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G. K. THOMPSON

MEANS FOR EQUALIZING TRANSMISSION OVER LINES OF DIFFERENT ELECTRICAL CHARACTERISTICS

Filed Oct. 29, 1918

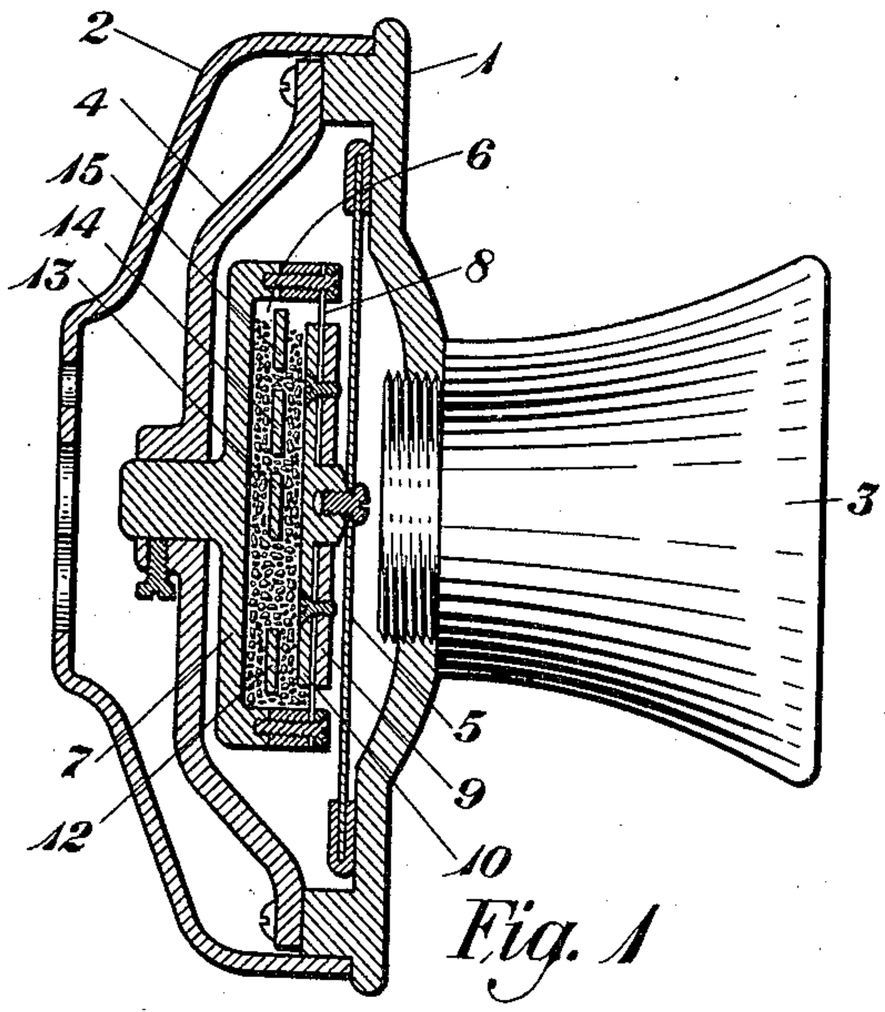

Fig. 1

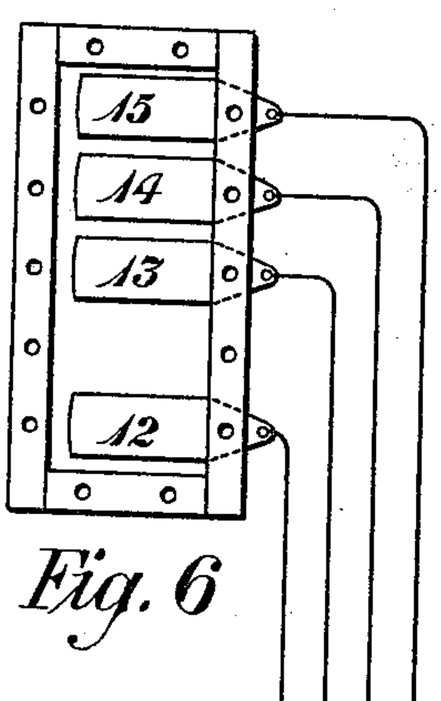

Fig. 6

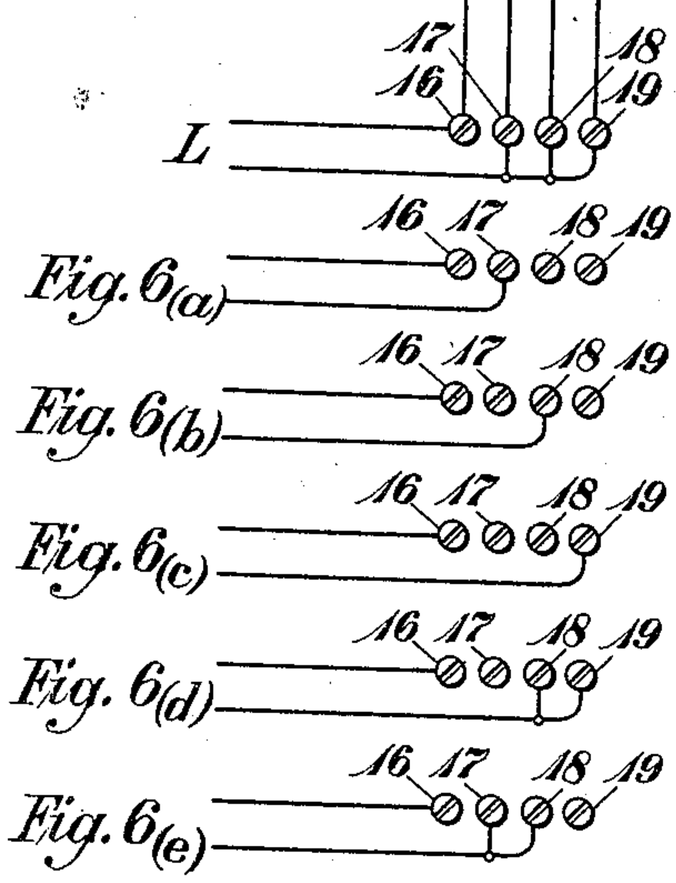

Fig. 6(a)

Fig. 6(b)

Fig. 6(c)

Fig. 6(d)

Fig. 6(e)

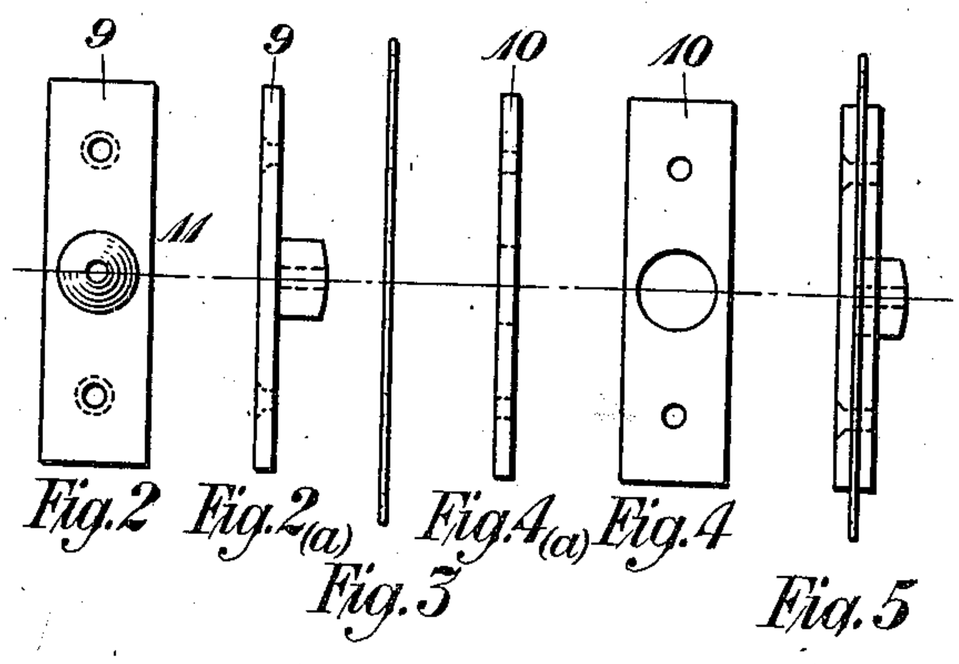

Fig. 2 Fig. 2(a) Fig. 3 Fig. 4(a) Fig. 4 Fig. 5

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UNITED STATES PATENT OFFICE.

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MEANS FOR EQUALIZING TRANSMISSION OVER LINES OF DIFFERENT ELECTRICAL CHARACTERISTICS.

Application filed October 29, 1918. Serial No. 260,149.

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 large 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 element of the type disclosed in patents to R. C. Browne No. 854025, 920424 and 920425, said resistance element having a plurality of fixed electrodes embedded in granular material, and a plunger movable with the transmitter diaphragm for varying the resistance of the granular material. By this arrangement a plurality of paths of different resistance may be established through the resistance element in a direction parallel to the transmitter diaphragm and by variably connecting these paths the resistance of the transmitter may be adjusted in accordance with the requirements of the line with which it is to be associated.

The invention may now be 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, 2^a, 3, 4, 4^a and 5 are views of details of the resistance element; and

Figures 6, 6[a], 6[b], 6[c], 6[d] and 6[e] are circuit diagrams showing a number of different ways in which the electrodes of the resistance element may be connected.

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 granular carbon resistance element 6 of the general type disclosed in the patents to R. C. Browne above referred to. This resistance element comprises a rectangular container 7 of non-conducting material in which the granular material is placed with a mica diaphragm 8 secured to the front face of the container. The mica diaphragm 8 carries a plunger comprising members 9 and 10 clamped upon either side thereof as shown in Figure 5, the member 9 being provided with a centrally located boss 11 projecting through the diaphragm 8 and the member 10 and suitably secured to the diaphragm 5. A plurality of fixed electrodes 12, 13, 14 and 15 are embedded in the granular material, and while these electrodes may have any desired spacing with reference to each other, they are preferably arranged as shown in Figures 1 and 6 so that the electrode 12 is somewhat distant from the other electrodes. The action of the plunger in response to movements of the diaphragm 5 varies the resistance of the granular material of the resistance element and thereby varies the resistance of the paths between the electrodes.

The electrodes may be interconnected in a number of different ways depending upon the electrical characteristics of the line with which the transmitter is to be associated. As shown in Figure 6 conductors extend from the electrodes 12, 13, 14 and 15 to terminals 16, 17, 18 and 19 respectively. By connecting one side of the line L to the terminal 16 and connecting the other side to the terminals 17, 18 and 19 which are strapped together, a low resistance connection is obtained suitable for a transmitter to be used in connection with a line of low impedance. By connecting one side of the line to terminal 16 and the other side of the line to the terminal 17 of the nearest electrode, a transmitter of somewhat greater resistance is obtained as shown in Figure 6[a]. By connecting the other side of the line to the terminal 18 of a still more distant electrode as shown in Figure 6[b] a transmitter of still higher resistance is obtained. By connecting the line to terminals 16 and 19 of the two most distant electrodes the highest resistance transmitter possible with this arrangement is secured and this connection is best adapted for lines of very high impedance. Still other adjustments of the resistance of the transmitter may be obtained by strapping together terminals 18 and 19 and connecting the line to terminals 16 and the two strapped terminals, or by strapping together terminals 17 and 18 and connecting one side of the line to these terminals and the other side to the terminal 16.

It will be seen that by means of the arrangements above described a large number of combinations may be obtained, so that a considerable variation in the resistance of the transmitter is possible. By associating a transmitter adjusted for the proper resistance with a given transmission line, the telephonic transmission over lines of different character may be equalized and rendered more uniform, so that subscribers having instruments on loops of different length 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 diaphragm and a resistance element, having a plurality of fixed electrodes embedded in granular material and a non-conducting plunger movable with said diaphragm to vary the resistance of said granular material, and means for interconnecting said electrodes differently in accordance with the electrical characteristics of the lines 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 diaphragm and a resistance element having a plurality of fixed electrodes embedded in granular material and a non-conductive plunger movable with said diaphragm to vary the resistance of said granular material, and means to establish circuits in a direction parallel to said diaphragm between two or more of said electrodes depending upon 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.