A. H. WEISS.

AUTOMATIC RINGING SYSTEM.

APPLICATION FILED AUG. 17, 1910.

1,030,038.

Patented June 18, 1912.

2 SHEETS—SHEET 1.

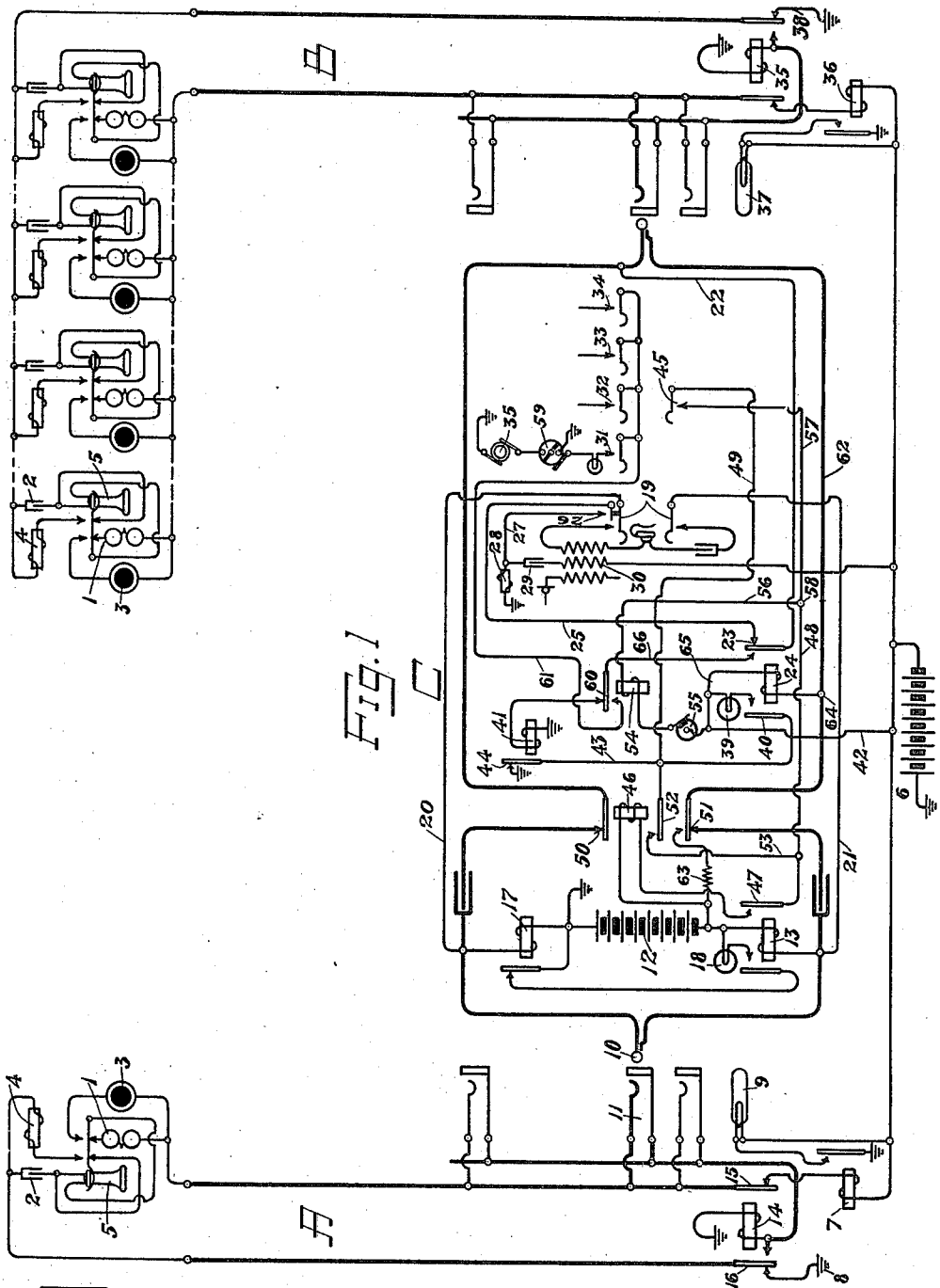

Fig. 1

Witnesses

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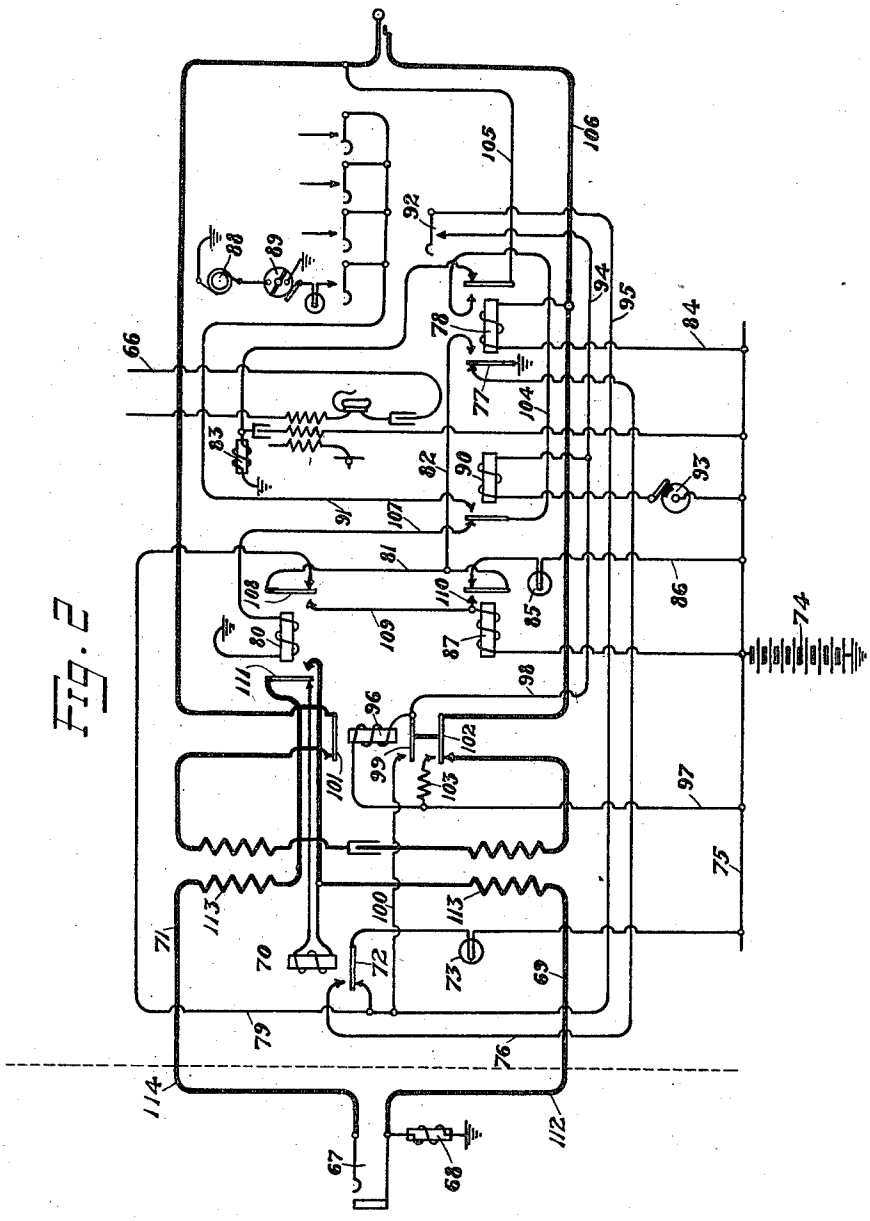

Fig. 2

Witnesses

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ALFRED H. WEISS, OF WILMETTE, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

AUTOMATIC RINGING SYSTEM.

1,030,038. Specification of Letters Patent. Patented June 18, 1912.

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To all whom it may concern:

Be it known that I, ALFRED H. WEISS, a citizen of the United States, residing in Wilmette, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Automatic Ringing Systems, of which the following is a specification.

My invention relates to common battery telephone exchange systems, and has for its object the provision of a simplified and efficient signaling arrangement for such systems. The arrangement is adapted particularly for signaling upon telephone party lines, although not limited to such use.

In the drawings, Figure 1 is a telephone system embodying one form of my invention, and Fig. 2 shows my invention adapted for use with a trunk circuit for making connection between subscribers whose lines terminate at different central offices.

Referring to Fig. 1, two subscribers' lines A and B are shown terminating at the central office C. The line A is shown as an individual line; that is, having a single subscriber, and line B is a polystation line having four subscribers. Any form of common battery substation circuit may be used, but for the purpose of illustration I have shown a well-known subscriber's circuit in which the bell 1 is normally bridged across the line in series with a condenser 2 for signaling purposes. When the receiver is removed from the switch-hook for conversation, this path for ringing current is broken at the switch-hook contacts and a path for talking and for energizing the substation transmitter 3 is established. This latter circuit includes the transmitter and impedance coil 4 in series for the energizing battery current, the voice currents flowing through the receiver 5 and condenser 2 which are placed in a shunt circuit around the impedance coil 4. Assuming the subscriber of the line A desires connection with one of the subscribers on line B, the telephone receiver would be removed from its switch-hook closing a path for current from the central office battery 6, through the line relay 7, the limbs of the telephone line to the ground pole of battery at 8. Responsive to this current, the line relay will attract its armature lighting the line lamp 9. Upon seeing the line lamp lighted, the operator will insert the answering plug 10 of the cord circuit in the jack 11 of the calling line. Current will then flow from the battery 12 through the sleeve supervisory relay 13, sleeve strand of the cord circuit, sleeve contact of the jack and through the cut-off relay 14 to battery, energizing the cut-off relay, which will attract its armatures 15 and 16. The attraction of armature spring 15 will open the circuit of the line relay 7 retiring the line signal 9, and the attraction of the contact spring 16 will remove the ground 8 from the line and establish connection between that limb of the line and the sleeve contact of the jack. Upon the attraction of the contact spring 16, a portion of the current flowing to ground through the cut-off relay 14 will flow over the telephone line to energize the substation apparatus and back to the central office, over the other limb of the telephone line, through the tip contacts of the jack and plug and through the winding of the tip supervisory relay 17 to battery.

It will be noted that current through the cut-off relay 14 energized the sleeve supervisory relay 13 to place the supervisory lamp 18 in condition to operate, but the flow of current over the line and through the tip supervisory relay 17 operated to open the circuit of the supervisory lamp 18 at the contacts of the latter relay, so that the lamp 18 remains inert. The supervisory relay 13 is energized over a local circuit so that the supervisory lamp 18 is placed in condition to light at the contacts of this relay as long as the plug is inserted in the jack, while the circuit of the tip supervisory relay 17 is through the substation apparatus, so that the supervisory lamp 18 is placed in condition to light or remain inoperative, dependent upon the position of the receiver at the subscriber's station, and the consequent attracted or unattracted condition of the contacts of supervisory relay 17.

Having noticed the line signal 9 and plugged into the calling line, the operator throws her listening key 19 bridging her operator's telephone set across the line, and inquires the number desired from the calling subscriber. The talking circuit between the operator and the calling subscriber will be over the limbs of the calling line, the tip and sleeve strands of the answering end of the cord circuit and conductors 20 and 21 to the contacts of the listening key between

which the operator's telephone is bridged. Ascertaining that a subscriber on the line B is desired, the operator would test the idle or busy condition of the line by touching the tip of the calling plug to the sleeve contact of the multiple jack of the desired line. If the line was in use, a battery potential would exist at the sleeve contacts of the jacks, due to the flow of current through the sleeve supervisory relay 13, sleeve contacts of the plug and jack at the operator's position where a connection was established, with the desired line. The tip of the calling plug of the operator testing would be connected with ground through conductor 22, the back normally closed contact 23 of the calling sleeve supervisory relay 24, conductor 25, normally open contact 26 of the ringing key, conductor 27 and impedance coil 28. If the desired line was idle and no potential existed at the sleeve contact of the multiple jacks of the line, no current would flow through this testing circuit when the tip of the plug was touched to the sleeve of the jack, but if the line is in use and a battery potential exists at the sleeve of the jack, current will flow through this testing circuit as the tip of the plug is touched to the sleeve of the jack in testing. The kick or discharge from the impedance coil 28 as the tip of the testing plug is touched to and removed from the sleeve of the jack of the line being tested, flows through the condenser 29 and the tertiary winding 30 of the operator's induction coil to ground through battery 6, thus producing an inductive click in the operator's telephone receiver, notifying her that the line desired is busy. If the desired line is idle, the operator inserts the calling plug of the cord circuit in the jack of the desired line. This closes a path for current from the battery 6, through the sleeve supervisory relay 24, the sleeve strand of the calling end of the cord circuit, the sleeve contacts of the plug and jack and through the winding of the cut-off relay 35 to ground. The cut-off relay attracts its contact springs cutting off the line relay 36 and the line lamp 37 from the one limb of the called line B and removing the ground 38 from the other limb of said line, connecting this latter limb with the sleeve contact of the jack. The energization of the sleeve supervisory relay 24 opens back normally closed contact 23 of said relay removing the testing conductor 25 from the tip contact of the plug and establishing connection with its alternate normally open front contact. The circuit of the supervisory lamp 39 is also completed by the attraction of contact spring 40 of the supervisory relay 24, thus placing the supervisory lamp 39 in condition to operate, and as the tip supervisory relay 41 is deënergized due to the fact that the subscriber's telephone has not yet been removed from its hook, the supervisory lamp 39 is lighted through battery 6, over conductor 42, closed contact 40, of supervisory relay 24, conductor 43, and normally closed contact 44 of supervisory relay 41. When the called subscriber responds, the supervisory relay 41 will be energized over the telephone line B, attracting its normally closed contact 44 and extinguishing the supervisory lamp 39 to notify the operator that the subscribers are in communication.

Any system of signaling to select the subscriber desired may be employed with my invention, but I prefer to use a well-known selective system in which a different frequency of current is used to operate the bell at each substation, the bell at each substation being adapted to respond to its particular frequency and being unresponsive to the frequencies adapted to ring the bells at the other stations upon the line.

I have indicated four ringing keys, 31, 32, 33 and 34 adapted to send out current from a suitable source such as the generator 35, to operate the bell at one of the substations upon the line B. I preferably provide a single contact 45 adapted to operate with each of the ringing keys 31, 32, 33 and 34, the arrangement being such that when any of the keys 31, 32, 33 and 34 are completely depressed to connect generator current with the line, the contact 45 will be closed momentarily, the ringing key 31, 32, 33 or 34 remaining closed to keep generator current upon the line, but the key 45 returning to its normally open position after having been closed momentarily by the act of depressing the ringing keys mentioned.

After finding the line idle as above described, and inserting the calling plug in the jack thereof, we will assume that the operator throws the ringing key 31 to signal the desired subscriber upon the line. As just described, this would close the normally open contact 45 temporarily, and the ringing contact 31 permanently, for the purpose of continuously signaling the subscriber until he responds to the call. When the normally open contact 45 is closed, current flows from the battery 12 through the control relay 46, the normally open contact 47, of answering sleeve supervisory relay 13, conductor 48, contact 45, conductor 49 and conductor 43 to ground at the normally closed contact 44 of supervisory relay 41. Current in this path would energize the control relay 46 and open the cord circuit at its normally closed contacts 50 and 51 to prevent ringing current from passing back over the line of the calling subscriber. The energization of the control relay 46 would also close the locking circuit for said relay through its normally open contact 52 which may be traced from the battery 12 through the

winding of said relay 46, the normally open contact 47 of supervisory relay 13, conductors 53 and 43 to the ground contact 44. The control relay 46 would therefore remain energized until the ground contact 44 was broken by the energization of supervisory relay 41, when the called subscriber responded by removing his telephone receiver from its hook. The contact 45 should remain closed long enough to establish this locking circuit for the control relay 46. The closing of the ringing key contact 45 also closes a path for current through the flip-flop relay 54, which may be traced from battery 6, conductor 42, circuit breaker 55, the winding of flip-flop relay 54, conductors 56 and 57, contact 45 and conductors 49 and 43 to ground 44. When the contact 45 is open, however, the circuit of the flip-flop relay 54 is continued from point 58, over conductors 48 and 53, contact 52 of control relay 46 and conductor 43 to the ground connection 44. So that the flip-flop relay 54 is first preferably energized through the ringing key contact 45, and is afterward energized through the locking contact 52 of the control relay 46.

The circuit breaker 55 in the circuit of the flip-flop relay 54 and the circuit breaker 59 in the generator circuit, are preferably mounted upon the same shaft so as to rotate together, and the segments thereof are so proportioned that the live contact of the circuit breaker 55 will be of slightly longer duration than the live contact upon the circuit breaker 59, so that the flip-flop relay 54 will have its circuit closed by the circuit breaker 55 and be energized to connect generator current with the line at its contact, just before the circuit breaker 59 is in position to connect generator current with the line at the ringing key contacts 31, and the live contact at circuit breaker 59 should be maintained so as to keep the generator circuit intact at the contacts of the flip-flop relay until the generator circuit has been broken by the circuit breaker 59. That is, the generator circuit should be made at the contact of the flip-flop relay before it is made by the circuit breaker 59, and should be maintained at the contact of the flip-flop relay until after it is broken by the circuit breaker 59. If the circuit breaker 55 in series with the flip-flop relay should open the circuit of that relay and allow its armature to drop back before the ringing circuit was opened by the circuit breaker 59 in series with the generator, the discharge from the substation condenser over the tip side of the line would pass through the tip supervisory relay 41, energizing it and removing the ground 44, which would open the locking circuit of control relay 46, thus restoring the ringing circuit to normal before the subscriber had responded to the call. This discharge would flow from the condenser over the tip side of the line, the tip contacts of the jack and plug, conductor 22, normally open front contact of supervisory relay 24, the normally closed back contact 60 of the flip-flop relay, through the winding of supervisory relay 41 to ground. For this reason, as stated, the make contact on the circuit-breaker for the flip-flop relay is made longer than the corresponding segment on the circuit breaker in series with the generator so that the flip-flop relay holds its armature attracted for an instant after the ringing current has been removed at each revolution of the circuit breaker 59 and until the discharge from the condenser at the substation has passed over the path just traced to the armature 60 of the flip-flop relay 54, and from that point through conductor 61, contacts 31 of the ringing key and the grounded segment of circuit breaker 59 to ground. The flip-flop relay 54 continues to intermittently close its contacts 60 in response to the revolutions of the circuit breaker 55 to put ringing current upon the line at that point, and the circuit breaker 59 rotating synchronously therewith continues to intermittently impress ringing current at the closed ringing key contact 31, the path for this intermittent ringing current being traced from the generator 35, through the circuit breaker 59, ringing key contact 31, conductor 61, closed front contact 60 of the flip flop relay 54, the closed front contact of supervisory relay 24, conductor 22, tip contacts of the plug and jack, the limbs of the telephone line and the substation ringing apparatus, sleeve contacts of the plug and jack, the sleeve strand 62 of the cord circuit, contact 51 of the flip flop relay 46, non-inductive resistance 63 to ground through battery 12. The non-inductive resistance 63 is provided to prevent the ringing current from flowing through the sleeve supervisory relay 24 from the point 64, and passing to ground through conductor 42 and battery 6, thus chattering said relay. This intermittent ringing current continues until the subscriber removes his receiver from the hook which closes a path for battery current through the substation apparatus operating the tip supervisory relay 41 and opening the locking circuit of control relay 46 by removing the ground 44 therefrom. The ringing current therefore continues until the subscriber responds, when it is automatically shut off by the removal of his telephone from the hook which closes a path for current through the supervisory relay 41, thus restoring the ringing apparatus to normal condition. This current flow through the substation apparatus may be traced from battery 6 through conductors 42 and 65, the winding of supervisory relay

24, sleeve strand 62 of the cord circuit, the sleeve side of the line, through the substation apparatus, the tip side of the line, conductor 22, the closed front contact of supervisory relay 24, conductor 66, closed back contacts 60 of the flip-flop relay 54 to ground through the winding of supervisory relay 41. The energization of the said relay 41 removes the ground 44 from the locking circuit of control relay 46, which releases its armatures, armatures 50 and 51 restoring the continuity of the cord circuit for talking, armature 51 opening the ringing circuit through the non-inductive resistance 63, and armature 52 opening the locking circuit of the control relay 46. The circuit of the flip-flop relay 54 is interrupted at contact 52 of the control relay 46 and also at the contact 44 of supervisory relay 41. The response of the called subscriber therefore restores all parts of the ringing apparatus to normal condition. The energization of supervisory relay 41 also removes the ground from the circuit of supervisory lamp 39, extinguishing the lamp and indicating to the operator that the subscriber has responded to the call.

At the termination of the conversation, either subscriber by replacing his telephone upon the hook, opens the circuit through the supervisory relay 17 or 41, thus lighting the corresponding supervisory signal 18 or 39 to indicate this fact to the operator. The ringing circuit however, is not established by the restoration of the ground 44 due to the deënergization of tip supervisory relay 41, due to the fact that the circuit of the flip-flop relay is open at contact 52 of the control relay 46, and the circuit of control relay 46 is open at this point, and also at the key contacts 45. Upon seeing the supervisory lamps lighted, the operator removes the plug from the jacks, restoring all parts of the system to normal condition.

In Fig. 2 I have shown a trunk circuit equipped with my ringing arrangement for signaling subscribers where the call originates at a distant office. The ringing arrangement may be used with various forms of trunk circuits and I do not wish to be limited to the form shown. Assuming the subscriber on line A, Fig. 1 desires a connection with a subscriber whose line terminates at a distant exchange, the cord circuit shown in Fig. 1 would be used at the first exchange, and the trunk circuit shown in Fig. 2 would be used for completing the connection with the subscriber at the distant exchange, the calling plug of the cord circuit in Fig. 1 being inserted in the jack of the trunk circuit in Fig. 2 instead of being inserted directly into the jack of the desired line.

The operation of the system in making a connection with the trunk circuit as above described would be as follows: The operator at the office where the call originated would notify the operator at the distant office by means of order wire 66 connected with her head telephone, the number of the subscriber desired, and the operator at the distant exchange would reply telling the first operator the number of the trunk circuit to be used in making the connection. The first operator would then insert the calling plug of the cord circuit into the jack 67 of the trunk circuit designated. An impedance coil 68 is legged to ground from the sleeve side of the trunk circuit, through which the supervisory calling relay 24 of the cord circuit would be energized to close the circuit of the supervisory cord signal 39, the impedance coil 68 performing the same function in this respect as the cut-off relay 35 when the cord circuit is inserted directly into the jack of the desired line. When the calling plug of the cord circuit is inserted in the jack 67 of the trunk, a path for current is closed from battery 6, through conductors 42 and 65, supervisory relay 24, sleeve strand of the cord circuit 62, sleeve contacts of the plug and jack, trunk conductor 112 and 69, the winding of high resistance relay 70, conductor 71, tip contacts of the jack and plug, conductors 22 and 66, and the winding of the tip supervisory relay 41 to ground. The resistance of the trunk relay 70 is such that the tip cord relay 41 is not energized in response to this flow of current so that its armature is not attracted, and the supervisory lamp 39 continues to glow to indicate to the operator at the first exchange that the connection has not yet been completed with the desired subscriber. The high resistance relay 70 is energized in response to this flow of current, attracting its contact 72 and closing a circuit through the guard and disconnect lamp 73, which may be traced from battery 74, through conductors 75 and 76 and to ground through the normally closed back contact 77 of sleeve supervisory relay 78. If the first operator therefore connects with the trunk circuit before the second operator plugs into the desired line, the guard lamp 73 will be lighted over the above path, or if the first operator should plug into the wrong trunk through mistake and the second operator should plug into the desired line, thus energizing the sleeve supervisory relay 78, the guard lamp 73 would be energized over a path traced from battery 74, through conductor 75, normally closed contact 72 of the high resistance relay 70, conductor 79, normally closed contact of tip supervisory relay 80, conductors 81 and 82 to ground through the closed front contact 77 of the sleeve supervisory relay 78. After the operator at the first exchange has plugged into the correct trunk and the operator at the second exchange has plugged

into the desired line, the guard lamp 73 would be extinguished, the first circuit traced for it being opened in that event at the normally closed contact 77 of supervisory relay 78, and the second circuit traced for it being opened in that event at contact 72 of the high resistance relay 70.

The testing apparatus for determining the idle or busy condition of the desired line is the same with the trunk circuit shown as in the cord circuit of Fig. 1, the test being obtained by means of the impedance coil 83 connected normally between the tip of the plug and ground, and adapted to discharge through the tertiary winding of the operator's induction coil when the tip of the plug is touched to and removed from the terminal of a busy line. Assuming the second operator finds the desired line to be idle, she inserts the plug of the trunk in the jack of the line, energizing the sleeve supervisory relay 78 from battery 74, over conductor 84, the winding of said relay and the sleeve strand of the trunk circuit to ground, through the cut-off relay of the desired line. The energization of the supervisory relay 78 closes a path for current through ring lamp 85, from battery 74, through conductor 86, normally closed contacts of relay 87, conductor 82, and the contacts of supervisory relay 78 to ground. The ring lamp 85 will therefore remain lighted until the subscriber responds to the call.

After inserting the plug in the jack of the desired line, the operator will throw her ringing key which will connect the generator 88 intermittently through the circuit breaker 89 with the front contact of the flip-flop relay 90, through conductor 91. The flip-flop relay will be energized to extend this ringing current over the line by the actuation of the ringing key contact 92, this circuit through the flip-flop relay being traced from battery 74 through the circuit breaker 93, flip-flop relay 90, conductor 94, ringing key contact 92, conductors 95, and 79, normally closed contacts of relay 80 and conductors 81 and 82 through the closed contact 77 of supervisory relay 78. The operation of the key 92 also closes a path for current through the control relay 96 which may be traced from battery 74, conductor 97, coil of said relay, conductors 98 and 94, contact 92, conductors 95 and 79, normally closed contacts of relay 80, and conductors 81 and 82 to ground through contact 77 of supervisory relay 78. The attraction of contact spring 99 of control relay 96 closes a locking circuit for said relay from battery 74 through conductor 97, the winding of said relay, closed contact 99, conductors 100 and 79, closed contacts of relay 80 and conductors 81 and 82 to ground through contact 77 of relay 78. The actuation of control relay 96 also opens the trunk circuit at contacts 101 and 102 of said relay to prevent the ringing current from going back over the line to the calling subscriber. A non-inductive resistance 103 is employed to provide a shunt about the supervisory relay 78 for the ringing current. The calling plug of the cord circuit is now inserted in the jack 67 of the trunk and the supervisory cord lamp 39 is lighted due to the high resistance of the trunk relay 70 which prevents the cord supervisory relay 41 from being actuated, and the calling plug of the trunk circuit is inserted in the jack of the desired line, lighting the ring lamp 85 through the contacts of the supervisory relay 78. In this condition the intermittent ringing current is being sent over the line from generator 88 which may be traced from said generator through the circuit breaker 89, contacts of the ringing key, conductor 91, the vibrating contact of flip-flop relay 90, conductor 104, front contact of supervisory relay 78, conductor 105, over the telephone line and through the substation ringing apparatus, sleeve strand 106 of the trunk circuit, contact 102 of control relay 96, non-inductive resistance 103, and conductor 97 to ground through battery 74. Said ringing current is prevented from flowing through the supervisory relay 78 chattering said relay by the shunt circuit containing the non-inductive resistance 103. When the subscriber responds to this ringing current a path for current is completed through the substation apparatus and through supervisory relay 80 which may be traced from battery 74, conductor 84, supervisory relay 78, sleeve strand 106, the telephone line, conductors 105, 104 and 107 through the winding of supervisory relay 80 to ground. The supervisory relay 80 is energized by current in this path and attracts its armature 108 which removes the ground 77 from the locking circuit of control relay 96, deënergizing said relay and permitting it to release its contacts. The deënergization of control relay 96 completes the trunk circuit for conversation at its contacts 101 and 102. This also opens the circuit of the flip-flop relay 90 restoring the ringing apparatus to normal.

The attraction of contact spring 108 of supervisory relay 80 closes a path for current through relay 87 which may be traced from battery 74, through the winding of said relay, conductor 109, contact 108, and conductors 81 and 82 to ground through contact 77 of supervisory relay 78. The operation of relay 87 opens the circuit of ringing lamp 85, thus indicating to the operator that the called subscriber has responded, and a locking circuit is established for said relay 87 from battery 74 through the winding of said relay, its front contact 110

and conductor 82 to ground through contact 77 of relay 78. This locking circuit prevents the lamp 85 from being re-lighted when the calling subscriber restores his telephone at the completion of the conversation. The operation of supervisory relay 80 when the called subscriber responds also operates to open the circuit of high resistance relay 70. This is due to the attraction of contact 111 of supervisory relay 80. The attraction of armature 111 of relay 80 also closes a path of comparatively low resistance through supervisory relay 41 at the first exchange. Supervisory relay 41 is responsive to this flow of current, attracting its armature and extinguishing the supervisory lamp 39, thus notifying the operator at the first exchange that the called subscriber has responded. The flow of current through supervisory relay 41 may be traced from battery 6 through conductors 42 and 65, supervisory relay 24, sleeve cord strand 62, the sleeve contacts of the plug and jack, trunk strand 112, repeating coil winding 113, front contact 111 of relay 80, trunk strand 114, tip contacts of the plug and jack, conductors 22 and 66 through the winding of tip supervisory relay 41 to ground.

It will be seen that the supervision of the connection is performed entirely by the operator at the first exchange. The guard lamp 73 is prevented from lighting when the subscriber replaces his telephone upon the hook, its circuit being open at contact 108 of supervisory relay 80 when the high resistance relays 70 is deënergized, and its circuit being open at contact 77 of supervisory relay 78 when the high resistance relay 70 is actuated. Similarly, the circuit of ringing lamp 85 is opened at contact 110 of relay 87, regardless of whether the subscriber's telephone is on or off the hook. When the subscribed replaces his telephone upon the hook, supervisory relay 80 is deenergized, its armature 111 drops back again, inserting the high resistance relay 70 in the circuit in series with supervisory cord relay 41. Due to the high resistance of relay 70, cord supervisory relay 41 does not obtain sufficient current to maintain it actuated, its armature 44 drops back closing the circuit of supervisory lamp 39, which is lighted to inform the operator at the first exchange that the called subscriber has terminated the conversation. The operator then removes the plug from the trunk circuit deënergizing the high resistance relay 70 and closing a path for current for the lamp 73 from battery 74, over conductor 75, contact 72 of high resistance relay 70, conductor 79, closed back contact 108 of supervisory relay 80 and conductors 81 and 82 to ground through contact 77 of supervisory relay 78. Upon seeing the operation of disconnect lamp 73, the operator at the second exchange would know that the first operator had taken down the connection and would remove the plug from the jack of the subscriber's line restoring all apparatus to normal condition.

It should be understood that the ringing system and apparatus is the same in Fig. 2 as that shown in Fig. 1 and is intended to be operated in the same manner, being adapted for use with a trunk circuit instead of with an operator's cord circuit.

While I have described my invention with reference to the details of construction, it is to be understood that many changes may be made in the apparatus and arrangements shown without departing from the spirit or scope of the invention and for this reason I do not wish to be limited to the arrangement shown, but intend to cover modifications of the invention that realize the advantages and benefits thereof.

I claim:

1. A telephone system comprising a calling and a called line, an operator's link circuit uniting said lines, a ringing key, normally open contacts therefor, a control relay, an initial energizing circuit for said relay closed responsive to actuation of said key and contacts, a supervisory relay, a locking circuit for said control relay including contacts of said supervisory relay and effective upon energization of said control relay, a flip-flop relay operated responsive to the energization of said control relay, the energizing circuit of said flip-flop relay also including contacts of said supervisory relay.

2. In a telephone system, the combination with a called subscriber's telephone line, of an operator's link circuit connected thereto, a ringing key, a control relay, means for energizing said relay responsive to actuation of said key, talking strands of said link circuit disunited upon energization of said control relay, a supervisory relay, a source of ringing current, a flip-flop relay operated responsive to the energization of said control relay, the energizing circuit of said flip-flop relay being jointly controlled through contacts on said control and supervisory relays, the said flip-flop relay in its operation alternately bridging said ringing source and supervisory relay across the called line, and means controlled by the called subscriber to energize said supervisory relay, whereby said control relay is deënergized to restore the continuity of the link circuit strands, and said flip-flop relay is rendered inoperative.

3. In a telephone system, the combination with a calling and a called telephone line, of a link circuit establishing connection between said line, an operator's ringing key actuated to call the desired subscriber, a control relay energized responsive

to said actuation to disunite the two lines, a supervisory relay, a flip-flop relay, a locking circuit for said control relay and an energizing circuit for said flip-flop relay effective upon energization of said control relay, said circuits including contacts of said supervisory relay, said supervisory relay being energized upon response of the called subscriber to render said locking and energizing circuits ineffective, whereby said control and flip-flop relays are restored.

4. A telephone system comprising a called substation telephone line, a link circuit connected thereto, a control relay, a flip flop relay and a source of ringing current, a ringing key having contacts adapted to be closed when said ringing key is operated to close an initial energizing circuit for said control relay whereby said flip flop relay is operated to connect said ringing current with the called line, a tip supervisory relay, a substitute locking circuit for said control relay effective upon its actuation including normal contacts of the tip relay, and means controlled at the substation for energizing said tip relay to cause the restoration of said control and flip flop relays whereby said ringing current is disconnected.

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

ALFRED H. WEISS.

Witnesses:
MARJORIE E. GRIER,
WM. BERGHAHN.