June 2, 1936. A. F. BENNETT ET AL 2,042,822

TELEPHONE TRANSMITTER

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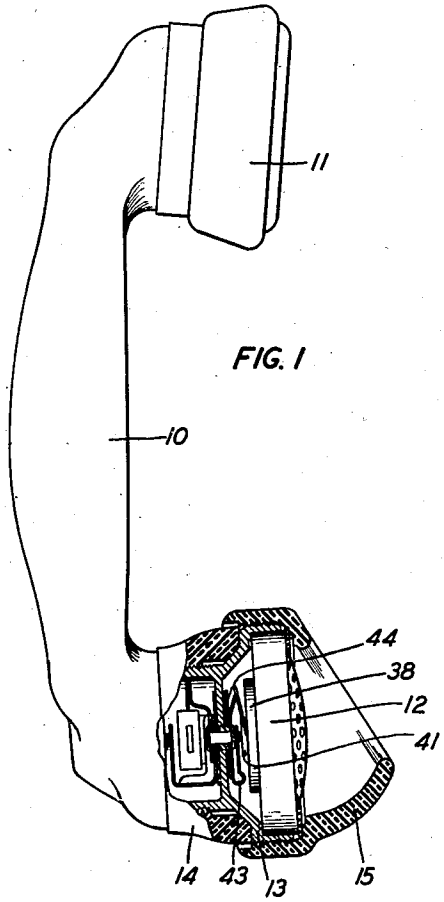

FIG. 1

FIG. 2

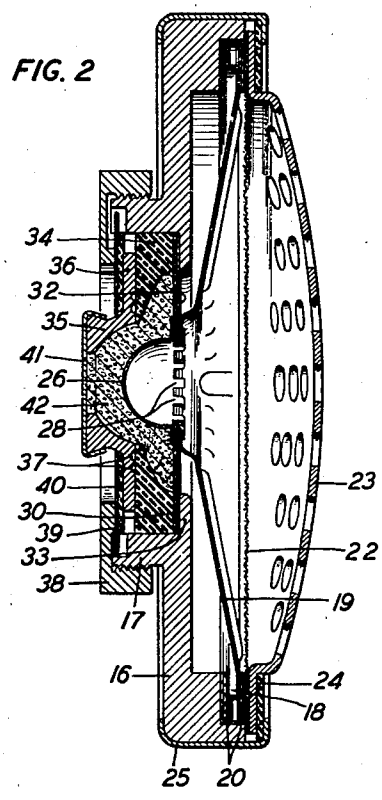

FIG. 3

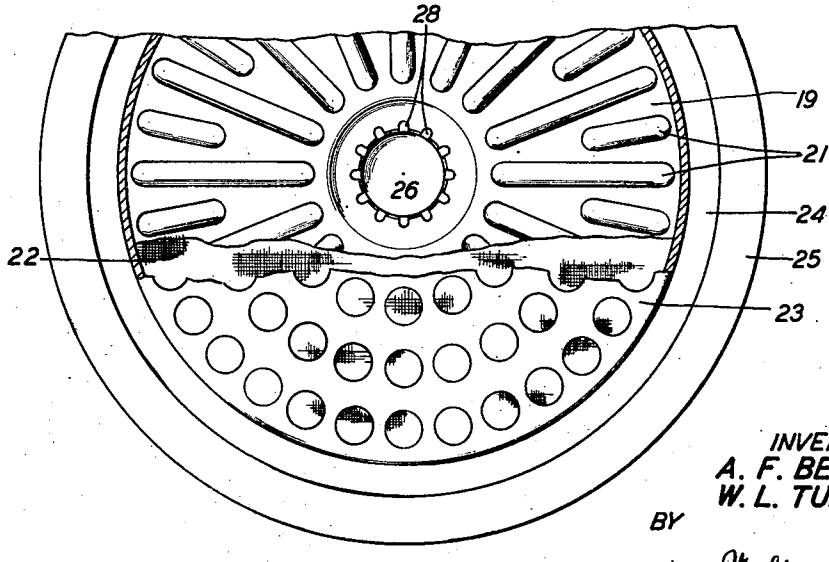

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FIG. 4

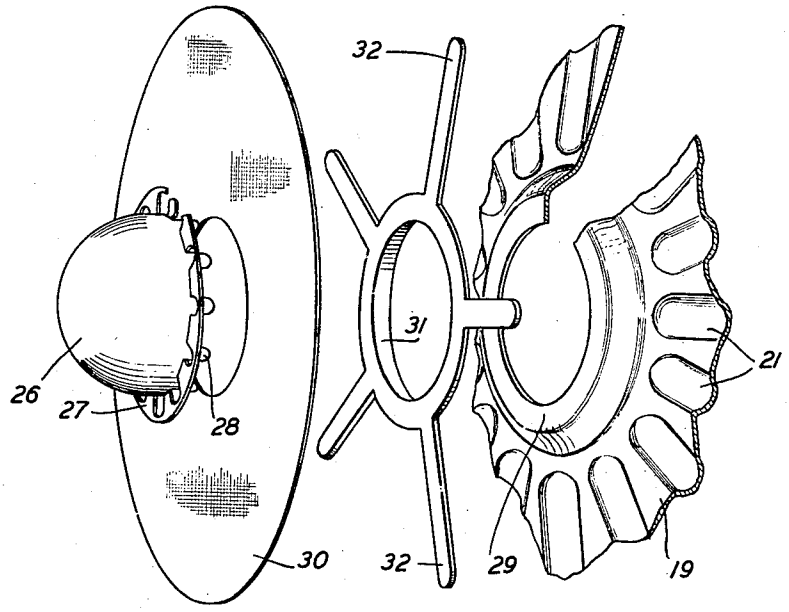
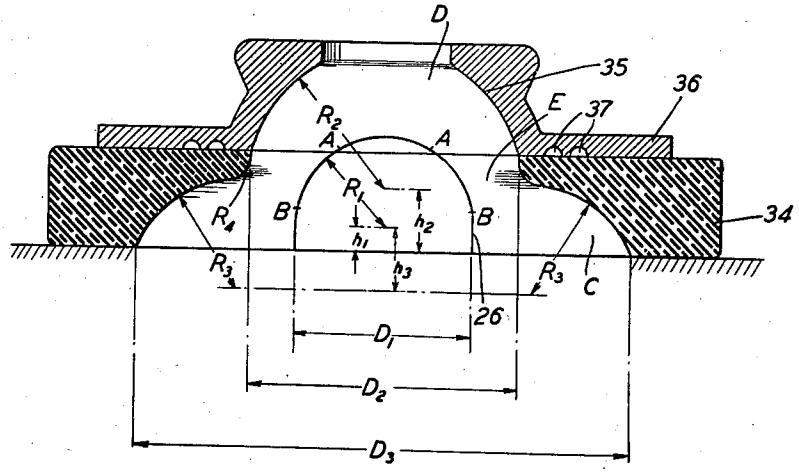


FIG. 5



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Patented June 2, 1936

2,042,822

UNITED STATES PATENT OFFICE

2,042,822

TELEPHONE TRANSMITTER

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Application May 11, 1933, Serial No. 670,406

22 Claims. (Cl. 179—122)

This invention relates to telephone transmitters and more particularly to such transmitters of the carbon granule type adapted to be embodied in hand telephones.

Hand telephones usually include a handle, a receiver unit mounted on the handle adjacent one end thereof, and a transmitter unit mounted on the handle adjacent the other end thereof. When the hand telephone is in use, it is held in a variety of positions so that the transmitter necessarily assumes a large number of different positions. In carbon granule transmitters, therefore, the position of the granules with respect to the diaphragm or to an electrode vibratile with the diaphragm changes due to gravitational action. As a result and due to the non-fluid characteristics of the granules in transmitters of present design for hand telephones, the pressure between the granules and the diaphragm or vibratile electrode varies over a wide range with a resultant variation in the transmission characteristics of the transmitter.

A general object of this invention is to improve the transmission characteristics of telephone transmitters. More specifically, objects of this invention are to insure a good and uniform contact between the carbon granules and a vibratile electrode in a telephone transmitter for all positions of the transmitter; to insure the flow of transmitter current through a path embracing carbon granules which are well agitated in accordance with the vibrations of said electrode; and to insure a low resistance between the electrodes of the transmitter without packing of the carbon granules.

In one embodiment of this invention, a telephone transmitter comprises a support or frame, and a diaphragm seated upon the frame. A dished or dome-shaped electrode is positioned at the center of the diaphragm and extends from one surface thereof. A recessed or annular member having an electrically conductive portion is mounted upon the support or frame and together with the dished or dome-shaped electrode and a flexible annular member extending between the electrode and the support or frame, forms a chamber which is substantially filled with a comminuted resistance-varying material such as carbon.

In accordance with a feature of this invention, the surface of the recessed member in juxtaposition to the electrode on the diaphragm and the surface of said electrode, are of such configuration that good quality, high efficiency, and uniform operating characteristics are obtained for all positions of the transmitter.

The invention and the various features thereof will be understood more clearly and fully from the following detailed description with reference to the accompanying drawings in which:

Fig. 1 is a view partly in cross-section of a hand telephone including a transmitter unit of a type comprehended by this invention;

Fig. 2 is a side view in cross-section of a telephone transmitter unit constructed in accordance with this invention;

Fig. 3 is a partial front view of the transmitter unit shown in Fig. 2, partly broken away and partly in cross-section to show details of the diaphragm more clearly;

Fig. 4 is an enlarged exploded view in perspective showing details of the diaphragm and vibratile electrode assembly; and

Fig. 5 is an enlarged diagrammatic view showing the configuration and relative proportions of the vibratile electrode and of the recessed or annular member including the stationary electrode, of the telephone transmitter unit shown in Figs. 2 and 3.

Referring now to the drawings, the hand telephone shown in Fig. 1 comprises a handle 10, a receiver 11 mounted at one end of the handle, and a transmitter at the other end of the handle. The transmitter comprises a transmitter unit, designated generally as 12, which is seated upon a shoulder in a dished member 13 threaded to a ring 14 which is in turn threaded to the handle 10. A mouthpiece 15 is threaded to the dished member 13 and locks the unit 12 in position. The transmitter unit 12, as shown clearly in Figs. 2 and 3, comprises a dished annular support or frame 16, which may be of metal, having an externally threaded tubular portion 17 on one side thereof, and an annular recess or seat 18 in the other side. A dished diaphragm 19, the major portion of which is frusto-conical, is seated at its periphery in the annular recess 18, a plurality of damping leaves 20, of paper or the like, being disposed adjacent opposite faces of the peripheral portion of the diaphragm. The diaphragm 19 may be of a lightweight metal, such as thin duralumin, and may be provided with a plurality of alternately arranged radially extending flutes or corrugations 21 of unequal length, to assure vibration of the diaphragm as a whole analogous to a piston throughout a wide range of frequencies. A moisture-resistant screen 22, for example of oiled silk, overlies the front surface of the diaphragm 19 and is clamped

to the support or frame 16 together with a perforated protective cover 23 and a washer 24, by a crimped band 25.

The diaphragm 19 is provided with an aperture at its center into which a dome-shaped member 26, having a marginal flange 27 with a plurality of tabs 28, is fitted. The dome-shaped portion may be of duralumin but it is preferably of thin brass and its outer surface is gold plated so that it serves as an electrode. A flexible annular closure member 30, for example of silk, is positioned between the rim 27 and a flange or shoulder 29 on the diaphragm. A flexible metallic spider, such as of annealed copper, having an annular flanged portion 31 extending through the aperture in the diaphragm adjacent the shoulder 29 and a plurality of radially extending arms 32 is held in position on the flange 29 by the tabs 28 which are bent over the flange 31 and against the surface of the flange 29. The closure member 30 and the arms 32 are also clamped to an inwardly extending annular flange 33 on the frame or support 16 by an annular insulating member 34, which may be of a ceramic material, the arms 32 forming an electrical connection between the electrode 26 and the frame 16.

A stationary electrode, which may be of brass, is mounted on the insulating member 34 and comprises an apertured dished or dome-shaped portion 35, the inner surface of which may be gold-plated, and an annular flange 36 having a plurality of annular grooves 37 in one face thereof. The stationary electrode is coaxially disposed with the vibratile electrode 26 and the insulating member 34, and may be secured to the insulating member by a suitable cement. To insure a good adhesion between the flange 36 and the insulating member 34, the cement may be heated through the flange so that it is distributed uniformly over the contacting surfaces of the flange and insulating member. The grooves 37 receive any excess of the cement and prevent the flow thereof onto the inner surfaces of the insulating member and the dished portion 35 of the stationary electrode. The stationary electrode and the insulating member 34 may be secured to the frame 16 by an annular clamping ring 38 which is threaded to the tubular extension 17 and bears against a metallic ring 39 seated on an annular insulating washer 40 on the flange 36. A metallic cap 41 is crimped over the edge of the dished portion 35 of the stationary electrode and closes the aperture therein.

The stationary and vibratile electrodes 35 and 26, respectively, the annular closure member 30, and the insulating member 34 form a chamber which is substantially filled with a comminuted resistance-varying material 42, such as granulated carbon.

Electrical connection between the electrodes 35 and 26 and an external circuit is established, as shown in Fig. 1, by a pair of metallic springs 43 and 44 which are mounted on the dished support 13 and insulated therefrom and from each other. The spring 43 engages the cap 41 and the spring 44 engages the clamping ring 38 and is, therefore, electrically connected to the electrode 26 through the frame 16 and the spider 31, 32.

When a hand telephone such as shown in Fig. 1 is used, it is held in a wide variety of positions and consequently the transmitter unit 12 likewise is held in numerous positions. As a result, and because of the gravitational forces acting upon the comminuted resistance-varying material, the material shifts in the chamber. Inasmuch as the transmission characteristics of the transmitter unit are largely dependent upon the contact pressure between the electrodes and the material, it is desirable for uniform and satisfactory transmission, that this pressure be substantially uniform for all positions in which the transmitter may be held during operation. To this and other ends, the electrode 26 and the other elements forming the chamber for the comminuted material are proportioned and correlated in a particular manner to be described in detail hereinafter. As clearly shown in Fig. 5, the vibratile electrode 26 comprises a substantially hemispherical portion of radius R_1 and a cylindrical portion of diameter D_1, the center of the hemispherical portion being a distance h_1 from the base of the cylindrical portion. The inner surface of the insulating member 34 comprises two oppositely curved portions one being concave and having a radius R_3, and the other being convex and having a radius R_4, the centers for the radii R_3 being on a line a distance h_3 below the center of the hemispherical portion of the vibratile electrode. The minimum and maximum diameters of the aperture in the insulating member 34 are D_2 and D_3, respectively.

As will be apparent from Fig. 5, the electrodes 26 and 35, the insulating member 34, and the closure member 30 form an enclosure comprising two relatively large chambers C and D which are connected by a restricted passageway E. Inasmuch as the comminuted material, such as granulated carbon, flows somewhat as a semi-fluid, the material in the chambers C and D provides a pressure head at the restricted passageway E for all positions of the transmitter so that a good and high contact pressure is obtained between the material and extensive portions at least, for example, the portion between the points A and B, of the vibratile electrode 26. The material adjacent these portions is well agitated in accordance with the vibrations of the diaphragm, and hence of the electrode 26, so that good modulation of the current flowing between the electrodes 26 and 35 is attained with a resultant good quality of transmission. It has been found also that the above described configuration of the elements forming the chamber for the comminuted material prevents packing of the material, so that the material is always held loosely in the chamber and is susceptible to vibrations of the electrode 26.

Extensive tests have indicated that in a transmitter of the general construction shown and described, the greatest density of current flow between the electrodes 26 and 35 occurs in paths including the portions between the points A and B for all positions of the transmitter. This path is of low resistance and embraces granules which are well agitated by the vibration of the electrode 26 so that good modulation is obtained through a current path of low resistance.

In a specific embodiment of this invention, the dimensions of the elements may be as follows: R_1—.1125 inch; R_2—.180 inch; R_3—.140 inch; R_4—.025 inch; D_1—.225 inch; D_2—.350 inch; D_3—.650 inch; h_1—.0375 inch; h_2—.080 inch; h_3—.0875 inch. Such a transmitter has been oppeatedly throughout a range of angles of 360° without perceptible variations in quality and efficiency, from which it follows, of course, that a substantially uniform pressure is extant between the carbon granules and parts of the dished electrode 26 for all positions of the transmitter.

It will be understood, of course, that the embodiment of this invention shown and described and the specific dimensions given are merely illustrative and that many modifications may be made therein without departing from the scope and spirit of this invention as defined in the appended claims.

What is claimed is:

1. A telephone transmitter comprising a supporting member, a diaphragm mounted on said supporting member having a dished electrode, means mounted on said supporting member forming a chamber with said electrode and having surfaces in juxtaposition to said electrode that are curved in the same direction as and eccentric with respect to said dished electrode, and comminuted resistance material in said chamber.

2. A telephone transmitter comprising a support, a diaphragm mounted on said support having a dished electrode at its center, means including an annular member mounted on said support forming a chamber, and comminuted resistance varying material within said chamber, the surface of said annular member in juxtaposition to said diaphragm including a portion of substantially the same form as said electrode, dished in the same direction as and eccentric with respect to said electrode.

3. A telephone transmitter comprising a support, a diaphragm mounted on said support having a dome-shaped electrode, means including an annular member mounted on said support and forming a chamber with said electrode, and comminuted resistance varying material within said chamber, the surface of said annular member in juxtaposition to said diaphragm including a dome-shaped portion of substantially the same form as said electrode and eccentric with said electrode and a curved portion merging with and eccentric with respect to said dome-shaped portion.

4. A telephone transmitter comprising a support, a diaphragm mounted on said support, an electrode having a substantially hemispherical portion, coupled to said diaphragm and vibratile therewith, means including an annular member mounted on said support forming a chamber with said electrode, and comminuted resistance-varying material within said chamber, said annular member having a substantially hemispherical surface in juxtaposition to and curved in the same direction as said electrode, said surface being coaxial with said electrode and eccentric with the hemispherical portion thereof.

5. A telephone transmitter comprising a support, a diaphragm mounted on said support, an electrode having a substantially hemispherical portion associated with said diaphragm and vibratile therewith, means including an annular member forming a chamber with said electrode, and comminuted resistance-varying material in said chamber, said annular member having a substantially hemispherical surface extending about and in juxtaposition to said electrode and coaxial and eccentric with the hemispherical portion of said electrode and having a curved surface merging with said hemispherical surface and in juxtaposition to said electrode.

6. A telephone transmitter comprising a support, a diaphragm mounted on said support, an electrode having a substantially hemispherical portion associated with said diaphragm and vibratile therewith, means including an annular member mounted on said support forming a chamber with said electrode, and comminuted resistance-varying material in said chamber, said annular member having a substantially hemispherical surface in juxtaposition to said electrode and coaxial but eccentric with the substantially hemispherical portion of said electrode, the radius of said surface being greater than the radius of said portion of said electrode, and having a curved surface of greater radius than said portion, merging with said substantially hemispherical surface and coaxial with and in juxtaposition to said electrode.

7. A telephone transmitter comprising a support, a diaphragm mounted on said support, a dome-shaped electrode attached to said diaphragm, an annular insulating member mounted on said support and having a curved surface in juxtapostion to said electrode, a closure member extending between said electrode and said insulating member, another electrode mounted on said insulating member having a dome-shaped surface in juxtaposition to said first electrode and merging with the curved surface of said insulating member, and comminuted resistance-varying material between said first electrode and said surfaces.

8. A telephone transmitter comprising a support, a diaphragm mounted on said support, a dished electrode connected with said diaphragm and vibratile therewith, means forming an enclosure for said electrode, said means including an insulating member encompassing said electrode and a second dished electrode, and comminuted resistance-varying material in said enclosure, portions of said insulating member and said second electrode in juxtaposition to said first electrode being shaped to form with said first electrode a pair of chambers interconnected by a restricted passageway.

9. A telephone transmitter comprising a support, a diaphragm mounted on said support, a dome-shaped electrode coupled to said diaphragm and vibratile therewith, means including an annular member mounted on said support and forming an enclosure with said electrode, and comminuted resistance-varying material within said enclosure, the walls of said annular member in juxtaposition to said electrode including eccentric curved portions spaced to form with said electrode a plurality of chambers connected by a restricted passageway.

10. A telephone transmitter comprising a support, a diaphragm mounted on said support, an electrode having a substantially hemispherical portion, coupled to said diaphragm and vibratile therewith, an annular insulating member mounted on said support, having an annular concave surface in juxtaposition to and coaxial with said electrode, a closure member extending between said electrode and said insulating member, another electrode seated on said insulating member and having a substantially hemispherical surface coaxial with and eccentric to the hemispherical portion of said first electrode, said insulating member having also a convex surface merging with said concave and hemispherical surfaces, and comminuted resistance-varying material between said first electrode and said surfaces.

11. A telephone transmitter comprising a support, a diaphragm mounted on said support, an electrode coupled to said diaphragm and vibratile therewith, said electrode having a cylindrical portion secured to said diaphragm and a

substantially hemispherical portion extending from said cylindrical portion and coaxial therewith, an insulating member seated on said support having a reversely curved circular surface in juxtaposition to said electrode and coaxial therewith, the major portion of said surface having a radius of curvature greater than the radius of said hemispherical portion of said electrode, a closure member extending between said cylindrical portion and said insulating member, an electrode seated on said insulating member having a substantially hemispherical surface merging with said reversely curved surface, said hemispherical surface being coaxial but eccentric with the hemispherical portion of said first electrode and having a radius greater than the radius of said hemispherical portion, and comminuted resistance-varying material between said first electrode and said surfaces.

12. A telephone transmitter comprising a metallic support, a diaphragm mounted on said support, an electrode coupled to said diaphragm and vibratile therewith, means mounted on said support forming a chamber with said electrode, comminuted resistance-varying material within said chamber, and a metallic spider electrically connected to said electrode and to said support.

13. A telephone transmitter comprising a dished metallic support having an inwardly extending flange, a diaphragm mounted on said support, an electrode coupled to said diaphragm and vibratile therewith, an insulating closure member extending between said diaphragm and said flange, means including said closure member forming a chamber with said electrole, comminuted resistance-varying material within said chamber, and a metallic spider having a portion electrically connected to said electrode and a plurality of arms extending along said closure member and engaging said support.

14. A diaphragm and electrode assembly for a telephone transmitter, comprising a diaphragm including a substantially conical shaped member having an aperture and a shoulder adjacent said aperture, and a dished member having a flange disposed adjacent one surface of said shoulder and a plurality of tabs extending through said aperture and bent over the opposite surface of said shoulder, one side of said dished member being gold plated.

15. A telephone transmitter comprising a dished support having an annular inwardly extending flange, a diaphragm mounted on said support, having an aperture and a shoulder adjacent said aperture, an annular closure member seated on said flange and one surface of said shoulder, and an electrode having a flange seated on said closure member and a plurality of tabs extending through said aperture and bent over the opposite surface of said shoulder.

16. A telephone transmitter comprising a support, a diaphragm mounted on said support, an electrode having a dished portion, coupled to said diaphragm and vibratile therewith, means including an annular insulating member and a second electrode successively mounted on said support and forming a chamber with said electrode, and comminuted resistance-varying material within said chamber, said second electrode having an eccentric surface curved in the same direction as and in juxtaposition to said dished portion, and said insulating member having concave and convex surfaces, said convex surface being positioned intermediate the ends of said chamber.

17. A telephone transmitter comprising a support, a diaphragm mounted on said support, an electrode having a dished portion, coupled to said diaphragm and vibratile therewith, means including a second electrode and an insulating member mounted on said support and forming a chamber with said first electrode, and comminuted resistance-varying material within said chamber, said second electrode having a surface of substantially the same configuration as said dished portion extending about coaxial and eccentric with respect to said dished portion, said insulating member having a concave surface and a convex surface, said convex surface and said concave surface merging with said first surface and being in juxtaposition to said first electrode.

18. A telephone transmitter comprising a support, a diaphragm mounted on said support, an electrode having a substantially hemispherical portion, coupled to said diaphragm and vibratile therewith, an insulating member mounted on said support having a circular concave surface in juxtaposition to said electrode and coaxial therewith, a closure member extending between said electrode and said insulating member, another electrode mounted on said insulating member having a substantially hemispherical surface coaxial and eccentric with the hemispherical portion of said first electrode and being of greater radius than said hemispherical portion, said insulating member having also a convex surface merging with said concave surface and the hemispherical surface of said second electrode, and comminuted resistance-varying material between said first electrode and said surfaces.

19. A telephone transmitter comprising a diaphragm having a central aperture, a member having a dome-shaped central portion secured to said diaphragm at said aperture, one surface of said central portion being plated and serving as a movable electrode, a supporting member on which said diaphragm is mounted, a second electrode mounted on said supporting member, an insulating member between said second electrode and said supporting member, and a thin annular member secured between said insulating member and said support at its outer edge and at its inner edge to said diaphragm, portions of said first member, said annular member, said insulating member and said second electrode serving as walls of a chamber for carbon granules.

20. A telephone transmitter comprising in combination, a diaphragm, a dished member secured to the center thereof and having one surface plated to serve as an electrode, a support on which said diaphragm is mounted, and means including a second electrode mounted on said support and forming with said dished member a chamber having a filling of carbon granules, the walls of said chamber having curved portions merging in proximity to side portions of said dished member between the top and bottom thereof to form a restricted passageway adjacent said side portions, whereby a pressure head at said restricted passageway is afforded regardless of the position in which the transmitter is held.

21. A telephone transmitter of the granule type comprising a support, a diaphragm having a central aperture, mounted on said support, an electrode coupled to said diaphragm at said aperture, means including a back electrode mounted on said support and defining walls of a granule chamber, and a flexible fibrous member connect-

ed to said diaphragm at the junction of said aperture and said electrode and extending outwardly to said support for closing the front of said chamber, said diaphragm and said first electrode having cooperating portions gripping said fibrous member.

22. A telephone transmitter comprising a diaphragm, an electrode mounted on said diaphragm, a carbon granule chamber having a second electrode therein, said chamber having an opening greater than the diameter of said first electrode, a closure member connecting said diaphragm and a wall of said chamber, and a metallic spider extending between said first electrode and said wall and serving as an electrical connection to said first electrode.

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