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APPARATUS FOR DEFORMING THIN DIAPHRAGMS

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Fig. 1.

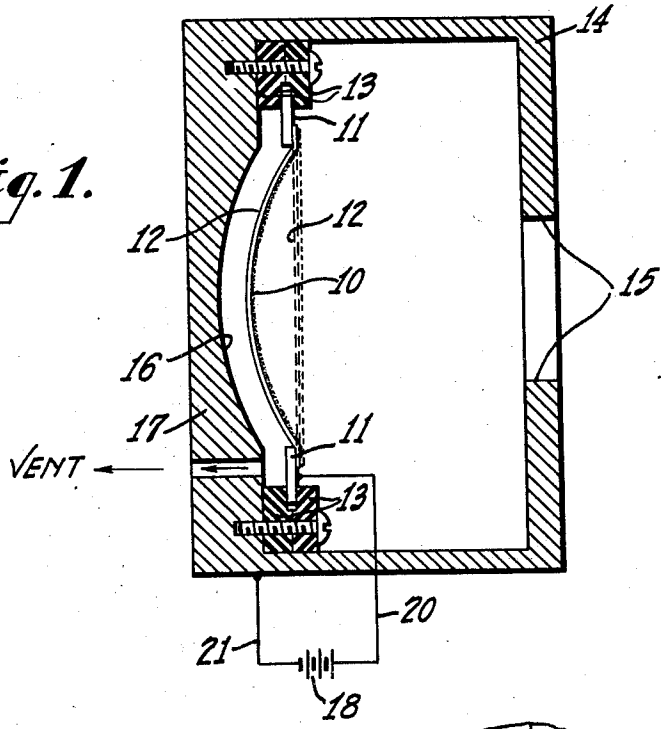
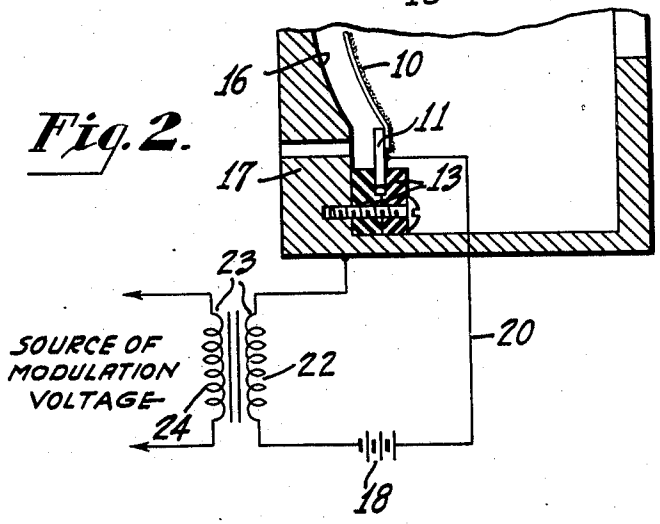


Fig. 2.



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APPARATUS FOR DEFORMING THIN DIAPHRAGMS

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5 Claims. (Cl. 88—74)

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The present invention relates to the formation of diaphragms and more particularly to the deforming of extremely thin films.

An object of the invention is to provide an improved apparatus for shaping thin diaphragms or films.

Another object of the invention is to provide an improved apparatus for producing a thin diaphragm having a shape conforming to the contour of a selected shape.

A further object of the invention is to provide means for causing a thin diaphragm to vary in shape in accordance with variations of radiant energy.

Further objects will appear hereinafter.

In the accompanying drawing, Fig. 1 represents a sectional elevation of an apparatus embodying one form of the present invention; and Fig. 2 represents a detail embodying a modification of the invention.

Referring to the drawing, diaphragm 10 is of the extremely thin membranous type, such as may be formed by the flotation process. For example, it may be made of a cellulose derivative which is incorporated into a solution sufficiently plastic to prevent breakage and containing an ingredient to minimize the effects of humidity. Where the use contemplates a heat-responsive property, a material having a very high coefficient of expansion may be used as its base. Preferably, also, the solution is impregnated with a dye which renders the completed diaphragm opaque to heat radiation. In forming the diaphragm, an annular gasket 11 is mounted horizontally at the bottom of a container and completely covered with distilled water. A few drops of the foregoing solution are deposited upon the surface of the water and the solution spreads entirely across the surface of the water in the form of a film which is then allowed to dry sufficiently to resist movement. When thus dried, the water level is gradually and carefully lowered so that the film seats upon the gasket 11 and is then marginally affixed thereto. The film is thus framed in a substantial manner and dries completely, becoming very tight and exhibiting considerable elasticity when stretched or deformed. In the present instance, the diaphragm is coated on one side with an evaporated extremely thin layer 12 of a metallic nature forming a good conductor of electricity. In some instances, this film may be an aluminum coating to serve as a mirror for observation by means of an optical system.

In accordance with the present invention, the

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framed diaphragm 10 is mounted in a ring clamp 13 of insulating material fastened to the inner walls of a hollow metal body 14 so that the diaphragm extends transversely thereof as indicated in dotted lines. One side of the body 14 is provided with a sight opening 15, which is coaxial with respect to the diaphragm 10, while the inner face 16 of the opposite wall 17 of the body 14 is formed of the predetermined contour which it is desired the diaphragm shall assume. In this instance, and by way of example, this contour is part of a sphere but may be of other configuration. As assembled, the diaphragm 10 locates the metal layer 12 in relatively close proximity to the face 16 but spaced sufficiently therefrom as to prevent the maximum movement of the diaphragm from bringing the metal layer 12 into contact with the face 16.

For causing the desired deformation of the diaphragm, it is biased toward the face 16 by utilizing the layer 12 and the face 16 as terminals respectively of an electric circuit having a source of voltage 18, and conductors 20 and 21, the conductor 20 being connected to the layer 12 and the conductor 21 being connected to the body 14. When the circuit is closed, the potential difference at the terminals 12 and 16 will bias the diaphragm 10 toward the face 16 and result in its assuming a counterpart of the selected configuration and thus serve as a datum position.

While in the foregoing the diaphragm is shaped in accordance with a predetermined contour, the invention can also be used to reproduce diaphragm deformations corresponding to variations of radiant energy. Thus, by inserting the secondary 22 of a transformer 23 in series with the circuit upon which the voltage 18 is impressed, and including the primary 24 of the transformer 23 in a circuit having a source of electrical vibrations which have been transformed from modulated waves of radiant energy from a heat, light or electrical source. The current of the circuit, including the terminals 12 and 16, is thus modulated in accordance with variations of the source energy and thereby deforms the diaphragm 10 in a corresponding manner. Where the layer 12 is a mirror, these deformations can be visibly detected by a suitable optical system focussed upon the diaphragm 10 by way of the sight opening 15.

It will now be apparent that a novel unitary device has been devised wherein a diaphragm is caused to be deformed in a predetermined manner to conform to a selected shape or may be deformed in incremental areas in accordance with

modulations impressed upon a control voltage. The deformation of the diaphragm is due to the static force acting thereon by difference of potential and is effective to the end desired provided the elastic limit of the diaphragm is not exceeded. In other words, the radius of any selected curvature must be below the elastic limit of the membranous diaphragm.

Having thus described my invention, I claim:

1. In a device of the character stated, a hollow body having a metal wall of predetermined concave shape to form one terminal of an electrical circuit, a membranous diaphragm stretched transversely in said body in spaced relation to said wall, means associated with said diaphragm to form the second terminal of said circuit, and a source of current in said circuit for causing a difference of potential between said terminals, whereby said diaphragm is biased to assume said predetermined shape as a datum position.

2. In a device of the character stated, a hollow body having a metal wall of predetermined concave shape to form one terminal of an electrical circuit, a membranous diaphragm stretched transversely in said body in spaced relation to said wall, a metallic film on said diaphragm juxtaposed to said wall to form the second terminal of said circuit, and a source of current in said circuit for causing a difference of potential between said terminals, whereby said diaphragm is biased to assume said predetermined shape as a datum position.

3. In a device of the character stated, a hollow body having a metal wall to form one terminal of an electrical circuit, a transparent membranous diaphragm stretched transversely in spaced relation to said wall, said body having a sight opening located on the opposite side of said diaphragm from said wall and coaxially with respect to said diaphragm, a metallic film on said diaphragm juxtaposed to said wall to form the second terminal of said circuit and also transform the diaphragm into a mirror to reflect a light beam entering said sight opening, and a source of current in said circuit for causing a difference of potential between said terminals, whereby said diaphragm is deformed to assume a datum position.

4. In a device of the character stated, a body forming a cavity and having a metal wall to form one terminal of an electrical circuit, a membranous diaphragm mounted transversely of said cavity and substantially parallel to said wall but spaced therefrom, a metallic film on the wall side of said diaphragm to form the second terminal of said circuit, and a source of current for causing a difference of potential between said terminals whereby said diaphragm is deformed to assume a datum position.

5. In a device of the character stated, a body forming a cavity and having a metal wall to form one terminal of an electrical circuit, a membranous diaphragm mounted transversely of said cavity and substantially parallel to said wall but spaced therefrom, a metallic film on the wall side of said diaphragm to form the second terminal of said circuit, a source of current for causing a difference of potential between said terminals to deform said diaphragm to assume a datum position, and means to modulate said current in accordance with radiant energy variations, whereby said diaphragm is shifted from said datum position to vary the potential difference as a function of the modulations of said means to modulate.

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