Nov. 10, 1931. W. T. HAINES 1,830,873

TELEPHONE SYSTEM

Filed Jan. 15, 1931

2 Sheets-Sheet 1

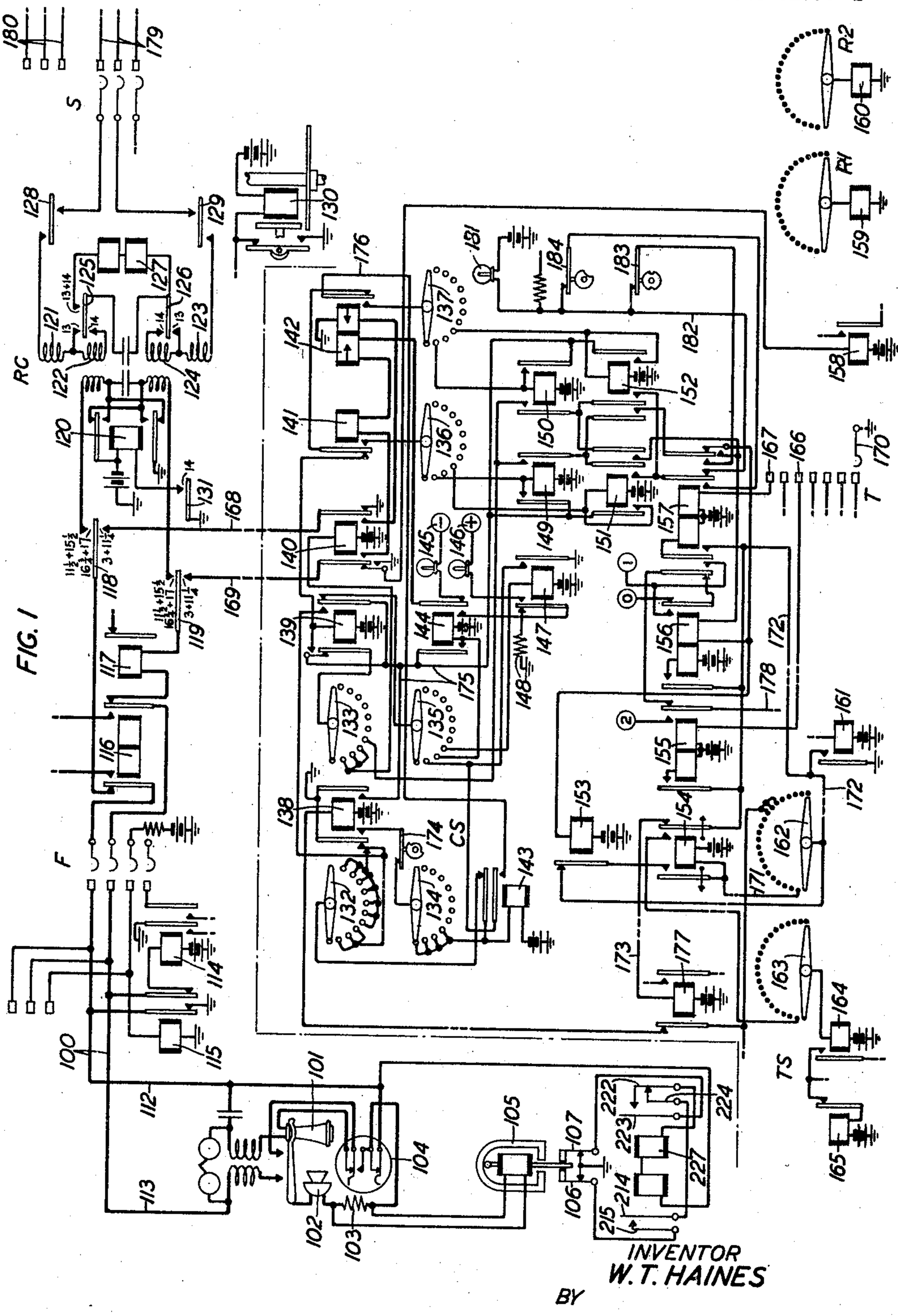

FIG. 1

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FIG. 2

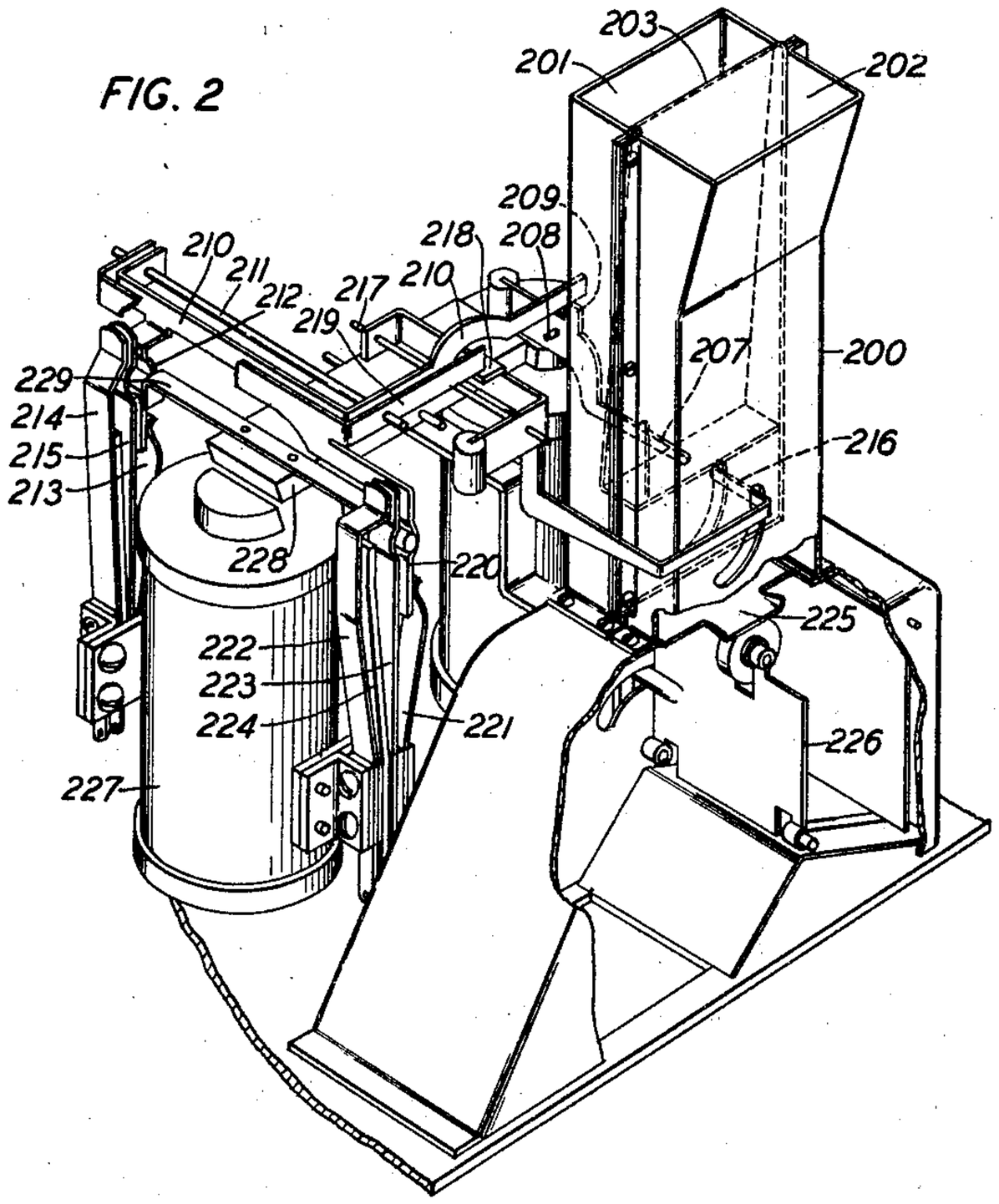


FIG. 3

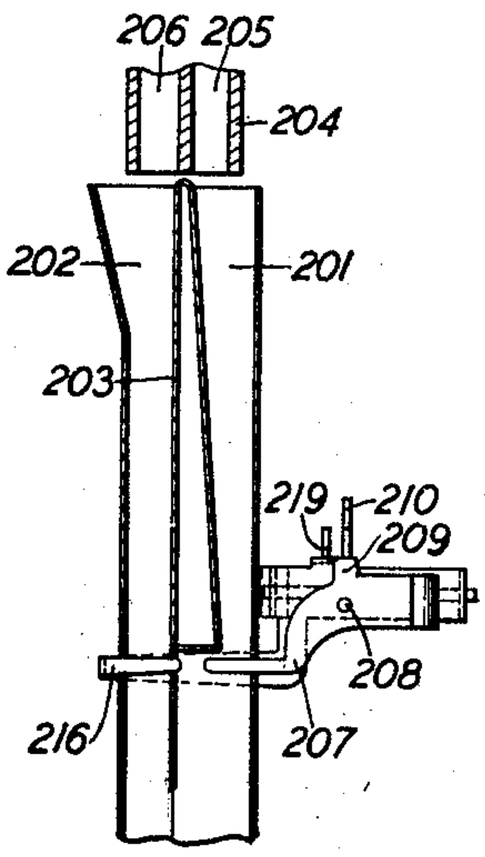


FIG. 4

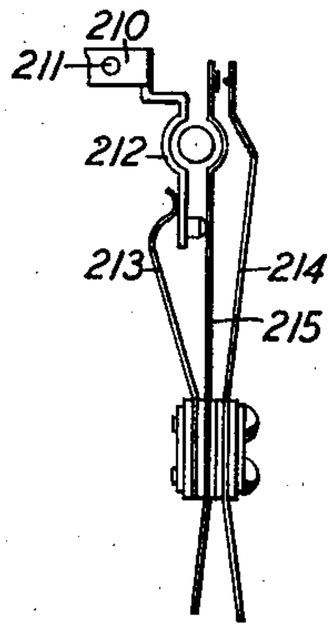
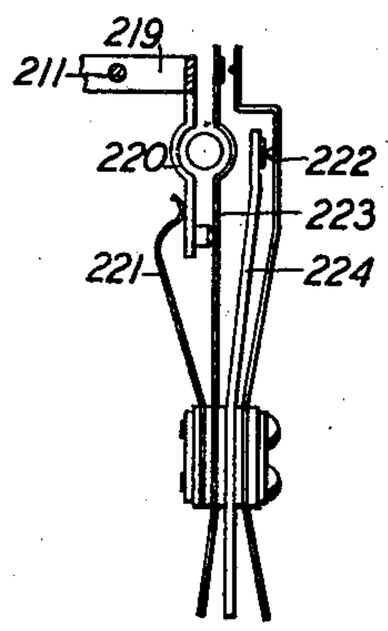


FIG. 5



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Patented Nov. 10, 1931 1,830,873

UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

Application filed January 15, 1931. Serial No. 508,973.

This invention relates to telephone systems and particularly to automatic systems involving coin controlled lines.

The objects are to extend the range of coin-line service in dial areas, to secure a reliable test of the calling line to distinguish coins of different values, to prevent the test circuits at the substation from interfering with the quality of transmission, and to otherwise improve systems of this character.

According to the present practice a calling party at a coin-box station can establish calls on a purely automatic basis only within certain local areas, such as those for which the rate is a five-cent coin. If he wishes to make a call to a distant zone requiring a higher toll, he must secure the assistance of an operator whose duty it is to advise him as to the required amount and to verify, usually by audible signals, the sum deposited in the coin box.

This invention overcomes the limitations of these prior systems by means of an arrangement in which a calling party at a coin station in an automatic system may extend calls, without the assistance of an operator, into zones requiring different toll charges. This is accomplished by a testing mechanism at the central office which makes two separate tests of the line, one by applying current in one direction and the other by applying current in the opposite direction. The first test operates a polarized relay at the substation to remove a normal ground connection from one of two coin contacts, allowing a test to be made to determine if the other contact has been operated by the deposit of the required coin. The second test operates the polarized relay in such a way as to remove the ground potential from the second contact, allowing a test to be made of the first contact. In this manner the central office mechanism automatically determines whether the coin deposited by the calling party is of a denomination sufficient to entitle him to obtain the connection for which he has dialed.

A feature of the invention is an arrangement in which the control switch of one of the automatic selectors is capable of taking a plurality of different settings, these settings representing respective calls requiring deposits of different values. In its different settings the control switch causes talking current to be supplied to the calling line in different manners for the purpose of removing ground potential at the substation regardless of the denomination of the deposited coin. This is for the purpose of improving the transmission during the conversational period.

Another feature of the invention is an arrangement whereby a subscriber may obtain a call requiring deposit of a given coin, such as a five-cent piece, by using a coin of higher denomination, such as a ten-cent piece. Since the subscriber dials a number for which a five-cent piece is sufficient, the control switch of the selector would in its normal operation take up a setting representative of a five-cent call. When, however, the testing mechanism tests the line and discovers that a ten-cent piece has been deposited, it automatically alters the setting of the control switch so that it now takes up a position the same as it would had a ten-cent call been established. This insures that the ground connection at the substation is removed during the conversational period.

In the drawings accompanying this specification Figure 1 discloses a portion of an automatic telephone system embodying the features of the invention, Fig. 2 is a perspective view showing the structure of the coin mechanism employed at the substation, Figs. 3, 4 and 5 are details of this structure.

Referring particularly to Fig. 1, the coin-controlled telephone line 100 is equipped at the substation with the usual receiver 101, talking transmitter 102, and impulse dial 104 for controlling the selector switches at the central office. The substation is also provided with a coin box including the operating magnet 227 and coin-operated contacts 214, 215, 222, 223 and 224. Also there is provided a polarized relay 105 which responds to test current for the purpose of controlling the application of ground potential to the coin-operated contacts. The structure of the coin

mechanism will be described in detail hereinafter.

The line 100 extends to the central office and terminates in the bank of a line finder switch F, only a portion of which is shown in the drawings. Finder F serves to extend the calling line over the link circuit to a first or district selector switch S, also shown only in part.

The central office is also equipped with register senders which serve to receive impulses representing the wanted designations, including both office and numerical codes, to control the selective operation of the switches in accordance with the registered designations and to perform the necessary tests of the calling line to determine whether the proper coin has been deposited, entitling the calling party to the call for which he has dialed and also to signal a monitoring operator in case the coin test proves unsatisfactory. One of these senders is partly illustrated in the drawings, including a disclosure of only what is necessary to a clear understanding of the invention. These senders are associated with the link circuit extending between the finder F and selector S by means of a selecting switch (not shown) usually called the sender selector. The equipment comprising the register sender is shown in the drawings below and to the right of the broken line. It includes a timing switch TS, a series of office and numerical registers, two of which, R1 and R2, are illustrated, a control switch CS which controls the testing of the calling line to determine the nature of the coin deposited, and a translator switch T, together with numerous relays and other devices. The switches TS, R1, R2 and CS may be of the single-motion step-by-step type well known in the art. Translator T may also be of this type, or it may, if desirable, be a switch of the power driven type.

The link circuit between the finder F and selector S is controlled by a sequence switch 130 having numerous contact springs which are closed in various positions as the switch moves from one position to another. The link also includes a repeating coil RC, the secondary windings of which are divided into sections in order to obtain the necessary transmission characteristics for the particular call concerned.

The line finder-selector unit may employ panel switches and a circuit arrangement similar to that disclosed in the Henry Patent No. 1,575,336 of March 2, 1926 and in the Kopp Patent No. 1,589.402 of June 22, 1926. Certain features having to do with the selection of the repeating coil windings and other control circuits may be of the same general nature as those shown in the Stearn et al. Patent No. 1,395.977 of November 1, 1921. The register sender and manner in which it controls the switches and the testing and disposition of coins may, in general, be the same as disclosed in the above-noted patents to Henry and Kopp.

The construction and operation of the coin mechanism employed at the substation is, in general, the same as the devices shown and described in the patents to Forsberg, No. 1,043,219 of November 5, 1912 and No. 1,117,485 of November 17, 1914.

Before proceeding with the detailed operation of the circuits, a description will be given of the structure and operation of the coin mechanism shown in Figs. 2, 3, 4 and 5. This mechanism comprises a hopper or coin receptacle 200 having two compartments 201 and 202 formed by a partition 203. These compartments receive coins of different denominations which have been directed to the entrance of the receptacle by the coin chute 204 having the runways 205 and 206. For example, coins of one denomination, such as five-cent pieces, traverse the chute 205 and enter the compartment 201, whereas coins of another denomination such as ten-cent pieces, descend the chute 206 and enter the other compartment 202.

Within the compartment 201 is a trip finger 207 pivoted at 208. This trip finger carries a shoulder 209 which, in its normal position, supports a lever 210 pivoted on the rod 211, thus holding the contact actuating arm 212 against the pressure of spring 213, permitting the coin contacts 214 and 215 to remain open. When, however, a coin descends the compartment 201, it strikes the finger 207 causing it to rotate about its pivot 208 and permitting the shoulder 209 to move out of engagement with the lever 210. With the lever 210 free, the spring 213 immediately causes it to rotate about the rod 211 closing the contact 215 against the contact 214. The purpose of these contacts will be explained in connection with the circuit description.

Within the other compartment 202 is a second trip finger 216 pivoted about the rod 217 on the frame of the device. The trip finger 216 also carries a shoulder 218 which, in the normal position, supports the lever 219, pivoted to the rod 211, and holds the contact actuating arm 220 against the pressure of spring 221, permitting coin contacts 222 and 223 to remain open and contacts 222 and 224 to remain closed. When, however, a ten-cent piece descends the compartment 202, it strikes the trip finger 216 and rotates it about its pivot, causing the shoulder 218 to escape from beneath the lever 219. Thereupon the lever 219 is rotated by the spring 221 to close contacts 222 and 223 and to open contacts 222 and 224.

After the coins have operated their respective trip fingers, they land on the usual trap 225 where they await final disposal either into the coin till or into the return chute. The coins are disposed of by means

of the usual operating magnets 227, which attract the armature 228 to rotate the deflecting vane 226 either in one direction or the other according to which way the armature 228 is tilted. The armature 228 also carries a restoring bar 229 which acts on the contact arms 212 and 220 to restore the levers and trip fingers to their normal latched positions.

A detailed description will now be given of the operation of the circuits shown in Fig. 1. For this purpose it will first be assumed that the calling party wishes to make a call into a zone for which the charge is five cents and that he deposits a five-cent piece in the coin box. When the receiver 101 is removed from its switchhook, a circuit is completed from battery, through the winding of line relay 114, contact of cut-off relay 115, over the ring conductor 113, through the left winding of the induction coil, switchhook contacts, transmitter 102, winding of the polarized relay 105, normally closed contacts of dial 104, over the tip side of the line 112, through the contact of relay 115 to ground. The line relay 114 operates and, in the well known manner, initiates the operation of the line finder F and a sender selector switch. The finder F finds the calling line 100, the sender selector chooses an idle sender, and the controlling sequence switch 130 advances into some position where contacts 118 and 119 are closed to extend the tip and ring conductors of the calling line over conductors 168 and 169 to the impulse relay 158 of the register sender.

The subscriber proceeds to manipulate his dial 104 to transmit impulses representing the designation of the wanted line, causing the setting of registers R1, R2 and other similar registers. As soon as the first two digits, representing the office code, are dialed, the translator T assumes its position depending upon these digits. Since the calling party has dialed for a zone for which the charge is five cents, it will be assumed that the translator T positions its brush 170 on some terminal other than the terminals 166 and 167. Accordingly, neither of the relays 155 and 157 operates.

Following the seizure of the sender, the time-measure switch TS is caused to move from its normal to its first off-normal position, where a circuit is completed from battery, through the winding of relay 154, conductor 171, brush 162 of said switch, conductor 172 and thence to ground over an operated relay 161. The relay 154 operates, and locks in a circuit from battery through its winding and left contact, back contact of relay 153 and thence to ground over conductor 172. With relay 154 operated, a circuit is completed from battery, through the winding of relay 164, brush 163 of the time measure switch, front contact of relay 154 to the grounded conductor 172. Relay 164 causes the stepping magnet 165 to advance the time-measure switch TS. Relay 154 at its back contact disconnects the grounded conductor 172 from conductor 173 to prevent the sender from completing the talking connection to the called line until relay 154 has released subsequent to a satisfactory coin test.

Following the completion of the dialing operation, the time measure switch TS advances into position 15 where a circuit is closed from battery, through the winding of relay 138, back contact of relay 177, brush 162 to the grounded conductor 172. Relay 138 in conjunction with interrupter 174 advances the control switch CS through a number of positions to perform the tests of the calling line to determine whether the proper coin has been deposited by the calling party. As soon following the energization of relay 138 as the interrupter 174 closes its contacts, a circuit is completed from battery, through the stepping magnet 143 of the switch CS and brush 134 in the normal position of the switch, contacts of the interrupter 174, front contacts of relay 138 to ground. Magnet 143 energizes preparatory to advancing the brushes to the first operated position. When interrupter 174 again opens its contacts, magnet 143 releases and moves the brushes 132 to 137 inclusive to their first off-normal position. Relay 140 now operates in a circuit from battery, through the winding of said relay, brush 133, left back contact of relay 139, conductor 175 to ground at the right contacts of relay 138. Relay 140 transfers the tip and ring conductors of the line 100 from the impulse relay 158 and connects them across a test loop including the relay 141 and the differential relay 142.

A test circuit is now traceable from the negative source of potential 145, right back contact of relay 144, left winding of relay 142, winding of relay 141, left front contact of relay 140, conductor 169, sequence switch spring 119, winding of relay 117, right back contact of relay 116, thence over the ring conductor 113 of the line 100, through the winding of polarized relay 105 and returning over the tip conductor 112, through the left back contact of relay 116, sequence switch spring 118, conductor 168, right front contact of relay 140, right winding of relay 142 to ground. Should the line 100 be free from ground connections, current will flow through both winding of relay 142 causing it to remain inert due to its differential character. It will be recalled the assumption is that a five-cent piece has been deposited in the coin box resulting in the closure of the coin contacts 214 and 215. When negative current is applied to the ring conductor of the line, as above traced, relay 105 moves its armature in such a direction as to open the contacts 106, allowing ground potential to remain on contacts 107. Since, however, the contacts 222 and

223 are open, ground potential is completely disconnected from the tip conductor 112 of the line. Therefore, the differential relay 142 remains inert as explained, and relay 141 attracts its armature. As soon as the interrupter 174 again closes its contacts, the magnet 143 operates, and a circuit is completed from battery, through the winding of register relay 149, brush 136, front contact of relay 141, back contact of relay 142, conductor 176, front contact of the magnetic 143, brush 135, right back contact of relay 139 to grounded conductor 175. Relay 149 operates and locks directly to conductor 175. On the next opening of the interrupter 174, the magnet 143 releases and advances the brushes of switch CS into position 2.

In position 2 a circuit is closed from battery, through the winding of relay 144, brush 135, right back contact of relay 139 to the grounded conductor 175. Relay 144 operates and disconnects the source 145, permitting relay 141 to release. Relay 144 at its right front contacts extends the ring conductor through the left back contact of relay 147 and resistance 148 to ground. This acts as a drain for any electrostatic charges that are present on the line. Relay 144 locks through its left front contact to the conductor 175.

The next closing and opening of the interrupter 174 causes the advance of the switch CS into position 3. In this position a circuit is completed from battery, through the winding of relay 147, brush 135 and thence to the grounded conductor 175 as above traced. Relay 147 disconnects the resistance 148 and substitutes the positive source of test potential 146. The test circuit now extends from the source 146, through the left front contact of relay 147, right front contact of relay 144, thence as above traced, to relays 142 and 141 to the ring conductor of the line. Since current now flows in the opposite direction, relay 105 attracts its armature in the opposite direction to remove ground potential from the contact 107 and to permit ground potential to remain on contact 106. The circuit is now traceable from ground through the contacts 106, coin contacts 215 and 214 closed by the deposit of the five-cent piece, contacts 224 and 222, windings of magnet 227 to the tip conductor 112 of the line 100. The coin magnet 227 is not operated in this circuit, but the presence of ground potential on conductor 112 shunts the right winding of relay 142, and said relay attracts its armature. Relay 141 also operates in series with the left winding of relay 142. When the stepping magnet 143 again closes its contacts, a circuit is completed from battery, through the winding of register relay 152, brush 137, front contact of relay 142, conductor 176, contact of magnet 143 to ground at the right contact of relay 147. Relay 152 operates and locks to the grounded conductor 175.

When magnet 143 again deenergizes, the switch CS steps into position 4 releasing relay 147 to disconnect the source 146 from the line. This permits relay 105, 141 and 142 to release. With the switch in position 4 and the test completed, a comparison is now made between the results of the test recorded on the register relays 149, 150, 151 and 152 and the record established on relays 155 and 157 in accordance with the number dialed by the subscriber. Since the call is a five-cent one, neither of the relays 155 and 157 has operated. As already explained, relays 149 and 152 have operated as a result of the test, showing that a five-cent piece was deposited by the calling party. Inasmuch as the results of the test compare favorably with the number dialed, a circuit will be completed for the relay 153. This circuit may be traced from battery, through the winding of the relay, outer right back contact of relay 157, outer left contact of relay 152, right contact of relay 149, brush 133, left back contact of relay 139 to the grounded conductor 175. Relay 153 operates and releases relay 154. Relay 154 on releasing extends the grounded conductor 172 to the conductor 173 causing the operation of relay 177, which acts as a signal to the sender that it may proceed to complete the partially established connection to the called subscriber's line.

The relay 177 in operating causes the release of relay 138, which places ground potential on the remaining terminals associated with brush 132 resulting in an obvious circuit for operating the stepping magnet 143 to return the brushes of the switch CS to their normal position. Relays 140, 149, 144 and 152 are now deenergized.

At some convenient time following the coin test, the district controlling sequence switch 130 is advanced into a talking-selection position depending upon the nature of the call extended. It will be assumed that for a five-cent call, such as the one now being discussed, the sequence switch 130 is driven into position 13 where it remains during conversation. The positioning of the sequence switch 130 for talking selection is controlled by a circuit which extends from conductor 178, over the right back contact of relay 155, outer left back contact of relay 157, right back contact of relay 156 and thence over a conductor extending to the zero counting relay (not shown) in the sender. In the manner fully explained in the above-mentioned patents to Henry, Kopp, and Stearn et al., the sequence switch 130 is selectively advanced into talking-selection position 13. In position 13 current is supplied to the calling line from battery, through the upper back contact of relay 120, lower left winding of repeating coil RC, thence over the ring conductor of the line, through the winding of polarized relay 105 in shunt of the resistance 103 and return-

ing over the tip conductor, through the upper left winding of the coil RC, lower back contact of relay 120 to ground. In this circuit it will be noted that the negative pole of battery is connected to the ring conductor of the line. This, it will be remembered, causes the relay 105 to move its armature to the left opening contacts 106, thus removing the ground potential from the line during the conversation. Resistance 103 prevents magnet 105 from interfering with the voice currents. With the district selector sequence switch 130 in position 13, the windings 121 and 123 are included in the called end of the circuit of the connection. Assuming that the five-cent call has been extended over trunk 179, the circuit may be traced from the tip conductor of this trunk, over the uppermost brush of selector S, sequence switch spring 128, winding 121 of coil RC, contacts of spring 125 to the winding of relay 127, lower contact of spring 126, winding 123, spring 129, thence to the ring conductor of the trunk 179.

Assume next that the calling party dials a designation corresponding to a ten-cent zone and deposits therefor a ten-cent piece. In this case the translator T advances its brush 170 to the terminal 167 following the setting of the registers R1 and R2, and a circuit is closed through the right winding of relay 157. Relay 157 operates and locks through its left winding and contact to the grounded conductor 172. The sender controls the district selector S to seize the trunk 180 leading to a ten-cent zone, the time-measure switch TS is operated in the manner hereinbefore mentioned, and the control switch CS is driven from positions 1, 2 and 3 to perform the coin test.

Since a ten-cent piece is now deposited in the coin box, contacts 222 and 223 are closed, and contacts 222 and 224 are opened, and the five-cent contacts 214 and 215 are also open. When the negative source of potential 145 is connected to the line for the first part of the test, relay 105 moves its armature to the left removing the ground potential from contact 215 and allowing it to remain on contact 223. Thus, ground potential exists on conductor 112, and the differential relay 142 is unbalanced and attracts its armature. With relay 142 operated in position 1 of the control switch, and magnet 143 operated on the second closure of interrupter 174, a circuit is completed from battery, through the winding of register relay 150, brush 137, front contact of relay 142, ground over conductor 176 as above explained. Relay 150 operates and locks to conductor 175. During the second part of the test the positive source of potential 146 is connected to the line, causing relay 105 to move its armature to the right to remove ground potential from the contact 223. In this case no ground potential occurs on conductor 112, and relay 142 is not unbalanced to attract its armature. Accordingly, a circuit is completed in position 3 of the control switch from battery, through the winding of relay 151, brush 136, front contact of relay 141, back contact of relay 142 to ground over conductor 176. Relay 151 operates and locks to conductor 175.

When the control switch advances into position 4 as previously explained, a circuit is completed through the winding of relay 153, outer right-hand front contacts of relay 157, outer right contact of relay 151, left contact of relay 150 and thence through the brush 133 to ground. The operation of relay 153 in this circuit indicates that a ten-cent piece has been deposited in payment for the desired call which extends into a ten-cent zone. Relay 153 brings about the completion of the connection as above explained.

In this case a different setting of the sequence switch 130 is required in order to remove the ground potential from the substation during conversation and to provide a different arrangement of the repeating coil RC. The talking selection circuit for this purpose may be traced over the conductor 178, right back contact of relay 155, outer left front contact of relay 157 and thence to the No. 1 counting relay. The counting relays cause the positioning of the sequence switch 130 in position 14 rather than in position 13 as in the case of a five-cent call. With the sequence switch in position 14, an obvious circuit is closed for relay 120. Relay 120 reverses the direction of current over the calling line during conversation so that the relay 105 at the substation now moves its armature to the right, removing ground potential from the ten-cent contacts and thus preventing this potential from occuring on the conductor 112. With the sequence switch 120 in position 14, the called end of the connection may be traced from the tip conductor of trunk 180, through the upper brush of selector S, spring 128, windings 121 and 122, contacts of spring 125, winding of relay 127, contact of spring 126, windings 124 and 123, spring 129, and thence to the other side of the ring conductor of trunk 180.

It will next be assumed that the subscriber deposits a ten-cent piece in order to secure a connection into a five-cent zone. Having dialed a code representing a five-cent call, neither relay 155 nor 157 will operate. The coin test is made in the manner already explained, and, since a ten-cent piece has been deposited, register relays 150 and 151 are operated. As soon thereafter as the switch CS reaches position 4, a circuit is completed from battery, through the winding of relay 153, right winding of relay 156, contacts of relays 151 and 150 and thence to ground as above traced. Relay 156 operates, and it locks through its left winding and contact, and

relay 153 operates to permit the completion of the connection. With relay 156 operated, the talking selection circuit now extends over conductor 178, right back contact of relay 155, outer left back contact of relay 157, right front contact of relay 156 and thence to the No. 1 counting relay. This, it will be remembered, is the same circuit that was closed for a call extended into the ten-cent zone. Accordingly the sequence switch 130 assumes position 14 during conversation, and relay 105 is operated to remove ground potential from the ten-cent contacts, thus preventing this potential from existing on the line during conversation.

Assume next that the subscriber dials for a call into a five-cent zone but fails to deposit any coin. No ground potential occurs on the line 100 during the test, and the differential relay 142 remains inert both when connected in series with source 145 and in series with source 146 in positions 1 and 3 respectively of the switch CS. Accordingly, a circuit is closed in position 1 from battery, through the winding of relay 149, brush 136, front contact of relay 141, back contact of relay 142 to ground over conductor 176. Relay 149 operates and locks as explained. In position 3 a similar circuit is closed for relay 151. With relays 149 and 151 operated no circuit is closed for operating the relay 153; accordingly the sender refuses to complete the extension of the connection to the called line. Instead a circuit is closed from battery, through the lamp 181, conductor 182, inner right back contact of relay 157, front contacts of relays 151 and 149, thence to ground as above traced. The lamp 181 attracts the attention of the monitoring operator, who listens in and instructs the calling party to deposit the necessary coin.

Assume next that the calling party dials for a ten-cent call, but deposits a five-cent piece. Having dialed for a ten-cent call, the translator T sets its brush 170 on terminal 167, and relay 157 operates. During the test, however, relays 149 and 152 are operated as above explained in connection with the establishment of a five-cent call. Therefore, relay 153 fails to operate when the switch CS reaches position 4, and a circuit is completed instead from battery, through the lamp 181, interrupter 183, middle right front contact of relay 157 and thence through contacts of relays 152 and 149 to ground.

Interrupter 183 causes the lamp to flicker as a signal to the operator that a five-cent piece was deposited whereas a ten-cent call is desired by the calling party.

In a similar manner it will be found that the lamp 181 is caused to flash by means of interrupter 184 should the calling subscriber seek a ten-cent call without depositing any coin. Similarly a false ground potential on the tip conductor causes the light to burn steadily when a five-cent call is attempted and causes the lamp to flash by means of the interrupter 184 when a ten-cent call is attempted.

Should the calling subscriber abandon the call by replacing the receiver on the switchhook during the test period, the relay 141 releases, and a circuit is completed from battery, through the winding of relay 139, back contact of relay 141, back contact of relay 142, thence over conductor 176 to ground. Relay 139 locks to conductor 175 and extends this grounded conductor through its right front contact to the first, second and third terminals associated with brush 132. This causes the magnet 143 to step the selector immediately into position 4 and the connection is again placed under control of the impulse relay 158. If the receiver remains on the hook, relay 158 releases and brings about the release of the equipment.

What is claimed is:

1. In combination, a telephone line having a substation thereon, a coin mechanism at said substation having a pair of contacts, controlled respectively by coins of different denominations, means normally effective for applying a given electrical condition to both of said contacts, means for removing said condition first from one contact, then restoring it thereto and removing it from the second contact, and means for testing said contacts to determine which one has been operated by a deposited coin.

2. In combination, a telephone line having a substation thereon, a coin mechanism at the substation having a pair of contacts controlled respectively by coins of different values, a relay at the substation normally effective to apply a given potential to both of said contacts, means for operating said relay in one manner to remove said potential from one of said contacts, means for operating said relay in another manner for restoring said potential to said first contact and for removing it from the second contact, and means for testing said contacts over the telephone line to determine which one of said contacts has been operated by a deposited coin.

3. The combination in a telephone system of a line having a substation thereon equipped with a coin device, said coin device including a pair of contacts controlled respectively by coins of different denominations, a polarized relay at the substation normally serving to apply ground potential to both of said contacts, means for connecting a source of potential of one polarity to the line to operate said relay to remove said ground potential from the first one of said contacts, means for applying a source of potential of opposite polarity to the line to operate said relay to remove said ground potential from said second contact and to restore it to said first contact, and testing means ef-

fective to test said contacts to determine which one has been operated by a deposited coin.

4. The combination in a telephone system of a line having a substation thereon equipped with coin receiving mechanism, said mechanism including a pair of coin controlled contacts, automatic switches for extending said line, means controlled from the substation for sending designations to control the operation of said switches, means normally effective for applying a given potential to both of said contacts, means for removing said potential first from one contact, then restoring it thereto and removing from the second contact, means for testing said contacts to determine which one has been operated by a deposited coin, and means responsive to said testing means for enabling the extension of the wanted connection in accordance with the designation transmitted from the substation.

5. The combination in a telephone system of a line having a substation thereon equipped with a toll device, a connection for applying a potential to said toll device, an automatic switch, means for operating said switch to extend said line in either of two directions, a source of talking current for supplying said line during conversation, means for causing said switch to take up either one of two positions according to the direction in which said line is extended, and means for determining the direction of flow of said talking current according to the position of said switch to cause the disconnection of said source of potential from said toll device.

6. In a telephone system, a line having a substation thereon equipped with a toll device, a polarized relay for connecting a potential to said device to control the operation thereof, a selector switch, a designation recorder, means for transmitting impulses over said line to record a desired designation on said recorder, means for setting said selector switch under the control of said recorder to one position for a call of one value and to another position for a call of another value, a source of talking current for said line, means effective in one position of the selector for connecting said source of talking current to the line in such a direction as to operate said relay to remove said potential from the toll device, and means effective in another position of said selector to reverse the direction of talking current to cause the operation of said polarized relay to remove said potential from the toll device.

7. In a telephone system, a line having a substation thereon, a coin mechanism at said substation arranged to receive coins of two different denominations, means controlled by the deposit of a coin of either denomination for closing a ground connection to said line, an automatic selector switch, a register controller for recording designations and for selectively operating said switch to extend the line in either of two directions, one representing a coin of one denomination and the other a coin of the other denomination, means dependent upon the position to which said selector is set under the control of said register controller for determining the direction of current flow in said line during conversation, means at the substation responsive to the flow of current in the line during conversation for disconnecting said ground connection, means effective to permit the establishment of a connection represented by a coin of the lower denomination when a coin of the higher denomination is deposited instead, and means effective to cause said selector switch to take up the same position it would have taken had the call been one represented by the coin of higher denomination.

In testimony whereof, I have signed my name to this specification this 13th day of January, 1931.

WILLIAM T. HAINES.