

April 4, 1944.

W. Y. LANG ET AL

2,345,851

TELETYPEWRITER SWITCHING SYSTEM PAY STATION

Filed May 9, 1941

4 Sheets-Sheet 1

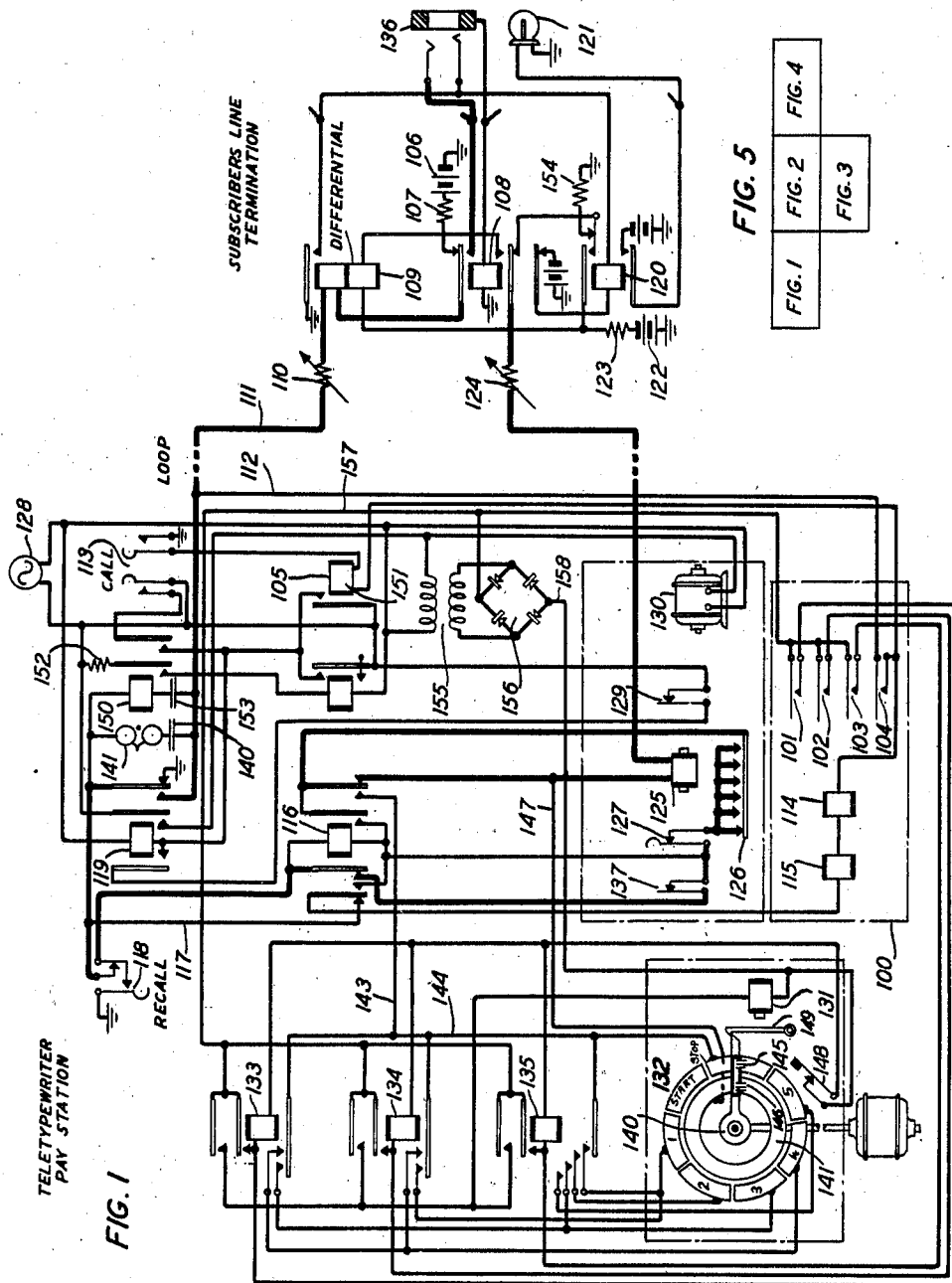


FIG. 5

FIG. 1	FIG. 2	FIG. 4
FIG. 3		

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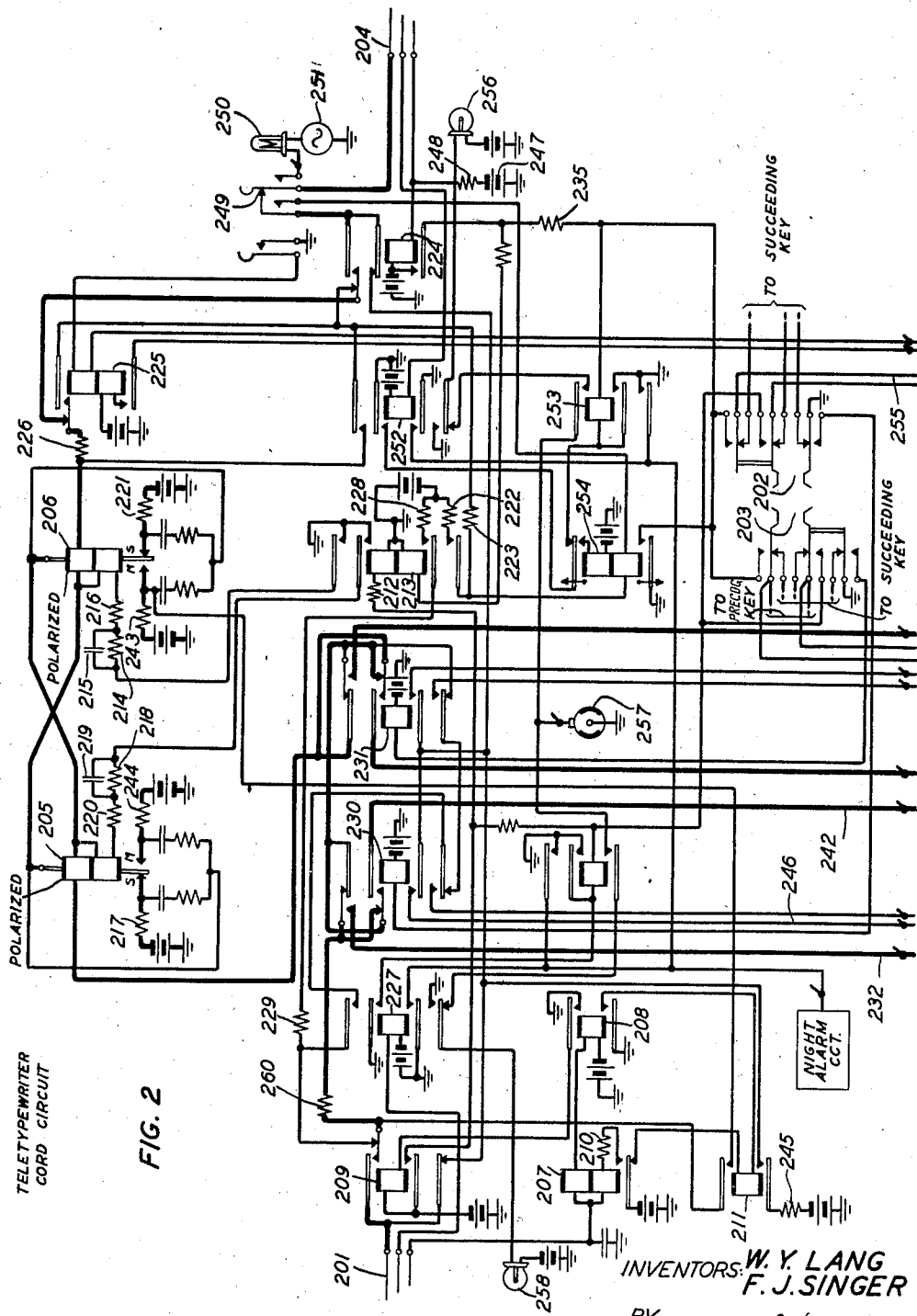
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TELETYPEWRITER SWITCHING SYSTEM PAY STATION

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4 Sheets-Sheet 2



TELETYPEWRITER
CORD CIRCUIT

FIG. 2

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TELETYPEWRITER SWITCHING SYSTEM PAY STATION

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4 Sheets-Sheet 3

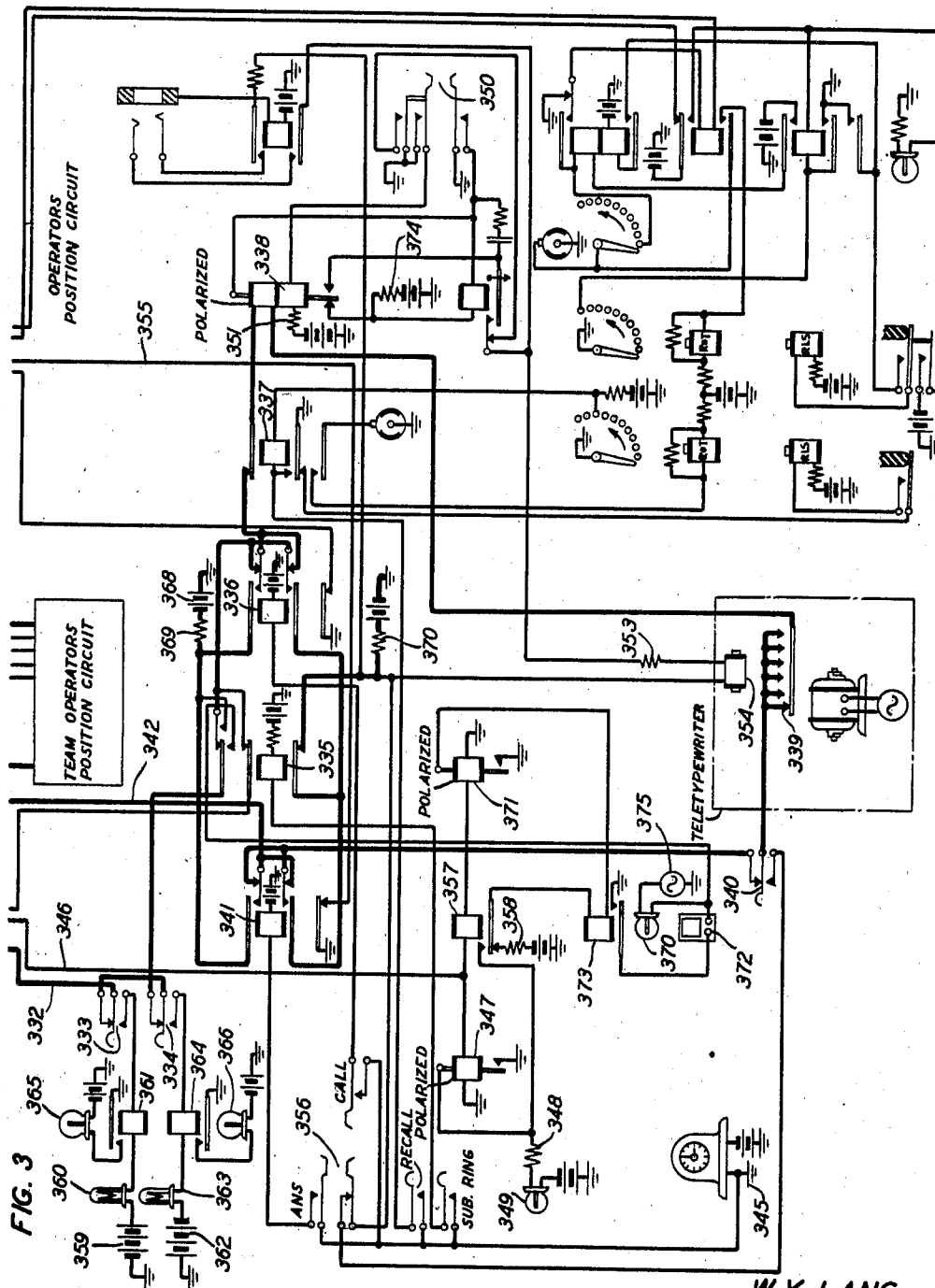


FIG. 3

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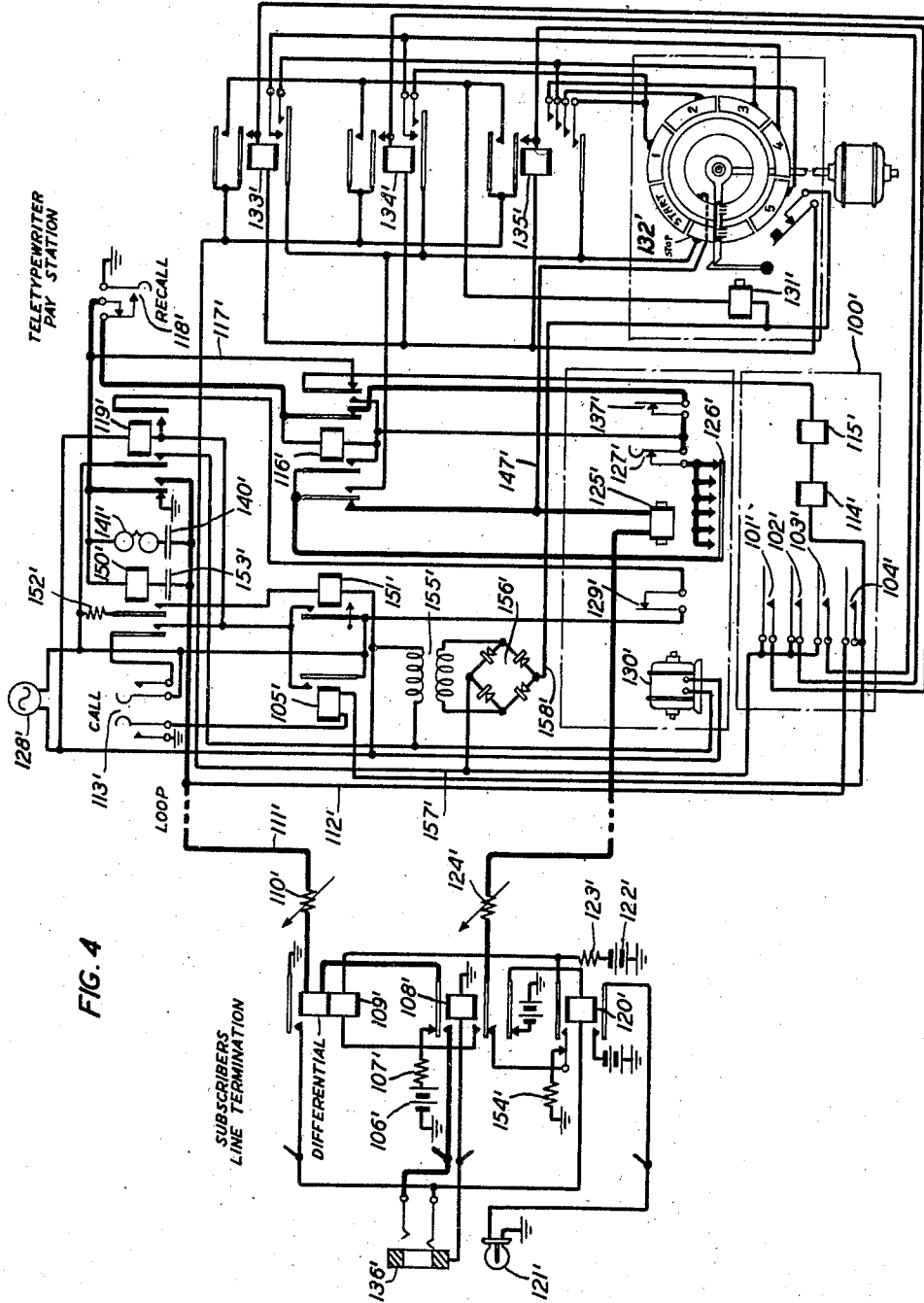
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TELETYPEWRITER SWITCHING SYSTEM PAY STATION

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,345,851

TELETYPEWRITER SWITCHING SYSTEM
PAY STATION

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Application May 9, 1941, Serial No. 392,682

25 Claims. (Cl. 178—2)

This invention relates to teletypewriter switching systems and more particularly to teletypewriter switching systems including prepayment or pay station circuits as they are otherwise called.

An object of this invention is the improvement of teletypewriter switching systems.

A more particular object of this invention is the improvement of pay station controlled teletypewriter switching systems.

A feature of this invention is an arrangement wherein a coin is deposited in a coin collection device in order to initiate a call. The teletypewriter motor cannot be started at the station until this has been done.

A further feature of this invention is an arrangement wherein the station teletypewriter may be started either by the subscriber at a station where a call is being initiated or it may be started from the central office and in which the teletypewriter may be stopped at either of these two points or from a distant station in the connection. The station motor is stopped on the reception of a teletypewriter code signal corresponding to a particular character.

A further feature is an arrangement wherein on incoming calls to the teletypewriter pay station a common type ringer at the pay station may be controlled at the central station to give an audible signal to call the pay station subscriber.

A further feature of this invention is an arrangement wherein the pay station loop circuit, which is normally open at the pay station, may be closed in response to a continuous ringing signal of longer than normal duration transmitted from the central station.

A further feature is an arrangement wherein the central station operator may either return coins which have been deposited in the coin collection device at the pay station or collect said coins and these operations may be performed either while the station motor is operating or while the station motor is stopped.

A further feature is an arrangement wherein the central station operator may prevent the subscriber from typing until additional coins have been deposited at the pay station.

A further feature is an arrangement wherein the central station operator may permit the subscriber at the pay station to resume communication after additional coins have been deposited at the pay station in response to the central station operator's request.

A further feature is an arrangement wherein a typed record of the amount of money deposited in

the pay station coin box is provided both at the pay station and at the central office as each coin is deposited.

A further feature is an arrangement wherein when the station is idle all power is disconnected from the pay station apparatus.

These and other features will become apparent from the following description when read with reference to the associated drawings in which:

Fig. 1 shows a teletypewriter pay station circuit, located at the left of the figure and interconnected by means of a pair of conductors to the teletypewriter pay station line terminating circuit at the central teletypewriter switching station, indicated at the right of the figure;

Fig. 2 shows a teletypewriter cord circuit for use in flexibly interconnecting the circuit per Fig. 1 with other circuits;

Fig. 3 is an operator's position circuit which may be connected to a particular cord, such as Fig. 2, when an operator at the central station desires to communicate either with a subscriber at the teletypewriter pay station per Fig. 1 or over some other circuit to which the cord per Fig. 2 may be connected;

Fig. 4 is electrically the same as Fig. 1, but is inverted, so as to better illustrate a called line, as an aid in understanding how Fig. 1 and Fig. 4 cooperate with the cord circuit of Fig. 2; and

Fig. 5 is a diagram representing the position in which Figs. 1, 2, 3 and 4 should be arranged to conform to the description herein.

The manner in which the circuits function will now be described in detail.

Pay station subscriber initiates a call

Please refer to Fig. 1.

In order to initiate a call, the subscriber at the teletypewriter pay station in Fig. 1 deposits a coin in the coin collection device at the teletypewriter pay station. The coin collection device is represented by the rectangle 100. We are not herein concerned and will not here describe the mechanism of the coin collection device except for its electrical apparatus and connections. Coin collection devices of the same general type as that indicated by rectangle 100 are described in Patent 1,043,219 to O. F. Forsberg, November 5, 1912, and Patent 1,137,399 to C. L. Goodrum, April 27, 1915. It is to be understood that in the coin collection device a number of coin slots are provided. The mechanism is arranged in a well-known manner so that the different coins will follow different paths to operate different contacts. Thus a five-cent piece which is deposited

will close contacts 101; a ten-cent piece will close contacts 102; a twenty-five-cent piece will close contacts 103. In initiating a call any coin which is deposited will close contacts 104. The closure of contacts 104 prepares a circuit for the operation of relay 105. This circuit may be traced from ground, through battery 106 at the central office, resistance 107, top back contact and armature of relay 108, top winding of relay 109, variable resistance 110 and over the top loop conductor 111, connecting the central office with the teletypewriter pay station, conductor 112, contacts 104, winding of relay 105 to the right-hand armature of key 113, which is disengaged from the path which extends to ground through its cooperating contact. The closure of contacts 104 also establishes a parallel branch extending through the windings of coin collect magnet 114, coin return magnet 115, left-hand outer armature and back contact of relay 116, conductor 117 and through the right-hand outer armature and back contact of relay 119 to ground. The energization of the top winding of relay 109 in the circuit just traced closes a circuit from ground, through the armature and front contact of relay 109, winding of relay 120 and the bottom outer armature and back contact of relay 108 to battery, which operates relay 120. The operation of relay 120 closes a circuit from battery, through the bottom front contact and armature of relay 120 and the filament of lamp 121 to ground, lighting lamp 121 as a signal that the pay station subscriber is calling the central station. The operation of relay 120 also closes a circuit from ground, through battery 122, resistance 123, top armature and front contact of relay 123, bottom inner back contact and armature of relay 108, variable resistance 124, printer receiving magnet 125, right-hand outer back contact and armature of relay 116, teletypewriter sending contacts 126, contact and armature of break key 127 to a parallel circuit. One branch of said circuit extends through contacts 137 which can be opened momentarily by the teletypewriter receiver on reception of a train of signals corresponding to the code for the upper case S by the teletypewriter receiver and through the left-hand inner back contact and armature of relay 116. The second branch extends through the winding of relay 116. The parallel branches join and the circuit extends through the continuity contacts of recall key 118 and through the right-hand outer armature and back contact of relay 119 to ground.

The pay station subscriber will now operate key 113 so as to close the path heretofore traced, through the winding of relay 105, to ground. This results in the operation of relay 105. The operation of relay 105 in turn causes the operation of relay 119 over a path extending from the right-hand side of the alternating current power supply 128, through the winding of relay 119 and the front contact and armature of relay 125 to the left-hand side of the power source 128. This causes the operation of relay 119. Relay 119 locks in the operated position over a circuit from the right-hand side of power source 128 through the winding, left-hand armature and front contact of relay 119, through contacts 129, which are arranged so that they can be opened momentarily in response to the reception of a train of code signals by the teletypewriter corresponding to the upper case H, to the left-hand side of the power source 128. The operation of relay 119 disconnects ground from the

windings of coin collect magnet 114 and coin return magnet 115. The operation of relay 119 further short-circuits magnets 114 and 115 as well as coin collect contacts 104 when the top loop conductor is closed through the right-hand outer front contact and armature of relay 119. The closure of these contacts establishes the pay station transmitting loop by extending the loop through these contacts, through the continuity contacts of recall key 118, left-hand inner armature and back contact of relay 116, contacts 137, break key 127, transmitting contacts 126, right-hand outer armature and back contact of relay 116, receiving magnet 125, variable resistance 124, bottom inner armature and back contact of relay 120, continuity contacts of relay 120 and resistance 154 to ground. The operation of relay 119 also closes the power circuit to the teletypewriter motor 130. This circuit may be traced from the right-hand side of power supply 128, through the windings of motor 130, the right-hand inner front contact and armature of relay 119 to the left-hand side of the power supply 128. This starts motor 130. The operation of relay 119 also establishes a circuit which extends from the left-hand side of power source through the right-hand inner armature and front contact of relay 119 and the top winding of transformer 155 to the right-hand side of power source 128. Alternating current supplied through the transformer 155 is rectified in rectifier 156. The rectifier supplies direct current to the coin collect apparatus over a circuit which extends from the bottom terminal of the rectifier through conductor 158, through the start magnet 131 of the rotary distributor 132, to the top front contact of relays 133, 134 and 135 in parallel. These contacts are open at this time. The cooperating armatures of these relays are connected in parallel and the circuit extends through conductor 157 to the top terminal of rectifier 156.

After the pay station transmission loop has been established, relay 109 remains in the operated condition due to the effect of current flowing through its top winding.

The central station operator answers

Refer now to Fig. 2.

When the cord circuit per Fig. 2 is idle, the circuits through both the top and bottom windings of repeater relays 205 and 206 are open so that no current flows in any of these windings. The armature of each of these relays is shown in engagement with its spacing contact. When the circuit per Fig. 2 is conditioned for communication, the armatures of relays 205 and 206 will each be in engagement with its marking contact. How this is accomplished will be described below.

Upon noting the lighted line lamp, a switch-board operator at the central station answers the call by operating either of two typing keys 202 or 203 in her cord circuit per Fig. 2 and then inserting plug 201 of Fig. 2 into jack 136 of Fig. 1.

It is to be understood that there are a plurality of cord circuits such as Fig. 2 available at each operator's position in the central office. Each operator has only one operator's position circuit per Fig. 3 by means of which she may communicate. Upon the selection of a particular cord at her position for use in responding to a particular call, it is necessary for the operator at the position to connect her single operator's position circuit to the selected cord.

The cord and position circuits per Fig. 2 and

Fig. 3 are arranged for teamwork. By this is meant that they are arranged in such manner that an operator at a position adjacent the position in which a particular cord has been selected for answering a call may connect her single operator's position circuit such as Fig. 3, to the selected cord in the adjacent position so as to cooperate with the operator thereat during intervals of heavy load.

In order to permit this cooperation, each cord circuit is equipped with two keys, one of which is used to connect the operator's position circuit at the same position and the other of which is used to connect the operator's position circuit at an adjacent position to the cord circuit. Key 202 is used to connect the operator's position circuit at the same position and key 203 is used to connect the operator's position circuit at an adjacent position to Fig. 2.

It will be assumed that the central station operator actuates key 202 to its alternate position so as to connect her own operator's position circuit to the cord circuit per Fig. 2.

When plug 201 is inserted in jack 136, a circuit is established which may be traced in Fig. 1 from ground through the winding of relay 108 and the sleeve of jack 136 into Fig. 2 through the sleeve of plug 201, top winding of relay 207 and winding of relay 208 to grounded battery. Relays 108, 207 and 208 are operated. The operation of relay 108 disconnects loop conductor 111 from the path which extends through the top back contact of relay 108 to positive battery and connects the top loop conductor through the top armature and front contact of relay 108 to the tip of jack 136. The bottom loop conductor of Fig. 1 is disconnected from the path through the bottom inner armature and back contact of relay 108 and connected through the bottom inner front contact of relay 108 and through the bottom winding of relay 109 and resistance 123 to negative battery 122. When the loop circuit is extended through the bottom winding of relay 109, relay 109 releases. This, in turn, releases relay 120 by breaking the connection to ground through the front contact and armature of relay 109. The release of relay 120 opens the circuit through the filament of lamp 121 as the bottom armature of relay 120 is disconnected from its front contact and lamp 121 is extinguished.

The operation of relay 208 closes a circuit from ground through the top front contact and armature of relay 208 and the winding of relay 209 to battery, operating relay 209. The operation of relay 209 establishes a circuit from negative battery through the bottom inner armature and front contact of relay 209, resistance 212 and the top winding of relay 213 to ground, operating relay 213. The operation of relay 213 establishes a circuit from ground through the top outer front contact and armature of relay 213 to a parallel circuit comprising resistance 214 and condenser 215 and then in series through resistance 216, the bottom winding of relay 206, through the armature and spacing contact of relay 205 and resistance 217 to negative battery. A circuit is also established from ground through the top inner front contact and armature of relay 213 to a parallel circuit comprising resistance 218 and condenser 219 and then in series through resistance 220, the bottom winding of relay 205 through the armature and spacing contact of relay 206 and resistance 221 to negative battery. A circuit is also established from negative battery through resistance 222, the bottom outer front contact and

armature of relay 213, resistance 223, the continuity contacts associated with the top outer armature of relay 224, the continuity contacts associated with the top armature of relay 225, resistance 226, top winding of relay 206 through the armature and spacing contact of relay 205 and resistance 217 to negative battery. The circuit which extends from negative battery through resistance 228 and the bottom inner front contact and armature of relay 213 through resistance 229 is opened as relay 227 is released and relay 209 is operated.

The operation of the typing key 202 closes a circuit from ground through the bottom armature and front contact of key 202, through the winding of relay 230 to battery, operating relay 230. This extends the transmission path which will be traced below through the operator's position circuit.

The transmission path interconnecting Figs. 1, 2 and 3 may be traced from ground in Fig. 1 through battery 122, resistance 123, bottom winding of relay 109, bottom inner front contact and armature of relay 108, variable resistance 124, receiving magnet 125, right-hand outer front contact and armature of relay 116, transmitting contacts 126 and break key 127 to a two-branch parallel circuit. Branch 1 of this parallel circuit extends through the winding of relay 116. Branch 2 of this parallel circuit extends through contacts 137. These contacts are controlled by a functional lever in the teletypewriter receiver which in turn responds to a train of signals corresponding to the code for upper case S. Branch 2 continues through the left-hand inner back contact and armature of relay 116 where it joins with branch 1. The circuit continues through the continuity contacts of recall key 118, the right-hand outer armature and front contact of relay 119, through the top loop conductor 111, variable resistance 110, top winding of relay 109, top armature and front contact of relay 108, tip of jack 136, tip of plug 201, top armature and front contact of relay 209, resistance 260, through the continuity contacts associated with the top outer armature of relay 230, which continuity contacts are closed when relay 230 is operated in order to connect the operator's position circuit to the cord per Fig. 2. The circuit continues through conductor 232 in Fig. 2, which connects to conductor 332 in Fig. 3, through the armature and back contact of key 333, through the armature and back contact of key 334, through the top outer armature and back contact of relay 335, through the continuity contact associated with the top armature and the bottom inner armature of relay 336 in parallel, through the top back contact and armature of relay 337, through the top winding of relay 338, the transmitting contacts 339 of the printer in the operator's position circuit, the armature and back contact of break key 340, the continuity contacts associated with the top armature and bottom inner armature of relay 341 in parallel, through conductor 342 which connects to conductor 242 in Fig. 2, through the top inner armature and front contact of relay 230, through the continuity contacts associated with the top inner armature of relay 231 and the top outer back contact and armature of relay 231 in parallel, top winding of relay 205, the armature and spacing contact of relay 206 and resistance 221 to negative battery.

In tracing the path which extends through the top winding of relay 206, it was shown that both ends of the path are terminated in negative bat-

tery so that no current flows through the top winding. In tracing the path which extended through the top winding of relay 205, it was shown that both ends of the path are also terminated in negative battery so that no current flows through the top winding of relay 205 for this condition. The circuit through the bottom winding of relay 205, as well as that through the bottom winding of relay 206, when the armatures of these relays are in engagement with their spacing contacts, as shown, is terminated in ground at one end and negative battery on the opposite end in each instance. When no current flows through the top winding of each of these relays, the effect of current flowing from negative battery to ground through the bottom winding in each instance actuates the armature of each of these relays to engage with its alternate or marking contact. When the armature of relay 206 is in engagement with its left-hand or marking contact, positive battery is connected through resistance 243 and the left-hand or marking contact and armature of relay 206. The other end of the loop circuit heretofore traced is terminated, as has been shown in negative battery 122. For this condition the batteries connected to each end of the transmission circuit through the subscriber's station per Fig. 1 and the answering end of the cord per Fig. 2 are in series-aiding relationship. The effect of this current flowing through the top winding of relay 205 tends to maintain the armature of relay 205 in engagement with its right-hand or marking contact. When the armature of relay 205 is in engagement with its right-hand or marking contact, positive battery is connected through resistance 244 to the right-hand or marking contact and armature of relay 205. For this condition the batteries connected to each end of the circuit extending through the top winding of relay 206 are in series-aiding relationship and the effect of current flowing through the top winding of relay 206 actuates the armature of relay 206 to engage with its left-hand or marking contact. When the armatures of relays 205 and 206 are in engagement with their marking contacts, positive battery is connected to one end of the circuit extending through the bottom winding of each of relays 205 and 206 and ground is connected to the opposite end of each circuit. The effect of the current through each bottom winding for this condition tends to actuate the armature of relay 205 and the armature of relay 206 to engage with its corresponding spacing contact. The effect of the current through the top winding of relays 205 and 206 is dominant, however, so that the armature of each of these relays is maintained in engagement with its marking contact.

Prevention of interference between answering cords

It is to be understood that the jack 136 in Fig. 1 is provided with multiple appearances at various positions in the switchboards. Ordinarily, a plurality of jacks, such as 136, together with their associated lamps, such as 121, will appear at a plurality of operators' answering positions, so that lamp 121 is lighted at a plurality of answering positions to enable any one of several operators to respond to the incoming line signal when a subscriber at teletypewriter pay station, per Fig. 1, initiates a call. In addition to jacks, such as 136, located at a plurality of answering positions, a number of similar jacks, connected in multiple with jack 136,

appear at a plurality of operators' positions in another switchboard wherein calls originated by other subscribers may be completed to a particular subscriber's station such as the station connected to Fig. 1. The circuit herein provides protection against the simultaneous connection of more than one cord, per Fig. 2, to a subscriber's circuit, per Fig. 1. If a second plug, such as 201, of a second Fig. 2 is inserted into one of the multiple jacks, such as 136, while the plug of a first Fig. 2 is so connected, the relay corresponding to relay 203 in the second cord will operate, but the relay corresponding to relay 207 in the second cord will not operate, due to the shunting effect of relay 203 in the first cord. The operation of the relay corresponding to relay 203 in the interfering cord will, in turn, operate the relay corresponding to relay 209 in the interfering cord. At the same time a circuit is established in the interfering cord from ground through the bottom armature and front contact of the relay corresponding to relay 203, through the winding of the relay corresponding to relay 211, through the bottom back contact and armature of the relay corresponding to relay 207 to negative battery. This operates the relay corresponding to relay 211 in the interfering cord.

The operation of the relay corresponding to relay 211 in the interfering cord closes a circuit from positive battery through the resistance corresponding to resistance 243, through the top front contact and armature of the relay corresponding to relay 211, through the resistance corresponding to resistance 260 and over a circuit corresponding to the circuit traced in Fig. 2 above, through the top winding of the relay corresponding to relay 205 and the armature and marking contact of the relay corresponding to relay 206. Since both ends of the circuit through the top winding of the relay corresponding to relay 205 in the interfering cord are terminated in the same positive battery, no current will flow through this winding in the interfering cord. The effect of current flowing from positive battery through the marking contact and armature of the relay corresponding to relay 206 and the bottom winding of the relay corresponding to relay 205 to ground, when no current flows through the top winding of the relay corresponding to relay 205 actuates the armature of the relay corresponding to relay 205 to engage with its left-hand or spacing contact. When the armature of the relay corresponding to relay 205 is in engagement with its left-hand or spacing contact, no current will flow through the top winding of the relay corresponding to relay 203, since both ends of the circuit are terminated in negative battery. The effect of current flowing through the bottom winding for this condition maintains the armature of the relay corresponding to relay 203 in engagement with its left-hand or marking contact. Since the armature of the relays corresponding to relays 205 and 206 in the interfering cord are maintained in this condition, namely, the armature of the relay corresponding to relay 205 in engagement with its spacing contact, and the armature of the relay corresponding to relay 206 in engagement with its marking contact, due to the effect of current conditions, supplied from the interfering cord itself, it is not possible to transmit through the interfering cord.

When an interfering cord is connected to a

line circuit, a visual signal is provided in the operator's position circuit to indicate the condition. The manner in which this is performed is as follows:

The operation of the relay corresponding to relay 211 in the interfering cord establishes a circuit from negative battery through resistance 245 to the armatures of the relays corresponding to relays 230 and 231 in the interfering cord. Assuming that the key corresponding to key 202 in the interfering cord has been operated to connect the interfering cord to the operator's position circuit in the same position, the circuit will be extended through the bottom inner armature and front contact of relay 230, through conductor 246 which connects to conductor 346 in Fig. 3 and through the winding of a relay, such as 347, in the position circuit connected to the interfering cord, to ground, operating the relay, such as 347. This closes a circuit from ground through the armature of the relay, such as 347, through a resistance, such as 348, and the filament of a lamp, such as 349, to battery, lighting the lamp such as 349 as an indication of the interfering condition.

When the interfering cord is removed the relays in the interfering cord which have been operated will be restored to normal.

Calling subscriber and central station operator communicate

The transmission circuits extending through Figs. 1, 2 and 3 are now in condition so that communication may proceed between the calling subscriber at the pay station and the operator at the central station. The subscriber at the pay station types the necessary information to enable the operator at the central station to complete the call. As the various characters are transmitted, the transmitting contacts 126 are set in various combinations corresponding to the code of the desired characters and the transmitting path through these contacts is opened and closed in conformity.

In the operator's position circuit, per Fig. 3, key 350 is actuated to its alternate position. This closes a circuit from battery through resistance 351, the bottom winding of relay 338 and through the top inner armature and front contact of key 350 to ground.

When the circuit, per Fig. 3, is in such condition that key 350 is actuated to its alternate position so that current flows through the bottom winding of relay 338 and the circuit through the top winding of relay 338 is open so that no current flows through the top winding, the armature of relay 338 is actuated so as to engage with its left-hand or spacing contact, as shown. When the circuit extending through the top winding of relay 338 is closed and its two ends are connected to batteries of opposite polarities, the effect of current flowing through the top winding of relay 338 preponderates over the effect of current flowing through the bottom winding of relay 338 and the armature of relay 338 is actuated so as to engage with its right-hand or marking contact. Relay 352 is a slow-release relay. A circuit may be traced from ground through the bottom armature and front contact of key 350, the winding of relay 352 and resistance 374 to negative battery. When the armature of relay 338 is in engagement with its left-hand or spacing contact, this path is shunted by a circuit extending from ground through the armature and front contact of key 350, the armature and left-hand or spacing con-

tact of relay 338 to resistance 374 and thence to negative battery. Relay 352 releases too slowly to follow spacing signals of normal duration. Relay 352 will release, however, on spacing signals of protracted duration, such as break signals. During normal communication, therefore, relay 352 remains operated. As relay 338 follows the communication signals, ground is connected from the bottom armature and front contact of key 350, through the armature and right-hand or marking contact of relay 338 to a circuit which extends through the armature and front contact of relay 352, through resistance 353, the winding of receiving magnet 354 and resistance 370 to positive battery. For this condition the winding of receiving magnet 354 is energized to record a marking signal in the teletypewriter receiver. When the armature of relay 338 is actuated so as to engage with its left-hand or spacing contact, the circuit through the winding of receiving magnet 354 is open and the magnet is deenergized to record a spacing signal. Thus, signals transmitted from the pay station teletypewriter are recorded in the teletypewriter receiver in the operator's position circuit at the central station. Relay 205 in the cord circuit, per Fig. 2, follows these signals also, but this is ineffective to produce any further result at this time, as the plug 204 is not connected as yet to any cooperating circuit. As the armature of relay 205 is operated between its marking and spacing contacts, the armature of relay 206 is maintained in engagement with its left-hand or marking contact. This, as is well known, is due to the fact that when the armature of relay 205 is connected to its right-hand or marking contact, the effect of current flowing through the top winding of relay 206, which effect tends to operate the armature of relay 206 so as to engage with its left-hand or marking contact, preponderates over the effect of the current flowing through bottom winding of relay 206 which latter effect tends to actuate the armature of relay 206 to engage with its right-hand or spacing contact. When the armature of relay 205 is actuated so as to engage with its left-hand or spacing contact, under which condition negative battery is connected to both ends of the circuit extending through the top winding of relay 206 so that no current flows through the top winding, the effect of the current flowing through the bottom winding of relay 206 is reversed so that the armature of relay 206 is now maintained in engagement with its left-hand or marking contact.

After the operator at the central station has received the information requisite to completing the connection to the called party, she will extend the connection. The calling party may wish to be connected to another party whose line is connected directly to the same central station at which Fig. 2 is located. In this case, the operator at the central station, where Fig. 2 is located, may complete the connection directly to the called party's line. It will be assumed herein that such a connection is desired. It is to be understood that the circuit, per Fig. 2, may be used to extend a call to a more remote central terminal for completion by means of a trunk circuit extending toward the more remote central terminal. As it is not necessary to an understanding of the invention herein, the manner in which Fig. 2 cooperates with the trunk circuit where completion to a remote subscriber is desired will not be described; such extension involves circuits and operating practices in commercial use as well as

disclosed in prior patents and will be understood by persons skilled in the art.

Testing called line

Before the central station operator completes the connection to the called party, she will test the called line to determine whether or not it is available. A number of conditions may prevent the called line from being available. It may be temporarily engaged in communication with another party. This condition is known as "busy." It may be out of order. The subscriber at the station to be called may be practicing. The circuits herein are arranged to indicate all of these conditions by means of special identifying signals. First the busy test and characteristic signal will be described.

The cord circuit, per Fig. 2, is arranged so that a busy test is provided with each end of the cord. Before inserting the plug associated with either end of Fig. 2 into a jack associated with a particular line circuit, the operator will momentarily connect the tip of the plug which she is using to the sleeve of the particular line. It will be assumed that the circuit, per Fig. 4, is to be used for the called line. If Fig. 4 is busy, another cord will be connected to some one of the multiple of appearances of jack 136'. Negative battery, such as 247 in the other cord, will be connected through a resistance, such as 248, and the sleeve of a plug, such as 204, to the sleeve of a multiple appearance of jack 136' and a circuit will be extended from said sleeve through the tip of plug 204 of the present Fig. 2, through the armature and back contact of key 249, the top inner armature and back contact of relay 224 to the bottom inner armatures of relays 230 and 231 in parallel. Depending upon whether the home or team operator's position circuit is connected to Fig. 2, relay 230 or relay 231 will be operated, as key 202 or key 203 is operated under these circumstances. It has been assumed that key 202 and relay 230 are operated and the circuit will, therefore, be extended through the bottom inner armature and front contact of relay 230, through conductor 246 into Fig. 3 where it connects with conductor 346 and is extended to ground through the winding of relay 347. In response to the negative battery connected to its winding, relay 347 will be actuated so that its armature engages with its right-hand contact. This, in turn, will light lamp 349 as heretofore described. Attention is called to the fact that relay 347 is operated and lamp 349 is lighted to indicate either an interfering cord condition or a busy test condition.

If the line is busy due to being connected up for practice, a positive potential will be present on the sleeve of the called line. Under these circumstances the armature of relay 371 will be actuated so as to engage with its right-hand contact and a circuit will be closed from ground through the armature of relay 371, winding of relay 373, bottom armature and back contact of relay 357 and through resistance 358 to battery, operating relay 373. The operation of relay 373 will close a circuit from ground through the front contact and armature of relay 373, through buzzer 372, filament of lamp 370 and power source 375 to ground, lighting lamp 370 and operating buzzer 372 as an indication that the line which has been called is engaged in practice and that the operator may insert her plug and proceed with the call. Attention is called to the fact that the positive potential supplied from

the sleeve of a busy line, while sufficient to operate the armature of relay 371 is insufficient to operate relay 357.

If the line is out of order, a positive potential will be present on the sleeve of greater magnitude than in the case of the practice circuit connection and both relays 371 and 357 will be operated. Under these circumstances a circuit will be established which extends from ground through the armature of relay 371, winding of relay 373, armature and front contact of relay 357, resistance 348 and the filament of lamp 349 to battery. This operates relay 373 and lights lamp 349. The operation of relay 373, in turn, operates buzzer 372 and lights lamp 370, as heretofore described. The operation of the buzzer and the lighting of the two lamps indicates the out-of-order condition.

It is to be understood, of course, that the necessary sleeve potentials are supplied from out-of-order cords and practice cords which are temporarily connected to one of the multiple appearances of jack 136' during the out-of-order or practice intervals.

Central station operator completes call to called line

If the operator finds that the called line is available, she will complete the call to the called line by inserting plug 204 into jack 136'. A circuit will, thereupon, be completed from battery through the winding of relay 224, sleeve of plug 204, sleeve of jack 136' and the winding of relay 108' to ground, operating relays 224 and 108'. The operation of relay 224 closes the transmission circuit through the calling side of the cord at the top outer armature and front contact of relay 224. It also disconnects the busy test lead at the top inner armature and back contact of relay 224. The operation of relay 224 also closes a circuit from negative battery through the lower make contact and armature of relay 224, resistance 235 to a parallel circuit. One branch of the parallel circuit extends through the winding of relay 253, top back contact and armature of relay 254, to the top inner make contact of relay 252 which is open at this time. The other branch connects in parallel to open contacts on keys 202 and 203 and on relay 254.

In the subscriber's line and pay station, per Fig. 4, the operation of relay 108' establishes a circuit from negative battery 122' through resistance 123', bottom winding of relay 109', bottom inner front contact and armature of relay 108', variable resistance 124', through the bottom loop conductor extending from the central terminal to the called subscriber's pay station, receiving magnet 125', left-hand outer back contact and armature of relay 116', the teletypewriter transmitting contacts 126', and break key 127' to a two-branch parallel circuit. The first branch of said parallel circuit extends through the winding of relay 116'; the second branch extends through contacts 137', which are controlled in response to the reception of a train of signals corresponding to the upper case S by the teletypewriter at the called subscriber's station, and through the right-hand inner back contact and armature of relay 116'. The two branches thereupon join and the circuit continues through the continuity contacts of recall key 118' and through the left-hand outer armature and back contact of relay 119' to ground. The circuit through the upper winding of relay 109' is open, for direct current, at the left-hand outer make contact of relay 119', so that the top winding of relay 109' is not energized.

Relay 109' operates due to the effect of current flowing through its bottom winding. This establishes a circuit from ground through the armature and front contact of relay 109', the ring conductor of jack 136', ring of plug 204 and through the winding of relay 252 to battery, operating relay 252. Relay 253 remains unoperated at this time as the circuit through its winding which may be traced from battery through the bottom front contact and armature of relay 224, resistance 235, winding of relay 253, top back contact and armature of relay 254 and through the top inner front contact and armature of relay 252 to ground is shunted by a circuit which extends through the top front contact and armature of key 202 through conductor 255 into Fig. 3, where it connects with conductor 355, through the bottom outer back contact and armature of relay 341 to ground. It is to be understood that typing key 202 is operated before plug 204 is inserted into jack 136'. The operation of relay 252 closes a circuit from ground through its bottom outer front contact and armature and the filament of lamp 256 to ground. Lamp 256 is lighted as a supervisory signal to indicate that the called subscriber has not yet responded. The operation of relay 252 also closes a circuit from ground through the bottom inner front contact and armature of relay 252 to the night alarm circuit indicated by a rectangle. The night alarm circuit is arranged so that it may be connected in series with the conductor just traced, by the operation of a switch in said circuit, to provide an audible or visual signal, or both, during periods of light load when an operator is not stationed at each position in the switchboard at the central station.

When the transmission conductor in the calling side of the cord is extended into Fig. 4, it is essential that the armature of relay 206 be maintained in engagement with its marking contact. It has been shown, in tracing the circuit of the transmission conductor in Fig. 4, that prior to the time when the subscriber at the called pay station responds, the transmission conductor in the line and station circuit which connects to the transmission conductor in the calling side of the cord, is open at the left-hand outer make contact of relay 119'. In order to maintain current in the top winding of relay 206, it is necessary to connect negative battery to the right-hand side of the winding until the called station responds. Relay 252 performs this function when it closes its top outer armature and front contact. A circuit may thereupon be traced from negative battery through resistance 222, bottom outer front contact and armature of relay 213, resistance 223, top outer armature and front contact of relay 252 to the right-hand side of the winding of relay 206 from which point the circuit has heretofore been traced.

Key 249 is operated so as to engage its alternate contacts to ring the called subscriber. A circuit may thereupon be traced from ground through a source of alternating current 251, the filament of lamp 250, right-hand front contact and armature of key 249, tip of plug 204, tip of jack 135', top front contact and armature of relay 108', top winding of relay 109', variable resistance 110' and the top loop conductor 111' to a parallel circuit consisting of two branches. One branch extends through condenser 153' and the winding of relay 150'. The other extends through condenser 140 and ringer 141'. The branches join and the circuit continues through the left-hand outer armature and back contact of relay 119' to

ground. This operates ringer 141' as a signal to the called station and also operates relay 150' while the ringing continues. In the cord circuit per Fig. 2 the operation of ringing key 249 also operates relay 254 over a path which may be traced from negative battery through resistance 222, bottom outer front contact and armature of relay 213, bottom winding of relay 254, left-hand make contact of ringing key 249, top outer armature and front contact of relay 224, top outer armature and front contact of the continuity contacts of relay 225, resistance 226, top winding of relay 206, armature and right-hand or marking contact of relay 205 and resistance 244 to positive battery. When relay 254 operates, it locks over a circuit from battery through its top winding, top front contact and armature of relay 254 to ground through the top inner front contact and armature of relay 252. The operation of relay 254 breaks the path heretofore traced which extended through the winding of relay 253.

In response to the ringing of the call bell at the called subscriber's station, the called subscriber will operate key 113' at the called station momentarily. A circuit may thereupon be traced from the right-hand side of the power source through the right-hand armature and front contact of key 113', through the left-hand outer armature and front contact of relay 150' and through the winding of relay 119' to the opposite side of the power source operating relay 119'. The operation of relay 119' closes the loop through the called subscriber's station at the left-hand outer armature and back contact of relay 119'.

The transmission circuit through the calling end of the cord and the called subscriber's loop is thereupon established. This circuit may be traced from positive battery, through resistance 244, in Fig. 2, right-hand or marking contact and armature of relay 205, top winding of relay 206, resistance 226, top continuity contacts of relay 225, top outer front contact and armature of relay 224, back contact and armature of key 249, tip of plug 204, tip of jack 136', in Fig. 4, top front contact and armature of relay 108', top winding of relay 109', variable resistance 110', top loop conductor 111' extending to the called station, left-hand outer front contact and armature of relay 119', continuity contacts of recall key 118', right-hand inner armature and back contact of relay 116', contacts 137', contacts of key 127', teletypewriter transmitting contacts 126', left-hand outer armature and back contact of relay 116', winding of receiving magnet 125', bottom loop conductor extending back to the central station, variable resistance 124', bottom inner armature and front contact of relay 108', bottom winding of relay 109' and resistance 123' to negative battery 122'. Attention is called to the fact that while the marking condition prevails the two ends of this circuit are terminated in batteries arranged in series-aiding relationship so that current flows around the called station loop during the marking condition. The path was shown to extend through both the top and bottom windings of relay 109'. For this condition the armature of relay 109' is released. This breaks the circuit which was heretofore traced through the winding of relay 252, in Fig. 2, and relay 252 releases. This in turn releases the holding circuit heretofore traced by means of which armature of relay 205 was held in engagement with its marking contact. The armature of relay 205, however, continues to remain in engagement with

its marking contact as negative battery 122', in Fig. 4, has been substituted for the negative battery which has been disconnected through the operation of relay 252. The operation of relay 252 further releases relay 254, which has been maintained operated through the locking circuit of relay 254, which extends to ground through the top inner armature of relay 252. The release of relay 252 further extinguishes the supervisory lamp 256 associated with the calling end of the cord, as an indication that the called subscriber has responded. The release of relay 252 further disconnects the night alarm circuit at the bottom inner back contact and armature of relay 252.

Operator returns coin

After obtaining the connection to the desired called party, the switchboard operator splits the cord by operating the splitting key 356 in the operator's position circuit per Fig. 3 to the answering position, which associates the position circuit with the answering end of the cord circuit per Fig. 2 and the calling subscriber's circuit, while excluding the called subscriber from the connection. The operation of key 356 closes a circuit from ground 345 through the top armature and front contact of key 356 and the winding of relay 341 to battery operating relay 341. The operation of relay 341 establishes a circuit which extends from negative battery 368, through resistance 369, top armature and make contact of the continuity combination of relay 341, conductor 342 into Fig. 2 where it extends through conductor 242, top inner armature and make contact of the continuity combination of relay 230, which relay is operated, top outer back contact and armature of relay 231, top winding of relay 205, armature and left-hand or marking contact of relay 206 and resistance 243 to positive battery. Attention is called to the fact that both ends of this circuit are terminated in batteries of opposite polarities so that current flows through the top winding of relay 205 to maintain the armature of relay 205 in engagement with its right-hand or marking contact. This prevents a spacing signal from being transmitted toward the called station by maintaining the repeater in the cord circuit closed during the splitting operation while the central station operator communicates with the calling subscriber. The operation of relay 341 also establishes a circuit which extends from positive battery, through resistance 370, bottom back contact and armature of relay 335, bottom inner armature and front contact of relay 341, break key 340, transmitting contacts 339, top winding of relay 338, top armature and back contact of relay 337, top continuity contacts of relay 336, top outer back contact and armature of relay 335, back contact and armature of key 334, back contact and armature of key 333, conductor 332, into Fig. 2, where it connects with conductor 232 and the circuit is extended through the top outer front and rear contacts of the continuity contact combination of relay 230, resistance 260, top front contact and armature of relay 209 to the tip of plug 201 which connects to the tip of jack 136. From this point the circuit extends around the calling subscriber's loop which has heretofore been traced to negative battery 122.

When the circuits interconnecting the calling subscriber's station and the operator's position circuit at the central station are arranged for communication, the operator at the central sta-

tion will inform the calling subscriber of the amount which is to be deposited in the coin collection device. The central station operator will type the amount on her teletypewriter transmitter and it will be recorded by the teletypewriter receiver at the calling station.

Following this instruction the central station operator transmits an upper case S signal from her teletypewriter. In response to this signal contacts 137 in Fig. 1, which are under control of the S type bar, are momentarily opened. This removes the shunt from around the winding of relay 116 and relay 116 operates. Relay 116 when operated locks through its right-hand inner front contact and armature. Contact 137 will reclose but, since relay 116 is locked over another path to be subsequently traced, the closing of contacts 137 is ineffective. Relay 116 is a slow-to-release relay and does not release on teletypewriter signal pulses. The operation of relay 116 also short-circuits the teletypewriter keyboard contacts 126 and the break key contacts 127 so that the pay station subscriber is not permitted to communicate until the amount designated by the central station operator has been deposited and recorded at the central station.

The operator at the central station will now operate key 333 in Fig. 3. This establishes a circuit from a high potential positive battery 359 through the filament of lamp 360, winding of relay 361, make contact and armature of key 333 to conductor 332. Conductor 332 connects to conductor 232 in Fig. 2 and the circuit continues through the top continuity contacts of relay 230, resistance 260, top continuity contacts of relay 209, tip of plug 201, tip of jack 136, top front contact and armature of relay 108, top winding of relay 109, variable resistance 110 and top loop conductor 111 to the junction with conductor 112. Here the circuit forms into parallel branches. One branch continues through the right-hand armature and front contact of relay 119, through the continuity contacts of recall key 118 and the winding of relay 116. The other branch extends through conductor 112, contacts 104, coin collect magnet 114, coin return magnet 115, and the left-hand outer armature and front contact of relay 116 to a junction with the first of the parallel branches above traced. The circuit continues through the right-hand inner make contact and armature of relay 116, right-hand outer armature and front contact of relay 116, conductors 143 and 144, stop segment of distributor 132, outer brush 145, inner brush 146 of the distributor 132, inner solid ring 141 of distributor 132, conductor 147, receiving magnet 125, the bottom loop conductor variable resistance 124, bottom armature and front contact of relay 109, bottom winding of relay 109 and resistance 123 to negative battery 122. As a result of the high positive potential impressed on this circuit, coin return magnet 115 will operate and the coin originally deposited by the pay station subscriber to initiate the call will be diverted into the coin return hopper where it may be retrieved by the pay station subscriber.

The pay station subscriber now deposits the amount which has been requested by the central station operator. It will be assumed that twenty-five cents has been requested and that a twenty-five cent piece is deposited in the coin collection device 100. In response to this contacts 103 will be closed. This establishes a circuit from the top terminal of the rectifier 156, through contacts 103, through the winding of relay 135 and contacts 148 back to the bottom terminal of the rec-

tifier 156. Relay 135 operates and locks through its top inner front contact and armature as the opposite terminals of its winding are connected to the opposite terminals of rectifier 156. It is to be understood that contacts, such as 103, when operated in response to the deposited coin are closed only momentarily. The operation of relay 135 also establishes a circuit for the operation of magnet 131 from the bottom terminal of rectifier 156, through magnet 131, through the top outer make contact and armature of relay 135 to the top terminal of rectifier 156. When magnet 131 operates, it withdraws the stop latch 149 from the path of the rotary arm 140 of the distributor and the distributor brush arm 140 rotates once. As the brush arm 140 rotates, the path connecting conductors 144 and 147 in the loop is open or closed, depending upon the manner in which the group of contacts cooperating with the bottom armature of relay 135 are connected to segments 1 to 5 of distributor 132. When the brush arm sweeps across the start segment an open pulse is transmitted as the path between conductors 144 and 147 is open. When the brush arm sweeps across segment 1, a circuit is established from conductor 144 through the bottom armature and lowest front contact of relay 135, segment 1 of the distributor, brush 145, brush 146 and inner solid conducting ring 141 to conductor 147. Since the station loop is thus maintained closed, a marking pulse is transmitted while the distributor brush arm 140 sweeps across segment 1. Similar circuits are established through segments 2, 3 and 5 upon the operation of relay 135. Since no path is closed through segment 4 upon the operation of relay 135, an open or spacing pulse will be transmitted as the brush arm sweeps across this segment. A train of pulses identifying a particular character, such as Q, will thereupon be impressed upon the loop and will be recorded by the teletypewriter receiver at the central station as well as on the receiver at the calling pay station itself. As the brush arm sweeps by contacts 148 these contacts are opened. This breaks the holding path for relay 135. Relay 135 releases, in turn deenergizing magnet 131, releasing stop lever 149, which engages with the rotating distributor arm 140 and stops its rotation.

The subscriber at the pay station is instructed to deposit one coin at a time and wait until a letter characterizing it has been printed on his home receiver before the succeeding coin is deposited. The mechanism is shown arranged in such manner that coins of any of three denominations may be inserted in the collection device 100 and a record will thereupon be provided at the central station and on the pay station subscriber's receiver. The manner in which the device may be expanded to accommodate a larger number of coins, as well as to provide a corresponding record, should be obvious from the above to any one skilled in the art. Further, by a minor wiring modification, it is possible to arrange the mechanism in such manner that a plurality of coins may be inserted in the collection device simultaneously whereupon a single character designating the total amount deposited will be recorded.

Operator removes lock-out condition on station teletypewriter

After the central station operator has verified the amount of money deposited in the coin box at the station by observing the characters on her

teletypewriter receiver, the central station operator transmits a break signal from her teletypewriter and restores the splitting key 356, in Fig. 3, as well as the home position typing key 202 in Fig. 2. The opening of the transmission circuit for the transmission of a break signal releases relay 116, in Fig. 1. The release of this relay removes the short circuit around the teletypewriter transmitting contacts 126 and the break key 127 as the right-hand inner and right-hand outer armatures disengage from their respective front contacts. The release of relay 116 further disconnects the circuit extending through the automatic coin indicator apparatus, heretofore traced, when the right-hand outer armature of relay 116 disconnects from its back contact. The loop circuit through the teletypewriter pay station in Fig. 1 is now arranged in such manner that it extends in series once more through break key 127, transmitting contacts 126, and the winding of the receiving magnet 125. The operator's position circuit, per Fig. 3, has been disconnected from the cord circuit per Fig. 2. The transmission circuit in the answering side of the cord circuit, per Fig. 2, is established directly through the normal contacts of relay 230 to the single line repeater in the cord circuit and no longer extends through the transmission loop in the operator's position circuit. The calling subscriber and the called subscriber may now communicate directly through the transmission circuits in Figs. 1, 2 and 4.

Calling and called subscribers communicate

As the calling subscriber at the pay station, per Fig. 1, operates the various keys in his teletypewriter transmitter, the transmitting contacts 126 in his transmitter are positioned in such manner that the transmission circuit extending through a particular transmitting contact is either opened or closed. When a particular contact is closed, the transmission path connecting the calling station with the cord circuit at the central station will be closed. Current will flow through the transmission conductors in the calling loop and the answering end of the cord. The armature of relay 205 will be actuated to engage with its marking contact. The armature of relay 206 will be held in engagement with its marking contact as current flows through its top winding when batteries of opposite polarities are connected to opposite ends of the calling end of the cord and the called loop connected in series. Receiving magnets 125, in Fig. 1, and 125' in Fig. 4, will be energized and a marking signal will be recorded at both teletypewriter receivers. If the path through a particular transmitting contact of contacts 126 is open, the transmitting path through the corresponding subscriber's loop circuit and the answering end of the cord circuit, per Fig. 2, cooperating directly therewith will be opened. No current will then flow through the top or line winding of receiving relay 205 in the single line repeater of the cord. The armature of relay 205 will be actuated under the influence of current through its bottom or biasing winding to engage with its spacing contact. Batteries of the same polarity will be connected to each end of the corresponding loop through the calling end of the cord and the called line. The armature of relay 206 will be maintained in engagement with its marking contact as the polarity of the current through its bottom or biasing winding is reversed. The teletypewriter receiver

ing magnets in both loops will be deenergized to record a spacing signal at both the calling and called subscribers' stations.

The subscriber recalls

The subscriber at either the calling or the called station may recall the operator at the central station by operating the recall key 118 in Fig. 1 or 118' in Fig. 4. In response to this, the supervisory lamp associated with the answering end of the cord or with the calling end of the cord, depending upon which subscriber recalls will be flashed intermittently to indicate this condition. The manner in which this is performed is as follows.

It will be assumed that the called subscriber wishes to recall the operator. The called subscriber will thereupon operate recall key 118'. This opens the circuit through the top loop conductor in Fig. 4 and connects the bottom loop conductor directly to ground. This in turn breaks the circuit through the top winding of relay 109'. The circuit through the bottom winding of relay 109' is connected at one end to battery 122' and at the other end to ground connected to the armature of recall key 118'. Under these circumstances, relay 109' will operate. This in turn connects ground to the ring conductor of jack 136' operating relay 252 in the cord circuit, per Fig. 2, over a path heretofore traced. The operation of relay 252 will establish a circuit from ground through the top inner armature and front contact of relay 252, top armature and back contact of relay 254, winding of relay 253, resistance 235 and the bottom armature and front contact of relay 224 to battery, relay 224, being operated, operating relay 253. When relay 253 is operated, it locks to ground through its bottom inner armature and front contact. Recall key 118' in Fig. 4, is thereupon restored to normal, reestablishing the transmission circuit and releasing relay 109'. Relay 252 is thereupon released. A circuit is now established which may be traced from ground, through interrupter 251, the top armature and front contact of relay 253, the bottom outer back contact and armature of relay 252 through the filament of lamp 256 to battery. Lamp 256 flashes following the interruptions of the interrupter 251.

If the calling subscriber wishes to recall, recall key 118 is operated which will cause a circuit corresponding to that described for the calling end of the cord to operate in the answering end of the cord, flashing lamp 258.

Upon noting the flashing cord lamp, the operator connects her position circuit, Fig. 3, to the cord by operating key 202. This shunts relay 253 which releases, extinguishing lamp 256.

Subscriber disconnects

In order to disconnect, a train of signals corresponding to the upper case H may be transmitted by either the calling subscriber, the called subscriber or the operator at the central station. The operator at the central station would transmit such a signal in order to disconnect when the station was being operated on an unattended basis. The reception of the signals corresponding to an upper case H opens contacts 129 in Fig. 1 and 129' in Fig. 4 in the well-known manner. This in turn opens the circuit which is maintaining relay 119 and relay 119' operated and locked. This circuit was heretofore traced. Relay 119 and relay 119' thereupon release. The release of relay 119 and of relay 119' restores

all apparatus at the station to its normal condition when idle. For example, in the calling loop, ground is connected to each of the loop conductors at the pay station. For the top loop conductor a circuit extends from ground on the right-hand outer back contact and armature of relay 119, conductor 117, left-hand outer back contact and armature of relay 116, through the windings of magnets 115 and 114, contact 104, which is closed while coins are in the coin collect box 100, conductor 112 to top loop conductor 111 and thence to the circuit extending through the tip of jack 136 which connects with the tip of the cord, per Fig. 2. The circuit for the top conductor extends through the transmission path in Fig. 2 which has heretofore been traced and terminates in positive battery connected to the marking contact and armature of relay 206. For the bottom conductor, the circuit extends from ground, through the right-hand outer back contact and armature of relay 119 and the continuity contacts of recall key 118 to a parallel circuit. One branch of said parallel circuit extends through the winding of relay 116. The other branch extends through the left-hand inner armature and back contact of relay 116 and contacts 137. The branches join and the circuit continues through the contacts of break key 127, teletypewriter transmitting contacts 126, the right-hand outer armature and back contact of relay 116, the winding of the teletypewriter receiving magnet 125, the bottom loop conductor, variable resistance 124, bottom armature and front contact of relay 108 at the central station, which relay remains in the operated condition while the cord circuit is still connected to jack 136, through the bottom winding of relay 109 and resistance 123 to battery 122.

In tracing the path for each of the loop conductors each was seen to extend through a winding of relay 109. The effect of the current in each winding for this condition, however, is not balanced and the armature of relay 109 will be actuated. This connects ground to the ring conductor of the cord circuit operating relay 227 which, in turn, lights lamp 256 as has been heretofore explained. The lighting of the lamp serves as a disconnect signal.

A train of signals corresponding to an upper case H impressed upon the receiving magnet 125' of the called subscriber's station will result in the opening of contacts 129'. This in turn will release relay 119'. This will ground the bottom loop conductor only of the called line at the called central station, operating relay 109'. Relay 252 in the cord, per Fig. 2, will be operated and lamp 256 will be lighted in a manner which may be understood from the description of the operation of corresponding apparatus in the calling subscriber's line, per Fig. 1, and the answering side of the cord circuit, per Fig. 2.

Central station operator collects coins deposited in coin collection box

Upon noting the lighted cord lamp, the operator, if her position circuit is not already connected to the cord, will operate key 202 which connects the operator's position circuit, per Fig. 3, to the cord circuit, per Fig. 2, in the manner heretofore described. The operator at the central station will now operate coin collection key 334. The operation of this key impresses negative battery 362, of high potential, on a circuit which extends through the filament of lamp 363, winding of coin collect relay 364, front contact

and armature of coin collect key 334, back contact and armature of key 333 to conductor 332. The circuit has been traced from this point over the tip circuit of Fig. 2, through the top loop conductor 112, through the winding of coin collect magnet 114 to ground, through the right-hand outer armature and back contact of relay 119, which is released. Magnet 114 controls the mechanism in the coin collection device 100 which is operated to direct the suspended coins into a coin collection chamber at the bottom of the coin collection device. This mechanism is well known and will not be described herein. Attention is called to the fact that relay 361 is operated upon the operation of key 333 and relay 364 is operated upon the operation of key 334. The operation of these relays, in turn, lights lamp 365 or 366 to give a visual indication that coins deposited in the collection device 100 are being returned or collected.

It is to be understood that if any condition such as connection to the wrong called party warrants return rather than collection of deposited coins, key 333 may be operated rather than key 334 to return the coin to the calling subscriber.

Central station operator disconnects

After the coins have been collected or returned as described above, the central station operator will once more restore key 202 to normal, disconnecting the operator's position circuit per Fig. 3 from the particular cord circuit per Fig. 2 with which it has been connected. The operator will then remove the answering plug 201 from jack 136 and the calling plug 204 from jack 136'. Relays 108 and 108' are thereupon restored to normal. This, in turn, restores the relays in the subscriber's line termination for the calling and called stations to the normal condition when idle. Relays in the cord circuit are also restored to normal.

Starting an unattended station

The circuits herein are arranged in such manner that in the event that the called party does not respond to normal ringing, the station apparatus at the called station may be started on an unattended basis by ringing for a period longer than the normal ringing interval. Under these circumstances, relay 150' at the called party station remains operated for a sufficient time to permit relay 151' to operate, over a circuit from the left-hand side of the power source 128' through the winding of relay 151', the inner front contact and armature of relay 150', and resistance 152' to the right-hand side of the power source 128'. The operation of relay 151' will establish a circuit for the operation of relay 119' which establishes the called station loop and supplies power to operate the teletypewriter mechanism at the called station. The circuit for the operation of relay 119' may be traced from the right-hand side of the power source 128', through the armature and make contact of relay 151', the winding of relay 119', to the left-hand side of the power source 128'.

After the unattended station has been started as described above, it is in condition to receive communication signals either from the central station or from a distant calling station.

What is claimed is:

1. In a teletypewriter switching system, a local teletypewriter station, a central teletypewriter switching station, a telegraph circuit connecting said stations, a coin collection device connected

to said circuit at said local station, a telegraph transmitting device at said local station and means responsive to the insertion of a coin in said collection device for operating said transmitting device.

2. In a teletypewriter switching system, a local telegraph station, a central switching station, a telegraph path connecting said stations and means connected to said path responsive to the depositing of a coin in a coin collection device at said local station for recording the denomination of said coin at said central station.

3. In a teletypewriter switching system, a local telegraph station, a central telegraph switching station, a telegraph path connecting said stations, a telegraph transmitter connected to said path at said local station, a telegraph receiver connected to said path at said central station, a coin collection device connected to said path at said local station and means responsive to the insertion of a coin in said collection device for operating said transmitter so as to transmit telegraph code signals characterizing said coin to said receiver.

4. In a teletypewriter switching system, a local telegraph station, a central telegraph switching station, a telegraph path connecting said stations, a coin collection device connected to said path at said local station, and means responsive to the insertion of a coin in said device for recording a permanent record of said insertion.

5. In a teletypewriter switching system, a local telegraph station, a central telegraph switching station, a telegraph path connecting said stations, a coin collection device connected to said path at said local station, a telegraph recording device at said central station and means responsive to the insertion of a coin in said collection device for operating said recording device so as to provide a permanent record of said insertion.

6. In a teletypewriter switching system, a local teletypewriter station, a central teletypewriter switching station, a telegraph path connecting said stations, a coin collection device connected to said path at said local station, a telegraph signal recording device connected to said path at said central station and means connected to said path responsive to the insertion of a coin in said collection device for transmitting signals characteristic of said coin to said recording device.

7. In a teletypewriter switching system, a local telegraph station, a central telegraph switching station, an operable telegraph path connecting said stations, a multi-coin collection device connected to said path at said local station, a recording device connected to said path at said central station and means responsive to the depositing of any one of a plurality of coins in said collection device for operating a particular transmitting device so as to transmit signals, characterizing the particular coin deposited, to said recording device.

8. In a telegraph switching system, a local telegraph station, a central telegraph switching station, an operable telegraph path connecting said stations, a coin collection device connected to said path at said local station, a recording device connected to said path at said central station, means in said collection device for depositing therein coins of a plurality of denominations, means responsive to the depositing of said coins for operating a transmitting device individual to each denomination so as to transmit signals characterizing the denomination of the deposited coins to said recording device.

9. In a teletypewriter switching system, a telegraph transmitter, a telegraph receiver, a telegraph path connecting said transmitter and said receiver, a coin collection device connected to said path and means also connected to said path for preventing the operation of said path unless a coin has been deposited in said collection device and a record thereof has been recorded by said receiver.

10. In a teletypewriter switching system, a local teletypewriter pay station, a central teletypewriter switching station, a telegraph circuit connecting said stations, a teletypewriter transmitter connected to said circuit at said pay station, means for connecting an operator's position circuit to said telegraph circuit at said central station, means in said circuits for designating an amount of money to be deposited in a coin collection device at said pay station and means at said central station for recording the amount deposited.

11. In a teletypewriter switching system, a teletypewriter pay station, a central teletypewriter switching station, a telegraph circuit connecting said stations, a coin collection device connected to said circuit at said pay station, means responsive to the depositing of a coin in said collection device for signaling an operator at said central station, means at said central station for extending said telegraph circuit toward a called station, means in said circuits for designating an amount of money to be deposited in said collection device before communication may proceed, means for preventing communication from proceeding until said amount has been deposited in said device and means responsive to the depositing of coins in said device for recording the amount deposited at said central station.

12. In a teletypewriter switching system, a teletypewriter transmitting station, a teletypewriter receiving station, means for flexibly interconnecting said stations and means for preventing communication between said stations until a permanent record of a charge for such communication has been made by a recording device connected to said circuit.

13. In a teletypewriter switching system, a calling teletypewriter station, a called teletypewriter station, means for establishing temporarily a continuous telegraph circuit between said stations, means for connecting a tariff charge recorder temporarily in said path and means for providing a permanent record of the charge for communication between said stations.

14. In a teletypewriter switching system, a telegraph central switching station, means for interconnecting calling teletypewriter stations with called teletypewriter stations through said central station, means at said central station for temporarily connecting a recording device to said connections as said connections are established for recording the tariff to be charged for such connections.

15. In a teletypewriter switching system, a central telegraph switching station intermediate a calling and called station, means in said central station for establishing connections between said calling and called stations, means at said central station for informing a subscriber at said calling station of a charge to be prepaid before communication may proceed with said called station and means for recording the prepayment of said charge.

16. In a teletypewriter switching system, in

combination a teletypewriter central switching station, a subscriber's local teletypewriter station, an operable telegraph path connecting said stations, means in said path, responsive to the depositing of a coin in a coin collection device connected to said path at said local station, for controlling communication over said path and means, connected to said path remote from said local station, for starting a teletypewriter machine at said local station.

17. In a teletypewriter switching system, in combination, a teletypewriter central switching station, a subscriber's local teletypewriter station, an operable telegraph path connecting said station, means in said path, responsive to the depositing of a coin in a coin collection device connected to said path at said local station, for controlling communication over said path and means, connected to said path, remote from said local station for stopping a teletypewriter machine at said local station.

18. In a teletypewriter switching system, a telegraph line, a coin collection device connected thereto and means responsive to the depositing of a coin of a particular denomination in said device for transmitting telegraph code signals characterizing its denomination.

19. In a teletypewriter switching system, a telegraph line, a coin collection device and a telegraph code signal transmitter both connected to said line and means also connected to said line, responsive to the depositing of a coin in said device, for operating said transmitter so as to transmit telegraph code signals over said line.

20. In a teletypewriter switching system, a transmitter arranged to transmit baudot telegraph code signals, a coin collection device and means responsive to the depositing of a coin of a particular denomination in said device for operating said transmitter so as to transmit telegraph code signals characterizing the denomination of said coin.

21. In a teletypewriter switching system, a baudot code telegraph signal transmitter and coin-operated control means connected to said transmitter for generating baudot code telegraph signals characterizing the denomination of a coin.

22. A system for transmission of permutation code comprising a channel of transmission, permutation code emitting means for impressing upon said channel message codes, coin operated means, and means controlled thereby for emitting upon said channel codes indicative of the operation of said coin operated means.

23. A permutation code transmitter in combination with a coin controlled circuit changer and means operable by control of said changer by a coin to cause said transmitter to send a permutation code.

24. A permutation code transmitter in combination with coin actuatable circuit changing means and means selectively operated by coins of different nature to selectively actuate said transmitter.

25. A telegraph system comprising a message transmitter of coded impulses and a supplemental transmitter in combination with check controlled means for actuating the supplemental transmitter and interconnections whereby said transmitters may be operated at different times without interference one with the other.