

Oct. 24, 1950

R. R. STEVENS
TELEPHONE TRANSMITTER WITH RADIAL
SLOTS IN THE CARBON CHAMBER

2,527,159

Filed April 26, 1947

2 Sheets-Sheet 1

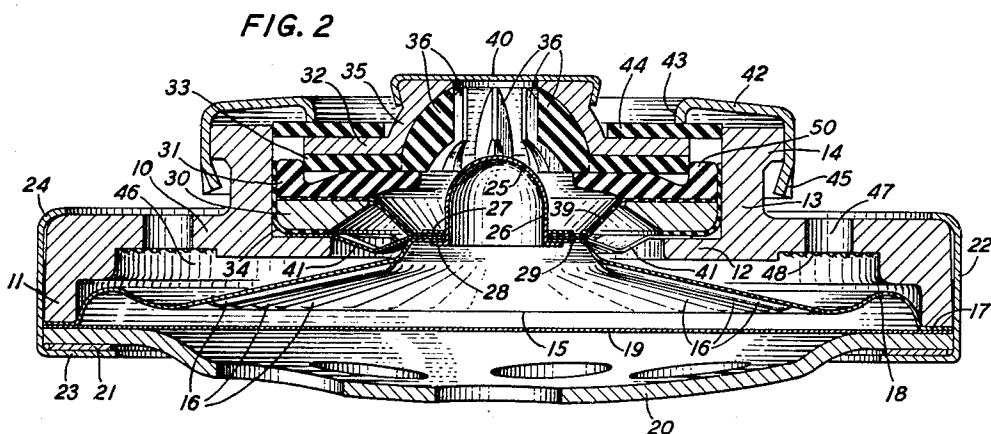
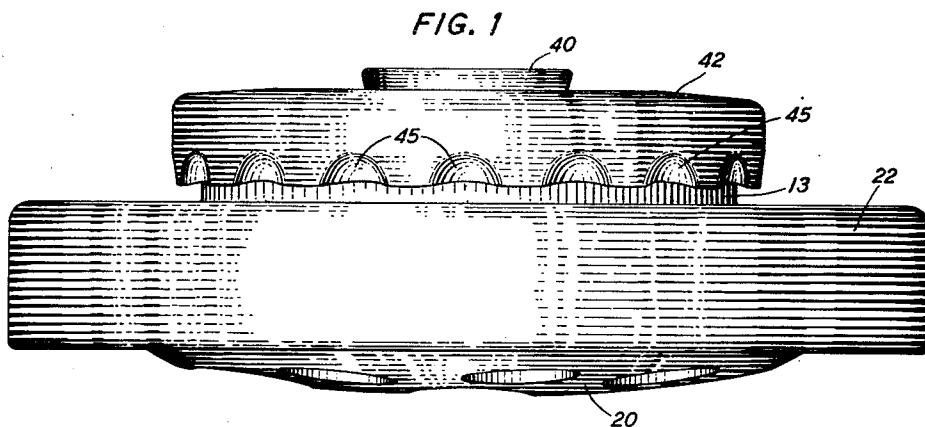
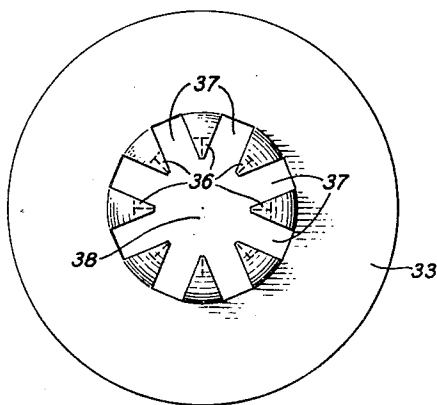


FIG. 3



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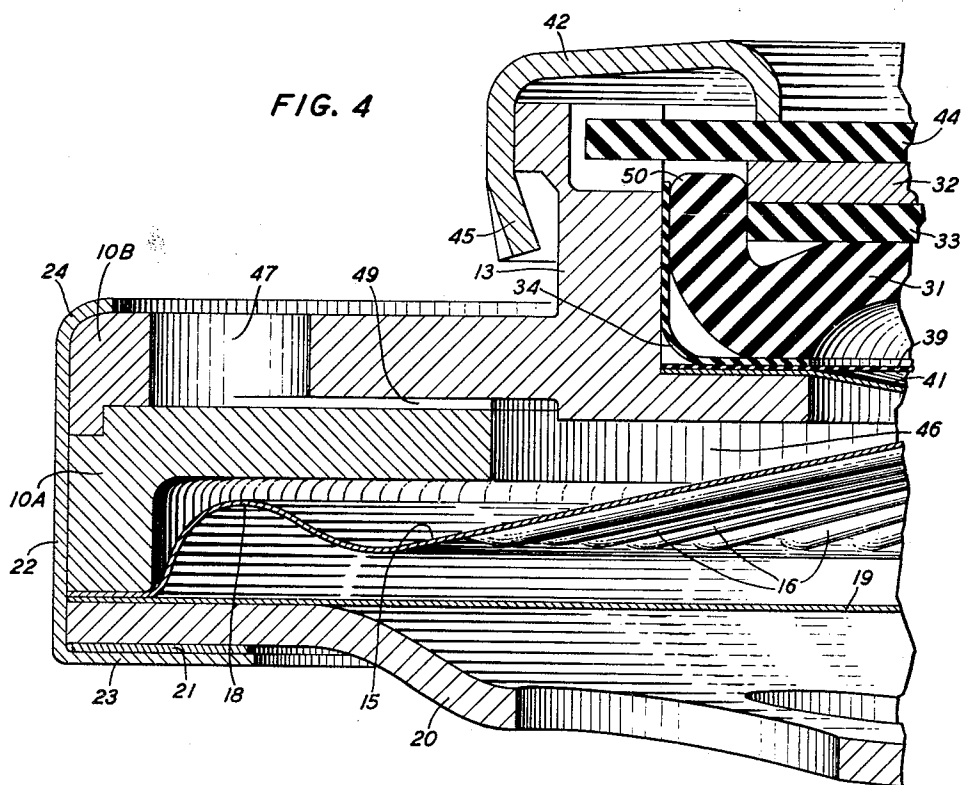
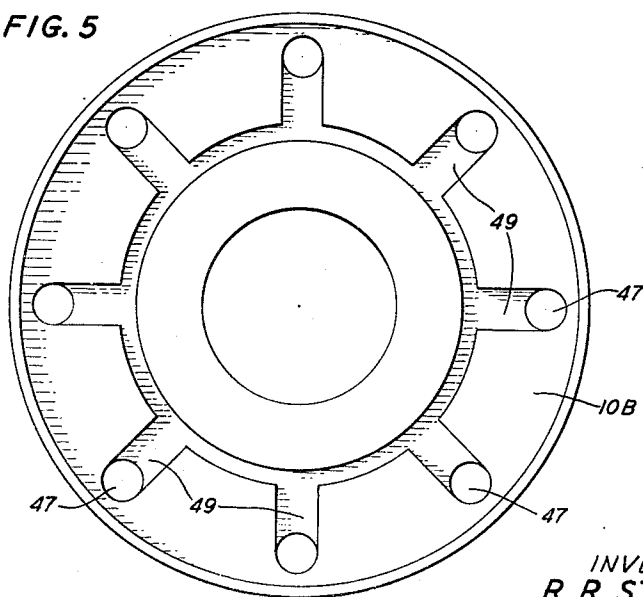


FIG. 5



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TELEPHONE TRANSMITTER WITH RADIAL SLOTS IN THE CARBON CHAMBER

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Application April 26, 1947, Serial No. 744,059

14 Claims. (Cl. 179-122)

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This invention relates to telephone transmitters and more particularly to carbon granule transmitter units especially suitable for use in hand telephones.

Such transmitter units, of which the unit disclosed in Patent 2,042,822, granted June 2, 1936 to Arthur L. Bennett and William L. Tuffnell is illustrative, comprise in general a fixed and a movable electrode associated with a chamber containing carbon granules to define a variable resistance path. Operating desiderata for the units include high modulation efficiency and non-positional response characteristics, i. e., freedom of variation in the operating characteristics with changes in position in which the units are held during use thereof. Additionally, it is eminently desirable in some fields of use that the resistance of the units be relatively high.

It has been found that, generally speaking, carbon granules of such character that good modulation efficiency is obtained by their use have a relatively low resistance.

One object of this invention is to obtain a relatively high resistance for transmitter units of the carbon granule type.

More specifically, one object of the invention is to increase the resistance of such transmitter units without degradation of either the modulation efficiency or non-positional operating characteristics thereof.

Another object of this invention is to enable ready collocation of the elements defining the carbon granules chamber in a transmitter in prescribed relation, specifically in accurate coaxial relation, whereby the manufacture of units is facilitated and realization of uniformity of product in quantity manufacture is expedited.

In accordance with one feature of this invention, in a carbon granule type transmitter having juxtaposed fixed and vibratile electrode surfaces, an insulating insert is provided between the surfaces for reducing the effective cross-sectional area of the current path between the two electrodes whereby the transmitter resistance is substantially increased.

More specifically, in accordance with one feature of this invention, the insert is fitted against the dish surface of the fixed electrode and is constructed and arranged to divide a portion of the granule chamber into a plurality of slots extending radially from a central space coaxial with the electrode surfaces, whereby a plurality of substantially identical current paths electrically in parallel are provided between the electrodes.

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In accordance with another feature of this invention, the electrodes and other elements bounding the carbon granule chamber are mounted by a support or foundation member and are physically associated therewith and with one another in such manner that the electrodes and elements are accurately positioned in coaxial relation automatically upon placement thereof in or onto the foundation member in the assembly of the unit.

The invention and the above-noted and other features thereof will be understood more clearly and fully from the following detailed description with reference to the accompanying drawing in which:

Fig. 1 is a side elevational view of a transmitter unit illustrative of one embodiment of this invention;

Fig. 2 is a diametral sectional view of the transmitter unit shown in Fig. 1;

Fig. 3 is a plan view of the insulating insert included in the unit;

Fig. 4 is a partial view in section of a transmitter unit illustrative of another embodiment of this invention; and Fig. 5 is a face view of the damping plate included in the transmitter unit illustrated in Fig. 4.

Referring now to the drawing, the transmitter unit shown in Figs. 1 and 2 is adapted for use particularly in hand telephones such as disclosed in the application, Serial No. 744,179 filed April 26, 1947 of William G. Turnbull and comprises a circular metallic frame or foundation member, designated generally as 10, having a shallow cylindrical portion 11, an annular inwardly extending flange 12 and a second cylindrical portion 13 coaxial with the portion 11 and terminating in an outwardly directed flange 14.

A diaphragm, for example formed in one piece of a lightweight metal such as duralumin, comprises a central frusto-conical portion 15 provided with radially extending stiffening flutes or corrugations 16, an annular peripheral portion 17 and an intermediate, annular trough portion or corrugation 18. The annular portion 17 is seated upon the end of the cylindrical part 11 of the foundation member; the corrugation 18 abuts the cylindrical portion 11 and is sufficiently flexible to allow bodily movement, analogous to a piston, of the frusto-conical diaphragm portion 15.

Disposed in front of the diaphragm is a moisture-proof membrane 19 over or in front of which a metallic, multi-apertured protective grill or cap 20 extends. The membrane 19, grill or cap 20 and peripheral portion 17 of the diaphragm together with a washer 21 are secured together and

against the end of the frame or foundation member by a clamping band 22 having a flange 23 bearing against the washer 21 and having one end crimped over the frame as illustrated at 24.

An electrode, for example of brass, mounted on the frusto-conical diaphragm portion 15, is vibratile therewith and comprises a hemispherical portion 25 and a circular cylindrical part 26. The latter is provided with an annular flange 27 having integral tabs 28, the flange and tabs being adjacent opposite faces of an annular flange 29 on the diaphragm and locking the electrode thereto. The outer surface of the electrode may be plated with a low resistance material such as, for example, gold.

Arranged in pile-up fashion upon the flange 12 are a metallic spacer ring 30, an annular insulator 31, a metallic back electrode 32, and an insulating insert 33, the ring 30 being insulated from the frame 10 by a thin cup-shaped insulating member 34. The insulator 31 has an upstanding cylindrical flange 50 coaxial with the electrode 25, 26 against which the periphery of the insert 31 is fitted, whereby the insert is located in coaxial relation with the electrode 25, 26. The back electrode 32 includes a central dished portion 35 the inner surface of which is hemispherical and coaxial with but eccentric with respect to the portion 25 of the movable electrode.

The insulating insert 33, which in a particularly advantageous construction is of anodized aluminum, includes a central portion comprising a plurality of radially extending, inwardly tapered arms or sections 36 which are equally spaced to form a plurality of radial slots 37, as shown clearly in Fig. 3, extending from a central cylindrical opening 38. As shown in Fig. 2, the arms or sections 36 are generally arcuate and the curved walls thereof conform to segments of hemispherical surfaces coaxial with but eccentric with respect to the hemispherical portion 25 of the movable electrode. The outer walls of the arms conform to and fit against the inner surface of the dished part 35 of the back electrode, whereby this electrode is located coaxially with the electrode portion 25.

Clamped at one margin between the ring 30 and insulator 31 and at its other margin between the flanges 27 and 29 is a thin, flexible insulating annulus 39, for example of silk. This annulus, together with the front and back electrodes, the insert 33 and insulator 31, defines a chamber which is filled with carbon granules. In the interest of clarity of illustration, the carbon granule filling is not shown in Fig. 2. The carbon granules are introduced into the chamber through the outer end of the back electrode and the opening in this end is closed subsequently by a metallic cap 40 crimped over this electrode and adapted to serve as a terminal or contact through which electrical connection to the back electrode may be established.

Electrical connection to the front electrode 25, 26 is established by a thin, metallic spider member having a plurality of bent, flexible arms 41. These arms extend radially from an integral annulus clamped between the diaphragm flange 29 and annulus 39 and have their outer ends clamped between the flange 12 and the insulating member 34.

The elements arranged in pile-up fashion upon the flange 12 of the frame or foundation member 10 are locked or clamped in place in coaxial relation by a metal ring spring 42 having a flange

43 bearing against an insulating washer 44 and having its outer marginal part crimped under the flange 14 as indicated at 45. As shown clearly in Fig. 2, the washer 44 fits slidably within the cylindrical portion 13 of the frame or foundation member 10.

It will be noted that the insulating insert 33 not only reduces the effective cross-sectional area of the current path between the movable electrode 25 and 26 but also assures a relatively long current path. Hence, a relatively high resistance, for example of the order of 45 ohms, is realized for the transmitter unit. It has been found that the insert does not affect deleteriously the modulation characteristics of the unit so that the desired high resistance is attained without degradation of the modulating efficiency. Furthermore, it has been found that because of its construction and particularly of the plurality of radial slots 37 extending from the central space 38, the transmitter unit is highly non-positional. Thus, the desiderata of high resistance, good modulation and non-positional characteristics are realized in transmitter units constructed in accordance with this invention. Additionally, it has been found that the insert reduces the tendency of the carbon granules to pack to an insensitive state.

It will be noted further that the various elements bounding the granule chamber are aligned in accurate coaxial relation by mere assembly of the parts. Specifically, the diaphragm and the movable electrode are positioned in coaxial relation with the frame 10 by edge abutment of the annular corrugation 18 with the cylindrical part 11 of the frame; the insulating ring 31 automatically is located coaxially with the electrode 25, 16 when the ring is inserted into the cup-shaped member 34 and, in turn, by virtue of engagement of the flange 50 with the periphery thereof, locates the insert 33 in coaxial relation with the electrode 25, 26; and the insert positions the back electrode 35 coaxially with respect to the other elements. Hence, the construction facilitates the manufacture of high quality transmitter units and enables manufacture of such units in quantity at low cost.

Because of its mass and stiffness, the diaphragm may have a vibrational resonance frequency within the intended operating range of the transmitter unit, which would result in distortion of the transmitted signals. To prevent such distortion, there is provided in association with the diaphragm an acoustic network for damping the diaphragm to substantially suppress the response peak due to the resonance and for equalizing the response over a broad frequency band. This network is constituted by the chamber 45 behind the diaphragm and a plurality of apertures 47 in the frame over which acoustic resistance material 48, such as acoustic silk, extends, the chamber 46 providing the stiffness component of the network and the material 48 the mass and resistance components thereof.

In another illustrative construction, shown in Figs. 4 and 5, the frame or foundation member comprises two mating parts 10A and 10B, the part 10B being provided with shallow radially extending slots 49 which extend from the chamber 46 to the apertures 47 and provide the mass and resistance components of the damping network.

Although specific embodiments of the invention have been shown and described, it will be

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understood that they are but illustrative and that various 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 means including a pair of juxtaposed electrodes bounding a carbon granule chamber, one of said electrodes being vibratile to vary the current path between said electrodes, and insulating means in said chamber dividing a portion of said current path into a central part and a plurality of separate parts extending outwardly from said central part to one of said electrodes.

2. A telephone transmitter comprising means including a pair of opposed, axially aligned electrodes bounding a carbon granule chamber, one of said electrodes being vibratile to vary the current path between said electrodes, and insulating means within said chamber dividing a portion of the space between said electrodes into a central cylindrical part coaxial with said electrodes and a plurality of parts extending radially from said central part.

3. A telephone transmitter comprising means including a pair of electrodes bounding a carbon granule chamber, one of said electrodes having a dished portion in juxtaposition to the other electrode, and an insulating insert in said portion, said insert having a central opening therein and having also a plurality of arms defining a plurality of slots extending from said opening to said one electrode.

4. A telephone transmitter comprising means including a pair of electrodes bounding a carbon granule chamber, one of said electrodes being vibratile and said electrodes having juxtaposed axially aligned portions dished in the same direction, and an insulating insert fitted in one of said portions and dividing the space therein into a plurality of slots extending radially with respect to the axis of alignment of said portions.

5. A telephone transmitter comprising means including a pair of electrodes bounding a carbon granule chamber, one of said electrodes being fixed and having a concave portion and the other of said electrodes being vibratile and having a convex portion in juxtaposition to said concave portion, and an insulating insert in said concave portion, fitted in face to face relation therewith and having therein a plurality of slots defining separate current paths between said concave and convex portions.

6. A telephone transmitter comprising means including a pair of electrodes bounding a carbon granule chamber, one of said electrodes being fixed and having a concave portion and the other of said electrodes being vibratile and having a convex portion in juxtaposition to said concave portion, and insulating means intermediate said convex and concave portions dividing a portion of the space therebetween into a plurality of similar slots extending from said concave portion.

7. A telephone transmitter comprising a fixed electrode having a concave surface, a vibratile electrode having a convex surface opposite and axially aligned with said concave surface, means including said fixed and vibratile electrodes bounding a carbon granule chamber, and an insulating member within and in face to face relation with said concave surface and having a plurality of arms extending radially inwardly from said concave surface.

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8. A telephone transmitter in accordance with claim 7 wherein said arms taper inwardly from said concave surface.

9. A telephone transmitter in accordance with claim 7 wherein each of said arms has one edge face fitted to said concave surface and the opposite edge face in juxtaposition to and curved in the same direction as said convex face.

10. A telephone transmitter comprising a first electrode having a dished portion, a vibratile electrode having a convex surface opposite said dished portion, means including said first and vibratile electrodes bounding a carbon granule chamber, and an insulating insert in said dished portion including a plurality of arms having faces toward said convex surface lying in a concave boundary coaxial with and eccentric with respect to said convex surface.

11. A telephone transmitter comprising a first electrode having a concave substantially hemispherical surface, a vibratile electrode having a convex substantially hemispherical surface opposite, axially aligned with and eccentric with respect to said concave surface, means including said concave and convex surfaces bounding a carbon granule chamber, and an insulating insert in said first electrode including a portion having a convex face fitted to said concave surface and a concave part in juxtaposition to, coaxial with and eccentric with respect to said convex surface, said portion having an axial opening therethrough and having also a plurality of arms defining slots extending radially from said opening to said concave surface.

12. A telephone transmitter in accordance with claim 11 wherein said arms taper inwardly from said concave surface to said opening.

13. A telephone transmitter comprising a foundation member having a cylindrical portion and an annular flange extending inwardly adjacent one end of said portion, a diaphragm mounted on said member, a first electrode coupled to said diaphragm and coaxial with said portion, and means mounted upon said flange and defining a carbon granule chamber with said electrode, said means including an annular member supported from said flange, positioned coaxially with said electrode by said cylindrical portion and having a flange coaxial with said electrode, a second electrode, and a second annular member between said second electrode and said first annular member, said second annular member being seated upon said first annular member and positioned in coaxial relation therewith by said coaxial flange and said second electrode being seated upon said second annular member and positioned in coaxial relation therewith by said second annular member.

14. A telephone transmitter comprising a foundation member having a cylindrical portion and an inwardly extending flange adjacent one end of said cylindrical portion, a diaphragm mounted upon said member, an electrode coupled to said diaphragm, coaxial with said cylindrical portion and extending into said cylindrical portion at said one end thereof, and means comprising a pile-up of elements upon said flange defining a carbon granule chamber with said electrode, said elements including an annular insulating member supported from said flange and positioned in coaxial relation with said electrode by said cylindrical portion, said insulating member having an upstanding cylindrical flange coaxial therewith, a second electrode having an outer flange and a central dished portion the concave face of which

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is toward said first electrode, and an insulating insert between said second electrode and said insulating member, said insert having an annular flange seated upon said insulating member and coaxially fitted within said upstanding cylindrical flange and having also a central coaxial portion fitted to said concave face.

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REFERENCES CITED

The following references are of record in the file of this patent:

Number
1,105,066
1,558,643
1,565,581
2,042,822
2,225,488
2,250,781

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8

UNITED STATES PATENTS

Name	Date
Comer	July 28, 1914
Smith	Oct. 27, 1925
Moore	Dec. 15, 1925
Bennett	June 2, 1936
Stevens	Dec. 17, 1940
Sutton	July 29, 1941

FOREIGN PATENTS

Country	Date
Great Britain	Nov. 29, 1940