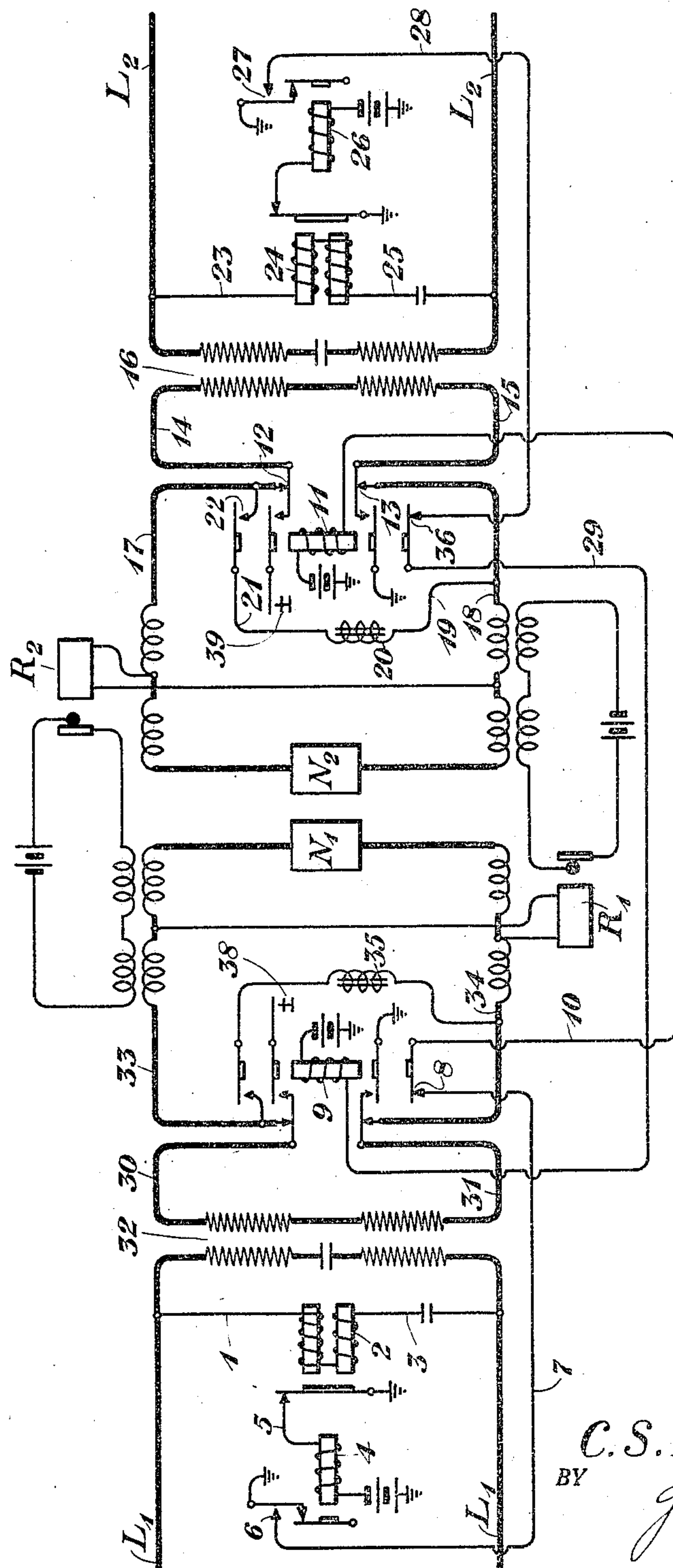


C. S. DEMAREST.
THROUGH RINGING REPEATER CIRCUITS.
APPLICATION FILED APR. 11, 1918.

1,321,723.

Patented Nov. 11, 1919.



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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES S. DEMAREST, residing at Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Through Ringing Repeater Circuits, of which the following is a specification.

This invention relates to transmission lines in which are included repeater elements, and more particularly to a means for transmitting ringing current over such lines.

It is one of the objects of the invention to provide a means for transmitting signaling currents, for ringing or other purposes, about a repeater station included in a transmission line. Another object consists in providing a means for associating the relaying apparatus with the repeater arrangement so that the relaying apparatus will receive a greater proportion of the incoming signaling current than in previous arrangements. A further object consists in providing relaying apparatus which is independent of the repeater apparatus and which is capable of being associated with different types of repeaters. A further object is to provide means for preventing the repeater from singing when signaling current is transmitted around it. Other and further objects of the invention will be clear from the detailed description to be given later.

The purposes of this invention are accomplished by associating with the transmission line on either side of the repeater, bridges including relay means adapted to transmit ringing currents, but offering a high impedance to talking currents. Incoming ringing current will pass through one of these bridges and operate the relay means included therein. These relay means serve to close a circuit about the repeating apparatus and operate relay means located at the other side of the repeater. These last mentioned relay means serve to open the talking circuit of the repeater and to connect the outgoing conductors of the repeater to a source of ringing current. These last mentioned relay means also serve to close a bridge including a balancing network element across the talking conductors of the repeater to balance the repeater when the line is opened for ringing and thus prevent singing of the repeater.

This invention may now be more fully understood from the following description taken in connection with the accompanying drawing in which is illustrated a preferred form of the circuit arrangement of my invention. The characters L_1 and L_2 represent incoming and outgoing transmission lines associated with a two-way two-element repeater which is diagrammatically illustrated as including the repeater elements R_1 and R_2 . The repeater elements R_1 , R_2 are herein illustrated as of the mechanical type, although any other well known type, such as the vacuum tube repeater may be employed. Associated with the repeater elements R_1 and R_2 are the artificial lines N_1 and N_2 adapted to balance sections L_1 and L_2 , respectively, of the transmission line. Bridged across the sections L_1 and L_2 of the transmission line are the relays 2 and 24, respectively. These relays respond to ringing current coming in over the sections L_1 and L_2 of the line, but offer high impedance to talking currents. Under the control of relays 24 and 2, respectively, are additional relays 9 and 11 which serve to connect sources 38 and 39 of ringing current to the outgoing sections of the line. Under the control of the relays 9 and 11 are bridges across the talking conductors of the repeater set which include the balancing network elements 20 and 35. These balancing network elements serve to balance artificial lines N_2 and N_1 with respect to the repeater elements R_2 and R_1 when the talking conductors of the repeater set are opened for ringing purposes by the relays 9 and 11, and thus provide means for preventing singing during the ringing operation.

Further details of the invention will now be clear from the following description of its operation: Ringing current coming in over the line section L_1 will be transmitted over the bridge including conductor 1, windings of relay 2 and over conductor 3. Ringing current will energize relay 2 which pulls up its armature and opens the following normally closed circuit: From ground and battery, winding of relay 4, conductor 5, contact and armature of relay 2 to ground. The opening of this circuit deenergizes the relay 4. The deenergization of relay 4 allows its armature to retract and closes the

following circuit: from ground, contact 6, over conductor 7, contact 8, lower armature of relay 9, over conductor 10, winding of relay 11, to battery and ground. The closing of the above described circuit energizes the relay 11 which will pull up its armatures and open the talking circuit of the repeater at contact points 12 and 1" and connect the talking conductor 14 with the source of ringing current 39 and apply ground to conductor 15. Ringing current will then be transmitted through the transformer 16 and out over the section L_2 of the transmission line. If it is desired the transformer 16 may be eliminated and conductors 14 and 15 may be directly connected to the sides of line L_2 . When the relay 11 is energized, as previously pointed out, and the talking circuit of the repeater is opened at contact points 12 and 13, the following bridge is closed across the talking conductors 17 and 18. From conductor 17, contact point 22, upper armature of relay 11, conductor 21, balancing network 20, conductor 19 to the conductor 18. The balancing network 20 has an impedance substantially equal to the artificial line N_2 and accordingly prevents the repeater from singing when ringing is taking place as it maintains the balance of the repeater which would normally be destroyed when the talking circuit was broken at contact points 12 and 13. When the relay 11 is energized, as previously pointed out, and ringing current is applied to the outgoing section L_2 of the transmission line the relay 11 will also pull up its lower armature and hold open at contact point 36 a circuit through the winding of relay 9. By this means any of the ringing current transmitted out over line L_2 which may pass over the bridge including relay 24 and may operate said relay will be prevented from operating the relay 9 which would send ringing current back in the wrong direction.

45 Ringing current coming in over the section L_2 of the transmission line will be transmitted through the bridge, including the conductor 23, windings of relay 24 and the conductor 25 and will energize the relay 24. The relay 24, in a manner similar to the relay 2, controls the operation of the relay 26 which in a manner similar to the relay 4 controls the operation of the relay 9. The operation of relay 9 in a manner similar to the relay 11 will serve to connect the source 38 of ringing current to the conductors 30 and 31 which in turn will be transmitted through the transformer 32 and out over the section L_1 of the transmission line. At the same time the relay 9 will close the bridge across the talking conductors 33 and 34 to the repeater which includes the balancing network 35 which serves to maintain the balance of the repeater in a manner similar to the balancing network 20 and to prevent

singing of the repeater during ringing. The relay 9 will in a manner similar to relay 11 pull up its lower armature and hold open at contact point 8 a circuit through the winding of relay 11 and thus prevent the transmission of a ringing signal in the wrong direction by the operation of relay 2 due to ringing current sent out over line L_1 .

It will be obvious that the general principles herein disclosed may be embodied in many other organizations different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. A transmission line including a repeater, means responsive to ringing current bridged across the line on one side of the repeater, relay means controlled by said responsive means and associated with said transmission line on the other side of said repeater, a source of ringing current and means controlled by said relay means to connect said source of ringing current to said transmission line.
2. A transmission line including a repeater, means responsive to ringing current bridged across said line on either side of said repeater, relay means controlled by said responsive means and associated with said transmission line on either side of said repeater, sources of ringing current and means controlled by said relay means to connect said sources of ringing current to said transmission line.
3. A transmission line including a repeater, means responsive to ringing current bridged across said line on either side of said repeater, relay means controlled by said responsive means and associated with said transmission line on either side of said repeater, sources of ringing current, means controlled by said relay means to connect said sources of ringing current to said transmission line, and means operating when the relay means at one side of the repeater is actuated to prevent the actuation of the relay means at the other side of the repeater.
4. A transmission line including a repeater, means responsive to ringing current bridged across said line on either side of said repeater, relay means controlled by said responsive means and associated with the said transmission line on either side of said repeater, sources of ringing current associated with said relay means, and means controlled by said relay means to associate said sources of ringing current to said transmission line.
5. In a telephone transmission line including a repeater, relay means bridged across the transmission line at one side of the repeater, a normally energized relay controlled by said relay means, a relay controlled by said normally energized relay, and a source

of ringing current associated with said third-mentioned relay, said relay controlling the application of ringing current to the line.

5 6. In a telephone transmission line, a repeater, artificial lines associated therewith, balancing networks located on either side of the repeater, a source of ringing current associated with either side of the line, means
10 responsive to ringing current transmitted over one portion of said transmission line to connect said source to another portion of said transmission line and to bridge one of said balancing networks across a portion of said
15 transmission line.

7. In a transmission line the combination of a repeater, artificial lines associated therewith, balancing means for said repeater and

artificial lines, means responsive to ringing current bridged across the line at either side of the repeater, relay means associated with the incoming and outgoing sections of the line and controlled by the responsive means at the opposite side of the repeater, sources of ringing current for each section of the transmission line, and means controlled by said relay means to connect said sources of ringing current to sections of the transmission line and to associate the balancing means with the portion of the transmission line connected to the repeater. 20 25 30

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

CHARLES S. DEMAREST.