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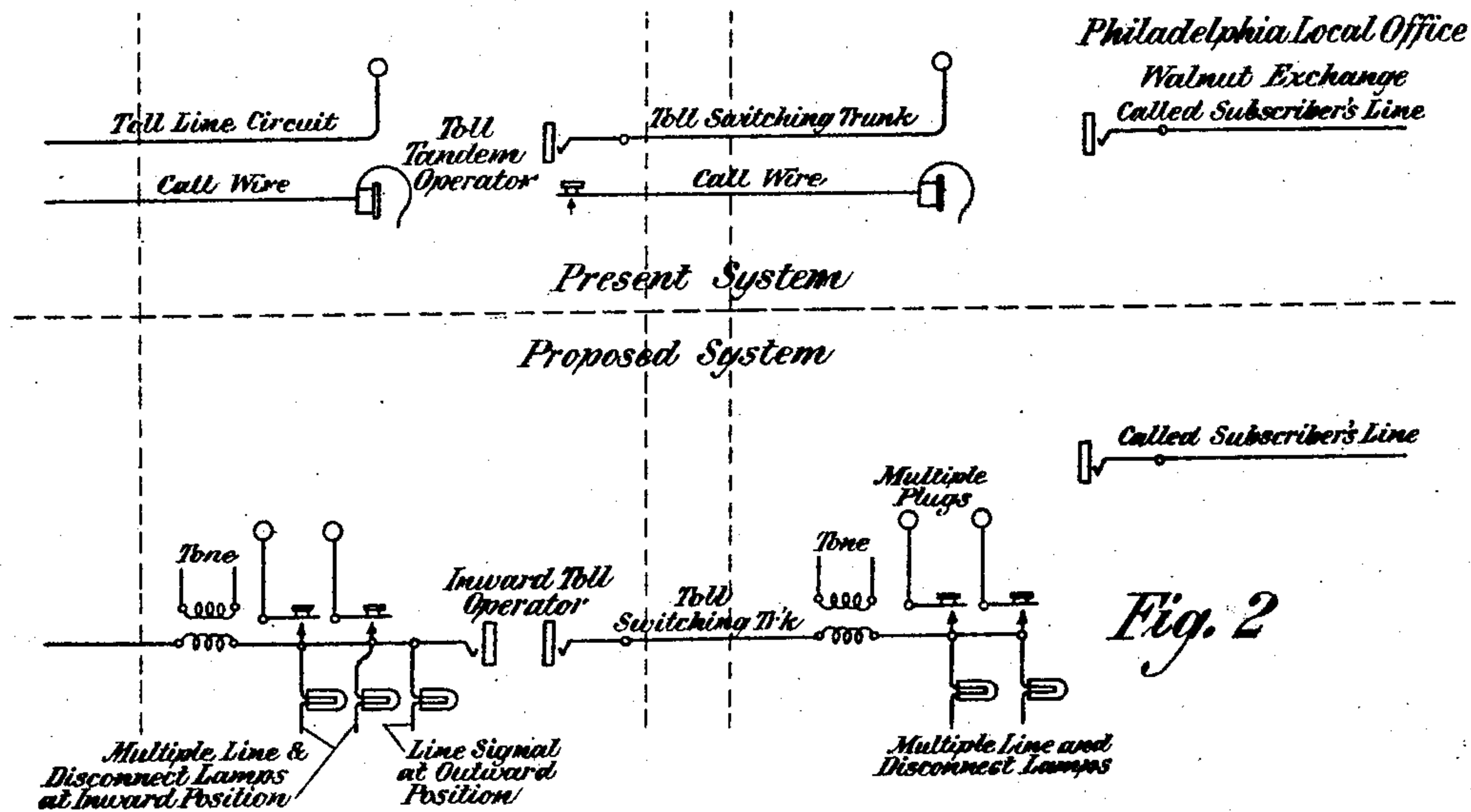
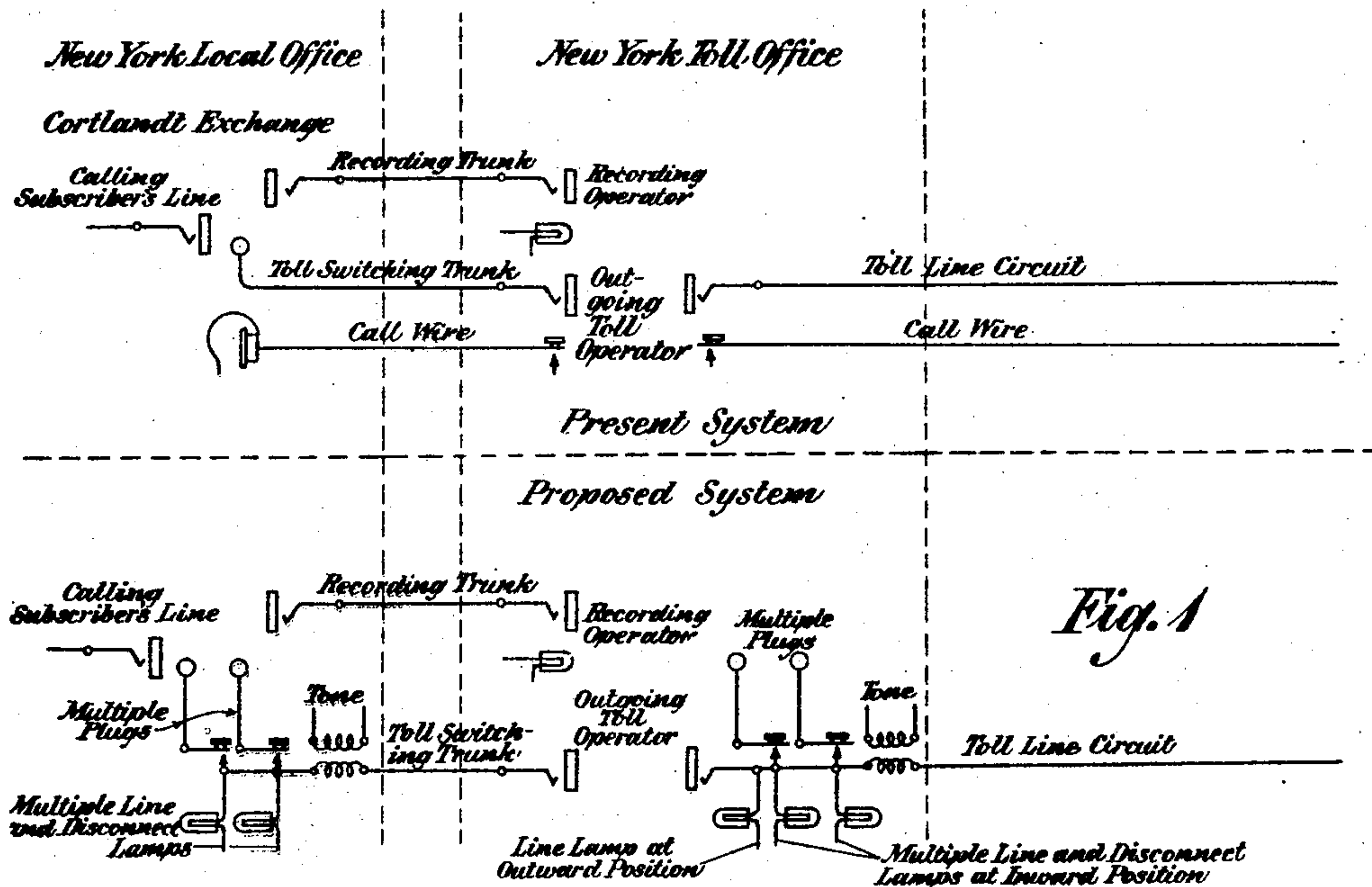
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J. F. TOOMEY

TELEPHONE TOLL CIRCUITS

Filed June 9, 1923

4 Sheets-Sheet 1



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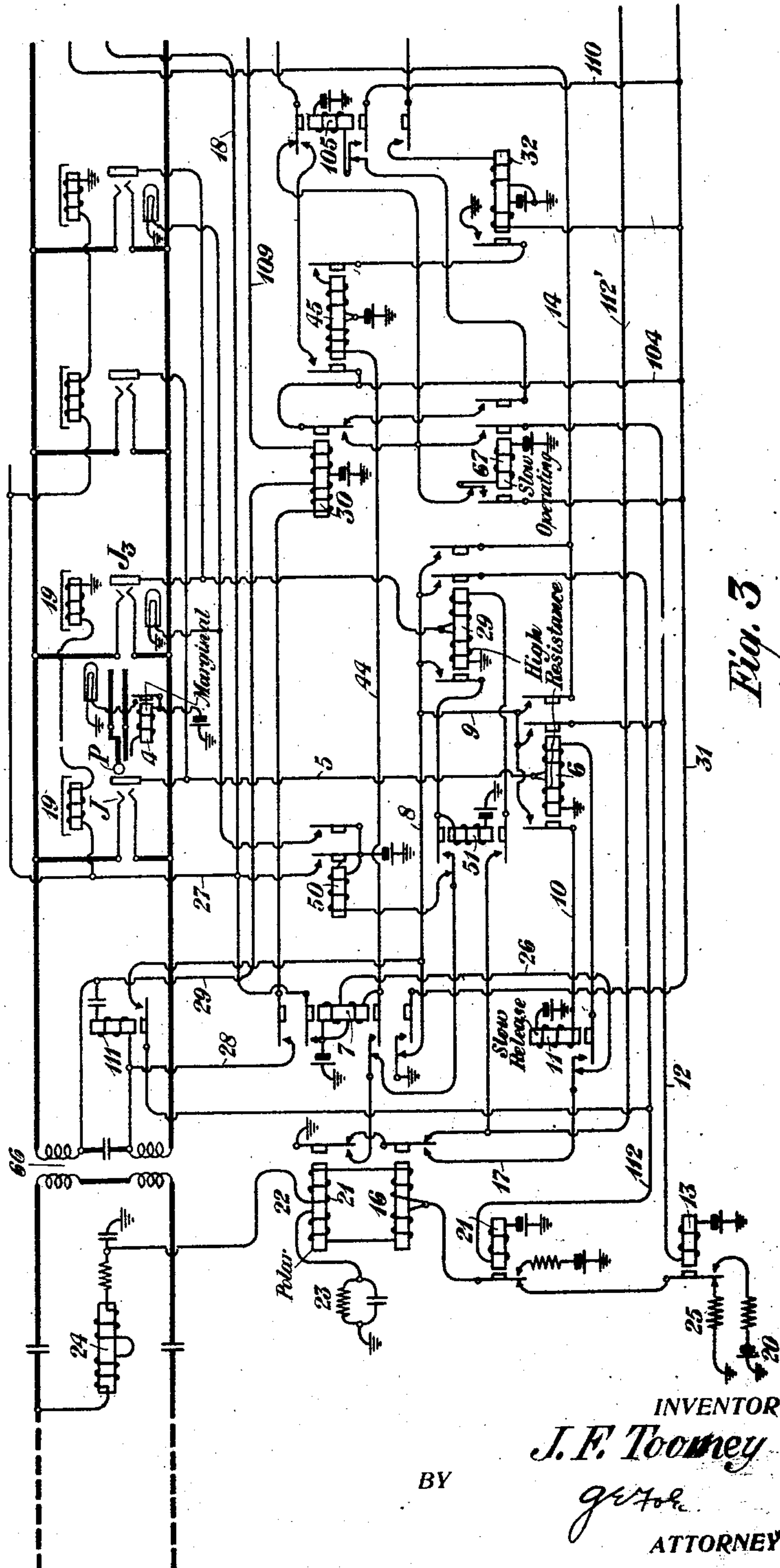
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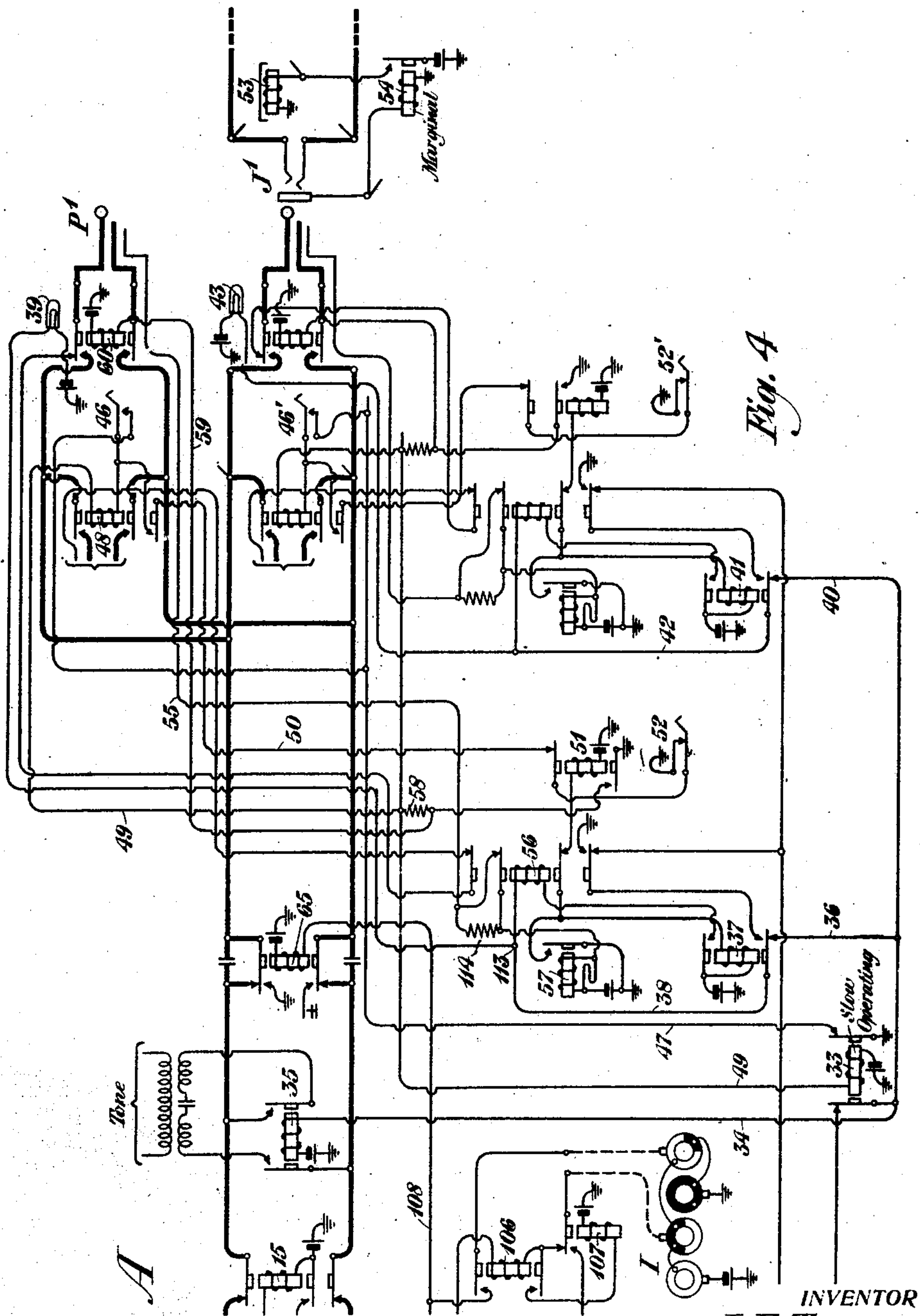
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4 Sheets-Sheet 3



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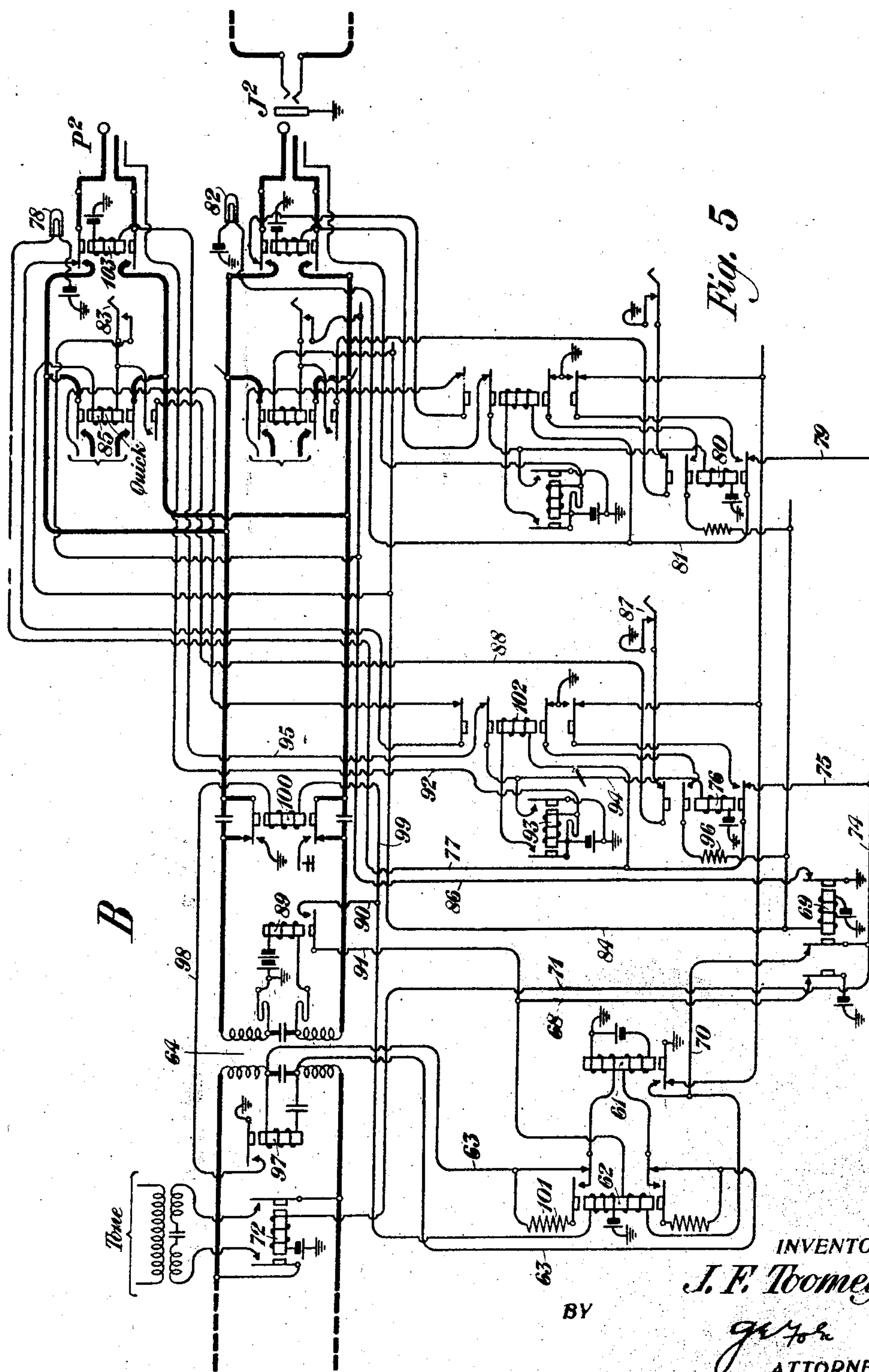
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J. F. TOOMEY

TELEPHONE TOLL CIRCUITS

Filed June 9, 1923

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UNITED STATES PATENT OFFICE.

JOHN F. TOOMEY, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

TELEPHONE TOLL CIRCUITS.

Application filed June 9, 1923. Serial No. 644,405.

To all whom it may concern:

Be it known that I, JOHN F. TOOMEY, residing at New York, in the county of New York and State of New York, have invented certain Improvements in Telephone Toll Circuits, of which the following is a specification.

This invention relates to an improvement in the method of and means for operating toll circuits and relates particularly to toll trunk circuits and toll switching trunk circuits.

Heretofore the method of operating toll circuits has called for the use of order wires or call circuits. It is one of the cardinal features of the trunk circuits of this invention that they do not require call circuits, or order wires, for their operation. Owing to the elimination of the call circuit and the addition of improved operating features the arrangements of the invention will constitute a distinct improvement over former call circuit toll line systems in that substantial savings in circuit time as well as an appreciable reduction in toll operators' loads may be effected resulting in greater efficiency and improved service in a much larger proportion of the toll plant than could be effected with former circuits. Other objects and features of the invention will appear more fully from the detailed description hereinafter given.

The invention may be more fully understood from the following description together with the accompanying drawing in the Figures 1, 2, 3, 4, and 5 of which the invention is illustrated. Figs. 1 and 2 when taken together illustrate schematically an outline of the method of operation of former types of call circuit toll line systems and of the toll line system of this invention. Figs. 3, 4, and 5 when taken together show a detailed circuit diagram of a portion of the arrangements of the system of the invention.

In the upper portion of Figs. 1 and 2, when taken together, there is shown schematically a call circuit toll system interconnecting a local office, such as the Cortlandt exchange in New York, with a local office, such for example as the Walnut exchange in Philadelphia. The calling subscriber at Cortlandt will have the desired

number transmitted to a recording operator at the New York toll office who will make out the usual ticket and transmit it to the toll operator thereat. The toll operator will call back to the Cortlandt operator over an order wire, or call circuit. The Cortlandt operator will then assign a certain toll switching trunk which will be connected to the line of the calling subscriber. The New York toll operator will then talk to the Philadelphia tandem toll operator over a call circuit and be assigned a toll trunk circuit which will be connected to the toll switching trunk at New York. The Philadelphia tandem toll operator will then talk over a call circuit to the operator at the Walnut exchange and be assigned a toll switching trunk to which the toll trunk circuit may be connected. This toll switching trunk will be connected to the called subscriber. The details of the above described method are well known in the art but have been outlined for purposes of comparison with the method of operation of the arrangements of the invention illustrated schematically in the lower portion of Figs. 1 and 2. In the arrangements of the invention the called number is transmitted to the recording operator, who makes out a ticket and transmits it to the toll operator at the toll office as heretofore. The toll operator at the New York toll office will now pick out a toll switching trunk to the Cortlandt exchange, the busy condition of the trunks being indicated by busy signals so that the toll operator will not choose one in use. When the toll operator connects with this switching trunk a tone will be applied to the line at the Cortlandt office and the multiple line lamps thereat will be operated. One of the Cortlandt operators will now connect her listening set to the trunk. This will remove the tone from the line. Upon the removal of the tone from the line the toll operator will give the calling subscriber's number and the Cortlandt operator will take the plug associated with the trunk at her position and connect the trunks with the calling subscriber's line. The New York toll operator will now pick out a toll trunk circuit to the Philadelphia toll office, the busy condition of the toll trunks being indicated by busy signals so that the toll

operator will not pick out one in use. When the New York toll operator connects with this toll trunk a tone will be applied to the line at the Philadelphia toll office and the multiple line signal lamps thereat will light. One of the Philadelphia inward toll operators will now connect her listening set to the line and this will operate to shut off the tone. The New York toll operator will then give the name of the called exchange, such as Walnut. The inward Philadelphia toll operator will then take the plug associated with the toll trunk at her position and connect it with a free toll switching trunk to the Walnut exchange. This will disconnect her telephone set from the line during the time the connection is up and will also cause the multiple line signal lamps at the Walnut exchange to operate and will also cause a tone to be applied to the toll switching trunk thereat and back over the toll trunk to the New York toll operator. One of the operators at the Walnut exchange will now connect her listening set to the toll switching trunk and this will remove the tone from the line. The New York toll operator will then give the Walnut operator the number of the called subscriber.

It is believed that with this outline of the operation of the system in mind that the novel features and details of operation of the invention will be more readily apparent from the detailed description hereinafter given. Several of the novel features of the invention are pointed out as follows.

The system provides for automatic operation of the line signal, that is, the line signal at the distant end of the circuit is operated as soon as the originating, or toll, operator inserts her plug in the jack.

The toll circuits are terminated in single cords as well as jacks, both of which may be multiplied before several operators. Associated with these cords are the line signals and the keys for connecting the operator's telephone set to the circuit. The single cords are connected to the circuit only after the operator has operated the answering key. The feature of having the cords multiplied before several operators is deemed important because it permits of team work among the operators and greater service efficiency. After one operator has answered, the other operators are locked out. As soon as the operator completes the connection, her telephone set is automatically cut off and cannot be connected again.

When the originating toll operator removes the plug from the jack of the trunk, the cords at the distant offices are automatically disconnected, disconnect signals set, and the busy signals released, thereby making the toll line and the toll switching trunk circuit immediately available to other oper-

ators even though the cords at the distant offices are not removed from the jack. Under this condition, when the line is taken up, the line signals at the other positions will be operated and the connection completed in the usual manner.

As no call circuit, or order wire, is required for operating the trunk circuits of this invention, they may be arranged so as to be operated in both directions. This is an important feature when the trunk groups are small, that is, less than 12 circuits.

As soon as the line signals are operated at the distant office, a tone is connected to the circuit which is removed when the distant operator answers. When the tone is disconnected the originating toll operator understands that the distant operator has cut in on the circuit and passes the order so that it is unnecessary for the distant operator to challenge on the circuit.

Selective signal arrangements are provided which enable the originating toll operator to call either the inward or the delayed call operator.

As the toll switching trunks provided between the distant toll office and the local office have the same operating features as the toll circuit, the originating toll operator may talk directly with the "B" operator in the local office. This tends to eliminate errors occasioned by the operating method previously employed at the toll tandem switchboards. Furthermore, when the originating toll operator removes the plug from the jack, the trunk circuit between the tandem position and the local "B" position is released, and the cord circuit at the local office is automatically disconnected. A disconnected signal associated with the cord at the "B" position is operated. This feature permits the above trunks to be immediately available to other operators as soon as the originating operator releases the toll circuit.

A further feature of the circuits of the invention consists in the fact that they may be so arranged that they may be operated in tandem when desired. For example, circuits of this type may be employed between New York and Boston, which can be operated in tandem with similar circuits between Boston and Worcester, in which case, the operator at New York would receive the switchhook supervision of the subscriber at the Worcester office.

In Figs. 3, 4, and 5, when arranged together from left to right respectively, there is illustrated in detail the circuit arrangements of the invention. In Figs. 3 and 4 are shown the terminal arrangements of a toll trunk circuit of this invention. The arrangements at the distant end of the toll trunk are the same as those shown and will not be illustrated. In Fig. 5 is shown a toll switching trunk embodying the invention

and adapted to cooperate with the toll trunk shown.

The invention may be more fully understood from the following description of its operation.

On a call originated at the Cortlandt exchange the operator at the long distance office at New York city, who receives this call over the recording trunk, selects an idle toll switching trunk similar to the one shown in Fig. 5 to the Cortlandt office and plugs into this trunk with a toll cord (not shown), which lights the multiple line signals at the Cortlandt office. When the Cortlandt operator answers, the long distance operator gives her the number of the calling subscriber's line. The Cortlandt operator then plugs one of the cords associated with the toll switching trunk into the calling subscriber's line.

The long distance operator then proceeds to select an idle toll line to the desired office and inserts therein the other end of the toll cord, thereby operating the multiple line signals at the distant office.

As the toll arrangements at both ends of the line are the same as those shown on Figs. 3 and 4, reference will be made at this point to those figures to describe the operations at the outgoing end of the line. The toll cord, which terminates in a plug such as P, would be inserted in a jack such as J. When the plug P is inserted in the jack J, the circuit is closed from battery through the winding of the marginal relay 4, sleeve contacts of plug P and jack J, conductor 5, left-hand high resistance winding of relay 6 to ground. The closure of this circuit causes the operation of relay 6, but marginal relay 4 which is included in the circuit will not operate at this time. The operation of relay 6 closes a circuit from ground, lower normal contact of relay 7, conductors 8 and 9, left-hand closed contact of relay 6, conductor 10, winding of relay 11, to battery. The closing of this circuit causes the operation of relay 11, which performs no useful function at this time. The operation of relay 6 also closes a circuit from the normally grounded contact of relay 7, conductors 8 and 9, inner right-hand contact of relay 6, conductor 12, winding of relay 13, to battery, thus causing the operation of the latter relay. The operation of relay 13 through its make contact connects negative battery 20, through the back contact of relay 21, left-hand windings of relays 16 and 22, resistance 23 to ground. An additional circuit is also closed upon the operation of relay 13 through the right-hand windings of relays 16 and 22, through the coil 24, to the tip conductor of the toll line. The two windings of relays 16 and 22 are balanced under this condition so that neither relay operates. An additional circuit is also closed by the operation of relay 6 from the grounded contact of relay 7, over

conductors 8 and 9, outer right make contact of relay 6, conductor 14, winding of relay 15, (Fig. 4) to battery, thereby operating relay 15. The operation of relay 15 cuts off the incoming multiple of the toll line A, and closes a circuit through its middle make contact from battery, conductor 18, through the windings of the visual signals 19, 19, to ground. The closure of this circuit operates each of the visual signals, which serves as an indication at each position that the toll line is in use.

The operation just described in connection with the outgoing end of the toll line will result in the operation of mechanism at the incoming end of the toll line which terminates at a distant exchange in the arrangements shown in Figs. 3 and 4.

Assuming that negative battery is connected to the tip conductor of the toll line at the distant exchange, in a manner similar to that just outlined, in connection with the energization of relay 13 thereat, a circuit is closed over the tip conductor, through coil 24 of Fig. 3, right-hand windings of relays 22 and 16, back contacts of relays 21 and 13, resistance 25 to ground. The closing of this circuit operates relay 16, but as relay 22 is of the polar type, it will not operate at this time.

The operation of relay 16 closes the following circuit: From ground, back contact of relay 22, front contact of relay 16, conductor 17, normal contact of relay 11, conductor 26, upper winding of relay 7, to battery. The closing of this circuit causes the operation of relay 7, which through its inner upper contact closes a locking circuit from battery, conductor 27, through windings of visual signals 19, 19, to ground, causing said signals to operate as an indication the toll line is in use. The operation of relay 7 through its upper contact bridges supervisory relay 30 by way of conductors 28 and 29 across the middle of the repeating coil 66, but this relay does not operate at this time. The operation of relay 7 also closes a circuit through its lower armature from ground, conductor 31, winding of relay 32 to battery, thus causing the operation of relay 32, the function of which will later appear. An additional circuit will also be closed upon the operation of relay 7 through its lower armature, from ground, conductor 31, left-hand normal contact of relay 33, (Fig. 4) conductor 34, winding of relay 35 to battery, causing the operation of relay 35. Another circuit will be closed upon the operation of relay 7 through its grounded contact, conductor 31, to left normal contact of relay 33, from which it divides into two paths—one path extending over conductor 36, lower contact of relay 37, conductor 38, through filament of line lamp 39 to battery, and the other path over conductor 40, lower contact

of relay 41, conductor 42, filament of line lamp 43 to battery. The closure of these two circuit paths through the filaments of line lamps 39 and 42 cause their illumination. The operation of relay 35 connects a tone to the tip and ring conductors of the toll line in the usual manner, and this serves as a signal to the outward operator that the line lamps 39 and 43 are lighted at the incoming toll tandem positions.

An operator at a position at the incoming toll tandem board, for instance, at the position where plug P' (Fig. 4) is located, upon noting the lighting of the line lamp 39, will operate the connect key 46 at her position thereby closing a circuit from ground, right-hand contact of relay 33, conductor 47, closed contact of said key, winding of relay 48, conductor 49, winding of relay 33 to battery. The closing of this circuit operates relays 33 and 48, and thereby completes a locking circuit from battery, winding of relay 33, conductor 49, winding and lower contact of relay 48, conductor 50, back contact of relay 51 to grounded contact of release key 52, which is common to that position. The operation of relay 33 disconnects ground from the connect keys at other positions so that a second operator is prevented at this time from connecting her set to the toll line. The operation of relay 33 also causes the release of relay 35 thereby disconnecting the tone from the line and also extinguishing the line lamps 39 and 43. The operation of relay 48 connects the operator's telephone set with the tip and ring or talking conductors of toll line in the customary manner.

When the tone is disconnected from the toll line by the release of relay 35, the outward operator announces the exchange name of the called number to the inward or tandem operator. The latter operator repeats the name for verification and inserts a plug, for instance plug P', associated with the incoming end of the toll line in the jack of an idle toll switching trunk corresponding to jack J' of trunk B (Fig. 4) which extends to the called local office. The toll switching trunks are provided with visual busy signals, such as indicated at 53 of trunk B, the operation of which serves as an indication that the trunk is in use. The insertion of plug P' in jack J' closes a circuit from ground, winding of marginal relay 54, sleeve contacts of jack J' and plug P', conductor 55, inner upper contact of relay 56, winding of relay 57 to battery. The closure of this circuit causes the operation of marginal relay 54 of trunk B and relay 57 of trunk A. The operation of relay 54 actuates busy signal 53, and the operation of relay 57 closes two circuits through its make contacts. One circuit may be traced from the ground, winding of relay 37 to battery; and the other from said grounded contact, inner lower

contact of relay 56, winding of relay 51 to battery. The closure of these two circuits causes the operation of relays 37 and 51. The operation of relay 37 transfers the guard and disconnect line lamp 39 to another lead, and connects battery to the winding of relay 56 in preparation for the disconnect signal to be described later. The operation of relay 51 breaks the locking circuit previously described in connection with relay 48 causing it to release, thereby disconnecting the operator's set from the line. Relay 33, however, is maintained operated over a circuit through its winding from battery, conductor 49, resistance 58, closed contact of relay 51 to ground. The operation of relay 51 also closes a circuit through its front contact from ground, conductor 59, winding of relay 60 to battery, thus causing relay 60 to operate and connect the tip and ring conductors of trunk B to like conductors of the toll line A through the medium of plug P' and jack J¹.

When plug P¹ of the toll line A is first inserted in jack J¹ of the switching trunk B, a circuit is momentarily closed over said trunk from battery and ground, through upper and lower windings of relay 61, back contacts of relay 62, conductors 63, left-hand windings of repeating coil 64, tip and ring conductors of trunk B, tip and ring conductors of jack J¹ and plug P¹, tip and ring conductors of trunk A, right-hand windings of coil 66 (Fig. 3) conductors 28 and 29, left-hand winding of supervisory relay 30. The closing of this circuit operates relay 61 and also supervisory relay 30 momentarily, but it does not perform any useful function at this time. The operation of relay 61 through its lower front contact closes a circuit from ground, lower winding of relay 62, conductor 68, outer left-hand contact of relay 69 to battery. The closing of this circuit causes relay 62 to operate. The operation of relay 61 also closes a circuit through its lower front contact from ground, conductor 70, inner left-hand contact of relay 69, conductor 71, winding of relay 72 to battery. An additional circuit is also closed through the lower front contact of relay 61, conductor 70, inner left-hand contact of relay 69, conductors 74 and 75, lower back contact of relay 76, conductor 77, filament of line lamp 78 to battery. A parallel circuit continues from conductor 74, conductor 79, lower back contact of relay 80, conductor 81, filament of multiple line lamp 82 to battery. The closing of these circuits through the front contact of relay 61 causes the lighting of the line lamps 78 and 82 and also the operation of relay 72. The operation of relay 72 connects a tone over the tip and ring conductors of the toll line A.

The operation of relay 62 connects re-

sistance 101 in the circuit previously described in connection with supervisory relay 30 causing its release. The inclusion of this resistance, however, will not affect relay 61 of trunk B.

When the line lamps light, an operator at a position at trunk B will operate a connect key, for instance key 83. The operation of key 83 closes a circuit from battery, winding of relay 69, conductor 84, winding of relay 85, key 83, conductor 86, right-hand contact of relay 69 to ground. The closing of this circuit operates relays 69 and 85. The operation of these relays closes a locking circuit from ground through key 87, which is common to the position, upper back contact of relay 76, conductor 88, lower closed contact and winding of relay 85, conductor 84, winding of relay 69 to battery. The operation of relay 69 removes ground from the connect keys at the other operators' positions of the trunk B so that another operator is prevented from connecting her set to the trunk at this time. The operation of relay 69 also opens the circuits previously described in connection with lighting of the line lamps 78 and 82 causing them to be extinguished, and also the circuit described in connection with the operation of relay 72, causing it to be deenergized and disconnect the tone from the line. The operation of relay 85 connects the operator's set to the tip and ring or talking conductors of trunk B.

Relay 69 upon operating opens the circuit by which relay 62 was operated, but the bridging of the operator's telephone set across the trunk B by the operation of relay 85 completes a circuit through its closed contacts, over the tip and ring conductors of trunk B, winding of relay 89 to grounded battery which causes the operation of relay 89. The operation of relay 89 closes a circuit from battery through the upper winding of relay 62, conductor 90, make contact of relay 89, conductor 91, lower winding of relay 62, make contact of relay 61 to ground, thus holding relay 62 operated.

When the tone is disconnected from the trunk B by the release of relay 72, the outward operator announces the called number, the operator connected with trunk B repeats the number for verification, and then inserts a plug of the trunk into the jack leading to the called subscriber's line. In this instance, it will be assumed that plug P² is inserted in jack J² which will cause the closure of the following circuit: from ground sleeve contact of jack J² and plug P², conductor 92, winding of relay 93 to battery. thus operating relay 93. The operation of relay 93 closes a circuit through its right-hand make contact from ground, upper contact of relay 102, conductor 95, winding of relay 103 to battery, causing the operation

of the latter relay. The operation of relay 93 also closes a circuit through its right-hand make contact from ground, conductor 94, winding of relay 76 to battery, causing the operation of relay 76. The operation of relay 103 connects the tip and ring conductors of the line L to like conductors of trunk B. The operation of relay 76 removes ground from the locking circuit just described in connection with relay 85 causing it to release and disconnect the operator's set from the trunk, relay 69 being held operated by a circuit from ground, lower inner contact of relay 102, middle closed contact of relay 76, resistance 96, winding of relay 69 to battery. The operation of relay 76 also transfers the line and disconnect lamp to another lead in preparation for the disconnect signal which will be later described. The release of relay 85 causes the release of relay 89 which, in turn, causes the release of relay 62. The release of relay 62 removes the resistance 101 from the circuit previously outlined in connection with supervisory relay 30 which is bridged across the toll trunk A (Fig. 3) permitting it to operate and causing said trunk to function in the following manner:

When the connection is completed in the local office to the called subscriber's line, a circuit is closed from battery and ground through the windings of relay 61, over the tip and ring conductors of the toll switching trunk B and toll line A, causing the operation of supervisory relay 30 as previously described. The operation of relay 30 closes a circuit from grounded contact of relay 7, conductors 31 and 104, front contact of relay 30, winding of relay 67 to battery, causing the operation of relay 67. The operation of relay 30 also closes a circuit from grounded contact of relay 7, conductors 31 and 104, front contact of relay 30, back contact of relay 105, winding of relay 106, (Fig. 4) upper back contact of relay 107, interrupter I to battery. The operation of relay 67 closes a locking circuit from grounded contact of relay 7, conductor 31, left-hand make contact and winding of relay 67 to battery. Relay 106 will not operate until pick-up battery is furnished from the interrupter I through the contact of relay 107. The operation of relay 67 closes a circuit from grounded contact of relay 7, conductors 31 and 104, front contact of relay 30, inner right-hand contact of relay 67, conductor 12, winding of relay 13 to battery, thus causing the operation of relay 13. The operation of relay 13 connects negative battery 20 through its front contact over the back contact of relay 21, left-hand windings of relays 16 and 22 to ground; and an additional circuit is also closed from negative battery 20, front contact of relay 13, back

contact of relay 21, right-hand windings of relays 16 and 22 through coil 24 to the tip side of the tool line A, as described above, thereby operating relay 16 and a corresponding relay at the outward end. The operation of relay 16 (at the outward end) connects ground from the back contact of relay 22, front contact of relay 16, conductor 17, make contact of relay 11, right-hand winding of relay 6, conductor 5, sleeve contacts of jack J and plug P, winding of marginal relay 4 to battery. The closure of this circuit shunts the left-hand high resistance winding of relay 6, and permits the marginal relay 4 in the connected cord circuit to operate, thereby lighting the supervisory lamp associated therewith. The lighting of the supervisory lamp indicates that the connection is completed with the subscriber's line.

When relay 106 (Fig. 4) operates, the lead from ground on the ringing interrupter commutator is connected over the upper make contact of said relay, conductor 108, winding of relay 65 to battery, and also from ground on said interrupter, conductor 109, right-hand winding of relay 30 to battery, so that when the grounded segment of the interrupter ring makes contact with this lead, relay 65 will operate and ringing current will be transmitted through the contacts of said relay, over the tip and ring conductors of trunks A and B. When ringing current is impressed on trunk B, relay 97 is operated. The operation of relay 97 closes a circuit through its make contact from ground, conductor 98, relay 100, conductor 99, upper winding of relay 62 to battery. The closing of this circuit operates relays 100 and 62. The operation of relay 100 through its contacts impresses signaling current in a well understood manner over the tip and ring conductors of the trunk B and tip and ring conductors of plug P² and jack J² over the called subscriber's line causing the bell at subscriber's station to ring. The operation of relay 65 (Fig. 4) would cause the release of relay 30, but this latter relay is held operated through its second winding which is bridged across the toll line as previously described. This prevents a false signal off the hook receiver being sent to the outward operator. It should be noted that as long as pick-up battery is connected to the winding of relay 106, this relay is operated when relay 107 is short-circuited and cannot operate. When the interrupter pick-up battery is disconnected from the winding of relay 106, relay 107 will operate in series with relay 106 through the make contact of relay 30 from the grounded contact of relay 7 as previously described. The operation of relay 107 does not affect the circuit at this line, as relay 105 is not operated.

When the subscriber answers, a circuit is established through the switchhook at the subscriber's station over the talking conductors of the connected line and trunk B which causes the operation of relay 89 in the trunk B. The operation of relay 89 causes the operation of relay 62, which connects resistance 101 in circuit with supervisory relay 30 in cord A causing it to release. The release of relay 30 causes the release of relays 13, 106 and 107. Relay 105 is operated at this time by a circuit from grounded contact of relay 7, conductors 31 and 104, back contact of relay 30, outer right-hand contact of relay 67, through the winding of relay 105 to battery. The closing of this circuit establishes a locking circuit from grounded contact of relay 7, conductors 31 and 110, through the middle closed contact and winding of relay 105 to battery. The release of relay 106 disconnects ringing current from the line, releasing relay 65 and in turn, relays 97 and 100 of trunk B. The release of relay 13 causes the release of relay 16 at the outward end, removing the ground connected with the low resistance right-hand winding of relay 6. The removal of this shunt restores the circuit through the high resistance winding of relay 6 to the sleeve of jack J and plug P causing the release of marginal relay 4 in the connected cord circuit and the consequent extinguishing of the supervisory lamp associated therewith.

Should the subscriber leave the telephone, either replacing or not replacing the receiver on the switchhook, the outward operator may recall the subscriber by ringing on the circuit in the usual manner. The impression of ringing current, under this condition, closes a circuit over the tip and ring conductors of trunk A which causes the operation of relay 111. The operation of relay 111 closes a circuit from battery, relay 21, conductor 112, make contact of relay 111, to ground on the normal contact of relay 7. The closure of this circuit energizes relay 21. The operation of relay 21 connects positive battery to the tip conductor of the toll line. At the distant end the positive battery received over the toll line operates a relay corresponding to polar relay 22 and holds relay 16 operated. The operation of polar relay 22 connects ground through its closed contact to battery through the winding of relay 7 and over conductor 44, to battery through the winding of relay 45, thus holding relay 7 operated and operating relay 45. Relay 45 upon operating, closes a locking circuit from ground, make contact of relay 32, right-hand winding of relay 45 to battery. The operation of relay 45 closes a circuit through its left-hand make contact from grounded make contact of relay 7, conductors 31 and 104, upper make contact

of relay 105, winding of relay 106, back contact of relay 107, to interrupter 1. Relay 106 operates when battery is received from the pick-up interrupter.

5 The energization of relay 106 causes the energization of relays 65 of trunk A (Fig. 4) and relay 100 of trunk B (Fig. 5), thus impressing ringing current on the subscriber's line as previously outlined.
 10 When pick-up battery of the interrupter I is disconnected from the winding of relay 106, relay 107 will operate in series with relay 106 on the ground received from grounded contact of relay 7 through the make contact of relay 45. The operation of relay 107
 15 transfers the pick-up battery lead from the winding of relay 106 through the lower make contact of relay 105 to battery through the right-hand winding of differential relay 32.
 20 When battery is again connected to the pick-up lead, relay 32 will release as its windings are at this time opposing. The release of relay 32 causes the release of relays 45, 106 and 107. On a re-ring, but one impulse of
 25 ringing current will be sent over the toll switching trunk for each operation of the ringing key associated with the outward operator's cord circuit.

30 At the termination of the conversation, when the subscriber whose line terminates in jack J² returns the receiver to its hook, relays 89 and 62 of trunk B release, and relay 61 operates connecting battery and ground again to the toll trunk A, operating
 35 relay 30 as previously explained. The operation of relay 30 causes the operation of relay 13, as previously described, which connects negative battery 20 to the tip conductor of the toll line, operating relay 16 at the
 40 outward end, and connects ground to the right-hand low resistance winding of relay 6, shunting the left-hand high resistance winding of said relay, causing the operation of marginal relay 4, thus lighting the associated
 45 supervisory lamp in the outward operator's cord circuit.

Should the subscriber at the called station move the receiver hook up and down, relay 13, and at the outward end relay 16, the
 50 marginal relays and their associated supervisory lamps in the connected cord circuit will follow the operation of relay 30.

When the calling and called subscribers have restored their receivers to their hooks, the outward operator disconnects her cord
 55 circuit from the toll line A, releasing relay 6. The release of relay 6 releases relays 13, 11 and 15. The release of relay 13 causes the release of relay 16 at the distant end of the toll line. The release of relay 15 restores the visual busy signals 19 to normal, and connects the incoming multiple to the toll line. Relay 11 is of the slow-releasing type, and will not release until relay 16 is released.
 60 This prevents a false signal being given to

the operator at the incoming multiple. The release of relay 16 at the distant end releases relay 7, which opens the supervisory bridge, releasing relays 30 and 13, and restores the visual busy signals 19 and signaling lead
 70 from the make contact of relay 22 to battery, through the winding of relay 50, which causes the operation of the latter relay and the release of relays 32, 105 and 67. The release of relay 16 connects ground through
 75 the back contacts of relays 22 and 16, conductor 112, lower back contact of relay 56, make contact of relay 37, to point 113 where the circuit divides one path passing through filament of disconnect lamp 39 and the other
 80 through winding of relay 56 to battery through the upper closed contact of relay 37. The closure of this circuit causes the lighting of lamp 39 and the operation of relay 56. The operation of relay 56 closes a locking
 85 circuit from battery, upper make contact of relay 37, winding of relay 56, lower make contact of relay 37 to lower grounded contact of relay 56.

The operation of relay 56 causes the release of relays 51, 60 and 33, opens the busy test sleeve to the operator's telephone set, and removes the shunt around resistance 114 and the sleeve circuit. The release of relay
 90 60 disconnects the tip and ring conductors of plug P¹ from the toll line. The release of relay 33 permits the toll line to be used for a new connection although the plug P¹ used in the above connection is still in the
 95 toll switching trunk jack J¹ and the inclusion of resistance 114 added to the sleeve circuit will cause the release of the marginal relay 54 in the sleeve circuit of the jack J¹ and the release of visual busy signal 53. The guard lamp 39 remains lighted
 100 until plug P¹ is withdrawn from jack J¹, after which relays 57, 56 and 37 are released and the circuit is restored to normal.

The toll line of this invention is arranged for selective signaling so that when an outward operator wishes to signal the distant
 110 outward operator, the plug of a toll cord, similar to that indicated at P is inserted in an idle jack of the toll line A, say jack J³, thus closing a circuit from battery, winding of marginal relay, sleeve contacts of the
 115 toll cord and jack J³, left-hand winding of relay 29 to ground. The closure of this circuit causes the operation of relay 29 which connects ground from the normal contact of relay 7 over conductor 8 and establishes the following circuits: from conductor 8, left-hand contact of relay 29, winding of relay
 120 51 to battery; from conductor 8, middle contact of relay 29, winding of relay 21 to battery; and from conductor 8, outer right-hand contact of relay 29, conductor 14, winding of relay 15 to battery. The closure of these circuits causes the operation of relays
 125 51, 21 and 15, respectively. The operation of

relay 51 closes a circuit from ground, back contacts of relays 22 and 16, lower make contact of relay 51, right-hand winding of relay 29 to battery through the sleeve contacts of jack J^3 , plug of the connected cord circuit, and winding of the marginal relay associated therewith. The closure of this circuit shunts the high resistance winding of relay 29 and permits the operation of the marginal relay and the lighting of the supervisory lamp in the connected cord circuit. The operation of relay 21 connects positive battery through its make contact and right-hand windings of relay 16 and 22, coil 24 to the tip conductor of the toll line. The operation of relay 15 cuts off the incoming multiple of the toll line A and operates the visual busy signals 19, 19, as previously explained.

The connection of positive battery to the tip conductor of the toll line A, causes relays at the distant end of said line to operate which correspond to relays 16 and 22. The operation of relay 22 removes ground from the armature of relay 16 so that its operative does not affect the circuit. The operation of relay 22 connects ground through the lower inner normal contact of relay 7, upper normal contact of relay 51, to battery through the winding of relay 50. The closure of this circuit causes the energization of relay 50 which operates the visual signals 19 and lights the lamps L associated with the second jack of the toll line multiple at the outward positions in an obvious manner.

When an outward operator in response to the lighting of a lamp answers by inserting a plug of a toll cord in one of the second jacks with which the calling lamps are associated, battery connected to the sleeve of the toll cord operates a relay corresponding to relay 29 in the sleeve circuit of the jack of toll line A. The energization of relay 29 causes the operation of relays 51, 21 and 15 which function in a manner just described.

At the other end of the toll line, relays 16 and 22 are operated. The operation of these relays disconnects the ground from the right-hand winding of relay 29, extinguishing the supervisory lamp in the connected cord circuit thus indicating that the outward operator at the distant end has answered.

When the two outward operators at the opposite ends of the toll line have their cords plugged in the second jacks of the toll line multiple, the circuit conditions of the two ends are the same. Either operator may signal the other by removing the plug from the jack and plugging in again. While the toll cord is out of the jack at one end, a circuit closed through the supervisory relay in the connected cord circuit of the operator at the other end will operate and light the calling lamp L at the first mentioned end.

The first operator to disconnect the cord circuit from the jack will give a disconnect

signal to the outward operator at the other end, the supervisory lamp in the cord circuit being lighted, as explained above.

While the invention has been disclosed in certain specific arrangements which are deemed desirable, it is understood that it is capable of embodiment in many and widely varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. A toll line, the incoming end of which terminates in a plurality of jacks and plugs, a tone source associated with said incoming line, busy signals associated with said jacks, signaling means associated with said plugs, and means associated with the incoming end of said line and responsive automatically to a connection with the outgoing end of said line for operating said busy signals and said signaling means and for operatively connecting said tone source to said line.
2. A toll line, the incoming end of which terminates in a plurality of jacks and plugs, a tone source associated with said incoming line, busy signals associated with said jacks, signaling means associated with said plugs, a polar relay associated with the incoming end of said line and responsive to the application of current of a definite polarity to the outgoing end of said line, and relay means controlled by said polar relay for operating said busy signals and said signaling means and for operatively connecting said tone source to said line.
3. A toll line multiplied at both ends at a plurality of operators' positions, means associated with the outgoing end of said line and responsive to a connection with the line thereat for applying current of a definite polarity to said line, means associated with the incoming end of said line and responsive to said current, and means controlled by said last mentioned means for producing a busy signal indication at certain of the operators' positions at said incoming end and a signal indication at other of the operators' positions at said incoming end and for applying a tone to said line at the incoming end thereof.
4. A toll line, the incoming end of which terminates in a plurality of operators' positions, signaling means and switching means and operators' sets at each position, a tone source associated with the incoming end of said line, relay means associated with the incoming end of said line and controlled by a connection with the outgoing end of said line, means controlled by said relay means for operatively connecting said tone source to said line and for operating said signaling means, means controlled by said switching means for controlling said relay means whereby said tone may be disconnected from said line and said signaling means may be

rendered inoperative, and means controlled by said switching means for connecting one of said operators' sets to said line.

5 5. A toll line, the incoming end of which terminates in a plurality of operators' positions, signaling means and switching means and operators' sets at each position, a tone source associated with the incoming end of said line, relay means associated with the incoming end of said line, means controlled over the contacts of said relay means when energized by a connection with the outgoing end of said line for operatively connecting said tone source to said line and for operating said signaling means, and means controlled by said switching means for deenergizing said relay means and for connecting one of said operators' sets to said line.

6. A toll line, the incoming end of which terminates in a plurality of operators' positions, signaling means and switching means and operators' sets at each position, a tone source associated with the incoming end of said line, relay means associated with the incoming end of said line, means controlled over the contacts of said relay means when energized by a connection with the outgoing end of said line for operatively connecting said tone source to said line and for operating said signaling means, and means controlled by said switching means for deenergizing said relay means and for connecting one of said operators' sets to said line and preventing any of the other of said operators' sets from being connected to said line.

7. A telephone system comprising an incoming toll line terminating in a plurality of operators' positions comprising plugs and operators' sets and signaling means, a toll switching trunk terminating in a jack, a busy signal associated therewith, a sleeve circuit completed when one of said plugs is connected with said jack, means controlled by said sleeve circuit for operating said busy signal, means controlled by said sleeve circuit for disconnecting one of said operators' sets from the talking conductors of said toll line and for connecting said talking conductors to one of said plugs, and means controlled by said sleeve circuit for preparing a circuit for one of said signaling means whereby said signaling means may operate as a disconnect signal.

8. A long distance telephone system comprising a toll line and a toll switching trunk, a supervisory circuit connected in parallel both with said toll line and with said switching trunk when said line is connected to said trunk and including a toll supervisory relay and a switching trunk supervisory relay, both of said relays being operated when said toll line is connected with said switching trunk, means responsive to the operation of said switching trunk relay for in-

creasing the resistance of said supervisory circuit to cause the deenergization of said toll supervisory relay, signaling means and a tone source associated with said switching trunk, and means controlled by said switching trunk relay for applying said tone source to said trunk and for operating said signaling means.

9. A long distance telephone system comprising a toll line and a toll switching trunk, a supervisory circuit connected in parallel both with said toll line and with said switching trunk when said line is connected to said trunk and including a toll supervisory relay and a switching trunk supervisory relay, both of said relays being operated when said toll line is connected with said switching trunk, means responsive to the operation of said switching trunk relay for increasing the resistance of said supervisory circuit to cause the deenergization of said toll supervisory relay, a tone source associated with said switching trunk, a plurality of operators' positions associated with said switching trunk, each of said operators' positions including signaling means and operators' sets and switches, means controlled by said switching trunk relay for applying said tone source to said switching trunk and for operating said signaling means, and means controlled by any of said switches for disconnecting said tone source from said trunk and for extinguishing all of said signaling means and for connecting one of said operators' sets to said switching trunk to the exclusion of the other operators' sets.

10. A long distance telephone system comprising a toll line and a toll switching trunk, a supervisory circuit connected in parallel both with said toll line and with said switching trunk when said line is connected to said trunk and including a toll supervisory relay and a switching trunk supervisory relay, both of said relays being operated when said toll line is connected with said switching trunk, means responsive to the operation of said switching trunk relay for increasing the resistance of said supervisory circuit to cause the deenergization of said toll supervisory relay, a tone source associated with said switching trunk, a plurality of operators' positions associated with said switching trunk, each of said operators' positions including signaling means and operators' sets and switches, means controlled by said switching trunk relay for applying said tone source to said switching trunk and for operating said signaling means, means controlled by any of said switches for disconnecting said tone source from said trunk and for extinguishing all of said signaling means and for connecting one of said operators' sets to said switching trunk to the exclusion

of the other operators' sets, a subscriber's line; means responsive to a connection of said switching trunk to said subscriber's line for disconnecting said operator's set from said switching trunk, and means responsive to the disconnection of said operator's set from said switching trunk for deenergizing said resistance increasing means in said supervisory circuit whereby said toll supervisory relay will be operated.

11. A long distance telephone system comprising a toll line and a toll switching trunk, a supervisory circuit connected in parallel both with said toll line and with said switching trunk when said line is connected to said trunk and including a toll supervisory relay and a switching trunk supervisory relay, both of said relays being operated when said toll line is connected with said switching trunk, means responsive to the operation of said switching trunk relay for increasing the resistance of said supervisory circuit to cause the deenergization of said toll supervisory relay, a tone source associated with said switching trunk, a plurality of operators' positions associated with said switching trunk, each of said operators' positions including signaling means and operators' sets and switches, means controlled by said switching trunk relay for applying said tone source to said switching trunk and for operating said signaling means, means controlled by any of said switches for disconnecting said tone source from said trunk and for extinguishing all of said signaling means and for connecting one of said operators' sets to said switching trunk to the exclusion of the other operators' sets, a subscriber's line, means responsive to a connection of said switching trunk to said subscriber's line for disconnecting said operator's set from said switching trunk and for preparing a circuit for the signaling means associated with said set whereby said signaling means may operate as a disconnect signal.

12. A long distance telephone system comprising a toll line and a toll switching trunk, a supervisory circuit connected in parallel both with said toll line and with said switching trunk when said line is connected to said trunk and including a toll supervisory relay and a switching trunk supervisory relay, both of said relays being operated when said toll line is connected with said switching trunk, means responsive to the operation of said switching trunk relay for increasing the resistance of said supervisory circuit to cause the deenergization of said toll supervisory relay, a tone source associated with said switching trunk, a plurality of operators' positions associated with said switching trunk, each of said operators' positions including signaling means and operators' sets and switches, means controlled by said

switching trunk relay for applying said tone source to said switching trunk and for operating said signaling means, means controlled by any of said switches for disconnecting said tone source from said trunk and for extinguishing all of said signaling means and for connecting one of said operators' sets to said switching trunk to the exclusion of the other operators' sets, a subscriber's line, means responsive to a connection of said switching trunk to said subscriber's line for disconnecting said operator's set from said switching trunk, means responsive to the disconnection of said operator's set from said switching trunk for deenergizing said resistance increasing means in said supervisory circuit whereby said toll supervisory relay will be operated, and means controlled by the operation of said toll supervisory relay for signaling the distant end of said toll line.

13. A long distance telephone system comprising a toll line and a toll switching trunk, a supervisory circuit connected in parallel both with said toll line and with said switching trunk when said line is connected to said trunk and including a toll supervisory relay and a switching trunk supervisory relay, both of said relays being operated when said toll line is connected with said switching trunk, means responsive to the operation of said switching trunk relay for increasing the resistance of said supervisory circuit to cause the deenergization of said toll supervisory relay, a tone source associated with said switching trunk, a plurality of operators' positions associated with said switching trunk, each of said operators' positions including signaling means and operators' sets and switches, means controlled by said switching trunk relay for applying said tone source to said switching trunk and for operating said signaling means, means controlled by any of said switches for disconnecting said tone source from said trunk and for extinguishing all of said signaling means and for connecting one of said operators' sets to said switching trunk to the exclusion of the other operators' sets, a subscriber's line, means responsive to a connection of said switching trunk to said subscriber's line for disconnecting said operator's set from said switching trunk, means responsive to the disconnection of said operator's set from said switching trunk for deenergizing said resistance increasing means in said supervisory circuit whereby said toll supervisory relay will be operated, and means controlled by the operation of said toll supervisory relay for signaling said subscriber's line.

14. A long distance telephone system comprising a toll line and a toll switching trunk, a supervisory circuit connected in parallel both with said toll line and with said switching trunk when said line is con-

nected to said trunk and including a toll
 supervisory relay and a switching trunk
 supervisory relay, both of said relays being
 operated when said toll line is connected
 5 with said switching trunk, means respon-
 sive to the operation of said switching
 trunk relay for increasing the resistance of
 said supervisory circuit to cause the de-
 energization of said toll supervisory relay,
 10 a tone source associated with said switching
 trunk, a plurality of operators' positions
 associated with said switching trunk, each
 of said operators' positions including sig-
 naling means and operators' sets and
 15 switches, means controlled by said switch-
 ing trunk relay for applying said tone
 source to said switching trunk and for oper-
 ating said signaling means, means con-
 trolled by any of said switching means for
 20 disconnecting said tone source from said
 trunk and for extinguishing all of said
 signaling means and for connecting one of
 said operators' sets to said switching trunk
 to the exclusion of the other operators' sets,
 25 a subscriber's line, means responsive to a
 connection of said switching trunk to said
 subscriber's line for disconnecting said
 operator's set from said switching trunk,
 means responsive to the disconnection of
 30 said operator's set from said switching
 trunk for deenergizing said resistance in-
 creasing means in said supervisory circuit
 whereby said toll supervisory relay will be
 operated, and means controlled by the oper-
 ation of said toll supervisory relay for sig-
 naling the distant end of said toll line and
 for signaling said subscriber's line.

15. A long distance telephone system
 comprising a toll line and a toll switching
 40 trunk, a supervisory circuit connected in
 parallel both with said toll line and with
 said switching trunk when said line is con-
 nected to said trunk and including a toll
 supervisory relay and a switching trunk
 45 supervisory relay, both of said relays being
 operated when said toll line is connected
 with said switching trunk, means respon-
 sive to the operation of said switching
 trunk relay for increasing the resistance of
 50 said supervisory circuit to cause the de-
 energization of said toll supervisory relay,
 a tone source associated with said switch-
 ing trunk, a plurality of operators' posi-
 tions associated with said switching trunk,
 55 each of said operators' positions including
 signaling means and operators' sets and
 switches, means controlled by said switch-
 ing trunk relay for applying said tone
 source to said switching trunk and for
 60 operating said signaling means, means con-
 trolled by any of said switches for discon-
 necting said tone source from said trunk
 and for extinguishing all of said signaling
 means and for connecting one of said oper-
 65 ators' sets to said switching trunk to the

exclusion of the other operators' sets, a
 subscriber's line, means responsive to a
 connection of said switching trunk to said
 subscriber's line for disconnecting said
 operator's set from said switching trunk, 70
 means responsive to the disconnection of
 said operator's set from said switching
 trunk for deenergizing said resistance in-
 creasing means in said supervisory circuit
 whereby said toll supervisory relay will be 75
 operated, a source of ringing current asso-
 ciated with said toll line, and means con-
 trolled by the operation of said toll super-
 visory relay for intermittently applying
 said ringing current from said toll line over 80
 said switching trunk to said subscriber's
 line.

16. A long distance telephone system com-
 prising a toll line and a toll switching trunk,
 a supervisory circuit connected in parallel 85
 both with said toll line and with said switch-
 ing trunk when said line is connected to
 said trunk and including a toll supervisory
 relay and a switching trunk supervisory re-
 lay, both of said relays being operated when 90
 said toll line is connected with said switch-
 ing trunk, means responsive to the operation
 of said switching trunk relay for increas-
 ing the resistance of said supervisory cir-
 cuit to cause the deenergization of said toll 95
 supervisory relay, a tone source associated
 with said switching trunk, a plurality of
 operators' positions associated with said
 switching trunk, each of said operators' posi-
 tions including signaling means and oper- 100
 ators' sets and switches, means controlled by
 said switching trunk relay for applying said
 tone source to said switching trunk and for
 operating said signaling means, means con- 105
 trolled by any of said switching means for
 disconnecting said tone source from said
 trunk and for extinguishing all of said
 signaling means and for connecting one of
 said operators' sets to said switching trunk
 to the exclusion of the other operators' sets, 110
 a subscriber's line, means responsive to a con-
 nection of said switching trunk to said sub-
 scriber's line for disconnecting said opera-
 tor's set from said switching trunk, means
 responsive to the disconnection of said opera- 115
 tor's set from said switching trunk for
 deenergizing said resistance increasing means
 in said supervisory circuit whereby said toll
 supervisory relay will be operated, means
 controlled by the operation of said toll 120
 supervisory relay for signaling the distant
 end of said toll line and for signaling said
 subscriber's line, and relay means in said
 toll switching trunk operated when the sub-
 scriber responds for reenergizing said re- 125
 sistance increasing means in said supervisory
 circuit whereby said toll supervisory relay
 will be deenergized.

17. A long distance telephone system com-
 130 prising a toll line and a toll switching trunk,

a supervisory circuit connected in parallel both with said toll line and with said switching trunk when said line is connected to said trunk and including a toll supervisory relay and a switching trunk supervisory relay, both of said relays being operated when said toll line is connected with said switching trunk, means responsive to the operation of said switching trunk relay for increasing the resistance of said supervisory circuit to cause the deenergization of said toll supervisory relay, a tone source associated with said switching trunk, a plurality of operators' positions associated with said switching trunk, each of said operators' positions including signaling means and operators' sets and switches, means controlled by said switching trunk relay for applying said tone source to said switching trunk and for operating said signaling means, means controlled by any of said switching means for disconnecting said tone source from said trunk and for extinguishing all of said signaling means and for connecting one of said operator's sets to said switching trunk to the exclusion of the other operators' sets, a subscriber's line, means responsive to a connection of said switching trunk to said subscriber's line for disconnecting said operator's set from said switching trunk, means responsive to the disconnection of said operator's set from said switching trunk for deenergizing said resistance increasing means in said supervisory circuit whereby said toll supervisory relay will be operated, a source of ringing current associated with said toll line, means controlled by the operation of said toll supervisory relay for intermittently applying said ringing current from said toll line over said switching trunk to said subscriber's line, and means independent of said toll supervisory relay and controlled from the distant end of said toll line for intermittently applying said ringing current from said toll line over said switching trunk to said subscriber's line.

18. A telephone system comprising an incoming toll line terminating in a plurality of operators' positions comprising plugs and a operators' sets and signaling means, a toll switching trunk terminating in a jack, a busy signal associated therewith, a sleeve circuit completed when one of said plugs is connected with said jack, means controlled by said sleeve circuit for operating said busy signal, means controlled by said sleeve circuit for disconnecting one of said operators' sets from the talking conductors of said toll line and for connecting said talking conductors to one of said plugs, means controlled by said sleeve circuit for preparing a circuit for one of said signaling means whereby said signaling means may operate as a disconnect signal, and means in said toll line responsive when the

operator at the distant end disconnects therefrom for completing said last mentioned circuit to operate said signaling means.

19. A telephone system comprising an incoming toll line terminating in a plurality of operators' positions comprising plugs and operators' sets and signaling means, a toll switching trunk terminating in a jack, a busy signal associated therewith, a sleeve circuit completed when one of said plugs is connected with said jack, means controlled by said sleeve circuit for operating said busy signal, means controlled by said sleeve circuit for disconnecting one of said operators' sets from the talking conductors of said toll line and for connecting said talking conductors to one of said plugs, means controlled by said sleeve circuit for preparing a circuit for one of said signaling means whereby said signaling means may operate as a disconnect signal, means in said toll line responsive when the operator at the distant end disconnects therefrom for completing said last mentioned circuit to operate said signaling means, and means in said toll line responsive when the operator at the distant end disconnects therefrom for controlling said sleeve circuit to restore said busy signal to normal.

20. A telephone system comprising an incoming toll line terminating in a plurality of operators' positions comprising plugs and operators' sets and signaling means, a toll switching trunk terminating in a jack, a busy signal associated therewith, a sleeve circuit completed when one of said plugs is connected with said jack, means controlled by said sleeve circuit for operating said busy signal, means controlled by said sleeve circuit for disconnecting one of said operators' sets from the talking conductors of said toll line and for connecting said talking conductors to one of said plugs, means controlled by said sleeve circuit for preparing a circuit for one of said signaling means whereby said signaling means may operate as a disconnect signal, means in said toll line responsive when the operator at the distant end disconnects therefrom for completing said last mentioned circuit to operate said signaling means, and means in said toll line responsive when the operator at the distant end disconnects therefrom for controlling said sleeve circuit to restore said busy signal to normal and for disconnecting said plug from the talking conductors of said toll line.

21. A toll line multiplied at both ends at a plurality of operators' positions, means associated with the outgoing end of said line and responsive to a connection with the line thereat for applying signaling current of a definite polarity to said line, relay means associated with the incoming end of said line and responsive to said current, busy signals

at certain of said operators' positions, signaling means at certain of said operators' positions, means controlled by said relay means for operating said busy signals and
5 said signaling means, additional signaling means at said operators' positions which include busy signals, and relay means independent of said first mentioned means and re-

sponsive to a connection with the outgoing end of said line different from said first mentioned connection for operating said additional signaling means. 10

In testimony whereof, I have signed my name to this specification this 6th day of June 1923.

JOHN F. TOOMEY.