

April 25, 1933.

H. W. ULRICH

1,905,662

TELEPHONE SYSTEM

Filed Nov. 27, 1931

5 Sheets-Sheet 1

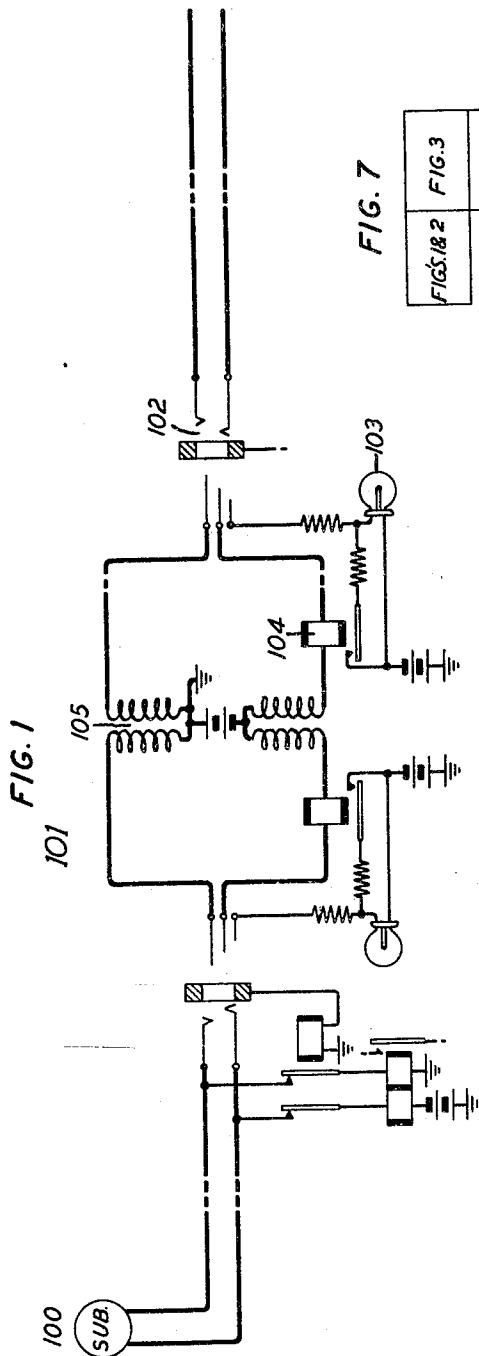
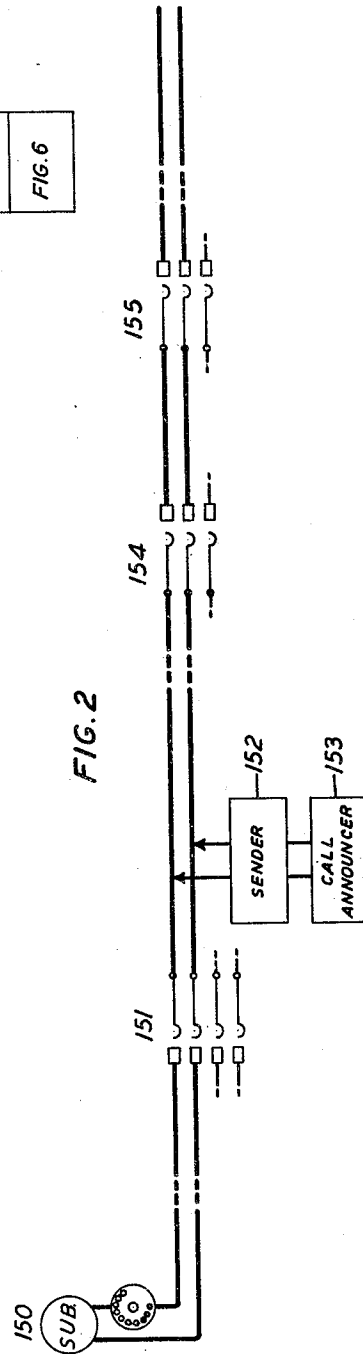


FIG. 7

FIG. 1 & 2	FIG. 3	FIG. 4	FIG. 5	FIG. 6
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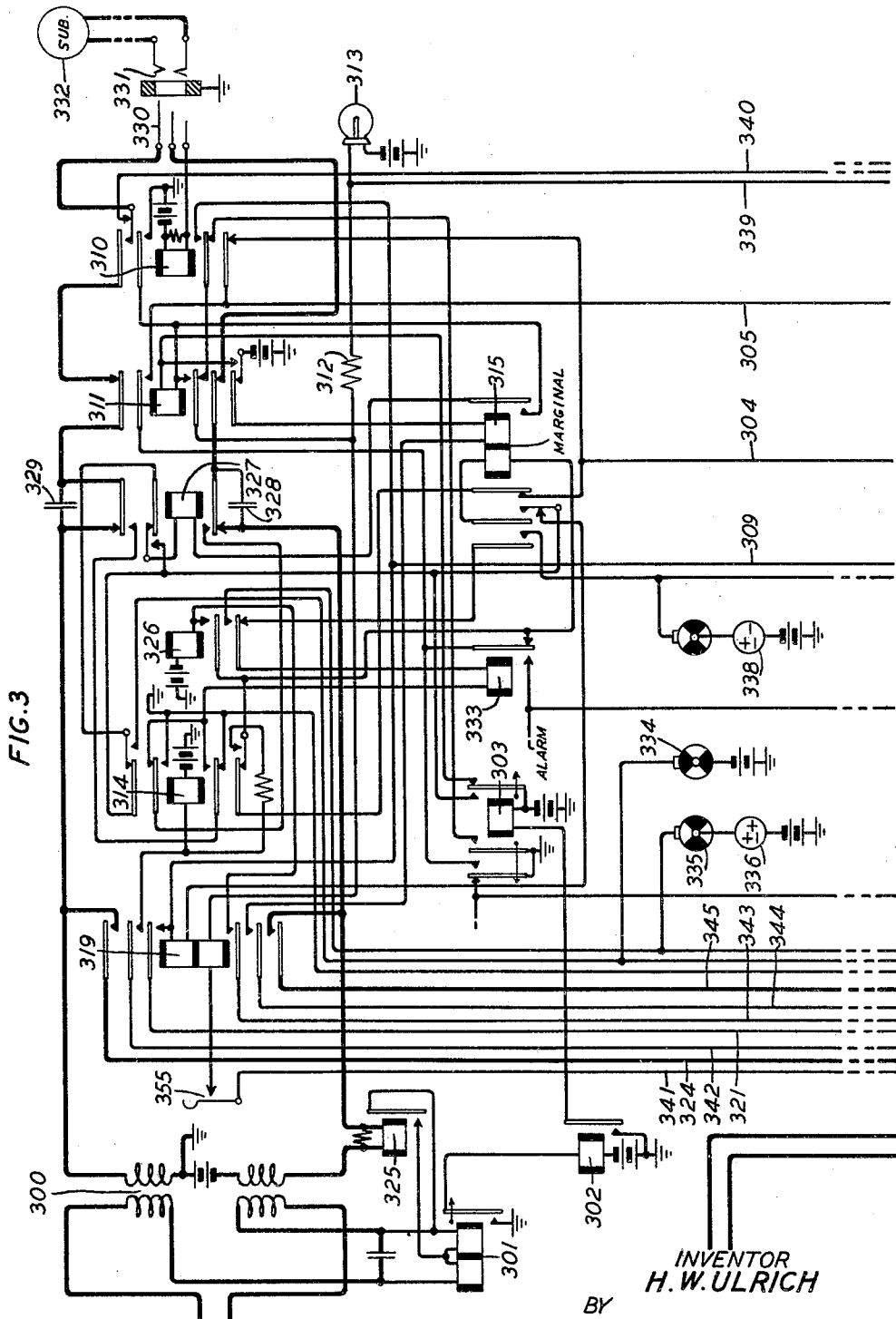
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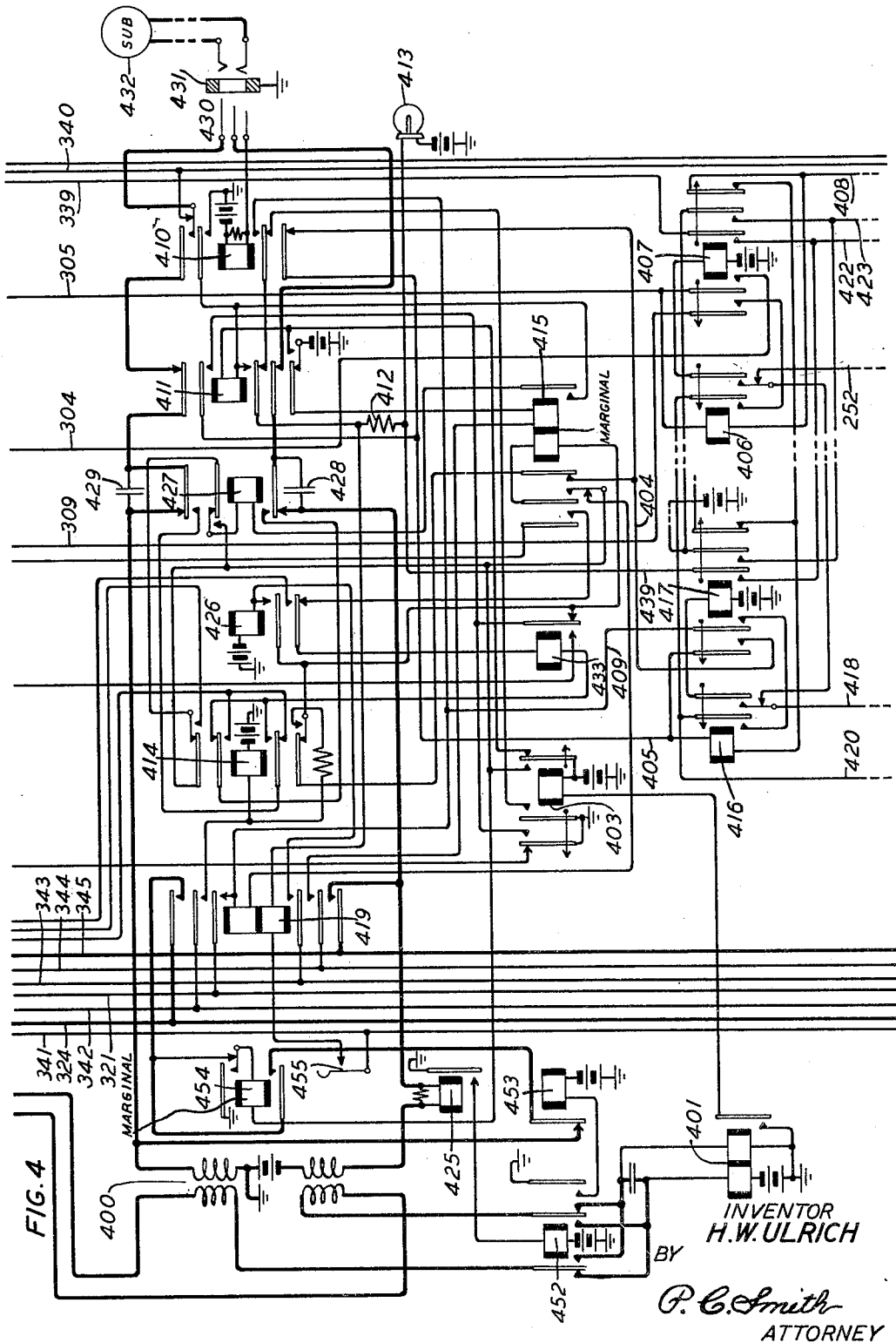
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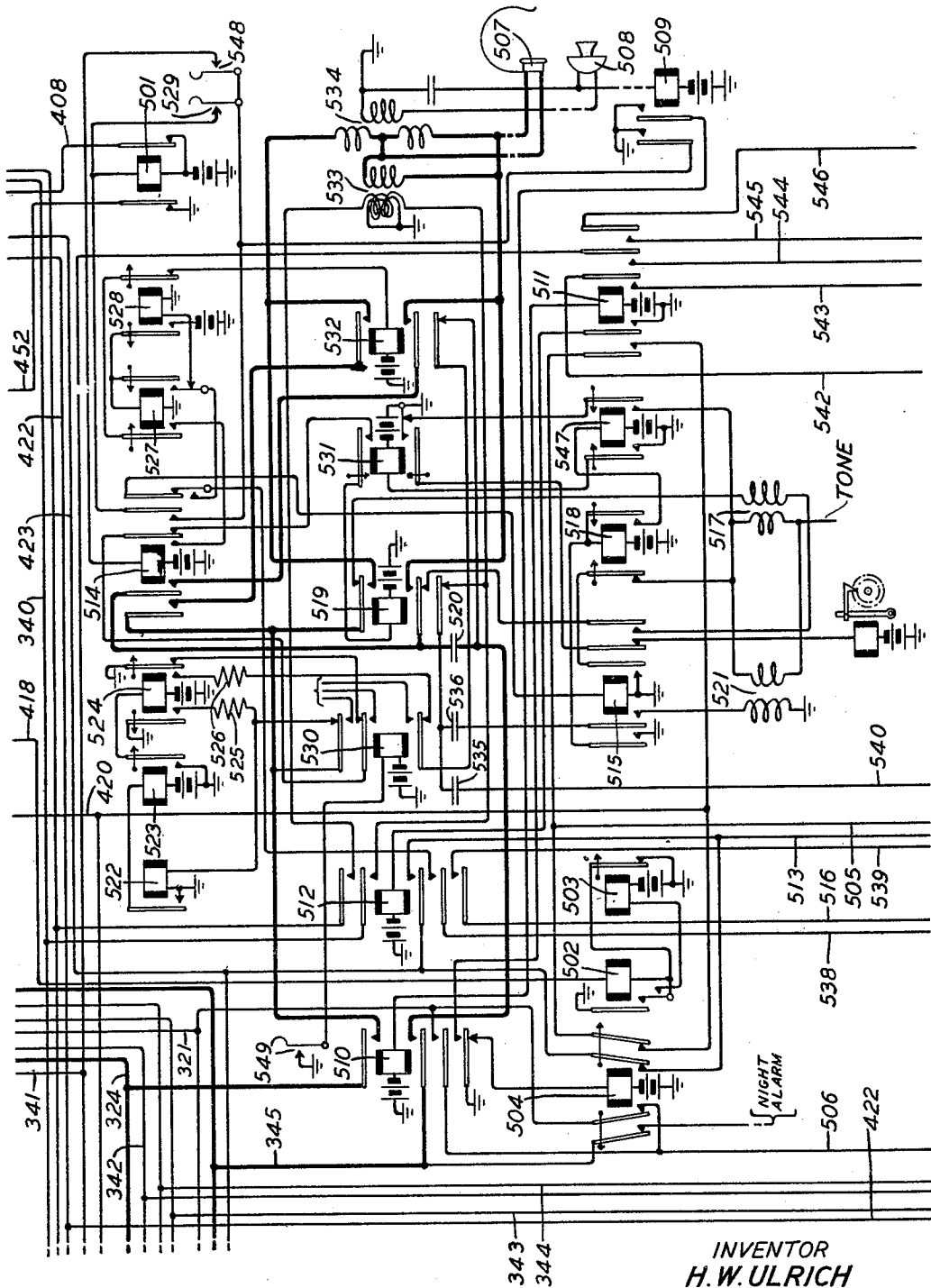


FIG. 5

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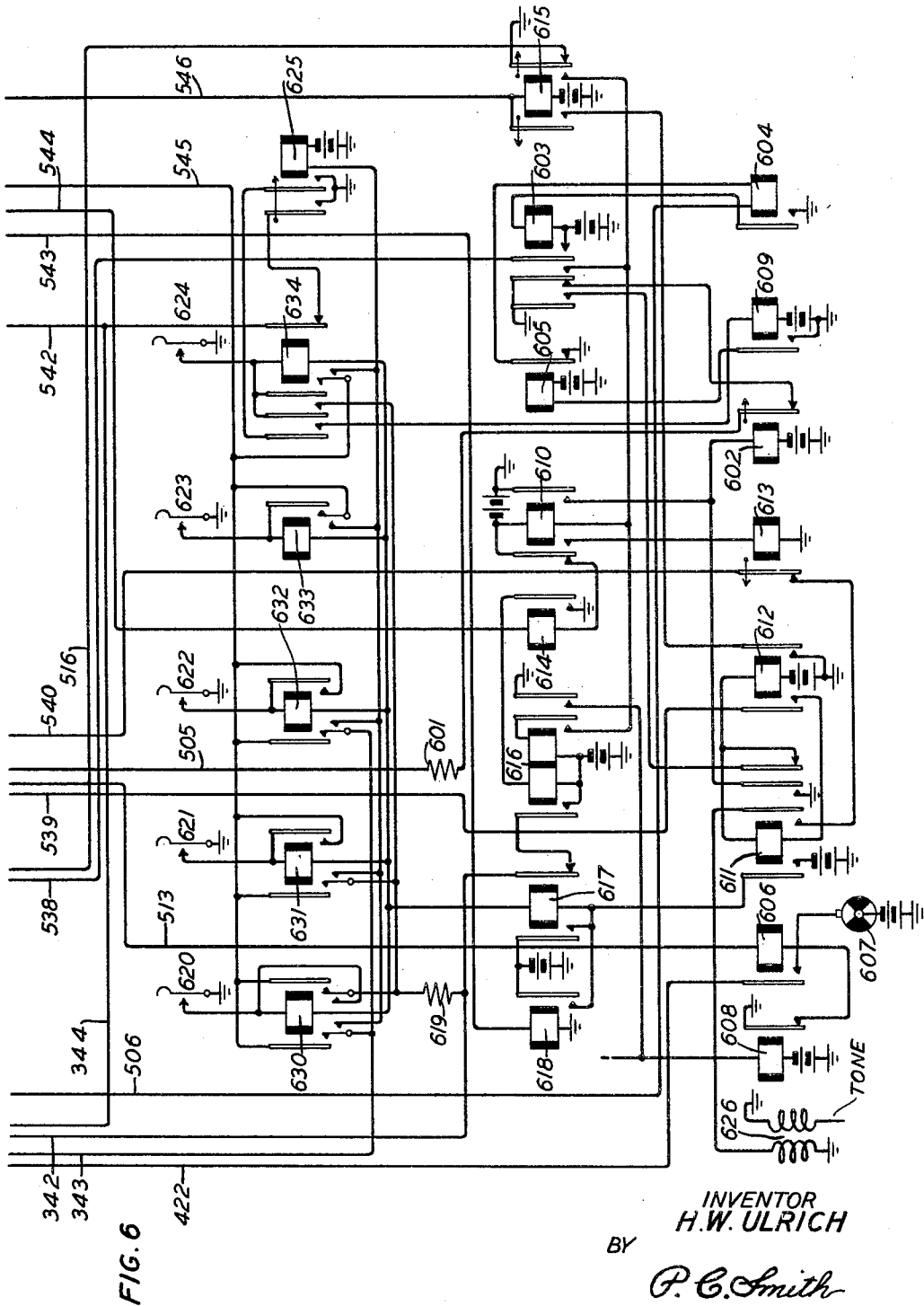
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5 Sheets-Sheet 5



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TELEPHONE SYSTEM

Application filed November 27, 1931. Serial No. 577,571.

This invention relates to telephone systems employing both manual and dial equipment and has for its object to increase the efficiency with which connections are established between such offices.

More particularly the invention concerns the establishment of connections which originate in dial offices and are completed by means of manual operators. In the past this type of connection has been accomplished by the aid of a visual indicator located at each operator's position. More recently a development has arisen by means of which the wanted line designation is transmitted to the operator by means of mechanically generated voice currents, representative of the elements of the designation. The present invention has to do with the operator's equipment for completing connections extended from offices provided with such call announcing equipment.

One operator may serve calls incoming from both manual and dial offices and may be equipped with a common control circuit which is automatically associated with the trunks over which calls are incoming. To distinguish between calls incoming from manual offices and those incoming from dial offices, the trunks incoming from dial offices are equipped with means for identifying themselves to the control equipment and the control equipment is provided with means for transmitting a signal to the dial office for causing the initiation of the call announcement in response to such identification. This signal consists of the momentary reversal of the current flow over the trunk. After the connection is completed the response of the called subscriber causes a prolonged reversal of the current flow for supervisory purposes. If the called line is busy, the plug of the trunk is inserted into a busy-back jack which causes repeated reversals of the current flow as a busy signal. When the calling subscriber in the dial office disconnects, the restoration of the automatic switches renders the trunk selectable and causes the display of a disconnect signal before the operator. If she delays removing the plug, it is possible to reselect the trunk

and prepare for the transmission of a call announcement while the plug is in the busy-back jack or in the jack of a called subscriber's line whose receiver may be off the switchhook. To prevent such a condition from causing premature operation of the call announcer equipment, means is provided responsive to the disconnection of the first calling subscriber to restore the direction of current flow to normal and to prevent its reversal until the plug has been withdrawn. Should such release and reseizure occur before the operator's control equipment is disconnected from the trunk, the control equipment is rendered inoperative until the operator operates her disconnecting means. Release of the incoming end of the connection at this time causes the application of a tone to the operator's headset to notify her that the call has been abandoned.

The invention will be more clearly understood from a consideration of the following description in connection with the drawings in which:

Fig. 1 shows in diagrammatic form a connection between a manual substation and the trunk of Fig. 3.

Fig. 2 shows in diagrammatic form a connection between a dial substation and the trunk of Fig. 4.

Fig. 3 shows a trunk incoming from a manual office.

Fig. 4 shows a trunk incoming from a dial office.

Fig. 5 shows the operator's telephone and control equipment.

Fig. 6 shows the common ringing key equipment; and

Fig. 7 shows the manner in which the several figures should be arranged.

For a detailed description of the call announcing system as used in connection with a tandem sender, reference is made to the patent of T. H. Roberts, No. 1,840,132, granted Jan. 5, 1932.

When the subscriber at substation 100 wishes to talk with the subscriber at substation 332, he removes the receiver from the switchhook lighting a lamp (not shown) before an operator who responds by inserting

the answering plug of her cord circuit 101 in the answering jack of the subscriber's line. He then gives the number of substation 332 to the operator who inserts the calling plug 5 of the cord circuit 101 in the jack 102 connected with the trunk of Fig. 3. The insertion of the plug in jack 102 closes a circuit from ground over the sleeves of the jack and plug for lighting supervisory lamp 103. At 10 the same time a circuit is closed from battery through the lower right winding of the cord circuit repeating coil 105, supervisory relay 104, rings of the plug, jack and trunk, lower left winding of repeating coil 300, 15 windings of relay 301 in series, upper left winding of repeating coil 300, tips of trunk, jack and plug, upper right winding of repeating coil 105 to ground. Relay 301 operates in this circuit, but relay 104 can not 20 operate due to the high resistance of the right winding of relay 301. Relay 301 causes relays 302 and 303 to operate in turn. Relay 303 closes a circuit from battery through guard lamp 313, resistance 312, inner lower 25 back contacts of relays 311 and 310 to ground at the inner left contact of relay 303 as an indication that a call is incoming over the associated trunk. Relay 303 also connects ground over its outer left contact, 30 back contact of relay 333, outer lower back contact of relay 314, inner left back contact of relay 315 to conductor 304 and over the outer lower back contact of relay 310 to conductor 305.

35 Conductor 305 extends to the winding of relay 406 which is connected over conductor 408 to the right contact of relay 501 and battery. Relays 406 and 407 comprise a pair of sequence relays individual to the trunk of 40 Fig. 3, while the relays 416 and 417 are a similar pair of relays individual to the trunk of Fig. 4 and other pairs of relays, provided for the remaining trunks at the operator's position, are indicated by the dotted sections of the conductors associating the two 45 pairs of sequence relays. The function of these relays is to connect the operator's control circuit of Fig. 5 and the common ringing key circuit of Fig. 6 with the trunk circuit in a predetermined sequence, regardless of the order in which the trunks are selected. A trunk splitting circuit would ordinarily be provided by means of which one operator 50 can serve groups of trunks of varying size, but it has been omitted from the disclosure. A typical splitting arrangement is disclosed in Patent 1,667,830 granted to H. W. Ulrich, May 1, 1928.

Assuming that the call on the trunk of 60 Fig. 3 is the only one present at the time, relay 406 operates in the circuit above traced and closes a circuit from battery through the winding of relay 407, outer front contact of relay 406, over the back contacts of similar 65 relays belonging to intermediate trunks,

over the back contact of relay 416, conductor 418, winding of relay 502, back contact of relay 503 to ground. Relay 407 in operating disconnects battery on conductor 408, from 70 other relays similar to relays 406 and 416 of trunks higher in the chain, while relay 406 opens the operating ground for relays such as relay 407 which may be lower in the chain.

When the operator occupies her position, 75 she connects her headset including receiver 507 and transmitter 508, with the position equipment by means of a plug and jack (not shown). A circuit is thereby closed from battery through the winding of relay 509, 80 transmitter 508, winding of repeating coil 534 to ground. Relay 509, operating in this circuit, operates relay 510, in turn operating relays 511 and 512. With these relays operated the position is ready to handle calls. 85 While the position is unoccupied, relay 504 is operated over a back contact of relay 510 and a circuit is closed for giving an indication that a call has been received on an unattended position. 90

With relays 510; 511 and 512 operated, the operation of relay 407 closes a circuit from battery over the middle right contact of relay 407, conductor 423, inner lower contact of relay 512, conductor 513, winding of relay 606 to ground at the back contact of relay 608. Relay 606 connects battery through 95 interrupter 607 to conductor 422, inner right contact of relay 407, conductor 339, to resistance 312, in shunt of lamp 313 so that lamp 313 is intermittently extinguished. In addition relays 406 and 407 close a circuit from battery over the right front contact of relay 303, outer left back contact of relay 315, upper winding of relay 319, conductor 309, outer left contact of relay 407, inner 100 right contact of relay 406, conductor 420, outer left contact of relay 511, conductor 505, resistance 601, back contact of relay 602, back contact of relay 603 to ground. Relay 319 locks over its inner upper contact, conductor 321, middle lower contact of relay 510, conductor 506, winding of relay 604, back contact of relay 605 to ground. 105 Relay 319 connects the operator's control circuit to the trunk thereby preparing for the transmission of the wanted number to the operator and the control of the ringing equipment by the operator.

Relay 604 also operates in this circuit closing an obvious circuit for relay 603 which 120 locks over its inner left contact, conductor 538, middle lower contact of relay 512, outer right back contact of relay 514, winding of relay 515 to ground. Relay 515 starts the transmission of the order tones to the originating operator and to the B operator. To do so it closes a circuit from the tone source through the primary windings of tone coils 521 and 517, left back contact of relay 518 125 130

to ground at the inner right front contact of relay 515. At the same time it connects the secondary of tone coil 521 over its inner left contact, through condenser 536, outer lower back contact of relay 519 to one of the windings of coil 533 for transmitting the tone to the B operator, and connects the secondary of tone coil 517 to the trunk over a circuit extending from the tip conductor, outer upper contact of relay 319, conductor 324, upper contact of relay 510, upper back contact of relay 519, secondary winding of tone coil 517, outer right contact of relay 515, inner lower back contact of relay 519, condenser 520, inner lower front contact of relay 510, conductor 345, outer lower front contact of relay 319, to the ring conductor thereby transmitting a tone to the originating operator. In addition relay 515 closes an obvious circuit for relay 518. Relay 518 in operating opens the primary circuit of the tone coil and extends its own operating ground to the winding of relay 547. Relay 547 recloses the primary circuit of the tone coils over its right contact to ground at the lower normal contact of relay 531 and in turn operates relay 531. Relay 531 opens the primary circuit of the tone coil thus terminating the second impulse of tone. It also closes a circuit from battery through the winding of relay 519, upper contact of relay 531, inner right back contact of relay 514, inner upper back contact of relay 530, to ground at the outer right contact of relay 524. Relay 519 disconnects the secondary winding of coil 517 from the tip and ring conductors of the trunk and connects the secondary winding of repeating coil 534 to the trunk. It also disconnects the secondary of tone coil 521 from repeating coil 533.

The termination of the second impulse of tone informs the originating operator that the B operator's telephone has been connected to the trunk and she then transmits the number of the wanted subscriber. The B operator thereupon tests the wanted line by touching the tip of plug 330 to the sleeve of jack 331. If the line is busy, battery from the associated trunk is transmitted over the sleeve of jack 331, tip of plug 330, upper normal contact of relay 310, conductor 340, inner upper contact of relay 512, through the winding of test repeating coil 533 to ground, producing a click in the operator's receiver.

When relay 603 operated as above described, it removed the operating ground from relay 319 causing that relay to be held under the control of its locking circuit only. Relay 603 also closes an obvious circuit for relay 610 which in turn operates relay 602 and relay 613. In addition relay 603 closes a circuit from battery through the winding of relay 612, back contact of relay 611 to

ground at the outer front contact of relay 603. Relay 612 locks through the winding of relay 611, left contact of relay 612, conductor 539, outer lower contact of relay 512, conductor 516 to ground at the right back contact of relay 615. Relay 611 is prevented from operating in this locking circuit because of the shunt provided by the operating circuit of relay 612.

Having found the wanted line idle, the operator then operates one of the common ringing keys 620 to 623. These keys when operated operate the corresponding relays 630 to 633 and connect ground to conductors 342 and 343 to select the proper ringing current for signaling the wanted subscriber. Key 620 connects ground to both conductors 342 and 343; key 621 grounds conductor 342; key 622 grounds conductor 343; key 623 grounds neither conductor. All four keys operate relay 625 which grounds conductor 344. In the trunk circuit ground on conductor 342 operates relay 314; ground on conductor 343 operates relay 326; and ground on conductor 344 operates relay 315. Relay 314 determines whether ringing current is applied to the tip or the ring conductor, while relay 326 determines whether source 336 or 338 shall be used and relay 315 starts the ringing.

Assuming that key 620 is operated, a circuit is closed from ground through the winding of relay 618, conductor 543, inner right contact of relay 511, conductor 542, conductor 344, middle lower contact of relay 319, right winding of relay 315, outer lower back contact of relay 311 to battery. Relay 618 operates, but relay 315 which is marginal can not operate in series with relay 618. Relay 618 connects battery through the windings of relays 617 and 630 in series to key 620. Relay 617 operates, locking to battery over its inner front contact. Relay 630 also operates, connecting ground from key 620 through resistance 619 to conductor 342, over its outer left contact to conductor 343 and over its inner left contact to the winding of relay 625. Relay 625 connects ground over its outer contact and the back contact of relay 634 to the point of junction of conductors 344 and 542 in shunt of the winding of relay 618 causing that relay to release and operating relay 315 in the trunk circuit. The connection of ground to conductor 343 operates relay 326 which locks over its inner lower contact and the back contact of relay 333 to ground at the outer left front contact of relay 303. The connection of ground through resistance 619 to conductor 342 operates relay 314 which locks over its outer lower contact to the same circuit as relay 326. Relay 615 is also operated in a circuit over conductor 546, outer right contact of relay 511, conductor 545, right contacts of relay 630 to

ground at key 620. Relay 615 locks over its left contact to relay 612 and opens the locking circuit of relays 612 and 611, which release, in turn releasing relay 615 as soon as the ringing key is opened. Relay 615 provides a holding circuit for relay 610 until the key is released. In addition it extends its holding ground back over conductor 546 and the front contact of relay 511 to conductor 545 and the right contact of relay 630 to hold that relay operated until after relays 612 and 615 have released in case the closure of the ringing key is very short. Since relay 625 is slow to operate, ample time is provided for relays 314 and 326 to operate before the operation of relay 315.

Relay 315, in operating, locks in a circuit from battery over the right contact of relay 303, middle left front contact and left winding of relay 315, back contact of relay 333, outer left contact of relay 303 to ground. Relay 315 disconnects ground from conductors 304 and 305 releasing relay 406 and in turn relay 407. The release of these relays opens the intermittent shunt around lamp 313 permitting it to again light steadily. Relay 315 also opens the locking circuit of relay 319, thus completing the disconnection of the trunk from the operator's control circuit. The operator now inserts plug 330 in jack 331, operating relay 310 over the sleeves of the plug and jack. The operation of relay 310 opens the circuit of lamp 313 extinguishing it. With relays 310 and 315 operated, a circuit is closed for ringing relay 327 from ground over the inner upper contact of relay 310, right contact of relay 315, winding and inner upper normal contact of relay 327, outer upper front contact of relay 314, pick-up interrupter 334 to battery. Relay 327 operates in this circuit and locks over its inner upper front contact to battery at the right front contact of relay 303. Relay 327 completes the ringing circuit prepared by relays 314, 326 and 315. This circuit may be traced from ringing source 336 through interrupter 335, outer lower front contact of relay 326, winding of relay 333, inner lower front contact of relay 314, upper front contact of relay 327, upper back contact of relay 311, outer upper front contact of relay 310, tips of plug 330 and jack 331, over the subscriber's line and ringer, over the rings of jack 331 and plug 330, middle lower back contact of relay 311, lower front contact of relay 327, inner upper front contact of relay 314 to ground. The subscriber is signaled over the circuit above traced, while ringing tone is transmitted back to the calling subscriber through condensers 329 and 328. When the called subscriber answers, relay 333, which was included in the ringing circuit, operates opening the locking circuit of relays 314, 315 and

326. The release of relay 315 opens the circuit of relay 327 which restores the talking conductors and permits conversation to take place. When the talking circuit is completed, relay 325 operates in series with the subscriber's line, closing a shunt around the high resistance right winding of relay 301, causing the supervisory relay 104 in the cord circuit 101 at the originating office to operate and shunt the calling supervisory lamp 103, thereby extinguishing it.

At the completion of the conversation, when the receiver is replaced on the switchhook at the called substation, relay 325 releases, opening the shunt around the right winding of relay 301 permitting lamp 103 to be displayed as a disconnect signal at the originating office. When the operator at that office disconnects, relay 301 releases, in turn releasing relays 302 and 303. When relay 303 releases, a circuit is closed from battery over the right back contact of relay 303, winding of relay 311 to ground at the inner upper front contact of relay 310. Relay 311 locks to battery over its lowermost contact and connects ground over its inner lower contact to resistance 312 and lamp 313 lighting the lamp as a disconnect signal. Relay 311 also opens the tip and ring conductors. When the plug is withdrawn from the jack, relay 310 releases in turn releasing relay 311 and extinguishing lamp 313.

If the trunk should be reselected at the originating office while plug 330 is still in jack 331, that is, with relays 310 and 311 operated, the operation of relays 301, 302 and 303 connects ground to conductor 305 over the front contacts of relays 303 and 311. Relays 406, 407 and 319 operate and the circuit functions as described hereinbefore. After the order is received from the originating operator, plug 330 must be removed from jack 331 before the ringing relays can be operated and the trunk disconnected from the operator's control circuit, since with relay 311 operated, battery is disconnected from the operating winding of relay 315.

This operator's position is also equipped, as stated previously, to handle calls incoming from panel offices at which the call is registered and transmitted to the manual office by means of automatically generated voice currents, transmitted by a call announcer machine. A trunk incoming from such an office is shown in Fig. 4.

Assume that the subscriber at substation 150 in a dial office wishes to converse with the subscriber at substation 432, he will be connected by means of line finder 151 with the sender 152 which will record the wanted number to control the selection of the trunk outgoing to the desired manual office by district selector 154 and office selector 155. The call announcer machine 153 will then be con-

nected with the sender and prepared for operation. When the sender is ready for the transmission of the call announcement, it bridges a relay across the trunk conductors, completing a circuit through the left windings of repeating coil 400, back contacts of relay 452 and the windings of relay 401 to battery and ground. Relay 401 operates closing an obvious circuit for relay 403 which lights lamp 413 and operates relay 416 if no trunk lower in the sequence has been seized at the same time. Relay 416 in turn operates relay 417. The operation of relays 416 and 417 causes the connection of the operator's control circuit with the trunk in the manner described for relays 406 and 407. However, this trunk differs from the trunk of Fig. 3, in that it is provided with a relay 454 which identifies the trunk as one incoming from an office equipped with a call announcer machine. Therefore, when relay 419 operates to complete the connection of the control circuit with the trunk, a circuit is closed from battery at the right front contact of relay 403, winding and normal contact of relay 454, outer upper front contact of relay 419, conductor 324, upper front contact of relay 510, outer upper back contact of relay 530, winding of relay 522 to ground. Marginal relay 454 does not operate in this circuit, but relay 522 does, in turn operating relay 523 which in turn operates relay 524. Relay 524 connects ground through low resistance 525 in shunt of the winding of relay 522 and connects ground through resistance 526 to the lower back contact of relay 530, lower back contact of relay 532, inner lower front contact of relay 510, conductor 345, outer lower front contact of relay 419, winding of relay 425, lower right winding of repeating coil 400 to battery. Relay 425 operates in this circuit, in turn operating relays 452 and 453. Relay 452 reverses the connection of battery and ground through relay 401 to the incoming end of the trunk, thereby transmitting a signal to the sender at the panel tandem office that the wanted number may be transmitted.

The connection of ground through low resistance 525 in shunt of the winding of relay 522 causes that relay to release in turn releasing relays 523 and 524 thereby opening the circuit of relay 425 and restoring the direction of current flow over the incoming trunk to terminate the signal to the distant tandem office at the termination of which signal the designation is transmitted. The connection of ground through low resistance 525 in shunt of the winding of relay 522 also reduces the resistance in series with relay 454 sufficiently to permit that relay to operate, locking over its upper front contact to ground. With relay 454 operated, as soon as relay 453 releases, following the termination of the signal to the sender, the

tip conductor of the trunk is connected over the back contact of relay 453, lower front contact of relay 454, outer upper contact of relay 419 to conductor 324 and thence to the operator's telephone, thus completing the circuit over which the designation is transmitted to the B operator. The call is completed at the manual office in the manner above described, the dial equipment functioning in the well known manner to establish the talking circuit at that office. The operation of relay 425, following the response of the called subscriber, reoperates relays 452 and 453 to again reverse the direction of current flow through the trunk for supervisory purposes. When relay 403 releases at the termination of the connection, relay 454 also releases.

In the control circuit the tone relays 515, 518, 547 and 531 operate as previously described. However, during the time that relay 524 is operated, ground is removed from the operating circuit of relay 519 so that it will not be operated before the signal to the sender is terminated. Otherwise, the operation is the same as for straightforward manual trunks.

If the B operator inserts the plug of the trunk, for example, plug 330 in the jack 331 of the wanted line, before operating one of the common ringing keys, relay 310 operates over the sleeves of the plug and jack. Relays 406 and 407 are held operated under this condition in a circuit from battery over conductor 408, winding of relay 406, inner left contact of relay 407, conductor 304, inner left back contact of relay 315, outer lower back contact of relay 314, back contact of relay 333, outer left contact of relay 303 to ground. The circuit for steadily lighting lamp 313 extends through resistance 312, inner lower back contact of relay 311, inner lower front contact of relay 310, inner upper front of relay 319 to ground over the locking circuit of that relay. The circuit for flashing the lamp remains as previously traced. When the ringing key has been operated relay 319 releases, thus removing ground from lamp 313 and extinguishing it. The operation of the ringing key operates relays 315, 314 and 326 according to the party to be signaled. Relay 315 opens the circuit of the sequence relays and these relays release.

If for any reason the automatic listening circuits fail to function, the operator can connect her telephone with a trunk by the operation of the emergency listening key individual to the trunk. The operation of key 355, for example, closes a circuit from ground at the inner left contact of relay 303, back contact of relay 310, back contact of relay 311, lower winding of relay 319, contact of key 355, conductor 341, middle right contact of relay 511, conductor 544, winding

of relay 614, back contact of relay 610 to battery. Relay 319 operates and locks in the same circuit as traced for automatic listening, connecting the trunk with the control circuit. However, lamp 313 does not flash since the sequence relays have not been operated. In the control circuit, relay 614 operates in turn operating relay 616. Relay 604 operates in the locking circuit of relay 319, in turn operating relay 603 as for automatic operation. With relay 603 operated, a locking circuit is closed for relay 616 through its right winding and inner right contact. Relay 616 connects ground to the winding of relay 608 opening the circuit of flashing relay 606. The operation of relay 603 causes the transmission of the tones in the usual manner.

When the emergency listening key is to be used, either key 529 or 548 must also be operated. These keys lock when operated. Key 529 operates relay 501 to remove battery from the sequence relays to prevent interference with the progress of a call. Key 548 is operated if the tone circuits are also out of order. In this case a circuit is closed for relay 514 which in turn operates relay 501. Relay 514 connects the tip and ring conductors to the contacts of relay 532 and substitutes relay 528 for relay 515 so that relay 528 is operated from relay 603 following the connection of the trunk with the control circuit. Relay 528 in turn operates relay 527 which locks to the front contact of relay 603, disconnecting relay 528 therefrom. When relay 528 releases, a circuit is closed from battery through the winding of relay 532, back contact of relay 528, right front contact of relay 527, inner right contact of relay 514, upper back contact of relay 530, back contact of relay 524 to ground. Relay 532 in operating connects the talking conductors through to the operator's telephone. Relays 527 and 528 introduce a sufficient delay to permit the completion of the signal to the sender before connecting the operator's telephone to the trunk. This is further insured by the fact that ground for the circuit of relay 532 is obtained from the back contact of relay 524. Key 549 and relay 530 permit the transfer to an emergency set of relays (not shown) for transmitting the call announcer signal.

Relays 502 and 503 are used for applying ground to sequence relays 406 and 407, 416 and 417, etc. Relay 502 operates when the circuit of relay 407 or 417 is closed and locks through its own contact to ground, in turn operating relay 503. Relay 503 opens the operating ground for relay 502. By means of a make-before-break contact of relays 416, etc., relay 502 is held operated when a pair of sequence relays releases if a call is waiting on a trunk further along in the sequence. When the last pair of se-

quence relays releases, relay 502 also releases, disconnecting ground from conductor 418 and releasing relay 503. After an interval relay 503 reconnects ground to the winding of relay 502. This interval permits the relays such as relays 416 or relay 406, of trunks over which calls are incoming to operate, and the waiting calls are connected to the operator's control circuit in sequence as before.

During the night there may be insufficient calls to warrant the operator sitting at the board or she may have so many positions to handle that it is necessary to patrol the board instead of sitting at one position. In that case she will remove her telephone, releasing relays 509, 510, 511 and 512. The release of relay 510 permits relay 504 to operate. When, thereafter, a trunk is seized at the distant end, the sequence relays function as above described operating relay 606 over the inner right front contact of relay 504, causing the trunk lamp to flash as before. Relay 319 is operated over the outer right front contact of relay 504 and locks over the inner left front contact of relay 504. With relay 504 operated, battery through the winding of repeating coil 300 and relay 325 is also connected over conductor 345 and the outer left contact of relay 504 to the night alarm, warning the operator that a call is awaiting her attention. Neither the order tones nor the order signal can be transmitted. However, as soon as the operator's telephone is connected with the position control circuit, these circuits can function and the call progresses as before.

If a call is abandoned at the originating end prior to the insertion of the plug in the jack, the release of relay 301 releases relays 302 and 303, in turn releasing relay 319 and any other relays which may have been operated, restoring the circuit to normal. In the ringing key circuit it will be remembered that the operation of relay 603 following the connection of the trunk with the position, operates relay 612 which locks through the winding of relay 611, but relay 611 could not operate, being shunted by the operating circuit of relay 612. If, now, the call is abandoned, the release of relay 319 releases relay 604 and in turn relays 603 and 610, thereby removing the shunt from the winding of relay 611. Relay 611 thereupon operates, in turn operating relay 602. Relay 611 also supplies battery to the winding of relay 617 and holds relay 602 operated, preventing the operation of any other relays such as relay 319 until a ringing key or trunk key has been operated. It also connects the secondary of tone coil 626 through its inner right front contact, back contact of relay 613 which is now released, conductor 540, condenser 535, outer lower

back contact of relay 519, winding of test coil 533, thus transmitting an abandoned call tone to the operator. Assuming that the operator now operates the trunk key 624, relays 617 and 634 operate in series. Relay 617 locks to battery at its front contact. Relay 634 operates relay 625, but opens the circuit over which relay 315 in the trunk is operated by the ringing keys. Relay 625 also operates relay 609, which in turn operates relay 605 removing ground from relay 604, which would cause the disconnection of the trunk from the control circuit had it not already been released. Relay 634 also connects ground through resistance 619 to conductor 342 operating relay 314. With relay 314 operated and relay 315 non-operated, ground is removed from the sequence relays and the release of the trunk from the position control circuit is completed. The release of key 624 releases relay 314. Key 624 is also used for releasing the control circuit from the trunk when the call is directed to an intercepting operator.

What is claimed is:

1. In a telephone system, an operator's position, trunks incoming to said position from a manual office, trunks incoming to said position from a dial office, means at said dial office to automatically announce wanted line designations, common control equipment at said operator's position, an operator's telephone associated with said control equipment and normally disconnected therefrom, means in said control equipment for connecting said telephone with said trunks, means responsive to the seizure of any one of said trunks for automatically connecting said control equipment with said trunk, means to identify said trunks incoming from the dial office to said control equipment, means in said control equipment to transmit a tone signal to said operator's telephone, means responsive to said identifying means to transmit a signal to initiate the operation of said announcing means, means normally responsive to the completion of said tone signal to connect said telephone with said trunk, and means responsive to said identifying means to delay the connection of said telephone with said trunk until the termination of said signal.

2. In a telephone system, a dial office, an operator's position, trunks connecting said dial office and said operator's position and terminating in plugs at said position, jacks at said position, a call announcer mechanism at said dial office, control equipment common to said trunks at said position, means responsive to the seizure of one of said trunks at said dial office to connect said control equipment with said trunk, means responsive to the connection of said control equipment with said trunk to cause a mo-

mentary reversal of the current flow over said trunk to initiate the operation of said call announcer mechanism, other means to reverse the current flow over said trunk with the plug of said trunk in a jack, and means to render said other means ineffective if said trunk is released and resealed before said plug is removed from said jack.

3. In a telephone system, a dial office, an operator's position, trunks connecting said dial office and said operator's position and terminating in plugs at said position, jacks at said position, a call announcer mechanism at said dial office, control equipment common to said trunks at said position, means responsive to the seizure of one of said trunks at said dial office to connect said control equipment with said trunk, a supervisory relay, means responsive to the operation of said supervisory relay to cause a reversal of the current flow over said trunk, means responsive to the connection of said control equipment with said trunk to momentarily operate said supervisory relay to initiate the operation of said call announcer mechanism, other means to reoperate said supervisory relay with the plug of said trunk in a jack, and means to prevent the reoperation of said supervisory relay if said trunk is released and resealed before said plug is removed from said jack.

4. In a telephone system, a dial office, an operator's position, trunks connecting said dial office and said operator's position and terminating in plugs at said position, jacks at said position, a call announcer mechanism at said dial office, control equipment common to said trunks at said position, means responsive to the seizure of one of said trunks at said dial office to connect said control equipment with said trunks, a supervisory relay, means responsive to the operation of said supervisory relay to cause a reversal of the current flow over said trunk, means responsive to the connection of said control equipment with said trunk to momentarily operate said supervisory relay to initiate the operation of said call announcer mechanism, other means to reoperate said supervisory relay with the plug of said trunk in a jack, and means to disconnect said supervisory relay from said plug to prevent the reoperation of said supervisory relay if said trunk is released and resealed before said plug is removed from said jack.

5. In a telephone system, a dial office, an operator's position, trunks connecting said dial office and said operator's position and terminating in plugs at said position, jacks at said position, a call announcer mechanism at said dial office, control equipment common to said trunks at said position, means responsive to the seizure of one of said trunks at said dial office to connect said control equipment with said trunk, a super-

visory relay, means responsive to the operation of said supervisory relay to cause a reversal of the current flow over said trunk, means responsive to the connection of said

5 control equipment with said trunk to momentarily operate said supervisory relay to initiate the operation of said call announcer mechanism, other means to reoperate said supervisory relay with the plug of said
10 trunk in a jack, a relay, means responsive to the release of said trunk to operate said relay, and means under the control of said relay to prevent the reoperation of said supervisory relay if said trunk is re seized
15 before said plug is removed from said jack.

6. In a telephone system, an operator's position, trunks appearing at said position, an operator's telephone and control equipment common to said trunks, means responsive to the seizure of one of said trunks to
20 automatically associate said control equipment with said trunk, ringing keys in said control equipment, means responsive to the operation of one of said keys for disconnecting
25 said control equipment from said trunk, and means to render said association ineffective if said trunk is released and re seized prior to the operation of one of said keys.

7. In a telephone system, an operator's position, trunks appearing at said position, an operator's telephone and control equipment common to said trunks, means responsive to the seizure of one of said trunks to automatically
30 associate said control equipment with said trunk, ringing keys in said control equipment, means responsive to the operation of one of said keys for disconnecting said control equipment from said trunk, means responsive to the release of said trunk
35 prior to the operation of one of said keys to disconnect said trunk from said control equipment, and means to prevent the reassociation of said trunk with said control equipment if said trunk is re seized prior
40 to the operation of one of said keys.

8. In a telephone system, an operator's position, trunks appearing at said position, an operator's telephone and control equipment common to said trunks, a relay responsive to the seizure of one of said trunks to
50 automatically associate said control equipment with said trunk, ringing keys in said control equipment, means responsive to the operation of one of said keys for disconnecting
55 said control equipment from said trunk, means to deenergize said relay responsive to the release of said trunk prior to the operation of one of said keys to disconnect said trunk from said control equipment, and
60 means to prevent the reoperation of said relay if said trunk is re seized prior to the operation of one of said keys.

9. In a telephone system, an operator's position, trunks appearing at said position,
65 an operator's telephone and control equip-

ment common to said trunks, means responsive to the seizure of one of said trunks to automatically associate said control equipment with said trunk, ringing keys in said control equipment, means responsive to the
70 operation of one of said keys for disconnecting said control equipment from said trunk, and means to apply a tone to said operator's telephone if said trunk is released prior to the operation of one of said keys.
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10. In a telephone system, an operator's position, trunks appearing at said position, an operator's telephone and control equipment common to said trunks, means responsive to the seizure of one of said trunks to
80 automatically associate said control equipment with said trunk, ringing keys in said control equipment, means responsive to the operation of one of said keys for disconnecting said control equipment from said trunk, means to apply a tone to said operator's telephone if said trunk is released prior
85 to the operation of one of said keys, and means responsive to the operation of one of said keys to remove said tone.
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11. In a telephone system, an operator's position, trunks appearing at said position, an operator's telephone and control equipment common to said trunks, means responsive to the seizure of one of said trunks to
95 automatically associate said control equipment with said trunk, ringing keys in said control equipment, means responsive to the operation of one of said keys for disconnecting said control equipment from said trunk, means responsive to the release of said trunk
100 prior to the operation of one of said keys to disconnect said trunk from said control equipment, means also responsive to such disconnection of said trunk circuit to apply a tone to said operator's telephone, means
105 to prevent the reassociation of said trunk with said control equipment if said trunk is re seized prior to the operation of one of said keys, and means responsive to the operation of one of said keys to remove said tone and to permit the reassociation of said trunk with said control equipment.
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In witness whereof, I hereunto subscribe my name this 23d day of November 1931.
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HORACE W. ULRICH.

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