

(No Model.)

G. L. ROBERTS.
TELEPHONE TRANSMITTER.

No. 350,772.

Patented Oct. 12, 1886.

Fig. 1.

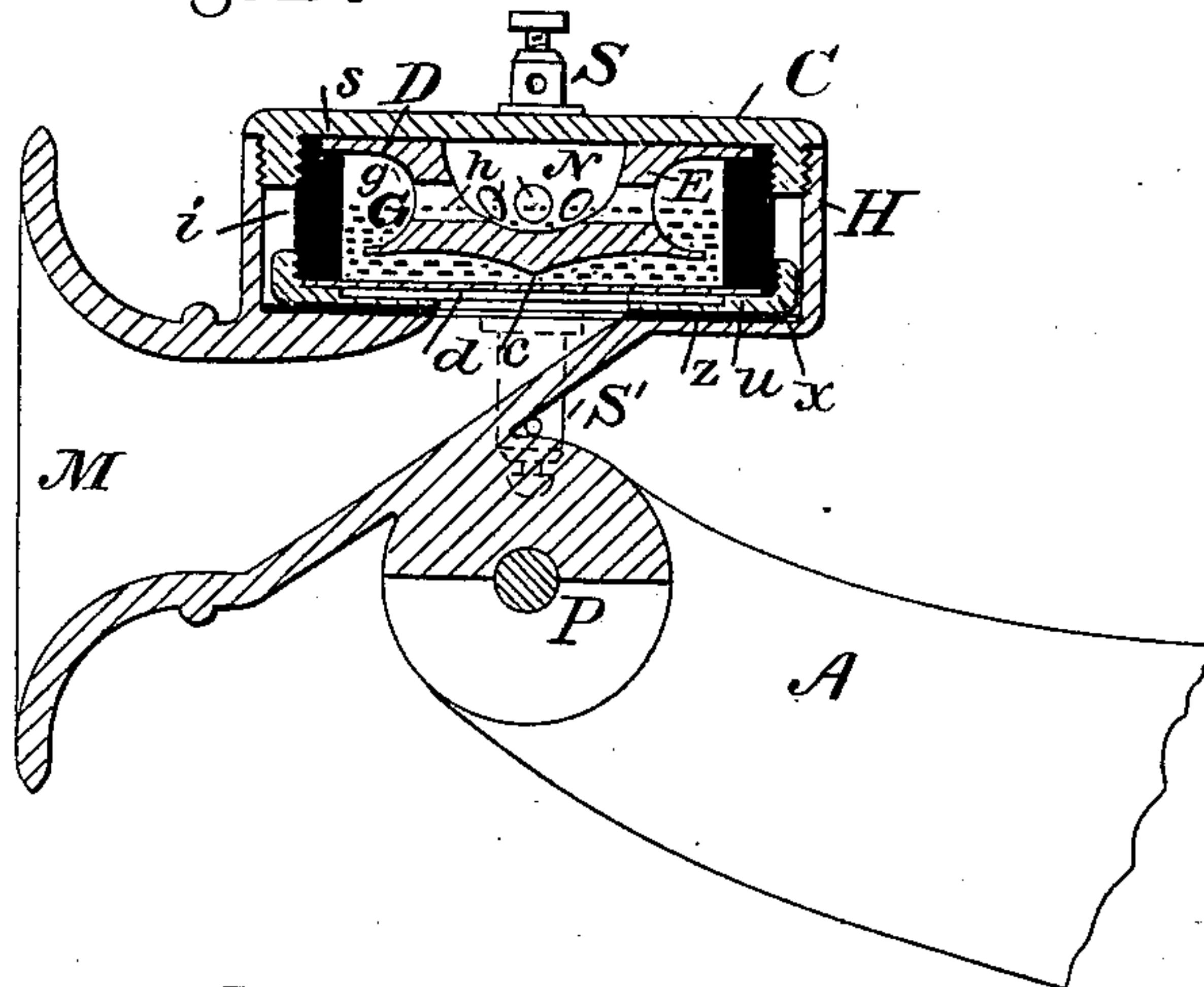


Fig. 4.

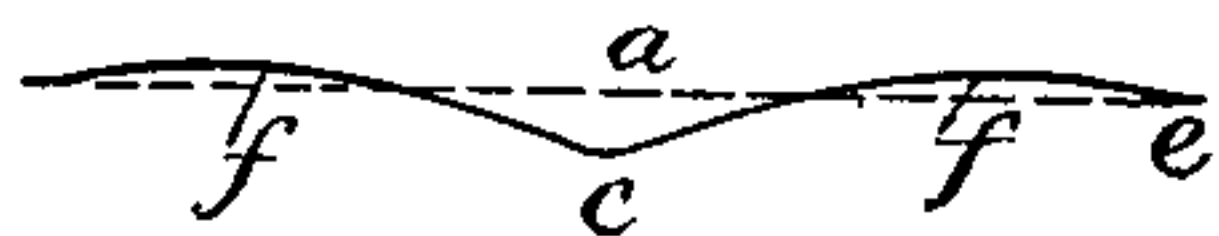


Fig. 5.

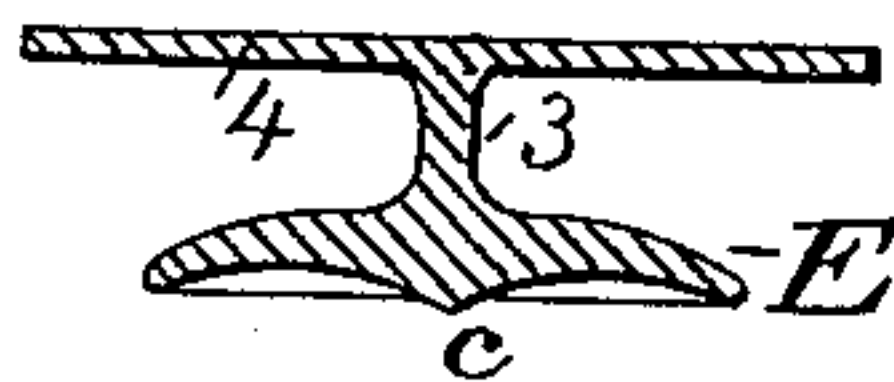


Fig. 2.

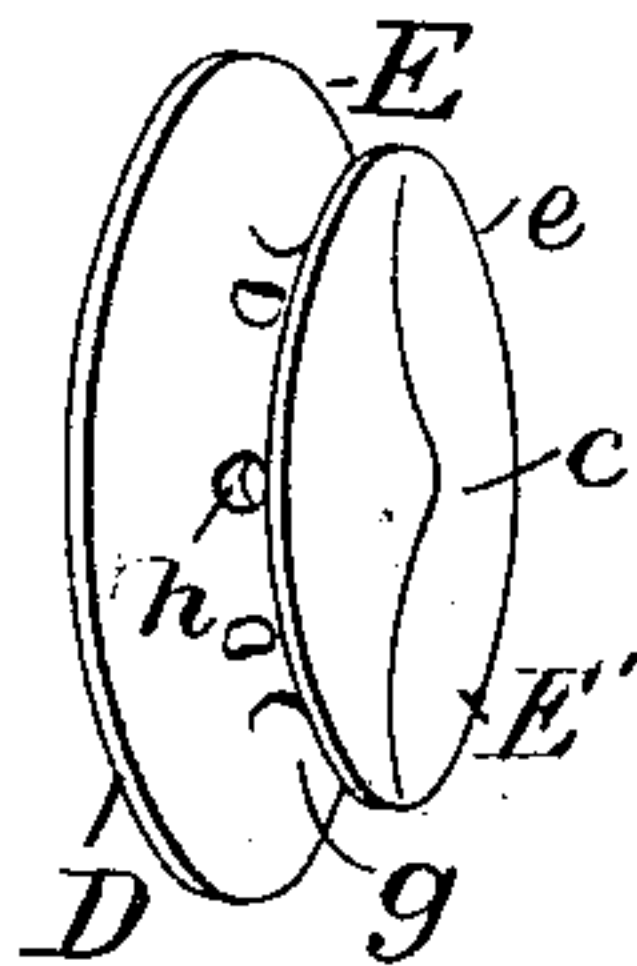


Fig. 3.

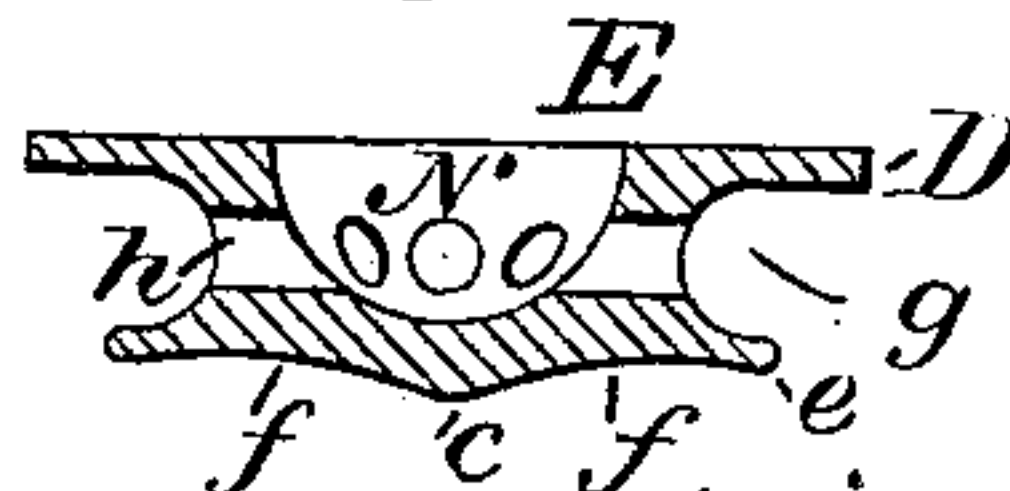
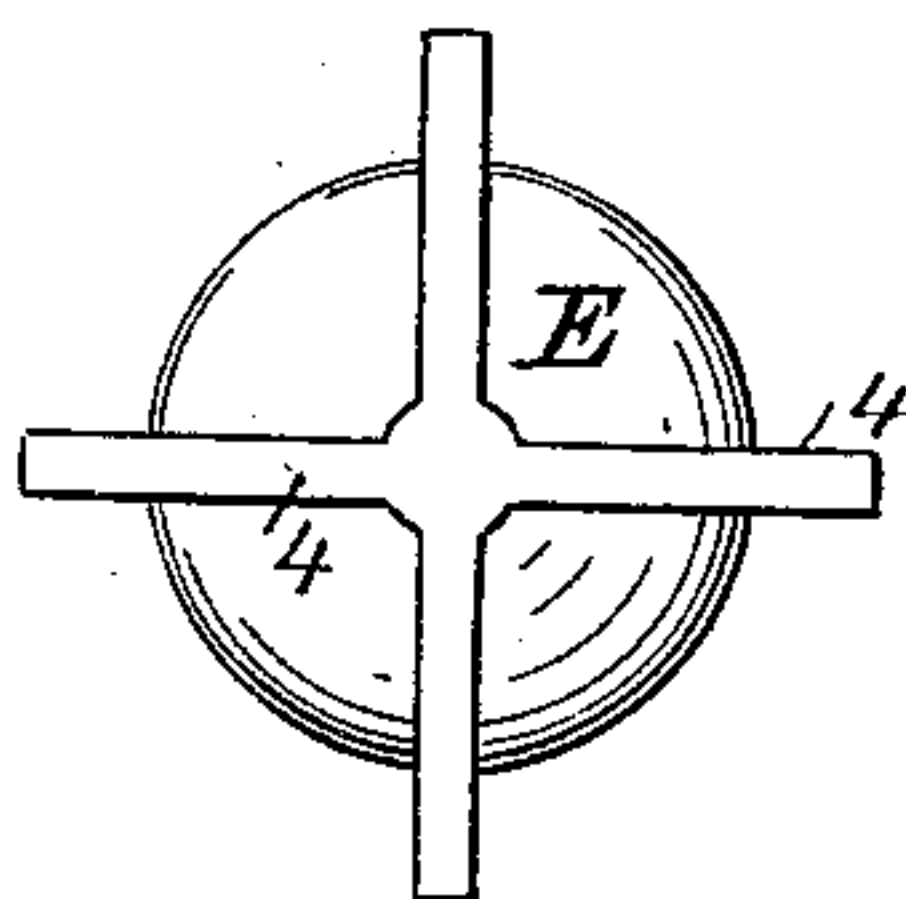


Fig. 6.



Witnesses.
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Inventor.

UNITED STATES PATENT OFFICE.

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TELEPHONE-TRANSMITTER.

SPECIFICATION forming part of Letters Patent No. 350,772, dated October 12, 1886.

Application filed June 7, 1886. Serial No. 204,382. (No model.)

To all whom it may concern:

Be it known that I, GEORGE L. ROBERTS, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Telephone-Transmitters, of which the following is a specification.

This invention is an improvement in telephone-transmitters, and relates especially to that class in which a mass of loose and finely-divided conducting material constitutes the resistance-varying medium. In transmitters of this class the finely-divided material is inclosed in a chamber formed by two opposing plates or electrodes separated by a non-conducting wall, one of these plates being adapted to serve as a diaphragm or vibrating plate, and both, together with the said finely-divided material, (which is preferably granulated carbon,) being included in the circuit of a voltaic battery. When the sound-waves of the voice or other source of sound are directed upon the vibrating plate, variations corresponding in character to the sound-waves are effected in the resistance of the conducting material, and the electric current is consequently varied in like manner, this resulting in the reproduction of the original sounds in any telephonic receiver included in the circuit. It has furthermore been experimentally demonstrated that the efficiency of the transmitter is improved when the diaphragm is mounted in a horizontal plane and provided with a curved mouth-piece extending from the condensing-chamber in front of the diaphragm, and having its external orifice in a vertical plane, whereby the sound-waves may be conveniently directed upon the lower face of the diaphragm. When such a construction is adopted, the granulated material is supported upon the upper surface of the diaphragm, and the complementary electrode is mounted in such a way that it hangs as a pendant from the rear of the chamber or containing-cell and dips into the mass of the conducting material.

In a patent issued February 2, 1886, to Albert K. Keller and Edward H. Lyon, No. 335,364, a form of complementary electrode is shown and described, resembling a shade-roller pulley, perforated completely through its center and suspended by means of its wider flange from the upper edge of the surrounding non-

conducting wall of the containing-cell. This electrode has a circumferential groove, like the sheave of a pulley, and radial openings or channels connect this groove with the central perforation. In the present invention the general form of this electrode may be retained, or, as hereinafter stated, other forms may be adopted.

The main condition of successful operation in transmitters of this class is, that the conducting particles or granules must be maintained always loose and free for comparatively energetic motion with respect to one another upon a relatively small vibration of the movable electrode. It is essential, therefore, that packing of the resistance-varying material must be prevented; and to provide a construction whereby this end shall be attained, and whereby the volume and character of the transmitted currents shall be improved, is the object of this invention.

The invention consists in dispensing with the central channel or perforation through the substance of the pendent electrode, and in a peculiar conformation of the lower or operative surface thereof; also, in the combination of an electrode of the conformation and character herein described with the other elements of the transmitting-instrument.

It is well known to those skilled in the art that in electric telephony the forces at work are so delicate, the range of motion of the vibratory parts so infinitesimal, and the electrical currents developed and controlled so feeble that slight changes in construction may effect important modifications in result, and it has been found upon trial that the adoption of the improvement described herein is attended with marked advantages.

In the drawings which illustrate and form a part of this specification, Figure 1 is a vertical section of a transmitting-instrument embodying the invention. Fig. 2 is a perspective view of the electrode, showing especially the improved conformation. Fig. 3 is a vertical section through the center of the pendent electrode. Fig. 4 is a linear or profile representation of the operative face of the said electrode considerably exaggerated in size; and Figs. 5 and 6 are, respectively, different views of a modified electrode possessing an operative face

characteristic of this invention, but in other respects differing in general form.

In Figs. 1, 2, and 3 the pendent or back electrode, E, resembles in general form the electrode shown in the patent of Keller and Lyon, hereinbefore cited. Both upper and lower surfaces are flanged, and a groove, *g*, is formed by the space between the said flanges. A conical or hemispherical depression, N, is formed in the upper surface, and, for convenience in introducing the granulations, is united with the groove *g* by radial channels or canals *h*. The form of that surface of the fixed electrode which is opposite to the diaphragm may be described as an inverted conoid with curved sides. Good results have been obtained when the concave sides have been made in the form of a parabolic or hyperbolic curve, and accordingly I have chosen an approximately parabolic curve to illustrate the invention, as in Figs. 3 and 4. I do not, however, limit my invention to this precise curve, since it is obvious that others may serve the purpose. From the apex *c* of the conoid the declivity of the curve is at first somewhat steep and abrupt, but becomes more gradual and reaches its greatest depression at a point, *f*, about half the distance between the apex and the outer edge of the base, and after reaching the said point the curve ascends again toward the edge or lower flange, *e*, of the electrode, and finally terminates in a flattened surface at the extreme edge. This electrode may be mounted in the ordinary or usual case comprising an outer metallic case, H, integral with the mouth-piece M, this being attached by the pivot-point P, or in any desired way, to a suitable support, A. The vibrating diaphragm *d*, which constitutes or supports the front or movable electrode, rests upon a shoulder, *u*, in the plate *x*, which lies on the floor of the outer case, but which is insulated therefrom by the interposed non-conducting plate *z*, through which the shank of the screw terminal S' passes, this being in metallic contact with the plate *x*, and a cap, C, is provided, which closes the entire chamber, being fitted with a screw-thread or secured in any other preferred way. The side wall of the inclosing-cell is non-conducting, and consists of a ring, *i*, of suitable material, which is placed in the outer case, and held in place in a manner well understood between the diaphragm-seat and the cap C. A shoulder, *s*, is cut in the internal periphery of this ring and serves as a seat for the upper flange, D, of the pendent electrode, which for this purpose is made wider than the lower flange thereof. The vibrating plate is connected with one side of the circuit through the plate *z* and binding-screw S', (shown in dotted lines,) and the pendent electrode is united with the other side of the circuit by means of its contact with the cap C and binding-screw S. The granulated conducting material G may be introduced by pouring it into the cavity N and shaking the instrument, so that the mass passes down through the lateral holes *h*, and is deposited

upon the diaphragm *d* and surrounding the flange *e* of the lower surface of the electrode E, so that the said lower flange is at all times covered by the conducting material, whereby it is made impossible to break the circuit.

It is to be understood that I do not restrict myself to an electrode of the general form which so far I have described. The form of the upper portion of the electrode is by no means material to this invention, and any desired conformation may be adopted, provided the operative face or lower surface of the pendent electrode is formed in accordance with the principles herein enunciated. Figs. 5 and 6 accordingly show a modification in general form, which yet retains the curved conoidal inferior face. In this modification the solid upper portion of the electrode, together with its wide flange, spherical chamber, and lateral channels, is dispensed with, and the lower or operative portion, E, is suspended from the roof of the chamber merely by a central vertical shaft, 3, surmounted by a spider, 4, of three or more metallic arms, the extremities of which rest upon the shoulders of the insulating-ring. When, in the operation of a transmitter provided with a pendent electrode constructed as hereinbefore described, the sound-waves of the voice are directed upon the diaphragm through the mouth-piece M, the conducting particles resting upon the diaphragm at or near its center are agitated and receive from the plate an upward tendency. Reaching the conoidal apex or the concave curved sides thereof, they are reflected therefrom at an angle, and again reach the diaphragm, but necessarily at a position thereon differing from their original one. Meanwhile their original places are filled by other particles. The same is true of the particles nearer to the wall of the chamber, although in a lesser degree, inasmuch as the amplitude of vibration of that part of the diaphragm is not so great as in the center. The particles are directed against the curved surface near the edge *e*, and are caused to rebound in a direction toward the center of the diaphragm. The extreme edge of the lower flange is slightly flattened on its lower surface to prevent muffled transmission, which has been found to occur if the curve is continued to the said extremity. Thus the particles, being at no time suffered to fall in their original positions, are virtually deprived of their normal tendency to pack.

It is obvious that many slight modifications may be made in the conformation of the active face of the electrode without departing from my invention. For instance, the concave-sided conoid may be formed to rise directly from the center of the face, and the greater portion of the said face be left with a plane surface, instead of confining the said plane surface to the extreme edge only.

Having thus described my invention, I claim—

1. In a telephone-transmitter, a pendent stationary electrode having its operative face

in the conformation of an inverted conoid with curved sides, substantially as described.

2. In a telephone-transmitter of the class hereinbefore specified, a pendent back electrode provided with an operative surface in the form of a conoid with concave sides.

3. In a telephone-transmitter of that class wherein a horizontally-supported diaphragm sustains a resistance-varying medium of finely-divided conducting material, a complementary or back electrode having its operative surface in the form of a disk with an inverted concave conoid projecting from the center thereof toward the diaphragm or movable electrode, substantially as hereinbefore set forth.

4. In a telephone-transmitter having a horizontal diaphragm and a mass of granulated conducting material resting thereon, a complementary or back electrode, consisting of a pendant having an imperforate disk-shaped face, the center whereof is a cone or conoid projecting toward the diaphragm, and having concave sides, the curve of which is continued in a depression concentric with the apex, and rising toward the edge of the disk-shaped surface, substantially as described herein, and shown in profile in Fig. 4.

5. An electrode for telephone-transmitters

of the general class herein shown and described, comprising a pendant hanging from the upper part of the inclosing-cell, the operative face of which is generally in the form of a disk, having an inverted conoidal concave sided central apex, a concentric concavity surrounding the same, and a flattened concentric space at the extreme edge of the disk.

6. The combination, in a telephone-transmitter, of a containing-cell with non-conducting side walls, a diaphragm or vibratory plate supporting or constituting the movable electrode, a complementary pendent electrode hanging from the roof of said containing-cell, and having its lower face formed as a concave disk with a central inverted cone projecting therefrom toward the diaphragm, and a mass of granulated or finely-divided conducting material resting upon the said diaphragm and surrounding the operative portion of the pendent electrode, as specified herein.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEO. L. ROBERTS.

Witnesses:

THOS. D. LOCKWOOD,

GEO. WILLIS PIERCE.