Jan. 7, 1958 I. HELLER 2,819,351

MICROPHONE

Filed July 21, 1955

Fig. 1

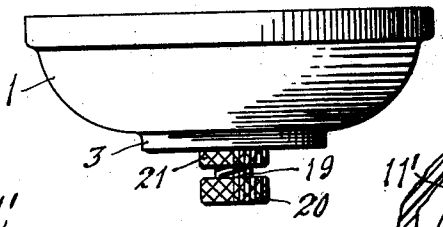


Fig. 6

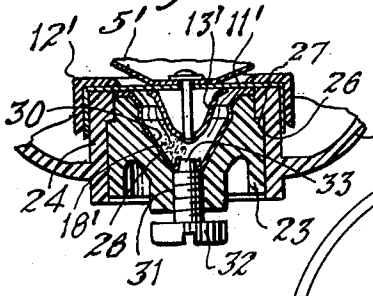


Fig. 2

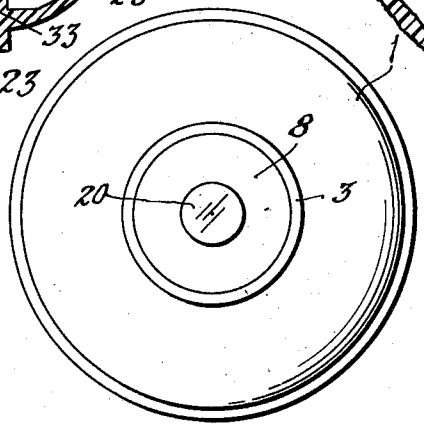


Fig. 7

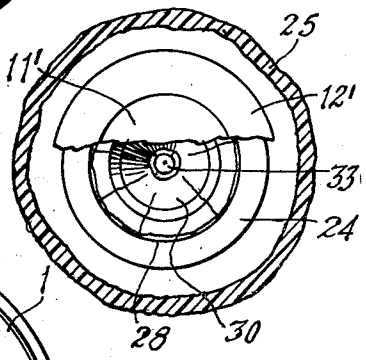


Fig. 4

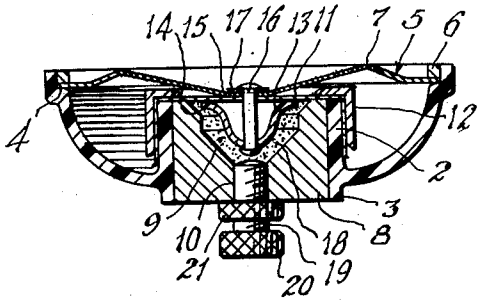


Fig. 5

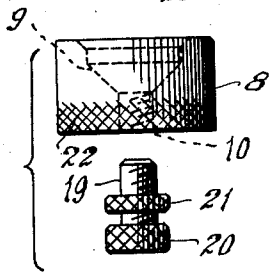
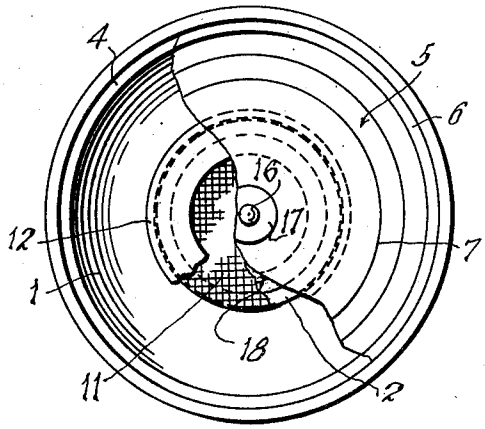


Fig. 3



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MICROPHONE

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9 Claims. (Cl. 179—122)

This invention relates to microphones and more particularly to a new and useful improvement in a carbon granule type microphone.

One object of the present invention is to provide a novel and improved construction and combination of a diaphragm, a one piece housing of electrical insulating material and a combined electrode and container for granulated carbon whereby carbon granules can be inserted into and removed from the microphone from the rear thereof and said container and electrode can be easily and quickly removed from the housing without disturbing the diaphragm.

Another object of the invention is to provide in a microphone of this character, which includes a sheet silk closure for the chamber that contains the granulated carbon, novel and improved means for easily and quickly securing the sheet silk closure in the housing.

It is another object of the invention to provide in such a microphone, a novel and improved vibratile electrode and simple and inexpensive means for securing together said vibratile electrode, said silk sheet and said diaphragm.

Another object is to provide a microphone that shall comprise a one-piece housing of electrical insulating material, and a stationary electrode that shall include a separate cup of insulating material inserted into the casing and having a cup-shaped lining of metallic foil possessing a highly conductive electroplated inner surface, separably inserted into the plastic cup to hold the carbon granules.

A further object is to provide such a microphones which shall be simple in construction, extremely sensitive, faithful in reproducing speech sounds throughout a wide range of angular positions which the microphone may assume during operation, and which can be manufactured and sold at low cost.

For a further comprehension of the invention and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

Figure 1 is a side elevational view of a microphone embodying my invention.

Figure 2 is a bottom plan view thereof.

Figure 3 is a top plan view thereof, parts being broken away.

Figure 4 is a vertical sectional view of the microphone taken through the center thereof.

Figure 5 is a disassembled view of the fixed electrode and associated adjusting screw.

Figure 6 is a fragmentary sectional view similar to Figure 4 showing a modification of the stationary electrode, with portions of the diaphragm and of the casing omitted.

Figure 7 is a top plan view of the parts illustrated in Figure 6 with portions broken away and other portions omitted.

Referring in detail to the drawings, a microphone made in accordance with the invention is shown in Figure 1 and comprises a bowl-shaped supporting frame 1 formed of suitable insulating material such as synthetic plastic electrical insulating material. The frame is formed preferably integrally with a cylindrical tubular hub portion 2, open at both ends and protruding below the bottom of the bowl body, constituting an annular flange 3. The flaring top end of the frame is formed with an inner shoulder 4 constituting a supporting surface.

A main vibrating diaphragm 5 for receiving the sound vibrations is seated at its periphery on the shoulder 4 and is clamped in place by a clamping ring 6. The diaphragm 5 may be of a lightweight metal, such as aluminum or thin Duralumin, and is corrugated as indicated at 7.

A stationary or fixed electrode which may be of brass is fitted in the tubular hub portion 2 of the frame and comprises a solid cylindrical member 8, with its inner end flush with the inner edge of the hub portion and with its outer end flush with the outer edge of the flange 3. The inner end of the electrode is dished out in the form of a substantially frusto-conical-shaped chamber 9, the chamber opening at its larger end through the inner end of the electrode. At its inner smaller end, the chamber communicates with a screw-threaded passage 10 leading outwardly of the outer end of the electrode. The inner surface of chamber 9 is preferably gold plated to enhance the conductivity thereof.

A closure member in the form of a flexible silk sheet 11 is stretched over the inner edge of the tubular hub portion 2 and over the inner end of the electrode 8 thereby sealing the chamber 9 in the electrode and serving as an auxiliary diaphragm. The silk closure member has a fullness overlying the outer surface of the hub portion 2 of the frame 1 and is clamped in position by a flanged ring 12 preferably of plastic material.

A metallic electrode having a generally frusto-conical body portion 13 having a convexly curved top and a slightly out-turned curved base 14, is disposed in the center of the chamber 9 of the fixed electrode 8. The frusto-conical body portion 13 is fixed to the central depressed portion 15 of the main diaphragm 5 by means of a rivet 16, the rivet extending through aligned openings in the closure member 11 and diaphragm 5. A washer 17 is interposed between the diaphragm 5 and the outer upset head of the rivet. The outer surface of the frusto-conical body portion 13 of the vibratile electrode is preferably gold plated. The silk closure member 11 is clamped at its center between the main diaphragm 5 and the base 14 of the vibratile electrode.

A quantity of a comminuted resistance-varying material such as carbon granules 18 is inserted through the passage 10 in the fixed electrode 8 and is packed in and substantially fills the chamber 9 bounded by the fixed and vibratile electrodes and the silk closure member 11. Vibrations of the main diaphragm 5 are communicated to the comminuted material and the resistance between the electrodes 8 and 13 is thereby varied. The passage 10 in the bottom of the fixed electrode 8 through which the carbon granules are introduced is closed by an adjusting screw 19 having a knurled head constituting a finger piece 20. A knurled lock nut 21 is provided on the screw for clampingly connecting a conductor (not shown) to the screw between the electrode 8 and the nut 21. By moving the screw, the compactness of the mass of carbon granules may be adjusted.

When the microphone is in operation, the current flow takes place over the following path: from the conductor attached to the screw 19 to said screw, then from the screw to the fixed electrode 8, then from the inside sur-

face of electrode 8 through the carbon granules 18, then to the frusto-conical shaped surface of electrode 13, and through the rivet 16 to the diaphragm 5 to which the other conductor (not shown) of the circuit is attached.

The formation of the chamber 9 in fixed electrode 8 in cooperation with the frusto-conical electrode 13 serves to retain the mass of carbon granules in substantially uniform arrangement and compactness between the vibratile electrode 13 and the fixed electrode 8 and so to maintain a high degree of uniform action of the comminuted carbon granules in varying the current flow in response to diaphragm movements, in whatever position the microphone may be placed.

In addition to the formation of the chamber serving to properly maintain the comminuted carbon granules in uniform arrangement and compactness, the frusto-conical formation of the electrode 13 provides an advantageous and effective movable contact for accurately conveying to the compressible carbon mass the varying pressure effects derived from diaphragm movements.

It will be seen that the brass cylinder constituting the fixed electrode 8 may be readily withdrawn from the tubular hub portion 2 of the frame by manually pulling on the screw 19, the finger piece 20 serving as a handle for this purpose, leaving the remaining elements of the microphone undisturbed, and in position for ready disassembly if desired. The outer surface of the cylinder 8 may be roughened as indicated at 22 to hold it in place.

A modification of the stationary electrode is shown in Figures 6 and 7 where the electrode comprises a cup 23 of electro-insulating material that is nicely fitted into the tubular hub portion 24 of the housing or frame 25. Preferably the cup and the inner wall of the hub portion 24 have the respective abutting shoulders 26 and 27 to limit the insertion of the cup into the hub portion. The inner end of the cup has a frusto-conical shaped chamber 28, the open end of which is flared at 29, and seated in the chamber 28 is a lining 30 of metallic foil that preferably has an electroplated highly conductive concave inner surface to contact with the carbon granules (not shown) in the same manner in which the granules 18 contact the wall of the chamber 9 in the construction shown in Figure 4. The foil lining 30 may initially comprise a flat circular sheet or disk of foil which may be laid over the open end of the chamber 28 and then pressed into the chamber to bring the foil into close contact with the walls of the chamber, the foil being folded or pleated to permit the sheet to be deformed into the concave cup-like shape. The auxiliary silk diaphragm 11' is stretched over the edge of the hub portion 24 and secured by the flanged ring 12' in the same maner that the auxiliary diaphragm 11 is secured by the flange ring 12.

At the bottom of the chamber 28 and coaxial therewith is an opening 31 that opens through the end of the plastic cup, and into this opening is screwed a self-tapping screw 32 which has a reduced inner end 33 that normally is snugly disposed in an opening punched in the bottom of the lining 30 so as to provide an electrical contact between the screw and the lining and to permit the screw to be used in the same manner as the screw 19 for connecting the stationary electrode in a circuit.

The plastic cup 23 may be tightly frictionally fitted in the hub portion 24 but preferably is secured by adhesive, and the cup-shaped lining 30 is clamped between the screw 32 and the auxiliary diaphragm 11'. The carbon granules may be inserted through the opening 31 and lightly clamped between the auxiliary diaphragm 11' and the inner end 33 of the screw 32.

While I have illustrated and described the preferred embodiment of my invention, it will be understood that changes in details of construction might be made within the principle and scope of the invention and I desire therefore to be limited only by the state of the prior art and the appended claims.

Having thus described the invention, what I claim as new and desire to secure by United States Letters Patent is:

1. A microphone comprising a one piece frame open at its front and rear ends, a diaphragm secured upon the front end of the frame, a combined stationary electrode and container for granulated carbon removably fitted into the rear end of said frame and having a concave inner end portion, a non-conductive flexible auxiliary diaphragm secured on said frame in overlying relation to said concave inner end and providing a chamber, granulated carbon in said chamber, a vibratile electrode disposed in said chamber in contact with said granulated carbon and comprising a hollow generally frusto-conical body having a convex curved end extending into the concave end of said combined stationary electrode and container, and a fastening member passing through and rigidly connecting said vibratile electrode, said auxiliary diaphragm and said diaphragm.

2. A microphone comprising an insulating bowl-shaped frame with a tubular hub portion, a main metallic diaphragm clamped to the outer edge of said frame, an electrically conductive cylindrical member in said hub portion constituting a fixed electrode, said cylindrical member having a dished-out chamber at its inner end, an auxiliary non-conductive flexible diaphragm sealing the inner end of the chamber, means of connection between said auxiliary diaphragm and said main diaphragm, a frusto-conical shaped electrode in said chamber connected to both of said diaphragms, and carbon granules in the chamber between said electrodes.

3. A microphone comprising an insulating bowl-shaped frame with a tubular hub portion open at both ends, a main metallic diaphragm clamped to the outer edge of said frame, an electrically conductive cylindrical member in said hub portion constituting a fixed electrode, said cylindrical member having a dished-out chamber at its inner end and having a central passage at its outer end communicating with said chamber, carbon granules in the chamber between said electrodes, an auxiliary non-conductive flexible diaphragm of silk sealing the inner end of the chamber, means of connection between said auxiliary diaphragm and said main diaphragm, a frusto-conical shaped electrode in said chamber connected to both of said diaphragms, and means for plugging the passage leading to said chamber.

4. A microphone comprising an insulating bowl-shaped frame with a tubular hub portion open at both ends, a main metallic diaphragm clamped to the outer edge of said frame, an electrically conductive cylindrical member in said hub portion constituting a fixed electrode, said cylindrical member having a dished-out chamber at its inner end and having a central passage at its outer end communicating with said chamber, carbon granules in the chamber between said electrodes, an auxiliary non-conductive flexible diaphragm of silk sealing the inner end of the chamber, means of connection between said auxiliary diaphragm and said main diaphragm, a frusto-conical shaped electrode in said chamber connected to both of said diaphragms, and a screw plugging said passage, said screw having a protruding head for clamping a conductor to the fixed electrode.

5. A microphone comprising an insulating bowl-shaped frame with a tubular hub portion open at both ends, a main metallic diaphragm clamped to the outer edge of said frame, an electrically conductive cylindrical member in said hub portion constituting a fixed electrode, said cylindrical member having a dished-out chamber at its inner end, an auxiliary non-conductive flexible diaphragm stretched across the inner end of said chamber and over the inner end edge of said hub portion, means of connection between said auxiliary diaphragm and said main diaphragm, a frusto-conical shaped electrode in said chamber connected to both of said diaphragms, carbon granules in the chamber between said electrodes, and a flanged ring clamped over said auxil-

iary diaphragm for securing same in place on the fixed electrode and hub portion.

6. A microphone comprising an insulating bowl-shaped frame with a tubular hub portion open at both ends, a main metallic diaphragm clamped to the outer top end edge of said frame, an electrically conductive cylindrical member removably mounted in said hub portion through the open bottom end thereof, said cylindrical member constituting a fixed electrode, said cylindrical member having a dished-out chamber at its inner end, an auxiliary non-conductive flexible diaphragm sealing the inner end of the chamber, means of connection between said auxiliary diaphragm and said main diaphragm, a frusto-conical shaped electrode in said chamber connected to both of said diaphragms, carbon granules in the chamber between said electrodes, a portion of the outer surface of said cylindrical member being roughened, said cylindrical member having a bottom passage leading to said chamber, and a screw plugging said passage, said screw having a protruding head serving as a finger piece for ready withdrawal of the cylindrical member.

7. A microphone as defined in claim 1 wherein the combined stationary electrode and container comprises a cup of insulating material and a separate lining of metallic foil in said cup.

8. A microphone as defined in claim 7 wherein said cup has a coaxial opening and a screw threaded into said

opening with its inner end in direct electrical contact with said lining.

9. A microphone comprising a one piece frame open at its front and rear ends, a diaphragm secured upon the front end of the frame, a combined stationary electrode and container for granulated carbon removably fitted into the rear end of said frame and having a concave inner end portion, a non-conductive flexible auxiliary diaphragm secured on said frame in overlying relation to said concave inner end and providing a chamber, granulated carbon in said chamber, a vibratile electrode disposed in said chamber in contact with said granulated carbon at the side of said auxiliary diaphragm opposite said diaphragm, and a fastening member connected to the center of said vibratile electrode and passing through said diaphragm and said auxiliary diaphragm and rigidly connecting together said vibratile electrode, said auxiliary diaphragm and said diaphragm.

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