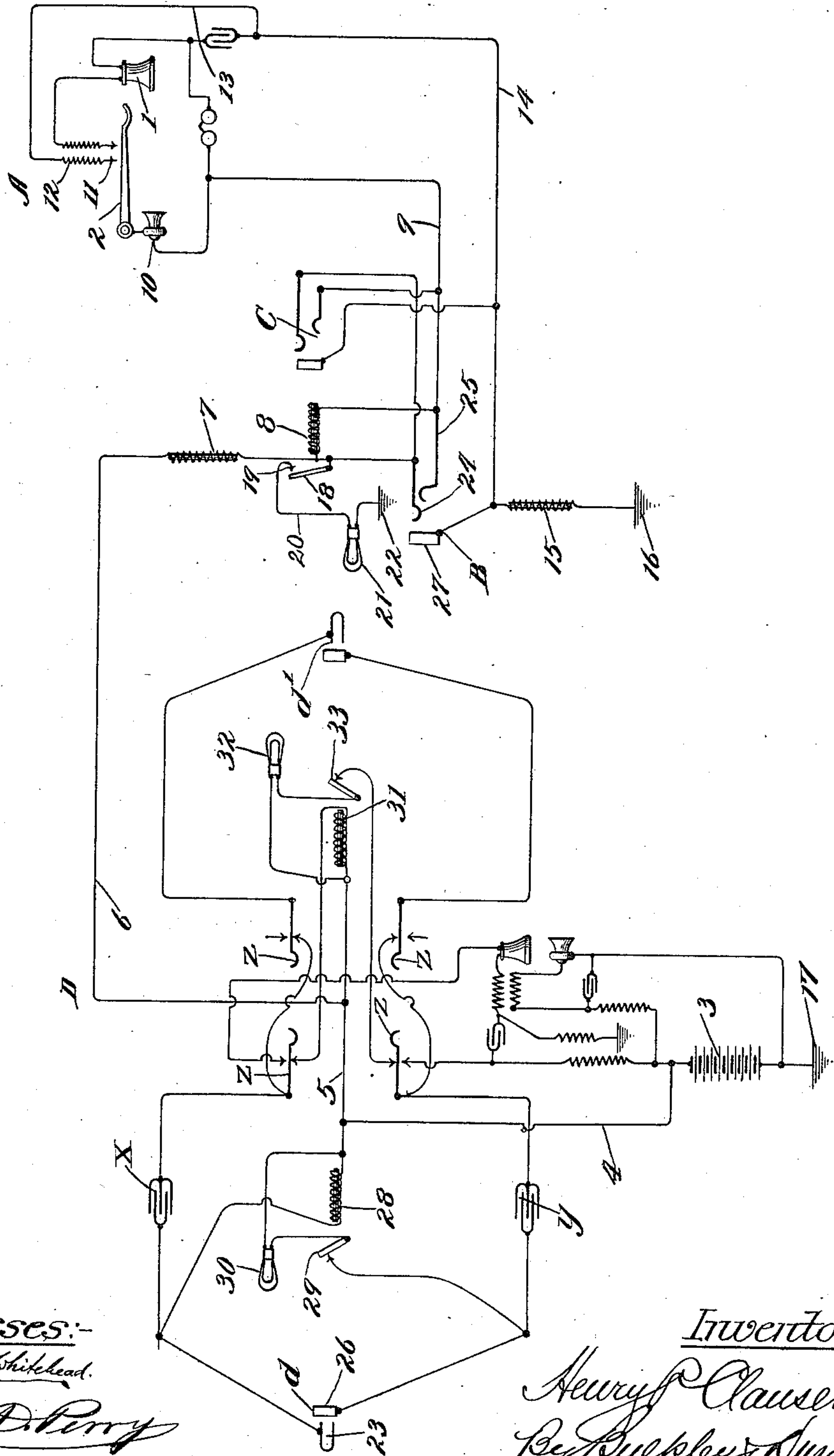


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TELEPHONE SYSTEM.  
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1,043,300.

Patented Nov. 5, 1912.



Witnesses:-

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# UNITED STATES PATENT OFFICE.

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## TELEPHONE SYSTEM.

1,043,300.

Specification of Letters Patent.

Patented Nov. 5, 1912.

Application filed March 11, 1903. Serial No. 147,323.

*To all whom it may concern:*

Be it known that I, HENRY P. CLAUSEN, 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 that type of telephone system in which all of the current, both for talking and signaling purposes is supplied from suitable sources located at the exchange or central station.

Generally stated, the object of my invention is the provision of an improved and highly efficient telephone system of the common battery or central energy type.

A special object is to provide an improved arrangement and mode of operation of the supervisory and line signals.

Another object is to provide an improved construction and arrangement of the circuits and impedance coils through which the current is supplied to the subscribers' lines.

It is also an object to provide certain details and features of improvement tending to increase the general efficiency and serviceability of a telephone system of this particular character.

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

The accompanying drawing is a diagram illustrating a subscriber's line and telephone set, and showing also the construction and arrangement of the line signal apparatus, and also the construction and arrangement of one of the operator's cord-circuits. As thus illustrated, my invention may comprise a subscriber's telephone set A, of any suitable known or approved construction. This telephone set may have complete metallic line connection with the answering jack B and the multiple jack C on the switchboard at the exchange or central station. It will be understood that any number of multiple jacks can be connected with the line leading from the answering jack on the switchboard.

The operator's cord-circuit D may constitute a portion of the apparatus of the switchboard upon which the subscriber's line terminates, and is preferably provided at its ends with plugs *d*, *d'*. These plugs can

be of the usual and well known construction, each one being adapted for insertion in a spring-jack connected with the subscriber's line, and each one being provided with tip and sleeve contacts. With this arrangement the cord-circuit is of the two-way type.

For convenience in illustration, only one subscriber's telephone set and line circuit is shown, it being understood that the balance of the subscribers' telephone sets and line circuits can be of the same character as that shown in the drawing, and that any practicable number of lines may terminate at the switchboard upon which the jacks B and C and the cord-circuit D with its plugs are located. As is well understood, the said cord-circuit and plugs constitute the medium by which the operator establishes connection between any two subscribers' lines, the answering plug of the cord-circuit, when the two lines are connected, being inserted in the calling subscriber's jack, and the calling plug in the jack connected with the calling subscriber's line. This, however, will be better understood by considering the various operations and circuit connections which necessarily take place in connecting up two subscribers.

For example, assuming that the subscriber at substation A desires to talk to another subscriber, the removal of the receiver 1 from the hook-switch 2 completes a line circuit from the battery 3 at the central station, through the connections 4, 5 and 6, through the impedance coil 7, through the line relay 8, through the limb or line conductor 9, thence through the subscriber's transmitter 10, through the said hook-switch 2, through the contact point 11, through the primary 12 of the induction coil, through the conductor 13, thence through the other limb or line conductor 14, through the other impedance coil 15, and thence through the ground or common connections 16 and 17 at the central exchange or central station to said battery. The current flowing from the battery through this closed line circuit is sufficient to energize the line relay 8, thereby causing it to attract its armature 18. When attracted, this armature closes a local circuit from the battery 3, through the conductors 4, 5 and 6, through the impedance



coil 7, through the said armature 18 and its contact-point 19, thence through the conductor 20 and the line lamp signal 21, and through the ground or common connections 22 and 17 to said battery. The amount of current thus allowed to flow through this closed local circuit is sufficient to cause the lamp 21 to rise to full glow. The operator at the central station or exchange, observing this signal, understands that the subscriber at substation A has sent in a call for connection with some other subscriber's line. Accordingly, the operator then inserts the answering plug of the cord-circuit, which may be the plug *d* in the answering-jack B, which latter is connected with the calling subscriber's line. This act, it will be seen, operates to short-circuit the relay 8, the tip contact 23 of the plug being long enough to make contact with both springs 24 and 25 of the jack, while the sleeve contact 26 of the plug only makes contact with the testing ring or thimble 27 of the jack. Thus, in answering the call, the line relay is automatically short-circuited by the tip of the plug, and by thus deenergizing the relay releases its armature and opens the circuit of the line lamp signal. At such time, the current for talking purposes is fed from one pole of the battery through one side of the line, through the impedance coil 7 and the contacts 23, 24 and 25, and through the other pole of the battery through the impedance coil 15. The insertion of the answering plug in this manner also places the supervisory relay 28 in the line circuit, causing it to attract its armature 29, and thereby preventing the flow of current through the supervisory lamp signal 30.

Having thus established connection with the line, the operator then communicates with the subscriber in the usual well known manner, and upon learning the number of the connection desired, then proceeds to make the proper connection.

Assuming that the subscriber at substation A desires connection with a subscriber's line having a multiple jack located on the same board on which the answering jack B is located, the operator then inserts the calling plug *d'* in said multiple jack, it being understood that the line circuit of the called subscriber will preferably be the same as that shown in the drawing, and that the called subscriber's telephone apparatus, answering jack line signal, etc., may be duplicates of the apparatus, jacks, and relays illustrated as constituting the apparatus of the calling subscriber's line circuit. The insertion of the calling plug in the multiple jack connected with the called subscriber's line complete a short circuit around the line relay of the called subscriber's line in the same manner that the insertion of the answering plug served, as explained, to

short-circuit the line relay of the calling subscriber's line. Also, the insertion of the calling plug into the multiple jack connected with the called subscriber's line operates to place the supervisory relay 31 in the line circuit, but in as much as this line circuit of the called subscriber's line is still open, the said relay receives no current, and consequently current from the battery 3 is free to flow from the battery 3 through the supervisory lamp 32, thence through the sleeve contacts of the calling plug and the multiple jack of the called subscriber's line, and thence back through the ground or common connections to said battery. This signal, as is well known, advises the operator that the called subscriber has not answered the call. The operator then signals the called subscriber in the usual and well known manner until the latter answers the call. When the called subscriber answers the call by removing the receiver from the hook-switch, the line circuit is then closed, the supervisory relay 31 becomes energized, and the movement of the armature 33 away from its contact then opens the circuit of the lamp 32. The obliteration of this signal advises the operator that the called subscriber has answered the call and that the two subscribers are now in communication with each other. It will be readily understood that the operator's head telephone, etc., and also the means for signaling the called subscriber, can be of any suitable known or approved character.

With the two subscribers thus connected up, the talking circuit between the two substations includes the limbs of the two lines, the tip and sleeve contacts of the plugs and jacks, and the tip and sleeve strands of the cord-circuit. It will be observed that the answering end of the cord-circuit is preferably provided with condensers X and Y, which are located in the two talking strands at points between the answering plug and the springs Z of the ringing and listening keys. In this way the talking circuit is divided into two inductively connected halves, and the current is fed from one pole of the battery through the cord-circuit and the impedance coil and jack springs and tip contacts of the plugs to one side of the cord circuit, and directly from the other pole of the battery through the ground or common connections and the impedance coils to the other side of the circuit.

When the subscribers have finished talking and have hung up their receivers, the opening of the line circuits takes the current away from the relays 28 and 31, thereby allowing the armatures 29 and 33 to close the circuits of the lamps 30 and 32, it being understood that the energizing circuit of each supervisory relay includes the switch-hook of a subscriber's apparatus. The operator,



observing these two signals, understands that the subscribers have finished talking and have hung up their receivers.

From the foregoing, it will be seen that the invention contemplates a simple and highly efficient telephone system in which only two strands are necessary for the cord-circuit, and in which the system is, at the same time, characterized by all or at least most of the approved methods of operation. Other advantages will be obvious to those skilled in the art.

It will be readily understood that the resistances of the various relays, impedance coils, etc., can be varied or changed to suit the requirements of any particular case, and in such manner as to insure the desired results.

I claim as my invention:—

1. In a telephone system, the combination of a subscriber's line, substation apparatus including a hook-switch for opening and closing the line circuit, switchboard apparatus including a spring-jack and a line relay connected with the subscriber's line and including also an operator's cord-circuit provided with a plug adapted for insertion in said jack, a battery at the central station connected and arranged for supplying current to the line for both talking and signaling purposes, an impedance coil in series with said line relay between one side of the line and one pole of said battery, and a line lamp signal having a local circuit provided with a normally open switch point controlled by said line relay said local circuit including said impedance coil, and the said plug having a tip contact adapted to short-circuit the said line relay when inserted in the jack.

2. In a telephone system, the combination of a subscriber's line, substation apparatus involving a subscriber's hook switch for opening and closing the line circuit, a battery at the central station connected and arranged for supplying current to the line for both signaling and talking purposes, a line relay and impedance coil connected in series and serving as medium of connection between one side of the line and one pole of said battery, another impedance coil serving as medium of connection between the other side of the line and the other pole of the battery and a line lamp signal having a local circuit provided with a normally open switch-point controlled by said relay, said local circuit including said battery and one of said impedance coils.

3. In a telephone system, the combination of a subscriber's line, substation apparatus including a subscriber's hook-switch for opening and closing the line circuit, a spring jack in which said line terminates, a suitable line signal associated with said jack and adapted to be controlled by said hook-

switch, a battery at the central station connected and arranged for supplying current to the line for both talking and signaling purposes, an operator's cord-circuit provided with a plug adapted for insertion in said jack, a supervisory relay associated with the cord-circuit and adapted to serve as medium of connection between the tip of said plug and one pole of said battery, suitable connection between the thimble or testing ring of the jack and the other pole of said battery, and a supervisory lamp having a local circuit including the battery and contacts of said supervisory relay and including also the sleeve contacts of the plug and jack, but excluding the substation apparatus.

4. In a telephone system, the combination of a subscriber's line, sub-station apparatus including a subscriber's hook-switch for opening and closing the line circuit, a battery at the central station connected and arranged for supplying current to the line for both talking and signaling purposes, a jack connected with the line and provided with three contacts, a line relay connected between two of said contacts, an impedance coil serving as medium of connection between one terminal of the said relay and one pole of said battery, another impedance coil serving as medium of connection between the other side of the line and the other pole of the battery, a line lamp signal having a local circuit controlled by said relay, said local circuit including the battery and the first-mentioned impedance coil, an operator's cord-circuit provided with a plug adapted for insertion in said jack, said plug having but two contacts, the tip contact of the plug being adapted to engage two of the contacts in the jack for the purpose of short-circuiting the line relay, a supervisory relay adapted to serve as medium of connection between one pole of the battery and the tip contact of the plug, and a supervisory lamp signal having a local circuit adapted to be controlled by said supervisory relay when the plug is in the jack, said local circuit of the supervisory lamp signal including a talking strand of the cord-circuit and the sleeve contacts of the plug and jack.

5. In a telephone system, and in combination with the essential elements thereof, a line lamp signal having a normally open local circuit, and a battery and an impedance coil included in said circuit together with a spring jack having contacts which are excluded from said circuit and the said impedance coil and battery being connected in series across the talking circuit.

6. In a telephone system, the combination of a line relay, means for shunting the said line relay when the operator establishes connection with the line, a line lamp signal having a normally open circuit, and a central-



ized source of current and an impedance coil included in the circuit of said lamp, said impedance coil and relay connecting one side of the line with the source of current.

5 7. In a telephone exchange system, the combination of a line lamp circuit, a line relay, a talking circuit, an impedance coil connected with the talking circuit and included in said line lamp circuit, means for  
10 shunting said relay to retire the line signal, a battery for operating said relay and line signal, and a battery circuit including said relay and impedance coil in series.

8. In a telephone system, a subscriber's  
15 line, a battery for talking purposes, an impedance coil permanently connecting one pole of the battery with one side of the line, a supervisory lamp signal, a supervisory relay controlling said lamp signal and energized over the line while the latter is in use,  
20 and a local circuit for said lamp signal, said circuit including said impedance coil and being controlled by said relay.

9. In a telephone system, a subscriber's  
25 line, a battery for talking purposes, an impedance coil connecting one pole of the battery with one side of the line, a supervisory relay controlling a lamp signal and energized over the line while the latter is in use,  
30 and a local circuit for said lamp signal, each circuit including said impedance coil.

10. In a telephone system, a subscriber's  
35 line, a battery for talking purposes, an impedance coil interposed between one pole of the battery and one side of said line, an impedance coil and a relay coil connected in series and interposed between the other pole of the battery and the other side of the line, said battery thereby permanently bridged

across said line, other lines to which said battery is common in the same bridged relation, a supervisory lamp signal, a supervisory relay controlling said lamp signal and energized over the line while the latter is in use, a local circuit for said lamp signal and a plug switch having contacts in the said local circuit.

11. In a telephone system, a subscriber's line, a line relay, a supervisory lamp signal, a single supervisory relay controlling said lamp signal, a battery for talking purposes, an impedance coil connecting one pole of the battery with one side of the line, the supervisory relay controlling said lamp signal being energized over the line while the latter is in use, and a local circuit for said lamp signal, each circuit including said impedance coil.

12. In a telephone system, the combination with line and cord circuits, of a spring jack for the line circuit having its test contact connected with a limb of the telephone line, a central source of current, an impedance coil connected between a pole of said source and the test contact of said jack, a supervisory signal for the cord circuit normally connected between the sleeve contact of the plug and the other pole of said source, and a supervisory relay for the cord circuit controlling normally closed contacts in the circuit of said supervisory signal.

Signed by me at Chicago, Cook county, Illinois, this 6th day of March, 1903.

HENRY P. CLAUSEN.

Witnesses:

CHAS. W. HICKOK,  
WM. A. HARDERS.