

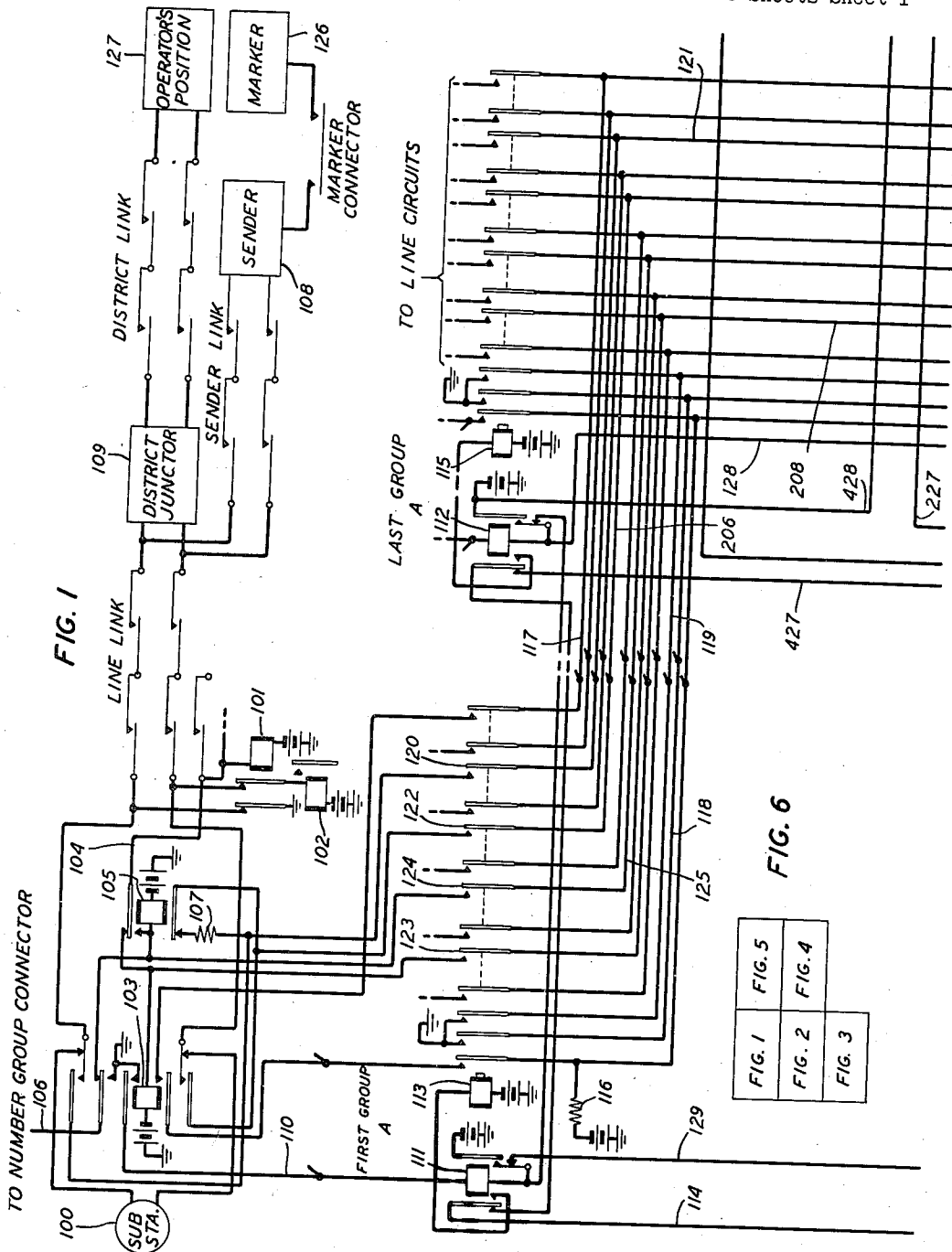
Nov. 4, 1941.

E. W. FLINT  
TELEPHONE SYSTEM

2,261,243.

Filed April 3, 1940

5 Sheets-Sheet 1



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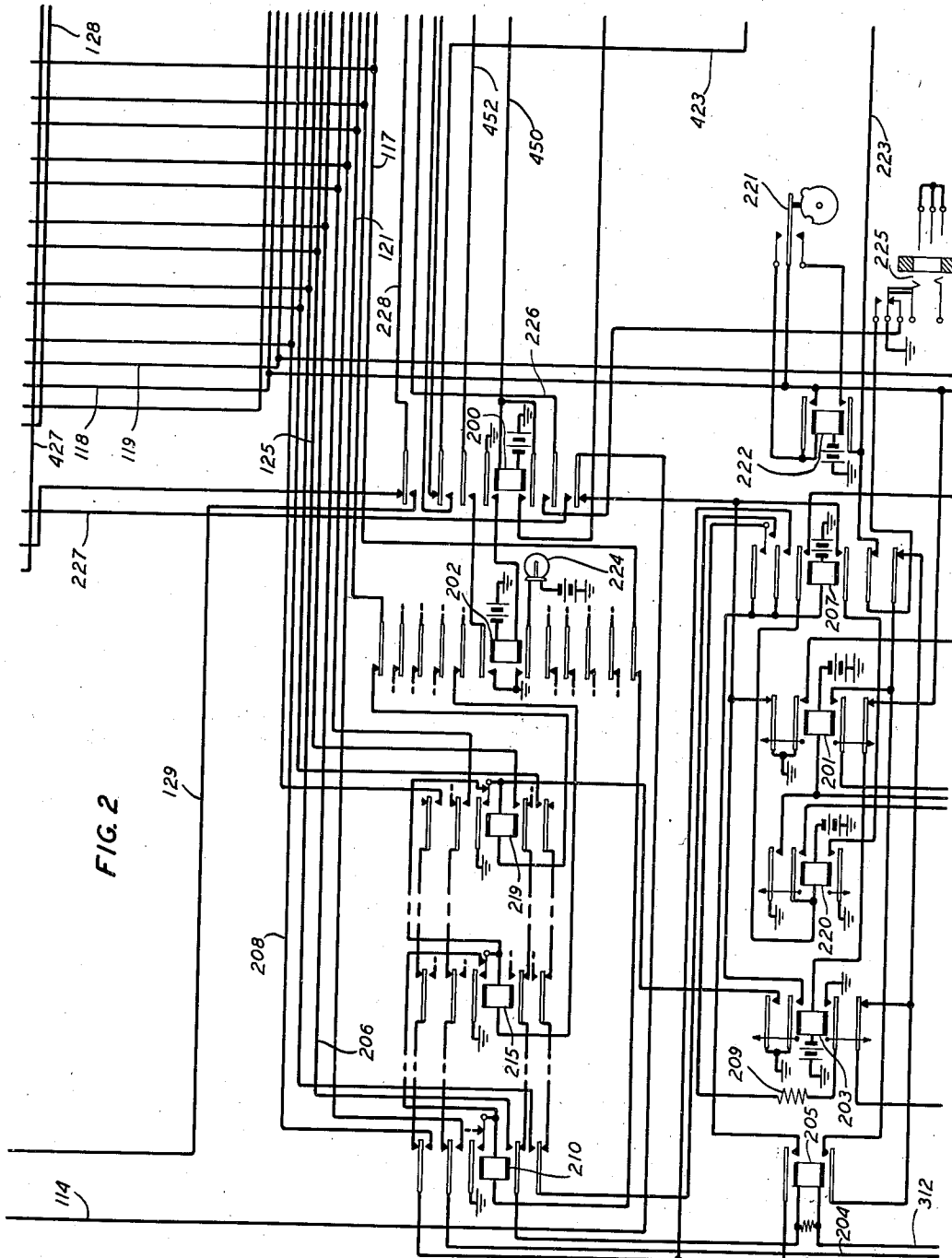


FIG. 2

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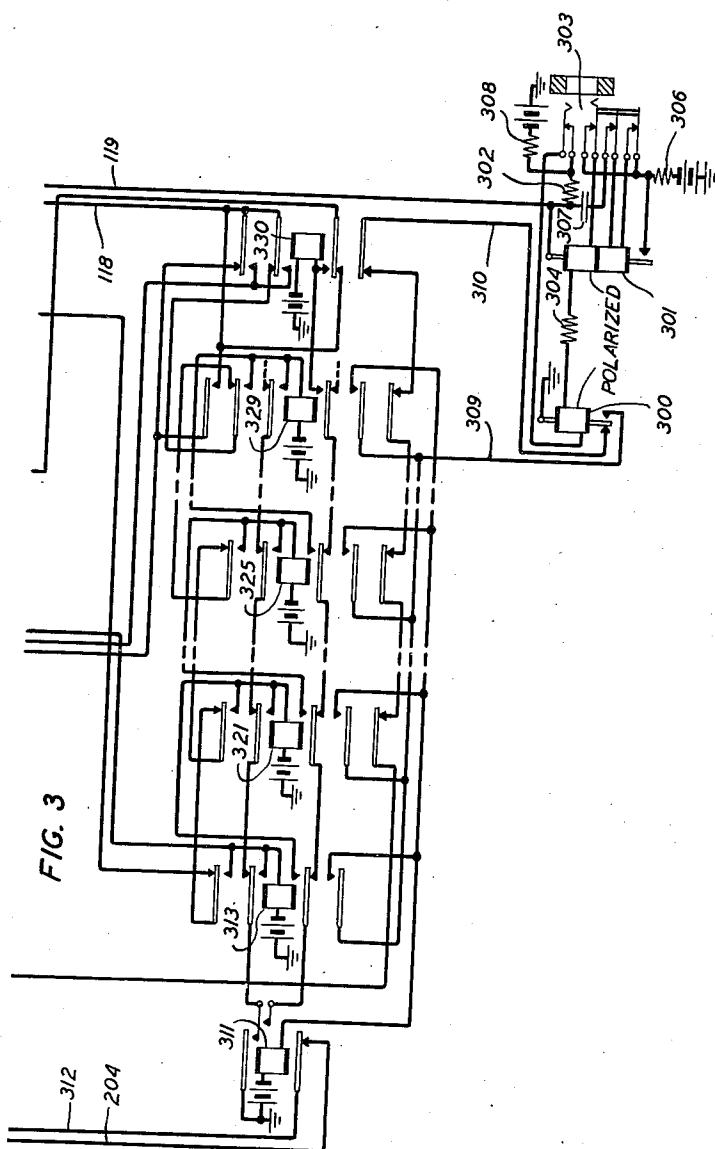
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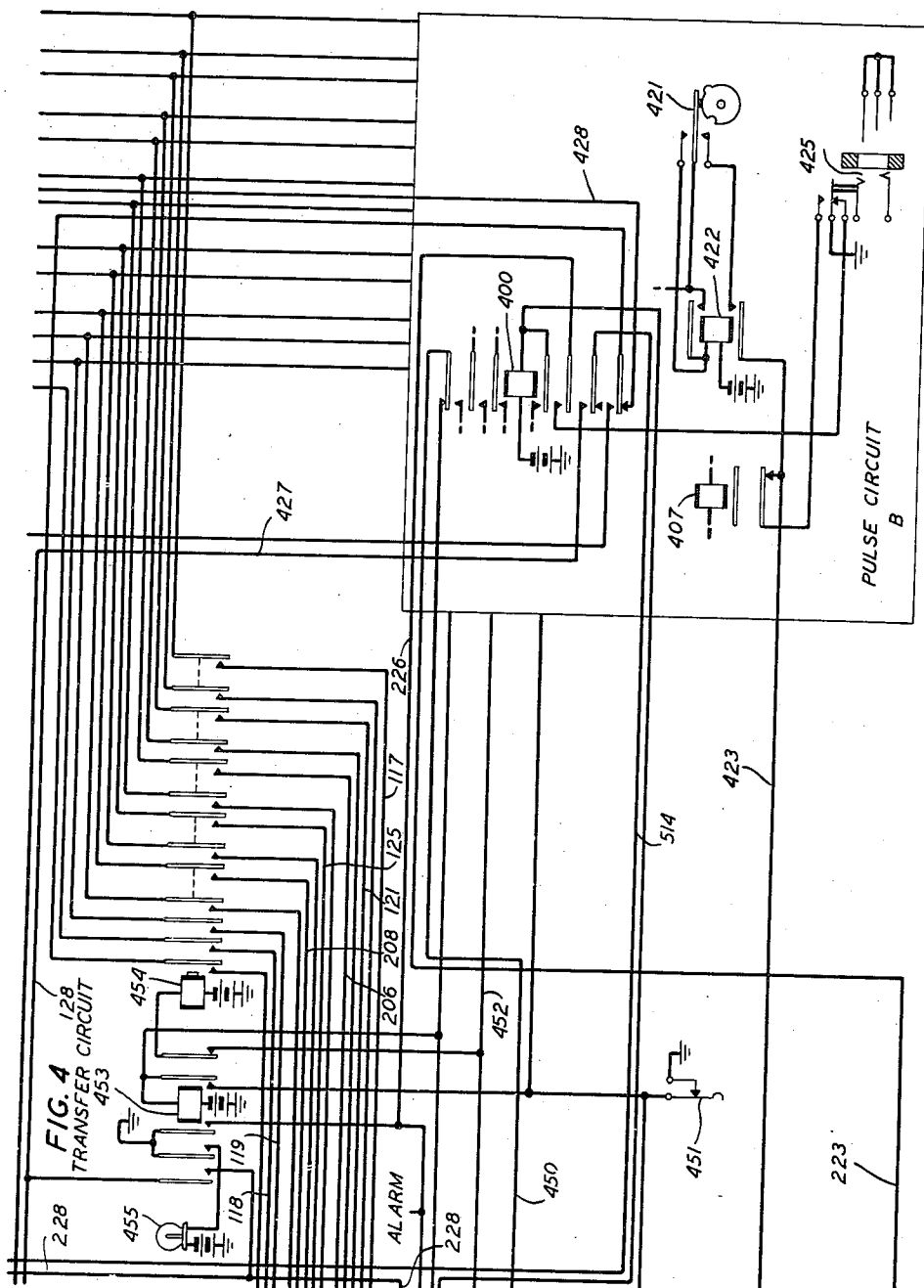
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TELEPHONE SYSTEM

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5 Sheets-Sheet 4



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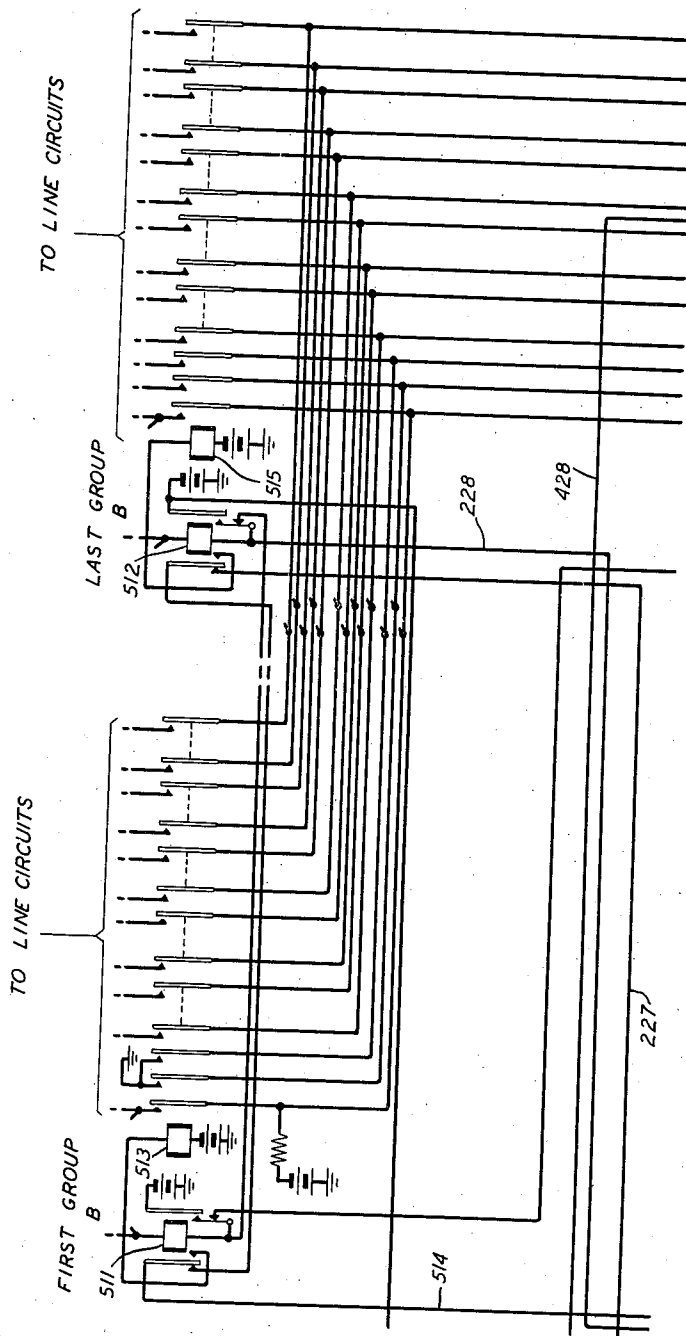
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2,261,243

5 Sheets-Sheet 5

FIG. 5



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## UNITED STATES PATENT OFFICE

2,261,243

## TELEPHONE SYSTEM

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Application April 3, 1940, Serial No. 327,556

5 Claims. (Cl. 179—27)

This invention relates to telephone systems and has for its object to increase the flexibility of such systems.

During the transformation of telephone service in large centers from a manual basis to a dial basis, it has become apparent that many people are physically or psychologically incapable of handling the dial. In general, dial offices are so arranged that, when the initiation of a call is not followed by the operation of the dial, after a measured interval the call will be directed to an operator. The use of this method for avoiding dialing involves delay and usually directs the call to the attention of a trouble operator.

In accordance with the present invention means is provided, responsive to the initiation of a call, which immediately transmits an operator code to the central office equipment which responds thereto to connect the calling line with an operator's position.

This equipment is common to a number of lines and is individualized to a calling line only if idle. A plurality of groups of lines each served by a dialing equipment may, in case of trouble, be combined in one group.

These and other features of the invention will be more apparent from a consideration of the following detailed description in connection with the drawings in which:

Fig. 1 shows a calling line and, in diagrammatic form, a telephonic connection to an operator's position, as well as two group relays;

Fig. 2 shows the connection control relays;

Fig. 3 shows the pulse generating and counting circuit;

Fig. 4 shows a transfer circuit and a second pulsing circuit;

Fig. 5 shows two additional group relays; and

Fig. 6 shows the manner in which Figs. 1 to 5 should be arranged.

For a complete description of a dial central office with which the present invention would function, reference is hereby made to Patent 2,235,803, granted March 18, 1941, to W. W. Carpenter.

Substation 100 is connected to one of a subgroup of ten manual lines in a group served by the dialing circuit of the present invention. This circuit is connected between the subscriber's line and the normal connection of the line to the line link frame. When a call is initiated on this line, the line relay 102 is operated in a circuit from battery through its winding, inner back contact of hold magnet 101, lower normal contacts of relay 103 over the line and substation circuit, upper

normal contacts of relay 103 to ground at the outer back contact of hold magnet 101. The operation of line relay 102 initiates the operation of the line link and sender link control circuits which connect the line with an idle sender 108 and an idle district junctor 109.

When the hold magnet 101 is operated, its operating ground is extended to conductor 104, upper back contact of relay 105, winding of relay 103 and battery. Relay 103 operates and connects ground to conductor 106 to mark the line busy to terminating calls. At its upper and lower normal contacts, it disconnects substation 100 from the line link to prevent dial tone from reaching the subscriber, and at its alternate contacts connects resistance 107 over the lower back contact of relay 105 to the link to hold the connection with the sender 108.

At its inner upper front contact, relay 103 connects ground to conductor 110 to seize the dialing circuit. If no other group is attempting to seize the dialing circuit, a circuit is closed from ground on conductor 110, winding of relay 111 of the first group of lines, normal contacts of the intermediate group start relays, normal contacts of relay 112 of the last group of lines, conductor 128, outer lower back contact of relay 400, conductor 428 to battery. Relay 111 operates, locking to battery at its own right alternate contact. At its left front contact it closes a circuit from battery through the winding of group connecting relay 113 to conductor 114 which extends, if the dialing circuit is idle, over the outer lower back contact of relay 200 to ground at the upper back contact of relay 201. At the same contact it opens the operating circuit of group connecting relay 115 of the last group as well as of the corresponding intermediate relays.

From a consideration of Fig. 1, it will appear that the group start relay of an intermediate or last group may be operated, while the first group is being served, but that the corresponding group connecting relays cannot operate until the first group start relay releases.

Relay 113 at its second contact connects ground to conductor 118, lower back contact of relay 201 to the winding of relay 203 and battery. Relay 203 connects ground over its inner upper contact to the circuit of relay 113.

With relays 113 and 203 operated a circuit is closed from battery through resistance 116, first contact of relay 113, inner lower front contact of relay 103, outer contact of relay 113, conductor 117, lowermost contact of relay 202, winding of relay 210, normal contacts of relays 215 and 219, to

ground at the outer upper contact of relay 203. Relay 210 locks to ground at its upper alternate contact and extends the dialing circuit to the sender. Relays 210 to 219 are individual to the ten lines of a group and serve in combination with the group connecting relay to individualize the dialing circuit to a particular line. As in the case of the group relays, the lower numbered relays operate over normal contacts of the higher numbered relays so that more than one relay of the chain may operate but the lowest numbered relay is effective first.

Relay 113 also connects ground over its third contact to conductor 119, thereby starting the operation of the polarized pulsing relays 300 and 301. Two circuits normally exist through relays 300 and 301, one from battery through resistance 308, tip contact of jack 303, winding of relay 300, resistance 304, upper winding of relay 301, ring contact of jack 303, resistance 306 to battery. The second circuit extends from battery through resistances 308 and 302, condenser 307, inner auxiliary contact of jack 303, lower winding of relay 301, outer auxiliary contact of jack 303 to battery through resistance 306. With battery connected to both sides of the relay windings, the relays are inert. When conductor 119 is grounded, it shunts battery through resistances 302 and 308, thereby energizing the upper winding of relay 301 in a direction to close the relay contact, but the charging current for condenser 307 opposes that in the upper winding so that the closure of the contact is delayed a definite time. Grounded conductor 119 is also connected to the armature of relay 301 and when the contact closes it connects ground in shunt of battery through resistance 306. The upper winding is now energized to open the relay contact, but the discharge current from condenser 307 delays the opening. Relay 300 operates in synchronism with relay 301, alternately connecting ground to conductors 309 and 310.

When the sender is ready to receive a registration it connects ground and battery to the dialing circuit, thereby completing a circuit from ground over the tip contacts of the sender link and line link, upper alternate contacts of relay 103, contact 120 of relay 113, conductor 121, middle upper front contact of relay 210, conductor 204, back contact of relay 311, conductor 312, winding of relay 205, inner lower front contact of relay 210, conductor 206, contact 122 of relay 113, lower alternate contact of relay 103, over the ring contacts of the line link and sender link to battery in the sender. Relay 205 operates in this circuit and closes a circuit from battery through the winding of relay 207, upper front contact of relay 205, outer upper front contact of relay 210, conductor 208, contact 123 of relay 113, to the operating circuit of relay 103 which is grounded over the sleeves of the links from the sender 108.

If the sleeve ground is properly closed, relay 207 operates, and locks over its outer upper front contact, through resistance 209 to ground at the lower front contact of relay 203. It also closes a locking circuit over its second upper front contact to its operating circuit independent of relay 205. With relay 207 operated, a circuit is closed from battery through the winding of relay 105, contact 124 of relay 113, conductor 125, outer lower front contact of relay 210, third and fourth upper front contacts of relay 207, resistance 209 to ground at the lower front contact of relay 203. Relay 105 operates in this circuit locking over its upper front contact to conductor 104 and open-

ing the circuit of relay 103. However, relay 103 is held operated over contact 123 of relay 113, conductor 208, upper front contact of relay 210, second and third upper contacts of relay 207, outer lower front contact of relay 210, conductor 125, contact 124 of relay 113, front contact of relay 105 to ground over the link holding circuit. Relay 105 disconnects resistance 107 from across the dialing circuit.

Relay 207 closes a circuit from battery through the winding of relay 220, inner upper front contact of relay 207 over the back contacts of relays 313 and 321 to 330 to ground on conductor 118, to determine that the pulse counting circuit is normal. Relay 220 operates and locks over its inner upper contact and the outer upper back contact of relay 330 to grounded conductor 118. At its outer upper front contact relay 220 closes an obvious circuit for relay 201, and at its lower front contact connects ground over the inner lower front contact of relay 207 to the holding circuit of relay 113. Relay 201 connects ground over its upper front contact and the inner lower back contact of relay 330 to conductor 118 and opens the circuit of relay 203 which releases slowly in order to delay the start of pulsing sufficiently to allow any pulse caused by switching the line at relay 103 to register as a preliminary pulse rather than to be added to the chain of ten pulses which follows.

When relay 203 releases it closes a circuit from battery through the winding of relay 313, lower front contact of relay 201, lower contact of relay 205, lower back contact of relay 203, lower back contacts of relays 321 to 330, to conductor 310. When relay 300 closes its left contact, connecting ground to conductor 310, relay 313 operates, locking over its outer upper front contact and the outer upper back contacts of relays 321 to 330 to grounded conductor 118.

When relay 300 closes its right contact, grounding conductor 309, it completes a circuit over the outer lower front contact of relay 313 to the winding of relay 311 and battery. Relay 311 opens the dialing circuit to transmit a pulse to sender 108, closes a temporary holding circuit for relay 313 at its outer upper contact and an operating circuit for relay 321 which may be traced from ground over the inner upper contact of relay 311, inner lower front contact of relay 313 to the winding of relay 321 and battery. Relay 321 operates and locks over its outer upper front contact and the back contacts of relays 325, 329, 330, etc., to conductor 118 and opens the locking circuit of relay 313 but that relay is held until the termination of the pulse when relay 311 releases, reclosing the dialing circuit and in turn releasing relay 313.

The next closure of ground to conductor 309 operates relay 311 over the outer lower front contact of relay 321. Relay 311 opens the dialing circuit to transmit the second pulse, closes a holding circuit for relay 321 and an operating circuit for the next counting relay, which in operating opens the locking circuit of relay 321 leaving the latter relay under the control of relay 311. The remaining eight pulses are sent in a similar manner, relay 311 opening and closing the line under the control of relay 300. When relay 329 operates, it closes at its outer upper front contact a shunt around the back contact of relay 330 thereby maintaining the holding circuit of relay 220 until the end of the tenth pulse. Relay 330 in operating closes a circuit from battery through the winding of relay 201,

upper front contacts of relay 330 to conductor 118, to hold relay 201 operated under the control of relay 113. Relay 330 locks over its lower front contact to ground at the upper front contact of relay 201.

Relay 220 is made slow to release to prevent any accidental pulse, due to transferring the tip and ring leads back to the subscriber's line, from registering as an eleventh pulse. When relay 220 releases, relay 113 is released, opening the circuit of relays 103, 210, 207, 205 and 201, and removing ground from conductor 118. Relay 113 also removes ground from conductor 119 to stop the pulsing relays. Relay 201 is slow to release to prevent a second group connecting relay from operating until relay 113 has opened its contacts. When relay 201 releases, relay 330 releases and the circuit for the next group connecting relay is prepared.

The release of relay 103 restores the connection of the substation line to the central office equipment. With the digit zero recorded in the sender, the marker 126 is seized over the marker connector and an operator's position 127 is connected to the junctor 109. The subscriber may now give the wanted number to the operator at position 127 who is provided with means for completing the connection.

During the dialing operation, the substation is disconnected from the central office equipment and the abandonment of the call is ineffective. However, there are some conditions which may cause the sender link to time out, thus producing a condition similar to an abandoned call.

If the dialing circuit fails to close, relay 205 cannot operate and timed release by the link control circuit, removing ground from conductor 104 permits all operated relays to release and places the circuit in condition for another call.

If the sender link control circuit removes ground from conductor 104 before relay 207 closes its holding circuit the relays may all release. If ground is removed from conductor 104 after relay 207 has operated, the link hold magnets will remain operated under the control of relay 203, but when relay 203 releases, relays 207, 103 and 105 release, in turn releasing relays 111 and 113.

To guard against failures in the dialing circuit itself, two pulse circuits are provided, each normally serving a plurality of groups of lines. However, in case of trouble either pulse circuit may serve all of the line groups and means is provided for automatically transferring the line groups. For this purpose the grounding of conductor 118, as above described, applies ground to the armature of interrupter 221. When the interrupter closes its upper contact, it operates relay 222 which locks to conductor 118. If the call is completed and the circuit restores to normal in the next five seconds, the locking ground is removed and relay 222 releases. If not, when the interrupter closes its lower contact ground is extended over the lower front contact of relay 222, conductor 223, upper back contact of transfer relay 400 of the second pulse circuit, conductor 450, winding of transfer relay 200 and battery. Relay 200 locks over its inner lower front contact to ground on key 451. Relay 200 operates relay 202 which opens the circuits of relays 210 to 219 and lights lamp 224. With relays 202 and 200 operated a circuit is closed from ground at the inner upper front contact of relay 202, second upper contact of relay 200, con-

ductor 452, back contact of relay 453, winding of relay 454 to battery. Relay 454 operates and connects the circuits controlled by the group connecting relays of the first dialing circuit in parallel with those of the second dialing circuit. Relay 200 also prepares a circuit for relay 453 under the control of interrupter 421 of the second dialing circuit, and closes a circuit from ground over the normal contact of jack 225, middle lower front contact of relay 200, to conductor 226 leading to an alarm.

The two sets of group relays now form one group, the circuit of the group start relays of the operative dialing circuit extending over the contacts of the group start relays of the disabled dialing circuit. The circuit of relay 511, for example, extends from ground in the associated line circuit, winding of relay 511, normal contacts of the intermediate group start relays and relay 512, conductor 228, front contact of relay 200, conductor 129, normal contacts of the group start relays 111, 112, etc., of the first dialing circuit, conductor 128, back contact of relay 400, conductor 428 to battery. The circuit of relay 113 extends over the front contact of relay 111, conductor 114, lower front contact of relay 200, conductor 227 to the back contact of group start relay 512 of the last group of lines served by the second dialing circuit and over the back contacts of the other line group relays 511, etc., to conductor 514 leading to the second dialing circuit. Similarly, if the second dialing circuit were disabled, conductor 514 would be extended over a front contact of transfer relay 400 to conductor 427 and the back contact of the last line group relay of the first dialing circuit. Therefore, the group connecting relays of the two dialing circuits form one chain, with the relays of the disabled dialing circuit having later choice than those of the working circuit.

If both dialing circuits time out, relay 453 is operated over the front contact of the transfer relay of one circuit and the lower contact of the timing interrupter of the other circuit. Relay 453 locks to key 451, lights lamp 455, sounds an alarm and releases relay 454 to open the connection between the dialing circuits. It also connects conductors 128 and 228 to permit the operative dialing circuit to continue to function.

When the line of substation 100 is called, the terminating marker grounds conductor 106, operating relay 105 over the inner upper back contact of relay 103. Relay 105 extends its operating ground over conductor 104 to the winding of the line hold magnet. This magnet and relay 105 are held over the sleeve of the link under the control of the incoming junctor and thereby ground conductor 106 after the marker releases. With relay 105 operated, relay 103 cannot operate and the dialing circuit is not affected by a terminating call.

What is claimed is:

1. In a telephone system, telephone lines, operators' positions, and means for automatically connecting one of said telephone lines with one of said operators' positions comprising switching equipment, control means for operating said switching equipment and means automatically responsive to the initiation of a call by said one telephone line to automatically generate and transmit a series of impulses representing an operator code to said control means, said control means responsive to said operator code to cause said switching equipment to connect said line with an operator's position.



2. In a telephone system, telephone lines, operators' positions, and means for automatically connecting one of said telephone lines with one of said operators' positions comprising switching equipment, control means for operating said switching equipment and means common to a plurality of said lines automatically responsive to the initiation of a call on one of said plurality of lines to automatically transmit an operator code to said control means.

3. In a telephone system, telephone lines, operators' positions, and means for automatically connecting one of said telephone lines with one of said operators' positions comprising switching equipment, control means for operating said switching equipment, impulse generating means common to a plurality of said lines and means automatically responsive to the initiation of a call on one of said plurality of lines to cause said impulse generating means to transmit an operator code to said control means.

4. In a telephone system, telephone lines equipped with dials, other telephone lines without dials, operators' positions, switches, equipment for controlling said switches, means responsive to the initiation of a call on any one of said lines to connect said line with said control equipment, and means common to a plurality of said other telephone lines for extend-

ing one of said other lines to one of said operators' positions, comprising impulse generating means, means associated with said impulse generating means for disconnecting said control equipment from said line and for connecting said control equipment to said impulse generating means, means for causing said impulse generating means to transmit an operator's code to said control equipment for causing said control equipment to extend said line to an operator's position whereupon said operator may extend said line to a wanted line.

5. In a telephone system, telephone lines arranged in groups, impulse generating means common to said groups of lines, means for individualizing said impulse generating means to one of said lines comprising a connecting relay individual to each group of lines, said relays arranged in a chain circuit, other groups of lines, a second impulse generating means common to said other groups of lines, a chain of connecting relays individual to said other groups of lines, and means effective in case of trouble with one of said impulse generating means to connect said chains of relays into a single chain, the chain individual to the faulty impulse generating device occupying the less favored position in the combined chain.

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