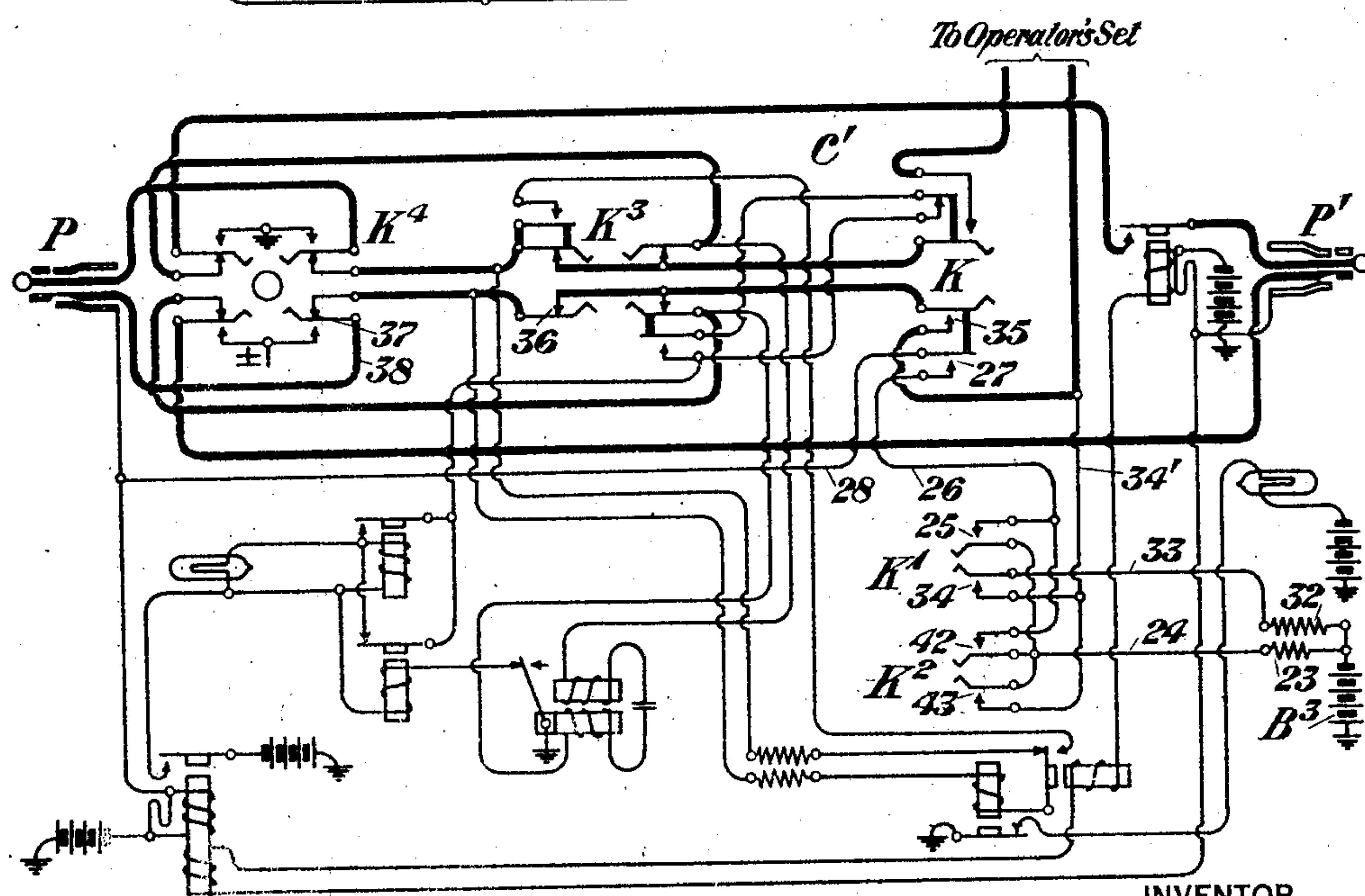
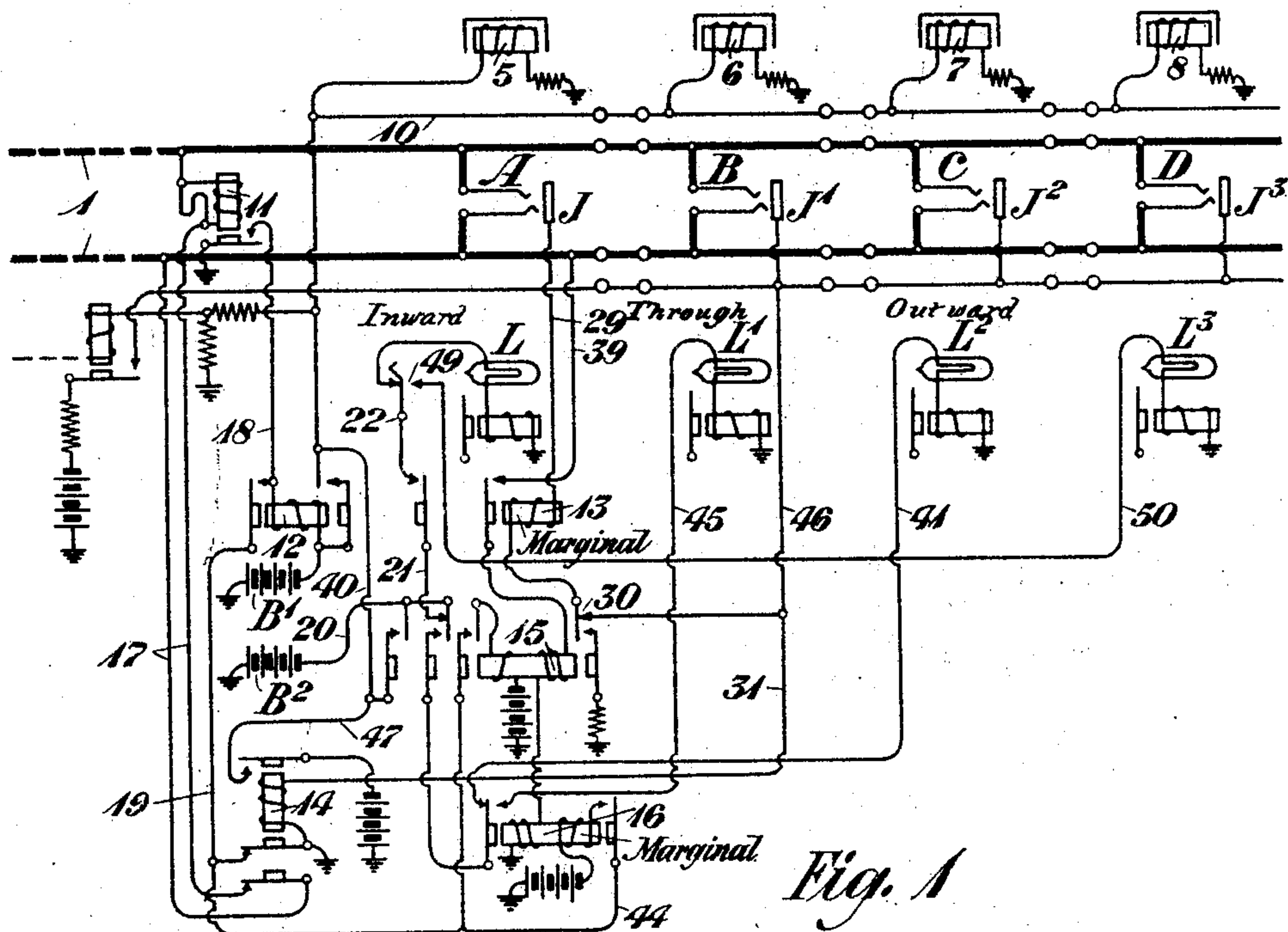


J. F. TOOMEY.
TELEPHONE CALL TRANSFER SYSTEM.
APPLICATION FILED JUNE 3, 1919.

1,364,965.

Patented Jan. 11, 1921.



INVENTOR
J. F. Toomey
BY *g. f. Toomey*
ATTORNEY

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-CALL-TRANSFER SYSTEM.

1,364,965.

Specification of Letters Patent.

Patented Jan. 11, 1921.

Application filed June 3, 1919. Serial No. 301,396.

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-Call-Transfer Systems, of which the following is a specification.

This invention relates generally to telephone switchboard apparatus and has particular reference to arrangements associated with long distance transmission lines at a central office.

In practice a long distance transmission line may be associated with a plurality of different switchboards and positions at a central office. At one switchboard, positions may be provided for incoming calls, and at other switchboards positions may be provided for outgoing, through and other calls. Calls are usually received at the incoming position and when connections cannot be completed at this position, it is customary to transfer said calls to the proper switchboard position. For this purpose there is provided switching apparatus whereby an operator may transfer calls that cannot be completed at a particular switchboard position to the position where a complete connection may be established. In transferring calls from one position to another it has heretofore been the practice to provide at the inward positions individual transfer keys for each multiple jack of the switchboard. The provision of individual keys for each of these jacks necessarily takes up valuable space on the face of the switchboard and also entails considerable expense in equipment. Accordingly, a cardinal feature of the invention is the provision of an arrangement for switching calls from one position to another whereby the number of transfer keys may be greatly reduced and whereby a saving in equipment and also space on switchboard panels is effected. Other and further features of the invention will hereinafter appear.

This invention may now be more fully understood by reference to the accompanying drawing, in Figures 1 and 2 of which are diagrammatically illustrated a long distance line terminating at different positions in a central station, and a toll cord adapted to be associated therewith.

In the arrangements of this invention, a

long distance transmission line 1 is connected at a central office to switchboards A, B, C, and D. These switchboards may include a plurality of positions, each being provided with a plurality of jacks, such as J, J¹, J², and J³. Board A is used for handling calls incoming over line L. The boards B and C are used for handling through and outward calls respectively. Board D may be used for handling night calls. The long distance line 1 is provided at the various positions with a plurality of busy signals 5, 6, 7, and 8. These signals are connected to a common conductor 10 so that when a source of current is applied thereto all the signals will operate. When a call comes in over the long distance transmission line 1, ringing current will be transmitted over the line and will operate ringing relay 11, which is bridged across said line in the usual manner. Under the control of relay 11 is shown relay 12 which operates to connect a source of electrical energy B¹ to the common conductor 10, leading to all the previously mentioned busy signals. The operation of relay 12 also provides a circuit for lighting line lamp L from battery B², over the outer right hand armature of said relay as will later appear.

In response to an incoming call indicated by the operation of said line lamp L, the operator will associate plug P of the cord C¹ with jack J at the incoming position. The operator will then operate the key K of cord C¹ and connect her telephone set with the line 1. Having ascertained the desired number, the operator will, when possible, complete the connection at that position by associating plug P¹ with the jack of the wanted line in the customary manner. If the call cannot be completed at this inward position, however, the operator will leave the talking key K in its operative position, and will manipulate transfer key K¹ or key K², depending upon the destination of the call, which will serve to place battery on conductors of the cord and toll line, thereby operating marginal relay 13 and relay 14. The operation of relay 14 will cause it to attract its armatures, opening the bridge across the transmission line and disconnecting relay 11 and releasing relay 12. The actuation of key K¹ and the operation of relay 13 connects current to transfer relay 15

thereby causing it to operate so that a call may be transferred to the outward position. If it is desirable to complete the call at a through position the key K^2 will be operated rather than the key K^1 . This will bring
 5 relays 13, 15 and 16, into action and transfer the call to a through position.

The invention may now be more fully understood from the following description
 10 of its operation. When a call comes in over the long distance transmission line 1, ringing current will be transmitted over the bridge, including conductors 17, lower armature of relay 14, and the winding of relay
 15 11. Relay 11 is thus energized and completes a circuit over its grounded armature, conductor 18, winding of relay 12, to grounded battery B^1 . The closing of this circuit energizes relay 12 which becomes
 20 locked by a circuit from grounded battery B^1 , through the winding of relay 12, conductor 19, contact and lower inner armature of relay 14, to ground. The energization of relay 12 also completes a circuit from
 25 grounded battery B^1 , armature and contact of said relay and conductor 10 to ground, through the signals 5, 6, 7 and 8. The closing of this circuit operates said drops or busy signals, and informs the operators at
 30 the various positions and switchboards that the long distance line is in use. The operation of relay 12 also closes the following circuit: from ground, battery B^2 , conductor 20, contact of relay 15, conductor 21,
 35 outer armature of relay 12, through the contacts of key 22, signal lamp L, to ground. This circuit provides for the lighting of signal lamp L at the incoming board A and informs the operators at positions on this
 40 board that there is an incoming call on long distance line 1. In response to the incoming call an operator at a position on the incoming board associates plug P of the toll cord C^1 with jack J and operates talking key K.
 45 Should the operator find that the incoming call requires the attention of an operator at the board C, which may be used for completing outward calls, she will manipulate transfer key K^1 . The operation of this key
 50 will complete the following circuit: from grounded battery B^3 , low resistance 23, conductor 24, contact 25 of key K^1 , conductor 26, contact 27 of key K, conductor 28, sleeve contacts of plug P and jack J, conductor
 55 29, marginal relay 13, contact 30 of relay 15, conductor 31, winding of relay 14 to ground. This circuit operates marginal relay 13 which upon attracting its armature completes a circuit from grounded battery B^3
 60 of cord C^1 , high resistance 32, conductor 33, contact 34 of key K^1 , conductor 34¹, contact 35 of key K, contact 36 of key K^3 , contact 37 of key K^4 , conductor 38, ring contacts of plug P and jack J, conductor 39, contact
 65 and armature of relay 13, and windings of

relays 15 and 16 to ground. This circuit will operate relay 15, but due to the inclusion of the high resistance 32 in the circuit, marginal relay 16 will not at this time be energized. The operation of relay 15 causes
 70 it to attract its armatures, completing a circuit through its outer left hand armature, from grounded battery B^2 , conductor 20, said armature and its contact, conductors 40 and 10, to ground. This circuit operates
 75 signals 5, 6, 7 and 8 which would otherwise be released when relay 14 is deenergized by the operation of relay 15. The energization of relay 15 also completes a circuit from
 80 grounded battery B^2 , conductor 20, middle left hand armature of said relay, armature and normal contact of relay 16, conductor 41 and lamp L^2 at switchboard C, to ground. Said lamp is lighted by this circuit and an
 85 operator at any of the positions on the outgoing switchboard C is signaled and in response thereto associates a plug of her cord circuit with jack J^2 , and completes a connection through her position in the usual way.
 90 The operator at the inward position A, after transferring the call to the outward position in the manner just described, dissociates plug P from jack J.

Should the operator in response to a call at the incoming position at switchboard A
 95 associate plug P of cord C^1 with the jack J and find that said call requires the attention of a through operator, such as an operator at board B, the following conditions will prevail: The talking key K will be operated
 100 and the transfer key K^2 manipulated in place of the transfer key K^1 thereby causing a circuit to be completed from battery B^3 , low resistance 23, conductor 24, contact 42 of key K^2 , conductor 26, contact 27 of key K,
 105 conductor 28, sleeve contacts of plug P and jack J, marginal relay 13, contact 30, conductor 31, winding of relay 14 to ground. This circuit will operate marginal relay 13. The operation of relay 13 provides for the
 110 energization of relays 15 and 16 by a circuit from grounded battery B^3 , low resistance 23, conductor 24, contact 43 of key K^2 , conductor 34¹, contact 35 of key K, contacts 36 and 37 of keys K^3 and K^4 respectively,
 115 conductor 38, ring contacts of plug P and jack J, conductor 39, contact and armature of relay 13, windings of relays 15 and 16 to ground. As resistance 23 is sufficiently low, the closing of this circuit will operate relay
 120 15 and the marginal relay 16. The energization of relay 15 provides for the deenergization of relay 14 and also serves to maintain the busy condition of signals 5, 6, 7 and 8 as previously outlined. The operation of relay
 125 16 provides a locking circuit from grounded battery, through its right hand winding, contact and armature, conductor 44, contact and armature of relay 14, to ground. The energization of relay 16 also causes a circuit
 130

to be completed from battery B², conductor 20, left hand middle contact and armature of relay 15, front contact and armature of relay 16, conductor 45, lamp L¹, to ground.

5 The lamp L¹ is thus illuminated and the operator at a through position on switchboard B is notified that a connection is desired. In response thereto an operator at such a position, upon the association of her cord circuit with the jack J¹, may complete a through connection. When the cord circuit of an operator at a through position as at switchboard B, is associated with jack J¹, the following circuit is closed: The relay 10 14, is energized over the sleeve contacts of the associated plug and jack J¹, conductor 46, winding of relay 14 to ground. The energization of relay 14 provides a circuit by way of grounded battery, upper armature and contact of said relay, conductors 47 and 40, through the signals 5, 6, 7 and 8 to ground, thereby maintaining the said signals and holding them in operated condition until the termination of the connection.

25 At periods, such as at night, when a decrease in traffic might warrant a decrease in the operating force at a central office, it may be found desirable to employ night key 22 so that all calls may be handled at night position D. When this key is operated lamp L³ at said night position will be lighted in response to an incoming call over line 1 in the following manner: Relays 11 and 12 will function as previously described and 35 the latter relay in operating will provide a circuit through its outer right hand armature from grounded battery B², conductor 20, middle contact of relay 15, conductor 21, closed contact 49 of key 22, conductor 50, through lamp L³ to ground. The operator at said night position D in response to said signal upon associating her cord circuit with jack J³ may handle and complete all calls at that position in a well understood 45 manner.

It will be obvious that the general principles herein disclosed may be embodied in many other circuit arrangements widely different from those illustrated, without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a telephone exchange system, a transmission line terminating at a central office 55 in a plurality of positions, signal receiving means at each of said positions, a cord circuit adapted to be associated with said line at one of said positions, and means including resistances associated with the ring conductor of said cord circuit whereby the signal receiving means at another of said positions may be operated.

2. In a telephone exchange system, a transmission line terminating at a central office 65 in a plurality of positions, one of said posi-

tions being adapted to handle incoming calls, another of said positions being adapted to handle outgoing calls, signaling means at each of said positions, a cord circuit adapted to be connected to said line at said first mentioned position, and means including a high resistance associated with the ring conductor of said cord circuit responsive to the connection of said cord circuit with the first mentioned position for operating the signaling means at said second position. 70 75

3. In a telephone exchange system, a transmission line terminating at a central office in a plurality of positions, being adapted respectively to handle incoming calls, to 80 handle outgoing calls, and to handle through calls, signal receiving means at each of said positions, a marginal relay associated with the sleeve conductor of said transmission line, switching relays controlled by said 85 marginal relay, a cord circuit adapted to be associated with said transmission line, master keys associated with said cord circuit and controlling said marginal relay and said switching relays, and means associated with 90 said switching relays for operating the signal receiving means at either said through position or said outgoing position.

4. In a telephone exchange system, a transmission line terminating at a central office 95 in a plurality of positions, adapted respectively to handle incoming calls, to handle outgoing calls, and to handle through calls, signal receiving means at each of said positions, a circuit including two relays, means 100 controlled by one of said relays when energized for operating the signal receiving means at said outward position, means controlled by both of said relays when energized for operating the signal receiving means at 105 said through position, a cord circuit adapted to be connected to said line at said incoming position, two resistance elements of different values associated with said cord circuit, and switching means associated with said cord 110 circuit whereby said circuit including said relays may be completed through either of said resistance elements and the resistance of said circuit varied so as to operate one or more of said relays. 115

5. In a telephone exchange system, a transmission line terminating at a central office in an incoming position, in an outgoing position, and in a through position, signal receiving means at each of said positions, 120 a circuit including two relays each adjusted to operate with currents of different values, means controlled by one of said relays when energized for operating the signal receiving means at said outward position, means controlled by both of said relays when energized for operating the signal receiving means at said through position, a cord circuit adapted to be associated with 125 said line at said incoming position, and means 130

associated with said cord circuit for varying the resistance of said circuit including said two relays.

5 6. In a telephone exchange system, a transmission line terminating at a central office in a plurality of positions, a plurality of signal receiving means located at said positions, a cord circuit adapted to be associated with said line, relay means associated with
10 said line and controlling said signal receiving means, and means including resistances associated with the ring conductor of said cord circuit for operating combinations of said relay means.

15 7. In a telephone exchange system, a transmission line terminating at a central office in a plurality of positions, indicating means at each of said positions, signal receiving means at each of said positions, a ringing
20 responsive relay associated with said line, means controlled by said relay when ener-

gized for operating all of said indicating means, means for maintaining said indicating means in an operated condition, means controlled by said ringing responsive relay 25 for operating the signal receiving means at one of said positions, a plurality of relays at said position, said relays controlling the signaling means at other positions, a cord circuit adapted to be connected to said line at 30 said first mentioned position, switching means in said cord circuit controlling said last mentioned relays, and means common to said positions and responsive to the association of said cord circuit with the first men- 35 tioned position for maintaining said indicating means in operated condition.

In testimony whereof, I have signed my name to this specification this 2nd day of June, 1919.

JOHN F. TOOMEY.