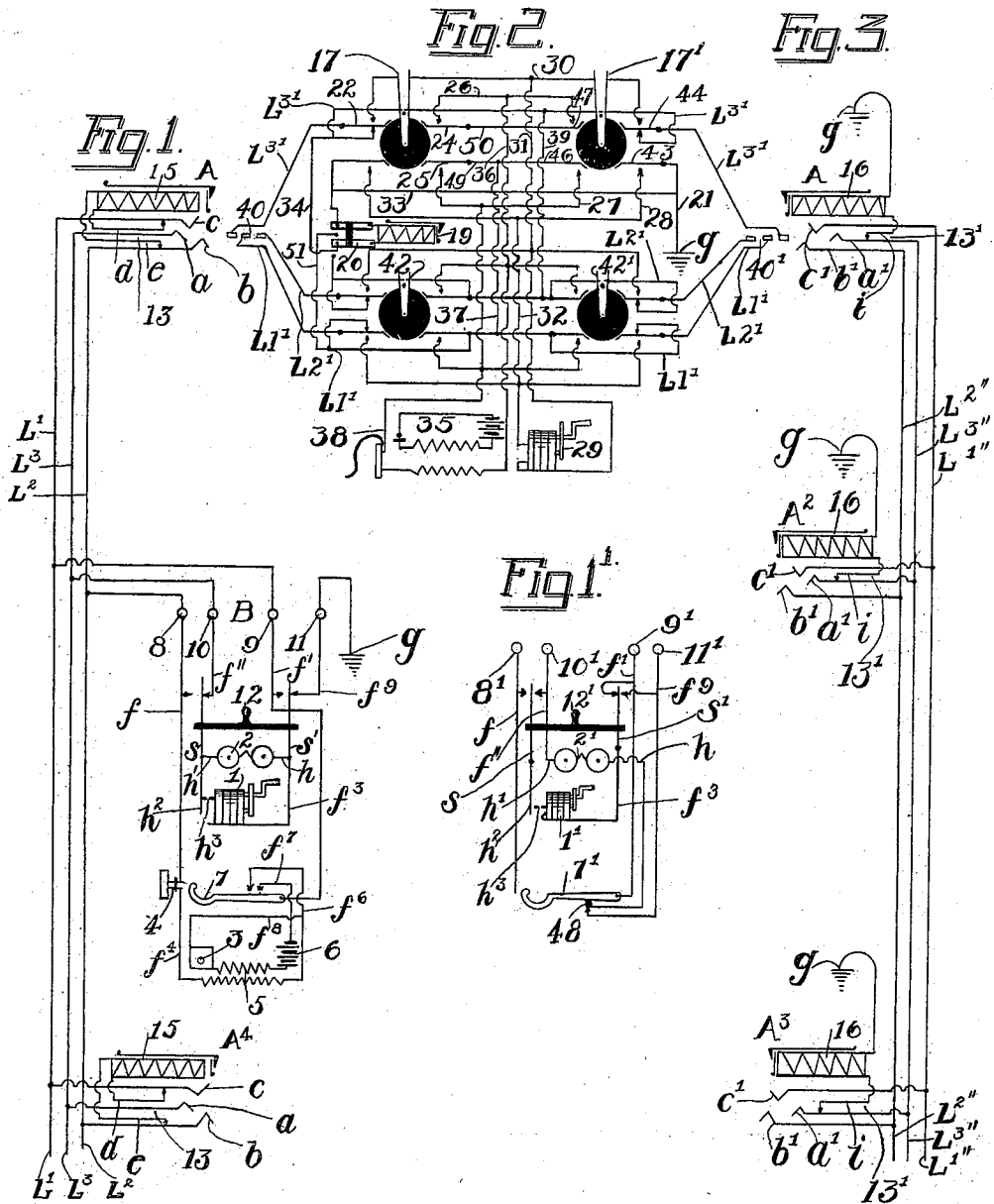


H. F. JOECKEL.
BRIDGING TELEPHONE SYSTEM.
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982,209.

Patented Jan. 17, 1911.



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BRIDGING TELEPHONE SYSTEM.

982,209.

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To all whom it may concern:

Be it known that I, HENRY F. JOECKEL, a citizen of the United States, residing at Camp Point, in the county of Adams and State of Illinois, have invented certain new and useful Improvements in Bridging Telephone Systems, of which the following is a specification, and which are illustrated in the accompanying drawings, forming a part thereof.

The invention relates to bridging telephone systems in which the telephone sets consist of a magneto, a bell, a transmitter, an induction coil, a receiver, a local battery, and hook switch, and wherein any one party of a party line may call any other party of the same line by a signaling code and wherein the metallic line circuits of trunk and long distance lines are used to complete line circuits between telephone lines terminating at different central stations.

It has for its object the provision of means for a balanced metallic talking line circuit and a ground return signaling line circuit, insulated from one another, for the different lines of the system.

In systems of this kind it frequently happens that a signal upon a party line causes a number of receivers to be taken from their switch hooks and if the signal must be repeated while those receivers are from their switch hooks, and when the line has but one line circuit, signaling becomes indistinct. It also frequently happens that a sub-station of a party line wants connection with a distant sub-station and when the system is a one line circuit system, talking is frequently unsatisfactory on account of the heavy leakage of the talking circuit caused by the many bridges of sub-station bells, central station clearing-out drops, and central station line signals bridged upon the talking line circuit, this same unsatisfactory talking condition frequently exists when a sub-station of an exchange system gets connection with a sub-station of a distant exchange system. These unsatisfactory conditions are overcome, and other advantages obtained in the mechanism and system of wiring, as hereinafter described and shown in the accompanying drawings in which—

Figure 1 is a view of a telephone line with one sub-station and two central stations. The telephone line consists of three line wires. Two of said line wires are used to form a balanced metallic line circuit which

is used for talking and for signaling the central station. The other line wire and a ground return is used to form a separate signaling line circuit for signaling the sub-stations and operating the clearing-out drop. Fig. 1' is a view of a switch 12' magneto 1', bell 2', and switch hook 7' being the same shown in Fig. 1, but wired slightly different and provided with a switch 48 in the bell circuit. Fig. 2 is a view of cord circuits and operator's set of a metallic circuit magneto call bridging switch board of the usual one circuit line bridging system, the cord set having been provided with an additional metallic lead and the additional arrangements necessary to make the cord circuits and operator's set suitable to complete line circuits between two telephone lines of this divided circuit three wire line system. Fig. 3 is a view of a bridging trunk or long distance telephone line having three central stations and consisting of three line wires and a ground return, and the necessary arrangements to make the line suitable to complete line circuits of telephone lines of this divided circuit three line wire system, terminating at different central stations.

In the drawings like numbers and like letters represent like parts.

Referring first to Fig. 1, L^1 , L^2 , and L^3 , are the metallic conductors of the telephone line of one sub-station B and two central stations A and A', at the sub-station B, 1 is a magneto, 2 is a bell, 3 is a transmitter, 4 is a receiver, 5 is an induction coil, 6 is a local battery, 7 is a switch hook, and 12 is a double switch. These instruments and their wiring f' f'' f^3 f^4 f^5 f^6 f^7 f^8 f^9 h h' and h^2 , except the change made by adding the double switch 12, are those of a telephone set of the usual one circuit line magneto call local battery bridging telephone system, 8 9 10 and 11 are the binding posts of the said telephone set, the double switch 12 has arms S and S'. The magneto circuit is from binding post 10 to switch arm S by f'' , to magneto 1 by h^2 , and the usual cut out h^3 , to switch arm S' by f^3 , and to binding post 11 by f^9 . The bell circuit is from binding post 10 to switch arm S by f'' , to bell 2 by h' , to switch arm S' by h , and to binding post 11 by f^9 . Binding post 10 is connected to L^3 , and binding post 11 is connected to the ground g , the line wire L^3 and the ground form a signaling line circuit, which is used for signaling only, and forms no

part of the talking line circuit. The double switch 12 with this wiring, is adapted to bridge the magneto and bell circuit together from binding post 10 to 11, or from binding post 8 to 9, the normal position of the switch 12 in this system, is to leg the magneto and bell circuit from L^3 , to ground. The circuit of the magneto is however normally open at the usual cut out regardless of the position of the double switch 12. The switch 12 may be wired as in Fig. 1' and may be of any suitable pattern. An ordinary double pole double throw knife switch could be used but a more compact switch would be more desirable. The secondary talking circuit of this telephone set is from binding post 8 to receiver 4 by f , to induction coil 5 by f^4 , to switch hook 7 by f^6 , and to binding post 9 by f' . Binding post 8 is connected to L^2 , and binding post 9 is connected to L^1 . The line conductors L^2 and L^1 form a balanced metallic talking line circuit. The talking circuit of the telephone set is normally open at the switch hook 7. When the switch 12 is in the normal position then the bell 2 is legged to the ground from L^3 and signals are then received upon the ground return signaling line circuit and the magneto 1 may be cut into said signaling circuit to signal in the usual manner. When the magneto 1 and bell 2 are bridged with the switch 12 from binding post 8 to 9 then signals may be received upon the metallic talking line circuit and the magneto 1 may be cut into said circuit to signal in the usual manner and the telephone set may therefore still be used upon one circuit line bridging telephone systems. The switch 12 further adapts this telephone set to be used upon the telephone system disclosed in my Patent No. 955,335, dated April 19, 1910, in which a metallic line conductor is used to form a metallic line circuit with another metallic conductor and is also used to form a ground return line circuit, as binding posts 8 and 10 may both be connected to the metallic conductor L^2 which then forms the ground return signaling line circuit, the switch 12 will then furnish the same signaling possibilities as the switch E in the pending application does. The switch 12 may be placed in circuit of the magneto and bell of any make of one line circuit magneto call local battery bridging telephone sets in the manner above described and thereby adapt any make of one circuit line bridging telephone set to be used as the one described of station B.

The central station A is connected to L^1 , L^2 and L^3 by a three point contact line jack 13, a is the tip contact spring connected to L^3 , b is the sleeve contact spring connected to L^2 , and c is the between contact spring connected to L^1 . 15 is an annunciator normally bridged from L^1 to L^2 at contact

springs b and c by contacts e and d respectively. The annunciator 15 is cut out whenever a switching plug is inserted into the line jack 13. The line jack and annunciator of central station A are duplicated at central station A' and are connected to L^1 , L^2 and L^3 in the same manner and relation. Only one sub-station is shown but it is to be understood that there may be more of them equipped and connected in the same manner. Also it is to be understood that there may be but one central station upon the line. The switch 12, magneto 1, bell 2, and switch hook 7, may be wired like the switch 12', magneto 1', bell 2', and switch hook 7', shown in Fig. 1'.

Fig. 1' is a diagram of a magneto 1', bell 2', switch 12', switch hook 7', and switch 48. 8' 9' 10' and 11' are the binding posts. These instruments are wired suitable for a telephone set to be used upon the same line with the telephone set of Fig. 1. The bell 2' is permanently connected to binding post 10', while the wire leading from the bell 2' to binding post 11' has a switch 48 interposed which is normally closed, but is open when the receiver is from the switch hook 7'. The switch 48 is insulated from the switch hook 7'. It may be omitted without interfering with the usefulness of the wiring for this system, or it may be interposed in the wires h or h' of Fig. 1, and it is especially recommended for telephone sets of party lines. The circuit of the magneto 1' is controlled by the switch 12' like the circuit of the magneto 1 in Fig. 1 is by the switch 12, and thus permits switching the magneto circuit from binding post 8' to 9' or from binding posts 10' to 11'. In wiring the magneto and bell of a telephone set of the usual one circuit line bridging telephone system, like the magneto 1' and bell 2', the normal position of the switch 12 is immaterial as the magneto is normally cut out at the usual cut out. For this system the usual cut out is, however, not needed as the switch 12' may normally be open. These descriptions of the different wiring of the magneto and bell show that changes in detail may be made without departing from the principle of the system, as either or all of the wiring described may be used in different telephone sets of the same telephone line.

Fig. 2 is a diagram of an operator's cord set of a metallic circuit magneto bridging switch board of a central station of the usual one circuit line system, that has been provided with an additional cord lead L^3 , a double switch 20, three point contact switching plugs 40 and 40', and ringing and listening keys 17 and 17'. L^1 and L^2 are the original cord leads and 42 and 42' are the original ringing and listening keys of the cord leads L^1 and L^2 , the added cord

lead L^3 is normally continuous from the tip contact of switching plug 40 to the tip contact of switching plug 40' and forms a separate ground return signaling line circuit, when connected with the separate ground return signaling line circuit of telephone lines of Fig. 1 and Fig. 3. The ringing and listening key 17 when in the ringing position, opens L^3 at the key spring 22 and connects the magneto 29 or its equivalent to L^3 of switch plug 40 through wires 31 30 and key spring 22 and to the ground through wires 32 28 and key spring 23 and wires 33 and 21. When the key 17 is in the normal position L^3 is closed at the key spring 22 and the magneto 29 is disconnected from said key springs. When the key 17 is in the listening position the operator's talking set 35 is connected to L^1 by wires 38 27, key spring 25, wires 49 and 37, and to L^2 by wires 36 26, key spring 24, wires 50 and 39. When the key 17' is in the ringing position it opens L^3 at the key spring 44 and connects the magneto 29 or its equivalent to L^3 of switch plug 40' through wires 31 30 and key spring 44 and to the ground through wires 32 28, key spring 43, and wire 21. When the key 17' is in the normal position L^3 is closed at key spring 44, and the magneto 29 is disconnected from said key springs. When the key 17' is in the listening position, the operator's talking set 35 is connected to L^1 by wires 38 27, key spring 46, wires 49 and 37, and to L^2 by wires 36 26, key spring 47, wires 50 and 39. The operator's talking set 35 is normally disconnected from L^1 and L^2 . The clearing-out drop 19 is normally connected to L^3 through one limb of switch 20, and wire 34, and to the ground through the other limb of switch 20, and wires 33 and 21. The wiring of the original ringing and listening keys 42 and 42' has not been changed and they will therefore operate as before the lead L^3 and its fixtures were added to the cord set.

There are a number of different styles of ringing and listening keys used in the different makes of one circuit line bridging switch boards. They all ring and talk upon the same line circuit, and are thus alike in these respects. The switching plugs 40 and 40', the cord lead L^3 may therefore be added to any cord set of such switch boards and a set of ringing and listening keys for such boards may be wired upon the principle shown in Fig. 2. The switch 20 may then also be added to the clearing-out drop circuit, and may be of any suitable pattern.

In Fig. 3 a trunk or long distance telephone line with three line wires L^1 , L^2 and L^3 , and three central stations A^2 and A^3 are shown. There may, however, be more central stations, or there may be but two of them. The line wires L^1 and L^2 are used

to form a balanced metallic talking line circuit that is free from signaling coils, and the line wire L^3 and the ground is used to form a signaling line circuit that is used for signaling only. These line wires are connected to central station A by a three point contact, spring line jack 13'. a' is the tip contact spring connected to L^3 , b' is the sleeve contact spring connected to L^2 , and c' is the between contact spring connected to L^1 . An annunciator 16 is normally legged to ground g from the tip contact spring a' by contact i . The annunciator 16 is cut out at the line jack by the inserting of a switching plug as usual. The line jack 13' and annunciator 16 and their connections with L^1 , L^2 and L^3 at central stations A^2 and A^3 are duplicates of station A. In this system the line conductors L^1 and L^2 are used for talking only and are entirely separate from the signaling line circuit. These line conductors L^1 and L^2 may, however, be used to complete line circuits between telephone lines of the usual one circuit line bridging system, and in that case the clearing-out drop 19 needs to be placed and operated upon these line conductors. The central station A^2 and A^3 each are supposed to have cord sets like the one described in Fig. 2. The line wire L^3 with a ground return signaling circuit may be added, to any properly transposed or balanced metallic trunk or long distance telephone line circuit now used in the usual one circuit line bridging telephone system by using three point contact line jacks as in Fig. 3. The line conductor L^3 need not be transposed and may be of any kind suitable for signaling only.

The metallic conductor and ground return signaling circuit, when Fig. 1 and Fig. 3 are connected together by Fig. 2, may be traced from station B, from g to binding post 11, wire f^3 , switch arm S' , wire h , bell 2, wire h' , switch arm S , wire f'' , binding post 10, line conductor L^3 , line jack spring a' of station A, tip contact of switch plug 40, cord lead L^3 tip contact of switch plug 40', line jack spring a' of station A, line conductor L^3 , line jack spring a' of station A^2 and A^3 , annunciator contacts i of station A^2 and A^3 and g of stations A^2 , and A^3 , and from cord lead L^3 to wire 34, one switch arm 20 clearing-out drop 19, other switch arm 20, wire 33 and 21 to g . It is to be supposed that central stations A^2 and A^3 have sub-station telephone lines like central station A.

The construction and operation of all of the instruments of the one circuit line bridging telephone system here described are generally well understood. Therefore the change made with the system and the advantages gained thereby need only be explained. In the one circuit line bridging telephone system, party lines of from twenty to thirty sub-stations and one or more central sta-

tions have been built. In practice, however, it was found that when a few receivers were taken from their hooks signaling became indistinct. It was also found that whenever several such lines were connected together that talking was often very weak on account of the leakage of the many signaling coils bridged across their talking line circuit. For those reasons party telephone lines of from ten to fifteen sub-stations are now considered better practice, yet receivers from their hooks sometimes cause such lines to ring heavy, and the leakage of the signaling coils upon the talking line circuit has only been partly disposed of.

In the improved system above described, receivers being taken from their hooks upon party lines will not interfere with signaling other sub-stations upon the line as the receivers are not upon the signaling line circuit, and when the switch 48 is used in each bell circuit as shown in Fig. 1' an improvement of the signaling will be noticed by part of the receivers being from their hooks.

The central station line signal in this improved system is upon the metallic talking line circuit, but as there are no other signals upon that line circuit therefore they can be operated even when some receivers are from their hooks, furthermore as signaling a central station does not ring the sub-stations' bells it is not likely that receivers will be taken from their hooks. The central station line signal is cut out by the inserting of a switching plug as usual. The metallic talking line circuit of party lines having but one central station are therefore free from cross leakage through signaling coils when connected with one another.

Another advantage of this improved bridging telephone system is that about twice as many sub-stations may be put upon one line as would be considered good practice in the one circuit line system, and in that case twice as many sub-stations can call one another direct, the central station would accordingly have less calls from these sub-stations, than if upon two lines. Further it will in some cases be cheaper to build one three wire line of the improved system, than two two wire lines of the old system.

The individual or exchange telephone line of the improved three wire line system costs more than a two wire line, but better results in distant talking can be obtained with this three wire line system, as the talking circuit will be free from bridges of signaling coils and an operative signaling circuit may always be available by using clearing-out drops at all central stations. Besides it frequently happens that individual telephone lines and party telephone lines of distant stations need connection with one another and therefore need be alike to obtain best results.

Having thus described how another line circuit may be added to all telephone lines of the usual metallic circuit magneto call local battery bridging telephone system, and its advantages, what I desire to secure by Letters Patent, is—

1. In a bridging telephone system, the combination of the metallic line circuit, magneto call, local battery, bridging telephone with an additional signaling line circuit consisting of a metallic conductor and a ground return circuit, which is insulated from the usual metallic talking line circuit, substantially as described.

2. In a bridging telephone system, the combination of a bridging telephone set, comprising a secondary talking circuit containing a receiver, hook switch, and secondary winding of an induction coil, terminating at two binding posts, said talking circuit being normally interrupted at the switch hook, and a signaling circuit containing a magneto in normally open circuit with means to close the circuit, and a bell in closed circuit normally terminating at two binding posts separate from the binding posts of the secondary talking circuit with means in the normally open circuit of the magneto and the closed circuit of the bell to terminate these circuits at the binding posts of the secondary talking circuit or at the binding posts of the normal signaling circuit, substantially as described.

3. In a bridging telephone system, the combination of a telephone set, comprising a secondary talking circuit containing a receiver, hook switch, and secondary winding of an induction coil, terminating at two binding posts, said talking circuit being normally interrupted at the switch hook, and a signaling circuit containing a magneto in normally open circuit with means to close the circuit, and a bell in normally closed circuit normally terminating at two binding posts separate from the binding posts of the secondary talking circuit, with means in the normally open circuit of the magneto and the normally closed circuit of the bell to terminate these circuits at the binding posts of the secondary talking circuit, or at the binding posts of the normal signaling circuit, the bell circuit, however, being interrupted when the receiver is removed from the switch hook, substantially as described.

4. In a bridging telephone system, the combination of a telephone set, comprising a secondary talking circuit containing a receiver, hook switch, and secondary winding of an induction coil terminating at two binding posts, said talking circuit being normally interrupted at the switch hook, a normal signaling circuit containing a magneto in normally open circuit with means to close the circuit at the usual cut in, and a bell in normally closed circuit with means to open

the bell circuit at the switch hook, said normal magneto and bell circuits normally terminating at two binding posts separate from the binding posts of the secondary talking circuit with means in the normally open circuit of the magneto to terminate the circuit of the magneto at the binding posts of the secondary talking circuit while the bell remains upon the normal signaling circuit, or to terminate the circuit of the magneto at the binding posts of the normal signaling circuit, the bell circuit, however, being interrupted at the switch-hook when the receiver is from the switch-hook, substantially as described.

5. In a bridging telephone system, the combination of a telephone set, comprising a secondary talking circuit containing a receiver, hook switch, and secondary winding of an induction coil terminating at two binding posts, said talking circuit being normally interrupted at the switch hook, and a normal signaling circuit containing a bell in closed circuit terminating at two binding posts separate from the binding posts of the secondary talking circuit, and a magneto and means to terminate the circuit of the magneto at the binding posts of the normal signaling circuit, or at the binding posts of the secondary talking circuit, or to leave the magneto circuit disconnected from either binding post, substantially as described.

6. In a bridging telephone set, the combination, of a secondary talking circuit, containing a receiver, hook switch, and secondary winding of an induction coil, terminating at two binding posts, said talking circuit being normally interrupted at the switch hook, and a signaling circuit containing a magneto and a bell terminating at two binding posts separate from the binding posts of the secondary talking circuit with means in the signaling circuit to switch the circuit of the magneto to terminate at the binding posts of the secondary talking circuit or at the separate binding posts of the signaling circuit thereby adapting a bridging telephone set to be used upon telephone systems having a talking, and signaling line circuit insulated from one another or upon telephone systems having a talking line circuit and a separate signaling circuit from one of the metallic leads of the talking circuit or upon telephone systems having but one line circuit for talking and signaling, by the proper connection of the different binding posts to the line circuits, the magneto being, however, normally cut out, substantially as described.

7. In a bridging telephone system, the combination of one or more sub-stations and one or more central stations and a three metallic conductor line therebetween, two of said conductors forming a metallic talking line circuit normally free from bells of sub-

stations, the other metallic conductor and a ground return circuit forming a signaling line circuit normally containing the bells of sub-stations and during line connections through central station cord sets, the clearing-out drops of such cord sets, said ground return line circuit being free from coils of talking instruments, and insulated from the metallic talking line circuit substantially, as described.

8. In a bridging telephone system, the combination of a metallic talking and signaling line circuit consisting of two metallic main limbs, and a signaling line circuit insulated therefrom, consisting of one metallic main limb and a ground return, of local sub-station talking sets bridged across the metallic talking line circuit, said bridges being normally interrupted at the switch-hooks, local bells normally legged to the ground upon the ground return signaling circuit, a line signal at the central station normally bridged across the metallic talking line circuit, a switch in the circuit of the local magneto adapted to bridge the circuit of the local magneto across the metallic line circuit to operate the line signal of a central station, or to bridge the circuit of the local magneto across the ground return signaling line circuit to operate bells of sub-stations or clearing-out drops of central stations, said metallic talking line circuit being normally free from sub-station bells, and said ground return signaling line circuit being free from talking instruments, substantially as described.

9. In a bridging telephone system, the combination of a central station, a metallic circuit leading therefrom, and being normally closed at said station by a line signal, a plurality of telephones bridged upon the circuit, said bridges, however, being normally interrupted at the switch-hooks, a ground return circuit insulated from said metallic circuit normally open at the central station, and normally closed at each telephone by a bell, a magneto at each telephone and means in connection with each magneto to place the magneto upon the metallic circuit in circuit with the line signal of the central station, or upon the ground return circuit in circuit with the bells of the telephones, substantially as described.

10. In a bridging telephone system, the combination of a central station, a metallic line circuit leading therefrom, normally closed at the central station by a line signal, a plurality of sub-station talking sets bridged upon the metallic line circuit, said bridges being normally interrupted at the switch-hooks, a ground return line circuit insulated from the said metallic line circuit normally open at the said central station, and normally closed at each of said sub-stations by a signaling bell, means at each sub-station

to signal the central station upon the metallic line circuit, or to signal any of said sub-stations upon the ground return line circuit by a signaling code.

5 11. In a bridging telephone system, the
combination of a central station cord set of
the metallic circuit magneto call bridging
switch board and ringing and listening keys
42 and 42', a lead L^3 with a ground return
10 circuit provided with a set of ringing and
listening keys 17 and 17' wired to ring from
 L^3 to the ground, or to listen upon the original
metallic leads L^1 and L^2 , a switch 20
to switch the clearing-out drop 19 to the metallic
15 circuit or to the ground return circuit,
adapted to complete line connections between
sub-station telephone lines and trunk or long
distance telephone lines having a metallic
talking line circuit and a ground return signaling
20 line circuit which are insulated from
one another, substantially as described.

12. In a bridging telephone system, the
combination, of a central station cord set of
three cord leads L^1 , L^2 and L^3 terminating
25 in a pair of switching plugs 40 and 40',
ringing and listening keys 42 and 42' to
alternately bridge the operator's talking set
35 or the magneto 29 or its equivalent from
 L^1 to L^2 , and ringing and listening keys
30 17 and 17' to alternately bridge the operator's
talking set 35 from L^1 to L^2 or to leg
the magneto 29 or its equivalent from L^3
to the ground, and a switch 20 to alternately
bridge the clearing out drop 19 from L^1 to
35 L^2 or to leg the clearing out drop 19 from
 L^3 to the ground, L^1 and L^2 being insulated
from L^3 and the ground, substantially
as described.

13. In a bridging telephone system, the
40 combination of a trunk or long distance
telephone line, consisting of a metallic line
circuit of two metallic main limbs for a talking
line circuit and a signaling line circuit
45 insulated therefrom, consisting of another
metallic main limb and a ground return,
extending to two or more central stations,
each central station having normally a line
signal upon the signaling line circuit, and
50 a cord set signal or clearing-out drop, instead,
during connection with said line, the said
signaling line circuit being free from cross
leakage of signaling current through
talking coils, the said talking line circuit being
55 normally open at each central station,
and being free from cross leakage of talking
current through signaling coils during
line connections, substantially as described.

14. In a bridging telephone system, the
60 combination of a metallic talking line circuit
consisting of two metallic main conductors
and a signaling line circuit insulated therefrom,
consisting of another metallic conductor
and a ground return of local sub-
65 station telephone sets of different central
stations connected together through two or

more central stations having clearing-out
drops in their cord sets, the metallic line circuit
being free from bridges of sub-station bell
coils, and the ground return line circuit
being free from bridges of sub-station
70 talking coils, a magneto and means at each
sub-station to operate the clearing-out drop
of their central station upon the ground return
signaling line circuit and means at each
central station to operate the clearing-out
75 drop or line signals of other central stations
in the connection upon the ground return
signaling line circuit, substantially as described.

15. In a telephone system the combination,
80 of a long distance telephone line, a plurality
of central stations, two metallic main leads
 L^1 and L^2 to form a metallic line circuit
and one metallic main lead L^3 and a
ground return to form a ground return line
85 circuit therebetween, a line jack 13' with
three contacts a' , b' , and c' at each central
station, connected to L^3 , L^2 , and L^1
respectively, an annunciator 16 with a contact
 i , normally legged to ground from a' of
90 the line jack 13' at each central station,
substantially as described.

16. In a telephone system the combination,
of a long distance telephone line of two metallic
95 main leads L^1 and L^2 to form a metallic
talking line circuit, and one metallic main
lead L^3 and a ground return to form a
ground return line circuit leading to a plurality
of central stations, the metallic talking
100 line circuit being normally open at each
central station and the ground return line
circuit being normally closed at each central
station by an annunciator, a cord set at each
central station with a lead L^3 , and ringing
105 and listening keys 17 and 17' to furnish
means to complete the ground return line
circuit between telephones or telephone lines
of this telephone system, and to signal upon
said line circuit, and leads L^1 and L^2 , and
110 ringing and listening keys 42 and 42' to
complete the metallic line circuit between
the aforesaid telephones or telephone lines
of this system, substantially as described.

17. In a telephone system the combination,
115 of a long distance telephone line, a plurality
of central stations, two metallic main limbs
 L^1 and L^2 to form a metallic line circuit
therebetween normally open at each central
station, and one metallic main limb L^3 and
120 a ground return to form a ground return
line circuit normally closed at each of said
central stations by an annunciator 16, a cord
set at each of said central stations with a
lead L^3 and ringing and listening keys 17
125 and 17' to signal any central station upon
the ground return line circuit of the long
distance telephone line, and leads L^1 and
 L^2 and ringing and listening keys 42 and
42' to signal and listen upon the metallic
130 circuit of the long distance telephone line

and upon telephone lines of only one metallic line circuit and to connect such lines to $L^{1''}$ and $L^{2''}$ of the long distance telephone line, and a switch 20 at each cord set to
5 bridge the clearing out drop 19 from $L^{1'}$ to $L^{2'}$ or from $L^{3'}$ to the ground, substantially as described.

10 18. In a telephone system the combination, of a trunk or long distance telephone line, a plurality of central stations, a three metallic conductor line therebetween, one metallic conductor and a ground return serving as a signaling circuit between central stations,

the other two metallic conductors serving as a talking circuit between central stations 15 and to complete line connections between telephones or telephone lines of two different central stations, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of 20 two subscribing witnesses.

HENRY F. JOECKEL.

Witnesses:

G. C. GRUBER,
J. B. STAUFFER.