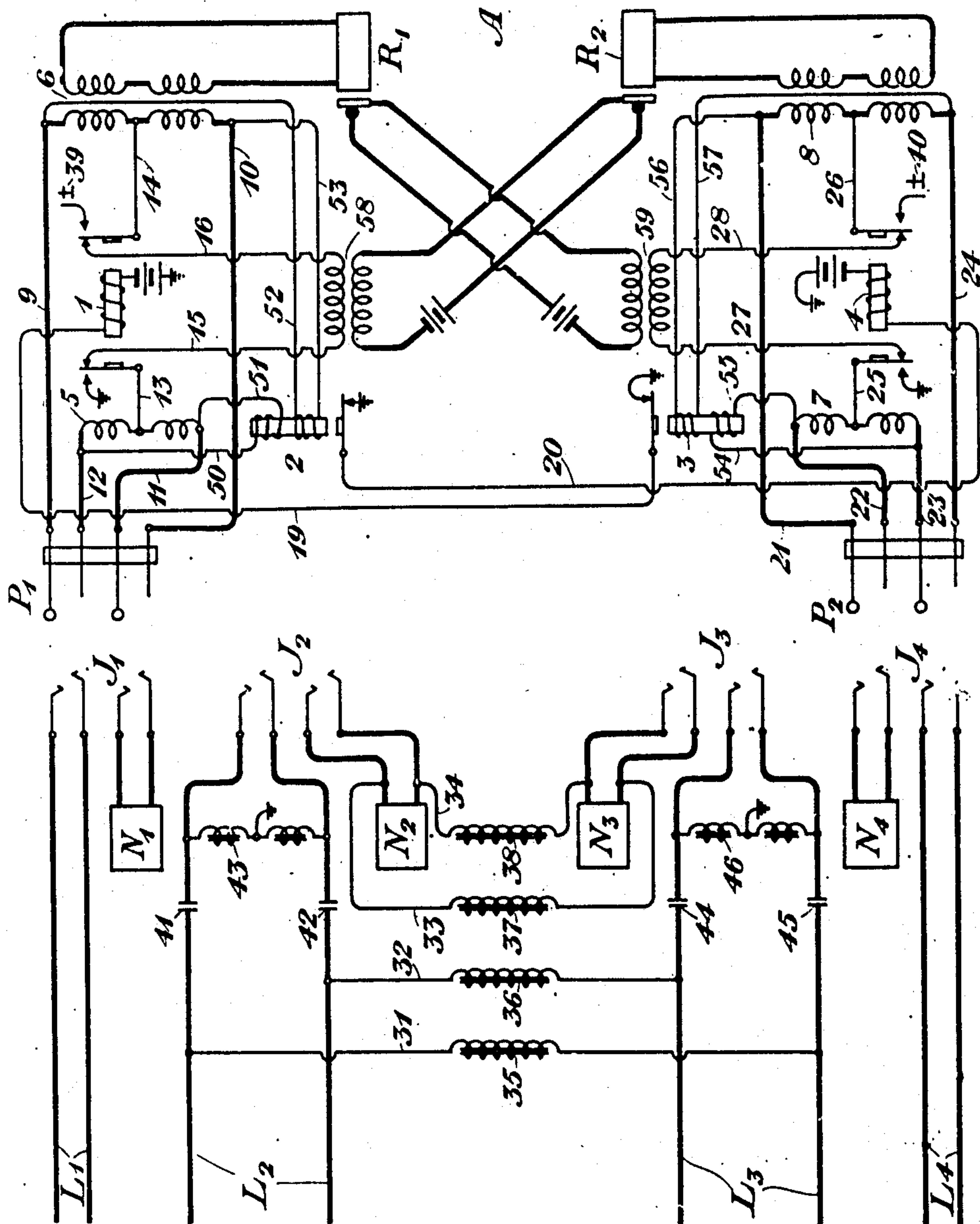


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COMPOSITE RINGING APPARATUS.
APPLICATION FILED AUG. 1, 1918.

1,313,413.

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COMPOSITE RINGING APPARATUS.

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To all whom it may concern:

Be it known that I, HAROLD S. OSBORNE, residing at New York, in the county of New York and State of New York, have invented certain Improvements in Composite Ringing Apparatus, of which the following is a specification.

This invention relates to transmission lines which are composited for telephone and telegraph service and more particularly to the signaling or ringing arrangements associated therewith.

It has often been found desirable to associate with a transmission line composited for both telephone and telegraph service arrangements for relaying ringing current transmitted over the line, and such arrangements are particularly desirable for relaying ringing current about repeater elements included in a line. It has been found in practice that with former relaying arrangements, the relayed ringing current would have a tendency to leak back over the telegraph conductors, which connect the two sections of the composited line independently of the relaying arrangements, and cause the relaying arrangements to become locked in a working position, thereby causing a steady ring over the transmission line. Accordingly it is one of the objects of this invention to provide means for relaying ringing current from one section of a transmission line to another section of the same line or other lines and in associating with such relaying means arrangements which will insure the restoration to normal of the relaying means upon the cessation of the original ringing current coming in over the line. A further object consists in providing means for preventing the occurrence of false ringing over a transmission line connected telegraphically with sections of other lines when ringing current is being transmitted over such sections. Other and further objects of the invention will be clear from the detailed description of the operation to be given later.

In the arrangements of this invention the ringing current coming in over a line is applied to the relaying means over conductors bridged across conductors leading to the line and to the network adapted for balancing the line. The relayed ringing current is in turn applied to the connecting

points of conductors leading to the outgoing line and to a network adapted for balancing such a line. The two networks are interconnected by conductors having an impedance equal to that of the telegraph conductors which interconnect the two lines. By the above arrangements any of the relayed ringing current, which leaks back over the telegraph conductors to the incoming line and the conductors connected thereto, will be opposed by an equal and opposite current which leaks back over the conductors interconnecting the networks and which tends to produce a potential equal and opposite thereto. These currents will accordingly neutralize each other and have no effect on the relaying arrangements. If it is desired to employ the arrangements of this invention on a line including a two-way two-element repeater, the relaying means may be connected to conductors connected to the input windings of the repeaters, and the relayed ringing current applied to the mid-points of such windings and the networks connected as formerly pointed out. The output circuits of the repeaters are also associated with the mid-points of these windings for purposes of balance. However, it will be understood that the arrangements of this invention are adapted for use with lines connected telephonically by apparatus other than repeaters.

The invention may be more fully understood with reference to the accompanying drawing in the figure of which is illustrated a preferred form of the circuit arrangements of the invention. For purposes of convenience the relaying arrangements have been illustrated as associated with the cord circuit A including the repeater elements R_1 and R_2 and adapted for interconnecting the lines L_1 , L_2 , L_3 , and L_4 , although it will be understood that the arrangements of the invention might equally well be associated with a two-way two-element repeater directly connected to the lines, or with other means for connecting the lines telephonically. The repeater elements R_1 and R_2 are shown as of the mechanical type although other types such as the vacuum tube repeater may be employed. Associated with the lines L_1 , L_2 , L_3 , and L_4 are the artificial lines or networks N_1 , N_2 , N_3 , and N_4 adapted to balance the lines respectively. The lines

L_2 and L_3 are connected for telegraph purposes by the conductors 31 and 32 in which are included the inductances 35 and 36 which offer a high impedance to telephone currents but do not interfere with the transmission of telegraph currents. The networks N_2 and N_3 are interconnected by conductors 33 and 34 in which are included the inductances 37 and 38 which are similar to inductances 35 and 36. Included in the lines L_2 and L_3 are the condensers 41 and 42, and 44 and 45, which prevent telegraph currents from being transmitted to the telephone apparatus connecting the lines, but which do not hinder the transmission of telephone currents thereto. Bridged across the lines L_2 and L_3 are the inductances 43 and 46 each having a tap to ground. These inductances are of high impedance to telephone currents but are of low impedance to telegraph currents and accordingly serve to shunt to ground any telegraph currents which may pass through the condensers 41, 42, 44 and 45. Associated with the repeaters R_1 and R_2 respectively are the input windings 5 and 6, and 7 and 8. Bridged across the conductors 9 and 10, and 11 and 12 which are connected to the windings 5 and 6 is the ringing relay 2 which responds to ringing current coming in over a line with which a connection is made by plug P_1 . Under the control of relay 2 is the relay 4 which serves to apply ringing current from the source 40 to the mid-points of windings 7 and 8 and thence out over a line with which a connection is made by plug P_2 . Bridged across the conductors 22 and 23 and 21 and 24, which are connected to the windings 7 and 8 is the ringing relay 3 which responds to ringing current coming in over a line with which a connection is made by plug P_3 . Under the control of relay 3 is the relay 1 which serves to apply ringing current from the source 39 to the mid-points of windings 5 and 6 and thence out over a line with which a connection is made by plug P_4 . Associated with the mid-points of windings of 5 and 6 by means of conductors 15 and 16 and transformer 58 is the output circuit of repeater R_1 . Associated with the mid-points of windings 7 and 8 by means of conductors 27 and 28 and transformer 59 is the output circuit of repeater R_2 .

The operation of the invention is as follows: If the lines L_2 and L_3 are interconnected by the cord circuit A by inserting the plugs P_1 and P_2 into the jacks J_2 and J_3 respectively, ringing current coming in over the line L_2 will be transmitted over the following circuit: from one side of line L_2 upper tip contacts of jack J_2 and plug P_1 , conductor 9, conductor 52, lower winding of relay 2, conductor 53, conductor 10, lower ring contacts of plug P_1 and jack J_2 through

network N_2 , lower tip contacts of jack J_2 and plug P_1 , over conductor 11 and conductor 51, upper winding of relay 2, conductor 50, conductor 12, upper ring contacts of plug P_1 and jack J_2 and over the other side of line L_2 . As the windings of relay 2 are included in the above mentioned ringing circuit, the relay 2 will be energized and by pulling up its armature will open the following normally closed circuit: from ground, contact and armature of relay 2, conductor 20, winding of relay 4, to battery and ground. The opening of this circuit will deenergize relay 4 which will allow its armatures to retract and will thereby connect ground to conductor 25 leading to the mid-point of winding 7 and will connect a source 40 of ringing current to conductor 26 leading to the mid-point of winding 8. At the mid-point of winding 8 the ringing current from source 40 will divide, a portion thereof being transmitted out over line L_3 as follows: from mid-point of winding 8, lower coil of winding 8, conductor 24, lower ring contacts of plug P_2 and jack J_3 , out over the lower side of line L_3 and back over the upper side of line L_3 , lower tip contacts of jack J_3 and plug P_2 , conductor 23, lower coil of winding 7 conductor 25 and armature and contact of relay 4, to ground. The other portion of the ringing current from source 40 will be transmitted over artificial line N_3 as follows: from mid-point of winding 8, upper coil of winding 8, conductor 21, upper tip contacts of plug P_2 and jack J_3 , artificial line N_3 , upper ring contacts of jack J_3 and plug P_2 , conductor 22, upper coil of winding 7, conductor 25, armature and contact of relay 4, to ground. The portion of the ringing current from source 40, which is transmitted out over the line L_3 , may have a tendency to leak back over the telegraph conductors 31 and 32 to the line L_2 and to the ringing relay 2, as follows: from the lower side of line L_3 over telegraph conductor 31, upper side of line L_2 , upper tip contacts of jack J_2 and plug P_1 , over conductors 9 and 52 lower winding of relay 2, conductors 53 and 10, lower ring contacts of plug P_1 and jack J_2 , artificial line N_2 , lower tip contacts of jack J_2 and plug P_1 , conductors 11 and 51, upper winding of relay 2, conductors 50 and 12, upper ring contacts of plug P_1 and jack J_2 , lower side of line L_2 , over telegraph conductor 32 to the upper side of line L_2 . However, at the same time, the other portion of the ringing current from source 40, which divided equally at the mid-point of winding 8 and was transmitted through the artificial line N_3 , would have a tendency to leak back over the telegraph conductors 33 and 34 and to the ringing relay 2, in the following manner: over telegraph conductor 34, lower ringing contacts of jack J_2 and plug P_1 , conductors 10 and

53, lower winding of relay 2, conductors 52 and 9, upper tip contacts of plug P_1 and jack J_2 , out over the upper side of line L_2 and back over the lower side of line L_2 , upper ring contacts of jack J_2 and plug P_1 , over conductors 12 and 50, upper winding of relay 2, over conductors 51 and 11, lower tip contacts of plug P_1 and jack J_2 and over telegraph conductors 33. It will be seen that the direction of this last mentioned current, which has a tendency to leak back to the ringing relay 2, over the telegraph conductors 33 and 34 interconnecting the balancing networks, is directly opposite to the direction of the current which has a tendency to leak back to the ringing relay 2 over the telegraph conductors 31 and 32, interconnecting the lines L_2 and L_3 . As the ringing current from source 40 originally divided equally at the mid-point of winding 8 and as each portion of the current would be attenuated equally by the inductances 35, 36 and 37, 38, the two portions of the current would be equal and by tending to flow through the ringing relay 2 in opposite directions would neutralize each other and accordingly would cause no interference with the ringing relay 2.

In like manner ringing current coming in over line L_3 will operate the ringing relay 3, which in turn controls relay 1, whereby ringing current from source 39 will be applied to the mid-points of windings 5 and 6 and thence out over the line L_2 and the artificial line N_2 .

A portion of the ringing current thus transmitted in relayed form out over the line L_2 , may leak back over the telegraph conductors 31 and 32 to the line L_3 , and to the ringing relay 3. However, this current would be neutralized by an equal current which would tend to leak back over the telegraph conductors 33 and 34 and would tend to flow through the ringing relay 3 in an opposite direction and accordingly would cause no interference with the ringing relay 3. As the operation would be similar to that previously described with respect to ringing current coming in over the line L_2 , no further description thereof will be given.

If a connection should be made between the lines L_1 and L_2 , and at the same time a connection be made between the lines L_2 and L_3 , with cord circuits or arrangements employing former types of relaying means for ringing current, it will be seen that the relayed ringing current transmitted out over the line L_3 might leak back over the telegraph conductors 31 and 32 to the line L_2 and actuate the relaying means interconnecting the lines L_2 and L_3 , and accordingly cause a false ring to result over line L_2 . However if the lines L_1 and L_2 and the lines L_2 and L_3 are interconnected by cord circuits, such as the cord circuit A, or with

other arrangements employing the relaying means of this invention, the possibility of relayed ringing current leaking back from line L_3 to line L_2 over conductors 31 and 32, and operating the relaying means in the cord circuit interconnecting lines L_2 and L_3 will be obviated, as such ringing current would be neutralized in the cord circuit interconnecting lines L_2 and L_3 by an equal current leaking back over conductors 33 and 34 and tending to flow through the relaying means in an opposite direction. As the description of this operation would be substantially the same as has previously been given, a further description of the circuits will be omitted.

While the arrangements of this invention have been illustrated as embodied in certain specific arrangements which have been deemed desirable, it will be understood that they are capable of embodiment in many and widely varied forms without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A plurality of transmission lines, networks for balancing said lines, means to connect said lines and means to connect said networks for telegraph purposes, means to connect said lines telephonically including windings associated with one of said lines and networks and windings associated with another of said lines and networks, a source of current, and means associated with one set of said windings and responsive to current coming in over the line associated therewith for applying current from said source to the mid-points of said other set of windings.

2. A telephone repeater system comprising two line sections, repeaters connecting said line sections, a normally disconnected source of ringing current associated with said repeaters, and means responsive to ringing current received over either line section to connect said source of ringing current to the mid-points of the repeater input windings.

3. A plurality of transmission lines, artificial lines for balancing said lines, means for connecting said lines and means for connecting said artificial lines for telegraph purposes, means for connecting said lines telephonically, a source of current, and means associated with conductors leading to one of said transmission lines and its artificial line and responsive to current coming in over said line for applying current from said source to the connecting points of another of said transmission lines and its artificial line.

4. A plurality of transmission lines, networks for balancing said lines, means to connect said lines and means to connect said networks for signaling purposes, means to connect said lines telephonically including

windings associated with one of said lines and networks and windings associated with another of said lines and networks, a source of current, and means associated with one
5 set of said windings and responsive to current coming in over the line associated therewith for applying current from said source

to the mid-points of said other set of windings.

In testimony whereof, I have signed my name to this specification this sixteenth day of July 1918.

HAROLD S. OSBORNE.