

J. F. TOOMEY.
TELEPHONE SYSTEM.
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2 SHEETS—SHEET 1.

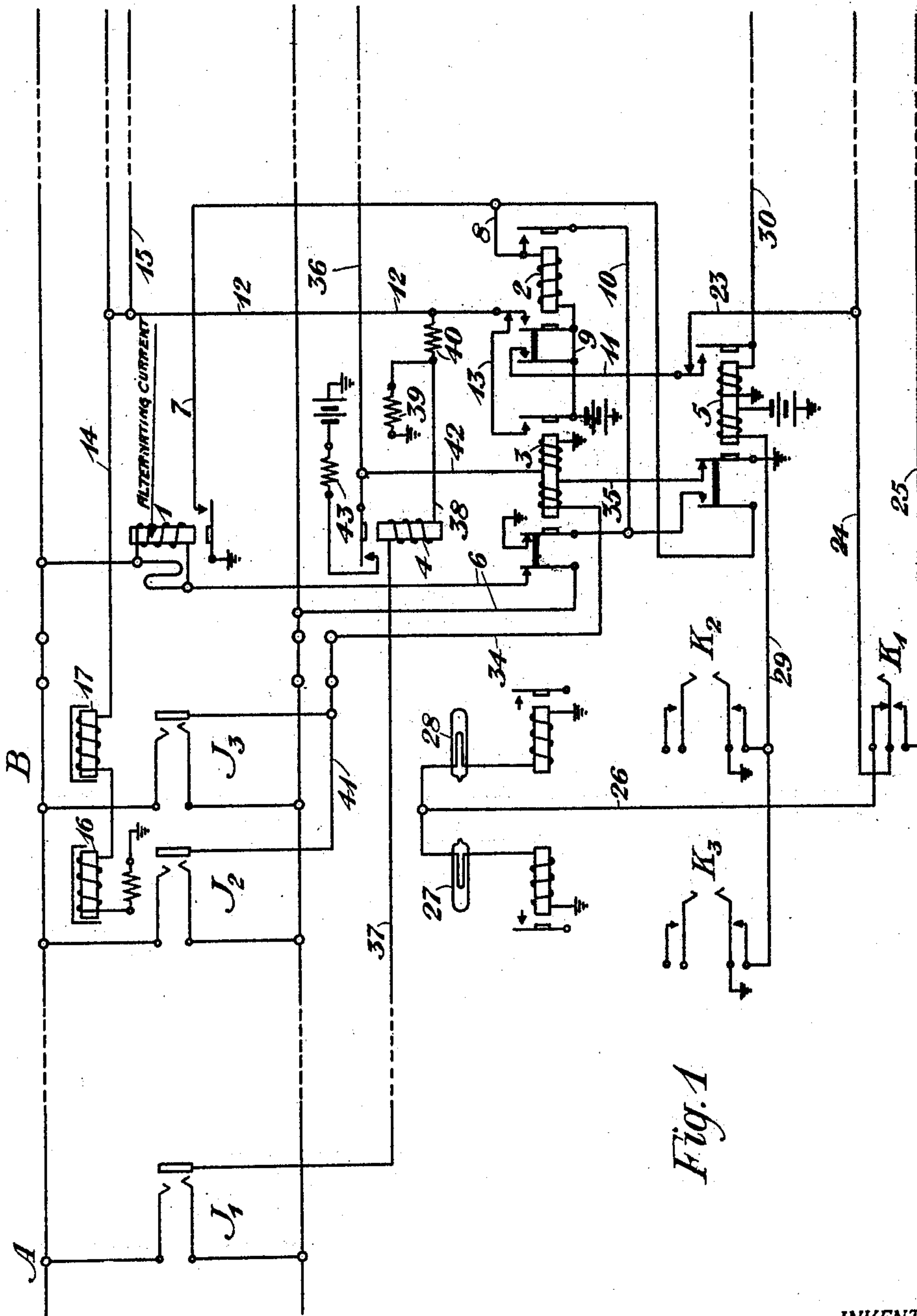


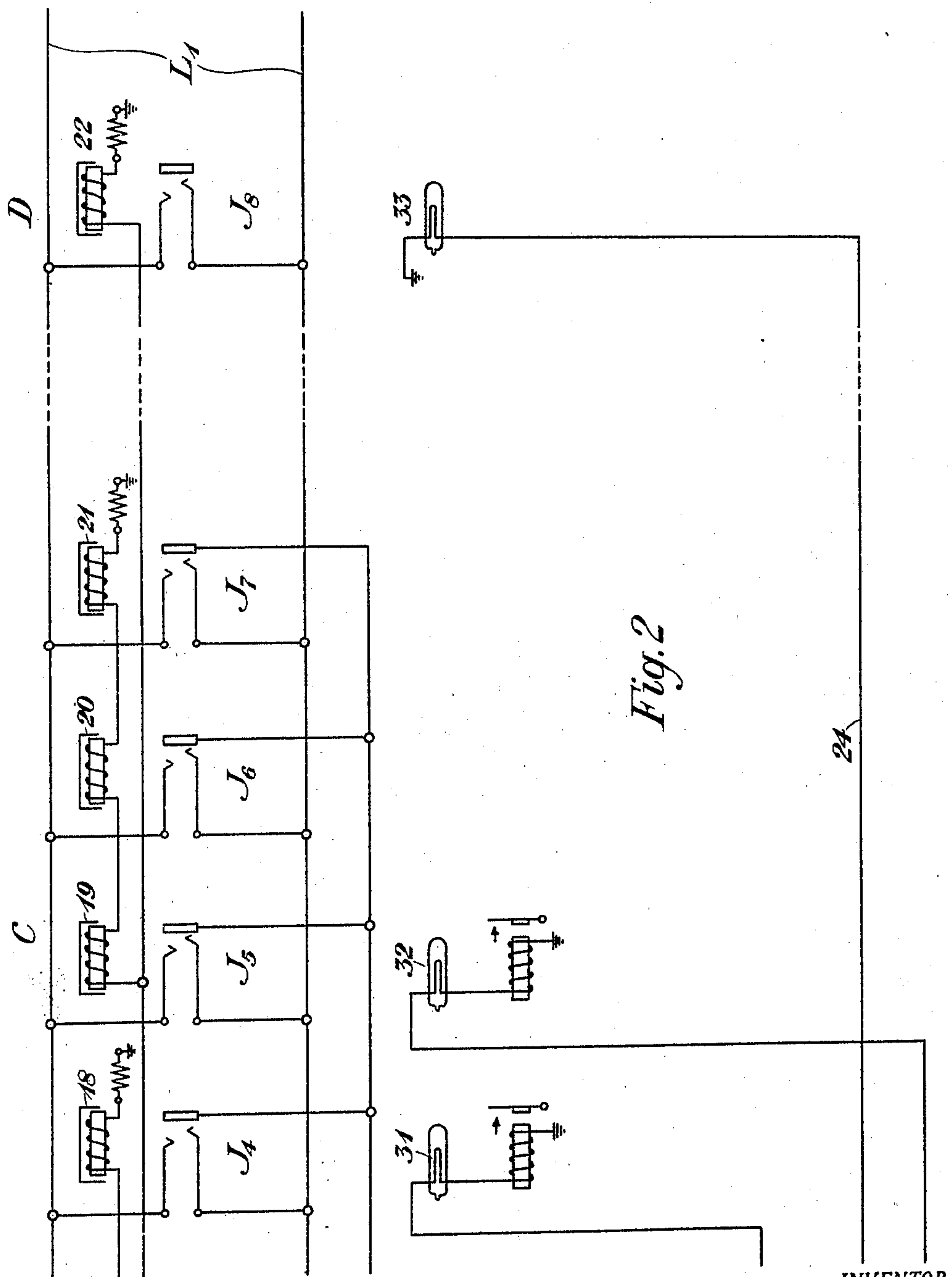
Fig. 1

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2 SHEETS—SHEET 2.



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TELEPHONE SYSTEM.

1,400,583.

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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 Systems, of which the following is a specification.

This invention relates to telephone switchboards and particularly to arrangements associated with a long distance transmission line 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 handling outgoing calls over the line, and calls coming in over the line may be taken care of at positions on other switchboards. In addition it may be found desirable to have the line connected with other boards and positions suitable for purposes of testing and supervision. If a connection is made with the line at any one of the positions associated therewith, it is desirable to notify the operators at all the other positions on the line that the line is busy so that no attempt will be made to make connections therewith. Accordingly one of the objects of this invention consists in the provision at a plurality of the positions connected with a long distance transmission line in a central office of means for indicating whenever the line is being used.

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 have both the incoming and the outgoing calls over the long distance line handled at positions on a board which would normally be used only for one type of call, such as the board used for outgoing calls. In instances when a call is received at an incoming board which requires the attention of a through operator, such as an operator at an outgoing board, it is desirable to transfer such a call to an outgoing board. Accordingly further objects of the invention consists in the provision of means, which will operate when desired, to inform the operators at positions on the outgoing board that there is an incoming call on the line which it is desired that they should handle. Other and further objects of the invention will be clear from the detailed description to be given later.

In the arrangements of this invention there is provided at the positions with which the long distance line is associated, a plurality of drops which, when operated, serve as busy signals to show that the line is being used. These drops are all connected to a common conductor so that, when a source of current is connected thereto, all of the drops will operate. The ringing current from a call coming in over the long distance line will operate a relay included in a bridge across the line which will operate relay means under its control to connect a source of electrical energy to the common conductor leading to the drops, thereby causing them to operate, and to close a circuit through the signal lamps located at positions on the incoming board. If it be found in single instances that an incoming call requires the attention of an operator at an outgoing board, a plurality of switching means are provided which serve to close the last mentioned circuit through signal lamps at positions on the outgoing board instead of at the incoming board. If operators at positions on either the incoming or outgoing boards make a connection with the transmission line, a circuit will be closed over the conductors connected to the sleeve contacts of jacks at such positions and through one of the two windings of another relay. This relay serves to deenergize the aforementioned relay means and to extinguish the signal lamps, and substitutes further means for connecting a source of electrical energy to the common conductor leading to the drops. If the operator at the test board makes a connection with the line a circuit will be closed over the conductor leading from the sleeve of the jack at the test board about the winding of another relay. The operation of this relay serves to energize the above mentioned relay with the double winding, which functions, as formerly, to extinguish the signal lamps and to continue the operation of the drops.

This invention may now be more fully understood with reference to the accompanying drawing, in the Figs. 1 and 2 of which, when taken together, is illustrated a circuit diagram of the preferred form of the invention. Connected to the long distance transmission line L_1 at the central office, are shown the switchboards A, B, C and D. Board A is used for testing purposes, and includes a

position at which is located suitable switching means, such as the jack J_1 . The board B is used for handling incoming calls over the line L_1 , and may include a plurality of positions, each having suitable switching means, such as the jacks J_2 and J_3 . The board C is used for handling outgoing calls over the line L_1 , and may include a plurality of positions, each having suitable switching means, such as the jacks J_4 , J_5 , J_6 and J_7 . The board D is used for purposes of supervision, and includes a position with switching means, such as the jack J_8 . At each of the positions on the boards B, C and D are provided drops, or busy signals, such as the drops 16, 17, 18, 19, 20, 21 and 22. These drops are connected by the conductors 14 and 15 to a common conductor 12. Bridged across the transmission line L_1 is the relay 1, which responds to ringing current coming in over the line. Under control of the relay 1 is shown the relay 2, which operates to connect a source of electrical energy to the common conductor 12, leading to all the aforementioned busy signals or drops. The relay 2 also serves to close the circuit through the signal lamps 27 and 28, located at positions on the incoming board B. For the purpose of handling incoming calls during certain periods, such as at night, at the outgoing board C, the switching means K_1 are provided, which serve to cause circuits to be closed upon the operation of relay 2 through the signal lamp 32, located at a position on the outgoing board C, instead of closing circuits, as formerly, through the signaling means at the incoming board B. When it is desired in single instances to switch an incoming call to the outgoing board C, the switching means K_2 and K_3 are provided at the incoming board B. Under the control of these switching means is the relay 5, which when operated allows the circuit closed by the operation of the relay 2 to be completed through the signal lamp 31, located at a position on the outgoing board C. Connected to the sleeve contacts of the jacks at the incoming board by the conductor 34, and connected to the sleeve contacts of the jacks at the outgoing board C by the conductor 36, is a relay 3 with a double winding. When a connection is made with the transmission line at any of the positions on the boards B or C, the relay 3 will be operated and connect a source of electrical energy to the common conductor 12, and accordingly operate the beforementioned drops or busy signals. Connected to the sleeve contact of the jack at board A is the relay 4. When a connection is made with the transmission line L_1 at the board A, the relay 4 will operate and close a circuit through the beforementioned relay 3, which will function, as formerly, to connect the source of electrical energy to the conductor leading to the drops or busy sig-

nals. The relay 3 also controls means for opening the bridge across the transmission line, which includes the relay 1, and for de-energizing the relay 2, which controls the operation of all the signal lamps.

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

When a call comes in over the long distance transmission line L_1 , ringing current will be transmitted over the bridge, including the conductors 6 and the winding of relay 1, which becomes energized. The operation of relay 1 closes the following circuit:—From ground, armature and contact of relay 1, conductors 7 and 8, winding of relay 2, conductor 9, to battery and ground. The closing of this circuit energizes relay 2, which becomes locked up over the following circuit:—From ground and battery, conductor 9, winding of relay 2, right-hand contact and armature of relay 2, conductor 10, left-hand middle contact of relay 3 to ground. Operation of relay 2 serves to close the following circuit:—From ground and battery, left-hand middle armature and contact of relay 2, over conductors 12, 14 and 15 to the drops 16, 17, 18, 19, 20, 21, and 22. The closing of this circuit operates the above-mentioned drops, or busy signals, and informs the operators at the various positions and switchboards that the long distance line is in use. The aforementioned operation of relay 2 also closes the following circuit:—From ground and battery, conductor 9, left-hand armature and contact of relay 2, over conductors 11, 23 and 24, upper contact of key K_1 , over conductor 26 to the filaments of signal lamps 27 and 28 to ground. This operates the signal lamps 27 and 28, located at the incoming board B, and thereby informs the operators at positions on this board that there is an incoming call on the long distance line L_1 which it is desired that they should handle.

At periods, such as at night, when a decrease in traffic might warrant a decrease in the operating force at a central office, the key K_1 is thrown. Incoming calls over the line L_1 will, in the same manner as has been formerly pointed out, operate the relays 1 and 2. Relay 2 will, in the same manner as formerly pointed out, operate the drops or busy signals. The circuit formerly closed by the operation of relay 2 through the signal lamps 27 and 28, will now, by the operation of key K_1 , be completed as follows:—From ground and battery, conductor 9, left-hand armature and contact of relay 2, over conductors 11, 23 and 24, lower contact of key K_1 , over conductor 25, filament of signal lamp 32 to ground. The closing of this circuit operates the signal lamp 32, located at a position on the outgoing board C, and thereby notifies the operator at this position that

there is an incoming call on the line which it is desired that she should handle.

When an operator at an incoming board finds that an incoming call requires the attention of an operator at an outgoing board, the switching means K_2 or K_3 , located at positions on the board B, may be operated. The operation of the key K_2 closes the following circuit:—From ground, contact of key K_2 , conductor 29, winding of relay 5 to battery and ground. The closing of this circuit will energize relay 5. The incoming call over the line L_1 will, in the same manner as has been formerly pointed out, operate the relays 1 and 2. Due to the energization of the relay 5, the signaling circuit closed by the operation of relay 2 will now be as follows:—From ground and battery, conductor 9, left-hand armature and contact of relay 2, conductor 11, right-hand contact and armature of relay 5, over conductor 30, filament of signal lamp 31 to ground. The closing of this circuit will operate the signal lamp 31, located at a position on the outgoing board C, and will notify the operator at such a position that there is an incoming call on the line L_1 , which it is desired that she should handle. Upon the closing of this last-mentioned circuit, the relay 5 will become locked up over its right-hand winding. A similar operation will take place should the key K_3 be thrown, and the description thereof will be omitted.

If a connection is made with the transmission line L_1 at positions on the board B by the switching means J_2 or J_3 , a potential from a source in the link circuit will be applied over the following circuit:—Sleeve contact of jack J_2 , conductors 41 and 34, left-hand winding of relay 3, over conductor 35, left-hand middle contacts of relay 5 to ground. This will energize the relay 3. The energization of relay 3, by pulling up its right-hand armature, connects a source of energy to the conductor 13, leading to the common conductor 12, which leads to the drops or busy signals. By this means the busy signals will remain in operation after the relay 2 has ceased to operate, and until the connection with the transmission line at the board B is terminated. The operation of the relay 3, by pulling up its left-hand armatures, opens the locking circuit formerly closed through the winding of relay 2, and opens the bridge across the transmission line, including the conductors 6 and the winding of relay 1. If a connection is made with the long distance line L_1 at any of the position on the outgoing board C by the switching means such as J_4 , J_5 , J_6 or J_7 , a potential from a source in the link circuit will be applied over the following circuit:—From the sleeve contact of one of said switching means, over conductors 36 and 42, right-hand winding of relay 3 to ground.

By the closing of this circuit the relay 3 will become operated and will perform the same functions as previously described.

If a connection is made with the long distance line L_1 at the board A, by the jack J_1 , a potential from a source in the link circuit will be applied over the following circuit:—Sleeve contact of jack J_1 , over conductor 37, winding of relay 4, conductor 38, resistance 39 to ground. The closing of this circuit will operate the relay 4. The operation of relay 4 closes the following circuit:—From ground and battery, resistance 43, contact and armature of relay 4, over conductor 42, right-hand winding of relay 3 to ground. The closing of this last-mentioned circuit energizes the relay 3, which will accordingly function in the same manner as previously pointed out to operate the drops, to hold open the bridge including the relay 1 and to hold open the locking circuit about the relay 2. The operation of relay 4 also serves to apply a busy potential to the conductor terminating at the sleeve contacts of the jacks at the board C so that they will test busy.

While the invention has been disclosed as embodied in certain specific arrangements which have been deemed desirable, it will be understood that it may be capable of embodiment in many other arrangements without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. In a telephone exchange system, a trunk transmission line terminating at a central office in a plurality of sets of switching terminals located at different switchboard positions, indicating means located at a plurality of said switching terminals, signaling means located at one of said last mentioned sets of switching terminals, and means responsive to current coming in over said transmission line for operating said indicating means and said signaling means.

2. In a telephone exchange system, a trunk transmission line terminating at a central office in a plurality of sets of switching terminals located at different switchboard positions, indicating means located at a plurality of said switching terminals, signaling means located at one of said last mentioned sets of switching terminals, a relay included in a bridge across said transmission line and responsive to current coming in over said transmission line, and means controlled by said relay for operating said indicating means and said signaling means.

3. In a telephone exchange system, a transmission line terminating at a central office in a plurality of sets of switching terminals, a line relay connected with the transmission line, indicating means actuated upon the energization of said line relay, link cir-

cuits for extending the transmission line, a relay associated with a plurality of said sets of switching terminals and operating upon connection of one of the link circuits therewith to disconnect said line relay from the transmission line and to continue the operation of said indicating means, and a relay associated with another of said sets of switching terminals and responsive to the connection of a link circuit therewith to cause the operation of the relay associated with said other sets of switching terminals.

4. In a telephone exchange system, a transmission line terminating at a central office in a plurality of sets of switching terminals, indicating means located at a plurality of said switching terminals, link circuits for extending the transmission line, a

relay for controlling said indicating means and associated with a plurality of said switching terminals and operating upon the connection of one of the link circuits therewith, a relay associated with another of said sets of switching terminals, and responsive to the connection of one of said link circuits therewith for causing the operation of said first mentioned relay, and means controlled by said second mentioned relay for altering the electrical potential of terminals at another of said sets of switching terminals.

In testimony whereof, I have signed my name to this specification this 5th day of April, 1918.

JOHN F. TOOMEY.