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SIGNALING SYSTEM

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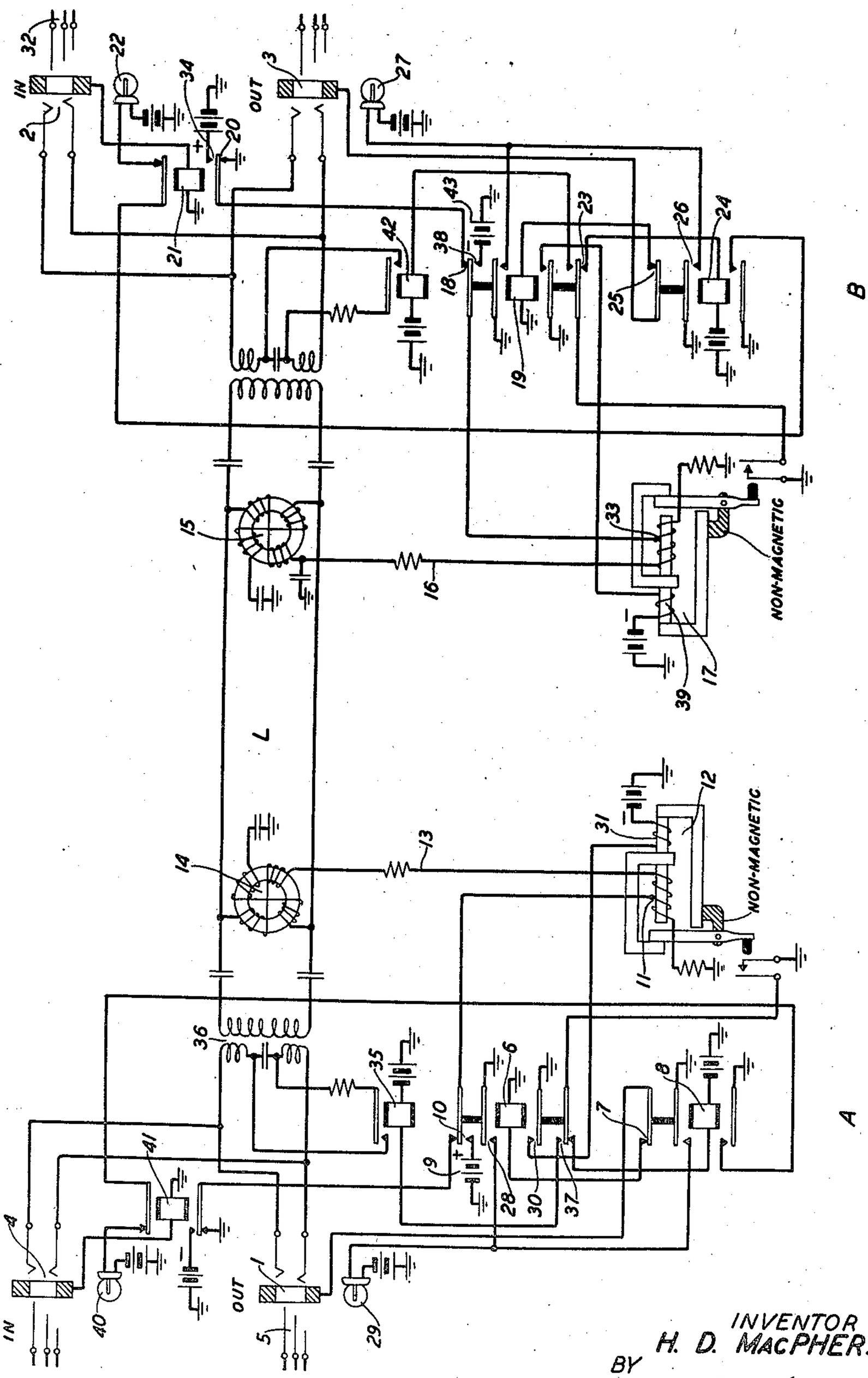

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SIGNALING SYSTEM

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This invention relates to signaling systems and more particularly to telephone systems arranged for two-way differential duplex signaling between two stations, i. e., signaling over a line in either direction, in which systems the calling signal device and an answering terminal of the line at each station are located at a point remote from the outward or calling terminal at the same station as for example at different operators position of a switchboard.

An object of the invention is to prevent calling signals from being displayed at the stations when attempts to initiate outward calls are made at both stations simultaneously.

A feature of the invention resides in providing sources of both positive and negative signal potentials at each station, arranging the circuits so that one station transmits positive potenial to the line as an outgoing or calling signal and negative potential when an incoming call is answered at the inward terminal and the other station transmits negative polarity when initiating a call and positive polarity when answering, and further in so arranging the differential line relay at each station in such a manner that when an outgoing terminal at either station is seized to initiate a call, the respective differential relay will be electropolarized in such a direction that it will be responsive only to signal potential transmitted from the distant station, which has the same polarity as that of the transmitted calling or outgoing signal.

The invention will be understood from the following description when read in connection with the accompanying drawing which shows a trunk line extending between two central offices, or exchanges, A and B and arranged for two-way differential duplex signaling over a so-called ground composite circuit including one of the two conductors of the line (upper or tip conductor in the drawing).

A description of the operation of the system, as shown by the drawing, will best serve to explain the feature of the invention, and therefore it will be first assumed that an outward operator at exchange A, who has access to outward jack 1 of the line L desires to call the inward operator at exchange B, who has access to the inward or answering jack 2 at that exchange. As before mentioned it will be understood that the inward jacks and associated signal devices at each exchange are located apart from the respective outward jack, and we will therefore assume that the outward jack 1 at exchange A and outward jack 3 at exchange B are located at corresponding outward operator's positions and inward jack 2 at exchange B and inward jack 4 at exchange A are likewise located at inward positions of the switchboard at these exchanges.

As it is to be assumed that an outward call is to be initiated at exchange A for exchange B, the outward operator at A will insert a plug 5 of one of her cord circuits into jack 1 thus operating the sleeve relay 6 of the line, from battery over the sleeve of the plug 5 in the usual manner which circuit includes contact 7 of relay 8.

Operation of relay 6 performs two functions, the first being to connect signaling current to the line, in the present case of positive polarity, which can be traced from positive battery 9, and contact 10 of relay 6 to the mid-point 11 of the left-hand winding of differential line relay 12 from which point it flows to the line through the right-hand portion of the winding and also through the left portion to ground. The current applied to the line flows over conductor 13, winding of retardation coil 14 and upper or tip conductor of the line L, and passes to ground at station B over windings of retardation coil 15, conductor 16, left-hand portion of the right-hand winding of line relay 17, contacts 18 of relay 19, and contacts 20 of sleeve relay 21. Current flowing from battery 9 has differential action on relay 12 due to the fact that current passes to ground in opposite directions through the two halves of the relay winding and consequently this relay is not energized thereby, but relay 17 at station B is energized due to current flowing in only the left-hand portion of its right winding, its right-hand portion being short circuited at this time.

Relay 17 at station B, in operating, lights the line signal (lamp 22) at the inward position which circuit can be traced from ground, contacts of relay 17, contacts 23 of relay 19 and winding of relay 24 to battery, which relay operates to close its lowermost contacts to light lamp 22 over the upper contacts of relay 21. Relay 24 also opens its contacts 25 thus preventing outward sleeve relay 19 from operating in case a plug is subsequently inserted in the outward jack 3. Further, relay 24 closes its contact 26 to light all busy lamps, such as 27 associated with line L, to indicate to the outward operator that the line is in use.

Returning to station A, it will be noted that operation of relay 6 also closed its contacts 28 to light busy lamp 29, and any other similar lamps which may be multipled therewith at the outward switchboard, and further closed its contacts 30 thereby completing an obvious circuit

to energize the polarizing winding 31 of differential line relay 12 in such a manner that this relay thereafter, as long as relay 6 is operated, will only operate in case a positive potential is applied to the line at station B to effectively short-circuit its right-hand portion of the left-hand winding, which will be the condition when the inward operator at station B inserts an answering plug 32 in the inward jack 2 to operate sleeve relay 21. The operation of this relay (21) opens its contact 20 thereby removing ground from the mid-point 33 of the right-hand winding of relay 17 and by closing its contacts 34 substitutes a positive potential for the original ground at this station. Operation of relay 21 alos opens its upper contacts to extinguish the line lamp 22. Substituting positive potential, in place of ground, to the mid-point 33 of the winding of relay 17, energizes the right-hand portion of the winding to hold the relay operated and at the distant station A effectively short-circuits the right-hand portion of the left-hand winding of relay 12. This latter relay now operates due to the flux caused by current, from battery 9, in the left-hand portion of the winding aided by the flux caused by the polarizing winding 31 which, as before mentioned, is in such a direction as to produce this effect. Relay 12 in operating causes relay 35 to operate in a circuit from ground, contact of relay 12, contact 37 of relay 6, and winding of relay 35 to battery, which latter relay, in closing its contacts places a low resistance bridge across the condenser in the switchboard side of the repeating coil 36 to actuate a supervisory relay in the outward operator's cord circuit (not shown) to cause a previously lighted supervisory lamp to be extinguished as an indication to the operator that the called station has answered, which is well-known practice. At this point it should be mentioned that relays 12 and 17, described, may be of the type described in United States Patent 1,673,884 to H. C. Pye, issued June 19, 1928.

Operation in the other direction, i. e., for an outgoing call from station B to station A, will be the same, that is insertion of an outward operator's plug in jack 3 at station B will connect negative polarity at contacts 38 of relay 19 to the mid-point 33 of the winding of relay 17 and also energize the polarizing winding 39 of that relay which will cause relay 12 at station A to operate, which in turn operates relay 8 and lights line lamp 40 in the inward position associated with jack 41 and when the inward operator at station A answers, relay 41 will operate to extinguish line lamp 40 and substitute negative potential for the ground normally connected to the mid-point 11 of the winding of relay 12.

When relay 8 operates it opens its contact 7 thus preventing subsequent attempts at the outward position to initiate outward calls from effecting the established circuit.

Connection of negative potential from the line at station A in opposition to corresponding potential connected at station B to hold relay 12 operated and causing relay 17 to operate due to its polarizing flux to energize winding 39 whereupon relay 42 is operated to extinguish the outward operator's supervisory lamp.

In case, however, that outward operators at both ends of the line should simultaneously seize outward jacks 1 and 3, relays 6 and 19 will operate. Under this condition, relay 6 will connect positive polarity to the line by way of the mid-point 11 of the winding of relay 12 and also energize the polarizing winding of this relay and at station B relay 19 will energize the polarizing winding of relay 39 of the respective differential relay 17 and connect negative potential to the line at that end thereby causing current to flow from the positive pole of battery 9 at station A to the negative pole of the battery 43 at station B in series with the right-hand half of the left winding of relay 12 and the left-half of the right-hand winding of relay 17. Under this condition signaling battery 9 at station A and battery 43 at station B are in series with the line which will cause a flux in both relays 12 and 17 sufficient to overcome the flux tending to operate these relays caused by the balancing portions of the relay windings plus the aiding polarizing flux and therefore neither relay 12 nor 17 will operate until one or the other of the outward operators disconnects.

What is claimed is:

1. In a telephone signaling system, a pair of stations, a line therebetween, outward and inward line terminals at each station, a signal device associated with each inward terminal, duplex signaling means including a differential relay at each station interconnected by a signaling channel, each relay being normally operative to display the respective signal device when a connection is established with the distant end of the line by way of the outward terminal thereat, characterized in this that each of said relays is adapted to be electropolarized in a predetermined manner, responsive to a connection to the line by way of the respective outward terminal to prevent operation of said relay in case a simultaneous connection is made with the line by way of the outward terminal at the distant station.

2. In a duplex signaling system, a line, stations at each end thereof, positive and negative polarity sources of signaling potentials at each station, means at one station for connecting positive polarity to the line for initiating transmission of a signal thereover, and for connecting negative polarity when answering a signal transmitted from the distant station, and means at the second station for connecting negative polarity to the line for initiating a signal over the line and for connecting positive polarity to answer a signal transmitted from the first station, differential relay means in said line at each station so arranged that connection of a potential source at a station to initiate a call will actuate the differential relay at the called station and subsequent connection of the same polarity to the line at the called station will hold the relay thereat operated and cause operation of the relay at the calling station, and means effective when signal initiation potential is connected to the line at a station to prevent the respective relay at that station from operating in case potential of the opposite polarity is simultaneously connected to the line at the other station.

3. In a duplex signaling system, a line, stations at each end thereof, positive and negative polarity sources of signaling potential at each station, means at one station for connecting positive polarity to the line for initiating transmission of a signal thereover and for connecting negative polarity when answering a signal transmitted from the distant station, and means at the second station for connecting negative polarity to the line for initiating a signal over the line and for connecting positive polarity to answer a signal transmitted from the first station, relay means in said

line at each station so arranged that connection of a potential source at a station to initiate a call will actuate the differential relay at the called station and subsequent connection of the same polarity to the line at the called station will hold the relay thereat operated and cause operation of the relay at the calling station, and means effective when signal initiation potential is connected to the line at a station to electrically bias the respective relay at that station in such a direction that the relay will not operate in case signal initiation potential is simultaneously connected to the line at the other station.

4. In a duplex signaling system, a line, stations at each end thereof, outgoing and incoming line terminals at each station, signaling potential at each station, a differential relay associated with the line at each station so arranged that connection of signal potential to the outgoing terminal of the line at one station causes operation of the relay at the other station and subsequent connection of potential to the input terminal at said other station holds the relay thereat operated and also causes the relay at said one station to operate, and means responsive to the simultaneous connection of signaling potential to the outward terminal at both stations for preventing either of said relays from operating, said means comprising an electropolarizing winding on each relay which is energized in a predetermined direction responsive to connection of signaling potential to the outgoing line terminal at the corresponding station.

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