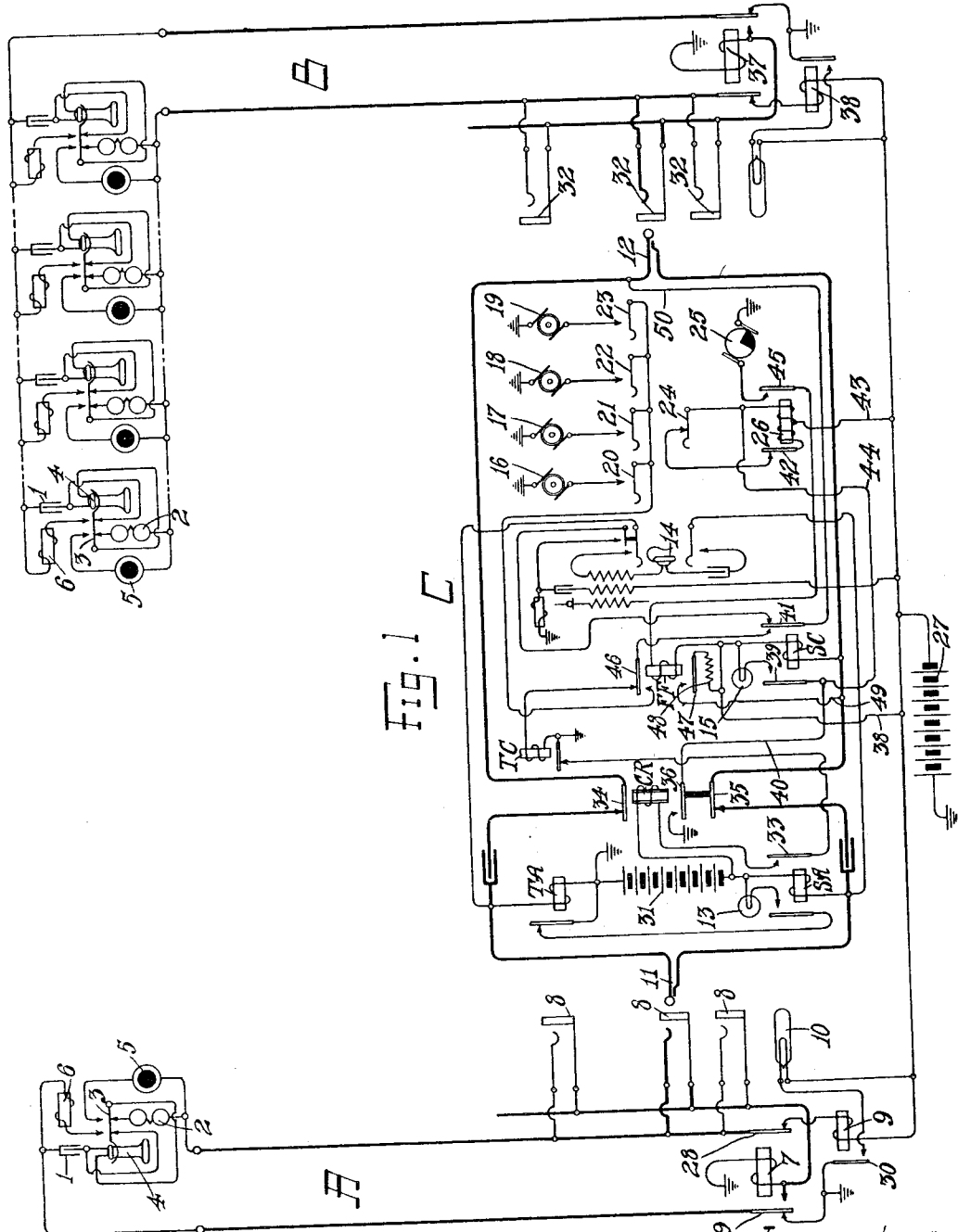


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 AUTOMATIC RINGING SYSTEM.
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Patented June 18, 1912.

2 SHEETS—SHEET 1.

1,030,039.



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2 SHEETS-SHEET 2.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC RINGING SYSTEM.

1,030,039.

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 of America, residing in Wilmette, county of Cook, 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 more particularly to automatic ringing or signaling means, the object being to provide such a system which is simple in construction and most efficient in operation.

In the accompanying drawings, Figure 1 represents diagrammatically a telephone exchange system with a pair of lines A and B and an operator's cord circuit C embodying my invention; Fig. 2 is a modification of the system shown in Fig. 1.

Referring now more particularly to the system shown in Fig. 1, the said system includes a pair of telephone lines A and B entering an exchange and adapted to be connected by the cord circuit C. The subscriber's station connected to the line A is a well known substation circuit including a condenser 1 and call bell 2 normally bridged across the limbs of line A through the contacts of the switch-hook 3. When the receiver 4 is removed from the said switch-hook 3, the call bell 2 is disconnected and the said switch-hook 3 cuts in the transmitter 5 and impedance coil 6. The limbs of the line A terminate at the exchange in contacts of a cut-off relay 7. The said line A also includes at the exchange, answering and multiple jacks 8 and the line relay 9, the said line relay being adapted when energized to light the line lamp 10.

To the right of Fig. 1 is shown the line B having four substations connected thereto, the circuit of each of the said substations being similar to that shown connected to line A. The line B terminates at the exchange in apparatus similar to that of line A. The cord circuit C comprises the answering plug 11 and the calling plug 12, the said plugs being conductively united by the heavily traced conductors and the interposed condensers.

Associated with the answering end of the cord circuit C is the tip answering supervisory relay TA and the sleeve answering supervisory relay SA. The said relays are

operated to control the answering supervisory lamp 13. The control relay CR which is actuated when the plug 11 is inserted in the jack of a calling line, is adapted to open the talking strands of the cord circuit C at its contacts 34 and 35. The operator's telephone 14 associated with the cord circuit C is common to and adapted to be connected to any one of a number of cord circuits in a well known manner. The tip calling supervisory relay TC and the sleeve calling supervisory relay SC are adapted to control the calling supervisory lamp 15 in a well known manner.

For ringing purposes, I employ four generators 16, 17, 18 and 19, each one being of a different frequency, while the bells of the subscribers on the party lines are tuned to correspond to the frequencies of the said generators. In ringing a called-for subscriber, one of the contact springs 20, 21, 22 or 23 is actuated, depending upon the tuned frequency of the bell of the desired subscriber. The contact spring 24 which is normally closed, is adapted to be momentarily opened when any one of the contact springs 20, 21, 22, or 23 are actuated. In ringing the call bell of a desired subscriber, an intermittent operation of the subscriber's bell is secured by means of the flip-flop relay FF, the said relay being adapted to have its energizing circuit opened and closed by means of the interrupter 25. The said interrupter 25 is connected to the said relay FF through contacts on the differential relay 26, the said relay being actuated when any one of the ringing keys is operated.

Operation of Fig. 1: Assuming now that the subscriber on line A desires a connection, he would remove his receiver 4 from its switch-hook 3, thereby closing an energizing circuit through the line relay 9 traced from battery 27, the winding of said relay 9, normal contact 28 of relay 7, the two limbs and the telephone of line A and normal contact 29 to ground. The resultant energization of the relay 9 closes a circuit through the line lamp 10 traced from battery 27, through the said lamp 10 to ground at alternate contact 30 of relay 9. The operator observing the said signal, inserts the plug 11 into the answering jack 8, energizing the cut-off relay 7 and disconnecting the line relay 9, thereby effacing the line lamp 10. The energizing circuit for the cut-off

relay 7 is traced from the negative pole of battery 31 through the winding of relay SA, the sleeve strand of the cord circuit C, sleeve contacts of plug 11 and jack, through the winding of said cut-off relay 7 to ground. The relay 7 and the relay SA are now connected in series and are both energized. Responsive to the energization of the cut-off relay 7, a circuit is closed through the tip answering supervisory relay TA, the said circuit branching from alternate contact 29 of relay 7, as just described, including the limbs and telephone of line A, tip contacts of jack 8 and plug 11, tip conductor of cord circuit C, through the winding of said relay TA to ground. The relays TA and SA being energized, the supervisory lamp 13 is not lighted.

Upon the energization of the relay SA a circuit is established through the control relay CR traced from the negative pole of battery 31, through the winding of the said relay CR, alternate contact 33 of relay SA to ground at the normally closed contact of relay TC. The control relay CR is energized responsive to the closing of the said circuit, thereby opening the talking conductors of the cord circuit C at the contacts 34 and 35. This is for the purpose of preventing the ringing circuit when applied to a called line, from affecting the telephone of the calling subscriber. Although at this time the contact 36 of relay CR is closed, thereby closing a circuit through the relay 26, the said relay 26 will not attract its armature due to the fact that the windings thereof are differentially connected.

The operator now actuates the listening key of her telephone 14 to ascertain the number of the desired subscriber. Having secured the number and finding it is one of the subscribers on line B, the operator would test one of the multiple jacks of line B in a well known manner to ascertain its idle or busy condition.

If the line B is busy, there will be a potential above that of ground at the sleeve or test contact of jack 32, and when the tip of the plug 12 is momentarily connected to the said test contact, the operator would receive a click or busy signal in her receiver.

Assuming that the line B is idle, there will be no potential above that of ground at the test contact of the jack 32, and the operator would receive no click or busy signal, and would therefore insert the plug 12 into one of the multiple jacks 32.

The sleeve calling supervisory relay SC and the cut-off relay 37 are now energized over a path traced from the negative pole of battery 27, conductor 38, winding of said relay SC, the sleeve conductor of cord circuit C, sleeve contacts of the plug 12 and jack 32, through the winding of the said cut-off relay 37 to ground. The relay 37 at-

tracts its armature opening its normally closed contacts, removing the sub-station control of the line relay 38 and connecting the terminals of the jack 32 to the limbs of the line B. The relay SC being energized, the supervisory lamp 15 is lighted over a path traced from the negative pole of battery 27, conductor 38, through the said lamp 15, alternate contact 39 of relay SC, conductor 40 to ground at alternate contact 36 of said relay CR. The said lamp 15 now remains lighted until the calling subscriber has responded to the call. The energization of the relay SC also connects the tip calling supervisory relay TC to the tip strand of the cord circuit, through the alternate contact 41, but the circuit of the line B being open at the substation, the said relay TC is not energized.

Assuming now that the bell of the desired subscriber is tuned to correspond to the frequency of the generator 16, the operator will close the contact 20 and at the same time momentarily open the contact springs 24. It will be remembered that when the relay CR closed the contact 36, a circuit was established through the relay 26, but the said relay 26 being differentially connected, did not attract its armature. The operator having momentarily opened the contacts 24, opened the circuit through the left hand winding of the said relay 26, thereby unbalancing the energizing effect of the two windings, as a circuit from ground at contact 36 is now closed only through the right-hand winding of the said relay 26 to battery 27. The relay 26 now attracts its armature opening the contact springs 42, thereby opening the circuit through the left-hand winding. The relay 26 now remains locked over a circuit traced from the negative pole of battery 27, conductor 43, right-hand winding of said relay 26, conductors 44 and 40 to ground at alternate contact 36 of relay CR. Responsive to the energization of the relay 26, the alternate contact 45 is also closed, establishing an intermittent energizing circuit through the relay FF from ground at interrupter 25, alternate contact 45, the winding of said relay FF to the negative pole of battery 27. The flip flop relay FF now responsive to the interruptions of its circuit at interrupter 25 alternately attracts and retracts its armature. Due to the intermittent energizations of the said relay FF, the contact spring 46 alternately connects the generator 16 and the supervisory relay TC to the tip strand of the cord circuit C, thereby intermittently ringing the bell of the called subscriber. The contact 47 of the relay FF is adapted to connect the non-inductive winding 48 to the sleeve strand of the cord circuit C, for the purpose of providing a return path for the ringing current by connecting the said resistance 48

to the sleeve strand of the cord circuit. By means of the said resistance 48, a non-inductive shunt is provided around the winding of the sleeve supervisory relay SC, thereby preventing the ringing current from chat-

5 tering the armature of the said relay SC.
The operator now having closed contact springs 20, as soon as the flip-flop relay FF is energized, a circuit for the ringing cur-
10 rent is established from the ungrounded pole of generator 16 through said contact 20, alternate contact 46 of relay FF, alter-
15 nate contact 41 of relay SC, the tip contacts of the plug 12, contact 32, the tip side of line B through the bell and condenser of
the called subscriber, sleeve conductor of line B, closed contact of cut-off relay 37,
20 sleeve contacts of jack 32 and plug 12, sleeve conductor of the cord circuit C, conductor
49, alternate contact 47 of relay FF, resistance 48, through the battery 27 to
ground. The flip-flop relay FF now contin-
25 ues to alternately connect the ringing generator 16 and the supervisory relay TC to the tip strand of the cord circuit until the called subscriber responds.

Each time the relay FF retracts its armature disconnecting ringing current from
the line, the discharge of the condenser of
30 the called line will have a tendency to kick up the relay TC thereby opening the circuit of relay CR. To prevent the relay CR from
prematurely retracting its armature, due to these interruptions of its circuit, the said
35 relay is provided with a copper sleeve about its core rendering the said relay slow to retract its armature.

When the called subscriber responds by removing his receiver from its switch hook,
40 and when the flip-flop relay FF is in its deenergized condition, a circuit is established through the relay TC from the negative pole of battery 27, conductor 38, the
winding of relay SC, sleeve contact of cord
45 circuit C, sleeve contacts of plug 12 and jack 32, the limbs and answering telephone of line B, tip contacts of jack 32 and plug
12, conductor 50, alternate contact 41 of relay SC, normal contact 46 of relay FF,
50 through the winding of supervisory relay TC to ground. The relay TC is thereby energized opening its contact and dis-
connecting the ground connection from the control relay CR. The control relay having
55 had its circuit opened at the contact of relay TC, returns its contacts to normal and restores the continuity of the talking con-
ductors of the cord circuit C at contacts 34 and 35. The contact 36 of the said relay
60 CR having returned to normal, the circuit through the supervisory signal lamp 15 is opened, thereby effacing the said signal.
The opening of contact 36 also allows the differential relay 26 to be deenergized open-
65 ing the contact 45 and disconnecting the in-

terrupter 25 from the flip flop relay FF. The operator observing the effacing of the signal lamp, knows that the called sub-
scriber has responded.

The subscribers of lines A and B are now
70 connected in a conversational circuit which is traced over the heavily marked conduc-
tors, talking battery for the calling sub-
scriber being furnished through the relays
TA and SA from battery 31, and talking
75 battery for the subscriber on line B being
supplied through the relays TC and SC from the battery 27.

When the subscribers have finished their
80 conversation, they restore their receivers to their switch-hooks, thereby opening the cir-
cuits for the supervisory relays TA and TC and as the supervisory relays SA and SC
remain energized, while the plugs are in
the jacks, the supervisory lamps 13 and 15
85 are lighted. The operator in response to this signal removes the plugs 11 and 12
from the respective jacks 8 and 32, extin-
guishing the said lamps. The cord circuit
C and lines A and B are now restored to
90 normal and are available for another con-
nection.

Fig. 2: Referring now to Fig. 2, the sys-
tem shown therein includes two lines A'
and B', the said lines being equipped sim-
95 ilarly to the lines A and B of Fig. 1, and the parts are therefore numbered the same
as those of the lines of Fig. 1. The cord
circuit C' comprises the answering plug 55
and calling plug 56, the said plugs being
100 conductively united over the heavily marked
conductors, and having a pair of condensers
interposed between the terminals thereof.
Associated with the answering end of the
cord circuit C', is the tip answering super-
105 visory relay TA' and the sleeve answering
supervisory relay SA'. The said relays are
adapted to control the answering supervi-
sory lamp 57 in a manner similar to that de-
scribed in connection with the answering
110 supervisory lamp and relays of the cord
circuit C of Fig. 1.

The control relay CR' is adapted to open
the talking strands of the cord circuit C'
and also when energized to connect the in-
115 terrupter 58 to the flip-flop relay FF. In
the cord circuit C', the control relay CR'
connects the non-inductive shunt around the
sleeve supervisory relay SC' instead of this
connection being performed by the flip-flop
120 relay, as it is done in the cord circuit C of
Fig. 1. The flip-flop relay FF' due to the
interruption of its circuit by the interrupter
58 is adapted to alternately connect the tip
supervisory relay TC' and the selected ring-
125 ing generator to the tip conductor of the
plug 56. The calling supervisory lamp 59
is jointly controlled by the tip supervisory
relay TC' and the sleeve supervisory relay
SC'. The operator's telephone set 60 is
130

adapted to be connected to the talking strands of the cord circuit by means of a key in a well known manner.

The four ringing generators are of different frequencies and the bells of the subscribers on line B' are tuned to correspond to the frequencies of the said generator in a manner similar to that described in connection with the generators and bells of Fig. 1. The ringing key for the cord circuit C' is so constructed that when any one of the upper ringing contacts is closed, the lower contact 61 is only momentarily closed. In the ringing keys of the cord circuit C, the single contact set is normally closed, while the contact set 61 of the cord circuit C' is normally open.

Operation of Fig. 2: Assuming now that the subscriber of line A' desires a connection, he would remove his receiver from its switch hook, thereby lighting the line lamp 10 as previously described in connection with Fig. 1. The operator in response to the call would insert the plug 55 in the answering jack 8 of the calling line A', thereby energizing the cut-off relay 7 and the supervisory relays SA' and TA' and effacing the line signal. In this instance the sleeve supervisory relay SA' would close its contact 62 but without any further result therefrom, as the conductors leading from the said contact 62 do not as yet close any energizing circuit.

The operator now actuates the listening key of her telephone 60 and having ascertained the wants of the calling subscriber of line A' and having found that the said subscriber desires a connection with a subscriber on line B', the operator would test the said line B' in the usual manner.

Assuming that the line B' is in an idle condition, the operator would insert the plug 56 in one of the multiple jacks 32 of line B', thereby closing a circuit through the relay SC' and the cut-off relay 37. This circuit is traced from the negative pole of battery 63, through conductor 64, the winding of said supervisory relay SC', sleeve strand of the cord circuit C', the sleeve contacts of the plug 56 and jack 32, through the winding of the cut-off relay 37 to ground. The two relays are now energized, the cut-off relay disconnecting the line relay from the substation control and connecting the limbs of the said line to the jack contacts. The energization of the supervisory relay SC' closes a circuit through the calling supervisory lamp 59, the said circuit being traced from the negative pole of battery 63, conductor 64, through said lamp 59, alternate contact 65, normal contact 66 to ground at normally closed contact of relay TC', lighting the said lamp 59. The energization of the said relay SC' also moves the contact spring 67 to its alternate position,

disconnecting the test conductor from the tip strand of the cord circuit and connecting the contact spring 68 of the flip-flop relay FF' to the said tip strand. Assuming now that the generator 69 is of the proper frequency to ring the bell of the desired subscriber, the operator closes the contact springs 70 and thereby also momentarily closes the contact springs 61. The momentary closing of the contact springs 61 establishes an energizing circuit through the relay 71, the said circuit being traced from the negative pole of battery 63, conductor 64, winding of said relay 71, conductor 72, closed contact 61, alternate contact 62 of relay SA' to ground at the closed contact of relay TC'. The relay 71 is thereupon energized and a locking circuit therefor is established by the closing of the contact 73, this locking circuit retaining the relay 71 in its energized condition after the contacts 61 of the ringing key are again opened. The contact 66 of the relay 71 is moved to its alternate position by the energization of the said relay 71, thereby retaining the supervisory lamp 59 lighted through the ground at alternate contact 66 in place of the ground through the normal contact of the relay TC' and the normal contact 66.

The purpose of replacing the original circuit through the supervisory lamp 59 by the circuit to ground at the alternate contact 66 of relay 71, is to prevent the flickering of the said lamp 59, should the tip supervisory relay TC' kick up due to the discharge of the condenser of the called line when the bell of the said called line is being rung. Also upon the energization of the relay 71, a circuit is closed through the control relay CR', the said circuit being established over a path traced from the negative pole of battery 63, conductor 64, through the winding of the said relay CR', alternate contact 74 of relay 71, alternate contact 65 of relay SC' to ground at alternate contact 66 of relay 71. The control relay CR' is thereupon energized opening the talking strands of the cord circuits C' at the contacts 75 and 76, for the purpose of preventing the ringing current from affecting the telephone of the calling subscriber. The moving of the contact 76 of the relay CR' to its alternate position connects the non-inductive winding 77 to the sleeve strand of the cord circuit C' for the purpose of shunting the ringing current around the coil of the relay SC' and preventing the ringing current from chattering the armature of the said relay. The energization of the said relay CR' also connects the interrupter 58 to the flip-flop relay FF' through the alternate contact 78.

The relay FF' due to the interruption of current therethrough from the interrupter 58, alternately attracts and retracts it arma-

ture, thereby moving the contact spring 68 from its normal to its alternate contact and continuing so until the called subscriber responds. Upon the closing of alternate contact 68 of the said relay FF', current from the generator 69 is applied to the line B' over a path traced from the ungrounded pole of the said generator 69 through contact 70, alternate contact 68 of relay FF', alternate contact 67, conductor 79, tip contacts of the plug and jack, the limbs of the line B and the bell and condenser of the called subscriber, the sleeve contact of the jack and plug, sleeve strand of the cord circuit C', alternate contact 76 of relay CR', non-inductive winding 77, conductor 64, and through the battery 63 to ground, ringing the bell of the desired subscriber on the line. The flip-flop relay FF' now continues to alternately connect the ringing generator and the tip supervisory relay TC' to the tip strand of the cord circuit C'. Due to the alternate connection and disconnection of the ringing generator to the line, the discharge of the condenser of the called subscriber is apt to kick up the armature of relay TC'. This would, of course, remove the ground from the energizing circuit through the relay 71, but this relay is purposely made sluggish to prevent the retraction of its armature, due to the momentary opening of its circuit.

The subscriber now responding to the call, removes his receiver from its switch-hook and as soon as the flip-flop relay FF' retracts its armature, if it is not already in this condition when the subscriber responds, an energizing circuit for the relay TC' is established from the negative pole of battery 63, through the winding of sleeve supervisory relay SC', the sleeve strand of the cord circuit C', sleeve contacts of the plug and jack, the limbs and answering telephone of line B', the tip contacts of the jack and plug, conductor 79, alternate contact 67, normal contact 68 of relay FF', through the winding of the said relay TC' to ground. The relay TC' is thereupon energized attracting its armature, opening the locking circuit previously traced through the relay 71. The said relay 71 is thereupon deenergized opening the circuit through the calling supervisory lamp 59, indicating to the operator that the called subscriber has responded to the call. The opening of contact 74 of relay 71 disconnects the control relay CR' permitting the said relay CR' to restore its contact springs to normal. The closing of the contacts 75 and 76 of said relay CR' again establishes the continuity of the talking strands of the cord circuit, and the opening of the contact 78 thereof disconnects the interrupter 58 from the flip-flop relay FF' and the said relay now remains inert. The calling and called sub-

scribers are now connected in a conversational circuit, the said circuit being traced over the heavily marked conductors, and talking battery being supplied to the calling subscriber from the battery 80, through the windings of the relays TA' and SA', while the talking battery for the called subscriber is supplied through the relays TC' and SC' by the battery 63.

When the subscribers have finished their conversation, they replace their receivers upon their switch-hooks, thereby interrupting the circuits for the relays TA' and TC', deenergizing said relays. As the two supervisory relays SA' and SC' remain energized while their respective plugs are inserted in the jacks, the supervisory lamps 57 and 59 are lighted. The operator observing this signal, withdraws the plugs 55 and 56 from their respective spring jacks and the apparatus of the two lines A' and B' and the cord circuit C is now at normal, and available for another connection.

While I have shown my invention as operating in connection with a party line ringing system, I do not wish to be limited to the use of party line ringing, as it is obvious that individual ringing may be used. Neither do I wish to be limited to the particular system of ringing as any method of signaling may be used in connection with my invention.

I claim:

1. A telephone system comprising a calling and a called subscriber's telephone line, a link circuit establishing connection between said lines, a control relay actuated responsive to said connection, a differential relay having its windings energized responsive to said actuation, a ringing key, a source of ringing current, means controlled by actuation of said key to unbalance said differential relay to attract its armature, a flip-flop relay operated responsive to the attracted armature of said differential relay to apply said ringing current to said called line, and means actuated upon the response of the called subscriber to restore all of said relays.

2. In a telephone system, the combination with a calling and a called subscriber's telephone line, a link circuit connecting said lines, a differential relay having its windings energized responsive to said connection, a ringing key, a source of ringing current, means effective upon the actuation of said key to unbalance said differential relay to attract its armature, whereby said ringing current is applied to the called line.

3. In a telephone system, the combination with a called subscriber's telephone line, a link circuit connected thereto, a differential relay, means for energizing the windings thereof, a flip-flop relay, a source of ringing current, a ringing key, means effective

tive upon the actuation of said key to render said differential relay operative to attract its armature, an intermittent energizing circuit closed through said flip-flop relay upon the attraction of said armature to connect said ringing source to said called line, and means controlled by the called subscriber to disconnect said ringing current from said line.

4. In a telephone system, the combination with a called subscriber's telephone line, an operator's link circuit connected thereto, a differential relay, means for energizing the windings thereof, a source of ringing current, a ringing key, means effective upon the actuation of said key to render the windings of said relay operative to attract the armature of said relay, means controlled by the attraction of said armature to apply said ringing current to said line, a locking circuit for said relay effective upon the attraction of said armature, and means actuated upon the response of the called subscriber to open said locking circuit, whereby said ringing current is disconnected.

5. In a telephone system, the combination with a calling and a called subscriber's telephone line, an operator's link circuit having tip and sleeve conductors connecting said lines, a sleeve supervisory relay energized responsive to said connection, a tip supervisory relay, a relatively slow relay, means for energizing said slow relay, a supervisory signal, an energizing circuit therefor closed through series contacts of said sleeve supervisory and said slow relays upon their energization, means for signaling the called subscribers, and means actuated upon the response of said called subscriber to ener-

gize said tip relay and thereafter deenergize said slow relay, the said energizing circuit for said signal being rendered ineffective thereby.

6. A telephone system comprising a called substation telephone line, an operator's link circuit having tip and sleeve conductors connected with said line, a tip supervisory relay, a sleeve supervisory relay energized responsive to said connection, a relatively slow relay, means for energizing said slow relay and placing it under control of the tip relay, a supervisory signal and an energizing circuit therefor closed through series contacts of said sleeve and slow relays upon their energization, means for signaling the called substation, and means effective upon response from the called substation to energize said tip relay whereby said slow relay is restored and said signal circuit interrupted.

7. A telephone system comprising a called substation telephone line, a link circuit connected with said line, a two winding relay differentially energized responsive to said connection, a ringing key, a source of ringing current, means effective upon actuation of said key whereby the windings of said relay are unbalanced to cause its energization and the closing of its contacts to apply the ringing current to the called line.

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,

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