

Sept. 5, 1933.

F. S. IRVINE

1,925,696

TELEPHONE SYSTEM

Filed March 18, 1931

2 Sheets-Sheet 1

FIG. 1

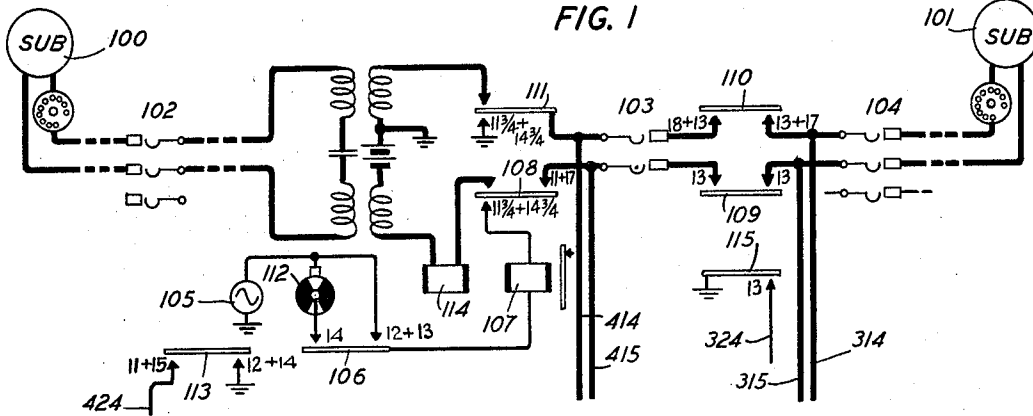


FIG. 2

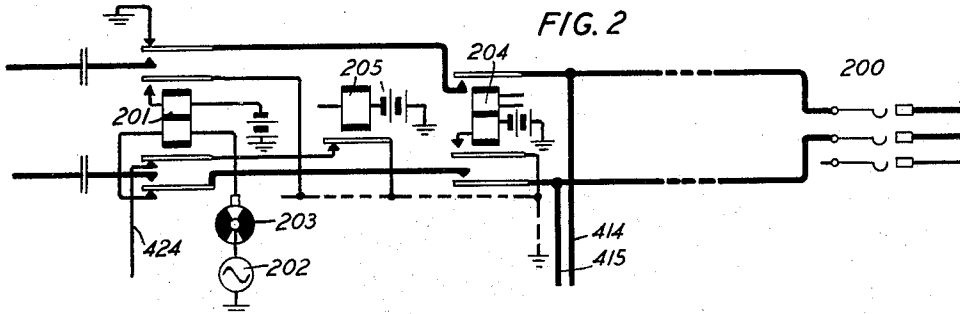
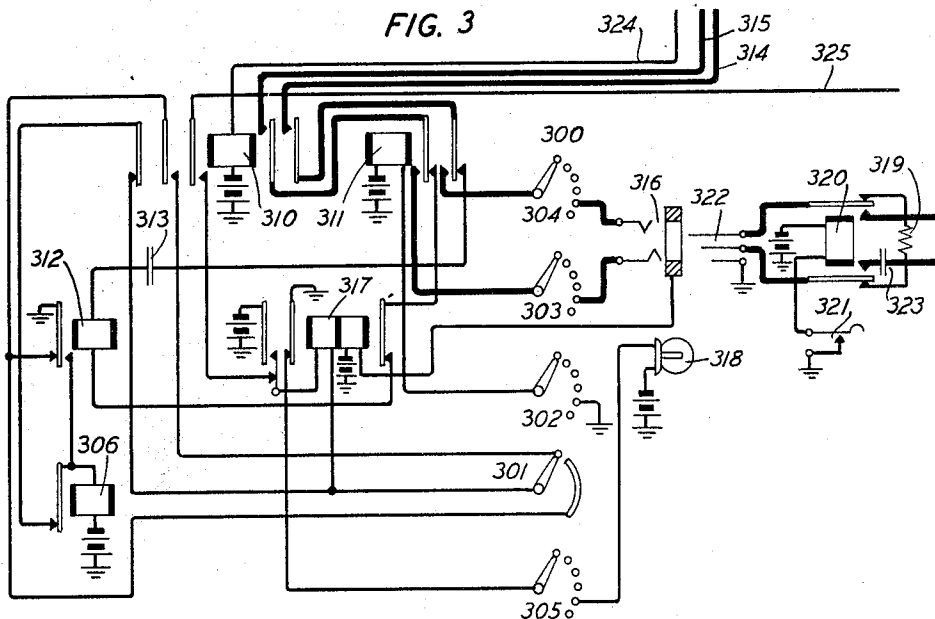


FIG. 3



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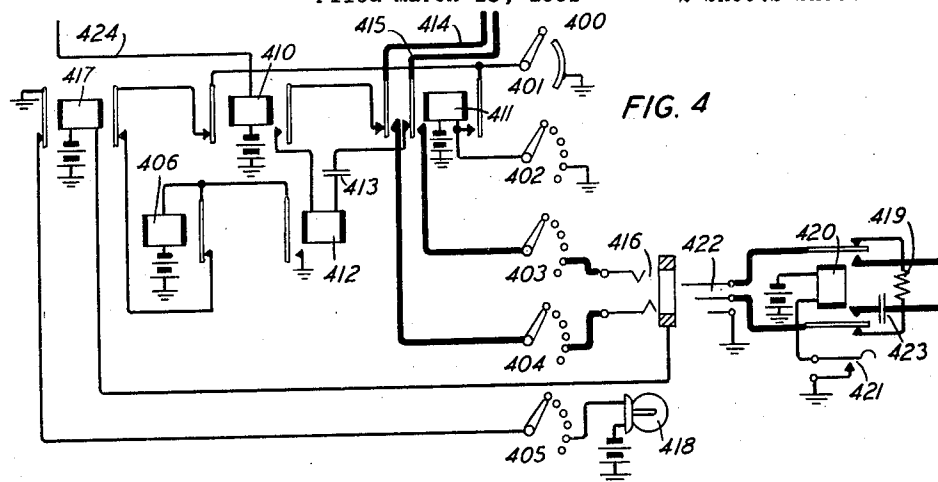


FIG. 4

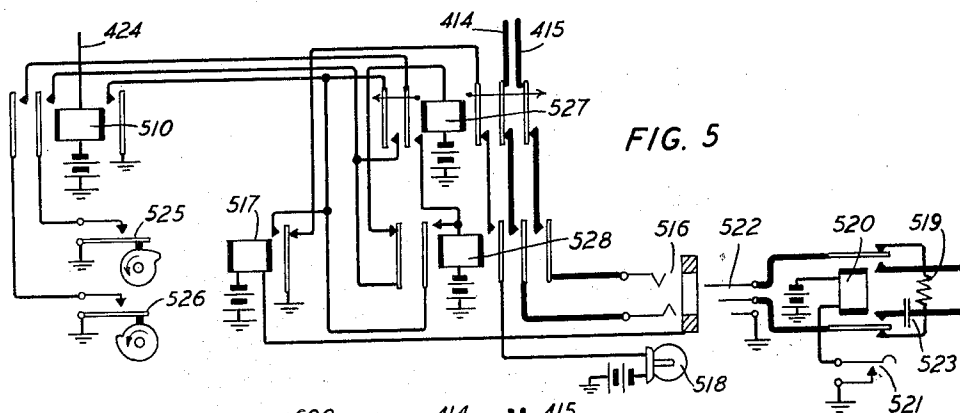


FIG. 5

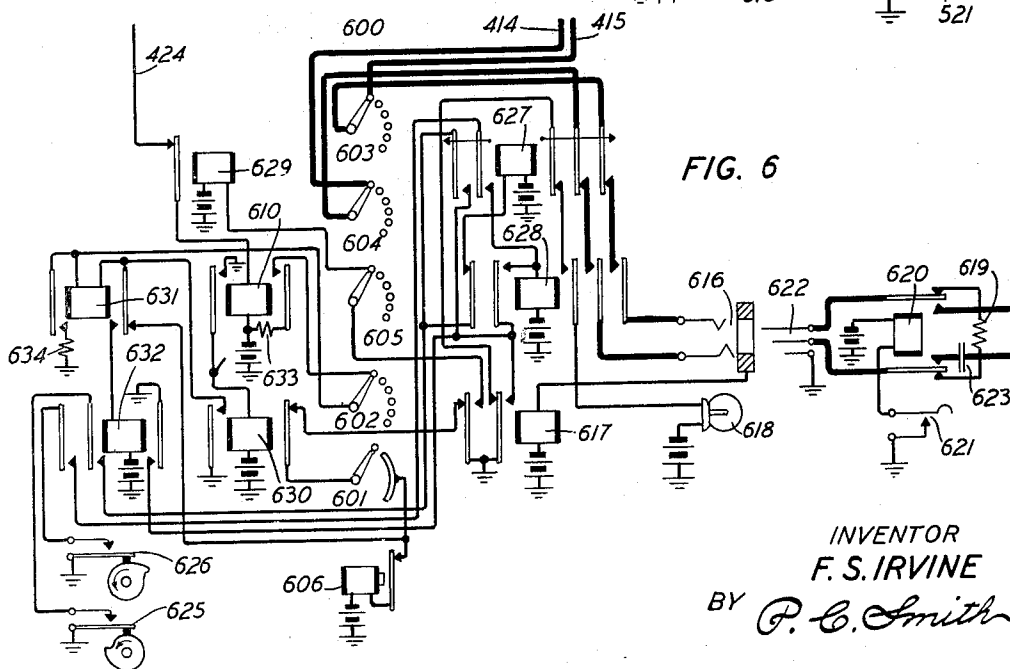


FIG. 6

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1,925,696

TELEPHONE SYSTEM

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Application March 18, 1931. Serial No. 523,392

18 Claims. (Cl. 179—27)

This invention relates to telephone systems and has for its object to increase the efficiency of such systems by reducing the number of uncompleted calls.

The two chief reasons for failure to complete connections are that the line is already busy or that the subscriber does not answer. Where the line is busy a second call after a short interval will usually be completed. Where the call is not answered it may require many trials before a response is received.

In accordance with the present invention the application of ringing current to the called line initiates the operation of a timing arrangement associated with a link in the connection. After a predetermined time elapses without a response on the called line a signal is displayed at an operator's position. When the operator responds, the ringing current is removed from the connection and the operator's telephone connected therewith so that she may converse with the calling subscriber and record the identity of the calling party and any message which he may care to have delivered to the called subscriber. When the called subscriber returns he may establish a connection with this operator and be informed of incoming calls received during his absence.

The invention is capable of a number of embodiments some of which are shown in the drawings in which:

Fig. 1 shows a portion of a telephonic connection employing panel type automatic switches;

Fig. 2 shows a portion of a telephonic connection employing step-by-step switches;

Fig. 3 shows the form of the timing arrangement for connection with a final selector;

Figs. 4, 5 and 6 show forms of the timing arrangement for connection with an incoming selector, a connector switch or a manual inter-office trunk, Fig. 4 employing a timing switch, Fig. 5 is an interrupter mechanism, and, Fig. 6 showing an arrangement in which the "don't answer" trunk is common to a number of selector switches.

The incoming selector of Fig. 1 and the connector switch of Fig. 2 represent automatic equipment of the type disclosed in the patent to C. H. Berry, No. 1,658,329, granted February 14, 1928 and in pages 53 to 62 of the second edition of Automatic Telephony by Smith and Campbell. Either Fig. 1 or Fig. 2 may be connected with any one of Figs. 4, 5 and 6, while Fig. 3 can only be connected with Fig. 1. The preferred embodiment of the invention is represented by the combination of Fig. 1 with Fig. 4. A somewhat simi-

lar arrangement in which the "don't answer" trunk is individual to the called line is disclosed and claimed in the copending application of E. E. Hinrichsen, Serial No. 523,388, filed Mar. 18, 1931.

The preferred embodiment of the invention will first be described. The establishment of a connection from a calling substation 100 to a called substation 101 by means of panel type switches is well known in the art. Such a connection will include a line finder 102, an incoming selector 103 and a final selector 104. When the called line has been selected, tested and found idle, the final selector sequence switch is advanced to position 13 and the incoming selector sequence switch is advanced to position 12. In this position a ringing circuit is established from ringing source 105, right contact of cam 106, through the winding of relay 107, lower left and upper right contacts of cam 108, ring brush of the incoming selector 103, contacts of cam 109, ring brush of the final selector 104, through the subscriber's substation ringer back to the tip brush of the final selector 104, contacts of cam 110, tip brush of incoming selector 103, lower contact of cam 111, to ground. The subscriber's bell is given a long steady ring in this circuit while the incoming selector sequence switch is advanced under the control of an interrupter to position 14 where the ringing interrupter 112 is included in the ringing circuit. If the subscriber answers he completes a direct current circuit for relay 107, which further advances the sequence switch to disconnect ringing current from the line, and to establish the talking circuit.

During the time that ringing current is being applied to the called line, the "don't answer" apparatus is functioning. When the incoming selector sequence switch reaches position 12, ground is connected over the contacts of cam 113, to conductor 424 and the winding of relay 410. Relay 410 operates and prepares a circuit for relay 412. Conductors 414 and 415 are connected in multiple with the tip and ring conductors of the established connection at the brushes of the incoming selector. Therefore when ringing current is applied to the called line it also flows over conductor 415, inner back contact of relay 411, through condenser 413, winding of relay 412, front contact of relay 410, outer back contact of relay 411 and conductor 414. Relay 412 responds to the application of ringing current, and in so doing closes a circuit for magnet 406 of the timing switch 400. Each time that ringing current is interrupted, magnet 406 releases and steps the timing switch one step. If the subscriber an-

swers while the timing switch 400 is operating, the advance of the incoming selector sequence switch will release relay 410 and open the circuit of relay 412. If the subscriber fails to answer, after a predetermined number of steps have been taken a circuit is closed from battery through the winding of relay 411, brush 402, and the terminal on which it is resting, to ground. Relay 411 locks over its right contact and brush 401 to the grounded off-normal contact. It also transfers conductors 414 and 415 over brushes 404 and 403 to the tip and ring contacts of jack 416. A circuit is also closed in this position of switch 400 from ground at the back contact of relay 417 over brush 405 to lamp 418 and battery. Lamp 418 lights as a signal to the "don't answer" operator.

This operator is equipped with cord circuits having a resistance 419 bridged across the tip and ring conductors over the back contacts of relay 420. The insertion of plug 422 in jack 416 connects resistance 419 in series with relay 107 at the incoming selector. Relay 107 operates in this direct current circuit and establishes the talking circuit in the usual manner. The insertion of plug 422 in jack 416 also closes a circuit from ground over the sleeves of the plug and jack through the winding of relay 417 to battery. Relay 417 operates, opening the circuit of lamp 418 and also opening the restoring circuit of switch 400. The operator on seeing lamp 418 go out closes key 421 thereby operating relay 420 and establishing a talking circuit between her telephone and the calling line. The inclusion of condenser 423 in this talking circuit prevents the operation of supervisory relay 114 at the incoming selector. After the operator has ascertained the identity of the calling and called subscribers and any message which the calling subscriber wishes to have delivered, she removes plug 422 from jack 416 releasing relay 417. The advance of the incoming selector sequence switch to talking position has already opened the circuit of relay 410 so that a circuit is now closed from ground over the off-normal contact of brush 401, back contact of relay 410, right back contact of relay 417, back contact and winding of magnet 406 to battery. Magnet 406 interrupts its own circuit to advance the timing switch 400 to its normal position where the operating circuit of magnet 406 and the locking circuit of relay 411 are opened, restoring the "don't answer" apparatus to normal.

The manner of using the "don't answer" apparatus in connection with a step-by-step connector switch will be apparent from a consideration of Fig. 2. In accordance with the usual operation of step-by-step apparatus, following the selection of a called line by a connector switch 200, a relay such as relay 205 is operated and connected in a circuit for testing whether the called line is busy or idle. If the line is idle relay 205 releases and a relay such as relay 204 is operated to establish the ringing circuit. Relay 204 locks under the control of the calling subscriber. When relay 204 operates the ringing circuit is closed from ringing source 202 through the interrupter 203, lower winding and outer lower back contact of relay 201, outer lower front contact of relay 204 to the ring brush of the connector 200, through the subscriber's substation ringer to the tip brush of the connector 200, upper front contact of relay 204 to ground at the upper back contact of relay 201. When relay 205 closes its back contact it connects ground over its back

contact and the inner lower back contact of relay 201 to conductor 424 operating relay 410. Conductors 414 and 415 are connected in multiple to the tip and ring conductors of the connector circuit so that the operation of relay 204 also connects them to the source of ringing current 202. The response of the called subscriber causes the operation of relay 201 which locks to holding ground and opens the circuit of relay 410. The operation of the "don't answer" apparatus is the same as previously described so that, if the subscriber has not answered when brush 402 reaches its grounded terminal, relay 411 operates to connect the connector switch with jack 416 and lamp 418 is lighted to signal the operator. As before the insertion of plug 422 in jack 416 provides a direct current circuit for the tripping relay, in this case relay 201, which operates and locks as on the response of the subscriber. The release of relays 201 and 204 is under the control of the calling subscriber and the restoration of the timing circuit is under the control of the operator.

If it is desired to associate the "don't answer" equipment with final selectors, the circuit must be slightly modified as shown in Fig. 3. When the final selector sequence switch reaches position 13, in which position the ringing circuit is established, a circuit is closed from ground over cam 115, conductor 324, winding of relay 310 to battery. Relay 310 prepares the ringing circuit from the tip brush of the final selector 104, conductor 314, outer right contact of relay 310, outer back contact of relay 311, condenser 313, winding of relay 312, right back contact of relay 317, inner back contact of relay 311, inner right contact of relay 310, conductor 315 to the ring brush of the final selector 104. Relay 312 responds to the impulses of ringing current and closes a circuit from ground over its front contact to the winding of magnet 306. At the end of each impulse magnet 306 releases, advancing the timing switch 300 one step. If the called subscriber answers before the predetermined time interval has elapsed, relay 107 will function as previously described to remove ringing current from the line. Impulses of battery are connected by the ringing machine to conductor 325 in synchronism with the ringing current. These impulses are ineffective as long as the ringing current is being received, but with ringing current cut off by relay 107, relay 312 is not operated and a circuit is closed during the next ringing interval from battery over conductor 325, inner left front contact of relay 310, normal contact and left winding of relay 317, over the normal contact of brush 301 and the outer left front contact of relay 310 or over the off-normal contact of brush 301 to ground at the back contact of relay 312 dependent upon whether switch 300 has advanced from normal. Relay 317 operates, locking to battery at its alternate contact and opening the ringing bridge across the talking conductors. When the connection has been released, the final selector sequence switch leaves position 13 and relay 310 releases. If switch 300 has not stepped off-normal, this immediately releases relay 317. If the selector is in any other position, a circuit is closed from ground at the back contact of relay 312, off-normal terminal of brush 301, back contact of relay 310, back contact and winding of magnet 306 to battery. Magnet 306 restores switch 300 to its normal position where relay 317 releases.

If the called subscriber does not answer, when brush 301 reaches its grounded terminal an ob-

vious circuit is closed for relay 311. Relay 311 disconnects the ringing bridge and connects conductors 314 and 315 to the tip and ring contacts of jack 316. In this position a circuit is also closed for lamp 318 over brush 305 and the back contact of relay 317. When the operator observes that lamp 318 is lighted, she inserts plug 322 in jack 316 connecting resistance 319 across the talking circuit to operate relay 107 and disconnect the ringing current. The operation of key 321 extends the talking circuit to her headset. The insertion of plug 322 connects ground over the sleeves of plug 322 and jack 316 and the right winding of relay 317 to battery. Relay 317 locks in a circuit from battery over its alternate contact and left winding, off-normal contact of brush 301 to ground at the back contact of relay 312, extinguishing lamp 318 and further opening the ringing bridge. After the operator has attended to the wants of the calling subscriber, the removal of plug 322 is ineffective, relay 317 remaining locked under the control of the calling subscriber. The release of the circuit is the same as above described.

The modification of the "don't answer" equipment shown in Fig. 5 depends for its timing upon two related interrupters instead of upon the ringing current. The connection of ground to conductor 424 in this instance operates relay 510 which extends the circuit controlled by interrupters 525 and 526 to relays 527 and 528 and also provides locking ground for those relays. When interrupter 525 closes its contact, a circuit is completed from ground over interrupter 525, inner left contact of relay 510, back contact of relay 528, winding of relay 527 to battery. Relay 527 closes a holding circuit for itself over the back contact of relay 528, outer left contact of relay 527, to ground at the right contact of relay 510. A measured interval thereafter interrupter 526 closes a circuit from ground over its contact, over the outer left contact of relay 510, inner left contact of relay 527, to the winding of relay 528 and battery. Relay 528 locks directly to the contact of relay 510 and opens the holding circuit of relay 527. When relay 527, which is slow to release, closes its back contact, it completes a circuit from battery through the lamp 518, inner front contact of relay 528, inner back contact of relay 527, to ground at the back contact of relay 517, lighting the lamp as a signal to the operator. With relay 527 released and relay 528 operated, conductors 414 and 415 are extended to the tip and ring of jack 516. The response of the operator, by inserting plug 522 in jack 516, operates relay 517 extinguishing lamp 518 and providing a substitute holding circuit for relay 528. The advance of the incoming selector sequence switch as previously described, releases relay 519, but relay 528 remains operated under the control of the operator. When the operator removes plug 522 the "don't answer" equipment is completely restored to normal.

The modification of the "don't answer" equipment shown in Fig. 6 is intended for use in common with a number of incoming selectors and employs switch 600 as a finder switch instead of a timing switch, the timing function being carried out by interrupters 625 and 626. When the incoming selector reaches its ringing position and connects ground to conductor 424, a circuit is completed over the back contact of relay 629 through the winding of relay 610 to battery. Relays 629 and 610 are individual to the incoming selector, while the remaining equipment is

common to a plurality of selectors. Relay 610 closes an obvious circuit for relay 630 and connects battery through resistance 633 to the terminal of brush 602 corresponding to this incoming selector in the back of switch 600. Relay 630 closes a circuit from ground over its left contact, back contact of relay 631, back contact and winding of magnet 606 to battery. Magnet 606 operates in this self-interrupting circuit to advance switch 600 in search of the incoming selector over which the call is being extended. When this selector is found, a circuit is completed from battery over brush 602 through the winding of relay 631 to ground at the front contact of relay 630. Relay 631 operates in this circuit, opening the circuit of magnet 606 and connecting ground through resistance 634 to brush 602 to reduce the potential on the terminal which the brush is engaging to mark it as busy. It also closes a circuit from ground at the front contact of relay 630 over its right front contact through the winding of relay 632. Relay 632 operates and prepares a circuit for relay 627. When interrupter 625 closes its contact the circuit of relay 627 is extended over the back contact of relay 628, inner left contact of relay 632 to ground at the interrupter 625. Relay 627 closes a holding circuit for itself over the back contact of relay 628, outer left contact of relay 627 to ground at the right contact of relay 632. A measured interval thereafter, interrupter 626 closes a circuit from ground over its contacts, outer left contact of relay 632, inner left contact of relay 627, winding of relay 628, to battery. Relay 628 locks to ground at the right contact of relay 632. It also opens the holding circuit of relay 627 which, being slow to release, closes its back contact after an additional interval extending conductors 414 and 415 over brushes 604 and 603, back contacts of relay 627, front contacts of relay 628 to jack 616. Relay 627 also closes a circuit from battery through lamp 618, inner right front contact of relay 628, inner right back contact of relay 627 to ground at the inner back contact of relay 617, lighting the lamp as a signal to the operator.

When the operator responds, the ringing current is cut off by relay 107 and the incoming selector sequence switch is advanced so that relay 610 is released, in turn releasing relays 630, 631 and 632. Ground on the sleeve of plug 622 operates relay 617 which opens the restoring circuit of the finder 600, closes a circuit over brush 605 for relay 629 to immediately release relay 610 and provides a substitute holding circuit for relay 628. When the operator has recorded any message delivered by the calling subscriber, she removes plug 622, releasing relay 617 to complete a circuit from ground over the back contact of relay 617, back contact of relay 630, off-normal terminal of brush 601, back contact and winding of magnet 606 to battery. Magnet 606 operates to restore the finder switch to normal. If the calling subscriber releases or the called subscriber answers before the lamp 618 is lighted, relay 610 is released as above described and, since relay 617 has not been operated, the finder is immediately restored to normal. The finder switch 600 is, of course, not limited to the number of terminals shown, but may be of any convenient size. Likewise a plurality of the circuits may be furnished to serve larger groups of selectors.

Although in the case of manual connections supervision by the operator renders any sort of "don't answer" service more or less unnecessary it is apparent that the equipment is readily

adaptable for use with interoffice or interposition trunks.

What is claimed is:

1. In a telephone system, a calling line, a called line, means to establish a connection from said calling line to the terminals of said called line, a source of ringing current, a timing device associated with said connecting means, means simultaneously effective to apply ringing current from said source to said called line and to start said timing device, an operator's position, a signal thereat, and means under the control of said timing device to extend said calling line to said operator's position and to operate said signal.
2. In a telephone system, a calling line, a called line, means to establish a connection from said calling line to the terminals of said called line, a source of ringing current, a timing device associated with said connecting means, means simultaneously effective to apply ringing current from said source to said called line and to start said timing device, an operator's position, a signal thereat, means under the control of said timing device to extend said calling line to said operator's position and to operate said signal, and means under the control of the called line prior to the completion of said predetermined time to prevent the extension of said calling line to said operator's position.
3. In a telephone system a calling line, a called line, an operator's position, a signal at said position, means to establish a connection from said calling line to the terminals of said called line, means to apply ringing current to said called line, means associated with said connecting means responsive to said ringing current to measure a predetermined time, means effective at the end of said time to operate said signal, and means to connect said calling line with said operator's position.
4. In a telephone system, a calling line, a called line, an operator's position, a cord circuit, a jack and a signal at said position, means to establish a connection from said calling line to the terminals of said called line, means to apply ringing current to said called line, means responsive to said ringing current to measure a predetermined time, means effective at the end of said time to connect said calling line with said jack, means to operate said signal, and means responsive to the connection of said cord circuit with said jack to disconnect said ringing current from said called line.
5. In a telephone system, a calling line, a called line, means including a plurality of conversational links for establishing a connection from said calling line to the terminals of said called line, means to apply ringing current to said called line, means individual to one of said links responsive to said ringing current to measure a predetermined time, and means effective at the end of said time to operate a signal.
6. In a telephone system, a calling line, a called line, means to establish a connection from said calling line to the terminals of said called line, means to apply ringing current to said called line, a stepping switch, means responsive to said ringing current to step said switch to measure a predetermined time, and means effective at the end of said time to operate a signal.
7. In a telephone system, a calling line, a called line, means to establish a connection from said calling line to the terminals of said called line, means to apply ringing current to said called line, a stepping switch means responsive to said ring-

ing current to step said switch and means effective in a predetermined position of said switch to operate a signal.

8. In a telephone system, a calling line, a called line, an operator's position, a signal at said position, means to establish a connection from said calling line to the terminals of said called line, means to apply ringing current to said called line, a stepping switch, means responsive to said ringing current to step said switch, and means effective in a predetermined position of said switch to operate said signal.

9. In a telephone system, a calling line, a called line, an operator's position, a signal at said position, means to establish a connection from said calling line to the terminals of said called line, means to apply ringing current to said called line, a stepping switch, means responsive to said ringing current to step said switch, and means effective in a predetermined position of said switch to operate said signal and to connect said calling line with said operator's position.

10. In a telephone system, a calling line, a called line, means to establish a connection from said calling line to the terminals of said called line, an operator's position, a cord circuit, jack and signal at said position, means to apply ringing current to said called line, a stepping switch, means responsive to said ringing current to step said switch, means effective in a predetermined position of said switch to connect said calling line with said jack and to operate said signal, and means responsive to the connection of said cord circuit with said jack to disconnect said ringing current from said called line.

11. In a telephone system, a calling line, a called line, means to establish a connection from said calling line to the terminals of said called line, an operator's position, a cord circuit, jack and signal at said position, means to apply ringing current to said called line, a stepping switch, means responsive to said ringing current to step said switch, means effective in a predetermined position of said switch to connect said calling line with said jack and to operate said signal, means responsive to the connection of said cord circuit with said jack to disconnect said ringing current from said called line, and means responsive to the disconnection of said cord circuit from said jack to restore said stepping switch.

12. In a telephone system, a calling line, a called line, means including a plurality of conversational links for establishing connection from said calling line to the terminals of said called line, means to apply ringing current to said called line, a stepping switch individual to one of said links, means responsive to said ringing current to step said switch, and means effective in a predetermined position of said switch to operate a signal.

13. In a telephone system, a calling line, a called line, means including a plurality of selector switches for establishing a connection from said calling line to the terminals of said called line, means to apply ringing current to said called line, means individual to one of said selector switches responsive to said ringing current to measure a predetermined time, and means effective at the end of said time to operate a signal.

14. In a telephone system, a calling line, a called line, means including an incoming selector circuit for establishing a connection from said calling line to the terminals of said called line, means in said incoming selector circuit to apply ringing current to said called line, means in-

dividual to said incoming selector circuit responsive to said ringing current to measure a predetermined time, and means effective at the end of said time to operate a signal.

15. In a telephone system, a calling line, a called line, means including an incoming selector circuit for establishing a connection from said calling line to the terminals of said called line, means in said incoming selector circuit to apply ringing current to said called line, a stepping switch individual to said incoming selector circuit, means responsive to said ringing current to step said switch and means effective in a predetermined position of said switch to operate a signal.

18. In a telephone system, a calling line, a called line, a plurality of selector switches, means including one of said selector switches to establish a connection from said calling line to the terminals of said called line, a source of ringing current, a timing device common to said plurality of selector switches, means simultaneously effective to apply ringing current from said source to said called line and to cause the association of said timing device with said one selector switch, means responsive to the association of said timing device with said selector switch to start the timing operation, an operator's position, a signal thereat, and means under the control of said timing device to extend said calling line to said operator's position and to operate said signal.

17. In a telephone system, a calling line, a called line, a plurality of selector switches, means including one of said selector switches to establish a connection from said calling line to the terminals of said called line, a source of ringing current, a timing device common to said plurality of selector switches, means simultaneously effective to apply ringing current from said source to said called line and to cause the association of said timing device with said one selector switch, means responsive to the association of said timing device with said selector switch to start the timing operation, an operator's position, a signal thereat, means under the control of said timing device to extend said calling line to said operator's position and to operate said signal, and means under the control of the called line prior to the completion of said timing operation simultaneously effective to disconnect said ringing current and to disconnect said timing device from said selector switch.

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