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TRANSMITTER CELL

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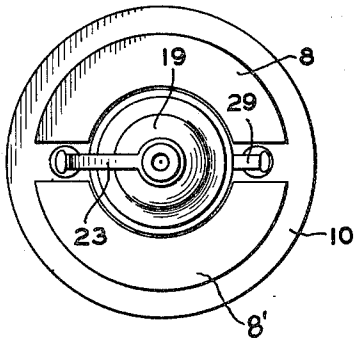

FIG. 2

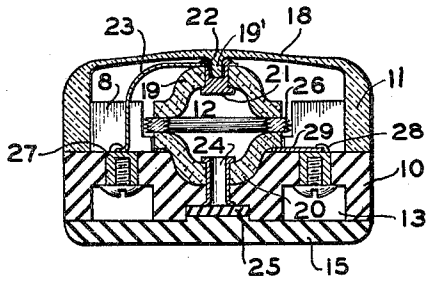

FIG. 1

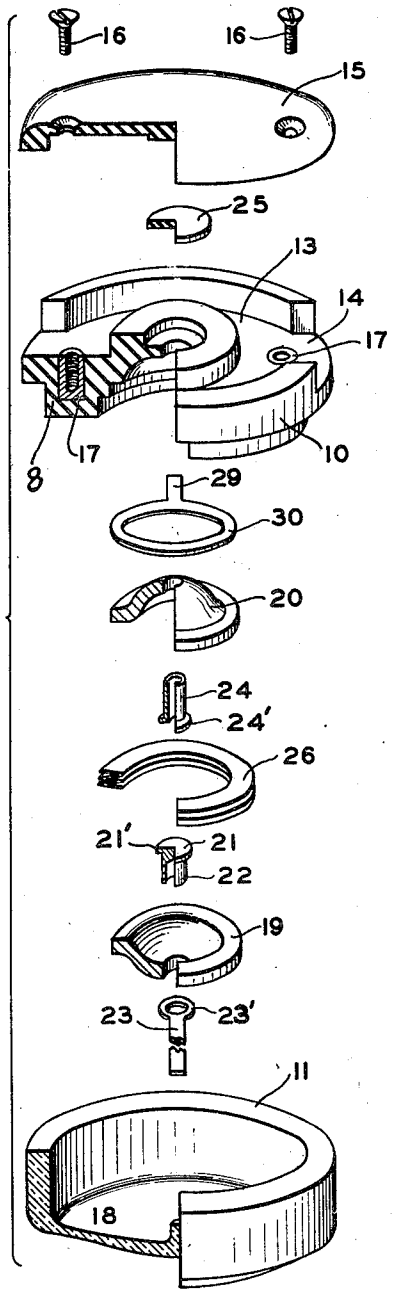

FIG. 3

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TRANSMITTER CELL

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3 Claims. (Cl. 179—122)

The present invention relates to transmitter cells and more particularly to cells of this character which are, in operation, responsive to received mechanical vibrations as contrasted to transmitter cells of conventional form which respond to sound waves transmitted thereto.

The type of transmitter cell noted, which usually comprises a vibratory structure including a diaphragm directly exposed to the mechanical vibrations representing the intelligence or speech to be transmitted, possesses certain desirable operating characteristics when used for the transmission of speech by wire or radio from an area in which the background noise is exceptionally high. One such application which readily suggests itself relates to the transmission of speech by radio from a radio transmitter carried in the cockpit of an airplane. When a microphone cell of this character is used for the transmission of speech, the vibratory diaphragm thereof is usually supported directly against the throat of the wearer or user so that it responds to the muscular vibration of the wearer's throat during speech. By this arrangement, the background noises are substantially eliminated and only the mechanical vibrations of the diaphragm caused by the speech of the user are transformed into electrical undulations for modulation on the carrier transmitted from the associated radio transmitting apparatus. Although possessing the advantages noted, the mechanically responsive transmitter cell has not been extensively used in applications of the type just referred to for the reason that the previously known cells of this form have not been characterized by any substantial degree of sensitivity, as regards the response characteristic thereof, and have been of a cumbersome and relatively expensive construction.

It is an object of the present invention, therefore, to provide an improved transmitter cell of the character briefly described above which is highly responsive to mechanical vibrations transmitted thereto and is of simple, economical, compact and rugged construction.

In general, the object as set forth above is attained in accordance with the present invention by providing a throat microphone cell comprising a base member, a cup-shaped member having its rim bonded to the surface of the base member by cement and including integral therewith a thin walled bottom portion adapted to function as a vibrating diaphragm responsive to the audio-frequency muscular vibrations of the throat of a wearer or user. Positioned between the bottom portion of the cup-shaped member and the base member is a structure for retaining therein a granulated carbon pile, which structure comprises a pair of rigid, cup-shaped electrodes, one of which is supported by the base member, and the other of which is oppositely disposed with respect to the first electrode and is connected to the bottom portion of the cup-shaped member for vibration therewith. This structure also includes a flexible member connecting the oppositely disposed rims of the two electrodes to complete the enclosure for the carbon pile. Various other improved features of the structure pertain to the construction and composition of the electrodes, the manner in which they are supported on or connected to their respective supporting members, the manner in which the diaphragm portion of the cup-shaped member is formed and the manner in which the cup-shaped member is secured to the base member.

The novel features believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the specification taken in connection with the accompanying drawing, in which Figure 1 is a cross sectional view illustrating a transmitter cell constructed and arranged in accordance with the present invention. Fig. 2 is a plan view of a portion of the cell shown in Fig. 1, and Fig. 3 is an exploded view illustrating the manner of assembling the elements of the cell as shown in Figs. 1 and 2.

Referring now to the drawing, there is illustrated a transmitter cell having embodied therein the features of the present invention as comprising a cylindrical base member 10 constructed of insulating material, a cup-shaped member 11, of circular contour and having an outer diameter equal to the outer diameter of the base member 10, and a structure indicated generally at 12 for retaining therein a granulated carbon pile, not shown. The bottom portion of the base member 10 is provided with an annular depression 13 which is adapted to accommodate the end of a flexible supporting member, not shown, forming a part of an improved microphone supporting assembly which is described and claimed in the present applicants' co-pending application S. N. 162,252, filed Sept. 3, 1937. The narrowed length of the flexible supporting member rests in a slot 14 extending from the depression 13 exteriorly of the base member 10. For the purpose of retaining the end of the flexible supporting mem-

ber within the depression 13, there is provided a cover plate 15 which is adapted to be mounted on the base member 10 by means comprising screws 16 threaded into metal inserts 17 molded into the base member 10.

The rim portion of the side wall of the cup-shaped member 11 is cut flat across so that the surface thereof engages at substantially all points thereof the upper flat sealing surface of the base member 10. Integral with and extending upwardly from the base member 10 are two oppositely disposed shoulders 8 and 8' having an outer contour which conforms to and engages with the inner surface of the side walls of the cup-shaped member 11. These shoulders provide support for the side walls of the cup-shaped member to prevent the same from being crushed during rough handling and thereby enhance the ruggedness of the cell. In accordance with one feature of the present invention, the surface of the rim of the member 11 and the inner wall surfaces thereof are secured to the oppositely disposed surfaces of the base member 10 by bonding the same thereto with cement. In this connection, it is pointed out that the word "cement" is used in a generic sense to denote any form of compound having the necessary adhesive qualities firmly to hold the member 11 secured to the base member 10. This method of attachment possesses distinct advantages in that it insures an extremely tight joint which prevents the entrance of foreign matter interiorly of the chamber formed between the members 10 and 11, it enhances the pleasing appearance of the cell, and it eliminates any possibility of the diaphragm, forming an integral portion of the member 11, being affected in its operation by the attachment of this member to the base member 10.

The cup-shaped member 11 is provided with a thin walled bottom portion or end wall 18 adapted to function as a vibrating diaphragm responsive to the audio-frequency muscular vibrations of the body of a user when the device is attached to the throat of a wearer or user. This portion 18 has extending inwardly therefrom a projection 19' forming a part of the connection between the diaphragm portion of the member 11 and one electrode of the structure 12. It has been found that the responsiveness of the cell is considerably enhanced by making the thickness of the bottom portion 18 the least at points displaced substantially from the center of this portion and approaching the side walls of the cup-shaped member 11 in the manner illustrated. In this connection, it is pointed out that the member 11 is preferably constructed of cellulose acetate material which, as is well known, is transparent in character. Such material is well suited for this particular use in that the ratio between its elasticity and mass is relatively high and it is thus possessed of the one characteristic which is highly desirable in a diaphragm material. Moreover, this material is practically indestructible when subjected to the handling accompanying ordinary usage of the cell.

The structure 12, as noted above, comprised a pair of cup-shaped electrodes 19 and 20, one of which is connected to the bottom portion 18 of the member 11 for vibration therewith, and the other of which is supported by the base member 10. More specifically, the electrode 19 is provided with an opening through which extends a metal insert piece 21 having a flange 21' engaging the inner surface of the electrode 19 and a walled portion 22 spun over at its upper edge to seat against a flexible circuit element 23 having an annular portion 23' encircling the walls of the insert piece 21 and seated on the upper portion of the electrode 19. Extending within the walls of the insert 21 is a projection which juts downward from the bottom or diaphragm portion 18 of the member 11. This projection is provided at its lower end with a flat surface which is bonded to the oppositely disposed flat surface forming the bottom of the walled portion 22 of the insert piece 21. Preferably, such bonding is accomplished through the use of cement or glue having the requisite adhesive qualities rigidly to secure the electrode 19 to the portion 18 of the member 11 for vibration therewith. The oppositely disposed electrode 20 is seated in a depression provided in the central portion of the base member 10 and conforming in contour to the contour of the outer surface of the electrode. This last-mentioned electrode, like the electrode 19, is provided with an opening coinciding with an opening formed in the center of the base member 10 and is secured to the base member by means comprising a hollow metal insert piece 24 extending through the coincidental openings noted. This insert piece 24 is provided with a flange 24' which abuts the surface adjacent the upper edge of the opening in the electrode 20 and the edge of the opposite end thereof is spun over to engage the surface adjacent the lower edge of the opening in the member 10. The opening through the insert piece 24 serves for the introduction of granulated carbon into the enclosure formed by the two oppositely disposed electrodes 19 and 20. This opening is plugged by a cap 25 seated in a circular depression axially coincident with the opening in the insert piece 24 and clamped in position by a projection of circular contour integral with and extending from the bottom plate 15. The structure 12 is completed by the provision of a flexible member 26 constructed of paper or like material and having a number of reversely folded sections so constructed as to form a bellows having its opposite edges cemented to the oppositely disposed rims of the electrodes 19 and 20. By this arrangement, the vibratory structure including the bottom portion 18 of the member 11 and the electrode 19 is left free to vibrate in accordance with the mechanical vibrations impressed thereon, thereby to vary the resistance of the carbon pile enclosed within the structure 12 without an excessive amount of damping.

Each of the two electrodes 19 and 20 is preferably constructed of a compressed mixture of granulated carbon and a suitable binder material. As thus formed, the electrodes are not susceptible of permanent distortion due to mechanical forces impressed thereon during rough handling. Moreover, the carbon constituent of the electrodes enhances the electrical contact between each of the electrodes and the granulated carbon in the carbon pile, thus improving the electrical characteristics of the cell.

The circuit conductor 23 terminating at the electrode 19 is connected to a metal insert piece 27 molded in the base member 10, which insert piece forms one of the terminals of the cell. Similarly, the stationary electrode 20 is connected, by means comprising a conductor element 29, to an insert piece 28 molded into the base member 10. The element 29 is provided with an annular portion 30 which encircles the electrode 20 and is clamped between the outer

edges of this electrode and the oppositely disposed surface of the base member 10.

In assembling the cell, as described above, the electrode 20 is first positioned in its accommodating depression provided in the base member 10, with the annular portion 30 of the conductor element 29 encircling the same, following which the metal insert piece 24 is extended through the coincident openings provided in this electrode and the base member 10. The inserted leading edge of the insert piece 24 is then spun over, thereby rigidly to secure the electrode 20 and the element 29 in position. Thereafter, one edge of the flexible member 26 is cemented to the rim of the electrode 20. The insert piece 21, the electrode 19, and the conductor 23 are assembled in a similar manner by first inserting the metal insert piece 21 through the accommodating opening provided in the electrode 19 and the circular opening in the conductor element 23, and then spinning over the edge of the walled portion 22 of this piece. With the last-mentioned assembly operation performed, the remaining exposed edge of the flexible member 26 is cemented to the rim of the electrode 19 and the two conductors 23 and 29 are soldered to the respective terminal insert pieces 27 and 28. In order to cement or bond the projection 19' to the bottom of the walled portion 22 of the insert piece 21, a tool is inserted through the opening in the insert piece 24 and placed against the flanged end of the insert 21. Thus, the flat surface of the projection 19' may be pressed firmly against the engaging surface of the insert 21 until the cement provided for bonding these two elements together has completely set. Also, the flat rim surface of the member 11 is cemented or bonded to the flat surface of the base member 10 in order to provide a seal therebetween. Thus, a transmitter cell is provided which is not only thoroughly reliable in operation but is of extremely rugged construction.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is contemplated to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

We claim:

1. A transmitter cell comprising, in combination, a base member provided with a sealing surface, a one-piece cup-shaped member including a side wall provided with a rim bonded to the sealing surface of said base member by cementing and a thin end wall adapted to function as a vibrating diaphragm responsive to the audiofrequency muscular vibrations of the body of a wearer, the thickness of the end wall of said cup-shaped member decreasing gradually toward the side wall thereof and being the least at points displaced from the center thereof and approaching the side wall of said cup-shaped member, and a structure positioned between the end wall of said cup-shaped member and said base member for retaining therein a granulated carbon pile, said structure including an electrode supported by said base member, and an electrode connected to the end wall of said cup-shaped member for vibration therewith.

2. A transmitter cell comprising, in combination, a base member provided with a sealing surface, a cup-shaped member including a side wall provided with a rim secured and sealed to the sealing surface of said base member, said cup-shaped member having a thin end wall provided with a continuous outer surface and adapted to function as a vibrating diaphragm responsive to the audiofrequency muscular vibration of the body of a wearer, the end wall of said cup-shaped member carrying an integral and inwardly extending projection substantially at the center thereof, and a structure positioned between the end wall of said cup-shaped member and said base member for retaining therein a granulated carbon pile, said structure including an electrode supported by said base member, a second electrode having an opening therein, and an insert piece extending through said opening, said insert piece having a flange abutting the inner surface of said second electrode and a hollow walled portion spun over the outer edge of said opening, the projection carried by the end wall of said cup-shaped member being arranged within the hollowed portion of said insert piece and being bonded to said insert piece by cement, thereby to connect said second electrode to the end wall of said cup-shaped member for vibration therewith.

3. A transmitter cell comprising, in combination, a base member, a cup-shaped member having its rim bonded to the surface of said base member by cement, said cup-shaped member having a thin walled bottom portion adapted to function as a vibrating diaphragm responsive to the audio-frequency muscular vibration of the body of a wearer, the bottom portion of said cup-shaped member having an inwardly extending projection substantially at the center thereof, said base member having an opening therein, and a structure positioned between the bottom portion of said cup-shaped member and said base member for retaining therein a granulated carbon pile, said structure including a pair of electrodes, said electrodes each having an opening therein and being composed of a compressed mixture of granulated carbon and a binder material, a hollow metal insert piece extending through the opening in said base member and the opening in one of said electrodes, said insert piece having a flange at one edge and being spun over at its other edge to secure said one electrode to said base member, the opening in said insert piece serving for the introduction of granulated carbon into said structure, and a second metal insert piece extending through the opening in the second of said electrodes, said second insert piece having a flange abutting the inner surface of said second electrode and a walled portion spun over the outer edge of the opening through which it extends, said projection extending within the walled portion of said second insert piece and being bonded thereto by cement, thereby to connect said second electrode to the bottom portion of said cup-shaped member for vibration therewith.

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