Nov. 24, 1931. D. K. GANNETT 1,832,977

MULTIPLE WAY CONNECTION FOR A PLURALITY OF LINES

Filed Aug. 25, 1928 2 Sheets-Sheet 1

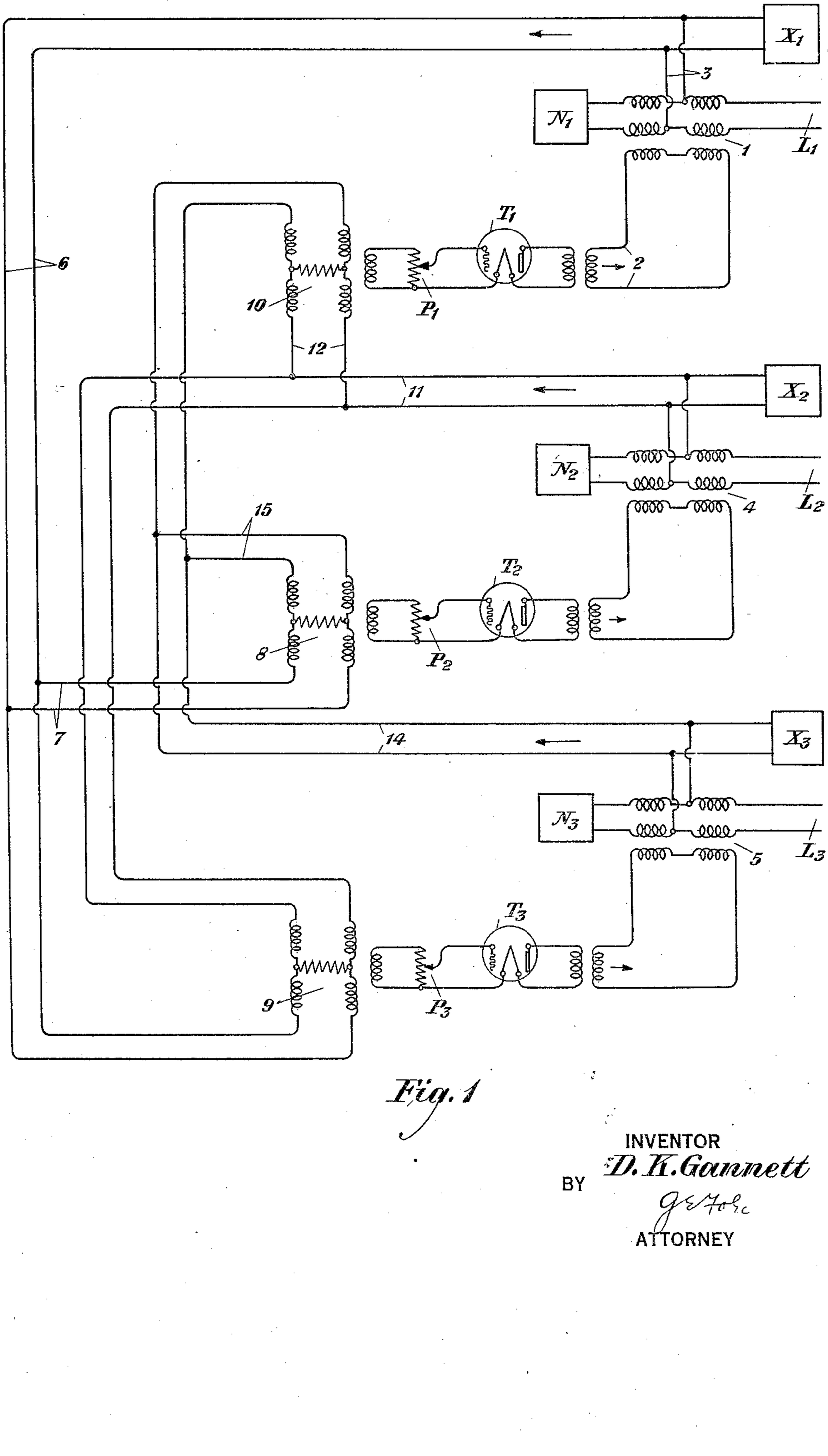

Fig. 1

INVENTOR
D. K. Gannett
BY
ATTORNEY

Nov. 24, 1931. D. K. GANNETT 1,832,977

MULTIPLE WAY CONNECTION FOR A PLURALITY OF LINES

Filed Aug. 25, 1928 2 Sheets-Sheet 2

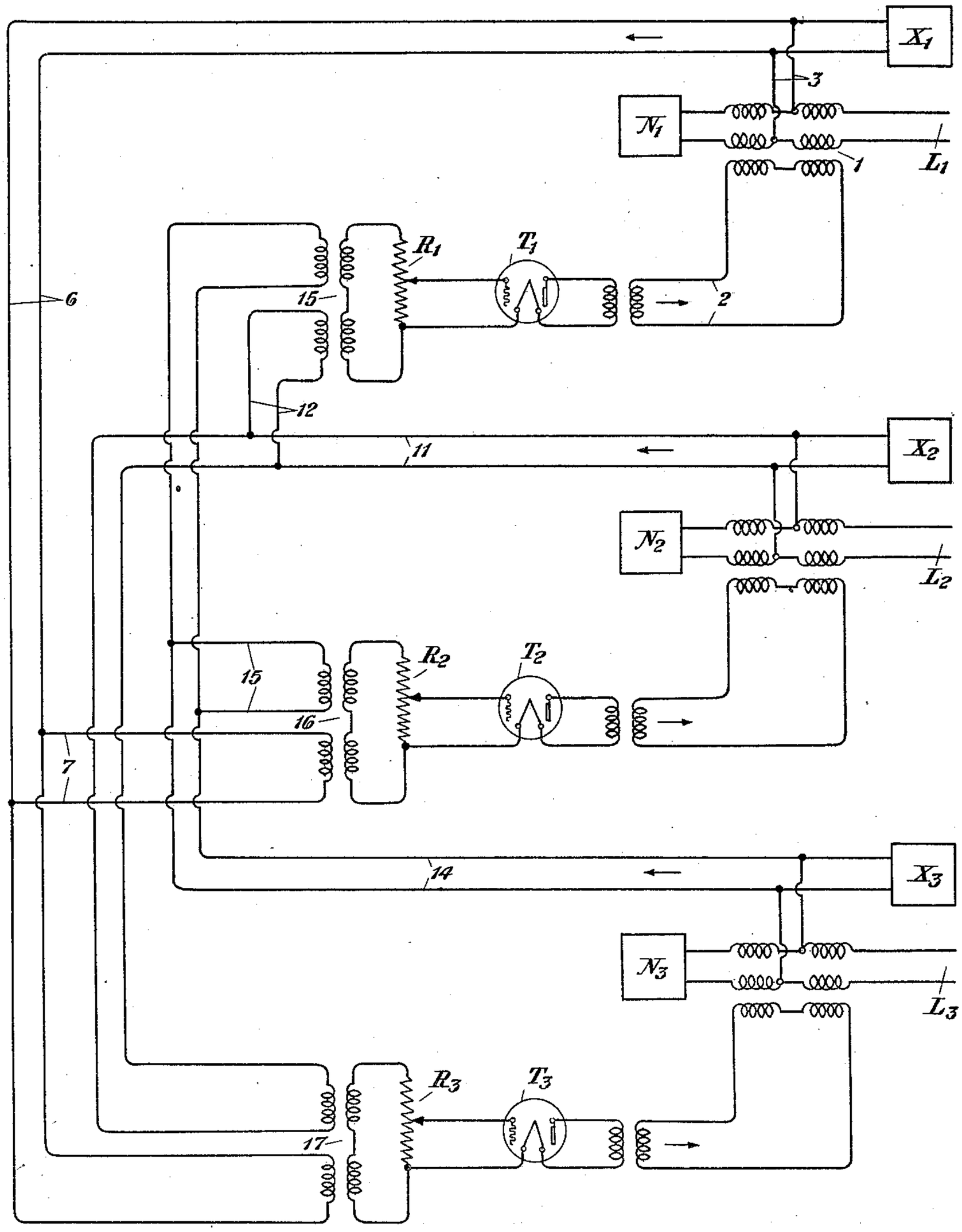

Fig. 2

INVENTOR
D. K. Gannett

BY

ATTORNEY

Patented Nov. 24, 1931 1,832,977

UNITED STATES PATENT OFFICE

DANFORTH K. GANNETT, OF JACKSON HEIGHTS, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK

MULTIPLE WAY CONNECTION FOR A PLURALITY OF LINES

Application filed August 25, 1928. Serial No. 301,951.

This invention relates to arrangements for establishing a multiple way connection between a plurality of transmission lines. By a multiple way connection is meant an arrangement whereby a plurality of subscribers may be so connected together that speech originating with any subscriber may be heard by all the other subscribers. In other words, by the arrangements of the invention a greater number than two subscribers may all be brought together for purposes of joint conversation.

In the arrangements of the invention repeater circuits are utilized for connecting a plurality of lines together in such a way that each line is in two-way communication with the other lines. A particular feature of the arrangements of the invention is that voice-frequency signaling devices, or other devices, may be connected to the circuit in such a manner that each of said devices receives currents only from a particular line. This minimizes the effect of echoes on the signaling device since when a signal is sent from the terminal of one line to the repeater point, the first echoes from the other two lines cannot reach the signaling device. Other objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

The invention may be more fully understood from the following description, together with the accompanying drawings in the Figures 1 and 2 of which the invention is illustrated. In Fig. 1 is shown an arrangement whereby a multiple way connection may be established between three transmission lines. In Fig. 2 is an alternative arrangement whereby a multiple way connection may be established between a greater number of lines. Similar reference characters have been utilized to denote like parts in both of the figures.

In the arrangements of Fig. 1 are shown three lines L_1, L_2 and L_3 between which it is desired to establish a multiple connection. These lines will terminate in the hybrid coils 1, 4 and 5 and the balancing networks N_1, N_2 and N_3, respectively. Each hybrid coil arrangement will be provided with an input circuit, such as 2, which will include amplifying arrangements, such as the tube T_1. The side of each of these hybrid coils which transmits from the line is connected to the input circuits of the amplifying arrangements which transmit into the other hybrid coils. In other words, line L_1 will be connected through hybrid coil 1 and circuits 6 and 7 to the input circuits of amplifiers T_2 and T_3, which in turn transmit into lines L_2 and L_3. Line L_2 will be connected through transformer 4 and circuits 11 and 12 to the input circuits of amplifiers T_1 and T_3, which in turn transmit into lines L_1 and L_3. Line L_3 will be connected through transformer 5 and circuits 14 and 15 to the input circuits of amplifiers T_1 and T_2, which in turn transmit into lines L_1 and L_2. The input transformers 8, 9 and 10 of each amplifier are shown arranged in the form of hybrid coils with connections from two of the line hybrid coils being made to the terminals which would ordinarily be "line" and "network". The series windings of each of these hybrid coils 8, 9 and 10 are connected to the potentiometers P_1, P_2 and P_3, as shown, for adjusting the gain and thence to the grids of the tubes. The mid-points of each of the hybrid coils are connected to a resistance for balancing the potentiometer. It will be seen that this arrangement gives two way communication between all three of the lines.

Connected to the sides of the line hybrid coils which transmit from the lines L_1, L_2 and L_3 are the devices X_1, X_2 and X_3. These devices may, for example, be voice operated signaling devices. However, they are so referred to for purposes of illustration only and may be any other desired type of wave responsive device. Due to the conjugate re-

lationship between the branches of each of the hybrid coils 8, 9 and 10, it will be seen that device X_1 can receive only those currents which come in over line L_1, either directly or as a second echo. Similarly, X_2 and X_3 can receive only those currents which come in over lines L_2 and L_3, respectively. Accordingly, the three devices X_1, X_2 and X_3 are in the most favorable position which it is possible to obtain with respect to interference from echoes.

Other arrangements may be substituted for the hybrid-input coils 8, 9 and 10 used for connecting the inputs of the amplifying elements to the proper lines. Such an alternative arrangement is shown in the circuit diagram of Fig. 2. In this arrangement the transformer arrangements 15, 16 and 17 are utilized in place of the hybrid coils 8, 9 and 10. The transformer arrangements 15, 16 and 17 each employ two input transformers whose secondary windings are in series and whose primary windings are connected to the proper circuits. In series with each secondary winding will be a relatively high resistance, such as the resistances R_1, R_2 and R_3. For example, with respect to the transformer arrangement 15 the resistance R_1 will be sufficiently large so that current coming in over circuit 14 will be so reduced in the secondary winding of the transformer that practically none of such current will be transmitted to circuit 12. While the circuit of Fig. 2 has been shown as arranged for connecting three lines together, it is obvious that the arrangement may be expanded to connect four or more lines together. In each case, the number of amplifying elements will be equal to the number of lines which it is desired to connect together, and with the arrangements of Fig. 2 any number of circuits may be connected to the input of each amplifier.

While the invention has been disclosed as embodied in certain specific arrangements which are deemed desirable, it is understood that it is capable of embodiment in many and other widely varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. An arrangement for providing multiple way connection of three or more transmission lines, comprising a plurality of amplifiers each having its output circuit inductively connected with a certain one of said lines, a plurality of circuits each leading from a certain one of said lines, wave responsive devices in said circuits, and means associated with any certain one of said amplifiers to connect to the input thereof, and in conjugate relation with each other, those of said circuits leading from lines other than that to which the certain amplifier is connected.

2. Three or more transmission lines terminating in hybrid coils, input and output circuits for each of said hybrid coils, wave responsive devices in each of said output circuits, amplifiers in each of said input circuits, and means to connect the output circuit of each of said hybrid coils with the input circuits of the other hybrid coils.

In testimony whereof, I have signed my name to this specification this 23rd day of August, 1928.

DANFORTH K. GANNETT.