

March 15, 1932.

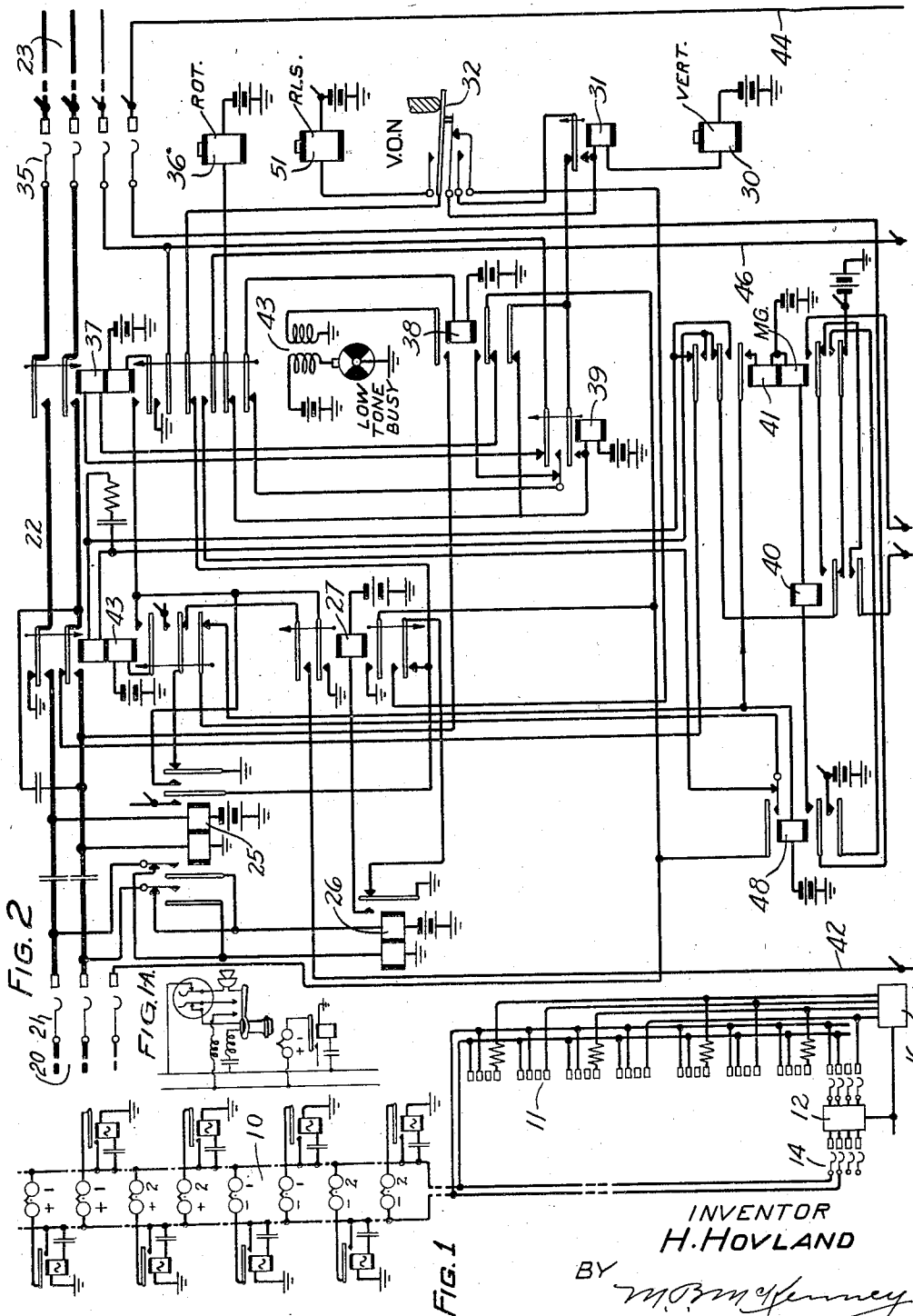
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1,849,088

TELEPHONE SYSTEM

Filed May 14, 1930

3 Sheets-Sheet 1



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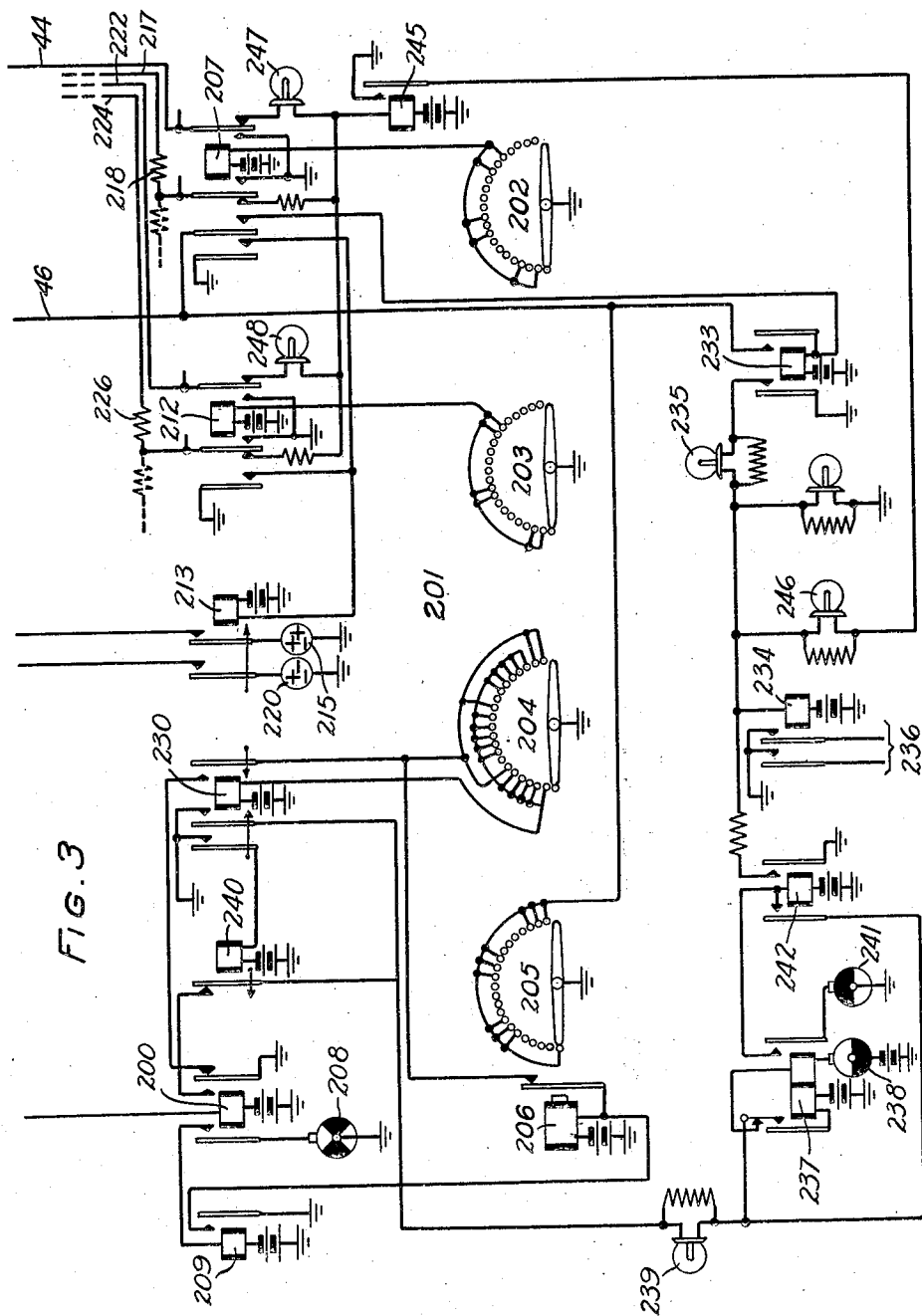
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TELEPHONE SYSTEM

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

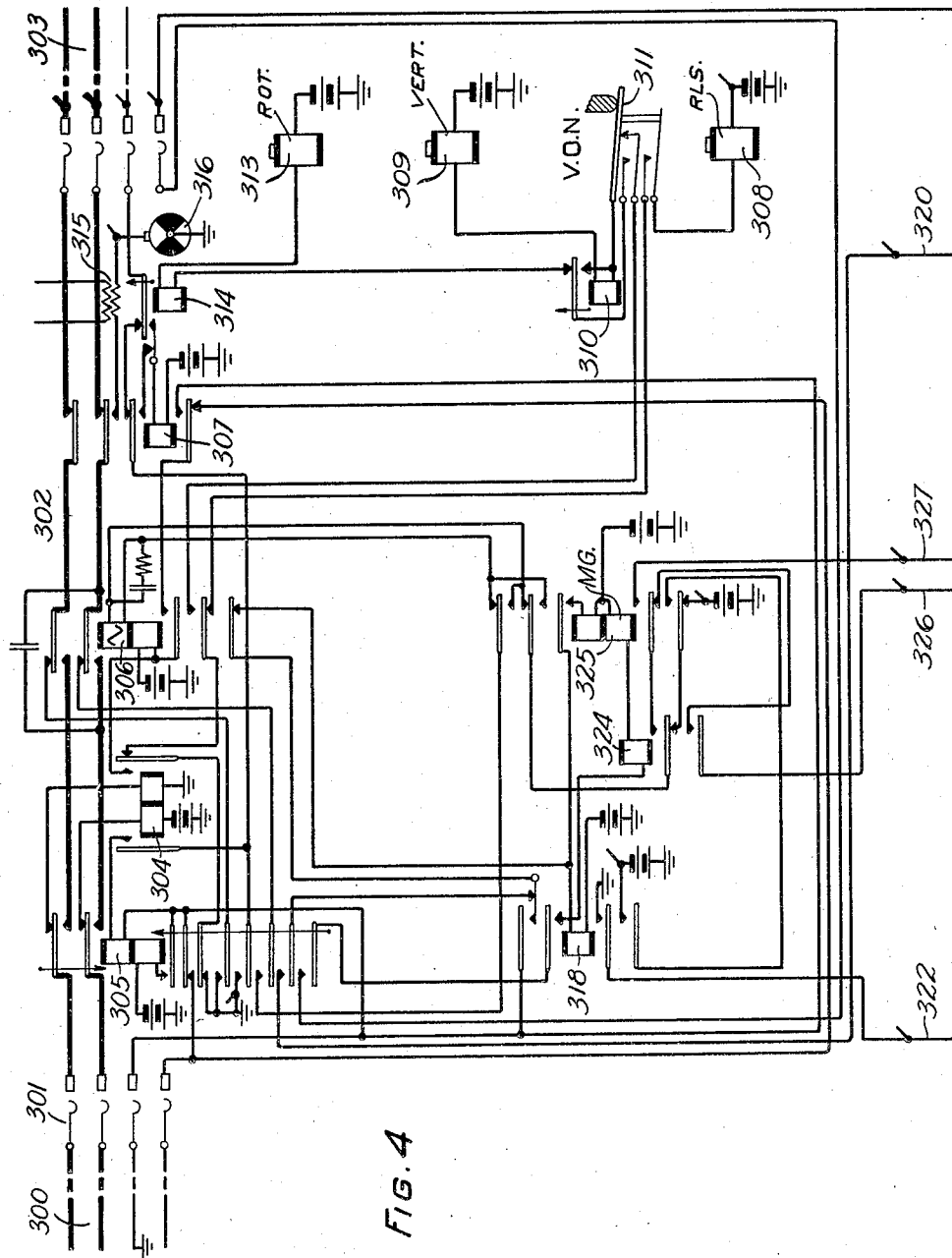


FIG. 4

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TELEPHONE SYSTEM

Application filed May 14, 1930. Serial No. 452,156.

This invention relates to telephone systems, and in particular to party line telephone systems.

An object of the invention is to simplify and improve the signaling of party line subscribers.

Heretofore subscribers on a party line have been signaled by having a connector switch select the party line through different corresponding terminal points and thus cause interrupter devices common to a plurality of connectors to be actuated to transmit code signals comprising one or more impulses of either polarity or of different frequencies to the line depending on the terminal point selected. It has also been the practice to trans-

pose the talking conductors at the terminal points to cause signals to be transmitted over the tip or the ring conductor to actuate correspondingly responsive signaling apparatus at the subscribers' stations on the line.

In my copending application, Serial No. 452,155, filed on the same date as this application is disclosed a system of this kind in which signal current interrupters are individual to the connectors and common control means are provided whereby when a connector seizes the party line through any of the terminal points the individual interrupter is controlled to transmit the code signals.

A feature of this invention is a system of the same type as disclosed in the above mentioned copending application, in which an interrupter in the form of a marginal relay is provided for each connector with means whereby said relay is controlled to transmit different kinds of signaling currents for the code signals depending on the terminal point through which the connection is established.

Another feature is a system whereby the connections to this marginal relay from the common control means are not completed until the common control means is in condition to control the relay to transmit complete code signals, regardless of what time the connector completes the connection to the desired line and in case said common means is in use by another connector.

This invention has been illustrated in the accompanying drawings in which:

Fig. 1 shows in general the circuit connections for an eight party subscriber's line;

Fig. 1A shows one party line subscribers' telephone circuit in detail.

Fig. 2 shows a connector circuit embodying the features of this invention with a selector switch in diagrammatic form for connecting a calling subscriber through the connector to a called subscriber's line;

Fig. 3 shows a circuit common to a plurality of connector circuits for supplying the four different codes required in this system; and

Fig. 4 shows a connector similar to that shown in Fig. 2 except that it may be used for extending calls from toll boards to called subscribers' lines.

Referring to Fig. 1, an eight party line 10 has been shown with the alternating current responsive relays of four subscribers connected to one conductor and the alternating current responsive relays of the other four subscribers connected to the other conductor. The ringers for these eight subscribers have also been shown with their circuits controlled respectively by these relays to connect the ringers to the line conductors. The relays may be of the general alternating current responsive type shown in the patent to Dean, 722,680 of March 17, 1903, while the ringers may be of any well known alternating current responsive type biased to respond to positive or negative ringing currents. The ringers have been marked with a plus or minus sign to indicate their operating characteristics and with a numeral 1 or 2 to indicate the code signal to which the associated subscribers will respond. In Fig. 1A is shown an ordinary subscriber's telephone circuit of the type suitable for use in party lines of the this kind with an alternating current responsive relay for closing the circuit for the associated ringer. Eight sets of multiple terminals for this line have been shown at 11 with a connector 12 in diagrammatic form having access to these eight sets of terminals. A selector 14 has been shown in diagrammatic form and this selector may be actuated to select a connector which in turn may be actuated to select one of the eight parties through a corresponding set of terminals. The code signal

to be transmitted to the desired party will then be selected and applied through the common equipment shown at 16 in diagrammatic form. The code signals will consist of one or two impulses of positive or negative ringing current transmitted over the tip or the ring conductor to control the relays to connect the ringers, and to control the ringers to respond to the proper code signal. The arrangement is such that if, for example, positive ringing current is applied to the left hand conductor in Fig. 1 the four relays connected to this conductor will respond to the alternating current component of the ringing signal to close the ringer circuit at the associated subscribers' stations. The two ringers marked with a plus sign will then respond to this positive ringing current signal while the ringers marked with a minus sign will remain unresponsive. Depending then on whether the code signal consists of one or two impulses a one ring code signal will be answered only by the subscriber to which this code signal has been assigned whereas the subscriber assigned to respond to a two ring code signal will ignore the one ring code signal and vice versa.

Detailed descriptions will now be made of the functions of this system, in connection with a call from a subscriber on line 20 through the selector 21 and connector 22 to a subscriber on party line 23. A description will also be made of a call over the circuits shown in Fig. 4 from a toll board connected through conductors 300 and over selector 301 and connector 302 to line 303 of a desired subscriber, with this line considered as a party line.

Referring now to the first type of connection, Figs. 2 and 3 may be considered connected together with Fig. 2 above Fig. 3. When a subscriber on line 20 has selected through selector 21 connector 22 a circuit is completed for the operation of the connector 22 to select the desired subscriber's line. This circuit will be completed from the loop of the calling subscriber's dial through the tip and ring conductors over the make-before-break contacts of relay 25, winding of relay 26 to battery and ground respectively. Relay 26 is thereby operated and an obvious circuit completed for the operation of relay 27. Relay 27 in operating connects at its inner lower armature and front contact a ground for the purpose of holding the preceding switches used in this connection actuated. This relay also opens the circuit for the release magnet at its lower outer armature and back contact and prepares an operating circuit for the vertical magnet 30 and a number of other circuits which will be described hereinafter. Relay 27 being slow to release remains operated during the sending of the impulses for controlling the connector. The first release of relay 26 in response to the im-

pulses from the calling subscriber's station, closes a circuit for the vertical magnet 30 from battery, winding of this magnet, winding of the change-over relay 31, lower contacts of vertical off-normal contacts 32, lower outer armature and front contact of relay 27, armature and back contact of relay 26 to ground. Both the vertical magnet and the change-over relay operate and change-over relay 31 which is slow in releasing will remain operated during the succeeding impulses transmitted to the vertical magnet 30. When the vertical magnet has taken one step the original pulsing circuit is changed to pass through the lower make contacts of the vertical off-normal contacts 32 and the armature and front contact of relay 31. The succeeding impulses now cause the vertical magnet to advance the brushes 35 of the connector to the proper level in which the desired subscriber's line is located.

When the pulses cease relay 31 releases and prepares a circuit for the rotary magnet 36 from battery winding of magnet 36, fourth lower armature and back contact of relay 37, lower outer armature and back contact of relay 31, armature and back contact of relay 31, lower make contacts of the vertical off-normal contacts 32, lower outer armature and back contact of relay 27 to ground at the armature and back contact of relay 26 when this relay releases in response to the first impulse. Relay 39 also operates on the first release of relay 26 over a circuit from battery and the winding of this relay in parallel with the rotary magnet 36 over the same circuit traced for this magnet. When the relay 39 operates the circuit for this relay will extend over its upper inner armature and front contact independent of the connection through the lower outer armature and back contact of relay 38. Relay 39 is also slow in releasing so that it will remain operated during the sending of the second series of impulses.

Relay 39 now closes a circuit for testing the called line. If the line called is busy, ground will be found on the sleeve terminal of this line to cause the operation of relay 38 before relay 39 releases after the last digit has been transmitted. This circuit may be traced from battery; winding of relay 38, lower outer armature and back contact of relay 37, upper outer armature and front contact of relay 39 to ground at the sleeve conductor of the busy line and when relay 39 releases relay 38 will be locked through the make-before-break of the relay 39 and the inner lower armature and front contact of relay 38 to ground at the lower inner armature and front contact of relay 27. Relay 38 in operating applies a busy tone from the source 43 through the upper armature and front contact of relay 38 to the ring conductor back to the calling subscriber's line.

If on the other hand the called line is idle, relay 39 will release without causing the operation of relay 38 and the connection completed for the application of ringing current.

5 The release of relay 39 closes a circuit for the partial operation of relay 37 from battery through the winding of the usual cut-off relay of the called line over the sleeve conductor, upper outer armature and back contact of
10 relay 39, upper winding of relay 37, lower inner armature and back contact of relay 38 to ground at relay 27. This ground will serve as a guard potential on the sleeve terminal for the called line until relay 37 has
15 fully operated. The partial operation of relay 37 closes a circuit, from battery, the lower winding and lower inner armature and front contact of relay 37 to ground at the upper inner armature and front contact of relay 27
20 to cause relay 37 to fully operate and close connections through the remaining contacts. Relay 37, thereby, establishes connections for ringing the called subscriber as will herein-
after be described.

25 When an idle connector has been found and actuated to select the set of terminal of the desired party line subscriber the common equipment shown in Fig. 3 is actuated to transmit the proper code signal. It should
30 be observed that on the operation of relay 27 a circuit was completed for the starting of this common control equipment in Fig. 3 to function to supply the ringing signal. This circuit may be traced from battery winding
35 of start relay 200, lead 42, upper outer armature and front contact of relay 27, middle lower armature and back contact of relay 43, outer right-hand armature and back contact of relay 25 to ground. In Fig. 3 the switch
40 201 is provided with terminal banks 202 to 205 the associated brushes of which are driven in a step-by-step manner by the stepping magnet 206 for the purpose of controlling the code signaling as well as the type of
45 ringing current to be applied. When relay 37 operates, connector 22 in conjunction with the common control equipment will be actuated to select the proper signaling code. In case the fourth terminal of terminals 23 is
50 associated through lead 44 with the right-hand armature of relay 207 this relay will control the signaling. On the operation of relay 200 a circuit is completed from interrupter 208 for the operation of relay 209 under
55 control of the interrupter to actuate the stepping magnet 206 to step the switch 201 at the rate of one step for each operation of the magnet 205 which, as shown, is controlled by relay 209 over an obvious circuit. As noted,
60 the brush of bank 202 will close circuits for relay 207 as the brush travels over the first and third terminal, the eighth and tenth terminal, the fifteenth and seventeenth terminal for each revolution of the brush and thus
65 cause relay 207 to be actuated twice at short

intervals three times for each revolution. These operations of relay 207 close a circuit from ground to lead 44 at these intervals.

When now relay 37 operates a circuit is completed for conductor 46 to cause the oper- 70
ation of relay 48 provided that the switch 201 is in normal position, or in positions 5, 6 or 7, 12, 13 or 14, or 19, 20 or 21. Assuming
75 that switch 201 is in normal position this circuit may be completed from battery winding of relay 48, lower outer armature and back contact of relay 43, make-before-break
80 contacts of relay 48, fourth lower armature and front contact of relay 37, conductor 46, brush of bank 205 in normal position to ground. Relay 48 in operating provides a
85 locking circuit for itself independent of this ground over lead 46 to the upper armature and front contact of relay 48 to ground at relay 27. When the selector 201 has taken
90 one step the ground on conductor 46 is moved so that if any other connector reaches the ringing stage at this time, its relay corresponding to relay 48 will not operate and
95 therefore prevent ringing until the next cycle of the ringing interrupter is reached, that is, at the above mentioned positions for bank 205. Relay 207 is now operated from the
100 brush of bank 202 in positions 1 and 3, 8 and 10, 15 and 17, to operate this relay to control the transmission of a code of two impulses of ringing current at fixed inter-
105 vals. On each operation of relay 207 a circuit is completed for the operation of relays 40 and 41 as follows: from battery, lower winding of relay 41, winding of relay 40,
110 lower inner armature and front contact of relay 48, the fourth terminal of line 23, conductor 44, right-hand armature of relay 207 to ground. It will be noted that the operation of relay 207 also causes a circuit to be
115 closed for relay 213 to operate this relay each time relay 207 is operated. Relay 213 is slow to operate to permit the prior operation of relays 40 and 41. The operation of relays
120 213, 40 and 41 now causes the transmission of a two-ring code signal to the called line over a circuit as follows: from the positive ringing source 215, inner left-hand armature and
125 front contact of relay 213, inner lower armature and front contact of relay 41, inner lower armature and front contact of relay 40, second upper armature and front contact of relay 41, upper winding of relay 43, upper inner armature and front contact of relay
130 41, upper inner armature and back contact of relay 43, inner upper armature and front contact of relay 37 to the ring conductor of the party line 23 to the called subscriber's relay. The called subscriber's alternating current responsive relay will now respond to this ringing signal to connect the associated ringer across the line so that this ringer may respond to the positive two ring code signal. It should, of course, be observed

that the relays of all four subscribers' sets connected with this conductor will respond, but the positive two ring code signal will only cause the ringers responsive to a positive ringing signal to operate and a two ring code signal will be answered only by the subscriber to whom this code signal has been assigned whereas the subscriber assigned to respond to a one ring code signal will ignore the two ring code signal.

If the connector 22 had selected terminals in which the tip and ring conductors had been reversed the relays of two of the subscribers having them connected to the other conductor would have responded and the subscriber to which the two-ring positive code signal had been assigned would have answered the call. In case the subscriber assigned to a two-ring code and having his relay responsive to negative ringing current, had been desired, the connector would have selected another set of terminals in which the fourth terminal is connected to lead 217. In this case the circuits for relays 40 and 41 would have been completed to ground through a resistance 218. As relay 41 is marginal it would not have operated and therefore current from the negative source 220 would have been supplied through the outer left-hand armature and front contact of relay 213, lower outer armature and front contact of relay 40, lower inner armature and back contact of relay 41, inner lower armature and front contact of relay 40, middle upper armature and back contact of relay 41, upper winding of relay 43, upper outer armature and back contact of relay 41 over the ring conductor to the called subscriber's relay. On the other hand, if the connector had selected a set of terminals in which the lead 222 had been connected to the fourth terminal a different code signal would have been transmitted. In this case relay 212 would have been operated in positions 1 to 2, 8 to 9 and 15 to 16, so as to cause a single signaling impulse to be transmitted at these three sets of positions. In this case both relays 40 and 41 would have operated and a positive ringing signal of one impulse would have been repeatedly transmitted from source 215 to the called subscriber over the circuit heretofore traced when both relays are operated. And finally, if lead 224 had been connected to the fourth terminal of the set selected, relay 41 would not have operated due to the resistance 226 being inserted in the circuit completed to ground through the inner left-hand armature and front contact of relay 212 and therefore negative ringing current from source 220 would have been transmitted to the party line over the circuit hereinbefore traced when only relay 40 operates.

It is therefore evident that depending on how the fourth terminals are connected and whether the tip and ring conductors have

been reversed, the eight subscribers' bells on a party line may be actuated by distinctive ringing signals comprising one or two impulses from sources 215 or 220. As shown, the ringing current passes through the upper winding of relay 43 and when the called subscriber answers this relay operates to establish the connection, through tip and ring conductors. Relay 43 is first partially operated to close a circuit for the full operation of this relay through its lower winding from battery, lower inner armature and front contact to ground at the upper inner armature and front contact of relay 27. When relay 43 operates fully the ringing circuit is opened at the upper inner armature and back contact and the connection is cut through from the calling subscriber to the called subscriber over the upper armatures and front contacts of this relay. The operation of relay 43 also opens the holding circuit for relay 48 which is now released and opens the circuit over conductor 42 to release relay 200 which thereby causes switch 201 to be released from the control connector 22.

When relay 200 is released switch 201 will be returned to normal. Relay 230 is operated over an obvious circuit if the switch is in positions 1 to 5, 8 to 12 or 15 to 19, when relay 200 is released. Under these circumstances a circuit for the operation of the stepping magnet 206 will therefore be completed from battery winding of this magnet and its self-interrupting contacts, right-hand armature of relay 230, right-hand armature and back contact of relay 200 to ground to cause switch 201 to be advanced to position 6, 14, or 20 depending on the position in which the switch is when relay 200 releases. When the switch arrives to either one of these positions the self-interrupting circuit for magnet 206 will again be completed through the brush of bank 203 to ground to advance the switch to the nearest normal position. It should be noted that in case this circuit has been closed to advance the switch to position 7 or 14, this self-interrupting circuit will not be opened in these positions and that in case the switch has been advanced to position 21 it will again be advanced to the zero position. The switch will then remain in position 7, 14, or 0 until again taken for use. This switch has therefore, three normal positions and may be started from either of these positions by the ground provided on the brush of bank 20 to lead 46.

When the conversation is completed and if the called subscriber disconnects before the calling subscriber's relay 25 will release and when the calling station disconnects relays 26 and 27 are released causing relays 43, 37 and 42 to release. The releasing magnet 51 will then have its energizing circuit completed to return the switch to normal. This circuit may be traced from battery winding

of the magnet, vertical off-normal contacts of relay 32, third lower armature and back contact of relay 37, lower outer armature and back contact of relay 27 to ground at the armature and back contact of relay 26. When the switch has returned to normal, the vertical off-normal contacts 32 open the circuit for magnet 51.

If the calling subscriber disconnects before the called subscriber, relays 26 and 27 will release whereas relay 25 will remain operated to hold relays 43 and 37 thus maintaining the holding circuit for relay 25 until the called subscriber hangs up his receiver. However, before the release of relay 27 a momentary circuit is completed for relay 39 as follows: from battery, winding of this relay lower outer armature and back contact of relay 38, armature and front contact of relay 31, vertical off-normal contacts 32, lower outer armature and front contact of relay 27, armature and back contact of relay 26. Relay 39 in operating momentarily removes the ground from the sleeve of selector 21 to cause the preceding switches to release. When relay 27 releases, relay 39 releases and thereby again applies a ground to the sleeve to guard connector 22 against seizure before its release. When the called subscriber releases, the connector returns to normal as hereinbefore described.

An alarm circuit arrangement has been provided to indicate irregularities in the performance of the common control equipment. For example, if for some reason or another a false ground connection is made on lead 46 while relay 207 is operated a circuit will be completed for the operation of relay 233. This relay will operate and lock itself to this ground over its right-hand armature and front contact. A circuit is thereby closed for the operation of relay 234 and the lighting of lamp 235. Relay 234 closes an alarm circuit connected at 236, not shown, and the lighting of the lamp will indicate that the system had not functioned properly in this respect. If the switch 201 fails to operate when the starting relay 200 is operated a circuit will be completed for the operation of relay 237, when interrupter 238 closes a circuit to battery. This circuit may be traced from battery, interrupter 228, right-hand winding of relay 237, make-before-break contacts of this relay, lamp 239, armature and back contact of relay 240 to ground at the right-hand armature and front contact of relay 200. Then when the interrupter 241 applies ground to the right-hand armature of relay 237 a circuit is completed for the operation of relay 242 which in turn closes a circuit for the operation of relay 234 to establish the alarm circuit. Relays 242 and 237 provide a locking circuit for themselves to the circuit established by relay 200. If the selector 201 fails to return to any of its normal positions

when relay 200 releases, relay 230 will remain operated and cause an alarm circuit to be closed by the operation of relays 237, 242 and 234 and the lamp 239 will be lighted to indicate this trouble. If there is a false ground connection on any of the leads connected to the fourth terminals of party lines such as leads 44, 217, 222 and 224, relay 245 will operate to light lamp 246 and operate relay 234 for establishing of the alarm circuit. Lamp 247 or 248 will indicate the location of the trouble.

Referring to Fig. 4, this figure shows a connector that may be used in extending calls from a toll board over a trunk 300 through the selector 301 to a party line 303. This connector circuit may be associated with the control circuit shown in Fig. 3 in the same manner as the connector in Fig. 2 is associated with this circuit. When selector 301 seizes connector 302, ground is placed on the sleeve lead and through the second lower armature and back contact of relay 105. This ground is thereby also placed on the fourth lead to the selector 301 for purposes as will hereinafter be explained. Relay 304 is also operated on the seizure of the connector from battery and ground through the two windings of this relay, upper armatures and back contacts of relay 305, tip and ring conductors, selector 301 trunk 300 through the operator's dial at the toll board. Relay 304 in operating now closes a circuit for relay 306 from battery, lower winding of this relay, right-hand armature and front contact of relay 304, second lower armature and back contact of relay 305 to ground. Relay 306 in operating provides a locking circuit for itself from battery, the lower winding and lower armature and front contact of relay 306, lower armature and back contact of relay 307, second lower armature and back contact of relay 305, to the sleeve terminal of selector 301 to ground. Relay 306 opens a circuit for the release magnet 308 at the second lower armature and back contact and prepares a pulsing circuit for the vertical magnet 309. On the first release of pulsing relay 304 in response to the first series of impulses for the control of this switch a circuit will be completed for the vertical magnet and the change-over relay 310 as follows: Battery, windings of magnet 309 and relay 310 in series, vertical off-normal contacts 311, second lower armature and front contact of relay 306, right-hand armature and back contact of relay 304 to ground at the second lower armature and back contact of relay 305. Relay 310 is slow in releasing so that it will remain operated during the sending of the impulses to the vertical magnet. When relay 310 operates the circuit for the succeeding impulses to the vertical magnet will pass through the armature and front contact of

relay 310 and made contacts of vertical off-normal contacts 311.

After the first series of impulses have been received to raise the brushes of switch 302 to the level in which the desired subscriber's line is located, relay 310 releases and transfers the pulsing circuit to the rotary magnet 313. This circuit will also pass through the winding of relay 314 as follows: battery, windings of magnet 310 and relay 314 in series, armature and back contact of relay 310, vertical off-normal contacts of relay 311, second lower armature and front contact of relay 302, right-hand armature and back contact of relay 304 to ground at the second lower armature and back contact of relay 305. The second series of impulses will now cause the operation of relay 314 and the rotary magnet will advance the brushes of switch 302 to the desired subscriber's party line terminals.

Relay 314 is slow in releasing and will remain operated for a short period after the pulsing is completed to prepare a busy test circuit. If the selected line is busy there will be a ground connection on the sleeve terminal to cause the operation of relay 307 before relay 314 releases. This circuit may be traced from battery, winding of relay 307, armature and front contacts of relay 314 to ground on the sleeve. Relay 307 prepares a locking circuit for itself which will be closed through the make-before-break contacts of relay 314 when it releases, upper inner armature and front contact of relay 307, left-hand armature and front contact of relay 304, upper winding of relay 305, to ground on the sleeve of selector 301. Relay 305 is thereby operated partially to close its operating circuit from battery through its lower winding and lower inner armature and front contact to ground on the sleeve of selector 301. Relay 305 is thereby completely energized to operate all its armatures. The locking circuit for relay 307 will now receive its ground connection from the ground at the fourth lower armature and front contact of relay 305. The operation of relays 307 and 305 also changes the holding circuit for relay 306 which now extends from battery, lower winding of relay 306, lower inner armature and front contact of this relay, lower armature and front contact of relay 307, to ground on the sleeve of selector 301. The operation of relay 305 opens at the second lower armature and back contact the connection to ground for the control lead causing functions to take place at the toll board to disconnect the trunk from the dial circuit and extend it to a cord circuit. The toll board circuits form no part of this invention and have therefore not been shown. Relay 305 in operating its upper armatures opens the circuits for the pulsing relay 305 and the operation of relays 305, 307 and 306 apply a busy tone from the alarm circuit indicated at 315 and 316 over

the second upper armature and front contact of relay 307, upper inner armature and front contact of relay 306, upper inner armature and front contact of relay 305 to the tip conductor of the selector 301 to cause the usual supervisory relay of the cord circuit at the toll board to function to operate a lamp to indicate that the called line is busy. This lamp will be alternately lighted and extinguished due to the interrupter shown at 316 for the alternate opening and closing of the busy signal circuit.

If the desired line is idle, there will be no ground connection on the sleeve thereof and relay 307 will therefore not be operated. A circuit will instead be established when relay 314 is released for the operation of relay 305 from battery through the winding of the usual cut-off relay of the desired line (not shown) over the sleeve conductor, and back contact of relay 314, upper inner armature and back contact of relay 307, left-hand armature and front contact of relay 304, upper winding of relay 305 to ground on the sleeve conductor. This causes relay 305 to be partially operated and be completely operated through the circuit hereinbefore traced to the lower inner armature and front contact to the sleeve conductor. Relay 305 in operating opens the connection to ground for the control lead to transfer the trunk to the operator's cord circuit as hereinbefore mentioned. Relay 305 opens the circuit for relay 304 and transfers the trunk from the relay 304 to the transmission circuit of the connector and prepares the circuits for ringing. Relay 305 provides a locking circuit as hereinbefore mentioned through its secondary winding to the ground sleeve to cause the release of relay 304.

When the trunk circuit is transferred to the cord at the operator's toll board it also replaces a ground on the control lead through the fourth conductor before relay 306 has time to release. Hence relay 306 is held operated from this ground connected through the lower armature and back contact of relay 307, lower armature and front contact of relay 306 and its lower winding to battery. When now the operator desires to ring the subscriber this ground on the control lead is removed permitting relay 306 to release. Relay 306 in releasing closes a circuit for the operation of relay 318 from battery winding of relay 318, lower outer armature and back contact of relay 306, make-before-break contacts of relay 318, sixth lower armature and front contact of relay 305, lead 320 which corresponds to lead 45 Fig. 1 and to ground at the brush of bank 205 of switch 201, provided this switch is in any of its normal positions. If this is the case relay 318 operates and provides a locking circuit for itself through its upper outer armature and front contact directly to the ground on the sleeve. Relay 318

closes a connection to ground for the start lead 322 which corresponds to the start lead from Fig. 1 and thereby causes the operation of the start relay 200 in Fig. 3 to start the switch 201 to supply the proper code signal.

Depending now on which lead 44, 217, 222 or 224 is connected from the control circuit to the fourth terminal relays 324 and 325 relay 324 alone will be operated to transmit the desired signal in the same manner as relays 40 and 41 were operated in Fig. 2. The signals in this case will be received over lead 326 or 327, which may be connected through the front contacts and armatures of relay 213 to sources 220 and 215 respectively. It should be noted in this case that the circuits from the sources 220 and 215 will pass through the upper winding of relay 306 so that this relay will serve as the trip relay. When now the called subscriber answers a call by removing the receiver from the hook, relay 306 will be operated to open the signaling circuit and cause the release of relays 325, 324 and 318. The release of relay 318 stops the control equipment from transmitting signals and the release of relay 200 returns the equipment to the next normal position as hereinbefore described. When relay 306 operates the talking circuit is completed from the toll board to the desired subscriber's line over the upper armatures and front contacts of this relay. After the conversation is completed and the called subscriber hangs up his receiver and the toll operator abandons the call, the selector 301 releases causing relays 305 and 303 to release which in turn prepare the circuit for energizing the release magnet 308 from battery winding of this magnet, made contacts of the vertical off-normal contacts 311, second lower armature and back contact of relay 306, right-hand armature and back contact of relay 304 to ground to the second lower armature and back contact of relay 305.

It should be understood that while the invention has only been disclosed in connection with two connector circuits and a control circuit it could readily be applied to a plurality of other systems without departing from the spirit thereof.

What is claimed is:

1. In a telephone system, a line, a switch, sources of signaling current, current interrupting devices associated with said switch, a plurality of terminal points through which said switch has access to said line, and control means responsive to the establishing of a connection from the switch to the line for actuating said devices to apply signaling current to said line in a particular code of a particular kind and to one side or the other of the line depending on the terminal point employed in the establishing of the connection.

2. In a telephone system, a line, a plurality of switches, means for establishing connections

from any one of said switches to said line, means including two relays associated with each switch for applying code signals to said line, a common control device for controlling said relays, and means for selectively determining the type of code signals to be applied.

3. In a telephone system, a line, a plurality of switches, means for establishing connections from any one of said switches to said line, means including two relays associated with each switch for applying code signals to said line, a common control device for controlling said relays, means for selectively determining the type of code signals to be applied, and means for preventing the application of a selected code signal except at the beginning of the code.

4. In a telephone system, a line, a switch, means for establishing connections between said switch and line over different paths, sources of signaling current, a current interrupter associated with said switch, another current interrupter in the form of a marginal relay associated with said switch, and means responsive to the establishing of a connection to said line for controlling said interrupters to transmit different code signals from said sources of said line depending on the path over which the connection is established.

5. In a telephone system, a line, a switch, sources of signaling current, two relays associated with said switch, a plurality of terminal points through which connections may be established to said line, and means responsive to the establishing of said connections for controlling said relays to transmit different current code signals over said line depending on the terminal point through which the connections are made.

6. In a telephone system, a switch, a line, two sources of signaling current, two relays associated with said switch, a plurality of terminal points in said switch through which connections may be made to said line, and means responsive to the establishing of such connections for controlling said relays to transmit code signals comprising combinations of one or more impulses of current from either source depending on the terminal point through which said connections are established.

7. In a telephone system, switches, lines, sources of signaling current, two relays associated with each switch, a plurality of terminal points for each line in each switch, a control circuit for each set of relays, a switching device common to said switches for controlling the control circuit for said relays, and means responsive to the establishing of a connection from a switch to a line for actuating said common switching device to control the control circuit to actuate said relays to transmit code impulses to said line, said signals comprising one or more impulses from

either of said sources of current transmitted over either of the talking conductors in said line with the character of the code signals determined by the terminal point through which the connection is established.

8. In a telephone system, switches, lines, sources of signaling current, two relays associated with each switch, a plurality of terminal points for each line in each switch, a control circuit for each set of relays, a switching device common to said switches for controlling the control circuit for said relays, means responsive to the establishing of a connection from a switch to a line for actuating said switching device to control the control circuit to actuate said relays to transmit code impulses to said line, said signals comprising one or more impulses from either of said sources of current transmitted over either of the talking conductors in said line with the character of the code signals determined by the terminal point through which the connection is established, and means for preventing said switching device from controlling said control circuit when engaged until said device is in condition to permit said relays to transmit a complete code signal in case said device is employed for control over another connection.

In witness whereof, I hereunto subscribe my name this 8th day of May, 1930.

HENRY HOVLAND.

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