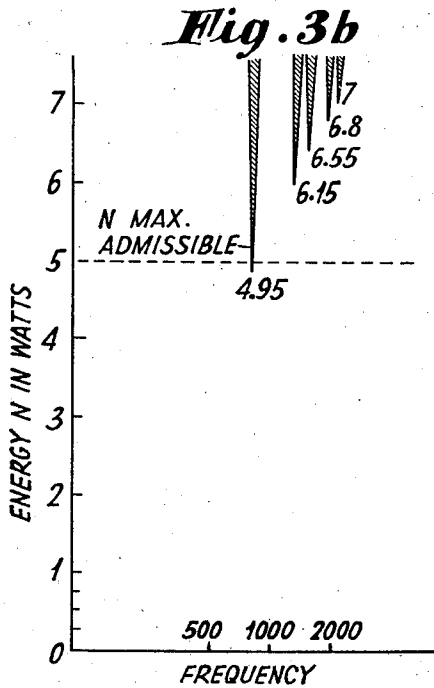
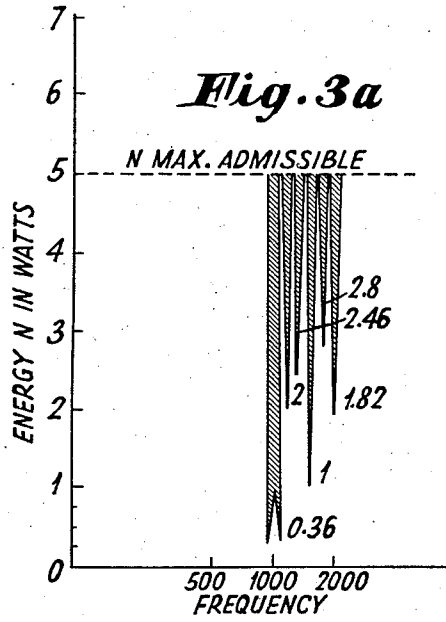
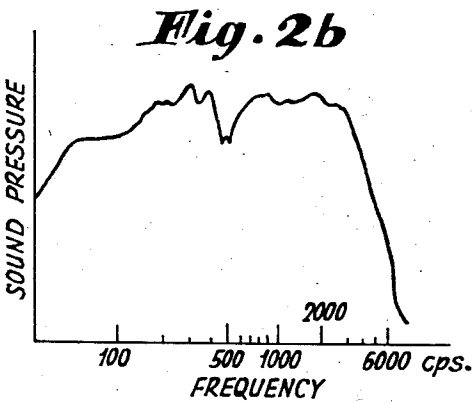
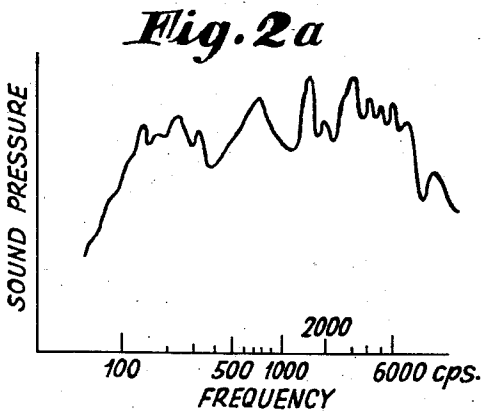
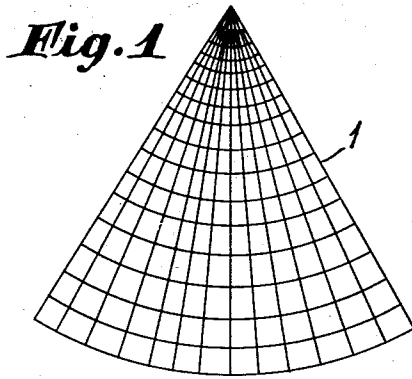


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LOUDSPEAKER DIAPHRAGM

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LOUDSPEAKER DIAPHRAGM

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1 Claim. (Cl. 181—32)

The upper part of the frequency band of a loudspeaker comprising a diaphragm of large area and having a low natural period consists of the various partial resonance points or responses of the diaphragm. The ensuing partial vibrations either have radial common or nodal lines, or else nodal lines which represent concentric circles. But in addition, transition stages between both vibration-forms are feasible. Now, the lower the internal friction of the diaphragm material, such as paper, cardboard cast or papier mâché, metal, or the like, the less will these partial resonances be damped or attenuated. Some of the peaks or crests of the frequency characteristic which are due thereto are spaced considerable distances apart, and the result is that more or less deep dips or crevasses result between a pair of crests in the frequency band. Such pronounced peaks produce appreciable distortions and vitiations of the reproduction, and these distortions make themselves particularly noticeable because of the circumstance that between a pair of peaks a comparatively appreciable lowering of the frequency band occurs.

It is therefore desirable to use for the diaphragm a kind of material which inheres high internal friction. The partial resonances will thus be damped and diminished, the peaks will not turn out as high and the crevasses as deep; in short, the frequency band as a whole will be leveled and smoothed down.

In the conventional kind of cone (diaphragm) loudspeakers very disturbing distortions are produced which are due to bending or flexural vibrations of the diaphragm (sub-harmonics or sub-octave vibrations resulting in what is known as "son rauque" or raucous sounds). In order to reduce these distortions it is known in the art to use forms of diaphragm other than conical, more particularly doubly bent surfaces.

The usual material used for diaphragms, such as paper, cardboard cast or pulp, etc., involve the serious disadvantage that their mechanical data which govern the position and the pitch of the partial resonance points (modulus of elasticity, specific gravity, internal friction, homogeneity) are subject to great variations so that there is no practical chance of reproducing or controlling them. Microscopic examination, for instance, of a commercial cardboard diaphragm shows that the fibrous structure and direction of the fibers are subject to great variations from one spot of the surface to another. In fact, the structure is

neither uniform in direction nor is it entirely without order (perfectly disorganized).

It is known from the prior art that a diaphragm may be built from two dissimilar materials in such a way that material was removed from a cone structure reinforced by ribs so that there remained nothing but a supporting frame or skeleton, whereupon the latter was enveloped with paper, silk, or some similar low-weight material. It is also known in the art to make a diaphragm of large surface from paper, silk, or the like impregnated with natural or artificial resins by removing portions from the diaphragm structure, the resultant recesses or openings being thereupon closed by a coating of varnish or gelatine. Diaphragms are furthermore known in the art which are made of a doubly bent wire network or gauze, the latter being thereupon covered with a coating material consisting of light and thin cloth or fabric.

The diaphragm constructions hereinbefore mentioned, however, inhere a number of disadvantages as regards weight and method of manufacture.

Now, these shortcomings of diaphragms known in the prior art are obviated according to the invention in a new kind of diaphragm material which distinguishes itself by high internal friction combined with high lateral bending or buckling strength. As a result, particularly the flexural vibrations or subharmonics are extensively suppressed as demonstrated by actual measurements, so that they will no longer become noticeable inside the energy ranges capable of transmission.

According to the invention a braided or knitted mesh grid or grate structure consisting of tenuous aluminum wires or else wires made of other light metals possessing high internal friction (moldable material is also suited therefor) is coated with an artificial substance of low specific gravity (synthetic resin, thin, low-weight and more particularly transparent foil of cellulose derivatives or the like), the ensuing structure being then worked into a diaphragm of desired shape. To the inherent internal friction of aluminum wire is here added the friction between the constituent wires. Owing to the fact that the meshes are filled with the artificial substance or resin there results finally a diaphragm combining low weight, high buckling or bending strength and reproducible structure or texture.

In order to favor certain frequency ranges, it is possible to change the mesh width of the wire

gauze from the coil in the direction towards the rim. The meshes are preferably so arranged that the highest partial resonances will be able to develop near the coil in the middle, and the low pitched ones at the outer rim.

Very satisfactory results have been obtained, for instance, with a commercial product sold by the trade-name of "Ricella" which is a structure consisting of light-metal wires such as aluminum wires and which is coated with a cellulose derivative.

For a clearer understanding of the invention, reference will now be made to the accompanying drawing, wherein Fig. 1 represents a sector of a conical diaphragm which embodies the features of this invention, Fig. 2a is a response curve of a loudspeaker utilizing a known diaphragm, Fig. 2b is a response curve of a loudspeaker utilizing a diaphragm made according to the present invention, Figs. 3a and 3b are graphs depicting the instability ranges of loudspeakers according to the prior art and the present invention, respectively. The reticulate or mesh fabric we made of aluminum or the like wires is fashioned to result in a conical diaphragm, for instance. The meshes thereupon are coated with the transparent artificial material which is transparent and also preferably weather-proof and acid-resistant. If desired, the fabric could be so coated with the synthetic substance when still in flat or unfashioned form, the diaphragm then being shaped out of the flat material after this treatment has been finished.

Figs. 2a and 2b show the characteristics of two loudspeakers which have been fitted into an

acoustic wall. Fig. 2a shows the frequency curve of a modern type of loudspeaker, and Fig. 2b a similar curve of a loudspeaker fitted with a diaphragm of the kind here disclosed. The crevasse or dip of the frequency characteristic, at around 500 cps., designated by A in the Fig. 2b is ascribable to the acoustic wall, and has nothing to do with the diaphragm itself.

Figs. 3a and 3b show the instability ranges which are occasioned by flexural or bending vibrations (sub-octave or subharmonic oscillations), Fig. 3a showing the instability ranges for a modern 5-watt loudspeaker. The measurements included only the range up to 4 watts since no exact measurements were feasible any more beyond this level.

Fig. 3b shows the same instability ranges for a diaphragm according to the present invention which also was intended for a 5-watt loudspeaker. It will be noticed that the instability ranges occur only in the presence of energies which are greater than 5 watts, that is, above the nominal (rated) load.

What is claimed is:

An acoustic diaphragm of large area and conical formation comprising a sheet of wire gauze serving as a base for the diaphragm and a cellulose derivative coating applied thereto, the mesh openings of the wire gauze varying in size in the direction from the apex to the outer rim of the diaphragm, thereby providing greater rigidity at the apex than at the rim portion of the diaphragm.

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