said switch, means responsive to the operation of said relay for retaining said switch in operated position, means responsive to the operation of said device to another position for retaining said relay operated, and means operated when said device is operated from said one position for operating said signal and for disassociating said telephone instrument from said line, said relay remaining operated during the time interval said device is operated from said one position to said other position, thereby to retain said switch in operated position.

38. In a telephone system, a switchboard having a plurality of lines associated therewith, a signal at said switchboard, an operating circuit for said signal, a switch having access to said lines, an operator's position having a telephone instrument thereat, a trunk line extending between said operator's position and said switch, a device at said operator's position and having a plurality of operating positions, a slow-acting relay, an operating circuit for said relay, means responsive to the operation of said device to one position for associating said telephone instrument with said trunk line and for completing said second-mentioned operating circuit, means responsive to the association of said telephone instrument with said trunk line for seizing said switch, means responsive to the operation of said relay for retaining said switch in operated position and for preparing said first-mentioned operating circuit, and means operated when said device is operated from said one position to another position for completing said first-mentioned operating circuit and for interrupting said second-mentioned operating circuit, said relay restoring shortly thereafter to cause said switch to be released and to interrupt said first-mentioned operating circuit.

39. In a telephone system, a switchboard having a signal thereat, an operator's switchboard position, a second operator's position having a telephone instrument thereat, a signal at said second operator's position, a trunk line extending between said positions, a switch, means under the control of an operator at said operator's switchboard position for causing said switch to seize said trunk line, a first relay, means responsive to the seizure of said trunk line for operating said first relay, means controlled by the operation of said first relay for operating both of said signals, a device at said second operator's position and having a plurality of operating positions, a second relay, means controlled by the operation of said device to one position for associating said telephone instrument with said trunk line, for operating said second relay and for arresting operation of said first-mentioned signal, means controlled by the operation of said second relay for arresting operation of said second-mentioned signal, and means controlled jointly by the operation of said device to another position and the release of said switch for causing said second relay to restore, thereby to prepare said second-mentioned signal to be again operated.

40. In a telephone system, a switchboard having a plurality of lines associated therewith and extending to a distant exchange, a plurality of operator's switchboard positions, means operative to assign a call on one of said lines to an idle one of said operator's switchboard positions to be answered, another operator's position having a signal thereat, and means controlled by the presence of a call on one of said lines when all of said operator's switchboard positions are busy for operating said signal.

41. In a telephone system, a switchboard having a plurality of lines associated therewith and extending to a distant exchange, a plurality of operator's switchboard positions, means operative to assign a call on one of said lines to an idle one of said operator's switchboard positions to be answered, another operator's position having a signal thereat, a timer, means controlled by the presence of a call on one of said lines when all of said operator's switchboard positions are busy for causing operation of said timer, and means controlled by the operation of said timer a predetermined time interval for operating said signal.

42. In a telephone system, a switchboard having a plurality of lines associated therewith and extending to a distant exchange, a plurality of operator's switchboard positions, means operative to assign a call on one of said lines to an idle one of said operator's switchboard positions to be answered, another operator's position having a signal thereat, a timer, means controlled by the presence of a call on one of said lines when all of said operator's switchboard positions are busy for causing operation of said timer, a relay, means controlled by the operation of said timer a predetermined time interval for operating intermittently said relay, and means controlled by the operation of said relay for operating said signal.

43. In a telephone system, a switchboard having a plurality of lines associated therewith and extending to a distant exchange, a plurality of operator's switchboard positions, means operative to assign a call on one of said lines to an idle one of said operator's switchboard positions to be answered, another operator's position having a signal thereat, a relay having a first winding of relatively high impedance and a second winding of relatively low impedance, a first circuit including said signal and the first winding of said relay, a second circuit including said signal and the second winding of said relay, said signal being operated only when said second circuit is completed and said relay being operated when

either one of said circuits is completed, means controlled by the presence of a call on one of said lines when all of said operator's switchboard positions are busy for completing said first circuit, a timer, means controlled by the operation of said relay for causing operation of said timer, and means controlled by the operation of said timer a predetermined time interval for completing said second circuit.

44. In a telephone system, a switchboard having a plurality of lines associated therewith and extending to a distant exchange, a plurality of operator's switchboard positions, means operative to assign a call on one of said lines to an idle one of said operator's switchboard positions to be answered, another operator's position having a signal thereat, means controlled by the presence of a call on one of said lines when all of said operator's switchboard positions are busy for operating said signal, and means controlled by the operation of said first-mentioned means to assign the call on the one of said lines to an idle one of said operator's switchboard positions for arresting the operation of said signal.

45. In a telephone system, a plurality of operator's positions, a plurality of trunk lines individually extending to said operator's positions, a switch having access to said trunk lines and operative to seize one of said trunk lines, a distributor operative to assign one of said trunk lines extending to an idle one of said operator's positions to be seized by said switch, means for causing said switch to seize said assigned trunk line, and means responsive to the seizure of said assigned trunk line for causing said distributor to assign another one of said trunk lines extending to an idle one of said operator's positions to be seized by said switch.

46. In a telephone system, a plurality of operator's positions, a plurality of trunk lines individually extending to said operator's positions, an auxiliary trunk line commonly associated with said operator's positions and to which each operator's position has access, a switch having access to said trunk lines and operative to seize one of said trunk lines, means for causing said switch to seize idle ones of said first-mentioned trunk lines in a predetermined order, and means controlled when all of said operator's positions are busy for causing said switch to seize said auxiliary trunk line.

47. In a telephone system, a plurality of operator's positions, a plurality of trunk lines individually extending to said operator's positions, an auxiliary trunk line commonly associated with said operator's positions and to which each operator's position has access, a switch having access to said trunk lines and operative to seize one of said trunk lines, a distributor operative to assign one of said first-mentioned trunk lines extending to an idle one of said operator's positions to be seized by said switch, means for causing said switch to seize said assigned trunk line, means responsive to the seizure of said assigned trunk line for causing said distributor to assign another one of said first-mentioned trunk lines extending to an idle one of said operator's positions to be seized by said switch, and means controlled when all of said operator's positions are busy for causing said switch to seize said auxiliary trunk line.

48. In a telephone system, a plurality of operator's positions, a plurality of trunk lines individually extending to said operator's positions, an auxiliary trunk line commonly associated with said operator's positions and to which each operator's position has access, a switch having access to said trunk lines and operative to seize one of said trunk lines, means for causing said switch to seize idle ones of said first-mentioned trunk lines in a predetermined order, means responsive to the seizure of one of said first-mentioned trunk lines for transmitting a signal to the corresponding operator's position, means controlled when all of said operator's positions are busy for causing said switch to seize said auxiliary trunk line, and means responsive to the seizure of said auxiliary trunk line for transmitting a signal to each of said operator's positions.

49. In a telephone system, a plurality of operator's positions, a telephone instrument at each operator's position, a local telephone circuit individual to each telephone instrument, means at each operator's position for controlling the connection of the telephone instrument thereat to the local telephone circuit individual thereto, a plurality of trunk lines individually extending to said operator's positions, a switch having access to said trunk lines and operative to seize one of said trunk lines, distributor means for causing said switch to seize idle ones of said trunk lines in a predetermined order, and means responsive to the disconnection of the telephone instrument at one of said operator's positions from the local telephone circuit individual thereto for rendering busy the trunk line individual to said one operator's position.

50. In a telephone system, a plurality of operator's positions, a telephone instrument at each operator's position, a repeater individual to each telephone instrument, means at each operator's position for controlling the connection of the telephone instrument thereat to the repeater individual thereto, a plurality of trunk lines individually extending to said operator's positions, a switch having access to said trunk lines and operative to seize one of said trunk lines, distributor means for causing said switch to seize idle ones of said trunk lines in a predetermined order, and means responsive to the disconnection of the telephone instrument at one of said operator's positions from the repeater individual thereto for rendering busy the trunk line individual to said one operator's position.

51. In a telephone system, a plurality of operator's positions, a telephone instrument at each operator's position, a plurality of trunk lines individually extending to said operator's positions, an auxiliary trunk line commonly associated with said operator's positions and to which each operator's position has access, a switch having access to said trunk lines and operative to seize one of said trunk lines, means for causing said switch to seize idle ones of said first-mentioned trunk lines in a predetermined order, means controlled when all of said operator's positions are busy for causing said switch to seize said auxiliary trunk line, and means at each operator's position for selectively connecting the telephone instrument thereat to the first-mentioned trunk line individual thereto and to said auxiliary trunk line.

52. In a telephone system, a plurality of operator's positions, a telephone instrument at each operator's position, a plurality of trunk lines individually extending to said operator's positions, an auxiliary trunk line commonly associated with said operator's positions, a switch having access to said trunk lines and operative to seize one of said trunk lines, distributor means for causing said switch to seize idle ones of said first-mentioned trunk lines in a predetermined order,

means controlled when all of said operator's positions are busy for causing said switch to seize said auxiliary trunk line, means at each operator's position for selectively connecting the telephone instrument thereat to the first-mentioned trunk line individual thereto and to said auxiliary trunk line, and means controlled when the telephone instrument at each of said operator's positions is connected to said auxiliary trunk line for rendering busy the first-mentioned trunk line individually extending thereto.

53. In a telephone system, a plurality of operator's positions, a telephone instrument at each operator's position, a local telephone circuit individually associated with each telephone instrument, a plurality of trunk lines individually extending to said operator's positions, a switch having access to said trunk lines and operative to seize one of said trunk lines, distributor means for causing said switch to seize idle ones of said trunk lines in a predetermined order, a conductor associated with each of said local telephone circuits and connected to a source of tone current, and automatic means responsive to the seizure of one of said trunk lines for intermittently connecting the conductor to the local telephone circuit associated with the telephone instrument at the corresponding one of said operator's positions, thereby to cause the receiver of the telephone instrument at said one operator's position to emit sound intermittently.

54. In a telephone system, a plurality of operator's positions, a telephone instrument at each operator's position, a repeater individually associated with each telephone instrument, a plurality of trunk lines individually extending to said operator's positions, a switch having access to said trunk lines and operative to seize one of said trunk lines, distributor means for causing said switch to seize idle ones of said trunk lines in a predetermined order, a conductor associated with each of said repeaters and connected to a source of tone current, automatic means responsive to the seizure of one of said trunk lines for intermittently connecting the conductor to the repeater associated with the telephone instrument at the corresponding one of said operator's positions, thereby to cause the receiver of the telephone instrument at said one operator's position to emit sound intermittently.

55. In a telephone system, a plurality of operator's positions, each having a signal thereat, a telephone instrument at each operator's position, a plurality of trunk lines individually extending to said operator's positions, an auxiliary trunk line commonly associated with said operator's positions and to which each operator's position has access, a switch having access to said trunk lines and operative to seize one of said trunk lines, means for causing said switch to seize idle ones of said first-mentioned trunk lines in a predetermined order, means responsive to the seizure of one of said first-mentioned trunk lines for operating the signal at the corresponding operator's position, means controlled when all of said operator's positions are busy for causing said switch to seize said auxiliary trunk line, means responsive to the seizure of said auxiliary trunk line for operating the signal at each operator's position, means at each operator's position for selectively connecting the telephone instrument thereat to the first-mentioned trunk line individual thereto and to said auxiliary trunk line, and means controlled when the telephone instrument at one of said operator's positions is connected to said auxiliary trunk line for arresting the operations of said signals.

56. In a telephone system, a plurality of operator's positions, a plurality of trunk lines individually extending to said operator's positions, an auxiliary trunk line commonly associated with said operator's positions and to which each operator's position has access, a switch having access to said trunk lines and operative to seize one of said trunk lines, another operator's position, a plurality of signals at said other operator's position and individually corresponding to said first-mentioned trunk lines, another signal at said other operator's position and corresponding to said auxiliary trunk line, means for causing said switch to seize idle ones of said first-mentioned trunk lines in a predetermined order, means responsive to the seizure of one of said first-mentioned trunk lines for operating the corresponding one of said first-mentioned signals, means controlled when all of said operator's positions are busy for causing said switch to seize said auxiliary trunk line, and means responsive to the seizure of said auxiliary trunk line for operating said other signal.

57. In a telephone system, a plurality of operator's positions, a telephone instrument at each operator's position, a plurality of trunk lines individually extending to said operator's positions, a switch having access to said trunk lines and operative to seize one of said trunk lines, distributor means for causing said switch to seize idle ones of said trunk lines in a predetermined order, another operator's position, a plurality of signals at said other operator's position and individually corresponding to said first-mentioned operator's positions, and means at each of said first-mentioned operator's positions for causing operation of the signal individual thereto and for rendering busy the trunk line individual thereto.

58. In a telephone system, a plurality of operator's positions, a telephone instrument at each operator's position, a plurality of trunk lines individually extending to said operator's positions, an auxiliary trunk line commonly associated with said operator's positions, a switch having access to said trunk lines and operative to seize one of said trunk lines, distributor means for causing said switch to seize idle ones of said first-mentioned trunk lines in a predetermined order, means controlled when all of said operator's positions are busy for causing said switch to seize said auxiliary trunk line, means at each operator's position for selectively connecting the telephone instrument thereat to the first-mentioned trunk line individual thereto and to said auxiliary trunk line, another operator's position, a plurality of signals at said other operator's position and individually corresponding to said first-mentioned operator's positions, means controlled jointly by the seizure of said auxiliary trunk line and the connection of the telephone instrument at one of said first-mentioned operator's positions to said auxiliary trunk line for operating a corresponding one of said signals, and means controlled when the telephone instrument at said one first-mentioned operator's position is connected to said auxiliary trunk line for rendering busy the first-mentioned trunk line individual thereto.

59. In a telephone system, a switchboard having a signal thereat, an operator's switchboard position, a plurality of other operator's positions, a plurality of trunk lines individually ex-

tending to said other operator's positions, a switch having access to said trunk lines and operative to seize one of said trunk lines, means at said operator's switchboard position for causing the operation of said switch, distributor means for causing said switch to seize idle ones of said trunk lines in a predetermined order, a further operator's position, a plurality of signals at said further operator's position and individually corresponding to said other operator's positions, a device at each of said other operator's positions and having a plurality of operating positions, means controlled by the operation of the device at one of said other operator's positions to one position for causing operation of said first-mentioned signal, and means controlled by the operation of the device at said one other operator's position to another position for causing operation of the one of said second-mentioned signals individual to said one other operator's position and for rendering busy the trunk line individual thereto.

60. In a telephone system, a switchboard, a plurality of operator's switchboard positions, a plurality of other operator's positions, a plurality of trunk lines individually extending to said other operator's positions, an auxiliary trunk line commonly associated with said other operator's positions and to which each of said other operator's positions has access, a switch having access to said trunk lines and operative to seize one of said trunk lines, means at each of said operator's switchboard positions for operating said switch, means for causing said switch to seize idle ones of said first-mentioned trunk lines in a predetermined order, and means controlled when all of said other operator's positions are busy for causing said switch to seize said auxiliary trunk line.

61. In a telephone system, a switchboard, a plurality of operator's switchboard positions, a plurality of other operator's positions, a plurality of trunk lines individually extending to said other operator's positions, an auxiliary trunk line commonly associated with said other operator's positions and to which each of said other operator's positions has access, a switch having access to said trunk lines and operative to seize one of said trunk lines, means at each of said operator's switchboard positions for operating said switch, means for causing said switch to seize idle ones of said first-mentioned trunk lines in a predetermined order, means responsive to the seizure of one of said first-mentioned trunk lines for transmitting a signal to the corresponding other operator's position, means controlled when all of said other operator's positions are busy for causing said switch to seize said auxiliary trunk line, and means responsive to the seizure of said auxiliary trunk line for transmitting a signal to each of said other operator's positions.

62. In a telephone system, a switchboard, a plurality of operator's switchboard positions, a plurality of other operator's positions, a plurality of trunk lines individually extending to said other operator's positions, a switch having access to said trunk lines and operative to seize one of said trunk lines, means at each of said operator's switchboard positions for operating said switch, a distributor operative to assign one of said trunk lines extending to an idle one of said operator's positions to be seized by said switch, and means responsive to the seizure of said assigned trunk line for causing said distributor to assign another one of said trunk lines extending to an idle one of said operator's positions to be seized by said switch.

63. In a telephone system, a switchboard, a plurality of operator's switchboard positions, a plurality of other operator's positions, a plurality of trunk lines individually extending to said other operator's positions, an auxiliary trunk line commonly associated with said other operator's positions and to which each of said other operator's positions has access, a switch having access to said trunk lines and operative to seize one of said trunk lines, means at each of said operator's switchboard positions for operating said switch, a distributor operative to assign one of said trunk lines extending to an idle one of said other operator's positions to be seized by said switch, means responsive to the seizure of said assigned trunk line for causing said distributor to assign another one of said trunk lines extending to an idle one of said other operator's positions to be seized by said switch, and means controlled when all of said other operator's positions are busy for causing said switch to seize said auxiliary trunk line.

64. In a telephone system, a plurality of operator's positions, a plurality of trunk lines individually extending to said operator's positions, a first switch having access to said trunk lines and operative to seize one of said trunk lines, means for causing said first switch to seize idle ones of said trunk lines in a predetermined order, a second switch, a plurality of trunk lines extending to said second switch and individually associated with said operator's positions, means at each operator's position operative to seize the second-mentioned trunk line individually associated therewith, and means controlled when the second-mentioned trunk line individually associated with one of said operator's positions is seized for rendering busy the one of the first-mentioned trunk lines individually extending thereto.

65. In a telephone system, a plurality of operator's positions, a plurality of trunk lines individually extending to said operator's positions, a first switch having access to said trunk lines and operative to seize one of said trunk lines, distributor means for assigning one of said trunk lines extending to an idle one of said operator's positions to be seized by said first switch, a second switch, a plurality of trunk lines extending to said second switch and individually associated with said operator's positions, means at each operator's position operative to seize the second-mentioned trunk line individually associated therewith, and means controlled when the second-mentioned trunk line individually associated with said one operator's position is seized for causing said distributor means to assign another of said first-mentioned trunk lines extending to an idle operator's position to be seized by said first switch.

66. In a telephone system, a plurality of operator's positions, a telephone instrument at each operator's position, a plurality of trunk lines individually extending to said operator's positions, a first switch having access to said trunk lines and operative to seize an idle one of said trunk lines, a second switch, a plurality of trunk lines extending to said second switch and individually associated with said operator's positions, means at each operator's position for selectively connecting the telephone instrument thereat to the one of said first-mentioned trunk lines individually ex-

tending thereto and to the one of said second-mentioned trunk lines individually associated therewith, and means controlled by the connection of the telephone instrument at one of said operator's positions to the one of said second-mentioned trunk lines individually associated therewith for rendering busy the one of said first-mentioned trunk lines individually extending thereto.

67. In a telephone system, a plurality of operator's positions, a telephone instrument at each operator's position, a plurality of trunk lines individually extending to said operator's positions, an auxiliary trunk line commonly associated with said operator's positions and to which each operator's position has access, a first switch having access to said trunk lines and operative to seize any one of said trunk lines, means for causing said first switch to seize idle ones of said first-mentioned trunk lines in a predetermined order, means controlled when all of said first-mentioned trunk lines are busy for causing said first switch to seize said auxiliary trunk line, a second switch, a plurality of trunk lines extending to said second switch and individually associated with said operator's positions, means at each operator's position for selectively connecting the telephone instrument thereat to the one of said first-mentioned trunk lines individually extending thereto, to the one of said last-mentioned trunk lines individually associated therewith and to said auxiliary trunk line, and means controlled by the connection of the telephone instrument at one of said operator's positions to the one of said last-mentioned trunk lines individually associated therewith or to said auxiliary trunk line for rendering busy the one of the first-mentioned trunk lines individually extending thereto.

68. In a telephone system, a plurality of operator's positions, a telephone instrument and an impulsing apparatus at each operator's position, a repeater individually associated with each telephone instrument, a plurality of trunk lines individually extending to said operator's positions, a first switch having access to said trunk lines and operative to seize an idle one of said trunk lines, a second switch, a plurality of trunk lines extending to said second switch and individually associated with said operator's positions, means at each operator's position operative to connect the repeater individually associated with the telephone instrument thereat to the one of said first-mentioned trunk lines individually extending thereto, means at each operator's position operative to connect the impulsing apparatus thereat and the repeater individually associated with the telephone instrument thereat to the one of said second-mentioned trunk lines individually associated therewith, means controlled by the operation of said last-mentioned means at one of said operator's positions for rendering busy the one of said first-mentioned trunk lines individually extending thereto, and means controlled by the operation of the impulsing apparatus at said one operator's position for rendering ineffective the receiver of the telephone instrument thereat and for completing a path around at least a portion of the repeater associated with the telephone instrument thereat, thereby to complete a low impedance impulsing circuit by way of the one of said second-mentioned trunk lines individually associated therewith between the impulsing apparatus thereat and said second switch.

69. In a telephone system, a switchboard having a plurality of lines associated therewith, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said lines to a selected one of said operator's switchboard positions, another operator's position, means controlled by the operation of said selecting means to select a particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular operator's switchboard position, and means controlled by the operation of said assigning means to assign a particular calling one of said lines to said selected particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular line.

70. In a telephone system, a switchboard having a plurality of lines associated therewith, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said lines to a selected one of said operator's switchboard positions, another operator's position, a first group of signals at said other operator's position individually corresponding to said operator's switchboard positions, a second group of signals at said other operator's position individually corresponding to said lines, means controlled by the operation of said selecting means to select a particular operator's switchboard position for controlling the operation of the one of the signals in said first group corresponding to said particular operator's switchboard position, and means controlled by the operation of said assigning means to assign a particular calling one of said lines to said selected particular operator's switchboard position for controlling the operation of the one of the signals in said second group corresponding to said particular line.

71. In a telephone system, a switchboard having a plurality of lines associated therewith, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said lines to a selected one of said operator's switchboard positions, another operator's position, a first group of signals at said other operator's position individually corresponding to said operator's switchboard positions, a second group of signals at said other operator's position individually corresponding to said lines, a device under the control of an operator at said other operator's position, means under the joint control of said device and the operation of said selecting means to select a particular operator's switchboard position for operating the one of the signals in said first group corresponding to said particular operator's switchboard position, and means under the joint control of said device and the operation of said assigning means to assign a particular calling one of said lines to said selected particular operator's switchboard position for operating the one of the signals in said second group corresponding to said particular line.

72. In a telephone system, a switchboard having a plurality of lines associated therewith, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said lines to a selected one of said operator's switchboard positions, means at each operator's

switchboard position operative to answer a call on one of said lines assigned thereto, another operator's position, a first group of signals at said other operator's position individually corresponding to said operator's switchboard positions, a second group of signals at said other operator's position individually corresponding to said lines, means controlled by the operation of said selecting means to select a particular operator's switchboard position for operating the one of the signals in said first group corresponding to said particular operator's switchboard position, means controlled by the operation of said assigning means to assign a particular calling one of said lines to said selected particular operator's switchboard position for operating the one of the signals in said second group corresponding to said particular line, and means controlled by the operation of the answering means at said particular operator's switchboard position for preventing the subsequent operations of said selecting means and said assigning means from causing operations of other of said signals.

73. In a telephone system, a switchboard having a plurality of lines associated therewith, a plurality of operator's switchboard positions, means operative to select an idle operator's switchboard position, means operative to assign a calling one of said lines to said selected operator's switchboard position, means controlled by the operation of said assigning means for causing said selecting means to operate to select another idle operator's switchboard position, another operator's position, means controlled by the operation of said selecting means to select a particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular operator's switchboard position, and means controlled by the operation of said assigning means to assign a particular calling one of said lines to said selected particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular line.

74. In a telephone system, a switchboard having a plurality of lines associated therewith, a plurality of operator's switchboard positions, means operative to select an idle operator's switchboard position, means operative to assign a calling one of said lines to said selected operator's switchboard position, means controlled by the operation of said assigning means for causing said selecting means to operate to select another idle operator's switchboard position, means at each operator's switchboard position operative to answer a call on one of said lines assigned thereto, another operator's position, a first group of signals at said other operator's position individually corresponding to said operator's switchboard positions, a second group of signals at said other operator's position individually corresponding to said lines, means controlled by the operation of said selecting means to select a particular operator's switchboard position for operating the one of the signals in said first group corresponding to said particular operator's switchboard position, means controlled by the operation of said assigning means to assign a particular calling one of said lines to said selected particular operator's switchboard position for operating the one of the signals in said second group corresponding to said particular line, and means controlled by the operation of the answering means at said particular operator's switchboard position for preventing the subsequent operations of said selecting means and said assigning means from causing operations of other of said signals.

75. In a telephone system, a switchboard having a plurality of lines associated therewith, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said lines to a selected one of said operator's switchboard positions, another operator's position, means controlled by the operation of said selecting means to select a particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular operator's switchboard position, means controlled by the operation of said assigning means to assign a particular calling one of said lines to said selected particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular line, and means at said other operator's position for selectively monitoring a connection including said particular operator's switchboard position and a connection including said particular line.

76. In a telephone system, a switchboard having a plurality of lines associated therewith, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said lines to a selected one of said operator's switchboard positions, another operator's position, means controlled by the operation of said selecting means to select a particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular operator's switchboard position, means controlled by the operation of said assigning means to assign a particular calling one of said lines to said selected particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular line, and means at said other operator's position for monitoring simultaneously a connection including said particular operator's switchboard position and a connection including said particular line.

77. In a telephone system, a switchboard having a group of incoming lines and a group of outgoing lines associated therewith, switching means operative to route a call between a line in said incoming group and a line in said outgoing group, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said incoming lines to a selected one of said operator's switchboard positions, means at each operator's switchboard position for controlling the operation of said switching means, another operator's position, means controlled by the operation of said selecting means to select a particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular operator's switchboard position, means controlled by the operation of said assigning means to assign a particular calling one of said lines to said selected particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular incoming line, and means controlled by the operation of said switching means to route the call between said particular incoming line and a particular

outgoing line for transmitting to said other operator's position a signal characteristic to said particular outgoing line.

78. In a telephone system, a switchboard having a group of incoming lines and a group of outgoing lines associated therewith, switching means operative to route a call between a line in said incoming group and a line in said outgoing group, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said incoming lines to a selected one of said operator's switchboard positions, means at each operator's switchboard position for controlling the operation of said switching means, another operator's position, a first group of signals at said other operator's position individually corresponding to said operator's switchboard positions, a second group of signals at said other operator's position individually corresponding to said incoming lines, a third group of signals at said other operator's position individually corresponding to said outgoing lines, means controlled by the operation of said selecting means to select a particular operator's switchboard position for controlling the operation of the one of the signals in said first group corresponding to said particular operator's switchboard position, means controlled by the operation of said assigning means to assign a particular calling one of said incoming lines to said selected particular operator's switchboard position for controlling the operation of the one of the signals in said second group corresponding to said particular incoming line, and means controlled by the operation of said switching means to route the call between said particular incoming line and a particular outgoing line for controlling the operation of one of the signals in said third group corresponding to said particular outgoing line.

79. In a telephone system, a switchboard having a group of incoming lines and a group of outgoing lines associated therewith, switching means operative to route a call between a line in said incoming group and a line in said outgoing group, a plurality of operator's switchboard positions, means operative to select an idle operator's switchboard position, means operative to assign a calling one of said incoming lines to said selected operator's switchboard position, means controlled by the operation of said assigning means for causing said selecting means to operate to select another idle operator's switchboard position, means at each operator's switchboard position for controlling the operation of said switching means, another operator's position, means controlled by the operation of said selecting means to select a particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular operator's position, means controlled by the operation of said assigning means to assign a particular calling one of said incoming lines to said selected particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular incoming line, and means controlled by the operation of said switching means to route the call between said particular incoming line and a particular outgoing line for transmitting to said other operator's position a signal characteristic to said particular outgoing line.

80. In a telephone system, a switchboard having a group of incoming lines and a group of outgoing lines associated therewith, switching means operative to route a call between a line in said incoming group and a line in said outgoing group, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said incoming lines to a selected one of said operator's switchboard positions, means at each operator's switchboard position for contolling the operation of said switching means, another operator's position, means controlled by the operation of said selecting means to select a particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular operator's switchboard position, means controlled by the operation of said assigning means to assign a particular calling one of said incoming lines to said selected particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular incoming line, means controlled by the operation of said switching means to route the call between said particular incoming line and a particular outgoing line for transmitting to said other operator's position a signal characteristic to said particular outgoing line, and means at said other operator's positions for selectively monitoring a connection including said particular operator's switchboard position, a connection including said particular incoming line and a connection including said particular outgoing line.

81. In a telephone system, a switchboard having a group of incoming lines and a group of outgoing lines associated therewith, switching means operative to route a call between a line in said incoming group and a line in said outgoing group, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said incoming lines to a selected one of said operator's switchboard positions, means at each operator's switchboard position for controlling the operation of said switching means, another operator's position, means controlled by the operation of said selecting means to select a particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular operator's switchboard position, means controlled by the operation of said assigning means to assign a particular calling one of said incoming lines to said selected particular operator's switchboard position for transmitting to said other operator's position a signal characteristic to said particular incoming line, means controlled by the operation of said switching means to route the call between said particular incoming line and a particular outgoing line for transmitting to said other operator's position a signal characteristic to said particular outgoing line, a first and a second receiver at said other operator's position, a first and a second current amplifying means, means comprising said first receiver and said first amplifying means for monitoring a connection including said particular operator's switchboard position, and means comprising said second receiver and said second amplifying means for simultaneously monitoring a connection including said particular outgoing line.

82. In a telephone system, a switchboard hav-

ing a group of incoming lines and a group of outgoing lines associated therewith, switching means operative to route a call between a line in said incoming group and a line in said outgoing group, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said incoming lines to a selected one of said operator's switchboard positions, means at each operator's switchboard position for controlling the operation of said switching means, a first device at each operator's switchboard position operative to cause ringing current to be projected over an outgoing line over which a call is to be routed, a second device at each operator's switchboard position operative to release a connection routed by way of said switching means between an incoming line and an outgoing line, another operator's position, a first and a second signal at said other operator's position, means controlled by the operation of the first device at a predetermined one of said operator's switchboard positions for controlling the operation of said first signal, and means controlled by the operation of the second device at said predetermined operator's switchboard position for controlling the operation of said second signal.

83. In a telephone system, a switchboard having a group of incoming lines and a group of outgoing lines associated therewith, switching means operative to route a call between a line in said incoming group and a line in said outgoing group, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said incoming lines to a selected one of said operator's switchboard positions, means at each operator's switchboard position for controlling the operation of said switching means, a first device at each operator's switchboard position operative to answer a call on one of said incoming lines assigned thereto, a second device at each operator's switchboard position operative to cause ringing current to be projected over an outgoing line over which a call is to be routed, another operator's position, a first group of signals at said other operator's position individually corresponding to said operator's switchboard positions, a second group of signals at said other operator's position individually corresponding to said incoming lines, a third group of signals at said other operator's position individually corresponding to said outgoing lines, means controlled by the selection of a particular operator's switchboard position for operating the corresponding signal in said first group, means controlled by the assignment of a particular calling one of said incoming lines to said particular operator's switchboard position for operating the corresponding signal in said second group, means controlled by the operation of the first device at said particular operator's switchboard position for preventing the operations of other signals in said first and second groups, means controlled by the selection of a particular outgoing line over which the call is to be routed for preparing the corresponding signal in said third group to be operated, and means controlled by the operation of the second device at said particular operator's switchboard position to cause ringing current to be projected over the selected outgoing line for operating the prepared signal in said third group.

84. In a telephone system, a switchboard having a group of incoming lines and a group of outgoing lines associated therewith, switching means operative to route a call between a line in said incoming group and a line in said outgoing group, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said incoming lines to a selected one of said operator's switchboard positions, means at each operator's switchboard position for controlling the operation of said switching means, a first device at each operator's switchboard position operative to answer a call on one of said incoming lines assigned thereto, a second device at each operator's switchboard position operative to cause ringing current to be projected over an outgoing line over which a call is to be routed, another operator's position, a first group of signals at said other operator's position individually corresponding to said operator's switchboard positions, a second group of signals at said other operator's position individually corresponding to said incoming lines, a third group of signals at said other operator's position individually corresponding to said outgoing lines, means controlled by the selection of a particular operator's switchboard position for operating the corresponding signal in said first group, means controlled by the assignment of a particular calling one of said incoming lines to said particular operator's switchboard position for operating the corresponding signal in said second group, means controlled by the operation of the first device at said particular operator's switchboard position for preventing the operations of other signals in said first and second groups, means controlled by the selection of a particular outgoing line over which the call is to be routed for preparing the corresponding signal in said third group to be operated, means controlled by the operation of the second device at said particular operator's switchboard position to cause ringing current to be projected over the selected outgoing line for operating the prepared signal in said third group, and means controlled by the operation of the second device at said particular operator's switchboard position to cause the projection of ringing current over the selected outgoing line to be arrested for causing the operation of the signal in said third group to be arrested after a predetermined time interval.

85. In a telephone system, a switchboard having a group of incoming lines and a group of outgoing lines associated therewith, switching means operative to route a call between a line in said incoming group and a line in said outgoing group, a plurality of operator's switchboard positions, means operative to select idle ones of said operator's switchboard positions in a predetermined order, means operative to assign a calling one of said incoming lines to a selected one of said operator's switchboard positions, means at each operator's switchboard position for controlling the operation of said switching means, another operator's position having a signal thereat, and means responsive to a busy condition of all of the lines in one of said groups for controlling the operation of said signal.

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