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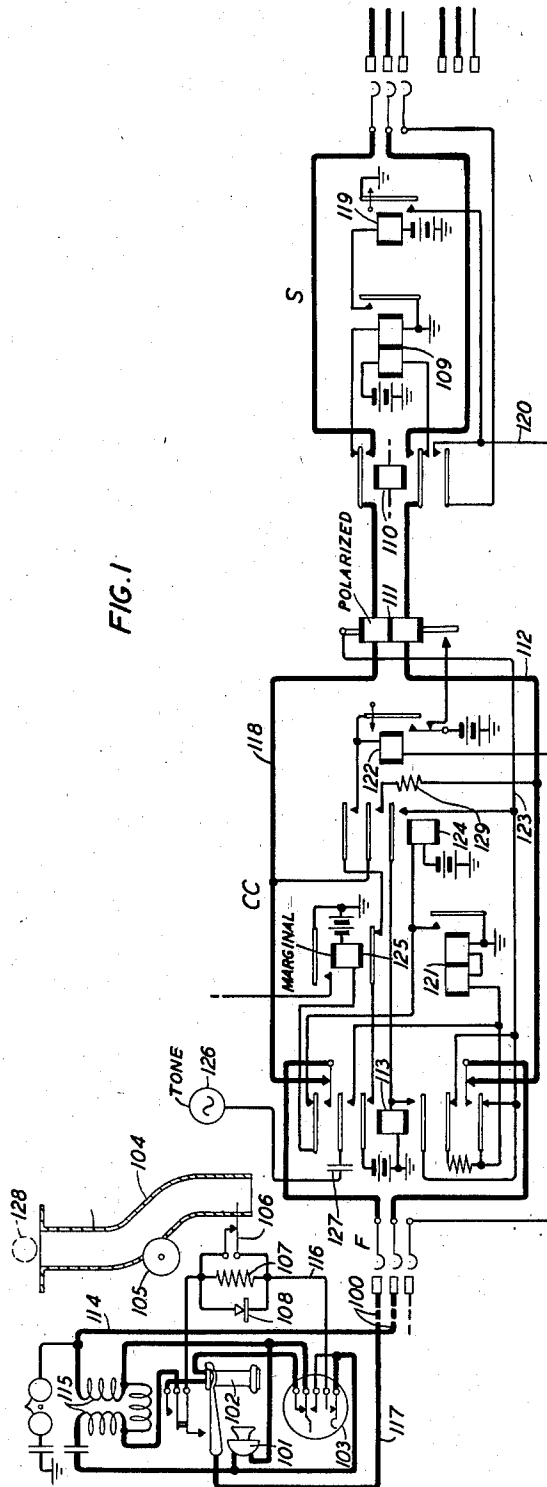
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2,281,062

TELEPHONE SYSTEM

Filed Feb. 4, 1939

2 Sheets-Sheet 1



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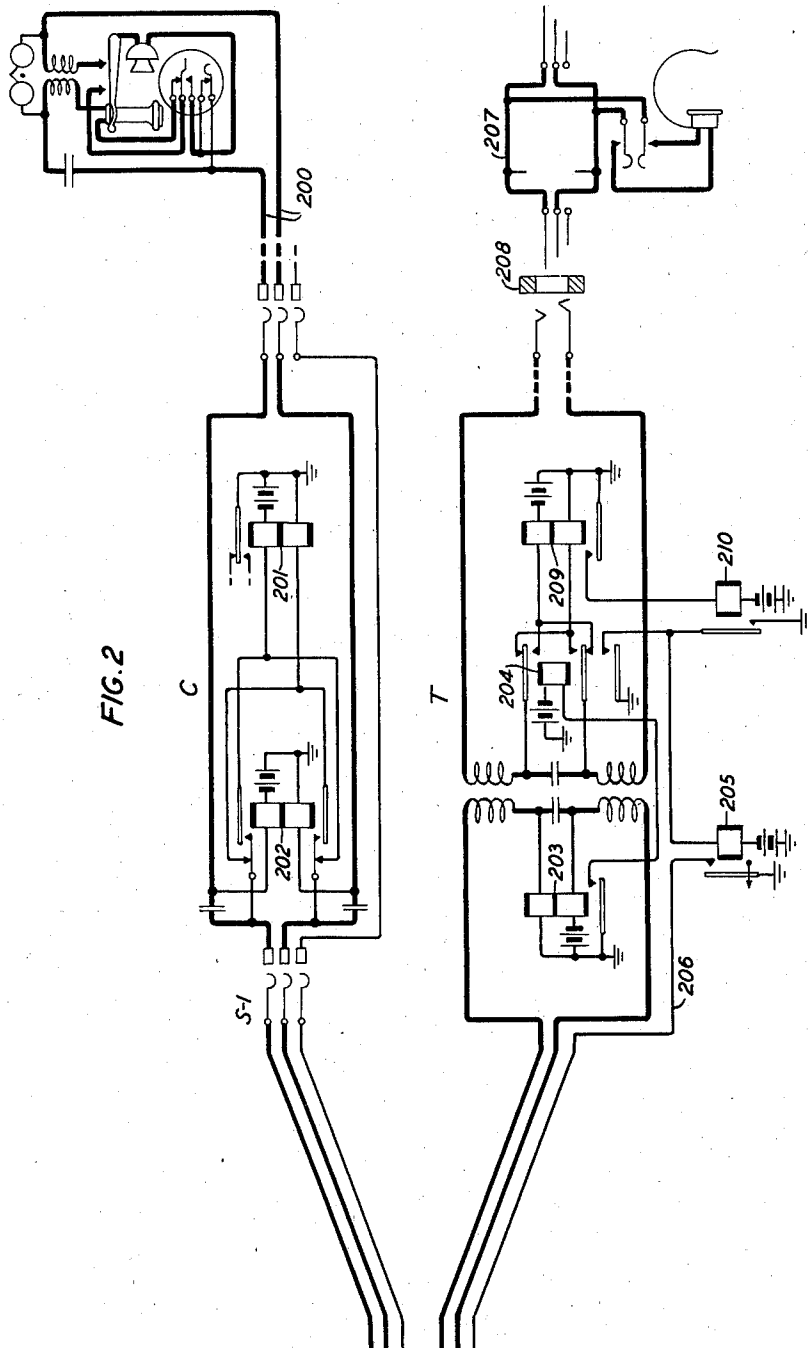
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TELEPHONE SYSTEM

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7 Claims. (Cl. 179-6.3)

This invention relates to telephone systems and particularly to systems in which coin stations are equipped with designation transmitters for establishing connections automatically.

The objects of the invention are to facilitate the establishment of different types of connections, such as connections to subscribers' lines and to operators' positions; to improve the signals that are used to distinguish the type of call that is being made from a coin station; to minimize the acoustic disturbances incident to the deposit of coins; and otherwise to effect improvements in systems of this character.

It has been the practice heretofore to permit the patron of a coin station to dial and establish a connection to a local subscriber's line and to deposit his coin after the called party answers. This is known as post-pay service. When the called party responds, the talking connection is disabled at the central office, and a tone is sent to the calling party notifying him that he must deposit a coin. The subsequent deposit of the coin reestablishes the connection, and conversation may then proceed. Also it has been possible in these prior systems for the coin patron to dial for an operator who makes the connection for him and requests him to deposit the necessary coins. In this case the operator verifies the deposit of the coins by means of the coin tones that are transmitted over the line to her headset. It will be noted, therefore, that the act of depositing the coin serves in one case to send a signal to cause the automatic reestablishment of the talking connection and in the other case to send audible signals to the operator.

According to the present invention improvements are secured in these prior systems by means of a circuit arrangement in which the deposit of the coins by the coin patron, and without any discriminatory act on his part, causes a signal current of reduced intensity to be sent to the central office to effect the automatic reclosure of the talking connection, on a call to a subscriber's line, and causes signal current of full intensity to be transmitted to the central office, when the coin patron has dialed for the operator, to notify her by the audible signal tones that the necessary coins have been deposited. One of the principal advantages of this feature is that the operator is better able to hear and distinguish the coin tones since they are transmitted over the connection by currents of unreduced intensity.

A further feature and advantage of the invention is that the deposit of the coin for the

transmission of the signal tone to the operator does not appreciably alter the intensity of the current normally flowing over the line to which the operator's headset and also the receiver at the coin station are effectively connected. Consequently the deposit of the coins is not accompanied by acoustic disturbances.

The foregoing and other features of the invention will be discussed more fully in the following detailed specification.

In the drawings accompanying the specification Figs. 1 and 2 when taken together disclose an automatic telephone system including the equipment essential to an understanding of the present invention.

Fig. 1 illustrates, largely in diagrammatic manner, a line finder switch and the associated first selector switch. This figure also discloses the details of the coin-control circuit interconnecting the line finder and first selector. The figure further discloses a telephone line equipped with a coin-controlled substation.

Fig. 2 illustrates diagrammatically a succeeding selector switch and a connector switch for completing connections to a called subscriber's line. This figure also illustrates an operator's position and a trunk circuit extending to her position from the first selector switch of Fig. 1.

The equipment at the substation of the coin line 100 includes the usual telephone transmitter 101, receiver 102 and an impulse dial 103. It also includes a coin receiving chute 104, a tone gong 105, and contacts 106 which are opened momentarily by the action of the coin falling through the chute 104 and into the till below. In parallel with the contacts 106 is a resistance 107, which in turn is shunted by a rectifying element 108.

The purpose of the resistance 107 is to diminish the flow of current over the line to the central office to cause the release of a relay thereat to condition for conversation a connection that has been established to a subscriber's line. As will be explained more fully hereinafter, the direction of current flowing over the coin line 100, on a call extended to a subscriber's line by dialing, is such that the rectifier 108 does not interfere with the function of the resistance 107, whereas on a call to an operator's position current flows in the opposite direction over the coin line 100 and passes through the rectifier 108 undiminished by the resistance 107 when the contacts 106 are momentarily opened by the deposited coin. In this latter case the operator is listening to the tone produced by the gong 105,

which is in acoustic relation with the transmitter 101, and the opening of contacts 106 an instant after the gong is struck by the coin does not reduce the intensity of the tone current or produce an objectionable acoustic disturbance, both of which would tend to impair the effectiveness of the signal tone on which the operator depends to detect the fact that the patron has complied with her request.

Thus on a call to a subscriber's line the act of depositing a coin, after the connection has been established, serves to transmit a signal of reduced intensity to operate equipment at the central office for the purpose of rendering the established connection effective for conversation; and the same act of depositing a coin at the request of the operator on a call to her position serves to transmit to the operator a signal tone of un-reduced intensity.

The coin line 100 appears in the bank of a line finder switch F at the central office, and the finder F is interconnected by a coin-controlled circuit CC with the first selector switch S. The selector S has access to succeeding switches, such as selector S—1 and connector C, to other lines in the exchange. The selector S also has access by way of the trunk circuit T to an operator's position.

While the invention is not limited to any particular type of telephone system, it may be assumed for the purpose of the present disclosure that the central office illustrated is equipped with switches of the well-known step-by-step type. And the rectifying element used at the substation in conjunction with the resistance and coin-operated contacts may be of any suitable type, such as the copper-oxide rectifier.

The invention will be explained further by describing the operation of the equipment shown in the drawings. To this end it will be assumed first that a patron at the substation of the coin line 100 wishes to converse with the subscriber of line 200. The calling patron first removes the receiver 102 from the switchhook, closing the line loop circuit to initiate the hunting operation of the line finder F. When the finder F seizes the calling line, a dialing circuit is completed through to the first selector switch S. This circuit may be traced from battery through the left winding of impulse relay 109, normal contact of relay 110, through the lower winding of the polarized relay 111, conductor 112, lower normal contacts of relay 113, middle brush of the line finder F, line conductor 114 through the right winding of the induction coil 115, transmitter 101, contacts of dial 103, conductor 116, normally closed contacts 106, through the closed switchhook contacts over the other line conductor 117, upper brush of the finder F, upper normal contacts of relay 113, conductor 118, upper winding of relay 111, normal contacts of relay 110, through the right winding of relay 109 to ground. Relay 109 operates and causes the operation of the slow-release relay 119, which applies holding ground potential to the sleeve conductor 120 to hold the line finder switch F in the well-known manner.

Since the coin line 100 is a post-pay line, the patron proceeds to dial the desired number without depositing a coin. The operation of the dial 103 transmits the usual series of designation impulses, and the selector switches S and S—1 are operated successively to extend the line to the connector switch C. When connector C is seized, the impulse circuit is extended through to the windings of the impulse relay 201 by way of the

front contacts of the operated cut-through relay 110 in selector S, and a similar relay in selector S—1, and the normal contacts of relay 202 associated with the connector switch C. The calling patron, continuing to dial, sets the connector switch C on the terminals of the called line 200, the called subscriber's line is rung, and, when the called party answers, relay 202 operates in series with his line to reverse the connection of the windings of relay 201 to the circuit incoming from the calling station.

Up to the time the called party answers, the direction of current flowing through the windings of polarized relay 111 is such that the relay does not operate. However, the reversal of current, caused by the answering of the called line, results in the operation of relay 111 and the closure of its contacts. Relay 111 in operating causes the operation of relay 121 in a circuit traceable from battery through the normal contacts of relay 122, contacts of relay 111, conductor 123 through the normal contacts of relay 113, windings of relay 121 to ground. Relay 121 closes an obvious circuit for the operation of relay 124 and also closes a circuit through the upper normal contacts of relay 113 and the winding of relay 125 to battery. Although relay 125 is marginal, it receives sufficient current from this circuit to operate. Relay 124 in operating closes a circuit from battery on conductor 123 through the lower contact of relay 124 and the winding of relay 113 to ground. Relay 113 operates and locks through its inner lower front contact independently of its operating circuit.

Relay 113 in operating opens the tip and ring conductors of the established connection to disable said connection so that conversation cannot ensue until the calling patron has deposited a coin at the substation. During the time the connection is severed at the contacts of relay 113 the switches beyond are held by a bridge circuit closed through the middle front contacts of relay 124 and the resistance 129. Relay 113 also connects relays 121 and 125, to the conductors of the coin line 100 for the purpose of testing the line and detecting the depositing of the necessary coin. The test circuit may be traced from battery through the winding of the marginal test relay 125, upper front contacts of relay 113 thence through the line finder and over conductor 117, through the switchhook contacts at the substation, through the parallel paths including coin contacts 106 and resistance 107 to conductor 116, thence as previously traced over the other line conductor through the finder and the lower front contacts of relay 113, windings of relay 121 to ground. Since the contacts 106 close a short circuit around resistance 107, the intensity of current flowing in the test circuit is sufficient to hold the marginal relay 125 operated. It will be noted that the polarity of the rectifier 103 is such as to oppose the flow of current in the test circuit above traced. Accordingly, the current in this test circuit must flow by way of the contacts 106, when closed, or by way of the resistance 107 when the contacts are open.

The calling patron, having completed his dialing and having established a connection to the called subscriber's line, is apprised by means of a signal tone that the connection will be ready for conversation as soon as he deposits the necessary coin. The tone circuit may be traced from the tone source 126 through condenser 127, closed contacts of relay 113, through the windings of relay 121 and also over the test circuit

above traced through the winding of induction coil 115 at the substation and returning over the line through the winding of test relay 125. The patron hears the distinctive tone in his receiver 102 and deposits a coin 128 in the chute 104. As the coin falls, it hits the gong 105, serving no useful purpose on this type of call, and an instant later opens the coin contacts 106 for a brief interval. The opening of these contacts includes the resistance 107 directly in the test circuit, diminishing the intensity of the current flow and causing the marginal relay 125 to release. Relay 121, however, being sensitive, does not release at this time. Relay 125 completes a circuit from battery through the inner upper contact of relay 113, closed contacts of relay 125, uppermost closed contacts of relay 124, through the winding of relay 122 to the grounded sleeve conductor 120. Relay 122 operates and locks through its closed contacts to the sleeve conductor 120. In operating, relay 122 removes battery from the conductor 123 causing relay 113 to release. Relay 113 disconnects the relays 121 and 125 and recloses the tip and ring conductors to condition the established connection for conversation. Relay 121 in releasing opens the circuit of relay 124. Relay 122 remains energized to prevent the reoperation of the associated relays during the conversational period. The release of relay 124 opens the bridge circuit through the resistance 129 and restores the control of the switches to the switchhook contacts at the calling station.

After the coin passes into the till, the contacts 106 reclose the short circuit around the resistance 107 and the rectifying element 108 to effectively remove these devices from the transmission circuit.

At the end of conversation the calling and called parties replace their receivers, and the established connection is released in the usual manner.

Assume next that the patron of the coin line 100 wishes to call one of the service operators, such as the toll operator. He initiates the call in the same manner, and the line finder F seizes the line and extends it to the first selector switch S. The patron dials the necessary designation to operate the selector switch S to seize the terminals of the trunk T extending to the operator's position. As explained hereinbefore, the direction of current flowing through the windings of relay 109 over the calling line, while the selector switch S is being operated, is such that the polarized relay 111 fails to operate. When the selector S seizes the trunk T, relay 110 operates to extend the subscriber's line through to the trunk, and current is supplied to said line through the windings of relay 203 without change of direction. That is to say, since the patron is calling the operator the established connection should not be disabled, as it was in the case of a call to a subscriber's line. Accordingly, no change is effected in the direction of current flow when the selector S seizes the trunk T, and the polarized relay 111 remains unoperated, and relay 113 does not operate as before to disable the extended connection. Relay 203 in the trunk closes an obvious circuit for relay 204, and the latter relay operates the slow-release relay 205. Relay 205 applies holding ground potential to the sleeve conductor 206 of the trunk.

A signal (not shown) is displayed in any well-known manner to attract the attention of the operator. When she responds by connecting the

plug of her cord circuit 207 in the jack 208, the relay 209 operates and closes an obvious circuit for relay 210. Relay 210 closes an alternate operating circuit for the relay 205. The operator converses with the calling patron and proceeds to assist him in the establishment of the desired connection.

Having control of the desired connection, the operator requests the calling patron to deposit the necessary coins in the chute 104 before permitting the parties to converse. As hereinbefore described, the deposited coin 128 first strikes the gong 105 and then opens the contacts 106. At this time current is flowing over the extended connection from the windings of relay 203 in such a direction that it passes readily through the rectifier 108 at the substation. The opening of contacts 106, therefore, is without effect on this call, since the rectifier 108 offers a low resistance to the flow of current and prevents the resistance element 107 from diminishing the current intensity. Thus the tone transmitting current flowing over the connection to the operator's telephone continues with undiminished intensity without regard to the action of the coin in opening the contacts 106. Furthermore, since the opening of these contacts does not produce a sudden change in the resistance of the circuit, the objectionable acoustic disturbance that would otherwise occur is obviated.

At the end of conversation the calling patron replaces his receiver on the switchhook, resulting in the release of relays 203 and 204. Relay 204 opens one of the circuits for relay 205, but the latter relay remains operated until the operator removes the cord circuit from the trunk. When she does this, having received a signal that the calling party has replaced his receiver, relays 209 and 210 release, and relay 205 releases to remove holding ground from conductor 206. This permits the release of selector switch S and finder switch F.

What is claimed is:

1. In a telephone system, a line equipped with coin-receiving mechanism at the substation, a central office having automatic switches therein, a subscriber's line, an operator's position, means controlled by the party at said coin substation for selectively operating said automatic switches to establish either a connection to said subscriber's line or a connection to said operator's position, means for supplying current to said coin line, impedance means, means responsive to the deposit of a coin in said receiving mechanism when a connection has been extended to the subscriber's line for rendering said impedance means effective to change the intensity of the current flowing in said line to transmit a distinctive signal to the central office, means at the central office responsive to said distinctive signal, and means responsive to the deposit of a coin in said mechanism when a connection has been extended to said operator's position for sending a distinctive signal to the operator without rendering said impedance means effective.

2. In a telephone system, a coin line having mechanism at the substation for the reception of coins, subscribers' lines, an operator's position, automatic switches for extending a connection to a subscriber's line and for extending a connection to said operator's position, means controlled by the party at the coin substation for selectively operating said automatic switches, means for supplying current to said coin line, a resistance element at said coin substation, means responsive

to the deposit of a coin when a connection has been extended to a subscriber's line for effectively including said resistance element in circuit to lower the intensity of the current flowing in the coin line and to transmit thereby a distinctive signal over the extended connection, means at the central office responsive to said distinctive signal, means responsive to the deposit of a coin when connection has been extended to the operator's position for sending a distinctive signal over the coin line to the operator, and means effective while said signal is being transmitted to the operator for disabling said resistance element.

3. In a telephone system, a line equipped with coin-receiving mechanism at the substation, a central office having automatic switches therein, a subscriber's line, an operator's position, means controlled by the party at said coin substation for operating said automatic switches to establish either a connection to said subscriber's line or a connection to said operator's position, means for supplying current over said coin line, means effective upon the answering of the called subscriber when a connection is extended to said subscriber's line for disabling the extended connection to prevent conversation, a resistance element and a set of contacts rendered effective by the deposit of a coin at the coin station for reducing the intensity of the current flowing in the line to enable said established connection for conversation, means responsive to the deposit of a coin when a connection has been extended to the operator's position for sending a distinctive signal over the calling line to the operator, and means cooperating with said resistance element and said contacts to render said resistance element ineffective when said signal is transmitted to the operator.

4. In a telephone system, a coin line having coin-receiving mechanism at the substation, a subscriber's line, an operator's position, means for establishing a connection from said coin line either to the subscriber's line or to the operator's position, means for causing current to flow over the coin line in one direction after a connection has been established to the subscriber's line and in the opposite direction after a connection has been established to the operator's position, a resistance element at the coin substation, means responsive to the deposit of a coin for including said resistance element effectively in circuit with said coin line, a rectifying device at said coin substation for forcing the current in the coin line to flow through said resistance element on a call to said subscriber's line to transmit a distinctive signal over the established connection and for shunting the current around said resistance element on a call to the operator to prevent said resistance element from effecting a reduction in the current flowing in said line, means at the central office responsive to said distinctive signal, and means for sending a distinctive signal to the operator when said resistance element is in circuit with said coin line.

5. In a telephone system, a coin line having coin-receiving mechanism at the substation, a subscriber's line, an operator's position, means for establishing a connection from said coin line either to the subscriber's line or to the operator's position, means for causing current to flow over the coin line in one direction after a connection has been established to said subscriber's line and in the opposite direction after a connection

has been established to the operator's position, a resistance element connected in series with said coin line at the substation, normally closed contacts in parallel with said resistance element opened by the deposit of a coin to include said resistance element effectively in circuit with said coin line, a rectifier connected in permanent parallel relation to said resistance element and said contacts, said rectifier serving to force the current in the coin line through said resistance element to transmit a distinctive signal over the established connection on a call to said subscriber's line and serving to shunt said resistance element on a call to the operator to prevent the resistance element from effecting a reduction in the current flowing when said resistance element is in circuit, means at the central office responsive to said distinctive signal, and means for transmitting a distinctive tone signal current over the coin line to the operator while said resistance element is in circuit with the coin line.

6. In a telephone system, a coin line, a substation for said line including a coin chute, a gong arranged to be struck by coins passing through said chute, a microphone disposed in acoustic relation with said gong, a subscriber's line, an operator's position, means for establishing a connection from said coin line either to the subscriber's line or to the operator's position, means for causing current to flow over the coin line in one direction after a connection has been established to a subscriber's line and in the opposite direction after a connection has been established to the operator's position, a resistance element connected in series with said coin line at the substation, normally closed contacts in parallel with said resistance element opened by a coin passing through said chute after the coin has struck said gong, said contacts when opened serving to include said resistance element effectively in circuit with said coin line, a rectifier connected in permanent parallel relation to said resistance element and said contacts, said rectifier serving to force the current in the coin line through said resistance element to transmit a distinctive signal over the established connection on a call to said subscriber's line and serving to shunt said resistance element on a call to the operator to prevent the resistance element from effecting a reduction in the current flowing when said resistance element is in circuit, means at the central office responsive to said distinctive signal, and means including said gong and said microphone for transmitting a distinctive tone signal current over the coin line to the operator while said resistance element is in circuit with the coin line.

7. In a telephone system, a coin line, a substation for said line including a coin receptacle, a signal device arranged to be operated by coins passing into said receptacle, acoustic means associated with said signal device, means for extending said coin line to establish either of two telephone connections of different character, means for causing current to flow over the coin line in one direction when one of said telephone connections has been established and in the opposite direction when the other of said telephone connections has been established, an impedance element connected in series with said coin line at the substation, normally closed contacts in parallel with said impedance element opened by the coin passing into said receptacle after the coin has operated said signal device, said contacts when opened serving to include said

impedance element effectively in circuit with said coin line, a unidirectional device connected in parallel relation to said impedance element and said contacts, said unidirectional device serving to force the current in the coin line through said impedance element to transmit a distinctive signal when one of said telephone connections is established and serving to shunt said impedance element when the other of said telephone connections is established to prevent the im-

pedance element from effecting a reduction in the current flowing when said impedance element is in circuit, means responsive to the distinctive signal caused by the flow of current through said impedance element, and means including said signal device and said acoustic means for transmitting a distinctive signal current over the coin line while said impedance element is in circuit with the coin line.

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