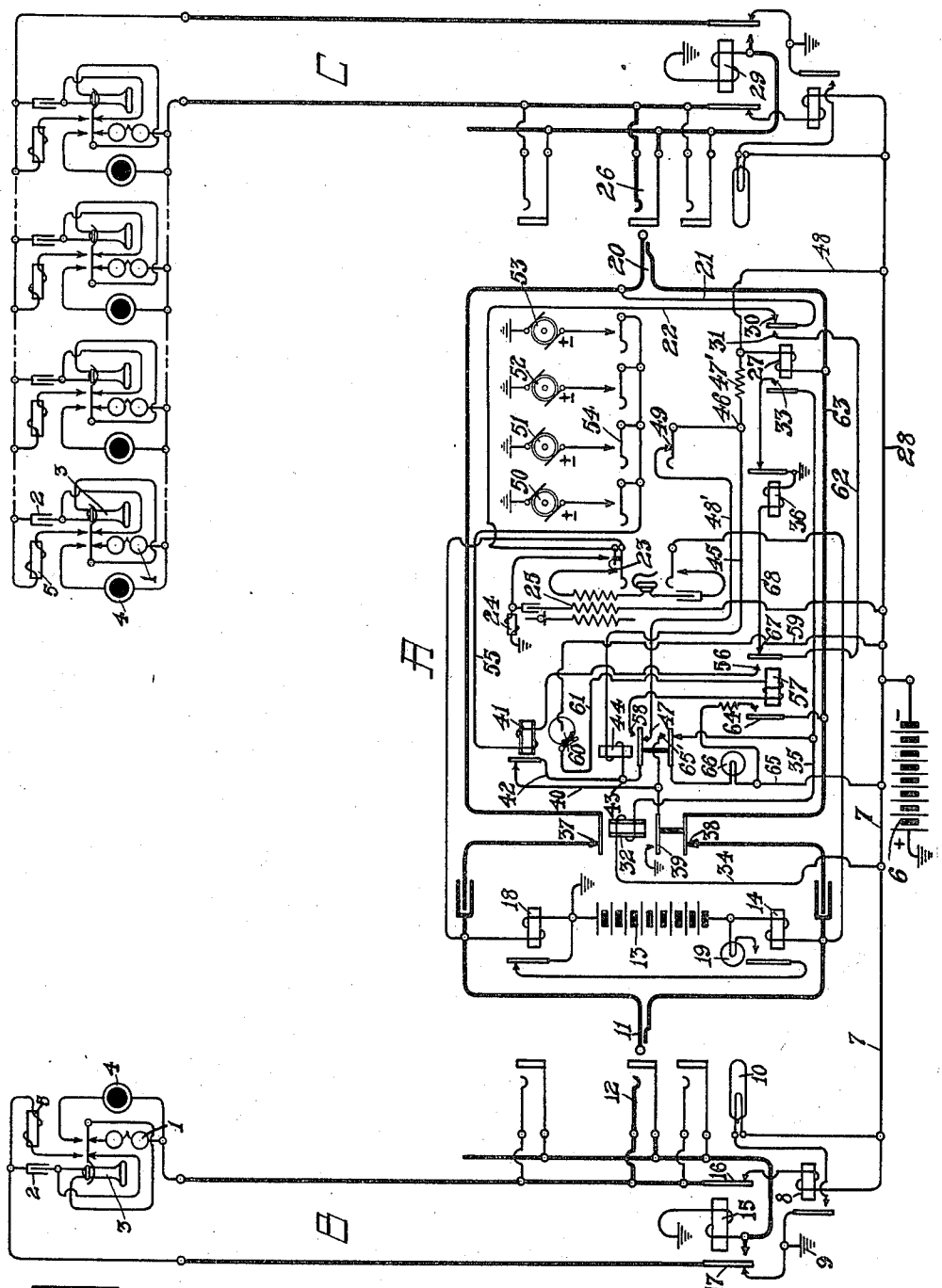
A. H. WEISS.

AUTOMATIC RINGING SYSTEM.

APPLICATION FILED AUG. 17, 1910.

1,030,037. Patented June 18, 1912.



Witnesses
George E. Mueller
Wm. Berghahn.

Inventor
Alfred H. Weiss
By Curtis B. Camp
Attorney

UNITED STATES PATENT OFFICE.

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

AUTOMATIC RINGING SYSTEM.

1,030,037. Specification of Letters Patent. Patented June 18, 1912.

Application filed August 17, 1910. Serial No. 577,663.

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 systems and particularly to simplified and efficient means for signaling the telephone subscribers in such exchanges.

I have illustrated one form of my invention which is now in commercial operation in the accompanying drawing.

The system as shown comprises the central office apparatus A and two subscribers' lines B and C extending therefrom. One subscriber's station is shown upon the line B and four subscribers' stations are shown upon the line C.

Any subscriber's apparatus suitable for use with a common battery system may be employed with the automatic ringing system of my invention. For illustrating the operation I have shown the telephone bell 1 and condenser 2 normally bridged across the telephone line forming a closed path for the ringing current when the telephone receiver 3 is upon its hook. When the receiver is removed from its hook in initiating or responding to a call, the bell 1 is removed from the circuit and a path for the energizing current from the central office battery is closed through the transmitter 4 and the impedance coil 5. A circuit containing the receiver 3 and the condenser 2 is also closed in parallel with the impedance coil 5 for the transmission of the voice current. The same subscriber's apparatus has been shown at the several substations.

It will be understood that there are many lines similar to the lines B and C entering the exchange and the cord circuits A are duplicated for making connection between the lines, and the operation of the system is the same in initiating supervisory and clearing out connections for conversation between subscribers upon any of the lines entering the exchange.

Assuming the subscriber on line B desires a connection with one of the subscribers on line C, the receiver 3 of line B will be removed from the switch-hook which will close a path for current from the central office battery 6, over conductor 7, through the winding of line relay 8, over the limbs of the telephone line and through the substation apparatus in series to the battery at the ground 9. Current in this path will energize the line relay which will attract its contact spring and light the line lamp 10 to attract the attention of the operator. The operator will then insert her answering plug 11 in the jack 12 of the calling line which will close a path for current from the battery 13, through the winding of supervisory relay 14, the sleeve contacts of the plug and jack and through the winding of cut-off relay 15. The cut-off relay is energized by this flow of current opening the circuit of the line relay at contact spring 16 and removing the ground from the sleeve side of the line at contact 17, connecting said limb of the line with the sleeve side of the jack. Upon the energization of the cut-off relay 15, this current flows through contact spring 17, over the telephone line, through the tip contacts of the plug and jack and through the winding of supervisory relay 18 to ground. The tip supervisory relay 18 is thus energized to open the circuit of the supervisory lamp 19 which remains inert due to the fact that the calling subscriber's telephone is removed from its hook. When the subscriber upon line B returns his receiver to the hook at the termination of the conversation, the flow of current just traced through supervisory relay 18 will be broken at the switch hook contacts, and said relay will permit its contact spring to drop back and light the supervisory lamp 19 as a signal to the operator for disconnection. The supervisory relay 14 remains locally energized through the cut-off relay 15 maintaining the lamp circuit 19 closed at its contacts as long as the plug is inserted in the jack of the line, so that during a connection the condition of the supervisory lamp 19 is controlled by the subscriber through supervisory relay 18. After inserting plug 11 in the jack of the calling line, the operator throws her listening key and inquires the number of the desired subscriber. She then tests the condition of the desired line by touching the tip of her calling plug 20 to the sleeve of the said line, and removing it therefrom in the usual manner. If the line is busy a potential above that of earth will exist upon the

sleeve contacts of the jacks of said line, and a flow of current will result through the tip of the plug, conductors 21 and 22, normally open contact 23 upon the listening key, through the impedance coil 24 to ground. The dicharge from the impedance coil 24 as this circuit is made and broken during the operation of testing will flow through the tertiary winding 25 of the operator's induction coil to battery, producing the usual inductive click in the operator's head receiver, thus notifying her that the line is busy. Any suitable testing arrangement may be substituted for that described. If the line is idle no potential will exist at the sleeve contacts of the jacks and the operator receiving no click in her receiver will insert the calling plug 20 in the jack 26 of the line. This will close a path for current through the supervisory relay 27 which may be traced from battery 6, over conductors 28 and 48, the winding of said relay 27, the sleeve contacts of the plug and jack, through the cut-off relay 29 to ground. Current in this path will energize these relays, the relay 27 removing the testing conductor 22 from the tip of the plug at its contact 30. It also closes a path for the ringing current at its front contact 31, and closes the circuit of control relay 32 at its front contact 33. Control relay 32 is therefore energized from battery 6 over conductors 7 and 34, the winding of said relay, conductor 35, the contacts 33 of relay 27 and through the normally closed contacts of relay 36 to ground. The energization of control relay 32 opens the cord circuit at its contacts 37 and 38 to prevent the ringing current from passing back over the line of the calling subscriber. It also puts a ground connection upon its contact 39. This ground connection may be traced from contact spring 39 to conductor 40, the normally closed contacts of relay 41, conductor 42, to the point 43. From the point 43, the current divides, a portion flowing through the winding of relay 44, and conductor 45 to point 46, and a portion flowing through the normally closed contact 47 of the relay 44 and conductor 48′ and the normally closed contact 49 of the ringing key to point 46, the two paths uniting at this point and flowing through non-inductive resistance 47′ and conductors 48 and 28 to the live pole of battery 6. It will be noted therefore that relay 44 is not energized by the flow of current in this path because of the short circuit placed about the winding of said relay, including the contacts 49 of the ringing key. When this short circuit is removed, however, by the operation of the ringing key, said relay 44 is energized as will be hereinafter described.

It will be understood that any selective signaling means may be employed with my automatic ringing system for operating the bells upon polystation lines, but I have indicated separate generators 50, 51, 52 and 53 for each subscriber's station. These generators are adapted to deliver ringing current of different predetermined frequencies, and the bells at the substations are tuned to selectively respond to the frequency impressed upon the line. The preferable arrangement of the ringing key is such that when the contacts for either generator are operated the contacts 49 would also be operated momentarily. That is, when the ringing key is depressed, the contact closing the generator circuit will be closed and remain closed during ringing, while contacts 49 will be opened momentarily and then closed.

We have seen that when the plug is inserted in the jack the supervisory relay 27, the cut-off relay 29 and the control relay 32 are energized, and current is closed through relay 44, but said relay is not energized due to the short circuit placed about its winding including the normally closed ringing key contacts 49. In this condition of the circuit, the operator throws the ringing key of the proper generator to call the desired subscriber, which we will assume is generator 51. When this ringing key is thrown, ringing current is impressed from the generator upon the ringing key contacts 54, conductor 55, through the winding of relay 41, the normally open front contact 56 of the flip-flop relay 57. As already stated, when the ringing key contact 54 is operated, the ringing key contact 49 is opened momentarily to remove the shunt circuit from the relay 44. The opening of this shunt circuit at the ringing key contacts 49 causes the energization of relay 44 which attracts its contact springs, and closes a path for battery through the flip-flop relay 57 at the front contact 58 of said relay. The path for this current is traced from battery 6, over conductor 59, the circuit-breaker 60, conductor 61, the winding of flip-flop relay 57, contact 58 of relay 44 and conductors 42 and 40 to ground at contact 39 of control relay 32. The flip-flop relay 57 is therefore intermittently energized and deënergized in response to the rotation of the circuit breaker 60 to intermittently close the contact 56 of the flip-flop relay 57 to impress the generator current upon the line, said generator current flowing from contact 56, over conductor 62, front normally open contact 31 of supervisory relay 27, conductor 21, the tip contacts of the plug and jack, the limbs of the telephone line and the substation apparatus, the sleeve contacts of the jack and plug, sleeve strand 63 of the cord circuit, normally open contacts 64 of the flip-flop relay and conductor 65 to battery. The flip-flop relay at each time it is actuated to impress ringing current upon

the line also closes its contact 64, connecting the non-inductive resistance to provide a return path for the ringing current, by means of which said current is prevented from flowing through the supervisory relay 27 and conductors 48 and 28 to battery. The supervisory relay 27 is therefore not affected by the ringing current. It will be noted that contact 47 of relay 44 is open when its relay is actuated, thus preventing reëstablishing the shunt circuit path about the winding of relay 44 when the key contacts 49 return to normal position. It will also be noted that front contact 65′ of relay 44 is closed when said relay is energized, thus switching the circuit of supervisory lamp 66 from the path including the contact of relay 36 to the path including the contact 39 of relay 32. The subscriber's bell is now being sounded intermittently by current from generator 51 as the flip-flop relay 57 is energized and deenergized in response to the rotation of circuit breaker 60. The control relay 32 is provided with a copper shell making it sluggish in action to prevent said relay releasing its contact springs, due to the discharge from the condenser at the subscriber's station when the flip-flop relay drops back and cuts off the ringing current at contact 56 of said relay. This discharge may be traced from the condenser at the subscriber's station, over the tip side of the line, the tip contacts of the jack and plug, conductors 21 and 62, front normally closed contact 67, conductor 68, through the winding of relay 36 to ground. This discharge would cause relay 36 to momentarily attract its contact spring which would deënergize control relay 32 momentarily causing it to release its contact springs and release the ringing apparatus. The copper shell, however, makes relay 32 unresponsive to this momentary break in its circuit. The ringing current is automatically discontinued and the ringing apparatus restored to normal condition by the response of the called subscriber in removing his telephone receiver from the switch-hook, and in the present system this is accomplished whether the subscriber responds during the ringing interval or during the interval between rings. By this arrangement, if the subscriber responds during a ringing interval, the current is at once shut off so that the subscriber does not receive a ring in the ear. Assuming the subscriber to respond during the interval between rings, the ringing is restored in the following manner. During this interval the flip-flop relay 57 is deënergized by the circuit breaker 60 and the ringing circuit is open at contact 56 of said relay. Current therefore flows from battery 6, over conductors 28 and 48, the winding of supervisory relay 27, sleeve contacts of the plug and jack, the limbs of the telephone line and the substation apparatus in series, the tip contacts of the plug and jack, conductor 21, front contact 31 of supervisory relay 27, conductor 62, back contact 67 of flip-flop relay 57, conductor 68, through the winding of relay 36 to ground. The relay 36 is energized attracting its contact spring and opening the circuit of control relay 32 which is deënergized permitting its contact springs to return to normal. Control relay 32 completes the continuity of the cord circuit for conversation at its contacts 37 and 38, and opens the circuit of relay 44 at its contact 39. Relay 44 therefore releases its contact springs opening the circuit of the flip-flop relay 57 at its front contact 58 and opening the circuit of the supervisory signal 66 at its contact 65′, thus preventing the further operation of the flip-flop relay, and retiring the signal 66 to notify the operator that the called subscriber has responded. The ringing apparatus is thus restored to normal condition and the cord circuit is placed in condition for conversation. Assuming the subscriber to respond during a ringing interval, the ringing current would be discontinued and the ringing apparatus restored to normal condition in the following manner. During such interval the flip-flop relay 57 is actuated and the ringing current is completed at the front contact 56 of said relay. It will be noted that relay 41 is provided with a copper shell to render it unresponsive to the alternating ringing current, but responsive to battery current. When the subscriber responds a low resistance path is closed for the ringing current which increases the peak of the wave of the ringing current and a low resistance path is also closed for the battery current. The ringing current being of positive and negative polarity, and the battery current of negative polarity, the battery current bucks or opposes the ringing current of positive polarity and assists the ringing current of negative polarity. This results in an increase in the peak of the ringing current of negative polarity due to the low resistance path closed for the ringing current when the subscriber answers, and this peak of negative sign is further increased by the battery current of negative polarity, while the peak of the ringing current of positive polarity is decreased due to the opposition of the battery current. This results in battery current of negative polarity flowing through the relay 41 and ringing current with a wave form having a high peak of negative polarity and a comparatively short peak of positive polarity, the combined effect of this battery current and ringing current with a wave form to assist the battery, resulting in the operation of relay 41. A path for this com-

bined battery and ringing current through relay 41 when the subscriber answers during the ringing interval may be traced through battery 6, over conductors 28 and 48, the winding of relay 27, the sleeve contacts of the jack and plug, over the limbs of the telephone line and the subscriber's apparatus in series, tip contacts of the jack and plug, conductors 21 and 62, front contact 56 of flip-flop relay 57, winding of relay 41, conductor 55 and the ringing key contacts through the generator to ground. Relay 41 is therefore energized attracting its contact spring and opening the circuit of relay 44 at that point. The relay 44 is therefore deënergized opening the circuit of flip-flop relay 57 at its contact 58. When flip-flop relay 57 is deënergized, relay 36 is actuated by battery current as previously described, opening the circuit of control relay 32, thus restoring all parts of the automatic ringing apparatus to normal condition. At the conclusion of the conversation by either subscriber, upon the return of the receivers to their hooks, the corresponding supervisory signals 19 and 66 are lighted over the circuits already described as a clearing out signal for the operator, who removes the plugs from the jacks, thus restoring all parts of the system to normal condition.

While I have described my invention with reference to details of construction which have been worked out for commercial purposes, and which are now in successful commercial operation, I do not wish to be limited to such details or to the specific arrangement of circuits and apparatus shown, as I am aware that many changes and modifications may be made therein and still realize the beneficial results of the invention.

I claim:

1. In a telephone system, the combination with a cord circuit, of a called subscriber's telephone line, a ringing control relay for said cord circuit, means for closing a circuit through said relay responsive to a connection between said line and cord circuit, a source of ringing current, a ringing key, means actuated responsive to the operation of said key whereby said ringing relay is energized by said circuit to apply the ringing current to said line, and means for automatically disconnecting said ringing current upon response of the called subscriber.

2. In a telephone system, the combination with a cord circuit connected with a called subscriber's telephone line, a ringing control relay having a circuit closed therethrough, a ringing key, means actuated upon operation of said key whereby said relay is energized by said circuit, a supervisory relay and a source of ringing current, a flip-flop relay operated responsive to the energization of said ringing relay to alternately connect said supervisory relay and said ringing current to said line, and means actuated upon response of said called subscribers to deënergize said ringing control relay, whereby said flip-flop relay is rendered inoperative.

3. In a telephone system, the combination with a cord circuit connected with a called subscriber's telephone line, a ringing control relay having a closed battery circuit including its winding but ineffective to energize said ringing relay, a source of ringing current, a ringing key, means actuated responsive to the operation of said key whereby said battery circuit is rendered effective to energize said relay, and means actuated responsive to said energization to apply said ringing current to said line.

4. In a telephone system, the combination with a cord circuit, of a called subscriber's telephone line, a control relay energized responsive to a connection between said cord circuit and said line, a source of ringing current, a ringing key, means actuated, responsive to the operation of said key to apply the ringing current to said line, a slow relay included in said ringing circuit and unresponsive to said ringing current, a source of direct current, means actuated upon the response of the called subscriber to connect said direct current to said slow relay, whereby said relay is actuated, and means actuated responsive to the energization of said relay to deënergize said control relay, whereby said ringing current is disconnected.

5. In a telephone system, the combination with a cord circuit connected with a called subscriber's telephone line, of a control relay, means for energizing said control relay to disunite the talking conductors of said circuit, a source of ringing current, a source of direct current, means for alternately bridging said currents across the limbs of said line, and means actuated upon response of the called subscriber while either source of current is connected to said line to deenergize said control relay.

6. In a telephone system the combination with a calling and a called subscriber's telephone line, of a cord circuit for connecting said lines in a conversational circuit, a control relay for said cord circuit energized responsive to said connection to conductively disunite said lines, a source of ringing current, a source of direct current, means for alternately connecting said currents in bridge of the called line, a relay included in each bridge, either one of said relays being adapted to be actuated upon response of the called subscriber, whereby said control relay is deënergized to conductively unite said lines.

7. In a telephone system, the combination with a calling and a called subscriber's tele-

phone line, of a cord circuit connecting said lines responsive to a call, a ringing key a ringing control relay energized responsive to actuation of said key, a flip-flop relay operated responsive to the energization of said ringing relay, a ring-through relay, and a supervisory relay alternately bridged across the called line responsive to the operation of said flip-flop relay, and means actuated on response of the called subscribers to render said flip-flop relay and ringing relay inert, irrespective of which relay is in bridge of the called line on said response.

8. In a telephone system, the combination with a cord circuit, of a called subscriber's telephone line, a supervisory lamp signal displayed upon connection between said circuit and line, a source of ringing current, means for periodically applying said current to said line, a supervisory relay connected to said line and adapted to control the effacement of said signal upon a response of the called subscriber and means to prevent effacement or flickering of said lamp by any premature momentary energization of the supervisory relay previous to a response of said subscriber.

9. In a telephone system, the combination with a cord circuit and a called subscriber's telephone line connected for a conversational circuit, a displayed supervisory lamp signal, a source of ringing current, a call bell and condenser in bridge of said line, means for periodically applying said source to said line to operate said call bell, a supervisory relay in bridge of said line and adapted to control the effacement of said signal lamp upon a response of the called subscriber, and means to prevent the effacement or flickering of said lamp by any premature momentary operation of the supervisory relay due to the discharge of ringing current by said condenser through said supervisory relay.

10. In a telephone system, the combination with a calling and a called subscriber's telephone line, an operator's link circuit connecting said lines, having tip and sleeve conductors, a sleeve supervisory relay energized responsive to said connection, a ringing key, a relatively slow relay energized responsive to said supervisory relay, a ringing relay responsive to the actuation of said key when signaling said called subscriber, a supervisory lamp signal, an energizing circuit therefor closed upon the energization of said ringing and slow relays, and means controlled by the called subscriber to de-energize said ringing and slow relays to open said energizing circuit and efface said lamp signal.

11. In a telephone system, the combination with a called substation telephone line, a cord circuit connected with said line, a ringing key, a ringing control relay energized responsive to actuation of said key, a flip flop relay operated responsive to said ringing relay, a ring-through relay and a supervisory relay alternately bridged across the called line responsive to the operation of said flip flop relay, either the ring-through relay or the supervisory relay being adapted upon response from the called substation to be actuated to render said flip flop and ringing relays inert, irrespective of which relay is in bridge of the called line at the time of said response.

12. A telephone system comprising a called telephone line, a cord circuit connected thereto, a ringing key, a flip flop relay for applying ringing current to the called line responsive to actuation of said ringing key, a tip supervisory relay, a relatively slow relay, a supervisory lamp and circuit connections controlled by said last two relays, means for placing the supervisory lamp under the control of the slow relay previous to a response from the called substation, and means for removing the control of the lamp by the slow relay and substituting the control of said lamp by the supervisory relay upon response from the called substation.

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.