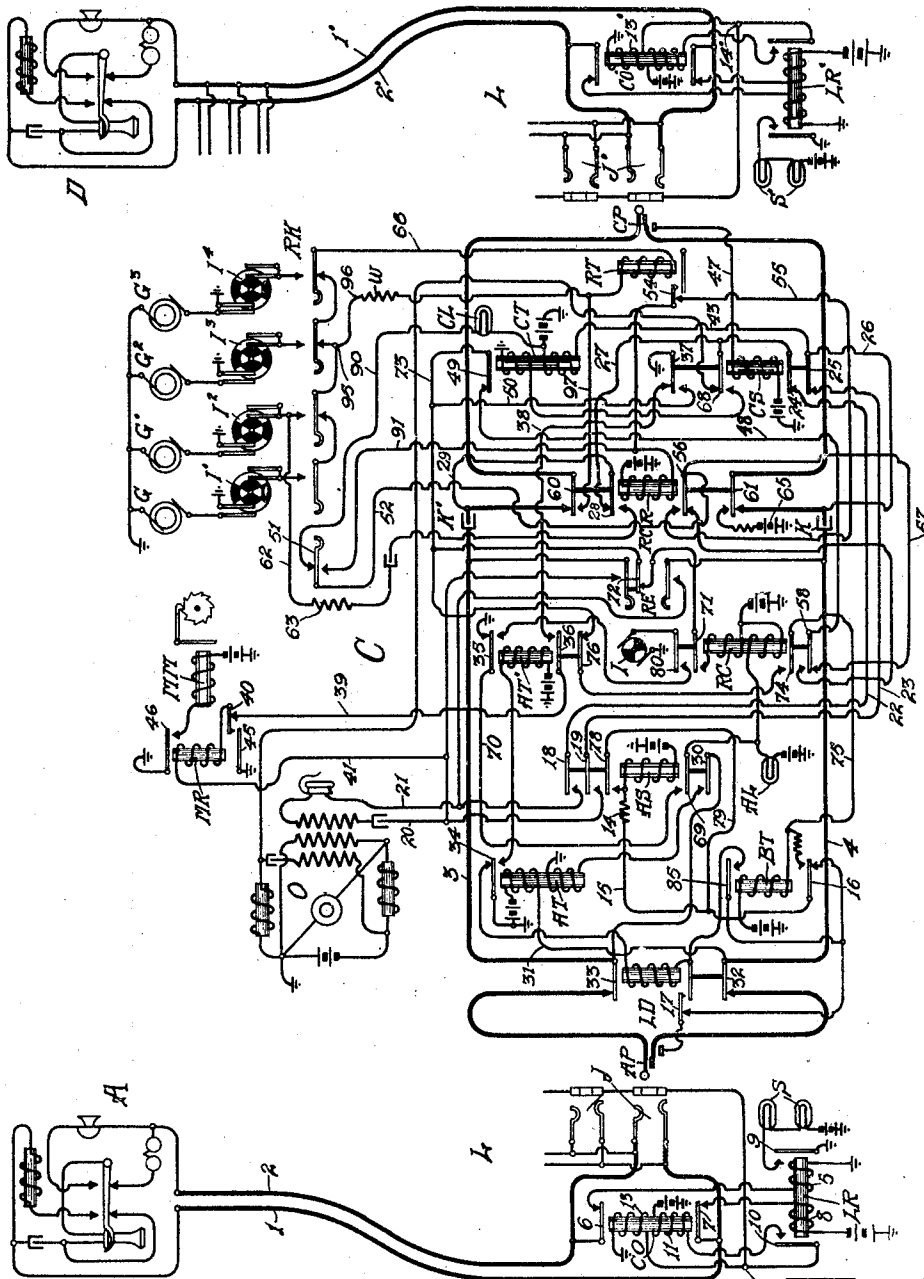


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C. SPARKS.
TELEPHONE SYSTEM.
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TELEPHONE SYSTEM.

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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 new and improved busy test for a multiple line jack and line lamp system which is placed upon the sleeve of the jacks the instant a calling subscriber removes his receiver, the said line remaining in such busy condition until the subscriber again replaces his receiver. The calling subscriber, upon replacing his receiver, immediately removes the busy test so that should the operator who established the connection fail or be slow to disconnect the calling line from the link circuit, the said calling line is immediately rendered non-busy even though the answering plug of the first link circuit remains inserted in the jack. The subsequent insertion of a plug into the multiple jack of the line as a called line, again brings about the re-establishment of the busy test and also operates means in the first connected link circuit to disassociate the said first link from the jack of the line.

These and other objects of my invention will be more particularly pointed out in the ensuing specification and in the appended claims.

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 K² 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 AT¹ are also provided, said relays AT and AT¹ 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 opera-

tion 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
5 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
10 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
15 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
20 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
25 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
30 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
35 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
40 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
45 G, G¹, G², and G³ are shown connected to the interrupters I¹, I², I³ and I⁴ to supply interrupted generator ringing current as is well known in the art. A ringing trip relay RT
50 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
55 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
60 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
65 called substation D connected by the line

limbs 1¹ and 2¹ to a line circuit L¹ 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
70 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 re-
75 lay 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 re-
80 lay 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
85 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
90 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
95 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
100 substation has been removed. The relay CO does not operate due to it being differentially wound but remains at normal. An operator noting the lighted line signals S now inserts the answering plug AP of a link
105 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
110 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
115 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
120 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
125 the said relay, alternate contact 78, conductor 79 and normal contact 16 to ground through winding 13 of relay CO. The relay AS remains in locked position until disconnection takes place. The closing of
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the alternate contacts 18 and 19 of the relay AS connects the operator's set O to the cord conductors 3 and 4 by way of conductors 20 and 21, said alternate contacts 18 and 19 of relay AS, conductors 22 and 23, normal contacts 24 and 25 of relay CS, conductors 26 and 27, to the sleeve conductor 4 and to the tip conductor 3 of the cord circuit C. 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 traced from battery through the winding of the said relay AT to ground at alternate contact 34 of the relay AT. The opening of normal contact 35 of relay AT prevents the lighting of the answering supervisory signal AL.

The closing of alternate contact 36 of relay AT 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, 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 CO¹ of the line circuit L¹ 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 13¹ of the relay CO¹ 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 substation'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, 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^2 , through the interrupter I^3 , 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 frequencies 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 disconnection 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 bring 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, 130

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 5 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.

10 The relay CT, upon energizing, opens its normal contact 49 which opens the energizing circuit for the calling supervisory lamp CL bringing about the extinguishment of the said lamp.

15 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.

20 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 AT¹ to restore. The closing of the 25 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.

30 The closing of normal contact 35 also brings about the energization 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 35 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 40 battery through the winding of the said relay BT, conductor 75, alternate contact 74 of said relay RC normal contact 76 of relay AT¹, conductor 73 and conductor 50 to ground at alternate contact 37 of relay CS.

45 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 re-

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main 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 AT¹, 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 calling 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 80 switch-hook contacts, the relay CT restoring again lights the supervisory signal CL.

Should the subscriber at the substation A wish to recall before disconnect on has taken place, the removal of the receiver at the 85 substation A again brings about the energization of the relays AT and AT¹. 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 AT¹, which relay then energizes as before described.

Upon the energization of the relay AT¹, the interrupter I is connected in circuit with the answering supervisory lamp AL over 95 a circuit traced from the interrupter I through alternate contact 80 of relay RC, alternate contact 35 of relay AT¹, conductor 70, and alternate contact 69 of relay AS through the lamp AL to battery. The lamp 100 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 AT¹ its normal contact 76 105 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 115 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 125 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 130

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 removed from the jack of 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 disconnect-

ing 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.

Having described my invention, what I claim as new and desire to secure by United States Letters Patent, is:

1. A telephone system including a subscriber's telephone line, a plurality of terminals for said line, a link circuit for extending connection from said line, means responsive to the actuation of the substation switch for placing a busy potential upon said terminals before connection is made by said link circuit with one of said terminals, a supervisory signal for said link circuit, calling subscriber-controlled means for automatically and intermittently operating said signal, disconnect means for said link circuit for automatically disassociating said link circuit and said line, means responsive to the connection of the calling end of a second link circuit to one of the said terminals for operating said disconnect means, and automatic means for said first link circuit operable when the calling subscriber replaces his receiver to disconnect busy potential from said terminals to render said terminals idle prior to the operation of said disconnect means.

2. A telephone system including a subscriber's line, a link circuit for connecting with said line, said line being provided with multiple terminals, means responsive to the actuation of a substation switch for placing a busy potential upon said terminals before connection is made by said link circuit with one of said terminals, a second substation switch for placing a busy potential upon one of said terminals after connection has been made with one of said terminals, disconnect means for temporarily disassociating said link circuit and said line, and operator-controlled means effective when said line is in an idle condition for operating said disconnect means.

3. A telephone system including a calling telephone line, a link circuit provided with an answering terminal for connection thereto, said line being provided with multiple terminals, means responsive to the actuation of the substation switch for placing a busy

potential upon said terminals before connection is made with said terminal by said link circuit, a second means responsive to the actuation of the substation switch for placing a busy potential upon said terminals after connection has been made with one of said terminals by said link circuit, a supervisory signal for said link circuit, substation control means for flashing said signal, and electromagnetic means for disconnecting the talking conductors of the link circuit from said answering terminal, and for removing the substation control of said signal, said electromagnetic means being responsive to the connection of a second link circuit terminal to the calling line if the calling line is in an idle condition.

4. A telephone system including a calling subscriber's line, a plurality of multiple lamps and multiple answering terminals for said line, means controlled at the substation of said line for operating said signals and for placing a busy potential upon said terminals, a link circuit for connection to said line, a signal for said link circuit and substation-controlled means for intermittently operating said signal, and means responsive to the connection of said link circuit to said line for removing said first busy potential, and for substituting a second busy potential, and means controlled at the said substation for removing said second busy potential.

5. A telephone system including a calling subscribers' line, a plurality of multiple lamps and multiple answering terminals for said line, means controlled at the substation of said line for operating said signals and for placing a busy potential upon said terminals, a link circuit for connection to said line, means responsive to the connection of said link circuit to said line for removing said first busy potential and for substituting a second busy potential, and means controlled at the said substation for removing said second busy potential when disconnection is signaled for and for subsequently replacing said latter busy potential when a recall is signaled for.

6. A telephone system including a subscriber's line provided with an answering terminal, means controlled at the substation of said line for placing a busy potential upon a contact of said answering terminal, a link circuit including operator controlled means for removing said busy potential and for substituting a second busy potential, substation controlled means for removing said second busy potential, and substation-controlled means for replacing a busy potential upon said line while maintaining said subscriber's line operatively connected to said link circuit.

7. A telephone system including a subscriber's telephone line provided with mul-

multiple terminals, multiple line signals for said line, substation controlled means for operating said signals and for placing a busy potential upon said multiple terminals upon the initiation of a call, a link circuit provided with a supervisory signal, and subscriber controlled means responsive to a single actuation of a substation switch for intermittently operating said link circuit signal.

8. A telephone system including a subscriber's telephone line provided with multiple terminals, multiple line signals for said line, means responsive to an actuation of a substation switch for operating said signals and for placing a busy potential upon said multiple terminals, a link circuit for extending a connection from said line, a signal associated with said link circuit, and means controlled by a subsequent unitary actuation of the said substation switch for intermittently operating said link circuit signal.

9. A telephone system including a subscriber's telephone line provided with multiple terminals, multiple line signals for said line, means responsive to an actuation of a substation switch for operating said signals and for placing a busy potential upon said multiple terminals, a link circuit for extending a connection from said line, a signal associated with said link circuit, means for operating said link circuit signal when disconnection is desired, and means for thereafter intermittently operating said link circuit signal responsive to a single actuation of said substation switch when a recall is desired.

10. A telephone system including a subscriber's line provided with an answering terminal, means responsive to the removal of the receiver at the substation on said line when initiating a call for placing a busy potential upon said answering terminal, a link circuit provided with a supervisory signal, operator controlled means for connecting said link circuit to said line for extending a connection therefrom, means for removing said busy potential, and means controlled by a subsequent removal of the receiver at the said substation for automatically intermittently operating said supervisory signal.

11. A telephone system including a subscriber's line provided with an answering terminal, means responsive to the removal of the receiver at the substation on said line for placing a busy potential upon said answering terminal, a link circuit provided with a supervisory signal, operator controlled means for connecting said link circuit to said line for extending a connection therefrom, means for removing said busy potential, and means controlled by a subsequent removal of the receiver at the said substation for automatically intermittently

operating said supervisory signal and for replacing said busy potential.

12. A telephone system including a subscriber's telephone line provided with an answering terminal, means responsive to the removal of the receiver at the substation on said line for placing a busy potential upon said answering terminal, a link circuit for extending a connection from said telephone line, means for removing said busy potential, and means responsive to a subsequent removal of the receiver at the substation during the period that said link circuit is connected with said line for replacing a busy potential upon said answering terminal while maintaining said link circuit operatively connected to said subscriber's line.

13. A telephone system including a subscriber's telephone line provided with multiple terminals, subscriber-controlled means including a switch for placing a busy potential upon said multiple terminals before connection is made with one of said terminals, other subscriber-controlled means for placing a busy potential upon said multiple terminals after connection has been made to said line, a link circuit provided with a connection terminal for connection to one of said multiple terminals, a supervisory signal for said link circuit, subscriber-controlled means for causing the intermittent actuation of said supervisory signal, subscriber-controlled means for rendering said line idle, a second link circuit, and means responsive to the connection of said second link circuit to another of said multiple terminals for automatically disassociating said first link circuit from said line, and for placing a busy potential upon said multiple terminals.

14. A telephone system including a subscriber's telephone line provided with an answering terminal, a link circuit provided with a connection terminal for connection to said answering terminal, means responsive to the actuation of a substation switch for placing a busy potential upon said terminals before connection is made to one of said terminals by said link circuit, a second means responsive to the actuation of the substation switch for placing a busy potential upon said terminal after connection has been made with one of said terminals by said link circuit, a supervisory signal, subscriber-controlled means for intermittently controlling said supervisory signal, disconnect means for disassociating said link circuit terminal from said link circuit, and operator-controlled means for automatically operating said disconnect means.

15. A telephone system including a subscriber's telephone line provided with an answering terminal, a link circuit provided with a connection terminal for connecting

to said answering terminal, means responsive to the actuation of the substation switch of the said line for placing a busy potential upon said answering terminal before said link circuit is connected to said terminal, a second means responsive to the actuation of the substation switch of said line for placing a busy potential upon said answering terminal after said link circuit has been connected to said terminal, disconnect means for disassociating said link circuit terminal from said link circuit, and operator-controlled means for automatically controlling said disconnect means when a connection is extended to said line as a called line.

16. A telephone system including a subscriber's line provided with multiple terminals, a link circuit for connection to said line, means responsive to the actuation of a substation switch on said line for placing a busy potential upon said terminals before said link circuit is connected to said line, a second means responsive to the actuation of the substation switch on said line for placing a busy potential on said terminals after said link circuit has been connected to said line, a supervisory signal for said link circuit, subscriber-controlled means for operating said signal to denote a recall, electromagnetic disconnect means for disconnecting said link circuit from said line, and operator-controlled means operative only if said terminals test idle for operating said disconnect means when calling said line as a called line.

17. A telephone system including a subscriber's telephone line provided with multiple terminals, a link circuit provided with a connection terminal for connection to said line for extending a connection therefrom, means responsive to the actuation of a substation switch on said line for placing a busy potential upon said terminals before said link circuit is connected to one of said terminals, a second means responsive to the actuation of a substation switch on said line for placing a busy potential upon said terminals after said link circuit has been connected to one of said terminals, a supervisory signal for said link circuit, subscriber-controlled means for operating said signal to denote a recall and for rendering said terminals either idle or busy, and operator-controlled means for automatically disconnecting said link circuit terminal from said link circuit and for rendering said subscriber-controlled means inoperative.

18. A telephone system including a subscriber's telephone line provided with multiple terminals and multiple line signals at the exchange, subscriber controlled means for operating said signals and for placing a busy potential upon said terminals, a plurality of operators' link circuits, means for pre-

venting the operative connection of more than one of said link circuits to said line when answering a call therefrom, a supervisory signal for said link circuit, and means responsive to the removal of the receiver at the substation on said line when recalling for intermittently operating said supervisory signal and for placing a busy potential upon said multiple terminals.

10. 19. A telephone system including a subscriber's telephone line provided with multiple terminals, substation-controlled means for placing a busy potential upon said multiple terminals when initiating a call, a link circuit for connection to said line via one of its multiple terminals, a supervisory signal for said link circuit, and subscriber-controlled means responsive to a single actuation of the switch hook for intermittently operating said supervisory signal.

20. 20. A telephone system including a subscriber's telephone line provided with multiple terminals, a link circuit for connection to said telephone line via one of its multiple terminals, means responsive to the actuation of a substation switch on said line for placing a busy potential upon said terminal before said link circuit is connected to one of said multiple terminals, a supervisory signal for said link circuit, subscriber-controlled means responsive to a single actuation of a substation switchhook for intermittently operating said supervisory signal, and operator-controlled means for automatically disconnecting said subscriber's line from the strands of said link circuit.

21. 21. A telephone system including a subscriber's telephone line provided with multiple terminals, a link circuit for connection to said telephone line via one of its multiple terminals, means responsive to the actuation of a substation switch on said line for placing a busy potential upon said terminals before said link circuit is connected to said line, a supervisory signal for said link circuit, subscriber-controlled means responsive to a single actuation of the substation switchhook for intermittently operating said supervisory signal, a second link circuit, and means for automatically disconnecting said subscriber's line from the strands of said first link circuit; said last means being responsive to the connection of said second link circuit to one of the multiple terminals of said line.

22. 22. A telephone exchange system including a subscriber's telephone line having line conductors, a terminal at the central office in which said line conductors terminate, an auxiliary independent test contact for said terminal, subscriber's substation switch-controlled means actuated upon the initiation of a call for placing a busy potential upon said test contact and for removing said busy potential from said test contact upon a subse-

quent actuation of said substation switch, a link circuit for connection to said line via said terminal, provided with a supervisory signal, subscriber's substation switch-controlled means for controlling the intermittent flashing of said signal, and operator's controlled means for rendering said subscriber-controlled busy means ineffective and interrupting said intermittent flashing of said signal.

23. 23. A telephone exchange system including a subscriber's telephone line terminating at the exchange in a connection terminal, an auxiliary independent test contact for said terminal, subscriber's substation switch-controlled means actuated upon the initiation of a call for placing a busy potential upon said test contact and for removing said busy potential from said test contact upon a subsequent actuation of said substation switch, a link circuit connection to said line terminal provided with a supervisory signal and subscriber's substation switch-controlled means for controlling the intermittent flashing of said signal, operator's controlled means for rendering said subscriber's controlled busy means ineffective, said operator's means being controlled by the connection of a second link circuit to said subscriber's line.

24. 24. A telephone system including a calling subscriber's telephone line, a plurality of terminals for said line, a called line, a link circuit for extending a connection from said calling line to said called line, a recall relay for said link circuit, an operator's telephone, automatic means for connecting and disconnecting said operator's telephone and said link circuit, a supervisory signal for said link circuit, subscriber-controlled means for intermittently operating said signal, automatic ringing means for said link circuit, said recall relay controlling a contact of said ringing means for disconnecting ringing current from said called line should the calling subscriber replace his receiver before the called subscriber responds, disconnect means for said link circuit for automatically disassociating said link circuit and said calling line, and means responsive to the connection of the calling end of a second link circuit to one of said terminals for operating said disconnect means.

25. 25. A telephone system including a subscriber's telephone line provided with a plurality of multiple terminals, a link circuit provided with a connection terminal for connecting to one of said terminals for extending a call from said line to a called line, a recall relay for said link circuit, an operator's telephone, automatic means for connecting and disconnecting said operator's telephone and said link circuit, automatic ringing means for the link circuit, said recall relay controlling a contact of

said ringing means for disconnecting ringing current from the called line, means associated with said link circuit for automatically disassociating said link terminal and said link circuit, and means controllable only by the connection of a second link circuit terminal to another of said multiple terminals for operating said means for disassociating said link terminals from said link circuit.

26. A telephone system including a calling subscriber's line, a called subscriber's line, a link circuit for connecting said calling line to said called line, a recall relay for said link circuit, an operator's telephone, automatic means for connecting said operator's telephone to said subscriber's line, automatic ringing means for said link circuit, said recall relay controlling a contact of said ringing means for disconnecting ringing current from said called line should the calling subscriber replace his receiver before the called subscriber responds, disconnect means for automatically disassociating said link circuit and said line, and operator-controlled means free from substation control but effective when said line is in an idle condition for operating said disconnect means.

27. A telephone system including a calling telephone line, a link circuit provided with an answering terminal for connection thereto, an operator's telephone, electromagnetic means for connecting and disconnecting said operator's telephone and said link circuit, a supervisory signal for said link circuit, a recall relay in said link circuit, substation-controlled means for flashing said signal, electromagnetic means for disconnecting the talking conductors of the link circuit from the said answering terminal and for removing the substation control of said signal, said electromagnetic means being responsive to the connection of a second link circuit terminal to the calling line if the calling line is in idle condition, and automatic ringing means for said link circuit, said recall relay controlling a contact of said ringing means for disconnecting ringing current from the called line.

28. A telephone system including a subscriber's telephone line provided with multiple terminals, a called line, multiple line signals for said line, substation controlled means for operating said signals and for placing a busy potential upon said multiple terminals, a link circuit provided with a supervisory signal, a recalling relay in said link circuit, automatic ringing means for signaling a substation upon said called line, said recalling relay controlling a contact of said ringing means for disconnecting ringing current from said called line, and subscriber-controlled means responsive to a single actuation of a substation switch for intermittently operating said link circuit signal.

29. A telephone system including a subscriber's line provided with an answering terminal, means responsive to the removal of the receiver at the substation on said line for placing a busy potential upon said answering terminal, a called line, a link circuit provided with a supervisory signal, a recalling relay in said link circuit, operator-controlled means for connecting said link circuit to said line for extending a connection therefrom, means for removing said busy potential, automatic ringing means for signaling a substation upon said called line, said recalling relay controlling a contact in the circuit of said ringing means for disconnecting current from said called line, and means controlled by a subsequent removal of the receiver at the said first substation for automatically intermittently operating said supervisory signal.

30. A telephone system including a subscriber's telephone line provided with multiple terminals, subscriber-controlled means for placing a busy potential upon said multiple terminals before connection is made with said multiple terminals, a second subscriber-controlled means for placing a busy potential upon said multiple terminals after connection is made with said multiple terminals, a link circuit provided with a connection terminal for connecting to one of said multiple terminals, a supervisory signal for said link circuit, subscriber-controlled means for causing the intermittent actuation of said supervisory signal, subscriber-controlled means for rendering said line idle, and means responsive to the connection of a second link circuit to another of said multiple terminals for automatically disassociating said first link circuit from said line and for placing a busy potential upon said multiple terminals, said link circuit being provided with automatic ringing means and with automatic listening.

31. A telephone system including a subscriber's telephone line provided with an answering terminal, a link circuit provided with a connection terminal for connecting to said answering terminal, a recalling relay in said link circuit, a supervisory signal, subscriber-controlled means for intermittently operating said supervisory signal, disconnect means for disassociating said link circuit terminal from said link circuit, operator-controlled means for automatically operating said disconnect means, and automatic listening means and ringing means for said link circuit, said recalling relay controlling a contact of said ringing means.

32. A telephone system including a subscriber's telephone line provided with an answering terminal, a link circuit provided with a connection terminal for connecting to said answering terminal, a busy test relay

in said link circuit, disconnect means for disassociating said link circuit terminal from said link circuit, operator-controlled means free from substation control for automatically operating said disconnect means when connecting to said line as a called line, and automatic listening means and ringing means for said link circuit, said recalling relay controlling a contact in the circuit of said busy test relay and also controlling a contact of said automatic ringing means for disconnecting ringing current from the called line.

33. A telephone system including a subscriber's line provided with multiple terminals, a link circuit for connection to said line, a supervisory signal for said link circuit, subscriber-controlled means for operating said signal to denote a recall, electromagnetic disconnect means for disconnecting said link circuit from said line, operator-controlled means operative only if said terminals test idle for operating said disconnect means when calling said line as a called line, and automatic listening means and ringing means for said link circuit, said subscriber-controlled means controlling a contact of said automatic ringing means for disconnecting ringing current from the called line.

34. A telephone system including a subscriber's telephone line provided with multiple terminals, substation-controlled means for placing a busy potential upon said multiple terminals when initiating a call, a link circuit for connection to said line via one of its multiple terminals, a supervisory signal for said link circuit, subscriber-controlled means responsive to a single actuation of the switchhook for intermittently operating said supervisory signal, and automatic listening means and ringing means for said link circuit, said subscriber-controlled means controlling a contact in the circuit of said automatic ringing means.

35. A telephone system including a subscriber's telephone line provided with multiple terminals, a link circuit for connection to said telephone line via one of its multi-

ple terminals, a supervisory signal for said link circuit, subscriber-controlled means responsive to a single actuation of the substation switchhook for intermittently actuating said supervisory signal, operator-controlled means for automatically disconnecting said subscriber's line from the strands of said link circuit, and automatic listening means and ringing means for said link circuit, said subscriber-controlled means controlling a contact in the circuit of said automatic ringing means.

36. A telephone system including a subscriber's telephone line provided with multiple terminals, a link circuit for connection to said telephone line via one of its multiple terminals, a supervisory signal for said link circuit, subscriber-controlled means responsive to a single actuation of the substation switchhook for intermittently actuating said supervisory signal, means for automatically disconnecting said subscriber's line from the strands of said link circuit, said last means being responsive to the connection of a second link circuit to one of the multiple terminals of said line, and automatic listening means and ringing means for said link circuit, said subscriber-controlled means controlling a contact in the circuit of said automatic ringing means.

37. A subscriber's line and a telephone system having multiple connection terminals, a connecting circuit for connection to said line through one of said terminals, subscriber-controlled means for placing a busy potential upon said terminals prior to the said establishment of the connection to the line, a signal for said circuit, subscriber-operated means for intermittently operating said signal, and operator controlled means for disconnecting said subscriber's line from said connecting circuit.

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

CHAS. SPARKS.

Witnesses:

G. A. YANOSCHOWSKI,
B. O'BRIEN.