(No Model.)

N. L. BURCHELL.

TELEPHONE TRANSMITTER.

No. 567,077. Patented Sept. 1, 1896.

Fig. 2.

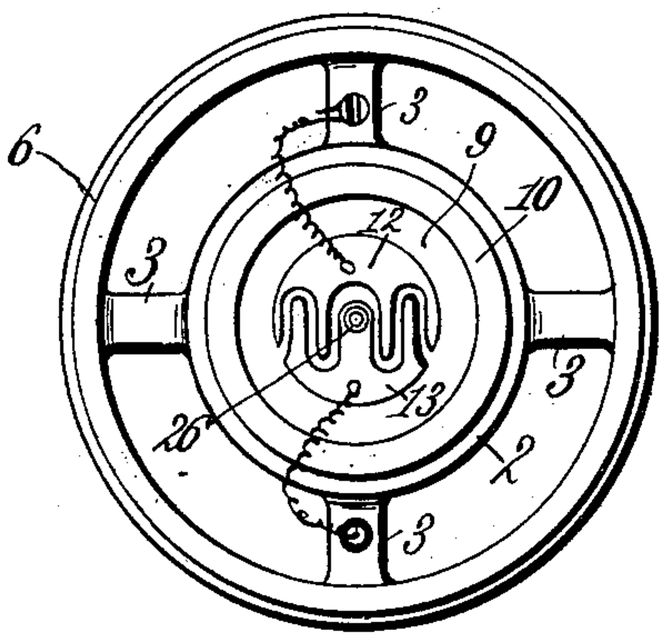


Fig. 1.

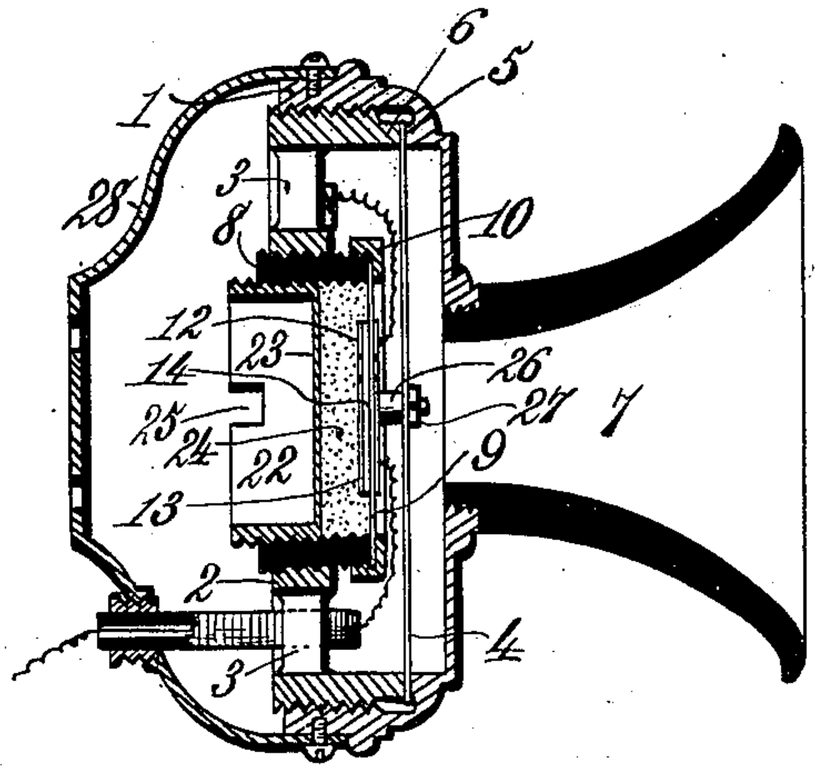


Fig. 3.

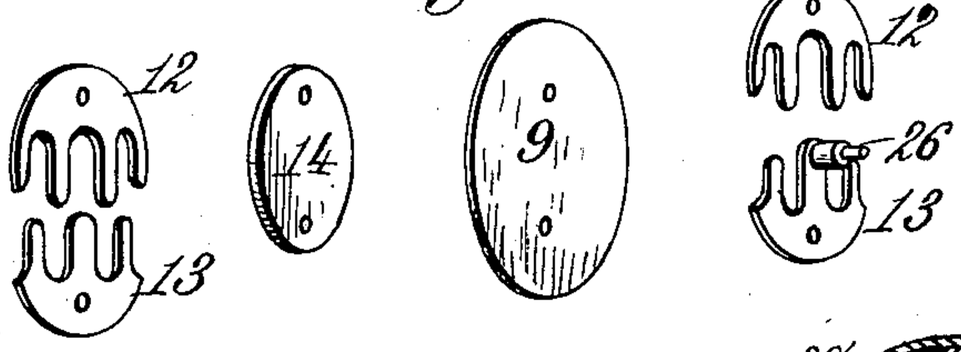


Fig. 4.

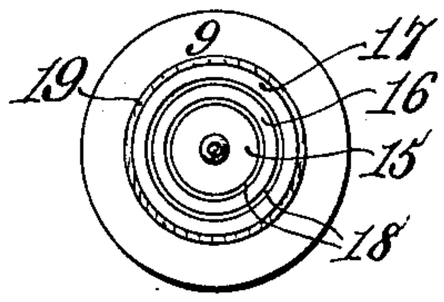


Fig. 5.

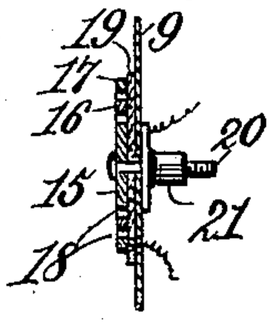
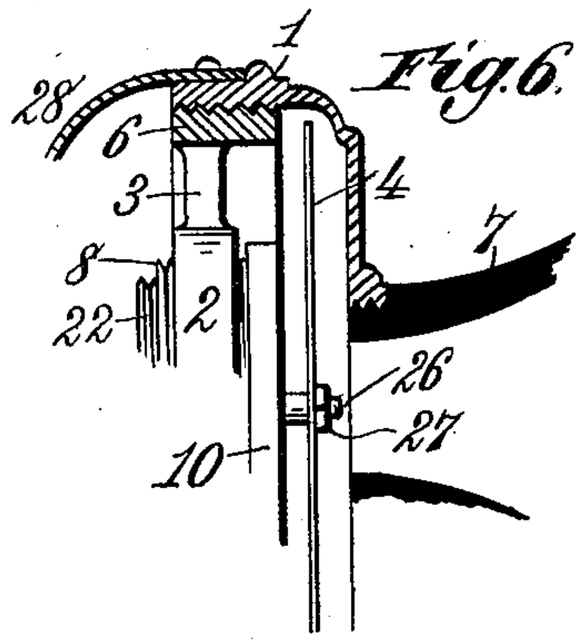


Fig. 6.



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UNITED STATES PATENT OFFICE.

NORVAL LANDON BURCHELL, OF WASHINGTON, DISTRICT OF COLUMBIA.

TELEPHONE-TRANSMITTER.

SPECIFICATION forming part of Letters Patent No. 567,077, dated September 1, 1896.

Application filed September 5, 1895. Serial No. 561,545. (No model.)

To all whom it may concern:

Be it known that I, NORVAL LANDON BURCHELL, a citizen of the United States, residing at Washington city, in the District of Columbia, have invented new and useful Improvements in Transmitters for Electric Telephones, of which the following is a specification.

My invention relates to transmitters for electric telephones. It is my purpose to provide a transmitter which shall respond to the vocal pulsations with maximum sensitiveness and accuracy and translate all such pulsations into a practically continuous electric current, consisting of a succession of phases of different wave length, the latter corresponding identically with the lengths of the successive vocal pulsations by which they are produced, and to provide a multiple-contact path for the current, whereby pulsations of every possible length and intensity shall find ready passage from one electrode to the other and thence to the line-wire. With this object in view it is my aim to provide a telephone-transmitter with electrodes which are relatively immovable and which shall have a relatively great amplitude of contiguous contact-surface with an intermediate granular conducting material as a variable-resistance medium, in combination with a diaphragm electrically isolated from but mechanically connected with the electrodes in such manner that the latter shall vibrate in unison with it, whereby the arrangement of the particles of conducting material and their relations to the electrodes shall undergo a constant change, thereby affording a great multiplicity of paths for the passage of the electric pulsations, which enables every vocal vibration to be translated into a phase of the current of accurately-corresponding quality, and giving a consequent reproduction in the telephonic receiver which is more distinct and powerful and practically an exact reproduction of the voice in the transmitter, without the abnormal sounds often noticed in the receiver, said diaphragm vibrating in unison with a primary diaphragm, which is supported centrally by it.

My invention also consists in certain new and useful parts and features of construction, all of which will be fully described, and then particularly pointed out in the claims which conclude this specification.

To enable those skilled in the art to which my invention pertains to fully undertand the same, I will now explain said invention in detail, reference being had for this purpose to the accompanying drawings, in which—

Figure 1 is a central section taken in the line of the axis of a transmitter, showing my invention. Fig. 2 is a front elevation of the transmitter-casing, the concentrator and diaphragm being removed. Fig. 3 is a view showing the secondary diaphragm, the reinforce, and the electrodes in perspective, the parts being separated but in their correct relation. Fig. 4 is a front elevation of a secondary diaphragm, showing another form of electrodes. Fig. 5 is a central section of the parts shown in Fig. 4. Fig. 6 is a detail section in the same plane as Fig. 1, and illustrating a portion of the transmitter to show an alternative construction for supporting the primary diaphragm.

In the said drawings the reference-numeral 1 indicates the transmitter-casing, which may be formed of metal or of any other suitable material. When the circuit is completed through the casing, it should be formed of a suitable conducting metal, so that one of the electrodes may be connected directly to a convenient portion thereof. I have shown this construction in the present instance, although I do not limit my invention to this feature, as I may connect the electrodes in any other preferred manner.

Within the casing 1, and concentric with it, is a circular frame 2, supported by arms 3. Upon the casing, and separated by a short interval from the outer face of the circular frame 2, is mounted a diaphragm 4, which is supported in any suitable manner. I have shown it in Fig. 1 as having a marginal bearing upon a circular rib 5, against which it is held by the outer face of the ring 6, which is screwed into the casing 1, as shown in Fig. 1. The wall of the casing in front of the diaphragm is provided with an opening to receive the concentrator 7, which may be screwed into said opening or otherwise attached.

In the circular frame 2 is mounted a circular shell 8, formed of suitable insulating material and having an exterior thread which

meshes with a female thread in the ring 2, so that the shell may be adjusted toward or from the diaphragm 4. Upon the end of this shell adjacent to the said diaphragm is mounted a secondary diaphragm 9, secured by a flanged ring 10, which is screwed upon the end of the shell 8. The secondary diaphragm is constructed of non-conducting material and is very thin, that it may have the least possible weight and a high degree of elasticity and flexibility. I may, therefore, use a thin plate of mica for this secondary diaphragm, though there are many other substances which will answer the purpose.

Upon the inner or rearward face of the secondary diaphragm 9 are mounted the electrodes 12 and 13, both of which are rigidly secured to the diaphragm by suitable means. In the drawings I have shown the fastenings as consisting of small rivets, and when these are used upon a plate of mica I prefer to duplicate the electrodes upon the outer face of the secondary diaphragm, in order to provide a surface upon which the rivets may be clenched. To prevent injury to the mica by the force with which the metal is clamped against it by upsetting the ends of the rivets, I may also interpose a thin cushion 14 between the electrodes and one face of the diaphragm. The electrodes may, however, be secured to the latter in other ways, and the outer electrodes may be wholly omitted, as shown in Fig. 5.

The specific shape of the electrodes 12 and 13 may be widely varied, the essential point being that they shall have opposite edges of the utmost extent possible and so formed that the one shall be the counterpart of the other, so that its edge or edges may be brought into substantial parallelism with those of the other electrode, a narrow interval of separation being allowed between them, as seen in Figs. 2 and 4. With this object I may form each electrode with a series of alternate projections and openings, as in Fig. 3, whereby the edge is greatly increased in length, as compared with a simple straight edge. The construction may be infinitely varied, with this purpose in view, but I have shown only two forms to illustrate my purpose, the second being that shown in Figs. 4 and 5. In these figures the electrodes consist of a central disk 15 and two surrounding concentric annuli 16 and 17, separated from each other and from the disk 15 by narrow intervals 18. The electrodes are preferably mounted upon an insulating-disk 19, which is secured to the secondary diaphragm by a central bolt 20 and nut 21. The wires are connected to the outer annulus 17 and to the central bolt, or to the disk 15.

The interior face of the circular frame 2 is threaded and an open box 22 is screwed therein from the rear, its end which is nearest the secondary diaphragm being closed by a thin plate 23, which is preferably capable of a suitable degree of vibration. In the confined space between this plate 23 and the secondary diaphragm is placed a quantity of granular conducting material 24, of any suitable character, such as carbon, and the box 22 is adjusted by turning it in one direction or the other to bring the plate 23 nearer to or farther from the secondary diaphragm or to such a point that the granular variable-resistance medium 24 shall be properly confined without crowding or compressing it. The proper point of adjustment will readily be ascertained by experiment.

The secondary diaphragm, carrying the electrodes, is connected centrally to the main or primary diaphragm 4 by means of a shouldered spindle 26, projecting from one of the electrodes, its reduced extremity passing through an opening in the primary diaphragm and receiving a nut 27, as seen in Fig. 2. In the construction shown in Fig. 5 the bolt 20 forms the connection to the diaphragm 4 in the same manner.

The transmitter-casing 1 is provided with an inclosing shell or housing 28, and the whole structure is mounted upon a suitable support in any preferred manner.

I have shown in Fig. 1 the common manner of supporting the primary diaphragm 4 by clamping its edge more or less tightly between two annular supports. I may, however, support the primary diaphragm at a single central point, and entirely remove the circular shoulders 5 and 6, thus leaving the entire diaphragm free to vibrate, its movement being entirely unobstructed by the contact of the edge or any part of the same with a rigid portion of the structure. The single central support for the diaphragm is the shouldered spindle 26, which also serves to connect the primary to the secondary diaphragm 9.

Except the omission of the shoulders 5 and 6, no change whatever is made in the transmitter in adopting the construction shown in Fig. 6. When the primary diaphragm 4 is supported at its central point only, as seen in said figure, better results are obtained by slightly increasing the thickness of the secondary diaphragm 9, if the latter is formed of a highly elastic or flexible material, such as mica. This increased thickness will afford a more substantial base of support and enable it to carry the weight imposed upon it and will aid in rendering its vibrations synchronous with those of the primary diaphragm and free from false vibrations.

In Figs. 4 and 5 I have illustrated electrodes in the form of concentric circular strips of metal 16 and 17, surrounding a central circular electrode 15, narrow intervals 18 being provided between. This construction also illustrates one form by which I increase the length of the opposite edges of the electrodes. The construction shown in these figures, however, is intended to show one of the features of my invention by which I obtain increased clearness and more accurate reproduction of

speech by reason of the largely-increased number of possible makes and breaks of the current. The narrow intervals 18 are bridged by the granular conducting material, which constitutes the variable-resistance medium, and as the electrodes vibrate with the diaphragm in presence of this granular material, which lies in a stationary chamber and is only disturbed by the vibration of the electrodes, the relations between it and the electrodes are constantly changed, and by largely multiplying the number of such changes at each vibratory movement the number of closures between the electrodes will be correspondingly multiplied. Thus a multitude of possible paths are provided which are differentiated by such slight modifications in the resistance offered that every pulsation or phase of the current finds a bridge exactly suited for its passage. I have shown only one circular strip intermediate the electrodes, but it is evident that the number may be increased, if desired.

What I claim is—

1. A telephone-transmitter having electrodes which are relatively fixed and immovable, a primary diaphragm, a secondary diaphragm on which said electrodes are rigidly mounted with an interval of separation, a connection between the primary and secondary diaphragm whereby both shall vibrate in unison, and a granular conducting material for a variable-resistance medium inclosed in a chamber which also contains the electrodes, and means for varying the space inclosed by said chamber, substantially as described.

2. A telephone-transmitter having a primary and a secondary diaphragm centrally connected to vibrate in unison, electrodes isolated from each other and from the secondary diaphragm and rigidly mounted on the latter so as to be relatively immovable, their adjacent, substantially parallel edges being separated, and a granular conducting material to bridge the interval of separation, said granular medium being contained within a chamber, the secondary diaphragm constituting one wall thereof, substantially as described.

3. In a telephone-transmitter the combination with a primary diaphragm of a secondary diaphragm having a central connection with the first, electrodes separated from each other and rigidly mounted upon the secondary diaphragm, a granular conducting material for a variable-resistance medium, a chamber in rear of the secondary diaphragm to receive the granular conducting material, and means for regulating the dimensions of the chamber, substantially as described.

4. A telephone-transmitter having a primary diaphragm without support save at its center a secondary diaphragm supported at its edge and having a central connection to the primary diaphragm, electrodes isolated electrically from each other and from the secondary diaphragm upon which they are rigidly mounted, their adjacent edges being parallel and formed with a maximum prolongation, and a granular conducting material for a variable-resistance medium inclosed in a chamber in rear of the secondary diaphragm which forms one wall of said chamber, substantially as described.

5. A telephone-transmitter having a primary diaphragm having support at its center, only, and left entirely free at all other parts, a secondary diaphragm supported at its edge and having a central connection with the primary diaphragm which is supported by it, electrodes mounted rigidly upon and vibrating with the secondary diaphragm, from which they are electrically isolated, their substantially parallel adjacent edges being separated by a narrow interval, and a granular conducting material for a variable-resistance medium, or bridge for the current, said material being contained in a chamber in rear of the secondary diaphragm, which constitutes one wall of said chamber, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

NORVAL LANDON BURCHELL.

Witnesses:

HARVEY S. W. DE GALL,

GEO. W. REA.