United States Patent [19]

Bozak

[11] **3,837,425**

[45] **Sept. 24, 1974**

[54] **EDGE-DAMPED DIAPHRAGM FOR ELECTRODYNAMIC LOUDSPEAKERS**

[75] Inventor: **Rudolph T. Bozak,** Darien, Conn.

[73] Assignee: **Bozak, Inc.,** Darien, Conn.

[22] Filed: **June 11, 1973**

[21] Appl. No.: **368,977**

[52] **U.S. Cl.** ..... **181/32 R**

[51] **Int. Cl.** **G10k 13/00, H04r 7/00**

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

[56] **References Cited**

UNITED STATES PATENTS

1,523,670	1/1925	Sutline	181/32 R
1,554,794	9/1925	De Forest	181/32 R
1,783,385	12/1930	Nystrom	181/32 R
2,815,823	12/1957	Olson et al.	181/32 R
3,019,849	2/1962	King	181/32 R

Primary Examiner—Stephen J. Tomsky

Attorney, Agent, or Firm—Eyre, Mann & Lucas

[57] **ABSTRACT**

A diaphragm having a damping member formed of soft rubber compressed and retained at its outer periphery by a crimped flange to damp undesirable vibrations in the diaphragm.

5 Claims, 2 Drawing Figures

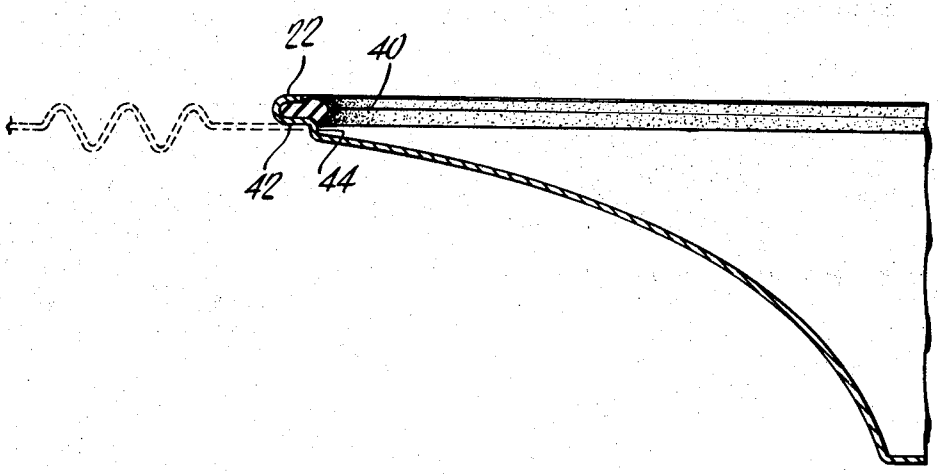


Fig. 1.

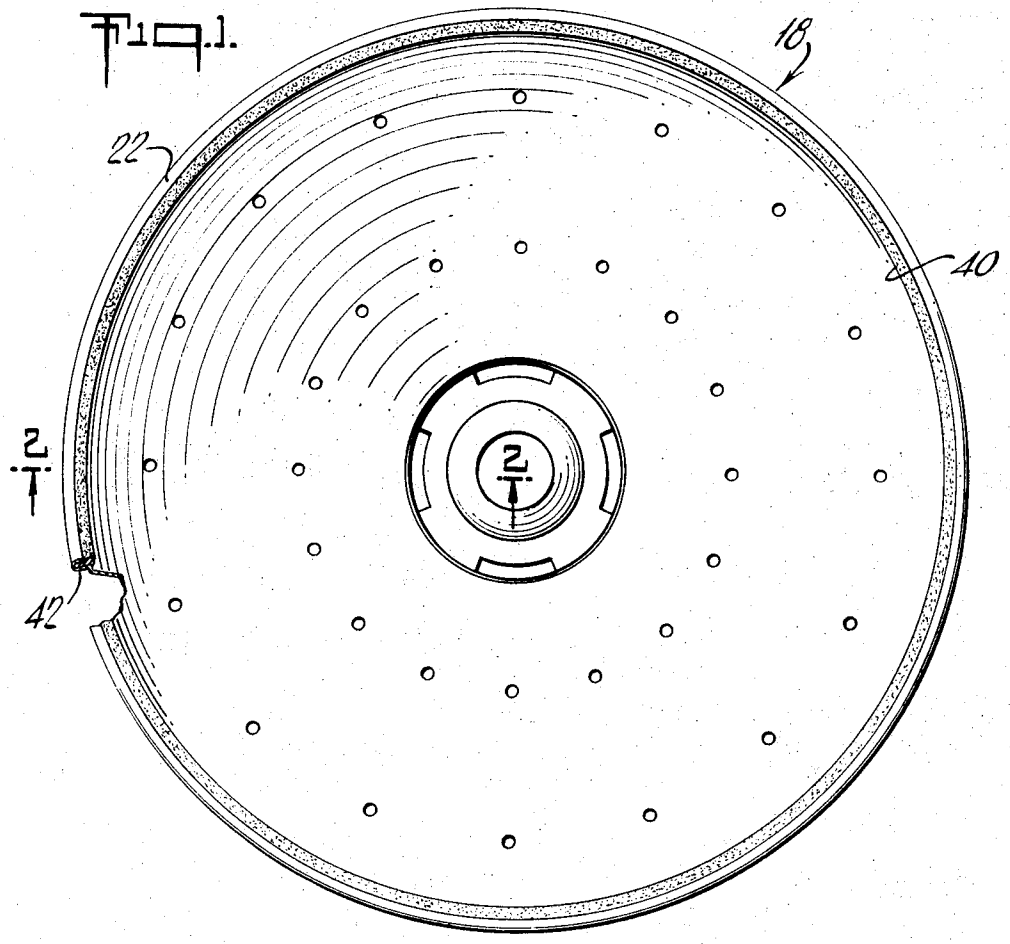
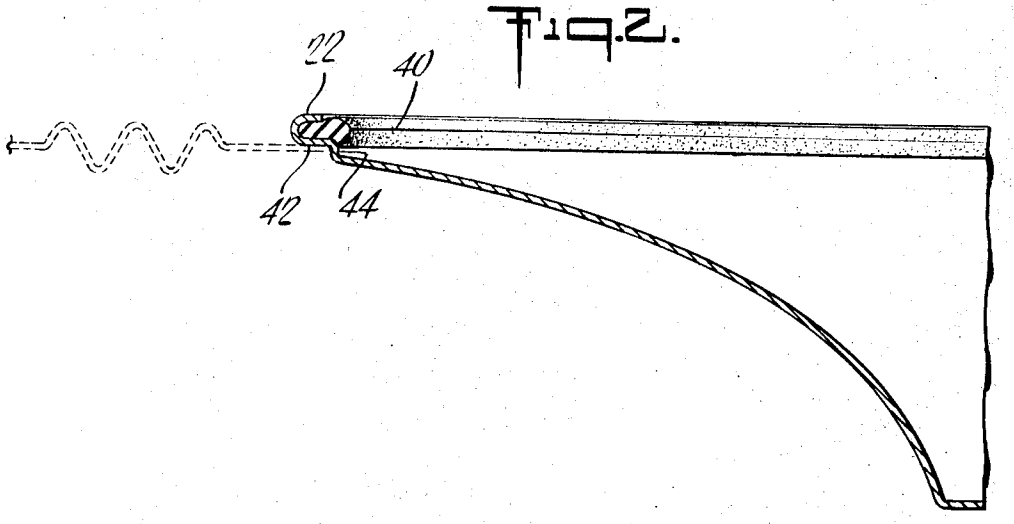


Fig. 2.



EDGE-DAMPED DIAPHRAGM FOR ELECTRODYNAMIC LOUDSPEAKERS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is properly classifiable in Class 181, Subclass 32 (Acoustics, Diaphragms).

2. Description of the Prior Art

The present invention represents a significant technological advance over the invention described and claimed in U.S. Pat. No. 3,093,207 for a METALLIC DIAPHRAGM FOR ELECTRODYNAMIC LOUDSPEAKERS issued on June 11, 1973 and assigned to The R. T. Bozak Mfg. Company, and the disclosure of this patent is incorporated herein by reference.

The problem of eliminating undesirable vibrations in loudspeaker diaphragms arises from the inherent lack of rigidity of these necessarily lightweight components of dynamic loudspeakers. Various means for rigidifying the diaphragm have been employed with limited success in an effort to eliminate these vibrations, which have been known to cause a number of problems including resonance of the corrugated annulus (wale or surround) which connects the diaphragm to the loudspeaker housing. In an effort to overcome this problem, an annular soft foam rubber or sponge member has been employed at the outer edge of the diaphragm in the device shown in U.S. Pat. No. 2,815,823 (Olson). However, there remains the problem of reflection from the edge of the diaphragm of radially-propagated vibrations. Such vibrations result from the rigidity of the thin, lightweight diaphragm, which has the characteristic of low attenuation of such radial vibrations. If such vibrations are allowed to be reflected at the diaphragm's edge, they will cause cancellation of particular frequencies, resulting in a valley or "hole" in the frequency response characteristic of the loudspeaker as well as increased harmonic distortion. Furthermore, metallic loudspeaker diaphragms also have a bell mode of vibration at some frequency within the operating range of the loudspeaker. This phenomenon is basically a mechanical resonance inherent in the diaphragm, which results in a sharp peak in the frequency response characteristic of the loudspeaker. This phenomenon is objectionable because it is perceived by the listener as a coloration or distortion of the sound being reproduced, and causes a piercing sensation in the ear of the listener. It is the purpose of the present invention to minimize these undesirable vibrations in lightweight diaphragms, and thereby improve the frequency response characteristic of the loudspeakers of which the diaphragms form a part.

SUMMARY OF THE INVENTION

The present invention is embodied in and carried out by a diaphragm having an annular member formed of soft rubber positioned at the outer periphery of the diaphragm and compressedly secured thereto by a crimped flange.

BRIEF DESCRIPTION OF THE DRAWING

The present invention may be better understood by reading the written description thereof with reference to the accompanying drawing, of which:

FIG. 1 is a plan view of a diaphragm embodying the present invention, partly broken away; and

FIG. 2 is a partial sectional side view of the diaphragm shown in FIG. 1, taken along line 2—2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, the diaphragm **18** shown is preferably formed of any suitable lightweight material and is preferably coated with a damping material in accordance with the teaching of the referenced patent. The reference numerals shown in the drawing are the same for the same components or parts of components shown in the drawing of the referenced patent. In constructing the diaphragm embodying the present invention, the flange **22** extending around the periphery of diaphragm **18** is initailly upstanding as described in the referenced patent. The damping member **40** is of annular configuration and has an adhesive bottom side which is fixed to the upper surface of annular rim **42** and to at least a portion of the inner face of vertical step **44.** Flange **22** is then crimped or bent radially inward to compress and further secure the damping member **40** in position at the edge of the diaphragm. The damping member **40** is preferably formed of low durometer (i.e., soft) rubber, but may be of any other material which is capable of achieving the desired damping of radially-propagated waves and resonance waves. The compliant annulus (wale or surround) for mounting the diaphragm, shown in phantom in FIG. **2,** is affixed to the diaphragm by being glued to the annular rim **42** of the diaphragm **18,** which rim underlies damping member **40** and in cooperation with crimped flange **22** applies compressive force to a substantial portion of damping member **40.** The combination of the soft rubber annulus thus positioned at the outer periphery of the diaphragm **18,** and the crimping of the flange **22,** yield superior results in terms of the reduction of undesirable vibrations in the diaphragm.

The advantages of the present invention, as well as certain changes and modifications of the disclosed embodiment thereof, will be readily apparent to those skilled in the art. It is the applicant's intention to cover all those changes and modifications which could be made to the embodiment of the invention herein chosen for the purposes of the disclosure without departing from the spirit and scope of the invention.

What is claimed is:

1. A loudspeaker diaphragm comprising a thin, lightweight sheet and a damping member retained and partially compressed at the outer periphery of said sheet by a crimped flange.

2. A loudspeaker diaphragm according to claim **1** wherein said sheet has an annular rim, and at least a first portion of the bottom surface of said damping member is adhesively secured to the upper surface of said annular rim.

3. A loudspeaker diaphragm according to claim **2** wherein said sheet has a vertical step extending from the inner periphery of said annular rim, and a second portion of the bottom surface of said damping member is adhesively secured to at least a portion of the inner face of said vertical step.

4. A loudspeaker diaphragm according to claim **1** wherein said damping member is of annular configuration.

5. A loudspeaker diaphragm according to claim **1** wherein said damping member is formed of soft rubber.

* * * * *