

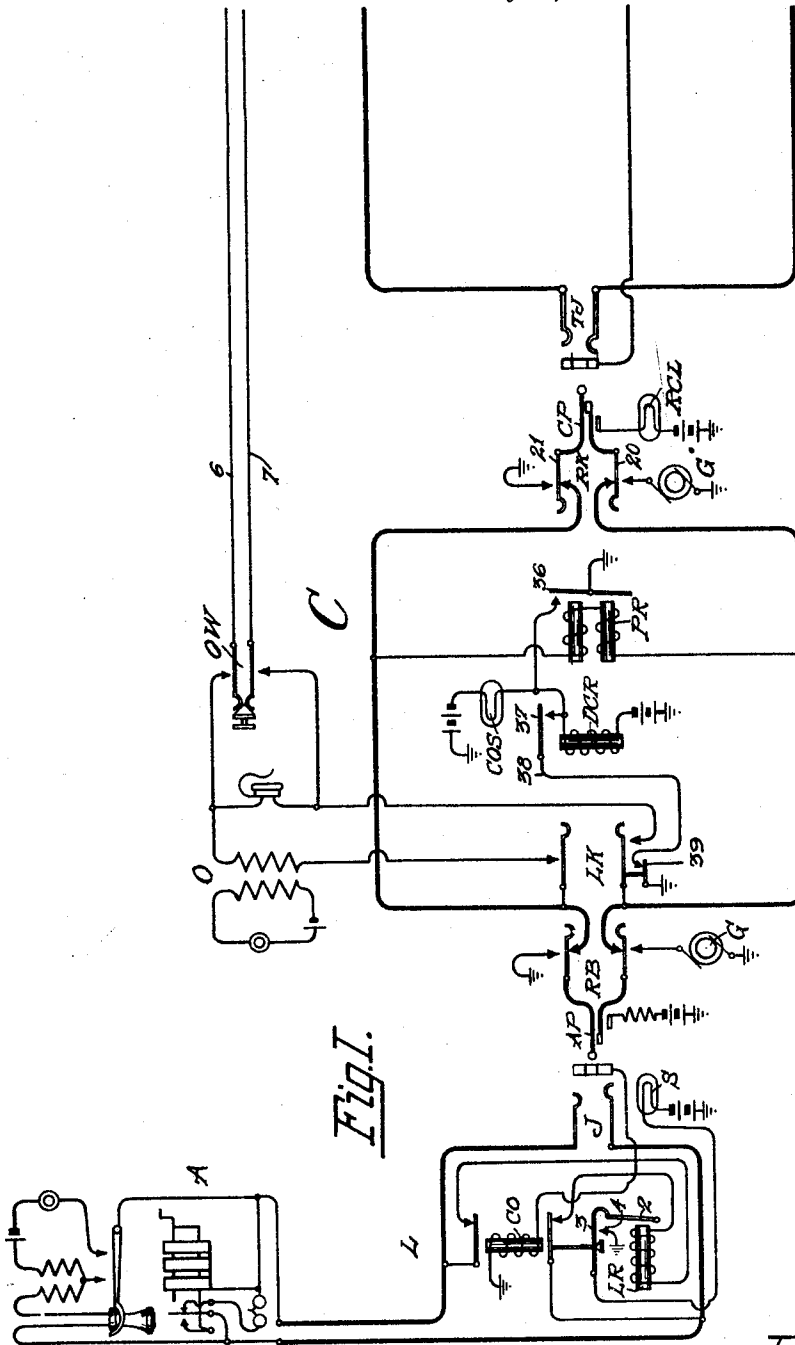
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1,693,824

M. B. STAZAK
TELEPHONE SYSTEM

Filed May 10, 1926

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

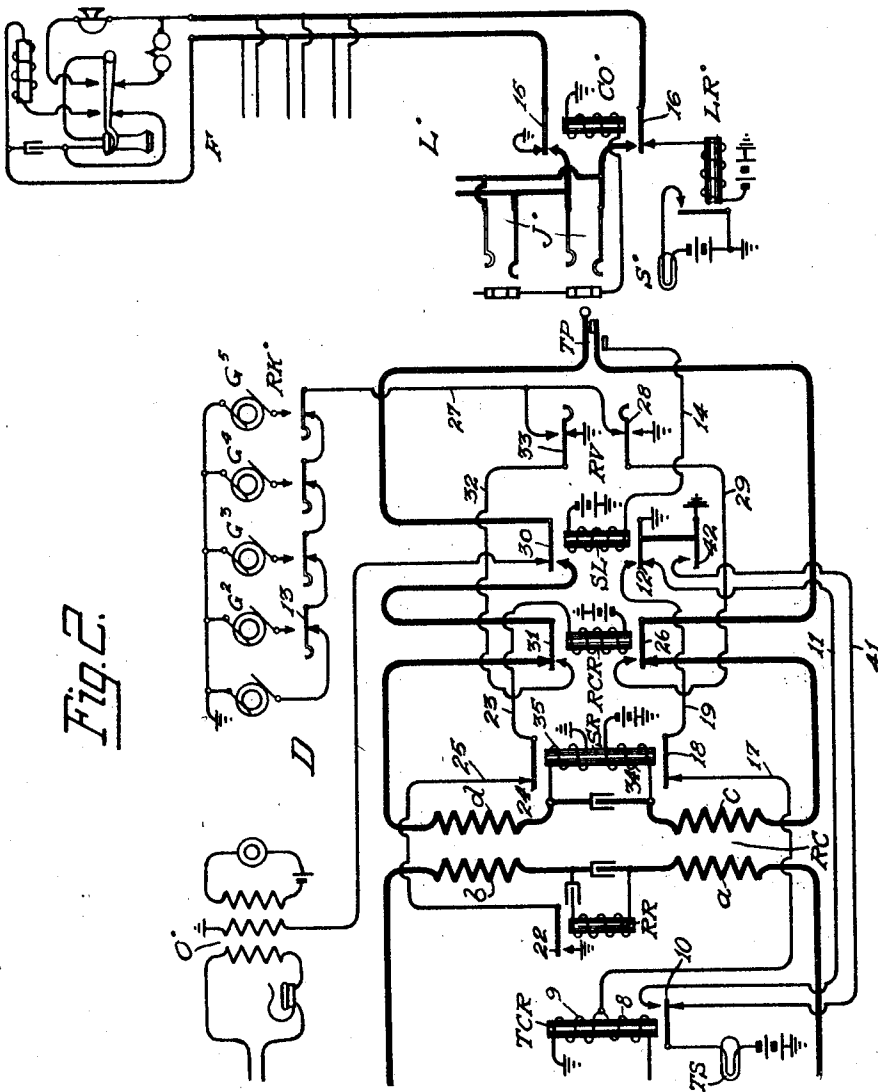


Fig. 2.

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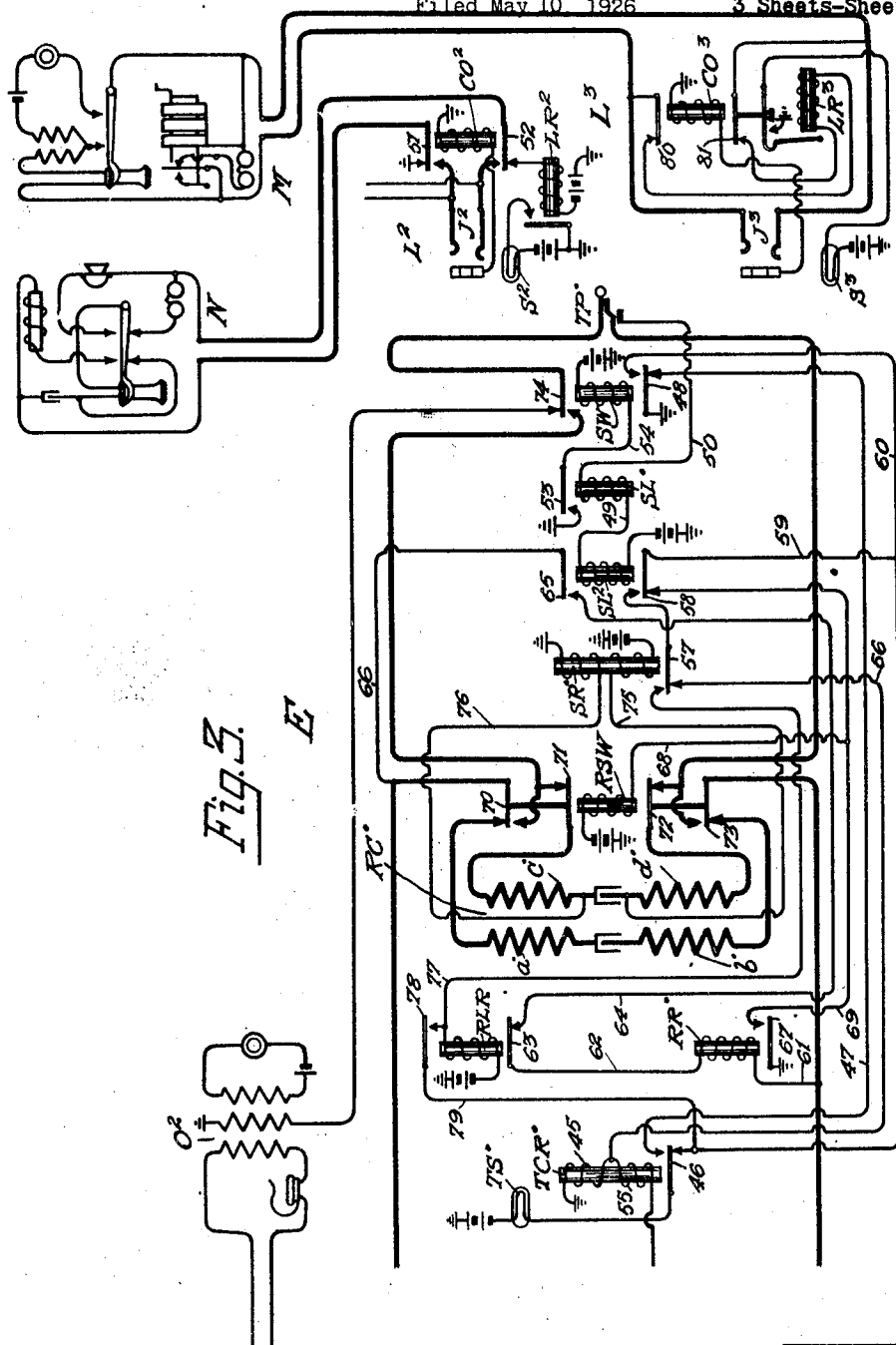
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TELEPHONE SYSTEM

Filed May 10, 1926

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

Application filed May 10, 1926. Serial No. 107,928.

My invention relates to telephone systems and more particularly to telephone trunking systems for toll line use, and has for one of its objects the provision of an improved method of trunking from a toll line to a local subscriber's telephone.

A feature of my invention consists of providing means so that when a toll call has been extended through from the toll operator by the aid of a second operator and a toll switching trunk to a called for subscriber's local telephone line, the signalling of the called for subscriber although set by the operator of the toll switching trunk is not applied to the called line by her but controlled by the toll operator who actuates means to extend the ringing current conditioned by the toll switching trunk operator to the called line.

Another feature of my invention is the provision of a universal toll switching trunk which when used in association with a toll cord circuit may extend connections from a toll line through the medium of the universal toll switching trunk to magneto or common battery local lines terminating at a universal local switchboard.

The above features as well as others not specifically pointed out will be more fully described in the ensuing specification and the appended claims. To more clearly understand the same reference may be had to the accompanying drawings in which:

Fig. 1 illustrates a toll substation and a toll cord circuit for connecting the same to the jack of a trunk circuit;

Fig. 2 illustrates a trunk circuit for connection to a called common battery substation;

Fig. 3 illustrates a trunk circuit of the universal type for connection to magneto or common battery substations.

Referring now in general to my invention as illustrated in the accompanying drawings which comprise Figs. 1, 2 and 3, and referring to Fig. 1 I illustrate a toll substation A which comprises the usual magneto substation equipment. The toll substation A terminates at the exchange in a line circuit L comprising a line relay LR, a cut off relay CO, a line signal S, and spring jack J.

At C I illustrate a toll cord circuit C, of which there are a plurality at a toll operator's position and which comprises an answering plug AP and a calling plug CP connected by the heavily marked conductors. The toll cord circuit C can be used for connecting

directly to another toll subscriber's line or to a toll switching trunk circuit such as is illustrated at D or E in Figs. 2 and 3. The toll cord circuit C comprises a ring back key RB which when actuated connects the generator G to ring a calling toll subscriber as is well known in the art. A listening key LK is provided which when actuated connects the toll operator's set O in circuit with the cord conductors to place herself in communication with the calling toll subscriber. A polarized relay PR, a disconnect control relay DCR and clearing out signal COS are used for the usual clearing out purposes. A ringing key RK associated with the calling end of the toll cord circuit C when actuated connects the ringing generator G' to signal a called subscriber on a toll to toll connection or is used for signalling purposes when a call from the toll line A is extended to a called subscriber through the medium of the toll switching trunks D and E illustrated in Figs. 2 and 3 as will be more fully hereinafter described. A ringing control lamp signal RCL is also associated with the calling end of the toll cord circuit C and lights under certain conditions when the plug CP is inserted into a trunk jack TJ of the toll switching trunks D and E of Figs. 2 and 3.

Referring now to Fig. 2 I illustrate a toll switching trunk circuit D which may be used to establish a connection between a toll subscriber A and a called common battery subscriber's substation F. The system with reference to Figs. 1 and 2 as will be readily understood, illustrates an arrangement for establishing a connection from the subscriber at a toll substation A by means of the toll cord circuit C to the toll switching trunk circuit D, which switching trunk may be an interoffice trunk in a multi-office system, and by means of the trunk D extend a connection through to a called common battery subscriber's substation F as illustrated in Fig. 2. The toll switching trunk circuit D comprises a trunk signal control relay TCR which is energized when the operator of a toll cord circuit as C inserts the calling plug CP into a trunk jack TJ leading to a toll switching trunk as D and the relay TCR controls the lighting of a trunk signal lamp TS for the usual purposes. The calling end of the trunk D comprises a trunk plug TP which may be inserted in the jack of a called common battery line. A sleeve relay SL associated with

the calling end of the trunk is energized when the plug TP is connected to a called line as just described to efface the signal TS. The sleeve relay SL in association with the relay TCR provides means for signalling the operator of the toll cord C through the agency of a ringing control lamp RCL that she may now operate the ringing key RK of the cord C to operate means including a ringing relay RR in the trunk D to connect ringing current to the called line. The operator of the trunk D is equipped with a party line ring key RK' and its associated frequency generators G², G³, G⁴ and G⁵ and the operator of the trunk D selects the proper ringing generator frequency through the agency of the party line ringing key RK' but does not connect the ringing current to the called line as will be hereinafter described. The relay RR of the trunk D when operated by current from the generator G' of the toll cord C of Fig. 1 causes the operation of a ringing control relay RCR which now connects the frequency selected by the operator to the called line.

A calling supervisory relay SR in the trunk D operates when the called for substation answers and prevents further application of ringing current on the called line. A reversing key RV is also associated with the trunk D for reversing the application of ringing current from the tip to ring conductors of the trunk D and vice-versa as done in ringing called subscribers on a ten party line in which five of the substations are connected for ringing purposes to the tip conductor and the other five to the ring conductor and thence to ground. When ringing the subscribers connected to the ring conductor the key RV is left undisturbed. When ringing those substations in which the ringer is connected from the tip conductor to ground the key RV is operated. Thus only five ringing generators are necessary to operate the harmonic ringers of the subscribers on the ten party line.

To the right of Fig. 2, I illustrate a called substation F terminating at the exchange into a line circuit L' comprising a cut off relay CO', a line relay LR', a line signal S' and the multiple jacks J'.

Referring now to Fig. 3 I illustrate another toll switching trunk circuit E which is adapted to operate in connection with the toll cord circuit C. Fig. 3 when placed to the right of Fig. 1 illustrates a complete system and operates in association with a universal system in which common battery and magneto lines terminate at a universal local switchboard. The universal toll switching trunk circuit E comprises a trunk signal control relay TCR' which is energized when the operator of the toll cord circuit C inserts the calling plug CP into the trunk jack TJ leading to the trunk E. A trunk signal TS' associated with the relay TCR' is provided for the usual purposes. A ringing relay RR' is

operated when ringing current is applied to the trunk E by the toll operator of the cord C when connection is established with a called common battery line but does not operate when ringing current is extended to a called magneto line.

A ringing lock out relay RLR is provided and operates when a called common battery subscriber answers to prevent further application of ringing current to the called line. A repeating coil switching relay RSW is provided which controls the connection of the repeating coil RC depending on whether a connection is established with a called common battery line or a called magneto line. The outgoing end of the trunk E is provided with a trunk plug TP' whereby connection may be established with either a common battery line or a magneto line and is also provided with a pair of sleeve relays SL' and SL² and a switching relay SW and a supervisory relay SR'. To the right of Fig. 3 I illustrate a common battery substation N terminating at the exchange in a line circuit L² comprising a line relay LR², a cut off relay CO², line signal S² and spring jack J². I also illustrate a magneto substation M terminating at the exchange in a line circuit L³ which comprises a line relay LR³, a cut off relay CO³, a line signal S³ and a spring jack J³.

For a clearer understanding of my invention a detailed description will be given in which a call is assumed to come over the toll line from the substation A of Fig. 1 and which is to be extended to a common battery called subscriber F terminating at a local common battery exchange switchboard through the medium of the toll switching trunk D as illustrated in Fig. 2. For a clear understanding of this connection Fig. 2 is placed to the right of Fig. 1 and assuming that the toll subscriber at substation A operates his hand generator whereupon current is applied to the line to operate the line relay LR. The line relay LR energizes to attract its armature 2 to permit the latching spring 3 to lock the armature 2 in its actuated position and the movement of the latching spring 3 closes a circuit for the line signal S from battery through the lamp S to ground at alternate contact 4 of the latching spring 3. In response to this signal the toll operator at C inserts the answering plug AP into the jack J of the calling line A to close an energizing circuit for the cut off relay CO of the line circuit L traced from battery through the sleeve contacts of the connected plug AP and jack J to ground through the winding of relay CO. Relay CO causes the latching spring 3 of relay LR to be raised to permit the armature 2 to fall back to again open the alternate contact 4 of the relay LR to efface the line signal S. The operator now actuates her listening key LK to connect her operator's set O to inquire the wants of the call-

ingsubscriber and learning that the line wanted is the substation F at the distant operator's position D she restores her listening key and actuates her order wire key OW directly cutting her operator's set O into circuit with the operator's set O' of the toll switching trunk D.

The toll operator at C then tells the operator of the trunk D over the order wires 6 and 7 the number of the subscriber that is wanted, and the toll switching trunk operator at D in turn assigns the trunk to be used. Assuming that it is the trunk jack TJ before the toll operator C that is assigned; the operator at C now inserts the calling plug CP of the toll circuit C into the trunk jack TJ. The insertion of the plug CP into the trunk jack TJ closes an energizing circuit for the trunk signal control relay TCR which is energized by current flowing from battery, through the ringing control signal lamp RCL the sleeve contacts of the connected plug CP and jack TJ through the windings 8 and 9 of the relay TCR to ground. Relay TCR energizes over this circuit, but the lamp RCL does not light due to the high resistance winding 9 of relay TCR. The closing of alternate contact 10 of relay TCR closes a circuit for the trunk signal TS which is caused to glow by current flowing from battery, through the lamp TS, alternate contact 10 of relay TCR, conductor 11, to ground at normal contact 12 of the sleeve relay SL, and the lighting of the lamp TS gives the operator of the trunk D a visual indication that the toll operator at C has plugged into the assigned trunk jack. The operator of the trunk D now tests the called line F in the usual manner and having found the same idle inserts the trunk plug TP in the jack J' of the called line F. The operator of the trunk D also depresses the proper key plunger of the ringing key RK' to connect the proper ringing frequency to the called line and assuming that the generator G² is the one selected the depression of the key plunger closes the alternate contact 13 of this selected key plunger. The trunk operator D in establishing a connection to a called line only sets the key plunger to select the proper ringing frequency but does not cause ringing current to flow out on the called line as the application of ringing current to the called line is solely under the control of the toll operator at C as will now be described. The operator at D having inserted the plug TP into the jack J' of the called line an energizing circuit is established for the sleeve relay SL and the cut off relay CO' of the line circuit L' of the called line traced from battery through the winding of relay SL, conductor 14, sleeve contacts of the connected plug TP and jack J' to ground through the winding of relay CO', the latter relay operating to clear the line conductors of the called line for talking and ringing by

the closure of its alternate contacts 15 and 16.

The sleeve relay SL upon energization opens its normal contact 12 to efface the signal TS and the closing of alternate contact 12 establishes a circuit for the signal RCL of the toll cord circuit C through the relay TCR of the trunk D traced from battery, through the lamp RCL, sleeve contacts of the connected plug CP and jack TJ through the low resistance winding 8 of relay TCR, conductor 17, normal contact 18 of relay SR, conductor 19 to ground at alternate contact 12 of relay SL. This low resistance path just described shunts the high resistance winding 9 of relay TCR and permits the signal RCL to light indicating to the toll operator at C that the trunk operator of the trunk D has established a connection with the wanted called line at F and that ringing current may now be applied to actuate the ringer of the called substation at F. The toll operator at C now actuates the ringing key RK and connects generator current from the generator G' through the alternate contact 20 of the key RK, ring contacts of the plug CP and jack TJ, winding "a" of the repeating coil RC, winding of the ringing relay RR, winding "b" of the repeating coil RC, tip contacts of the jack TJ and plug CP to ground at alternate contact 21 of the key RK.

The relay RR is energized by this application of ringing current from the cord C and the closing of its alternate contact 22 establishes an energizing circuit for the ringing control relay RCR traced from battery, through the winding of relay RCR, conductor 23, normal contact 24 of relay SR, conductor 25 to ground at alternate contact 22 of relay RR. As before described the operator of the trunk D has already depressed the key plunger of the party line ringing key RK' to place it in condition so that ringing current of the selected generator frequency G² may be impressed upon the called line when the relay RCR energizes. Now when the relay RCR energizes its alternate contact 26 is closed to connect ringing current from the selected generator G² to the called line and which may be traced from the generator G², alternate contact 13 of the depressed key plunger, conductor 27, normal contact 28 of the key RV, conductor 29, alternate contact 26 of relay RCR, ring contacts of the connected plug TP and jack J' through the call bell at the called substation F, back through the tip contacts of the connected jack J' and plug TP, alternate contact 30 of relay SL, alternate contact 31 of relay RCR, conductor 32, to ground at normal contact 33 of the key RV. Each time that ringing current is desired to be applied to the called line from the generator G², the operator at C must actuate the ringing key RK, to apply current to the relay RR and this relay RR in turn causes the relay RCR to operate to close its alter-

nate contacts 26 and 31 to connect the generator G^2 which was selected by the operator of the trunk D.

When the called subscriber at the substation F responds in answer to his call signal the removal of his receiver closes an energizing circuit for the supervisory relay SR traced from battery through the winding 34 of relay SR, winding "c" of the repeating coil RC, normal contact 26 of relay RCR which relay is deenergized after each application of ringing current, ring contacts of the connected plug TP and jack J', the now closed contacts of the substation switch hook at F, back through the tip contacts of the jack J' and plug TP, alternate contact 30 of relay SL, normal contact 31 of relay RCR, winding "d" of the repeating coil RC to ground through the winding 35 of relay SR.

The relay SR upon energization opens its normal contact 24 which prevents the energization of the relay RCR should the relay RR be energized by ringing current after the called subscriber answers so as to prevent further application of ringing current after the subscriber at the called substation F has answered. The relay SR upon energization opens its normal contact 18 and opens the low resistance path through the winding 8 of the relay TCR and the circuit for relay TCR now extends from ground through the high and low windings 9 and 8 to battery through the lamp RCL as previously described. The lamp RCL is again effaced to notify the toll operator at C that the called subscriber at F has answered. The calling toll subscriber at A and the called subscriber at F are now in a conversational circuit which may be traced over the heavily marked conductors.

When conversation is terminated the subscriber at the substation F replaces his receiver to again open the circuit of the relay SR and the relay deenergizing the closure of its normal contact 18 again closes the low resistance path through the winding 8 of the relay TCR to permit the lamp RCL to again light to notify the toll operator at C that the called subscriber at F has replaced his receiver. The toll subscriber at A also replaces his receiver and operates his hand generator to cause the relay PR to operate and the closing of its alternate contact 36 closes an energizing circuit for the disconnect control relay DCR traced from battery through the relay DCR to ground at alternate contact 36 of relay PR. The closure of alternate contact 37 of the relay DCR closes a locking circuit for the said relay DCR traced from battery, through relay DCR alternate contact 37, conductor 38 to ground at normal contact 39 of the listening key LK.

The closure of alternate contact 37 also closes a circuit for the clearing out signal COS traced from ground at normal contact 39 of key LK, conductor 38, alternate contact 37

of relay DCR, through the lamp COS to battery. The clearing out signal COS is lighted by current flowing over this circuit and notifies the operator at C that the calling toll subscriber at A has also replaced his receiver.

The toll operator noting the two lighted signals COS and RCL withdraws the plugs AP and CP from the respective jacks J and TJ. The plug AP when disconnected from the jack J allows the cut off relay CO to restore and the operator of C also momentarily operates the listening key LK to open the normal contact 39 to open the circuit of relay DCR to efface the signal COS. The removal of plug CP from the trunk jack TJ effaces the signal RCL and also restores the relay TCR of the trunk D. The relay TCR restoring, its normal contact 10 is restored closing a circuit for the signal TS traced from battery through the lamp TS, normal contact 10 of relay TCR, conductor 41, to ground at alternate contact 42 of the sleeve relay SL. The lamp TS is lighted and notifies the trunk operator at D that the toll operator has disconnected the plug CP from the jack TJ. The trunk operator at D now withdraws the plug TP from the jack J' to open the circuit of relay SL of the trunk D and the cut off relay CO' of the line circuit L' of the called line. Relay SL restoring, its alternate contact 42 is opened to efface the signal TS. The apparatus used in establishing the connection just described is now at normal and available for establishing other connections.

Having described in detail the operation of Fig. 1 in connection with the toll switching trunk circuit as illustrated in Fig. 2 I will now describe the operation of the toll cord circuit C of Fig. 1 in connection with Fig. 3 which illustrates a universal toll switching trunk circuit E which may be used for extending a connection from the toll substation A of Fig. 1 with either the common battery substation N or magneto substation M as called lines and as illustrated in Fig. 3.

Assuming that the toll subscriber at A initiates a call and desires to be placed in communication with the common battery substation N; the operation of the toll cord C is the same up to and including the time that the calling plug CP is inserted into the trunk jack TJ assigned by the trunk operator O^2 of trunk E leading to the universal toll switching trunk circuit E. The insertion of the plug CP into the trunk jack TJ closes a circuit for the relay TCR' of the universal trunk E traced through the lamp RCL to battery as before described to allow relay TCR' to operate but due to the high resistance winding 45 of relay TCR' the lamp RCL does not light for reasons as before described. The relay TCR' operating, its alternate contact 46 is closed and completes a circuit for the trunk signal TS' traced from

battery, through the lamp TS' alternate contact 46 of relay TCR', conductor 47 to ground at normal contact 48 of the switching relay SW. The lamp TS' is lighted over this circuit and notifies the trunk operator of E that the toll operator of C has inserted the plug of the cord C into the assigned trunk jack TJ.

The operator of the trunk E having received the number of the called substation now tests the called line N in the usual manner and assuming that the line of the called common battery substation N is idle she now inserts the trunk plug TP' into the jack J² of the called line thus closing a series energizing circuit for the cut off relay CO² and the sleeve relays SL' and SL² traced from battery through the winding of relay SL², conductor 49, winding of relay SL', conductor 50, sleeve contacts of the connected plug TP' and jack J² to ground through the winding of the cut off relay CO² of the line circuit L². The relay CO² operating, its alternate contacts 51 and 52 are closed to condition the line of the called subscriber at N for ringing and talking purposes. The sleeve relay SL' operating, its alternate contact 53 is closed thus establishing an energizing circuit for the switching relay SW, traced from battery, through the winding of relay SW, conductor 54, to ground at alternate contact 53 of relay SL'. The relay SW operating over this circuit now opens its normal contact 48 to efface the signal TS' and also closes a low resistance path through the winding 55 of relay TCR' traced from battery through the lamp RCL, sleeve contacts of the connected plug CP and jack TJ, the low resistance winding 55 of relay TCR', conductor 56, normal contact 57 of relay SR', alternate contact 58 of sleeve relay SL², conductors 59 and 60 to ground at alternate contact 48 of the switching relay SW. This low resistance path for the lamp RCL permits the same to light and this circuit just traced shunts out the high resistance winding 45 of relay TCR'. The lighting of the lamp RCL gives the toll operator at C an indication that the trunk operator at E has connected the plug TP' of the trunk E to the jack J² of the called common battery line and that ringing current may now be impressed upon the called line N to signal the subscriber thereat.

The toll operator at C now actuates the ringing key RK and the closing of its alternate contact 20 connects ringing current from the generator G' which is traced from the generator G', the alternate contact 20 of the key RK, ring contacts of the connected plug CP and jack TJ, conductor 61, the winding of ringing relay RR' conductor 62, normal contact 63 of the ringing lockout relay RLR, conductor 64, alternate contact 65 of the sleeve relay SL², con-

ductor 66, tip contacts of the connected jack TJ and plug CP to ground at alternate contact 21 of the ringing key RK. Ringing current through the relay RR' causes the relay to operate and the closing of its alternate contact 67 establishes an energizing circuit for the repeating coil switching relay RSW, traced from battery through the winding of relay RSW, conductors 68 and 69 to ground at alternate contact 67 of relay RR'. The relay RSW operates to open its normal contacts 70, 71, 72 and 73 to disconnect the windings a', b', and c', d' of the repeating coil RC' from the tip and ring conductors of the trunk E and ringing current from the generator G' also traverses a path extending over the ring conductor, through alternate contact 73 of relay RSW, ring contacts of the connected plug TP' of the trunk E and jack J² of the line circuit L² through the call bell of the called substation N, back through the tip contacts of the jack J² and plug TP' alternate contact 74 of relay SW, alternate contact 70 of relay RSW, tip contacts of the jack TJ and plug CP to ground at alternate contact 21 of the ringing key RK. The call bell at the called substation is now operated and after each application of ringing current the relays RR' and RSW deenergize and again energize when current is again applied. The subscriber in response to his call signal removes his receiver and when the relay RSW is in a deenergized condition a circuit is established for the supervisory relay SR' traced from battery through the lower winding of relay SR', conductor 75, winding "d" of the repeating coil RC' normal contact 72 of relay RSW, ring contacts of the plug TP' and jack J², the closed contacts of the switchhook at substation N back through tip contacts of the jack J² and plug TP', alternate contact 74 of relay SW, normal 71 of relay RSW, winding "c'" of the repeating coil RC', conductor 76 to ground through the upper winding of relay SR'. The relay SR' operating closes its alternate contact 57 thereby establishing an energizing circuit for the ringing lock out relay RLR traced from battery through winding of relay RLR, conductor 77, alternate contact 57 of relay SR', alternate contact 58 of relay SL², conductors 59 and 60 to ground at alternate contact 48 of relay SW. The relay RLR operates and the closure of its alternate contact 78 closes a locking circuit for itself traced from battery, through the winding of relay RLR, its alternate contact 78, conductors 79 and 60 to ground at alternate contact 48 of relay SW. The relay RLR is now energized and locked up and the opening of its normal contact 63 prevents relay RR' from being actuated by ringing current from the generator G' should the toll operator at C apply ringing current after the called subscriber has answered. The

relay RR' failing to energize relay RSW remains at normal and it is thus readily apparent that ringing current cannot be transmitted to the called line after the subscriber
5 thereat has removed his receiver.

The opening of normal contact 57 of relay SR' upon energization of that relay opens the low resistance path for the lamp RCL at the toll cord C through the low resistance
10 winding 55 of the relay TCR' and the high resistance path for lamp RCL is again closed through the high and low windings 45 and 55 of relay TCR' to ground to again efface the lamp RCL to notify the toll operator at C
15 that the called subscriber at the substation N has answered. The relay RSW being deenergized its normal contacts 70, 71, 72 and 73 are again closed to again connect the windings a', b' and c', d' of the repeating coil RC'
20 across the respective tip and ring conductors of the trunk E and the talking circuit between the calling toll subscriber at A and the called subscriber at N may be traced over the heavily marked conductors including the windings
25 a', b', c' and d' of the repeating coil RC'.

When conversation has terminated the subscribers replace their receivers upon their respective switchhooks and the replacing of the receiver at the toll substation A is the same
30 as previously described in connection with Figs. 1 and 2. The replacing of the receiver at the called substation N again opens the energizing circuit of relay SR' and the closing of its normal contact 57 again closes the low resistance path through the winding 55 of
35 relay TCR' for the lamp RCL of the toll circuit C and the lamp RCL lighting gives the toll operator at C a visual indication that the called subscriber at N has replaced his receiver. The toll operator at C noting the two
40 lighted signals COS and RCL withdraws the respective plugs AP and CP from the respective jacks J and TJ and operates her listening key LK momentarily to efface the signal COS and the withdrawal of the plug
45 CP from the jack TJ effaces the signal RCL. The relay TCR' of the trunk E restores when the disconnection of the plug CP from the jack TJ takes place and the closing of its normal contact 46 closes a circuit for the lamp
50 TS' to ground at alternate contact 48 of relay SW over conductor 60. The lighting of the lamp TS' indicates to the trunk operator at E that the toll operator at C has disconnected and she now withdraws the plug TP'
55 from the jack J² of the called line permitting relays SL' and SL² to restore and the relay SL' restoring its alternate contact 53 is opened to allow the relay SW to restore and the opening of its alternate contact 48 opens
60 the locking circuit of the relay RLR and the relay restores. The cut off relay CO² of the line circuit L² associated with the called line N also restores when the plug TP' is disconnected and the apparatus used in establish-

ing a connection between the toll subscriber at A of Fig. 1 and the called common battery subscriber at N of Fig. 3 is now at normal and available for establishing other connections.

I will now describe how a connection is established between the calling toll substation A of Fig. 1 and the called magneto substation M of Fig. 3 through the agency of the
70 toll cord C of Fig. 1 and the universal toll switching trunk E of Fig. 3. The operation of the apparatus is the same as just described up to and including the point of operation of the relay TCR' of the trunk E when the plug CP is inserted into the trunk jack TJ leading
80 to trunk E to light the lamp TS' of the trunk E to notify the operator that the toll operator of C has connected to the assigned trunk jack as before described. The trunk operator at E tests the called magneto line M in the
85 usual manner and finding it idle inserts the plug TP' into the jack J³ of the called line. This insertion brings about the operation of the sleeve relay SL' and the cut off relay CO³ of the line circuit L³ associated with the
90 called magneto line M over a circuit traced from battery through the winding of relay SL², the winding of relay SL', sleeve contacts of the connected plug TP' and jack J³, to ground through the winding of cutoff
95 relay CO³. Relay SL' and CO³ operate in series but relay SL² does not due to the high resistance of the cut off relay CO³. The relay CO³ of the line circuit L³ operates to open its normal contacts 80 and 81 to pre-
100 pare the line for ringing and talking purposes. The relay SL' operating closes a circuit for the relay SW to ground at alternate contact 53 of relay SL' and the opening of normal contact 48 of the relay SW opens the
105 circuit for the signal TS' and the lamp TS' is effaced. The closure of alternate contact 48 of relay SW also closes a circuit for the relay RSW traced from battery, through the winding of relay RSW, conductors 68 and
110 69, normal contact 58 of the relay SL², conductors 59 and 60 to ground at alternate contact 48 of relay SW. The relay RSW operates over this circuit and remains energized as long as the plug TP' remains in the jack
115 J³ of the called line, and the opening of its normal contacts 70, 71, 72, and 73 disconnects the windings a', b' and c' and d' of the repeating coil RC' from the tip and ring conductors of the trunk E.

The relay SL² having failed to energize as before described no low resistance path for the lamp RCL of the toll cord C is closed through the winding of relay TCR' and the toll operator at C does not receive a visual in-
125 dication to notify her that the trunk operator has inserted the plug TP' into the jack J³ of the called magneto line M. The lamp RCL does not light due to the circuit extending through the low resistance and high resist-
130

ance windings 55 and 45 of the relay TCR' to ground.

The toll operator at C actuates the ringing key RK to connect ringing current from the generator G' to the called magneto substation M, and this ringing current may be traced from the generator G', alternate contact 20 of key RK, ring contacts of the plug CP and jack TJ, alternate contact 73 of the relay RSW, ring contacts of the plug TP' and jack J³, the call bell at the called substation M back through the tip contacts of the plug TP' and jack J³, alternate contact 74 of the relay SW, alternate contact 70 of the relay RSW, tip contacts of the jack TJ and plug CP, to ground at alternate contact 21 of the ringing key RK. Each time the substation M is signaled the toll operator at C actuates the listening key LK from time to time to listen in for supervision. When the subscriber at the called substation M answers the subscriber thereat and the subscriber at the toll substation A are in conversational circuit which may be traced over the heavily marked conductors.

When the subscribers at A and M have finished their conversation they replace their receivers upon their respective switchhooks. After the subscriber at the called substation M has replaced his receiver he operates the hand generator at the substation and current therefrom extends from one side of the hand generator thereat, through the tip contacts of the plug TP' and jack J³, alternate contact 74 of relay SW, alternate contact 70 of relay RSW, tip contacts of the connected jack TJ and plug CP, normal contact 21 of the ringing key RK of the toll cord C, through the windings of the relay PR back through the normal contact 20 of the ringing key RK, ring contacts of the connected plug CP and jack TJ, alternate contact 73 of relay RSW, ring contacts of the connected plug TP' and jack J³ to the other side of the generator at the magneto substation M.

The relay PR operating, its alternate contact 36 is closed thereby closing a circuit for the relay DCR of the toll cord C and the relay DCR energizing closes its alternate contact 37 to close a locking circuit for itself to ground at normal contact 39 of the listening key LK. The closing of alternate contact 37 also closes a circuit for the lamp COS to ground at contact 39 of the listening key LK. The toll operator at C seeing the lighted disconnect signal COS now removes the plug CP from the jack TJ which opens the circuit of relay TCR' of the trunk E. The relay TCR' deenergizing, its normal contact 46 is closed to close a circuit for the lamp TS' traced from battery, through the now normal contact 46 of relay TCR', conductor 60 to ground at alternate contact 48 of relay SW. The lighted signal TS' notifies the operator

of trunk E that the toll operator has withdrawn the plug CP from the jack TJ. The trunk operator at E now withdraws the plug TP' from the jack J³ which allows the relay SL' of the trunk E and the cut off relay CO³ of the line circuit L³ of the called line to deenergize. The relay SL' restoring opens the energizing circuit of relay SW and the relay SW restoring effaces the signal TS' and opens the energizing circuit of relay RSW. The toll operator of C also withdraws the plug AP from the jack J and operates her listening key LK momentarily to open the locking circuit of relay DCR to efface the signal COS. The apparatus used in establishing the connection just described is now at normal and available for establishing other connections.

Should the calling toll subscriber at A be the first to operate his hand generator after replacing his receiver, the current therefrom will operate the relay PR of C, to operate relay DCR to light the lamp COS and the disconnection of the established connection from this point on is the same as just described.

While I have illustrated and described a preferred embodiment of my invention, it is to be understood that I do not wish to be limited to the embodiment contained in the specification, as my invention may be readily applied in many different ways and various purposes without departing from the spirit of the invention.

Having described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a telephone system, an operator's cord circuit, a plug ended trunk circuit at another operator's position, connection means for said cord and trunk for connecting said cord to said trunk, a telephone line, said plug ended trunk adapted to be connected to said line, ringing current means for said trunk, set by the trunk operator but not connected to said line, said application of ringing current from said means set by said trunk operator to said line being solely under the control of the operator of said cord circuit, and means controlled over the said telephone line for preventing the further application of ringing current to the said line.

2. In a telephone system, an operator's cord circuit, a plug ended trunk circuit at another operator's position, connection means for said cord and trunk for connecting said cord to said trunk, a telephone line, said plug ended trunk adapted to be connected to said line, ringing current means for said trunk set by the trunk operator but not connected to said line, means for said cord circuit actuated by said operator of said cord circuit to operate means in said trunk to connect said ringing current means set by said trunk operator to the called line, and means in said trunk circuit controlled over said telephone

line for discontinuing the application of ringing current to the called line.

3. In a telephone system, an operator's cord circuit, a plug ended trunk circuit at another operator's position, a jack for said plug ended trunk adapted to be connected by a plug from said cord circuit, a telephone line, said plug end of said trunk adapted to be connected to said line, ringing current means for said trunk set by the trunk operator but not connected to said line, generator means for said cord and means in said cord operated to connect said generator means to said trunk, to operate means therein to connect the ringing current means set by said trunk operator to said telephone line, and means controlled over said telephone line for rendering inoperative the means for connecting said ringing current means to the said telephone line.

4. In a telephone system, an operator's cord circuit, a plug ended trunk circuit at another operator's position, connection means for said cord and trunk for connecting said cord to said trunk, a telephone line, said plug ended trunk adapted to be connected to said telephone line, ringing current means for said trunk set by the trunk operator but not connected to said line, generator means for said cord circuit, a ringing relay for said trunk, means for said cord actuated to connect said generator means to said trunk to operate said ringing relay to operate switching means in said trunk to connect said ringing current means set by said trunk operator to said telephone line, and means controlled over said telephone line for rendering said switching means inoperative.

5. In a telephone system, an operator's cord circuit, a plug ended trunk circuit at another operator's position, connection means for said cord and trunk for connecting said cord to said trunk, a telephone line at said other operator's position, said plug ended trunk adapted to be connected to said telephone line, ringing current means for said trunk set by the trunk operator but not connected to said line, generator means for said cord circuit, a ringing relay and a second relay for said trunk, means for said cord actuated to connect said generator means to said trunk to operate said ringing relay, said ringing relay operating said second relay to connect said ringing current means set by said trunk operator to said telephone line, and means controlled over said telephone line for preventing the operation of said second relay thereby preventing the further application of ringing current to the said line.

6. In a telephone system, an operator's cord circuit, a plug ended trunk circuit at another operator's position, connection means for said cord and trunk for connecting said cord to said trunk, a telephone line, connection means for connecting said trunk to said line, ringing means in said trunk adapted to be set by the

trunk operator but not connected to said line, operator controlled means in said cord solely affecting said ringing means to connect ringing current to said line, means in said trunk circuit controlled over said line for preventing the application of said current to said line, a relay for said trunk provided with a high and low winding and a signal for said cord, said relay preventing the operation of said signal when said cord is connected to said trunk to give the operator of said cord an indication of a certain condition of said trunk.

7. In a telephone system, an operator's cord circuit, a plug ended trunk circuit at another operator's position, connection means for said cord and trunk for connecting said cord to said trunk, a telephone line terminating at said other operator's position, a relay for said trunk provided with a high resistance winding and a low resistance winding and a signal for said cord, said relay preventing the operation of said signal when said cord is connected to said trunk to give the operator of said cord an indication of one condition of said trunk, means in said trunk operated upon the connection of said trunk with said telephone line to affect said relay to permit the operation of said signal to give the operator of said cord an indication of another condition of said trunk, and means in said trunk controlled over said telephone line adapted to affect said relay to give an indication of a third condition of said trunk.

8. In a telephone system, an operator's cord circuit, a plug ended trunk circuit at another operator's position, connection means for said cord and trunk circuit for connecting said cord to said trunk, telephone lines of different character terminating at said other operator's position, said plug ended trunk adapted to be connected to the said lines of different character and ringing current means for said cord circuit adapted to be connected to said lines through said trunk and solely under the control of the operator of said cord, and means in said trunk controlled over one type of said lines for preventing the connection of ringing current to said connected line.

9. In a telephone system, an operator's cord circuit, a plug ended trunk circuit at another operator's position, connection means for said cord and trunk for connecting said cord to said trunk, telephone lines of different character terminating at said other operator's position, said plug ended trunk adapted to be connected to said lines of different character, a relay for said trunk provided with a high resistance winding and a low resistance winding, a signal for said cord, said relay being connected in series with said signal when said cord is connected to said trunk to affect said signal of said cord to give the operator of the cord an indication of a

certain character and means operated when said trunk is connected to a line of a certain character to shunt out the high resistance winding of said relay to permit the operation of said signal to give the operator of the cord an indication of another condition of said trunk, and means controlled over said line for opening said shunt circuit whereby said signal is again placed in a series connection with said high and low resistance windings of said relay to give the operator of the cord an indication of a third condition of said trunk.

10. In a telephone system, an operator's cord circuit, a plug ended trunk circuit at another operator's position, connection means for said cord and trunk for connecting said cord to said trunk, telephone lines of different character terminating at said other operator's position, said plug ended trunk adapted to be connected to said lines of different character, a relay for said trunk provided with a high resistance and low resistance winding, a signal for said cord, said relay operating windings being connected in series with said sig-

nal when said cord is connected to said trunk to affect said signal of said cord, to give the operator of the cord an indication of a certain character and means operated when said trunk is connected to a line of certain character to shunt said high resistance winding of said relay out of said series connection to permit the operation of said signal, to give the operator of said cord an indication of another condition of said trunk, said means in said trunk only partially operative when said trunk is connected to a line of another character to prevent said relay from affecting said signal, and means in said trunk controlled over a line of said first character for opening said shunt circuit to again connect said signal in series with said high and low resistance windings whereby an indication of a third condition of said trunk is given to the cord operator.

In testimony whereof I have signed this specification.

MICHAEL B. STAZAK.