

April 5, 1932.

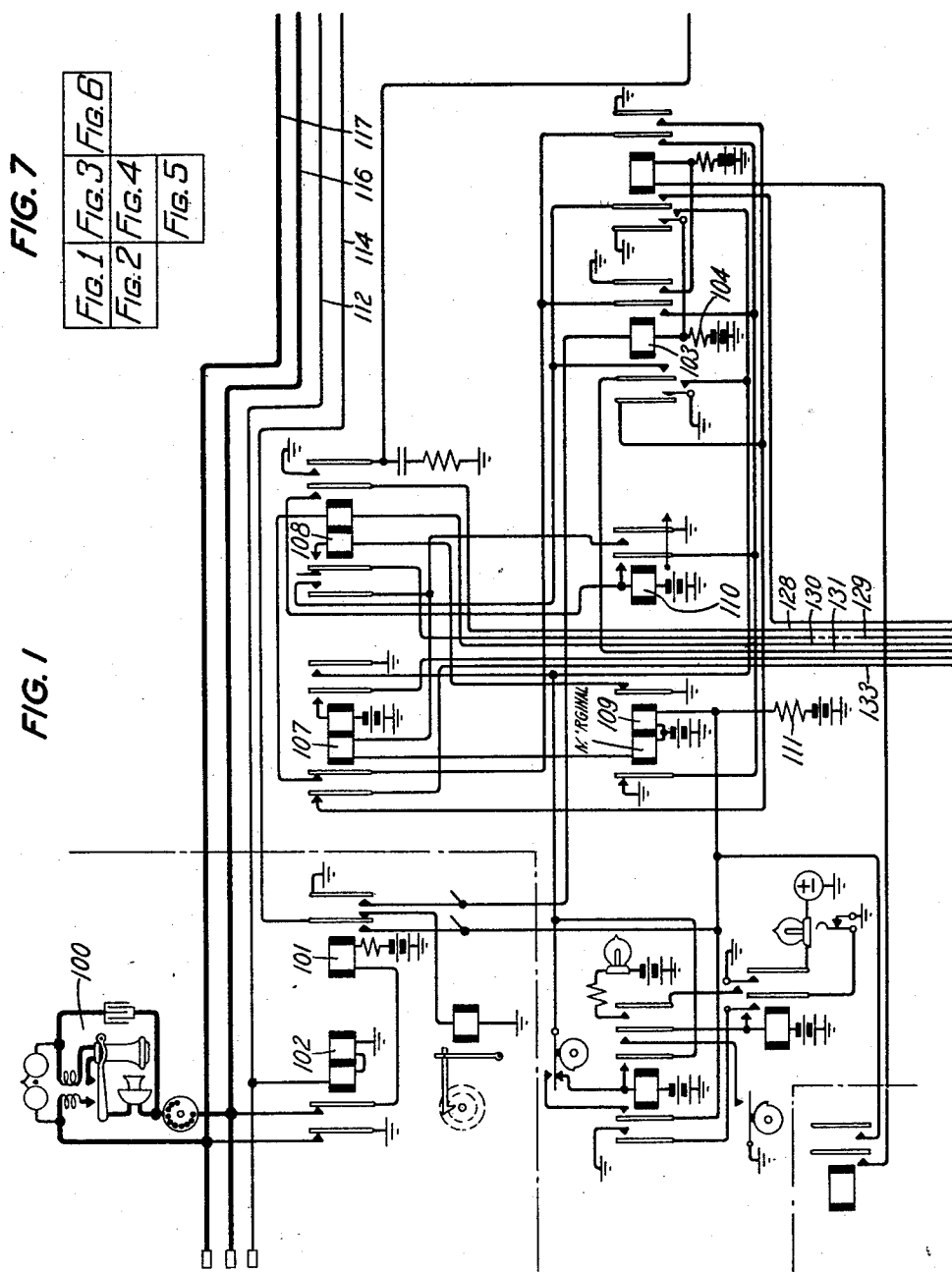
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1,852,747

TRUNK CIRCUIT FOR TELEPHONE EXCHANGE SYSTEMS

Filed Aug. 8, 1930

6 Sheets-Sheet 1



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6 Sheets-Sheet 2

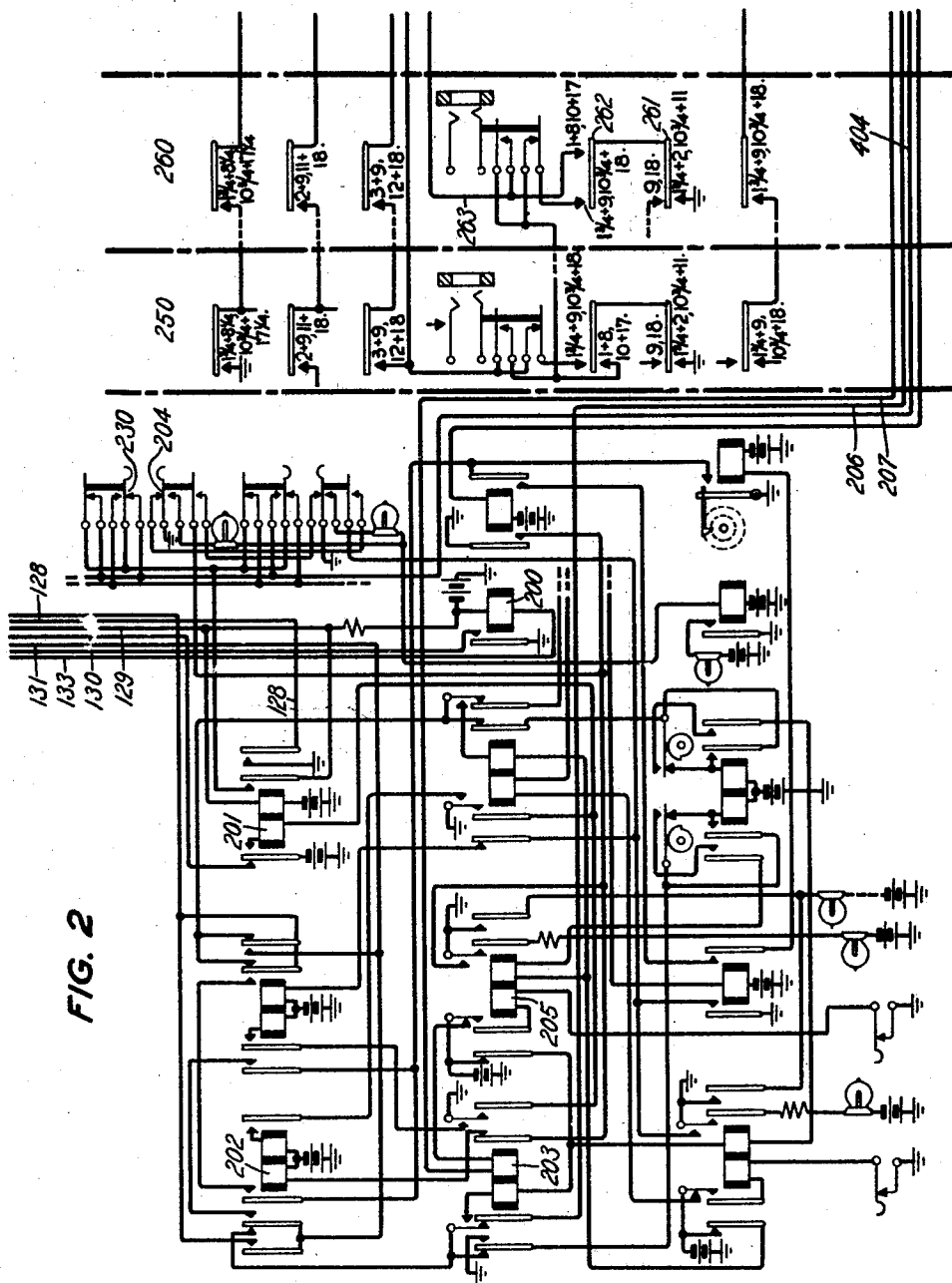


FIG. 2

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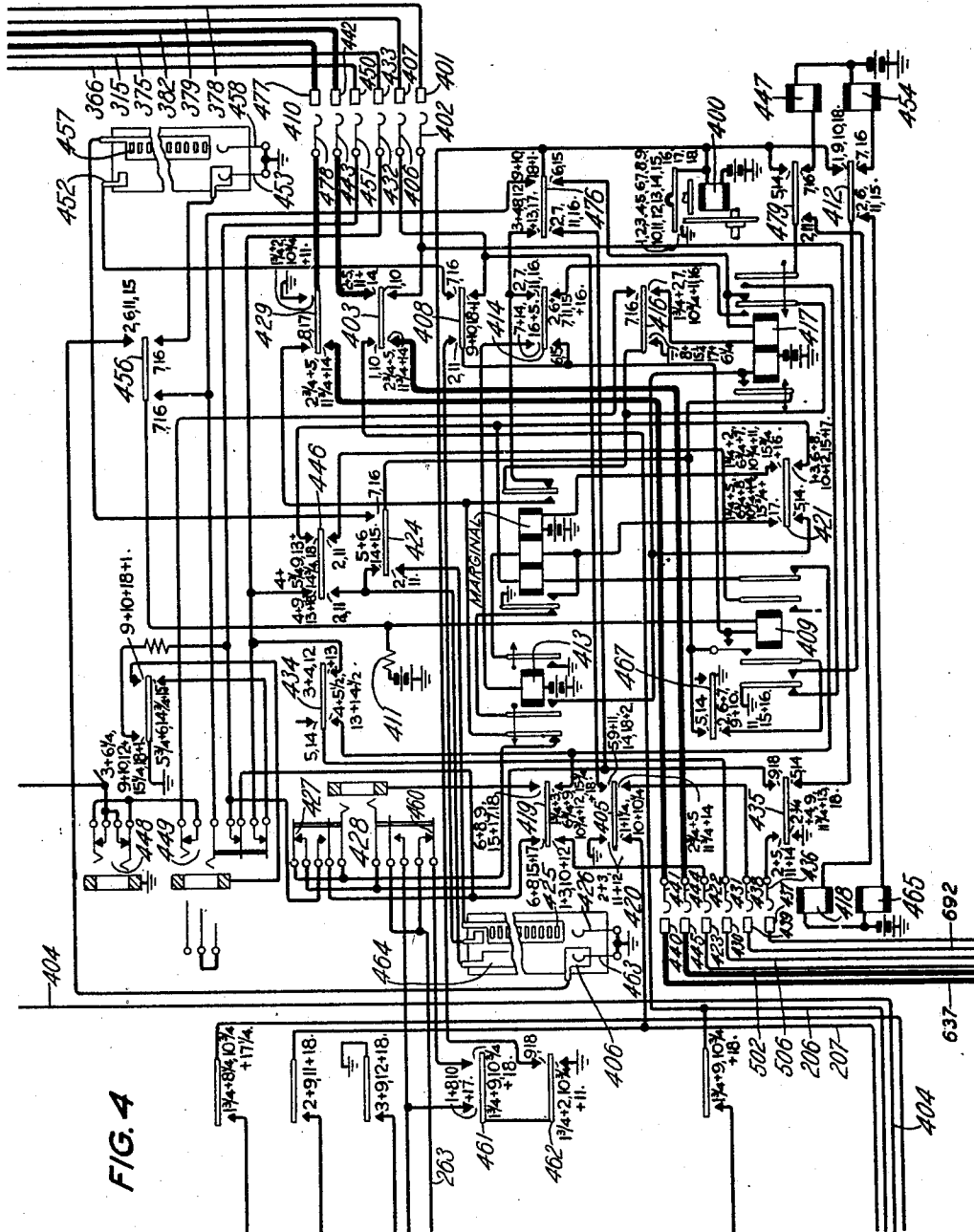
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TRUNK CIRCUIT FOR TELEPHONE EXCHANGE SYSTEMS

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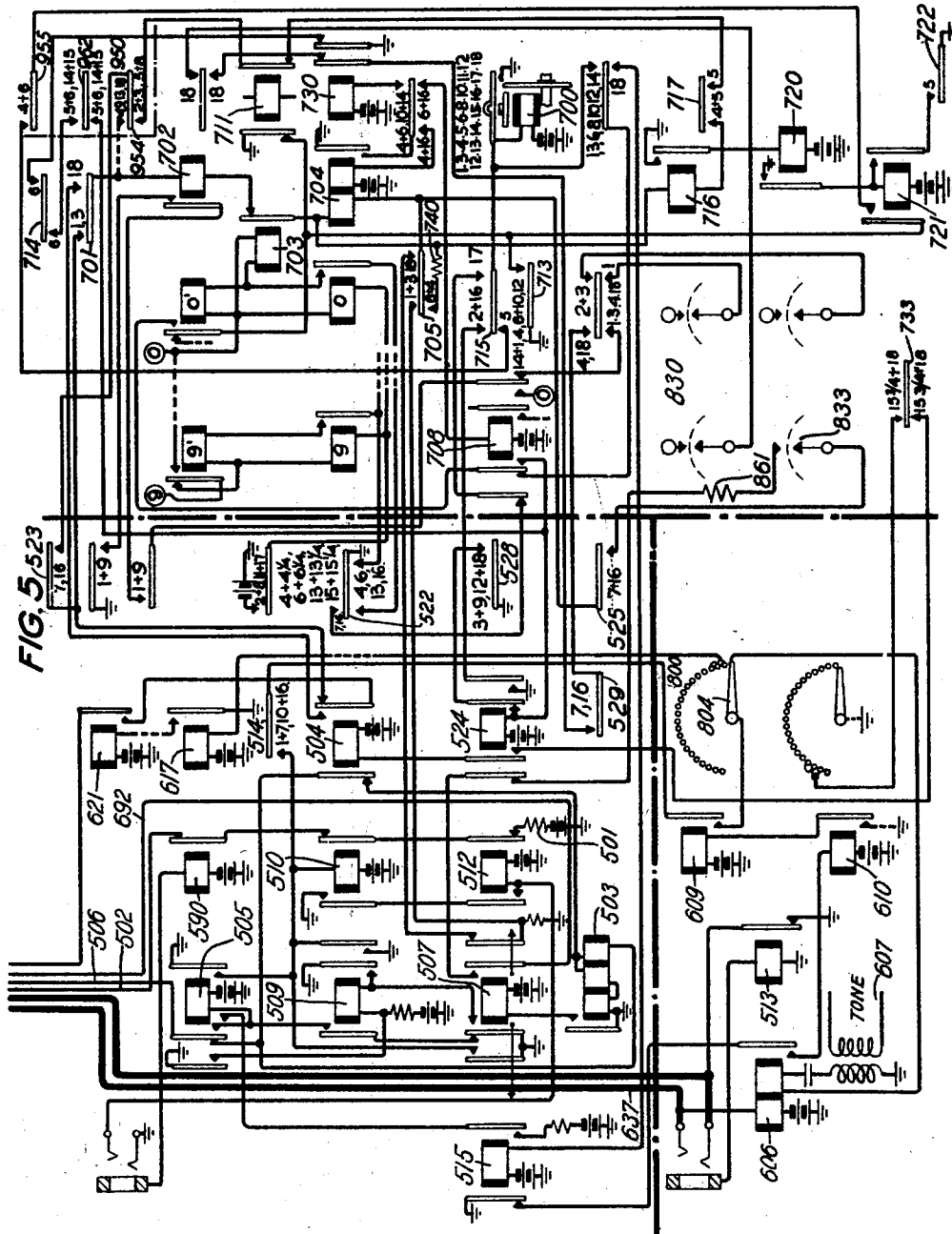
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6 Sheets-Sheet 5



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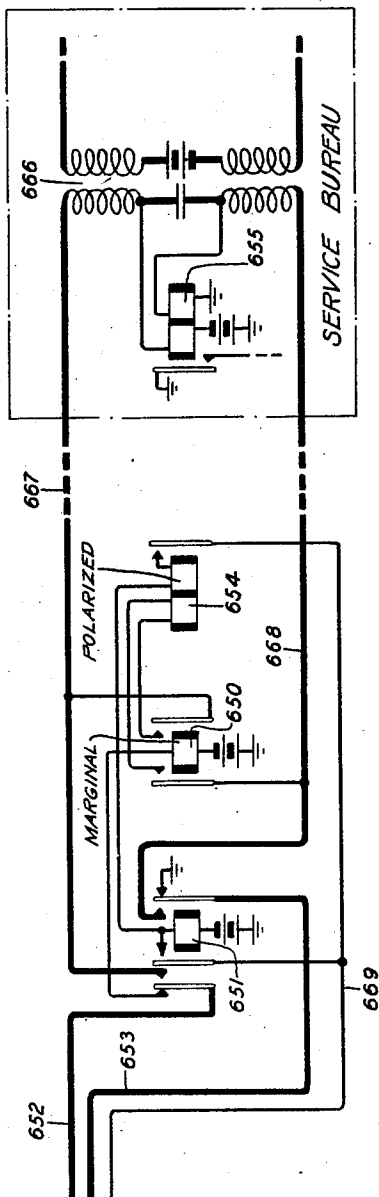
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TRUNK CIRCUIT FOR TELEPHONE EXCHANGE SYSTEMS

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6 Sheets-Sheet 6

FIG. 6



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TRUNK CIRCUIT FOR TELEPHONE EXCHANGE SYSTEMS

Application filed August 8, 1930. Serial No. 473,869.

This invention relates to a telephone exchange system and more particularly to the trunking of connections from a dial switching office of the exchange system to a centralized service bureau such as an information bureau. The object of the invention is the provision of means to insure that the establishment of the connection shall have reached a definite stage at the originating dial switching office before it is completed to the distant service bureau over the trunk circuit whereby greater accuracy in completing connections is obtained.

The development of dial switching telephone exchange systems has made it possible to centralize service bureaus whereby one such centralized bureau may supply its service to a plurality of offices of the exchange area. For example, instead of equipping each office of an exchange with a local information desk for answering calls for information as is now the customary practice in offices of a manual exchange area, through the superior trunking facilities of the dial switching system it is possible to trunk all calls for information originating in a plurality of offices of a dial switching system to a centrally located information bureau.

Such calls for information service or similar service should not, of course, be charged against a calling subscriber and if the calling line is equipped with a message register or coin box, provision must be made whereby such charging apparatus cannot be operated upon the establishment of such a call. Furthermore, it is essential that the trunk connection shall not be completed to the service bureau and an operator thereat associated with the trunk until the apparatus at the dial switching office has reached such a stage in its operation that the talking circuit between the calling line and interconnecting trunk has been completely established.

In accordance with one embodiment of the invention, illustrated herein by way of example, a trunk circuit is provided extending either from the terminal bank of a district or office selector in the dial switching office to the central bureau. The central bureau may, for example, be of the type disclosed in

the application of W. W. Carpenter, J. F. Dahl, R. C. Davis and L. E. Kittridge, Serial No. 388,705, filed August 27, 1929, Patent No. 1,816,634, July 28, 1931. The trunk circuit has two normally disconnected sections, the outgoing section of which has battery through a marginal line relay and ground normally connected to the tip and ring conductors respectively.

When the trunk is seized at its outgoing end by a selector, current from this battery is supplied to the sender in the originating office to signal the sender that the trunk has been seized. The sender in response to this signal then proceeds in the usual manner to advance the sequence switch of the district selector for talking selection. These operations are fully set forth in the patent to F. A. Stearn 1,505,171, issued August 19, 1924. The relay of the trunk being marginal does not operate at this time but as soon as the district selector has been advanced to the talking position, a low resistance path is established through the supervisory relay and repeating coil of the district selector over which this line relay then operates.

The line relay of the trunk upon operating bridges one winding of a polarized relay across the incoming section of the trunk circuit in series with a relay and source of current at the distant end of the trunk circuit terminating in the central bureau. If the source of current is connected at the distant end of the trunk in the proper direction, that is, so as not to operate the supervisory relay of the district selector, which would cause the operation of the calling subscriber's call charging device, the polarized relay and control relay at the distant end of the trunk operate, the control relay initiating the operation of apparatus at the central bureau to associate an operator's position with the distant end of the trunk circuit and the polarized relay locking over a secondary winding in series with a cut-through relay of the trunk. The cut-through relay upon operating connects the two sections of the trunk circuit together, thereby establishing the talking path from the calling line to the central bureau, locks, releases the trunk line relay and

disconnects the polarized relay from the incoming section of the trunk. If, however, the connection of the current source at the distant end of the trunk has been unintentionally reversed, the polarized relay does not operate and, therefore, the cut-through relay does not connect the two sections of the operating circuit, thereby blocking the call to prevent the false charging of the call on the calling subscriber's charging device.

A clearer conception of the scope and purpose of the invention will be obtained from a consideration of the following description in connection with the attached drawings in which:

Fig. 1 shows a calling subscriber's line together with certain relays for preventing interference between calling lines;

Fig. 2 shows a start circuit and a portion of two link circuits;

Fig. 3 shows a line finder and district selector;

Fig. 4 shows a link circuit for associating the sender with a district selector;

Fig. 5 shows a portion of the register sender;

Fig. 6 shows a trunk circuit outgoing from the district selector of Fig. 3 to a special service bureau, for example, to a centralized information desk; and

Fig. 7 is a diagram showing the manner in which Figs. 1 to 6 inclusive should be arranged to completely disclose the invention.

The invention has been embodied in a disclosure which is substantially like that of U. S. Patent No. 1,690,206, granted to A. Raynsford on November 6, 1928. Both the present disclosure and that of the Raynsford patent show a skeletonized sender in which the reference numerals employed are for the most part the same as those employed in the more complete disclosure of U. S. Patent No. 1,589,402, granted to O. H. Kopp, June 22, 1926. Reference to which is to be made for operations not completely disclosed herein. As in the case of the above-mentioned patent, a plurality of link circuits are arranged to serve a group of calling lines and are taken into service in rotation. When a link circuit completes its function it hunts for and associates itself with a district selector which is ready for use, and the link and district remain in a suballotted condition until the next link in the series has been put into service. The link circuit is then put into an allotted condition from which it will be advanced by the initiation of a call and the action of the start circuit of Fig. 2. The trip circuit of Fig. 1 and start circuit of Fig. 2 are so arranged that only one line may be served at a time and so that there may be cooperation between two groups of lines to each of which a group of link circuits is individual. The details of these functions are described in the above-mentioned Raynsford patent and

since they form no part of the present invention will be omitted from the following description.

It will be assumed that the subscriber at substation 100 desires to obtain some information with respect to a call and therefore establishes a connection to a central information bureau over the trunk shown in Fig. 6. When the subscriber at substation 100 removes his receiver from the switchhook, a circuit is closed from battery through the winding of line relay 101, inner back contact of relay 102, over the subscriber's line to ground at the outer contact of relay 102. Relay 101 in operating closes a circuit from battery through resistance 104, winding of relay 103, to ground at the outer front contact of relay 101. It also prepares a circuit from battery through resistance 111 and the right winding of relay 109 in parallel, inner front contact of relay 101 to conductor 114 to identify the calling line to the line finder. Relay 103 in operating closes a circuit from battery, over the back contact of relay 201, conductor 130, right winding of relay 108, inner back contact of relay 107, inner right contact of relay 103 to ground at the left contact of relay 109.

Relay 108 operates in this circuit and closes a locking circuit for itself from battery through the right winding of relay 201, conductor 129 over back contacts of relays similar to relay 108, individual to other groups of lines appearing before the same line finder, inner left front contact and left winding of relay 108, to ground at the right back contact of relay 109. Relay 108 closes a circuit from ground at its outer right front contact to the winding of trip magnet 303 of the line finder to battery in preparation for tripping the proper set of brushes when the line finder is operated. Relay 201 operates in the locking circuit of relay 108 and in combination therewith closes a circuit from ground over its outer right contact, conductor 128, inner right contact of relay 108, winding of relay 110, to battery. Relay 110 locks over its inner right contact to ground at the left back contact of relay 109 and closes a circuit for starting the allotted line finder. Assuming that the link and line finder shown are the ones to be used next, sequence switch 400 will be standing in position 1 and sequence switch 300 in position 2. The operation of relay 110 will therefore close a circuit from ground at its outer right contacts, outer left front contact of relay 108, inner left front contact of relay 103, conductor 131, left back contact of relay 202, inner left back contact of relay 203, conductor 206, upper left and lower right contacts of cam 403, brush 402 and terminal 401, conductor 378, upper right and lower left contacts of cam 301, winding of relay 302 to battery.

Relay 302 in operating closes a circuit

from battery through the winding of updrive magnet 304 of the line finder, right front contact of relay 302, lower right contact of cam 364, outer left front contact of relay 302 to ground at the lower left contact of cam 336. The line finder moves upwardly under the control of magnet 304, and since trip magnet 303 is operated, the proper set of brushes is tripped. As soon as the line finder moves upwardly, a locking circuit is provided for relay 302, extending over its inner left front contact, upper contacts of cam 308, right back contact of relay 320, commutator strip 321, brush 322 to ground which holds relay 302 operated independent of the trip circuit. As soon as the commutator brush 307 engages segment 305, a circuit is closed from ground over brush 307 and segment 305, lower right and upper left contacts of cam 306, conductor 404, contact 230 of key 204, inner right front contact of relay 201 to conductor 129 and the right winding of relay 201. This circuit shunts the winding of relay 108 and causes that relay to release in turn releasing the trip magnet 303. When brush 307 leaves segment 305, the circuit of relay 201 is opened and that relay also releases freeing the start circuit. When line finder brush 381 makes contact with terminal 380 which is connected to conductor 114 and therefore to battery, a circuit is completed from this battery through the winding of relay 320, lower left and upper right contacts of cam 341 to ground at the right contact of cam 339. Relay 320 operates in this circuit and closes a shunt around its winding through resistance 319 to ground over commutator strip 321 and brush 322. This reduces the resistance in series with the winding of marginal relay 109 sufficiently to cause that relay to operate and open the locking circuit of relay 110 which in turn opens the energizing circuit of relay 302. The operation of relay 320 also opens the locking circuit of relay 302 causing that relay to release. The release of relay 302 closes a circuit from ground through the winding of cut-off relay 102, conductor 112, terminal 327, brush 326, inner left back contact of relay 317, right back contact of relay 302, lower right contact of cam 324, resistance 323 to battery. The operation of cut-off relay 102 opens the circuit of line relay 101, removing battery from conductor 114 thereby releasing relays 109 and 320.

At the time relay 302 operated it closed a circuit from ground at the lower left contact of cam 336, outer left front contact of relay 302, lower right contact of cam 311, conductor 379, terminal 407 and brush 406 of the link district finder 410, lower right contact of cam 408, winding of relay 409, resistance 411, to battery. Relay 409 operates and closes a circuit from battery through the winding of sequence switch magnet 400, upper contact of cam 412, to ground at the outer left

contact of relay 409, advancing the link sequence switch 400 to position 2. When sequence switch 400 leaves position 1 relay 409 is released. In position 2 a circuit is closed from battery through the winding of relay 413, upper contacts of cam 414, right back contact of relay 415, to ground at the left contact of cam 416. Relay 413 operates closing a circuit from battery through the left winding of relay 417, left front contact of relay 413 to ground at the left back contact of relay 415. Relay 417 in operating closes a circuit from battery through the winding of updrive magnet 418 of the sender finder 420, left contact of cam 479 outer right contact of relay 417 to ground at the left back contact of relay 409. The sender finder moves upwardly through the control of magnet 418 in search of an idle sender.

Relay 413 also closes a circuit from battery through the right winding of relay 415, upper contacts of cam 421, middle winding of relay 415, to ground at the right contact of relay 413. The current in this circuit is not sufficient to operate relay 415 but does create a flux in the magnetic circuit of that relay, so that it becomes quick to operate when the test circuit is closed. The test circuit extends from brush 422 over the lower contacts of cam 419, right back contact of relay 409, left winding of relay 415, lower right and upper left contacts of cam 421, middle winding of relay 415 to ground at the right contact of relay 413. An idle sender is characterized by battery connected to conductor 502 and therefore when brush 422 engages terminal 423 corresponding to the sender of Fig. 5 which is assumed to be idle, the test circuit above traced is completed over terminal 423 to battery and relay 415 operates quickly. Relay 415 in operating closes a locking circuit for itself from battery through its right winding, upper contacts of cam 421 to ground at the left front contact of relay 415. It also opens the circuit of relay 417 which releases to in turn release magnet 418 and bring the sender finder to rest on the terminals of the idle sender. The release of relay 417 in turn releases relay 413. With relay 413 released, and relay 415 operated, a circuit is closed from battery through the winding of sequence switch magnet 400, lower left contact of cam 476, contact 427 of jack 428, left back contact of relay 413, right front contact of relay 415 to ground at the left contact of cam 416 advancing sequence switch 400 to position 3.

When sequence switch 400 reaches position 3, a circuit is closed from ground through the left end middle winding of relay 502, left back contacts of relays 504 and 505, conductor 506, terminal 430, brush 431, right contact of cam 434, brush 432 and terminal 433, conductor 315, lower contacts of cam 316, (assuming that the district selector sequence

switch has been advanced to position 3 as above described) through the left winding of relay 317, to battery and in parallel therewith over the upper left contact of cam 316, through the winding of relay 351 to battery. Relay 317 is marginal and does not operate. Relay 351 operates but is ineffective at this time. Relay 503 also operates and closes an obvious circuit for relay 507 which in turn closes a circuit for relay 509. Relay 509 closes a circuit for relay 510.

As soon as sequence switch 400 arrived in position 2 $\frac{3}{4}$, it prepared the dialing circuit for receiving dial pulses. This circuit may be traced from battery through the left winding of relay 606, conductor 637, terminal 440, brush 441, lower contact of cam 429, brush 478, terminal 477, conductor 375, left contact of cam 335, outer left back contact of relay 317, brush 334, terminal 333, conductor 117 through the subscriber's substation, conductor 116, terminal 332, brush 331, right back contact of relay 317, winding of relay 330, left contact of cam 329, conductor 382, terminal 442, brush 443, upper right and lower left contacts of cam 403, brush 444 and terminal 445 to ground at the back contact of relay 513. Relay 606 operates in turn operating relay 610 in the well known manner, relay 610 operating relay 609. A circuit is thereupon closed from the source of tone 607 through the right winding of relay 606, timing switch 804 in normal position, front contact of relay 609, lower contact of cam 514, to ground at the right contact of relay 509. This tone is transmitted to the calling subscriber to inform him that the sender is ready to receive impulses which he may then send out by manipulating his dial.

When relay 510 operated, it removed battery from conductor 502, releasing relay 415. With relay 415 released, a circuit is closed from battery through the winding of sequence switch magnet 400, upper left contact of cam 476, right back contact of relay 415, to ground at the left contact of cam 416. Sequence 400 advances to position 5 over this circuit and remains in this position throughout the further operation of the sender.

It will be assumed that the calling subscriber dials an office code which will cause the district selector of Fig. 3 to make connection with an idle trunk extending to the centralized information bureau indicated by the dot and dash rectangle of Fig. 6. The idle trunk selected is the trunk of Fig. 6. Following the selection of the trunk the district sequence switch 300 advances into the selection beyond position 10 and the sender sequence switch 700 advances into position 5.

At the completion of district selections, the office selections in the present case being skipped, and sequence switch 700 being therefore in position 5 a test is made to determine if the trunk of Fig. 6 has been properly seized.

A trunk test circuit is extended from battery, winding of relay 650, Fig. 6, outer left back contact of relay 651, conductor 652, terminal 345, brush 346, lower right and upper left contacts of cam 358, right back contact of relay 310, conductor 378, terminal 401, brush 402, lower right and upper left contacts of cam 435, brush 436, terminal 437, front contact of relay 621, right back contact of relay 504, contact of cam 523, lower contact of class switch cam 954, the class switch 950 having been set into position 6 for a call of this character, right back contact of relay 711, lower contacts of cam 717, winding of relay 716, left winding of relay 704, contact of cam 525, translator brush 823, compensating resistance 861, left back contact of relay 524, right front contact of relay 507, conductor 692, terminal 439, brush 438, right contacts of cam 405, brush 406, terminal 407, conductor 379, right contacts of cam 343, brush 347, terminal 348, conductor 653 to ground at the right back contact of relay 651.

The current flowing in this circuit operates relay 716 but relay 650 of the trunk circuit being marginal does not operate at this time. Relay 716 upon operating closes an obvious circuit for relay 720 which in turn closes an obvious circuit for relay 721, relay 721 locking over its right front contact to ground on cam 722 until sequence switch 700 leaves position 5. With relay 721 operated a circuit is established for advancing sequence switch 700 into position 6 which may be traced from battery, winding of sequence switch magnet 700, lower contact of cam 715, contact of class switch cam 955, left front contact of relay 721 to ground at the left back contact of relay 711. In position 6 of sequence switch 700 a circuit is completed from battery through the winding of relay 524, contact of cam 962, contacts of cam 714, outer right back contact of relay 730 to ground. Relay 524 operates and locks over its inner right front contact, contact of cam 528 to ground and closes a circuit from battery through the winding of sequence switch magnet 700, upper contact of cam 715, outer right front contact of relay 524 to ground advancing sequence switch 700 to position 17. Sequence switch 700 is then advanced to position 18 in a circuit over the upper right contact of cam 715, inner left back contact of relay 708, upper left contact of cam 522 to ground. Relay 524 also closes a circuit for operating relay 504.

Throughout the setting of the district selector and until sequence switch 300 of the district selector advances out of position 10, relay 351 is operated in parallel with one winding of relay 317. The operation of relay 504 above mentioned opens a shunt around the right winding of relay 503, including that winding in the circuit of relays 351, and 317. Relay 351 thereupon releases, advancing the

district selector to position 11, in which position ground is connected over the upper right contact of cam 336 to conductor 315 which is extended over terminal 433, brush 432, upper contacts of cam 446, left winding of relay 415, right back contact of relay 409, left contact of cam 434, brush 431, terminal 430, conductor 506, left back contact of relay 505, to the windings of relay 503. Since these are also connected to ground, relay 503 now releases in turn releasing relay 507. The release of relay 507 does not release relay 509 since that relay is locked to its own front contact. A circuit is therefore closed from ground over the back contact of relay 507, left front contact of relay 509, to the winding of relay 505 which locks over its middle left front contact to conductor 506 and to ground as above traced.

From position 11 sequence switch 300 is advanced into position 12 over a circuit extending from battery, winding of sequence switch magnet 300, upper left contact of cam 328, upper contacts of cam 341, to ground at the right contact of cam 339. A circuit is now established for controlling talking selection extending from battery, left winding of relay 314, lower right contact of cam 313, upper left contact of cam 312, conductor 378, terminal 401, brush 402, lower right and upper left contacts of cam 435, brush 436, terminal 437, front contact of relay 621, right front contact of relay 504, right contact of cam 701, sequence switch 700 having advanced into position 18 for controlling talking selection, winding of relay 702, back contact of counting relay 703, resistance 740, lower and right contacts of cam 705, right back contact of relay 507, resistance to ground. Relay 314 operates in this circuit and locks over its outer left front contact and the lower left contact of cam 313 to the circuit just traced, and closes a circuit for advancing sequence switch 300 from position 12 toward position 16. This circuit may be traced from battery, winding of magnet 300, upper left contact of cam 328, right front contact of relay 314, left back contact of relay 302 to ground at the lower left contact of cam 336. As the sequence switch advances, a shunt is intermittently connected to the control circuit extending through the winding of the relay 314 and the winding of sender control relay 702 over the upper right and lower left contacts of cam 350, thereby holding relay 314 operated and shunting sender relay 702. When the sender is satisfied as to its talking selection setting, relay 703 in the sender operates, releasing relays 702 and 314, thereby arresting the district sequence switch 300 in its next stopping position. It will be assured that the sequence switch is arrested in position 13.

When sequence switch 300 left position 11 $\frac{1}{4}$, the calling line was disconnected from the sender at contacts of cams 335 and 329,

and when sequence switch 300 reached position 11 $\frac{1}{2}$ the calling line was connected over a circuit extending from battery, lower left winding of repeating coil 360, upper right contact of cam 329, winding of relay 330, right back contact of relay 317, brush 331, terminal 332, conductor 116, thence through the calling substation 100, conductor 117, terminal 333, brush 334, outer left back contact of relay 317, lower contacts of cam 335, to ground through the upper left winding of coil 360. Relay 330 is operated over this circuit until the calling subscriber hangs up to release the connection, and operates relay 351 over a circuit from battery, winding of relay 351, resistance 390, front contact of relay 330 to ground over the upper contacts of cam 350. Relay 351 is thus operated until the calling subscriber releases the connection.

After talking selection is completed, relay 515 operates connecting battery to conductor 506 in parallel with the winding of relay 505. The current over this circuit is now sufficient to operate relay 415 which closes a circuit from battery through the left winding of relay 417, left contacts of cam 421 to ground at the left front contact of relay 415. Relay 417 closes a circuit from battery through the winding of sequence switch magnet 400, upper contact of cam 479, outer right front contacts of relay 417, left back contact of relay 409 to ground advancing sequence switch 400 to position 6. In this position all of the conductors extending to the sender are open and the sender is completely released. The link circuit of Fig. 4 now functions to restore the sender finder 420 thereof to normal, to hunt for and allot another line finder—district selector link for use on another call, and to advance link sequence switch 400 into position 10, so that the link is ready to operate in response to the next call in the group of lines served thereby.

With the district selector sequence switch 300 in the talking position 13 a new circuit is established for relay 650 of the selected trunk circuit which may be traced from battery, winding of relay 650, left back contact of relay 651, conductor 652, terminal 345, brush 346, lower contacts of cam 358, upper right winding of repeating coil 360, left contacts of cam 353, winding of polarized supervisory relay 361, lower right winding of coil 360, upper contacts of cam 343, brush 347, terminal 348, conductor 653 to ground at the right back contact of relay 651. The resistance of this circuit is low enough to enable marginal relay 650 to operate, but the current flowing is not in the proper direction to operate polarized relay 361.

With relay 650 operated a circuit is established from battery through the left winding of line relay 655 at the information bureau, upper left winding of repeating coil 666, thence over the tip conductor 667 of the in-

teroffice trunk extending from the dial switching office to the bureau, right contact of relay 650, left winding of polarized relay 654, left contact of relay 650, ring conductor 668 of the interoffice trunk, lower left winding of repeating coil 666, to ground through the right winding of relay 655. Relays 655 and 654 operate in this circuit, relay 655 starting the apparatus at the information bureau in the manner fully described in the application of Carpenter et al. hereinbefore referred to. Relay 654 upon operating locks in a circuit from ground, right contacts of cam 350, sleeve brush 349, sleeve terminal 354, conductor 669, contact and right winding of relay 654 to battery through the winding of relay 651.

Relay 651 operates in this locking circuit, locks directly to ground on conductor 669, disconnects relay 650 and ground from the conductors 652 and 653 and extends these conductors to conductors 667 and 668, respectively. Relay 650 releases and at its contact disconnects the left winding of relay 654 from the bridge connection between trunk conductors 667 and 668. With relay 651 operated a circuit is established from conductor 669, inner left front contact of relay 651, right winding and contact of relay 654, to conductor 669 thereby shunting the right winding of relay 654 and causing it to release. The trunk circuit is now in condition for talking there being no supervisory bridges thereacross. In the talking position relay 655, at the distant end of the trunk is held operated through the right windings of repeating coil 360 and the winding of polarized relay 361 at the district selector but the current is not supplied in this circuit in such a direction as to cause the operation of polarized relay 361.

When the calling subscriber 100 hangs up to release the connection, relay 330 releases in turn releasing relay 351, with relay 351 released the district selector and line finder return to normal in the manner well known in the art. As soon as the district selector sequence switch 300, advances beyond position 16 $\frac{1}{4}$ ground is removed from conductor 669, thereby releasing relay 651. The trunk circuit is now in normal condition.

This information service is intended to be given free of charge. It is therefore necessary to avoid conditions which might lead to charging the calling subscriber. Charging is controlled at the district selector through the operation of polarized relay 361 which is operated by receiving current through its winding in the proper direction when a call is established to another subscriber's line and such called subscriber has answered. To safeguard against the operation of polarized relay 361, on calls to the information bureau, should battery and ground be reversely connected to the winding of line relay 655 at the bureau, polarized

relay 654 is employed in the trunk circuit. Should battery and ground be incorrectly connected to the windings of relay 655 in such a direction as would operate relay 651, when polarized relay 654 is bridged across the trunk conductors 667 and 668 through the operation of relay 650 after the trunk has been seized, current will not flow in the proper direction, through the bridged winding of relay 654, to cause it to operate. Consequently cut-through relay 651 cannot operate to cut the conductors 652 and 653 through to the windings of line relay 655, and the reversely connected battery at line relay 655 does not become associated with the winding of polarized relay 361 to cause its operation.

From the foregoing description it will be apparent that the trunk circuit embodying the present invention is so constituted that when the trunk is first seized by the district selector or by an office selector a circuit condition is established to signal the sender to advance the district selector sequence switch into the talking position before the trunk is cut through to the information bureau, thereby avoiding a premature start of the apparatus associated with the distant end of the trunk, at the information bureau. The trunk circuit also recognizes when the district selector circuit has been advanced to the talking position and then cuts through to the information bureau but will not cut through if the polarity of the trunk at the distant end has been unintentionally reversed, thus safeguarding the calling subscriber against charges for a service call that should be granted free of charge.

What is claimed is:

1. In a telephone system, a trunk circuit having two normally disconnected sections, a selector switch for connecting with the outgoing section of said trunk circuit, a sender for controlling said selector switch, means normally connected to the outgoing section of said trunk circuit for controlling said sender to cause the closure of the talking circuit at said selector switch, means in said trunk circuit operative upon the closure of the talking circuit to connect a bridge across the incoming section of said trunk circuit, and means operative upon the establishment of said bridge to unite the sections of said trunk circuit.

2. In a telephone system, a trunk circuit having two normally disconnected sections, a selector switch for connecting with the outgoing section of said trunk circuit, a sender for controlling said selector switch, means normally connected to the outgoing section of said trunk circuit for controlling said sender to cause the closure of the talking circuit at said selector switch, a polarized relay, means in said trunk circuit operative upon the closure of said talking circuit to connect

said relay in bridge of the incoming section of said trunk circuit, said relay operative only if current is supplied to the distant end of said trunk circuit in the proper direction, and means responsive to the operation of said relay for uniting the sections of said trunk circuit.

3. In a telephone system, a trunk circuit having two normally disconnected sections, a selector switch for connecting with the outgoing section of said trunk circuit, a sender for controlling said selector switch, a battery supply relay normally connected to the outgoing section of said trunk circuit for supplying signalling current to said sender upon the seizure of said trunk circuit, means in said sender responsive to said current for controlling the closure of the talking circuit at said selector switch, said relay not responsive in circuit with said means but responsive upon the closure of said talking circuit, a second relay in said trunk circuit operative over the incoming section thereof upon the operation of said first relay, and a third relay operative upon the response of said second relay, said third relay upon operating uniting the sections of said trunk circuit and releasing said first and second relays.

4. In a telephone system, a trunk circuit having two normally disconnected sections, a selector switch for connecting with the outgoing section of said trunk circuit, a sender for controlling said selector switch, a battery supply relay normally connected to the outgoing section of said trunk circuit for supplying signaling current to said sender upon the seizure of said trunk circuit, means in said sender responsive to said current for controlling the closure of the talking circuit at said selector switch, said relay unresponsive in circuit with said means but responsive upon the closure of said talking circuit, a polarized relay in said trunk circuit operative over the incoming section thereof upon the operation of said first relay if current is supplied to the distant end of said trunk circuit in the proper direction, and a third relay operative upon the response of said second relay, said third relay upon operating uniting the sections of said trunk circuit and releasing said first and second relays.

5. In a telephone system, a calling line having a call charging device, a trunk circuit having two normally disconnected sections, a selector switch for connecting said line with the outgoing section of said trunk circuit, a sender for controlling said selector switch, a battery supply relay normally connected to the outgoing section of said trunk circuit for supplying signalling current to said sender upon the seizure of said trunk circuit, means in said sender responsive to said current for controlling the closure of the talking circuit at said selector switch, said relay not responsive in circuit with said means but

responsive upon the closure of said talking circuit, a polarized relay in the talking circuit at said selector switch for controlling the charging device of said calling line, a polarized relay in said trunk circuit operative over the incoming section thereof upon the operation of said first relay if current is supplied to the distant end of said trunk circuit in a direction which will not operate the polarized relay of said selector switch, and a third relay operative upon the response of the polarized relay of said trunk circuit to unite the sections of the trunk circuit.

6. In a telephone system a trunk circuit having two normally disconnected sections, a selector switch for connecting with the outgoing section of said trunk circuit, a sender for controlling said selector switch, a battery supply relay normally connected to the outgoing section of said trunk circuit for supplying signaling current to said sender upon seizure of said trunk circuit, means in said sender responsive to said current for controlling the closure of the talking circuit at said selector switch, said relay not responsive in circuit with said means, but responsive upon the closure of said talking circuit, a second relay having an operating and a locking winding, means controlled by said first relay upon operating to bridge the operating winding of said second relay across the incoming section of said trunk circuit, and a third relay operative in the locking circuit of said second relay, said third relay upon operating uniting the sections of said trunk circuit, opening the circuit of said first relay, opening the operating circuit of said second relay and shunting the locking winding of said second relay.

In witness whereof, I hereunto subscribe my name this 4th day of August, 1930.

ALFRED E. HAGUE.