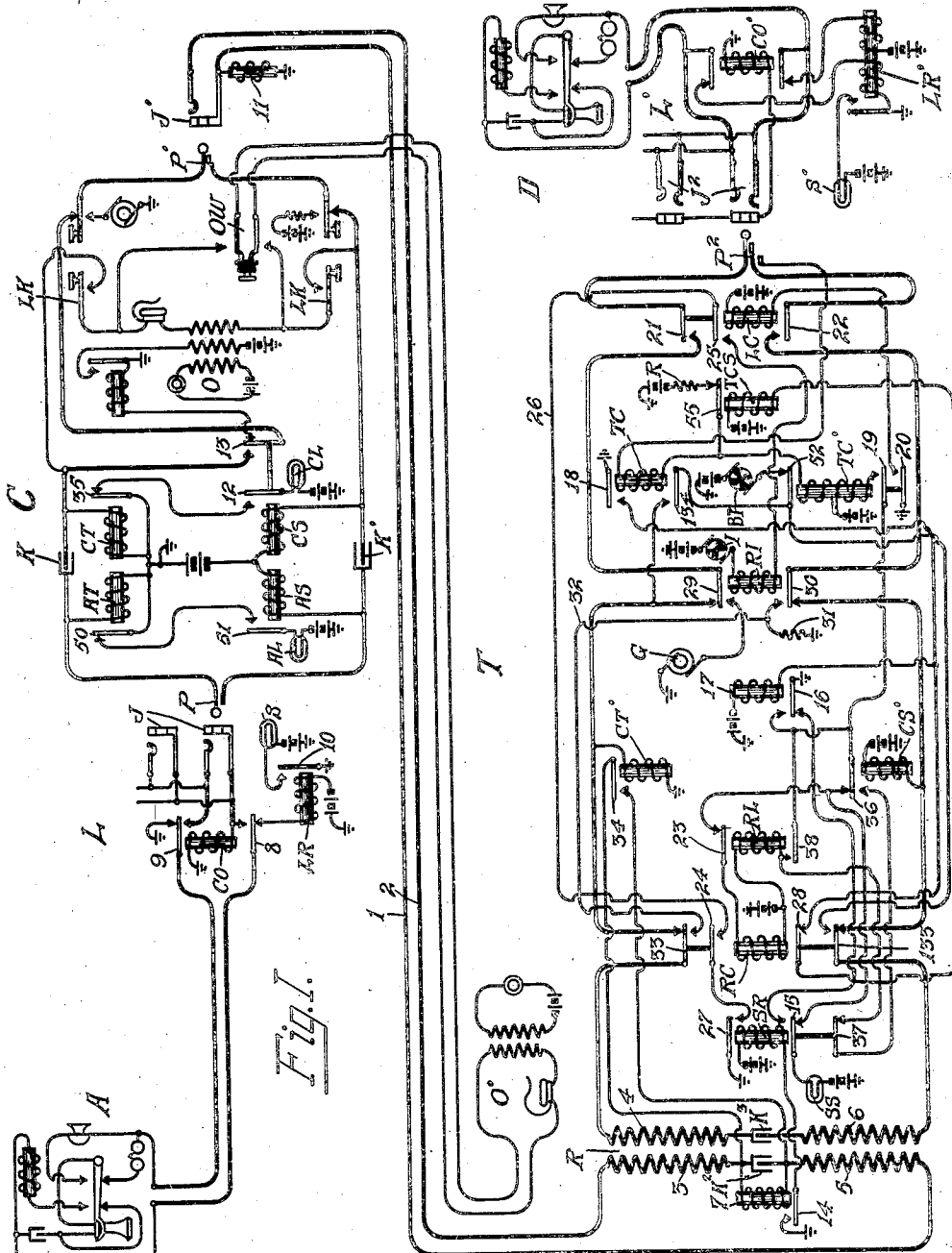


H. D. CURRIER AND H. W. BRYCE.
 TELEPHONE SYSTEM WITH AUTOMATIC RINGING AND AUTOMATIC BUSY.
 APPLICATION FILED JUNE 11, 1915.

1,354,891.

Patented Oct. 5, 1920.

2 SHEETS—SHEET 1.



Witnesses:
 G. H. Yanochowski.

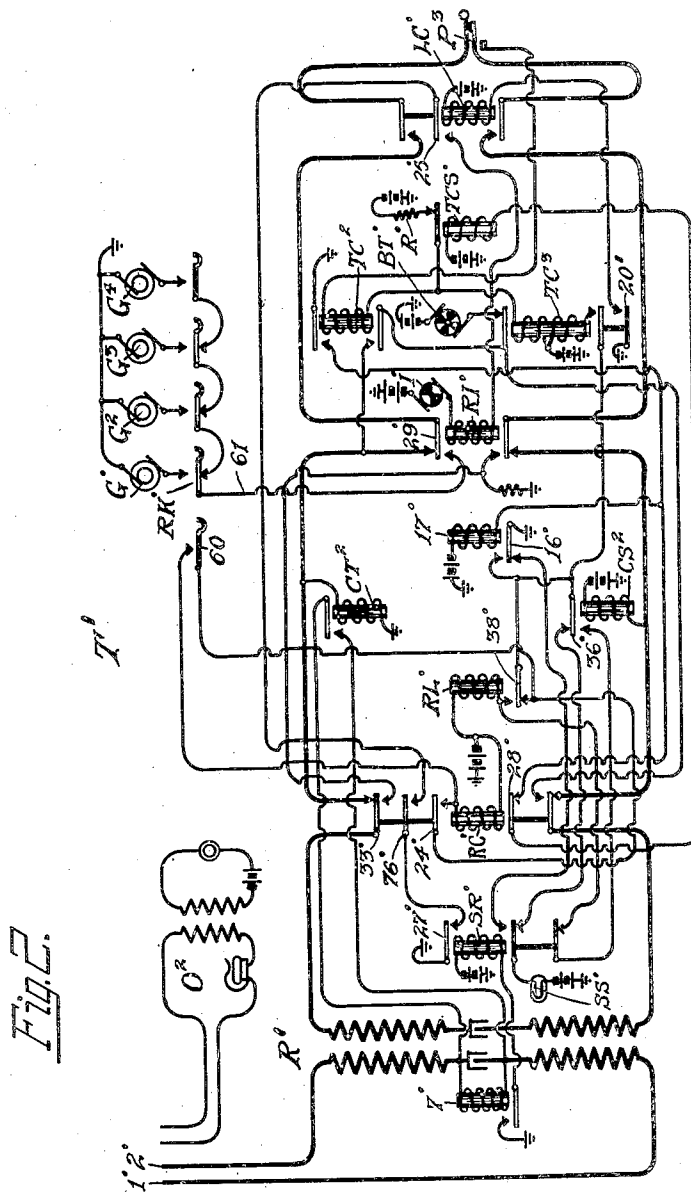
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Witnesses:
 G. H. Yanochowski.
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UNITED STATES PATENT OFFICE.

HIRAM D. CURRIER, OF CHICAGO, AND HARRY W. BRYCE, OF DOWNERS GROVE, ILLINOIS, ASSIGNORS TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM WITH AUTOMATIC RINGING AND AUTOMATIC BUSY.

1,354,891.

Specification of Letters Patent.

Patented Oct. 5, 1920.

Application filed June 11, 1915. Serial No. 33,628.

To all whom it may concern:

Be it known that we, HIRAM D. CURRIER and HARRY W. BRYCE, citizens of the United States of America, residing in Chicago, county of Cook, and Downers Grove, Du-
page county, respectively, in the State of Illinois, have invented certain new and useful Improvements in Telephone Systems with Automatic Ringing and Automatic
Busy, of which the following is a specifica-
tion.

Our invention relates to telephone systems and has to do more particularly with manually operated trunk or link circuits which are employed for interconnecting telephone lines, one of the features of our invention being the provision of an improved circuit arrangement by which no preliminary test of the called line is required by the B or trunk operator. To this end, means is provided which automatically adjusts itself to bring about the automatic ringing of the called subscriber if the called line is idle, or if the called line is busy to transmit an audible busy signal to the calling subscriber and at the same time to flash the supervisory lamp at the A operator's position to notify her of the busy condition of the called line.

Another feature of our invention is the provision of means whereby after a connection has been established to the called line, the application of ringing current to the said called line is dependent upon the operative association of the A operator's link circuit with the trunk or B operator's circuit. While still another feature of our invention is the provision of improved means for flashing the calling supervisory lamp at the A operator's position when the trunk or B operator establishes connection with a busy called line, thus eliminating any special operation on the part of the B operator in transmitting a busy signal to the A or originating operator. These and other objects of our invention will be more particularly pointed out in the ensuing specification and in the appended claims.

For a better understanding of our invention, reference may be had to the accompanying drawings in which—

Figure 1 illustrates one embodiment of our invention as applied thereto, and

Fig. 2 illustrates another embodiment of our invention adapted for four party ringing.

Referring now more in general to our invention as illustrated in the accompanying drawings, and referring to Fig. 1, in which we illustrate our invention operating in connection with a single party ringing, we show a calling substation A of a well-known type terminating at the exchange in a two-wire common battery line circuit L comprising a line relay LR, a cut-off relay CO, a line signal S and the multiple jacks J.

A cord circuit C is shown associated with the line circuit L, and comprises an answering plug P, and a calling plug P¹, the two plugs being connected by the heavily marked conductors, and having the condensers K and K¹ interposed. The calling plug P¹ is adapted for connecting to multiple jacks of the other telephone lines terminating in the same switchboard or may be connected to jacks as J¹ leading to trunk circuits as T, extending to distant exchanges or switchboards. The answering end of the cord circuit comprises a tip answering supervisory relay AT and a sleeve answering supervisory relay AS, the two relays AT and AS controlling the answering supervisory lamp AL. The calling end of the cord circuit comprises a calling tip supervisory relay CT and a calling sleeve supervisory relay CS, the two relays CT and CS controlling the calling supervisory lamp CL. A listening key LK is also shown which when thrown connects the operator's set O to the cord circuit. An orderwire key OW is provided for connecting the operator's set O with the trunk operator's set O¹ at the distant exchange so that the A operator at the cord circuit C may communicate with the operator at the trunk circuit T. The trunk jacks J¹ are located at the A operator's position and are connected by the heavily marked conductors 1 and 2 to the trunk circuit T.

The trunk circuit T comprises a calling plug P² connected to a repeating coil R. The repeating coil R having the condensers K² and K³ interposed between its windings 3 and 5 and 4 and 6. A relay 7 of high resistance is associated with the incoming end of the trunk circuit T and energizes when

the plug P^1 of the cord circuit C is inserted into the trunk jack J^1 . A supervisory relay SR is energized upon the operation of the relay 7, thereby causing the supervisory lamp SS to glow. A ringing control relay RC is provided which upon actuation brings about the operation of the ringing interrupter relay RI which is intermittently energized and deenergized through the medium of the interrupter I to connect the ringing generator G to ring the call bell of the wanted substation. At the outgoing end of the trunk circuit T, we show the test control relays TC and TC^1 , the relay TC operating each time the plug P^2 is inserted into a jack of a called line, and the relay TC^1 automatically adjusts itself depending upon whether the line is in an idle or busy condition. A busy tone generator BT is provided which produces a busy tone that is heard by the calling subscriber and also brings about the flashing of the supervisory lamp CL of the A operator's cord circuit C to notify her of the busy condition of the called line. The tip and sleeve supervisory relays CT^1 and CS^1 are operated upon the response of the called subscriber. The relay CT^1 , upon energizing shunts out the high resistance relay 7 which allows the relay CT of the cord circuit C to operate to efface the supervisory signal CL of the said cord circuit to notify the A operator that the called subscriber has answered. A ringing lock-out relay RL is provided which operates when the relay 7 restores and interrupts the circuit of the relay RC which in turn opens the circuit of relay RI thereby cutting off the ringing generator G. A link control relay LC is also provided as is also a test control shunt relay TCS. The operation of these relays in conjunction with the other apparatus will be hereinafter more fully described.

The substation D as shown at the called end of the trunk circuit T is similar to that of the substation A and its associated line circuit L^1 except that it is of the three-wire common battery type. It comprises the usual line relay LR^1 , cut-off relay CO^1 , multiple jacks J^2 and the line signal S^1 .

Referring now in general to Fig. 2, the trunk circuit T^1 as shown illustrates our invention applied to four party ringing. We employ substantially the same apparatus with the addition of a party line ringing key RK^1 , and four ringing current generators G^1 , G^2 , G^3 , G^4 of different frequencies for signaling the correspondingly tuned bells at the substations on the party lines. The apparatus of Fig. 2 bears the same reference numerals as that of Fig. 1, but with different suffixes added.

Having described in general the apparatus which is embodied in our invention, we will

now describe more in detail the operation of the circuit as illustrated in Fig. 1.

Assuming that the subscriber at the substation A initiates a call by the removal of his receiver from its switch-hook, an energizing circuit for the line relay LR is established traced from battery through the winding of said relay, normal contact 8 of relay CO, through the substation to ground at normal contact 9 of relay CO. Upon the energization of relay LR, its alternate contact 10 is closed bringing about the lighting of the line lamp S. The operator noting the lighted signal S, inserts the plug P into the jack J of the calling line, establishing a series energizing circuit for the cut-off relay CO of line circuit L and the answering sleeve supervisory relay AS of the cord circuit C. This circuit extends from battery through the winding of the relay AS, the sleeve contacts of the connected plug and jack, through the winding of the relay CO to ground. The relay CO, upon energizing, opens the circuit of relay LR at contact 8 allowing the relay LR to restore to efface the line signal S. The answering tip supervisory relay AT is also energized over a circuit traced from battery, through the winding of relay AS, the sleeve contacts of the connected plug and jack, alternate contact 8 of relay CO, through the substation, alternate contact 9 of relay CO, tip contacts of the connected plug and jack and through the winding of relay AT to ground. The energization of relay AT and relay AS prevents the lighting of the answering supervisory lamp AL. The operator now throws the listening key LK to connect her operator's set O to the cord circuit and inquires the wants of the calling subscriber.

Assuming now that the calling subscriber at A desires connection with the substation D, the operator depresses the orderwire key OW leading to the exchange in which the line of substation D terminates, to connect her operator's set O with that of the operator's set O^1 associated with the trunk circuit T. The A-operator of the cord circuit C repeats the number of the called subscriber to the operator of the trunk circuit T and the operator at the trunk circuit T then assigns the trunk to be used by the A-operator. The A-operator then inserts the plug P^1 into the trunk jack J^1 thus bringing about the energization of the calling sleeve supervisory relay CS over a circuit traced from battery through the winding of the relay CS, sleeve contacts of the plug P^1 and jack J^1 through the impedance coil 11 to ground. The closing of the alternate contact 12 of relay CS brings about the glowing of the calling supervisory lamp CL. The closing of the alternate contact 13 of relay CS establishes an energizing circuit for the high resistance

relay 7 of the trunk circuit T, traced from battery through the winding of the relay CS, the sleeve contacts of the plug P¹ and jack J¹, conductor 1, winding 5 of the repeating coil R, winding of relay 7, winding 3 of the repeating coil R, conductor 2, the tip contacts of the jack J¹, plug P¹, alternate contact 13 of relay CS, through the winding of the relay CT to ground. The relay 7 being of comparatively high resistance does not permit sufficient current flow through the relay CT of the cord circuit C to cause it to energize, thus permitting the supervisory lamp CL to remain lighted until the called subscriber at the substation D. answers. Upon the energization of the relay 7, a circuit for the supervisory relay SR is established, traced from battery through the winding of the said relay, to ground at alternate contact 14 of relay 7. Upon the energization of the relay SR, its alternate contact 15 is closed, thereby closing a circuit for the supervisory lamp SS, traced from battery through the said lamp SS, the alternate contact 15 of relay SR to ground at normal contact 16 of relay 17. If the trunk operator has not yet plugged into the jack of the called line the lighting of the supervisory signal SS indicates to the trunk operator that the operator at the originating exchange has plugged into the assigned trunk jack, while if the operator at the originating exchange has plugged into a trunk jack other than that of jack J¹ (the jack of the assigned trunk), the lamp SS fails to light due to the failure of the relay 7 to energize.

The operator of trunk circuit T having obtained the number of the called subscriber from the A-operator, inserts the trunk plug P² into the jack J² of the wanted line, without any preliminary testing, and assuming that the called line is idle, an energizing circuit for the cut-off relay CO¹ of the line circuit L¹ and the test control relays TC and TC¹ of the trunk circuit T are established, traced from ground through the winding of the cut-off relay CO¹, the sleeve contacts of the jack J² and plug P² through the winding of the relay TC and through the upper winding of the relay TC¹ to battery. The relay TC, upon energizing, closes its alternate contact 18 thereby closing an energizing circuit for the relay 17, traced from battery through the winding of the said relay to ground at alternate contact 18 of relay TC. The closing of alternate contact 18 of relay TC also closes a circuit for relay TCS traced from battery through the winding of said relay, normal contact 28 of relay RC to ground at alternate contact 18, but this operation of relay TCS is only incidental at this time. The opening of normal contact 16 of relay 17 opens the energizing circuit of the supervisory signal SS, bringing about its effacement. The relay TC¹, upon ener-

gizing, closes its alternate contact 19, thereby establishing a locking circuit for itself, traced from battery through the lower winding of the said relay, its alternate contact 19 to ground at alternate contact 16 of relay 17. The closing of the alternate contact 20 of the relay TC¹ establishes a circuit for the link control relay LC traced from battery through the winding of said relay to ground at alternate contact 20. The energization of the relay LC brings about the closing of its alternate contacts 21 and 22, thereby establishing the continuity of the talking strands to allow the ringing current to be sent out over the line to the called substation's signal bell. The closing of the alternate contact 16 of relay 17 also establishes an energizing circuit for the relay RC, traced from battery through the winding of the said relay, the normal contact 23 of relay RL, normal contact 36 of relay CS¹ and to ground at alternate contact 16 of relay 17. The closing of the alternate contact 24 of relay RC establishes an energizing circuit for the ringing interrupter relay RI, traced from battery through the interrupter I, the winding of interrupter relay RI, alternate contact 25 of the relay LC, conductor 26, alternate contact 24 of relay RC to ground at alternate contact 27 of relay SR. The opening of contact 28 of relay RC opens the circuit of the relay TCS. The relay RI is thus intermittently energized and deenergized and opens and closes its alternate contact 29 thereby connecting ringing current from the generator G to the called line, said ringing current being traced from the ungrounded pole of the generator G, alternate contact 29 of relay RI, the alternate contact 21 of relay LC, the tip contacts of the plug P² and jack J², through the condenser and call bell of the called substation, the ring contacts of the connected jack and plug, the alternate contact 22 of relay LC, the alternate contact 30 of RI and through the resistance 31 to ground. An audible tone of the ringing current is also sent out to the calling subscriber's substation over the conductor 32, through the alternate contact 33 of relay RC, winding 4 and winding 6, alternate contact 133, alternate contact 134 of relay TC through the winding of relay CT¹ to ground. The tone is induced into the other winding of R and produces the audible tone to be heard by the calling subscriber. The call bell of the called substation is thus intermittently rung until the called subscriber answers.

Upon the response of the called subscriber, an energizing circuit for the relays CS¹ and CT¹ is established, traced from battery through the winding of the relay CS¹, normal contact 30 of relay RI, alternate contact 22 of relay LC, the ring contacts of the connected plug and jack through

the substation, the tip contacts of the jack and plug, alternate contact 21 of relay LC, normal contact 29 of relay RI, through the winding of relay CT¹ to ground. The closing of the alternate contact 34 of relay CT¹ brings about the shunting of the high resistance relay 7 allowing the relay CT of the cord circuit C to operate through the now closed alternate contact 34 of the relay CT¹. The relay CT, upon energizing, opens its normal contact 35 to efface the supervisory lamp CL, notifying the A operator of the cord circuit C that the called subscriber at substation D has answered. The relay 7, restoring to normal due to the said shunt, opens the energizing circuit of the relay SR, and the relay SR upon deenergizing, opens the energizing circuit for the interrupter relay RI at its alternate contact 27, whereupon relay RI restores preventing further application of ringing current to the called line. The restoration of the relay SR brings about the energization of the relay RL, traced from battery through the winding of the said relay, normal contact 37 of relay SR, alternate contact 36 of relay CS¹, to ground at alternate contact 16 of relay 17. Relay RL upon energizing, establishes a locking circuit for itself traced from battery through its winding, its alternate contact 38 to ground at alternate contact 16 of relay 17. The opening of normal contact 23 of relay RL opens the energizing circuit of control relay RC, and the closing of normal contact 28 of RC again establishes the circuit for relay TCS. The subscriber at the calling substation A, and the subscriber at the called substation D are now in conversational circuit, the said talking circuit being traced over the heavily marked conductors.

Assuming now that the subscribers have finished conversation, the subscriber at the substation A replacing his receiver upon the switch-hook, opens the circuit of the answering tip supervisory relay AT of the cord circuit C, and allows the relay to again close its normal contact 50 to cause the supervisory lamp AL to glow. The subscriber at the substation D replacing his receiver upon the switch-hook opens the circuit of the tip calling supervisory relay CT¹, and the sleeve calling supervisory relay CS¹ of the trunk circuit T. The restoration of the calling tip supervisory relay CT¹ opens the shunt about the high resistance relay 7 due to the opening of contact 34 of relay CT¹, allowing said relay 7 to again energize. The relay 7 energizing again causes the deenergization of the calling tip supervisory relay CT of the cord circuit C thereby causing the glowing of the calling supervisory relay CL. (The closing of the alternate contact 14 of the relay 7 again closes an energizing circuit

for the relay SR as previously described.) The A-operator of the cord circuit C noting the two lighted supervisory signals, withdraws the plugs P and P¹ from the respective jacks J and J¹. The answering sleeve supervisory relay AS and the calling sleeve supervisory relay CS restore to normal opening their alternate contacts 51 and 12 to cause the effacement of the two supervisory signals AL and CL. Upon the removal of the plug P¹ from the trunk jack J¹, the energizing circuit of the high resistance relay 7 is interrupted, allowing the said relay to restore to normal. The relay 7 restoring, opens the circuit of the supervisory relay SR, the said relay restoring again closes the circuit for signal SS through normal contacts 15 of relay SR, 36 of relay CS¹, to ground at contact 16 of relay 17, notifying the trunk operator that the A-operator has withdrawn the plug from the trunk jack. The operator at the trunk circuit T now withdraws the plug P² of the jack J² of the called line thereby opening the energizing circuit for the test control relay TC. The relay TC restoring to normal opens its contact 18 and thereby allows the relay 17 to restore to normal. The relay 17 restoring opens the locking circuits for the relay RL and the relay TC¹. The relay TC¹ restoring opens the circuit for relay LC. All the apparatus of the trunk circuit T is now in its normal condition as is also that of the cord circuit C, and therefore the cord circuit C and the trunk circuit T are now available for establishing other connections.

Assuming now that the calling subscriber D is busy the operation of the circuit is the same as previously described up to and including the insertion of the plug P² into jack J² of the called line. The operator of the trunk circuit T, without any preliminary testing, inserts the plug P² in the multiple jack of the called line, closing a circuit for the relay TC traced from ground through the sleeve contacts of the multiple jacks and the connected plug through the winding of the relay TC, through the relay TC¹ to battery. The relay TC operates, but sufficient current does not flow through the winding of the relay TC¹ to bring about its operation due to the fact that battery is connected through another cord circuit to the sleeve contact of a multiple jack of line D. The closing of the alternate contact 18 of relay TC establishes an energizing circuit for the relay 17 traced from battery through the winding of said relay to ground at alternate contact 18 of relay TC, and also closing an energizing circuit for relay TCS as previously described. The closing of the alternate contact 16 of relay 17 closes an energizing circuit for the relay RC, traced from battery through the winding of the

relay RC, normal contact 23 of relay RL and normal contact 36 of relay CS¹ to ground at alternate contact 16 of relay 17. The opening of the normal contact 28 of the relay RC opens the energizing circuit of the relay TCS, the said relay restoring as before described. Owing to the relay TC¹ remaining at normal a flash busy signal is transmitted to the A-operator of the cord circuit C. This flash busy signal is traced from the busy tone interrupter BT through normal contact 52 of relay TC¹, the alternate contact 134 of relay TC, through the winding of the relay CT¹ to ground. The relay CT¹ is thus intermittently energized and deenergized to open and close its alternate contact 34. The opening and closing of the said alternate contact 34 opens and closes the shunt about the high resistance relay 7 and this energization and deenergization of the relay 7 brings about the energization and deenergization of the relay CT, of the cord circuit C. The said relay CT opening and closing its normal contact 35 causes the flashing of the calling supervisory lamp CL, thus signaling the A-operator that the called subscriber is busy. The calling subscriber also receives a busy tone which may be traced from battery through busy tone interrupter BT, normal contact 52, alternate contact 133, winding 6 of R, condenser K³, winding 4 of R, alternate contact 33, through resistance 31 to ground. This tone is induced into the windings 3, 5 of the repeating coil R to the waiting calling subscriber which notifies him that the called line is busy. The A-operator noting the flash busy signal, withdraws the plug P¹ from the jack J¹ bringing about the deenergization of the relay 7, the said relay deenergizing opens the circuit for the sleeve supervisory relay SR, thereby allowing the relay SR to restore to normal and close the circuit of the supervisory signal SS thus notifying the trunk operator that the A operator has withdrawn the plug P¹ from the jack J¹. The trunk operator noting the lighted signal SS withdraws the plug P¹ from the connected jack and the apparatus restores as before described.

Should a local operator test the multiple jack of the called line while conversation is going on, the resulting ground from the test relay of the local cord circuit will assist in holding up the relay TC¹ of the connected trunk circuit T from the sleeve of the jack and connected plug through the relays TC and TC¹ to battery and not affect the circuit in any way. Again, should a local operator test while a second trunk circuit T is in connection with a multiple jack of a busy line, ground from the test relay of the local cord circuit will flow from the sleeve of the multiple jack through the tip of the plug of the second connected trunk circuit T

through the winding of the relay TC of the second trunk circuit, at this point the circuit divides one branch extending through the upper winding of relay TC¹ to battery, the other branch extending through the normal contact 55 of relay TCS of the second trunk through the resistance R to battery. The resistance R being lower than the resistance of the upper winding of relay TC¹ sufficient current is shunted away from the relay TC¹ to prevent its operative energization, thereby preventing any interference with the trunk circuit T, that is in a busy condition transmitting a busy tone to the calling subscriber and flashing the A operator's supervisory lamps.

Referring now more in detail to Fig. 2, we illustrate a trunk circuit T¹ embodying the features of our invention operating in connection with a four-party ringing system, and we do not deem it necessary to show a complete system as that illustrated in Fig. 1 because the apparatus used in connection with that illustrated in Fig. 2 is the same as previously described, with the addition of the four party ringing key RK¹. The operation of the trunk circuit T¹ as a whole, is practically the same as previously described. The operation of this circuit is practically the same as previously described in connection with Fig. 1, up to and including the act of inserting the trunk plug P³ of the trunk circuit T¹ into the jack of the called line. The operator having inserted the plug P³ of the trunk circuit T¹ into a multiple jack of the called line, (not shown) a circuit is established for the test control relay TC², and the test control relay TC³ as previously described. The relay 17¹ is also operated by the actuation of the relay TC². The relay TC³ operating closes a locking circuit for itself through the alternate contact 16¹ of the relay 17¹. The closing of the alternate contact 20¹ of the relay TC³ establishes an energizing circuit for the relay LC¹. The operator after having inserted the plug P³ into the jack of the wanted line, depresses the proper ringing plunger of the partly line ringing key RK¹ to connect the proper generator frequency to ring the call bell of the called substation. When the ringing key is in its fully depressed position, the end spring contact 60 assumes its alternate position, closing an energizing circuit for the ringing control relay RC¹ traced from battery through the winding of the said relay, the alternate contact 60 of the end spring of the ringing key RK¹, the normal contact 38¹ of relay RL¹ to ground at alternate contact 16¹ of relay 17¹. Upon pressure being released from the actuated plunger it assumes its ringing position. The relay RC¹, upon energizing forms a locking circuit for itself traced from battery through its winding, through its alter-

nate contact 24¹, normal contact 38¹ of relay RL¹ to ground at alternate contact 16¹ of relay 17¹. An energizing circuit for the ringing interrupter relay RI¹ is established upon the closure of the alternate contact 76¹ of relay RC¹ traced from battery through the interrupter I¹ through its own winding, alternate contact 25¹ and alternate contact 76¹ to ground at alternate contact 27¹. The relay RI¹ is thus intermittently energized and deenergized by the interrupter I¹. The call bell of the called subscriber is thus intermittently rung due to the energization and deenergization of the relay RI¹, which alternately connects and disconnects the ringing lead 61 to the alternate contact 29¹ of relay RI¹. Upon the response of the called subscriber, the relays CT² and CS² operate as previously described bringing about the operation of the relay RL¹ which then closes a locking circuit for itself through its contact 38¹ to ground at alternate contact 16¹. The locking circuit for the relay RC¹ is opened allowing it to restore to normal. The opening of the alternate contact 76¹ of relay RC¹ interrupts the circuit of the interrupter relay RI¹ thereby preventing further application of the ringing current to the called line. The subscribers having finished conversation replace their receivers and signal for disconnect, the same as hereinbefore described. The restoration of the apparatus of trunk circuit T¹ is the same as that of Fig. 1. The testless features as described in Fig. 1 in which the operator plugs into a called line without making preliminary tests is also incorporated in the trunk T¹ as illustrated. It is thought that a further description of this trunk circuit is unnecessary.

In working out our invention we have shown it operating with a particular form of link circuit but we contemplate using it in connection with other circuits than those shown and therefore we do not desire to be limited to the exact system as shown but aim to cover all such changes and modifications that come within the spirit and scope of the appended claims.

Having described our invention, what we claim as new and desire to secure by United States Letters Patent, is:

1. A telephone system comprising subscribers' lines terminating in multiple terminals at the exchange, a trunk circuit provided with a manual connection terminal for connecting to said lines as called lines, and apparatus responsive to the connection of said terminal to one of said called lines and differently operable according to the busy or idle condition of the called line to automatically connect ringing current to the said called line or to operate a flash supervisory signal according to such idle or busy condition.

2. A telephone system comprising subscribers' lines terminating in multiply connected jacks at the exchange, an operator controlled link circuit provided with a plug terminal for connecting with the jacks of said lines and apparatus differently operable upon the connection of said plug terminal to one of said jacks according to the busy or idle condition of the line connected with to connect ringing current to said line or to operate a flash supervisory signal according to such idle or busy condition.

3. A telephone system comprising subscribers' lines terminating in multiply connected jacks at the exchange, an operator controlled link circuit and an operator controlled manual trunk circuit for establishing connection between the jacks of said lines, a manual terminal for said trunk circuit, a signal for said link circuit, and automatic apparatus including a double-wound test relay automatically operable responsive to the connection of the manual terminal of said trunk circuit to the called one of said subscribers' lines according to the busy or idle condition of the called line connected with to connect ringing current to said line or to intermittently operate said signal according to such idle or busy condition.

4. A telephone system comprising subscribers' lines terminating in multiply connected jacks at the exchange, a manual link circuit and a manual trunk circuit for establishing connection between said jacks of calling and called lines, and apparatus responsive to the connection of said trunk circuit to the jack of the called line and differently operable according to the idle or busy condition of the called line whereby ringing current is connected to said line or a flash supervisory signal is operated according to such idle or busy condition, said apparatus including a double wound test relay.

5. A telephone system comprising subscribers' lines terminating in multiply connected jacks at the exchange, a link circuit and a manual trunk circuit for establishing connection between said jacks of calling and called lines, a visual signal for said link circuit and automatic apparatus responsive to the connection of said trunk circuit to a jack of the called line and differently operable according to the idle or busy condition of the called line whereby ringing current is connected to said line or said signal is operated according to such idle or busy condition.

6. A telephone system including telephone line, a trunk circuit provided with a manually controlled plug terminal for connection thereto, means for automatically ringing a substation on said line responsive to the connection of said plug to said line, said means being ineffective if said line is busy upon connection made therewith, and means responsive to the busy condition of

said called line to operate a flash supervisory signal if said means is ineffective.

7. A telephone system including a called subscriber's line, a trunk circuit provided with a plug for connection thereto, a pair of relays for said trunk circuit connected to a conductor of said plug, a visual signal for said trunk circuit, means controlled by the energization of said relays for automatically associating ringing apparatus with the said called line, said relays being responsive to the connection of said plug with said called subscriber's line, and means controlled by one of said relays for affecting an operation of said signal.

8. In a telephone system, a link circuit provided with a supervisory signal, a trunk circuit provided with testing means adapted to be manually connected to a called subscriber's line, automatic ringing means controlled by said testing means and responsive to the connection of the trunk circuit to the called subscriber's line for signaling the said called subscriber, means controlled by the called subscriber for operating the said supervisory signal, and means controlled by the said automatic testing means for flashing said supervisory signal if the called subscriber's line is busy.

9. In a telephone system, subscribers' lines, an operator's link circuit provided with a supervisory lamp and an operator's manually controlled trunk circuit for interconnecting said telephone lines, automatic testing means for said operator's trunk circuit for distinguishing between idle and busy called subscribers' lines, a manually controllable terminal for said trunk circuit for connecting the trunk circuit to the jack of the called subscriber's line, thereby operatively associating said automatic test means with the called subscriber's line, ringing means automatically controllable by said testing means and responsive to the connection of said trunk circuit to the called line for signaling said called subscriber, and means responsive to said automatic testing means for intermittently operating said supervisory lamp if the called subscriber's line is busy.

10. In a telephone system the combination of an A-operator's link circuit and a B-operator's link circuit for establishing connection between telephone lines, automatic testing means for said B-operator's link circuit for distinguishing between the idle and the busy condition of a called subscriber's line, means responsive to the idle condition of the called subscriber's line upon the connection of the B-operator's link circuit to the said called subscriber's line and to the operative association of the A-operator's link circuit with the B-operator's link circuit for controlling the application of ringing current to the said called subscriber's line, and a visual signal

for said A operator's link circuit responsive to a busy condition of the called subscriber's line.

11. In a telephone system a calling subscriber's line and a busy called subscriber's line, an A-operator's link circuit and a manually controllable trunk circuit provided with a plug terminal for connecting said lines, automatic means responsive to the connection of said plug terminal to one of said called lines for ringing the called subscriber, a signal for said A-operator's link circuit, automatic testing means for said trunk circuit responsive to the connection of the trunk circuit to the said busy called subscriber's line for intermittently operating the said supervisory signal to notify the A-operator of the busy condition of the called line.

12. In a telephone system an A-operator's link circuit and a B-operator's link circuit for extending a call to a called subscriber's line, automatic testing means for said B-operator's link circuit, signaling apparatus for the B-operator's link circuit, means controlled by the operative association of the A and B link circuits and by the said automatic testing means for operatively associating the said signaling means with the called subscriber's line, said means including a trunk relay, bridged across the strands of said trunk circuit, and subscriber controlled means for deenergizing said relay.

13. In a telephone system an A-operator's link circuit and a trunk circuit provided with a manually controllable terminal for extending a call to a called subscriber's line, a supervisory signal for said A-operator's link circuit, automatic testing means for said trunk circuit for operating said supervisory signal or for associating automatic ringing apparatus with the said called subscriber's line depending upon the busy or idle condition of the said called line, said automatic testing means being responsive to the connection of said manually controllable terminal to the called subscriber's line.

14. In a telephone system an A-operator's link circuit and a B-operator's trunk circuit for extending a call to a busy called subscriber's line, a visual signal for said A-operator's link circuit, a relay bridged across the conductors of said trunk circuit, and means responsive to the connection of said trunk circuit to said called subscriber's line for shunting said relay whereby said visual signal is intermittently operated to denote the busy condition of said called subscriber's line.

15. A telephone system including a busy called subscriber's line, a link circuit and a trunk circuit for extending a call to said subscriber's line, a visual signal for said link circuit, a relay bridged across the conductors of said trunk circuit, and means responsive to the connection of said trunk circuit

to said called subscriber's line for intermittently shunting the winding of said relay whereby said visual signal is intermittently operated.

- 5 16. A telephone system including a subscriber's telephone line, a connecting circuit provided with a plug terminal for connection to said line, a visual signal for said connecting circuit, ringing mechanism, and
10 apparatus responsive to the connection of said plug terminal to said telephone line and differently operable according to the busy or idle condition of said line to either automatically connect said ringing apparatus
15 to said line or to operate said visual signal according to such idle or busy condition.

17. A telephone system including a calling subscriber's line and a called subscriber's line, a link circuit and a trunk circuit for
20 connecting said lines, a visual signal for said link circuit, ringing mechanism for said trunk circuit, apparatus differently operable to automatically connect either said ringing mechanism to said called subscriber's line
25 or to operate said visual signal according to the idle or busy condition of the said called

subscriber's line, and a plug terminal for said trunk circuit adapted to be connected to said called subscriber's line to operatively associate said apparatus with the called subscriber's line. 30

18. A telephone system including a calling subscriber's line and a called subscriber's line, a link circuit and a trunk circuit for connecting said lines in conversational circuit, a connection terminal for said trunk circuit for manual connection to said called line, and apparatus associated with said trunk circuit for either signaling the called subscriber or the link circuit operator according to the idle or busy condition of said called line, said apparatus being operated responsive to the connection of said terminal to the said called line. 35 40

Signed by us at Chicago, county of Cook and State of Illinois, in the presence of two witnesses. 45

HIRAM D. CURRIER.
HARRY W. BRYCE.

Witnesses:

GEO. A. YANOCKOWSKI,
M. R. ROCKFORD,