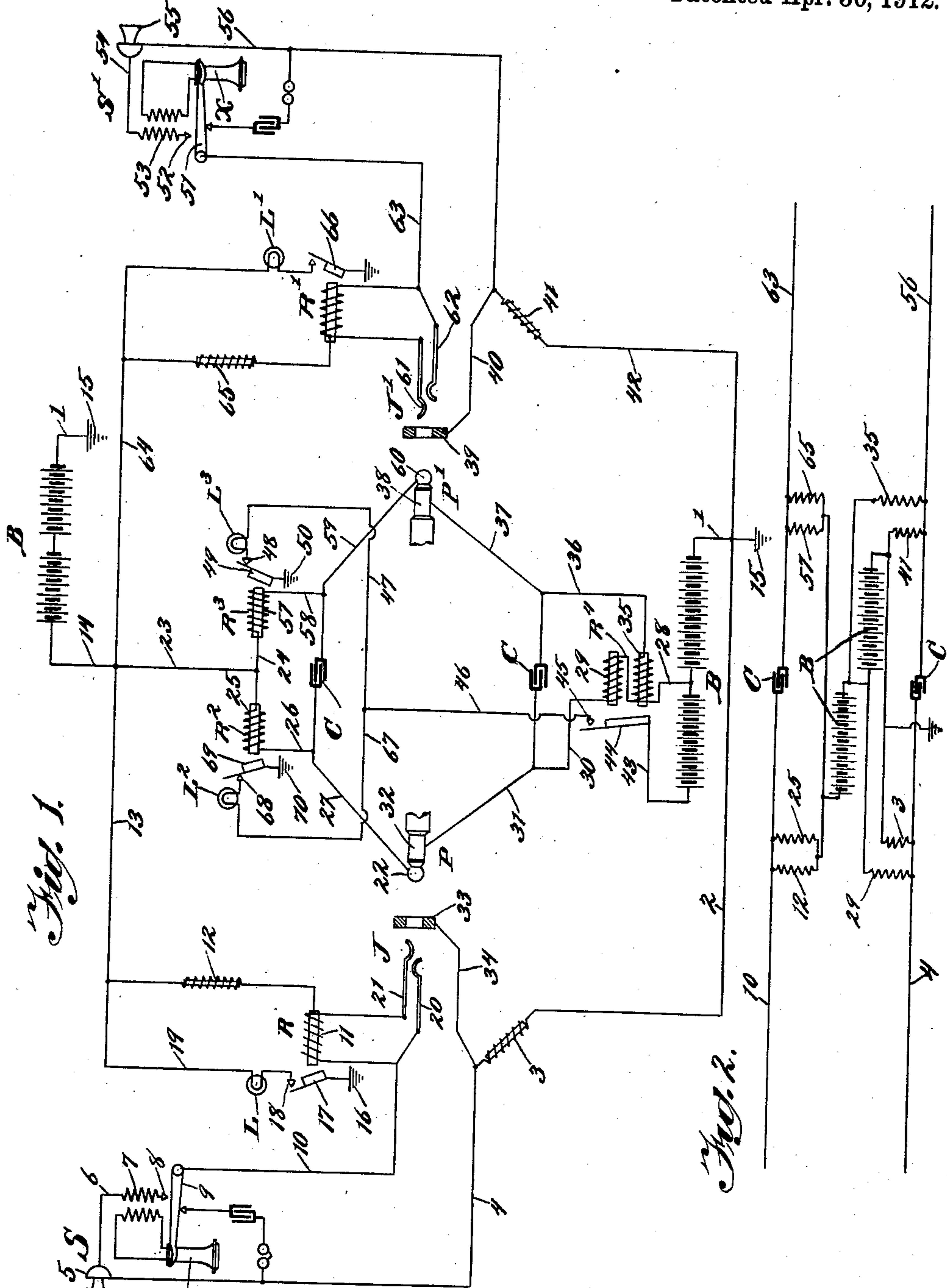


H. P. CLAUSEN.
TELEPHONE SYSTEM.
APPLICATION FILED FEB. 3, 1902.

1,024,498.

Patented Apr. 30, 1912.



Witnesses
Arthur F. Leland
Robert H. Meier

Inventor:
H. P. Clausen,
By Charles C. Buckley

UNITED STATES PATENT OFFICE.

HENRY P. CLAUSEN, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

TELEPHONE SYSTEM.

1,024,498.

Specification of Letters Patent.

Patented Apr. 30, 1912.

Application filed February 3, 1902. Serial No. 92,279.

To all whom it may concern:

Be it known that I, HENRY P. CLAUSEN, a citizen of the United States of America, and residing at Chicago, Cook county, 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 general, but more particularly to systems in which complete metallic circuits are employed between the substations and the central exchange, and especially to systems in which all of the current, both for talking and signaling purposes, is supplied from a common battery located at the central exchange. In telephone systems of this character it is usually the practice to provide calling or line signals, whereby the subscribers may call up the central operator, and also to provide supervisory or clearing-out signals. As stated, the line or calling signals are for the purpose of enabling the subscribers to attract the attention of the central operator, and are usually brought into action by the removal of the receiver from the hook at the substations. The said supervisory or clearing-out signals are usually associated with the cord circuit, which latter is employed by the central operator for establishing connection between the lines of any two subscribers. It is usually the practice to provide suitable relays and local circuits, whereby these supervisory or clearing-out signals can be operated or brought into action by the hanging up of the receiver at the substations. In this way, the taking down of a receiver at a substation automatically signals the central operator, who then makes the desired connection, and when the subscribers then hang up their receivers, the supervisory signals are automatically operated, thereby indicating to the central operator that the subscribers have finished their conversation. As stated, it is usually the practice in systems of this character to operate the various instruments, including the substation apparatus, and the relays, signals, and other devices at the central exchange, by current supplied from a battery or other suitable source of current located at the central station. Preferably, the said line and supervisory signals consist of small incandescent lamps arranged in such position as to be easily observed by the central operator. The

arrangement is also preferably such that the central operator in answering a call automatically restores or extinguishes the line lamp. Ordinarily this automatic restoration of the line signal is accomplished by the insertion of the answering plug of the operator's cord circuit in the jack allotted to the calling subscriber's line.

Generally stated, it is the object of my invention to provide a simple, serviceable, and highly efficient system of the foregoing character.

A special object is to provide an improved circuit arrangement for operating the line or calling signals.

A further object is to provide a simple and improved circuit arrangement for operating the supervisory or clearing-out signals. It is also an object to provide certain details and features of improvement tending to increase the general efficiency, and to render a system of this character more reliable and less expensive to install and maintain.

To the foregoing and other useful ends, my invention consists in matters herein after set forth and claimed.

In the accompanying drawings, Figure 1 illustrates a telephone system embodying the principles of my invention, it being observed that only two substations, together with a cord circuit and suitable connections, are shown, and it being understood that only such instruments and devices are illustrated as are necessary to a full understanding of the invention. Fig. 2 is a simplified diagram showing the manner in which the current is supplied to the lines after a talking circuit has been established by the insertion of the plugs in the jacks.

As thus illustrated, it will be seen that the system may comprise subscriber's talking sets of any suitable known or approved character located at the substations S and S'. Complete metallic line connection is preferably employed between the substation apparatus and the jacks J and J', which latter are mounted in the usual manner on the switchboard at the central station. Preferably, these jacks are each constructed with three contacts, as shown; and the line relays R and R', which may be of any suitable construction, have their terminals connected with the springs of the said jacks. The

switchboard apparatus involves the usual cord circuit for connecting the lines, the plugs P and P', in which the parallel talking strands terminate being adapted for insertion in the jacks. It will be observed that each plug is provided with a tip adapted to make contact with both of the springs of a spring jack. Furthermore, the cord circuit includes supervisory relays R^2 , R^3 and R^4 adapted for conjointly controlling the two supervisory lamps which are mounted in the usual manner upon the switchboard. Lamps controlled by the line relays are also employed as line signals. With the arrangement shown, the centralized battery B is permanently connected with the lines, and this battery is also bridged across the cord circuit. In this way, and when the two lines are connected, current is furnished directly to the lines, and also through the coils of the supervisory relays, and through the plugs and jacks to the lines. Preferably, each talking strand of the cord circuit is provided with a condenser to stop the flow of battery current. It will be observed that the supervisory relay coils are connected in parallel with these condensers. The operator's talking set and the means for supplying ringing current to the lines, can be of any suitable or desired character. As thus constructed, and assuming that the subscriber at substation S desires connection with the subscriber at substation S', the operations and circuit connections which then take place are substantially as follows: When the subscriber at substation S takes down the receiver X, a line circuit is then completed from the battery B through conductors 1 and 2, through impedance coil 3, through line conductor 4, thence through the transmitter 5 and the conductor 6, through the primary 7 of the induction coil, through contact points 8 and the switch-hook 9, through the line conductor 10, thence through the coil 11 of line relay R, through the impedance coil 12, and thence through conductors 13 and 14 to the battery B. This energizes the relay R and causes the latter to attract its armature. When attracted, the armature of said relay closes a short-circuit from the battery B through the conductor 7, through the ground or common connections 15 and 16, through the said armature 17, through contact-point 18 and line lamp L, thence through conductors 19 and 13, and through conductor 14 to the battery. The current flowing from the battery through this local circuit lights the lamp L, indicating to the central operator that the subscriber has sent in a call. In order to answer this call and ascertain the number of the substation with which the calling subscriber desires connection, the central operator then inserts the answering plug P of the operator's cord circuit in the jack J. This

jack, it will be observed, is connected with the line leading from the central station to the substation S. The insertion of this plug operates to short-circuit the relay R, it being observed that when the plug is inserted the current passes from spring 20 through the tip 22 and thence through spring 21 to the resistance 12, rather than through the coil 11 of said relay. In this way, the insertion of the plug serves to automatically shunt out the line relay and to allow the latter to release its armature. The release of the line relay armature breaks the local circuit including the lamp L. Thus the operator in answering the call automatically extinguishes or restores the line signal.

It will be understood that after inserting the answering plug, the operator communicates with the calling subscriber through the medium of the usual operator's talking set, which can be of any suitable form and character. It will also be seen that the insertion of the answering plug operates to complete a line circuit from the battery through conductors 23 and 24, through the coil 25 of the supervisory relay R^2 , thence through conductor 26 and the cord-strand 27, through the tip 22 of the answering plug, through the tip-spring 20 of the jack, thence through line conductor 10 to the switch-hook 9, from the latter through contact point 8, the primary 7 of the induction coil, through the conductor 6, thence through transmitter 5, through the line conductor 4, through the impedance coil 3, and through the conductor 2 to said battery. This energizes the supervisory relay R^2 , so as to prevent the supervisory lamp L^2 from lighting. In addition to the foregoing, the insertion of the answering plug also serves to complete a local circuit from the battery through conductor 28, through the coil 29 of the supervisory relay R^4 , through the conductor 30, thence through the cord-strand 31 to the sleeve contact 32 of the plug, through the ring or thimble 33 of the jack, thence through the conductor 34 and the impedance coil 3, and through the conductors 2 and 1 to the battery. This energizes the relay R^4 , and the latter in attracting its armature would close a local circuit through the lamp L^2 , were it not for the fact that the energization of relay R^2 has broken the circuit of this lamp. As stated, however, the insertion of the answering plug in the jack energizes the relay R^2 , thereby preventing the supervisory lamp L^2 from being lighted by the simultaneous closing of the circuit through the relay R^4 . In this way, the central operator is enabled to answer a call and to automatically extinguish the lamp L without lighting the lamp L^2 .

After learning the number of the substation with which the calling subscriber desires connection, the central operator then

inserts the plug P' of the cord-circuit in the
 jack J', which latter is connected with the
 line of the substation S'. The insertion of
 the calling plug in this manner completes a
 5 local circuit from the battery through the
 coil 35 of the supervisory relay R⁴, through
 conductor 36 and cord-strand 37, thence
 through the sleeve-contact 38 of the calling
 plug, through the thimble or ring 39 of the
 10 jack, thence through the conductor 40 and
 the impedance coil 41, and through the con-
 ductor 42 and back to said battery. This, it
 will be seen, serves to energize the other coil
 of the supervisory relay R⁴, which latter
 15 controls the local circuits for the two super-
 visory lamps. At this juncture, it will be
 seen that the energization of this relay by
 the insertion of the answering plug in the
 jack J serves to close the connection between
 20 the battery and the lamps, in the manner
 stated, and to complete a short local circuit
 from the battery through the conductor 43,
 through the armature 44 of said relay,
 thence through contact point 45 and con-
 25 ductor 46, through the conductor 47, thence
 through the supervisory lamp L³, through
 contact point 48 and armature 49 of the
 supervisory relay R³, and thence through
 the ground or common connections 50 and
 30 15, and back to said battery. In this way,
 the supervisory lamp L³, which is associated
 with the calling plug, is lighted by the in-
 sertion of the answering plug, and remains
 so lighted until the subscriber at substation
 35 S' answers the call. As soon as the sub-
 scriber answers the call, however, it will be
 seen that a line circuit is completed from the
 hook switch 51, through contact point 52
 and the primary 53 of the induction coil,
 40 through conductor 54, thence through the
 transmitter 55, through the line conductor
 56, through the impedance coil 41 and con-
 ductor 42, to the battery, from the battery
 through conductors 14 and 23, thence
 45 through conductor 24 and the coil 57 of
 supervisory relay R³, thence through the
 conductor 58 and the cord-strand 59, through
 the tip contact 60 of the calling-plug,
 through the tip contact 62, thence through
 50 the line conductor to the said hook-switch
 at the substation. The completion of this
 line circuit serves to energize the relay R³,
 and the latter in attracting its armature 49
 breaks the circuit through which the lamp
 55 L³ is lighted. In this way, the called-for
 subscriber in answering the call automati-
 cally extinguishes the lamp L³, thereby indi-
 cating to the central operator that the call
 has been answered. It will also be seen that
 60 when the subscriber at substation S' answers
 a call, a line circuit is completed from the
 battery through the conductors 14 and 64,
 and the impedance coil 65, through contacts
 61, 60 and 62, thence through the line con-
 65 ductor 63, through the switch-hook 51 and

contact point 52, through the coil 53 and the
 conductor 54, through transmitter 55 and
 the line conductor 56, thence through the
 impedance 41 and conductor 42, and through
 the conductor 7 and back to said battery. In
 this way, the contacts 60, 61 and 62 short-cir-
 70 cuit the line relay R' when the subscriber at
 substation S' answers the call, substantially
 in the same manner that the line relay R is
 short-circuited and cut-out when the answer-
 75 ing plug is inserted. For this reason, the
 relay R' does not attract its armature 66
 when the called-for subscriber answers the
 call, and consequently the line lamp L' does
 not light.

With both plugs inserted, and with the
 receivers at the substations removed from
 the hook-switches, a talking circuit is estab-
 lished from one substation to the other
 through the medium of the parallel strands
 85 of the cord circuit, and the subscribers are
 enabled to carry on their conversation. At
 this juncture it will be observed that a con-
 denser C is preferably provided for each
 strand of the cord circuit, and in this way
 90 the latter is divided into two parts which
 are inductively connected to transmit voice
 currents, but which are conductively dis-
 continuous as far as battery current is con-
 cerned. When the subscriber at substation
 95 S hangs up the receiver, the opening up of
 the line circuit deenergizes the relay R², and
 the armature of the latter when released
 completes a local circuit from the battery
 through conductor 43, and armature 44,
 100 through contact point 45 and conductor 46,
 through conductor 67 and the supervisory
 lamp L², thence through contact-point 68
 and armature 69, and through the ground
 or common connections 70 and 15 to said
 105 battery. The current flowing from the bat-
 tery through this local circuit lights the
 supervisory lamp L², and in this way the
 central operator is advised that the calling
 subscriber has hung up the receiver. In a
 110 similar manner, when the called-for sub-
 scriber at substation S' hangs up the re-
 ceiver X', a local circuit is completed
 through the lamp L³, in the manner previ-
 ously described, and for the purpose of
 115 lighting this lamp, so as to indicate that the
 called-for subscriber has also hung up the
 receiver. Thus the subscribers, having fin-
 ished their conversation, automatically sig-
 nal for a disconnection by hanging up their
 120 receivers. Upon observing these signals, the
 central operator withdraws both plugs of
 the cord-circuits, and the system, as far as
 the two substations shown are concerned, is
 then in its normal or disconnected condition.

With respect to the calling up of the sub-
 scriber at substation S' by the operator, it
 will be readily understood that this can be
 accomplished in any suitable manner, as,
 for example, by providing the operator's

cord-circuit with the usual generator and ringing key. With such provision the operator can establish connection between the generator and any of the substation lines, and can then project ringing current on to the subscriber's line for the purpose of ringing the bell at the substation. It will also be understood, as previously stated, that the operator's talking set by which the latter communicates with any subscriber may be of any suitable form or character, and can involve the usual listening key.

Fig. 2 illustrates, in a simplified manner, the connections existing between the battery and the talking circuit during conversation—that is to say, at the time that the two lines are connected for talking. At such time, it will be seen that current is supplied through all of the different coils to the talking circuit at points each side of the two condensers C, which latter are located in opposite sides of the circuit.

Thus it will be seen that the system, although simple and involving only a two-way cord-circuit, has substantially all the advantages of more complicated systems and is characterized by approved methods of operation. It will also be observed that the line signals are extinguished or restored in a simple and advantageous manner, preferably, as explained, by employing the plug tips and jack springs as shunts for shunting out the line relays R and R'. In this way the shunting out of the line relays is accomplished without employing any portion of the cord-strands, it being understood that the relays R² and R³ are preferably of relatively high resistance, whereas the coils 12 and 65, and also the relays R and R', are of relatively low resistance. In this way, as stated, the current is shunted through the line shunts, rather than through cord-circuit shunts, in extinguishing the line signals. With this arrangement, therefore, current is supplied directly to the lines from a common battery or source of current supply. The supervisory signals are also operated in a simple and efficient manner. It will be understood that the resistance of the various coils and relays can be readily regulated or adjusted by those skilled in the art, and in accordance with conditions. It will be seen, furthermore, that each supervisory lamp circuit is provided with two switch-points, one normally closed and one normally open, and that supervisory relays are provided for controlling these switch-points. When the line circuits are closed and before the plugs are inserted, only the line relays are energized. When the plugs are then inserted, and while the lines are closed, the line relays are shunted out and the supervisory relays are energized. Also, when the lines are opened and the plugs in, the relays controlling the normally closed switch-

points of the supervisory lamp circuits are deenergized, thereby causing the supervisory lamps to light. In this way, the circuit changing devices at the substations are closed to energize the line relays, so as to light the line lamps, but are opened for the purpose of deenergizing certain of the supervisory relays, so as to light the supervisory lamps. With this simplified arrangement, the system is easily and inexpensively installed and maintained. Furthermore, no disturbances are created on the line which are audible in the subscriber's receiver when the central operator answers a call. In this way, the improved circuit arrangement tends to quiet the lines.

What I claim as my invention is—

1. In a telephone system, the combination of substations and a central station and line connections between the same, a source of current supply connected with the lines, line relays, circuit-changing devices at the substations for closing the line circuits in which said relays are located, normally open local circuits including said source of current supply, said local circuits having switch-points controlled by said relays, line lamp signals located in said local circuits, jacks connected with the lines, an operator's cord-circuit provided with a pair of plugs, each jack being provided with a pair of tip springs forming a normally open shunt around one of said relays, and said plugs being provided with tip contacts adapted to engage said springs, so as to close said shunts.

2. In a telephone system, the combination of a subscriber's line, an electro-magnet in the line, a normally open shunt in the line around said magnet, and a two-way operator's cord-circuit having a plug provided with a tip adapted to be inserted in the normally open point or gap in said shunt together with a talking and signaling battery bridged across the cord circuit.

3. In a telephone system, the combination of a subscriber's line, a line relay in the line, a local circuit including a source of current, a line lamp signal in said local circuit, a circuit-changing device for closing the line circuit, and thereby energizing said relay, so as to close said local circuit, a normally open shunt in the line around said relay, and a two way operator's cord circuit having a plug provided with a tip adapted to close the normally open point in said shunt together with a talking and signaling battery bridged across the cord circuit.

4. In a telephone system, the combination of a substation and a central station and suitable line connection between the same, a central source of current connected with the line, a jack connected with the line, a line relay located in the line, a local circuit controlled by said relay and including said source or current, a line lamp signal located in said local

circuit, said jack being provided with a pair of contact springs included in a shunt around said relay, and an operator's cord-circuit provided with a plug having tip and sleeve contacts, the tip contact of said plug being adapted to engage said springs and close said shunt.

5. In a telephone system, the combination of a substation a central station and a line connected between the same, a line signal, a circuit-changing device at the substation for effecting the operation of the said line signal, a normally open shunt in the line, and a circuit-changing device for closing said shunt, so as to restore said signal together with a pair of talking strands connected with said last-mentioned circuit changing device, and a talking and signaling battery bridged across said talking strands.

6. In a telephone system, the combination of substations and a central station and suitable line connections between the same, circuit-changing devices at the substations for closing the line circuits, a central source of current supply permanently connected with the lines, jacks connected with the lines, each jack having a pair of tip contact springs, line relays located in the lines, normally open shunts around said relays including said tip contact springs, local circuits controlled by said relays and including said source of current supply, line lamp signals located in said local circuits, and an operator's two-way cord-circuit having plugs provided with tip and sleeve contacts, the tip contacts of the plugs being adapted to engage the said springs for the purpose of closing the said shunts.

7. In a telephone system, the combination of substations and a central station and complete metallic line connection between the same, a central source of current permanently connected to the line, line relays located in the lines, local circuits controlled by said relays and including said source of current supply, line lamp signals located in said local circuits, jacks connected with the lines, normally open shunts around said relays, each shunt including certain contact pieces of one of said jacks, an operator's cord-circuit provided with answering and calling plugs, supervisory lamp signals associated with said cord-circuit, the local circuit of each supervisory lamp having two switch-points, one normally open and the other normally closed, relays connected with the cord-circuit and arranged to control the said switch-points, and circuit-changing devices at the substations adapted to control the said line relays and also adapted to control said relays which control the normally closed switch-points of the supervisory lamp circuits.

8. In a telephone system, the combination

of substations and a central station and suitable line connection between the same, circuit-changing devices at the substations, a source of current connected with the lines, line relays, local circuits controlled by said relays and including said source of current, line lamps in said local circuits, jacks and a two-way cord-circuit for establishing connection between the lines, normally open shunts in the lines for cutting out or de-energizing said line relays, said shunts being closed by the insertion of said plugs in the jacks, two supervisory lamps associated with the cord-circuit, local circuits for said lamps including said source of current supply, the local circuit of each supervisory lamp having two switch-points, one normally closed and the other normally open, and relays connected with the cord-circuit and arranged to control said switch-points, the relays which control the normally closed switch-points being in parallel with the line relays when the plugs are inserted.

9. In a telephone system, the combination of substations, a central station, and suitable line connections between the same, jacks and a cord-circuit for establishing connection between the lines, electro-magnets in the lines, line signals controlled by said electro-magnets, normally open shunts in the lines for cutting-out or deenergizing said electro-magnets, said shunts being closed when the plugs are inserted in the jacks, a source of current permanently connected with the line, said source of current being also connected with the cord-circuit, supervisory signals associated with the cord-circuit, electro-magnets connected with the cord-circuit for controlling said supervisory signals, and circuit-changing devices at the substations, the electro-magnets in the lines being energized when the line circuits are closed by said circuit-changing devices, and certain of the electro-magnets connected with the cord-circuit being deenergized when the line-circuits are broken by said circuit-changing devices.

10. In a telephone system, the combination of substations, a central station, and suitable line connections between the same, hook-switches at the substations for opening and closing the line circuits, jacks and an operator's cord-circuit for establishing connection between the lines, a central source of current permanently connected with the lines, a condenser in each talking strand of the cord-circuit, relays located in the lines, normally open shunts in the lines around said line relays, local circuits controlled by said relays and including said source of current, line lamp signals in said local circuits, answering and calling plugs adapted when inserted in the jacks to close said shunts, supervisory lamps associated with the cord-circuit, the local circuit of each supervisory

lamp including said source of current and having two switch-points, one switch-point normally open and the other normally closed, and relays connected in parallel with the said condensers and arranged to control said switch-points in the circuits of the supervisory lamps.

11. In a telephone system, the combination of substations a central station and suitable line connections between the same, a central source of current at the central station permanently connected with the lines, impedance coils interposed between the source of current and the substations, jacks connected with the lines at points outside of said impedance coils, a cord-circuit having answering and calling plugs adapted for insertion in said jacks, line relays located in the lines at points outside of certain of said impedance coils, normally open shunts in the lines around said line relays, each shunt including contact pieces of said jacks, local circuits controlled by said line relays and including said source of current supply, line lamp signals located in said local circuits, supervisory lamps associated with the cord-circuit, the local circuit of each supervisory lamp including said source of current and having two switch-points, one switch-point normally closed and the other normally open, a condenser in one strand of the cord-circuit, supervisory relays connected in parallel with said condenser and arranged to control said normally closed switch-points, a connection leading from the source of current to a point between said supervisory relays, hook-switches at the substations for opening and closing the line circuits, the said line relays being energized when the line circuits are closed and before the plugs are inserted, the line relays being deenergized and the supervisory relays energized when the line circuits are closed and the plugs inserted, and a third supervisory relay adapted to control the normally open switch-point in the supervisory lamp circuits, said third supervisory relay having two local circuits each including the sleeve and ring contacts of the plugs and jacks.

12. In a telephone system, the combination of a line relay, and of a pair of springs and a plug tip for closing a shunt around

said relay together with a lamp signal controlled by said relay, and a battery connected and arranged for both talking and signaling purposes, and also for energizing said relay and lighting said lamp signal.

13. In a telephone system, the combination of a line relay, and of a line shunt for deenergizing said relay together with a lamp signal adapted to be controlled by said relay and a battery adapted to furnish current for both talking and signaling purposes, and for energizing said relay and lighting said lamp signal.

14. A common battery telephone system comprising a line relay, a normally open shunt around said relay, a two-way cord-circuit provided with a plug having a contact adapted in itself to electrically close the normally open gap in the shunt around said line relay, and a supervisory relay excluded from said shunt and energized over a path including said contact.

15. A common battery telephone system comprising a line relay, a plug contact adapted in itself to close a normally open gap in a shunt extending around said line relay, and a supervisory relay excluded from said shunt and energized over a path including said contact.

16. A telephone exchange system comprising a normally open line relay shunt circuit completed when a connection is made with the line, the shunt around the line relay comprising a pair of jack springs and a single plug contact, and the said system also comprising a supervisory relay circuit completed when a connection is made with the line.

17. In a telephone system, the combination with a telephone line, of a three-contact jack therefor, a two-contact plug for insertion into the jack, a pair of contacts of said jack being adapted to be short-circuited by a contact of said plug, and a line relay connected between said pair of contacts of the jack.

Signed by me at Chicago, Cook county, Illinois, this 30th day of January 1902.

HENRY P. CLAUSEN.

Witnesses:

ARTHUR F. DURAND,

HARRY P. BAUMGARTNER.