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Fig. 1. Fig. 2. Fig. 3. Fig. 4.

The diagrams illustrate a series of electrical circuits, likely for a relay-based system. The components and connections are labeled as follows:

- Fig. 1:** Shows a relay with a coil (15) and a switch (14). The circuit is connected to a battery (18) and a ground (13).
- Fig. 2:** Shows a relay with a coil (15) and a switch (14). The circuit is connected to a battery (18) and a ground (13).
- Fig. 3:** Shows a relay with a coil (15) and a switch (14). The circuit is connected to a battery (18) and a ground (13).
- Fig. 4:** Shows a relay with a coil (15) and a switch (14). The circuit is connected to a battery (18) and a ground (13).

The diagrams are labeled with various components and connections, including switches, relays, and batteries.

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BRIDGING-TELEPHONE SYSTEM.

955,335.

Specification of Letters Patent.

Patented Apr. 19, 1910.

Application filed July 27, 1907. Serial No. 385,911.

To all whom it may concern:

Be it known that I, HENRY F. JOECKEL, a citizen of the United States, residing at Clayton, 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, reference being had to the drawings.

This invention is an improvement in magneto bridging telephone systems and it consists in the combination and arrangement of the instruments of the usual one line circuit magneto call local battery bridging telephone system, with a two line circuit so as to avoid material interference of the signaling and talking instruments with one another, thereby increasing the effectiveness of the instruments of the system, thereby insuring better signaling and talking over greater distance and also to lessen the time required to send a message.

In the drawings, Figure 1 is a diagram of the wiring of a bridging telephone of a sub-station, connected with a central station by two line wires in accordance with my invention; Fig. 2 is a diagram of the wiring of a cord circuit of a magneto bridging switch board in accordance with my invention; Fig. 3 is a diagram of a long distance or trunk telephone line of two line wires with three central stations wired in accordance with my invention; Fig. 4 is a diagram of a magneto call local battery bridging telephone as used in the usual magneto bridging telephone system.

In Fig. 1 is shown a diagram of a magneto call local battery bridging telephone sub-station connected with a central station by two line wires No. 1 and No. 2 and the usual metallic circuit bridging line jack 13, the line wire No. 1 being connected to binding post A of the telephone and to the tip side of the line jack 13, and line wire No. 2 being connected to binding post C of the telephone and to the sleeve side of the line jack 13. 14 is a line signal at the central station bridged from the tip to the sleeve side of the line jack 13, said bridge is interrupted whenever a plug is inserted into the line jack 13. The line signal 14 is usually a drop but sometimes it is a bell. The line wires No. 1 and No. 2 form the talking circuit of the line, and said line wires also form the circuit over which the line signal 14 is operated. The bridging telephone of the sub-station is provided in addition to

the usual instruments, and binding posts A and C, with a binding post B and a two point contact switch E. The switch E and one contact are interposed in the wire 11 leading from the magneto and bell to wire 10 of binding post C. The other contact is connected to a wire leading from binding post B. Binding post B is connected to the ground.

The normal position of the switch E is to connect the magneto and bell circuits with the contact of binding post B, thereby forming a ground return signaling circuit from line wire No. 1 through binding post A, through bell, through binding post B to the ground. The switch E is adapted to disconnect the magneto and bell circuits from binding post B and connect them to wire 10 of binding post C in condition for signaling a central station over the metallic talking circuit of the line. The line wire No. 1 and the ground form the signaling circuit over which the sub-stations are called and over which sub-stations upon the same line call one another and over which sub-stations give central stations the clearing out signal. The switch E of the telephone shown controls the circuit of the magneto and bell between the binding posts C and B. It will be seen that the switch E and one contact have been interposed in a wire that formed part of the circuit from the magneto and bell to wire 10 of binding post C, and that the part of the circuit containing the switch E and said contact and the part of the circuit leading therefrom to binding post C were permanent before the switch E was interposed and that the magneto will therefore cut out at the usual cut out when not operated, and that the magneto, its cut out and bell operate, as before the switch E was interposed in their circuit.

There are a number of different types of magneto call local battery bridging telephones; some cut out their bells when the receiver is from its hook, some have their bells permanently bridged across the line circuit some alternately cut in their magneto or bell. A switch E and binding post B added to the circuit of the magneto and bell in the manner above described will fit either type to be used upon the above described two circuit line as well as upon the usual one circuit lines. The type that does not cut out its bell upon the one circuit line system will not cut out its bell upon the two

circuit line system, and the type that cuts out its bell upon the one circuit line system will cut out its bell upon the two circuit line system, and the type that alternately cuts in its magneto or bell upon the one circuit line system will alternately cut in its magneto or bell upon the two circuit line system. But one sub-station and one central station have been shown. It is however to be understood that there may be more sub-stations and more central stations connected to the same line in the same manner.

In Fig. 2 is shown a diagram of a cord circuit of a metallic circuit magneto call local battery bridging switch board, with an independent double switch 5 which is adapted to control the circuits of the magneto 7 or its equivalent and the clearing out drop 6 between the cord leads 8 and 12^a and the ground. 8 is the sleeve lead and 12^a is the tip lead of the cord circuit. 1^a and 2^a are movable switch springs resting upon contacts 3 and 4 respectively. The movable switch spring 1^a and contact 3 are interposed in the wire leading from the magneto 7 or its equivalent to the sleeve lead 8 of the cord circuit, the movable switch spring 1^a being connected to the magneto 7 and the contact 3 being connected to the wire leading to the sleeve lead 8 of the cord circuit. The movable switch spring 2^a and contact 4 are interposed in the wire leading from the clearing out drop 6 to the sleeve lead 8 of the cord circuit, the movable switch spring 2^a being connected to the clearing out drop 6 and the contact 4 being connected to the sleeve lead 8 of the cord circuit. In this position of the independent switch 5, the magneto 7 and the clearing out drop 6 are in their normal one circuit line position. When however the plug 5 is placed between the movable switch springs 1^a and 2^a they disconnect from contacts 3 and 4 and connect with contacts 9 and 10^a which latter are both connected to the ground as shown at 11^a. This position of the switch 5 puts the circuit of the magneto 7 and clearing out drop 6 upon a ground circuit from the tip lead 12^a of the cord circuit and thus puts the cord circuit in a two circuit line position, so that the central talking set may be bridged across a metallic line or the magneto 7 be legged to the ground by a ringing and listening key 15. It is to be understood that the independent switch 5 can be interposed in the wires leading from the magneto 7 and clearing out drop 6 to the tip lead 12^a of the cord circuit in which case the signaling instruments 7 and 6 of the cord circuit are also interposed in said wires and said instruments are further put upon a ground circuit from the sleeve lead 8 of the cord circuit. In either arrangement the talking circuit of the talking set remains in its original relation with the cord leads

8 and 12^a and the ringing and listening key 15 will close either the ringing or the talking circuit of the cord circuit and is used as before the independent switch 5 was added. The ringing current is however sent over the metallic circuit, or over the ground circuit from one of the cord leads according to the position of the independent switch 5. The cord circuit of the switch boards of the usual one circuit line magneto call bridging system have ringing and listening keys of various styles and they usually have two ringing and listening keys. The independent switch 5 may however be interposed in the wires leading from the magneto or its equivalent and the clearing out drop to one of the cord leads and thereby make the cord circuits suitable for this two circuit line system. The independent switch 5 may be of any suitable pattern.

In Fig. 3 is shown a diagram of a combination of a commercial or trunk or long distance magneto call bridging telephone line of two line wires and three stations A, B, and C with a ground return signaling circuit from one of said line wires to the ground. The line may however be built with but two stations or it may be built with twenty or more stations, each station must be provided with the combination cord circuit shown in Fig. 2. No. 1' and No. 2' are the line wires, 13' is the usual metallic circuit bridging line jack and 14' is the line signal which is usually a drop but sometimes it is a bell. The line wire No. 1' is connected to the tip side of the line jack 13' at each station and line wire No. 2' is connected to the sleeve side of the line jack 13' at each station. The line signal 14' is bridged from the tip side of the line jack 13' at each station to the ground. The line signal 14' is cut out as usual whenever a switch plug of a cord circuit is inserted into a corresponding line jack. The line wires No. 1' and No. 2' form the talking circuit and line wire No. 1' and the ground form the signaling circuit and thus form a talking and signaling circuit that corresponds with the telephone circuit shown in Fig. 1 and therefore are suitable to complete circuits between such telephones of different central stations. Commercial or long distance telephone lines having two line wires and two stations, each station having their line signal legged to the ground as 14' shown in Fig. 3, may be used as a single metallic circuit line with the combination cord circuit of Fig. 2, as the line signal 14' will be cut out by the inserting of the plug of the cord circuit into the corresponding line jack 13' and the magneto 7 and clearing out drop 6 may be bridged across the cord circuit in the one circuit line position after connections are complete, with the independent switch 5 by agreement of the operators. The usual me-

tallic circuit commercial or long distance telephone lines of only one line circuit and only two stations having the line jack and line signal at each station connected like the line jack 13 and the line signal 14 in Fig. 1 can be used as a two circuit line with a combination cord circuit of Fig. 2, at each station, as the line signal 14 is cut out by the inserting of the plug of the cord circuit into the line jack 13, and the magneto 7 and the clearing out drop 6 may be bridged across the ground circuit after connections are complete, by agreement of the operators, and the line will thus be a two circuit line during such connections the same as though the line signals 14 had been legged to the ground like 14'. The telephone line shown in Fig. 3 may be turned into a party line by connecting thereto a number of the telephones shown in Fig. 1, by connecting each telephone with binding post A to line wire No. 1' and with binding post C to line wire No. 2' and with binding post B to the ground. The signals 14' at the central stations will then be upon the ground circuit with the bells of the telephones of the sub-stations and the line signal 14' will then operate every time one sub-station signals for any other sub-station and the bells of the sub-stations will ring every time one central station signals for any other central station over the line. The legging of the line signals of central stations to the ground is therefore not desirable in party telephone lines but is all right for individual telephone lines of exchange systems.

In Fig. 4 is shown a diagram of a magneto call local battery bridging telephone as it is used in the usual exchange bridging system. The telephone is connected to the central station by the usual metallic circuit bridging line jack 13^b by two line wires. It will be seen that in this figure a wire leads from the receiver to the binding post C² and that another wire leads from the magneto generator and another from the bell which two last mentioned wires unite with the wire that leads from the receiver to the binding post C², while in Fig. 1 the wire leading from the magneto generator and bell has been disconnected, by means of the switch E from the wire that leads from the receiver to the binding post C and then connected to the ground by binding post B. This arrangement changes the one line circuit telephone to a two line circuit telephone. The line jack 13 and line signal 14 in Fig. 1 and the line jack 13^b and line signal 14^b in Fig. 4 are alike and are connected alike to the line wires, therefore the telephone in Fig. 4 can be replaced by the telephone shown in Fig. 1 and the line would then be a two circuit line since the telephone would have its signaling instruments upon a ground circuit the same as in Fig. 1.

I have shown the ground return signaling circuit in Fig. 1, from the line wire No. 1 which is connected to the tip spring of the central station line jack 13, in Fig. 2, from the tip lead 12^a of the cord circuit, and in Fig. 3 from line wire No. 1' which is connected to the tip spring of the central station line jacks 13' the line signals 14' being connected to the tip spring of line jacks 13' and to the ground. The tip lead 12^a of the cord circuit Fig. 2 makes contact with the tip springs of the line jack during the insertion of the switch plug of the cord circuit. It is to be understood that line wire No. 2 of Fig. 1, the sleeve lead 8 of the cord circuit of Fig. 2 and the line wire No. 2' of Fig. 3 may be used in connection with the ground return signaling circuit by reversing the line connections of binding posts C and A in Fig. 1 and by reversing the switch plug connections of the cord leads 8 and 12^a and by legging the line signals 14' from the sleeve side of the line jack 13' to ground and by using line jacks that cut out their signaling coils from the sleeve spring.

It is to be understood that changes in the form and minor details may be made within the scope of the claims.

From the description of the combination cord circuit of Fig. 2 under the different conditions it will be seen that the cord circuit can be used to furnish connections between two circuit telephone lines, between one circuit telephone lines and between one and two circuit telephone lines. And to furnish connections over one circuit commercial, trunk and long distance telephone lines for two circuit telephone lines and to furnish connections over two circuit commercial, trunk and long distance telephone lines for one circuit telephone lines, because the two metallic leads of the lines are used for talking in both one and two circuit telephone lines and the combination cord circuit is adapted to signal over the metallic or over the ground return circuit and is further adapted to bridge the clearing out drop across the circuit from which the call came after connections are complete.

From the drawings and descriptions given it will be seen that I have provided the usual metallic circuit magneto call local battery bridging telephone system of only one line circuit, with a ground return signaling circuit throughout its various branches. The arrangement has been so completely described and the instruments and their operations are so widely known and understood that very little need be said regarding the operation of the two circuit line bridging system except as to its advantages over the one circuit line bridging system. Telephone lines in rural districts containing from 15 to 25 substations upon which any one station can call direct any other station of the

line and which have connections with one or more central stations from which connections can be had with other substations direct or over commercial, trunk, or long distance telephone lines is the ideal arrangement and the magneto call, local battery bridging telephone system of only one line circuit is the system extensively used at present for that purpose. The system has however several well known drawbacks, namely, it is not possible for two parties from two different party lines of from 15 to 25 substations each to converse over as long a commercial or long distance line as it is possible to do from substations of individual telephone lines on account of the leakage of the talking circuit caused by the bridged coils of the 15 to 25 bells near each end of the talking circuit. I have remedied that leakage in the two line circuit system. Another drawback is that when a number of receivers have been taken from their hooks while ringing for a substation of a heavy loaded party line, the line is put out of ringing order. One remedy would be to leave the receivers upon their hooks. The listening in upon party lines of from 15 to 25 substations has however many advantages which would then be lost, to avoid that loss and to avoid the ringing trouble condensers have been placed in the talking circuit of each telephone of such party lines. This however cuts down the already low talking effectiveness of such lines. I have remedied the ringing trouble by the two line circuit system which gives the bell coils and the coils of the talking instruments separate line circuits. Party telephone lines of from 15 to 25 substations having connection with two central stations are usually used as trunk lines between those central stations for the purpose of connecting two parties of two party lines of 15 to 25 substations together for conversation. In such cases the one circuit line bridging system is unable to overcome much line resistance while the same practice upon the two line circuit system would talk as effectively through as much resistance as upon a line circuit of only two telephones. A further advantage of the two line circuit system is that the central station cord set has normally no clearing out drop coil bridged across the talking circuit but has the drop legged to the ground return signaling circuit, thus also avoiding the leakage of the clearing out drop coil upon the talking circuit.

Having described my invention what I think is new and desire to secure by Letters Patent is—

1. In a magneto telephone system, the combination of a ground return signaling and metallic talking line circuit, with the usual one circuit line, magneto call, local battery, bridging telephone system, a

metallic talking and signaling line circuit, and a signaling line circuit consisting of one of the limbs of the said metallic talking line circuit and a ground return, of local substation talking sets bridged across the metallic line circuit said bridges being normally interrupted at the switch hooks, local bells normally legged to the ground, central station line signals normally bridged across the metallic talking line circuit and the switch E interposed in the circuits of the local magneto and bell between the local magneto and bell and ground and adapted to bridge the circuits of the local magneto and bell across the metallic talking line circuit to call the central station or to bridge the circuits of the local magneto and bell across the ground return signaling line circuit in circuit with the bells of substations and clearing out drops of central stations, said magneto circuit being normally interrupted at the usual cut out regardless of the position of switch E, and the independent switch 5 at the central station interposed in the bridges of the electric generator 7 and the clearing out drop 6 between the cord leads 8 and 12^a, all substantially as shown and described.

2. In a magneto telephone system, the combination, in a sub-station telephone set, a secondary talking circuit extending from binding post A to C, normally open at the switch hook, and a signaling circuit containing a magneto and a bell, extending from binding post A to B, with means to extend the signaling circuit from binding post A to C, with means to interrupt the bell circuit while operating the magneto, the magneto circuit being, however, normally interrupted, substantially as described.

3. In a magneto telephone system the combination of a ground return signaling and a metallic talking line circuit with the usual one circuit line, magneto call, local battery bridging telephone system, a metallic talking line circuit and a signaling line circuit consisting of one of the limbs of the said metallic talking line circuit and a ground return of local substation talking sets bridged across the metallic line circuit said bridge being normally interrupted at the switch hook, local signals normally legged to the ground, central station line signals at the central stations normally legged to the ground in circuit with the local signals of substations and a switch E at each substation interposed in the normally interrupted circuit of the local magneto and the normally closed circuit of the local bell, adapted to place said magneto and bell circuit upon the ground return signaling circuit of the line substantially as described.

4. In a magneto telephone system, the combination of a metallic talking and signaling line circuit, and a signaling line circuit

consisting of one of the limbs of the said metallic talking line circuit and a ground return of local sub-station talking sets bridged across the metallic line circuit said
 5 bridge being normally interrupted at the switch hooks, local signals legged to the ground, central station line signals at each central station normally bridged across the metallic talking line circuit, and a switch E
 10 at each sub-station in circuit with the local magneto adapted to bridge the normally interrupted circuit of the local magneto across the metallic talking line circuit or across the ground return signaling line circuit, and
 15 a double switch 5 in the cord set at each central station interposed in the normally interrupted circuit of the signal sending instrument 7 and the normally closed bridge of the clearing out drop 6 between the cord
 20 leads 8 and 12^a associated with a ringing and listening key and therewith adapted to bridge the central station talking set across the metallic talking line circuit or to bridge the electric generator 7 and clearing out
 25 drop 6 alternately across the metallic talking line circuit substantially as described.

5. In a magneto telephone system, the combination of a metallic talking and signaling line circuit, and a signaling line circuit
 30 consisting of one of the limbs of the said metallic talking line circuit and a ground return, of a plurality of local sub-station talking sets bridged across the metallic talking line circuit, said bridges being normally
 35 interrupted at the switch hooks, local sub-station bells normally legged to the ground from one of the limbs of the metallic talking line circuit, and a central station line signal at the central station normally bridged across
 40 the metallic talking line circuit, a magneto and means at each sub-station to signal any other sub-station upon the ground return signaling line circuit by a signaling code or to signal the central station upon the metallic talking line circuit, and means at the
 45 central station to signal any sub-station upon the ground return signaling line circuit by a signaling code substantially as described.

6. In a magneto telephone system the combination of a metallic talking line circuit and signaling line circuit consisting of one
 50 of the limbs of the said metallic talking line circuit and a ground return, of commercial, trunk and long distance telephone line circuits of central stations, line signals at each central station normally legged to the
 55 ground from one of the limbs of the said metallic talking line circuit, and a double switch 5 at each central station in circuit with the electric generator 7 and clearing out
 60 drop 6 associated with the ringing and listening key or keys of a cord circuit, adapted to bridge the central station talking set across the metallic talking line circuit or to
 65 bridge the central station electric generator

7 and clearing out drop 6 alternately across the ground return signaling line circuit or to bridge the electric generator 7 and clearing out drop 6 alternately across the metallic talking line circuit, substantially as
 70 described.

7. In a magneto telephone system the combination of a ground return signaling and a metallic talking line circuit of all metallic talking and signaling, commercial,
 75 trunk and long distance telephone line circuits of central stations having a line signal bridged across the all metallic line at each central station, said bridges being interrupted by the inserting of a plug of a cord circuit
 80 at the respective station during line connections as usual, a double switch 5 at each central station in circuit with the signal sending instrument 7 and the clearing out drop 6 between the cord leads 8 and 12^a
 85 associated with the usual ringing and listening key or keys of the cord circuit therewith adapted to bridge the central station talking set across the metallic talking line circuit, or to bridge the signal sending instrument 7 and clearing out drop 6 alternately across the metallic talking line circuit or to leg the signal sending instrument 7 and clearing out drop 6 alternately to the ground from one of the cord leads there-
 90 by enabling two operators of two different central stations to produce a ground return signaling line circuit from one of the limbs of the said all metallic talking and signaling line circuit during connections with said
 95 commercial, trunk, and long distance telephone lines substantially as described.

8. In a magneto telephone system the combination of a ground return signaling and a metallic talking line circuit with the
 105 usual one circuit line magneto call, local battery bridging telephone system, a metallic talking and signaling line circuit said line circuit being free from cross leaks of substation signaling coils, and a signaling
 110 line circuit consisting of one of the limbs of the said metallic talking line circuit and a ground return, said signaling circuit being free from cross leaks of talking coils of local substation talking sets bridged across the
 115 metallic line circuit, said bridges being normally interrupted at the switch hook, local bells normally legged to the ground, central station line signals normally bridged across the metallic talking line circuit and the
 120 switch E interposed in the circuit of the local magneto and bell and the ground and adapted to bridge the local magneto and bell circuit across the metallic line circuit to call a central station or to bridge the local
 125 magneto and bell circuit across the ground return signaling circuit said magneto circuit being normally interrupted at the usual cut out, substantially as described.

9. In a magneto telephone system, the

combination, of sub-station telephone sets, connected together, through two or more central stations having clearing out drops in their cord sets, by a talking line circuit, and a signaling line circuit, consisting of two metallic conductors and a ground return from one of said conductors, the talking line circuit being free from cross leakage of talking current through signaling coils, and the signaling line circuit being free from cross leakage of signaling current through talking coils, means at each sub-station to operate the clearing out drop of their central station, and means at each central station to operate the clearing out drop of other central stations in the connection, substantially as described.

10. In a magneto telephone system the combination of a metallic talking and signaling line circuit consisting of two metallic main limbs for the talking circuit and a ground return from one of said limbs for the signaling circuit of local substation talking sets bridged across the metallic talking line circuit, said bridge being normally interrupted at the switch hook, local bells normally legged to the ground, central station line signals normally bridged across the metallic talking line circuit at the central station, the switch E interposed in the normally interrupted circuit of the local magneto, and the normally closed circuit of the local bell between the local magneto, bell and the ground, adapted to bridge the circuits of the local magneto and bell across the metallic talking and signaling line circuit to operate the line signal of a central station or to bridge the circuits of the local magneto and bell across the ground return signaling line circuit to operate bells of sub-stations or clearing out drops of central stations, and commercial, trunk, or long distance metallic talking and ground return signaling telephone line circuits of central stations, consisting of a talking circuit of two metallic main limbs and a signaling circuit of one of said metallic limbs and

a ground return adapted to complete line circuits between the aforesaid local substation talking sets, of different central stations substantially as described.

11. In a magneto telephone system, the combination of a metallic line circuit, a ground return line circuit consisting of one of the limbs of the metallic line and a ground return, a plurality of local sub-station bells normally bridged across one of the line circuits a central station line signal at the central station normally bridged across the other line circuit, the latter line circuit being also used as a talking line circuit, a magneto and means at each sub-station to bridge the magneto in circuit with the local sub-station bells or to bridge the magneto in circuit with the central station line signal upon the talking line circuit substantially as described.

12. In a telephone system, the combination, of a trunk or long distance telephone line, comprising separate line circuits for signaling and talking, consisting of a metallic line circuit of two metallic conductors, and a ground return line circuit from one of the metallic line conductors, extending to two or more central stations, each central station having normally a line signal upon the signaling line circuit, and a cord set signal or clearing out drop, instead, during connection with the said line, the said signaling line circuit being free from cross leakage of signaling current through talking coils, the said talking line circuit being normally open at each central station, and free from cross leakage of talking current through signaling coils during line connections, substantially as described.

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

HENRY F. JOECKEL.

Witnesses:

C. H. SMITH,
C. E. HOKE.