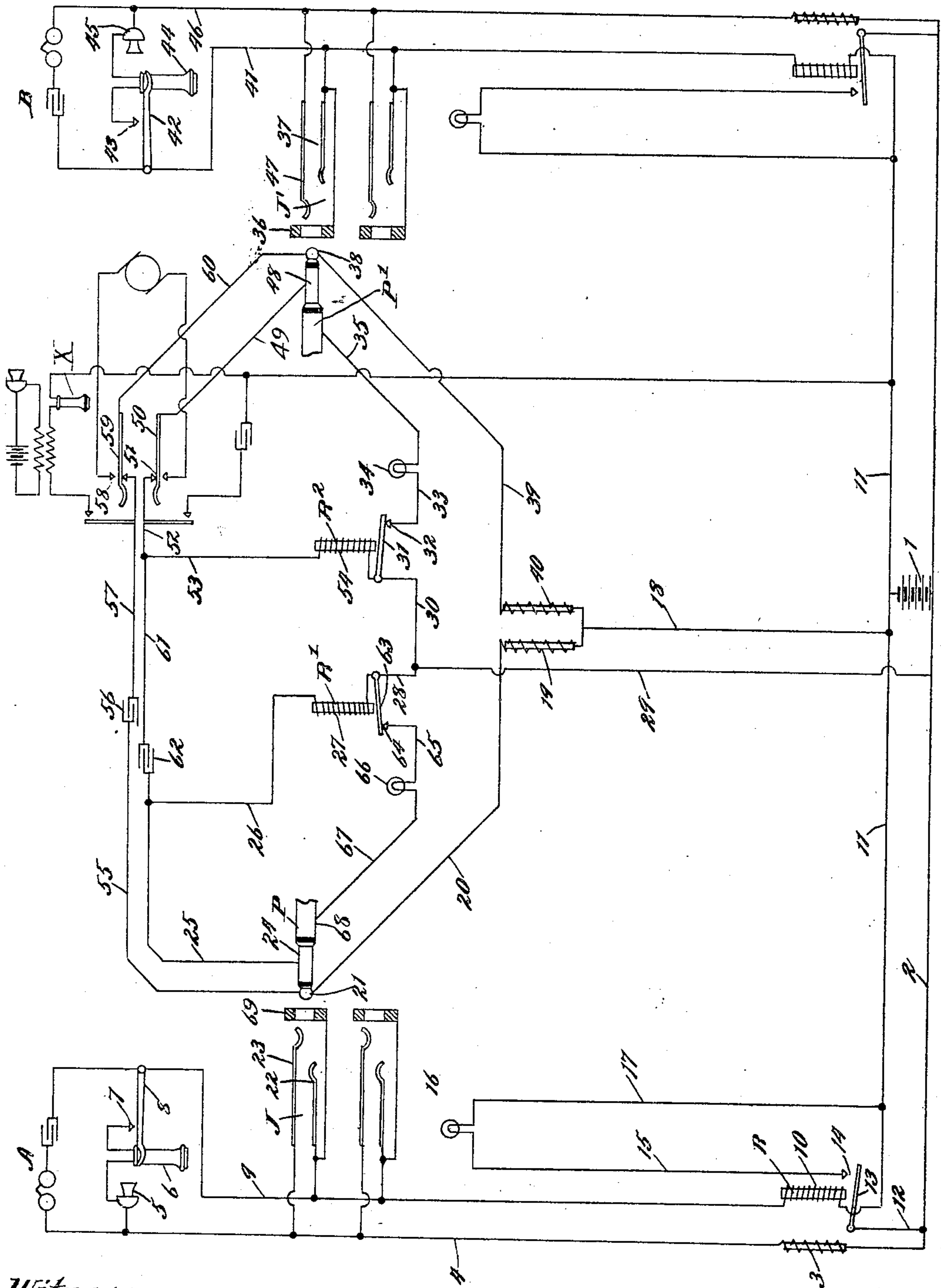


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TELEPHONE SYSTEM.  
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# UNITED STATES PATENT OFFICE.

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## TELEPHONE SYSTEM.

958,627.

Specification of Letters Patent.

Patented May 17, 1910.

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*To all whom it may concern:*

Be it known that I, CHARLES L. GOODRUM, a citizen of the United States of America, and resident of Atlantic City, Atlantic county, New Jersey, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates more particularly to telephone systems of the complete metallic circuit and central energy type. In telephone systems of this character it is usually the practice to employ complete metallic circuits between the substations and the central exchange, so as to avoid the use of grounded circuits. It is also the practice to operate all of the various instruments and devices from a common source of current, such as a battery located at the central station. Each subscriber's line is connected with what is commonly known as a jack on the switch-board at the central station. The central operator is provided with a cord circuit for connecting up the lines of any two subscribers. This cord-circuit is usually in the form of a cord having two or more strands provided at each end with a plug adapted for insertion in said jacks. Signaling devices are provided whereby the subscribers may attract the attention of the central operator, so as to advise the operator that connection is desired with some other substation. Similar signaling devices are also provided, whereby the central operator may know when the subscribers have finished talking. The signaling devices which respond to the calls from the substations are commonly known as line or calling signals, while the signaling devices which indicate the hanging up of the receivers at the substations are commonly known as supervisory signals. These signaling devices usually consist of small incandescent lamps arranged on the switchboard in front of the central operator. Suitable relays are provided and arranged to close the local circuits of these lamps at the proper times. These relays and lamps are, as previously explained, operated and lighted by current from the battery at the central exchange. In a system of this character the battery also furnishes the current over the lines to the microphone transmitters at the substations.

Generally stated, it is the object of my

invention to provide a simple and highly efficient telephone system of the foregoing character.

A special object is to provide an improved circuit arrangement and apparatus for controlling and operating the line and supervisory 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 satisfactory in use.

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

The accompanying drawing is a diagram illustrating a telephone system embodying the principles of my invention, it being observed that only two substations, together with line connections and the cord-circuit at the central station, are shown, and it being understood that only such instruments and electrical devices are illustrated as are necessary to a full understanding of the invention.

The general construction and the nature of the telephone system will be readily understood. The sub-station equipments or subscriber's apparatus can be of any suitable known or approved character. For example, it may be of the character shown at substations A and B, these sub-stations being connected with the switchboard at the central station by means of wires or complete metallic line connections. Also, as is usually the case, the subscribers' lines terminate, as shown, in spring jacks on the switchboard at the central station. Furthermore, the switchboard apparatus at the exchange or central station includes the usual cords provided with plugs adapted for insertion in the spring jacks, so as to connect one subscriber's line with another. Line signal apparatus is associated with each line, and supervisory signal apparatus is associated with the operator's cord circuit. Also, as a rule, the battery located at the central station or exchange is adapted for supplying the current to the lines for both talking and signaling purposes. Preferably, small incandescent lamps, controlled by the line or supervisory relays, as illustrated, are employed as the line and supervisory signals. The nature of the different circuit connections, and the functions of the various devices, will, how-



ever, be more clearly understood by considering the method employed for connecting up one subscriber with another.

As thus illustrated, and assuming that the subscriber at substation A desires connection with substation B, the circuit connections and operations which then take place are as follows: When the subscriber at substation A removes the receiver from the hook-switch, a line circuit is thereby closed from the common battery 1 at the central station, through the battery lead 2, through the impedance coil 3, thence through the line conductor 4, through the transmitter 5 and the receiver 6 at the substation, through the contact point 7 and the hook-switch 8, thence through the other line conductor 9, through the coil 10 of the line relay R, and through the other battery lead 11, to said battery. This, it will be seen, energizes the line relay R, and causes the latter to attract its armature. The said armature when attracted closes a short local circuit from the said battery through the conductors 2 and 12, through the armature 13 and the contact point 14, thence through the conductor 15 and the line lamp signal 16, and through conductors 17 and 11 to said battery. This lights the lamp 16, and advises the central operator of the call. The said operator then inserts the answering plug P of the cord-circuit in the jack J. This closes a line circuit from the battery 1, through the connection 18, through the impedance coil 19, thence through the tip-strand 20 of the cord-circuit, through the plug-tip 21 and the tip spring 22 of the jack, thence through the line 9, the hook-switch 8, contact-point 7, receiver 6, transmitter 5, line conductor 4, thence through the ring contact spring 23 of said jack, through the ring contact 24 of the plug, through the ring-strand 25 of the cord circuit, thence through conductor 26 and the coil 27 of the supervisory relay R', conductors 28 and 29 and through the conductor 2 to said battery. Preferably, the supervisory relays are of less resistance than the line relays. This, it will be seen, connects the battery with the line through the medium of the cord-circuit and the jack, and provides the current with a path of less resistance than the connection between the battery and the line including the relay R. Consequently, the insertion of the answering plug shunts out the line relay and allows the latter to release its armature. This, it will be seen, extinguishes or restores the line lamp signal 16. It will also be observed that the completion of this circuit through the cord-strands energizes the supervisory relay R', causing the same to attract its armature. At this juncture, the operator presses the usual listening key, so as to bridge the operator's talking set across the cord-circuit, and in this way establish connection with the

calling subscriber. Upon learning the number of the sub-station desired, which, as stated, is assumed to be substation B, the operator then inserts the calling plug P' of the cord-circuit in the jack J'. The operator also presses the ringing-key and operates the generator, so as to project ringing current on to the line of the called-for subscriber. The current thus projected from the central-station rings the bell at the substation B in the well-known manner. The insertion of the calling plug in this manner completes a circuit from battery 1, through conductors 29 and 30, through the armature 31, contact-point 32, through conductor 33 and supervisory lamp 34, thence through sleeve-strand 35 of the cord-circuit, through the ring or thimble 36 of the jack J', through the tip-spring 37 of the jack, through the tip 38 of the plug, thence through the cord-strand 39 and the winding 40 of the impedance coil, thence through the conductors 18 and 11 to said battery. This lights the supervisory lamp 34, which continues to glow until the called-for subscriber answers the call. When the called-for subscriber removes the receiver from the hook-switch at substation B, a circuit is then completed from the battery 1, through conductors 11 and 18, through the winding 40 of the impedance coil, through the cord-strand 39, through plug-tip 38, through jack-spring 37, through the line conductor 41, through the hook-switch 42 and the contact-point 43, through the receiver 44 and the transmitter 45, thence through line conductor 46, through the jack spring 47 and the ring contact 48 of the plug, thence through cord-strand 49, through key spring 50 of the ringing-key, through contact-point 51, through conductors 52 and 53, through the coil 54 of supervisory relay R<sup>2</sup>, thence through conductors 30, 29, and 2 to said battery. This energizes the supervisory relay R<sup>2</sup>, causing the same to attract its armature 31, and in this way opening up the local circuit of lamp 34. Thus the taking down of the receiver at substation B, automatically extinguishes the supervisory lamp 34, thereby indicating to the central operator that the called-for subscriber has answered the call. With both the receivers off the hook-switches at the substations, the subscribers' lines are connected, and the subscribers are in position to carry on their conversation. It will be understood that the talking circuit comprises the line conductors and the strands of the cord-circuit. In this way, the subscribers carry on their conversation over a complete metallic circuit including the tip 21, the cord-strand 55, condenser 56, and the other portion of said cord-strand 57, the contact 58 and key-spring 59, cord-strand 60, plug-tip 38, and also including ring contact 48, cord-strand 49, key-spring 50 and contact-point 51, con-



ductors 52 and 61, the condenser 62, and the conductor 25 and ring contact 24 of the other plug.

When the subscriber at substation A hangs up the receiver, the line-circuit is broken and the supervisory relay R' deenergized. This relay, releasing its armature, completes a local circuit from the battery 1, through conductors 2, 29 and 28, through the armature 63 and the contact-point 64, through conductor 65 and lamp 66, thence through cord-strand 67 and the sleeve contact 68 of the plug, through the ring or thimble 69 of the jack, thence through the jack spring 22 and the tip 21 of the plug, through the conductor 20 and the coil 19, thence through 18 and 11 to said battery. This, it will be seen, causes the supervisory lamp 66 to glow, and advises the central operator that the subscriber at substation A is through talking and has hung up the receiver. In a similar manner, when the subscriber at substation B hangs up the receiver, a local circuit is completed through the lamp 34 in the manner already described. Thus the central operator is automatically signaled when the subscribers hang up their receivers, and the operator then withdraws the plugs from the jacks.

It will be understood that the resistance of the various coils and relays can be regulated by those skilled in the art, in accordance with conditions. The supervisory circuit arrangement affords convenient opportunity for the employment of multiple jacks, it being observed that both the answering and the multiple jacks are each provided with but two conductors—that is to say, that with my improved circuit arrangement there are only two wires or conductors leading from each jack. It will be seen that the rings or thimbles of the jacks not only serve as test rings, so as to permit the operator to make the usual busy test, but also serve to complete circuit connections through the third strand of the cord-circuit. Furthermore, each of these test rings is connected solely with the tip spring of the jack.

When an operator makes a busy test, the tip of one of the calling plugs is placed against the sleeve or testing ring of the jack connected with the line being tested. If this line is closed at the subscriber's station, and no plugs are in the jacks thereof, the operator's receiver X receives current through the subscriber's station. But if another operator has a plug in one of the multiple jacks of the line, then the said receiver X receives current through a supervisory lamp of the other cord-circuit. And, as shown, one terminal of said receiver X is connected with the sleeve side of the line, while the other terminal is adapted to be temporarily connected with the tip of the plug with which the operator is making the test.

What I claim as my invention is:

1. A telephone system comprising substations and a central station and line connection between the same, circuit-changing devices at the substations for closing and opening the line circuits, a source of current at the central station connected with the lines and adapted to furnish current thereto for both talking and signaling purposes, line lamp signals having local circuits including said source of current, line relays for controlling said local circuits, jacks connected with the lines, a cord-circuit having plugs adapted for insertion in said jacks, a condenser in each talking strand of the cord-circuit, an impedance coil connected in parallel with one of said condensers, supervisory lamps associated with said cord-circuit, supervisory relays for controlling the circuits of said supervisory lamps, the impedance or retardation in the cord-circuit being in parallel with the line relays when the plugs are inserted, so as to shunt out the line relays and extinguish the line lamp signals, and the said supervisory relays being in series with the impedance or retardation when the plugs are inserted in the jacks.

2. A telephone system comprising substations and a central station and complete metallic line connection between the same, a plurality of jacks connected with each line, a line signal for each line, each jack having a pair of spring contacts and also a testing ring, said testing ring being connected with the line, a central source of current supply adapted to furnish current for both talking and signaling purposes, and a cord-circuit provided with plugs adapted for insertion in said jacks, both the tip and sleeve contacts of each jack being connected to the line-signal side of its allotted line.

3. A telephone system comprising subscribers' lines, a plurality of jacks connected with each line, a line signal for each line, each jack having a test ring normally connected solely with the line, and a cord-circuit having three-way plugs provided with sleeve contacts adapted to register with and thereby close suitable circuits through the said testing rings, both the tip and sleeve contacts of each jack being connected to the line-signal side of its allotted line.

4. A telephone system comprising substations and a central station, complete metallic line connection between the same, a plurality of jacks connected with each line, each jack having a testing ring normally connected with the line only, a central source of current supply connected with the lines, a cord-circuit having three-way plugs provided with sleeve contacts adapted to register with said testing rings, and supervisory lamps located in the sleeve strand of the cord circuit.

5. A telephone system comprising substa-



tions and a central station, complete metallic line connection between the same, a plurality of jacks connected with the line, each jack having tip and ring contact springs and also a test ring connected with the tip spring, a central source of current supply connected with the lines, a cord circuit having three-way plugs provided with sleeve contacts adapted to register with said test rings, a condenser in each talking strand of the cord circuit, supervisory lamps located in the sleeve strand of the cord-circuit, and suitable impedance means arranged in parallel with one of said condensers and connected with said source of current supply.

6. In a telephone system, the combination of a subscriber's line, a jack having three contacts, a source of current connected with the line, a cord-circuit provided with a plug having three contacts the contacts of the plug being adapted to engage the contacts of the jack, a supervisory lamp suitably associated with said cord-circuit, and a local circuit for said supervisory lamp including two of the jack contacts and also two of the plug contacts.

7. In a telephone system, the combination of the subscriber's line, a jack connected with the line, a source of current connected with the line, a cord-circuit provided with a plug adapted for insertion in said jack, said jack and plug having registering contacts, and a supervisory lamp associated with the cord-circuit, the local circuit of said supervisory lamp including a plurality of jack contacts and also a plurality of plug contacts, whereby said lamp is excluded from the talking circuit.

8. In a telephone system, the combination of subscribers' lines, a plurality of jacks connected with each line, each jack being provided with a testing ring connected with one side of the line, a source of current supply connected with the lines, an operator's cord-circuit having three-way plugs adapted for insertion in said jacks, supervisory lamps located in the sleeve strand of said cord-circuit, the local-circuit of each supervisory lamp including one of said testing rings, line relays and line signals controlled thereby, and cord-circuit connections for shunting out said line relays.

9. In a telephone system, the combination of a subscriber's line, a plurality of jacks connected with said line, each jack having but two wires or connections leading thereto, a cord-circuit having a plug adapted for insertion in said jacks, a central source of current supply adapted to furnish current for both talking and signaling purposes, a line signal and a line relay, a circuit-changing device for closing the line circuit and thereby operating said line signal, a supervising signal connected and arranged to be brought into operation by the opening of

the line circuit by said circuit changing device, both the tip and sleeve contacts of each jack being connected to the line-signal side of its allotted line, together with means for making a busy test, said busy test means including a receiver having one terminal permanently connected with the sleeve or testing ring side of the line, but having its other terminal adapted to be temporarily connected with the tip of the plug with which the operator is making the busy test.

10. A complete metallic line circuit and multiple switch-board telephone system comprising subscribers' lines, a line signal for and connected in only one side of each line, a plurality of jacks connected with each subscriber's line, each jack having but two wires or connections leading thereto, a central source of current supply connected with the lines and adapted for furnishing current thereto for both talking and signaling purposes, and a cord-circuit provided with plugs adapted for insertion in said jacks, both the tip and sleeve contacts of each jack being connected to the line-signal side of its allotted line, together with means for making a busy test, said busy test means including a receiver having one terminal permanently connected with the sleeve or testing ring side of the line, but having its other terminal adapted to be temporarily connected with the tip of the plug with which the operator is making the busy test.

11. In a telephone system, the combination of a substation and a central station, complete metallic line connections between the same, a plurality of jacks at the central station connected with each line, each jack having but two wires or connections leading therefrom, a central source of current supply adapted to furnish current for both talking and signaling purposes, hook-switches at the substations for opening and closing the line circuits, line lamp signals in local circuits, line relays for controlling the local circuits of said lamp signals, a cord-circuit having plugs adapted for insertion in said jacks, supervisory lamps in local circuits, and supervisory relays for controlling the local circuits of said supervisory lamps, both the tip and sleeve contacts of each jack being connected to the line signal side of its allotted line, together with means for making a busy test, said busy test means including a receiver having one terminal permanently connected with the sleeve or testing ring side of the line, but having its other terminal adapted to be temporarily connected with the tip of the plug with which the operator is making the busy test.

12. A telephone system comprising substations and a central station and complete metallic line connection between the same, a line signal for and connected in only one side of each line, a plurality of jacks con-



5 nected with each line, each jack having a  
pair of spring contacts and also a testing  
ring, said testing ring being connected with  
the line, a central source of current supply  
10 adapted to furnish current for both talking  
and signaling purposes, and a cord-circuit  
provided with plugs adapted for insertion  
in said jacks, both the tip and sleeve con-  
tacts of each jack being connected to the line  
20 signal side of its allotted line, together with  
means for making a busy test, said busy test  
means including a receiver having one ter-  
minal permanently connected with the  
sleeve or testing ring side of the line, but  
15 having its other terminal adapted to be  
temporarily connected with the tip of the  
plug with which the operator is making the  
busy test.

20 13. A telephone system comprising sub-  
stations and a central station, complete me-  
tallic line connections between the same, a  
plurality of jacks connected with the line,  
each jack having tip and ring contact  
springs, and each jack being also provided  
25 with a testing ring connected with the asso-  
ciated tip-spring contact, a central source  
of current supply connected with the lines  
and adapted to furnish current thereto for  
both talking and signaling purposes, and a  
30 cord-circuit provided with plugs adapted  
for insertion in said jacks, together with  
means for making a busy test, said busy  
test means including a receiver having one  
terminal permanently connected with the  
35 sleeve or testing ring side of the line, but  
having its other terminal adapted to be tem-  
porarily connected with the tip of the plug  
with which the operator is making the busy  
test.

40 14. A telephone system comprising sub-  
stations and a central station, complete me-  
tallic line connection between the same, a  
plurality of jacks connected with each line,  
each jack having tip, ring and sleeve con-  
45 tacts, each sleeve contact being connected  
with the tip contact of the jack, a suitable  
source of current supply connected with the  
lines and adapted to furnish current thereto  
for both talking and signaling purposes, and  
50 a cord-circuit provided with three-way  
plugs having tip, ring and sleeve contacts  
adapted to register with the said contacts of  
the jacks, together with means for making  
a busy test, said busy test means including  
55 a receiver having one terminal permanently  
connected with the sleeve or testing ring  
side of the line, but having its other termi-  
nal adapted to be temporarily connected  
with the tip of the plug with which the oper-  
60 ator is making the busy test.

15. A telephone system comprising sub-  
scribers' lines, a line signal for and connect-  
ed in only one side of each line, a plurality  
of jacks connected with each line, each jack  
65 having a test ring normally connected solely

with the line, and a cord-circuit having  
three-way plugs provided with sleeve con-  
tacts adapted to register with and thereby  
close circuits through the said testing rings,  
both the tip and sleeve contacts of each jack 70  
being connected to the line signal side of its  
allotted line, together with means for mak-  
ing a busy test, said busy test means includ-  
ing a receiver having one terminal perma-  
nently connected with the sleeve or testing 75  
ring side of the line, but having its other  
terminal adapted to be temporarily connect-  
ed with the tip of the plug with which the  
operator is making the busy test.

16. A telephone system comprising sub- 80  
stations and a central station, complete me-  
tallic line connection between the same, a  
plurality of jacks connected with each line,  
each jack having a testing ring normally  
connected with the line only, a central source 85  
of current supply connected with the lines,  
a cord-circuit having three-way plugs pro-  
vided with sleeve contacts adapted to regis-  
ter with said testing rings, and supervisory  
lamps located in the sleeve strand of the 90  
cord circuit, together with means for mak-  
ing a busy test, said busy test means includ-  
ing a receiver having one terminal perma-  
nently connected with the sleeve or testing  
ring side of the line, but having its other 95  
terminal adapted to be temporarily con-  
nected with the tip of the plug with which  
the operator is making the busy test.

17. A telephone system comprising sub- 100  
stations and a central station, complete me-  
tallic line connection between the same, a  
plurality of jacks connected with the line,  
each jack having tip and ring contact  
springs and also a test ring connected with  
the tip spring, a central source of current 105  
supply connected with the lines, a cord-cir-  
cuit having three-way plugs provided with  
sleeve contacts adapted to register with said  
test rings, a condenser in each talking strand  
of the cord-circuit, supervisory lamps lo- 110  
cated in the sleeve strand of the cord-circuit,  
and suitable impedance means arranged in  
parallel with one of said condensers and  
connected with said source of current sup-  
ply, together with means for making a busy 115  
test, said busy test means including a re-  
ceiver having one terminal permanently con-  
nected with the sleeve or testing ring side of  
the line, but having its other terminal  
adapted to be temporarily connected with 120  
the tip of the plug with which the operator  
is making the busy test.

18. In a telephone system, the combina-  
tion of a subscriber's line, a jack having  
three contacts, a source of current connected 125  
with the line, a cord-circuit provided with  
a plug having three contacts, the contacts  
of the plug being adapted to engage the con-  
tacts of the jack, a supervisory lamp asso-  
ciated with said cord-circuit, and a local 130



circuit for said supervisory lamp including two of the jack contacts and also two of the plug contacts, together with means for making a busy test, said busy test means including  
 5 a receiver having one terminal permanently connected with the sleeve or testing ring side of the line, but having its other terminal adapted to be temporarily connected with the tip of the plug with which the op-  
 10 erator is making the busy test.

19. In a telephone system, the combination of the subscriber's line, a jack connected with the line, a source of current connected with the line, a cord-circuit provided with a  
 15 plug adapted for insertion in said jack, said jack and plug having registering contacts, and a supervisory lamp associated with the cord-circuit, the local circuit of said supervisory lamp including a plurality of jack  
 20 contacts and also a plurality of plug contacts, together with means for making a busy test, said busy test means including a receiver having one terminal permanently connected with the sleeve or testing ring  
 25 side of the line, but having its other terminal adapted to be temporarily connected with the tip of the plug with which the operator is making the busy test.

20. In a telephone system, the combination of subscribers' lines, a plurality of jacks connected with each line, each jack being provided with a testing ring connected with one side of the line, a source of current supply connected with the lines, an operator's  
 30 cord-circuit having three-way plugs adapted for insertion in said jacks, supervisory lamps located in the sleeve strand of said cord-circuit, the local circuit of each supervisory lamp including one of said testing rings,  
 35 line relays and line signals controlled thereby, and cord-circuit connections for shunting out said line relays, together with means for making a busy test, said busy test means including a receiver having one terminal  
 40 permanently connected with the tip of the plug with which the operator is making the busy test.  
 45

21. A telephone system comprising subscribers' lines, a line signal for and connect-  
 50 ed in only one side of each line, suitable line signals, suitable supervisory signaling apparatus, and a battery adapted to furnish current to the lines for both talking and signaling purposes, both the tip and sleeve  
 55 contacts of each jack being connected to the line signal side of its allotted line, together with means for making a busy test, said busy test means including a receiver having one terminal permanently connected with  
 60 the sleeve or testing ring side of the line, but having its other terminal adapted to be temporarily connected with the tip of the plug with which the operator is making the busy test, substantially as shown and described  
 65 and for the purposes specified.

22. In a telephone exchange system, the combination of a telephone line, a line relay, a cord circuit having a condenser at each side thereof, a battery, an impedance coil, a line lamp signal controlled by said  
 70 line relay, means for connecting the line relay and battery in series in the line, a supervisory device and means for energizing it in series with the line and battery and impedance coil, with the battery interposed be-  
 75 tween the supervisory device and impedance coil, and means for connecting the impedance coil in parallel with the line relay to prevent display of the line signal.

23. In a telephone exchange system, the  
 80 combination of a telephone line, a line relay, a cord circuit having a condenser at each side thereof, a battery, an impedance coil, a line lamp signal controlled by said line relay, means for connecting the line relay and  
 85 battery in series in the line, a supervisory device and means for energizing it in series with the line and battery and impedance coil, with the battery interposed between the supervisory device and impedance coil,  
 90 and means for connecting the impedance coil in parallel with the line relay to prevent display of the line signal, said impedance coil permanently connecting the battery with one side of the cord circuit.  
 95

24. In a telephone exchange system, the combination of a telephone line, a line relay, a cord circuit having a condenser at each side thereof, a battery, an impedance coil, a line lamp signal controlled by said  
 100 line relay, means for connecting the line relay and battery in series in the line, and means for connecting the impedance coil in parallel with the line relay to prevent display of the line signal, a supervisory relay,  
 105 a supervisory lamp signal controlled by said supervisory relay, a circuit including the battery and supervisory relay in series with the telephone line, and a local circuit including the battery in series with the super-  
 110 visory lamp signal.

25. In a telephone exchange system, the combination of a telephone line, a line relay, a cord circuit having a condenser at each side thereof, a battery, an impedance coil,  
 115 a line lamp signal controlled by said line relay, means for connecting the line relay and battery in series in the line, and means for connecting the impedance coil in parallel with the line relay to prevent display of the  
 120 line signal, a supervisory relay, a supervisory lamp signal controlled by said supervisory relay, a circuit including the battery and supervisory relay in series with the telephone line, and a local circuit including the  
 125 battery in series with the supervisory lamp signal, together with an impedance coil connecting the battery with the telephone line and shunted by said supervisory relay when connection is made to line.  
 130



26. In a telephone exchange system, the combination of a telephone line, a line relay, a signal controlled by said relay, a battery, a cord circuit having a condenser at each side thereof, an impedance coil connecting the battery with one side of the cord circuit, a plug and jack for causing the impedance coil to shunt the line relay, a supervisory lamp signal, and a local circuit controlled by said plug and jack, through the medium of a plurality of contacts in each, and including the battery and lamp signal in series.

27. In a telephone exchange system, the combination of a telephone line, a line relay, a cord circuit having a condenser at each side thereof, a battery, an impedance coil, a line lamp signal controlled by said line relay, means for connecting the line relay and battery in series in the line, a supervisory device and means for energizing it in series with the line and battery and impedance coil, with the battery interposed between the supervisory device and impedance coil, and means for connecting the impedance coil in parallel with the line relay to prevent display of the line signal, said telephone line provided with a transmitter adapted to receive talking current from said battery.

28. In a telephone exchange system, the combination of a telephone line, a line relay, a cord circuit having a condenser at each side thereof, a battery, an impedance coil, a line lamp signal controlled by said line relay, means for connecting the line relay and battery in series in the line, a supervisory device and means for energizing it in series with the line and battery and impedance coil, with the battery interposed between the supervisory device and impedance coil, and means for connecting the impedance coil in parallel with the line relay to prevent display of the line signal, said impedance coil permanently connecting the battery with one side of the cord circuit, said telephone line provided with a transmitter adapted to receive talking current from said battery.

29. In a telephone exchange system, the combination of a telephone line, a line relay, a cord circuit having a condenser at each side thereof, a battery, an impedance coil, a line lamp signal controlled by said line relay, means for connecting the line relay and battery in series in the line, and means for connecting the impedance coil in parallel with the line relay to prevent display of the line signal, a supervisory relay, a supervisory lamp signal controlled by said supervisory relay, a circuit including the battery and supervisory relay in series with the telephone line, and a local circuit including the battery in series with the supervisory lamp signal, said telephone line provided with a trans-

mitter adapted to receive talking current from said battery.

30. In a telephone exchange system, the combination of a telephone line, a line relay, a cord circuit having a condenser at each side thereof, a battery, an impedance coil, a line lamp signal controlled by said line relay, means for connecting the line relay and battery in series in the line, and means for connecting the impedance coil in parallel with the line relay to prevent display of the line signal, a supervisory relay, a supervisory lamp signal controlled by said supervisory relay, a circuit including the battery and supervisory relay in series with the telephone line, and a local circuit including the battery in series with the supervisory lamp signal, together with an impedance coil connecting the battery with the telephone line and shunted by said supervisory relay when connection is made to line, said telephone line provided with a transmitter adapted to receive talking current from said battery.

31. In a telephone exchange system, the combination of a telephone line, a line relay, a signal controlled by said relay, a battery, a cord circuit having a condenser at each side thereof, an impedance coil connecting the battery with one side of the cord circuit, a plug and jack for causing the impedance coil to shunt the line relay, a supervisory lamp signal, a supervisory relay controlling said lamp signal, and a local circuit controlled by said plug and jack and including the battery and lamp signal in series, said telephone line provided with a transmitter adapted to receive talking current from said battery.

32. In a telephone exchange system, the combination of a telephone line, a line relay, an impedance coil for shunting said line relay, a supervisory lamp signal, a supervisory relay controlling said lamp signal, a circuit for said lamp including said impedance coil, means for opening and closing and thus controlling said lamp circuit, a battery for energizing the line relay, and a talking circuit having a condenser at each side thereof.

33. A telephone exchange system including a telephone line, a jack therefor, a cord circuit for uniting telephone lines in conversation, disconnect signal apparatus including a relay governed by line equipment, and a signal-presenting device governed by the armature of the said relay and adapted for inclusion in a circuit that contains two normally separated contacts of a plug of said cord circuit, said jack being adapted to connect said contacts of said plug when said plug is inserted, whereby circuit through said signal-presenting device is established in part by the engaged plug and jack.

34. A telephone exchange system including a telephone line, a jack therefor, a cord



circuit for uniting telephone lines in conversation, disconnect signal apparatus including a relay governed by line equipment, and a signal-presenting device governed by the armature of the said relay and adapted for inclusion in a circuit that contains two normally separated contacts of a plug of said cord circuit, said jack being adapted to connect said contacts of said plug when said plug is inserted, whereby circuit through said signal-presenting device is established in part by the engaged plug and jack, the armature of said relay when unattracted serving to establish a circuit for said signal-presenting device at another point.

35. In a telephone exchange system, the combination of a jack, a plug adapted to be inserted in said jack, a supervisory signal device, and a local energizing circuit for said device, including normally separated contacts of said plug, whereby said device is excluded from the talking circuit, said jack provided with means therein sufficient for connecting together said contacts to establish said circuit.

36. In a telephone exchange system, the combination of a jack, a plug adapted for insertion in said jack, a lamp, and a local circuit for said lamp, including normally separated contacts of said plug, whereby said device is excluded from the talking circuit, said jack provided with means therein sufficient for connecting together said contacts to establish said circuit.

37. In a telephone exchange system, the combination of a jack, a plug adapted for insertion in said jack, a lamp, a circuit for said lamp including normally separated contacts of said plug, and a relay controlling said circuit, said jack provided with means for connecting together said contacts to establish said circuit.

38. A telephone exchange system including a telephone line, a common battery having both poles thereof permanently connected with opposite sides of said line, a jack for said line, a cord circuit for uniting telephone lines in conversation, disconnect signal apparatus including a relay governed by line equipment, and a signal-presenting device governed by the armature of the said relay and adapted for inclusion in a circuit that contains two normally separated contacts of a plug of said cord circuit, said jack being adapted to connect said contacts of said plug when said plug is inserted, whereby circuit through said signal-presenting device is established in part by the engaged plug and jack.

39. A telephone exchange system including a telephone line, a common battery having both poles thereof permanently connected with opposite sides of said line, a jack for said line, a cord circuit for uniting telephone lines in conversation, disconnect

signal apparatus including a relay governed by line equipment, and a signal-presenting device governed by the armature of the said relay and adapted for inclusion in a circuit that contains two normally separated contacts of a plug of said cord circuit, said jack being adapted to connect said contacts of said plug when said plug is inserted, whereby circuit through said signal-presenting device is established in part by the engaged plug and jack, the armature of said relay when unattracted serving to establish a circuit for said signal-presenting device at another point.

40. In a telephone exchange system, the combination of a jack, a common battery permanently connected with said jack, a plug adapted to be inserted in said jack, a supervisory signal device, and a local energizing circuit for said device, including normally separated contacts of said plug, whereby said device is excluded from the talking circuit, said jack provided with means therein sufficient for connecting together said contacts to establish said circuit.

41. In a telephone exchange system, the combination of a jack, a common battery permanently connected with said jack, a plug adapted for insertion in said jack, a lamp, and a local circuit for said lamp, including normally separated contacts of said plug, whereby said device is excluded from the talking circuit, said jack provided with means therein sufficient for connecting together said contacts to establish said circuit.

42. In a telephone exchange system, the combination of a jack, a common battery permanently connected with said jack, a plug adapted for insertion in said jack, a lamp, a circuit for said lamp including normally separated contacts of said plug, and a relay controlling said circuit, said jack provided with means for connecting together said contacts to establish said circuit.

43. A telephone exchange system including a telephone line, a jack therefor, a cord circuit for uniting telephone lines in conversation, disconnect signal apparatus including a relay governed by line equipment, a signal-presenting device governed by the armature of the said relay and adapted for inclusion in a local circuit that contains two normally separated contacts of a plug of said cord circuit, and a line signal device adapted to be shunted by a portion of said local circuit to retire the line signal, said jack being adapted to connect said contacts of said plug when said plug is inserted, whereby circuit through said signal-presenting device is established in part by the engaged plug and jack.

44. A telephone exchange system including a telephone line, a jack therefor, a cord circuit for uniting telephone lines in conversation, disconnect signal apparatus in-



cluding a relay governed by line equipment,  
 a signal-presenting device governed by the  
 armature of the said relay and adapted for  
 inclusion in a local circuit that contains two  
 5 normally separated contacts of a plug of  
 said cord circuit, and a line signal device  
 adapted to be shunted by a portion of said  
 local circuit to retire the line signal, said  
 jack being adapted to connect said contacts  
 10 of said plug when said plug is inserted,  
 whereby circuit through said signal-present-  
 ing device is established in part by the en-  
 gaged plug and jack, the armature of said  
 relay when unattracted serving to establish  
 15 a circuit for said signal-presenting device  
 at another point.

45. In a telephone exchange system, the  
 combination of a jack, a plug adapted to be  
 inserted in said jack, a supervisory signal  
 20 device, a local energizing circuit for said de-  
 vice, including normally separated contacts  
 of said plug, whereby said device is excluded  
 from the talking circuit, said jack provided  
 with means therein sufficient for connecting  
 25 together said contacts to establish said cir-  
 cuit, and a line signal device adapted to be  
 shunted by a portion of said circuit to retire  
 the line signal.

46. In a telephone exchange system, the  
 30 combination of a jack, a plug adapted for  
 insertion in said jack, a lamp, a local cir-  
 cuit for said lamp, including normally sepa-  
 rated contacts of said plug, whereby said de-  
 vice is excluded from the talking circuit,  
 35 said jack provided with means therein suffi-  
 cient for connecting together said contacts  
 to establish said circuit, and a line signal de-  
 vice adapted to be shunted by a portion of  
 said circuit to retire the line signal.

40 47. In a telephone exchange system, the  
 combination of a jack, a plug adapted for  
 insertion in said jack, a lamp, a local cir-  
 cuit for said lamp including normally sep-  
 arated contacts of said plug, whereby said

device is excluded from the talking circuit, 45  
 a relay controlling said circuit, said jack  
 provided with means therein sufficient for  
 connecting together said contacts to estab-  
 lish said circuit, and a line signal device  
 adapted to be shunted by a portion of said 50  
 circuit to retire the line signal.

48. In a telephone system, a spring jack  
 having only two wires leading thereto, a line  
 signal device, means for shunting said line  
 signal device to retire the same in answering 55  
 a call, a supervisory signal device, and a  
 local circuit for said supervisory device in-  
 cluding two contacts of said jack.

49. In a telephone system, a spring jack  
 having only two conductors leading thereto, 60  
 a line signal device, means for shunting said  
 line signal device to retire the same in an-  
 swering a call, a plug adapted for insertion  
 in said jack, a supervisory signal device, and  
 a local circuit for said supervisory device, 65  
 said circuit including two contacts of the  
 jack and two contacts of the said plug.

50. In a telephone system a spring jack  
 having only two conductors leading thereto,  
 and a local circuit for a supervisory signal 70  
 device, whereby said device is excluded from  
 the talking circuit, said circuit including  
 two contacts of the jack and two contacts of  
 the plug inserted therein.

51. In a telephone system, a supervisory 75  
 signal device, and a local circuit for said  
 device including two normally separated  
 contacts of a plug, whereby said device is  
 excluded from the talking circuit, substan-  
 tially as disclosed. 80

Signed by me at Atlantic City, Atlantic  
 county, New Jersey, this first day of March,  
 1902.

CHARLES L. GOODRUM.

Witnesses:

ARTHUR WRIGHT,  
 J. S. CARRUTH.



It is hereby certified that in Letters Patent No. 958,627, granted May 17, 1910, upon the application of Charles L. Goodrum, of Atlantic City, New Jersey, for an improvement in "Telephone Systems," the name of the assignee was erroneously written and printed "C. P. Burns," whereas said name should have been written and printed *P. C. Burns*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of August, A. D., 1910.

[SEAL.]

F. A. TENNANT,  
*Acting Commissioner of Patents.*