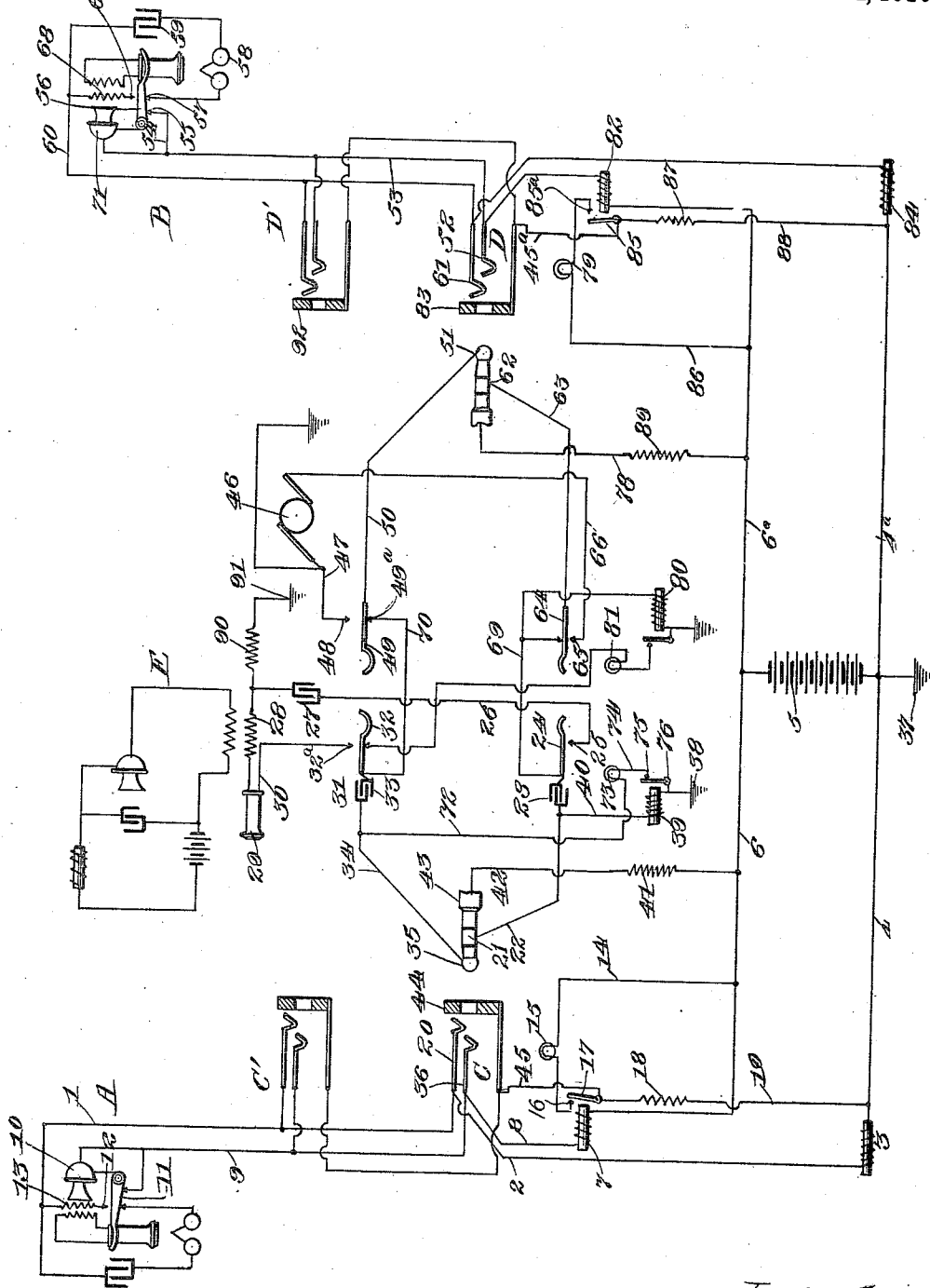


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TELEPHONE SYSTEM.
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TELEPHONE SYSTEM.

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To all whom it may concern:

Be it known that I, ALFRED H. DYSON, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems in general, and more particularly to systems of the complete metallic circuit and central energy type. In systems of this kind complete metallic line connections are employed between the sub-stations and the central exchange, so as to avoid the use of grounded circuits. The current, both for talking and signaling purposes, is furnished from a battery or other source of current supply located at the central exchange. At the central station each subscriber's line is provided with one or more jacks, according to whether the system is of the single or multiple switchboard type, and the central operator is provided with a cord circuit having plugs adapted for insertion in said jacks. When a subscriber sends in a call, the closing of the line circuit by the removal of the receiver at the substation causes the operation of the line signal at the central exchange, and the central operator observing this signal, then inserts the answering plug of the cord circuit in the jack corresponding to the calling subscriber's line. The line signal usually consists of a small incandescent lamp having a normally open circuit controlled by a line relay. The arrangement is usually such that the insertion of the answering plug by the operator operates to automatically extinguish or restore this line signal. Upon receiving the order for connection, the operator then inserts the calling plug of the cord circuit in the jack corresponding to the line of the called subscriber. Before doing this, however, it is usual for the operator to make what is known as the busy test, which consists in touching the tip of the calling plug to the ring or thimble of the called subscriber's jack. If the line of the called subscriber is busy, the test made in this way causes a click in the operator's receiver indicating that the line of the called subscriber is in use. However, as stated, if after making this test, the operator finds that the line is not busy, the calling plug is then inserted in the jack, and the operator's ringing key is then pressed

for the purpose of ringing the bell at the called subscriber's station. In addition to the line or calling signals, other signaling devices commonly known as supervisory or clearing-out signals are associated with the cord circuit. These supervisory signals indicate the hanging up of the receiver at the sub-station. Like the line signals, these supervisory signals usually consist of small incandescent lamps, and if the system is of the double supervisory character, a supervisory or clearing-out signal of this character is provided for each side of the cord-circuit. Thus when the called subscriber hangs up the receiver, the supervisory lamp associated with the calling plug lights up, indicating to the central operator that the called subscriber is through talking. In a similar manner, the hanging up of the receiver by the calling subscriber causes the other supervisory lamp to glow, and to thereby advise the central operator that this subscriber is also through with the line. Ordinarily the arrangement is also preferably such that a supervisory lamp lights up and continues to glow until the called subscriber answers. In this way the supervisory lamps perform a double function—that is to say, they not only indicate the answering of a call on the part of a called subscriber, but also supervise the connections and indicate when the subscribers have finished talking. The busy test, as explained, is only necessary in systems of the multiple switchboard type, as in such cases there are a number of jacks to each line, and an operator before plugging in one of these jacks must first ascertain whether or not the line is already in use by either of the plugs of another cord circuit being inserted in another jack. In systems of this character, it is also desirable to have the connections of the circuits such that no objectionable sounds will be produced in the receiver at the substation. For example, with approved methods the insertion of the answering plug in the jack of the calling subscriber does not produce any click or sound in the latter's receiver. Again, it is desirable to have the arrangement such that the busy test can be made without having the effect extend to and audible in the receiver at the substation with respect to which the test is made. Otherwise, in each case, the subscribers would be subjected to considerable annoyance due to the change of

current conditions on the lines. During conversation, the current for the microphone transmitters at the sub-stations is furnished over the line from the central station, suitable impedance or retardation being distributed in the circuit connections in such manner as to insure the proper amount of current for each line. As explained, the centralized or common battery is also employed for furnishing current to the line and supervisory relays, and to the lamps which serve as line and supervisory signals. Thus, as stated, the arrangement is preferably such that no grounded circuits are employed between the subscribers' stations and the exchange, either for talking or for signaling purposes, and, furthermore, the current necessary for the operation of the system is supplied from a common source.

Generally stated, the object of my invention is to provide a simple and improved system of the foregoing character, to reduce the cost of installing and maintaining a system of this character, and also to secure increased efficiency.

Certain special objects are to provide a circuit arrangement which will permit a central operator to make the "busy test" without causing any sound in the receiver at the substation with respect to which the test is made; to provide an arrangement whereby one side of the cord circuit and also one side of the line circuit can be employed to form a part of a supervisory lamp circuit, so as to avoid as much as possible the use in the cord circuit of certain electrical devices which are more or less objectionable in character, such, for example, as impedance, and so as to permit the utilization of the line circuit supply as a means for supplying current to a supervisory lamp; to provide a double source of current for one side of the line circuit, as, for example, by arranging the supervisory relay in parallel with the line impedance; to provide a circuit arrangement whereby the operator can restore or extinguish the calling signal without producing objectionable sounds in the receiver at the substation from whence the call came; and to avoid the use of certain electrical devices which are more or less objectionable in character, and which are expensive and tend to cut down the efficiency, such, for example, as repeating coils, cut-out relays and coils in the talking circuit, and at the same time to retain the advantages of approved methods.

To the foregoing and other useful ends, the change of potential necessary in making the busy test is localized to such an extent that no sounds are produced in the receiver at the substation with respect to which the test is made. This quieting of the line in making the busy test can be accomplished in any suitable manner, as, for example, by arranging a calling signal lamp circuit in

such manner as to, as stated, localize the change of potential necessary in making such test.

In order to reduce the number of impedance relays in the cord circuit, one side of this cord circuit and also one side of the line circuit, can be arranged to form part of the supervisory lamp circuit. This method of operating the supervisory lamps is simple and efficient, and, as stated, obviates the necessity of interposing an objectionable number of impedance coils in the cord circuit. And as a further advantage, the supervisory relay and the line impedance are arranged in parallel, so as to give a double source of current to one side of the line. Furthermore, with my improved circuit arrangement, no repeating coils or cut-off relays are employed, and no coils are interposed in the talking circuit. Electrical devices of this kind are more or less expensive and objectionable in character, and tend to cut down the efficiency of the system in which they are employed, but, as stated, with my improved circuit arrangement, all of the advantages of approved methods are retained, while at the same time the cost of installing and maintaining the system is reduced. Furthermore, the arrangement obviates the necessity of employing these said electrical devices, and in this way the arrangement, as stated, tends to increase the general efficiency of the system. The nature and advantages of my invention will, however, hereinafter more fully appear.

The accompanying drawing is a diagram illustrating a telephone system embodying the principles of my invention. In this view it will be understood, that only such devices and circuit connections are shown as are necessary to the application of the principles of my invention to the operation of two substations having a suitable connection with a central station.

As thus illustrated, the system shown comprises a couple of substations A and B, having suitable line connections with the spring jacks C and C¹ and D and D¹. These jacks, it will be readily understood, are located in the usual manner at the central station. It will also be understood that the operator's connecting means at the central station consist of the usual cord circuit E, whereby the spring jack of one substation can be connected with the spring jack of the other substation for the purpose of establishing a talking circuit.

The apparatus at each substation can be of any suitable known or approved form. As illustrated, a call can be sent in from either substation by simply lifting the receiver from the hook or switch. When the receiver at the substation A, for example, is lifted from its hook or switch, the operations and circuit connections which then

take place are as follows: When the receiver at the substation is lifted from its hook or switch, a calling circuit is immediately completed through line 1, conductor 2, impedance 3, conductor 4, battery 5, conductor 6, calling signal relay 7, conductor 8, line 9, transmitter 10, thence through the hook or switch 11 to contact point 12, and hence through the primary 13 of the induction coil to the line 1. The battery 5 and relay 7, it will be understood, are located at the central station, and upon closing the said circuit, the relay 7 attracts its armature 17. This instantly closes a local circuit from the battery 5, through conductor 6, connection 14, hence through the lamp 15 to contact point 16, through armature 17 and the resistance 18 to conductor 19, through the latter to the line 4, and thence back to the said battery. The connection and conductor 14 and 19, together with the interposed resistance 18, the lamps 15, and the contact point and armature 16 and 17, constitute a lamp circuit for conducting the current and thereby causing the said lamp to light up or be displayed for the purpose of advising the central operator of the call. The calling signal being thus displayed, the central operator then inserts the answering plug in jack C, and in so doing circuit connection is established from line 1, through the sleeve spring or contact 20 of the jack, thence through the sleeve 21 of the answering plug, through connection 22 of the cord circuit, thence through the condenser 23 and the listening key 24, to contact point 25, it being understood at this juncture that after inserting the plug the operator presses the listening key, thence through connection 26 and condenser 27 to the secondary 28 of the induction coil, from this induction coil through the receiver 29 of the operator's talking set, thence through the connection 30 to contact point 31, and from this contact point through the listening key 32 and the condenser 33 to the connection 34 of the cord circuit, thence through the plug tip 35 and the tip spring or contact 36 to line 9, through the transmitter 10 and the receiver hook or switch 11 to contact point 12, and thence through the primary 13 of the induction coil to the line 1. This places the central operator in communication with the subscriber at substation A, and, after learning the number of the substation called for, the operator then inserts the calling plug of the cord circuit in the spring jack D, it being assumed that substation B is the one with which the subscriber at substation A desires connection. At this juncture, however, it will be seen that the insertion of the answering plug in jack C also operates to complete a circuit from the battery 5, through the ground or common connections 37 and 38, to the supervisory relay 39, then through con-

nection 40, cord circuit strand 22, through plug sleeve 21 and sleeve spring or contact point 20 to line 1, through the primary 13 of an induction coil and the contact 12 to switch 11, thence through the transmitter 10 to line 9, through connection 8 and relay 7 to the conductor 6, and thence back to the battery 5. This causes the armature of the supervisory relay 39 to be attracted, this armature normally standing away from the relay magnet, so as to normally engage the contact point 75. The circuit thus established through this supervisory relay 39 prevents the supervisory lamp 73 from lighting up until the subscriber at substation A hangs up the receiver. It will also be seen that upon inserting the answering plug, the operator establishes a local shunt circuit for restoring or extinguishing the calling signal lamp 15. This shunt circuit is from the battery 5, through conductor 6, to resistance 41, through the resistance and conductor 42 to the shoulder 43 of the answering plug, thence through the testing ring 44 of the jack to the connection 45, through this connection and the resistance 18 to the connection 19, thence through the conductor 4 to the said battery 5. This, it will be seen, operates to take the current away from the calling signal lamp 15, thereby extinguishing the latter, and to direct the same through the local shunt circuit established by inserting the answering plug in jack C. The operator after thus learning the number of the substation called for, and upon restoring or extinguishing the calling signal in the manner described, then, as previously stated, inserts the calling plug in the jack D. Upon inserting the calling plug in the said jack the operator also presses the ringing key in the cord circuit, and the circuit is then completed from the magneto 46, through connection 47 and contact point 48 to ringing key 49, thence through the cord circuit strand 50 to plug tip 51, from this tip through the tip spring or contact 52 to line 53, through this line and the connection 54 and contact point 55 to the receiver hook-switch 56, thence through contact 57, bell 58 and condenser 59 to line 60, through this line to the sleeve spring or contact 61, thence through the plug sleeve 62 and the cord circuit strand 63 to the ringing key 64, through contact 65 and connection 66, and thence to the other terminal of the said generator 46. Upon the completion of the circuit in this way, the operator will then ring the bell at the substation B by operating the magneto or generator 46. The subscriber at substation B then removes the receiver from the hook or switch 56, and in so doing a circuit is completed through contact point 67, primary 68 of the induction coil, line 60, and sleeve spring or contact 61, to plug sleeve 62, thence through the connection 63, ring-

ing key 64 to connection 69, through this connection and the listening keys 24, through condenser 23, thence through connection 22 and the cord sleeve 21 to sleeve spring or contact 20, through the line 1 and the primary 13 of the induction coil at substation A, thence through the contact point 12 and switch 11 to the transmitter 10, through line 9 to tip spring or contact 36, thence through the plug tip 35 and the connection 34 to condenser 33, through listening key 32 and the connection 70 to ringing key 49, through connection 50 and plug tip 51 to tip spring or contact 52, through line 53 to transmitter 71 at substation B, and thence through switch 56 to contact point 67. The circuit thus completed constitutes the talking circuit between the two substations, and upon the establishment of this talking circuit, the two subscribers are in condition to communicate with each other.

While the receiver at the substation B is off the hook, the shunt 78 operates to keep the calling signal 79 from lighting up, and in a manner similar to the arrangement already described in connection with lamp 15 at substation A. It will also be seen that upon the insertion of the calling plug in spring jack D, and after the receiver at substation B has been removed, a circuit is completed through supervisory relay 80, in a manner similar to the completion of a circuit through the other supervisory relay 39. This, as already explained, operates to draw the relay armature away from this contact point, so as to prevent the lighting up of supervisory lamp 81, which, it will be understood, is in all respects for the same purpose as the supervisory lamp 73. In fact, the two substation line terminals and apparatus associated therewith, are substantially alike in form and operation. The calling signal relay 82 is similar in all respects to the calling signal relay 7, and the testing ring 83 and the impedance 84 are similar to the ring 44 and the impedance 3. Also, as in the case of substation A, the armature 85 corresponds to the armature 17, and the lamp connection 86 to the previously explained lamp connection 14. The resistance 87 and the connection 88 are also similar to the resistance 18 and connection 19 of the previously described substation. As in the case of the shunt 42, the shunt 78 is preferably provided with resistance 89. Upon completing their conversation the subscribers at the two substations replace the receivers upon their respective hooks or switches. For example, as soon as the subscriber at substation A is through talking, the receiver at this substation is hung up or replaced upon its hook or switch 11, thereby completing a circuit from the battery 5, through the connection 6 and the relay 7 and the connection 8 to the tip spring or contact 36, thence

through tip 35 and the cord circuit strand 34 to the connection 72, through this connection and the lamp 73 and connection 74 to contact 75, thence through the armature 76 and the ground or common connections 38 and 37 to the said battery 5. The establishment of this circuit in this manner is due to the breaking of the circuit through the relay 39, previously described. When this supervisory relay circuit is broken, the effect is to immediately release the armature 76 and to allow the latter to come in contact with its contact point 75. This, as explained, completes a local circuit through the supervisory lamp or signal 73, causing the latter to light up or be displayed, so as to advise the central operator that the subscribers are through talking. The central operator then removes the answering and calling plugs from the jacks of the two lines and the system, as far as the two substations shown are concerned, is then in its normal or disconnected condition.

The system shown is of the multiple switchboard character, that is to say, of that type in which each substation is connected with a plurality of jacks arranged upon different switchboards at a central station. In systems of this character, it is desirable that the operator at each switchboard be provided with means for ascertaining whether or not the substation of any certain jack is in use. The jacks C and D represent the jacks at the terminals of the two lines, while the jacks C¹ and D¹ represent similar jacks arranged upon another switchboard and having suitable connections with the same lines. The cord circuits of the different switchboards are preferably similar, and assuming that the substations A and B have been connected by the insertion of cord plugs in the jacks C¹ and D¹, the operator at the switchboard upon which the jacks C and D are located can then make what is known as a busy test, by placing the tip of a plug of the cord circuit against one of the testing rings. Should the operator, for example, at the switchboard upon which the jacks C and D are located desire to know whether the substation B is in use or not, what is known as a busy test may then be made by placing the tip 51 of the plug against the testing ring 83 of the jack D. For convenience of description and illustration, it may be assumed that the jack C is an answering jack, and that the jack D is a multiple jack of the line leading to station B. It may also be assumed that the jack C¹ is a multiple jack, and the jack D¹ an answering jack, the two being on a different board. When this is done, and the listening key operated, a circuit is immediately completed from this testing ring through plug tip 51 and the connection 50 to key 49, thence through the contact 49^a and the connection 70 to key 32 and con-

tact 32^a, through connection 30 and receiver 29, and through resistance 90 and ground or common connections 91 and 37 to the battery 5, thence through connection 6^a and 86, the lamp 79 and resistance 89 in parallel, to ring 83, to contact 85^a, through the armature 85 and connection 45^a to the ring 83 of the jack D, and thence back to the tip 51. This produces the usual change of current conditions in the talking set circuit, and produces a click or sound in the receiver 29 of the operator's talking set. This click or sound advises the operator that the substation B is already in use, and that this substation is, for example, connected up with substation A through the medium of the cord circuit of the switchboard upon which the spring jacks C¹ and D¹ are located. Vice versa, the central operator at the switchboard on which the jacks C¹ and D¹ are located can make a similar busy test, as it is called, for the purpose of ascertaining whether or not the apparatus for substation B is in use. This can be ascertained by placing the tip of the calling plug of the cord circuit at this switchboard against the testing ring 92 of the jack D¹. Thus the circuit arrangement affords opportunity for making the usual busy test. But it will be observed, however, that the change of current conditions necessary to such tests is localized, and that for this reason no objectionable sounds will be produced in the receiver of the substation with respect to which the test is made. In other words, the central operator can place the tip of the plug against the testing ring in the usual manner so as to ascertain whether or not the apparatus at the substation is in use, but in so doing the change of current conditions, in case such station is already connected up with some other substation, does not extend to the line. In this way, the lamp circuit, composed of the connections 86 and 88 operate to quiet the line in making a busy test. Ordinarily, the busy test is made in a way that produces an annoying and objectionable sound in the receiver at the substation, in case the latter is in use. With my improved circuit arrangement, however, two subscribers can be properly connected and can then carry on a conversation without being annoyed by constant busy tests. In addition to this advantage, it will also be seen that the call is answered without producing any objectionable sound in the receiver at the substation from whence the call came, and, for this reason, the circuit arrangement also tends to quiet the line in answering the call as well as in making the aforesaid busy tests. Furthermore, no objectionable or expensive electrical devices are necessary, such, for example, as repeating coils, cut-off relays, and coils in the talking circuit, all of which tend to reduce the efficiency of a telephone sys-

tem of this character. The system is fully as efficient, however, and in addition thereto the cost of installation and maintenance of the system is greatly reduced.

The condensers 23 and 33 serve to divide the cord circuit into two parts, and to insure an equal distribution of the current between the substations. With the three way plugs, the shunting arrangement, consisting, for example, of the shunt connection 42, can be employed for shunting the current and thereby extinguishing or destroying the calling signal lamp 15. It will also be seen that one side of the cord circuit and also one side of the line circuit are conveniently employed for forming part of the circuit through which the supervisory lamp is lighted. It also permits a convenient and efficient utilization of the line current supply as a means for supplying current to the supervisory lamp. As a further advantage, the supervisory relay 39 and the impedance 3, for example, are preferably and desirably arranged in parallel, thereby practically affording two sources of current supply to line Z. The testing rings or thimbles of the jacks although permanently connected with the lines, do not cause any sound in the receivers in making the busy test. This, as explained, is for the reason that when a plug tip is placed against a testing ring, the testing circuit through the operator's receiver includes the line lamp of the line being tested,—and may include the resistance 89 in parallel with said lamp,—and that no change of current conditions is created on the line. It will be understood that such is the testing circuit when the line circuit is closed by reason of the receiver at the substation being removed from the hook switch. Should the receiver still be hung up, however, and a plug of another cord circuit be in one of the jacks, then the testing circuit through the operator's receiver would include the resistance 89 of the cord circuit already in use, and would not include the line lamp of the line being tested. In either case, however, it will be seen that the test is purely local, and that consequently the circuit arrangement has a tendency to quiet the line, both in making connection and tests. If no plugs are in any of the jacks of the line being tested, but the receiver is down, then the test circuit includes the line lamp of this line, and does not include the resistance 89. Thus a line is in condition to test busy as soon as the receiver is off the hook.

What I claim as my invention is:

1. In a telephone system, the combination of a subscriber's line circuit, a line signal responsive to calls sent over the line circuit, a cord circuit shunt for restoring the line signal, a supervisory lamp and a supervisory relay, a central source of current supply nor-

mally included in the line circuit, suitable circuit connections whereby the energizing circuit of the supervisory relay includes the talking conductor on one side of the circuit, and suitable connections whereby current is furnished to the supervisory lamp through the talking conductor on the other side of the circuit together with a listening key adapted when pressed to disconnect the supervisory lamp from the circuit, and a ringing key adapted when pressed to disconnect both the lamp and relay from the circuit.

2. In a telephone system, the combination of a subscriber's line, a switch or circuit changing device for opening and closing the line circuit, a line relay adapted to be energized by the closing of the line circuit and arranged to operate a calling signal, a jack connected with the line, an operator's cord circuit provided with a plug adapted for insertion in said jack, a supervisory lamp associated with the cord circuit, a supervisory relay connected and arranged to be deenergized by the opening of the line circuit, and adapted to control the circuit of the supervisory lamp, a central source of current supply connected with the line, and suitable circuit connections whereby current is furnished from said source to the supervisory lamp through the line relay and the tip contacts of the plug and jack, together with an impedance coil in the line, the said supervisory relay and lamp and coil being locally connected with one and the same pole of said source of current.

3. In a telephone system, the combination of a subscriber's line, a subscriber's hook switch for closing and opening the line, a jack connected with the line, a source of current connected with the line, a line relay for operating a line signal, an operator's cord circuit provided with a plug adapted for insertion in said jack, a supervisory relay for operating a supervisory signal, and an energizing circuit for said supervisory relay including the ring contacts of the plug and jack and hook switch and line relay, said jack having a testing contact permanently connected with the supervisory relay to one pole of the source of current.

4. In a telephone system, the combination of a subscriber's line, a subscriber's hook switch for opening and closing the line circuit, a jack connected with the line, an operator's cord circuit provided with a plug adapted for insertion in said jack, a source of current connected with the line, a line relay for operating a line signal, an impedance coil interposed between the line and the source of current supply, a supervisory relay for operating a supervisory signal, and suitable circuit connections whereby the said impedance coil and the supervisory relay are in parallel when the plug is inserted in the

jack together with an operator's receiver, said supervisory relay and coil and receiver all being permanently connected directly with one and the same pole of the source of current.

5. In a telephone system, the combination of a subscriber's line, a subscriber's hook switch for opening and closing the line circuit, a jack connected with the line, an operator's cord circuit provided with a plug adapted for insertion in said jack, a source of current connected with the line, a line relay for operating a line signal, an impedance coil interposed between the line and the source of current supply, a supervisory relay and a supervisory lamp associated with the cord circuit, suitable connections whereby the energizing circuit of the supervisory relay includes one talking strand of the cord circuit, and circuit connections whereby the said impedance coil and the supervisory relay are in parallel when the plug is in the jack together with an operator's receiver, said supervisory relay and coil and receiver all being permanently connected directly with one and the same pole of the source of current.

6. In a telephone system, the combination of a subscriber's line, means for opening and closing the line circuit, a line relay responsive to calls sent over the line, a line signal operated by said line relay, a supervisory lamp and a supervisory relay, a central source of current supply connected with the line, an impedance coil interposed between the line and the source of current, a plug switch and suitable connections for placing the said impedance coil in parallel with the supervisory relay, and suitable connections whereby both the supervisory lamp and the supervisory relay are supplied with current through talking conductors.

7. In a telephone system, the combination of a subscriber's line, a source of current connected with the line, a jack connected with the line, an operator's cord circuit provided with a plug adapted for insertion in said jack, and suitable connections for providing parallel current paths to one side of the line, together with an operator's receiver permanently connected with said parallel paths to one and the same pole of the source of current, one parallel connection including the ring contacts of the jack and plug.

8. In a telephone system, the combination of a subscriber's line, a subscriber's hook switch for opening and closing the line, a plurality of jacks connected with the line, an operator's cord circuit provided with a plug adapted for insertion in said jacks, an operator's talking set and listening keys associated with the cord circuit, a line lamp signal and a line relay associated with the line, a source of current connected with the line, a shunt through the cord circuit for extin-

guishing or restoring the line lamp upon the insertion of the plug in one of said jacks the said line relay and line lamp and shunt being permanently connected in three branches directly with the same pole of the battery or central source of current supply, and suitable connections whereby the busy test circuit, when the line circuit is closed, includes the line lamp and also the contacts of the line relay.

9. In a telephone system, the combination of a subscriber's line, a subscriber's hook switch for opening and closing the line circuit, a plurality of jacks connected with the line, operator's cord circuits provided with plugs adapted for insertion in said jacks, a central source of current connected with the line, a line lamp signal and a line relay associated with the line, shunts through the cord circuits for extinguishing the line lamp upon the insertion of a plug in one of said jacks, an operator's talking set and listening keys associated with each cord circuit, and suitable connections whereby the busy test circuit, when the line is open and a plug in one of said jacks, includes one of said shunts the line relay and line lamp and shunts being permanently connected in separate parallel branches directly with one and the same pole of the source of current.

10. In a telephone system, the combination of a subscriber's line, a subscriber's hook switch for opening and closing the line circuit, a plurality of jacks connected with the line, operators' cord circuits provided with plugs adapted for insertion in said jacks, a line lamp signal and a line relay associated with the line, supervisory relays and supervisory lamps associated with the cord circuits, shunts through the cord circuits for extinguishing or restoring the line lamp upon the insertion of a plug in one of said jacks, an operator's talking set and listening keys associated with each cord circuit, and a local busy test circuit which, when the line is closed and a plug is in one of the jacks, includes one of said shunts, but which excludes the supervisory lamps, the local circuit formed thus operating to localize the busy test and prevent the same from extending to and being audible in the subscriber's receiver.

11. In a telephone system, a cord circuit shunt connected and arranged to be included in the busy test circuit; together with suitable line signal and supervisory signal apparatus, whereby the subscribers may signal the operator for connections and disconnections, the said supervisory signal apparatus being associated with said cord circuit; the said test circuit including the line signal device together with supervisory lamps for the opposite ends of the cord circuit, said supervisory lamps being excluded from the busy-test circuit.

12. In a telephone system of the complete metallic circuit and central energy type, the combination of a testing terminal having permanent connection with the line, a cord circuit provided with a plug, a source of current supply having permanent connection with said testing terminal, an operator's telephone and listening key, a lamp signal, and a local busy test circuit, which when closed, includes said lamp, operator's telephone and source of current supply together with supervisory lamps for the opposite ends of the cord circuit, said supervisory lamps being excluded from the busy-test circuit.

13. In a multiple switchboard and complete metallic circuit telephone system of the central energy type, an operator's cord circuit characterized by a localized busy test; together with suitable line signal and supervisory signal apparatus, whereby the subscribers may signal the operator for connections and disconnections, the said supervisory signal apparatus being associated with said cord circuit; the said test circuit including the line signal device together with supervisory lamps for the opposite ends of the cord circuit, said supervisory lamps being excluded from the busy-test circuit.

14. A telephone system, comprising substations and a central station and suitable line connection between the same, a central source of current supply, a calling signal lamp connected in parallel with each substation, a relay for closing each lamp circuit, and local circuits including said lamps for localizing the change of current conditions necessary in making a busy test, whereby such test can be made without producing any sound or noise in the receiver at the substation with respect to which the test is made together with supervisory lamps for the opposite ends of the cord circuit, said supervisory lamps being excluded from the busy-test circuit.

15. A telephone system, comprising substations and a multiple switchboard central station, complete metallic line connection between the substations and the central station, a central source of current supply, three-way plugs and jacks having terminals for testing located on the different switchboards at the central station, a line lamp at the central station adapted and arranged to form part of a local circuit for localizing the effect of touching a plug tip to a testing ring, whereby an operator at the central station can, in this way, make a busy test without having the effect of so doing extend to and be audible in the receiver at the substation with respect to which the test is made together with supervisory lamps for the opposite ends of the cord circuit, said supervisory lamps being excluded from the busy-test circuit.

16. A telephone system comprising sub-

stations and a central station with suitable plugs and jacks, complete metallic line circuits between the substations and the central station, a central source of current supply, calling lamps located in local circuits at the central station, said local circuits operating to localize the effect of touching a plug tip to a jack, whereby a central operator can, in this way, make a busy test without having the change of potential extend to and be audible in the receiver at the substation with respect to which the test is made together with supervisory lamps for the opposite ends of the cord circuit, said supervisory lamps being excluded from the busy-test circuit.

17. A telephone system comprising substations and a central station and suitable line connection between the same, a cord circuit and a supervisory electro-magnet, a central source of energy, and circuit connections whereby one side of the cord circuit and one side of the line circuit combine to form part of the supervisory electro-magnet circuit together with line lamps and line relays all permanently connected directly with one and the same pole of the source of current, and a key switch for opening and closing said circuit.

18. A telephone system comprising substations and a central station and suitable line connection between the same, a cord circuit, a supervisory lamp, means for sup-

plying current, and connections whereby one side of the cord circuit and one side of the line circuit combine to form part of a supervisory lamp circuit together with line lamps and line relays all permanently connected directly with one and the same pole of the source of current, and a key switch for opening and closing said circuit.

19. A telephone system comprising substations and a central station and suitable line connection between the same, jacks having testing terminals at the central station, a cord circuit with three-way plugs, a central source of current supply, local circuits containing calling signal lamps, relays for closing said local circuits, supervisory lamps, relays for controlling said supervisory lamps, shunts through the cord circuit for extinguishing the calling signal lamps when the plugs are inserted in the jacks, and connections whereby one side of the cord circuit and one side of the line circuit combine to form part of the supervisory lamp circuits, and whereby the calling lamp circuits operate to quiet the line in making a busy test.

Signed by me at Chicago, Cook county, Illinois, this 1st day of August, 1903.

ALFRED H. DYSON.

Witnesses:

A. F. DURAND,
WM. A. HARDEAS.