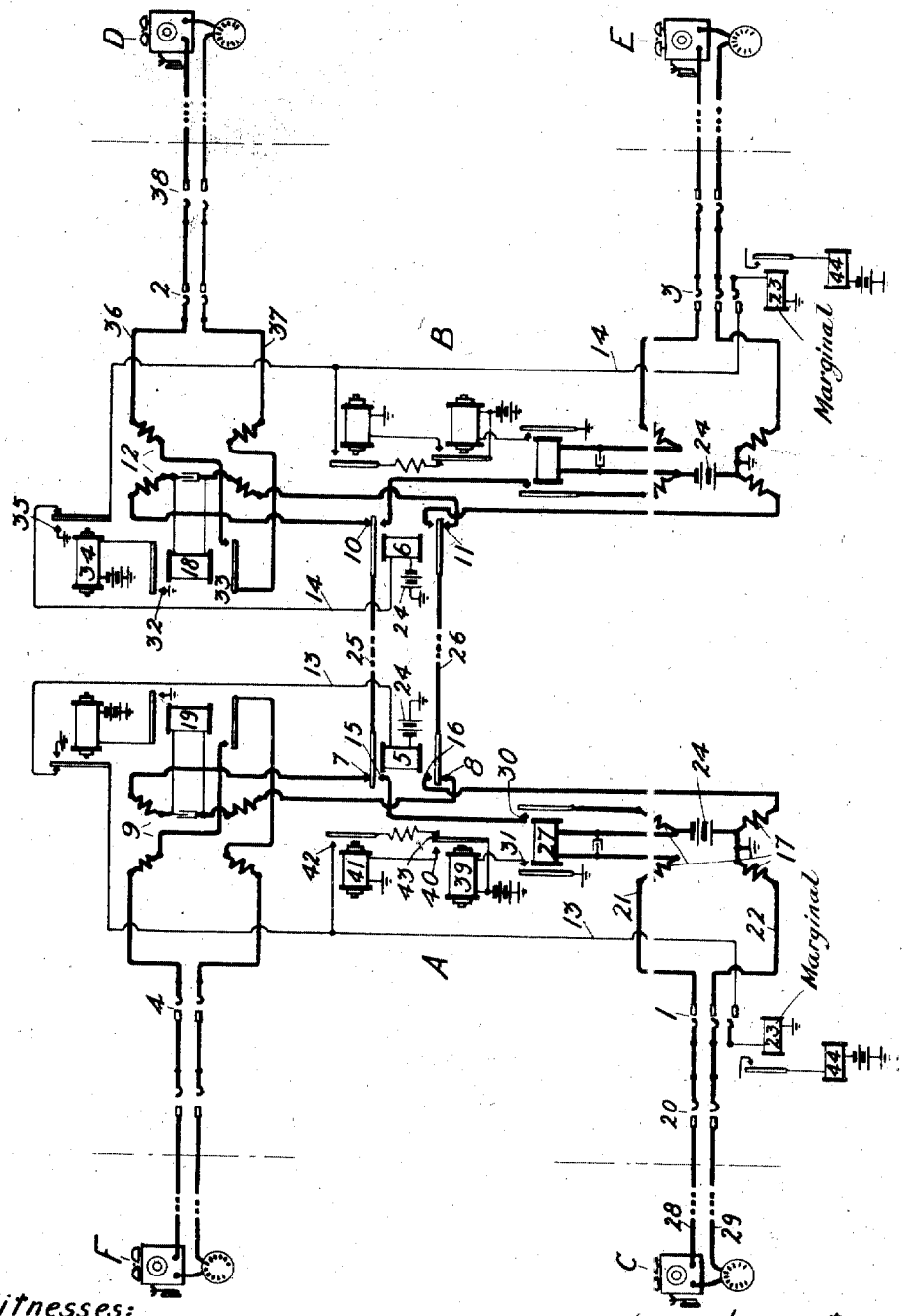
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TWO-WAY, TWO-WIRE TRUNK FOR MULTI-OFFICE AUTOMATIC EXCHANGE SYSTEMS.

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Witnesses:
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UNITED STATES PATENT OFFICE.

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TWO-WAY, TWO-WIRE TRUNK FOR MULTI-OFFICE AUTOMATIC EXCHANGE SYSTEMS.

1,224,374. Specification of Letters Patent. Patented May 1, 1917.

Application filed December 5, 1914, Serial No. 875,579. Renewed March 3, 1917. Serial No. 152,434.

To all whom it may concern:

Be it known that I, CHARLES L. GOODRUM, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Two-Way, Two-Wire Trunks for Multi-Office Automatic Exchange Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to a two-way, two-wire trunk for multi-office automatic exchange systems. Its object in general is to provide a two-way trunk having an improved and comparatively simple arrangement of circuits and apparatus. One object in particular is to provide a two-way trunk in which interference with the circuits by varying ground potentials between offices, is avoided.

In accordance with the invention, the trunk circuit is connected at both central offices through repeating coils to the multiple bank of an outgoing selector, and also to the brushes of an incoming selector. Calls at one end of the trunk enter at the bank terminals of the outgoing selector and are extended beyond the other end by the incoming selector at that end. A relay at each end of the trunk controls the connection of the trunk to either the bank terminals or the selector brushes at that end. The circuit established between the outgoing selector at one end of the trunk and the incoming selector at the other end, includes battery and ground at one end only of the trunk, whereby interference with the circuit by varying ground potentials between the offices connected by the trunk is avoided.

The invention may be more readily understood by reference to the accompanying drawing of a system embodying the invention.

Referring to the drawings, the two-wire two-way trunk terminates at the central office A in the multiple bank of an outgoing selector 1, and at the central office B in the brushes of an incoming selector 2. For example, a call from the subscriber's station C for a called subscriber D, entering the office A, arrives at the bank terminals of the outgoing selector 1 and is extended beyond the other office B by the incoming selector 2. In the opposite direction, calls over the same trunk arrive at the bank terminals of an outgoing selector 3 at the office B, and are extended beyond the station A by means of the incoming selector 4. Thus a call from the subscriber's station E for a called subscriber F will enter the office B at the bank terminals of the outgoing selector 3 and will be extended by the incoming selector 4 at the office A. It will be seen, therefore, that at each end of the trunk there is an outgoing and an incoming selector, and that the outgoing selector at one end coöperates with the incoming selector at the other end to extend a call.

At each end, the connection of the trunk to either the outgoing or the incoming selector is under the control of a relay, the relay 5 at office A, and the relay 6 at office B. Normally the trunk is connected at both ends to the incoming selectors, at office A through back contacts 7 and 8 of relay 5 and repeating coil 9 to the brushes of the selector 4, and at office B through back contacts 10 and 11 of relay 6 and repeating coil 12 to the brushes of the selector 2.

The relay 5 is included in a third wire 13 local to the office A, and the relay 6 is likewise included in a third wire 14 local to the office B. A call entering, for example, at the bank terminals of the selector 1 results in the energization of the relay 5, which thereupon disconnects that end of the trunk from the selector 4 and connects it through front contacts 15 and 16 of relay 5 and repeating coil 17 to the outgoing selector 1.

When a call is being extended from either office over the trunk line, a relay at the other office, relay 18 at office B or relay 19 at office A, responds, and through circuit connections controlled by it over the third wire, renders the trunk busy at said other office.

The operation of the system is as follows: Assume that the subscriber at C, whose line terminates at office A, desires to call the subscriber at D whose line terminates at office B. The subscriber's telephone line is extended in the usual manner through the line finder 20 and the brushes of the outgoing selector 1 to an idle trunk, the two wires 21 and 22 of which are connected to the contact terminals of selector 1. Thereupon, a circuit is closed for the relay 5

as follows: from ground, through trunk relay 23, wire 13, relay 5, battery 24 to ground. The resultant energization of relay 5, opens contacts 7 and 8 and closes contacts 15 and 16, thereby disconnecting the two wires 25 and 26 of the trunk from the selector 4 and connecting them to the outgoing selector 1. Though the trunk relay 23 is included in the circuit closed over the third wire 13, said relay does not operate, since it is a marginal relay and the windings of relay 5 are of such high resistance that the current flow in the circuit of the third wire is insufficient to operate the relay 23.

The subscriber's line being extended from station C to selector 1, a circuit is established for a relay 27, as follows: from battery 24, relay 27, wire 21, contact terminal and brush of selector 1, wire 28 of the telephone line, the subscriber's telephone set, wire 29 of the telephone line, brush and contact terminal of selector 1, wire 22, to battery. The resultant operation of relay 27 closes contacts 30 and 31 of said relay. The closure of contact 31 controls the flow of current for the actuation of relay 23 for the purpose of releasing the selector 1, as will be hereinafter described.

The above mentioned closure of contact 30 establishes an operating circuit from office A to office B over the trunk, as follows: from battery 24 at office B, through contacts 30 and 15, wire 25, contact 10, relay 18, contact 11, wire 26, contact 16 to battery. Thereupon relay 18 operates, closing its contacts 32 and 33. The closure of contact 32 completes a circuit for a relay 34, which is thereupon actuated and, through its contact 35, places ground upon the third wire 14, thereby rendering the trunk busy at office B.

The closure of contact 33 of relay 18 completes the operating circuit for the incoming selector 2 over the wires 36 and 37 which are connected to the brushes of said selector.

Circuits are thus established for extending the connection from the incoming selector 2 at office B to the called subscriber's station D. That is, the calling subscriber at station C, by operating his dial, interrupts the above described circuit through relay 27. There is, therefore, a corresponding interruption of the circuit over the trunk wires 25 and 26 at contact 30 of relay 27. In turn, there is a corresponding interruption of the circuit of selector 2 at contact 33 of relay 18. The selector 2 and connector 38 may thus be actuated in the usual manner from the dial at station C, to extend the connection to the called subscriber at station D. The two wires 25, 26 of the trunk line being inductively connected through the repeating coil 17 at office A with the calling line, and also being inductively connected through the repeating coil 17 at office B with the called line, a talking circuit is established between stations C and D. It will be noted that the trunk over which this connection is made includes ground and battery at office A only.

As hereinbefore stated, the function of contact 31 of relay 27 is to establish a releasing circuit for selector 1 when the calling subscriber hangs up his receiver. This will now be described. The closure of contact 31, at the time the subscriber at station C removes his receiver, completes a circuit for a slow-acting relay 39. The resultant operation of said relay closes its contact 40, thereby completing a circuit for another slow-acting relay 41, which thereupon closes its contact 42. Relays 39 and 41 being of the slow-release type, do not respond to interruptions of the circuit at contact 31 by the operation of the calling subscriber's dial. However, when contact 31 is opened by the subscriber hanging up his receiver, relay 39 is released and closes its back contact 43. Relay 41 being of the slow-release type, maintains its contact 42 closed for an appreciable time after contact 43 is closed, during which interval operating current is supplied to the marginal relay 23 over the following circuit: from grounded battery, through contacts 43 and 42, wire 13, relay 23, to ground. Relay 23 thereupon responds to close the circuit of release magnet 44 of selector 1. It will be understood that the structure, operation and circuit connections of the several switches at each end of the trunk may be of any usual or known type and hence further illustration and description thereof is deemed unnecessary.

What is claimed is:

1. In an automatic telephone exchange system, a two-wire trunk extending between two central offices, an outgoing and an incoming selector for said trunk at each of said offices, and automatically operated means for completing in either direction a battery connection to said trunk at one office and a connection free of battery to the incoming selector at the other office.

2. In an automatic telephone exchange system, a trunk extending between two central offices, selecting apparatus and a battery for said trunk at each of said offices, and means operating automatically in setting up a connection through said trunk in either direction for closing the trunk to battery at one end, and for maintaining it as a closed loop free from external connections with battery at the other end.

3. In an automatic telephone exchange system, a trunk extending between two central offices, selecting apparatus and a battery for said trunk at each of said offices, and means operating automatically in setting up a connection in either direction through said trunk for closing it to battery at the outgo-

ing end, and for maintaining it as a closed loop free from external connections with battery at the incoming end.

4. In an automatic telephone exchange system, a repeating trunk extending between two central offices, selecting apparatus and a battery for said trunk at each of said offices, said trunk being normally maintained at each end as a closed loop free from connections with battery, means operating automatically in setting up a connection to said trunk at either office for closing the trunk to battery at one end and for maintaining the normal condition thereof at the other end, and means for interrupting the trunk at the outgoing end to repeat calling impulses to control the selecting apparatus at the incoming end of the trunk.

5. In an automatic telephone exchange system, a two-wire trunk between two central offices, an outgoing and an incoming selector for said trunk at each of said offices, a local circuit at each office including multiple bank contacts of an outgoing selector and battery, a second local circuit at each office including brushes of an incoming selector, two connecting circuits at each office inductively connected, respectively, to said local circuits, and automatically operated means at each office for controlling the connection of the trunk line to one or the other of said connecting circuits at the respective offices.

6. In an automatic telephone exchange system, a two-wire trunk between two central offices, an outgoing and an incoming selector for said trunk at each of said offices, a local circuit at each office including multiple bank contacts of an outgoing selector and battery, a second local circuit at each office including brushes of an incoming selector, connecting circuits at each office inductively connected to said local circuits and extending to said trunk said trunk at each end being normally connected to the incoming selector through the corresponding local and connecting circuits, and automatically operated means at each office for disconnecting the trunk from the incoming selector and transferring the connection, over the other connecting and local circuits, to the outgoing selector.

In witness whereof, I hereunto subscribe my name this 3rd day of December A. D., 1914.

CHARLES L. GOODRUM.

Witnesses:
E. EDLER,
K. L. STAHL.