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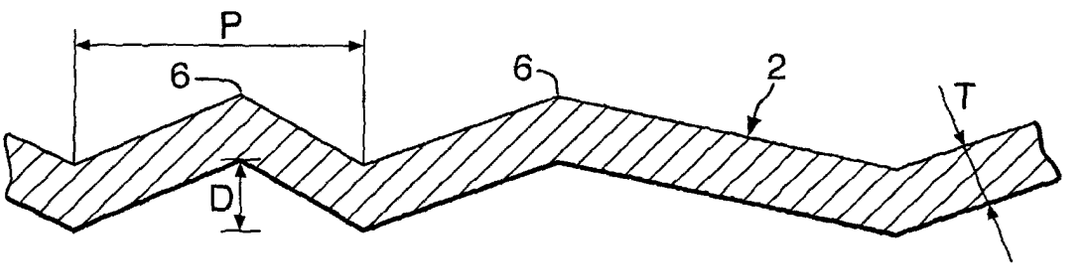
(54) Membrane for optical microphone/sensor

(57) A membrane (2) for an optical microphone/sensor comprises a film of a selected thickness. The film (2) has crinkles forming ripples (6) on at least one of its surfaces, the depths and pitches of the ripples being in the order of the thickness of the film.

Fig.2.



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Description

[0001] The present invention relates to microphones and sensors, and more particularly, to membranes for optical microphone/sensors.

Background of the Invention

[0002] Optical microphone/sensors of the type according to the present invention consist of a source of light transmitted through a light guide for illuminating a membrane moving under acoustic pressure or otherwise, the membrane reflecting light impinging thereon into a light guide leading to a photo detector for transforming the reflected light energy into electrical signals.

[0003] The membrane is one of the main elements of the microphone/sensor. It constitutes an interface between the two different media of acoustics and light. It makes a connection between sound and light, and the better this connection is, the better are the results, and the better and more reliable is the microphone/sensor over a wide range of environmental conditions.

[0004] With a change of ambient temperatures, the position and/or stretching of a membrane may change; consequently, its mechanical characteristics, such as sensitivity at different frequencies and its own resonance, may also be changed. There are different known ways of overcoming the dependence of a membrane's mechanical characteristics on temperature. One of these is to produce and use a pre-tensioned membrane which is initially tightened so that its position almost does not change; however, its resonance characteristics do change with temperature, but are still within the desired range.

[0005] Another way to produce a membrane which is reliable at different conditions of temperature is to use a membrane having a specific regulating spring, usually at its periphery. The spring compensates for all changes in the membrane's size and tension resulting from changes in temperature. This method is used in dynamic microphones, in load speakers, and recently also in silicon microphones.

[0006] The above-mentioned methods of membrane compensation, however, have drawbacks. Pre-tensioning leads to the production of very tight membranes having low-sensitivity. The use of specific regulating springs involves very complex, difficult and expensive production processes for producing membranes with very specific forms or configurations.

Disclosure of the Invention

[0007] It is therefore a broad object of the present invention to provide an optical microphone/sensor that operates reliably under a wide range of environmental conditions.

[0008] It is a further object of the present invention to provide a membrane for an optical microphone which is less sensitive to changes in ambient temperature.

[0009] The invention therefore provides a membrane for an optical microphone/sensor, comprising a film of a selected thickness, having crinkles forming ripples on at least one of its surfaces, the depths and pitches of said ripples being in the order of the thickness of said film.

Brief Description of the Drawings

[0010] The invention will now be described in connection with certain preferred embodiments with reference to the following illustrative figures so that it may be more fully understood.

[0011] With specific reference now to the figures in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of the preferred embodiments of the present invention only, and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the invention. In this regard, no attempt is made to show structural details of the invention in more detail than is necessary for a fundamental understanding of the invention, the description taken with the drawings making apparent to those skilled in the art how the several forms of the invention may be embodied in practice.

[0012] In the drawings:

Fig. 1 is a cross-sectional view of a membrane according to the present invention, mounted on a ring;
Fig. 2 is an enlarged cross-sectional portion of the membrane, and
Fig. 3 is a magnified microscopic photograph of the surface of a membrane according to the present invention.

Detailed Description

[0013] There is shown in Fig. 1 a cross-section of the membrane 2 as mounted on a ring 4. The membrane is made of a metal, e.g., aluminum, nickel or titanium, film stretched over and attached to the ring 4 made of the same metallic material. The thickness *T* of the film may be from 0.1-10 μ, or even less.

[0014] Fig. 2 illustrates an enlarged portion of membrane 2 in cross-section, while Fig. 3 shows a magnified, microsopic photograph of the surface of such a membrane. The surface of membrane 2 is crinkled, having random ripples 6. The depths *D* and pitches *P* of the ripples 6 are in the order of the range of membrane thickness *T*. The crinkled surface of the membrane functions as a two-dimensional, random spring, and easily compensates for temperature-affected changes in membrane size. At the same time, the production of the membrane is simple and of low cost.

[0015] To make the surface of membrane 2 act as a real, two-dimensional random spring, the sizes of the

ripples, their depth and their pitch have to be in the same order of range as the membrane thickness *T*. At the same time, the size of the random ripples has to be smaller than the light spot impinging on the membrane, so as to prevent the undesirable modulation of the intensity of the light reflected by the random ripples of the membrane surface. As the light spot on the membrane is in the order of 100-1000 μ, the ripple size of 0.1-10 μ, will neither essentially change nor modulate the intensity of the reflected light.

[0016] It will be evident to those skilled in the art that the invention is not limited to the details of the foregoing illustrated embodiments and that the present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

Claims

1. A membrane for an optical microphone/sensor, comprising a film of a selected thickness, having crinkles forming ripples on at least one of its surfaces, the depths and pitches of said ripples being in the order of the thickness of said film.

2. The membrane as claimed in claim 1, said ripples being distributed on said surface at random.

3. The membrane as claimed in claim 1, the thickness of said film being between 0.1-10 μ.

4. The membrane as claimed in claim 1, further comprising a ring to which said membrane is attached along its peripheral edge.

5. The membrane as claimed in claim 1, wherein said film is made of metal.

6. The membrane as claimed in claim 4, wherein said ring is made of metal.

Fig.1.

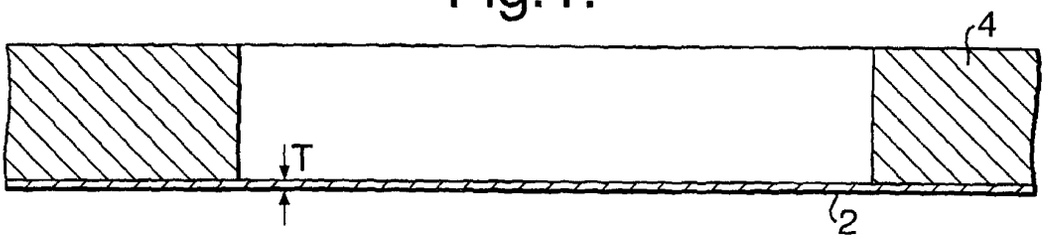


Fig.2.

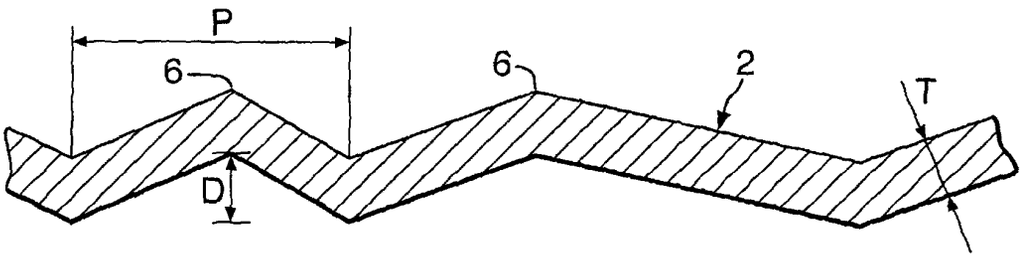
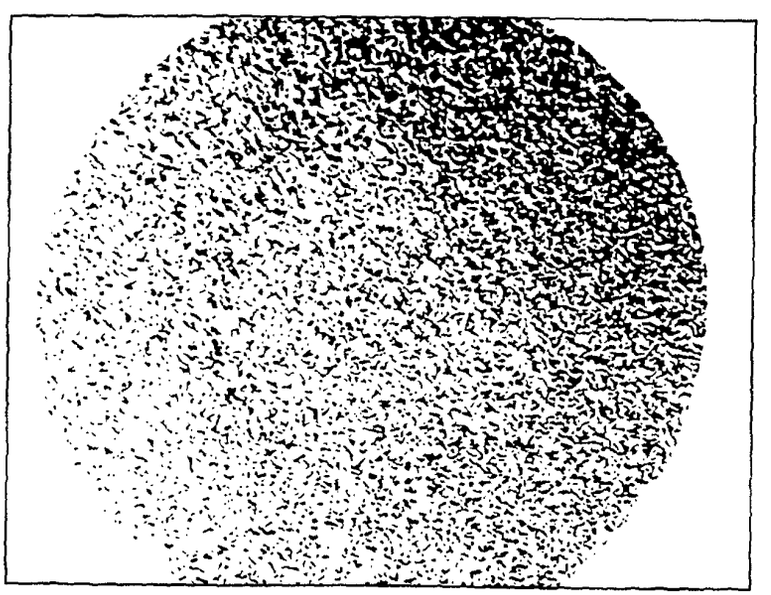


Fig.3.



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EUROPEAN SEARCH REPORT

Application Number
EP 01 30 2813

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

H04R
G01L
H01R
F16J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	6 September 2001	Ramboer, P

CATEGORY OF CITED DOCUMENTS

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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06-09-2001

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82