June 19, 1923. 1,459,004

G. K. THOMPSON

MEANS FOR EQUALIZING TRANSMISSION OVER LINES OF DIFFERENT ELECTRICAL CHARACTERISTICS

Filed Oct. 29, 1918 2 Sheets-Sheet 1

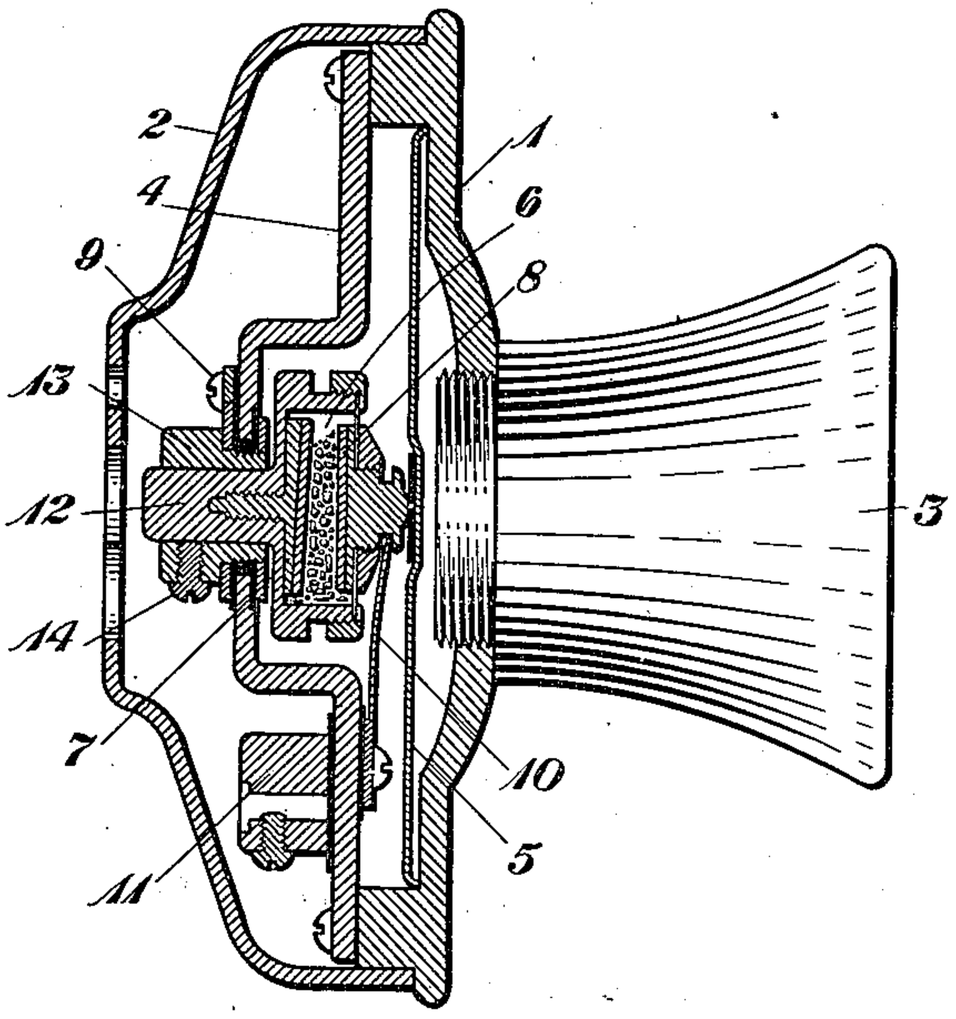

Fig. 1

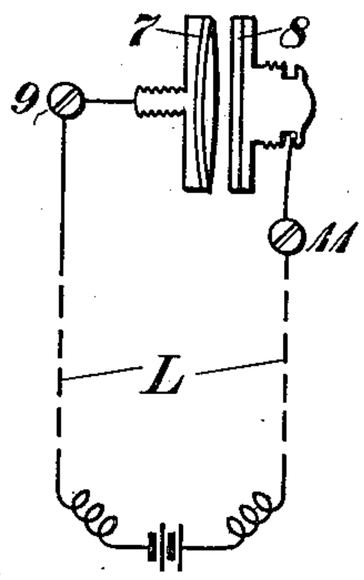

Fig. 2

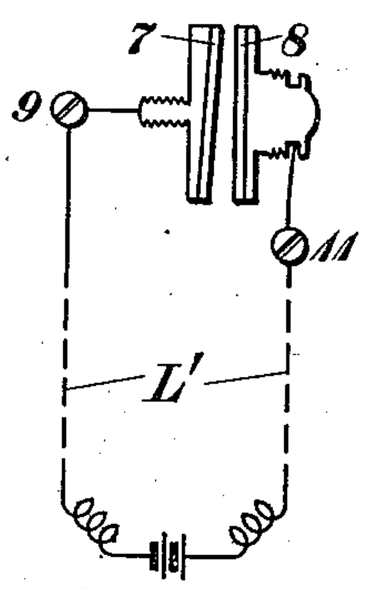

Fig. 3

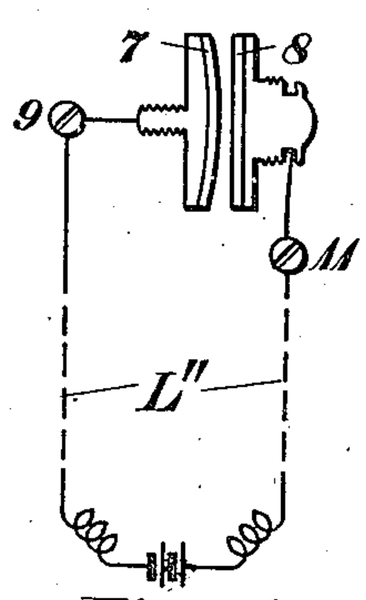

Fig. 4

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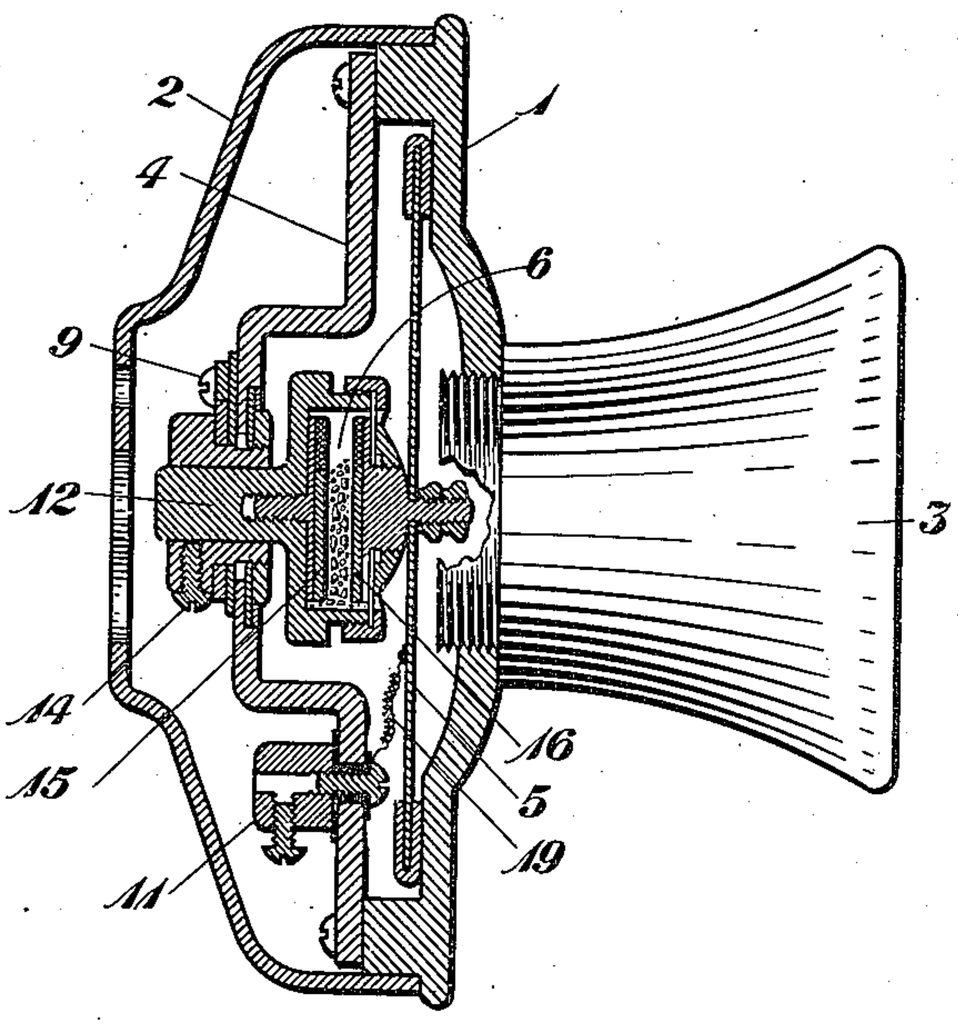

Fig. 5

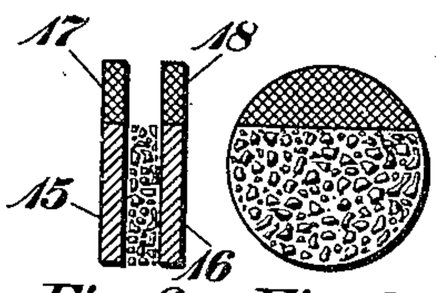

Fig. 6(a) Fig. 6 Fig. 7 Fig. 8 Fig. 9 Fig. 10 Fig. 10(a)

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UNITED STATES PATENT OFFICE.

GEORGE K. THOMPSON, OF MAPLEWOOD, NEW JERSEY, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

MEANS FOR EQUALIZING TRANSMISSION OVER LINES OF DIFFERENT ELECTRICAL CHARACTERISTICS.

Application filed October 29, 1918. Serial No. 260,148.

To all whom it may concern:

Be it known that I, GEORGE K. THOMPSON, residing at Maplewood, in the county of Essex and State of New Jersey, have invented certain Improvements in Means for Equalizing Transmission Over Lines of Different Electrical Characteristics, of which the following is a specification.

This invention relates to telephone systems and more particularly to the provision of means whereby the transmission over telephone lines of different electrical characteristics may be equalized or rendered more uniform.

Telephone lines have, in general, different electrical characteristics varying with the length of the lines. For any particular type of line construction which may be employed the resistance, capacity, inductance and leakage of the circuit increase with the length. These variations in the electrical characteristics of the different subscribers' lines in a telephone system introduce a number of variable effects in the telephone service rendered from different stations. For example, the different electrical characteristics result in different degrees of attenuation in the alternating telephone current passing over the subscribers' lines and thus give louder and more effective telephonic communication to subscribers connected by means of short lines than to subscribers connected by means of long lines. As a result, a subscriber having a long line, when connected with any other subscriber, does not receive as good telephone transmission as would a subscriber having a short line similarly connected. Furthermore, in the common battery systems now so generally employed in all but small communities, the resistance of the line causes a further effect on the transmission in that it reduces the amount of direct current which the transmitter receives from the central office battery and so renders it less efficient in the generation of the alternating telephone current.

In view of the conditions above referred to, it has not been heretofore possible to provide all subscribers with the same grade of transmission and it is one of the objects of this invention to provide means whereby this difficulty may be overcome, although other and further objects of the invention will appear from the description hereinafter given.

The objects of this invention may be secured by associating with each line a telephone transmitter whose resistance is adjusted in accordance with the electrical characteristics of the line. Where the transmission line is of high impedance, since the direct current supplied to the transmitter over the line is small, the transmitter should be of high resistance so that for a given variation of the transmitter resistance a proportionately larger variation of the total resistance including that of the line will be produced, and consequently a greater transmission efficiency will result. Where the line is of low impedance and the current supplied large, the transmitter resistance should be comparatively small so that a given variation in the transmitter resistance produces a relatively small variation in the total resistance. Consequently the transmission efficiency under this condition may be made little if any greater than under the first condition above mentioned.

In its more specific aspects the invention contemplates the provision of a transmitter having a resistance button whose electrodes are so arranged that by changing the position of the electrodes, as for instance by rotating them upon their axes, or by rotating the instrument itself, the resistance of the transmitter will be varied so that it may be adjusted in accordance with the electrical characteristics of the line with which it is associated. By means of this expedient it is possible by a simple manipulation to adjust or position any transmitter of the design described to meet the requirements of any line of reasonable length so that the transmission over lines having different characteristics may be substantially equalized.

The invention may now be more fully understood from the following description when read in connection with the accompanying drawings in which Figure 1 is a sectional view of a transmitter embodying the principles of the invention; Figures 2, 3 and 4 are circuit diagrams showing the electrodes of the transmitter in Figure 1 adjusted in

the various positions in accordance with the requirements of different transmission lines; Figure 5 is a sectional view of a modified form of transmitter and Figures 6, 6ª, 7, 8, 9, 10 and 10ª are views showing different adjustments of the electrodes of the transmitter of Figure 5.

Referring to Figure 1 a telephone transmitter is shown comprising the usual front casing 1, back casing or shell 2, mouthpiece 3, supporting bridge 4 and diaphragm 5. Suitably mounted upon the supporting bridge 4 is a carbon resistance button 6 of a well known type, comprising a back electrode 7 and a front electrode 8 between which is placed a suitable amount of granulated carbon, said front electrode 8 being so arranged as to be movable with the diaphragm 5. The front electrode 8 is similar in all respects to electrodes well known in the art. The back electrode 7, however, is so constructed that one edge is much thinner than the other, as is clearly indicated in Figure 1, the reasons for this construction being more fully explained hereinafter. The back electrode is electrically connected to a binding screw 9 through the body of the resistance button 6 which is electrically insulated from the supporting bridge 4. The front electrode 8 is connected through a spring member 10 to a binding post 11 carried by the supporting bridge 4 and insulated therefrom. The resistance button 6 is provided with a shank 12 adapted to be inserted in a sleeve 13 carried by the supporting bridge 4. By rotating the resistance button 6 upon the shank 12 the granular carbon between the electrodes will be more or less compressed, depending upon the position of the electrodes. When rotated to any desired position the resistance button 6 may be locked in that position by means of a set screw 14. Another and more practical way would be to rotate the entire instrument upon its support and lock it firmly in place when the proper amount of rotation has been secured.

When the transmitter is to be associated with a line of low impedance, the resistance button 6 or instrument itself should be rotated so that the electrodes 7 and 8 assume the position shown in Figure 2 looking down upon the electrodes from above. In this position the distance between the electrodes at the bottom where the granular carbon is collected is relatively small, and the resistance of the transmitter will accordingly be low. For a line of higher impedance such as L′ of Figure 3, the resistance button 6, or the instrument itself, may be given a quarter turn so that the electrodes 7 and 8 assume the position shown in said figure. The resistance of the transmitter will in this case have a medium value. In the case of a line such as L″ of high impedance the resistance button or instrument will be rotated another quarter turn so that the electrodes will be relatively far apart at the bottom of the button where the granular carbon is collected. The resistance of the transmitter will therefore be relatively high. It will be obvious that intermediate steps in the adjustment may also be made if desired so that a finer adjustment of the resistance of the transmitter with respect to the impedance of the line may be obtained.

A modified form of transmitter is illustrated in Figure 5 in which the same general arrangement is disclosed as in Figure 1 except that the electrodes of the resistance button 6 are of slightly different character. In this case both the front and back electrode 15 and 16 are of the same thickness throughout, but each electrode is provided with a segment of non-conducting material as shown at 17 and 18 in Figure 6ª. The front electrode 16 is secured to and movable with the diaphragm 5 and the diaphragm 5 is electrically connected by means of a conductor 19 with the binding post 11, so that an electrical connection exists between the front electrode 16 and said binding post. The rear electrode 15 is electrically connected to the binding screw 9 in the same manner as in Figure 1. When the resistance button 6 or instrument itself is rotated to such a position that the electrodes assume the condition shown in Figures 6 and 6ª the resistance of the transmitter will be at its lowest value, so that the transmitter can be used in connection with a line of low impedance.

By rotating the button 6 or instrument itself through an angle of about 45 degrees, the electrodes will assume the position shown in Figure 7, so that a portion of the granular carbon is included between the insulated segments of the electrode and the resistance of the transmitter is increased. By a still further rotation to the position shown in Figure 8, the resistance of the transmitter will have a medium value. Still further rotation to the position shown in Figure 9 will still further increase the resistance of the transmitter, while a rotation through an angle of 180 degrees from that of Figure 6 as shown in Figures 10 and 10ª will include the largest amount of carbon between the non-conducting segments, so that the resistance of the transmitter is at its highest value. It will be obvious that various intermediate adjustments of the resistance button may be made if a greater degree of precision is desired.

It will be seen that by means of the arrangements above described a simple yet efficient means has been provided whereby the telephonic transmission over lines of different character may be equalized and rendered more uniform, so that subscribers having instruments on loops of different lengths

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

What is claimed is:

1. A telephone transmitter for use in connection with lines of different electrical characteristics, said transmitter including a resistance button having a plurality of electrodes, and at least one of said electrodes having a non-conducting segment whereby rotation of the electrodes about their axes will vary the effective conducting area of the electrodes to adjust the resistance of the transmitter in accordance with the electrical characteristics of the line with which the transmitter is to be used.

2. A telephone transmitter for use in connection with lines of different electrical characteristics, said transmitter including a resistance button having a plurality of electrodes and said electrodes having non-conducting segments whereby rotation of the electrodes about their axes will vary the effective conducting area of the electrodes to adjust the resistance of the transmitter in accordance with the electrical characteristics of the line with which the transmitter is to be used.

In testimony whereof, I have signed my name to this specification this 3rd day of October 1918.

GEORGE K. THOMPSON.