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(54) Benævnelse: **Ringformet membran til elektro-akustisk højtaler**

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Description

Field of the Invention

[0001] The present invention relates to an electro-acoustical loudspeaker.

Background of the Invention

[0002] Electro-acoustical loudspeakers are widely used and traditionally comprise a chassis in which a driver and a membrane are arranged. The driver is typically a magnetic system defining an air gap, in which air gap the magnets have been arranged such that a magnetic flux will be present across the gap. By having a voice coil connected to the membrane and arranging set voice coil in the air gap and furthermore connecting the coil to an amplifier, the current in the coil will be influenced by the magnetic field in the gap and thereby move up and down depending on the direction of the current in the coil.

[0003] The voice coil is traditionally connected to the membrane such that, as the voice coil moves back and forth in the air gap, the membrane will move accordingly and thereby create the sound.

[0004] From US 2001/0010725 A1 an electroacoustic transducer is known , where a moving coil is mounted in a mounting zone to a diaphragm of the transducer, the diaphragm having projections in the mounting zone, whereby in an interspace between two projections two stabilizing walls are arranged.

[0005] From JP 2006041783 is a speaker system known comprising a membrane consisting of two dome shaped annulus arranged coaxially. The coil is attached to the connection between the inner and outer annulus and arranged in an air gap in the driver motor. The centre portion of the inner annulus is fastened to an upper portion of the loudspeaker driver motor. As the coil moves up and down in the airgap, sound will emit from the surface of the membrane. The emission direction will be substantially perpendicular to the surface of the membrane, in each point on the membrane. In action the inner annulus will thereby emit sound (waves) towards the center from the portions of the membrane being angled towards the central portion of the membrane. Theses sound waves will instantly interfere with sound waves deriving from the same membrane part diametrically opposite on the membrane. This interference will cause a certain degree of distortion in the resulting "sound picture".

Object of the Invention

[0006] A number of suggestions in the art of how to make membranes with improved characteristics are suggested and among these are also a number of ring shaped membranes having two or more dome-shaped annulus arranged concentrically around a central portion, see discussion above. These particular embodiments are designed in order to provide the possibility for higher sound pressure, better distribution meaning more even and more realistic sound distribution utilizing a larger membrane surface area within a smaller space. In a number of these prior art constructions, they have been provided with a sound plug centrally in the membrane in order to fasten the membrane to the chassis centrally. Furthermore, the design of the plug has been carried out in a number of different manners in order to avoid disturbances and/or interference in the response of the membrane and the sound emitted by the membrane. It is however a drawback of these constructions that the plug in the centre takes away part of the effective membrane area and thereby, part of the ability of the loudspeaker construction to emit sound. Membranes using plugs, become less sensible whereby, an altogether relatively larger membrane area is needed in order to reproduce the sound satisfactory. This in turn creates new problems in that larger membranes tends to distort, wobble and/or be prone to intemal wave propagation, which are phenomena detrimental to the quality of the sound.

Description of the Invention

[0007] It is therefore an object of the present invention to provide an electro-acoustical loudspeaker according to claim 1, which alleviates drawbacks of prior art ring dome constructions having a centrally arranged plug.

[0008] According to the invention the central portion of the membrane is fastened to the tower by means of an adhesive and the tower is provided with a cavity, which cavity is at least partly filled with an adhesive, thereby connecting the central portion of the membrane to the tower. The adhesive may optionally retain elastic or resilient properties during its service life.

[0009] In this manner the fastening of the membrane to the tower is carried out such that no concentration of forces and thereby tension in the membrane is present. Furthermore, by having the adhesive provided with resilient or elastic properties, the adhesive as such is also an important member in dampening the moving membrane whereby any distortion or wobbling in the membrane, which could arise, will be dampened by the adhesive in the cavity. As furthermore, the adhesive is arranged on the backside of the membrane relative to the sound admitting surface, the adhesive as such will have no influence on the sound emitting properties of loudspeaker incorporation such a membrane, and thereby the membrane's characteristics as explained above will be maintained free of interference from the fastenings.

[0010] The plane as defined above is traditionally the plane in which the chassis of the loudspeaker construction will be placed. As the sound is generated by the membrane, the tower, to which the central portion of the membrane is fastened, does not interfere with the sound generation of the present invention. By furthermore fastening a central portion of the membrane to the tower, without having a plug interfering with the central portion

just in front of the membrane, the sound is free to be emitted from the entire surface of the membrane. For steeper angles a problem of interference would arise but due to the shallow angels used within the present invention in the interval 0° to 40° the interference problems are avoided and at the same time a relatively large effective area radiating sound is provided. Traditionally it is desirable to provide as much membrane surface perpendicular to the direction into which it is desirable to radiate the sound but once the membrane becomes too flat undesirable effects will arise in the membrane such as for example wobbling, distortion, resonances and the like having a detrimental effect on the sound reproducing properties of such a membrane.

[0011] With the present invention, however, it has been found that by providing annular shaped ring segments concentrically arranged around a central axis of symmetry where the angles between the membrane material and the plane discussed above which is typically the plane where the membrane is fastened to the chassis, is in the interval 0° to 40°, a very advantageous construction is achieved in that a relatively large and effective membrane area is provided in relation to the prior art devices such that a higher efficiency may be achieved with a smaller area and thereby with a more compacted construction.

[0012] Tests have indicated that the membrane construction according to the present invention in relation to prior art devices has an efficiency which is 3 to 5dB more than the traditional membranes. Furthermore, the sound distribution due to the lack of the plug in the centre portion of the membrane is greatly improved as compared to prior art devices. In a further advantageous embodiment of the invention the voice coil is attached to the membrane and preferably the voice coil is attached in a point coinciding with the lowest point between the two innermost annular dome-shaped annulus. In this manner the voice coil is fastened to the strongest point of the membrane for transferral of the mechanical forces arising from the movement of the voice coil in the air cap as discussed above. It is therefore possible to transfer relatively large forces to the ring-shaped membrane's annuluses even at the shallow angles according to the invention, providing for the enlarged effective membrane area such that in addition to a better sound reproduction with no or negligible sound interference the effectiveness of the membrane as such is also greatly improved due to the voice coil arrangements in the relatively strong section of the membrane, where the forces may be evenly distributed to the two concentrically arranged dome-shaped annulus.

[0013] By furthermore, as set out in a further advantageous embodiment of the invention, designing the adhesive such that it has a certain viscosity and thereby predesigning the mechanical dampening properties of the membrane the choice of adhesive may actually be chosen such that it is possible to adjust the mechanical dampening properties of the membrane by adjusting the viscosity of the adhesive. Typically adhesives containing long polymers are preferred, in that their elastic properties will remain even when exposed to extended mechanical action as is the case for loudspeakers of this type. The person skilled in the art will know how to modify the adhesives in a manner in order to obtain the desired viscosity.

[0014] In a manner exhibiting comparable advantages as stated above the membrane in a further advantageous embodiment is provided with a V-shaped portion along and immediate adjacent the outer periphery, which V-shaped portion is received in a reservoir either provided in the surround or in the chassis, which reservoir connects with the membrane by means of an adhesive.

[0015] As an example not falling under the scope of the claims, an alternative to fastening the membrane by means of an adhesive is an embodiment wherein the central portion of the membrane is fastened to the tower by means of fastening member, having a head portion and a stem, where said stem penetrates the membrane and is fastened to the tower, and where said head has a size maintaining the membrane in contact with said tower. The head portion of the fastening member shall be designed such that it does not interfere with the admission of sound which is to say that the head portion should be relatively shallow and not have a size substantially larger than the cross section of the tower in connection with the membrane.

[0016] The relatively shallow design of the membrane, in the direction in which the membrane extends along the axis of symmetry in combination with the dome-shaped annulus and central fastening, provides for a very stable construction such that the voice coil in the air gap does not exhibit much play, whereby the air gap may be optimised whereby thereby the magnetic field in the air gap is increased, whereby the membrane as such may be persistent to higher power output.

Description of the Drawing

[0017] The invention will now be described with reference to the accompanying drawing wherein Figure 1 illustrates a cross section of a membrane according to the invention and Figure 2 illustrates a detailed view of the fastening of the membrane centrally to the tower.

[0018] Turning to Figure 1, the membrane 1 comprises two dome-shaped annulus 2,3 arranged concentrically one inside the other. Along the outer most periphery, adjacent the outer dome-shaped annulus 3 is provided a flange 4 which is suitable in a traditional way to be fastened to a surround and thereafter to a loudspeaker chassis. Between the two concentrically arranged dome-shaped annulus 2,3 is a valley 5 defining the lowest point between the two innermost annual dome-shaped annulus 2,3. A voice coil cylinder 6 carrying a voice coil 7 is attached in this point. As the voice coil cylinder moves up and down in response to the direction change of the current in the voice coil, when arranged in a magnetic

field, the forces will be distributed in the ring segments of the dome-shaped annulus 2, 3 without wasting energy in bending the membrane, but most of the energy will be used in moving the dome-shaped annulus back and forth thereby emitting sound.

[0019] Centrally, a central portion 8 of the membrane is fastened to a tower 9, which tower again is fastened to a loudspeaker driver construction (not illustrated). The fastening of the central portion 8 to the tower 9 will be explained with reference to Figure 2 below.

[0020] The membrane 1 is symmetrical around an axis of symmetry 10 going through the central portion 8 of the membrane. An imaginary plane 11 arranged perpendicular to the imaginary axis of symmetry 10 will be referred to in order to explain the detailed properties of the membrane 1. Along the periphery i.e. inside the flange 4 the outermost dome-shaped annulus is arranged at an angle of no more than 40° in relation to the imaginary plane 11 as illustrated by the angle a.

[0021] Turning to Figure 2 the detailed fastening arrangement of the central portion 8 to the tower 9 is illustrated. The angle a between the imaginary plane 11 and the inner dome- shaped annulus 2 is to be arranged in the interval including 0° to 40°. In the particular embodiment the angle a is approximately 30°, which has proven to be a desirable compromise in that the strength that the dome-shaped annulus in relation to the effective membrane area is relatively high, such that a very good efficiency with very low distortion is achieved.

[0022] The tower is furthermore in this embodiment provided with a cavity 12 which in order to fasten the membrane 2 to the tower 9 may be filled with an adhesive (not illustrated). The adhesive may be selected having an appropriate viscosity such that the adhesive will exhibit elastic or resilient properties which in turn will act as a dampener on the membrane therefore in addition to fastening the central portion 8 of the membrane to the top of the tower 9 the fastening will also exhibit dampening properties. The dampening properties will not interfere with the membrane's ability to emit sound and as such in contradiction to other ring-shaped or dome-shaped membranes implementing a plug with the construction with a cavity in the top of the tower not influence the effective membrane area significantly.

P A T E N T K R A V

1. Elektro-akustisk højttaler, omfattende en ringformet membran (1), et randelement, en højttalerdriver, et tårn (9) og en svingspolecylinder (6) bærende en svingspole (7), hvor membranen (1) omfatter to eller flere kuppelformede ringelementer (2, 3) koncentrisk arrangeret omkring en central del (8) af membranen (1), gennem hvilken en imaginær symmetriakse passerer, hvor en ydre periferi af membranen (1) er fastgjort til randelementet; hvor den centrale del (8) af membranen (1) er fastgjort til tårnet (9), som igen er fastgjort til højttalerdriveren, hvor en vinkel mellem et plan, der er vinkelret på symmetriaksen, og en fastgørelse af membranen (1) til randelementet og til tårnet (9) er i intervallet 0° til 40°, mest fortrinsvis omkring 30°, hvor den centrale del (8) af membranen (1) er fastgjort til tårnet (9) ved hjælp af et klæbemiddel, hvor tårnet (9) er forsynet med et hulrum, som mindst delvist er fyldt med klæbemidlet og derved forbinder membranen (1) til tårnet (9) ved den centrale del (8) af membranen (1).

2. Elektro-akustisk højttaler ifølge krav 1, hvor svingspolen (7) er fastgjort til membranen (1), og hvor svingspolen (7) fortrinsvis er fastgjort sammenfaldende med det laveste punkt mellem de to inderste ringformede, kuppelformede ringelementer (2, 3).

3. Elektro-akustisk højttaler ifølge krav 1, hvor membranen (1) langs med og umiddelbart tilgrænsende den ydre periferi er forsynet med en V-formet del, som modtages i et reservoir, der enten er tilvejebragt i randelementet eller i chassiset, hvilket reservoir er i forbindelse med membranen ved hjælp af et klæbemiddel.

4. Elektro-akustisk højttaler ifølge krav 1 til 3, hvor klæbemidlet er udformet til at have en vis viskositet, således at de mekaniske dæmpningsegenskaber af membranen (1) kan justeres ved at justere viskositeten.

5. Elektro-akustisk højttaler ifølge ethvert af de foregående krav, hvor klæbemidlet er et skum.

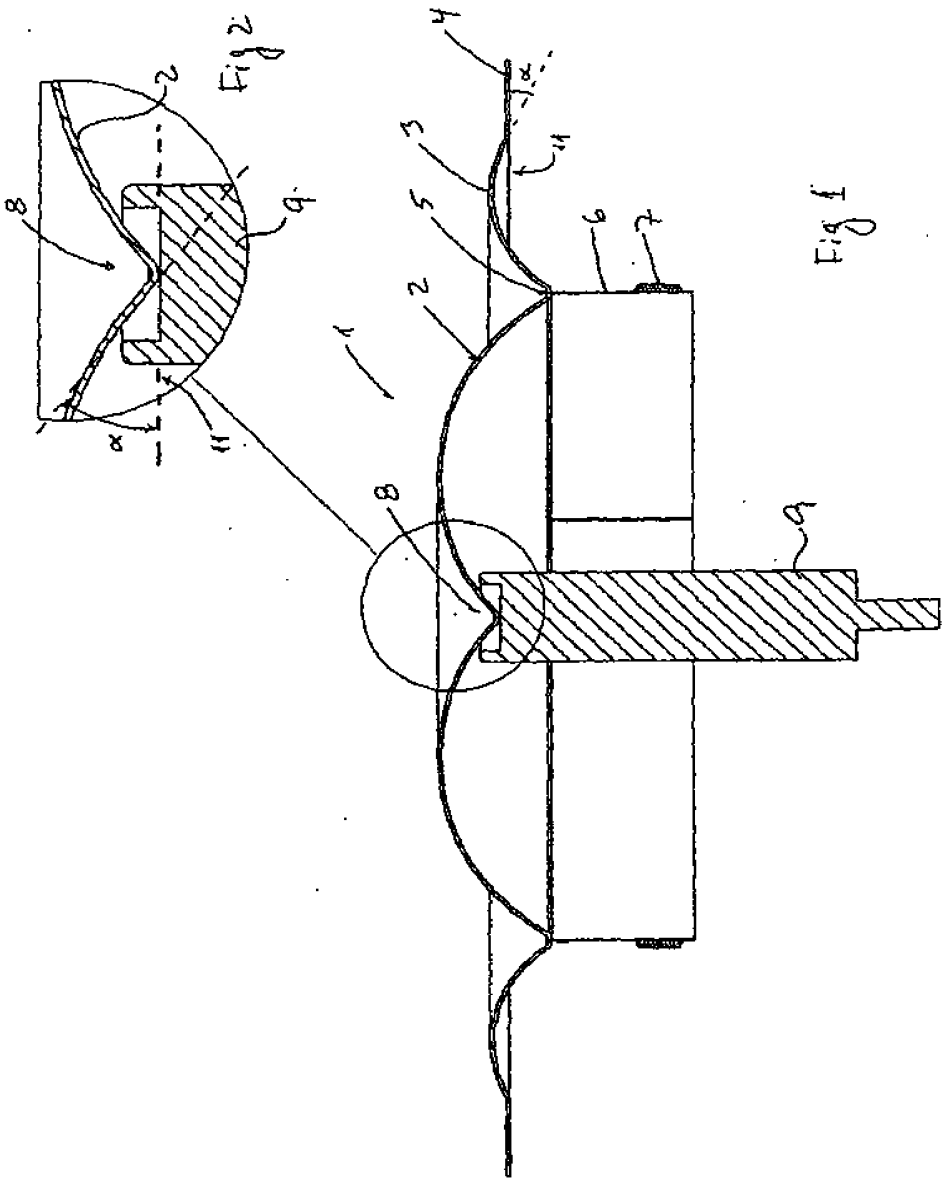
Fig 2
Fig 1
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