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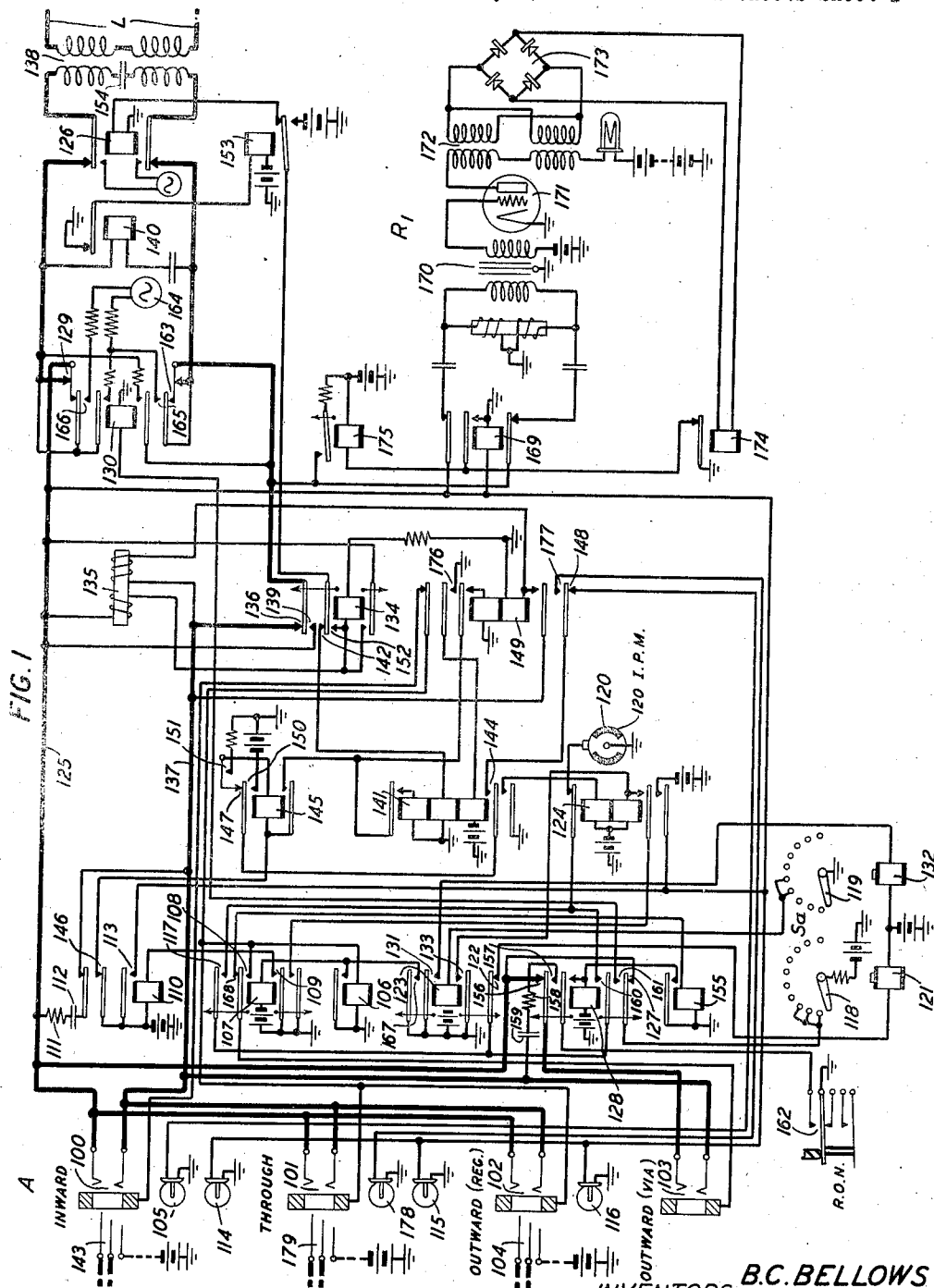
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SELECTIVE SIGNALING SYSTEM

Filed July 1, 1939

2 Sheets-Sheet 1



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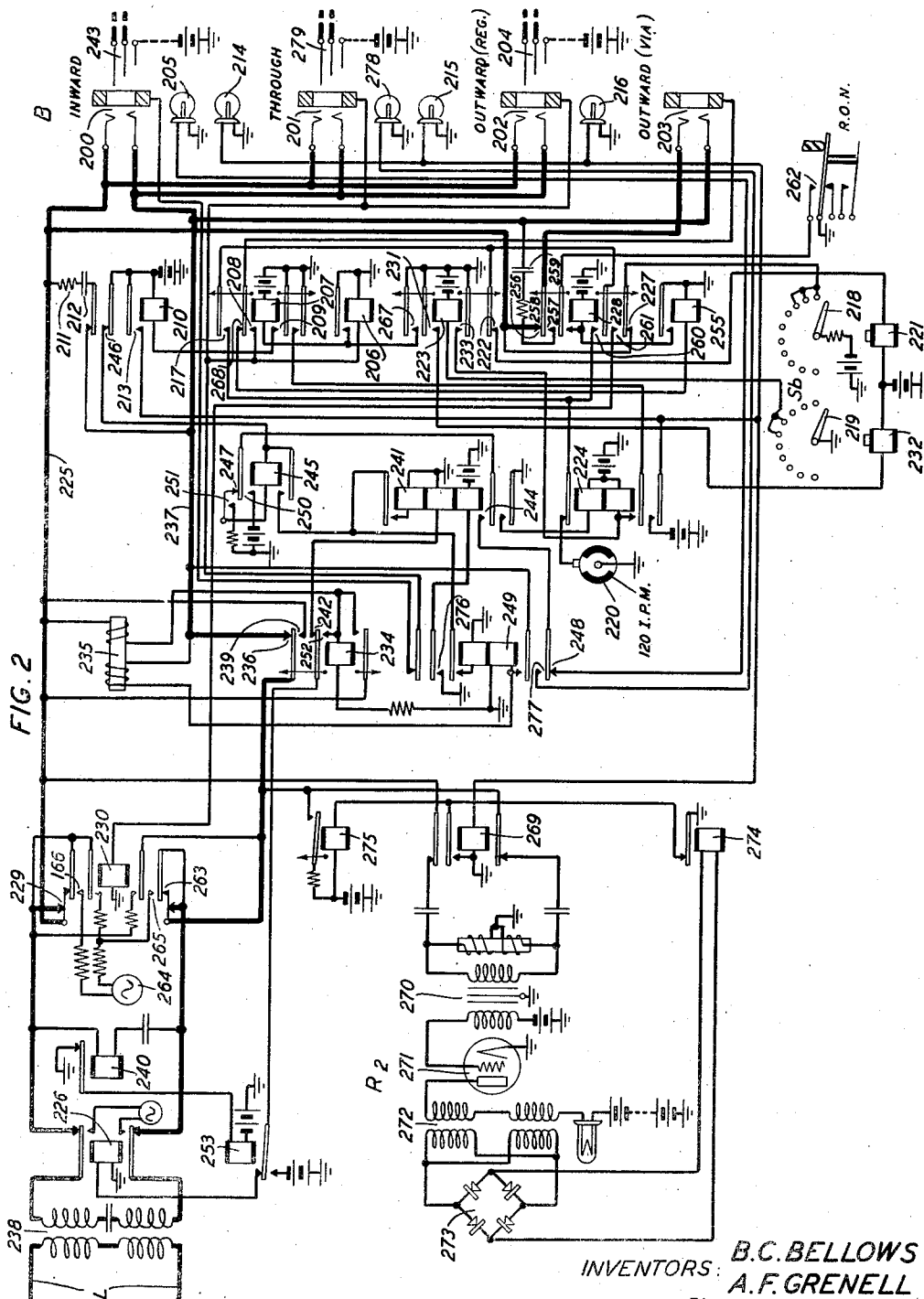
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SELECTIVE SIGNALING SYSTEM

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6 Claims. (Cl. 179—41)

This invention relates to improvements in signaling systems and more particularly to means for selectively controlling the operation, over a ringdown toll line, of line signals located at different operators' positions as, for example, at either so-called "inward" or "through" positions. In such system it is desirable that the originating operator, at one end of the line, be able to selectively signal, i. e., light the line lamp, before either an "inward" or a "through" operator at a distant toll office, depending on the nature of the connection desired.

A feature of the invention resides in means at the originating or outward operators' positions for selectively applying to the line one or the other of two different signaling frequencies, for example, 20 and 1000 cycles, and in means at the distant end of the line selectively responsive to the transmitted frequency to actuate one or the other of two corresponding line signals located before different operators.

More specifically, the line at the originating or outward switchboard is terminated in two jacks, one of which may, for example, be designated in such a manner as to indicate that when it is seized a predetermined frequency will be transmitted to operate apparatus at the other end of the line to in turn cause the line signal at the "inward" position to be displayed whereas if the other jack of the pair is seized, it will be understood that another predetermined frequency will be transmitted to display the line signal at the "through" operator's position. The invention will be understood from the following description and accompanying drawings, in which:

Fig. 1 represents one end of a two-way toll line L terminating at a toll office A in inward jacks 100 and 101 and outward jacks 102 and 103; and

Fig. 2 represents the other end of the same line terminating at a toll office B in inward jacks 200 and 201 and outward jacks 202 and 203.

Jacks 100 and 200 appear at terminating or so-called inward positions, jacks 101 and 201 appear at switching or so-called through positions and jacks 102, 103, 202 and 203 appear at so-called outward positions. As both ends of the line L are identical, it will only be necessary for a complete understanding of the invention to trace the circuit operation in one direction for the two types of calls referred to previously, i. e., "terminating" and "through" and therefore we will first trace a call originated by the outward operator at office A by way of jack 102 for a subscriber within the local exchange area of office B and reached therefrom either directly or over a

trunk circuit by way of jack 200 of the inward position and secondly we will trace the circuit operation for a call also originated at office A, by way of jack 103, for a third toll office, and reached over a second toll line, neither of which is shown, by way of jack 203 at office B.

When the outward operator is in possession of the details of a call for a subscriber which is to be completed by the inward operator at toll office B, she inserts the plug 104 of her cord circuit in jack 102 whereupon ringing current is automatically connected to the line and causes the line lamp 205 at office B to light before the inward operator.

The circuit operation is as follows: When the plug 104 is inserted in jack 102, battery on the sleeve of the plug causes operation of the sleeve relay 106 which in turn operates relay 107. Relay 107 in closing its contacts 108 connects the sleeve of jack 103 in multiple with the normally connected sleeves of jacks 100, 101 and 102.

Closure of contacts 109 of relay 107 operates relay 110 which opens the normally closed bridge across the line consisting of resistance 111 and condenser 112 and closes its contacts 113 to light all the busy lamps 114, 115 and 116 at that end of the line and also operates relay 109 which disables the voice frequency receiving circuit R₁ and prevents its false operation by speech.

When relay 107 closed its contacts 117, it completed a circuit to step the selector brushes 118 and 119 of the selector S₂, under control of interrupter 120. This circuit can be traced from battery, winding of magnet 121, contacts 122 of relay 123, contacts 117 of relay 107 and the upper back contact of relay 124 to ground through interrupter 120. Stepping magnet 121 energizes and releases in step with the interrupter and moves the selector brushes forward in a clockwise direction. On its first step brush 118 engages the first contact of the bank, thereby connecting battery to the tip conductor 125 of the line to cause operation of the ringing relay 126 which connects ringing current to the toll line L. This circuit can be traced from battery, brush 118, contacts 127 of relay 123, tip conductor 125, left-hand winding of retard coil 135, and winding of slow-release relay 134 to ground. Relay 134 operates and closes its contacts 152 thereby extending battery on the tip conductor 125 to relay 126 by way of the normally closed front contacts of relay 153. Closure of the lower contacts of relay 134 short-circuits the left-hand winding of retard coil 135.

Magnet 121 continues to step the brushes 118

and 119 ahead and as the first three contacts of the left-hand bank are connected together, relay 126 will remain operated to continue ringing. When the selector brush 118 steps off the third contact, relay 126 will release and ringing will cease and soon thereafter relay 134 will release and on the fourth step brush 119 will engage the fourth contact of the right-hand bank thereby completing a circuit to operate the release relay 123 in an obvious circuit. Operation of relay 123 opens its contacts 122 thereby disconnecting the stepping magnet 121 from the interrupter and stopping the forward movement of the selector.

Relay 123 also closes its contacts 133 thereby energizing relay 124 and disconnecting the interrupter at another point. Relay 124 thereupon locks in an energized condition over its inner lower contact to ground at the lowermost contacts of relay 107 which relay was operated when the plug was inserted in jack 102. Further, relay 123 closes its contacts 131 thereby completing an obvious circuit to operate the release magnet 132 which causes the selector to restore to normal in a counter-clockwise direction.

Restoration of the selector to normal opens the circuit for relay 123 which thereupon releases. Operation of relay 124 also connects battery, at its lowermost contact, to supplement the battery connected at contacts 113 of relay 110 to the busy lamp circuit, also relay 169. Relays 106, 107, 110 and 124 are now operated and held under control of the sleeve circuit of plug 104 and jack 102.

It will be noted that when battery was removed from conductor 125 on the fourth step of the selector, relay 134 was deenergized but due to its slow-release characteristics, it held the ring conductor open at its contacts 136 and maintained a short circuit across the repeating coil at contacts 139 for a sufficient interval, before connecting the line through to the operator's telephone circuit to obviate objectionable clicks therein due to the charge built up in the line by the ringing current.

Now, directing attention to office B (Fig. 2), when ringing current is received over the toll line, it causes the operation of the bridged ringing relay 240 which in turn releases relay 253 to operate relay 241, the circuit for which can be traced from battery, back contacts of relay 253, contacts 242 of relay 234 and the middle winding of relay 241 to ground. Relay 241 in operating closes its lowermost contacts thereby operating relay 224 which disables selector Sb by disconnecting the interrupter 220 thereby preventing a ringing impulse being transmitted toward office A when the inward operator answers the call by inserting plug 243 in jack 209. Operation of relay 224 also connects battery at its lowermost contact to light all the busy lamps 214, 215 and 216, associated with this line at office B and also operates relay 269 to disable the voice frequency ringer R₁ to prevent its operation by speech. Relay 241 in operating also closes its contacts 244 thereby completing a circuit to operate relay 245 which can be traced from battery, contacts 246 of relay 210, winding and contact 247 of relay 245, contacts 244 of relay 241, contacts 248 of relay 249 and line lamp 205 to ground. Relay 245 is sufficiently sensitive to operate in series with lamp 205 but lamp 205 does not burn at full brilliancy in series with this relay. When relay 245 operates, it closes its lower contact thereby completing a locking circuit for relay 241 and at its contacts 250 connects direct

battery to the circuit previously traced through lamp 205, which lamp thereupon lights to full brilliancy as an indication to the inward operator of the arrival of a call. Relay 245 itself locks operated over its contacts 251. Relays 241, 245 and 224 are now operated and held in this condition pending the operator's answer. When the inward operator observes the lighted line lamp 205 she inserts the plug 243 of one of her cord circuits in jack 200 thereby causing the operation of relay 236 which operates relay 207 which in turn operates relay 210. Relay 210 in operating opens its contacts 246 thereby releasing relay 245 which extinguishes the line lamp by opening its contacts 250. Relay 245 also opens its lower contacts thereby releasing relay 241. The release of relay 241, however, does not release relay 224 as this latter relay is now locked over its lower contact to ground at the lowermost contacts of relay 207. Operation of relay 207 closes its contacts 208 thereby connecting the sleeve of the jack 203 to the sleeve of jack 200 thus making this jack busy to any subsequent attempt to connect a cord circuit thereto. Sleeves of jacks 201 and 202 are normally connected to the sleeve of jack 200.

Relay 210 connects battery at its contacts 213 to the busy lamps 214, 215 and 216 in parallel with the battery supplied over the lower contacts of relay 224 and also holds relay 269 operated. When the operators at both ends of the line disconnect, the respective ends of the circuit restore to normal.

As previously mentioned, both ends of the circuit are identical and, therefore, the initiation of a call at office B for the inward operator at office A will be effected in the same manner as just described except in the reversed direction.

Calling a through operator

Now let us assume that the outward operator at office A desires to be connected to a third toll office distant from office B and reached via office B over a second toll line, not shown, which type of switch connection is handled by a so-called "through" operator. Knowing that the call is for a toll point beyond office B and therefore must be switched there by a so-called through or switching operator, the outward operator at office A inserts the plug 104 of her cord circuit in the so-called "via" jack 103 instead of in jack 102 as before.

When the plug is inserted in jack 103, relay 155 operates in an obvious circuit which in turn operates slow-release relay 128. Relay 128 opens its contacts 156 and closes its contacts 157 thereby disconnecting the jack 103 from the line and connecting a termination consisting of resistance 158 and condenser 159 across the tip and ring of the jack and, therefore, across any line which may be connected thereto by means of plug 104.

At its contacts 160, relay 128 closes a circuit to energize the stepping magnet 121 of selector Sa in the following circuit, battery, winding of magnet 121, contacts 122 of relay 123, contacts 160 of relay 128 and upper back contacts of relay 124 to ground through interrupter 120. On the first closure of the interrupter 120, magnet 121 moves selector brush 118 into engagement with the first contact of the selector bank thereby closing a circuit to operate relay 130, the circuit for which includes contacts 161 of relay 128. At the same time off-normal contacts 162 of the selector are closed thereby providing a locking ground for relay 128 which, therefore,

cannot release until the selector has been restored to normal. During the first three steps of the selector, ground will remain connected to relay 130 which relay opens the tip and ring at its contacts 129 and 163 and connects the voice frequency source of alternating current 164 (which may be of the order of 1000 cycles) to the transformer 138 at contacts 165 and 166, over the back contacts of relay 126. Relay 140 which is bridged across this circuit does not respond to the frequency of source 164 due to its electrical characteristics.

When the brush 118 moves off the third contact of the switch, relay 130 releases which disconnects the source 164 from the line and reconnects the conductors 125 and 137 to the line through the transformer 138.

When brush 119 of the selector makes contact with the fourth terminal of its associated bank, the slow-to-release relay 123 operates which closes its contacts 123 to operate relay 124 thereby disconnecting the interrupter 120 from the stepping magnet 121. At its lowermost contacts, relay 124 lights the busy lamps 114, 115 and 116 and also operates relay 169 whose purpose has already been mentioned. Operation of relay 123 also closes its contacts 131 which energizes the release magnet 132 and causes the selector to restore to normal thereby deenergizing relay 123 which, however, is slow to release and holds operated for a short interval. When the selector restores, the off-normal contacts 162 are opened thereby removing the holding ground for relay 123. Further, relay 123, on operating, closes its contacts 167 thereby operating relay 107 which opens its contacts 168 and opens the circuit between the sleeve of jack 103 and relay 155 which thereupon releases in turn releasing relay 128 as this relay now has no locking ground due to the release of the selector and the opening of the off-normal contacts. Relay 107 also closes its contacts 108 thereby connecting the sleeve of jack 103 to relay 106 which now operates and holds relay 107 operated which otherwise would release due to the release of relay 123. Relay 107 in operating closes a circuit to operate relay 119 which removes the termination consisting of resistance 111 and condenser 112 from across the conductors 125 and 137 and at its contacts 113 closes a circuit to insure the continued lighting of busy lamps 114, 115 and 116 and operation of relay 169. When relay 107 operated it also closed its lowermost contacts to hold relay 124 operated thereby disabling the selector stepping circuit as long as the plug remains in jack 103.

It will be noted that release of relay 128 recloses its contacts 156 and opens contacts 157 thereby connecting the tip conductor through to the tip of the jack and removing the termination consisting of resistance 158 and condenser 159 from across the tip and ring.

Relays 196, 107, 110, 124 and 169 are now operated and remain so during the continuance of the call.

When the voice frequency signaling current connected to the line by operation of relay 130 arrives at the other end of the line (Fig. 2), it passes through transformer 238, over the normal back contacts of relay 226, contacts 229 and 263 of relay 230 and back contacts of relay 269 to the right-hand winding of transformer 270 of the so-called voice frequency ringer R₂ whose method of operation is well known, it being sufficient to point out that the incoming wave is amplified by the vacuum tube

271 and transmitted through transformer 272 to the rectifier 273 which delivers a unidirectional current to operate relay 274 which relay in operating removes ground from normally operated relay 275 which presently releases to connect battery at its back contact to operate relay 249 in a circuit including contacts 236 of relay 234, left winding of retard coil 235 and lower winding of relay 249 to ground.

Operation of relay 249 closes its contacts 276 thereby operating relay 241 and opening its contacts 248 and closing its contacts 277 thereby transferring the previously described lamp lighting circuit from lamp 205 at the regular inward position, to lamp 278 at the through position, the operation of which is as follows: Battery is first connected over contacts 246 of relay 210 through the winding of relay 245 and its contacts 247, contacts 244 of relay 241, contacts 277 of relay 249 and lamp 278 to ground which lamp does not light to full brilliancy at this time due to the resistance of relay 245 which relay, however, receives sufficient current to operate thereby connecting direct battery over its contacts 250 to the circuit just described to light lamp 278 to full brilliancy. Relay 245 also locks up at its contact 251 to battery and at its lower contacts provides holding battery to lock relays 241 and 249.

Relay 241 in operating also operates relay 224 thereby disconnecting the interrupter to prevent operating the selector S_b when the operator answers. Relay 224 in operating connects battery at its lower contacts to light the busy lamps 214, 215 and 216 and also to operate relay 269. Operation of relay 249 opens its uppermost contact thereby opening the sleeve circuit of the regular inward jack 200 thereby preventing the regular inward operator from extinguishing the line lamp 278 in case she should connect to the line at this time.

When the through operator observes the lighted lamp 278 she inserts plug 279 of one of her cord circuits in jack 201, thereby operating relay 206 which in turn operates relay 207. Relay 207 closes its contacts 208 thereby connecting the sleeve of jack 203 to the sleeves of jacks 201 and 202, and thus jacks 202 and 203 will test busy as long as the plug is in jack 201. Relay 207 also closes its contacts 209 thereby operating relay 210 which opens its contacts 246 thereby releasing relays 245, 249 and 241 and extinguishes the line lamp 278. Relays 224 and 269, however, do not release as they are held operated by ground connected at the lowermost contacts of relay 107.

Disconnection by either operator restores the circuit, at that end of the line, to normal.

What is claimed is:

1. In a selective signaling system, a line, a plurality of operators' positions at one end of said line, a corresponding number of jacks connected in multiple to the other end of the line, a signal device at each of said positions, an operator's cord circuit adapted to cooperate with any one of said jacks, a generator of voice frequency alternating current having an output circuit, means responsive to the connection of said cord circuit with one of said jacks to momentarily connect said output circuit to the line and thereafter prevent its reconnection during the period the cord is connected to the jack, a second source of alternating current of a different frequency adapted to be connected to said line when said cord circuit is connected to an-

other of said jacks, means at the other end of the line responsive to the momentary transmission thereof of said voice frequency current to energize one of said signal devices, and means responsive to transmission of said different frequency to energize another of said signal devices.

2. In a selective signaling system, a line, a plurality of operators' positions at one end of said line, a corresponding number of jacks connected in multiple to the other end of the line, a signal device at each of said positions, a plurality of sources of alternating current of different frequency corresponding in number to the number of signal devices, an operator's cord circuit at the jack end of said line, means automatically responsive to the connection of said cord circuit to one of said jacks to momentarily connect one of said frequency sources thereto and thereafter prevent its reconnection during the period the cord is connected and means responsive to connection of said cord circuit to another of the jacks to connect another of said frequency sources to the line, translating means at the other end of the line individual and responsive to each of said different frequencies, and means individually responsive to operation of each of said translating means to selectively actuate a different one of said signal devices.

3. In a selective signaling system, a two-way ring-down toll line, a plurality of answering jacks connected in multiple to said line at each end thereof, a corresponding number of calling jacks connected in multiple to each end of said line, a line lamp associated with each answering jack, different frequency sources of alternating current at each end of the line individual to each line lamp at the other end of the line, an operator's cord circuit at each end of the line adapted to be connected to any one of said jacks thereat, means automatically responsive to the connection of a cord circuit to any one of said calling jacks to selectively cause the momentary connection of a particular source to the line, and thereafter prevent any of said frequency sources from being connected, translation means at each end of the line individual and responsive to each of said different frequencies at the other end of the line, means individually responsive to operation of each of said translation means to selectively light the line lamp corresponding to the particular frequency transmitted, and means responsive to the connection of a cord circuit to the answering jack corresponding to the lighted lamp to prevent a different frequency transmitted over the line from lighting another line lamp at that end.

4. In a selective signaling system, a line, a plurality of operators' positions at one end of said line, a corresponding number of jacks connected in multiple to the other end of the line, a signal device at each of said positions, an operator's cord circuit adapted to cooperate with any one of said jacks, a generator of voice frequency alternating current adapted to have its output circuit connected to said line, means including a

selector switch responsive to the connection of said cord circuit with one of said jacks to momentarily connect said output circuit to the line and thereafter prevent its reconnection during the period the cord is connected to the jack, a second source of alternating current of a different frequency, and other means including said same selector switch adapted to connect the second source to said line when said cord circuit is connected to another of said jacks, means at the other end of the line responsive to the momentary transmission thereof of said voice frequency current to energize one of said signal devices, and means responsive to the transmission of said different frequency to energize another of said signal devices.

5. In a selective signaling system, a toll line, two operators' positions at one end of said line, a signal device at each of said positions, a source of alternating current below the voice frequency range, and a source within the voice range, means for selectively connecting either one of said sources to the line, translating means associated with said line individual and responsive to each of said different frequencies, means individually responsive to said translating means to selectively energize said signal devices, and other means operated by the response of either translating means to dissociate the voice frequency translating means from the line.

6. In a selective signaling system, a two-way ring-down toll line, a plurality of answering jacks connected in multiple to said line at each end thereof, a corresponding number of calling jacks connected in multiple to each end of said line, a line lamp associated with each answering jack, a source of voice frequency alternating current and a source of alternating current of a frequency below the voice range at each end of the line, each of said sources being individual to one of the line lamps at the other end of the line, an operator's cord circuit at each end of the line adapted to be connected to any one of said jacks thereat, means automatically responsive to the connection of a cord circuit to any one of said calling jacks to selectively cause the momentary connection of a particular source to the line and prevent another frequency source from being connected, translation means at each end of the line, individual and responsive to each of said different frequencies at the other end of the line and means individually responsive to operation of each of said translation means to selectively light the line lamp corresponding to the particular frequency transmitted, means in each end of the line for disabling the voice frequency translation means thereat, said means at an answering end being operated by the response of either translating means thereat and the corresponding means at a calling end being operated in response to connection of the cord circuit to either calling jack.

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