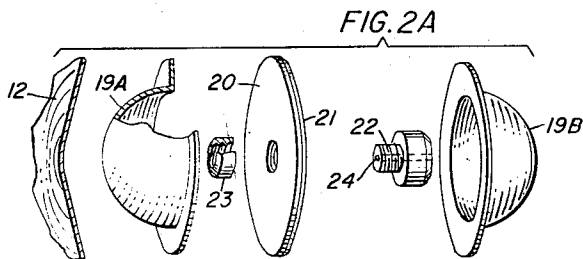
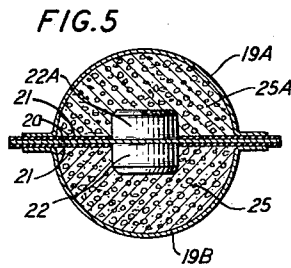
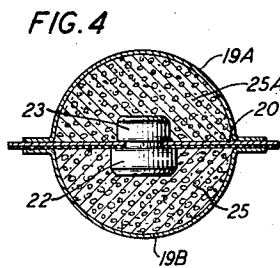
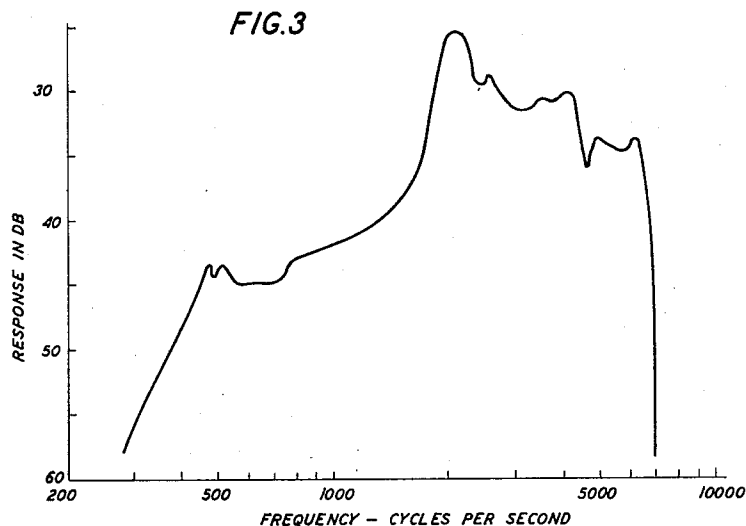
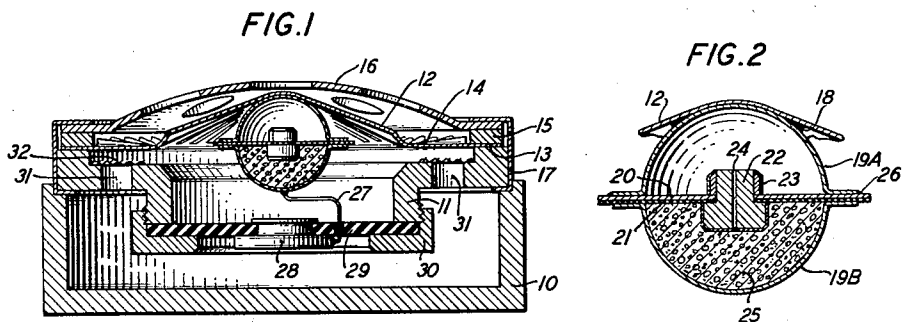


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TELEPHONE TRANSMITTER
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TELEPHONE TRANSMITTER

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

One general object of this invention is to improve the performance of carbon granule type telephone transmitters.

More specific objects of this invention are to reduce aging of the carbon granules in telephone transmitters, whereby the useful life of such devices is extended, to minimize changes in the operating characteristics of such transmitters with variations in ambient pressure or temperature or both, to improve the frequency response characteristic, and to reduce harmonic and modulation product distortion.

In illustrative embodiments of this invention, a telephone transmitter comprises, in general, a rigid hollow body or container mounted for vibration in accordance with sound waves effective thereon, the body having therein comminuted resistance varying material, such as carbon granules, and having also therein an electrode mounted so that relative motion between the electrode and body occurs when the latter is vibrated, whereby the resistance of the current path through the comminuted material is modulated in accordance with the sound waves.

In accordance with one feature of this invention, the hollow body is constructed so that the characteristics of the relative motion between the electrode and the body are substantially unaffected by variation in ambient temperature conditions. Specifically, in one illustrative embodiment, the body comprises two metallic hemispheres joined in edge-to-edge relation to form an air-tight housing, a diaphragm dividing the interior of the housing into two chambers, carbon granules in one of the chambers, and an electrode mounted upon the diaphragm and vibratile therewith, the electrode having therein a restricted passageway coupling the two chambers. The passageway is of such construction as to permit free flow of air between the two chambers but to prevent passage of the carbon granules. Inasmuch as the housing is air-tight, the carbon granules are shielded from the atmosphere and aging effects are minimized. Because interiorly of the housing, air may pass freely between the two chambers, equilibrium between the air pressures upon opposite faces of the diaphragm is automatically maintained.

Particularly advantageously, the housing is constituted of a metal having a very small temperature coefficient of expansion, for example of nilvar, whereby ambient temperature effects upon the operating characteristics of the housing-electrode combination are minimized.

In accordance with another feature of this invention, both of the chambers have a filling of

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carbon granules, those in one chamber serving to provide the variable resistance current path for the transmitter and the granules in the other chamber providing a dissipative load to damp the vibrations and suppress resonance peaks in the response characteristic of the transmitter.

In accordance with a further feature of this invention, in a device such as described hereinabove wherein both chambers have carbon granules therein, both masses of granules are utilized as variable resistance paths, thereby providing push-pull operation in the transmitter, and reducing modulation product and harmonic distortion.

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 an elevational view in section of a telephone transmitter illustrative of one embodiment of this invention;

Fig. 2 is a sectional view to an enlarged scale of the vibratory granule chamber element included in the device shown in Fig. 1;

Fig. 2A is an exploded perspective view of the assembly illustrated in Fig. 2;

Fig. 3 is a graph illustrating the frequency response characteristic of a typical device of the construction shown in Fig. 1; and

Figs. 4 and 5 are sectional views, similar to Fig. 2, illustrating other embodiments of this invention.

Referring now to the drawing, the telephone transmitter illustrated in Figs. 1 and 2 comprises a cup-shaped housing 10 upon which a transmitter unit is mounted. This unit comprises a frame or foundation member 11 upon which a diaphragm is seated adjacent its periphery, the diaphragm having a dished or conical central portion 12, a peripheral mounting portion 13 and an intermediate corrugated and flexible portion 14. The peripheral portion 13 has seated thereon an annular spacer 15 upon which in turn a perforated protective cap or cover 16 rests. The several elements, namely, the frame 11, diaphragm, spacer 15 and cover or cap 16 are assembled in pile-up relation and securely held together by a metallic band 17, the edges of which are crimped over the frame 11 and the peripheral part of the cover 16.

Supported from the diaphragm and securely affixed to the center of the conical part 12 thereof, as by an adhesive indicated at 18 in Fig. 2, is a rigid spherical housing or container composed of two similar hemispherical parts 19A and 19B advantageously of a metal, such as nilvar, having a very low temperature coefficient of expansion. Extending transversely of the spherical housing

is a thin metallic diaphragm 20 which is sealed adjacent its periphery to the juxtaposed flanges on the hemispherical parts 19A and 19B thereby to form an air-tight enclosure. The sealing of the parts to one another may be effected by a suitable cement and joining of the parts and diaphragm under heat and pressure. One face of the diaphragm 20 which may be, for example of beryllium copper, has thereon a layer 21 of insulation for example, a coating of an enamel. Thus the diaphragm 20 is electrically integral with the hemispherical part 19A but is insulated from the hemispherical part 19B. A low resistance connection may be assured between the diaphragm 20 and part 19A by soldering the two together as indicated at 26 or, alternatively, by crimping the peripheral portion of the diaphragm 20 around and against the flange on the hemispherical part 19A.

Mounted upon and carried by the diaphragm 20 is a metallic stub-like electrode 22 which may be affixed to the diaphragm by a nut 23 threaded thereon. The electrode 22 is provided with a restricted slot or bore 24, the purpose of which will appear presently.

The chamber bounded by the electrode 22, diaphragm 20 and hemispherical part 19B has therein a filling of comminuted resistance varying material 25, such as carbon granules. Advantageously, the inner wall of the part 19B and the surface of the electrode 22 in juxtaposition thereto have thereon a coating of gold to assure a permanent low resistance connection between the surfaces and the carbon granules.

As illustrated in Fig. 1, the hemispherical part 19B is connected electrically by a conductor 27 to a terminal 28 which is carried by an insulating plate 29. The latter is held upon the frame 11 by a clamping ring 30 threaded to the frame. This clamping ring may serve as a second terminal for the transmitter, leading to the electrode 22 over a path which may be traced from the ring 30 over frame 11 to diaphragm 12, 13, 14, thence to the hemispherical part 19A and by way of the diaphragm 20 to the electrode 22.

In the operation of the device, sound waves incident upon the diaphragm 12, 13 and 14 through the apertures in the protective cover 16 cause corresponding vibrations of the diaphragm. The housing 19A, 19B is actuated directly by and in accordance with the vibrations of the diaphragm. However, because of the compliant coupling between the electrode 22 and the housing 19 by way of the diaphragm 20 and the difference in mass between the housing and the electrode 22, relative motion between the electrode and the housing obtains. Consequently, the resistance of the current path between the electrode 22 and the housing part 19B through the carbon granules 25 is modulated in accordance with the relative motion noted.

The frequency response of the device will be dependent, of course, upon the mechanical impedances of the vibratory system and these may be correlated in ways known in the art to produce a response covering any desired band of frequencies. For example, in one device, the parameters of the mechanical vibratory system may be correlated so that the device covers a frequency band of about 400 to 6,000 cycles in the manner illustrated in Fig. 3.

To reduce resonance effects due to the chamber within the casing 10, the frame or foundation member 11 may be provided with a plurality of apertures 31 over which acoustic damping mate-

rial 32 extends. This material serves to lower the fundamental resonance frequency of the vibratory system including the diaphragm 12, 13 and 14 and improve the response over the lower portion of the frequency range, say from about 400 to 1,000 cycles.

As is indicated in Fig. 3 and as is inherent in the structure disclosed, the vibratory system constituted by the electrode 22, the diaphragm 20 and the carbon granules 25, will have a resonance frequency which may be, for example, in the vicinity of about 2,000 cycles. The reponse peak due to this resonance frequency may be damped and substantially reduced by the construction illustrated in Fig. 4. In this construction both the chambers within the housing 19A, 19B, that is, the two hemispherical chambers on opposite sides of the diaphragm 20, have therein fillings of carbon granules indicated at 25 and 25A. The granular mass 25 in the construction illustrated in Fig. 4, as in that illustrated in Fig. 2 and described heretofore, provides the variable resistance current path between the electrode 22 and the hemispherical part 19B. The mass of granules 25A does not carry any of the transmitter current but acts as a dissipative load to damp the vibratory system including the diaphragm 20 and the electrode 22.

In another embodiment illustrated in Fig. 5, both the carbon masses 25 and 25A may be utilized as variable resistance elements. In this case, both faces of the diaphragm 20 have insulating coatings indicated at 21 and 21A thereon and two electrodes 22 and 22A both connected electrically to the diaphragm 20 are provided on opposite sides thereof. Each electrode together with the corresponding hemispherical part 19A or 19B, and the intervening carbon granules 25 or 25A, defines a variable resistance path separate from the other. The two paths may be associated electrically in known ways to provide push-pull operation.

It will be understood that in the constructions illustrated in Figs. 4 and 5, the electrode or electrodes are provided with a restricted slot or bore similar to the bore or slot 24 illustrated in Fig. 2.

The slot or bore 24 allows free flow of air between the two chambers within the spherical housing 19A and 19B but is sufficiently small to prevent passage of the carbon granules there-through. Because of the free flow of air permitted, it will be appreciated that automatic balancing of the air pressure forces acting upon opposite surfaces of the diaphragm 20 is realized. Thus, the vibratory characteristics of the inertia element are substantially unaffected by changes in the ambient pressure. Furthermore, inasmuch as, as has been pointed out heretofore, the housing parts 19A and 19B advantageously are of a material having a very small temperature coefficient of expansion, the performance of the transmitter is substantially unaffected by variations in ambient temperature. Additionally, inasmuch as the housing is air-tight, aging of the carbon granules 25 or 25 and 25A is substantially reduced whereby the operating life of the telephone transmitter is extended.

Although specific embodiments of this invention have been shown and described, it will be understood that they are but illustrative and that various modifications may be made therein without departing from the scope and spirit of this invention.

What is claimed is:

1. A telephone transmitter comprising a hous-

ing, means mounting said housing for bodily vibration, means within said housing dividing the interior thereof into two chambers connected by a restricted passageway, said dividing means including an electrode and a flexible member mounting said electrode from said housing, said electrode extending into one of said chambers and the wall of said housing opposite said electrode being electrically conductive and insulated from said electrode, and comminuted resistance varying material in said one chamber, said restricted passageway being of such cross section as to permit the passage of air and to preclude the passage of said comminuted resistance varying material.

2. A telephone transmitter in accordance with claim 1 comprising comminuted damping means for said flexible member in the other of said chambers.

3. A telephone transmitter comprising a housing, means mounting said housing for bodily vibration, means within said housing dividing the interior thereof into two chambers connected by a restricted passageway, said dividing means including a pair of electrodes and a flexible member supporting said electrodes from said housing, each of said electrodes extending into a respective one of said chambers and being insulated from the wall of said housing in juxtaposition thereto, and comminuted resistance varying material in both of said chambers, said restricted passageway being of such cross section as to permit the passage of air and to preclude the passage of said comminuted resistance varying material.

4. A telephone transmitter comprising a diaphragm, a container coupled to said diaphragm for vibration therewith, a second diaphragm within said container and dividing the interior thereof into two chambers, one face of said diaphragm being electrically insulating and the wall of said container opposite said one face being electrically conductive, an electrode mounted upon said second diaphragm and facing said wall, said electrode having a restricted passageway therein extending between said two chambers, and comminuted resistance varying material in the chamber between said wall and said one face.

5. A telephone transmitter comprising a diaphragm, a spherical metallic container mounted by said diaphragm, a second diaphragm extending across said container and dividing the interior thereof into a pair of chambers, carbon granules in one of said chambers, and an electrode mounted on said second diaphragm, contacting said granules and insulated from the wall of said housing bounding said one chamber, said electrode having a restricted passageway therein extending between said pair of chambers.

6. A telephone transmitter comprising a diaphragm, a container coupled to said diaphragm for vibration therewith, said container including a pair of dished members having their open ends in juxtaposition, a second diaphragm extending between said ends and affixed thereto, and defining with said members a pair of chambers, an electrode mounted by said second diaphragm and facing the base of one of said dished members, said one member being electrically conductive and insulated from said electrode, and carbon granules in the chamber between said one member and said second diaphragm.

7. A telephone transmitter in accordance with

claim 6 comprising granular damping means for said second diaphragm in the other of said chambers.

8. A telephone transmitter comprising a diaphragm, a container coupled to said diaphragm for vibration therewith, said container including a pair of dished members having their open ends in juxtaposition, a second diaphragm extending between said ends and affixed thereto, and defining with said members a pair of chambers, said diaphragm being insulated from said container, a pair of electrodes on opposite sides of said diaphragm and mounted thereby, and fillings of carbon granules in both of said chambers.

9. A telephone transmitter comprising a diaphragm, a spherical air-tight container composed of two hemispherical nilvar members, a second diaphragm extending across said container and dividing the interior thereof into a pair of chambers, said second diaphragm being electrically conductive and insulated from one of said members, an electrode carried by said second diaphragm and facing said one member, and a carbon granule filling in the chamber between said electrode and said one member, said electrode having a restricted passageway therein defining an air coupling between said chambers.

10. A telephone transmitter comprising a metallic diaphragm having an insulating coating upon one face thereof, a pair of similar, aligned hemispherical members on opposite sides of said diaphragm and having their edges sealed in air-tight relation to said diaphragm, the hemispherical member opposite said coating being electrically conductive and defining a carbon granule chamber with said diaphragm, an electrode mounted by said diaphragm, electrically connected thereto and extending into said chamber, said electrode having a restricted passageway therein defining an air leak between opposite sides of said diaphragm, and means for vibrating the diaphragm-hemispherical member assembly in accordance with sound waves.

11. A telephone transmitter comprising a housing, means mounting said housing for bodily vibration, means within said housing dividing the interior thereof into two chambers connected by a restricted passageway, comminuted resistance varying material in one of said chambers, the wall of said housing bounding said one chamber being electrically conductive, and an electrode in said one chamber, insulated from said wall and vibratile relative to said housing, said restricted passageway being of such cross section as to permit the passage of air and to preclude the passage of said comminuted resistance varying material.

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