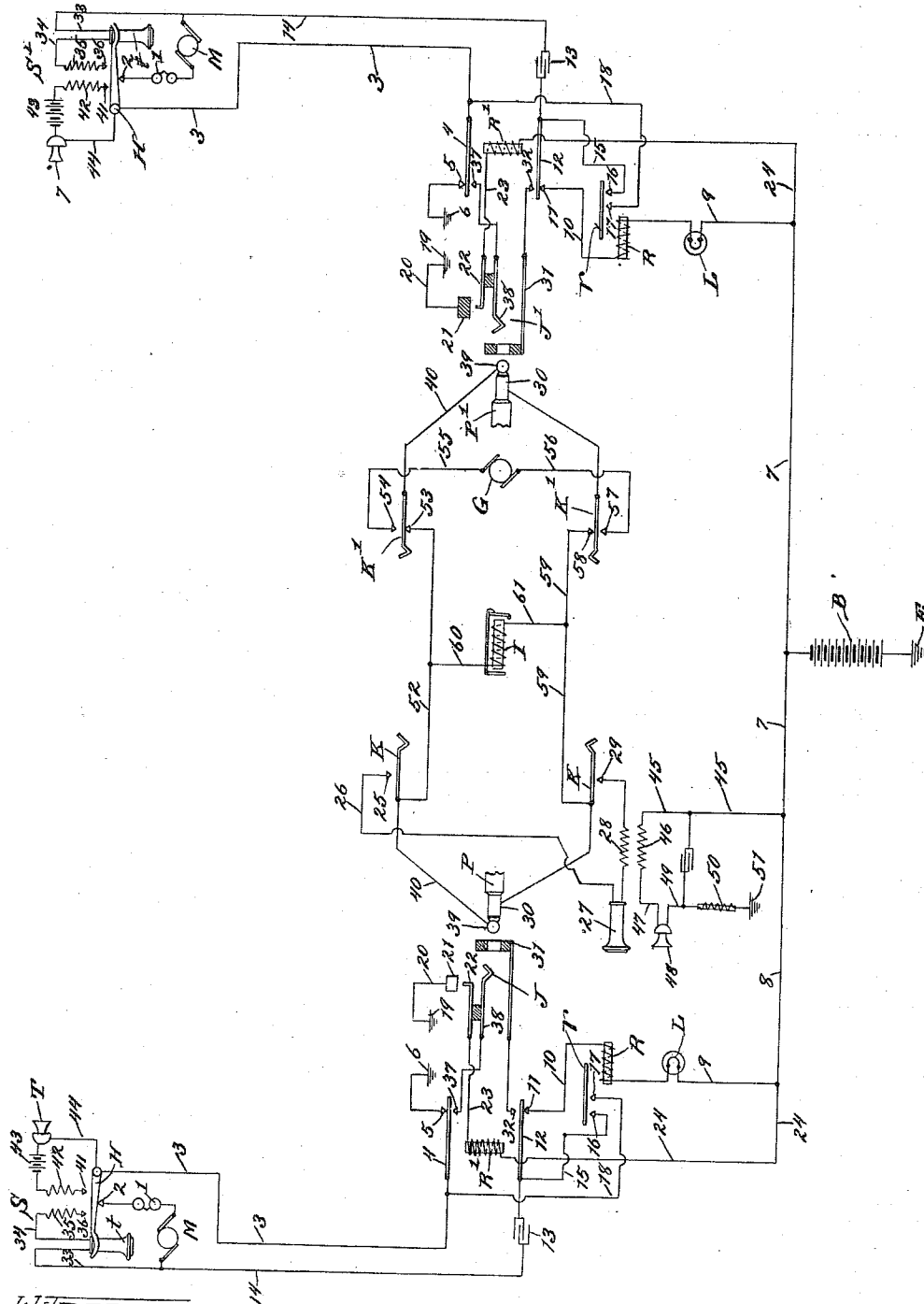


H. P. CLAUSEN.
TELEPHONE SYSTEM.
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Patented June 13, 1911.



WITNESSES

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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 certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems in general, but more particularly to systems in which magnetos are employed at the substations for operating the calling signals at the central station, and in which complete metallic circuits are employed between the substations and the central station.

Generally stated, the object of my invention is to provide certain details and features of improvement tending to increase the general efficiency of a telephone system.

Certain special objects are to provide a circuit arrangement which will enable the central operator to answer a call without producing objectionable or unpleasant sounds in the receiver at the substation, and which will cause the calling signal to remain displayed or in operation until the call is answered by the operator, it being also an object of my invention to provide a circuit arrangement which will permit the current which lights the calling signal lamp to be supplied through a local circuit of comparatively low and unvarying resistance.

To the foregoing and other useful ends, the magneto at the substation is preferably normally in circuit through a condenser with a relay and battery at the central station. The relay and battery are also arranged to form a part of a local circuit which is closed when the relay is operated by a call sent in from the substation. When the magneto at the substation is operated, said relay at the central station is operated and the movement of its armature causes the current of the battery to flow through the short circuit for the purpose of operating the calling signal. This calling signal can be of any suitable or approved form, but is preferably in the nature of an incandescent lamp arranged in the local circuit and adapted to be lighted by the current from the battery when the relay is operated by the magneto at the substation. In this way,

the relay is first operated by the magneto at the substation, and after its armature closes the local circuit it then continues to be energized by the said battery which furnishes the current for lighting the calling signal-lamp. The current from the battery through the relay holds the local circuit closed and keeps the calling signal displayed until the call is answered by the operator. The local circuits and condensers can be so arranged that when the operator answers the call and cuts out the battery for the purpose of restoring or extinguishing the calling signal lamp, there will not, as a result of thus breaking a circuit, be any objectionable or unpleasant sounds caused in the receiver at the substation. In other words, the operator in restoring the calling signal simply opens up a local circuit and does not cut out the calling signal battery or break a circuit in such manner as to have the effect of such break extend to and be audible in the receiver at the substation.

The arrangement has the further advantage of permitting a call to be made over a line circuit of comparatively high resistance, and of permitting a calling signal to be maintained in operation by the current from the battery through a local circuit of comparatively low and unvarying resistance.

The nature and advantages of my invention will, however, hereinafter more fully appear.

The accompanying drawing is a diagram illustrating a telephone system embodying the principles of my invention.

As thus illustrated, the telephone system may, for example, comprise substations S and S', having suitable line connection with the central station. At the central station are the usual spring jacks forming the terminals of the subscribers' lines, in this case indicated by J and J'. Connection between the two substations thus illustrated is effected through the medium of a cord circuit having the plugs P and P'. The cord circuit and the jacks and also the substation apparatus may be of any suitable or approved form, but it will be observed that magnetos M are preferably employed at the substations for the purpose of operating the

calling signal L at the central station, and it will also be observed that the system is preferably of the complete metallic circuit type.

In operation, a call can be sent in from
 5 substation S by operating the magneto M and thereby causing the calling signal L at the central station to be operated or displayed for the purpose of attracting the attention of the central operator and advising
 10 such operator that the subscriber at substation S desires connection with a subscriber at some other substation. When the magneto M at sub-station S is operated, a current is thereby caused to flow from this magneto through a circuit formed by the line 14,
 15 condenser 13, relay armature 12, contact point 11, line 10, relay R, lamp L, line 9, line connections 8 and 7, and thence through the battery B into the ground at E. The
 20 circuit is then completed from E through the ground to the ground connection 6, thence through contact points 5 through armature 4 and line connection 3, thence through the receiver-hook or switch H to the
 25 contact-point 2, and finally through the bell 1 to the said magneto M. A current from the magneto in flowing through this circuit causes the armature *r* of the relay R to move
 30 into contact with the adjacent contact points 16 and 17. The operation of the relay R in this manner closes a short circuit and thereby establishes a short local circuit through which the current from battery B is allowed
 35 to flow for the purpose of lighting the lamp L. This short local circuit comprises the connections 7 and 8 leading from the battery B, the conductor 9, lamp L, relay R, connection 10, contact point 11, armature 12,
 40 conductor 15, contact point 16, armature *r*, contact point 17, conductor 18, armature 4, contact point 5, the circuit being then completed through the ground from 6 to E, and thence back to the battery B. This, as
 45 stated, operates to throw the current from the battery B through a short local circuit of which the lamp L and the relay R are a part. This, as stated, causes the calling signal L, which is preferably a lamp, to be
 50 displayed, and in this way, the operator is advised of the call from substation S. In order to answer the call and to ascertain the number of the substation with which the calling subscriber desires connection, the
 55 operator then inserts the plug P of the cord circuit in spring-jack J, which latter, it will be observed, forms the terminal of the line connection with substation S. The insertion of plug P in jack J operates to complete a
 60 circuit from battery B through line connections 7, 8 and 24, to relay R', from this relay through connection 23, spring 22, through contact 21 and line 20 to ground at 19, thence through the ground to E and back to the battery B. This circuit, it will be
 65 understood, is established by the insertion

of the plug P which causes the contact 22 to move upwardly into contact with the contact 21. The circuit thus completed places the relay R' in parallel with the lamp L and the relay R, and the relay R', by attracting the
 70 armatures 4 and 12, serves to open up the previously described circuit of which the relay R is a part, and to thereby extinguish or restore the calling signal L. In other words, when a current from battery B is
 75 caused to flow through the cut-out relay R', the latter breaks or opens up the circuit for the relay R, thereby releasing the armature *r* and permitting the latter to move away from the points 16 and 17. In this way, the
 80 insertion of the cord plug P cuts out the relay R and extinguishes or restores the calling signal L, and at the same time the relay R', by attracting its armatures 4 and 12 establishes connection between the substation
 85 S and the operator's talking set in the cord circuit. When the armatures 4 and 12 are attracted by the magnet of the relay R', a circuit is thereby completed which establishes connection between the substation S
 90 and the listening key K of the cord circuit. The operator then presses the listening key K and, as stated, the substation S is then in communication with the talking set in the operator's cord circuit. When the listening
 95 key K is pressed by the operator, a circuit is immediately completed from the operator's receiver 27 through the secondary 28 of the induction coil, through contact 29 and key K to the sleeve 30 of the plug P, through the
 100 ring 31 of jack J to contact 32, thence through the armature 12 and the condenser 13 to line 14, through the latter to the connection 33, thence through the receiver *t* and the conductor 34 to the secondary 35 of the
 105 induction coil, through contact 36, receiver-hook or switch H, to line 3, through the latter to armature 4, thence through contact 37, spring contact 38 of the jack to the tip 29 of the plug P, thence through connection 40
 110 and key K to contact 25, and finally through connection 26 back to the receiver 27. At this point, it will also be seen that the operator's transmitter 48 is inductively connected with the substation through the medium
 115 of the primary 46 of the induction coil, and that the talking current for the operator's set is supplied from battery B through connections 7, 45, the primary 46 of the induction coil, connection 47, the transmitter
 120 48, connection 49, and thence through the impedance coil 50 to ground connection 51, and from the latter through the ground to the ground connection E, and thence back to the battery B.
 125

It will be understood that after a call is sent in from substation S, the receiver *t* is lifted from the hook H, so as to bring the latter into contact with the adjacent contact points 36 and 41. In this way, the line is in
 130

condition to permit communication to be established, as explained, between the operator and the subscriber at substation S.

When the operator at the central station
5 learns the number of the substation called for by the subscriber at substation S, the calling plug P' is then inserted in jack J' for the purpose of establishing connection between the operator's ringing key and the substa-
10 tion S', which latter is assumed to be the substation with which the subscriber at station S desires connection. The insertion of the plug P' in the spring jack J', and the pressing of the ringing key K' by the opera-
15 tor, establishes a circuit from the magneto G through connection 55 to contact point 54, from the latter through key K' and connection 40 to plug-tip 39, from the latter to jack-spring 38, and thence through contact
20 point 37 and armature 4 to line 3, through the latter to receiver-hook or switch H at substation S', from this hook or switch to contact point 2 through bell 1 and magneto M to line 14, thence through the condenser
25 13 and armature 12 to contact 32, from the latter through the ring or casing 31 of the jack J' to plug sleeve 30, from this sleeve of the plug to ringing key K', from the latter to contact point 57, and thence through
30 connection 56 to the magneto G. The operator then operates the magneto G, and the current thereby generated causes the bell 1 at substation S' to ring. The subscriber at substation S' then lifts the receiver t of this
35 station off the hook H, thereby bringing the receiver-hook or switch into contact with the adjacent contact points 41 and 36 of this station. At this juncture, it will be under-
40 stood that the insertion of plug P' in jack J' causes the contacts 22 and 21 to come together, thereby completing the circuit from battery B to the right through connections 7 and 24 to cut out relay R', from the latter
45 through 23, 22, 21 and 20 to 19, thence through the ground to E and back to the battery B. This, it will be seen, draws the armatures 4 and 12 of relay R' into contact with the contact points 32 and 37, and, as
50 explained, establishes electrical connection between the operator's magneto G and the bell 1 at substation S'. Electrical connection being thus established between substation S' and the plug P', the operator then releases the ringing key K', thereby establishing con-
55 nection between the line of substation S' with the cord circuit. The subscribers at substations S, S', are now in communication with each other through their respective lines, and through the medium of the cord
60 circuit connecting the plugs P and P'. The circuit thus completed for the purpose of permitting the two subscribers to communi-
65 cate with each other, consists of line 3 from substation S, through armature 4 of relay R', through contact 37 and jack spring 38

to plug-tip 39 of plug P, through connec-
tions 40 and 52 to ringing key K', through the latter and the connection 40 to tip 39 of plug P', from this plug-tip to jack-spring 38, and from the latter to contact 37, from
70 this contact through armature 4 to line 3 of substation S, through this said substation to line 14, thence through condenser 13 to arma-
75 ture 12, through contact 32 to jack ring or casing 31, thence to the sleeve 30 of plug P', from this plug sleeve to ringing key K', from this said ringing key to contact 58, and
80 thence through connection 59 to sleeve 30 of plug P, from this plug sleeve to the ring or casing 31 of jack J, thence through contact
85 32 and armature 12 and the condenser 13 to line 14 of substation S, and thence through substation S to the line 3.

It will be observed that the talking cur-
rent is supplied by the batteries 43 at the
85 substations, and that in talking at substa-
tion S, for example, the circuit is completed from line 3 through the transmitter T to battery 43, through the primary 42 of the
90 induction coil, thence through contact 41 and the receiver-hook or switch H, and in-
ductively through the induction coil to line 14. In this way, the system permits the two subscribers to communicate with each other
95 in the usual well-known manner.

The clearing-out signal, by which the
central operator is advised that the conver-
sation is at an end, and that the subscribers
have hung up their receivers, consists, in this
100 case, of the relay I, adapted to operate a
suitable drop or clearing-out signal. For ex-
ample, when the receiver at substation S is
hung up, the subscriber operates the mag-
neto M for the purpose of advising the
105 operator that the plugs may be removed for the purpose of disconnecting the two substa-
tions. When the receiver is thus hung up,
a circuit is completed from the magneto M
of station S, through line 14 to condenser 13,
thence through relay armature 12 to contact
110 32, through the ring or casing 31 of jack J to the sleeve 30 of plug P, thence through
connections 59 and 61 to relay I, through
this relay and connections 60, 52 and 40 to
tip 39 of plug P, from this plug-tip to jack
115 spring 38 of the jack J, thence through con-
tact 37 and armature 4 to line 3, from this
line 3 through the receiver-hook or switch H
to contact 2, and thence through the bell 1
120 to the magneto M. The subscriber at sub-
station S can then operate the magneto, and
the current thereby generated will cause the
relay I to operate the clearing-out signal.
This clearing-out signal, as stated, may be of
125 any suitable form or character, and, when
displayed, advises the central operator that
the subscribers have hung up their receivers
and rung off. The operator then withdraws
the plugs P and P' from the jacks J and J'
130 of the respective substations, and the system

is then in its normal or inoperative condition.

In answering the call sent in from substation S, it will be observed that the operator causes the operation of cut-out relay R', and that in so doing the relay R and lamp L are cut out as a result of the short circuit through which these devices are operated being broken or opened by the attraction of the armatures 4 and 12 to the magnet of the relay R'. It will be observed, however, that the condenser 13 is interposed in the line, and that in thus restoring the calling signal only a short circuit is broken, and that consequently the effect of this break is not electrically communicated to the substation S, and that consequently this break will not extend to and be audible in the receiver at said station. In this way, the circuit arrangement permits the central operator to answer a call and to break a circuit for the purpose of restoring the calling signal without causing an objectionable or unpleasant sound in the receiver of the substation from whence the call came. It is apparent, therefore, that the circuit arrangement operates to quiet the line, and, at the same time, that the advantages of certain approved apparatus and methods of operation are retained. Furthermore, the circuit arrangement has the advantage of enabling the battery B to light the calling signal lamp L through a short local circuit of comparatively low and unvarying resistance.

The magneto M is employed for initially energizing the relay R, it being observed that the magneto current is carried over a line circuit of comparatively high resistance. The operation of the relay R by the magneto current in this manner, is, however, sufficient to close the short circuit formed by connections 18 and 15 which, it will be observed, are in the nature of a short circuit connection extending between the line terminals at the central station. Thus the magneto current is employed, as stated, for initially energizing the relay R, and when once the short local circuit is closed, this relay continues to be energized by the current of battery B. Thus the call sent in operates to display the calling signal, and this signal continues to be displayed until the operator in answering inserts the plug of the cord circuit in the spring jack. In other words, the calling signal is capable of locking or holding itself in operation until the cut-out relay is operated by insertion of the plug and regardless of the condition of the apparatus at the substation.

The condensers 13 not only form a gap in the line and thereby tend to quiet the latter in answering calls, but also serve as a means for preventing the constant displaying of the calling signals. Furthermore, the jacks, it will be observed, are normally disconnected

from the lines, and are only connected to the latter when the cut-out relays are energized by the insertion of the plugs. Practically, therefore, the jacks are normally insulated both from the line and from the ground. This also is instrumental in quieting the lines and in eliminating the effects or conditions which would tend to annoy the listening subscribers. In addition, it will be seen that each line relay is part of both the line and local circuits. In this way, each line relay is initially energized through a line circuit, and is then permanently energized by being included in the local battery circuit—that is to say, it is energized by the local circuit until the answering plug is inserted in the jack. The conductors 15 and 18, together with the armatures and contact-points of the relays R, constitute normally open short-circuit connections across the line terminals at the central station. When closed, these short circuit connections operate to short-circuit the substations, regardless of the interposition of the condensers 13. In other words, when these short-circuit connections are closed, the substations will be cut off whether condensers are inserted in the line or not. With the local batteries 43 at the substations, and with the centralized battery B at the central exchange, it will be observed that the system is of the central energy type, current for the signals being furnished from a common battery, but the current for talking purposes being furnished from local batteries.

It will be readily understood that any suitable arrangement can be employed for making the busy test—that is to say, for testing the line of a called subscriber, where the exchange is of the multiple switch-board type, as by touching the tip of the plug to the thimble or testing ring of the multiple jack, connected with the called subscriber's line, in the usual and well-known manner.

I claim as my invention,

1. In a telephone system, the combination of signal devices by which the subscriber signals the operator, a substation and a central station, complete metallic line connection between said stations, and a condenser included in the talking circuit and located in one limb of the line at the central station together with a battery at the central station for supplying current to the signal devices by which the subscriber attracts the attention of the operator at the central station.

2. In a telephone system, the combination of a subscriber's line, a subscriber's magneto normally connected with both sides of the line, a normally open short-circuit connection across the line terminals at the central station, a relay normally connected with the line and arranged to be en-

energized by said magneto, said relay when energized closing the short-circuit connection, a battery at the central station, and a normally open local circuit including said

5 battery, relay and short-circuit connection.

3. In a telephone system, the combination of a subscriber's line, a subscriber's magneto connected with the line, a normally open short-circuit connection across
10 the line terminals at the central station, a line relay connected and arranged to be initially energized by said magneto, the said short-circuit connection being closed when the relay is energized, a line signal
15 and a battery at the central station, and a normally open local circuit including said battery, line signal, line relay and short-circuit connection.

4. In a telephone system, the combination of a subscriber's line, a spring-jack normally disconnected from the line, a line
20 signal, means at the substation for operating said line signal, and a condenser included in the talking circuit and located in the line at the central station for preventing
25 the constant display of said line signal together with means for connecting the jack to the line, and a battery for furnishing current to said line signal.

5. In a telephone system, the combination of a subscriber's line, a spring jack normally insulated both from the line and the ground, a line signal, means at the sub-
30 station for operating said line signal, a condenser included in the talking circuit and located in the line at the central station for preventing the continuous display of said
35 line signal, and a cut-out relay for restoring the line signal and establishing connection between the jack and the line.
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6. In a telephone system, the combination of a subscriber's line, a line lamp connected with a battery at the central station, a line
45 relay, means at the substation for initially energizing said line relay, a spring jack normally insulated both from the line and the ground, a condenser in the line at the central station, a normally open short-circuit
50 connection across the line terminals at the central station, a normally open switch-point for said short-circuit connection, said switch-point being controlled by said line relay, and a cut-out relay for restoring the
55 line signal and establishing connection between the jack and the line.

7. In a telephone system, the combination of a subscriber's line, a normally open short-circuit connection across the line terminals at the central station, a relay con-
60 nected with the line and arranged to control a normally open switch-point in said short-circuit connection, and a magneto at the substation adapted and arranged for energizing said line relay and thereby closing
65 said short-circuit connection.

8. In a telephone system, the combination of a subscriber's line, a line relay normally connected with the line, a line lamp in series with said line relay, and a subscriber's
70 magneto connected and arranged for projecting a current through the said relay and lamp.

9. In a telephone system, the combination of a subscriber's line, a line relay, a line
75 lamp arranged in series and normally connected with the line, a centralized battery connected in series with said relay and lamp, and a subscriber's magneto connected and arranged for projecting a current
80 through said relay, lamp and battery.

10. In a telephone system, the combination of a subscriber's line, a normally open short-circuit connection across the line terminals at the central station, a line relay
85 normally connected with the line and arranged to control a normally open switch-point in said short-circuit connection, a line lamp and a battery connected in series with said line relay, and a subscriber's magneto
90 connected and arranged for projecting a current through said relay, lamp and battery, so as to initially energize the relay, the said-circuit connection when closed including the relay, lamp and battery in a local
95 circuit.

11. In a telephone system, the combination of a subscriber's line, a spring jack normally disconnected from the line, a con-
100 denser in the line at the central station, a line lamp normally connected with the line at the central station, a battery connected with said lamp, and a subscriber's generator connected and arranged for projecting current through said lamp and battery to-
105 gether with means for connecting the jack to the line.

12. In a telephone system, the combination of a substation equipped with local battery apparatus, a central station provided with a centralized signaling battery,
110 suitable line connection between said stations, a normally open short-circuit connection across the line terminals at the central station, a line relay connected with the line and arranged to control said short-circuit
115 connection, and means for initially energizing said relay.

13. In a telephone system, the combination of a subscriber's line, a normally open short-circuit connection across the line terminals
120 at the central station, a condenser in the line at the central station, a line relay normally connected with the line, a battery connected with said relay, a line lamp arranged in series with said relay and battery, said relay
125 being arranged to control said short-circuit connection, a subscriber's magneto at the substation for initially energizing said relay, the latter when energized closing the short-circuit connection and thereby including
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itself and the latter and also the lamp and battery in a local circuit, and manually operated means for deenergizing said relay and thereby restoring or extinguishing said lamp.

14. In a telephone system, a substation and central station and line connection between the same, a condenser in the line, a relay and calling signal and a battery for operating the same at the central station, a short circuit connection between the terminals of the line at the central station, said short circuit connection being normally open but closed when the relay is operated, a magneto at the substation adapted to operate said relay for the purpose of displaying the calling signal, the relay when operated by the magneto establishing a short local circuit through the short circuit connection, said relay being a part of said local circuit for the purpose of holding such local circuit closed until the call is answered, substantially as described.

15. A telephone system comprising a substation and a central station and a line connection between the same, a relay and a battery normally connected through a condenser with the line of said substation, a magneto at the substation normally in circuit with the line, and a short circuit connection between the line terminals at the central station, said short circuit being normally open but closed when the relay is operated by rotating the armature of said magneto, and the said short circuit when closed cutting out the substation and establishing a short local circuit through which the current of said battery flows until the call is answered by the operator at the central station, substantially as described.

16. A telephone system comprising a substation and a central station and a metallic line connection between the same, a magneto at the substation for effecting the operation of said calling signal, a battery at the central station, a lamp calling signal arranged to be lighted by said battery, a short circuit connection between the terminals of the line at the central station, said lamp battery being normally in circuit for calling purposes with the magneto at the substation, a relay for closing said short circuit connection and thereby causing the current from said battery to flow through said lamp, and a cut-out relay operative to break said circuit for the purpose of extinguishing or restoring said lamp, said cut-out relay being energized when the operator answers the call, substantially as described.

17. In a telephone system, the combination of signal devices by which the subscriber signals the operator, sub-station apparatus, central station switchboard apparatus, line connection between said sub-station apparatus and said switchboard apparatus, and a condenser in the line between the sub-sta-

tion apparatus and the switchboard apparatus, together with a battery at the central station for supplying current to the signal devices by which the subscriber attracts the attention of the operator at the central station.

18. In a telephone system, the combination of sub-station apparatus, central station switchboard apparatus, complete metallic line connection between the two stations, the line circuit being normally closed at the substation, said switchboard apparatus involving a battery and electromagnet normally connected in series with the said sub-station apparatus, and a condenser in the line between the sub-station apparatus and the switchboard apparatus, said condenser serving to prevent a continuous energizing of said electro-magnet.

19. In a telephone system, the combination of sub-station apparatus having a local battery for talking, central station switchboard apparatus, a centralized call battery associated with said switchboard apparatus, line connection between the said switchboard apparatus and sub-station apparatus, said switchboard apparatus involving a spring jack normally disconnected from the line, an operator's cord circuit provided with a plug for insertion in said jack, and a relay connected with said centralized call battery and adapted to connect the jack with the line when the plug is inserted, said switchboard also involving a calling signal adapted to be controlled by the sub-station apparatus and to be operated by current supplied from said centralized call battery.

20. The combination with a calling telephone line, of an individual connection terminal for the line normally disconnected therefrom, means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, and means for automatically connecting said terminal with the line when a connection is established therewith in response to the call, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

21. The combination with a telephone line, of an individual connection-terminal for the line, means for connecting the same with the line, means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, and means for automatically disconnecting the same from the line when not in use, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

22. The combination with a telephone line and an individual connection-terminal for the line, of means including a normally open

connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, means for automatically connecting the terminal with the line when in use, and for automatically disconnecting the same therefrom when not in use, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

23. The combination with a calling telephone line and an individual connection-terminal for the line normally disconnected therefrom, of means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, means actuated by the act of making connection with the line in response to the call for connecting said terminal with the line, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

24. The combination with a telephone line and an individual connection-terminal for the line normally disconnected therefrom, of means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, means actuated by the act of making connection with the line for connecting said terminal with the line, and means actuated by the act of unmaking connection with the line for disconnecting said connection-terminal from the line, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

25. The combination with a telephone line and an individual connection-terminal for the line normally disconnected therefrom, of a line signal, means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, a relay distinct from said signal for connecting said terminal with the line, and means actuated by the act of making connection with the line for operating said relay, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

26. The combination with a telephone line and an individual connection-terminal for the line normally disconnected therefrom, of a signal for said line, means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, a local circuit, a relay distinct from said signal and a source of current therein, and means actuated by the act of making connection with the line for closing said local circuit to actuate said relay and thereby connect said terminal with the line, sub-

stantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

27. The combination with a telephone line and a connection-terminal in the form of a spring-jack or switch-socket, of means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, a connecting plug, means actuated by the insertion of said plug in the socket for connecting said terminal with the line, and means actuated by the withdrawal of the plug for automatically disconnecting said terminal, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

28. The combination with a telephone line and a connection terminal in the form of a spring-jack or switch-socket, of means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, a connecting plug, a relay for controlling the circuit to said connection-terminal, a local circuit including said relay, normally-separated contacts at the switch-socket, and means for closing said contacts by the insertion of the connection-plug in said switch-socket, substantially as described.

29. The combination with a telephone line and an individual connection-terminal for the line, of a signaling device, means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, and means for automatically connecting the terminal with the line and disconnecting the signaling device therefrom, and vice versa, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

30. The combination with a telephone line, of an individual connection-terminal for the line and a signaling device, means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, and means for automatically connecting one of said elements with the line and simultaneously disconnecting the other therefrom, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

31. The combination with a telephone line, of an individual connection-terminal for the line normally disconnected therefrom, a signaling device normally connected therewith, means including a normally open connection between the line wire terminal at the central station for automatically short circuiting

the line when a call is sent in, and means actuated by the act of making connection with the line for connecting said terminal with the line and for disconnecting said signal device therefrom, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

32. The combination with a telephone line, of a connection-terminal, a signaling device, means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, and means actuated by the act of making connections with the line for connecting said terminal therewith and for disconnecting said signaling device therefrom, and means actuated by the act of unmaking connection with the line for disconnecting said terminal therefrom, and for connecting said signaling device therewith, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

33. The combination with a telephone line, of a connection-terminal and a signaling device, means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, and means for automatically connecting said connection terminal and signaling device with, and disconnecting the same from, the line so that both of said elements are never in connection with the line at the same time, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

34. The combination with a telephone line, of a connection-terminal normally disconnected therefrom, a signaling device normally connected therewith, means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, a relay, and means actuated by the act of making connection with the line for operating said relay to connect said terminal with the line and to disconnect said signaling device from the line, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

35. The combination with a telephone line, of an individual connection-terminal for the line, means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, a relay for connecting the same with and disconnecting the same from the line, and a test-circuit controlled by said relay, substantially as described, and an electric mag-

net excluded from the talking circuit for giving a disconnect signal.

36. The combination with a telephone line, of an individual connection-terminal for the line normally disconnected therefrom, means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, a relay, and means actuated by the act of making connection with the line for operating said relay to connect said terminal with the line, and a test-circuit controlled by said relay, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

37. The combination with a telephone line, of means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, a relay having a winding included in a local circuit including contacts at a connection-terminal, a pair of springs or other movable parts actuated by said relay, and connected respectively with the limbs of said telephone line, back contacts against which said springs or parts normally rest and a signaling device connected between said back contacts, front contacts with which said springs or parts engage when the relay is energized, and the line-contacts of a connection-terminal connected with said front contacts, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

38. In a telephone system, a line having two limbs extending to a central office, means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, a relay having a movable contact member for each limb of said line, a signal included in circuit between the back contacts of said members, a spring-jack normally disconnected from said line and having its talking contacts included between the front contacts of said relay members, and a local circuit including the coil of said relay controlled at the spring-jack, whereby said signal is disconnected from said line and said jack is connected with said line when a connection is made at the jack, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

39. In a telephone system, a line having two limbs extending to a central office, means including a normally open connection between the line wire terminals at the central station for automatically short circuiting the line when a call is sent in, a relay having a movable contact member for

each limb of said line, a signal included in circuit between the back contacts of said members, a spring-jack normally disconnected from said line and having its talking contacts included between the front contacts of said relay members, and a local circuit controlled by additional contacts at the spring-jack, whereby said signal is disconnected from said line and said jack is connected with said line when a connection is made at the jack, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

40. In a telephone system, the combination of signal devices by which the subscriber signals the operator, a spring jack and a subscriber's line, and a condenser in line just outside of said spring jack together with a battery at the central station for supplying current to the signal devices by which the subscriber attracts the attention of the operator at the central station.

41. A telephone system comprising a subscriber's line, a line signal, a magneto at the substation for initially operating said line signal, a condenser in the line and a battery at the central station for maintaining said line signal in operation after the current from the magneto has ceased and until the call is answered by the operator.

42. A telephone system comprising means whereby the calling signal is initially operated by alternating current from a substation, and then held in operation by current from the central station, by a winding forming part of the path of each current, and a cut off relay for retiring the line signal when the operator answers the call.

43. The combination with a calling telephone-line, of an individual connection-terminal for the line normally disconnected therefrom, and means for automatically connecting said terminal with the line when a connection is established therewith in response to the call, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

44. The combination with a telephone-line, of an individual connection-terminal for the line, means for connecting the same with the line, and means for automatically disconnecting the same from the line when not in use, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

45. The combination with a telephone-line and an individual connection-terminal

for the line, of means for automatically connecting the terminal with the line when in use, and for automatically disconnecting the same therefrom when not in use, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

46. The combination with a calling telephone-line and an individual connection-terminal for the line normally disconnected therefrom, of means actuated by the act of making connection with the line in response to the call for connecting said terminal with the line, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

47. The combination with a telephone-line and an individual connection-terminal for the line normally disconnected therefrom, of means actuated by the act of making connection with the line for connecting said terminal with the line, and means actuated by the act of unmaking connection with the line for disconnecting said connection-terminal from the line, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

48. The combination with a telephone-line and an individual connection-terminal for the line normally disconnected therefrom, of a line-signal, a relay distinct from said signal for connecting said terminal with the line, and means actuated by the act of making connection with the line for operating said relay, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

49. The combination with a telephone-line and an individual connection-terminal for the line normally disconnected therefrom, of a signal for said line, a local circuit, a relay distinct from said signal and a source of current therein, and means actuated by the act of making connection with the line for closing said local circuit to actuate said relay and thereby connect said terminal with the line, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

50. The combination with a telephone-line

and a connection-terminal in the form of a spring-jack or switch-socket, of a connecting-plug, means actuated by the insertion of said plug in the socket for connecting
 5 said terminal with the line, and means actuated by the withdrawal of the plug for automatically disconnecting said terminal, together with normally bridged bells and generators at the subscribers' stations, a line
 10 relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

51. The combination with a telephone-line and a connection-terminal in the form of a
 15 spring-jack or switch-socket, of a connecting-plug, a relay for controlling the circuit to said connection-terminal, a local circuit including said relay, normally-separated contacts at the switch-socket, and means for
 20 closing said contacts by the insertion of the connecting-plug in said switch-socket, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line
 25 relay, and bridging supervisory and ringing apparatus at the central station.

52. The combination with a telephone-line and an individual connection-terminal for the line, of a signaling-device, and means
 30 for automatically connecting the terminal with the line and disconnecting the signaling device therefrom, and vice versa, together with normally bridged bells and generators at the subscribers' stations, a line
 35 relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

53. The combination with a telephone-line, of an individual connection-terminal for the
 40 line and a signaling device, and means for automatically connecting one of said elements with the line and simultaneously disconnecting the other therefrom, together with normally bridged bells and generators at
 45 the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

54. The combination with a telephone-line, of an individual connection-terminal
 50 for the line normally disconnected therefrom, a signaling device normally connected therewith, and means actuated by the act of making connection with the line for connecting said terminal with the line and for
 55 disconnecting said signal device therefrom, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing
 60 apparatus at the central station.

55. The combination with a telephone-line, of a connection-terminal, a signaling
 65 device, and means actuated by the act of making connection with the line for con-

necting said terminal therewith and for disconnecting said signaling device therefrom, and means actuated by the act of unmaking
 connection with the line for disconnecting said terminal therefrom, and for disconnecting
 70 said signaling device therewith, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing ap-
 75 paratus at the central station.

56. The combination with a telephone-line, of a connection-terminal and a signaling
 device, and means for automatically connecting said elements with, and disconnecting
 80 the same from, the line so that both of said elements are never in connection with the line at the same time, together with normally bridged bells and generators at the subscribers' stations, a line relay, a
 85 local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

57. The combination with a telephone-line, of a connection-terminal normally dis-
 90 connected therefrom, a signaling device normally connected therewith, a relay, and means actuated by the act of making connection with the line for operating said relay to connect said terminal with the line
 95 and to disconnect said signaling device from the line, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging super-
 100 visory and ringing apparatus at the central station.

58. The combination with a telephone-line, of an individual connection-terminal
 105 for the line, a relay for connecting the same with and disconnecting the same from the line, and a test-circuit controlled by said relay, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing
 110 said line relay, and bridging supervisory and ringing apparatus at the central station.

59. The combination with a telephone-line, of an individual connection-terminal
 115 for the line normally disconnected therefrom, a relay, and means actuated by the act of making connection with the line for operating said relay to connect said terminal with the line, and a sleeve-circuit controlled by said relay, together with normally
 120 bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.
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60. The combination with a telephone-line, of a relay having a winding included
 in a local circuit including contacts at a connection-terminal, a pair of springs or
 130 other movable parts actuated by said relay,

and connected respectively with the limbs of said telephone-line, back contacts against which said springs or parts normally rest, and a signaling device connected between said back contacts, front contacts with which said springs or parts engage when the relay is energized, and the line-contacts of a connection-terminal connected with said front contacts, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

61. In a telephone system, a line having two limbs extending to a central office, a relay having a movable contact member for each limb of said line, a signal included in circuit between the back contacts of said members, a spring-jack normally disconnected from said line and having its talking contacts included between the front contacts of said relay members, and a local circuit including the coil of said relay controlled at the spring-jack, whereby said signal is disconnected from said line and said jack is connected with said line when a connection is made at the jack, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

62. In a telephone system, a line having two limbs extending to a central office, a relay having a movable contact member for each limb of said line, a signal included in circuit between the back contacts of said members, a spring-jack normally disconnected from said line and having its talking contacts included between the front contacts of said relay members, and a local circuit controlled by additional contacts at the spring-jack, whereby said signal is disconnected from said line and said jack is connected with said line when a connection is made at the jack, together with normally bridged bells and generators at the subscribers' stations, a line relay, a local circuit for energizing said line relay, and bridging supervisory and ringing apparatus at the central station.

63. In a telephone system, the combination of a line signal device, a battery for holding the line signal device in operation, and a generator adapted for supplying current through the battery for the purpose of initially operating the line signal device and thereby causing the latter to include itself in a closed battery circuit, which battery circuit insures the display of the line signal until the operator answers the call.

64. In a telephone system, the combination of the line relay, the cut-off relay, and the generator and hook-switch and battery

and plugs and jacks for operating and controlling the same, and means operated by the line relay for short circuiting the line when the subscriber calls, substantially as described, and an electric magnet excluded from the talking circuit for giving a disconnect signal.

65. In a telephone system, a subscriber's line, a line relay provided with means for short circuiting the line when the subscriber calls, by a normally open connection between the two sides of the line, a magneto by which the subscriber initially energizes said relay, and a battery for then keeping said relay energized over the short circuit.

66. In a telephone system, a subscriber's line, a line relay provided with means for short circuiting the line when the subscriber calls, and a condenser in the line.

67. In a telephone system, a subscriber's line normally closed at the sub-station thereof, a condenser in the line, in the path of the voice and ringing currents, so that the subscriber of said line talks through said condenser, and a line signal and a source of current normally bridged across the line.

68. In a telephone system, a subscriber's line, a jack and a line signal therefor, a sub-station source of current for calling, a central source for keeping the line signal displayed until the operator answers, and means for automatically retiring the line signal and connecting the jack with the line when the operator answers the call.

69. In a telephone system, a subscriber's line, a jack normally disconnected therefrom, a line signal and a cut-off relay, means for energizing a cut off relay to retire the line signal and connect the jack with the line, a jack normally disconnected therefor keeping the line signal displayed until the operator answers.

70. In a telephone system, a subscriber's line normally closed at the sub-station thereof, a battery normally bridged on the line, and a condenser in the line, in the path of the voice and ringing currents, so that the subscriber of said line talks through said condenser.

71. In a telephone system, a subscriber's line, a jack normally disconnected therefrom, a cord circuit having only two strands, said strands constituting part of the talking circuit, a supervisory mechanism bridged across the cord circuit, means for signaling the subscriber by projecting ringing current over both sides of the said line, and a central battery for signaling bridged across the line.

72. In a telephone system, a subscriber's line, a ringer normally bridged thereon, a jack normally disconnected therefrom, supervisory mechanism adapted to be included in bridge of the talking circuit, means for operating said ringer by projecting signal-

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ing current over both sides of the said line, and a central battery for signaling bridged across the line.

73. In a telephone system, a subscriber's
5 line, a jack normally disconnected there-
from, means for signaling the subscriber by
projecting ringing current over the two sides
of said line in series, a cord circuit having
only two strands, relay mechanism bridged
10 across the cord circuit between the said
strands, means for operating said super-
visory mechanism when the subscriber hangs
up his telephone, and a central battery for
signaling bridged across the line.

74. In a telephone system, a subscriber's
15 line, a ringer bridged across the same, a
line signal and jack, means for operating

said ringer over both sides of the line in
series, means comprising a cut-off relay for
automatically retiring the line signal and 20
connecting the jack with the line when the
operator answers, a cord circuit having only
two strands, a supervisory mechanism
bridged across the cord circuit between said
strands, said supervisory mechanism respon- 25
sive to the subscriber for giving a discon-
nect signal, and a central battery for signal-
ing bridged across the line.

Signed by me at Chicago, Cook county,
Illinois, this 22nd day of October 1901.

HENRY P. CLAUSEN.

Witnesses:

CHAS. C. BULKLEY,
HARRY P. BAUMGARTNER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."
