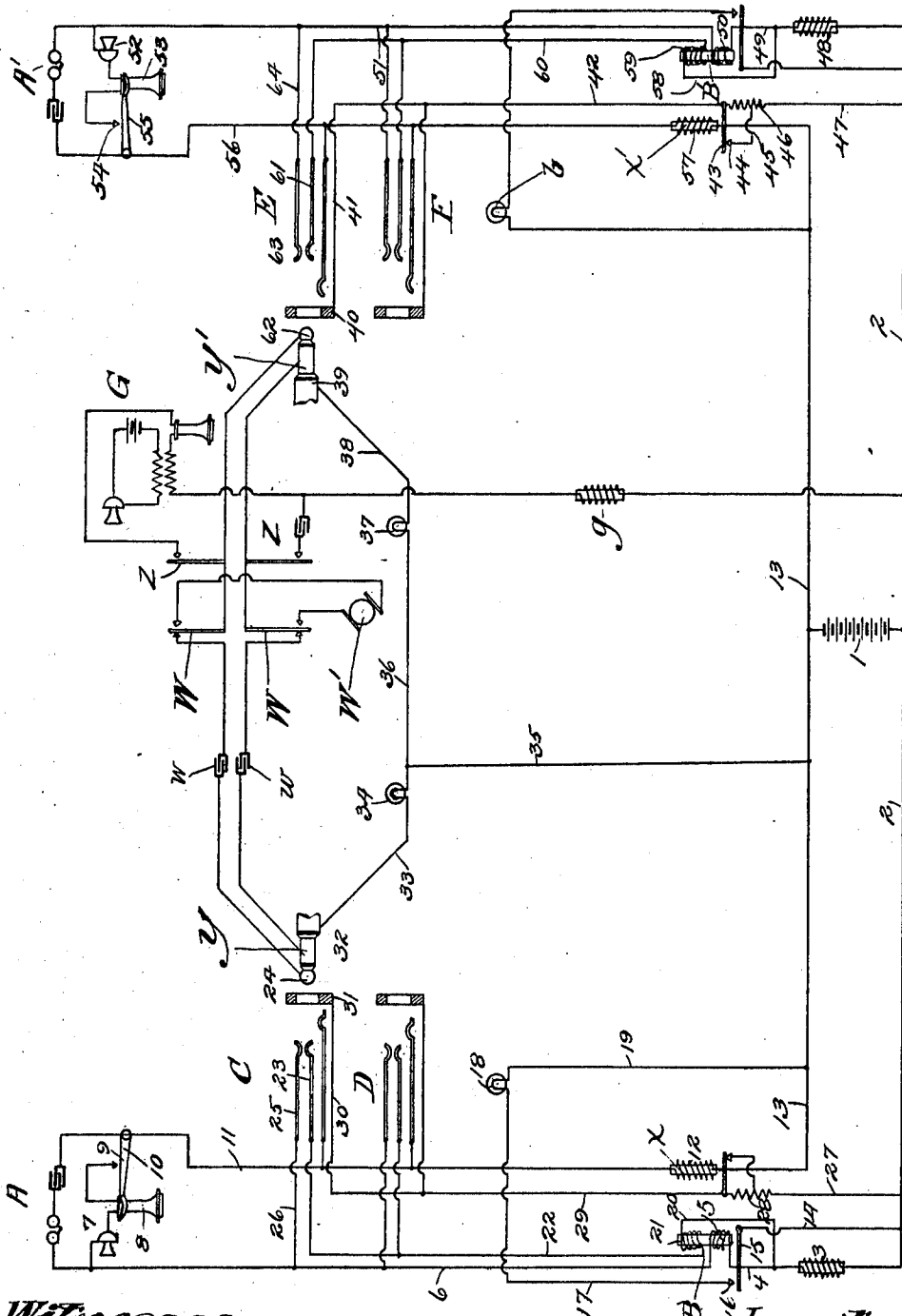


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TELEPHONE SYSTEM.

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UNITED STATES PATENT OFFICE.

DAVID L. TEMPLE, OF CHICAGO, ILLINOIS, AND CHARLES L. GOODRUM, OF ATLANTIC CITY, NEW JERSEY, ASSIGNORS, BY MESNE ASSIGNMENTS, TO STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

TELEPHONE SYSTEM.

989,205.

Specification of Letters Patent.

Patented Apr. 11, 1911.

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To all whom it may concern:

Be it known that we, DAVID L. TEMPLE and CHARLES L. GOODRUM, both citizens of the United States, and residents of Chicago, county of Cook, and State of Illinois, and of Atlantic City, county of Atlantic, New Jersey, respectively, have invented a certain new and useful Improvement in Telephone Systems, of which the following is a specification.

Our invention relates to telephone systems in general, but more particularly to systems having complete metallic circuits between the sub-stations and the central exchange, and especially to systems of this character having a central source of current supply. Systems of this character usually comprise a number of sub-stations—that is to say, stations at which telephones are located for the subscribers and a central station or exchange at which all of the subscribers' lines terminate.

It is usually the practice to provide complete metallic circuits between the sub-stations and the central exchange, and also to locate the source of current for operating the system at the central exchange. At the central station the line terminals are arranged upon switchboards, and usually consist of devices known as jacks. The central operator is provided with a connecting medium, commonly known as a cord circuit, by which she is enabled to connect up the jacks of any two subscribers' lines, so as to establish a talking circuit from one sub-station to the other. It is also customary in some cases to provide each subscriber's line with a number of jacks, one called the "answering jack," and the others the "multiple jacks," and to arrange these various jacks upon different switchboards. With this arrangement the system is what is ordinarily known as the multiple switchboard type. Each sub-station is ordinarily provided with a bell, and the central operator is provided with a generator, by which she can ring the bell at any sub-station and in this way attract the attention of the subscriber. Also each subscriber's line is provided with a line signal at the central exchange, whereby the subscriber may attract the attention of the central operator. In systems of this kind it is also usual to provide what are known as

clearing out signals, by which the operator has complete supervision of any lines which may be connected up for talking purposes. These line and supervisory signals at the central exchange usually consist in modern practice of small incandescent lamps arranged to light up or glow when their circuits are closed. These circuits for the signal lamps are controlled in different ways, as, for example, by relays arranged to close circuits when energized or deenergized, as the conditions may require. In this way a subscriber is enabled to call up the central exchange, and after being connected with some other sub-station by the operator's cord circuit, the two subscribers are then in position to carry on a conversation over the completed line circuit. When the subscribers have finished the conversation and have hung up their receivers, the line circuits are broken, and this has the effect of lighting the supervisory lamps at the central exchange, indicating that the subscribers are ready to be disconnected. The central operator then withdraws the plugs of the cord circuit from the jacks of the two subscribers' lines, and in this way the system, so far as the two sub-stations are concerned, is then in its normal or disconnected condition.

Generally stated, it is the object of our invention to provide a simple, reliable and highly efficient telephone system of the above character.

A special object is to provide an improved circuit arrangement whereby the advantages of approved methods may be obtained without the necessity of encumbering the cord circuit with relays.

A further object is to provide an improved circuit arrangement whereby the central operator may have complete supervision of connected lines, and whereby the true condition of any line may be readily ascertained at any and all times.

Another object is to provide an improved circuit arrangement for supplying the current directly to the line, rather than through the cord circuit.

It is also an object of our invention to provide an improved circuit arrangement, to gether with an improved arrangement of relays, for operating the line and supervisory signals.

In addition to these, it is a further object to provide certain details and features of improvement tending to render a system of this character more serviceable and reliable in use, and also tending to decrease the cost of installation and maintenance.

The nature and operation of our invention, together with certain other advantages, will, however, hereinafter more fully appear, and to the foregoing and other useful ends our invention consists in matters hereinafter set forth and claimed.

The accompanying drawing is a diagram illustrating a telephone system embodying the principles of our invention. In this diagram two sub-stations, together with a central exchange and suitable line connections, are shown diagrammatically, and only such instruments and portions of a system are illustrated as are necessary to a full understanding of the invention.

The system comprises subscribers' stations A and A¹ having any suitable equipment. These subscribers' stations are connected by line wires with the jacks C, D and E, F at the central station. The battery *l* is permanently connected with the said subscribers' lines. In the battery leads running to each line are the relays B, B¹, X, X¹. These relays are all in the line circuits, but the relays B, B¹ are calling relays while the relays X, X¹ are supervisory relays. The operator is provided with a three-way cord circuit having plugs *y*, *y*¹ adapted for insertion in said jacks. The subscribers attract the attention of the operators by means of lamps 18 and *b*, when calling for a connection. The third strand of the cord circuit is provided with supervisory lamps 34 and 37 by which the subscribers signal for a disconnection. The operator's cord circuit is provided with ringing switch springs W for connecting the generator W¹ with the circuit for the purpose of calling the subscriber. Also the cord circuit is provided with listening switch springs Z by which the operator connects her talking set G with the line of any subscriber. The said jacks are preferably four-way in character—that is to say that each jack has four electrical contacts. On the other hand, the plugs are three-way in character, the tip of each plug being adapted to make contact with the two tip springs with which each jack is provided. Condensers *w* stop the flow of battery current but maintain the continuity of the talking circuit as far as voice currents are concerned. As thus constructed, and assuming that the subscriber at sub-station A desires connection with sub-station A¹, the operations and circuit connections which take place are as follows: When the receiver at sub-station A is removed from its hook, a line circuit is completed from the battery 1 through the battery lead 2 and the retardation coil 3, thence

through conductor 4 and the coil 5 of the differential relay B, thence through the limb or line conductor 6, through transmitter 7 and receiver 8 to contact point 9, thence through the hook or switch 10 and the line conductor 11, through relay X, and thence through battery lead 13 to said battery. This, it will be seen, has the effect of energizing relay B, and of drawing up the latter's armature. This completes a short local circuit from the battery 1, through battery lead 2, thence through conductor 14 and the armature 15 to contact point 16, through conductor 17 to lamp 18, and thence through conductors 19 and 13 to the said battery. In this way the lamp 18 is lighted, and the central operator is advised that the calling subscriber desires connection with the line of some other sub-station. The central operator then inserts the answering plug *y* of the cord circuit in the jack C. This act serves to complete a circuit from battery 1 through battery lead 2 and retardation coil 3, through conductor 20 and coil 21 of the differential relay B, thence through conductor 22 to jack spring 23, through the plug tip 24 and the jack spring 25 to conductor 26, through the transmitter 7 and the receiver 8 to contact 9, through the hook switch 10 and the line conductor 11, through the coil 12 of relay X, and thence through battery lead 13 to said battery. The completion of this parallel circuit through the differential relay operates to release the armature 15, the differential winding of the relay permitting one current to neutralize the other. This of course extinguishes or restores the line signal lamp 18. It will also be observed at this juncture that the relay X is energized as soon as the receiver 8 is removed from its hook, and that consequently the armature of this relay is held away from its contact point. Hence the circuit completed from the battery 1 through the conductors 2 and 27, through the resistance 28 and the conductor 29, through the conductor 30 and the test ring 31 to the plug sleeve 32, through the cord strand 33, the lamp 34 and the conductor 35, and thence through conductor 13 to the battery, does not light the supervisory lamp 34. This is for the reason that the resistance 28 is of such character as to prevent sufficient current from flowing through the lamp circuit to light the lamp. At this point the central operator presses the usual listening key, so as to bridge the operator's talking set across the circuit. This, as will be readily understood, places the central operator in communication with the calling subscriber, and after learning the number of the sub-station with which such subscriber desires connection, the operator then inserts the calling plug *y*¹ in the jack E, assuming, as stated, that the subscriber at sub-station A desires connection

with sub-station A¹. At this juncture it will be understood, however, that before inserting the calling plug, the operator makes the usual busy test—that is to say, touches the tip of the calling plug to the testing ring 40, so as to ascertain whether or not the line is already in use.

The contact between the plug tip and the testing ring completes a local circuit through the operator's receiver, and if the line is in use, the flow of current through this local circuit causes a click or sound in the operator's receiver, which indicates that the subscriber is using the line. It will also be understood that this busy test can be made by directly inserting the plug if desired, and by noting the effect of this connection upon the supervisory lamp allotted to the line of sub-station A¹. If the lamp lights up or glows, the operator understands that the line is not in use and permits the plug to remain in the jack. Assuming, however, that the line is not in use, the operator after inserting the calling plug, presses the ringing key W, and then operates the generator W¹. This projects ringing current onto the line from the generator W¹, and rings the bell at sub-station A¹. During this signaling, the supervisory lamp 37 continues to glow, as a result of the local circuit completed from the battery 1 through conductor 13, through conductor 35 and cord strand 36, thence through said lamp 37 and the cord strand 38 to the sleeve contact 39 of the calling plug, thence through the testing ring 40 and the conductors 41 and 42, through the armature 43 and the contact point 44, through the shunt conductor 45 and a portion of the resistance 46, thence through conductors 47 and 2 to the said battery. As previously stated, the resistance 46 is sufficient to prevent the closing of this circuit from lighting the supervisory lamp until the shunt connection formed by the armature 43, the contact 44 and the conductor 45 is closed, so as to shunt out a part of said resistance, and thereby furnish the requisite amount of current to the lamp 37. When the subscriber at sub-station A¹ removes the receiver, a line circuit is completed from battery 1 through the conductor 2 and the retardation coil 48, thence through conductor 49 and the coil 50 of the differential relay B¹, through line conductor 51 to the transmitter 52, thence through receiver 53 and contact point 54, through the hook switch or arm 55, through the line conductor 56 to the coil 57 of supervisory relay X¹, and thence through battery lead 13 to the said battery. It will also be seen that a parallel circuit is completed from the battery 1 through conductor 2 and retardation coil 48, through conductor 58, through the coil 59 of the differential relay B¹, thence through conductor 60 to jack spring 61,

through the plug tip 62, through jack spring 63, thence through conductor 64, through line conductor 51 to transmitter 52, through the receiver 53 and the contact point 54 to hook switch 55, thence through line conductor 56 to relay coil 57, and through conductor 13 to said battery. This, it will be seen, has the effect of lifting the armature 43 away from the contact point 44, so as to extinguish supervisory lamp 37. Furthermore, the energizing of both coils in the relay B¹ prevents the latter from drawing up its armature, and consequently when the subscriber at sub-station A¹ answers the call the line lamp signal *b* does not light. Thus connected, the lines of the two sub-stations, together with the cord circuit, afford a complete metallic talking circuit between the two stations, it being seen that the two lines are inductively connected by the condensers *w w*, located in the two talking strands of the cord circuit. During conversation the current is supplied directly to the line from the battery 1, and through the retardation or impedance afforded by the coils 3 and 12, and 48 and 57. When the subscriber at sub-station A hangs up the receiver 8, the line circuit is broken, the relay X deenergized, and the supervisory lamp 34 lighted. In a similar manner when the subscriber at sub-station A¹ hangs up the receiver 3, the line circuit is broken, the relay X¹ deenergized, and the supervisory lamp 37 lighted. Upon receiving these signals, the operator withdraws the plugs from the jacks, and the system is then in its normal or disconnected condition. Thus it will be seen that the circuit arrangement affords opportunity for employing all of the approved methods of operation, and that the central operator has complete supervision of the lines. Furthermore, the circuit arrangement tends to quiet the line in answering calls, the insertion of the answering plug in the jack of the calling subscriber connecting the line with the cord circuit without producing any click or sound in the receiver at the sub-station. Also the busy test, made by touching the tip of the calling plug to the test ring of the multiple jack, does not cause a change of potential on the line, and consequently does not produce an objectionable click in the receiver at the sub-station, in case the called for subscriber is using the line. As a further advantage, the signals are controlled in an efficient and simple manner without the necessity of encumbering the cord circuit with relays.

It will be seen that the test circuit when the plug of some other cord circuit is in one of the multiple jacks, includes the supervisory lamp 37 and the impedance coil *g*.

It will be understood, of course, that the busy test is made in the usual way—that is to say, by touching the tip of the calling

plug to the thimble or test ring of the multiple jack connected with the called subscriber's line.

What we claim as our invention is:

5 1. A telephone system comprising sub-stations and a central station and suitable line connection between the same, four-way jacks forming the terminals of the lines at the central station, three-way plugs and a
10 three-way cord circuit for establishing connection between said jacks, a central source of current supply connected with the lines, line or calling signals at the central station, suitable circuit connections for said sig-
15 nals, and differential relays located in the lines and adapted to control the circuits for said signals.

2. A telephone system comprising sub-stations and a central station and suitable
20 line connection between the same, jacks and a three-way operator's cord circuit for establishing connection between the lines, line lamps located at the central station, suitable circuit connections for lighting said
25 lamps, a central source of current supply permanently connected with the lines and included in the circuits for lighting said lamps, and differential relays located in the lines and adapted to control the circuits
30 for said lamps together with cord plugs each provided with a tip contact, each subscriber's line having one side thereof connected with two jack-springs adapted to be electrically connected together by a plug tip,
35 and two relay windings placed in parallel by the engagement of said jack-spring by said plug-tip.

3. A telephone system comprising sub-stations and a central station and suitable
40 line connection between the same, jacks and a three-way cord circuit for establishing connection between the lines, line lamps and a source of current supply at the central station, local circuits for said lamps including
45 said source of current supply, differential relays located in the lines, each relay having one coil in the line, parallel connections including the other coils of said differential relays, said parallel connections also including
50 springs in said jacks, and circuit changing devices at the sub-stations for closing the line circuits and energizing said relays, so as to light the said lamps.

4. A telephone system comprising sub-stations and a central station and suitable
55 line connection between the same, jacks and a three-way cord circuit having plugs for establishing connection between the lines, a central source of current supply permanently connected with the lines, line lamps
60 having circuits including said source of current supply, each lamp circuit having a normally open switch point, a differential relay located in each line and adapted to control said normally open switch point, a nor-

65 mally open parallel connection for each relay circuit changing devices at the sub-stations for closing the line circuits and thereby energizing said relays, and each relay having a deenergizing coil located in the
70 normally open parallel connection adapted to be closed by the insertion of said plugs.

5. A telephone system comprising sub-stations and a central station and suitable line
75 connection between the same, jacks and a three-way cord circuit for establishing connection between the lines, a condenser in each talking strand of the cord circuit, two supervisory lamps in the third strand of the cord circuit, a central source of current
80 supply permanently connected with the lines, line signal lamps, suitable circuit connections for all of said lamps, differential relays located in the lines and adapted to control the circuits of said line lamps, and
85 circuit closing devices for suitably energizing the circuits of said supervisory lamps together with cord plugs each provided with a tip contact, each subscriber's line having one side thereof connected with two jack-
90 springs adapted to be electrically connected together by a plug tip, and two relay windings placed in parallel by the engagement of said jack-spring by said plug-tip.

6. A telephone system comprising sub-stations and a central station and suitable
95 line connection between the same, jacks and a three-way cord circuit for establishing connection between the lines, a condenser in each talking strand of the cord circuit, two
100 supervisory lamps in the third strand of the cord circuit, a battery having one pole permanently connected with the said third strand, the other pole of said battery being permanently connected with the test rings
105 of said jacks, suitable resistance interposed between said battery and said test rings, normally closed shunts around each resistance, relays in the lines adapted to open said shunts when energized, line lamp signals
110 having circuits including said battery, and differential relays in the lines for controlling the circuits of said line lamp signals.

7. A telephone system comprising sub-stations and a central station and suitable
115 line connection between the same, jacks and a cord circuit for establishing connection between the lines, a central source of current supply, a supervisory lamp associated with the cord circuit, a local circuit for said
120 lamp including said source of current supply, a resistance in said local circuit to prevent said lamp from lighting, a normally closed shunt around said resistance, and a relay permanently connected in the line for
125 opening said shunt together with cord plugs each provided with a tip contact, each subscriber's line having one side thereof connected with two jack-springs adapted to be electrically connected together by a plug tip, 130

and two relay windings placed in parallel by the engagement of said jack-spring by said plug-tip.

8. A telephone system comprising two stations, a spring jack, line connection between said stations, a battery at one station connected with the line, a signal lamp having a local circuit including said battery, a resistance in said local circuit to prevent the lamp from lighting, a normally closed shunt around said resistance, and a relay for opening said shunt, said relay being permanently connected with the line circuit between the two stations together with cord plugs each provided with a tip contact, each subscriber's line having one side thereof connected with two jack-springs adapted to be electrically connected together by a plug tip, and two relay windings placed in parallel by the engagement of said jack-spring by said plug-tip.

9. A telephone system comprising two stations, a spring jack, line connection between the same, a source of current supply at one station, said source of current supply being permanently connected with the line, a circuit changing device at the other station for closing said line circuit, and a signal lamp provided with a local circuit including said battery, the resistance of said local circuit being sufficient to prevent the lamp from lighting, a normally open switch point in said local circuit, a normally closed shunt for shunting out a portion of said circuit, so as to permit sufficient current to flow through the circuit to light the lamp, a relay permanently connected in the line for opening said shunt, and a switch device for manually closing the normally open switch point in the circuit of said lamp together with cord plugs each provided with a tip contact, each subscriber's line having one side thereof connected with two jack-springs adapted to be electrically connected together by a plug tip, and two relay windings placed in parallel by the engagement of said jack-spring by said plug-tip.

10. A telephone system comprising sub-stations and a central station and suitable line connection between the same, jacks and a cord circuit for establishing connection between the lines, line lamp signals and a source of current supply permanently connected with the lines, differential relays for controlling the circuits of said line lamps, supervisory lamps and other relays in the lines for controlling the circuits of said supervisory lamps.

11. A telephone system comprising sub-stations and a central station and suitable line connection between the same, jacks and a cord circuit for establishing connection between the lines, a line lamp signal for each line, a differential relay in one side of each line for controlling the associated line lamp,

supervisory lamps associated with the cord circuit, and a relay in the other side of each line for controlling the associated supervisory lamp.

12. In a telephone system, the combination of a subscriber's line, a spring jack, two lamp signals located at the terminal of a source of current supply connected with the line, circuit connections for said lamps including said source of current supply, a relay in one side of the line for controlling one of said lamps, and a relay in the other side of the line for controlling the other lamp together with cord plugs each provided with a tip contact, each subscriber's line having one side thereof connected with two jack-springs adapted to be electrically connected together by a plug tip, and two relay windings placed in parallel by the engagement of said jack-spring by said plug-tip.

13. In a telephone system, the combination of a subscriber's line, a line lamp and a supervisory lamp located at the terminal of said line, a battery permanently connected with the line, circuit connections for said lamps including said battery, a shunt in the circuit of the supervisory lamp, a differential relay in one side of the line for controlling the line lamp, and a relay in the other side of said line for opening and closing said shunt.

14. In a telephone system, the combination of a subscriber's line, a jack, a source of current permanently connected with the line, a supervisory lamp, a shunt in the circuit of the supervisory lamp, a cord plug cooperating with the jack to close the circuit of said supervisory lamp, a line relay controlling the shunt in the circuit of said supervisory lamp, a line lamp, and a 2nd line relay for controlling the circuit of said line lamp.

15. In a telephone system, the combination of a subscriber's line, a line signal, a differential relay having one coil, in the line for closing the circuit of said line signal, a jack and a plug tip included in a parallel connection through the other coil of said relay, a circuit changing device for closing the line circuit, a battery permanently connected with the line, a supervisory lamp permanently connected with the battery, a shunt in the circuit of said supervisory lamp, and another relay in the line for controlling said shunt.

16. In a telephone system, the combination of sub-stations and a central station and suitable line connection between the same, jacks and a three-way cord circuit for establishing connection between the lines, a source of current permanently connected with the lines, supervisory lamps located in the third strand of said cord circuit, a shunt in the circuit of each supervisory lamp, and line relays for controlling said

shunts, together with cord plugs each provided with a tip contact, each subscriber's line having one side thereof connected with two jack-springs adapted to be electrically
5 connected together by a plug tip, and two relay windings placed in parallel by the engagement of said jack-spring by said plug-tip.

17. In a telephone system, the combination of a sub-station and a central station and suitable line connection between the same, a bell at the sub-station, a generator, a plug and jack, a ringing key for bridging the generator across the line circuit, a central source of current supply permanently connected with the line, a supervisory lamp, a local circuit for said lamp including said source of current supply, a resistance in said local circuit, a normally closed shunt around
20 said resistance, and a line relay for controlling said shunt together with cord plugs each provided with a tip contact, each subscriber's line having one side thereof connected with two jack-springs adapted to be electrically connected together by a plug tip, and two relay windings placed in parallel by the engagement of said jack-spring by said plug-tip.

18. In a telephone exchange system, the combination of a telephone line, a line relay energized during talking, a resistance, a normally closed shunt around said resistance opened by the energizing of said line relay, a supervisory lamp, a supervisory lamp-circuit including said shunt, means by which
35 said line is opened to deenergize said relay and cause the lighting of said lamp, and a line lamp controlled independently of said relay.

19. In a telephone exchange system, the combination of a telephone line, a line relay energized during talking, a resistance, a normally closed shunt around said resistance opened by the energizing of said line relay, a supervisory lamp, a supervisory lamp-circuit including said shunt, means by which
45 said line is opened to deenergize said relay and cause the lighting of said lamp, a line lamp controlled independently of said relay, a second relay for controlling said line lamp, and means for deenergizing said second relay to retire the line lamp.

20. In a telephone exchange system, the combination of a telephone line, a line relay energized during talking, a resistance, a normally closed shunt around said resistance opened by the energizing of said line relay, a supervisory lamp, a supervisory lamp-circuit including said shunt, means by which
60 said line is opened to deenergize said relay and cause the lighting of said lamp, a line lamp controlled independently of said relay, a battery to one pole of which both lamps are permanently connected, a differential relay
65 for controlling said line lamp, and means

for producing a neutralized current flow in said differential relay to deenergize the same and retire the line lamp.

21. In a telephone exchange system, the combination of a telephone line, a line relay
70 energized during talking, a resistance, a normally closed shunt around a portion of said resistance opened by the energizing of said relay, a supervisory lamp, a supervisory lamp circuit including said shunt and the remainder of said resistance, means by which
75 said line is opened to deenergize said relay and cause the lighting of said lamp, and a line lamp controlled independently of said relay.

22. In a telephone exchange system, the combination of a telephone line, a supervisory lamp, a line lamp, a relay in one side of the line for controlling only the line
80 lamp, and a relay in the other side of the same having a normally closed contact for controlling only the supervisory lamp, each relay having its own armature.

23. In a telephone exchange system, the combination of a telephone line, a supervisory lamp, a line lamp, a relay in one side of the line for controlling only the line lamp, a relay in the other side of the same having a normally closed contact for controlling only the supervisory lamp, each relay having
90 its own armature, and a battery connected to supply current through windings of said relays to the line for talking purposes.

24. The combination of a telephone line, a relay in said line for supervisory purposes
100 solely, and a supervisory lamp controlled by said supervisory relay.

25. In a telephone system, a line, a cord circuit, a supervisory lamp in said circuit, a relay in the line, a line signal controlled independently of said relay, a local circuit including said lamp, and means for closing
105 said circuit by the deenergizing of said relay.

26. In a telephone system, a line, a relay in the line, a line signal controlled independently of said relay, a jack and plug, a lamp signal, a local circuit including said lamp and closed in part by the insertion of the
110 plug in the jack, and means by which said circuit is completed by the opening of the line and the deenergizing of said relay.

27. In a telephone system, a line, a relay individual to and energized over the line during conversation, a line signal controlled
120 independently of said relay, a connecting cord, a supervisory lamp, a local circuit including said lamp and a strand of said cord in series, and means by which the opening of said line and the consequent deenergizing of said relay when the subscriber hangs up
125 closes said local circuit.

28. In a telephone system, a line, a relay individual to and energized over the line during conversation, a line signal controlled
130

independently of said relay, a supervisory lamp, a plug and jack for partially closing a circuit through said lamp when the operator answers the call, and means by which
 5 said circuit is completed by the deenergizing of said relay to cause said lamp to give the signal for disconnection.

29. In a telephone system, a line, a relay individual thereto, a line signal controlled
 10 independently of said relay, a connecting cord, a lamp individual to said cord, and means for operating said lamp by the deenergizing of said relay.

30. In a telephone system, a line lamp
 15 and a supervisory lamp, means for placing said lamps in parallel in answering a call, electro-magnetic means operated thereby for retiring the line lamp when the call is answered, a local circuit including said super-
 20 visory lamp, and a device independent of said electro-magnetic means for reducing the resistance of said local circuit when the subscriber signals for a disconnection.

31. In a telephone exchange system, a
 25 supervisory relay in the line, and a supervisory lamp constituting the only signal controlled by said relay.

32. In a telephone system, a supervisory relay in the line, and a line lamp controlled
 30 independently of said relay.

33. In a telephone system, a line relay, a supervisory relay, and a line circuit for en-

energizing said relays in series when the subscriber calls.

34. In a telephone system, line and super- 35
 visory lamps connected in multiple to the same pole of the battery, line and supervisory relays for controlling said lamps, and a line circuit for energizing said relays in series when the subscriber calls. 40

35. In a telephone system, a line relay, a supervisory relay, a line circuit for energizing said relays in series when the subscriber calls, and a cord circuit with a condenser in each talking strand thereof. 45

36. In a telephone system, a line relay and a supervisory relay energized in series over a line circuit permanently connected with a battery for supplying current thereto for talking purposes. 50

Signed by me at Chicago, Cook county, Illinois, this 28th day of January 1902.

DAVID L. TEMPLE.

Witnesses:

ARTHUR F. DURAND,

HARRY P. BAUMGARTNER.

Signed by me at Atlantic City, Atlantic county, New Jersey, this eighth day of February 1902.

CHARLES L. GOODRUM.

Witnesses:

JOHN C. REED,

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