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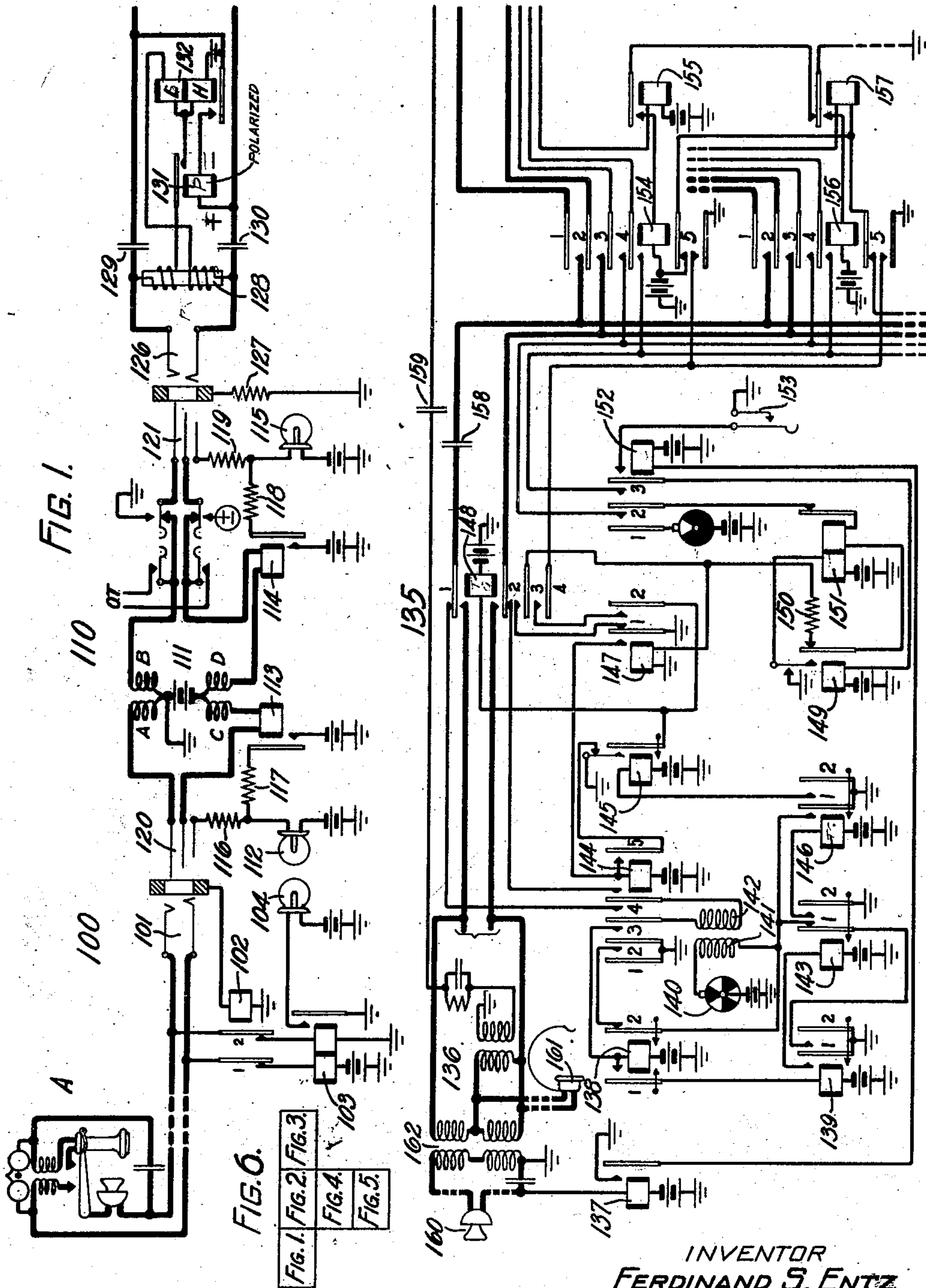
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1,763,036

TRUNKING SYSTEM

Filed Aug. 31, 1928

6 Sheets-Sheet 1



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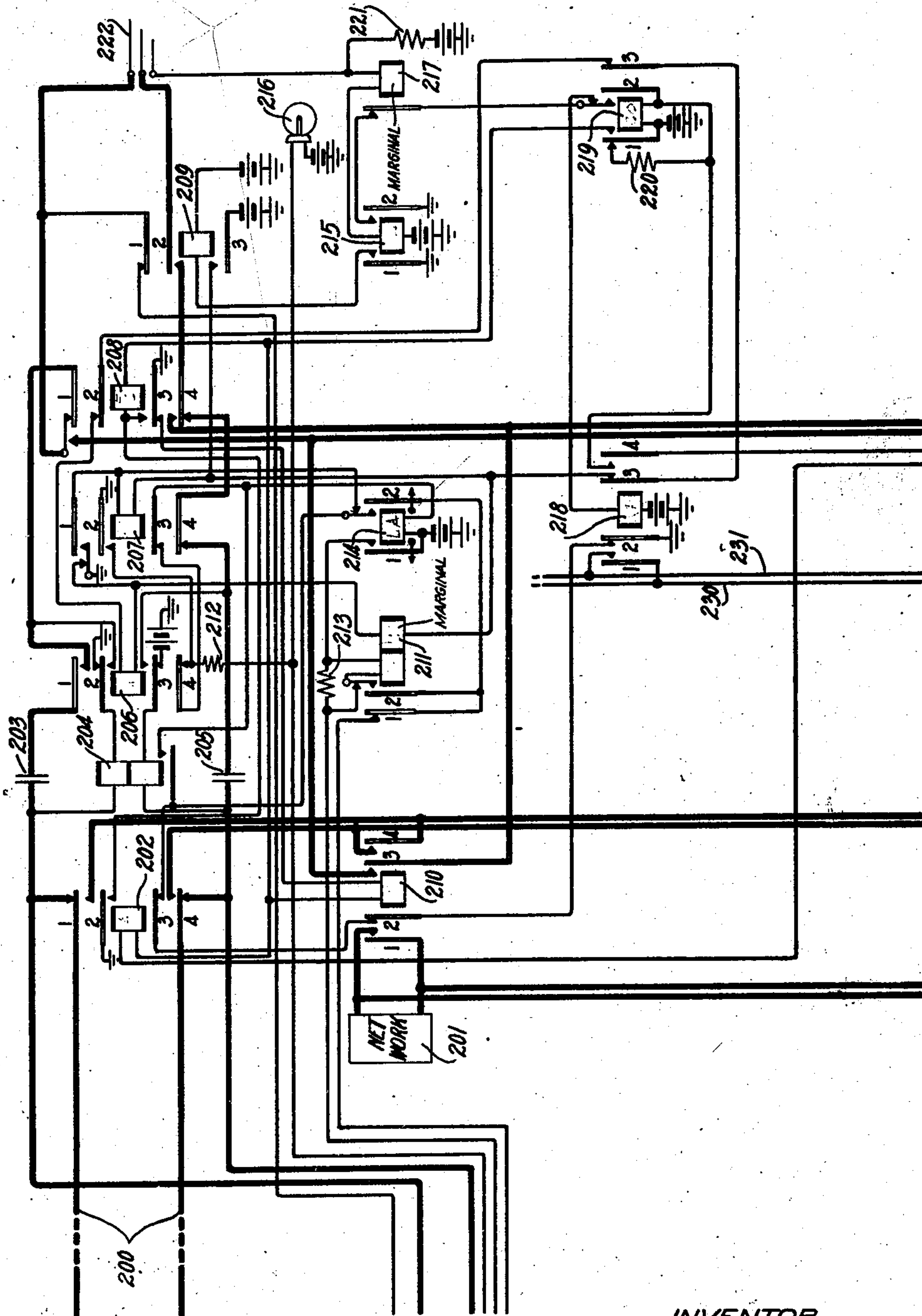
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FIG. 2.



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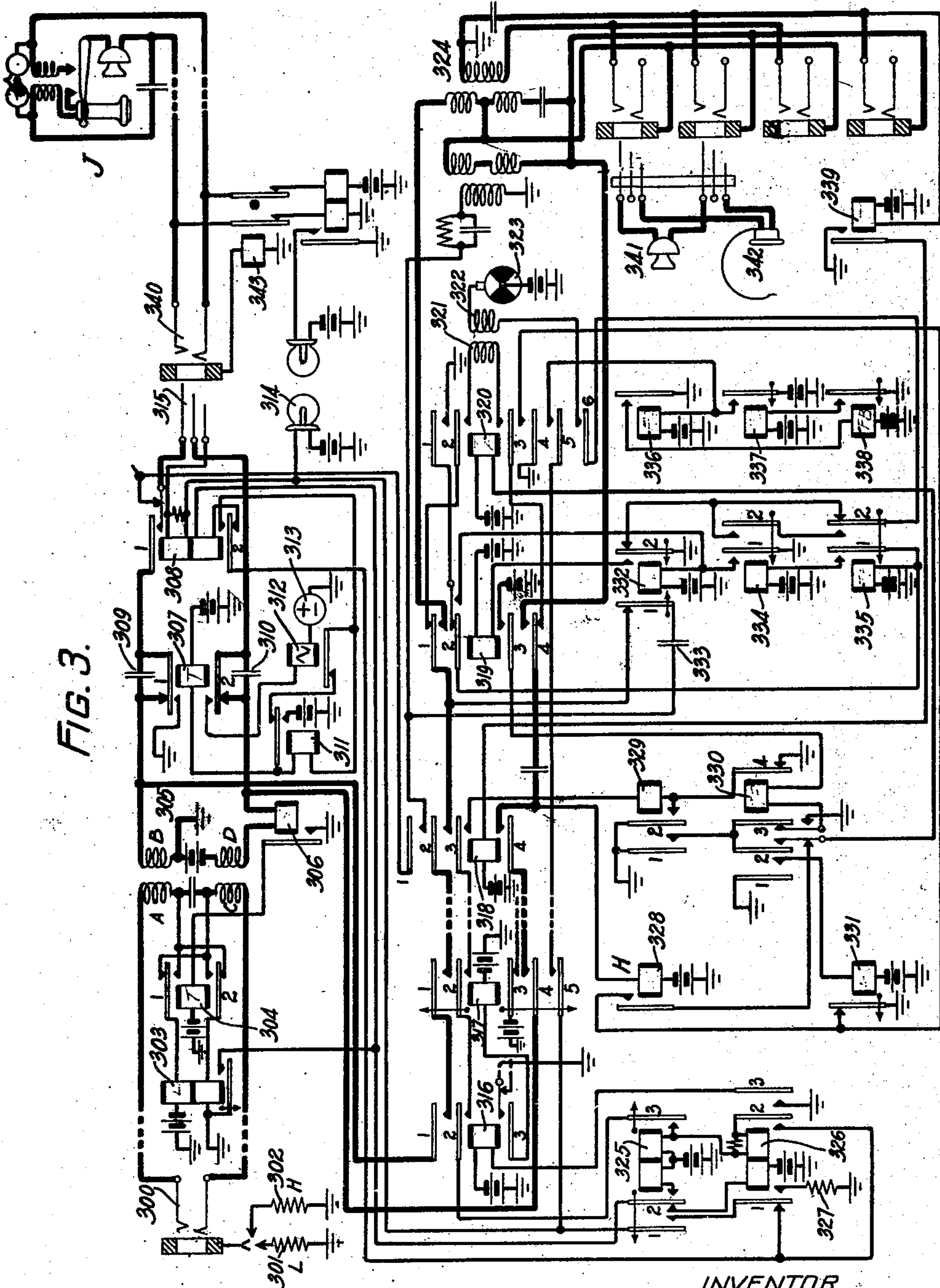
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TRUNKING SYSTEM

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6 Sheets-Sheet 3



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TRUNKING SYSTEM

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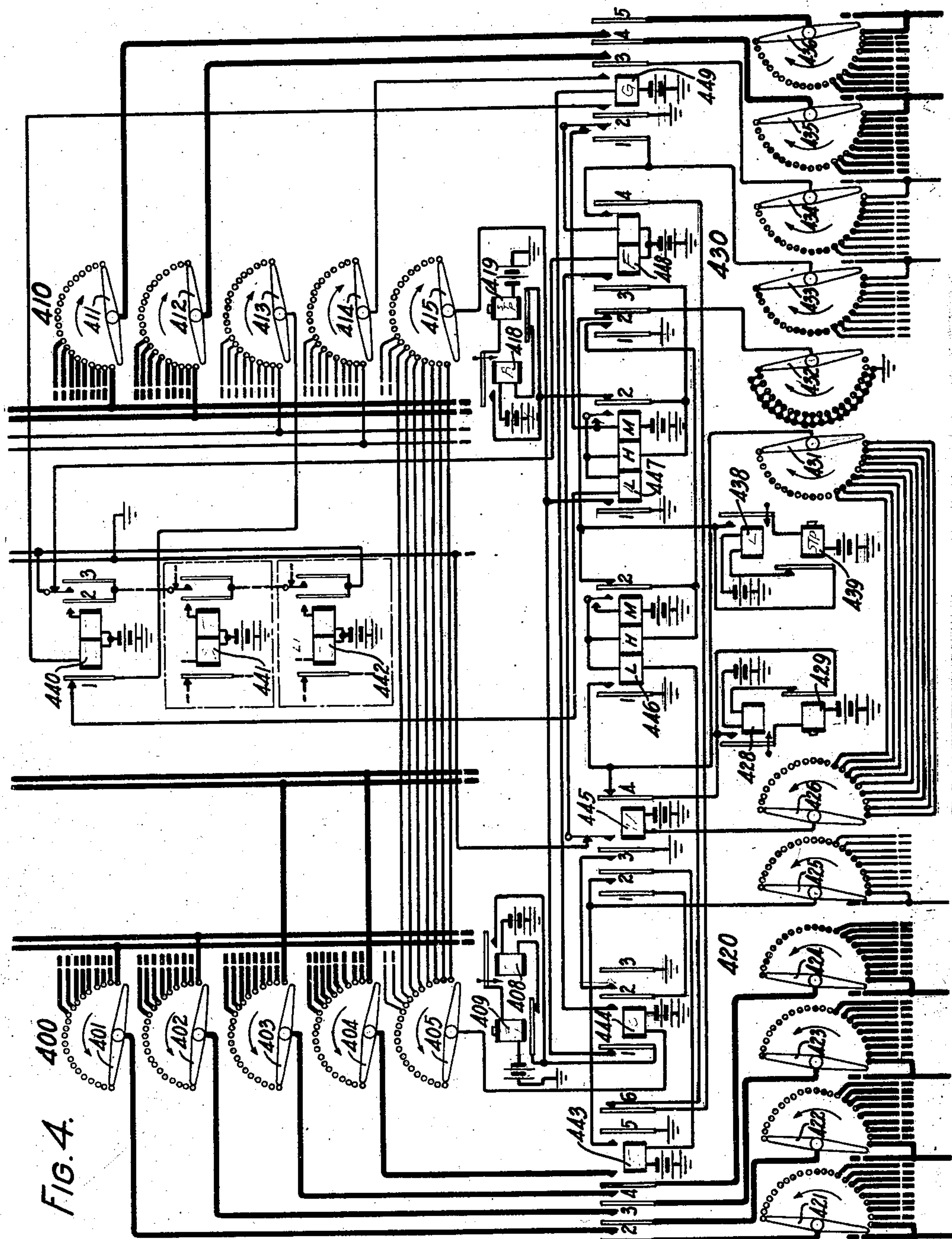


FIG. 4.

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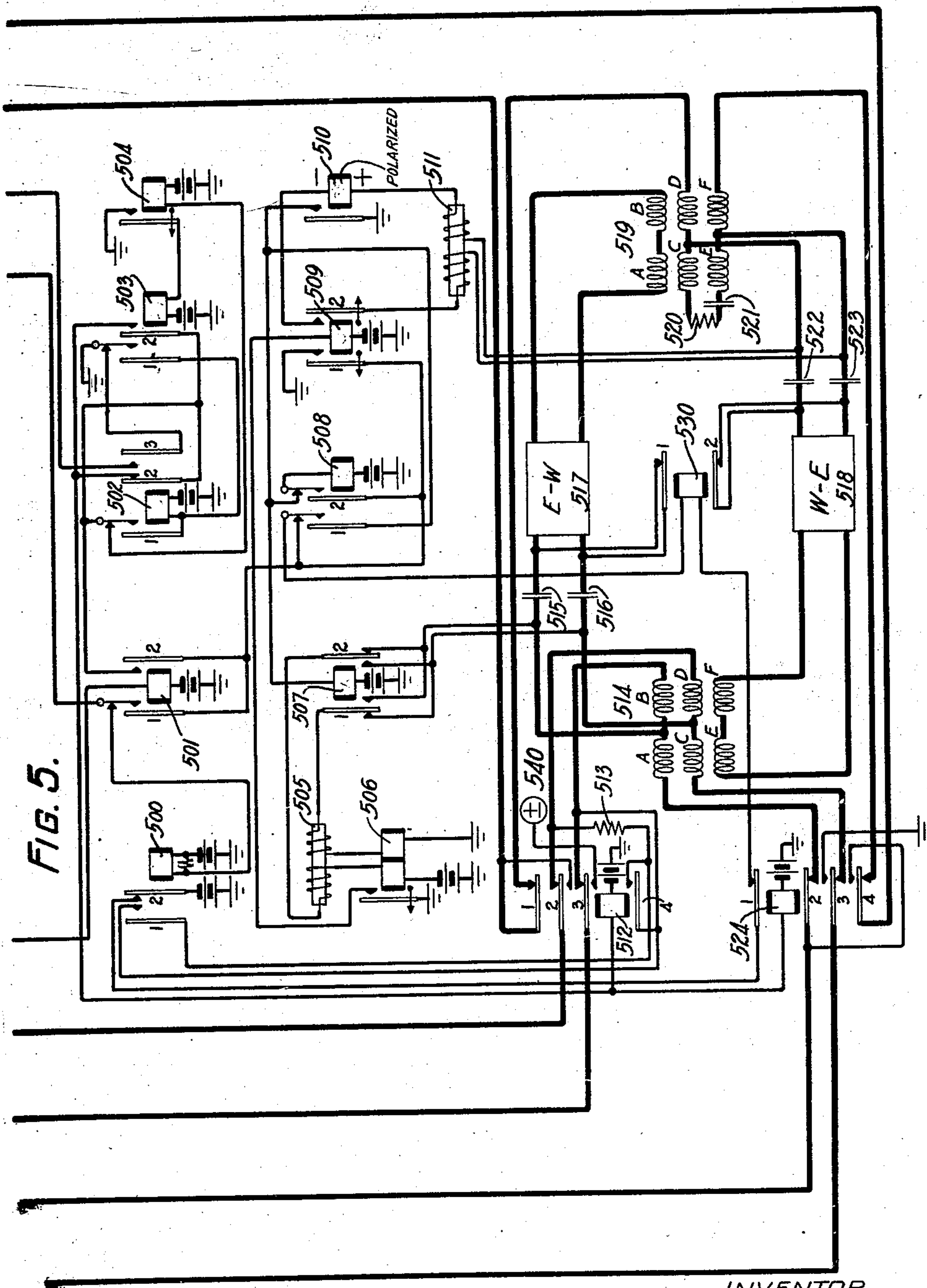
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TRUNKING SYSTEM

Filed Aug. 31, 1928

6 Sheets-Sheet 5



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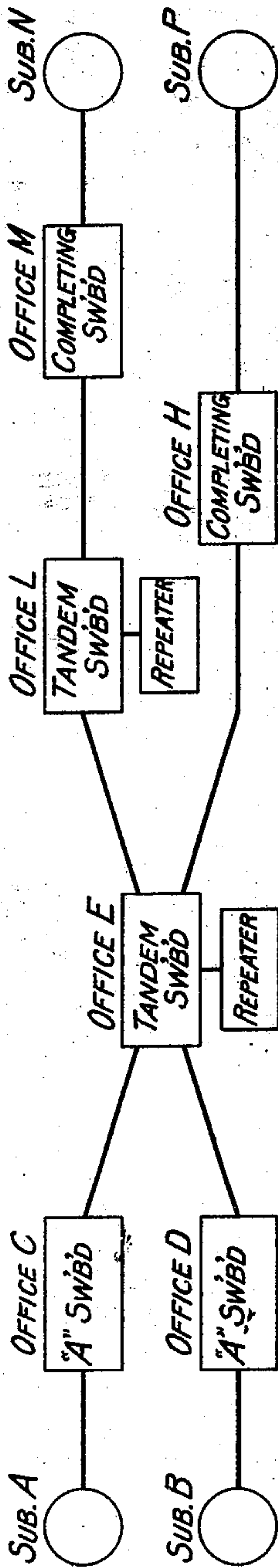
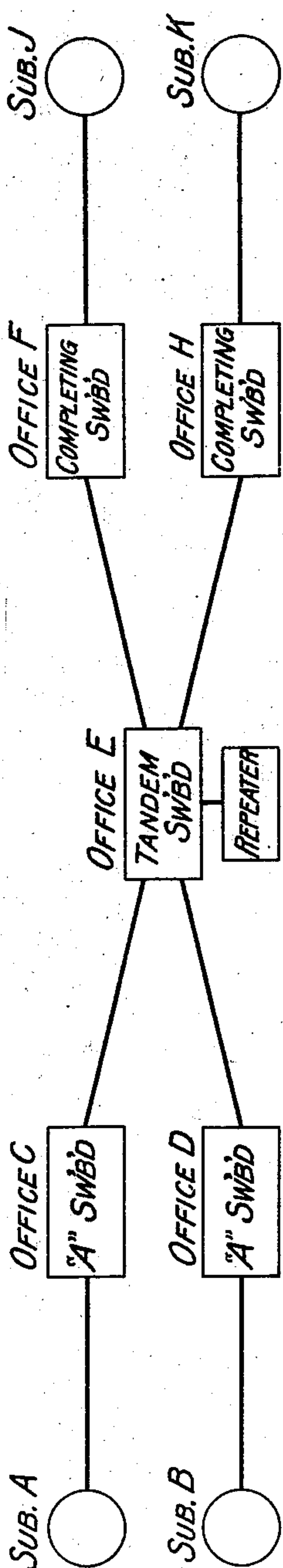
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TRUNKING SYSTEM

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FIG. 7.



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TRUNKING SYSTEM

Application filed August 31, 1928. Serial No. 303,161.

The present invention relates to a trunking system in which a telephone connection is built up by the interconnection of trunks at various telephone offices. More specifically, it relates to a trunking system wherein repeaters may be automatically added at certain offices as the telephone connection is built up.

The object of this invention is to provide an improved system of tandem straightforward long distance trunking.

One embodiment of the present invention comprises an arrangement in the trunks of the tandem trunk telephone office for automatically determining the character of trunks extended to another office in order that a repeater may be inserted in series with the trunk conductors if the trunk is of a character to require it. The operator at the tandem office is given the destination of the trunk connection by another operator and connects the terminating end of the tandem trunk to an outgoing trunk extending to the desired office. Responsive to this connection, the character of the outgoing trunk is determined by discriminating apparatus in the tandem trunk circuit. In response to one operation of this discriminating apparatus an idle repeater is selected from a group of repeaters and inserted in series with the conductors of the tandem trunk, and in response to another operation of the discriminating apparatus the trunk connection is made without the addition of a repeater.

Another embodiment of the invention resides in the combination of the repeater selecting arrangement with automatic listening circuits at the tandem offices and at the completing trunk offices to which the trunks are ordinarily extended from the tandem office. Responsive to the selection of a trunk to a tandem office by a subscriber's switchboard operator, the operator's telephone set at a tandem switchboard is automatically associated with the selected trunk. Three short impulses of tone are transmitted as a signal to the subscriber's operator that a tandem operator's telephone set is connected to the trunk. The name of the required completing office is then transmitted to the tandem op-

erator who selects an outgoing trunk extending to that office or to a second tandem office. Assuming that a repeater is required for the outgoing trunk a selection is made and the repeater connected in series with the trunk conductors. This trunk may at times be extended to a second tandem office in which case the telephone set at the second tandem office is automatically connected to the trunk in response to the selection of the repeater at the preceding tandem office. Three short impulses of tone are again transmitted to the subscriber's operator and the name of the required completing office is repeated by the subscriber's operator. If a repeater is required for the trunk extending from the second tandem office, it is selected upon the operation of the discriminating apparatus. In any event, the insertion of the repeater in the trunk at a tandem office causes a telephone set at the succeeding office to be associated with the trunk conductors. When the succeeding office is a tandem completing trunk office two short impulses of tone are transmitted from the completing trunk position to the subscriber's operator as a signal that the operator is prepared to receive the wanted subscriber's station designation. This designation is transmitted through one or more selected repeaters, depending upon the number of tandem offices through which the trunk is extended.

This invention has been illustrated in the accompanying drawings in which:

Fig. 1 in its upper portion shows a subscriber's station connected with a well known line circuit, a subscriber's operator's cord circuit and an outgoing trunk extending to a tandem switchboard. In the lower portion of this figure the part of the tandem switchboard circuit and apparatus is shown which automatically connects the tandem operator's telephone set to the selected trunk.

Fig. 2 illustrates the tandem position apparatus and circuits including means for determining the character of outgoing trunks and initiating the selection of a repeater.

Fig. 3 illustrates a tandem completing trunk circuit and a line circuit associated with a subscriber's station.

Fig. 4 shows a plurality of switches for finding the trunk circuit over which the connection has been established and for selecting an idle repeater. Control relays are also shown in this figure.

Fig. 5 shows a repeater and associated control relays which are used for supervisory purposes.

Fig. 6 shows the arrangement of drawings forming part of this specification.

Fig. 7 shows the arrangement of offices in the trunking system.

The apparatus disclosed in the foregoing drawings is of a type well known in the art and does not require explanation.

Let it be assumed that a subscriber at station A wishes to be connected with the subscriber at station J which connection requires the line to be extended through a tandem switchboard. The removal of the receiver at station A operates line relay 103 to light lamp 104. The subscriber's switchboard operator thereupon inserts plug 120 of cord circuit 110 into the line jack 101. A circuit is thus established for cut-off relay 102 from ground, through its winding, sleeve of jack 101, sleeve of plug 120, resistance 116 to battery through lamp 112 and through resistance 117 and the contact of relay 113. Relay 113 operates when plug 120 is inserted in jack 101 over the subscriber's loop, therefore, lamp 112 is not lighted at this time since the current flow through its filament is shunted by resistance 117. The subscriber's switchboard operator requests the station call from subscriber A and upon finding that a tandem connection is required inserts plug 121 into jack 126. A circuit is thus established for lighting lamp 115 and operating relay 132. The circuit for lamp 115 is obvious and need not be traced. The circuit for relay 132 extends from ground, through its low resistance and high resistance windings, lower winding of coil 128, ring of jack 126 and plug 121, winding of relay 114, winding D of repeating coil 111 to battery. Relay 114 is not operated in the circuit traced and therefore lamp 115 remains lighted. The operation of relay 132 establishes a bridge across trunk 200 which extends to the tandem operator's position circuit. This bridge furnishes an operating circuit for relay 204 which may be traced from ground, through normal contact 2 of relay 206, upper winding of relay 204, normal contact 1 of relay 202, tip conductor of trunk 200, contact of relay 132, winding of polarized relay 131, ring conductor of trunk 200, normal contact 4 of relay 202, lower winding of relay 204 to battery through normal contact 3 of relay 206. Polarized relay 131 does not operate in the circuit traced since the current flow is in the wrong direction for its operation. The operation of relay 204 establishes a circuit for operating relay 214 from ground, through the normal contact 2 of re-

lay 218, normal contact 2 of relay 210, normal contact 3 of relay 202, contact of relay 204, winding of relay 214 to battery. The operation of relay 204 also establishes a circuit for lighting lamp 216 which may be traced from battery through the lamp filament, resistance 212, normal contact 4 of relay 206, normal contact 3 of relay 207, contact of relay 204, normal contact 3 of relay 202, normal contact 2 of relay 210 to ground through normal contact 2 of relay 218. The operation of relay 214 establishes a circuit for relay 155 which may be traced from battery, through the winding of relay 155, normal contact 1 of relay 211, contact 2 of relay 214, normal contact 3 of relay 202, normal contact 2 of relay 210 to ground through normal contact 2 of relay 218. The operation of relay 155 establishes an obvious circuit for relay 154. The circuit for relay 154 is, however, established through a train of contacts on relays similar to relay 155. A plurality of trunks such as shown in Fig. 2 are used in each trunk switchboard position. Since these trunks are arranged for automatic listening some means such as the chain of relays represented by relays 155 to 157 must be used to prevent more than one trunk circuit being associated with telephone circuit 136 at the same time.

Whenever an operator is directing the work at a tandem position her headset constituting transmitter 160 and receiver 161 is connected through jacks with the telephone set 136. A circuit for operating relay 137 is thus established through transmitter 160 to ground through the left windings of induction coil 162 and the operation of relay 137 establishes an obvious circuit for operating relay 152. The operation of relay 154 thus establishes a circuit for operating relay 147 which may be traced from ground, through the winding of relay 147, resistance 150, normal contact of relay 149, right winding and contact of relay 151, contact 2 of relay 152, contact 4 of relay 154, resistance 213 and left winding of relay 211 in multiple to battery, through contact 1 of relay 214.

At this point in the operation three short impulses of tone are transmitted to the subscriber's operator as a signal that the telephone set of the tandem trunk operator is associated with trunk 200 and that the office designation may be transmitted to the tandem operator. The operation of relay 147 establishes an obvious operating path for relay 144 which locks to ground through its contact 5 and the normal contact of relay 145. The operation of relay 144 connects winding 142 of the tone transformer through contacts 3 and 4 of relay 144 and normal contacts 1 and 2 of relay 148 to the conductors of trunk 200. A circuit is established at the same time through the primary winding 141 of the tone transformer which may be traced

from battery, through the constantly rotating interrupter 140, winding 141, normal contact 2 of relay 138 to ground through contact 1 of relay 144. The tone generated in this circuit is transmitted by induction into winding 142 and thence to the subscriber's operator. A circuit is also established from ground, through contact 2 of relay 144 for operating relay 138. The latter relay is slow to operate which permits an impulse of tone to be transmitted over the trunk before its operation. The operation of relay 138 opens the circuit through the primary winding of the tone transformer for terminating the first impulse of tone which is known as a zip tone. A circuit is also established for operating relay 139 from battery, through its winding, contact 1 of relay 138 to ground through contact 2 of relay 144. Relay 139 is slow to operate in order to leave the proper open period between the periods that tone is associated with the trunk. Relay 139 again establishes a circuit through the primary winding of the tone transformer which may be traced from ground, through contact 2 of relay 139, normal contact 1 of relay 143, winding 141 to battery through interrupter 140. An obvious circuit is also established for the operation of relay 143 which is slow to operate for permitting the transmission of the second zip tone. The operation of relay 143 opens the circuit through the primary winding 141 and establishes an obvious circuit for operating relay 146. This relay is also slow to operate for permitting an open period between the second and third zip tones. The operation of relay 146 again establishes the circuit through the primary winding 141 of the tone transformer and also establishes an operating circuit for slow operating relay 145. The third zip tone is transmitted before the operation of relay 145 which opens the holding circuit for relay 144 to disconnect the secondary winding of the tone transformer from the trunk. The operation of relay 145 also establishes an obvious operating circuit for relay 148 which associates the tandem operator's telephone circuit 136 with the subscriber's operator's telephone circuit connected to cord circuit 110. Relay 148 locks through its contact 4 to ground at contact 5 of relay 154. The subscriber's operator thereupon furnishes the tandem operator with the office name to which the tandem trunk must be connected. The tandem operator immediately inserts plug 222 into the jack of a trunk which is extended by trunk conductors to the proper completing trunk office. As soon as the tandem operator has received the office name the emergency key 153 may be operated for immediately dissociating the telephone set from the trunk. A circuit is thus established through contact 3 of relay 152 for operating relay 149. The operation of relay 149 establishes an obvious

circuit through the left winding of relay 151 to cause the operation of relay 151 for releasing relay 147 and disconnecting the trunk circuit from the common telephone apparatus. Relay 145 is held in an operated position until the train of relays 138, 139, 143 and 146 release. These relays are slow releasing as well as slow operating and sufficient time elapses for the transmission of the office name before the release of relays 145 and 148. If key 153 is not operated the release of relay 148 awaits the operation of other apparatus hereinafter described.

Upon the insertion of plug 222 in the jack 300 relay 215 or relays 217 and 215 operate depending upon whether jack 300 is connected to a long trunk requiring a repeater or a short trunk which does not require a repeater. Let it be assumed that the trunk associated with jack 300 is of sufficient length to require the insertion of the repeater. The sleeve of jack 300 is connected to the high resistance 302 for discriminating purposes in order to prevent the operation of relay 217 and cause the operation of relay 215. An obvious circuit for operating relay 209 is established through contact 1 of relay 215. The operation of relay 209 operates relay 211 for opening the operating circuit for relay 155. The circuit for relay 211 may be traced from battery, through contact 3 of relay 209, right winding of relay 211 to ground through normal contact 1 of relay 207. The release of relay 155 releases relays 154 and 148. The release of relay 148 disconnects the trunk from the common telephone apparatus. Contact 2 of relay 209 does not establish any circuit at this time. Relay 215 in addition to establishing a circuit for relay 209 establishes a circuit for operating relay 218 which may be traced from ground at contact 2 of relay 215, normal contact of relay 217, normal contact 2 of relay 219 to battery through the winding of relay 218. The operation of relay 218 opens the circuit for lamp 216 extinguishing the lamp and also opens the operating circuit for relay 214 to cause its release. A circuit is also established by the operation of relay 218 for marking a terminal on switch 410 which may be traced from battery, through the winding of relay 219 in multiple with resistance 220, contact 4 of relay 218 to a terminal associated with brush 413. The terminal on switch 410 representing the tandem trunk is thus designated for connection to a repeater. Conductors 230 and 231 are connected together at contact 1 of relay 218 for starting the operation of the link circuit, Fig. 4. Relay 448 is operated in this circuit which circuit may be traced from battery, through the left winding of relay 448, normal contact 3 of relay 440, conductor 231, contact 1 of relay 218 to ground connected to conductor 230. The relays 440, 441 and 442 are representative of a chain of relays for

distributing the trunk connections to idle links.

The operation of relay 448 establishes circuits for successively energizing switches 410, 400, 430 and 420 for associating an idle repeater with the trunk circuit shown in Fig. 2 and thus interconnecting the repeater between the calling and the called lines. The operation of relay 448 establishes an energizing path for relay 418 which may be traced from battery, through the winding of the latter relay, normal contact of switch magnet 419, normal contact 2 of relay 447, contact 3 of relay 448, normal contact 3 of relay 445 to ground connected to conductor 230. The energization of relay 418 establishes an operating circuit for switch stepping magnet 419 over the operating path for relay 418 excluding the contact of magnet 419. When the stepping magnet 419 attracts its armature the circuit for relay 418 is opened which causes its release. The release of relay 418 causes the release of magnet 419 advancing the brush assembly of switch 410 one position. The operation and release of relay 418 and stepping magnet 419 continue until the marked terminal is associated with brush 413. It will be noted that the first terminal of switch 410 is connected to the trunk conductors. Thus brush 413 is associated with battery extending from relay 219 as previously traced when it has taken one step.

The association of battery with brush 413 establishes a circuit for operating relay 447 which may be traced from the battery on the terminal associated with brush 413, through the normal contact 1 of relay 440, low resistance winding and high resistance winding of relay 447, contact 3 of relay 448, normal contact 3 of relay 445 to ground connected to conductor 230. A locking circuit is established for relay 447 from battery, through its winding M and contact 2, through contact 3 of relay 448, normal contact 3 of relay 445 to ground connected to conductor 230.

The combination of contacts assembled as contact 2 of relay 447 is such that the ground from conductor 230 is extended through the low resistance winding of relay 447, normal contact 1 of relay 440, brush 413 and its associated contact, contact 4 of relay 218 to battery through the winding of relay 219 which causes the operation of the latter relay. Relay 219 locks through its contact 2 to ground at contact 2 of relay 215. The operation of relay 219 also opens the operating circuit for relay 218 which causes the release of the latter relay. A circuit is also established at this time for the operation of relay 210 which may be traced from battery, through contact 1 of relay 219, winding of relay 210 to ground at normal contact 3 of relay 208. Relay 210 does not serve any purpose at this time but later is used for es-

tablishing circuits for a switch contact cleaning circuit arrangement.

The operation of relay 447 opens the energizing circuit for relay 418 and magnet 419 and establishes a circuit for the operation of relay 408. This latter circuit may be traced from ground through contact 1 of relay 447, normal contact 1 of relay 444, normal contact of the stepping magnet 409 to battery through the winding of relay 408. The operation of relay 408 establishes an operating circuit for magnet 409 which may be traced from battery, through the stepping magnet, contact of relay 408 and thence to ground at relay 447 as previously traced. The operation of magnet 409 opens the operating circuit for relay 408 causing its release. The release of relay 408 opens the energizing circuit for magnet 409 causing its release which advances the brush assembly of switch 400 one step. It will be noted that ground through contact 1 of relay 447 is connected to brush 415 which is associated in position 1 with position 1 of brush 405. Therefore, when the switch 400 has taken one step a circuit is established for relay 444. The operation of relay 444 opens the energizing circuit for relay 408 and magnet 409 and switch 400 is brought to rest after it has taken one step.

Simultaneous with the operation of switch 410 a circuit is established for the operation of switch 430. Relay 438 is operated from a circuit extending from battery, through its winding and the contact of magnet 439 to ground at contact 1 of relay 448. The operation of relay 438 establishes a circuit for stepping magnet 439 which may be traced from battery, through the winding of the magnet, contact of relay 438 to ground at contact 1 of relay 448 as previously traced. Relay 438 and magnet 439 alternately operate and release to rotate the brush assembly of switch 430 in search of an idle repeater. An idle repeater is characterized by battery connected to the terminal associated with brush 433. It will be noted that this battery is supplied through the winding of relay 500 and normal contact 1 of relay 501. The circuit arrangement shown is such that the switch 430 encounters an idle repeater on the first terminal. At this time the circuit through relay 500 is extended to brush 433, contact 4 of relay 448, normal contact 6 of relay 443, low resistance and high resistance windings of relay 446 to ground at contact 1 of relay 448. Relay 446 operates in the circuit traced and opens at its contact 2 the circuit for relay 438 and stepping magnet 439. Relay 500 also operates in the circuit traced which establishes a circuit through its contact 1 for energizing relay 506. This circuit may be traced from battery, through the left winding of relay 506, left winding of coil 505, normal contact 2 of relay 507, wind-

ing B of coil 514, contact 1 of relay 500, resistance 513, winding D of coil 514, normal contact 1 of relay 507, right-hand winding of coil 505, right-hand winding of relay 506 to ground. The operation of relay 506 establishes an obvious circuit for the operation of relay 509. Relay 509 performs no function at this time.

The operation of relay 446, in addition to the above, establishes a circuit for energizing relay 428 from battery, through the winding of the latter relay, normal contact of magnet 429, normal contact 4 of relay 445 to ground through contact 1 of relay 446. The operation of relay 428 establishes an energizing circuit for magnet 429 from battery, through the magnet winding, contact of relay 428 to ground as previously traced, to contact 1 of relay 446. The operation of the stepping magnet opens the circuit for relay 428 which releases and in releasing opens the circuit for the stepping magnet 429. The release of the stepping magnet advances the brush assembly of the switch 420 one step where brush 425 is associated with battery through the winding of relay 501 and brush 426 is associated with ground through brush 431 and contact 1 of relay 446. The latter connection establishes an operating circuit for relay 445 which opens the energizing circuit for relay 428 and magnet 429. Relay 443 now operates over a circuit from battery, through its winding, contact 2 of relay 445 to ground at contact 3 of relay 444. The operation of relay 443 establishes a circuit for the operation of relay 449 which circuit may be traced from battery, through the winding of relay 449, contact 2 of relay 444, contact 1 of relay 445 to ground through contact 5 of relay 443. The ground from contact 5 of relay 443 is also extended through brush 425 to battery through the winding of relay 501 which operates relay 501.

Both ends of an idle repeater have now been selected by switches 420 and 430 which have been connected through the brush members and associated contacts of switches 400 and 410 to the trunk circuit. A number of circuits are established by the operation of relay 501 one of which places relay 448 under the control of the repeater circuit. This circuit may be traced from ground, through contact 1 of relay 509, contact 1 of relay 501, brush 433 and its associated contact, contact 1 of relay 449 to battery through relay 448. It will be noted that the operation of relay 449 establishes through its contact 2 an operating circuit for relay 440. The operation of relay 440 opens the original energizing circuit through the left winding of relay 448. This relay would therefore have released if a circuit were not established through its right winding. Relay 500 releases upon the operation of relay 501. A circuit for relay 506 ex-

tending through contact 1 of relay 500 is thus opened. A second circuit is, however, established for relay 506 which extends through brushes 423 and 424, contacts 3 and 4 of relay 443, brushes 403 and 404 and contact 4 of relay 210 which latter relay was operated upon the operation of relay 219. A circuit for the operation of relays 512 and 524 was also established through the contacts of relay 501 which may be traced from battery, through the windings of relays 512 and 524, normal contact 2 of relay 502, contact 2 of relay 501 to ground through contact 1 of relay 509. The circuit for relay 506 is again changed upon the operation of relay 512 and now extends through resistance 513 and contact 4 of the latter relay.

The contacts of brushes such as used with step-by-step switches 400, 410, 420 and 430 very often become dirty from oxidation or the accumulation of dust particles which forms an effective resistance that would cause an unbalance of the line. In order to eliminate this contact resistance a comparatively high potential is transmitted over a circuit which extends through the brush members and associated contacts that are connected with the talking conductors. This circuit is established immediately following the operation of relays 501, 512 and 524 and may be traced from alternating current source 540, through contact 3 of relay 512, brush 423 and its associated contacts, contact 3 of relay 443, brush 403 and its associated contact, contact 4 of relay 210, brush 404 and its associated contact, contact 4 of relay 443, brush 424 and its associated contact, contact 2 of relay 512, brush 435 and its associated contact, contact 4 of relay 449, brush 412 and its associated contact, contact 3 of relay 210, brush 411 and its associated contact, contact 5 of relay 443, brush 436 and its associated contact, contact 4 of relay 524, brush 422 and its associated contact, contact 2 of relay 443, brush 402 and its associated contact, contact 1 of relay 210, brush 401 and its associated contact, contact 1 of relay 443, brush 421 and its associated contact to ringing ground through contact 3 of relay 424. A plurality of relays are operated to control the timing of the application of the high potential for cleaning the brush contacts. Relay 504 is operated from battery, through its winding, normal contact 1 of relay 502, contact 2 of relay 501 to ground at contact 1 of relay 509. The operation of relay 504 establishes an obvious circuit for the operation of relay 503 and the operation of relay 503 establishes an obvious operating circuit for relay 502. Relay 502 establishes a locking circuit for itself through its contact 1 and contact 2 of relay 501 to ground at contact 1 of relay 509. Relay 502 opens the energizing circuit for relay 504 and the original energizing circuit for relays 512 and 524. A second circuit is, however, established for

relays 512 and 524 through contact 2 of relay 503 and remains established until slow release relay 504 releases relay 503. Relay 504 is carefully designed to release within a predetermined time and thus cause the release of relay 503 after the switch contacts have been thoroughly cleaned. With relay 502 operated and relay 503 released the energizing circuit for relays 512 and 524 is opened to cause their release which disassociates the ringing current source from the switch brushes.

At this time a circuit is established for relay 530 from battery, through normal contact 2 of relay 500, normal contact 1 of relay 524, winding of relay 530, normal contact 1 of relay 508 to ground through contact 1 of relay 509. Relay 530 is operated at this time to open the repeater for use in connection with the completing trunk operator's telephone circuit, Fig. 3. A circuit is further established at this time for the operation of relay 202, Fig. 2, which circuit may be traced from battery, through contact 1 of relay 219, winding of relay 202, brush 414 and its associated contact, contact 3 of relay 449, brush 434 and its associated contact, contact 3 of relay 502 to ground through normal contact 1 of relay 503. The operation of relay 202 establishes a circuit for operating relay 208 which may be traced from battery through contact 1 of relay 219, winding of relay 208 to ground through contact 2 of relay 202. The operation of relay 208 opens the energizing circuit for relay 210 which causes the release of the latter relay. Relay 208 also establishes a locking circuit for itself from ground, through its contact 3 and winding to battery through contact 1 of relay 219.

The repeater is now included in the trunk and the extension carried forward through plug 222 and jack 300 to the tandem completing trunk switchboard. Apparatus at the latter switchboard is now operated to automatically associate a position operator's telephone set with the trunk conductors. A circuit is established for the operation of relay 303 from battery, through its upper winding, normal contact 1 of relay 304, winding C of coil 305, ring of jack 300 and plug 222, contact 2 of relay 209, contact 4 of relay 208, brush 411 and its associated contact, contact 5 of relay 449, brush 436 and its associated contact, normal contact 4 of relay 524, winding F of coil 519, left winding of coil 511, contact 2 of relay 509, winding of relay 510, right winding of coil 511, winding D of coil 519, normal contact 1 of relay 512, brush 435 and its associated contact, contact 4 of relay 449, brush 412 and its associated contact, contact 1 of relay 208, tip of plug 222 and jack 300, winding A of coil 305, normal contact 2 of relay 304 to ground through the lower winding of relay 303. The operation of relay 303 establishes a circuit for relay 326 from ground, through the contact of relay

303, normal contact 2 of relay 325, left winding of relay 326 to battery. The operation of relay 326 establishes an operating circuit for relay 325 and a holding circuit for relay 326 which may be traced from battery, through the right windings of relay 325 and 326, contact 2 of relay 326, normal contact 2 and lower winding of relay 308 to ground through the contact of relay 303. Relay 308 does not operate in the circuit traced. Relay 325 in operating establishes a locking circuit for itself from battery, through its left winding and contact 2 to ground through the contact of relay 303. The circuit through the left winding of relay 326 is opened by the operation of relay 325. A circuit is now established for lighting lamp 314 which may be traced from battery, through the lamp filament, contacts 1 of relays 325 and 326, to ground through resistance 327. A circuit is also established at this time for relay 316 through contact 3 of relay 326. The operation of relay 316 establishes an obvious circuit for relay 317. Relays 316 and 317 are in a train of relays arranged to permit the association of only one call at a time with the common apparatus of the trunk circuit including the operator's telephone head set.

Whenever the operator is at the switchboard position, transmitter 341 and receiver 342 are associated with the telephone set 324. A circuit is thus established for relay 339 which is used in place of the retardation coil ordinarily a part of the telephone circuit. The operation of relay 339 establishes an obvious circuit for the operation of relay 318. Thus relays 339 and 318 are normally operated when the telephone operator is at the switchboard position. The operation of relays 316 and 317 therefore closes a circuit for relay 329 which may be traced from ground, through the normal contact 4 of relay 330, winding of relay 329, contact 3 of relay 318, contact 2 of relay 317, contact 2 of relay 316, to battery through the right winding of relay 325. Relay 329 establishes a locking circuit for itself through its contact 2. A circuit is also established for the operation of relay 328 from battery, through its winding, contact 4 of relay 318, contact 4 of relay 317, winding of relay 306, to battery through winding D of coil 305. Relay 328 operates in the circuit traced but since its winding is of high resistance the supervisory relay 306 does not operate. The circuit path through the winding of relay 306 is merely used for the sake of convenience and economy. The operation of relay 328 establishes a circuit for relay 320, which may be traced from battery, through the winding of relay 320, normal contact 2 of relay 330, contact of relay 328, to ground through the normal contact of relay 331. Relay 320 in operating establishes a locking circuit for it-

self from ground through its contact 4 under the control of relay 330 or relay 328.

Relay 320 in operating connects the secondary winding 321 of the tone coil with windings D and B of repeating coil 305 and also establishes a circuit for the primary winding 322 of the tone coil for transmitting an impulse of tone by induction through winding 321. This tone is also transmitted by induction to windings A and C of repeating coil 305 and thus transmitted to the subscriber's operator through cord circuit 110. The circuit for the secondary winding 321 is obvious and need not be traced. The circuit for the primary winding extends from battery, through interrupter 323, winding 322, contact 6 of relay 320, to ground through normal contacts 2 of relays 335 and 332.

A circuit is also established at this time for the operation of relays 336, 337 and 338 for flashing the lamp 314 during the transmission of tone to the subscriber's operator. Relay 336 is first operated over a circuit traced from battery, through its winding, contact 5 of relay 320, contact 5 of relay 317, contacts 1 of relays 325 and 326, to ground through resistance 327. Relays 338 and 337 operate in response to the operation of relay 336. The relays 337 and 338 are slow to operate in order that sufficient time may be permitted to elapse between flashes of the lamp. Upon the operation of relay 337, battery is connected through its contact, over a circuit extending through contact 5 of relay 320, contact 5 of relay 317, to ground through contacts 1 of relays 325 and 326 and resistance 327. This battery circuit effectively shunts the current flow through the filament of lamp 314 which extinguishes the light. The battery at the contact of relay 337 also shunts the current from relay 336 causing its release. Following the release of relay 336 both relays 338 and 337 release which permits relay 336 to again operate. This procedure continues until the flashing circuit is opened.

When the circuits are established for the primary and secondary windings 321 and 322 of the tone coil a circuit is also established for the operation of relay 335 from ground, through contact 1 of relay 320, normal contact 2 of relay 319, to battery through the winding of relay 335. This relay is slow to operate in order to permit the transmission of an impulse of tone of short duration to the subscriber's operator. Two impulses of tone are transmitted to the subscriber's operator to advise her that the telephone set 324 at the completing trunk operator's position is associated with the trunk. The operation of relay 335 opens the circuit through the primary winding 322 of the tone coil to terminate the transmission of tone and establishes an obvious circuit for the operation of relay 334. The latter relay is slow to operate,

thus permitting an interval between the transmission of tone impulses. When relay 334 operates, the circuit for the primary winding 322 of the tone coil is again established through contact 2 of relay 335 and contact 2 of relay 334 to ground through contact 2 of relay 332. The operation of relay 334 also establishes an obvious circuit for the operation of relay 332. The latter relay is slow to operate in order to permit the transmission of a tone impulse. When this relay operates the circuit through the primary winding 322 of the tone coil is permanently opened and the tone induction circuit through condenser 333 is also opened. The operation of relay 332 further establishes an obvious circuit for operating relay 319.

The operation of relay 319 connects the operator's telephone head set with the trunk circuit in order that the called station designation may be transmitted to the completing trunk operator by the subscriber's operator. This designation is transmitted by the subscriber's operator immediately upon the reception of the second impulse of tone. The operation of relay 319 further establishes a locking circuit for relay 332 from battery, through the winding of the latter relay, contact 2 of relay 319, to ground through contact 1 of relay 320. A circuit is also established from battery through contact 3 of relay 319 for operating relay 330 extending through the winding of relay 330 to ground at contact 1 of relay 329. Relay 330 in operating establishes a locking circuit for itself to ground through its contact 3. It will be noted that the circuit for relay 335 is opened at contact 2 of relay 319 and the release of relay 335 causes the release of relay 334. The operation of relay 330 establishes an obvious circuit for operating relay 331 to remove the control of relay 320 from relay 331. A circuit is, however, established for holding relay 320 through contact 2 of relay 330 to ground through contact 1 of relay 329.

The completing trunk operator now tests the line leading to the desired subscriber's station by touching the tip of plug 315 to the sleeve of jack 340 in the well known manner of testing lines. If the line is idle plug 315 is inserted in jack 340. A circuit is thus established for operating relays 343 and 308, which may be traced from ground through the winding of relay 343, sleeve of jack 340 and plug 315, upper winding of relay 308, to battery through lamp 314. It will be remembered that a circuit was previously established through the lower winding of relay 308 which assists in the operation of the relay. The circuit through the lower winding, is, however, opened as the relay completes its operation, and the relay is held operated through its upper winding. The operation of relay 308 opens at its contact 2 the circuit for relay 326 which latter relay releases.

The relays released in consequence of the release of relay 326 are as follows: The circuit for relay 316 is opened at the contact 3 of relay 326. The release of relay 316 opens the circuit for relay 317. The release of relay 317 opens the circuit for relays 336, 337 and 338 and also opens the circuits for relays 328 and 329. The release of relay 329 opens the circuit for relay 320. The release of relay 320 opens the circuit for relay 332 and the release of relay 332 opens the circuit for relay 319. The release of relay 319 opens the circuit for relay 330 which in turn opens the circuit for relay 331.

The operation of relay 308 establishes circuits for connecting ringing current to the subscriber's station for sounding the bell at that station. Relay 307 is operated for this purpose from battery, through its winding, normal contact of relay 311, normal contact of relay 312, contact 2 of relay 308, normal contact 1 of relay 326, contact 1 of relay 325, upper winding of relay 308 to ground through the winding of relay 343. Ringing current is extended over the line from ringing source 313 through the winding of relay 312, contact 2 of relay 307, thence over the line and through the ringer windings at subscriber's station J, returning to ground through contact 1 of relay 307. A ringing induction tone is transmitted to the calling subscriber at station A through condensers 309 and 310. When the subscriber at station J removes the receiver from the switchhook, sufficient energy is carried through the winding of relay 312 to cause its operation. The operation of relay 312 opens the short circuit around the winding of relay 311 which permits the operation of relay 311 in series with relay 307. Upon the operation of relay 311 battery is connected to its armature which shunts the current from the winding of relay 307 to cause its release and disconnect the ringing current from the subscriber's line. Relay 311 also establishes a locking circuit for itself to maintain relay 307 released.

Upon the release of relay 307, after the removal of the receiver from the switchhook a circuit is established for relay 306 over the subscriber's line and through the station apparatus which circuit is obvious and need not be traced. The operation of relay 306 establishes an obvious circuit for operating relay 304, for reversing the direction of current flow over the trunk conductors. The circuit over which the current flow is reversed is the same as traced for the operation of relay 303 except that as a result of this reversal, battery is extended over the tip conductor and ground over the ring conductor through the winding of polarized relay 510, Fig. 5. The current flow is now in the proper direction to cause the operation of relay 510. A circuit is thus established to operate relay 508 which locks to ground at contact 1 of relay 509. Upon

the operation of relay 508 ground is extended from the contact of relay 510 through contact 1 of relay 508, winding of relay 530, normal contact 1 of relay 524, to battery through the normal contact 2 of relay 500. The operation and release of relay 530 is now placed under the control of the subscriber at station A. Relay 530 is operated and released in the manner shown to prevent disturbances in the repeater circuit. The operation of relay 510 also controls the operation of relay 507 for reversing the current flow over the trunk extending to the subscriber's switchboard, in order to operate the polarized relay 131. With relay 507 operated the circuit for relay 131 may be traced from battery through the left winding of relay 506, left winding of coil 505, contact 2 of relay 507, winding D of coil 514, normal contact 2 of relay 512, brush 424 and its associated contact, contact 4 of relay 443, brush 404 and its associated contact, contact 1 of relay 202, contact of relay 132, winding of relay 131, contact 4 of relay 202, brush 403 and its associated contact, contact 3 of relay 443, brush 423 and its associated contact, normal contact 3 of relay 512, winding B of coil 514, contact 1 of relay 507 right winding of coil 505, right winding of relay 506 to ground. The operation of polarized relay 131 establishes a loop circuit for the operation of supervisory relay 114, through the low resistance winding of relay 132. This circuit may be traced from battery through winding D of coil 111, winding of relay 114, ring of plug 121 and jack 126, lower winding of coil 128, upper low resistance winding of relay 132, contact of relay 131, upper winding of coil 128, tip of jack 126 and plug 121, to ground through winding B of coil 111. The operation of relay 114 establishes a shunt for lamp 115 by associating battery through resistances 118, 119 and 127, to ground. Lamp 115 is thus extinguished. If the subscriber at station J flashes the switchhook by moving it up and down, it will be seen that relay 306 will be intermittently released and operated, in turn releasing and operating relay 304. The intermittent release and operation of relay 304 intermittently reverses the current in the winding of polarized relay 510 causing the latter relay to release and operate intermittently. The intermittent release and operation of relay 510 controls the release and operation of relays 507 and 530. The intermittent release and operation of relay 507 reverses the current flow in trunk 200 causing the intermittent release and operation of relay 131 for intermittently releasing and operating relay 114 to flash the lamp at the subscriber's switchboard. The operator at the subscriber's switchboard is thus signaled that the J subscriber requires attention and associates her telephone set with trunk 200 through the cord circuit 110.

The trunk circuit of Fig. 2 differentiates automatically between trunk circuits that require a repeater and those that do not. Let it be assumed that a connection has been made as previously described between the subscriber's cord circuit 110 and the trunk circuit and that the three zip tones have been transmitted to the subscriber's operator and also that the trunk operator's telephone set 136 has been associated with the trunk circuit, Fig. 2, for the transmission of the office name. It will be remembered that for such operation the relays 204 and 214 were operated. Upon receipt of the office name plug 222 is associated with a circuit, Fig. 3, as previously described. Assuming that plug 222 is inserted into the trunk jack 300 associated with a trunk not of sufficient length to require a repeater, the sleeve of the jack 300 will have connected therewith a low resistance 301. A circuit is thus established to operate both the marginal relay 217 and relay 215. The operation of relay 217 opens the circuit extending between contact 2 of relay 215 and the winding of relay 218 which prevents the operation of relay 218 and thus prevents the selection of a repeater. The operation of relay 215 establishes an obvious circuit for the operation of relay 209. The operation of relay 209 establishes a circuit for the operation of relay 206 which may be traced from battery, through contact 3 of relay 209, normal contact 3 of relay 218, normal contact 3 of relay 219, normal contact 2 of relay 208, winding of relay 206, to ground through normal contact 1 of relay 207. Relay 211 also operates from a circuit established through its left winding which may be traced from battery at contact 3 of relay 209, left winding of relay 211, to ground at the normal contact 1 of relay 207. The operation of relay 211 disconnects the telephone circuit from the trunk circuit as previously described. The operation of relay 206 disconnects battery and ground from relay 204 and extends the tip conductor of trunk 200 to the tip of plug 222 and jack 300 of the trunk circuit, Fig. 3. The tip conductor when thus connected reestablishes an operating circuit for relay 204 which may be traced from its upper winding, through contact 2 of relay 206, tip of plug 222 and jack 300, winding A of repeating coil 305, contact 2 of relay 304, lower winding of relay 303 to ground. The lower winding of relay 204 is extended through contact 3 of relay 206, normal contact 4 of relay 207, normal contact 4 of relay 208, contact 2 of relay 209, ring of plug 222 and jack 300, winding C of repeating coil 205, normal contact 1 of relay 304, upper winding of relay 303 to battery. The relay 204 is thus maintained operated which maintains an energizing circuit for relay 214 to prevent the operation of relay 207. The calling subscriber's station A is thus connected

to the called subscriber's station J without the insertion of a repeater.

Upon the removal of plug 121 from jack 126, relays 204 and 214 are released which permits relay 207 to operate. The circuit for relay 207 may be traced from battery, through contact 3 of relay 209, winding of relay 207, normal contact 2 of relay 214, normal contact 3 of relay 202, normal contact 2 of relay 210, to ground through normal contact 2 of relay 218. The operation of relay 207 establishes a circuit for lighting lamp 216 from battery through its filament, resistance 212, to ground through contact 2 of relay 207. This is a signal for the trunk operator to remove plug 222 from jack 300. The remaining apparatus of the circuits are automatically restored to normal.

What is claimed is:

1. In a trunking system, a plurality of offices, a plurality of trunks of different characteristics outgoing from an office, incoming trunks to said office terminating in conductor terminals, means at said office for physically connecting said conductor terminals with said outgoing trunks, repeaters common to said trunks, and means operably responsive solely to the seizure of an outgoing trunk of a certain characteristic to add a repeater in series with the talking conductors terminating in said conductor terminals.

2. In a trunking system, a plurality of offices, a plurality of trunks of different characteristics outgoing from an office, incoming trunks to said office terminating in conductor terminals, means at said office for physically connecting said conductor terminals with said outgoing trunks, discriminating means operable in response to said connection solely for determining the character of said outgoing trunk, repeaters common to said trunks, and means operably responsive to a particular operation of said discriminating means for adding a repeater in series with the talking conductors of said trunks.

3. In a trunking system in which a telephone connection is built up by adding successive links, repeaters common to a link in said connection, and means controlled solely by a condition individual to one of said links to connect a repeater to the preceding link responsive to the addition of said one link to said preceding link.

4. In a trunking system in which a telephone connection is built up by adding successive links, operators' telephone sets at each link, means responsive to the addition of a link to automatically associate an operator's telephone set with the added link for instructions regarding the extension of said link, repeaters common to a link in said connection, and means controlled by a condition individual to one of said links to connect a repeater to a preceding link responsive to the

addition of said one link to said preceding link.

5. In a trunking system in which a telephone connection is built up by adding successive links, a plurality of groups of repeaters, each group being common to a plurality of certain links and selectable thereby, and means controlled solely by a condition individual to certain ones of said links to connect a repeater to the preceding link responsive to the addition of successive links.

6. In a trunking system, a plurality of trunks interconnecting two distant points, a plurality of other trunks of various characteristics interconnecting one of said points with another distant point, means for connecting together the ends of said trunks terminating at said common point, a group of selectable repeaters common to said trunks, and means in a said first trunk automatically responsive to a said connection for selecting an idle repeater from said group and adding it in series with the conductors of said first trunk only if the second trunk is of a character that requires the addition of a repeater.

7. In a trunking system, a plurality of trunks interconnecting two distant points, a plurality of other trunks of various characteristics interconnecting one of said points with another distant point, means for connecting together the ends of said trunks terminating at said common point, a group of selectable repeaters common to said trunks, and means in a said first trunk automatically responsive to a said connection for determining the character of the second trunk for adding a repeater in series with the conductors of said first trunk or for preventing such addition.

8. In a trunking system, a plurality of trunks interconnecting a first point and a distant point, a second plurality of trunks of various characteristics interconnecting said distant point and a second distant point, a line, means to connect said line with the trunk at said first point, operators' telephone sets at each point, means automatically operable in response to the connection of said line to the trunk at said first point for connecting the operator's telephone set at said distant point to said same trunk, means for connecting the end of said same trunk to the end of a trunk outgoing from said distant point, repeaters, and means in said same trunk automatically responsive to said latter connection for distinguishing the character of the trunk connected therewith and for adding a repeater in series with the conductors of said trunk if the character of the trunk requires such addition.

9. In a trunking system, a plurality of trunks of different characteristics extending from one office to a distant office, a plurality of other trunks incoming from various points

and terminating at said first office, means for connecting the terminating end of said other trunks directly with the outgoing end of said trunks of different characteristics, repeaters, means operable responsive to said connection solely for distinguishing an outgoing trunk of a character that requires the addition of a repeater, and means responsive to the operation of said distinguishing means for connecting a repeater in series with the conductors of the trunks.

10. In a trunking system, a plurality of trunks of different characteristics extending from one office to a distant office, a plurality of other trunks incoming from various points and terminating at said office, means for connecting the terminating end of said other trunks directly with the outgoing end of said trunks of different characteristics, repeaters, means operable responsive to said connection solely for distinguishing outgoing trunks that require the addition of a repeater and those that do not require such addition, and means responsive to a certain operation of said distinguishing means for connecting a repeater in series with the conductors of said trunk.

11. In a trunking system, a plurality of trunks of different characteristics extending from one office to a distant office, a plurality of other trunks incoming from various points and terminating at said first office, means for connecting the terminating end of said other trunks directly with the outgoing end of said trunks of different characteristics, repeaters, and means operable responsive to said connection solely for distinguishing the character of an outgoing trunk for either causing the selection of an idle repeater for said trunk or for preventing the selection of a repeater.

12. In a trunking system, a plurality of trunks of different characteristics extending from one office to a distant office, a plurality of other trunks incoming from various points and terminating at said first office, means for connecting the terminating end of said other trunks directly with the outgoing end of said trunks of different characteristics, a common group of repeaters for said other trunks, and means operable responsive to a said connection solely for distinguishing the character of a connected trunk for causing the selection of an idle repeater in said group and for connecting the selected repeater in series with the conductors of said trunk.

13. In a trunking system, a plurality of trunks of different characteristics extending from one office to a distant office, a plurality of other trunks incoming from various points and terminating at said first office, means for connecting the terminating end of said other trunks directly with the outgoing end of said trunks of different characteristics, a common group of repeaters for said other

trunks, and means operable responsive to a said connection for solely distinguishing the character of a connected trunk for either causing the selection of an idle repeater in said group or for preventing said selection.

14. In a trunking system, a first switchboard, a second switchboard, a third switchboard, trunks extending from said first switchboard to said second switchboard, trunks of various characteristics extending from said second switchboard to said third switchboard, means at said second switchboard for connecting together the incoming and outgoing ends of any of said trunks, repeaters, and means responsive to a said connection solely for distinguishing the character of the outgoing trunk and for adding a repeater in series with the conductors of said trunk when the character of said trunk is such as to require a repeater.

15. In a trunking system, a first switchboard, a second switchboard, a third switchboard, trunks extending from said first switchboard to said second switchboard, trunks of various characteristics extending from said second switchboard to said third switchboard, an operator's telephone set at each switchboard, means at said second switchboard responsive to a connection to a trunk at said first switchboard for connecting the telephone set at said second switchboard with said trunk, means at said second switchboard for physically connecting the incoming end of the trunk to which the telephone set is connected to the outgoing end of a trunk extending to said third switchboard, repeaters, means responsive to said connection for distinguishing the character of said trunk and for connecting a repeater in series with the conductors of said trunk if the character of the trunk is such as to require a repeater, and means at said third switchboard operable in response to said connection for connecting the telephone set at said third switchboard with the trunk extending thereto.

16. In a trunking system, a plurality of trunks of different characteristics extending from jacks in one office to distant offices, a plurality of other trunks which terminate at said first office in a single plug for connection with any of said jacks, repeaters, means operable responsive to such connection for distinguishing the trunks that require the addition of a repeater, and means responsive to the operation of said distinguishing means for connecting a repeater in series with the conductors of said trunks.

17. In a trunking system, a plurality of trunks of different characteristics extending from jacks in one office to distant offices, a plurality of other trunks, each terminating at said first office in a single plug for connection with any of said jacks, a common group of repeaters for said other trunks, and means

operable responsive to a said connection for distinguishing the character of the trunk so connected for causing the selection of an idle repeater in said group, and for connecting said repeater in series with the conductors of said trunk.

18. In a trunking system, a plurality of trunks of different characteristics extending from the jacks in one office to distant offices, a plurality of other trunks, each terminating at said first office in a single plug for connection with any of said jacks, a group of repeaters common to said trunks, means operable responsive to such connections for distinguishing the character of the trunks so connected for either causing the selection of an idle repeater for insertion in a trunk of said connection or for preventing the selection of a repeater.

19. In a trunking system, a subscriber's switchboard, a tandem switchboard, a tandem completing switchboard, trunks extending from jacks in the subscriber's switchboard to plugs in the tandem switchboard, other trunks extending from jacks in the tandem switchboard to plugs in the tandem completing switchboard, operators' telephone sets in each switchboard, repeaters available for selection for said trunks, means responsive to a connection with one of said jacks at said subscriber's switchboard for connecting the telephone set at said tandem switchboard with the trunk connected to said jack, and means operable in response to the insertion of the plug of said trunk into a jack at said tandem switchboard for selecting an idle repeater and for inserting it in series with the conductors of said trunk.

20. In a trunking system, a plurality of trunks incoming at a tandem office, a plurality of trunks of different characteristics outgoing at said tandem office and incoming from a second tandem office, a plurality of trunks of different characteristics outgoing from said second tandem office and incoming at a completing office, repeaters at said tandem offices, and means responsive to the connection of the incoming and outgoing ends of the trunks at the tandem offices solely for distinguishing the character of the outgoing trunks and for adding repeaters in series with either or both of said trunks when the characteristic of the trunks requires such addition.

21. In a trunking system, a plurality of selectable trunks outgoing from one operator's position and terminating in a plug at a second operator's position, a plurality of other trunks of different characteristics terminating in jacks in said second operator's position and extending to a distant operator's position, operator's telephone sets at each position, means at said second operator's position operably responsive to the selection of a trunk at said first position for connecting the tele-

phone set at the second position to the selected trunk, repeaters, means operable in response to the insertion of the plug of a selected trunk into one of said jacks for distinguishing the character of the trunk connected therewith, and means operable in response to a certain operation of said distinguishing means for connecting a repeater in series with the conductors of said selected trunk.

22. In a trunking system, a plurality of selectable trunks outgoing from one operator's position and terminating in a plug at a second operator's position, a plurality of other trunks of different characteristics terminating in jacks in said second operator's position and extending to a distant operator's position, operators' telephone sets at each position, means at said second operator's position operably responsive to the selection of a trunk at said first position for connecting the telephone set at the second position to the selected trunk, repeaters, means operable in response to the insertion of the plug of a selected trunk into one of said jacks for distinguishing the character of the trunk connected therewith, means operable in response to a certain operation of said distinguishing means for connecting a repeater in series with the conductors of said selected trunk, and means at said distant operator's position operable in response to the connection of said repeater to said trunk for connecting the distant operator's telephone set to the trunk connected to said jack.

23. In a trunking system, a plurality of trunks of different characteristics extending from jacks in one office to distant offices, means to set up a condition on the sleeve terminals of said jacks indicative of said different characteristics, a plurality of other trunks which terminate at said first office in a single plug for connection with any of said jacks, repeaters, means operable responsive to said sleeve condition following the insertion of one of said plugs in one of said jacks for distinguishing trunks that require the addition of a repeater, and means responsive to the operation of said distinguishing means for connecting a repeater in series with the conductors of said trunks.

24. In a trunking system, a plurality of trunks of different characteristics extending from jacks in one office to distant offices, means to set up a condition on the sleeve terminals of said jacks indicative of said different characteristics, a plurality of other trunks which terminate at said first office in a single plug for connection with any of said jacks, a group of repeaters common to said other trunks, means operable responsive to said sleeve condition following the insertion of one of said plugs in one of said jacks for distinguishing the character of the trunk so connected for causing the selection of an idle

repeater in said group and for connecting said repeater in series with the conductors of said trunk.

25. In a trunking system, a plurality of trunks of different characteristics, outgoing from an office, trunks incoming to said office, means for connecting said incoming trunks with said outgoing trunks, repeaters common to said trunks and means in said incoming trunks operable responsive to the seizure of the outgoing trunk of a certain characteristic to add a repeater in series with the talking conductors of said trunk.

26. In a trunking system, a plurality of trunks of different characteristics extending from jacks in one office to distant offices, a plurality of other trunks which terminate at said first office in a single plug for connection to any of said jacks, repeaters, means in said plug ended trunks operable responsive to such connection for distinguishing the trunks which require the addition of a repeater and means responsive to the operation of said distinguishing means for connecting the repeaters in series with the conductors of said trunks.

27. In a trunking system, a plurality of trunks of different characteristics extending from jacks in one office to distant offices, means to set up a condition on the sleeve terminals of said jacks indicative of said different characteristics, a plurality of other trunks which terminate at said first office in a single plug for connection with any of said jacks, means in said plug ended trunks operable responsive to said sleeve condition following the insertion of one of said plugs in one of said jacks for distinguishing trunks that require the addition of a repeater, and means responsive to the operation of said distinguishing means for connecting a repeater in series with the conductors of said trunks.

In witness whereof I hereunto subscribe my name this 30th day of August, 1928.

FERDINAND S. ENTZ.