

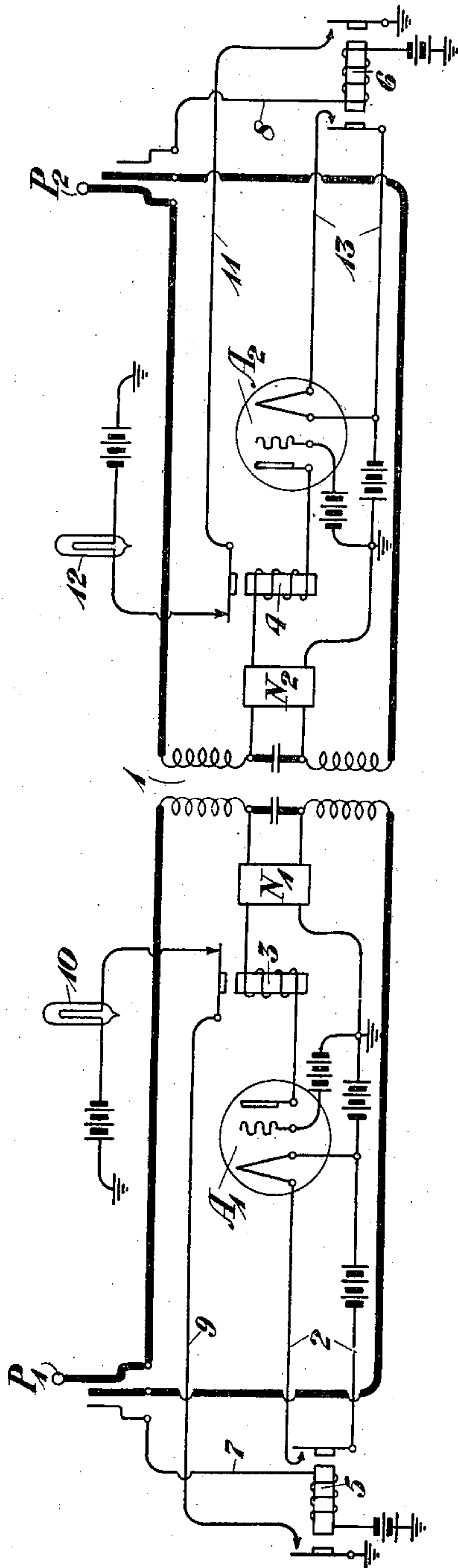
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TRANSMISSION EQUALIZATION ARRANGEMENT

Filed Dec. 23, 1920



INVENTOR

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UNITED STATES PATENT OFFICE.

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TRANSMISSION-EQUALIZATION ARRANGEMENT.

Application filed December 23, 1920. Serial No. 432,835.

To all whom it may concern:

Be it known that I, LEO H. DARROW, residing at Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Transmission-Equalization Arrangements, of which the following is a specification.

This invention relates to transmission lines and particularly to arrangements for equalizing transmission over such lines when such lines possess different electrical characteristics.

The arrangements of the invention are particularly applicable to a link, or cord, circuit which is used to establish connections with a plurality of subscribers' lines. As the subscribers' lines might be of different lengths and different electrical characteristics, it is apparent that the source of current supply in former types of link circuits would furnish varying amounts of current over the various lines and thus give variable transmission, the transmission being better over the shorter lines than over the longer lines ordinarily. In general it is the object of the invention to overcome this difficulty and to provide arrangements which will insure equal transmission over the various types of lines. Other objects and purposes of the invention will appear more fully from the detailed description hereinafter given.

The objects of this invention are accomplished by including in the talking current supply circuit of the link or cord circuit, by which connections are established with different subscribers' lines, a vacuum tube device so connected into the circuit that it possesses for the purposes of this invention the characteristic of negative resistance. A complete description of a vacuum tube device arranged so that it possesses the characteristic of a negative resistance may be found in volume 6, 1918, Proceedings of the Institute of Radio Engineers, in an article entitled, "The dynatron, a vacuum tube possessing negative electric resistance," by A. W. Hull, pages 5-35. It is evident that if a negative resistance of proper value is connected in series in the current supply circuit of the link circuit, the positive resistance of the line to which the link circuit is connected will neutralize a certain amount of the negative resistance in series with the source of cur-

rent supply. This will allow a greater current to be furnished to the longer lines than to the shorter ones and the greater current supply thus obtained on the longer lines will make up for the greater losses which would normally occur. In this manner transmission over lines of differing electrical characteristics may be maintained substantially constant. A device possessing the above mentioned characteristics of negative resistance may be broadly defined as one through which an increase of current is accompanied by a decrease of potential difference between the terminals, or vice versa. In other words, let E be the potential difference between the terminals of the converting device; let I be the corresponding current flowing through the converting device; assume that the current I be changed in any way by an amount represented by δI ; this will cause a corresponding change in the potential difference E , which may be called δE . As is usual, also, if an increase of current or potential is considered positive, then a decrease in either must be considered negative; then the converting device must be of such a character that the ratio $\delta E / \delta I$ is negative. When such is the case, it may properly be said to have the properties of negative resistances.

The invention may be more fully understood from the following description of the accompanying drawing, in which is illustrated a preferred embodiment of the invention and from the description of its operation. In the drawing is shown a link, or cord circuit, terminating in the plugs P_1 and P_2 with which connections may be established with lines, such as subscribers' lines which in turn might be of various types and possess differing electrical characteristics. The cord circuit includes a repeating coil 1. Associated with the left-hand windings of the repeating coil is a three-element vacuum tube device with battery supplies connected as shown, through which the talking current for the connection is furnished to the subscribers' loop. Associated with the plug P_1 is the relay 5 which operates when the plug is inserted in the jack of a subscriber's line, and serves to close the filament circuit of the vacuum tube device, and thus render it operative. The relay 5 also renders operative over conductor 9 a circuit for the supervisory lamp

10. The supervisory lamp 10 is controlled by the relay 3 included in the talking current supply circuit. The three-element vacuum tube device when connected in the manner shown is in itself a source of electrical energy. Accordingly, there is inserted in the talking supply circuit a network N_1 of such impedance characteristics that it will prevent the generation of continuous oscillations, and cause what is commonly termed "singing" to take place in the talking circuit. Associated with the right-hand winding of repeating coil 1 is apparatus similar to that already described with respect to the left-hand winding of repeating coil 1. Associated with plug P_2 is relay 6, which controls the filament circuit of the three-element vacuum tube device A_2 . In the talking supply circuit is supervisory relay 4, which controls the operation of the supervisory lamp 12, and also network N_2 .

The operation of the invention is as follows: If a connection is established with a line, such as a subscriber's line, by inserting the plug P_1 in the jack of said line, a circuit will be closed from a ground connection in the sleeve circuit of the jack of the line, sleeve contact of plug P_1 , over conductor 7, winding of relay 5, to battery and ground, thereby operating relay 5. The relay 5 will close at its right-hand contact the normally open filament circuit of the vacuum tube device A_1 . This will cause the filament to heat to incandescence, and will cause the vacuum tube device to function. Talking current will then be supplied through the vacuum tube device, relay 3, network N_1 and the left-hand windings of coil 1 over the talking conductors of the cord, contacts of plug P_1 , and the jack of the line, and thence over the talking conductors of the line. If the line with which connection is established happens to be a relatively long line, it will have a relatively large resistance which will neutralize a relatively large amount of the negative resistance of the vacuum tube device and allow a relatively large current for talking purposes to be supplied to the subscriber's line. Conversely, if the line with which connection is established happens to be a relatively short line, it will have a relatively small resistance and will neutralize a relatively small amount of the negative resistance of the vacuum tube device. This will allow a smaller talking battery supply to be furnished to the subscriber's line than in the case where connection is made to a long subscriber's line. The increase in battery supply which will be furnished to the longer loops will compensate for the greater high frequency losses in these loops and in this manner transmission over lines of differing electrical characteristics may be approximately equalized and made substantially constant.

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 widely varied forms without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A link circuit adapted for establishing connections with lines of differing electrical characteristics, a current supply circuit included in said link circuit, and a vacuum tube dynatron connected in series in said current supply circuit and possessing the characteristic of negative electrical resistance whereby transmission over said lines may be maintained substantially constant.
2. A link circuit adapted for establishing connections with subscribers' lines of differing electrical characteristics, a current supply circuit included in said link circuit for supplying direct current over said lines to the subscribers' stations, and a vacuum tube device connected in said current supply circuit which, when connected in series with a relatively large resistance, will allow a larger current to be transmitted therethrough than when connected in series with a smaller resistance.

In testimony whereof, I have signed my name to this specification this 18th day of December 1920.

LEO H. DARROW.