Dec. 27, 1938. A. E. SWICKARD 2,141,420

ACOUSTIC DEVICE

Filed July 28, 1936

FIG. 1

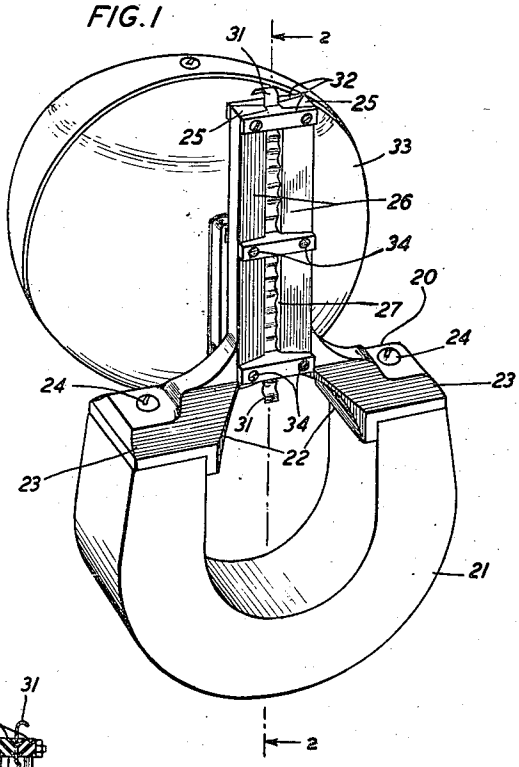
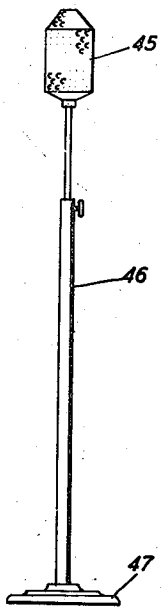


FIG. 4



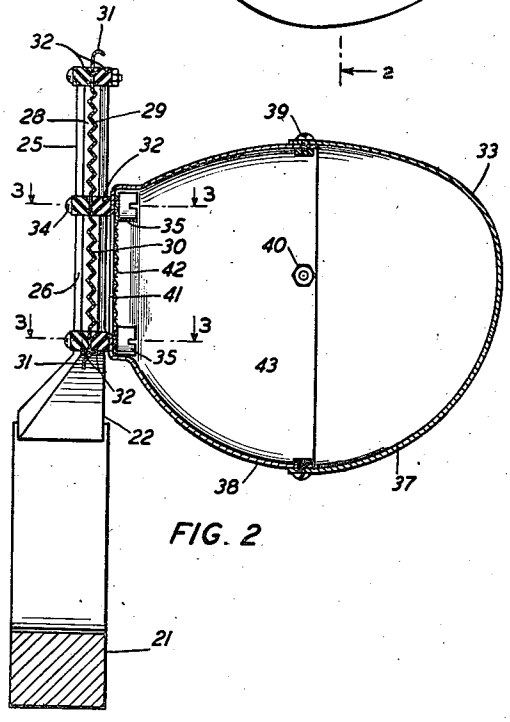
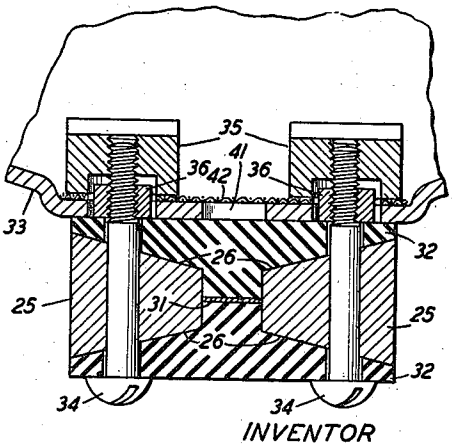


FIG. 2

FIG. 3



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ACOUSTIC DEVICE

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5 Claims. (Cl. 179—115.5)

This invention relates to acoustic devices, and, more particularly, to a microphone or transmitter of the conductive ribbon diaphragm type.

An object of the invention is to improve the structure and operating characteristics of microphones.

A feature of the invention comprises providing a microphone with a diaphragm having plurality of portions, one of which is responsive to the velocity component and another to the pressure component of incident sound waves, one side of one portion being isolated from sound waves.

Another feature comprises isolating one side of a portion of the diaphragm by providing an enclosure defining an air chamber thereadjacent.

Still another feature comprises so shaping the enclosure that the effects of diffraction about the enclosure are minimized.

A further feature comprises providing acoustic damping on the enclosed side of the diaphragm, preferably of such value that mechanical impedance of the diaphragm portion is negligible compared to the acoustic resistance of the damping over the entire frequency range, and the acoustic impedance of the air chamber stiffness is comparably small at the low freqencies.

Other and further features will be evident from the descriptive matter which follows.

A more complete understanding of this invention will be obtained from the detailed description which follows, taken in conjunction with the appended drawing, wherein:

Fig. 1 is a view in perspective of an acoustic device embodying the invention;

Fig. 2 is a cross-sectional view of the device of Fig. 1 taken along the line 2—2 thereof;

Fig. 3 is a cross-sectional view, taken along the line 3—3 of Fig. 2 of a fragment of the device of Fig. 1; and

Fig. 4 is a front elevational view of a housing and support for the device of Fig. 1.

The acoustic device of the drawing is a ribbon type microphone, designated generally as 20, comprising a horseshoe or U-shaped permanent magnet 21, for example, of cobalt steel, and a pair of pole-pieces 22, for example, of magnetic iron, secured by flange portions 23 and screws 24 to the ends of the magnet, and having straight, elongated, magnetic air-gap defining portions 25 having lateral surfaces 26 converging to provide the air-gap 27. A conductive ribbon diaphragm 28, preferably transversely corrugated, about .2 mil in thickness, and of a high-strength, lightweight material, such as aluminum alloy or duralumin, is positioned in the air-gap. The diaphragm is divided into two sections 29, 30 and is secured near its ends 31 and at its mid-portion by clamping members 32 of insulating material. The section 29 is exposed on its opposite sides to the atmosphere and to sound waves; it is adapted and intended to respond to the velocity component of the incident sound waves. The section 30, however, is exposed on one side only to incident sound waves, its other side being enclosed; it is adapted and intended to respond to the pressure component of the sound waves. One side of section 30 is enclosed by a hollow container or enclosure 33, preferably streamlined and substantially oval-shaped. The container is secured in place by the screws 34 and nuts 35, the screws 34 and nuts 36 also clamping together the pole-pieces and the insulating blocks. The container is in two portions 37, 38 to form the chamber 43, secured together by suitable fastening means, such as screws 39 and nuts 40, and has an elongated slot or opening 41 adjacent one or the rear side of the pressure component section of the diaphragm. An acoustic resistance 42, preferably silk fabric having substantially the characteristic impedance of air, extends across this opening, being held in position by the nuts 35.

If a combination comprising a pair of ribbon diaphragms, or a ribbon diaphragm having two sections, one ribbon or section being responsive to the velocity component and the other to the pressure component, is to operate as a unidirectional microphone, the motion of the pressure component ribbon or section should be in phase with the sound field pressure. The ribbon or section is not responsive to the pressure component unless one side is enclosed, as shown, so that no sound waves are incident thereon. Damping, in the form of the silk fabric, must be introduced in series with the pressure component section to ensure that the mechanical impedance of that ribbon section is negligible compared to the damping resistance, or the proper phase relationship does not result. The volume of the chamber provided by the container must be so large that the acoustic impedance of the air chamber stiffness is small at the lower frequencies as compared to the acoustic resistance of the damping material. In a device constructed in accordance with this invention, the chamber volume was about fifteen cubic inches. The streamlining of the container minimizes the effect of sound diffraction about the microphone.

The acoustic device 20 may be enclosed in a

perforated housing or case 45 supported at the upper end of a pedestal 46 rising from a floor or table base member 47.

While this invention has been disclosed with reference to a single embodiment, it will be understood that it is not specific thereto, but is to be considered as limited only by the scope of the appended claims.

What is claimed is:

1. A microphone having a ribbon diaphragm, one section of which is responsive to the velocity component of a sound wave, means for rendering another section of the diaphragm responsive to the pressure component of said wave, said means comprising an ovate hollow container enclosing one side of said other diaphragm section and providing an air chamber thereadjacent, and a fabric acoustic screen disposed adjacent the closed side of said other diaphragm section and completely across the entrance to said container.

2. A microphone comprising pole-pieces spaced apart to define an elongated air-gap, a conductive ribbon diaphragm disposed in said air-gap, means for securing said diaphragm at its ends and intermediate portion whereby the diaphragm is divided into two sections, one section being responsive to the velocity component of an incident sound wave, ovate hollow means enclosing one side of the other section and having an opening thereadjacent, and a layer of acoustic resistance fabric disposed entirely across said opening and spaced from said diaphragm.

3. A microphone comprising a conductive ribbon diaphragm, spaced pole-pieces defining an air-gap in which said diaphragm is positioned, clamping blocks of insulating material on opposite sides and at each end of said pole-pieces and diaphragm, an enclosure for one side of said diaphragm having an opening adjacent the diaphragm and defining an air chamber on said one side, fabric acoustic resistance means disposed across the entire opening and spaced from said diaphragm, and means for clamping together said pole-pieces, diaphragm, insulating blocks and enclosure.

4. A microphone comprising a conductive ribbon diaphragm, pole-pieces defining an air-gap for said diaphragm, means defining an air chamber enclosing one side of said diaphragm and having an opening adjacent said diaphragm, and fabric acoustic resistance means disposed entirely across said opening and spaced from said diaphragm.

5. A microphone comprising a conductive ribbon diaphragm, pole-pieces defining an air-gap for said diaphragm, means defining an ovate air chamber enclosing one side of said diaphragm and having an opening adjacent said diaphragm, and fabric acoustic resistance means disposed across said opening and spaced from said diaphragm, the mechanical impedance of the diaphragm being negligible compared to the damping resistance of said acoustic resistance means, and the air chamber volume being so large that the acoustic impedance of the air chamber stiffness is small even at the low frequencies compared to the damping resistance.

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