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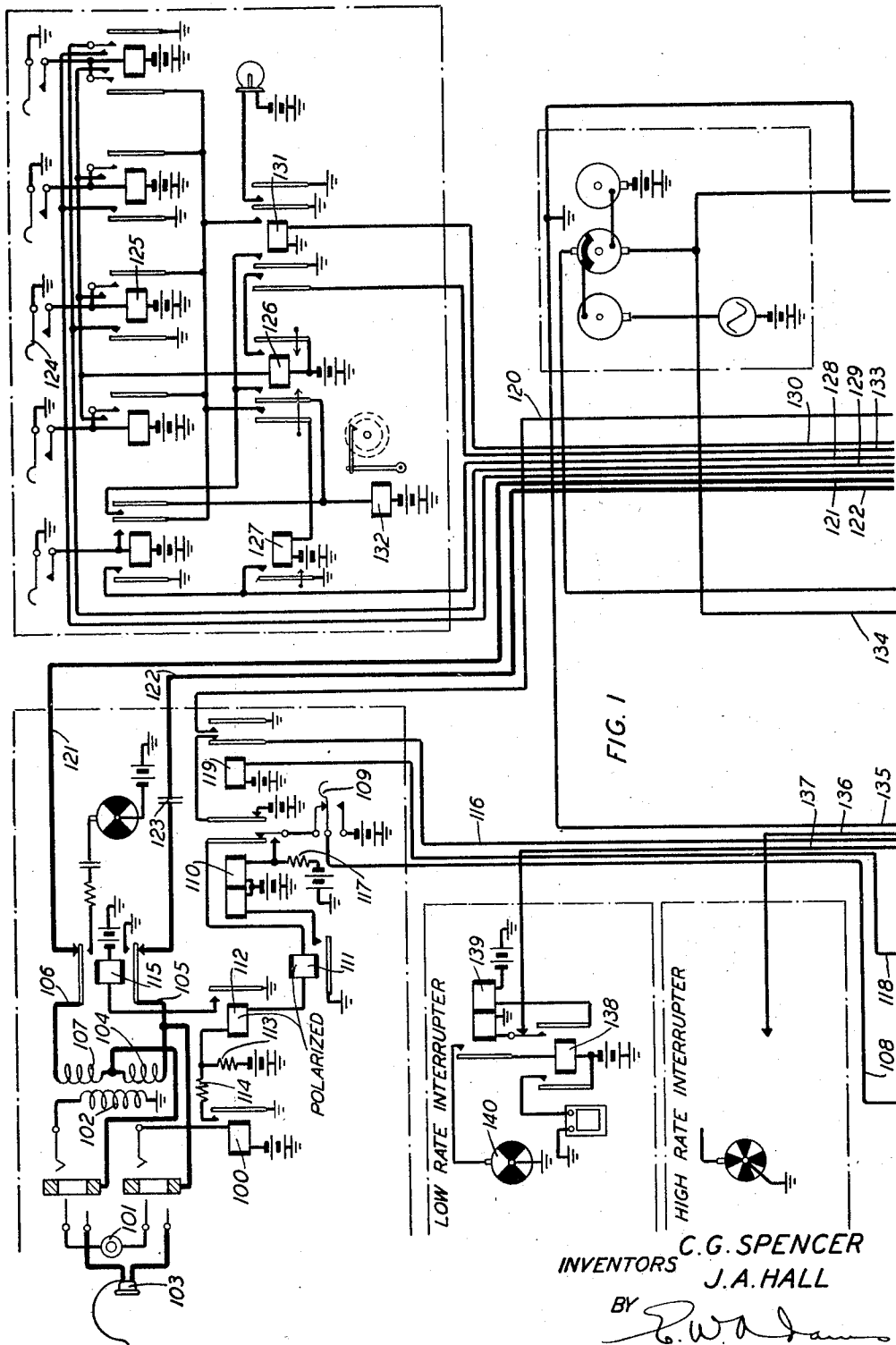
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1,831,398

TELEPHONE SYSTEM

Filed Jan. 27, 1931

2 Sheets-Sheet 1



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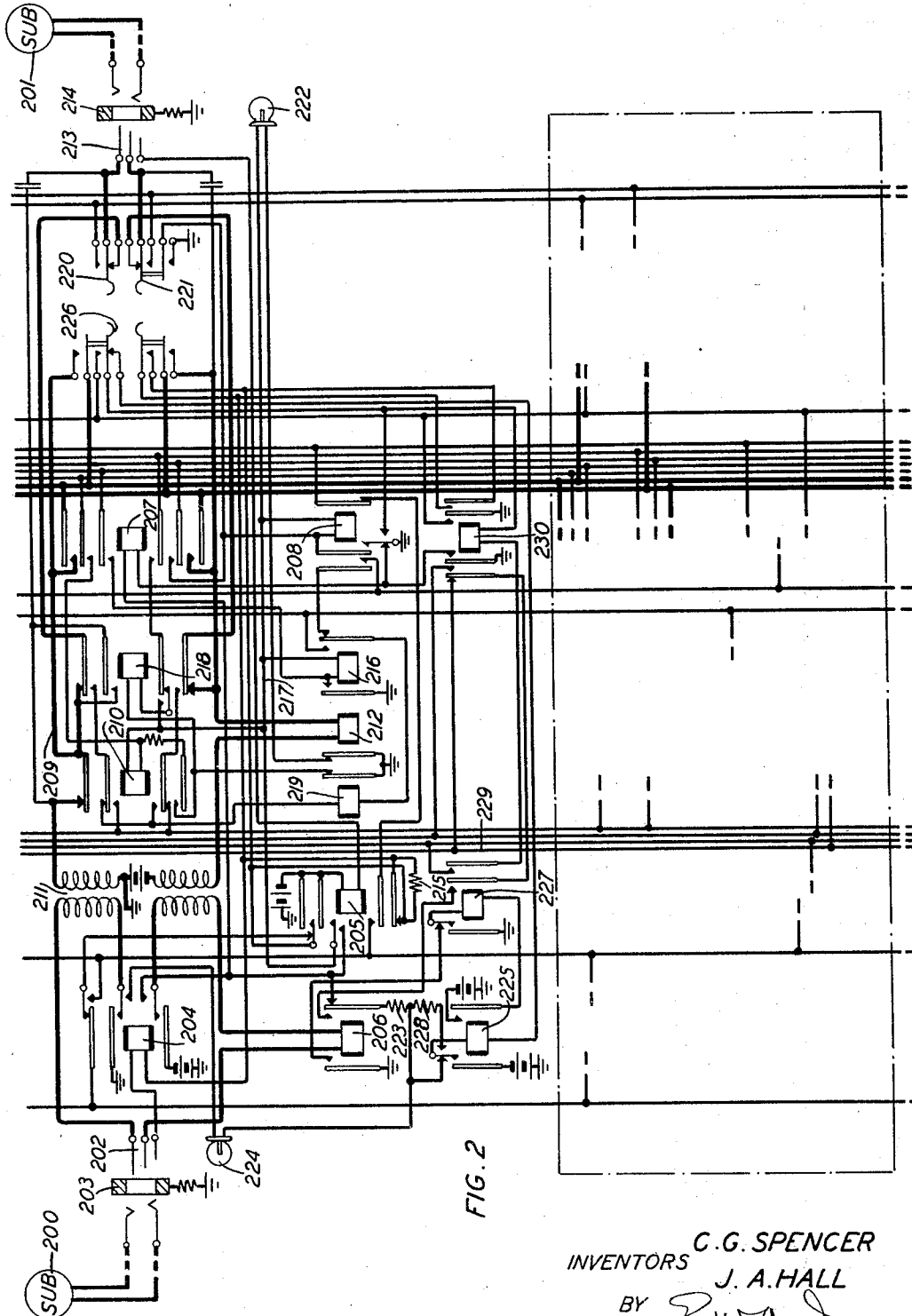


FIG. 2

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TELEPHONE SYSTEM

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This invention relates to telephone systems and particularly to an arrangement for connecting operator's telephone sets to operator's link circuits.

5 The object of the invention is to provide means whereby a subscriber who is a party to an established connection may recall the operator and actually cause a connection between her telephone set and the link circuit
10 through which his connection is to be established instantly if she is idle or if she is busy then as soon as she becomes idle.

In accordance with one feature of this invention a means is provided responsive to the
15 idle condition of the operator's set for connecting such set to a link circuit on which a recall condition has been established.

In accordance with another feature of this invention a means is provided for displaying
20 a signal before an operator which is distinctive and indicative of the fact that her telephone set has been automatically connected to a link circuit on which a recall condition has been established.

25 The drawings comprise two sheets of circuit diagrams which when placed with Fig. 1 above Fig. 2 illustrate the present invention. Fig. 1 shows a number of circuits that are common to a plurality of cord circuits,
30 one of which is shown in full in Fig. 2 and a second of which is indicated in that figure. The common circuits of Fig. 1 include the operator's circuit shown in the upper left hand enclosure, the common ringing key circuit shown in the upper right hand enclosure,
35 a low rate interrupter circuit and a high rate interrupter circuit shown in the small enclosures below the operator's circuit, and the ringing generators shown in the enclosure beneath the common ringing key circuit.
40

When the position is occupied by an operator, the operator's telephone circuit plug is in the circuit jack and relay 100 is operated in series with the operator's transmitter 101
45 and the primary 102 of the induction coil. The receiver 103 is bridged across the secondary coil 104 and the talking leads 105 and 106 are connected to the outer terminals of secondary coils 104 and 107.

50 We will now assume that a call is being

established from substation 200 to substation 201. The operator in response to the usual line signal inserts plug 202 into jack 203, whereupon a circuit is established from
55 ground through the sleeve of jack 203, the sleeve of plug 202, winding of relay 204; lower outer armature and back contact of relay 205, normal contacts of the upper outer armature of relay 205, back contact and upper
60 outer armature of relay 204, conductor 108 through the normal contacts of emergency key 109, the back contact and inner right armature of relay 110, windings of relays
65 111 and 112 in series and thence in one direction through resistance 113 to battery and in the other direction through resistance 114, the front contact and armature of relay 100 to ground. Both relays 111 and 112 are polarized and each responds to current in a different direction. If the plug 202 is the first
70 to be placed in jack 203 or another jack multiplied thereto, a simple ground will be found on the sleeve and relay 111 will operate. If jack 203 has already been rendered busy
75 by the insertion of another plug in a multiple jack, then battery potential will be found on the sleeve of jack 203 and relay 112 will respond. In the case of a busy line, when relay 112 responds, a circuit is established for relay 115 which connects through its front
80 contacts a busy tone to the operator's set so that she will know that she has plugged into a busy line.

We will assume in this case that relay 111 operates. Thereupon, a circuit is established
85 for relay 110 and this relay now locks to conductor 108 through the front contacts of its inner right hand armature. At the same time, relay 110 removes battery from conductor 116 for purposes which will be explained hereinafter. Upon the operation of relay 110
90 and the substitution of a connection to conductor 108 which extends in one direction through the resistance 117 to battery and in the other direction through the right hand winding of relay 110 to battery, relay 204 responds. Thereupon a circuit is established
95 through the winding of relay 204, the contacts of relay 205, the alternate contacts of the upper outer armature of relay 204, conductor 100

118, winding of relay 119 to battery. Through the action of relay 204, the ground connection on conductor 108 is removed and relay 110 is released. Although relay 110 now
 5 closes the battery connection to conductor 116, relay 119 opens it at its inner right hand armature and back contact. At the same time relay 119 through its outer right hand armature places ground on conductor 120 for pur-
 10 poses which will appear hereinafter.

Relay 204 in operating now connects ground and battery through its inner armatures to the tip and ring conductors of plug 202 and thus supplies talking battery to the
 15 substation 200. Supervisory relay 206 is serially included in the ring conductor and thus becomes operated.

Further, upon the operation of relay 204, a circuit is established from battery, the lower armature and second front contact thereof, winding of relay 207, normal contacts of the inner left hand armature of relay 208 to ground. Relay 207 operates and connects the operator's head set to the cord. Such a connection may be traced from conductor 106
 25 through the upper armature and back contact of relay 115, conductor 121, the outermost upper armature and front contact of relay 207, conductor 209, outer upper armature and back contact of relay 210, upper left hand
 30 winding of induction coil 211 to ground and thence from battery through the lower left hand winding of induction coil 211, calling supervisory relay 212, front contact and outermost lower armature of relay 207, conductor 122, condenser 123, back contact and lower armature of relay 115 to conductor 105.

The operator now learns from the calling subscriber at station 200 that a connection is desired to the telephone at station 201. Plug 213 is thereupon inserted in jack 214 and we will assume that ringing key 124 is depressed. Upon the insertion of plug 213 into jack 214 a circuit is established from ground
 40 through the sleeve of jack 214 and plug 213, the winding of relay 205 to battery. Relay 205 through its outermost upper armature opens the original energizing circuit of relay 119 and closes a direct battery connection through its front contact, resistance 215, winding of relay 204 to ground on the sleeve of jack 203.

Upon the depression of key 124, relay 125 is operated. This relay through its right hand armature places ground from the contacts of key 124 through its secondary front contact to cause the operation of relay 126 and connects ground through its right hand armature and front contact and the outer left
 55 hand armature of relay 126 to the winding of relay 127. Relay 127 places ground on conductor 128. Relay 125 through its left hand armature places ground on conductor 129.

65 When relay 205 operates a circuit is es-

tablished from battery, winding of relay 119, conductor 118, front contact and inner lower armature of relay 205, back contact and right hand armature of relay 208, conductor 130, winding of relay 131 to ground. Relay 131
 70 through its inner right hand armature places a ground on the right hand armature of relay 125 to maintain this relay and relay 126 locked after the key 124 has been released. Through its inner left hand armature, relay
 75 131 places a ground on the front contact of the inner left hand armature of relay 126 whereby peg count meter 132 is operated.

With ground placed on conductors 128 and 129, the following action takes place. Ground on conductor 129 may be traced through the innermost upper armature and front contact of relay 207, winding of relay 216, conductor 217, front contact and inner upper armature of relay 205 to battery and
 80 thus relay 216 locks through its own left hand armature and front contact.

A circuit may also be traced from battery through the right hand armature and front contact of relay 126, the front contact and outer left hand armature of relay 131, conductor 133, the innermost lower armature and front contact of relay 207, inner lower armature and back contact of relay 218, winding of relay 218, the back contact and armature of relay 219 to ground. Relay 218
 85 operates and locks through the alternate contacts of its inner lower armature to the battery on conductor 217.

Ground may now be traced from conductor 128 through the middle lower armature and front contact of relay 207, winding of relay 208 to battery on conductor 217. Relay 208 operates and locks through its inner left hand armature and front contact to ground. At this time the series connection from battery connected to one terminal of relay 119 to ground connected to one terminal of relay 131 is opened at the back contact and right hand armature of relay 208 and then both the operator's set and the common ringing key set are released and retired.
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Ringing current is now connected to the called subscriber's line from conductor 134 through the front contact and left hand armature of relay 216, winding of relay 219, the back contact and inner upper armature of relay 210, the front contact and outer upper armature of relay 218, the normal contacts of key 220, tip of plug 213, thence out over the subscriber's line, and back to ring of plug 213, the normal contacts of key 221, the outer lower armature and front contact of relay 218, the inner lower armature and back contact of relay 210, conductor 135 to ground. The current flowing through this ringing circuit is insufficient to cause the energization of relay 219 until the subscriber at station 201 responds. At this time relay 219 attracts its armature and releases relay 218. The cir-
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cuit for relay 219, however, is immediately opened when the automatic relay 218 becomes deenergized so that relay 219 becomes deenergized.

5 Prior to the response of the subscriber at station 201, a circuit could be traced from battery conductor 217 through supervisory lamp 222, the back contact and armature of calling supervisory relay 212 to ground.
10 When tripping relay 219 operates and restores the automatic ringing relay 218 to normal, then talking battery is substituted for ringing current to the called subscriber's line and supervisory relay 212 in series therewith becomes operated. This opens the circuit of
15 lamp 222 which indicates that the called subscriber has answered.

We will now assume that the calling subscriber at 200 finds some difficulty and wishes
20 to recall the operator. He will therefore depress his receiver hook once and then restore it. In other words, he will momentarily open the connection, thereby momentarily restoring answering supervisory relay 206 to normal.
25

When relay 206 becomes deenergized, a circuit may be traced from battery, the lower armature and front contacts of relay 204 or
30 from battery, the lower inner armature and front contacts of relay 205 through the back contact and right hand armature of relay 206, resistance 223, answering supervisory lamp 224 to ground through the contacts of the inner upper armature of relay 204. The
35 connection may also be traced from battery over the right hand armature of relay 206 through the normal contacts of the left hand armature of relay 225, winding of relay 225, the normal contacts of key 226, the alternate
40 contacts of the inner left hand armature of relay 208 to ground. Relay 225 operates and locks through its left hand armature to battery. Lamp 224 therefore glows to show a disconnect but since the period of deenergization of relay 206 is very short, the operator
45 will not recognize such a flash as a disconnect signal.

As soon as relay 206 reoperates, a circuit is established from battery through the front
50 contact and right hand armature of relay 225, the winding of relay 227, the normal contacts of the left hand armature of relay 227, the front contact and left hand armature of relay 206 to ground. Relay 227 operates and locks
55 to ground over its left hand armature.

A battery connection is now established from the left hand armature and front contacts of relay 225 through resistances 228 and
60 223, right hand armature and front contact of relay 206, front contact and inner right hand armature of relay 227, outer left hand armature and back contact of relay 230, conductor 229, conductor 137, the normal contacts of the right hand armature of relay 138, the
65 left hand winding of relay 139 to ground.

This path is of low enough resistance to shunt lamp 224 and it therefore becomes dark. However, relay 139 is operated and by closing a contact from interrupter 140 to the
70 winding of relay 138 it causes the energization of relay 137 when the interrupter 140 rotates to the proper position. At this time relay 139 remains energized through its two windings in series but the conductor 137 is
75 opened so as to allow lamp 224 to become illuminated. When interrupter 140 moves further the relay 138 becomes deenergized and the original condition for the energization of relay 139 is reestablished. Through the
80 operation of this flashing recall circuit, lamp 224 alternately lights and becomes dark.

When the flashing of lamp 224 is started by the energization of relay 227, a circuit is established from ground at the alternate contacts of the inner left hand armature of relay
85 208, winding of relay 230, outer right hand armature and front contact of relay 227, conductor 116 to the inner right hand armature of relay 119. If the operator is busy at this time, relay 119 will be operated and relay 230
90 cannot become energized and therefore nothing happens in the cord circuit except the flashing of lamp 224. As soon as the operator's set is released as hereinbefore described, then battery will be placed on conductor 116
95 and this will cause the energization of relay 230. Thereupon a ground will be extended from the inner left hand armature and front contact of relay 230, winding of relay 207 and
100 thence to battery over the contacts of the lower armature of relay 204. Relay 207 becoming operated immediately connects the operator's set to the cord circuit so that the subscriber at station 200 may appraise her of the
105 difficulty which he has encountered. Relay 230 in operating changes the connection to its outer left hand armature from the low rate interrupter reached over conductor 137 to the
110 high rate interrupter reached over conductor 136 so that when the operator's set is thus connected to a cord circuit on a recall she will be given a distinctive signal to let her know to which cord circuit she is connected.

Should the subscriber at station 200 wish
115 a new number or wish to recall the subscriber at station 201, the operator will take plug 213 from jack 214, whereupon the front sleeve relay 205 will become deenergized. This removes the battery for holding relay 208 and this relay becomes deenergized. At the same time
120 relay 208 in coming back to normal places a ground on the one winding of relay 207 so that this will remain energized even though relay 230 becomes deenergized. Upon the return to normal of relay 208, relays 225, 227,
125 230, 216 and 218 return to normal so that the circuit is now in the same condition as it would be when the operator first inserts plug 202 in jack 203. Thereafter, the operator may
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establish a new connection in the same manner as hereinbefore described.

What is claimed is:

1. In a telephone system, a link circuit, an operator's telephone set commonly associated with said link circuit, means associated with said link circuit responsive to a temporary interruption of a connection established by said link circuit for operatively connecting said operator's set to said link circuit and means individual to said operator's set responsive to the busy connection thereof to delay the said operative connection of said operator's set to said link circuit.

2. In a telephone system, a plurality of link circuits, an operator's telephone set common to said link circuits, means associated with said link circuits responsive to a temporary interruption of a connection established by one of said link circuits for operatively connecting said operator's set to said one of said link circuits and means individual to said operator's set responsive to the busy condition thereof to delay the said operative connection of said operator's set to said one of said link circuits.

3. In a telephone system, a plurality of link circuits, an operator's telephone set common to said link circuits, means associated with said link circuits responsive to a temporary interruption of a connection established by one of said link circuits for operatively connecting said operator's set to said one of said link circuits and means individual to said one of said link circuits responsive to said means for connecting said operator's set to said one of said link circuits for displaying a distinctive signal indicative of said connection.

In witness whereof, we hereunto subscribe our names, this 22 day of January 1931.

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