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PARTY LINE TELEPHONE SYSTEM

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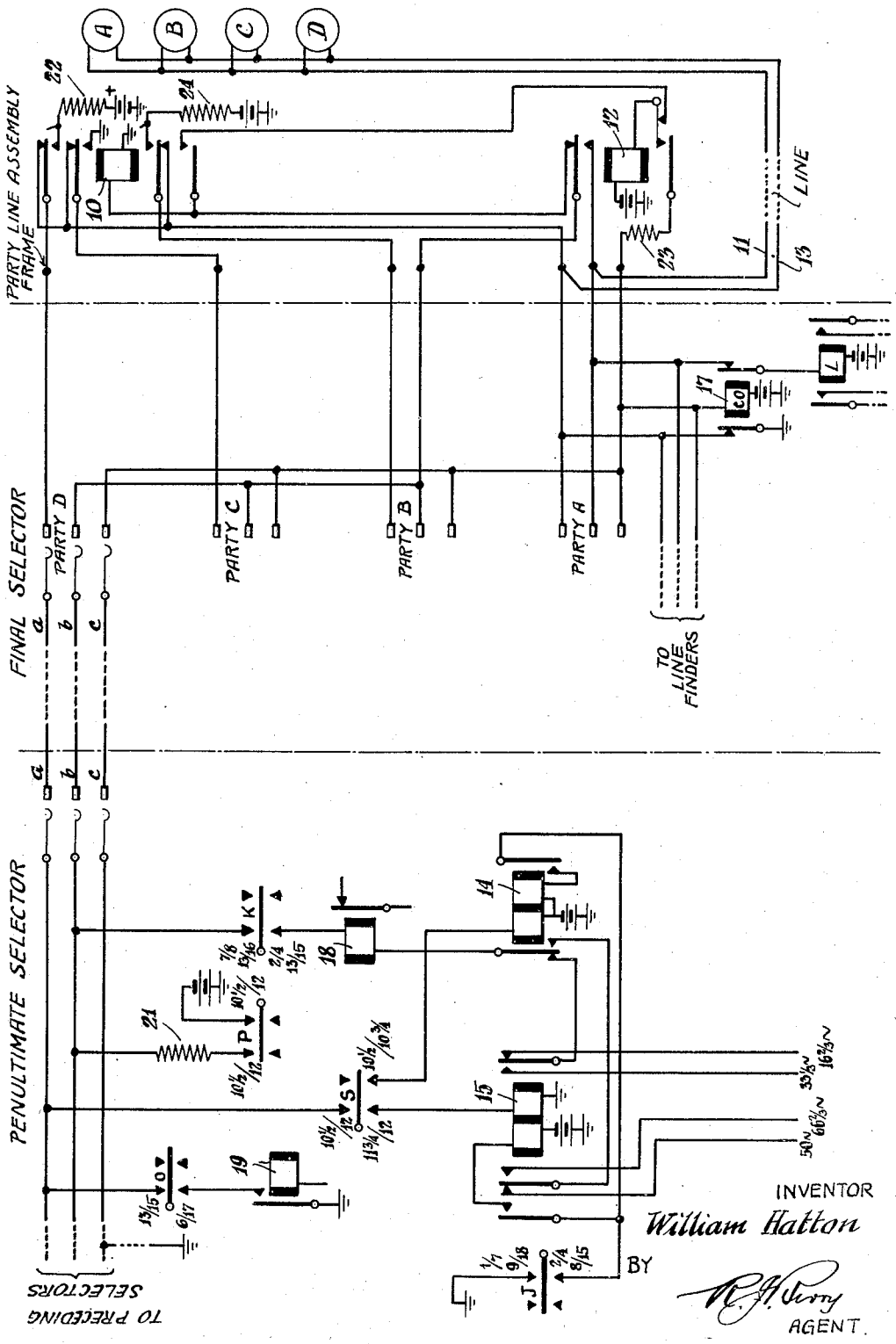

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PARTY LINE TELEPHONE SYSTEM

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1

This invention relates to automatic telephone systems, and has for an object to provide a simple and economical arrangement for selectively ringing a called party on a multi-party line.

Another object of the invention is to provide an improved arrangement for controlling ringing voltages of different station-selecting characteristics and for impressing the selected ringing voltage over the called multi-party line.

A further object of the invention is to convert by an improved adapter circuit the penultimate and final selectors of an automatic telephone switching system from an individual to a multi-party line basis.

A still further object of the invention is to arrange the final selectors for party line working on a terminal per station basis in a manner such that signaling for individual lines remains substantially the same.

In accordance with this invention, party lines are accommodated in the banks of the final selectors on a terminal set per station basis by associating with the terminal sets and with the party line a relay adapter circuit, which is provided with a particular identifying voltage for each of the stations and which in response to a call is adapted for initiating the selection in one of the selectors of the characteristic ringing voltage that is to be impressed over the line.

A feature of the invention resides in a final selector switch in which the (*a*) and (*b*) or talking terminals of the terminal sets allocated to a party line are connected to a two-relay adapter circuit which determines the selection of the proper ringing frequency.

A still further feature of the invention resides in a selector switch in which a particular one of a plurality of different ringing voltages of station-selecting characteristics is arranged to be impressed over a subscriber's line in response to a particular voltage indication from the terminal set engaged by the final selector.

Other features of the invention relate to circuit improvements which will be apparent from the following detailed description of the drawing, which shows by means of the usual circuit diagrams a sufficient amount of apparatus to enable the invention to be described and understood.

The invention is illustrated in an automatic telephone system of the harmonic ringing type employing rotary-type line finder and selector switches including associated sequence switches; but it is to be understood that the invention is not to be limited in its application to the specific arrangement shown.

2

Referring to the drawing, there is shown a multi-party line having four subscriber stations A, B, C and D associated therewith, a two-relay adapter circuit associated with four terminal sets in the bank of a final selector switch, and a penultimate selector switch including the pertinent sequence switch cams, harmonic ringing supply having the usual distinguishable frequencies, and relays for controlling the frequency selection of said ringing supply.

The subscriber's stations are of the type normally employed in automatic telephone systems and each includes a dial for use in obtaining connections with any other station. Four stations are shown connected over one line to the exchange, the line circuit at the exchange comprising the usual cut-off relay and line relay, the latter of which is actuated when any of the above subscribers initiates a call. As usual, the line is also multiplied in the banks of a group of line finders. As mentioned hereinbefore, the line finder and selector switches are of the well-known rotary type and a description of the details thereof is not required for an understanding of the present invention. A system of this type is fully described and illustrated in "Electrical Communication," Volume 3, published in the U. S. by Gerald Deakin, January 1925, pages 153 to 189. The terminals of the final selector are arranged on a terminal-per-station basis, that is, a separate set of terminals is provided in the selector switch for each party line subscriber's station.

In order to instal a party line, the terminal sets in the banks of the final selectors allocated to the party line stations are connected to a party line assembly frame to which is also connected the party line itself and a two-relay adapter circuit, comprising marking relay 10 and line-connecting relay 12, as shown. It will be noted that the contacts *a* and *b* of the terminal set of party A are connected directly to the party line, but the *a* contacts of parties B, C, and D are connected over respective back contacts of relay 10 to line conductor 13 and the *b* contacts of parties B, C, and D are connected in multiple over a front contact of relay 12 to complete the connection to line conductor 11. The test contact terminals *c* for all four parties are multipled together for obvious reasons. While the invention has been disclosed with reference to a four-party line, it is apparent that the invention may be readily applied to party lines having a greater or lesser number of stations by anyone skilled in the telephone switching art.

In the penultimate selector is shown a pair of relays 14, 15, which control selection of any of the four harmonic ringing frequencies provided by the ringing supply. Associated with these relays are some of the pertinent sequence switch cams, which are operated in sequential steps, as will be described hereinafter.

The invention will be most readily understood from a detailed description of the operation.

Assume a call to have been originated by a calling party (not shown) for subscriber's station A, the call having been routed to the Final selector in known manner, which has found the called party line to be free, and assume further that the sequence switch has reached position 10. Under this assumption it will be recognized that the bottom set of terminals, that is, for party A, has been seized by the Final selector, terminals *a*, *b* thereof being connected directly to the line conductors 13, 11, respectively. It will be further recognized that operation of the sequence switch cam K of the Penultimate selector has no effect with respect to the selection of ringing current up to position 12, inclusive, inasmuch, as the terminals *a*, *b* are not routed through relays 10, 12. However, when sequence switch cam K reaches its 13th position, ringing current is impressed over the line conductors 11, 13 to signal the called subscriber A. This circuit can be traced from grounded 16⅔ cycle ringing supply through the right back contact of relay 15, left back contact of relay 14, winding of relay 18, lower and upper left springs of sequence switch cam K, brushes and terminals of Penultimate and Final selectors, respectively, and thence over conductor *b* and line conductor 11 to the subscriber's set A where it is returned over line conductor 13 and conductor *a*, through terminals and brushes of Final and Penultimate selectors, respectively, left springs of sequence switch cam O, and thence to ground over the make contact of relay 19, which had been operated previously through a circuit not required to be described herein. Ringing continues over the line until the subscriber answers or until the sequence switch cam K reaches position 15.

Upon subscriber A answering, talking battery (not shown) is connected to the called line and the sequence switch of the Penultimate selector passes in the usual manner to position 15 and remains there during the conversational period. After the calling subscriber hangs up, the sequence switch passes to position 16 and thence to position 17 upon the called subscriber hanging up. The sequence switch then continues to position 18 after which it returns to its normal position in readiness for another call. It is readily apparent from the above that the addition of the relay adapter circuit to the Final selector has no material effect upon the manner in which party A is selectively rung.

Assuming now that any of the other three parties is to be called, for example, party D, and the appropriate set of terminals has been seized by the Final selector, then in this instance upon the sequence switch of the Penultimate selector reaching position 10½, marking relay 19 is energized in a circuit that can be traced from grounded battery through the two upper springs of sequence switch cam P, resistance 21, brushes and terminals of Penultimate and Final selectors, respectively, over lead *b*, via upper back contact of line-connecting relay 12, and thence to ground through the winding of relay 10. In energizing, relay 10 at its uppermost front contact connects

positive battery to relay 14 in the Penultimate selector to energize same; and at the lowermost front contact connects ground to relay 12 in a circuit that can be traced from grounded positive battery through winding and bottom back contact thereof, bottom front contact of relay 19, and thence through winding of relay 10 to ground. Relay 12, however, does not operate at this time in view of the resistance 21 of the Penultimate selector being in parallel with the winding thereof which is of relatively high resistance.

The circuit for the operation of relay 14 may be traced from grounded positive battery through left winding thereof, lower right and upper left springs of sequence switch cam S, brushes and terminals of Penultimate and Final selectors, respectively, over lead *a*, through uppermost make contact of relay 10 and resistance 22 to battery and ground. Relay 14, in operating, locks itself in a circuit that can be traced from grounded positive battery through right front contact thereof and to ground over right springs of sequence switch cam J of the Penultimate selector. Relay 14 also, in operating, closes its left front contact and connects it through the left back contact of relay 15 to a harmonic ringing supply source of 50 cycles. No material change in circuit operation occurs during the passage of the sequence switch from positions 10½ to 12. However, upon position 12 being reached the upper and lower left springs of sequence switch cam S close and provide an energizing circuit for relay 15, which can be traced from ground through the right winding thereof, left springs of sequence switch cam S, brushes and terminals of Penultimate and Final selectors, respectively over lead *a* through uppermost front contact of relay 19, and thence through resistance 22 to positive battery and ground. Relay 15, in operating, at its right front contact connects 33⅓ cycle harmonic ringing current thereto but this is ineffective in view of the operation of relay 14; at its outermost left front contact provides a locking circuit, which can be traced from positive grounded battery through the left winding thereof to ground through the right springs of sequence switch cam J; at its inner left front contact connects harmonic ringing current of 66⅔ cycles thereto, which is ineffective until sequence switch cam K reaches position 13. It is thus seen that the marking potential of positive battery provided by marking relay 10, which potential is characteristic of party D, is effective by operation of relays 14 and 15 to cause selection of a harmonic ringing frequency of 66⅔ cycles per second.

It is to be noted that when the sequence switch leaves position 12 that the above-traced energizing battery via sequence switch cam P for relay 10 is disconnected. However, inasmuch as energizing battery, through the winding of relay 12, is also connected to the winding of relay 10, this relay remains energized momentarily and relay 12 operates in the hereinbefore-traced circuit. Relay 12, in operating, opens the energizing circuit for relay 10 at its lower back contact and provides itself with a locking circuit that can be traced from grounded battery through the winding and make before break contact thereof, through resistance 23, over *c* conductor through terminals and brushes of the Final and Penultimate selectors, respectively, and thence to ground provided by the Penultimate selector.

Upon the sequence switch reaching position 13, left springs of sequence switch cam K close and connect ringing supply to the called line This

ringing circuit can be traced from grounded ringing supply of 66⅔ cycles over the left inner front contact of relay 15, left front contact of relay 14, winding of relay 18, springs of sequence switch cam K, over conductor *b* through the Penultimate and Final selector switches, upper front contact of relay 12, over line conductor 11 to subscriber's station D, back over the subscriber's loop including line conductor 13, uppermost back contact of relay 10, back over conductor *a* and through Final and Penultimate selector switches, left springs of sequence switch cam O, and front contact of relay 19 to ground. The remainder of the call proceeds in a manner similar to that described for party A, except that line-connecting relay 12 also releases upon the parties hanging up.

A similar procedure obtains in selecting the characteristic ringing voltage for party C. In this instance, when the selector terminals of party C have been seized and marking relay 10 operated, the upper intermediate front contact has ground placed on the *a* wire, which, obviously, cannot operate grounded winding of relay 15. However, this ground does operate the left winding of relay 14, which energizes in a manner above-described and which furnishes the called line with 50 cycle harmonic ringing current.

Similarly, if party B is to be called, and assuming the terminals thereof have been seized by the Final selector and relay 10 to have been operated in the above-described manner, then negative battery through resistance 24 is connected via the lower intermediate front contact of relay 10 in succession to relays 14 and 15 of the Penultimate selector. Obviously, relay 14 cannot operate but relay 15 does, in an obvious circuit that does not require tracing, with the result that harmonic ringing voltage of 33⅓ cycles is impressed upon the subscriber's line circuit.

It will be appreciated that the terminal sets allocated to a party line need not be adjacent to one another in the terminal banks of final selectors.

While this invention has been shown and described as embodying certain features merely for the purpose of illustration, it is clear to anyone skilled in the machine-switching art that many modifications are possible without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In a telephone exchange system, a party line having a plurality of stations associated therewith, a final selector having an individual set of terminals for each one of said stations, a plurality of sources of ringing current of different characteristics, sources for a plurality of marking signals, a relay associated with said party line, means for energizing said relay upon the seizure of said line by said final selector over one of said sets of terminals, means controlled by said relay for connecting one of said marking signals to a terminal of said one set of terminals, and means responsive to the marking signal thus connected for selecting a particular one of said sources of ringing current for application to the party line.

2. The system according to claim 1, and a second relay common to said party line and controlling the circuit of the first relay.

3. The system according to claim 2, an energizing circuit for the second relay including a contact of the first relay, and a holding circuit for the second relay including a terminal in any one of the sets belonging to the party line.

4. The system according to claim 1, and in which one marking signal is positive and another marking signal negative potential, and the means responsive to the marking signal comprising two relays one responsive only to positive and the other only to negative potentials.

5. The system according to claim 4, and in which the sets of terminals include talking terminals to which said marking signals are connected, and said two relays are connected in multiple over a final selector with a talking terminal of each called party line station.

6. In a telephone exchange system, a party line having four stations associated therewith, a final selector including four individual sets of terminals for said line, four sources of ringing current of different characteristics, sources for two marking signals, a relay associated with said party line, means for energizing said relay upon the seizure of said line by said final selector over any one of three sets of terminals, a front contact for said relay to connect one marking signal to one of the three sets and a second front contact for said relay for connecting another marking signal to another one of said three sets, and means variably operable depending on the presence or absence of the marking signals for selecting a particular one of said sources of ringing current for application to the party line.

7. In a telephone exchange system, a party line having a plurality of stations associated therewith, a final selector having an individual set of talking and test terminals for each one of said stations, means including said final selector for extending a calling line to any one of said sets of terminals, a plurality of sources of ringing current of different characteristics, first and second relays associated with said party line, back contacts for the second relay for connecting a talking terminal of all but one of said sets of terminals to the energizing winding of the first relay, front contacts for the second relay for connecting the last-mentioned talking terminals to one of the conductors of said party line, sources of a plurality of marking signals, front contacts for the first relay for connecting one of said marking signals to one and the second marking signal to a second talking terminal of said all but one of said sets of terminals, and means responsive to said marking signals for selecting a particular one of said sources of ringing current for application to the called party line.

8. The system according to claim 7, and an energizing circuit for the second relay controlled by front contacts of the first relay.

9. In a telephone exchange system, a plurality of party lines each having four stations associated therewith, a final selector having individual sets of talking and test terminals for each party line station, means including said final selector for extending a calling line to any one of the sets of terminals of the called party line, four sources of ringing current of different characteristics, a first and a second relay associated with each party line, back contacts for the second relay for connecting a talking terminal of three of said sets of terminals to the energizing winding of the first relay of the called party line, front contacts for the second relay for connecting the talking terminals of the three sets to one of the conductors of the called party line, sources of a plurality of marking signals common to the party lines, front contacts controlled by the second relay for connecting one of said marking signals to one and the second marking signal to a second talking terminal of said three sets of

terminals, and means common to said final selector and responsive to said marking signals for selecting a particular one of said sources of ringing current for application to the called party line.

10. The system according to claim 9, an energizing circuit for the second relay controlled in a front contact of the associated first relay, and a holding circuit for the second relay including the test terminal of any of the four sets.

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