Dec. 17, 1940. H. HOVLAND 2,225,478

TELEPHONE SYSTEM

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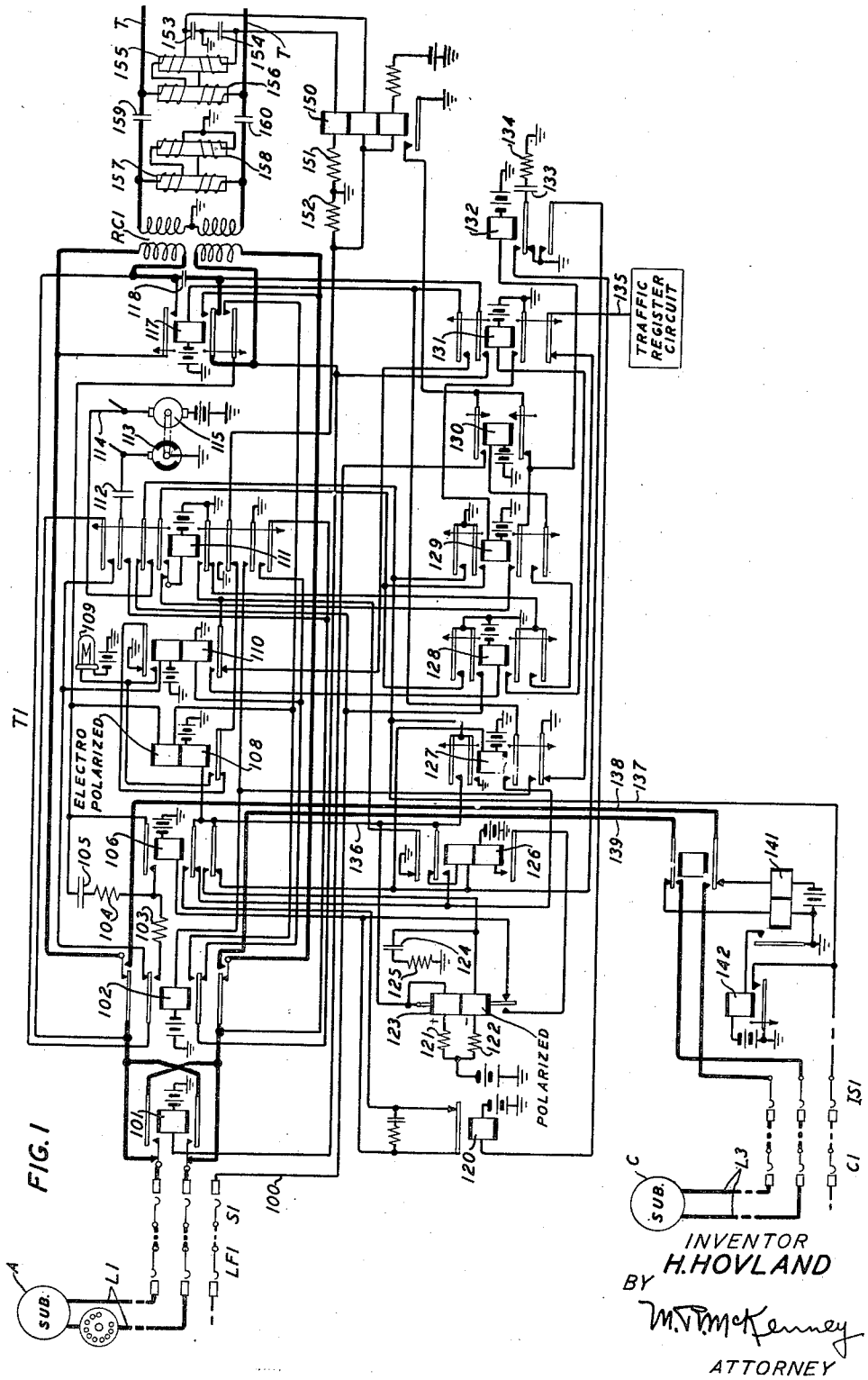

FIG. 1

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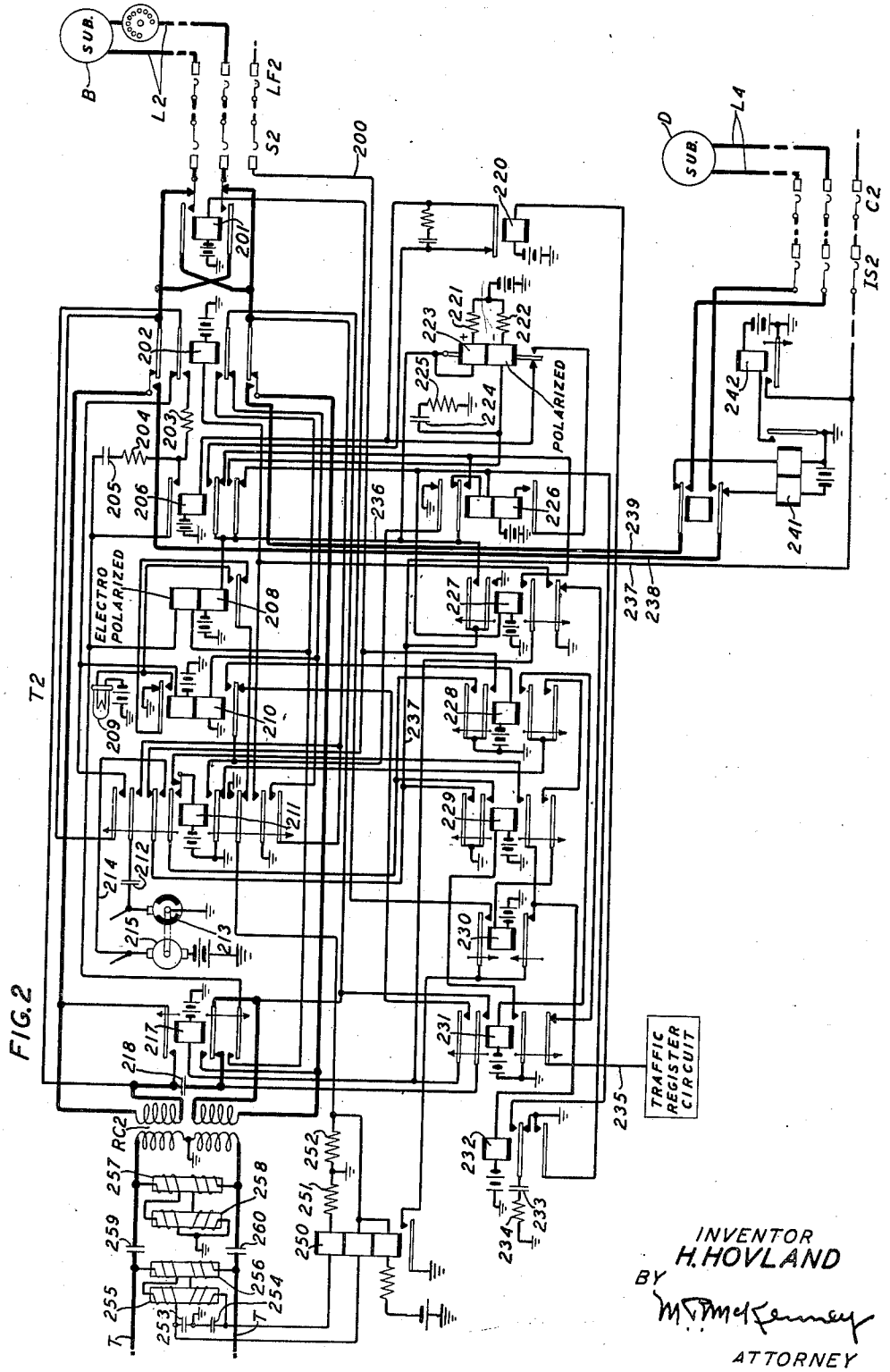

FIG. 2

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2,225,478

TELEPHONE SYSTEM

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11 Claims. (Cl. 179—16)

This invention relates to telephone systems and particularly to systems in which automatic switches are employed in establishing telephone connections.

It is an object of the invention to enable a more efficient use of interoffice trunks in automatic and semi-automatic telephone systems. Other objects are the prevention of double connections and the prevention of false charging on calls from message rate and prepayment coin lines in systems comprising two-way interoffice trunks.

The invention is an improved two-way trunk circuit which is arranged to prevent the establishment of a talking connection if the trunk is seized at both ends and to allow completion of a call over the trunk in case the trunk is seized at one end on a second call before the connection has been released at the other end on a preceding call. According to a feature of the invention, a connection over a two-way trunk arranged for composite signaling thereover is controlled by the calling party and the trunk is held busy at the outgoing end, after release by a calling party, for a longer interval of time than it is held busy at the incoming end so as to prevent seizure of the trunk on another call before the switches at the incoming end of the trunk on the first call have returned to normal. Means are provided for transmitting a tone signal to the calling subscriber when the subscriber's line is connected to a two-way trunk which has also been seized at the distant end. A further feature is a two-way trunk circuit arranged to momentarily disconnect the guarding potential from the test conductor at the outgoing end after release of the trunk on a first call to enable release of the train of switches at that end in case the trunk is again seized at the distant end on a second call before this train of switches has been released.

To facilitate a clear and complete description of the invention, an automatic telephone system arranged in accordance with the invention is represented schematically in the drawings which form a part of this specification. The invention is, however, not limited to the specific arrangements shown in the drawings and is generally applicable to all automatic telephone systems comprising two-way trunks.

Referring to the drawings, which consist of two figures:

Fig. 1 shows subscribers' lines L1 and L3, a line-finder switch LF1 and an associated selector switch S1, a two-way trunk circuit T1 and an associated incoming selector switch IS1, and a connector switch C1, all of which are in one office of a telephone system; and

Fig. 2 shows subscribers' lines L2 and L4, a line-finder switch LF2 and an associated selector switch S2, a two-way trunk circuit T2 and an associated incoming selector switch IS2, and a connector switch C2, all of which are in another office of the system.

The telephone stations A, B, C and D are of the usual type employed in common battery telephone systems and each includes a dial or equivalent impulse sender for use in controlling the operation of the selector and connector switches by which desired connections are established. Although lines L1 and L2 are shown connected only to terminals in the banks of line-finder switches and lines L3 and L4 are shown connected only to terminals in the banks of connector switches, all of these lines are connected to terminals in the banks of both line-finder and connector switches so that calls can be originated and received at each of the subscribers' stations.

The line-finder, selector and connector switches are of the well-known two-motion step-by-step type. For a description of the structure of such switches and their operation when used as selectors and connectors, reference may be had to pages 53 to 67 of the second edition of Automatic Telephony by Smith and Campbell. For a description of the operation of such line-finder switches, reference may be had to Patent 1,799,654, granted to R. L. Stokely, April 7, 1931. Each of the switches LF1, LF2, S1, S2, IS1, IS2, C1 and C2 is represented by a set of brushes and a single set of terminal, all magnets, relays and other associated apparatus being omitted with the exception of the line and release relays of the incoming selectors IS1 and IS2. Although not shown, additional selector switches may be included in the train required for completion of a desired connection.

The like trunk circuits T1 and T2 are shown in detail and include repeating coils RC1 and RC2, and composite sets terminating the ends of the interoffice trunk T. The corresponding relays, condensers, resistors, retard coils and conductors of trunk circuits T1 and T2 are given reference characters having like tens and units digits. The composite set at one end of trunk T comprises condensers 153, 154, 159 and 160, retard coils 155, 156, 157 and 158 and the composite signaling relay 150. The composite set at the other end of the trunk comprises like elements with corresponding reference characters. A

ground potential compensating circuit is traced from ground through resistor 151 and the upper winding of relay 150, lower windings of retard coils 155 and 156, lower conductor of trunk T, lower windings of retard coils 256 and 255, uppermost winding of relay 250, and through resistor 251 to ground. With trunk T idle, the composite signaling relays 150 and 250 are both normal, the junction between the middle and lowermost windings of relay 150 being normally connected through back contacts of relays 111, 108 and 110 to ground, and the junction between the middle and lowermost windings of relay 250 being normally connected through back contacts of relays 211, 208 and 210 to ground. The lower winding of each of relays 150 and 250 is connected in series with a biasing battery to hold the armatures of these relays in normal position.

Assume first that trunk T is used on a call from station A to station D. Upon removal of the receiver from the receiver hook at station A, a line finder LF1 operates in well-known manner to extend the line L1 to a first selector S1. In response to the dialing of the first digit of the called subscriber's number, the selector S1 selects the desired group and an idle set of terminals therein, the line L1 being thereby connected to an idle two-way trunk circuit T1. Relay 110 is operated by the current in a circuit from battery through the upper winding of relay 110, inner upper back contact of relay 102, left upper winding of repeating coil RC1, outer upper back contact of relay 102, upper back contact of relay 101, upper brushes of selector S1 and line finder LF1, through the line conductors and telephone instrument at station A, middle brushes of line finder LF1 and selector S1, lower back contact of relay 101, outer lower back contact of relay 102, lower left winding of repeating coil RC1, inner lower back contact of relay 102, and lower winding of relay 110 to ground. Relay 110 disconnects the ground normally connected to the junction between the lowermost and middle windings of signaling relay 150 and closes circuits from signaling battery through resistance lamp 109, upper front contact of relay 110, back contacts of relays 108 and 111, thence through resistor 152 to ground, through the lowermost winding of relay 150 to biasing battery, and through the middle winding of relay 150, upper windings of retard coils 155 and 156, upper conductor of trunk T, upper windings of retard coils 256 and 155, middle winding of relay 250, back contacts of relays 211, 208 and 210 to ground. Relay 150 does not operate since the current through the lowermost winding of relay 150 is electromagnetically opposed to and neutralizes the current through the middle winding; but signaling relay 250 at the other end of trunk T is operated, the energization of the middle winding of relay 250 being strong enough to overcome the energization of the biasing winding. The operation of relay 110 also closes a circuit from battery through the winding of slow-to-release relay 128, lower front contact of relay 110, to ground at the uppermost back contact of relay 126. At its inner upper front contact, relay 128 connects ground through sleeve conductor 100 to the sleeve terminals of trunk T1 in the banks of selector switches having access thereto to guard against seizure of trunk circuit T1 by another selector. At its inner lower front contact, relay 128 closes a circuit which includes a back contact of relay 111 for operating the slow-to-release relay 131. Relay 131 disconnects ground from conductor 135 leading to the group traffic register circuit, closes a circuit for operating the slow-to-release relay 129 and bridges the condenser 118 across the inner ends of the left windings of repeating coil RC1. Relay 129 connects ground through its outer upper front contact and a back contact of relay 111 to the sleeve conductor 100 and closes a circuit through its outer lower front contact for operating the slow-to-operate relay 130.

The aforementioned operation of relay 250 of trunk circuit T2 closes a circuit for operating relay 232. Relay 232 closes a circuit for operating relay 227, closes a circuit for energizing the lower, polarizing winding of relay 208, closes a circuit for energizing the upper winding of relay 223, and closes a circuit for charging condenser 233 in series with resistor 234 and the winding of relay 220. The energization of the upper winding of relay 223 is effective to close and hold closed its left contact. Relay 220 operates while condenser 233 is charging and then releases. Relay 227 locks through the outer lower back contact of relay 206, conductor 236 and both upper front contacts of relay 227; disconnects ground from conductor 235 leading to the group traffic register circuit; closes a circuit for operating relay 202; closes a circuit through both of its upper front contacts and conductor 236 for energizing the lower polarizing winding of relay 208, closes a circuit through both of its upper front contacts, conductor 236 and the left contact of relay 223 for operating relay 206; and connects ground through its inner upper front contact, conductor 237, the outer upper back contact of relay 211, and through conductor 200 to sleeve terminals in the banks of selector S2 and other selectors to guard against seizure of trunk circuit T1 by any of these selectors. The operation of relay 206 closes a circuit for energizing the lower winding of polarized relay 223, and closes a circuit for operating the line relay 241 of incoming selector IS2. The energization of the lower winding of relay 223 opposes and overcomes the energization of its upper winding to actuate its armature to close the right contact. Relay 223 opens the operating circuit of relay 206 but relay 206 remains operated in a locking circuit under the control of relays 220 and 227. The aforementioned circuit for operating relay 241 is traced from ground through its right winding, conductor 239, lowermost front contact of relay 202, lower right winding of repeating coil RC2, inner lower front contact of relay 202, upper winding of relay 208, upper front contact of relay 206, resistor 203, inner upper front contact of relay 202, upper right winding of repeating coil RC2, outer upper front contact of relay 202, conductor 238, and through the left winding of relay 241 to battery. Relay 241 closes a circuit for operating relay 242.

When the subscriber at station A dials a digit of the number of the called station, relay 110 releases and reoperates in response to each dial impulse, thereby momentarily transferring the junction between the lower and middle windings of relay 150 from battery to ground to cause the release and reoperation of relay 250 of trunk circuit T2. The release of relay 110, in response to the first impulse resulting from the dialing of a digit, closes a circuit which includes the outer upper front contact of relay 131, for operating the slow-to-release relay 117. Relay 117 short-circuits the left windings of repeating coil RC1 until all of the impulses in the train have been

received by relay 110; and also short-circuits the upper winding of relay 108 but without useful function on a call outgoing from trunk circuit T1. Being slow-to-release, relay 128 remains operated while relay 110 is responding to dial impulses. The release and reoperation of relay 250 of trunk circuit T2 in response to each dial impulse received by relay 110 of trunk circuit T1, causes the release and reoperation of relay 232. Each release of relay 232 causes discharge of condenser 233 and the reoperation of relay 232 causes the momentary operation of relay 220 while condenser 233 is again charging. The operation of relay 220 causes the release of relay 206. The release of relay 206 opens the impulse circuit over conductors 238 and 239 and opens the circuit through the lower winding of relay 223. The lower winding of relay 223 continues to be energized while condenser 224 is charging; but when the charging current has decreased sufficiently, the upper winding of relay 223 actuates the armature to open its right contact and close its left contact. Relay 220 having released after its momentary operation, the closing of the left contact of relay 223 causes the reoperation of relay 206 and relay 206 again closes the impulse circuit and the circuit for energizing the lower winding of relay 223 so that relay 233 again closes its right contact. The reoperation of relay 206 also causes the discharge of condenser 224. The capacity of condenser 224 and the resistances of resistors 222 and 225 are of such values as to delay the release of relay 223 a definite and predetermined interval of time, so that relay 206 is released and holds open the circuit of relay 241 for an interval sufficient to insure release of relay 241 and actuation of the vertical magnet of selector IS2. Upon release of relay 232 responsive to the first release of relay 250, relay 226 is operated by its upper winding in series with the winding of relay 227. Relay 226 opens its operating circuit but locks through its lower winding under control of relay 223 and closes a circuit for operating relay 217; this circuit includes the upper front contacts of relay 227, upper front contact of relay 226, and the inner lower front contact of relay 227. As soon as relay 223 opens its right contact, relay 226 releases and opens the circuit of relay 217; but relay 217 is slow in releasing and remains operated until relay 226 releases after the last impulse in the train has been received. Each impulse of the train causes the above cycle of operations of relays 232, 220, 206, 223 and 226 to be repeated. Relay 217 short-circuits the right windings of repeating coil RC2 and the upper winding of relay 208 to reduce the impedance in the impulse circuit while each train of impulses incoming to relay 250 is being repeated by the opening and closing of the upper contacts of relay 206. Relay 227 is slow to release and since its locking circuit is closed each time relay 206 releases and since its winding is momentarily held energized in series with the upper winding of relay 226 each time relay 206 operates, relay 227 does not release while dial impulses are being received by relay 250 and repeated by relay 206.

Relay 241 of incoming selector IS2 releases and reoperates in response to each impulse of the first train repeated by the contacts of relay 206 thereby causing the brushes of selector IS2 to be selectively advanced to the desired group of terminals in usual and well-known manner. Relay 242 is slow to release and remains operated while relay 241 is responding to impulses. The brushes of switch IS2 are advanced to select an idle set of terminals in the selected group and extend the impulse repeating circuit from conductors 238 and 239 to the line relay (not shown) of the connector circuit C2. Relays 241 and 242 are thereupon released and sleeve conductor 237 is connected to holding ground potential in the connector circuit in usual manner. The last two trains of impulses repeated by relay 206 are effective to advance the brushes of connector switch C2 to establish connection with the called line L4, in usual and well-known manner. The line being idle, the usual ringing circuit is closed and when the receiver is removed at station D to answer the call, the connector C2 reverses the current through conductors 238 and 239 and the upper winding of polarized relay 208 to cause the operation of relay 208. Relay 208 disconnects ground from the lower windings of relay 250 and connects battery thereto to cause the operation of relay 150 of trunk circuit T1 as an answering supervisory signal. Relay 150 closes a circuit, which includes the front contact of relay 130, for operating relay 101; and relay 101 reverses the current through the calling line L1.

If the called subscriber returns the receiver to normal before the calling subscriber releases the connection, the resulting reversal of current by the connector circuit causes the release of relays 208, 150 and 101. When the calling subscriber returns the receiver to normal, relay 110 releases thereby reconnecting the junction between the lower windings of relay 150 to ground to cause the release of relays 250 and 232 of trunk circuit T2. The release of relay 232 causes the discharge of condenser 233. Since relay 232 does not reoperate, relays 206 and 227 release, causing the release of relay 202, and disconnecting ground from conductor 237. Relay 217 operates when relay 206 releases and releases when relay 227 releases. The release of relay 206 opens the outgoing supervisory circuit over conductors 238 and 239 to cause the release of the line relay of the connector circuit and the release of relay 208 if not already released. When the connector C2 also disconnects holding ground from sleeve conductor 237, selector IS2 is returned to normal, and trunk circuit T2 is again ready for seizure by a selector S2. The connector is returned to normal in usual manner as soon as the receiver is returned to normal at the called station. The aforementioned release of relay 110 also causes the operation of relay 117, and the successive release of slow-to-release relays 128, 131 and 129 and the release of slow-to-operate relay 130. The release of relay 131 causes the release of relay 117. Relays 131 and 129 maintain the connection of ground to the sleeve conductor 100 for an interval of time after relay 110 releases so that trunk circuit T1 cannot be again seized on another call until the selector IS2 has been restored to normal. When ground is disconnected from conductor 100, the selector S1 and line finder LF1 are restored to normal in usual and well-known manner.

On a call from station B to station C, line L2 is extended through line finder switch LF2 and by the selective operation of selector S2 under control of the dial at station B to an idle trunk circuit T2. Thereupon trunk circuit T2 operates as did trunk circuit T1, and trunk circuit T1 operates as did trunk circuit T2, on the call above described from station A to station D.

In case the trunk circuit T1 is seized by a selector S1 at about the same time that trunk circuit T2 is seized by a selector S2, relays 110, 128, 131 and 129 of trunk circuit T1 operate as hereinbefore described in about the same interval of time that relays 210, 150, 132, 127 and 102 operate due to seizure of trunk circuit T2; and relays 210, 228, 231 and 229 of trunk circuit T2 operate in about the same interval of time that relays 110, 250, 232, 227 and 202 operate due to seizure of trunk circuit T1. The operation of relay 129 closes a circuit for operating relay 111; and the operation of relay 229 closes a circuit for operating relay 211. Relays 130 and 230 are slow in operating so that relays 111 and 211 will operate and prevent the operation of relays 130 and 230. Relay 111 locks under control of relay 128, connects relay 110 directly to the calling line, connects ground to the junction between the lower windings of relay 150 to cause the release of relay 250, disconnects sleeve conductor 100 from the sleeve conductor 137 of incoming selector IS1, connects ground to conductor 114 to start the interrupter motor 115 if not already operating, closes a circuit path from tone source 113 through condenser 112 to one of the conductors of the calling line, closes a circuit for operating relay 102 if not already operated, and causes the release of relays 130, 131 and 129. A similar series of operations results from the operation of relay 211 of trunk circuit T2. Each of the calling stations is thus disconnected from the trunk so that a wrong connection does not result. When the calling subscriber at the station connected to trunk T1 returns the receiver to normal, relays 110, 128, 111 and 102 release; and when the calling subscriber at the station connected to trunk T2 returns the receiver to normal, relays 210, 228, 211 and 202 release.

In case the trunk circuits T1 and T2 are both seized at about the same time, the operating times of the various relays may be such that relay 130 of trunk circuit T1 operates before relay 111 operates or that relay 230 of trunk circuit T2 operates before relay 211 operates. In this case if relays 111 and 230 are operated, the calling station connected to trunk circuit T1 is blocked and receives a tone as above described; but the call incoming to trunk circuit T1 from trunk circuit T2 will be completed. Or if relays 211 and 130 are operated, the calling station connected to trunk circuit T2 is blocked and receives a tone but the call incoming to trunk circuit T2 from trunk circuit T1 will be completed. When the calling subscriber whose call is blocked returns the receiver to normal, the release of relay 110 or 210 causes the release of relay 128 or 228. The release of relay 128 or 228 disconnects ground from the sleeve conductor 100 or 200 and causes the release of relay 111 or 211. Relays 111 and 211 are slow in releasing to insure release of the selector S1 and line finder LF1 or selector S2 and line finder LF2 before reconnecting conductor 100 or 200 to ground and to the sleeve conductor 137 or 237 of the associated incoming selector IS1 or IS2.

From the foregoing description, it is apparent that the trunk circuit at the called end of the trunk is restored to normal by the successive release of two slow-to-release relays,—for instance, relay 227 of trunk circuit T2 and the release relay of the associated connector; whereas the trunk circuit at the calling end is not restored to normal until completion of the successive release of three slow-to-release relays,—for instance, relays 128, 131 and 129 of trunk circuit T1. The trunk circuit at the called end may, therefore, be again seized on a second call before the trunk circuit at the calling end of the first call has restored to normal. In this case, operation of the composite signaling relay, 150 or 250, before the near trunk circuit has been restored to normal causes the operation of relays 132 and 111, or relays 232 and 211, in multiple. Relay 111, or 211, locks under control of relay 129, or 229, and disconnects ground from the sleeve conductor 100, or 200, to allow the line finder and first selector switches used on the first call to restore to normal. When relay 129, or 229, releases, relay 111, or 211, releases and the sleeve conductor 100, or 200, is then connected to the sleeve conductor of the associated incoming selector to guard against seizure by one of the first selectors. The second call is thereupon completed by operation of the incoming selector and a connector at the one end of the trunk under the control of the dial at the calling station at the other end of the trunk.

What is claimed is:

1. In a telephone system, subscribers' lines, a two-way trunk arranged for composite signaling thereover, means comprising a selector switch for connecting a calling line to said trunk, means comprising another selector switch for connecting said trunk to a called line, means responsive to seizure of said trunk for marking said trunk busy at both ends, and means at each end of the trunk and controlled by the calling subscriber for terminating the marking of said trunk as busy, said means being effective to terminate the busy marking of said trunk at the end to which the calling line is connected after the marking of said trunk as busy is terminated at the end to which the called line is connected.

2. In a telephone system, subscribers' lines, a two-way trunk arranged for composite signaling thereover, means comprising a selector switch for connecting a calling line to said trunk, means comprising another selector switch for connecting said trunk to a called line, means responsive to seizure of said trunk for marking said trunk busy at both ends, means responsive to the release of the connection by the calling subscriber for terminating the marking of said trunk as busy and for causing the return of said selector switches to normal, and means for delaying the return of the switch through which the calling line is connected to said trunk until a sufficient interval of time has elapsed for said switch through which the trunk is connected to the called line to have been restored to normal.

3. In a telephone system according to claim 2, means responsive to seizure of said trunk at the end connected to said called line for temporarily interrupting the marking of the trunk as busy at the end connected to said calling line if the last-mentioned seizure occurs prior to the release of the switch through which said calling line is connected to the trunk.

4. In a telephone system, subscribers' lines, a two-way trunk, means comprising a selector switch for connecting a calling line to said trunk, means comprising another selector switch for connecting said trunk to a called line, means responsive to seizure of said trunk for marking said trunk busy at both ends, means at each end of said trunk effective upon simultaneous connection of calling lines to both ends of said trunk for preventing the connection of said trunk to a called line at either end, means at one end of the trunk for transmitting to a calling line a signal indicating that the call cannot be completed

due to seizure of the trunk at the other end, and means at each end of the trunk and controlled by the calling subscriber for terminating the marking of said trunk as busy, said means being effective to terminate the busy marking of said trunk at the end to which the calling line is connected after the marking of said trunk as busy is terminated at the end to which the called line is connected.

5. In a telephone system, subscribers' lines, a two-way trunk, means comprising a selector switch for connecting a calling line to said trunk, means comprising another selector switch for connecting said trunk to a called line, means responsive to seizure of said trunk for marking said trunk busy at both ends, means at each end of said trunk effective upon simultaneous connection of calling lines to both ends of said trunk for preventing the connection of said trunk to a called line at either end, means at one end of the trunk for transmitting to a calling line a signal indicating that the call cannot be completed due to seizure of the trunk at the other end, like signaling means at the other end of the trunk, and means at each end of the trunk and controlled by the calling subscriber for terminating the marking of said trunk as busy, said means being effective to terminate the busy marking of said trunk at the end to which the calling line is connected after the marking of said trunk as busy is terminated at the end to which the called line is connected.

6. In a telephone system, subscribers' lines, a two-way trunk arranged for composite signaling thereover, means comprising a selector switch for connecting a calling line to one end of said trunk, like means for connecting a calling line to the other end of said trunk, means comprising a selector switch for connecting said one end of the trunk to a called line, like means for connecting the other end of the trunk to a called line, means responsive to seizure of said trunk for marking it busy at both ends, means responsive to release of the connection by the calling subscriber for terminating the marking of said trunk as busy and for causing the return to normal of the selector switches through which the trunk is connected to the calling and called lines, and means for delaying the return of the one of the last-mentioned switches which connects the calling line to the trunk until a sufficient interval of time has elapsed for the return to normal of the other one of the last-mentioned switches.

7. In a telephone system according to claim 6, means responsive to seizure of said trunk at the end connected to said called line for temporarily interrupting the marking of the trunk as busy at the end connected to said calling line if the last-mentioned seizure occurs prior to the release of the switch through which said calling line is connected to the trunk.

8. In a telephone system, subscribers' lines, a two-way trunk, means comprising a selector switch for connecting a calling line to said trunk, means comprising another selector switch for connecting said trunk to a called line, means responsive to seizure of said trunk for marking said trunk busy at both ends, and means at each end of the trunk and controlled by the calling subscriber for terminating the marking of said trunk as busy, said means comprising three slow-to-release relays released in succession at the end of the trunk to which the calling line is connected and comprising only two slow-to-release relays released in succession at the end of the trunk to which the called line is connected.

9. In a telephone system, subscribers' lines, a two-way trunk arranged for composite signaling thereover, means comprising a selector switch for connecting a calling line to said trunk, means comprising another selector switch for connecting said trunk to a called line, means responsive to seizure of said trunk for marking said trunk busy at both ends, means at each end of the trunk and controlled by the calling subscriber for terminating the marking of said trunk as busy, said means being effective to terminate the busy marking of said trunk at the end to which the calling line is connected after the marking of said trunk as busy is terminated at the end to which the called line is connected, and means effective upon simultaneous connection of calling lines to both ends of said trunk for preventing the connection of said trunk to a called line at either end and for transmitting a tone signal to each of the calling subscribers.

10. In a telephone system, subscribers' lines, a two-way trunk, means comprising a selector switch for connecting a calling line to said trunk, means comprising another selector switch for connecting said trunk to a called line, means responsive to seizure of said trunk for marking said trunk busy at both ends, means responsive to the release of the connection by the calling subscriber for terminating the marking of said trunk as busy and for causing the return of said selector switches to normal, means for delaying the return of the switch through which the calling line is connected to said trunk until a sufficient interval of time has elapsed for said switch through which the trunk is connected to the called line to have been restored to normal, and means responsive to seizure of said trunk at the end connected to said called line for temporarily interrupting the marking of the trunk as busy at the end connected to said calling line if the last-mentioned seizure occurs prior to the release of the switch through which said calling line is connected to the trunk.

11. In a telephone system, subscribers' lines, a two-way trunk, means comprising a selector switch for connecting a calling line to one end of said trunk, like means for connecting a calling line to the other end of said trunk, means comprising a selector switch for connecting said one end of the trunk to a called line, like means for connecting the other end of the trunk to a called line, means responsive to seizure of said trunk for marking it busy at both ends, means responsive to release of the connection by the calling subscriber for terminating the marking of said trunk as busy and for causing the return to normal of the selector switches through which the trunk is connected to the calling and called lines, means for delaying the return of the one of the last-mentioned switches which connects the calling line to the trunk until a sufficient interval of time has elapsed for the return to normal of the other one of the last-mentioned switches, and means responsive to seizure of said trunk at the end connected to said called line for temporarily interrupting the marking of the trunk as busy at the end connected to said calling line if the last-mentioned seizure occurs prior to the release of the switch through which said calling line is connected to the trunk.

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