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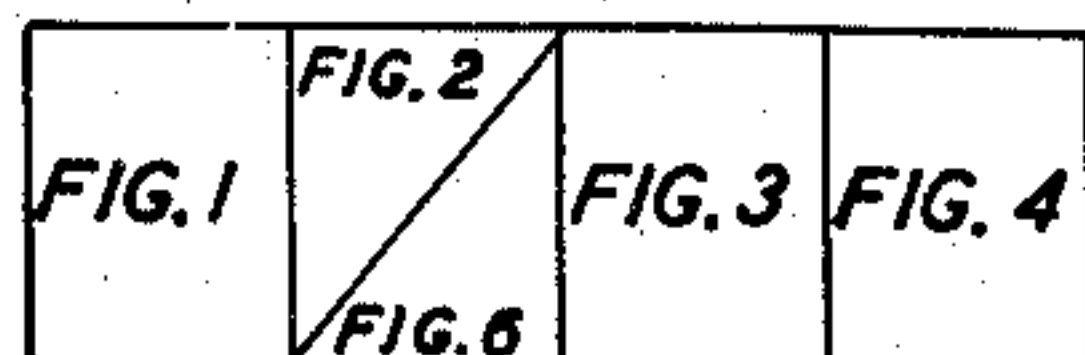
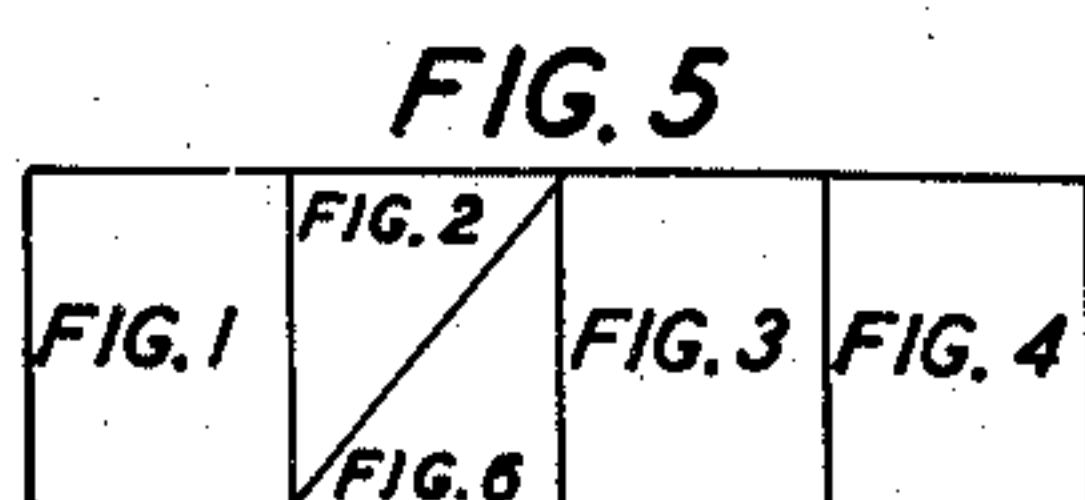
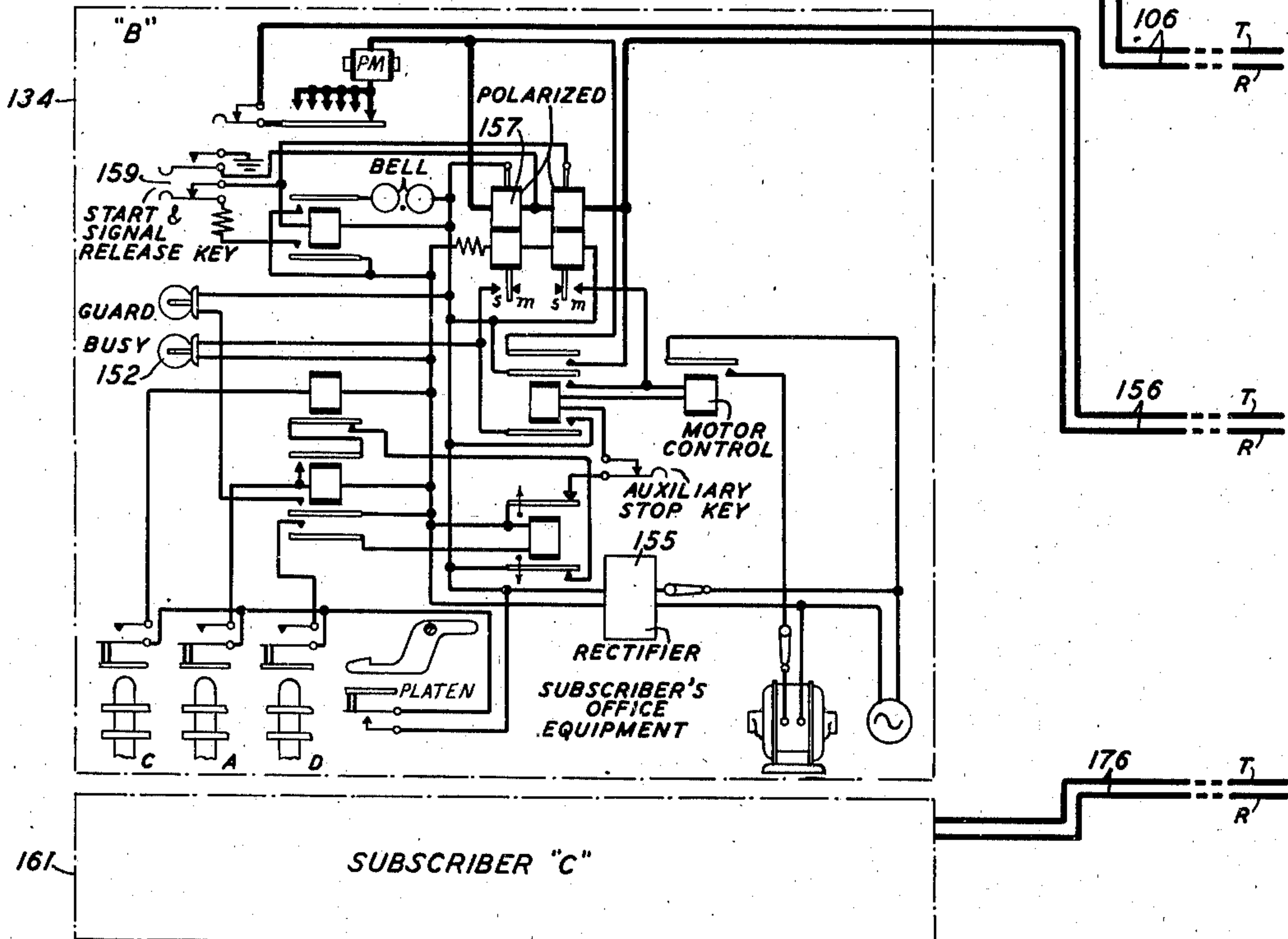
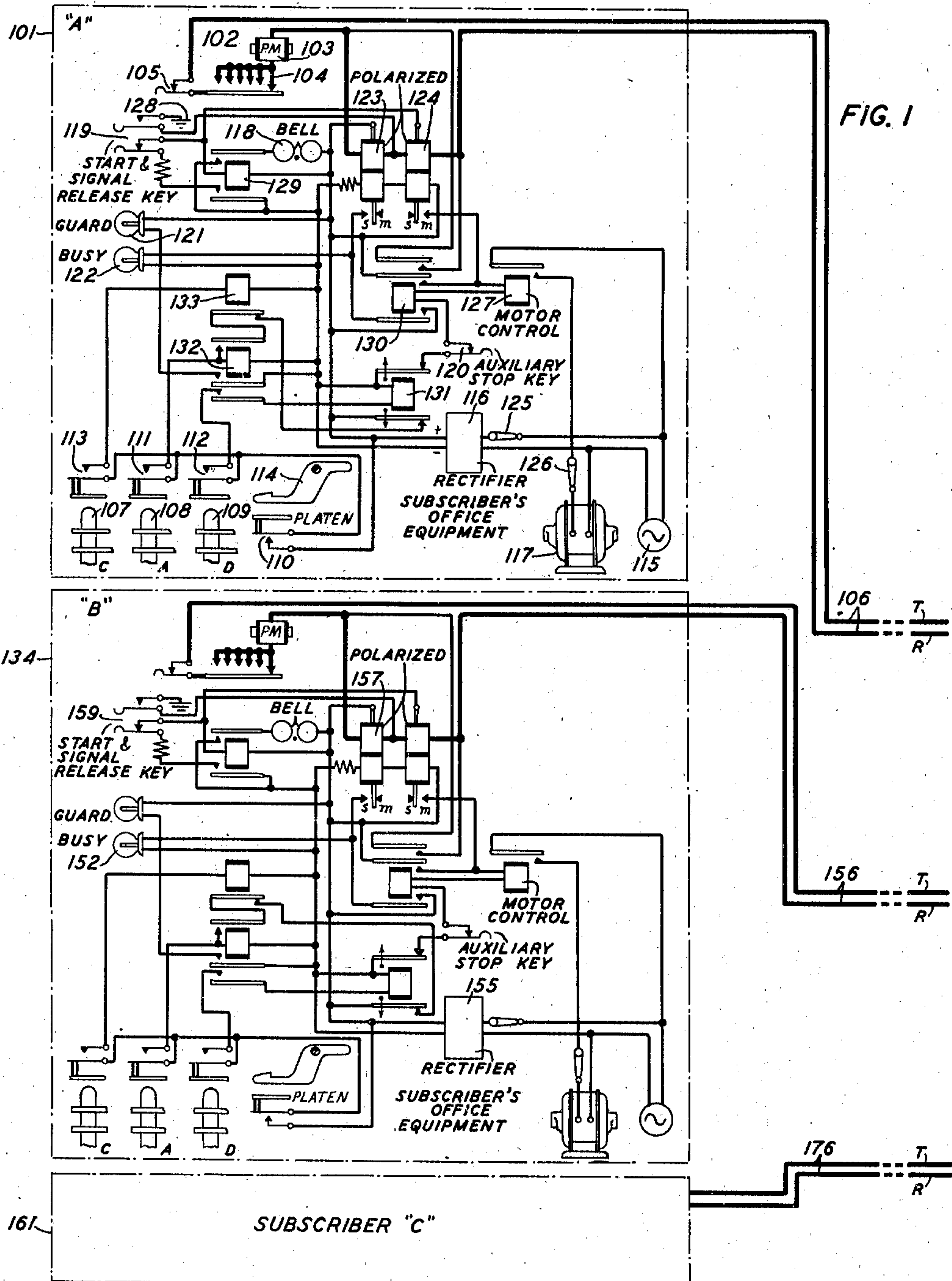
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2,262,541

TELETYPEWRITER SELECTIVE CALLING AND SWITCHING SYSTEM

Filed June 14, 1939

5 Sheets-Sheet 1



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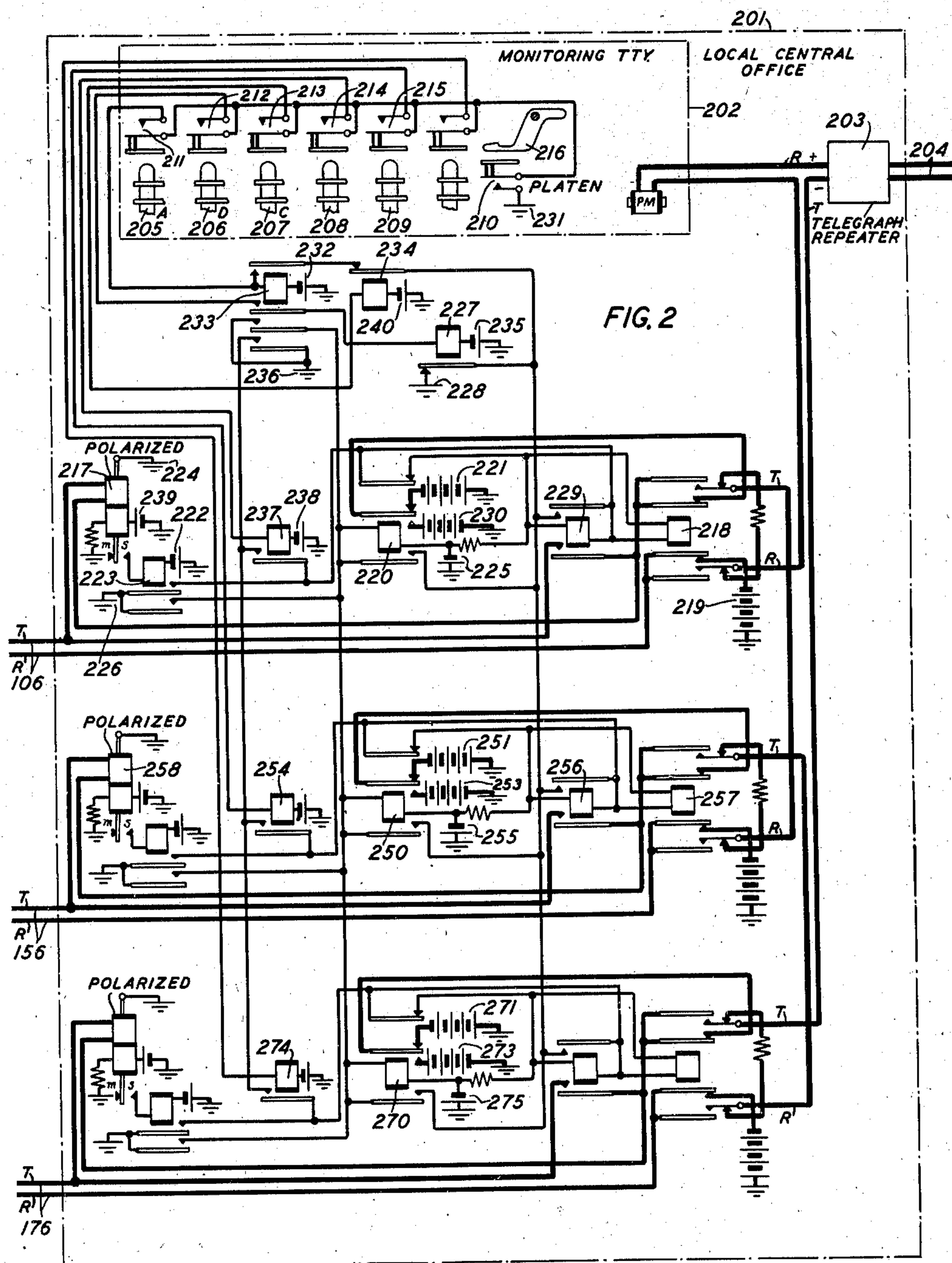
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TELETYPEWRITER SELECTIVE CALLING AND SWITCHING SYSTEM

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5 Sheets-Sheet 2



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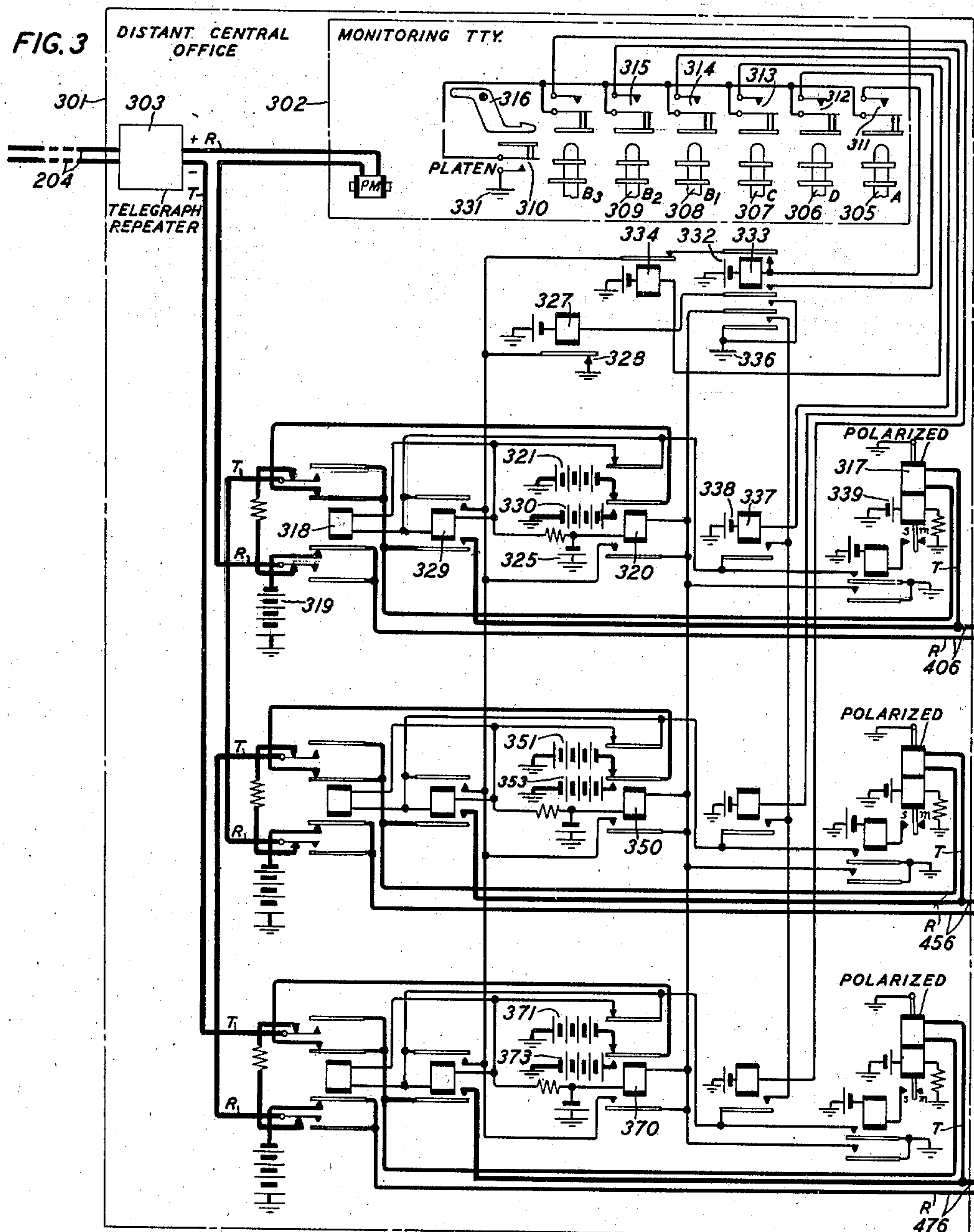
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2,262,541

TELETYPEWRITER SELECTIVE CALLING AND SWITCHING SYSTEM

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5 Sheets-Sheet 3



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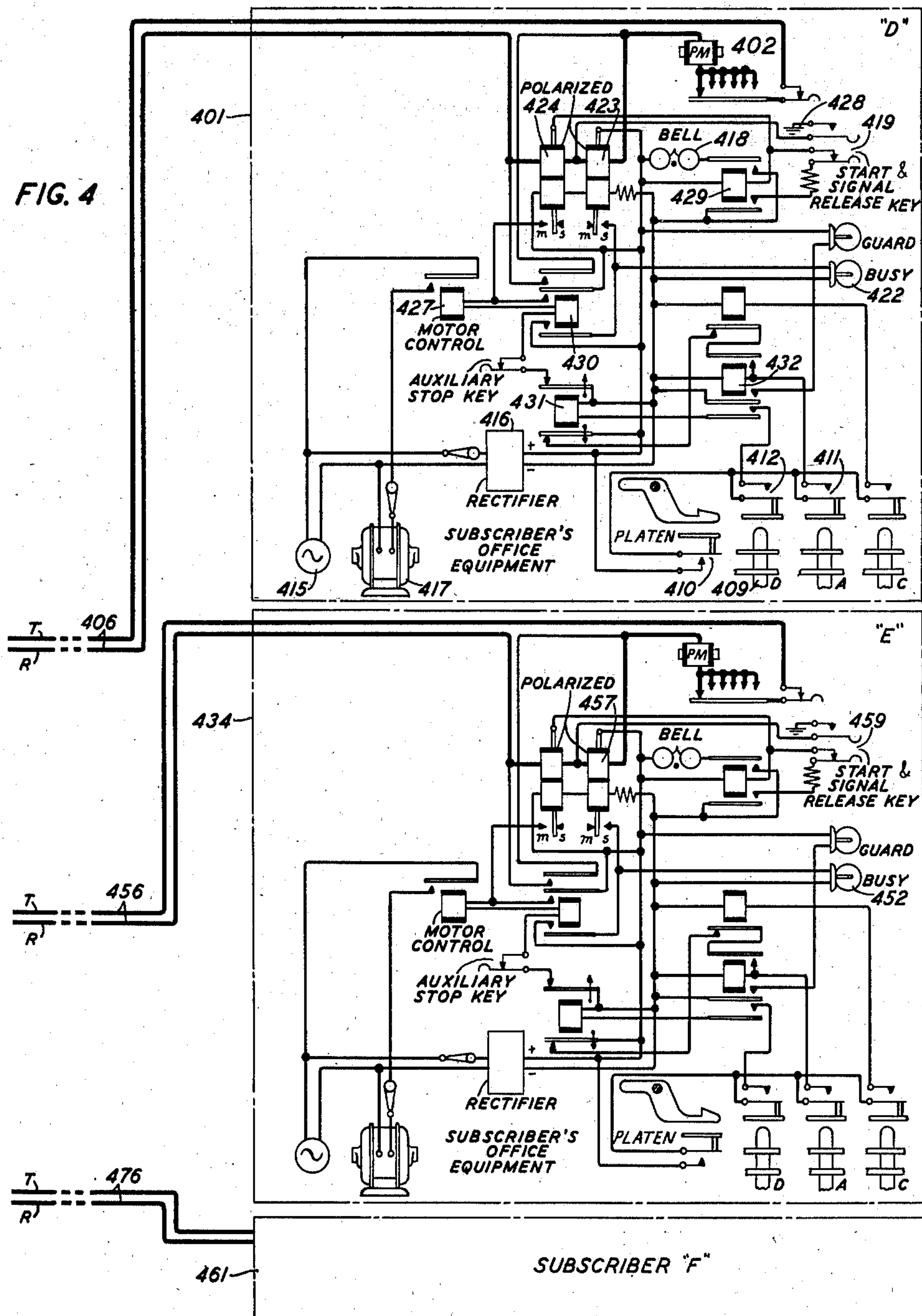
2,262,541

TELETYPEWRITER SELECTIVE CALLING AND SWITCHING SYSTEM

Filed June 14, 1939

5 Sheets-Sheet 4

FIG. 4



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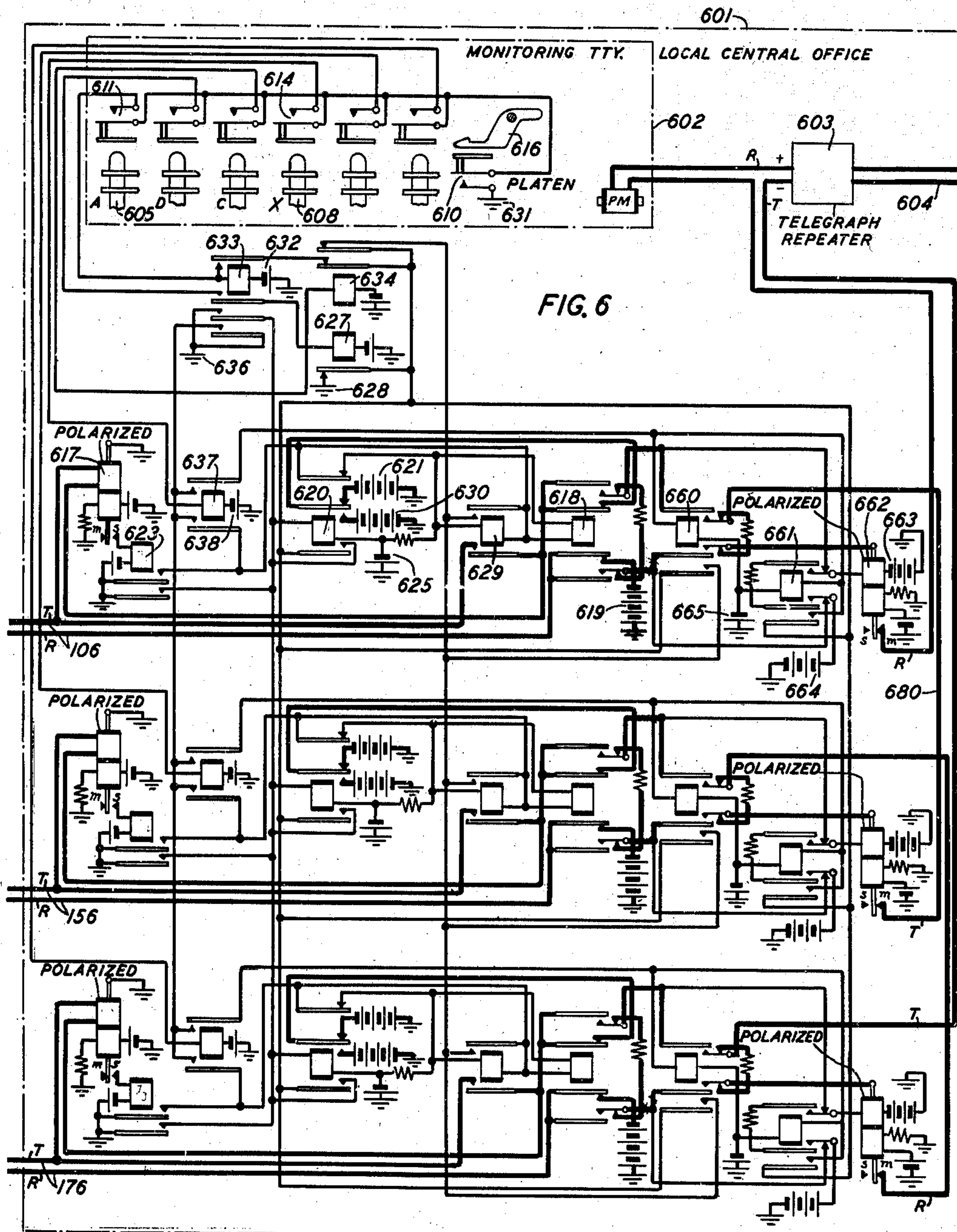
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TELETYPEWRITER SELECTIVE CALLING AND SWITCHING SYSTEM

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2,262,541

TELETYPEWRITER SELECTIVE CALLING
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Application June 14, 1939, Serial No. 279,190

14 Claims. (Cl. 178—2)

This invention relates to a teletypewriter selective calling and switching system having pull-bar-operated contacts for effecting calling and switching operations and, more particularly, to such a system having improved means for effecting supervisory operations.

Accordingly, it is an object of this invention to provide the system with means operating in response to a preassigned permutation code signal to cause a busy signal to be set up at all subscribers' stations in the system other than the calling subscriber's station, for rendering the local motor start mechanism at these stations ineffective, and also for conditioning the selective calling and switching apparatus for operation.

It is also an object of the invention to provide the system with means operating in response to another preassigned permutation code signal to disable the selective calling and switching apparatus after the desired calling and switching functions have been performed and to condition the system for the transmission of messages.

A further object of the invention is to provide the system with means for restoring the system to its normal condition, after the transmission of a message, in response to the transmission of certain preassigned permutation code signals.

A modification of the invention has for its object the insuring of privacy of communication by insuring that the loop extending from a subscriber's station to a central office will, after the subscriber has operated his start key, be conditioned on a one-way basis, the direction being from the subscriber's station to the central office, and will not be converted to a two-way basis until the signal assigned for selecting that station has been transmitted.

These and other objects of the invention are accomplished by means of a system employing teletypewriters of the type disclosed in Patent 1,745,633, granted February 4, 1930 to S. Morton et al. The disclosure of this Morton et al. patent is incorporated herein by reference as a part of this specification. These teletypewriters are located at subscribers' stations and are equipped with control contacts some of which are operated by the pullbars in the teletypewriters and some by other apparatus in the teletypewriters, such as by the platen shift mechanism, in the manner described in Patent 2,120,235, granted June 14, 1938 to J. F. Beattie et al. The disclosure of this Beattie et al. patent is incorporated herein by reference as a part of this specification. Each central office in the system is provided with a monitoring teletypewriter which is equipped with control contacts of the type just described.

When a subscriber wishes to connect his teletypewriter to that at another subscriber's station for the purpose of communication therebetween, he applies ground to the midpoint between the operating windings of two polarized

relays. This reverses the polarity of the current in the tip side of the loop to the calling station and extends the subscriber's loop circuit to the main transmission channel through all the central offices in the system which serves to start the calling subscriber's teletypewriter motor, ring his bell and light his busy lamp. The subscriber then transmits a "figures-shift" signal which effects as a preparatory condition the application of ground to pull-bar operated control contacts located in monitoring teletypewriters at all the central offices. He next transmits a preassigned permutation code signal, such as "A", which sets up a busy signal at all the other subscribers' stations connected into the system and renders their local motor start mechanism ineffective. It also causes a guard lamp to be lit at the calling subscriber's station and serves to condition the selective calling apparatus for operation.

The calling subscriber then transmits another preassigned permutation code signal, such as "B", which connects the called subscriber's loop into the circuit, causes the selected called subscriber's motor to be started by remote control and also effects an audible calling signal. This is followed by another preassigned permutation code signal, such as "C", transmitted from the calling station which serves to extinguish the guard lamp at the calling subscriber's station and also temporarily disables the selective calling arrangement.

After the subscriber has completed his communication, he can disconnect the communicative connection by transmitting a shift signal followed by the signal for "A" and then another preassigned permutation code signal, such as "D". The shift and the "A" signals perform the same functions at this time as was described above. The "D" signal causes the motor control circuit to be opened thereby stopping the motor at both the called subscriber's station and the calling subscriber's station. It also effects the extinguishment of the guard lamp at the disconnecting station which became operated in response to the transmission of the "A" signal, and causes the busy lamps at all stations to be extinguished. The circuit is thus restored to its normally unoperated condition.

In the modification of the invention whereby privacy of communication is assured, the operation of the start key at a subscriber's station will condition the subscriber's loop, extending from that station to a central office, on a one-way basis, the direction being from the subscriber's station to the central office. This one-way loop is not converted to a two-way basis until the signal assigned for selecting that station has been transmitted. After the loop has been converted to a two-way basis, communication takes place in the manner described above. Since none

of the loops extending from the subscribers' stations can be placed on a two-way basis until the signals assigned for selecting them have been transmitted, it is impossible for any subscriber not connected into the particular communicative connection to eavesdrop.

These and other features of the invention are fully described in connection with the following detailed description of the drawings, in which:

Figure 1 represents three subscribers' teletypewriter stations located at one end of the system and shows in detail the apparatus and circuit connections at two of the stations, it being understood that the third station is similarly equipped;

Fig. 2 illustrates switching relays and circuit connections at the teletypewriter central office nearest the subscribers' stations shown in Fig. 1;

Fig. 3 shows similar apparatus and circuits at a distant teletypewriter central office;

Fig. 4 illustrates three subscribers' teletypewriter stations, two in detail and one schematically, located at the distant end of the system;

Fig. 5 indicates the relationship of the apparatus and circuits shown in Figs. 1, 2, 3, and 4 to the system as an entirety; and

Fig. 6 shows a teletypewriter central office similar to the central office shown in Fig. 2 but which is provided with means for insuring secrecy of communication by preventing the loops extending from the subscribers' stations shown in Fig. 1 to be connected to the central office of Fig. 6 on a two-way basis until the signals assigned for selecting them have been transmitted.

In Fig. 1, a typical subscriber's teletypewriter station 101 is shown to be provided with a teletypewriter 102, similar to the teletypewriter disclosed in the Morten et al. patent mentioned above, having a receiving magnet 103, sending contacts 104, and break key 105 connected into a communication channel 106 extending to the local central office 201 shown in Fig. 2. Teletypewriter 102 is equipped with pullbars 107, 108, and 109 adapted to operate a plurality of control contacts 111, 112, and 113 in the manner described in the Beattie et al. patent mentioned above. Another control contact 110 is operated by a bell crank 114 which is a part of the mechanism used to shift the platen from lower case to upper case and vice versa in the manner described in the Beattie et al. patent.

A source of alternating current 115 is supplied to operate the subscriber's rectifier 116 and motor 117. Station 101 is further provided with a bell, or ringer, 118, a non-locking, manually operable start and signal release key 119, a guard lamp 121, and a busy lamp 122. It is also provided with an auxiliary stop key 120 for use particularly with the secrecy feature to be described hereinafter.

Of all the relays at station 101, only two are normally energized. These are the polarized relays 123 and 124 which are normally energized by their local biasing circuit to hold the armature of relay 123 on its marking contact and the armature of relay 124 on its spacing contact. Negative current in the tip circuit will hold the armature of relay 123 on its marking contact and positive current will move the armature to its spacing contact. Likewise, negative current in the ring circuit will hold the armature of relay 124 on its spacing contact and positive current will move it to its marking contact. During business hours, the subscriber

at station 101 keeps the manually operable switches 125 and 126 closed to continuously supply current to rectifier 116 and to prepare the energizing circuit for motor 117. However, motor 117 is unable to run at this time due to its energizing circuit being open at the contact of the motor control relay 127.

Station 101 has a loop 106 extending to the local central office 201 which is provided with a monitoring teletypewriter 202, similar to the teletypewriter described in the Morton et al. patent mentioned above, and a telegraph repeater 203, which may be of any suitable construction. Since both the repeater 203 and the monitoring printer 202 are connected into the main communication line 204 leading to the distant central office 301, printer 202 runs continuously during business hours. Mounted in teletypewriter 202 above the pullbars 205, 206, 207, 208, and 209 are control contacts 211, 212, 213, 214, and 215 which are designed to be operated by the pullbars 205 to 209, inclusive, in the manner described in the Beattie et al. patent mentioned above. Contact 210 is operated by a portion 216 of the shift mechanism in the manner described in the Beattie et al. patent.

Central office 201 is provided with a separate set of switching relays for each local outlying teletypewriter station in the selective calling and switching system that has a communication channel, similar to channel 106, leading to central office 201. In each set of switching relays, all of the relays are normally unenergized except polarized relay 217 which is normally energized by current from battery 239 passing over its local biasing circuit to hold its armature on its marking contact. Positive current in the operating winding of relay 217 will hold its armature on its marking contact and negative current will move the armature to its spacing contact.

The ring side R of line 106 is connected over the inner bottom armature of relay 218 to negative grounded battery 219. The tip side T of line 106 is connected through the operating winding of relay 217, over the inner top armature of relay 218, and over the inner top armature of relay 220 to negative grounded battery 221. As batteries 219 and 221 are of equal and like polarities, no current will flow in the subscriber's loop 106 to station 101 at this time which is the normal idle condition.

When the subscriber at station 101 desires to originate a call to some other station in the system, he manually operates his non-locking start and signal release key 119 thereby applying ground 123 to his loop at a point midway between the operating windings of polarized relays 123 and 124. Negative current from battery 219 will now travel over the ring side R of loop 106 and through the operating winding of relay 124 to ground 123. Negative current from battery 221 will pass through the operating winding of relay 217 and then over the tip side T of line 106 and through the operating winding of relay 123 to ground 123. As the direction of this current flow is such as to aid the current normally passing from rectifier 116 through the biasing windings of relays 123 and 124, the position of the armatures of relays 123 and 124 is not changed.

However, at the central office 201, the flow of negative current through the operating winding of relay 217 causes the armature of relay 217 to be moved to its spacing contact thereby closing a path for current from grounded battery 222

to pass through the winding of relay 223, over the armature of relay 217 to ground 224. This causes relay 223 to operate its armatures. The inner armature of relay 223 completes a short-circuit path across the windings of relays 218 and 229. This shunt path extends from battery 225, over the top armature of relay 220, and then over the inner armature of relay 223 to ground 226.

The outer armature of relay 223 closes a path for current from grounded battery 225 to pass through the winding of relay 220 and over the outer armature of relay 223 to ground 226 thereby energizing relay 220 which operates its armatures and locks up over its bottom armature and over the armature of relay 227 to ground 228. The operation of the inner top armature of relay 220 switches the tip side T of line 106 from negative battery 221 to positive battery 230. The operation of the outer top armature of relay 220 opens the short circuit across the windings of relays 218 and 229.

Accordingly, current from battery 225 will now pass through the windings of relays 229 and 218 and then over the inner armature of relay 223 to ground 226. This causes relays 218 and 229 to operate their armatures and lock up over the top armature of relay 229 and then over the armature of relay 227 to ground 228.

The operation of the inner bottom armature of relay 218 disconnects the ring side R of line 106 from battery 219 and the operation of the outer bottom armature of relay 218 connects this side of line 106 to one side of the main communication circuit leading through the monitoring teletypewriter 202 and repeater 203 at central office 201 and then out over line 204 to the distant central office 301. The operation of the inner top armature of relay 218 disconnects battery 230 from the tip side T of line 106 and the operation of the outer top armature of relay 218 connects this side of line 106 to the other side of the main communication circuit leading through repeater 203 and out over line 204.

Thus, the subscriber's circuit is extended through the monitoring teletypewriter 202 and the telegraph repeater 203 at the local central office 201, out over the main transmission line 204 to the distant central office 301, through the repeater 303, and the monitoring teletypewriter 302.

At the same time, the bottom armature of relay 229 closes a shunt path across the operating winding of relay 217 thereby, in effect, removing its inductance from the subscriber's loop. This causes relay 217 to move its armature back to its marking contact thereby opening the energizing circuit of relay 222 which releases its armatures.

When the inner top armature of relay 220 was operated to switch the tip side T of line 106 from negative battery 221 to positive battery 230 and before relays 229 and 218 became energized, positive current from battery 230 passed over the tip side T of the subscriber's loop 106 for a brief period of time. This current flow is of short duration because relay 218 soon operates its armatures to switch the subscriber's loop 106 from battery 230 to the main line 204. However, this temporary flow of current in the tip side of loop 106 merely causes the subscriber's relay 123 to move its armature momentarily to its spacing contact to momentarily light the busy lamp 122 over a circuit to be traced hereinafter.

When relays 229 and 218 become energized and

operate their armatures, the calling subscriber's circuit is extended to repeater 203 and the main communication channel 204. Negative current from the tip output terminal of repeater 203 will now pass over the tip side of loop 106, through the operating winding of relay 123, and then over the top part of start key 119 to ground 128. This causes relay 123 to move its armature to its marking contact thereby extinguishing busy lamp 122.

At the same time, positive current from the ring output terminal of repeater 203 will pass through the monitoring teletypewriter 202, over the ring side R of the calling subscriber's circuit, through the operating winding of relay 124, and then over the top part of key 119 to ground 128. This causes relay 124 to move its armature to its marking contact to permit current from the positive terminal of the subscriber's rectifier 116 to pass through the winding of relay 129, over the armature of relay 124 and its marking contact, through the winding of motor control relay 127, winding of relay 130, and then over the top armature and contact of slow-release relay 131 to the negative terminal of rectifier 116 thereby energizing relays 127, 129, and 130 which operate their armatures.

The operation of the top armature of relay 129 closes a path for current to pass from the positive terminal of rectifier 116, through ringer 118, and then over the top armature of relay 129 to the negative terminal of rectifier 116. This serves to operate the subscriber's audible signal device, ringer 118. The operation of the bottom armature of relay 129 does not accomplish any useful function at this time because the path leading from the bottom contact of relay 129 is open at the lower part of key 119 due to the subscriber holding this key open now in order to make his call.

Control relay 127 operates its armature to close the energizing circuit from the source 115 of alternating current through the subscriber's motor 117 thereby starting motor 117. Relays 130 and 127 lock up over a path leading from the positive terminal of rectifier 116, over the inner top armature of relay 130, through the windings of relays 127 and 130, and then over the top armature of relay 131 to the negative terminal of rectifier 116. Consequently, relay 127 remains energized and maintains its armature operated to keep the energizing circuit of motor 117 closed.

At the same time, the operation of the bottom armature of relay 130 closes a path for current to pass from the positive terminal of rectifier 116, over the bottom armature of relay 130, through busy lamp 122, and then back to the negative terminal of rectifier 116. This serves to operate the calling subscriber's visible signal device, busy lamp 122.

The operation of the outer top armature of relay 130 closes a shunt path from the ring side R of the line 106 over the outer top armature and contact of relay 130 to the subscriber's receiving magnet 103 thereby short-circuiting the operating windings of relays 123 and 124. When relays 123 and 124 are shunted out of the loop, the current in their biasing windings holds their armatures in the positions shown in Fig. 1. Consequently, the armature of relay 124 is moved to its spacing contact thereby opening the energizing circuit of relay 129 which releases its armatures to discontinue the operation of ringer 118. As the short-circuiting of the operating windings of relays 123 and 124 occurs

very shortly after relay 129 was energized, the operation of ringer 118 is so brief that it is hardly more than a momentary operation.

The starting of motor 117, the brief ringing of bell 118, and the lighting of busy lamp 122 all indicate to the subscriber at station 101 that his teletypewriter 102 is now connected into the main communication circuit 204 in communicative relation with both the monitoring teletypewriter 202 at the local central office 201 and the monitoring teletypewriter 302 at the distant central office 301 and is ready for operation.

For the sake of simplicity, the main communication channel is shown to extend between only two central offices 201 and 301. It is to be understood that, if desired, it may include other teletypewriter central offices and that the channel may be of any suitable type. Accordingly, the subscriber releases his start and signal release key 119 and proceeds to establish the desired communicative connection.

The subscriber at station 101 now transmits a "figures-shift" signal to effect the shifting of the platen in his teletypewriter 102 to its upper case position in the manner described in the Beattie et al. Patent 2,120,235 mentioned above. This causes the operation of the bell crank lever 114 to close the platen contact 110 which remains closed until a "letters-shift" signal is transmitted. The manner in which this platen contact 110 is operated is described in the Beattie et al. patent. Closure of platen contact 110 activates the pullbar contacts 111, 112, and 113 by connecting them to the positive terminal of rectifier 116. This "figures-shift" signal is also received by the monitoring teletypewriters 202 and 302 at the central offices 201 and 301 and effects the operation of bell cranks 216 and 316 to close the platen contacts 210 and 310. This activates the pullbar contacts 211 to 215, inclusive, by applying to them ground 231, and also activates pullbar contacts 311 to 315, inclusive, by applying to them ground 331.

Next, the subscriber at station 101 transmits a so-called "prepare" signal, such as the permutation code signal for "A". Other signals may be preassigned for use instead of "A" if desired and it is to be understood that this is the case with other specific signals to be mentioned hereinafter and that the specific designation of "A" and other letters hereinafter is set forth for the purpose of this description and that the invention is not limited to the use of only these particular code combinations. This "A" signal is received by all the teletypewriters monitoring on the circuit and causes each of them to operate the proper pullbar to momentarily close the "A" pullbar contact.

Thus, at central office 201, pullbar 205 is operated to close contact 211 to complete a path for current to pass from grounded battery 232, through the winding of relay 233, contact 211, and then over the platen contact 210 to ground 231 thereby energizing relay 233. Relay 233 now operates its armatures and locks up over its top armature, armature of relay 234, and then over the armature of relay 227 to ground 228. The inner bottom armature of relay 233 prepares an energizing circuit from battery 235 through relay 227 but this circuit is left open at the "D" pullbar contact 212. The outer bottom armature of relay 233 connects ground 236 to the contacts of relays 237, 254, and 274. The middle bottom armature of relay 233 closes a path for current from batteries 225, 255, and 275 to pass through

the windings of relays 220, 250, and 270, respectively, and then over the middle bottom armature of relay 233 to ground 236.

As was described above, relay 220 has already operated its armatures to lock up over its bottom armature and over the armature of relay 227 to ground 228. Relays 250 and 270 now operate their armatures to lock up in a similar fashion. The operation of the inner top armature of relay 250 switches the tip side of loop 156 from negative battery 251 to positive battery 253 and the operation of the outer top armature of relay 250 opens a short circuit across the windings of relays 256 and 257. This causes current to flow over loop 156 in such a direction as to cause the polarized relay 157 at the subscriber's station 134 to move its armature to its spacing contact thereby closing a path for current from the subscriber's rectifier 155 to energize busy lamp 152. The subscriber's start key 159 is rendered ineffective due to the positive current in the operating winding of relay 258 at central office 201 which holds the armature of relay 258 on its marking contact. Likewise, the operation of the armatures of relay 270 effects a similar flow of current in loop 176 which accomplishes the lighting of the busy lamp at the subscriber's station 161 and disables the start key at station 161 in a manner similar to that described above.

At the same time, pullbar 305 at the distant central office 301 is operated to close contact 311 to effect the energization of relay 333. Relay 333 operates its armatures to perform the same functions as relay 233 and causes the energization of relays 320, 350, and 370 which operate their armatures and lock up over their bottom armatures and the armature of relay 327 to ground 328. The operation of inner top armature of relay 320 switches the tip side T of the loop 406 extending to the subscriber's station 401 from negative battery 321 to positive battery 330. At the same time, the operation of the top armature of relay 320 opens a short circuit across the windings of relays 318 and 329.

Since the tip side T of the subscriber's loop 406 now has positive current from battery 330 and the ring side R still has negative current from battery 319, current will now flow over the subscriber's loop 406. However, in the normal operating condition of the circuit during communication, negative current is applied to the tip and positive current to the ring. Consequently, the current now in the subscriber's loop 406 is flowing in a direction which is the opposite of the normal marking loop current used during communication.

The positive current from battery 330 now flowing in the tip circuit causes polarized relay 423 at station 401 to move its armature to its spacing contact. This closes a path for current from the positive terminal of the subscriber's rectifier 416 to pass over the armature and spacing contact of relay 423, through the busy lamp 422, and then back to the negative terminal of rectifier 416. Consequently, the subscriber's indicator, lamp 422, becomes operated to provide the subscriber at station 401 with a visual indication that another subscriber in the system is making a calling selection.

The local motor starting mechanism at station 401 is rendered ineffective because operation of the subscriber's start and signal release key 419 will now be of no effect as it is in a state equivalent to being disabled. This is due to the fact that positive current from battery 330 is now on

the tip circuit extending through the operating winding of relay 317 and merely assists in holding the armature of relay 317 on its marking contact. Consequently, operation of start key 419 at this time will not be able to effect the operation of the armature of relay 317 to its marking contact.

Similarly, the operation of the armatures of relays 350 and 370 switches the tip sides of loops 456 and 476 from negative batteries 351 and 371 to positive batteries 353 and 373, respectively. This causes relay 457 at the subscriber's station 434 to effect the energization of busy lamp 452. At the same time, the subscriber's start key 459 is rendered ineffective. Likewise, at station 461, the busy lamp is illuminated and the start key rendered ineffective by means similar to those described above.

Thus, the transmission of the "prepare" signal, "A", by the calling subscriber at station 101, causes the busy lamps at all the other subscribers' stations in the system to become illuminated and also prevents the operation of their start keys from being effective to start their teletypewriter motors at this time.

The calling subscriber at station 101 is now the only subscriber whose teletypewriter is connected into the system for the transmission and reception of signals. Accordingly, the transmission of the "prepare" signal, "A", effects the operation of the "A" pullbar 108 in the teletypewriter at station 101 to close momentarily its contact 111 for closing a path from the positive terminal of rectifier 116 over the platen contact 110, contact 111, through the winding of relay 132, and then to the negative terminal of rectifier 116 thereby energizing relay 132.

Relay 132 operates its armatures and locks up over its top armature, armature of relay 133, and then over the bottom armature of relay 131 to the positive terminal of rectifier 116. The operation of the outer bottom armature of relay 132 prepares an energizing circuit for relay 131 but this circuit is left open at the "D" pullbar contact 112. The operation of the inner bottom armature of relay 132 closes a path for current to pass from the negative terminal of rectifier 116, over the inner bottom armature of relay 132, through the guard lamp 121, and then to the positive terminal of rectifier 116. This causes the calling subscriber's indicator, guard lamp 121, which may have a red bulb, if desired, to be operated to provide the subscriber at station 101 with a visual indication that the system has now been prepared for the transmission of a station selecting signal.

If it is found that the relays mentioned above are not sufficiently quick in operating, the selecting routine may be modified to require that the calling subscriber either transmit the "prepare" signal, "A", twice to allow sufficient time for these relays to operate their armatures and for the lamps to light or else pause for a brief interval of time before transmitting the station selecting signals. This applies also to the transmission of other permutation code signals to be mentioned hereinafter that have been preassigned to perform selective switching and supervisory functions.

The subscriber at station 101, having decided which of the other subscribers' stations, such as station 401, is to be conditioned for communication, now transmits the proper station selecting signal, such as "B". Only one teletypewriter in the system is provided with a pullbar contact the

operation of which is effected by the transmission of the "B" signal and that is the monitoring teletypewriter 302 at central office 301 serving station 401. Consequently, the "B" code signal effects the operation of the pullbar 308 in the monitoring teletypewriter 302 which closes the "B₁" pullbar contact 314. The closure of contact 314 closes a path for current from battery 338 to pass through the winding of relay 337, contact 314, and then over the platen contact 310 to ground 331 thereby energizing relay 337.

Relay 337 operates its armature to complete the path from ground 336 over the operated outer bottom armature of relay 333, armature of relay 337, and then through the windings of relays 318 and 329 to battery 325. This energizes relays 318 and 329 which operate their armatures and lock up over the top armature of relay 329 and armature of relay 327 to ground 328.

The operation of the bottom armature of relay 329 closes a shunt path across the operating winding of relay 317 thereby, in effect, removing the inductance of this relay from the subscriber's loop.

The operation of the inner bottom armature of relay 318 disconnects the ring side R of line 406 from battery 319 and the operation of the outer bottom armature of relay 318 connects this side of loop 406 through the monitoring teletypewriter 302 to the positive ring terminal of the telegraph repeater 303 at central office 301 leading out over the main communication line 204 to the other central office 201. The operation of the inner top armature of relay 318 disconnects the tip side T of line 406 from the battery 330 and the operation of the outer top armature of relay 318 connects this side of loop 406 to the negative tip terminal of repeater 303. Thus, the subscriber's loop 406 is extended from the subscriber's station 401 through the central office 301, over the main transmission line 204 to central office 201, and then over loop 106 to the calling subscriber's station 101.

When the inner top armature of relay 320 was operated previously to switch the tip side T of line 406 from negative battery 321 to positive battery 330, positive current passed over the tip side T of the subscriber's loop 406 to cause the subscriber's busy lamp 422 to be illuminated as was described above. This condition continues until relay 318 operates its armatures as described above to switch the subscriber's loop 406 from batteries 330 and 319 to the main line 204. The normal marking current now flows over the subscriber's loop 406 from positive on the ring to negative on the tip. This causes the armature of relay 423 to be moved to its marking contact and the armature of relay 424 to be moved to its marking contact.

The operation of the armature of relay 424 to its marking contact permits current from the positive terminal of the subscriber's rectifier 416 to pass through the winding of relay 429, over the armature of relay 424 and its marking contact, through the winding of motor control relay 427, winding of relay 430, and then over the top armature and contact of relay 431 to the negative terminal of rectifier 416, thereby energizing relays 427, 429, and 430 which operate their armatures.

Relay 429 locks up over a path from the positive terminal of rectifier 416 through the winding of relay 429, the lower portion of the start and signal release key 419, over the bottom armature

of relay 429, and then to the negative terminal of rectifier 416. The audible signal device, ringer 418, is now operated by being energized by current from the positive terminal of rectifier 416 passing through ringer 418 and then over the top armature of relay 429 to the negative terminal of rectifier 416. Since relay 429 is locked up, the operation of ringer 418 will be continued until stopped by the subscriber when he momentarily operates the key 419 to open the locking-up circuit of relay 429.

Control relay 427 operates its armature at this time to close the energizing circuit from the source 415 of alternating current through the subscriber's motor 417 to start motor 417. This energizing circuit for motor 417 is kept closed due to relays 430 and 427 locking up over a path leading from the positive terminal of rectifier 416, over the inner top armature of relay 430, through the windings of relays 427 and 430, and then over the top armature of relay 431 to the negative terminal of rectifier 416.

The operation of the outer top armature of relay 430 closes a shunt path from the ring side R of the line 406 over the outer top armature and contact of relay 430 to the subscriber's teletypewriter 402 thereby short-circuiting relays 423 and 424 and causing them to hold their armatures in the positions shown in Fig. 4. Also, at this time, the visible signal device, busy lamp 422, which was extinguished when relay 423 moved its armature to its marking contact, is operated by current passing from the positive terminal of rectifier 416, over the operated bottom armature of relay 430, and then through the busy lamp 422 to the negative terminal of rectifier 416.

The starting of motor 417, the ringing of bell 418, and the lighting of busy lamp 422 indicates to the subscriber at station 401 that his teletypewriter 402 is now connected into the main communication circuit in response to a call from some other subscriber in the system. Accordingly, the subscriber momentarily operates his start and signal release key 419 to unlock relay 429 to discontinue the operation of bell 418 and then awaits the transmission of signals from the calling subscriber.

Other subscribers' stations may be joined with stations 101 and 401 to form a conference connection. The calling subscriber at station 101 could establish such a conference connection by transmitting at this time the preassigned code signals to effect the closure of the proper pullbars in the central office monitoring teletypewriters serving the desired subscribers' stations, as only these particular monitoring teletypewriters will have pullbar contacts that will be operated in response to the particular station selecting signals. Thus, at central office 201, closure of the pullbar contact 215 in the monitoring teletypewriter 202 will effect the selection of the subscriber's station 134. Likewise, operation of pullbar 309 in the monitoring teletypewriter 302 at central office 301 will close contact 315 to effect the connection of subscriber's station 434.

After all the desired subscribers' stations have been connected for communication, the calling subscriber at station 101 transmits a so-called "go ahead" signal which is some preassigned code signal, such as the permutation code signal for "C". Reception of this signal at all central offices effects the operation of the "C" pullbars 207 and 307 to momentarily operate the "C" con-

tacts 213 and 313. Operation of contact 213 at central office 201 closes a path from battery 240, through the winding of relay 234 thereby energizing relay 234 which momentarily operates its armature to open the locking-up circuit of relay 233.

Accordingly, relay 233 releases its armatures to open the direct energizing circuits of relays 220, 250, and 270. However, relays 220, 250, and 270 remain locked up over their bottom armatures and the armature of relay 227 to ground 228. Operation of contact 313 at central office 301 likewise effects the momentary energization of relay 334 to perform functions similar to those of relay 234 while relays 320, 350, and 370 remain locked up. Since relays 220, 250, 270, 320, 350, and 370 remain energized and locked up, the busy lamps at all the uncalled subscribers' stations in the system are kept illuminated and the start keys at these stations remain disabled as described above.

At the calling subscriber's station 101, the transmission of the "C" signal will cause the momentary operation of pullbar 107 which will momentarily close the "C" contact 113 to close a path from the positive terminal of rectifier 116, over contacts 110 and 113, through the winding of relay 133, and then to the negative terminal of rectifier 116 thereby energizing relay 133. Relay 133 operates its armature to open momentarily the locking-up circuit of relay 132 which releases its armatures. The release of the inner bottom armature of relay 132 opens the energizing circuit of guard lamp 121 which, accordingly, is extinguished.

This conditions the apparatus at station 101 for communicative purposes and two-way communication may now be had between the calling station 101 and the called station 401 or any other selectively called stations that may be connected into a conference connection. The only restriction on this communication is that the permutation code combination, such as "A", that has been preassigned to serve as a "prepare" signal must not be used in ordinary communication whenever the platens of the teletypewriters are in their upper case positions.

When the purposes of this communication connection have been accomplished and it is desired to return the system to its normal idle condition, the subscriber at station 101 transmits a "figures-shift" signal to effect the closure of the platen contacts in all the operating teletypewriters in the system to activate the pullbar contacts as these pullbar contacts were deactivated when, during the course of communication, a "letters-shift" signal was transmitted to open the platen contacts. The subscriber at station 101 follows this with the "prepare" signal, which is some preassigned permutation code signal, such as "A".

Transmission of this signal causes the "A" pullbar contacts 211 and 311 at central offices 201 and 301 to be momentarily closed to effect the energization of relays 233 and 333. Relays 233 and 333 operate their armatures and lock up to perform the functions described above. In addition, this signal will effect the momentary closure of pullbar contacts 111 and 411 at stations 101 and 401 to cause relays 132 and 432 to become energized. Relays 132 and 432 operate their armatures and lock up to perform the functions mentioned above. Similar functions are performed at each of the other subscribers' stations connected into the conference connection.

The subscriber at station 101 now transmits the disconnect signal, such as "D," which has been preassigned to effect the operation of pullbars 109 and 409 for closing momentarily contacts 112 and 412. The disconnect signal "D," upon being received at central office 201, causes the "D" pullbar 206 to be actuated to operate momentarily contact 212. This closes a path for current to pass from battery 235, through the winding of relay 227, over the inner bottom armature of relay 233, over contact 212, and then over the platen contact 210 to ground 231 thereby energizing relay 227. Relay 227 operates its armature to remove ground 228 from the locking-up circuit of relays 220, 229, 218, and 233 thereby causing relays 220, 229, 218, and 233 and any similar relays at central office 201, such as relays 250, 256, and 257 that might have been energized for establishing a conference connection, to release their armatures. This extinguishes the busy lamps at stations 134 and 161 and also removes the disability from the start keys at these stations. The transmission of the disconnect signal "D" effects similar operations at the distant central office 301.

At station 101, closure of the "D" pullbar contact 112 closes a path for current from the positive terminal of rectifier 116 to pass over contacts 110 and 112, over the outer bottom armature of relay 132, through the winding of slow-release relay 131, and then to the negative terminal of rectifier 116 thereby energizing relay 131 which operates its armatures. The operation of the top armature of relay 131 opens the locking-up circuit of relays 130 and 127 and causes these relays to release their armatures. The release of the outer top armature of relay 130 opens the shunt path across relays 123 and 124 to switch them, in effect, back into the line circuit. The release of the bottom armature of relay 130 extinguishes the busy lamp 122 by opening its energizing circuit. The release of the armature of relay 127 opens the energizing circuit of the subscriber's motor 117 and causes it to stop. Operation of the bottom armature of relay 131 opens the locking-up circuit of relay 132 which, consequently, releases its armatures to open the circuit to the guard lamp 121 and the energizing path of relay 131.

Relay 131 releases its armatures in accordance with the time delay inherent in its slow-release characteristic. This time delay insures that the relays at the central office 201, especially relays 229 and 218, will release their armatures before relay 131 releases its armatures. This precaution is necessary because otherwise the subscriber's motor 117 might be unintentionally restarted due to the armatures of relays 229 and 218 not yet being released. The transmission of the disconnect signal "D" effects similar operations at station 401 and all other connected subscribers' stations, thus restoring the system to its normal idle condition.

In the modification of the invention wherein privacy of communication is assured, the system employs central offices that are of the type shown in Fig. 6. The central office 601 shown in Fig. 6 is assumed, for illustrative purposes, to be local to the subscribers' stations 101, 134, and 161 shown in Fig. 1. The distant subscribers' stations may be considered to be the stations 401, 434, and 461 shown in Fig. 4 and it is to be understood that the central office to which they are connected has been modified to resemble central office 601 and that the main line 604 extends

from the monitoring teletypewriter 602 and telegraph repeater 603 at central office 601 to a similar telegraph repeater and monitoring teletypewriter at the distant central office. In the idle condition of the system the subscriber's loop 106 has its tip side connected to negative battery 621 and its ring side connected to negative battery 619.

To originate a call, the subscriber at station 101 manually operates his start key 119 which causes the armature of relay 617 to move to its spacing contact to effect the energization of relay 623. This effects the energization of relay 620 in the manner described above for relay 220. Accordingly, relay 620 operates its armatures and locks up over the armature of relay 627 to ground 628. The operation of the inner armature of relay 623 closes a path for causing relays 629 and 618 to become energized. Relays 629 and 618 operate their armatures and lock up over the top armature of relay 629, outer armature and contact of relay 634, and then over the armature of relay 627 to ground 628.

The operation of the inner top and inner bottom armatures of relay 618 disconnects the subscriber's loop 106 from batteries 630 and 619. The operation of the outer top armature of relay 618 transfers the tip side of loop 106 over the top contact of relay 661, through the upper winding of polarized relay 662, and then to grounded negative battery 663. The operation of the outer bottom armature of relay 618 transfers the ring side of loop 106 over the inner bottom contact of relay 661 to grounded positive battery 664.

The subscriber's loop 106 now has negative current from battery 663 flowing over the tip side of loop 106 through the operating winding of polarized relay 123 to ground 128 and positive current from battery 664 flowing over the ring side of loop 106 through the operating winding of relay 124 to ground 128. Consequently, relay 123 holds its armature on its marking contact and relay 124 operates its armature to its marking contact.

As was described above, this starts the calling subscriber's teletypewriter motor 117, rings his bell 118 briefly, and lights his busy lamp 122, all of which indicates to the subscriber at station 101 that the system is now conditioned for the monitoring teletypewriters, such as the monitoring teletypewriter 602, at all the central offices in the system to receive signals transmitted from the subscriber's teletypewriter 102. Such signals will cause the armature of relay 662 to move back and forth between its spacing and marking contacts to open the circuit leading through the monitoring teletypewriter 602 to the ring and tip terminals of repeater 603 which will in turn repeat the signals out over the main transmission channel 604 to the other central offices and their monitoring teletypewriters.

However, although the subscriber at station 101 can now transmit signals over the main line 604, the system is in a condition such that the subscriber's teletypewriter 102 cannot receive any signals transmitted from any other teletypewriter in the system. This is because the circuit extending from the ring terminal of repeater 603 passes through the monitoring teletypewriter 602, over the armature of relay 662, inner bottom contacts of relay 660, top contacts of relay 660, along conductor 680, through the other sets of switching relays at central office 601, and then to the tip terminal of repeater 603. Thus,

the subscriber's loop 106 is conditioned on a one-way basis, the direction being from the subscriber to the central office, and any signals now passing over the main line 604 and through the central office circuit just traced cannot be received by the teletypewriter 102 at station 101.

The subscriber at station 101 now transmits a "figures-shift" signal to activate the pullbar contacts in his teletypewriter and in all the monitoring teletypewriters in the system. The subscriber then sends a "prepare" signal, such as "A," which, at central office 601, causes pullbar contact 611 to close a path for current from battery 632 to energize relay 633 which operates its armatures and locks up over its top armature, inner armature of relay 634, and armature of relay 627 to ground 628. This "prepare" signal also performs its other functions as described above, such as effecting the closure of pullbar contact 111 to energize relay 132 which operates its armatures to illuminate the guard lamp 121.

The calling subscriber next transmits the permutation code signal, such as "X," that has been preassigned to convert his loop 106 to a two-way basis. Only one teletypewriter in the system is provided with a pullbar contact the operation of which is effected by the transmission of the "X" signal and that is the monitoring teletypewriter 602 at central office 601 serving station 101. Consequently, the "X" code signal effects the operation of the pullbar 608 in the monitoring teletypewriter 602 which closes the "X" pullbar contact 614. Closure of contact 614 closes a path for current from battery 638 to pass through the winding of relay 637, contact 614, and then over the platen contact 610 to ground 631 thereby energizing relay 637 which operates its armatures.

The operation of the bottom armature of relay 637 closes an auxiliary energizing circuit for relays 629 and 618 over the outer bottom of armature relay 633 to ground 636. The operation of the top armature of relay 637 closes a path for current to pass from battery 665 through the winding of relay 661, over the top armature of relay 637, and then over the outer bottom armature of relay 633 to ground 636 thereby energizing relay 661. Relay 661 now operates its armatures and locks up over its outer bottom armature and the armature of relay 627 to ground 628. The operation of the top armature and inner bottom armature of relay 661 closes a path from negative battery 663, through the upper winding of relay 662, top armature of relay 661, and then over the inner bottom armature of relay 661 to positive battery 664 to maintain a closed circuit condition.

At the same time, the operation of the top armature of relay 637 also closes a path for current to pass from grounded battery 665, through the winding of relay 660, over the top armature of relay 637, and then over the operated outer bottom armature of relay 663 to ground 636 thereby energizing relay 660 which operates its armatures. The operation of the inner bottom armature of relay 660 switches the ring side of the calling subscriber's loop circuit to the armature of relay 662 and then through the monitoring teletypewriter 602 to the ring terminal of repeater 603. The operation of the top armature of relay 660 switches the tip side of the calling subscriber's loop circuit to conductor 680 leading to the tip terminal of repeater 603. This serves to switch the subscriber's loop to the monitoring

teletypewriter 602 on a two-way basis and in series with the main line 604.

The operation of the outer bottom armature of relay 660 completes an auxiliary locking-up circuit for relays 629 and 618 from battery 625, through the windings of relays 629 and 618, over the top armature of relay 629, over the outer bottom armature of relay 660, and then over the armature of relay 627 to ground 628 for a purpose to be explained hereinafter.

The calling subscriber at station 101 now transmits the proper station selecting signal to effect the energization of relays similar to relays 637, 629, 629, 618, 660, and 661 at the central office serving the called station. This connects the called subscriber's loop into the system on a two-way basis ready for communication. If desired, other subscribers' stations may be connected into a conference connection in a manner similar to that described above.

After the desired stations are connected, the calling subscriber transmits the "go ahead" signal, such as "C", which effects the closure of the "C" pullbar contact to close the energizing circuit for relay 634. Relay 634 operates its armatures, the inner armature opening the locking-up circuit for relay 633 which releases its armatures to open the path to relay 627. These same functions are performed by all of the monitoring teletypewriters in the system. This "go ahead" signal also effects the energization of relay 133 to extinguish the guard lamp 121 at the calling subscriber's station 101. The operation of the outer armature of relay 634 does not cause relays 629 and 618 to release their armatures because they remain locked up over their auxiliary locking-up circuit which extends from battery 625 through the windings of relays 629 and 618, over the top armature of relay 629, outer bottom armature of relay 660, and then over the armature of relay 627 to ground 628. The system is thus placed in the condition for communication to take place after which the communicative connection may be discontinued in a manner similar to that described above.

Privacy is assured because none of the loops extending from the subscribers' stations can be placed on a two-way basis until the signals assigned for selecting them have been transmitted. Consequently, it is impossible for message signals now passing over the system to be recorded by the teletypewriters at the subscribers' stations not connected into this particular communication connection.

In the event that a start key at a subscriber's station has been operated accidentally or through error, such operation would energize relays similar to relays 629 and 618 which would operate their armatures and lock up over the outer armature of relay 634 and armature of relay 627 to ground 628. As was described above, this causes negative current to flow over the tip side of the subscriber's loop and positive current over the ring side. In response to the positive current in the ring circuit, the subscriber's relay similar to relay 124, moves its armature to its marking contact to energize relays 130 and 127 which operate their armatures and lock up over a circuit including the auxiliary stop key 129 to start the subscriber's teletypewriter motor, ring his bell briefly and light his busy lamp.

This subscriber's motor will now run until the subscriber at this station realizes his motor is running for no useful purpose. The subscriber should then manually open his auxiliary stop key

similar to key 120 which opens the locking-up circuit of relays 130 and 127 to restore the station to its normal idle condition.

If some other subscriber should make a call over the system to this station before the subscriber has operated his auxiliary stop key 120 and while his motor is running, the transmission of the signal that has been preassigned to select this station will effect the energization of a relay similar to relay 637 which will operate its armatures. This will effect the energization of a relay corresponding to relay 660 which will operate its armatures to close the auxiliary locking-up circuit for relays 629 and 618 extending from battery 625, through the windings of relays 629 and 618, over the top armature of relay 629, outer bottom armature of relay 660, and then over the armature of relay 627 to ground 628. The station will thus be conditioned for communication.

If this station were not selected by the calling subscriber, then the operation of the "go ahead" signal would cause the relay 634 to operate its armatures and, since the relay 660 associated with this particular subscriber would not have been operated at this time, the operation of the outer armature of relay 634 would open the locking-up circuit of relays 629 and 618. However, relay 620 remains locked up over the armature of relay 627 to ground 628. This causes current to flow in the subscriber's loop in a direction which is the reverse of the normal marking current as was described above. If the subscriber's teletypewriter should be provided with a polar line relay, this reverse loop current would cause his teletypewriter to run open.

It is to be understood that the invention is not limited to the use of the particular letters mentioned above for performing switching operations but that various other letters and combinations of letters may be employed for this purpose. It is to be further understood that various modifications may be made in the apparatus and circuits shown in the drawings without departing from the scope of the invention which is to be limited only by the claims appended hereto.

What is claimed is:

1. A teletypewriter switching system comprising in combination a calling subscriber's station provided with a teletypewriter for transmitting permutation code signals, a plurality of other subscribers' stations each having a teletypewriter, a teletypewriter central office, a transmission circuit extending from each subscriber's station to the central office for connecting the subscribers' stations to the central office for communication, switching means at the central office for effecting the establishment of a communication connection from the calling subscriber's teletypewriter through the central office to a teletypewriter at any of the other subscribers' stations, said switching means including a plurality of control contacts in the teletypewriter at the central office, operating means for selectively operating said control contacts in response to certain preassigned permutation code signals transmitted by the teletypewriter at the calling station, conditioning means at the calling station for conditioning it for communicative purposes, said conditioning means including a plurality of control contacts in the teletypewriter at the calling station, and instrumentalities in the teletypewriter at the calling station for selectively operating said control contacts in response to the transmission of some of said certain preassigned permutation code signals.

2. A teletypewriter switching system comprising in combination a calling subscriber's station provided with an indicator and a teletypewriter for transmitting permutation code signals, a plurality of other subscribers' stations each having a teletypewriter, a teletypewriter central office, a transmission circuit extending from each subscriber's station to the central office for connecting the subscribers' stations to the central office for communication, switching means for effecting the establishment of a communication connection from the calling subscriber's station through the central office to a teletypewriter at any of the other subscribers' stations, said switching means including a plurality of control contacts in the teletypewriter at the central office, operating means for selectively operating said control contacts in response to certain preassigned permutation code signals transmitted by the teletypewriter at the calling station, preparing means at the central office for preparing said switching means for operation, control means at the calling subscriber's station for effecting the operation of said preparatory means, and operating means for operating the indicator at the calling subscriber's station in response to the operation of the preparatory means at the central office.

3. A teletypewriter switching system comprising in combination a calling subscriber's station provided with a teletypewriter for transmitting permutation code signals, a plurality of other subscribers' stations each having a busy lamp and a teletypewriter, a teletypewriter central office, a transmission circuit extending from each subscriber's station to the central office for connecting the subscribers' stations to the central office for communication, switching means for effecting the selective connection of the calling subscriber's station through the central office to any selected subscriber's station, operating means for selectively operating the switching means in response to certain preassigned permutation code signals transmitted by the calling station, and means for illuminating the busy lamp in at least each of the unselected subscribers' stations in response to the transmission of at least one of said certain preassigned permutation code signals by the teletypewriter at the calling station.

4. A teletypewriter switching system comprising in combination a calling subscriber's station provided with a teletypewriter for transmitting permutation code signals, a plurality of other subscribers' stations each having a teletypewriter and a motor with a start key for effecting the starting of the motor thereat, a teletypewriter central office, a transmission circuit extending from each subscriber's station to the central office for connecting the subscribers' stations to the central office for communication, switching means for effecting the selective connection of the calling subscriber's station through the central office to any selected subscriber's station, operating means for selectively operating the switching means in response to certain preassigned permutation code signals transmitted by the calling station, and means for disabling the start keys at all of the subscribers' stations other than the calling subscriber's station in response to the transmission of at least one of said certain preassigned permutation code signals by the teletypewriter at the calling station.

5. A communication system comprising in combination a plurality of subscribers' stations each provided with a teletypewriter for transmit-

ing permutation code signals, each of said stations also having a motor for operating the teletypewriter thereat, local motor control means at each station for starting the motor thereat, a central office having a teletypewriter, each station having a transmission circuit extending to the central office, a plurality of control contacts mounted in the teletypewriter at the central office, means for selectively operating said control contacts in response to preassigned permutation code signals transmitted from a teletypewriter at any of the stations, control means at the central office for preventing the operation of the local motor control means at all of the subscribers' stations but one from being effective, and means for operating said control means in response to the operation of certain of said control contacts.

6. A communication system comprising in combination a plurality of subscribers' stations each provided with an indicator and a teletypewriter for transmitting permutation code signals, a central office having a teletypewriter, each station having a transmission circuit extending to the central office, a plurality of control contacts mounted in the teletypewriter at the central office, means for selectively operating said control contacts in response to preassigned permutation code signals transmitted from a teletypewriter at any of the stations, control means at the central office for effecting the operation of the indicators at all of the subscribers' stations but one, and means for operating said control means in response to the operation of certain of said control contacts.

7. A communication system comprising in combination a first group of subscribers' teletypewriter stations, a first teletypewriter central office local to the first group of stations, a second group of subscribers' teletypewriter stations, a second teletypewriter central office which is local to the second group of stations, each station in each group having a transmission loop extending to its respective local central office, means for causing each of said transmission loops to be on a one-way basis the direction being from each subscriber's station to its local central office, a main transmission channel extending from one central office to the other central office, each subscriber's station having a motor for running its teletypewriter, local motor control means at each station for starting the motor thereat for permitting the transmission of permutation code signals from a subscriber's station to its central office, a plurality of control contacts mounted in each of said teletypewriters, means for selectively operating the contacts in the teletypewriter at a subscriber's station and in the teletypewriter at its local central office in response to certain permutation code signals transmitted from the particular subscriber's teletypewriter to the teletypewriter at its local central office, and means for converting a subscriber's loop to a two-way basis in response to the operation of certain of the contacts in the teletypewriter at the central office local to the particular subscriber's station.

8. A communication system comprising in combination a first group of subscribers' teletypewriter stations, a first teletypewriter central office local to the first group of stations, a second group of subscribers' teletypewriter stations, a second teletypewriter central office which is local to the second group of stations, each station in each group having a transmission loop extending to its respective local central office, means for causing

each of said transmission loops to be on a one-way basis the direction being from each subscriber's station to its local central office, a main transmission channel extending from one central office to the other central office, each subscriber's station having a motor for running its teletypewriter, local motor control means at each station for starting the motor thereat for permitting the transmission of permutation code signals from a subscriber's station to its central office, a plurality of control contacts mounted in each of said teletypewriters, means for selectively operating the contacts in the teletypewriter at a subscriber's station and in the teletypewriter at its local central office in response to certain permutation code signals transmitted from the particular subscriber's teletypewriter to the teletypewriter at its local central office, means for converting a subscriber's loop to a two-way basis in response to the operation of certain of the contacts in the teletypewriter at the central office local to the particular subscriber's station, and means for enabling a subscriber at one station to prevent the loops extending from the other subscribers' stations to their respective local offices from being converted to a two-way basis.

9. A communication system including in combination a teletypewriter central office, a plurality of subscribers' stations each having a communication loop extending to the central office, each of said subscriber's stations also having a teletypewriter for transmitting permutation code signals over its respective communication loop to the central office, said central office having means for normally placing each of said communication loops on a one-way basis the direction being from each subscriber's station to the central office, said central office also having control means for selectively converting any of said communication loops to a two-way basis, and operating means for selectively operating said control means in response to the transmission of at least one preassigned permutation code signal by a teletypewriter at one of said subscribers' stations over its respective communication loop to the central office.

10. A communication system including in combination a teletypewriter central office, a plurality of subscribers' stations each having a communication loop extending to the central office, each of said subscribers' stations also having a teletypewriter for transmitting permutation code signals over its respective communication loop to the central office, said central office having means for normally placing each of said communication loops on a one-way basis the direction being from each subscriber's station to the central office, said central office also having control means for selectively converting any of said communication loops to a two-way basis, operating means for operating said control means to convert any one of said communication loops leading to a subscriber's station to a two-way basis in response to the transmission of at least one preassigned permutation code signal by the teletypewriter at that subscriber's station over its communication loop to the central office, and means for preventing any of the other communication loops being converted to a two-way basis by means other than in response to at least one other preassigned permutation code signal transmitted by the teletypewriter at that subscriber's station which has its loop converted to a two-way basis.

11. A communication system including in combination a teletypewriter central office, a plurality

of subscribers' stations each having a communication loop extending to the central office, each of said subscribers' stations also having a teletypewriter for transmitting permutation code signals over its respective communication loop to the central office, said central office having means for normally placing each of said communication loops on a one-way basis the direction being from each subscriber's station to the central office, said central office also having control means for selectively converting any of said communication loops to a two-way basis, operating means for operating said control means to convert a first communication loop leading to a first subscriber's station to a two-way basis in response to the transmission of at least a first preassigned permutation code signal by the teletypewriter at said first subscriber's station over said first communication loop to the central office, and means for operating said control means to convert a second communication loop leading to a second subscriber's station to a two-way basis in response to the transmission of at least a second preassigned permutation code signal by the teletypewriter at said first subscriber's station over said first communication loop converted to a two-way basis.

12. A communication system including in combination a teletypewriter central office, a plurality of subscribers' stations each having a communication loop extending to the central office, each of said subscribers' stations also having a teletypewriter for transmitting permutation code signals over its respective communication loop to the central office, said central office having means for normally placing each of said communication loops on a one-way basis the direction being from each subscriber's station to the central office, said central office also having control means for selectively converting any of said communication loops to a two-way basis, operating means for operating said control means to convert a first communication loop leading to a first subscriber's station to a two-way basis in response to the transmission of at least a first preassigned permutation code signal by the teletypewriter at said first subscriber's station over said first communication loop to the central office, means for operating said control means to convert a second communication loop leading to a second subscriber's station to a two-way basis in response to the transmission of at least a second preassigned permutation code signal by the teletypewriter at said first subscriber's station over said first communication loop converted to a two-way basis, and means for restoring said first and second communication loops to a one-way basis in response to the transmission of at least a third preassigned permutation code signal by one of the teletypewriters at said first and second subscribers' station.

13. A communication system comprising in combination a first group of subscribers' stations each having a teletypewriter for transmitting permutation code signals, a first central office having a teletypewriter local to the first group of stations, a second group of subscribers' stations each having a teletypewriter for transmitting permutation code signals, a second central office having a teletypewriter which is local to the second group of stations, each station in each group having a transmission loop extending to its respective local central office, means for causing each of said transmission loops to be one a

one-way basis the direction being from each subscriber's station to its local central office, a main transmission channel extending from one central office to the other central office, each subscriber's station having a motor for running its teletypewriter, local motor control means at each station for starting the motor thereat for operating its teletypewriter for transmitting permutation code signals from a subscriber's station to its central office, a plurality of control contacts mounted in each of said teletypewriters, means for selectively operating the contacts in the teletypewriter at a subscriber's station and in the teletypewriter at its local central office in response to certain preassigned permutation code signals transmitted from the particular subscriber's teletypewriter to the teletypewriter at its local central office, control means for converting a first subscriber's loop to a two-way basis in response to the operation of at least one of said control contacts in the teletypewriter at the central office local to the first subscriber's station, and means for converting a second subscriber's loop to a two-way basis in response to the transmission of at least one preassigned permutation code signal transmitted by the teletypewriter at the first subscriber's station over said first subscriber's loop converted to a two-way basis.

14. A communication system comprising in combination a first group of subscribers' stations each having a teletypewriter for transmitting permutation code signals, a first central office having a teletypewriter local to the first group of stations, a second group of subscribers' stations each having a teletypewriter for transmitting permutation code signals, a second central office having a teletypewriter which is local to the second group of stations, each station in each group having a transmission loop extending to its respective local central office, means for causing each of said transmission loops to be on a one-way basis the direction being from each subscriber's station to its local central office, a main transmission channel extending from one central office to the other central office, each subscriber's station having a motor for running its teletypewriter, local motor control means at each station for starting the motor thereat for operating its teletypewriter for transmitting permutation code signals from a subscriber's station to its central office, a plurality of control contacts mounted in each of said teletypewriters, means for selectively operating the contacts in the teletypewriter at a subscriber's station and in the teletypewriter at its local central office in response to certain preassigned permutation code signals transmitted from the particular subscriber's teletypewriter to the teletypewriter at its local central office, control means for converting a first subscriber's loop to a two-way basis in response to the operation of at least one of said control contacts in the teletypewriter at the central office local to the first subscriber's station, means for converting a second subscriber's loop to a two-way basis in response to the transmission of at least one preassigned permutation code signal transmitted by the teletypewriter at the first subscriber's station over said first subscriber's loop converted to a two-way basis, and joining means for joining for communicative purposes said first and second subscribers' loops converted to a two-way basis.

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