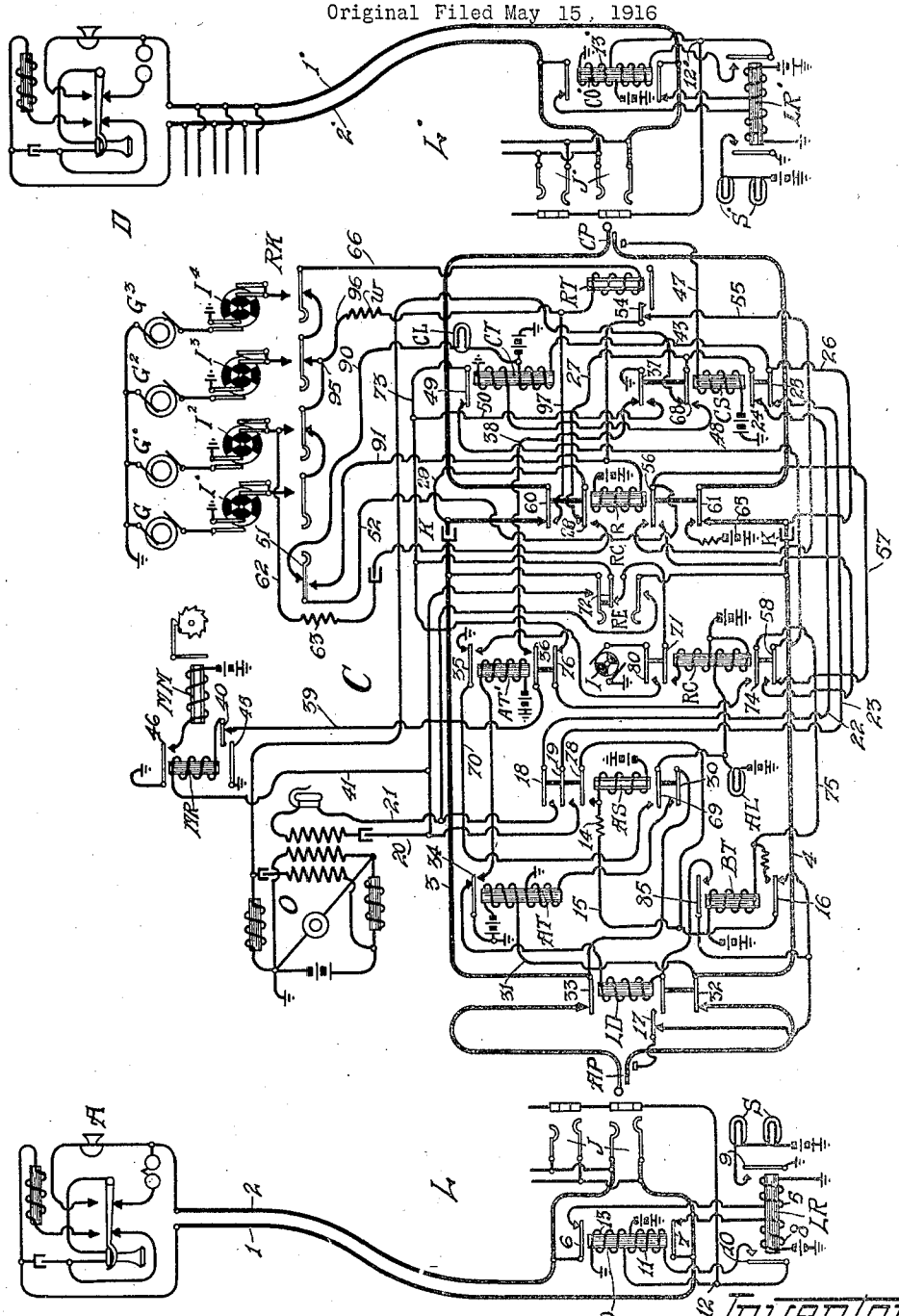
Oct. 30, 1923. 1,472,254

C. SPARKS

TELEPHONE SYSTEM

Original Filed May 15, 1916



Inventor:
Charles Sparks.
By Curtis B. Camp.
Attorney.

Patented Oct. 30, 1923. 1,472,254

UNITED STATES PATENT OFFICE.

CHARLES SPARKS, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

Original application filed May 15, 1916, Serial No. 97,512. Patent No. 1,440,113, dated December 26, 1922. Divided and this application filed May 11, 1918. Serial No. 233,865.

To all whom it may concern:

Be it known that I, CHARLES SPARKS, a citizen of the United States of America, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems in which manual link or cord circuits are provided for interconnecting telephone lines and has to do more particularly with so-called multiple line lamp systems in which instantaneous disconnect and recall, automatic listening and ringing, etc., are provided, and has for its object a new and improved system of the above character.

A feature of my invention is the provision of a non-inductive resistance associated with the two low frequencies of ringing current, which resistance permits automatic tripping means to disconnect any of the frequencies of ringing current from the line when a called subscriber answers during either a ringing or a silent period no matter whether the line be a short one of low, or a very long one of high resistance. These and other objects of my invention will be more particularly pointed out in the ensuing specification and in the appended claims. The present application is a division of my application Serial Number 97,512, filed May 15, 1916, issued as Patent No. 1,440,113, Dec. 26, 1922.

For a more complete understanding of my invention, reference may be had to the accompanying drawing in which I show a well-known common battery substation A connected by the line limbs 1 and 2 to a line circuit L. A double wound line relay LR controlling the line signals S is controlled over the limbs of the line circuit L. Multiple jacks J are provided and in the present embodiment of my invention a line signal S is provided for each jack, the jacks being distributed among different operators. When a call is initiated over any line, the line signals S associated with this line, are lighted and any one of a plurality of operators may seize the call. A differentially wound cut-off relay CO is provided which has its windings included in a closed circuit upon energization of the line relay LR, but the relay CO being differentially wound does not operatively energize until an answering plug is inserted in one of the multiple jacks at which time it is unbalanced and operatively energized. The operative energization of relay CO causes the circuit of relay LR to be opened, thereby restoring and effacing the line signals S.

The cord circuit C comprises an answering plug AP and a calling plug CP, the two plugs being connected by the heavily marked conductors 3 and 4 which have condensers K and K′ interposed. Associated with the answering end of cord circuit C is the answering sleeve supervisory relay AS which is energized in series with the resistance 14 and operates to connect the operator's set O to the cord conductors, 3 and 4. The resistance 14 is arranged so that the first operator to answer the call seizes it to the exclusion of any subsequent operator that attempts to answer the same call. That is, when the first plug AP is connected to the calling line the sleeve relay associated therewith is directly connected to the sleeve conductor and should a second operator attempt to seize this call the high resistance of the winding 14 of the second cord circuit prevents the sleeve relay of the second cord from receiving sufficient energizing current (due to the shunting effect of the sleeve relay of the first link circuit) and thereby prevents the second operator from connecting with the line. An answering tip supervisory relay AT and an auxiliary tip supervisory relay AT^1 are also provided, said relays AT and AT^1 and the sleeve supervisory relay AS controlling the lighting of an answering supervisory lamp AL. I also provide a recall relay RC energized when a calling subscriber replaces his receiver, and when the subscriber recalls the relay remains locked up to connect an interrupter I with the answering supervisory lamp AL to bring about the flashing of the said lamp AL. A busy test removing relay BT is also provided and is energized upon the operation of the relay RC, the said relay BT removing the busy test from the connected jacks when a calling subscriber replaces his receiver to immediately make the calling line available for connection as a called line.

I also provide a link disconnect relay LD which is operated when a second operator

connects to a line as a called line, that was last used as a calling line before the first operator has disconnected the answering plug therefrom. The function of the relay LD is to operatively disconnect the apparatus of the link circuit from the line. A recall key RE is also provided which the operator actuates to seize a recall to connect her operator's set O and which actuation also opens the circuit of the relay RC which in turn opens the circuit of relay BT allowing the busy test to be again placed upon the sleeve of the jack. A meter relay MR is also provided which actuates when the operator's set O is connected, the said relay in turn operating the meter magnet MM once, to register a connection. The relay MR closes a locking circuit for itself to prevent further operation of the meter magnet should the calling subscriber operate his switch hook, and remains in such locked position until the operator's set is disconnected from the cord conductors.

Associated with the calling end of the cord circuit C, I show a calling sleeve supervisory relay CS and a calling tip supervisory relay CT, the two relays controlling the lighting of the calling supervisory lamp CL. The relay CS, upon actuation, disconnects the operator's set O from the cord conductors. A ringing control relay RCR is also provided which is operated when one of the plungers of the party line ringing key RK is depressed, due to the end springs of the ringing key RK being momentarily closed, the said relay then closes a locking circuit for itself and operates to connect ringing current to the called line. Ringing generators G, G^1, G^2 and G^3 are shown connected to the interrupters I^1, I^2, I^3 and I^4 to supply interrupted generator ringing current as is well known in the art. A ringing trip relay RT is also shown which is operated when the called subscriber removes his receiver in response to a call, said relay opening the ringing circuit to disconnect the said ringing current should a subscriber remove his receiver during either a ringing period or a silent period. I also provide a non-inductive winding W in multiple with the relay RT, the said winding W being used on the two low frequencies of ringing current. The winding W is controlled by the ringing key RK and is not used on the high frequencies as will be more fully described in the ensuing specification.

To the right of the drawing, I show a called polystation line connected by the line limbs 1^1 and 2^1 to a line circuit L^1 similar to that of L and bearing the same reference characters but with the suffix prime added.

Having described in general the apparatus embodying my invention, I will now describe more in detail the operation of the system as illustrated. Assuming now that the subscriber at the substation A initiates a call, the removal of the receiver thereat closes an energizing circuit for the line relay LR traced from ground through the winding 5 of line relay LR, normal contact 6 of relay CO, line limb 2 through the substation A, line limb 1, normal contact 7 of relay CO and through the winding 8 of the line relay LR to battery. The closing of alternate contact 9 upon energization of line relay LR brings about the lighting of the line signals S. The closing of alternate contact 10 of relay LR places the busy potential upon the sleeve of the multiple jacks J associated with the calling line, the busy test circuit being traced from battery through the winding 11 of relay CO, alternate contact 10 of relay LR to the point 12. Here the circuit divides, one part extending to the sleeves of the multiple jacks, and the other part extending through the winding 13 of the relay CO to ground. The busy potential is placed upon the sleeve of the multiple jacks J immediately upon the initiation of a call so as to prevent another operator plugging into a multiple jack of the calling line after the receiver at the calling substation has been removed. The relay CO does not operate due to its being differentially wound but remains at normal. An operator noting the lighted line signals S now inserts the answering plug AP of a link circuit C into answering jack J of the calling line, thus closing a circuit for the sleeve supervisory relay AS, traced from battery through the winding of the relay AS, the resistance 14, the conductor 15, normal contact 16 of relay BT, normal contact 17 of relay LD, contacts of the connected plug AP and jack J and through the winding 13 of the relay CO to ground. The battery passing through the winding 13 of relay CO to ground unbalances the said relay CO allowing it to operatively energize to open its normal contacts 6 and 7 thereby interrupting the circuit of the line relay LR, which relay restores, effacing the line signals S. The relay AS supplies the busy potential to the multiple jacks J of the calling line, thus making them busy against incoming calls. The closing of alternate contact 78 of relay AS closes a locking circuit for itself traced from battery through the said relay, alternate contact 78, normal contact 16 of relay BT, and contacts of plug AP and jack J to ground through winding 13 of relay CO. The relay AS remains in locked position until disconnection takes place. The closing of the alternate contacts 18 and 19 of the relay AS connects the operator's set O to the cord conductors 3 and 4 over a path extending from one side of the operator's head set through contact 19 of relay AS, conductor 23, contact 25 of relay CS to the ring conductor of the cord circuit, and from the

other side of the operator's set through contact 18 of relay AS, contact 28 of relay RCR and conductor 29 to the test conductor of the cord circuit. Before proceeding further with the description of the connection, I will refer briefly to the arrangement for excluding operators who may subsequently attempt to answer the call from the said line. Assuming that a second operator inserts a plug AP into another jack J of this calling line, subsequent to the insertion of the first plug, this second operator's telephone will not be connected to the calling line, due to the fact that the high resistance winding 14 of the second cord is connected in multiple with the sleeve relay of the first cord, which relay shunts the sleeve relay AS of the second cord and prevents it from actuating, thereby preventing the operator's set of the second cord circuit from being connected to the calling line. The second operator not receiving any reply to her inquiry knows that the call has been seized by another operator. Again taking the first connection, the closing of alternate contact 30 of relay AS establishes an energizing circuit for the tip answering supervisory relay AT, traced from battery through the upper winding of the relay AT, conductor 31, normal contact 32 of relay LD, sleeve contacts of the connected plug and jack through the substation, back through the tip contacts of the connected jack and plug, normal contact 33 of relay LD, the alternate contact 30 of relay AS, and through the lower winding of the relay AT to ground. The closing of alternate contact 34 of relay AT closes a circuit for the relay AT^1 traced from battery through the winding of the said relay AT^1, to ground at alternate contact 34 of the relay AT. The opening of normal contact 35 of relay AT^1 prevents the lighting of the answering supervisory signal AL.

The closing of alternate contact 36 of relay AT^1 establishes an energizing circuit for the meter relay MR, traced from ground at normal contact 37 of relay CS, through conductor 38, alternate contact 36 of relay AT^1, conductor 39, the normal contact 40 of relay MR, the winding of relay MR, conductor 41, the alternate contact 19 of relay AS, conductor 23, normal contact 25, conductor 43, through the lower winding of relay CT to battery and ground. The meter relay MR, upon energizing, closes a locking circuit for itself, traced from battery through the lower winding of the relay CT, conductor 43, normal contact 25, conductor 23, alternate contact 19, conductor 41 through the winding of the relay MR to ground at alternate contact 45 of relay MR. The closing of alternate contact 46 of relay MR energizes the meter magnet MM and causes it to operate its mechanism to register one call. The meter relay MR remains locked up as long as the operator's set is connected to the cord circuit so that the subscriber at the calling substation A in flashing his receiver will not operate the meter magnet MM to cause the meter to again register.

The operator now inquires the wants of the calling subscriber, and assuming it is the substation D, the operator tests the multiple jack of the called line in the usual manner, and if busy receives the usual busy click. Assuming that the called line is idle, the operator inserts the calling plug CP into the jack of the wanted line bringing about the operation of the calling sleeve supervisory relay CS and the cut-off relay CO^1 of the line circuit L^1 over a circuit traced from battery through the winding of the relay CS, conductor 47, the sleeve contacts of the connected plug and jack, through the upper winding 13^1 of the relay CO^1 to ground. The opening of the normal contacts 24 and 25 of the relay CS brings about the disconnection of the operator's set O from the cord conductors and the opening of contact 25 also opens the locking circuit of meter relay MR, allowing said relay to restore. The closing of alternate contact 37 of relay CS brings about the lighting of the calling supervisory lamp CL, the circuit being traced from battery through the said lamp, conductor 90, the normal contact 51 of the end springs of the ringing key RK, conductor 52, conductor 57, normal contact 58 of relay RC, conductor 48, normal contact 49 of relay CT, conductor 73 and conductor 50 to ground at alternate contact 37 of relay CS, the lamp remaining lighted until the called subscriber answers. The operator having inserted the plug CP into the jack of the wanted line, now depresses one of the plurality of plungers of the ringing key RK. The depression of one of the ringing key plungers momentarily operates spring 51 of the end springs of the ringing key RK. The momentary operation of contact 51 of the end springs establishes a circuit for the ringing control relay RCR, traced from battery through the winding of the relay RCR, conductor 91, the momentarily closed alternate contact 51 of the end springs, conductor 52, conductor 57, normal contact 58 of relay RC, conductor 48, normal contact 49 of relay CT, conductors 73 and 50 to ground at alternate contact 37 of relay CS. The relay RCR then closes a locking circuit for itself traced from battery through the winding of relay RCR, normal contact 54 of relay RT, conductor 55, the alternate contact 56 of relay RCR, conductor 57, normal contact 58 of relay RC, conductor 48, normal contact 49 of relay CT and conductor 50 to ground at alternate contact 37 of relay CS. Ringing current is thus impressed upon the line of the called

subscriber, the path of the ringing current being traced from the ungrounded pole of the generator G^2, (assuming that the called subscriber's bells are tuned to respond to current from the generator G^2) through the interrupter I^3, the alternate contact of the depressed ringing key plunger, through the winding of the ringing trip relay RT, the alternate contact 60 of relay RCR, the tip conductor, the tip contacts of the connected plug and jack through the call bell and condenser of the called substation D back through the sleeve contacts of the connected plug and jack to battery and ground through the alternate contact 61 of relay RCR. The call bell of the called substation is thus intermittently rung due to the current being interrupted by the interrupter I^3. The calling subscriber receives an audible tone notifying him that the called subscriber is being rung, the said circuit for the audible tone being traced from the generator G^1, through the interrupter I^2, conductor 62, resistance 63, the alternate contact 28 of relay RCR, conductor 29, over the tip conductor of the cord circuit, the normal contact 33 of the relay LD, the tip contacts of the plug and jack through the substation receiver back over the sleeve contacts of the connected plug and jack, the normal contact 32 of relay LD, the sleeve conductor 4 of the cord circuit, conductor 26, conductor 43, through the winding of the relay CT to battery and ground. The non-inductive winding W which is in multiple with the winding of the ringing trip relay RT is only connected to the low frequences of the ringing current, say the 16 and 33 cycles of current. Should the operator have depressed a ringing key plunger to connect the ringing generator G which we will say is the generator delivering 16 cycles ringing current, the said current will pass through the interrupter I^1, through the closed contacts of the ringing key plunger to the point 95, the current dividing, part passing over conductor 96, the resistance winding W, conductor 97, through alternate contact 60 to the call bell at the called substation and back to battery and ground at alternate contact 61, while the other path is through the normal contacts of the other ringing key plungers over conductor 66, through the winding of relay RT, over conductor 97 and through alternate contact 60 to battery and ground at alternate contact 61, as above described. Without this resistance W, should the low frequencies as 16 and 33 cycles pass through the relay RT, the said relay would chatter and there would be a liability of opening the locking circuit of the ringing control relay RCR which would bring about the premature disconection of ringing current from the called line. The winding W in multiple with the winding of relay RT prevents this chattering of the relay RT. The winding W is not used on the two high frequencies, say 50 and 66, due to the high rate of alternation of the high frequency ringing currents and the relay RT does not therefore chatter. With the arrangement above described. I am able to obtain a positive operation of relay RT, thus making the trip operation most positive in its operation. Heretofore, it has been practically impossible to build a trip relay through which the different cycles of ringing current could be fed to the called line that would work not only on short, low resistance lines but also upon long, high resistance lines. But, by shunting part of the current around the trip relay on the lower frequencies a stiff enough adjustment of this relay may be secured so that it does not chatter on the lower frequencies.

Should the called subscriber at the substation D remove his receiver during a ringing period, the combined generator and battery current from the generator G^2 and that of battery 65 brings about the operation of the relay RT over a circuit traced from the generator G^2, through the closed contact of the ringing key RK, the conductor 66, through the winding of the relay RT, alternate contact 60 of the relay RCR, the tip contacts of the connected plug and jack through the now closed contacts at the substation D, back through the sleeve contacts of the connected plug and jack, the alternate contact 61 of relay RCR to battery 65 and ground. The combined generator and battery flow through the relay RT brings about this energization of the said relay RT, causing it to open its normal contact 54, the opening of the said contact 54 opens the locking circuit of the relay RCR, relay RCR restoring to normal preventing further application of ringing current to the called subscriber's line. Should the subscriber at the substation D remove his receiver during a silent period, an energizing circuit for the relay RT is established from ground through the contacts of interrupter I^3, the alternate contact of the ringing key RK, over the previously described path to battery 65 and ground, the relay RT energizing opens the circuit of the relay RCR. Thus, I provide a method by which ringing current is instantly disconnected should the subscriber remove his receiver either during a live or silent period. Upon the restoration of the relay RCR, an energizing circuit for the calling tip supervisory relay CT is established. The circuit for relay CT extends from battery through the lower winding of said relay CT, conductor 43, conductor 26, normal contact 61 of relay RCR, sleeve contacts of the connected plug and

jack, through the closed contacts at the substation switch hook, back over the tip contacts of the connected plug and jack, normal contact 60 of relay RCR, conductor 29, normal contact 28 of relay RCR, conductor 27, alternate contact 68 of relay CS, and through the upper winding of the relay CT to ground. The relay CT, upon energizing, opens its normal contact 49 which opens the energizing circuit for the calling supervisory lamp CL bringing about the effacement of the said lamp.

The subscriber at the calling substation A and the subscriber at the called substation D are now in conversational circuit, the said talking circuit being traced over the heavily marked conductors.

Assuming that the subscribers at the substations A and D have finished conversation, the subscriber at the substation A in replacing his receiver upon the switch hook opens the energizing circuit of the relay AT at the switch hook contacts, the relay AT restoring in turn opening its contact 34 allowing the auxiliary answering tip supervisory relay AT^1 to restore. The closing of the normal contact 35 brings about the lighting of the answering supervisory lamp AL over a circuit traced from battery through the lamp AL, alternate contact 69 of relay AS, conductor 70 to ground at normal contact 35. The closing of normal contact 35 also brings about the energizing of the recall relay RC, the circuit for relay RC being traced from battery through the lower winding of the relay RC, the alternate contact 69 of relay AS and conductor 70 to ground at normal contact 35. The relay RC, upon energizing, closes a locking circuit for itself traced from battery through the upper winding of the relay RC, its alternate contact 71, normal contact 72 of the recall key RE, conductor 73, and conductor 50 to ground at alternate contact 37 of relay CS. The closing of alternate contact 74 of relay RC establishes an energizing circuit for the busy test removing relay BT traced from battery through the winding of the said relay BT, conductor 75, alternate contact 74 of said relay RC, normal contact 76 of relay AT^1, conductor 73 and conductor 50 to ground at alternate contact 37 of relay CS. The relay BT, upon energizing, opens its normal contact 16, removing the busy potential from the sleeve of the jack of the calling line. With the above-mentioned arrangement upon the replacement of the receiver at the substation A, the busy potential is removed from the connected jack so that should an operator wish to connect with one of the multiple jacks of the substation A, she may do so without receiving a busy signal should the answering plug AP still remain in the jack. The relay AS remains locked up from battery through the winding of the relay AS, the alternate contact 78 thereof, conductor 79, alternate contact 16 of relay BT, conductor 75, alternate contact 74 of relay RC, normal contact 76 of relay AT^1, conductor 73 and conductor 50 to ground at alternate contact 37 of relay CS. The relay RC is locked up and is in readiness should the called subscriber wish to recall to bring about the flashing of the supervisory lamp AL through the medium of interrupter I. The replacing of the receiver at the substation D interrupts the energizing circuit of the relay CT at the substation switch hook contacts. The relay CT restoring again lights the supervisory signal CL.

Should the subscriber at the substation A wish to recall before disconnection has taken place, the removal of the receiver at the substation A again brings about the energization of the relays AT and AT^1. The relay AT again energizing, due to the closing of the switch hook contacts at the recalling subscriber's substation A, closes a circuit for relay AT^1, which relay then energizes as before described. Upon the energization of the relay AT^1, the interrupter I is connected in circuit with the answering supervisory lamp AL over a circuit traced from the interrupter I through alternate contact 80 of relay RC, alternate contact 35 of relay AT^1, conductor 70, and alternate contact 69 of relay AS through the lamp AL to battery. The lamp is thus flashed due to the connected interrupter I, thus notifying the operator of the cord circuit C that the subscriber at the substation A is recalling. Upon the actuation of relay AT^1, its normal contact 76 assumes its alternate position opening the energizing circuit of the relay BT. The relay BT, upon restoring, closes its normal contact 16 to immediately place the busy potential upon the multiple jacks of the recalling line, thus making the said jacks busy, thereby preventing another operator from plugging into a multiple jack of the recalling line. The operator then actuates the recall key RE, to connect her operator's set O to the cord conductors and this actuation of the key RE opens normal contact 72 of said key, thus opening the energizing circuit of the recall relay RC. The opening of alternate contact 80 of relay RC disconnects the interrupter I thereby preventing the further flashing of the answering supervisory lamp AL. The operation of the cord circuit in establishing another connection after an operator has seized a recall is the same as previously described.

At the termination of conversation, the display of the two supervisory signals AL and CL notifies the operator of the termination of the conversation and she thereupon removes the answering plug AP and the

calling plug CP from the connected jacks. The relays AS and CS now restore to normal and the cord circuit is now available for establishing other connections. Should the connected plugs remain in the jacks of the connected lines after the termination of conversation, and the busy potential be removed from the jack of the calling line, and should another operator insert a plug in a multiple jack of the said line for calling purposes, the insertion of the second plug into the multiple jack of the line brings about the energization of the link disconnect relay LD over a circuit traced from ground through normal contact 34 of relay AT, through the winding of the relay LD, the alternate contact 85 of relay BT, normal contact 17 of relay LD, the sleeve contact of the connected jack, through the winding of the sleeve relay of the second connected cord circuit to battery and ground. The relay LD upon energizing, closes a locking circuit for itself traced from ground through the normal contact 34 of relay AT, the winding of the relay LD, and the alternate contact 17 of relay LD to battery and ground at the second connected cord circuit, as previously described. The relay LD opens its normal contacts 32 and 33 disconnecting the first connected cord circuit from the jack of the substation A. The said relay LD remains energized until the answering plug AP is withdrawn from the jack of the substation A, or when the second connected plug is withdrawn at the termination of conversation. Now should the called subscriber at substation D wish to recall, he flashes his switch hook, which brings about the flashing of the calling supervisory lamp CL as is well known. The operator to answer the recall of the called subscriber actuates the recall key RE to connect her operator's set to the cord conductor. The actuation of the recall key, in response to the recall of the called subscriber, opens the contacts 72 but the relay RC does not de-energize as a substitute circuit is established from ground at normal contact 35 of relay AT', through conductor 70, alternate contact 69 of relay AS, to battery and ground through the lower winding of relay RC. The relay RC remaining energized in turn holds the relay BT in its energized condition, thus keeping the battery busy potential from the multiple jacks of the calling line, and this allows another operator to connect to the said calling line as a called line.

From the foregoing, it is thus seen that I have provided a system wherein when the calling subscriber recalls he automatically flashes a supervisory lamp so that the same operator may seize the recall, but I still retain the feature of automatically disconnecting the calling line from the cord circuit when it is desired to use the calling line as a called line prior to the time that the previous connection is taken down.

Although I have shown a preferred embodiment of my invention for the purpose of illustrating and describing my invention, I am aware that the features of my invention are applicable to other systems than that shown and many modifications and changes may be made by those skilled in the art, and I, therefore, do not wish to be limited to the exact structure as shown but aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

What I claim as new and desire to secure by United States Letters Patent is:

1. A telephone system including a called subscriber's line, a link circuit for connection to said line, a plurality of generator devices for signaling substations upon said line, a trip relay through which the currents from said generator devices are supplied to said called line, a shunt circuit for shunting a portion of the ringing currents from a part only of said generator devices around said relay, and means controlled by the response of the called subscriber for disassociating said line from said generator devices.

2. A telephone system including a telephone line provided with a plurality of substations, an operator's link circuit for connecting with said line, a plurality of ringing current generators associated with said link circuit, a trip relay through which ringing current is fed to said called line, shunting means for shunting a part of the ringing current from only a part of said ringing current generators around said trip relay, and means responsive to a removal of the receiver at one of the called substations for disassociating the connected generator and the said called line.

3. A telephone system including a subscriber's line circuit provided with a plurality of substations thereon, a link circuit for connection thereto, a plurality of ringing current generators associated with said link circuit, a trip relay, means for supplying all ringing current necessary to signal certain of said substations through said relay and for supplying part of the signaling current necessary for signaling other of said substations through said relay, and means controlled by said relay for disassociating a connected generator from said line.

4. A telephone system including a polystation called line, a link circuit provided with a terminal for connection thereto, sources of ringing current and a trip relay, means for applying current from one of said generators to said line through said relay, all the ringing current passing through said generator to said line traversing the wind-

ing of said relay, and a circuit connected in multiple with said relay for supplying a portion of the ringing current from another one of said generators to said line.

5. A telephone system including a polystation line, a plurality of ringing current generators and a trip relay, a circuit connection including the winding of said relay for supplying ringing current from one of said generators to said line, all the ringing current passing through said generator to said line traversing the winding of said relay, a second circuit connection in multiple of said first circuit connection for supplying a portion of the ringing current from another one of said generators to said line, and means for energizing said trip relay to disassociate a connected generator and said line.

6. A telephone system including telephone lines, an operator's link circuit having a calling terminal for connection with called ones of said lines, a plurality of frequencies of ringing current ranging from low to high, a non-inductive winding associated with the lower frequencies, a trip relay, said winding and trip relay being in multiple relation, a ringing key actuated to connect the lower ringing frequencies through said winding and relay in multiple and to connect said higher frequencies through said relay only to the connected called line.

7. A telephone system including a polystation telephone line, a plurality of ringing current generators, a trip relay, a resistance coil, a ringing key and circuit connections controlled by said key for connecting all of the current from one of said generators to said line directly through said relay to said line and for connecting another of said generators through said relay and resistance coil in multiple to said line.

8. A telephone system including a polystation telephone line, a plurality of current generating devices, a trip relay, a resistance coil, a manual ringing key, and circuit connections controlled by said key for connecting current from one of said devices through said relay and coil in multiple to signal one of the substations upon said line and for connecting current from another one of said devices through said relay only to signal another one of said substations upon said line.

9. A telephone system including a polystation telephone line, a circuit for extending a connection to said line, a plurality of ringing current generators, a trip relay, a resistance coil, and circuit connections for connecting current from one of said generators through said trip relay to the exclusion of said resistance coil to said line when it is desired to ring one of the substations connected to said line and for connecting another one of said generators through said relay and resistance coil in multiple to said line when it is desired to ring another one of the substations connected to said line.

10. A telephone system including a polystation telephone line, a circuit for extending a connection to said line, a plurality of ringing current generators, a trip relay, a resistance coil, circuit connections for connecting current from one of said generators through said trip relay to the exclusion of said resistance coil to said line when it is desired to ring one of the substations connected to said line and for connecting another one of said generators through said relay and resistance coil in multiple to said line when it is desired to ring another one of the substations conneeted to said line, and substation-controlled means for energizing said relay to disconnect ringing current from the line.

11. A telephone system including a polystation telephone line, a circuit for extending a connection to said line, a plurality of ringing current generators, a trip relay, a resistance coil, circuit connections for connecting current from one of said generators through said trip relay alone to said line when it is desired to ring one of the substations connected to said line and for connecting another one of said generators through said relay and resistance coil in multiple to said line when it is desired to ring another one of the substations connected to said line, interrupter means for intermittently applying ringing current from the generators to said line, and substation means adapted when actuated during a ringing period to energize said trip relay to disconnect the ringing current from the line.

12. A telephone system including a polystation telephone line, a circuit for extending a connection to said line, a plurality of ringing current generators, a trip relay, a resistance coil, circuit connections for connecting current from one of said generators through said trip relay to the exclusion of said resistance coil to said line when it is desired to ring one of the substations connected to said line and for connecting another one of said generators through said relay and resistance coil in multiple to said line when it is desired to ring another one of the substations connected to said line, interrupter means for intermittently applying ringing current from the generators to said line, and substation means for energizing said relay either during a ringing or a silent interval, thereby disconnecting the ringing current from the called line or preventing a reapplication of the ringing current to the called line.

13. A telephone system including a polystation telephone line, a circuit for extending a connection to said line, a plurality of

ringing current generators, a trip relay, a resistance coil, circuit connections for connecting all of the current supplied to said line from one of said generators through said trip relay to said line when it is desired to ring one of the substations connected to said line and for connecting another one of said generators through said relay and resistance coil in multiple to said line when it is desired to ring another one of the substations connected to said line, and a second relay controllable by said trip relay for disconnecting ringing current from the called line.

14. A telephone system including a polystation telephone line, a circuit for extending a connection to said line, a plurality of ringing current generators, a trip relay, a resistance coil, circuit connections for connecting all of the current supplied to said line from one of said generators through said trip relay to said line when it is desired to ring one of the substations connected to said line and for connecting another one of said generators through said relay and resistance coil in multiple to said line when it is desired to ring another one of the substations connected to said line, and a second relay controllable by said trip relay for preventing a reapplication of ringing current to the called line.

Signed by me at Chicago, in the county of Cook, and State of Illinois, this 9th day of May, 1918.

CHARLES SPARKS.