United States Patent [19]

Yamamuro et al.

[11] **3,828,144**

[45] **Aug. 6, 1974**

[54] **VIBRATION ABSORBING SUPPORT FOR LOUDSPEAKER VOICE COIL BOBBIN**

[75] Inventors: **Isao Yamamuro; Akio Obuchi,** both of Tokorozawa, Japan

[73] Assignee: **Pioneer Electronic Corporation,** Tokyo, Japan

[22] Filed: **June 14, 1973**

[21] Appl. No.: **370,107**

[30] **Foreign Application Priority Data**

June 20, 1972 Japan 47-72178

[52] **U.S. Cl. . 179/115.5 VC,** 179/115.5 R, 179/180

[51] **Int. Cl.** **H04r 9/04**

[58] **Field of Search** ..... 179/115.5 R, 115.5 VC, 179/180; 181/31 R, 32 A

[56] **References Cited**

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Primary Examiner—Kathleen H. Claffy
Assistant Examiner—Thomas L. Kundert
Attorney, Agent, or Firm—Sughrue, Rothwell, Mion, Zinn & Macpeak

[57] **ABSTRACT**

The suspension wires extending tangentially to the outer periphery of the coil bobbin which is positioned within a cylindrical air gap of the magnetic circuit of a loudspeaker partially defined by an annular magnetic plate forming a portion of that circuit and a cylindrical pole centered within the plate, are fixed at their outer end to the magnetic plate and are fixed at their inner end to the periphery of the bobbin by vibration absorbing members. The vibration absorbing members may comprise silicone rubber blocks having grooved outer surfaces to receive ends of the wires.

8 Claims, 3 Drawing Figures

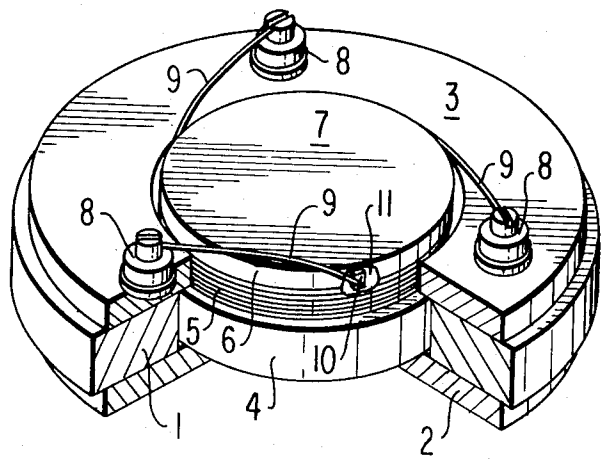
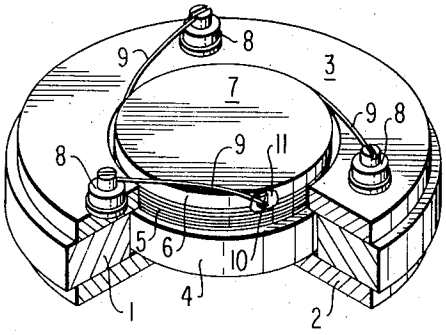


FIG. 1



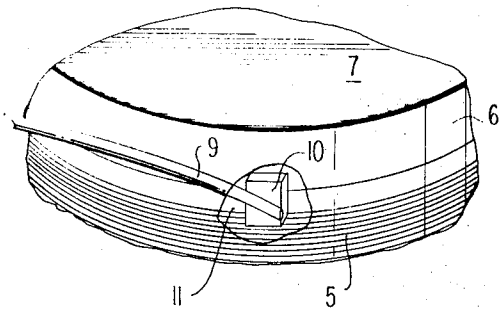


FIG. 2

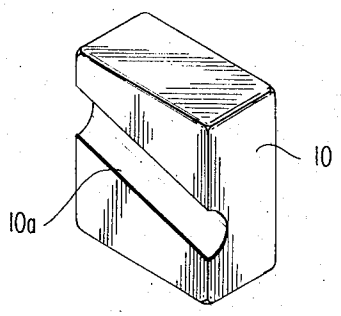


FIG. 3

VIBRATION ABSORBING SUPPORT FOR LOUDSPEAKER VOICE COIL BOBBIN

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to loudspeakers of the type wherein a voice coil bobbin having a voice coil wound about the bobbin periphery is suspended within a cylindrical air gap formed within the magnetic circuit, and more particularly, where the voice coil bobbin is suspended by a plurality of suspension wires which extend tangentially to the periphery of the bobbin and are coupled at one end to the bobbin periphery and at the other end to a stationary element of the magnetic circuit.

SUMMARY OF THE INVENTION

The present invention provides a loudspeaker in the form of an improved structure which insures no interference between the inherent vibrations of the suspension wires themselves and the vibration of the voice coil bobbin which is driven by an applied electrical signal current to the voice coil and in which the loudspeaker is characterized by superior sound reproduction.

In a preferred form, the loudspeaker which includes a cylindrical bobbin having a voice coil wound about its periphery and which is suspended within a cylindrical air gap of the loudspeaker magnetic circuit by means of a plurality of suspension wires extending in circumferentially spaced fashion tangentially to the outer periphery of the bobbin and each fixed at their inner end to the periphery of the bobbin and at their outer end to a fixed magnetic member partially forming the magnetic circuit and the air gap, is characterized by a vibration absorbing member which fixes the inner end of each wire to the bobbin periphery. Preferably, the vibration absorbing member comprises a resilient block formed of silicone rubber or the like and is provided on its outer face with a groove which in turn receives the inner end of the wire. The block may be adhesively affixed to the periphery of the bobbin and the wire in turn adhesively affixed to the grooved surface.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view, partially cut away, of a loudspeaker incorporating the wire suspension means of the present invention in one form.

FIG. **2** is an enlarged perspective view of a segment of the loudspeaker illustrated in FIG. **1** showing in greater detail the wire suspension means of the present invention.

FIG. **3** is an enlarged perspective view of a silicone rubber block employed as a vibration absorbing member in the suspension system for the loudspeaker bobbin of FIGS. **1** and **2.**

DESCRIPTION OF THE PREFERRED EMBODIMENT

In explaining the illustrated embodiment of the present invention in accordance with the drawings, particularly in FIG. **1,** an annular magnet **1** is provided with a discal yoke **2** secured to one end face of the magnet and is further provided with an annular plate **3** secured on the opposite end face of the magnet. A columnar pole **4** is secured to yoke **2** so as to define with plate **3,** an annular air gap of predetermined width between its peripheral surface and the inner periphery of plate **3.**

The magnetic circuit is therefore formed by magnet **1,** yoke **2,** annular plate **3** and columnar pole **4.**

About the upper end portion of pole **4** is concentrically disposed a cylindrical voice coil bobbin **6,** within the air gap, the bobbin **6** carrying a voice coil **5** wound about its periphery. The cylindrical assembly consisting of the bobbin **6** and the voice coil **5** has an inner diameter slightly larger than the diameter of the pole **4** and an outer diameter slightly smaller than the inner periphery of the plate **3** and is disposed within the air gap so as to be able to move freely in the axial direction, between pole **4** and plate **3.** A dome shaped diaphragm **7** is attached to the front end of bobbin **6,** that is, the end of the bobbin **6** which is remote from yoke **2.**

Further, on the upper surface of plate **3,** a plurality of terminals **8** (in the illustrated embodiment, the number is three) are secured thereto. Respective terminals **8** are circumferentially distributed and positioned concentric with respect to the axis of pole **4** and with a certain circumferential spacing between respective terminals. One end of the suspension wires **9** are respectively fixed to the terminals **8.**

Each suspension wire is made of a material having high resiliency such as beryllium-copper alloy. The suspension wires **9** extend in a tangential direction relative to the outer periphery of the bobbin **6,** inwardly from terminals **8.**

The present invention is directed to fixing the inner ends of the suspension wires **9** to vibration absorbing members **10** which, in turn, are attached to the periphery of bobbin **6** as shown in greater detail in FIG. **2.** The vibration absorbing members **10** which are in the form of blocks are preferably made of a suitable viscous resilient material such as silicone rubber as best seen in FIG. **3,** each member or block **10** is provided with a long, and inclined, groove **10***a* on the face of the silicone rubber block opposite that contacting the periphery of bobbin **6.** The groove **10** is so formed and positioned that its supports the inner end of its suspension wire **9** at a preset position, and each suspension wire **9** is fixed to its vibration absorbing member or block **10** and, in turn, the vibration absorbing member or block **10** is fixed to the bobbin **6** by a suitable adhesive. Preferably, the end of the suspension wire **9** and the complete mass of the vibration absorbing member or block **10** may be covered with a layer of suitable vibration absorbing material such as silicone rubber so as to completely embed the end portions of wires **9** in the vicinity of their point of attachment to the periphery of bobbin **6.**

In FIGS. **1** and **2,** the mass or layer of silicone rubber which covers block **10** and the end of wire **9** is illustrated at **11.**

In the loudspeaker constructed as above, the bobbin **6** forms one vibrating system and the suspension wires **9** form another vibrating system and are coupled to each other in such a state as to be insulated in relation to vibrations of high frequency. Therefore, especially where the vibration is so high in frequency as to cause the suspension wires **9** to resonate, vibration components resulting from bobbin **6** being driven with an applied electrical signal current, hardly transmits such vibration to the suspension wires **9** and thus there results little deterioration in the sound characteristics which normally would result from resonance of the suspension wires **9** as a result of applied electrical signals to the coil **5** and it is especially noted to remarkable de-

cline in the distortion ratio and high frequency sound range when the vibration absorbing arrangement of the present invention is employed.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention

What is claimed is:

1. In a loudspeaker including a cylindrical bobbin having a voice coil wound about its periphery and being suspended within a cylindrical air gap of the loudspeaker magnetic circuit by means of a plurality of suspension wires extending in circumferentially spaced fashion, tangentially to the outer periphery of the bobbin and each being fixed at its inner end to the bobbin and at its outer end, to a fixed magnetic member partially forming the magnetic circuit, the improvement comprising: vibration absorbing members respectively fixing the inner ends of said suspension wires to said bobbin periphery.

2. The loudspeaker as claimed in claim **1,** wherein said vibration absorbing members comprise blocks of viscous resilient material.

3. The loudspeaker as claimed in claim **2,** wherein said blocks are adhesively fixed to the periphery of the bobbin and the wires are adhesively fixed to the outer surface of the block.

4. The loudspeaker as claimed in claim **3,** wherein the surface of the blocks facing away from the bobbin are grooved, and the inner ends of the wires are received within said grooves to preset the bobbin within said air gap.

5. The loudspeaker as claimed in claim **1,** wherein the inner ends of the wires and the vibration absorbing members are embedded in an additional layer of vibration absorbing material.

6. The loudspeaker as claimed in claim **4,** wherein the inner ends of the wires and the vibration absorbing members are embedded in an additional layer of vibration absorbing material.

7. The loudspeaker as claimed in claim **5,** wherein said layer of vibration absorbing material comprises silicone rubber.

8. Th loudspeaker as claimed in claim **6,** wherein said block and said additional layer of vibration absorbing material comprises silicone rubber.

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