Dec. 17, 1940. R. R. STEVENS 2,225,488

IMPULSE TRANSLATING APPARATUS

Filed June 18, 1938

FIG. 1

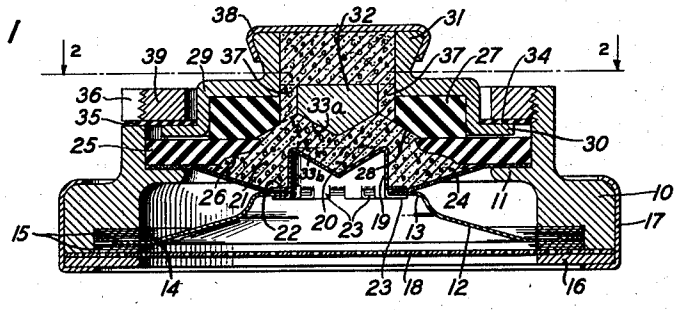



FIG. 2

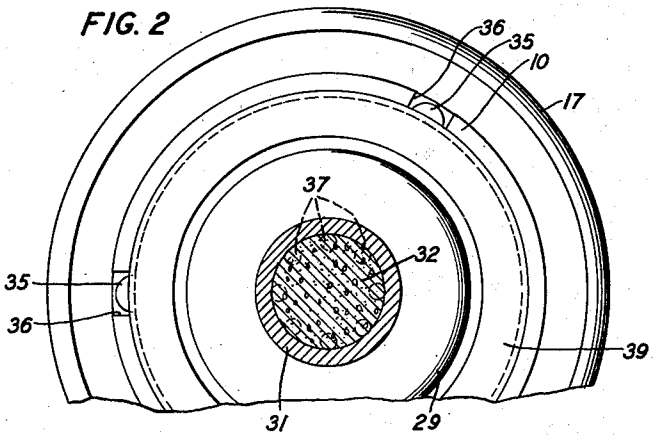



FIG. 3

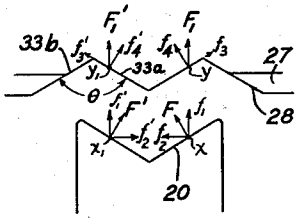



FIG. 4

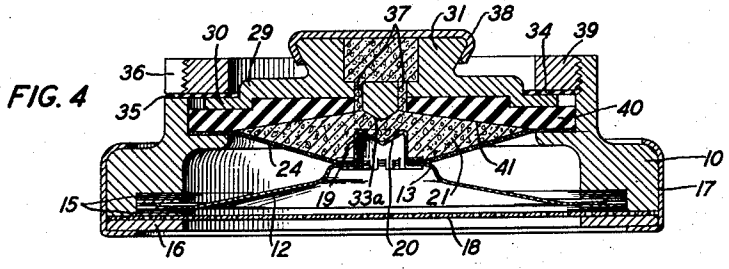
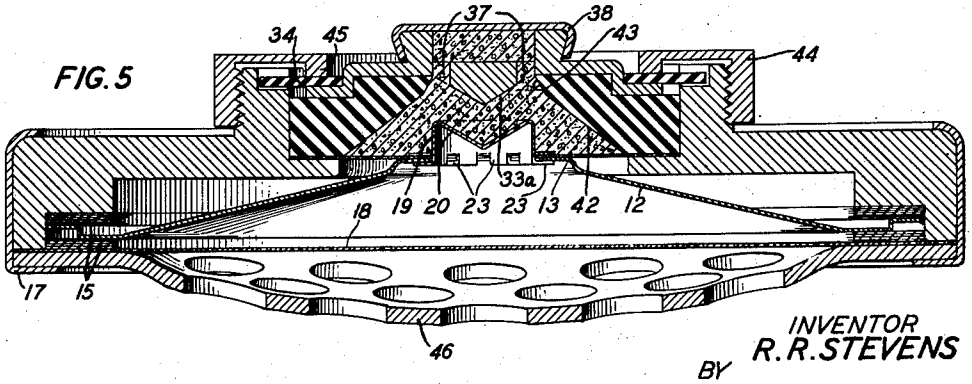



FIG. 5

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2,225,488

## IMPULSE TRANSLATING APPARATUS

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Application June 18, 1938, Serial No. 214,460

14 Claims. (Cl. 179—126)

This invention relates to telephone transmitters and more particularly to telephone transmitters of the carbon granule type.

Telephone transmitters of a type comprehended by this invention comprise, in general, a fixed or stationary electrode, a vibratile electrode, and means, which may include the electrodes, defining a chamber having therein a comminuted resistance varying material, such as carbon granules. When the vibratile electrode is actuated, as in accordance with sound waves, the resistance material is agitated so that the resistance of the path between the two electrodes is varied and the current flowing in a circuit including these electrodes is modulated.

One object of this invention is to improve the modulating efficiency of telephone transmitters.

Another object of this invention is to obtain substantial confinement of the comminuted resistance material between the vibratile and stationary electrodes in a telephone transmitter whereby controlled resistance and uniform operating characteristics are obtained.

A further object of this invention is to concentrate the current in telephone transmitters in restricted paths between the electrodes.

In accordance with one feature of this invention, the means defining the chamber having the resistance material therein are so shaped that but restricted portions of the material, principally that portion between the electrodes, are agitated in accordance with movements of the vibratile electrode and the tendency of the material to fall away from the region between the electrodes is reduced.

In accordance with another feature of this invention, the electrodes of a telephone transmitter are provided with juxtaposed surfaces of such form that the resistance material therebetween is subjected to substantially pure compressive forces when the vibratile electrode moves toward the fixed electrode.

The invention and the foregoing 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 view in section of a carbon granule type telephone transmitter illustrative of one embodiment of this invention;

Fig. 2 is a partial top view, partly in section, along line 2—2 of Fig. 1, of the telephone transmitter shown in Fig. 1;

Fig. 3 is an enlarged diagrammatic view of a portion of the electrodes in the transmitter shown in Fig. 1; and

Figs. 4 and 5 are side views in cross-section of telephone transmitters illustrative of other embodiments of this invention.

Referring now to the drawing, the telephone transmitter illustrated in Figs. 1 and 2 comprises an annular frame 10, for example of metal, having an inwardly extending annular flange 11 and an annular recess or groove in one end wherein the peripheral portion of the diaphragm is positioned. The diaphragm, which may be of sheet metal, for example an aluminum alloy, sufficiently rigid to vibrate as a whole, comprises a frusto-conical portion 12 having an annular flange 13 at one end, and a peripheral portion 14 which is provided with a stiffened edge, and is supported between damping leaves 15, such as thin paper annuli. The peripheral portion 14 and the damping leaves 15 may be held in position in the recess or groove in the frame by an annular plate 16 held against the frame 10 by a bent sheet metal clamping member 17. If desired, a moisture-proof and protective screen 18 may be provided over the front or concave surface of the diaphragm, the screen being clamped between the frame 10 and the plate 16.

Affixed to the diaphragm and vibratile therewith is an electrode having a cylindrical or sleeve portion 19 and a dished or conical portion 20, the apex of which is within the cylindrical or sleeve portion 19. Preferably the concave surface of the conical portion 20 is plated, as with gold, to provide a low resistance and intimate contact between the electrode and the comminuted resistance material 21, such as carbon granules. The vibratile electrode may be provided with a flange 22 adjacent one surface of the flange 13 and with integral fingers or tabs 23 bearing against the other surface of the flange 13 so that the vibratile electrode is securely affixed to the diaphragm and bodily movable therewith.

A flexible flaring or frusto-conical closure member 24, for example of silk or the like, is clamped at one edge between the flanges 13 and 22 and has its other edge clamped against the flange 11.

Seated upon the annular flange 11 of the frame 10 is an annular insulating member 25 having an inclined and curved inner wall 26 facing the diaphragm, the insulating member 25 being coaxial with the vibratile electrode 19, 20. A second annular insulating member 27 having an inclined inner wall portion 28 is seated upon the insulating member 25 and positioned coaxially therewith.

Seated in turn upon the insulating member 27 is a metallic member having a cup-shaped por-

tion 29 fitted on the member 27, a flange 30, a cylindrical portion 31 and a central portion 32 having a dished or conical surface 33a coaxial with the conical portion 20 of the vibratile electrode and having also a frusto-conical surface 33b. The conical surface 33a may be of the same angle as the conical portion 20 or may be of a greater or smaller angle. The metallic member is insulated from the frame 10 by an annular insulating washer 34 seated upon the flange 30 and having diametrically opposite tabs 35 fitted in notches or slots 36 in the frame 10.

The central portion 32 is provided with a plurality of small apertures 37 through which the comminuted resistance material may be introduced into the chamber defined by the electrodes, closure member 24 and the walls 26 and 28 of the insulating members 25 and 27, respectively. The outer end of the cylindrical portion 31 may be closed by a cap 38 having its edge portion crimped around the end of the portion 31.

The insulating members 25 and 27 and the metallic member 29, together with the closure member 24 and washer 34, are securely clamped in proper position on the frame 10 by a locking ring 39 threaded to the frame.

When the diaphragm vibrates, as in accordance with sound waves impinging thereon, the electrode 19, 20 vibrates correspondingly so that the pressure upon the carbon granules between the dished or conical surfaces 20 and 33 is varied and the current flowing in a telephone circuit connected to the two electrodes is modulated. When the electrode 19, 20 is thus vibrated, the conical portion 20 subjects the carbon granules to forces acting normal to the surface 20 at all points thereof. For example, as illustrated in Fig. 3, at two diametrically opposite points $x$ and $x_1$, the forces have the direction indicated by the arrows F and F', i. e., normal to the inner surface of the conical portion. The force F may be resolved into two components $f_1$, parallel to the axis of the portion 20, and $f_2$, at right angles to this axis. The force F' may be resolved into similar components $f_1'$ and $f_2'$. The component forces $f_2$ and $f_2'$, it will be seen, are of equal magnitude and opposite in direction so that they tend to counterbalance each other. The two components $f_1$ and $f_1'$ likewise are of equal magnitude but of the same direction, and force the carbon granules toward corresponding points $y$ and $y_1$ on the conical surface 33a, the forces exerted at these points being equal and represented by the parallel arrows $F_1$ and $F_1'$. The force $F_1$ may be resolved into two components $f_4$, normal to the surface 33a, and $f_3$, parallel to this surface, and the force $F_1'$ may be resolved into similar components $f_4'$ and $f_3'$. The component forces $f_3$ and $f_3'$ tend to cause a movement of the carbon granules outwardly along the surface 33a. However, if the angle $\theta$ between the surface 33a and the surfaces 33b and 28 is made 90 degrees or substantially 90 degrees, outward movement of the carbon granules will be substantially prevented.

The carbon granules outside of the cylindrical portion 20 are agitated somewhat by vibration of the flexible closure member 24. As will be apparent, because of the inclination of the closure member 24 and the walls 26 and 28, the forces thus produced will be toward the space between the surfaces 30 and 33a, so that this body of carbon granules produces a pressure head serving to prevent movement of the granules between the juxtaposed surfaces of the electrodes laterally outwardly.

Hence, it will be seen that the carbon granules lying between the juxtaposed surfaces of the electrodes are subjected to substantially pure compressive forces when the diaphragm vibrates, so that a high degree of modulation of the resistance in the current paths between these surfaces obtains.

Because of the form and disposition of the electrode surfaces, it will be appreciated that the current between the electrodes is substantially confined to paths lying between the lateral extremities of the surface 20. The electrical resistance of the structure, therefore, will be a direct function of the area of the surface 20. Hence, good regulation of the resistance may be achieved, inasmuch as the area of the surface 20 may be made relatively small and a sufficiently high contact force maintained between the granules and between the granules and this surface to prevent overloading at normal speech pressures.

The telephone transmitters shown in Figs. 4 and 5 are generally the same in construction as that illustrated in Fig. 1 and described heretofore. In the embodiment of this invention illustrated in Fig. 4, however, the electrodes are somewhat smaller and a single insulating member 40 is provided, having a frusto-conical surface 41 defining the major portion of the rear wall of the carbon granule chamber.

In the embodiment of this invention illustrated in Fig. 5, the inner wall of the single insulating member has two frusto-conical wall portions 42 and 43, the latter of which extends at substantially right angles to the surface 33a of the stationary electrode. The closure member 24 may extend substantially normal to the cylindrical or sleeve portion 19 of the vibratile electrode. The insulating member, stationary electrode structure and insulating washer 34 may be clamped in position by a locking ring 44 threaded to the frame 10 and having a bearing portion 45 engaging the washer 34.

If desired, a protective cover or grill 46 may be provided in front of the diaphragm 12 and secured to the frame by the clamping member 17.

Although specific embodiments of this invention have been shown and described, it will be understood, of course, 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 a diaphragm, an electrode connected to said diaphragm and vibratile therewith, said electrode having a central conical portion the apex of which is toward the front surface of said diaphragm, a fixed electrode having a conical portion coaxial with and facing in the same direction as said first portion, a wall member extending from the periphery of said fixed electrode and flaring toward said diaphragm, a flexible wall member extending between said first electrode and said first wall member, said wall members and said electrodes defining a chamber, and comminuted resistance material substantially completely filling said chamber.

2. A telephone transmitter comprising a vibratile element including a diaphragm, an electrode to the rear of said diaphragm, and a dish-shaped flexible annular member extending outwardly from said electrode and flaring away from said

diaphragm, and a stationary element including a second electrode and a wall member extending between said second electrode and the periphery of said annular member, said vibratile and stationary elements defining a chamber, and comminuted resistance material substantially completely filling said chamber, said electrodes having juxtaposed surfaces defining a restricted passageway.

3. A telephone transmitter in accordance with claim 2 wherein said wall member is substantially frusto-conical and flares toward said diaphragm.

4. A telephone transmitter in accordance with claim 2 wherein said juxtaposed surfaces are central with respect to the respective electrodes, coaxial and substantially conical, said surfaces tapering in the same direction and the apices thereof being toward the front of said diaphragm.

5. A telephone transmitter comprising a diaphragm, means to one side of said diaphragm defining a chamber, and comminuted resistance material substantially completely filling said chamber, said means comprising an electrode vibratile with said diaphragm and having a cylindrical portion and a central, continuous dished portion within said cylindrical portion, the concave surface of said dished portion facing away from said one side of said diaphragm, and a second electrode having a surface opposite and dished in the same direction as said dished portion.

6. A telephone transmitter in accordance with claim 5 wherein said dished portion and said surface are conical and coaxial.

7. A telephone transmitter comprising a diaphragm, an electrode vibratile with said diaphragm having a sleeve portion and a central, continuous dished portion within said sleeve portion, the inner surface of said dished portion facing away from said diaphragm, a second electrode having a surface in juxtaposition to the inner surface of said dished portion and conforming thereto, means including said electrodes defining a chamber, and comminuted resistance material in said chamber, said means including also an insulating member having a surface extending from the periphery of said second surface and inclined toward said first electrode.

8. A telephone transmitter comprising a diaphragm, an electrode coupled to said diaphragm and vibratile therewith, said electrode having a central portion dished toward said diaphragm, a second electrode having a surface opposite and substantially conforming to said portion, means including said portion and surface defining a chamber, and comminuted resistance material in said chamber, said means including also a flexible member extending from the periphery of said first electrode and flaring away from said diaphragm.

9. A telephone transmitter comprising a diaphragm, an electrode vibratile with said diaphragm, a stationary electrode, said electrodes having juxtaposed surfaces defining a restricted passageway and dished toward said diaphragm, means including said electrodes defining a chamber, and comminuted resistance material in said chamber, said means including also an insulating wall member flaring away from said diaphragm and a second insulating wall member inclined toward said diaphragm.

10. A telephone transmitter comprising a vibratile electrode having a dished portion, means defining a chamber with the concave surface of said dished portion of said electrode, and comminuted resistance material in said chamber, said means including an electrode having a surface in juxtaposition to and dished in the same direction as said portion, and including also an insulating member having a wall extending from adjacent the periphery of said second surface, flaring toward said first electrode and at substantially right angles to said second surface.

11. A telephone transmitter comprising a vibratile electrode having a central conical portion, means defining a chamber with the concave surface of said portion, and comminuted resistance material in said chamber, said means including a second electrode having a conical surface in juxtaposition to said portion and substantially uniformly spaced therefrom, an insulating member having a frusto-conical wall extending from said second surface and flaring in the direction of said first electrode, and a flexible member extending from the periphery of said vibratile electrode to said member.

12. A telephone transmitter in accordance with claim 11 wherein said flexible member is frusto-conical and flares toward said frusto-conical wall.

13. A telephone transmitter comprising a vibratile electrode having a conical portion, means defining a chamber with said electrode, comminuted resistance material in said chamber, said means including a flexible member extending outwardly from the periphery of said vibratile electrode, a second electrode having a conical surface coaxial with and equally spaced from said portion, and a member having a wall portion extending inwardly from the periphery of said flexible member and obliquely with respect to said flexible member and having a second wall portion extending from the periphery of said conical surface and at substantially right angles thereto.

14. A telephone transmitter comprising a diaphragm, an electrode coupled to said diaphragm and vibratile therewith, said electrode including a cylindrical portion extending normal to the central portion of the diaphrgam and coaxial with said diaphragm and including also a conical portion within said cylindrical portion and having its periphery joined thereto, the inner surface of said conical portion facing away from said diaphragm, a second electrode coaxial with said first electrode having a conical surface opposite said first surface and conforming thereto, means including said electrodes defining a chamber, and comminuted resistance material substantially completely filling said chamber, said means including also a fixed insulating member having a dished surface coaxial with said electrodes, extending from the periphery of said second electrode and having its elements inclined toward said diaphrgam, and including also a flexible frusto-conical insulating member coaxial with said electrodes and having its smaller end joined to said cylindrical portion and its larger end joined to said dished surface adjacent the periphery thereof, the inner surface of said frusto-conical flexible member facing toward said second electrode.

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