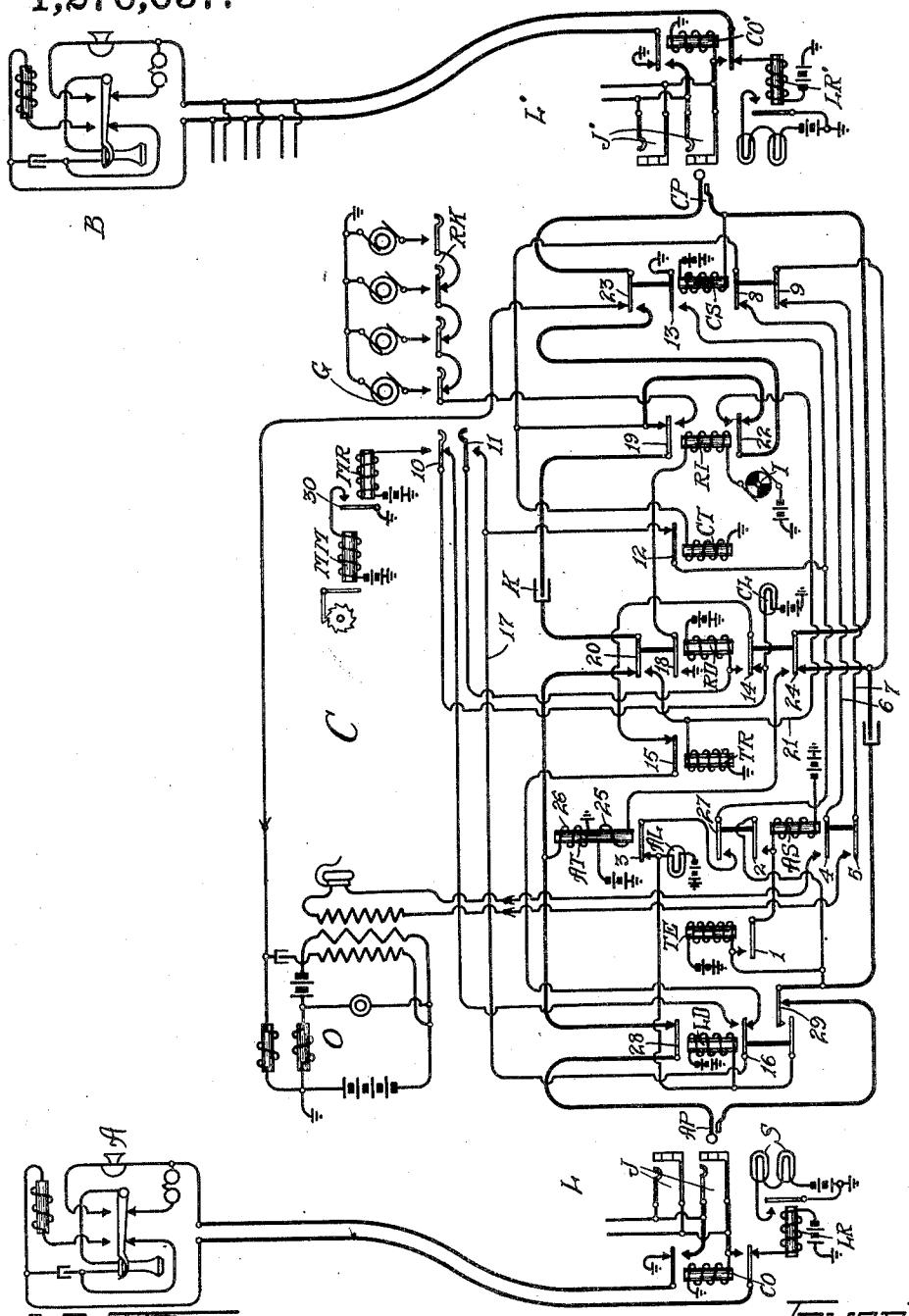
H. D. CURRIER & M. B. STAZAK.

AUTOMATIC RINGING SYSTEM.

APPLICATION FILED JAN. 9, 1915.

1,276,037.

Patented Aug. 20, 1918.



Witnesses:

George E. Mueller

W. Berghahn.

Inventors:

Hiram D. Currier

Michael B. Stazak

By Curtis B. Camp.

Attorney.

UNITED STATES PATENT OFFICE.

HIRAM D. CURRIER AND MICHAEL B. STAZAK, OF CHICAGO, ILLINOIS, ASSIGNORS TO KELLOGG SWITCHBOARD & SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

AUTOMATIC RINGING SYSTEM.

1,276,037. Specification of Letters Patent. Patented Aug. 20, 1918.

Application filed January 9, 1915. Serial No. 1,307.

To all whom it may concern:

Be it known that we, HIRAM D. CURRIER and MICHAEL B. STAZAK, citizens of the United States, and residing in Chicago, county of Cook, State of Illinois, have invented certain new and useful Improvements in Automatic Ringing Systems, of which the following is a specification.

Our invention relates to telephone systems, and has to do more particularly with automatic ringing systems, such as are provided in operator's link circuits, and one of the principal objects of our invention is to provide an improved circuit arrangement whereby the applied ringing current is disconnected from a called line immediately upon the removal of the receiver by a subscriber thereat whether during a silent or ringing interval, so as not to ring the called subscriber in the ear in the event that the called subscriber answers during the said ringing interval.

Referring to the accompanying drawing, we have illustrated the preferred embodiment of our invention and have shown two substations A and B terminating in line circuits L and L^1, respectively, each comprising the usual line relay LR, cut-off relay CO, multiple line jacks J and line signals S. The line circuits illustrated are known as multiple line lamp circuits in which a line lamp is provided for each line jack so that when a call is initiated, a lighted line signal appears before each of the multiple line jacks so that any one of a number of operators may answer the call to the exclusion of the others.

The cord circuit C comprises an answering plug AP and a calling plug CP connected by the heavily marked talking conductors. Upon the initiation of a call the operator answers by inserting an answering plug AP into a multiple jack J, causing the energization of a high resistance test relay T which connects an answering sleeve supervisory relay AS in series circuit with a relay CO of the line circuit L, the relay AS operating to connect the operator's set O to the cord circuit. The answering tip supervisory relay AT is also energized to prevent answering supervisory lamp AL from lighting prematurely. Upon the insertion of a call plug CP into the multiple jack J^1 of a called line, a calling sleeve supervisory relay CS is operated to disconnect the operator's set O from the cord circuit. One of a plurality of ringing plungers of the ringing key RK is then depressed, which connects the proper ringing frequency to ring the call bell of the called substation. The common contacts 10—11 of the ringing key are also actuated while the plunger is in its fully depressed position to close an energizing circuit for a ringing disconnect relay RD, which in turn closes an energizing circuit for an interrupter relay RI which is alternately energized and deënergized by the interrupter I to intermittently connect ringing current to the wanted line. A meter relay MR and a meter magnet MM are also provided which are operated when the common contacts are closed, to cause the meter to register. A trip relay TR, preferably of high resistance and non-inductive to ringing current, is provided which is energized upon the removal of the receiver at the called substation, to disconnect ringing current from the called line should the subscriber thereat remove his receiver during a ringing interval. A calling tip supervisory relay CT is also provided and is energized upon the response of the called substation. That is, if relay RI is back at the time of responding, relay CT comes up immediately, but if relay RI is up, then relay TR comes up followed by the restoration of RD, RI and energization of CT.

Should the calling subscriber replace his receiver before the called subscriber answers, a link disconnect relay LD is energized which causes the deënergization of the relays RD and RI to interrupt the ringing current which is being intermittently connected to the called line. The energization of the relay LD also caused the disconnection of the link conductors from the calling line which causes the restoration of the connected line circuit to normal to permit the calling subscriber to immediately recall without awaiting the removal of the answering plug AP from the connected jack.

Having described in general the apparatus used in establishing a connection between a calling and called substation, we will now describe the preferred embodiment of our invention more in detail.

Assuming now that a subscriber at substation A initiates a call, the line relay LR is energized closing a circuit for the line signals S. An operator now seizes the call

by inserting the answering plug AP into one of the multiple jacks J of the calling line. The high resistance test relay TE is energized to close its alternate contact I which closes a series energizing circuit including relay AS and cut-off relay CO. The relay AS is now connected to the sleeve of the cord independently of the contact 1 of the relay TE by way of its contact 2 and the flow of battery current over the line also energizes the answering tip supervisory relay AT which opens its normal contact 3 to prevent the lighting of the answering supervisory lamp AL. The closure of alternate contacts 4, 5 of relay AS connects the operator's set O to the cord circuit by way of conductors 6 and 7, and the normally closed contacts 8 and 9 of the calling sleeve supervisory relay CS. Should a second operator attempt to answer the initiated call, the low wound answering supervisory relay AS of the first cord circuit C prevents the high resistance relay T of the second cord circuit from operating due to the shunting effect of the relay AS of the first cord circuit C, and the second operator not being able to communicate with the calling subscriber, removes his answering plug AP from the jack.

The connected operator now ascertains the wants of the calling subscriber, and assuming that substation B is wanted, she tests in the usual manner and assuming that the line is idle, inserts the calling plug CP into a jack J^1 of the wanted line. The insertion of the calling plug CP closes a series energizing circuit including relays CS and the cut-off relay CO^1, and the relay CO^1 energizing removes the substation control of its line signals and extends the connected cord to the wanted line. The relay CS upon energization opens its normal contacts 8 and 9 to disconnect the operator's set O from the cord circuit, and also closes a circuit for the signal CL from battery through the said lamp normal contacts 14, 15 and 16, conductor 17, normal contact 12 to ground at alternate contact 13, thus lighting the signal CL.

The operator now depresses the proper ringing plunger of the ringing key RK to connect the proper frequency of ringing current to the called line. The ringing key RK upon being depressed to its fully operated position, also closes the common contacts 10 and 11 but when the key plunger assumes its indicating position the common contacts restore to normal. The closure of alternate contact 10 closes an energizing circuit for the meter relay MR traced from battery through the winding of said relay, alternate contact 10, normal contacts 14, 15 and 16, conductor 17, normal contact 12, to ground at alternate contact 13 of relay CS. The relay MR closes its alternate contact 30 which energizes the meter magnet MM to step the meter mechanism to register.

The closure of the common contact 11 closes an energizing circuit for the ringing disconnect relay RD, traced from battery through the winding of said relay, alternate contact 11, normal contact 12, the alternate contact 13 to ground. The relay RD then closes a locking circuit for itself, traced from battery through its winding and alternate contact 14, normal contact 15, normal contact 16, conductor 17, normal contact 12, the alternate contact 13 to ground. The opening of alternate contact 14 of RD effaces the signal CL and the closure of the alternate contact 18 of relay RD closes an energizing circuit for the relay RI traced from battery through the constantly rotating interrupter I, winding of said relay RI to ground at alternate contact 18.

The relay RI is thus alternately energized and deënergized, to connect ringing current to the called substation D, the circuit for the ringing current being traced from the connected generator G through the closed contact of the depressed ringing plunger, alternate contact 19, condenser K, alternate contact 20, part through the winding of relay TR to ground and part over conductor 21, alternate contact 22, alternate contact 23, the tip contacts of the connected plug and jack, through the condenser and call bell of the called substation B, sleeve contacts of the connected plug and jack, then dividing, part flowing through relay CS and part through alternate contact 24, through the winding 25 of the relay AT to battery and ground. This ringing current being thus intermittently connected to the called substation until the called subscriber thereat answers. The winding 25 of the relay AT is of few turns, and the ringing current passing through the said winding induces only sufficient current into the winding 26 of the relay AT to give an audible signal to the calling subscriber to notify him that ringing current is being applied. The tip relay TR is not energized by the ringing current, this result being assisted by interposing the condenser K which reduces the peak in the voltage but still permits of ringing over lines of considerable resistance. The copper shield on the core of relay TR also results in a non-inductive effect.

The subscriber at the substation B in answer to his call removes his receiver from its switch-hook, and assuming that he has removed the receiver during a ringing interval, an energizing circuit for the trip relay TR is established caused by a flow from battery through the winding 25 of the relay AT and the winding of CS, the sleeve contacts of the connected plug and jack through the closed contacts of the switch-hook at the substation B, the tip contacts of the con-

nected plug and jack, alternate contacts 23, 22, through the winding of relay TR to ground. The relay TR upon energization opens its normal contact 15 to open the locking circuit of the relay RD which deënergizing opens its alternate contact 18 to restore relay RI and disconnect ringing current from the called line. The relay RI upon deënergization opens its alternate contact 22 which allows the relay TR to restore. Upon deënergization of the relay RI an energizing circuit for the calling tip supervisory relay CT is established, traced from battery through the winding of relay CS, sleeve contacts of the connected plug and jack through the substation B, the tip contacts of the connected plug and jack, alternate contact 23, normal contact 22 of relay RI, through the winding of relay CT to ground. In fact, relay CT is simply substituted for relay TR.

Should a called subscriber respond during the silent interval, that is, when the relay RI is deënergized, a circuit for tip relay CT is established traced from ground through the winding of CT, normal contacts 19, 22, alternate contact 23, over the called line returning through the winding of CS and the winding 25 of AT in multiple to battery. Therefore relay CT interrupts its normal contact 12 removing the ground connection for the ringing disconnect relay RD which restores and by the opening of its alternate contact 18 prevents further energization of RI.

The subscribers at the substations A and B having finished conversation replace their receivers upon their respective switch-hooks. The replacing of the receiver at B opens the energizing circuit of relay CT which deënergizes and establishes an energizing circuit for the calling supervisory lamp CL, traced from battery through the said lamp, normal contacts 14, 15 and 16, conductor 17, normal contact 12, to ground at alternate contact 13, lighting said lamp. The subscriber at substation A replacing his receiver opens the energizing circuit of relay AT, and the closing of the normal contact 3 thereof establishes an energizing circuit for the link disconnect relay LD, traced from battery through the winding of the said relay, normal contact 3, alternate contact 27 to ground at alternate contact 13 of relay CS. The deënergization of relay AT also closes an energizing circuit for the answering supervisory lamp AL from battery through said lamp, normal contact 3, alternate contact 27, to ground at alternate contact 13. The initial energizing circuit for lamp CL was interrupted when the relay LD was energized but another circuit for the said lamp is established from battery through the said lamp, normal contact 10, alternate contact 16, conductor 17, normal contact 12, alternate contact 13 of relay CS to ground. Armature contact 16 simply shifts the circuit. The relay LD energizing opens the cord conductors at its contacts 28, and 29, opening the series circuit for the relays CO and AS. Relay CO deënergizing restores the line circuits of the calling line to normal, placing it in condition for an immediate recall so that if the subscriber at substation A again removes his receiver the line relay LR is energized to light the multiple line signals so the same operator or another operator may seize the recall without awaiting the removal of the plug AP.

The energizing circuit for the relays AS and TE is interrupted when the relay LD energizes but a substitute circuit is established through alternate contact 29 of relay LD, normal contact 3 and alternate contact 27 to ground at alternate contact 13. This continued energization of relay AS keeps the supervisory lamps AL and CL lighted and the operator therefore removes the plugs AP and CP from their connected jacks. Upon removal of the plug CP the deënergization of the relays CS and CO^1 is brought about. The restoration of relay CS causes alternate contact 13 to assume its normal position thus opening the circuit for the relays LD, T and AS and also effacing the signals AL and CL. The apparatus at the cord C is now at normal and the cord is available for making other connections.

It will be noted that relay LD is a slow restoring type, this being to prevent the seizing of a recall by more than one link circuit. That is, assuming a connection is established between substations A and B and that after conversation the subscribers have replaced their receivers to bring about the lighting of lamps AL and CL and the energization of LD. Should the calling subscriber at A initiate a recall prior to the removal of plug AP, the associated line signals will of course be lighted and should another operator than the one which controls cord C seize this call, upon the withdrawal of plug CP of C the locking circuit for relays LD, TE and AS is interrupted at alternate contact 13 of CS. Now if relays LD, TE and AS were fast relays, and relay LD should restore prior to TE and AS it will be seen that due to the closing of normal contact 29 of LD, relay AS would remain locked up over the sleeve strand and therefore the operator of cord C would have her telephone connected to the calling line in multiple with the telephone of the other operator who has seized the recall. But due to the slowness of relay LD, relays AS and TE will restore prior to LD, so that upon restoration of LD the associated relay TE will not again energize and therefore its relay AS also remains inert and the operator at C is prevented from coming in on the seized recall.

Although we have chosen a preferred embodiment for the purpose of illustrating our invention, we contemplate using it in other ways than that shown, and therefore we do not desire to be limited to the exact structure as shown and described, but aim to cover all that which comes 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. An automatic ringing system including a link circuit having calling terminals for connection with a called line, a grounded source of ringing current and a grounded trip relay having their ungrounded terminals connected, a calling tip relay, means for alternately connecting the tip relay and the generator and trip relay in circuit with the calling terminal to intermittently apply ringing current to a connected called line, and means whereby one or the other of said relays will operate according to which one is connected at the time a response is secured to prevent further application of ringing current.

2. A telephone system including telephone lines, a link circuit having calling terminals for connection with called ones of said lines, a source of ringing current and a trip relay, a condenser interposed in a connection extending between terminals of said relay and generator, means for intermittently connecting and disconnecting said condenser and relay to one of said calling terminals for intermittently applying ringing current to a connected called line, a source of direct current, means for connecting said source in operative relation with said relay when a response from the connected line is secured for operating said relay, and circuit changes effective responsive to such operation of the relay to prevent further application of ringing current.

3. A telephone system including telephone lines, a link circuit having calling terminals for connection with called ones of said lines, a source of ringing current, a trip relay, and a tip relay, means for alternately connecting the tip relay and the generator and trip relay in circuit with the calling terminal whereby ringing current is intermittently applied to a connected called line, and means whereby one or the other of said relays will operate according to which one is connected at the time a response is secured to prevent further application of ringing current.

4. A telephone system including telephone lines, a link circuit having calling terminals for connection with said lines as called lines, a source of ringing current, a pair of line operated relays, means for alternately connecting said ringing source and one of said relays and then the other of said relays in circuit relation with a calling terminal to intermittently apply ringing current to a connected called line, means whereby either one of said relays is operated when a response is secured according to which one is connected at the time of response, and circuit connections controlled by the operated relay for preventing further application of ringing current.

5. A telephone system including a called telephone line, a link circuit provided with a terminal for connection with said called line, a source of ringing current and a trip relay, means for simultaneously intermittently connecting said relay and said source of current in multiple to a contact of said terminal, and means controlled at the substation of said line for energizing said trip relay to disconnect said source of current.

6. A telephone system including a called telephone line, a link circuit provided with a terminal for connection with said called line, a source of ringing current and a trip relay, means for intermittently connecting said relay and said source of current in multiple to a contact of said terminal, and means controlled over the called line for operating said relay during the period said source of current is connected to said contact to disconnect said source of current from said contact.

7. A telephone system including a called subscriber's line, a source of ringing current adapted to be connected to said line, a pair of trip relays, means for alternately connecting said relays to said line, and means controlled at the substation of the called line for energizing one of said relays according to which one is connected at the time a response is secured to prevent a further application of ringing current.

8. A telephone system including a called subscriber's line, a trip relay and a ringing current generator having terminals connected together, a second trip relay, means for alternately connecting said relays to said called line whereby ringing current is intermittently connected to said called line, and means controlled over said called line for operating one of said relays depending upon which one is connected at the time a response is secured to prevent further application of ringing current to the called line.

9. A telephone system including a called subscriber's line, an interrupter relay, a trip relay and a source of ringing current provided with terminals connected to a contact of said first relay, a supervisory relay connected to another contact of said interrupter relay, means for energizing and deënergizing said interrupter relay for intermittently connecting ringing current to said called line and for alternately connecting said trip and supervisory relays to said called line, and means controlled at the substation of said called line for energizing said trip or said

supervisory relay for disconnecting said ringing current from said called line.

10. A telephone system including a called subscriber's line, an interrupter relay, a trip relay and a source of ringing current having terminals connected to a source of direct current and other terminals connected to a contact of said interrupter relay, a supervisory relay connected to a contact of said interrupter relay, means for operating said interrupter relay for alternately connecting said trip relay and said supervisory relay to said called line, and a circuit controlled at the called substation including one of said relays in circuit with said source of direct current for disconnecting said ringing current from said called line.

11. A telephone system including a subscriber's line, a source of ringing current, a trip relay, means for intermittently multiply connecting the said relay and the said source of current to said line, and means controlled over the called line for operating said relay to disconnect said source of current from said line.

12. A telephone system including a called subscriber's telephone line, a grounded source of ringing current, a trip relay having one of its terminals connected to ground, means for multiply connecting said relay and said source of current to said called line, and subscriber-controlled means for operatively energizing said relay to cause said source of current to be disconnected from said line.

13. A telephone system including a subscriber's line, a source of signaling current for connection to said subscriber's line, a pair of trip relays, means for alternately connecting said relays to said subscriber's line, and means controlled by either of said relays for preventing further application of said signaling current to said line.

14. A telephone system including a called subscriber's line, a source of ringing current adapted to be applied to said line, a pair of relays, means for alternately connecting said relays with said line, and means controlled over the called line for operating either of said relays to prevent further application of current from said source of current to said line.

15. A telephone system including a subscriber's line, a source of ringing current, means for connecting said current to said subscriber's line, a relay adapted to be connected to said subscriber's line each time said ringing current is connected thereto, a second relay adapted to be connected to said subscriber's line each time said ringing current is disconnected therefrom, and subscriber controlled means for energizing either of said relays to prevent a reapplication of said ringing current to said subscriber's line.

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

HIRAM D. CURRIER.
MICHAEL B. STAZAK.

Witnesses:
GEORGE E. MUELLER,
M. R. ROCHFORD.