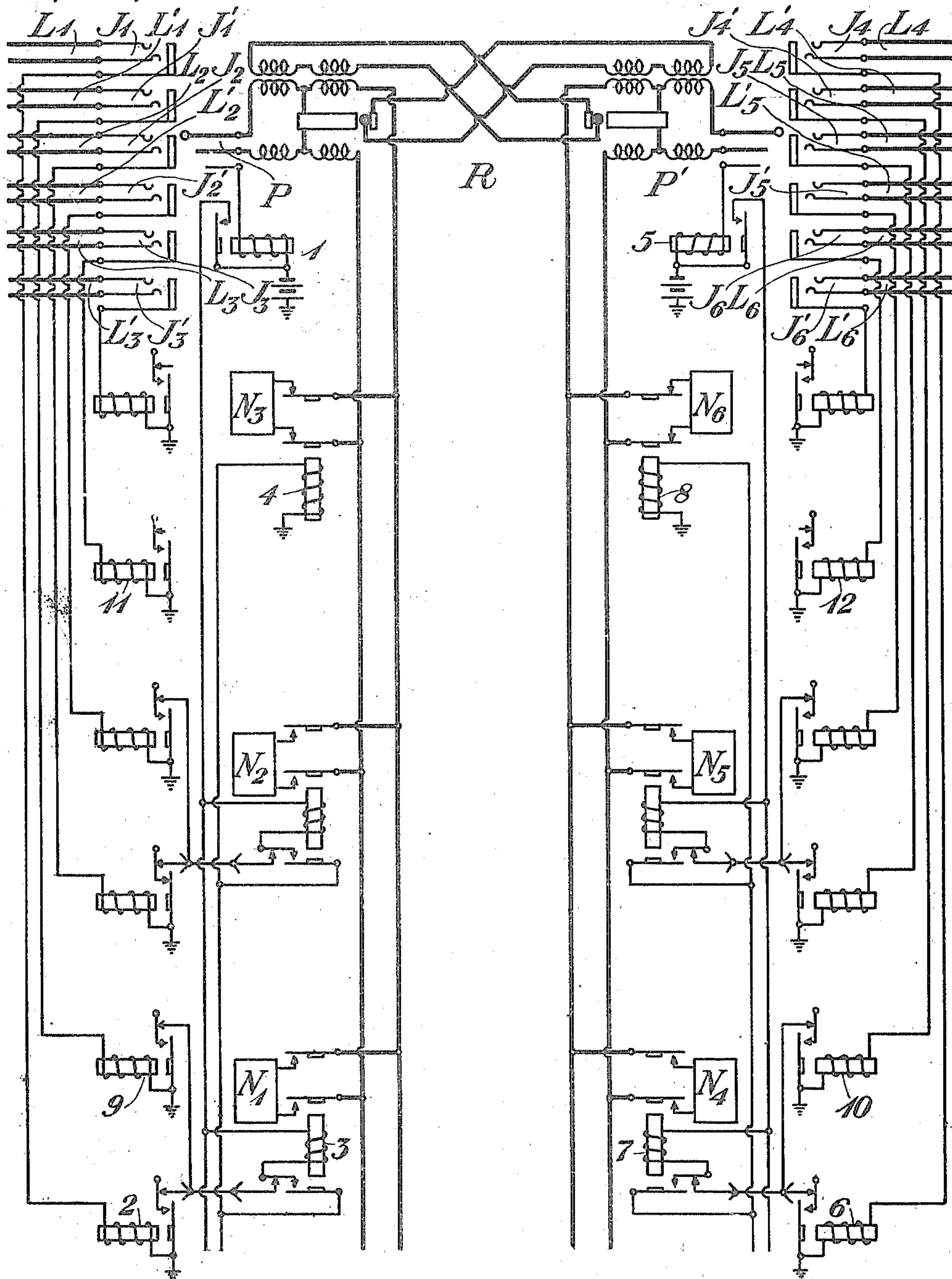


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RELAY SELECTING CIRCUIT FOR ARTIFICIAL LINES.
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RELAY SELECTING-CIRCUIT FOR ARTIFICIAL LINES.

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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 Flatbush, in the county of Kings and State of New York, have invented certain Improvements in Relay Selecting-Circuits for Artificial Lines, of which the following is a specification.

This invention relates to telephone repeater circuits and more particularly to a means for automatically selecting a suitable artificial line or net-work for balancing a line or trunk with which a repeater is temporarily associated.

It has heretofore been customary when a connection is made between two transmission circuits through a repeater, to provide a balancing artificial line or net-work for each line, said net-works being associated with the repeater. This necessitated either a special repeater circuit having the proper artificial lines or net-works associated therewith for each possible connection between lines of different characteristics, or else a manual switching means whereby the proper artificial line might be temporarily associated with the repeater for each connection. It is proposed by the present invention to provide automatic means, which shall operate, when a repeater is associated with a given transmission circuit, to associate with the repeater an artificial line of a type suitable for balancing such transmission circuit.

While the lines or circuits to be connected through a repeater vary considerably with respect to their impedance characteristics, said lines may be arranged in groups so that the lines of any group will have substantially the same impedance characteristic and may be balanced by the same artificial line. It will then be possible to reduce the number of artificial lines to the number necessary to handle the maximum traffic over lines of a given class. In accordance with this invention this result is accomplished by associating with each repeater an artificial line corresponding to each group of transmission lines, said artificial lines being individual to the repeater. Means are provided whereby, when the repeater is associated with a transmission line in a given group, the artificial line corresponding to that group will be connected with the repeater.

The invention will be more fully understood by reference to the following descrip-

tion taken in connection with the accompanying drawing, the figure of which constitutes a circuit diagram of the invention as applied to a cord circuit repeater.

Referring to the drawing, a plurality of transmission lines $L_1, L_1', L_2, L_2',$ etc., are shown terminating in jacks $J_1, J_1', J_2, J_2',$ etc. Each of the lines designated by a reference letter having the same subscript belongs to a group of lines having the same impedance characteristics. While but two lines are shown in each group, it will be understood, of course, that any number of lines may occur in any given group depending upon the character of the lines in an exchange. For interconnecting the lines a repeater R is shown terminating in plugs P and P' . While but one repeater is shown, it will be understood that, in practice, as many repeaters will be provided as traffic conditions may warrant. Associated with the answering end of the repeater is a balancing artificial line N_1 , said artificial line being normally connected to the repeater and being designed to balance lines of the group to which line L_1 belongs. Similarly an artificial line N_2 is normally connected to the calling end of the repeater to balance lines of the group to which line L_2 belongs. Other artificial lines such as $N_3, N_4,$ etc., may also be associated with the answering end of the repeater, said artificial lines being normally disconnected from the repeater, but being adapted to be connected thereto upon the association of the repeater with any line of the group to which one of these artificial lines corresponds. At the same time that one of these artificial lines is connected to the repeater, the artificial line N_1 is disconnected therefrom. Thus, if the answering end of the repeater is associated with line L_1' , the artificial line N_1 will be connected to the repeater and artificial line N_2 disconnected therefrom. Similarly the calling end of the repeater is provided with additional artificial lines $N_3, N_4,$ etc., which may be connected to the repeater upon the association of the calling end thereof with a line of a group to which the artificial line corresponds, the artificial line N_1 being at the same time disconnected.

In order to control the proper association of the artificial lines with the repeater, a set of selecting relays is provided, there being one relay for each artificial line of a given

repeater, said relay being under the control of any one of the lines of the corresponding group of transmission lines.

With this general description in mind, the invention will now be fully understood from a description of the operation. Assuming that it is desired to connect line L_1 to line L_4 through the cord circuit repeater R , the plug P is inserted in the jack J_1 and the plug P' is inserted in the jack J_4 . A circuit is thereby completed over the sleeve contacts of plug P and jack J_1 , from battery through the winding of relay 1, sleeve contacts of the plug and jack, and winding of relay 2 to ground. Relays 1 and 2 are energized over this circuit, relay 2 momentarily closing a circuit from ground over its make-break contacts, over the lower back contact and through the winding of relay 3 and over the front contact of relay 1 to battery. As soon as the armature of relay 2 is fully pulled up, the make-break contact is opened and the circuit just traced is broken but the contact remains closed a sufficient length of time before this occurs to energize the relay 3 over this circuit. Relay 3 upon being energized completes a locking circuit from battery over the front contact of relay 1, winding and front contact of relay 3 and through the winding of relay 4 to ground. Relay 4 is energized over this circuit and disconnects the artificial line N_3 from the repeater R . The relay 3 is locked up over the circuit just traced and at its upper contacts connects the artificial line N_1 to the repeater.

Returning now to the calling end of the repeater, upon inserting the plug P' into the jack J_4 a circuit is closed from battery through the winding of relay 5, sleeve contacts of plug P' and jack J_4 and winding of relay 6 to ground. Relays 5 and 6 are energized over this circuit, relay 6 at its make-break contact closing a momentary circuit from ground over the make-break contacts of relay 6, lower back contact and winding of relay 7, from contact of relay 5 to battery. When the armature of relay 6 is fully pulled up this circuit is broken but the circuit is completed for a sufficient length of time to permit of the energization of relay 7. Relay 7, upon being energized, at its lower front contact closes a locking circuit from battery, front contact of relay 5, winding and lower front contact of relay 7 and the winding of relay 8 to ground. Relay 8 is thereby energized and disconnects the artificial line N_6 from the calling end of repeater R , while relay 7 at its upper contacts connects the artificial line N_4 thereto.

It will now be seen that the lines L_1 and L_4 are interconnected through the repeater R and are balanced by artificial lines N_1 and N_4 . Had the connection been established between the lines L_1' and L_4' , relays 9 and 10 would have been energized to com-

plete momentary circuits through the windings of relays 3 and 7, whereby said relays would have been operated to connect the artificial lines N_1 and N_4 to the repeater in the manner just described. It will be noted that the make-break contacts of the relays individual to lines of the same group are connected in parallel to a conductor leading to the connecting relays which operate to connect an artificial line to the repeater.

In the case of the lines of the two groups to which lines L_3 and L_6 belong, the relays individual to the line do not control any selecting circuit. Therefore, if the connection be made between lines L_3 and L_6 or between lines L_3' and L_6' through the repeater R , although relays 11 and 12 are energized, no circuits are completed thereby and consequently the relays 4 and 8 are not energized so that artificial lines N_3 and N_6 will remain connected to the answering and calling ends of the repeater respectively, to balance the lines L_3 and L_6 . In practice it may be found that some one group of lines is much larger than any other group and it will be, therefore, advantageous to design the artificial lines N_3 and N_6 which are normally connected to the repeater, in such a manner as to balance the lines belonging to such large group. If this is done, in a large number of connections no artificial line need be selected, as the proper artificial line will be already associated with the repeater. However, when the repeater is associated with a line in a smaller group, an artificial line will be selected and connected to the repeater, the artificial line normally connected thereto being at the same time disconnected.

By means of the arrangements above described, it will be seen that simple and efficient means for the automatic selection of an artificial line to balance a transmission line has been provided, and while the invention has been disclosed as embodied in certain forms which are considered desirable, it will be understood that it may be embodied in many widely different organizations without departing from the spirit of the appended claims.

What is claimed is:

1. A plurality of transmission lines, a repeater for interconnecting said lines, a plurality of artificial lines associated with said repeater, one of said artificial lines being normally connected to said repeater, and means operating in response to the connection of said repeater to a transmission line to disconnect said artificial line and connect another artificial line to the repeater.

2. A plurality of transmission lines divided into groups, a repeater for interconnecting said lines, artificial lines associated with said repeater and corresponding to the various groups of transmission lines, the artificial line corresponding to one group be-

ing normally connected to the repeater so as to balance any line of that group when the repeater is associated therewith, and means responsive to the connection of the
5 repeater to a line of another group to disconnect the normally connected artificial line from the repeater, and to connect an artificial line corresponding to said other group to the repeater.

10 3. A plurality of transmission lines divided into groups, a repeater for interconnecting said lines, artificial lines associated with the repeater and corresponding to the various groups of transmission lines, the
15 artificial line corresponding to one group being normally connected to the repeater so as to balance any line of that group when the repeater is associated therewith, and selecting relays responsive to the connection
20 of the repeater to a line of another group to disconnect the normally connected artificial line from the repeater and to connect an artificial line corresponding to said other group to the repeater.

25 4. A plurality of transmission lines, a repeater for interconnecting said lines, a plurality of balancing artificial lines associated with the repeater, one of said artificial lines being normally connected to the repeater,
30 and relays corresponding to each of said artificial lines and controlling the connection and disconnection of the artificial lines from

the repeater, said relays being unresponsive to the association of the repeater with certain lines so that the normally connected artificial line remains associated with the repeater, and certain of said relays being responsive to the association of the repeater with other lines to disconnect the normally connected artificial line and connect another
40 artificial line to the repeater.

5. A telephone repeater, a plurality of artificial lines associated therewith, a relay normally connecting one of said artificial lines to the repeater, relays controlling the
45 connection of each of the other artificial lines to the repeater, and means whereby when any one of the latter relays operates to connect an artificial line to the repeater said first relay operates to disconnect the corresponding artificial line from the repeater.

6. A plurality of transmission lines divided into groups, a repeater for interconnecting said lines, a plurality of artificial lines for said repeater, one of said lines being preselected to balance any line of one
55 group when the repeater is associated therewith, and means to select another artificial line when the repeater is associated with a line in another group.

In testimony whereof, I have signed my name to this specification this seventh day of June 1917.

CHARLES S. DEMAREST.