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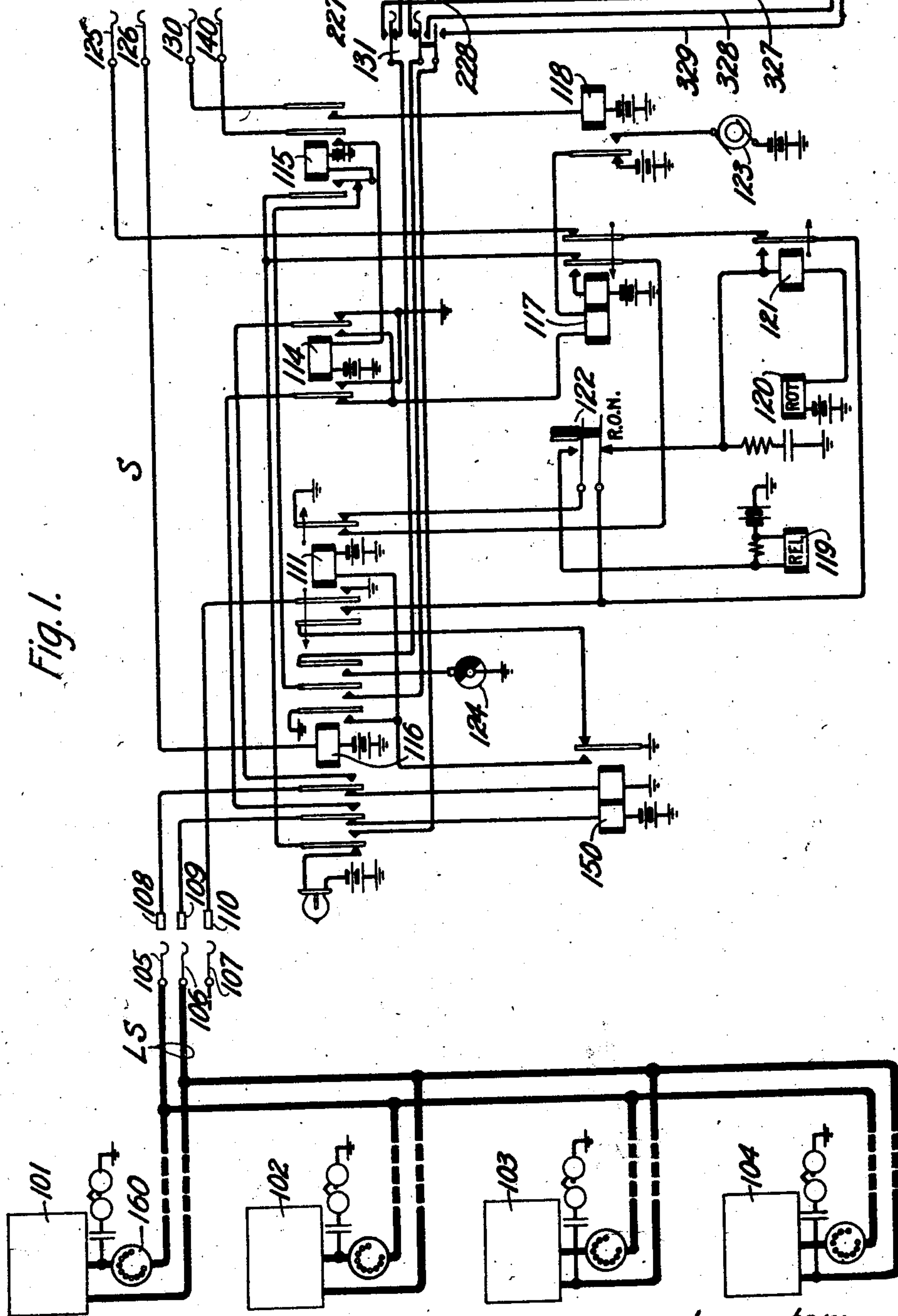
R. L. STOKELY

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SELECTOR SWITCH CIRCUITS FOR STEP-BY-STEP SYSTEMS

Filed March 31, 1926

2 Sheets-Sheet 1



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Ray L. Stokely.

by

J. E. Roberts

Att'y.

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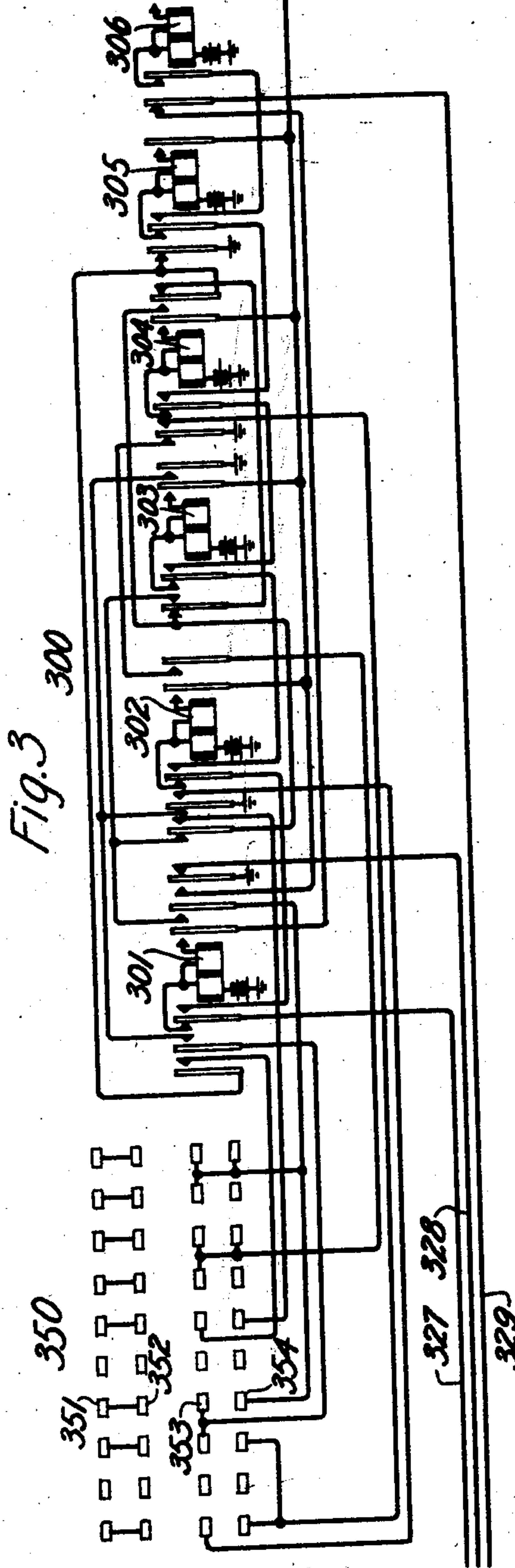
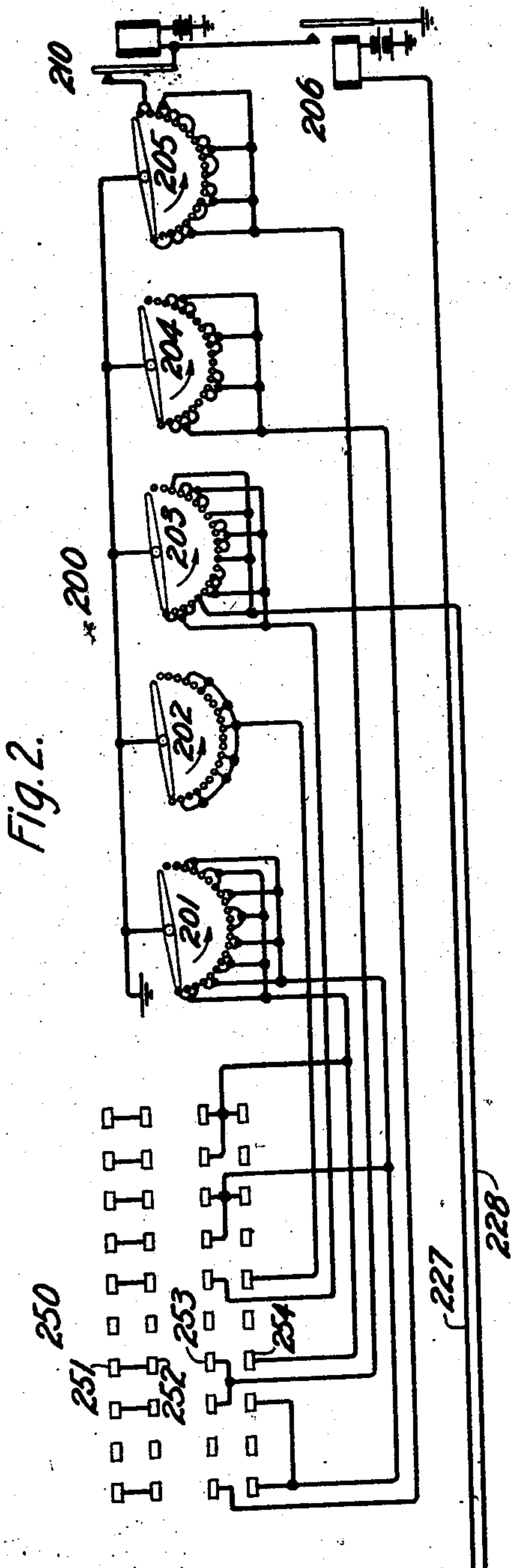
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SELECTOR SWITCH CIRCUITS FOR STEP-BY-STEP SYSTEMS

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Inventor:
Ray L. Stokely.
by J. S. Roberts Att'y.

UNITED STATES PATENT OFFICE.

RAY L. STOKELY, OF FLORAL PARK, NEW YORK, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

SELECTOR-SWITCH CIRCUITS FOR STEP-BY-STEP SYSTEMS.

Application filed March 31, 1926. Serial No. 93,647.

This invention relates to telephone exchange systems and more particularly to systems employing reverte ring on party lines.

5 In a telephone system including party lines, it is necessary to provide some system for ringing the different subscribers on the same party line. Code signals are usually provided and two of the parties are rung 10 over the tip side of the line while the other two are rung over the ring side of the line. Heretofore it has been necessary for this purpose to provide two or more generators which were connected through interrupted 15 contacts to the party line.

It is an object of this invention to provide means whereby one ringing generator only may be employed and connected to the party line.

20 A feature of this invention lies in controlling a pair of relays by means of an interrupter, one relay being used to control the connection of the ringing generator to the line and the other being used to determine 25 the side of the line to which the ringing current is to be applied.

These and other objects and features will be apparent from the following description.

Referring to the drawings, Fig. 1 discloses a four-party line, a line switch LS and a reverte ringing selector S. Fig. 2 shows an interrupting device composed of a switch under control of an interrupter of the usual type shown in Fig. 1 and a bank of contacts 35 for selector S. Fig. 3 discloses a modification of the interrupting device using relays instead of a switch.

In general the system functions in the following manner:

40 When a party line subscriber 101 removes the receiver from the switchhook, line switch LS operates, in a manner well known in the art, to connect brushes 105, 106 and 107 with terminals 108, 109 and 110 of the selector switch S. A circuit is thereby completed 45 from battery through the left winding of relay 150, middle left back contact of relay 116, terminal 109, brush 106, ring conductor of line switch LS through subscriber's station 101, tip conductors of line switch LS, 50 brush 105, terminal 108, inner left back contact of relay 116, to ground through the right winding of relay 150. The operation of relay 150 operates slow to release relay

111 over an obvious circuit, which relay con- 55 nects ground to the sleeve terminal 110 making the selector S test busy to all other line switches. The operation of relay 111 also closes the pulsing circuit through relay 121 for rotary magnet 120 through its outer left 60 front contact. When the subscriber 101 operates dial 160, relay 150 operates and releases, in accordance with the digit dialed. When relay 150 releases, a circuit is closed for operating the rotary magnet 120 and relay 121 65 over the pulsing circuit from battery, through magnet 120, winding of relay 121, rotary off-normal contact 122, outer left front contact of relay 111, to ground on the back contact of relay 150. The rotary off- 70 normal springs 122 operate at this time and open the circuit through relay 121 which, however, does not release, as it is slow to release and is held operated to ground on relay 150 through its own front contact. The suc- 75 ceeding impulses for operating the rotary magnet 120 are therefore received through the armature and front contact of relay 121. When the dialing is completed, relay 121 releases. The operation of the rotary off- 80 normal contact 122 also closes in part a circuit for release magnet 119.

Brushes 125, 126, 130 and 140 are now resting on some contacts of the group 250 providing key 131 is normal. We will as- 85 sume that the digit dialed was 4. No. 4 will position brushes 125, 126, 130 and 140 on contacts 251, 252, 253 and 254 respectively. The calling subscriber 101 now re- 90 places the receiver on the switchhook thereby opening the subscriber's loop and releasing relay 150. The release of relay 150 closes a circuit for operating relay 116 from ground on the back contact of relay 150, 95 outer left front contact of relay 111, back contact of relay 121, outer back contact of relay 117, brush 125, contacts 251 and 252, brush 126 to battery through the winding of relay 116. The operation of relay 116 connects interrupted ground through inter- 100 rupter 124, outer right front contact of relay 116, upper normal contact of key 131, conductor 227, to battery through the winding of relay 206. Relay 206 follows the ground interruptions and the stepping magnet 210 105 to be actuated accordingly, through an obvious circuit, and thus cause the brushes of arcs 201 to 205, inclusive, to rotate. This

switch is so arranged that the ringing machine 123 makes one cycle for each five terminals of the arc that the brushes pass over. There are twenty-two terminals to a bank but only twenty of these are used with the exception of the last two on arc 205 which are used for restoring the switch to normal. Therefore, the ringing machine makes four cycles for each complete revolution of the switch.

The parties on the line are rung by semi-selective ringing which means that two of the parties are rung by means of ringing current being connected to the ring side of the line and two over the tip side of the line. Also, each of these parties has a predetermined code ring, that is, ringing current is connected in impulses such as two short rings for party one and one ring for party two. In this type of revertive ringing it is necessary to ring the bell of the calling as well as that of the called subscriber. Should the bells of both parties be on the same side of the line, first one code and then the other will be rung. If the parties are on each side of the line, first one will be rung with its code ring and then the other and only the subscriber whose code number has been rung will answer. If the calling subscriber answers before the called subscriber, the ringing will cease.

The brushes of interrupting device 200 are caused to rotate over the first four terminals without affecting the operation of selector S. When the fifth terminal is reached a circuit is closed from ground through the brush and fifth terminal of arc 203, conductor 228, lower normal contact of key 131, outer right front contact of relay 116, left back contact of relay 115 to battery through the winding of relay 115. Relay 115 operates and locks over a circuit from battery through the winding of relay 115, left front contact of relay 115, inner right back contact of relay 117 to ground on the right front contact of relay 111. The switch is caused to rotate to the fifth terminal to prevent an incomplete code of ringing which would occur if relay 115 had been operated previous to the switch 200 reaching its fifth terminal. The switch will now move to its sixth terminal in which position an obvious circuit is closed from ground through arc 201 to contact 254 and then by brush 140 over the inner right front contact of relay 115 to battery through the winding of relay 114 causing it to operate. At the same time, ground is connected through the sixth terminal of arc 205 to contact 253, brush 130, outer right front contact of relay 115 to battery through the winding of relay 118. The operation of relay 118 closes a circuit from generator 123, front contact of relay 118, left winding of relay 117, right front contact of relay

114, inner left front contact of relay 116, terminal 108, brush 105, tip conductor of line switch LS to ground through the bells of stations 101 and 102. As explained above, both bells will be rung. Switch 200 now passes to the seventh terminal. As there is no circuit closed in this position for either relay 114 or relay 118 there will be a silent period. The switch now advances to the eighth terminal where a circuit will again be closed for relays 114 and 118 and another impulse of ringing current will be connected to the tip side of the line thereby again ringing the bells at stations 101 and 102. This will complete the code of two rings which indicates that station 101 is calling. The switch now advances to the ninth terminal in which position a circuit is closed for relay 118 but not for relay 114. Thereby a circuit is closed from generator 123, front contact of relay 118, left winding of relay 117, left back contact of relay 114, middle left front contact of relay 116, terminal 109, brush 106, ring conductor of line switch LS to ring the bells at stations 103 and 104. This circuit is also maintained closed for the tenth terminal of arc 205 thereby giving one continuous ring to the bells of stations 103 and 104, this one ring being an indication that station 104 is being called. This cycle of operations continues until the called subscriber at station 104 removes the receiver from the switchhook. Should the called subscriber fail to answer, it is necessary for the calling subscriber to remove the receiver from the switchhook to cut off ringing current.

When the called subscriber 104 removes the receiver from the switchhook, a circuit is closed from generator 123, front contact of relay 118, winding of relay 117, right front or left back contact of relay 114 (depending upon which part of the cycles the ringing interrupter is in), left inner front contacts of relay 115, terminals 108 or 109 and thence over the tip or ring through the subscriber's loop, back over the tip or ring, brushes 105 or 106, contacts 108 or 109, contacts of relay 116, to ground through either the right back or left front contacts of relay 114 thereby operating relay 117 which locks over an obvious circuit to ground on the right front contact of relay 111. The operation of relay 117 opens the circuit above traced for relay 116 releasing it and thereby removes ringing current from terminals 108 and 109. The release of relay 116 also opens the locking circuit for relay 115 thereby disconnecting brushes 130 and 140 and opening any possible circuit for relays 118 and 114. The release of relay 116 also closes the circuit for relay 150 so that this relay will again operate to hold relay 111 actuated over an obvious circuit after the release of relay 116. Talking battery is

supplied to both the calling and called subscribers through the windings of relay 150.

When the calling and called subscribers restore the receivers on the switchhooks, relay 150 releases, this relay in turn releasing relay 111. The release of relay 111 closes a circuit for the operation of release magnet 119 from battery through the magnet, alternate contact of rotary off-normal springs 122 to ground on the right back contact of relay 111 thereby restoring selector S to normal.

We will now assume that key 131 is operated and the digit 4 has been dialed by station 101. The operation of the selector S will be the same until dialing is completed at which time brushes 125 and 126 are centered on terminals 351 and 352 and brushes 130 and 140 are on terminals 353 and 354. Ground is now connected to conductor 327 through interrupter 124 and the outer right front contact of relay 116 to operate relay 301. Relay 301 operated locks over a circuit from ground on the right front contact of relay 111, inner back contact of relay 117, outer left front contact of relay 116, lower alternate contact of key 131, conductor 329, outer left back contact of relay 306, inner right front contact and both windings of relay 301 to battery. The operation of relay 301 closes a circuit from ground on its outer right back contact, conductor 328 and thence over the same circuit described above for the operation of relay 115. The operation of relay 301 closes a circuit from ground on the outer left back contact of relay 305, outer right back contact of relay 304, outer left back contact of relay 303, outer left back contact of relay 302, middle right front contact of relay 301, contact 354, brush 140, inner right front contact of relay 115 to battery through the winding of relay 114. The operation of relay 114 controls the connection of ringing current, as explained above. The operation of relay 301 also closes a circuit from ground on the middle left back contact of relay 302, middle left front contact of relay 301 to terminal 353 and thence over brush 130 to operate relay 118 and connect ringing current to the line from generator 123 as described above. The operation of relay 301 also closes a circuit for operating relay 302 from ground through interrupter 124, outer right front contact of relay 116, upper alternate contact of key 131, conductor 327, inner left front contact of relay 301, inner left back contact and left winding of relay 302, to battery. Relay 302 operated locks to ground on the outer right front contact of relay 301 over an obvious circuit under control of relay 301 and opens the circuits traced above for relays 118 and 114 thereby giving a silent period. Relay 302 also closes a circuit from interrupted ground on conductor 327, inner left

front contacts of relays 301 and 302 to battery through the inner left back contact and left winding of relay 303. Relay 303 operated again closes the circuit for relay 114 from ground on its middle right front contact, middle left front contact of relay 301 to contact 353, and also closes a circuit through its outer left front contact from ground on to outer right back contact of relay 305 for operating relay 118. This causes ringing current to be again connected to the tip side of the line giving a second impulse of ringing current and thereby finishing the code of two rings. The operating of relay 303 closes a circuit from interrupted ground on conductor 327, inner left front contacts of relays 301, 302 and 303, inner left back contact and left winding of contact 304 to battery. The operation of relay 304 opens the circuit above traced for relay 114 at its middle right contact. Relay 118 is held operated, however, by ground on the right middle front contact of relay 303 thereby connecting ringing current to terminal 109 and thence to the ring side of the line operating the bells at stations 103 and 104. Relay 304 operated closes the operating circuit for relay 305 through its inner left front contact. The operation of relay 305 has no effect on this particular code of ringing except to keep relay 118 operated for a longer period of time thereby giving one long ring which is the code for station 104. The operation of relay 305 in turn causes the operation of relay 306 which opens the locking circuit for relay 301 through its outer left back contact. The release of relay 301 opens the locking circuits of relays 302 to 306, inclusive, causing them all to release in preparation for another cycle of ringing current. Other codes may be rung according to the number dialed. The following table gives the numbers dialed and the number of rings on the tip and ring composing the code.

Code.	Number of rings.	
	Ring.	Tip.
1-----	1	1
2-----	For testing.	2
3-----	2	1
4-----	1	2
5-----	For testing.	2
6-----	2	2
7-----	For testing.	
8-----	For testing.	
9-----	For testing.	
0-----	For testing.	

It will be noted in the above table that numbers 2, 5, 7, 8, 9 and 0 are for testing, that is, the test man may use these numbers for various tests of the bells.

What is claimed is:

1. In a telephone system, a plurality of stations connected to one line, a selector

switch, an interrupting device, said device being connected to the contacts of said selector switch, a source of ringing current in said switch, and means in said switch under control of said device for applying said source of ringing current to two of said stations according to a predetermined code.

2. In a telephone system, four stations connected to one line, said line being composed of two conductors, a selector switch connected to said line, an interrupting device comprising a rotary switch, said device being connected to the contacts of said selector switch, a source of ringing current in said switch, means in said switch under control of said device for connecting said source of ringing current to said line, and a relay in said switch under control of said device for determining to which conductor said source of ringing current shall be connected.

3. In a telephone system, a two-conductor line, a calling station, a called station, the bells of said stations being connected to opposite conductors of said line, a selector switch, an interrupting device connected to the contacts of said selector switch, a source of ringing current in said switch, a relay in said switch under control of said devices for connecting said source of ringing current to said line, and a second relay in said switch under control of said device for determin-

ing to which conductor said source of ringing current shall be connected.

4. In a telephone system, a two-conductor line, a calling station, a called station, the bells of both stations being connected to a conductor of said line, a selector switch, an interrupting device connected to the contacts of said selector switch, a source of ringing current in said switch, and means in said switch under control of said device for connecting said source of ringing current to said calling and called stations, according to a predetermined code.

5. In a telephone system, a two-conductor line, a calling station and a called station on said line, the bell of the calling subscriber's station and the bell of the called subscriber's station being connected to separate conductors, a selector switch, an interrupting device connected to the contacts of said switch, a source of ringing current in said switch, means associated with said line for controlling the said switch, and means in said switch under control of said device for connecting said source of ringing current to said calling and called subscribers' stations alternately according to a predetermined code.

In witness whereof, I hereunto subscribe my name this 30th day of March A. D., 1926.

RAY L. STOKELY.