Sept. 6, 1927. 1,641,290

D. B. PERRY

PRINTING TELEGRAPH EXCHANGE SYSTEM

Filed Oct. 31, 1925 2 Sheets-Sheet 1

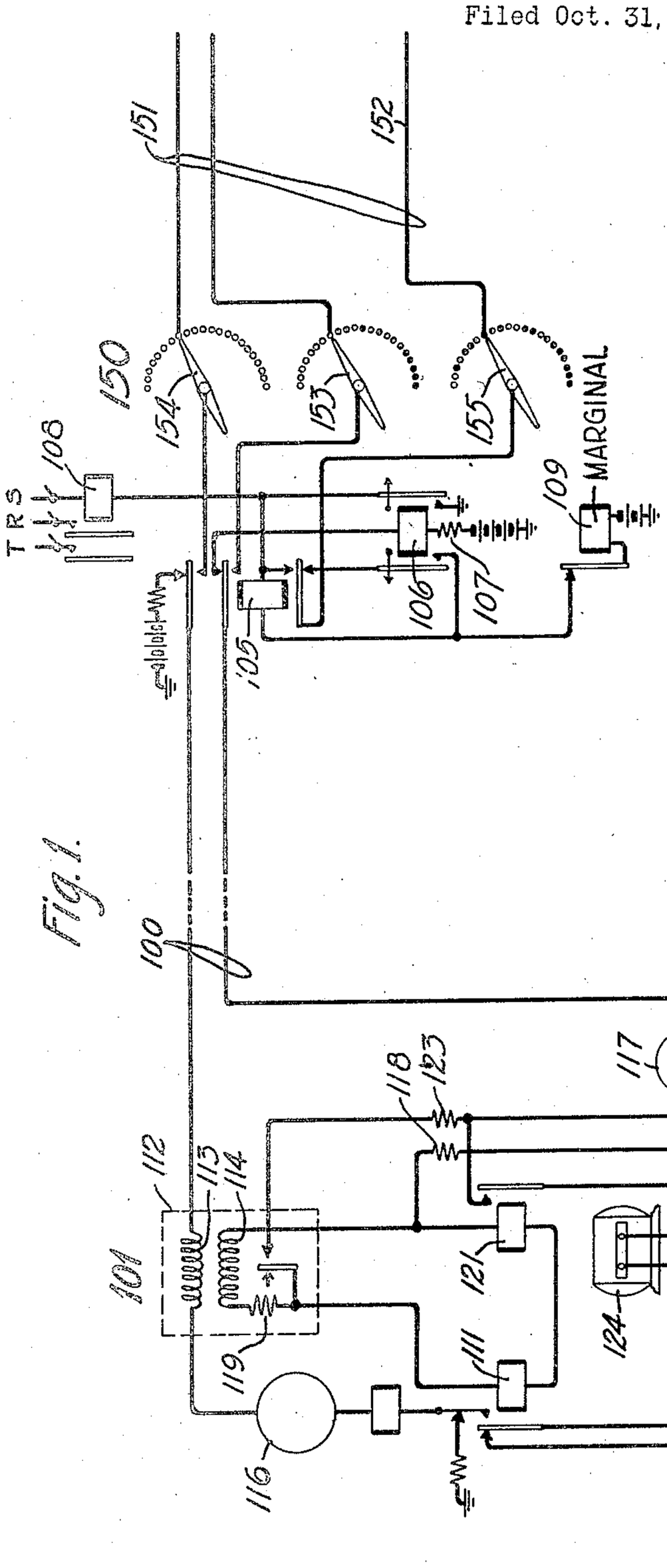
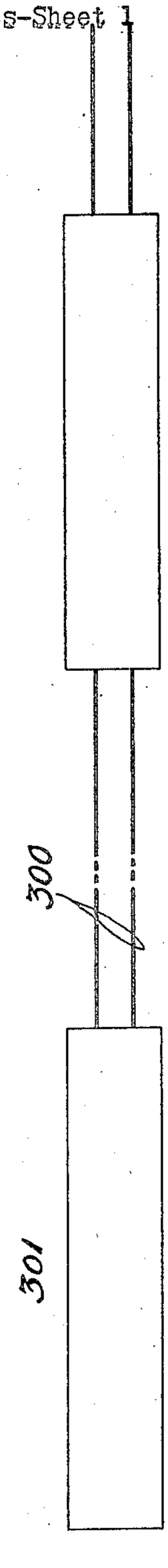


Fig. 1.



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Filed Oct. 31, 1925 2 Sheets-Sheet 2

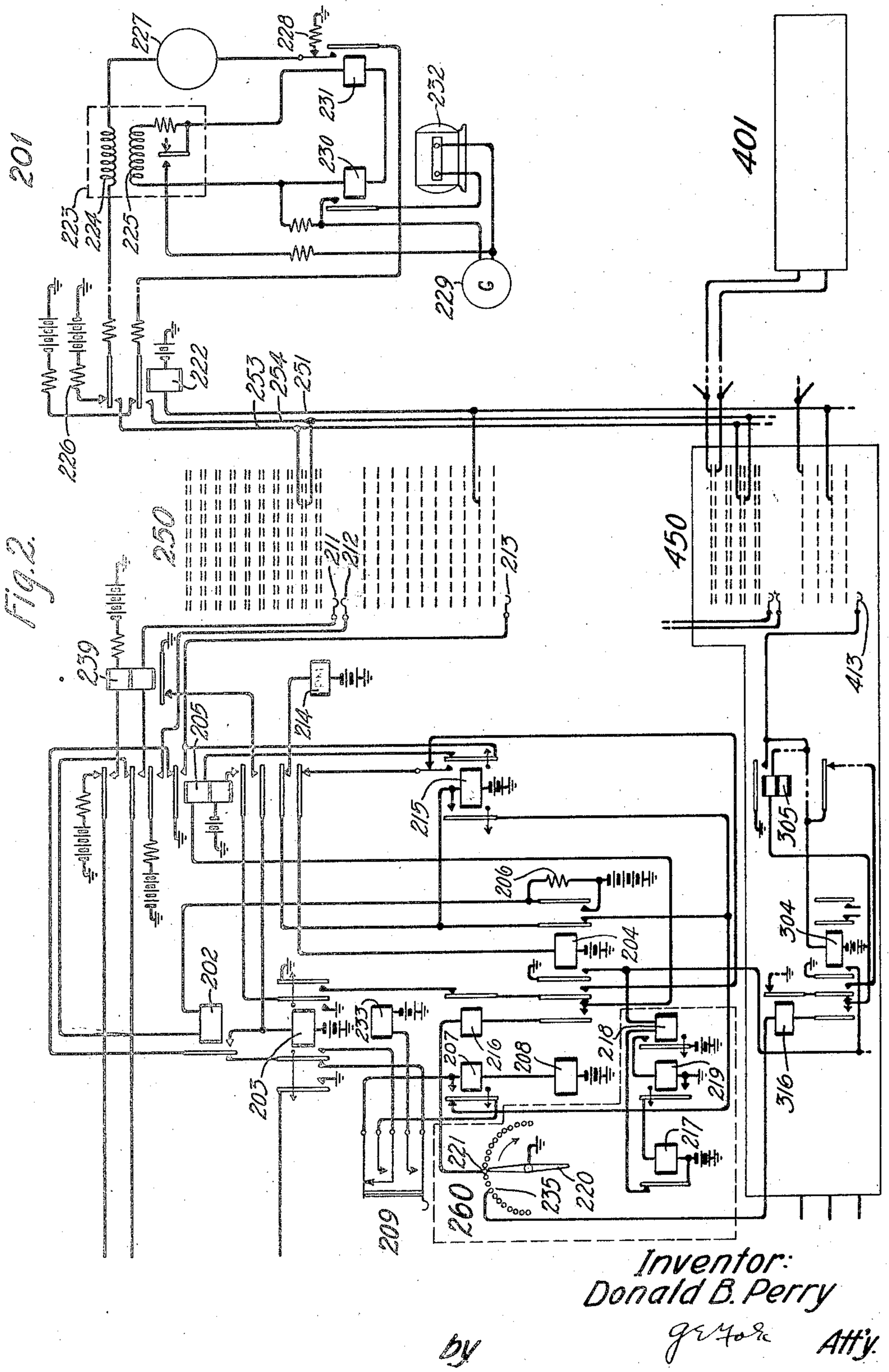

Fig. 2.

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UNITED STATES PATENT OFFICE.

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PRINTING-TELEGRAPH-EXCHANGE SYSTEM.

Application filed October 31, 1925. Serial No. 66,058.

This invention relates to printing telegraph exchange systems, and more especially to systems wherein communication circuits are established by means of automatic switches.

The object of the invention is to provide a highly efficient communicating system wherein a plurality of connections may be extended toward a busy line and the connections completed to said line in a definite order when said line becomes idle.

A feature of the invention relates to the means, in a printing telegraph exchange system, for allowing a calling subscriber to maintain an established connection regardless of the busy condition of the line toward which the established connection is extended.

A further feature relates to a special preference circuit in a printing telegraph system whereby a plurality of subscribers awaiting the establishment of a connection with a desired line, which is busy, may communicate with said line in a particular order without disrupting any of the established connections.

Another feature resides in the automatic means, in a printing telegraph exchange system, for delaying the starting of the driving motors at the calling and called stations until said stations have been interconnected.

Other features and advantages which are inherent in the invention will become apparent upon a consideration of the descriptions given hereinafter and from a consideration of the appended claims.

Referring to the drawing, Figure 1 shows, in comparative detail, circuits and apparatus at a printing telegraph subscriber's station together with an individual line switch therefor. This figure also represents schematically a second subscriber's station and its associated line switch at the central office.

Fig. 2 shows in detail one of a number of connector switches for establishing connections to called line. This figure also represents schematically a second connector switch and a second subscriber's station.

Detailed description.

Figs. 1 and 2 of the drawing when arranged with Fig. 2 at the right of Fig. 1, show sufficient details of a printing telegraph exchange system embodying the present invention to enable a clear understanding to be attained thereof. For this purpose it will be assumed that the subscriber at station 101 desires to send a printed telegraph message to the subscriber at station 201 which, it will be noted, is equipped for receiving only. The calling subscriber operates key 102 to close its left contacts, whereupon a circuit is completed from negative battery, through resistance 107, winding of relay 106, upper inner back contacts of relay 105, over the ring side of the calling line, right-hand normal contacts of key 102, back contacts of relay 111, through the busy lamp 104, left-hand contacts of key 102, to ground through the upper contacts of the dial 103. Relay 106 operates, and lamp 104 is lighted by means of this circuit. Relay 106 connects ground through its right contacts, the winding of relay 108, to the sleeve conductor of the calling line as multipled before the connector switches thus rendering this line busy thereat. Relay 106 also completes the circuit of the stepping magnet 109 traceable from battery through the winding and interrupter contacts of the stepping magnet, left contacts of relay 106, lower back contacts of relay 105, test wiper 155 of the rotary line switch 150, and the terminal coperating therewith to the sleeve conductor 152 of trunk 151. It is to be noted that switch 150 has no normal position. Its wipers therefore, remain on the contacts associated with the trunk last taken for use.

Should trunk 151 be busy, conductor 152 is grounded, in the manner described hereinafter, and the stepping circuit for magnet 109 is maintained closed, thus causing the brushes of switch 150 to be intermittently advanced until an idle trunk is reached. Should trunk 151 be idle when relay 106 operates, conductor 152 is ungrounded and the stepping magnet 109 remains normal. Each time the stepping magnet 109 releases to advance the brushes, a circuit is completed from battery, through the winding and contacts of said magnet, winding of cut-off relay 105, to ground at the right contacts of relay 106. So long as brushes of switch 150 are contacting with a busy trunk, the cut-off relay 105 is shunted by means of the ground connected to the test wiper of said switch, this ground being extended to the lower back contacts of relay 105, left contacts of relay 106. When, however, an idle trunk such as 151 is seized, conductor 152 being ungrounded, there exists no shunt for relay 105 and this

relay operates in series with the winding of magnet 109. Magnet 109, however, is marginal in character and does not operate when included in series with the winding of relay 105. Immediately that relay 105 operates the previously described operating circuit for line relay 106 is broken. But this relay having slow characteristics does not release until a substitute holding circuit is provided for relay 105 as described hereinafter.

The calling line is now extended by means of the upper front contacts of relay 105 to the trunk 151. A circuit may now be traced for the connector line relay 202 traceable from battery, through resistance 206, winding of relay 202, next to the upper outer back contacts of relay 205, ring conductor of trunk 151, brush 153 and cooperating terminal of switch 150, upper inner front contacts of relay 105, ring conductor of the calling line, right contacts of key 102, back contacts of relay 111, through the busy lamp 104, left contacts of key 102 to ground through contacts of dial 103. Relay 202 operates in this last traced circuit and completes an obvious operating path for relay 203 to the upper innermost back contacts of relay 205. Relay 203 by means of its left outer contacts connects ground to the sleeve conductor 152 to provide a locking circuit for the cut-off relay 105 which is independent of the line relay 106. This same ground is extended through locking contacts of relay 105 and the winding of relay 108 to the sleeve multiple of the calling line as it appears in the connector switches, thus rendering this line busy thereat. The connection through switch 150 is controlled by the release relay 203 which in turn is controlled by the key 102 at the calling station. It will be noted that because of the resistance 206 which is included in series with the busy lamp 104 as described above, the current in this circuit is reduced and lamp 104 ceases to glow. This serves as an indication to the subscriber that a connector has been seized and the circuits are in readiness for selective impulses from the dial 103.

The subscriber now manipulates the dial to send a series of two impulses corresponding to the tens digit of the desired station 201. As a result of the first opening of the circuit by the dial contacts, relay 202 releases but relay 203 being of a slow character retains its armatures attracted during the comparatively brief interval between successive impulses of the series. Accordingly a circuit is completed from battery through the winding of vertical operating magnet 208, winding of series relay 207, uppermost contacts of the off-normal switch 209, to the left inner front contacts of relay 203, back contacts of relay 202, to ground at the innermost back contacts of relay 205. Magnet 208 and relay 207 operate in this circuit. The first operation of magnet 208 advances the wipers 211, 212, and 213 into cooperative relation with the first bank of terminals in the connector switch 250. Upon the reclosure of the line circuit after the transmission of the first impulse, relay 202 reoperates and opens the above traced circuit for vertical magnet 208 which releases, but relay 207 is slow to release and retains its armatures attracted. Relay 207 therefore transfers the stepping circuit for magnet 208 through the front contacts of relay 207, make-before-break contacts of off-normal switch 209, front contacts of relay 203, to the back contact of relay 202. Switch 209 is operated immediately that wipers 211, 212 and 213 are advanced from normal. In response to the transmission of the second impulse of the tens series, relay 202 retracts its armatures and completes the stepping circuit last described. Thus magnet 208 causes the brushes 211, 212 and 213 to be positioned before the second level of contacts in switch 250. At the termination of the tens series of impulses, the line circuit is closed for a comparatively long interval and relay 202 correspondingly maintains its front contacts closed. Thus the circuit for series relay 207 is broken for a sufficiently long period to enable this relay to retract its armatures and vertical magnet 208 releases. With relay 207 released, the stepping circuit is transferred to the rotary magnet 214.

The subscriber next manipulates the dial 103 to transmit a series of eight impulses corresponding to the units designation of station 201. In response to the first opening of the line circuit, relay 202 releases and a circuit is closed from battery, through the winding of rotary magnet 214, lower back contacts of relay 205 (thence in parallel) also in parallel from battery through the winding of slow release relay 215, right back contacts of relay 204, back contacts of relay 207, off-normal contacts of switch 209, front contacts of relay 203, back contacts of relay 202 to ground at the contacts of relay 205. Magnet 214 ,therefore rotates wipers 211, 212 and 213 to the first set of contacts in the second level. In a similar manner the succeeding seven impulses of the units series cause magnet 214 to be intermittently energized and the wipers 211, 212 and 213 to be advanced into cooperative relation with the eighth set of contacts in the second level. It is to be noted that while the wipers of switch 250 are passing over called line terminals that there exists no complete circuit through the brushes 211 and 212 since relay 205 is deenergized at this time. However, the private wiper 213 may in being advanced pass over intermediate terminals which are busy and therefore grounded. Consequently, a circuit may therefore be completed

from battery through the winding of busy test relay 204, lowermost contacts of relay 205, right front contacts of relay 215, test wiper 213 to be grounded at test terminals of the busy intermediate lines. Relay 204 will therefore be intermittently energized when brush 213 passes over these busy terminals but a substitute operating circuit for the rotary magnet 214 is completed through the left front contacts of relay 215, this circuit being independent of the right back contacts of relay 204. Consequently since relay 215 is slow to release, it is maintained energized during the units series of impulses and the circuit for stepping magnet 214 is unbroken when relay 204 operates upon the passage of brush 213 over intermediate busy test terminals. Upon the cessation of the transmission of the units series of impulses, the line circuit is maintained closed and relay 202 is continuously energized. Relay 202 therefore opens the locking circuit of rotary relay 215 but this relay being slow to release provides sufficient time for a test to be made of the called line. When rotary magnet 214 releases after the transmission of the last impulse of the units series, wiper 213 is brought into cooperative relation with the test conductor 251 of the called line. If the called line is busy, ground exists on conductor 251. While relay 215 is maintaining its armatures attracted, after the transmission of the last units impulse, the grounded conductor 251 is extended by means of wiper 213 through the right front contacts of relay 215 and the lower back contacts of relay 205 to battery through the winding of relay 204. When therefore relay 215 releases, relay 204 is locked by means of a circuit traceable from battery through winding of said relay, lowermost contacts of relay 205, normal contacts of relay 215, left middle front contacts of relay 204, back contacts of relay 216 to ground at the outer right contacts of relay 203. With relay 204 operated, the resistance 206 is shunted and the circuit hereinbefore traced comprising the winding of relay 202 and the lamp 104 receives sufficient current to cause the said lamp to burn brightly. This serves as an indication to the calling subscriber that the called line is busy.

The calling subscriber because of the urgency of the connection may desire to maintain the switches in their operative condition until the called line becomes idle. Accordingly the connector circuits are so equipped that the cut-through relay 205 is automatically operated to complete the prepared connection with the called line as soon as said line becomes idle. It will be noted that when relay 204 operated in response to the testing of the busy line, the circuit is completed from battery, through the contacts of stepping magnet 217, winding of relay 218, to ground at the left inner contacts of relay 204. Relay 218 operates in this circuit and completes an energizing path for relay 219. Relay 219 when operated in turn causes the energization of the stepping magnet 217. Brush 220 which is associated with the magnet 217 is not advanced, however, until magnet 217 is deenergized. It will be noted that relays 218 and 219 are of the slow-to-release type. Thus they provide a definite time interval between the energization and release of magnet 217. Under control of the above traced stepping circuit, brush 220 is intermittently advanced over the succeeding terminals of the preference switch 260. This stepping operation continues so long as relay 204 remains energized. It is to be noted that the locking circuit for relay 204 comprises the back contacts of relay 216 and that relay 216 cannot be energized until brush 220 contacts with the terminal of switch 260 which is individual to connector 250. Assuming therefore that while brush 220 is advancing over succeeding terminals, the called line becomes idle, relay 216 cannot become energized and consequently relay 204 remains locked and the brush 220 is advanced until the terminal 221 is reached. When this terminal is reached, the called line having meanwhile become idle, ground is removed from conductor 251. A circuit is therefore completed which may be traced from battery, through the winding of relay 222, conductor 251, brush 213, right back contacts of relay 215, upper winding of relay 205, left outer front contacts of relay 204, winding of relay 216, to ground through terminal 221 and brush 220. Relay 216 operates over this circuit and breaks the locking circuit of busy test relay 204 which thereupon releases. Relay 204 in turn releases relay 216. With relay 204 released, ground is extended through the right outer contacts of relay 203, right contacts of relay 216, left middle back contacts of relay 204, upper winding of relay 205, and thence to battery through the winding of cut-off relay 222 as hereinabove described. Relay 204 in releasing may prevent further operation of the switch 260 by means of the opening of the left inner contacts of said relay.

The circuit above traced comprising the winding of relay 222 causes the operation of said relay as well as relay 205. Relay 205 when operated immediately, closes a locking circuit for itself by means of its lower winding and lower inner contacts to ground at the right inner contacts of relay 203. Relay 205 at its upper inner front contacts extends ground by means of wiper 213 to the conductor 251, thus rendering the called line busy and providing a holding circuit for the cut-off relay 222, this circuit being now independent of relay 204. It will be noted that the polarized motor relay 223 at the called station is provided with two wind-

ings, namely, winding 224 and winding 225. In a similar manner the polarized relay 112 at the calling station is provided with windings 113 and 114. With the cut-off relay 222 of the called station and (cut-off) relay 205 of the calling station deenergized, positive battery is connected to the windings 224 and 113 by means of back contacts of the respective cut-off relays. The polarity of the current through these windings is such as to maintain the armatures of the relays 223 and 112 against their respective back contacts. When therefore, relay 222 operates in series with relay 205 as above described, the positive battery through the uppermost outer back contacts of relay 205 is replaced by negative battery over a circuit traceable from negative battery, through the upper winding of differential relay 239, uppermost front contacts of relay 205 over the tip of trunk 151, brush 154, and cooperating terminal of switch 150, upper outer front contacts of relay 105, tip conductor of the calling line, winding 113 of relay 112, through the printer 116 to ground through the normal contacts of relay 111. Under control of this last traced circuit, the armature of relay 112 is attracted to its front contact thereupon closing a holding circuit for the polarized relay 112 which is completed from the source of power 117, resistance 118, winding of relays 111 and 121, holding winding 114, resistance 119, front contacts of relay 112, returning through resistance 123 to the power source. Relays 111 and 121 operate in this circuit. Relay 121, by means of its front contacts, connects the powers source 117 with the printer driving motor 124. Relay 111 in operating, brings about the reversal of current through the windings 224 of the polarized relay at the called station. This circuit may be traced from negative battery, through the upper winding of differential relay 239, uppermost front contacts of relay 205, tip conductor of trunk 151 and thence through the winding 113 of relay 112 as hereinabove described through printer 116, front contacts of relay 111, right contacts of key 102, returning over the ring side of the calling line, upper inner front contacts of relay 105, brush 153, ring conductor of trunk 151, next to the uppermost front contacts of relay 205, lower winding of differential relay 239, brush 211, and cooperating terminal in switch 250, uppermost front contact of relay 222, winding 224 of relay 223 to ground through resistance 228. This reversal of current through the winding 224 causes the armature of relay 223 to close its front contact, thereby completing a circuit from the power source 229 to operate relays 230 and 231 as well as to provide a holding circuit for relay 223. Relays 230 and 231 correspond to relays 111 and 121 at the calling station and it is believed therefore that the circuit for operating relays 230 and 231 need not be described. Relay 230 performs a similar function to relay 121 and connects the power source 229 with the printer driving motor 232. Similarly relay 231 completes the printing circuit. This printing circuit may now be traced from negative battery, through the upper winding of differential relay 229, uppermost front contacts of relay 205, tip conductor of trunk 151, brush 154, outer front contacts of relay 105, tip conductor of the calling line, winding 113 of relay 112 through the printer 116, front contact of relay 111, right contacts of key 102, ring side of the calling line, upper inner front contacts of relay 105, brush 153, ring conductor of trunk 151, next to the uppermost front contacts of relay 205, lower winding of differential relay 239, brush 211, conductor 253, uppermost front contact of relay 222, winding 224 of relay 223, through the printer 227, front contacts of relay 231, innermost front contacts of relay 222, conductor 254, brush 212, next to the upper inner contacts of relay 205 to positive battery. The starting of the motor at the calling station as above described, serves as an indication to the subscribed thereat that the connection is completed and that printer signals may now be transmitted. It is to be noted that the maintenance of the established connection is under control of the differential relay 239, which at its contacts, provides a holding circuit for the release control relay 203. Consequently, either subscriber may "break" without disestablishing the connection.

Disconnection.

When the communication is completed, the subscriber at station 101 operates key 102 to the right and holds it in this position until the motor 124 is stopped. The operation of key 101 in this manner extends ground through the right contacts thereof, front contacts of relay 111, and thence over the tip conductor of the calling line and tip conductor of trunk 151, to battery through the upper winding of differential relay 239. The lower winding of this relay is deenergized when key 102 is operated, consequently the contacts of relay 239 are broken and release control relay 203 is deenergized. After a short interval, relay 203 retracts its armatures, thus opening the locking circuit for the through relay 205 and the cut-off relay 105 which thereupon release. A circuit may now be traced from ground through the upper innermost back contacts of relay 205, back contacts of relay 202, left back contacts of relay 203, contacts of the off-normal switch 209, to battery through the winding of release magnet 233. Under the control

of this circuit magnet 233 restores the wipers 211, 212 and 213 to the normal position. Restoration of the connector to normal also causes the release of cut-off relay 222. The release of relay 222 connects positive battery to the winding 224 of relay 223, thus causing the armature of this relay to be attracted to its back contact. The holding circuit for relays 230 and 231 is thereupon broken and these relays release. Relay 230 in releasing, disconnects the motor 222 from the power source 229. In a similar manner, the release of relay 205, by means of its upper most back contacts reverses the current through the winding 113 of relay 112, causing the armature of this relay to open its front contacts and release relays 111 and 121. The release of relay 121 disconnects the motor 124 from the source of power 117. The stopping of motor 124 serves as a signal to the calling subscriber that key 102 may be restored. The circuits and connector switch are thus completely returned to normal.

Idle condition.

In the foregoing description, it was assumed that when the wipers 211 and 212 were positioned on the called line terminals, that this line was busy. Should, however, this line be idle when relay 204 is connected to conductor 251, as above described, said conductor is ungrounded and relay 204 remains normal. Therefore, an interval after the termination of dialing, the slow relay 215 releases and disconnects the test relay 204 from the test wiper 213. Since relay 204 remains normal, relay 216 cannot operate regardless of whether or not the switch 260 is being operated under control of some other connector as hereinafter described. Accordingly, immediately that relay 215 releases, the circuit hereinbefore traced for relays 205 and 222 is completed. These relays complete the connection of the calling and the called lines and prepare the printing circuits, as already described. It is seen, therefore, that relay 216 and the preference circuits included within the dotted rectangle do not function when the called line is idle.

Preference arrangements for two or more calling lines awaiting the same called line.

In the detailed description given hereinbefore, it was assumed that line 100 alone was calling the busy station 201. It was seen that under this condition, the established connection through switches 150 and 250 is maintained until the wanted station becomes idle. It will now be assumed that both lines 100 and 300 are awaiting connection with the station 201 and that this station is busy. In this case, busy test relay 204 associated with connector 250, is operated as well as busy test relay 304 associated with connector 450. Relay 204, therefore, closes the circuit for relay 218 which in turn operates relay 219, whereupon stepping magnet 217 operates as already described. After an interval determined by the release of relays 218 and 219, the stepping magnet 218 releases and advances brush 220 to the terminal associated with the next connector. As pointed out hereinbefore, this stepping process continues so long as the busy test relay associated with any connector served by switch 260 is operated. When, therefore, brush 220 reaches terminal 235 and assuming that station 201 has meanwhile become idle, then ground does not exist on conductor 251. Consequently, a circuit is completed from battery through winding of relay 222, conductor 251, test terminal No. 28 in switch 450, test wiper 413 cooperating therewith, upper winding of relay 305, left outer front contacts of relay 304, winding of relay 316, terminal 235 to the grounded brush 220. Relays 316, 305 and 222 operate in this circuit. Relay 316, in operating, opens the locking circuit of test relay 304 which thereupon releases. It is to be noted that connector 450 has associated therewith relays similar to those shown associated with connector 250. A few of these relays only are shown. Thus, relay 316 corresponds to relay 216; relay 304 corresponds to relay 204, etc. As described in connection with relay 205, the operation of relay 305 grounds the conductor 251 to render the station 201 busy. Since relay 204 is still locked under control of relay 216, brush 220 continues to advance. When terminal 221 is reached, since conductor 251 has been meanwhile grounded by wiper 413, relay 216 fails to operate (since it is shunted), consequently, brush 220 continues to rotate until station 201 becomes idle. At the instant brush 220 reaches terminal 221 after station 201 becomes idle, relay 216 operates and brings about the operation of relay 205 in the manner deemed to be already familiar.

In the foregoing description, a printing telegraph exchange accommodating 100 subscribers has been illustrated with a preference switch 220 common to all the connectors, each connector having an individual terminal such as 235, in this switch. It will be understood, however, that the invention may equally well be applied to telegraph systems accommodating more than 100 subscribers in which case first selective switches may be inserted between the line switches and the connectors. In this case, a preference switch having a multiple of levels similar to that shown cooperating with brush 220 is supplied, each level being adapted to serve a particular hundred subscribers' lines. Furthermore, the station 201 has been shown as a receiving station only, but from a con-

sideration of the description taken in conjunction with the showing of the station 101, it is believed that it will be perfectly obvious as to the manner in which the station 201 could be adapted for both sending and receiving printed telegraph messages.

What is claimed is:

1. In a signaling system, a first calling line, a second calling line, a called line, automatic switches for extending connections between said calling lines and said called line, means effective while said called line is busy for maintaining said extended connections open, and means effective when said called line becomes idle for determining the order in which said connections shall be completed.

2. In a printing telegraph exchange system, a first calling line, a second calling line, a called line, automatic switches operated under control of the calling lines for extending printing telegraph communication circuits from said calling lines to said called lines, means individual to each established connection for maintaining the same open while the called line is busy, and a preference switch for determining the order in which said last mentioned means shall operate to complete said open connections.

3. In a printing telegraph exchange system, a plurality of calling lines, a called line, a plurality of connector switches, means controlled by each of said calling lines for operating a different connector switch to prepare a printing telegraph circuit between said calling lines and said called line, means responsive to an idle condition of the called line for completing one of said prepared circuits without releasing the other prepared circuits and for rendering said called line busy, and means effective when said called line becomes idle for completing said other prepared circuits in a definite order.

4. In a signaling system, a plurality of calling lines, a called line, a plurality of connector switches having traveling wipers, means controlled by said calling lines for bringing the wipers of a corresponding plurality of connector switches into cooperative relation with the called line terminals, and a preference switch for determining the order in which said connectors are effective to establish telegraph communication circuits to said called line.

5. In a printing telegraph exchange system, a plurality of calling lines, called lines, a plurality of selectively operable connector switches, means under control of said calling lines for operating a corresponding number of connector switches to seize the terminals of one of said called lines, continuity controlling means individual to each connector for closing the printing communication circuit extending through the brushes of the associated connector switch, and means common to said connector switches and effective when said switches have seized the same called line terminals for operating the continuity means of each connector in a definite order.

6. In a printing telegraph exchange system, calling lines, a called line, a plurality of connector switches for preparing simultaneously channels of printing telegraph circuits from said calling lines to said called line, and a switch common to certain of said connector switches for determining the order in which said prepared channels shall be completed.

7. In a printing telegraph exchange system, calling lines, a called line, a plurality of connecter switches for preparing simultaneously channels of communication between said calling lines and said called line, and means comprising a relay individual to each connector and a rotary switch common to said connectors for determining the order in which said channels of communication shall be completed.

8. In a printing telegraph exchange system, the combination of a called line, a plurality of connector switches in which said called line terminates, means for operating said plurality of switches to seize said called line terminals to prepare telegraph communication circuits thereto, means responsive to a busy condition of said called line for causing said connectors to await the removal of the busy condition, and a preference switch for determining the order of completion of said prepared circuits by said connectors.

9. In a printing telegraph system, a calling station, a called station, printing apparatus and driving means therefor at each of said stations, a source of power at each station for the driving means thereat, and means for automatically connecting the power source at each station with its associated driving means at the time said stations are interconnected.

10. In a communication system, the combination of a plurality of separate stations with power driving means at each station, automatic means for establishing a communication circuit between any two of said stations, and means responsive to the establishment of such a circuit for starting in operation the driving means at each of the interconnected stations.

11. In a printing telegraph system, the combination of a plurality of stations, a telegraph printer and a motor therefor at each station, said motors being normally at rest, automatic means for establishing a communication circuit between any two of said stations, and means effective immediately on the establishment of such a circuit for starting in operation the motors at the interconnected stations.

12. In a printing telegraph exchange sys-

tem, a calling station, a called station, automatic switches for establishing a printing communication circuit between said stations, a motor at each station for driving the printing apparatus thereat, a normally opened power circuit for each motor, a relay at each station for controlling the associated power circuit, and means responsive to the interconnection of said stations for causing said relays to operate to close their respective power circuits.

13. In a printing telegraph exchange system, a calling station, a called station, a central office, automatic switches at the central office, a motor at each station for driving the printing apparatus thereat, a normally opened power circuit for each motor, means under control of the calling station for operating a train of said switches to establish a communication circuit with the called station, a polarized relay at each station for controlling the power circuit thereat, and means responsive to the establishment of said communication circuit for reversing the current therein to cause the polarized relays at both the calling and called stations to operate to close the respective power circuits.

In testimony whereof, I have signed my name to this specification this 30th day of October, 1925.

DONALD B. PERRY.