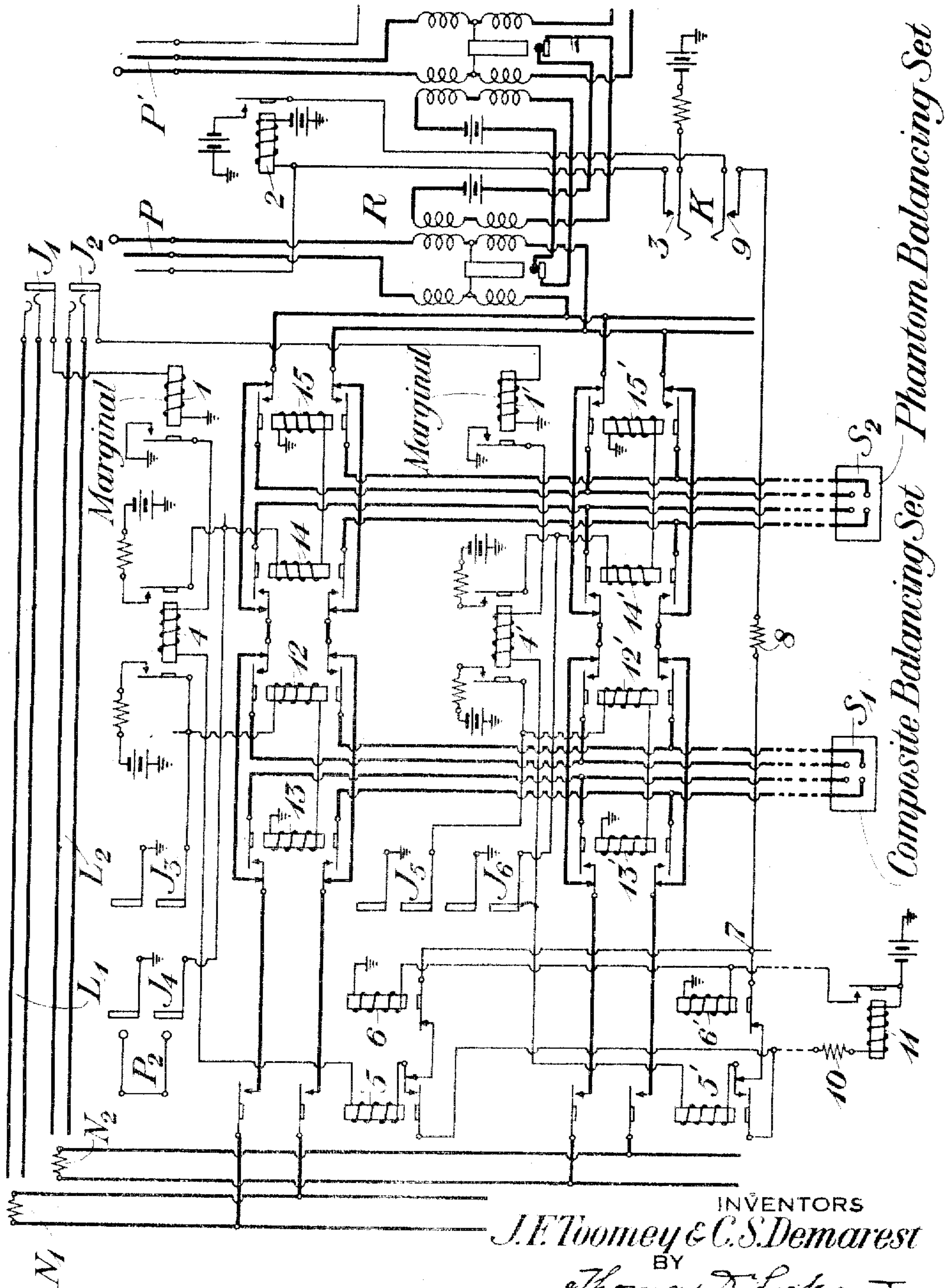


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 MEANS FOR CONTROLLING ARTIFICIAL LINES.
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1,308,726.

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MEANS FOR CONTROLLING ARTIFICIAL LINES.

1,308,726.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, JOHN F. TOOMEY and CHARLES S. DEMAREST, residing at New York and Flatbush, respectively, in the counties of New York and Kings, respectively, and State of New York, have invented certain Improvements in Means for Controlling Artificial Lines, of which the following is a specification.

10 This invention relates to telephone repeaters, and more particularly to arrangements for balancing the transmission circuit with which a telephone repeater may be associated.

15 In repeater organizations it is customary to construct a simple net-work adapted to simulate the impedance characteristic of the line with which the repeater is associated. When, however, as is frequently the case, the line is composited in order that it may be used for telegraphic or signaling purposes in addition to its use as a telephone transmission circuit, it is necessary to provide means to balance the composite apparatus which is applied to the line. Moreover, if 25 the line is used as one side of a phantom circuit, it is also necessary to provide means to balance the phantom apparatus applied to the line. Consequently, it is customary to supplement the simple net-work above referred to by an additional net-work to simulate the impedance of the composite apparatus and another net-work to simulate the phantom apparatus.

35 When the repeater is associated with the line, arrangements have been proposed whereby a balancing apparatus, constructed as above described, and suitable to balance such line, is connected to the repeater. If, however, the composite apparatus or the phantom apparatus should for any reason be removed from the line, the balancing apparatus would not properly balance the line. It is one of the objects of this invention to overcome this difficulty by providing means 45 to control the connection or disconnection of the composite balancing set, or the phantom balancing set, to or from the repeater.

Further objects of the invention will be apparent from the following description, when read in connection with the accompanying drawing, the figure of which con-

stitutes a circuit diagram of one embodiment of the invention.

Referring to the drawing, lines or trunks L_1 and L_2 are shown terminating in jacks J_1 and J_2 . While but two lines are shown it will be understood that any number of lines may similarly terminate in jacks before a repeater operator. A repeater R terminating in plugs P and P' is provided for interconnecting incoming lines with outgoing lines. While for simplicity the repeater elements are illustrated as being of the well-known mechanical type, it is understood that the vacuum tube type or any other type of repeater may be employed if desired. In practice a sufficient number of repeaters would of course be provided to handle the traffic. Artificial lines or net-works N_1 and N_2 are shown, said net-works to be adapted to balance the lines L_1 and L_2 , respectively. Associated with the repeater is a composite balancing set S_1 , which is adapted to balance the standard composite set which may be associated with any of the lines, a phantom balancing set S_2 being also associated with the repeater to balance the phantom apparatus which may be associated with a line. Normally the artificial lines N_1 and N_2 are disconnected from the repeater. When the repeater is connected to a calling line by inserting the plug P in the jack of that line, the selecting apparatus, herein shown as a set of selecting relays, is operated to select the artificial line corresponding to the line to which the repeater is connected, and such net-work is connected to the repeater. At the same time connecting relays are energized to connect the balancing sets S_1 and S_2 between the artificial line and the repeater. In accordance with this invention, the operation of these connecting relays may be prevented at will by inserting an idle plug such as P_2 in a controlling jack such as J_3 , J_4 , J_5 , or J_6 at the testboard. By this operation the connecting relay or relays corresponding to the jack in which the idle plug is inserted will be short-circuited, so that the balancing set controlled by said relay or relays will not be connected. The selecting arrangement whereby the artificial line is associated with the repeater forms no part of this invention; and while

for purposes of illustration the selecting arrangement is of the relay type which is more fully illustrated and claimed in the copending application of C. S. Demarest, Serial No. 174,886, filed June 15, 1917, it will be understood that any other type of selecting means may be used, such as for instance the automatic selector switch arrangement disclosed and claimed in a copending application of J. F. Toomey and C. S. Demarest, Serial No. 174,889, filed June 15, 1917, or the twin plug arrangement shown and claimed in the U. S. patent to J. F. Toomey and W. V. H. Read, No. 1,277,274, patented August 27, 1918.

While for purposes of illustration the arrangement for selecting an artificial line and for controlling the connection and disconnection of the balancing sets has been shown as associated with only the answering end of the repeater, it will be understood that similar arrangements will be provided for the calling end of the repeater.

With this brief description in mind the invention may now be fully understood from a description of the operation. Assuming that the line L_1 is to be connected through repeater R to some other line, the operator inserts the plug P in the jack J_1 and the plug P' in the jack of the other line (not shown). A circuit is now closed from ground to the winding of relay 1, sleeve contacts of jack J_1 and plug P, winding of relay 2 to battery. Relay 2 is energized over this circuit, but relay 1 is marginal and does not receive sufficient current when in series with the high resistance winding of relay 2 to energize its winding. The operator may now actuate a controlling key K, whereupon battery is connected over contact 3 of said key through a low resistance directly to the sleeve contact of plug P. Relay 1 now receives sufficient current to energize its winding and attracts its armature, thereby closing a circuit from ground, contact of relay 1, winding of relay 4, winding and lower back contact of relay 5, back contact of relay 6, resistance 8, contact 9 of key K and contact of relay 2 to battery. Relays 4 and 5 are energized over this circuit. Relay 5 at its lower front contact closes a locking circuit from ground, contact of relay 1, winding of relay 4, winding and lower front contact of relay 5, resistance 10 and winding of relay 11 to battery. Relay 11 is energized over this circuit, and then closes a circuit from battery over the front contact of said relay through windings of relays 6, 6', and other similar relays (not shown) to ground. Relays 6, 6', etc., are energized thereby and operate to disconnect the selecting circuit from the winding of relays 5, 5', and similar relays (not shown) so that no other connecting relay

can be operated. Relay 5 is maintained energized over the locking circuit above traced, and at its upper contacts connects the artificial line N_1 to the repeater R, so that the line L_1 is now balanced by said artificial line.

At the same time that relay 5 was energized relay 4, which is in series with relay 5, was energized so that the following circuits were closed over its contacts; from battery, left hand contact of relay 4, windings of relays 12 and 13 in series to ground, and from battery over the right hand contact of relay 4 through the windings of relays 14 and 15 in series to ground. Relays 12, 13, 14 and 15 operate to interconnect the balancing sets S_1 and S_2 between the artificial line N_1 and the repeater R, the circuit extending from the terminals of artificial line N_1 over the upper contacts of relay 5, front contacts of relay 13, through the balancing set S_1 , over the contacts of relays 12 and 14, through the balancing set S_2 and over the contacts of relay 15 to the repeater.

It will now be seen that the line L_1 is connected to the repeater and is balanced by an arrangement consisting of artificial line N_1 , a composite balancing set S_1 and a phantom balancing set S_2 . If, however, the composite apparatus (not shown) is disconnected from the line L_1 by an operator at the testboard through the coaction of the tip and ring contacts (not shown) of a plug P_2 inserted in a jack J_3 , a condition is brought about whereby the windings of relays 12 and 13 are short-circuited over a circuit from ground, sleeve contacts of jack J_3 and plug P_2 , left hand contact of relay 4 to battery. The relays 12 and 13 will consequently not be energized and the composite balancing set S_1 will not be connected in the balancing circuit, which extends from the terminals of artificial line N_1 over the upper contacts of relay 5, back contacts of relays 13 and 12, front contacts of relay 14, balancing set S_2 , front contacts of relay 15 to the repeater. In a similar manner, if the phantom apparatus should be disconnected from the line at the testboard, the operator at the testboard would insert a twin plug in jack J_4 , thereby short-circuiting relays 14 and 15 in a similar manner, so that said relays would be deenergized and the phantom balancing set S_2 would not be connected in circuit. If the line L_1 has neither a composite-balancing set nor a phantom balancing set, idle plugs would be inserted in both jacks J_3 and J_4 , so that all four relays 12, 13, 14 and 15 would be short-circuited.

Upon taking down the connection, relays 1 and 2 will be deenergized, the relay 1 at its contact opening the locking circuit through relays 4, 5 and 11, which will be restored to normal. Relay 4 opens the cir-

5 circuits of relays 12, 13, 14 and 15, thereby disconnecting balancing sets S_1 and S_2 . Relay 5 at its upper contacts disconnects the artificial line N_1 , while relay 11 opens the circuit previously traced through relays 6, 6', etc., so that said relays are deenergized and the circuits restored to normal.

10 If the repeater R had been connected to the line L_2 instead of L_1 by inserting the plug P in the jack J_2 , upon operating the key K, relays 1' and 2 would have been energized thereby closing circuits through relays 4' and 5'. Said relays would have been locked up over a circuit from ground, 15 front contact of relay 1', winding of relay 4', winding and lower front contact of relay 5', resistance 10 and winding of relay 11 to battery. Relay 5' at its upper contacts controls the connecting of an artificial line N_2 to the repeater in a manner similar to that by which relay 5 connected to the artificial line N_1 . Relay 4' controls the circuits of relays 12', 13', 14' and 15', to connect the balancing sets S_1 and S_2 in circuit 20 so that the line L_2 is balanced by means of a circuit including artificial line N_2 and extending from the terminals of said artificial line over the upper contacts of relay 5', front contacts of relay 13' to set S_1 , over the front contacts of relays 12' and 14' to the set S_2 and over the front contacts of relay 15' to the repeater. By inserting idle plugs in jacks J_5 or J_6 , the balancing sets S_1 or S_2 , respectively, may be disconnected 25 from the circuit in a manner similar to that already described in connection with jacks J_3 and J_4 . Upon taking down the connection the circuits will be restored to normal in a manner similar to that already described. 30 35 40

By means of the arrangements above described, it will be seen that simple and efficient means for controlling the connection and disconnection of certain apparatus from 45 a balancing circuit has been provided, and while the invention has been disclosed as embodied in a certain form, it will be understood that it may be embodied in many widely different organizations without departing from the spirit of the appended 50 claims.

What is claimed is:

1. In combination with a transmission line and auxiliary apparatus associated 55 therewith, a balancing arrangement therefor comprising an artificial line simulating the transmission line, an auxiliary balancing set for simulating the auxiliary apparatus,

and switching means for rendering the auxiliary balancing set inoperative at will. 60

2. A balancing arrangement comprising an artificial line for simulating a transmission line, an auxiliary balancing set for simulating auxiliary apparatus associated with a transmission line, and switching 65 means, controllable at will, for rendering said auxiliary balancing set operative and inoperative.

3. In combination, a transmission line, auxiliary apparatus associated therewith, a 70 repeater, an artificial line for balancing said transmission line, an auxiliary balancing set for balancing said auxiliary apparatus, means for associating said artificial line and auxiliary balancing set with the repeater 75 to balance the transmission line and auxiliary apparatus, and independent means, controllable at will, for governing the association of said auxiliary balancing set with the repeater. 80

4. In combination, a plurality of transmission lines, auxiliary apparatus associated therewith, artificial lines for balancing the transmission lines, a repeater for interconnecting the lines, an auxiliary balancing 85 set for simulating said auxiliary apparatus, means operative when said repeater is connected to a transmission line to associate said auxiliary balancing set and an artificial balancing line suitable to balance 90 the transmission line with the repeater, and means controllable at will to prevent the association of the auxiliary balancing set with the repeater.

5. In combination, a plurality of transmission lines, auxiliary apparatus associated with certain of said lines, artificial lines for balancing said lines, a repeater for interconnecting said lines, an auxiliary balancing 100 set for simulating said auxiliary apparatus, means operative when the repeater is connected to a transmission line with which auxiliary apparatus is associated, to select an artificial line suitable for balancing 105 said transmission line and to connect such artificial line and said auxiliary balancing set to the repeater, and means to prevent the connection of said auxiliary balancing set when the repeater is connected to a line with which no auxiliary apparatus is associated. 110

In testimony whereof, we have signed our names to this specification this seventh day of June, 1917.

JOHN F. TOOMEY.
CHARLES S. DEMAREST.