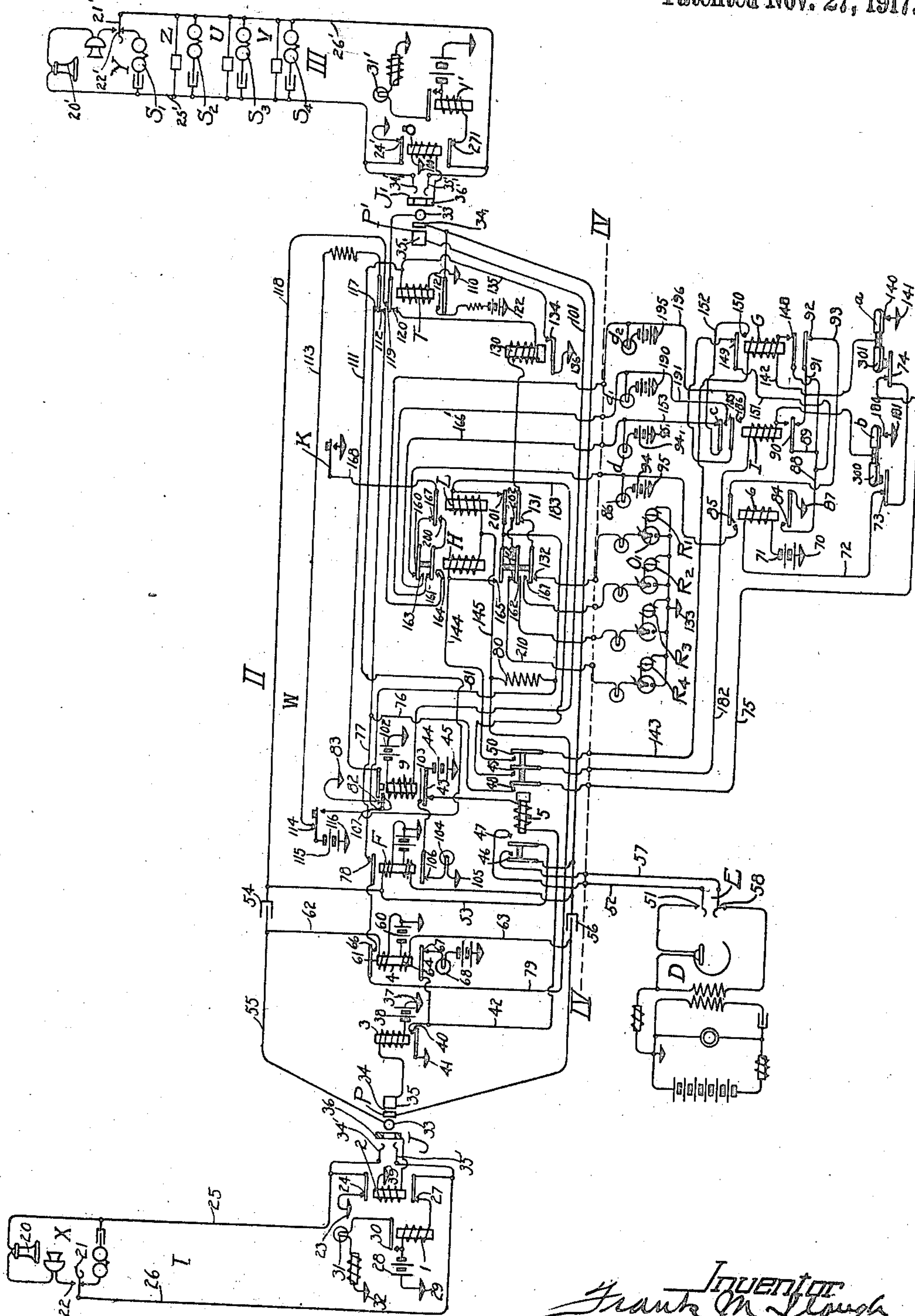


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UNITED STATES PATENT OFFICE.

FRANK M. SLOUGH, OF ROCHESTER, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS,
TO STROMBERG-CARLSON TELEPHONE MFG. CO., OF ROCHESTER, NEW YORK, A COR-
PORATION OF NEW YORK.

TELEPHONE SYSTEM.

1,247,887.

Specification of Letters Patent.

Patented Nov. 27, 1917.

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To all whom it may concern:

Be it known that I, FRANK M. SLOUGH, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Telephone Systems; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to telephone systems, and more particularly to such systems as are set forth in a companion application Ser. No. 35,013, filed June 19, 1915.

The objects of the present invention are to provide means in connection with the ringing keys to break down an established connection, in order that another connection may be set up. I also aim to provide means to indicate for which party the connection is set up. I also provide means which enable the operator at any time to ascertain for which party the connection is set up.

Other objects of my invention and the invention itself will probably be better understood from a description of an embodiment of the invention.

The drawing is a diagram of a portion of a telephone system showing an embodiment of my invention.

Referring now to the drawing, at I is indicated a telephone line which will be referred to as the called line. At II is the main or central station whereat the switch-board is installed, and whereat means are provided for connecting telephone lines together. In the form shown this connecting means consists of a cord circuit shown generally at W. A second telephone line is shown at III. Both the lines I and III lead to the station II where they terminate in the elements of switching means. In the embodiment shown apparatus is provided for connecting the means W to the telephone lines, here shown as switches P—J and P₁—J₁, which are preferably plugs and jacks. Substation apparatus is connected on the lines. On the line I I have shown, for convenience, but a single substation, illustrated generally at X, which includes a transmitter, receiver, receiver switch-hook and a signal. For convenience, I have illustrated upon the line III four substations Y, Z, U and V. At one of these only I have

illustrated in detail the substation apparatus, which is of the same character in general as that shown at the substation X. The talking set of the other substations, which includes the transmitter, receiver and receiver switch-hook are merely indicated by symbols, here shown as squares. The signals at the substations on the line III are shown at S₁, S₂, S₃ and S₄, and each is made responsive to currents of different characteristics. At the main station there is shown an operator's set D, a plurality of ringing machines R₁, R₂, R₃ and R₄, each adapted to produce currents of particular characteristics designed to operate the signals upon the line III. The numerous lamps, relays, keys, etc., shown at the main station, will be understood, as well as their operations, from a description of the operation of the system.

In general, the operation of the system is as follows: When the subscriber at X initiates a call, the lamp 31 is operated in the usual manner and the plug P inserted into the jack, resulting, among other things, most of which are understood, in the operation of the relay 5 which connects the operator's set to the cord and the apparatus shown in the lower right-hand corner of the figure with the other portions of the cord. To call the first party, the operator then inserts the plug P' into the jack J₁ and ringing current is supplied from the machine R₁ through the magnet 130 in a well known manner. When the subscriber responds, the ringing current will be disconnected from the line and the talking circuit completed, all of which is understood. At the end of the conversation, the plugs are withdrawn from the jacks and the apparatus restored to normal, as is well understood.

To call the second party, the key *a* is operated, causing the energization of the relays G and H. The relay G locks up and completes a circuit for the lamp *d* which indicates to the operator for which party the connections are set up. The relay H completes the connection of the ringing generator R₂ to the cord circuit, R₂ being designed to produce current which will operate the bell at the second station.

To call the third party, the key *b* is operated, which completes circuits for the relays I and L. These relays lock up, the relay I completing a circuit for the lamp *d*,

and the relay L connecting the ringing generator R_3 to the cord.

When it is desired to call the fourth party, both a and b are pushed, all of the relays 5 G, H, I and L are energized, each locks up and circuits are completed for the lamps d_2 and the ringing machine R_4 .

It will be seen that each time a ringing connection is set up; that is, each time the 10 central station apparatus is prepared for placing ringing current upon the line, one of the series of lamps 86, d , d_1 or d_2 is caused to burn, depending upon for which ringing generator the connections are set 15 up. The operation of the lamp indicates to the operator at all times for which character of current the central station apparatus is prepared to place upon the line. I have shown lamps at 86, d , d_1 and d_2 as being the 20 most convenient form of signal, though it will be understood that any suitable form may be used. It will also be seen that the key K is each time connected up to the lamp whose illumination would indicate the ring- 25 ing current for which the connection is set up, so that the operator can always test to ascertain what is the arrangement, or for what character of current the apparatus is prepared.

30 The provision of the keys 300 and 301, and the switches 73 and 74 controlled thereby, enable the operator to upset or break down any ringing current connection which has been completed. It sometimes happens 35 that the operator will, through inadvertence or mistake, set up the central station apparatus preparing it to furnish the wrong kind of current; that is, for example, she may set it up to supply current from the 40 generator R_2 upon the line when the third party is desired. The apparatus 73, 74, 300 and 301 is employed to enable her to be able to break down any established connection in order that she may correct the error.

45 A detailed operation of the system illustrated in the drawing is as follows: Assuming the subscriber at X on the line I desires to talk to the subscribers on the line III, —first, the subscriber at Y, the subscriber 50 at X removes the receiver 20 from the switch-hook 21, which rising, closes a switch 21—22 and completes a circuit as follows: ground 23, switch 24—conductor 25—20—22—21—conductor 26—switch 27—line 55 relay 1—battery 28—to ground 29. The relay 1 will become energized, closing the switch 30 in the circuit of the line lamp 31 and causing the same to light over a circuit from ground 32—31—30—28—29. The 60 line lamp and its associated parts are located at the main or central station III, where there are also a number of cords, one of which is shown at W. The operator connects the cord to the line by inserting the 65 plug P into the jack J of the line, the tip

contact 33, sleeve contact 34 and ringing contact 35 engaging respectively with the tip spring 34', sleeve spring 35' and ring 36 of the jack. A circuit will be completed through the magnets of the relays 2 and 3, 70 as follows: from ground 37—through battery 38—magnet of 3—35—36—magnet of 2—to ground 39. The magnet of 2 will be energized, opening the switches 24 and 27 and cutting off the line relay and line 75 lamp 31 of the line I, so that they are now disconnected from that line and will not in any way encumber the system during future operation. The magnet of 3 will be energized, closing a switch 40 and complet- 80 ing a circuit through the winding of the slow acting relay 5, as follows: ground 41—switch 40—conductor 42—winding of 5—switch 43—battery 44—to ground 45. The magnet of 5 will be energized, closing the 85 switches 46, 47, 48, 49 and 50, each of which is controlled by the armature of 5. The closing of the switches 46—47 connects the leads of the operator's set up to the opera- 90 tor's key E, the operator's set being shown generally at D. By operating the key E, the operator will now be connected to the line through the switch 51—conductor 52—the switch 47—the conductor 53—condenser 54 and the portion 55 of the cord circuit— 95 33—34'—25—20—26—35'—34—the condenser 56—switch 46—conductor 47—switch 58. Over this circuit the operator at station III, who employs the set D, and the subscriber at X converse, and the op- 100 erator learns what station is wanted by the calling subscriber at X.

The magnet of the relay 4 was energized when the connection between the cord and the line I was completed by inserting the 105 plug P into the jack J in the well known manner, such circuit being as follows: from battery 60—through winding 61 of such magnet—conductor 62—55—33—34'—25—20—22—26—35'—34—conductor 110 63—to winding 64 of the magnet 4. This magnet when actuated closed a switch 66 for a purpose to be described and opened a switch 67 in the circuit of the relay 68, preventing the same from being energized 115 at this stage of the proceedings, another switch 40 in the circuit of the relay 68 having been closed when the magnet of 3 was energized.

First, we will assume that it is the station 120 at Y that the subscriber at X desires, which, for convenience, will be called the first party, and who is provided with a signal at S_1 adapted to respond to current produced by the generator at R_1 . When the relay 5 was 125 energized, a circuit was completed for the magnet of the relay 6 as follows: ground at 70—battery 71—magnet of 6—conductor 72—switch 73—switch 74—conductor 75—now closed switch 48—conductor 76—con- 130

ductor 77— switch 78— now closed switch 66— conductor 79— resistance 80— conductor 81— switch 82— to ground 83. The magnet of the relay 6 closes the switches 84 and 85, completing a circuit for the lamp 86, as follows: ground 87— 84— conductor 88— conductor 89— switch 90— conductor 91— switch 92— conductor 93— switch 85— lamp 86— battery 94— to ground 95. The lamp 86 will light and will indicate to the operator that the circuit is set up to ring the first party, this lamp being so characterized as to convey that information to her. The operator then inserts the plug P_1 into the jack J_1 , the tip 33', the sleeve 34₁ and the ring 35₁ registering respectively with the tip spring 34₁', the sleeve spring 35₁' and the ring 36' of the jack J_1 . A circuit will be completed through the magnets of the relays 8 and 9 as follows: ground 100— winding of 8— 36'— 35₁— conductor 101— winding of 9— battery 102— to ground. The magnet 8 opens the switches 24' and 27' cutting off the line lamp 31' and the line relay 1' and associate apparatus of the line III, so as to prevent their encumbering the line in the future operations. The magnet 9 opens the switch 43, interrupting the circuit of the relay 5, which is made slow acting, that is, the switches 46 to 50 inclusive controlled by it are not opened until a short interval of time during which the more speedy relays are operated.

A switch 103 is closed in the circuit of the supervisory lamp 104, causing the illumination of that lamp over a circuit as follows: ground at 105— 104— switch 106— 103— 44— to ground 45. The magnet 9 will close a switch 107 and open the switch 82, but not until after the switch 107 is closed, thereby maintaining the circuit through the switch 82 and the magnet of the relay 6 until after the switch 107 is closed. The switch 107 is closed before either any of the switches 46 to 50 inclusive or 82 are opened. A circuit will now be completed for the ringing relay T as follows: ground 110— T— 111— switch 107— conductor 81— 80— 79— 66— 78— 77— 76— 48— 75— 74— 73— 6— 71— 70, such circuit, as explained, being maintained for a short interval of the time after the switch 107 is closed or until the relay T has attracted its armatures, thereby closing for itself a locking circuit through the switch 112, as follows: 110— T— 111— 107— 81— 79— 66— 78— 112— 113— 114— battery at 115— to ground at 116. The magnet of T also opened a switch 117 for a purpose to be described, interrupted the strand 118 of the cord circuit by opening the switch 119 and closed switches 120 and 121 in the ringing circuit. The ringing now takes place over the following circuit: from ground 122— 121— 34₁— 35₁'— 26'— S_1 — 25'— 34₁'— 33'— switch 120— the magnet of the relay

130— switch 131— switch 132— ringing machine R_1 — to ground at 133. This current is applied intermittently by the commutator O_1 until the subscriber at Y responds by removing the receiver 20' from the switch-hook 21', closing the switch 22' through the talking set, thereby admitting to the circuit current of a character which causes the operation of the magnet of the relay 130 to close the switch 134. The current which courses through this circuit and through the signal S_1 was incapable of causing the magnet 130 to close 134. When 134 is closed, a short circuit is completed about the magnet T through the conductor 135, the switch 134 to ground at 136. Instead of the current which heretofore passed through T passing through T, it will now pass through the short 135, so that the magnet T will be de-energized and its armature and the switches controlled thereby restored to the condition illustrated in the drawing.

When the subscriber at Y responds, the relay F will also be operated, opening the switches 178 and 106. The opening of the switch 106 extinguishes the lamp 104 and the opening of the switch 178 breaks the circuit of the relay T. The subscribers now carry on their conversations over the limbs of the two line circuits and the strands of the cord circuit, and when the conversation is terminated, restore the receivers to the hooks, breaking the circuits of the magnets 4 and F and causing the lamps 168 and 104 to be lighted, which signal the operator to withdraw the plugs P and P_1 from the jacks J and J_1 , which she will do, restoring the apparatus to the condition indicated in the drawing.

Second, assuming that it is the party at Z on the line III who is wanted. For convenience, we will call the party at Z the second party. This party is provided with a signal S_2 which is arranged to respond to current from the ringing machine R_2 . After the operator has learned that it is the party at Z that is wanted, she closes a switch 140 by operating a key, here shown as a foot pedal key α , which completes a circuit through the windings of the magnets G and H as follows: ground 141— 140— 142— magnet of G— conductor 143— switch 50— conductor 144— winding of H— conductor 145— 79— now closed switch 66— 78— 76— 48— 75— 74— 73— 72— 6— 71— 70. The winding of G will be energized, opening the switch 92, closing the switch 148 and opening the switch 149 and closing the switch 50. The relay G will lock itself up over a circuit as follows: 87— 84— 88— 148— G— 143— and to battery and ground as described in connection with the circuit through the switch 140. Owing to this arrangement, the relay G will remain energized after the key α has been released. A circuit will also be completed for

the second party lamp as follows: 87— 84— 88— 151— 150— 152— *c*— 153— second party lamp *d*— battery 94₁— to ground 95₁, such lamp indicating to the operator that the apparatus is set up for the ringing of the second party. The magnet of 6 closed a switch 84— 85, as previously described. The magnet of the relay H opened the switches 160, 161, 162 and 132 and closed the switches 163, 164, 165, 166 and 167. A circuit will now be completed to the contacts of the key K for the lamp *d*, in order that the operator may at any time test to find out for what party the connections are set. This connection would be as follows: 95₁— 94₁— *d*— 166'— 163— 167— 168— to K. The operator then inserts the plug P₁ into the jack J₁, as previously described, causing the actuation of the magnets of 9 and 7 and the operations as previously described. The magnet of H in closing the switch 165 locked itself up over the following circuit: 83— 82— 81— 165— winding of H— 143— through the winding of 6— and to ground at 70, as previously described. After the magnet of T is energized and 5 is deenergized, the circuit of H will be as follows: 110— T— 111— 107— 81— 165— winding of H— 145— 79— 66— 78— 77— 112— 113— 114— 115— and 116. The ringing circuit will now be as follows: 133— R₂— 167— 131— 130— 120— over the line 111— through the signal S₂ and back to ground at 122, as explained.

When the subscriber at Z has responded, the operation will be the same as previously described, the circuit of H being broken when T is deenergized and the system being restored to normal when the plugs are withdrawn from the jacks.

Assuming that the party at U is wanted, whose station is provided with a signal S₃ which we will call the third party signal, and which is adapted to respond to current from the third party ringing generator, after the connection of the operator's set to the calling line, the operator actuates the key *b*, closing the switch 180 and a circuit through the windings of the magnets I and L, as follows: 181— 180— I— 182— 49— 183— L— 145— 79— 66— 78— 77— 76— 48— 75— 74— 73— 6— 71— 70. The magnet of I is energized, opening the switches 90 and *c* and closing the switches 185, 186 and *f*. The magnet I completes a locking circuit for itself through the switch *f*, the conductor 89 and the switch 84 to ground at 87, substituting this portion of the circuit for the circuit through the switch 180, so that I will remain energized after the switch 180 is opened. A circuit will also be completed for the lamp *d*₂ which is as follows: ground 195— *d*₂— conductor 196— 186— 149— 88— 84— ground 87. The illumination of this lamp indicates to the operator that the apparatus is set for the third party,

The energization of the magnet at L will open the switches 131 and 167 and close the switches 200, 201 and 202. The closing of the switch 201 completes a locking circuit for L from ground 83— 82— 81— 201— to L. The closing of the switch 200 completes a circuit for the lamp *d*₂ up to the contacts of the relay K for test purposes. The operator then inserts the plug P₁ into the jack J₁, which causes the actuation of the magnets of 9 and T and completes a new circuit for the magnet L around through the switch 112 and the key 114. Ringing then takes place from ground 133— R₃— 162— 202— and as previously described, the operation being the same as in connection with the other parties.

Assuming that it is the fourth party that is wanted, both *a* and *b* will be operated, causing the actuation of the four magnets G, H, I and L over the circuits described. A circuit will now be completed for the lamp *d*₁ as follows: 190— *d*₁— 191— 185— 150— 151— 88— 84— 87. The ringing current from the machine R₄ will pass as follows from ground 133— R₄— 210— 166— 202— through 130, the operation thenceforth being the same as described in connection with the other parties.

If at any time the operator after setting up the connection of a particular frequency for any party desires to change it to another party, the connections can be knocked down by operating one of the switches 300 or 301 which causes the interruption of the circuit of 6 and the apparatus dependent thereon. If at any time the operator after having set up the connections for calling a certain party desires to test to determine that party, it can be done so by operating the key K, which completes a circuit for that one of the lamps 86, *d*, *d*₁ or *d*₂ for which the connection has been completed, thereby indicating which of the parties is being called when the plug is inserted.

All of the apparatus below the line IV—IV is common to a plurality of connecting means or cord circuits. I preferably provide a key K for each of the cords.

I have illustrated this particular embodiment of my invention and these details for the purpose of better describing the invention. I do not wish to be limited either to the embodiment or to the details, as it will be apparent to any one skilled in the art that numerous and extensive departures may be made both from this form and from these details without departing from the spirit of the invention.

I claim:—

1. In a telephone system, a calling telephone line, a called telephone line, a plurality of connective circuits having answering and calling connective switches, a relay operated when connection is made by means of the answering switch of a connective circuit

with a calling telephone line, a plurality of sources of signaling current, a plurality of ringing keys common to a plurality of connective circuits and adapted to be associated with a particular connective circuit by said relay, mechanism to indicate which of said keys has been operated, and means operated by the closure of the calling connective switch to disassociate said keys from the particular connective circuit.

2. In a telephone system, a calling telephone line, a called telephone line, a plurality of cord circuits for connecting telephone lines together, each cord having an answering switch and a calling switch for connecting it to a telephone line, a relay operated when connection is made by means of an answering switch of a cord circuit with a calling telephone line, a plurality of ringing generators, each adapted to produce a current of a certain characteristic, means to connect each of said generators to the cord circuit to supply ringing current to the called line, said means including selective keys common to a plurality of cord circuits, each key adapted to be associated with a particular cord circuit by said relay, apparatus to indicate which generator is connected to the cord circuit and means operated by the closure of the calling switch to disassociate said keys from the particular cord circuit employed.

3. In a telephone system, a calling telephone line, a called telephone line, a plurality of cord circuits for connecting telephone lines together, each cord being provided with an answering switch and a calling switch by which it may be connected to a telephone line, a relay operated when connection is made by means of the answering switch of a cord circuit with a calling telephone line, a plurality of ringing generators, each adapted to produce a current of a certain frequency for operating signals on the called line, means including a plurality of keys for connecting each generator to the cord circuit, apparatus including a plurality of signals controlled by said keys for indicating which generator is connected to the cord, said keys being common to a plurality of cords and adapted to be associated with the particular cord employed by said relay and means operated by the closure of the calling switch to disassociate said keys from the particular cord employed.

4. In a telephone system, a calling telephone line, a called telephone line, a plurality of connecting circuits having answering and calling connective switches, a relay operated when connection is made by means of the answering switch of a connective circuit with a calling telephone line, a selective key common to a plurality of connective circuits and adapted to be associated with a particular connective circuit employed by said re-

lay, means operated by the closure of the calling connective switch to disassociate said selective key from the connective circuit employed and apparatus independent of said means for disassociating said selective key from said connective circuit.

5. In a telephone system, a calling telephone line, a called telephone line, a plurality of cord circuits each having an answering switch and a calling switch for connecting said cord to telephone lines, a relay operated when connection is made by means of the answering switch of a cord with a calling line, a ringing generator, means to connect the ringing generator to the line, locking apparatus for locking said means, said means including a key common to a plurality of cords and adapted to be associated with a particular cord by said relay, a second key controlled by the operator for interrupting the connection of the generator with the cord and means operated by the closure of the calling switch to disassociate said first named key from the particular cord circuit employed.

6. In a telephone system, a main station, a plurality of substations, telephone lines leading from said main station to said substations, signal bells on said telephone lines, a connective circuit at the main station having answering and calling connective switches, a signaling generator at the main station for applying signaling current from said connective circuit through its calling connective switch to a telephone line to operate a signal bell on said line, a controlling magnet for controlling the association of said signaling generator to said connective circuit, a signal lamp for indicating such association, said signal lamp being initially operated by said magnet under the control of the answering connective switch and rendered inoperative by apparatus under the control of the calling connective switch.

7. In a telephone system, a main station, telephone lines leading from said main station to substations, one of said telephone lines being a calling line and another of said telephone lines being a called line, a plurality of substations for said called line, a signal bell for each of said substations adapted to be operated by ringing current of a distinctive character, a plurality of means at the main station for producing currents of distinctive characters, a connective circuit at the main station having answering and calling connective switches, a plurality of signaling lamps at the main station each associated with one of said current producing sources, one of said lamps being operated by mechanism under the control of the answering connective switch, said answering connective switch at the same time automatically associating one of said current producing sources with the connect-

tive circuit, manually operated means under the control of an attendant operator for substituting a second current producing means for the first current producing means initially associated with the connective circuit and means under the control of said manually operated means for simultaneously substituting a second signal lamp for the initially operated signal lamp to indicate the particular current producing means at the time associated with the connective circuit and means under the control of the calling connective switch for completing the circuit from the current producing means associated with the connective circuit to the called line.

8. In a telephone system, a main station, a plurality of lines leading from said main station to substations, one of said lines being a calling line and another of said lines being a called line, a plurality of signal bells on said called line, each adapted to be operated with current of a distinctive character, a plurality of means at the main station for supplying said currents each of a distinctive character, a plurality of connective circuits at the main station for associating calling and called lines by means of answering and calling switches, apparatus common to a group of said connective circuits for selecting a particular current supplying means for any one of said connective circuits, a plurality of signal lamps for indicating the particular character of current selected, said signal lamps being also common to the connective circuits, a magnetic switch under the control of said answering connective switch for associating said common apparatus with the particular connective circuit being used to make a connection between the calling and called telephone lines, relays associated with said connective circuit to retain the selection of the particular current supplying means in its association with the connective circuit, and means operated by the connection of the calling connective switch with the called telephone line to disassociate said common apparatus from the particular connective circuit, thereby extinguishing said common signal lamp, said relays retaining the selected current supplying means in its association with the connective circuit and a relay operated when said connection is made to complete a circuit between said current supplying means and said called line to operate a particular signal bell on the called line.

9. In a telephone system, a main station, a plurality of lines leading from said main station to substations, one of said lines being a calling line and another of said lines being a called line, a plurality of signal bells on said called line, each adapted to be operated with current of a distinctive char-

acter, a plurality of means at the main station for supplying said currents each of a distinctive character, a plurality of connective circuits at the main station for associating calling and called lines by means of answering and calling switches, apparatus common to a group of said connective circuits for selecting a particular current supplying means for any one of said connective circuits, a plurality of manually operated switches associated with said apparatus for initiating said selection, means under the control of one of said switches for disestablishing a prior selection of current supplying means, means under the control of one of said switches for establishing a different selection of current supplying means, a plurality of signal lamps for indicating the particular character of current selected, said signal lamps being also common to the connective circuits, a magnetic switch under the control of said answering connective switch for associating said common apparatus with the particular connective circuit being used to make a connection between the calling and called telephone lines, relays associated with said connective circuit to retain the selection of the particular current supplying means in its association with the connective circuit, and means operated by the connection of the calling connective switch with the called telephone line to disassociate said common apparatus from the particular connective circuit, thereby extinguishing said common signal lamp, said relays retaining the selected current supplying means in its association with the connective circuit and a relay operated when said connection is made to complete a circuit between said current supplying means and said called line to operate a particular signal bell on the called line.

10. In a telephone system comprising a main station, a plurality of substations, a plurality of lines leading from said main station to said substations, one of said telephone lines being a calling line and another of said lines being a called line, said called line having a plurality of substations each with an associated signal bell, an answering switch for connecting one of a group of connective circuits to the calling line and a calling switch for completing the connection between the particular connective circuit being used and the called line, a plurality of signaling generators to selectively operate a particular signal bell on the called line, a relay in the connective circuit for controlling the connection of a particular source of signaling current, a plurality of signaling lamps common to the group of connective circuits for indicating the particular source of signaling current which is at the time being applied to the signal bells of the called line, and a manually operated switch under

the control of the operator and associated with the particular connective circuit for operating the particular signal lamp to indicate the selected signaling current at any time subsequent to the completion of the connection.

11. A telephone system, a plurality of connecting circuits therefor, a plurality of ringing relays for each of said connecting circuits, a key common to said connecting circuits for controlling said ringing relays, and common indicating means for said connecting circuits controlled by said ringing relays.

12. A telephone system, a plurality of cord circuits therefor, a plurality of ringing relays for each of said cord circuits, a common key for controlling said ringing relays, and a common signal circuit controlled by said ringing relays.

13. In a telephone system, a plurality of connecting circuits therefor, relays in said connecting circuits and individual thereto, a key common to a plurality of said connecting circuits, means to associate said key with any of the connecting circuits, said key controlling the relays of said connecting circuits, visual indicating means common to a plurality of said connecting circuits and adapted to be controlled by the relays of any connecting circuit.

14. A telephone system, a plurality of signaling circuits therefor, relays in each of said signaling circuits, common means therefor, controlling means in each of said connecting circuits, a plurality of alternative circuits therefor, said signaling circuits being common to a plurality of connecting circuits, said relays controlling said signaling circuits.

15. In combination, a plurality of telephone connecting circuits, common key means for setting up a predetermined ringing condition in any of said connecting circuits, and common signal devices for indicating the ringing condition set up in any connecting circuit.

16. In combination, a plurality of telephone connecting circuits, common key means for setting up a predetermined ringing condition in any of said connecting circuits, common signal devices for indicating the ringing condition set up in any connecting circuit, and individual key means controlling said signal devices.

17. A telephone system, a plurality of connecting circuits therefor, a plurality of ringing relays for each of said connecting circuits, a common key for controlling said ringing relays, and a common signal circuit, said ringing relays having contacts in said common signal circuit.

18. A telephone system, connecting circuits therefor, a set of ringing generators therefor, a set of signals therefor, each of said signals corresponding to a particular

one of said ringing generators, said ringing generators and said signals being common to a group of connecting circuits.

19. A telephone system, a group of connecting circuits therefor, a common set of ringing generators, a common set of signals, each signal of the set corresponding to a particular ringing generator of the set, electro-magnetic controlling mechanism in each connecting circuit for selecting a ringing generator and its associated signal, and a common set of keys for interchangeably controlling said electro-magnetic mechanism.

20. In combination, a plurality of connecting circuits, common key means for setting up a predetermined ringing condition in any of said connecting circuits, common signal devices for indicating the ringing condition set up in any connecting circuit, and individual controlling means for said signal-devices.

21. In combination, a plurality of telephone connecting circuits, a plurality of selective relays for each of said connecting circuits, a common key for controlling said selective relays, a common signal circuit, and a plurality of branches therefor, said branches being controlled by said selective relays.

22. A telephone system, a plurality of cord circuits therefor, a plurality of ringing relays for each of said cord circuits, a common set of keys for controlling said ringing relays, a common signal circuit controlled by said ringing relays, and a key individual to the cord circuits, said key controlling said signal circuit.

23. A telephone system, a plurality of cord circuits therefor, a plurality of ringing relays for each of said cord circuits, a common set of keys for controlling said ringing relays, means in each of said cord circuits for associating said set of keys with the ringing relays of a cord circuit, and a common signal circuit controlled by said ringing relays.

24. A telephone system, a plurality of connecting circuits therefor, a plurality of selective ringing relays for each of said connecting circuits, a common set of keys controlling said selective relays, and means individual to each of the connecting circuits for associating said common set of keys with said selective ringing relays, a common set of signals, a source of current, and circuit connections for associating said source of current with one of said signals, said circuit including contacts of said relays.

25. A telephone system, a plurality of connecting circuits therefor, a plurality of selective ringing relays for each of said connecting circuits, a common set of keys controlling said selective relays, and means individual to each of the connecting circuits for associating said common set of keys with

said selective ringing relays, a common set of signals, a source of current, and circuit connections for associating said source of current with one of said signals, said circuit including contacts of said relays, and contacts of a controlling key individual to the connecting circuit.

26. A telephone system, a plurality of connecting circuits therefor, a plurality of ringing relays for each of said connecting circuits, a common key for said ringing relays, a common group of signals, and a key in each of said connecting circuits, said key and said ringing relays of any of the connecting circuits being adapted to control the said common signals.

27. The combination with a plurality of telephone lines, a plurality of connecting circuits therefor, common key means for setting up a predetermined ringing condition in any of said connecting circuits, a connection switch for one of said connecting circuits to connect said connecting circuit to a telephone line, a relay in said connecting circuit, said relay being under the control of said connection switch, and circuit connections including contacts of the said relay for dis-associating said common key means when said connection switch is operated.

28. The combination with a plurality of telephone lines, a plurality of connecting circuits therefor, common key means for setting up a predetermined ringing condition in any of said connecting circuits, a connection switch for one of said connecting circuits to connect said connecting circuit to a telephone line, a relay in said connecting circuit, said relay being under the control of said connection switch, circuit connections including contacts of the said relay for dis-associating said common key means when said connection switch is operated, common signal devices for indicating the ringing condition set up in any connecting circuit, and individual controlling means for said signal devices.

29. In combination, a plurality of telephone connecting circuits, interchangeable key means for setting up a predetermined ringing condition in any of said connecting circuits, signal devices for indicating the ringing condition set up in any connecting circuit, and individual key means controlling said signal devices.

30. A telephone system, a plurality of telephone circuits therefor, a plurality of ringing relays for each of said connecting circuits, interchangeable key means for controlling the ringing relays of any of said connecting circuits, and a common signal circuit, said ringing relays having contacts in said common signal circuit.

31. A telephone system, connecting circuits therefor, a set of ringing generators therefor, a corresponding set of signals associated therefor, each of the signals of the set corresponding to a particular ringing generator of the set, electro-magnetic means in each of the connecting circuits for associating a particular ringing generator with the connecting circuit, means to simultaneously condition one of the said signals corresponding to the selected ringing generator for operation, said ringing generators and said signals being common to a plurality of connecting circuits.

32. In combination, a plurality of connecting circuits, common key means for setting up a predetermined ringing condition in a connecting circuit, electro-magnetic means for retaining the set up ringing condition, a connection switch for said connecting circuit, dis-associating means for said common key means under the control of said connection switch, a common signal circuit, and a plurality of branches therefor, said branches being controlled by said electro-magnetic means.

33. A telephone system, connecting circuits therefor, a set of ringing generators therefor, a set of signals therefor, ringing relays in said connecting circuits controlling said signals, a common set of keys for operably setting up said ringing relays, said set of keys also controlling a set of common relays, said common relays controlling said signals and said ringing relays.

34. A telephone system, connecting circuits therefor, a set of ringing generators therefor, a set of signals therefor, ringing relays in said connecting circuits controlling said signals and said ringing generators, a common set of keys controlling said set of ringing relays, said set of keys also controlling a set of common relays, said common relays also controlling said signals.

35. A telephone system, a plurality of connecting circuits therefor, a plurality of ringing relays for each of said connecting circuits, a plurality of common associated relays, a common signal circuit, said common signal circuit being under the alternate control of said ringing relays and said common associated relays.

36. In combination, a plurality of telephone connecting circuits, common key means for setting up a predetermined ringing condition in any of said connecting circuits, common signal devices for indicating the ringing condition set up in any connecting circuit and common relay means controlling said signal devices.

In witness whereof, I have signed my name hereunto this 11th day of April, 1916.

FRANK M. SLOUGH.