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(71) Applicant:
**Fenson & Company Limited**
**Castlemorton, Worcestershire WR13 6BE (GB)**

(72) Inventor:
**George, Richard Warrington**
**Castlemorton, Worcestershire, WR13 6BE (GB)**

(74) Representative:
**Higgins, Michael Roger**
**A.R. Davies & Co.**
**27, Imperial Square**
**Cheltenham Glos. GL50 1RQ (GB)**

## (54) Apparatus for and a method of improving the sound quality of loudspeakers

(57) Apparatus for improving the sound quality of loudspeakers, comprises a rigid shell (10) having sound absorbing material (15) on its internal surface. The shell is adapted to fit over a loudspeaker enclosure (16) and the front of the shell is open or substantially open or is covered by material which permits sound to pass therethrough in an undistorted manner.

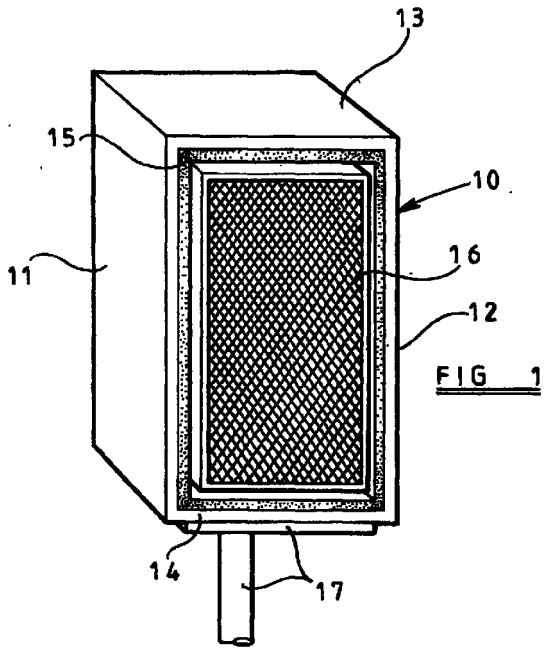


FIG 1

EP 1 022 928 A2

## Description

**[0001]** This invention relates to apparatus for and a method of improving the sound quality of loudspeakers.

**[0002]** Currently, several types of loudspeakers are manufactured including electrostatic, magnetic film types and moving coil cones or domes mounted into open baffles, infinite baffles (closed box types), reflex loaded infinite baffles and transmission line type enclosures.

**[0003]** Of these, the most popular is the infinite baffle type and its reflex loaded variant. Commercially, these account for the majority of speakers in use.

**[0004]** Typically, they consist of two or more moving coil type drive units each optimised to give uniform output over a limited frequency range, an electrical crossover being used to divide the incoming electrical signals to the appropriate drive unit. The drive units are mounted in an enclosure, commonly referred to as a cabinet and typically made of wooden panels, chipboard or medium density fibreboard (M.D.F.).

**[0005]** The purpose of the enclosure is to prevent the out of phase sound emitted from the rear of the drive unit from cancelling that from the front whilst providing a correct acoustic loading to the rear of the drive unit for optimum performance.

**[0006]** In use, the drive unit imparts vibrational energy to the cabinet from frame reaction to the vibrating cone and from coincident sound energy emitted from the rear of the drive unit. This results in vibration of the cabinet walls causing unwanted sound to be emitted. The panel walls typically exhibit a series of resonances whose output may only be a few decibels below of that of the frontal or drive unit output. As the panels have mass their resonance may continue for several milliseconds after excitation. The overall effect of this is to reduce system and sound clarity, dynamic definition and accuracy.

**[0007]** This form of coloration has posed a challenge to speaker designers for many years. The use of bracing, damping pads, and rigid floor coupling via spiked stands has been used to reasonable effect. To advance the art a few specialist manufacturers have used alternative specialist materials and construction methods for the enclosure including concrete, mineral loaded resins, honeycomb cored panels, dense matrix bracing systems, granite and slate panels and high mass lead seismic damping systems. Whilst effective at reducing coloration and providing substantial benefits in terms of improved sound quality these enclosures have the disadvantage of high cost, typically five to fifteen times greater than a conventional enclosure, and using materials and production processes not ideally suited to mass production.

**[0008]** The present invention seeks to overcome these problems whilst offering the additional benefit of being retrofittable to existing loudspeaker systems.

**[0009]** According to a first aspect of the present invention there is provided apparatus for improving the sound quality of loudspeakers, comprising a rigid shell having sound absorbing material on its internal surface, the shell being adapted to fit over a loudspeaker enclosure and the front of the shell being open or substantially open or being covered by material which permits sound to pass therethrough in an undistorted manner.

**[0010]** Preferred and/or optional features of the first aspect of the invention are set forth in claims 2 to 7, inclusive.

**[0011]** According to a second aspect of the invention there is provided a method of improving the sound quality of loudspeakers, the method comprising the steps of fitting apparatus according to the first aspect of the invention over a loudspeaker enclosure.

**[0012]** The invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which;

Figure 1 is a perspective view showing one embodiment of apparatus according to the present invention, fitted over a loudspeaker enclosure, and

Figure 2 is a sectional view, on an enlarged scale, of one example of the sound absorbing material of Figure 1.

**[0013]** Referring now to the drawings, apparatus for improving the sound quality of loudspeakers, comprises a rigid shell 10 having a rear wall, two side walls 11 and 12, a top wall 13 and a base 14 all internally lined with sound absorbing material 15. The front of the shell is open but this could be covered with a removable panel of material which permits sound to pass therethrough in an undistorted manner.

**[0014]** The shell 10 is adapted to fit over an existing loudspeaker enclosure, typically in the form of a cabinet 16, (housing one or more loudspeakers) preferably with a clearance of typically 2 to 3 mm. between the inner surface of the sound absorbing material 15 and the outer surface of the cabinet 16. The shell 10 may be mounted on a speaker stand 17 or on the floor. A soft foam sealing strip may be used on the inner edge of the shell to form a seal.

**[0015]** To give optimum performance, the shell 10 is ideally isolated from the loudspeaker cabinet 16. However, in practice this is difficult to achieve and the loudspeaker cabinet 16 will generally be supported on a plurality of support members, such as pins or spikes, upstanding from the base 14 of the shell 10. Alternatively, particularly with heavy speakers, the speaker cabinet could be mounted directly on the base 14 of the shell 10. In the case of a floor standing speaker cabinet, the shell may be coupled to the floor either directly or via a sub-frame/floor spikes as necessary. Typically, in this case, the shell 10 has no base.

**[0016]** The shell 10 is typically made from panels of wood, M.D.F. or chipboard.

**[0017]** The sound absorbing material typically comprises a single layer of sound absorbing material, preferably a foam material such as melamine foam, polyurethane foam or polyether foam. Alternatively the sound absorbing material may comprise at least two, and as shown in Figure 2 three, layers 20 of compressible sound absorbing material, and a barrier layer 21 between the or each pair of adjacent compressible layers 20. The compressible sound absorbing material 20 is preferably a foam material. In this case, the innermost foam layer absorbs high frequency sound energy. The inner barrier layer minimises the low frequency sound. The middle foam layer absorbs vibration of the inner barrier layer. The outer foam layer damps any vibration which may occur in the panel to which it is fixed.

**[0018]** The barrier layer(s) 21 are denser than the compressible sound absorbing material 20 and are typically formed of "dead rubber" sheet or bituminous or lead damping material. The particular make up of the absorbent material may be optimised to suit the speaker system.

**[0019]** An angled or rounded moulding (not shown) may be fixed to the front edge of the shell 10 adjacent to the drive unit baffle of the loudspeaker. This is to ensure good sound diffraction and to cover the exposed edge of the shell and sound absorbent material whilst imparting additional edge stiffness to the shell panels.

**[0020]** The use of this system typically reduces cabinet wall sound output by 20 to 30 decibels whilst dramatically reducing the effects of panel resonance resulting in a substantial improvement in sound quality at a relatively low cost with the added benefit of being retrofittable to existing systems.

## Claims

1. Apparatus for improving the sound quality of loudspeakers, comprising a rigid shell (10) having sound absorbing material (15) on its internal surface, the shell being adapted to fit over a loudspeaker enclosure (16) and the front of the shell being open or substantially open or being covered by material which permits sound to pass therethrough in an undistorted manner.

2. Apparatus as claimed in claim 1, wherein the shell comprises a rear wall, two side walls (11,12) and a top wall (13) all lined or substantially lined with sound absorbing material (15).

3. Apparatus as claimed in claim 2, wherein the shell further comprises a base (14).

4. Apparatus as claimed in claim 3, wherein the base is also lined or substantially lined with sound absorbing material (15).

5. Apparatus as claimed in any one of the preceding claims, wherein the sound absorbing material (15) is a compressible foam material.

6. Apparatus as claimed in any one of the preceding claims, wherein the sound absorbing material comprises at least two layers (20) of compressible foam material with a barrier layer (21) therebetween.

7. Apparatus as claimed in claim 6, wherein the barrier layer (21) is denser than the compressible sound absorbing material (20).

8. A method of improving the sound quality of loudspeakers, comprising the step of fitting the apparatus of any one of the preceding claims over a loudspeaker enclosure (16).

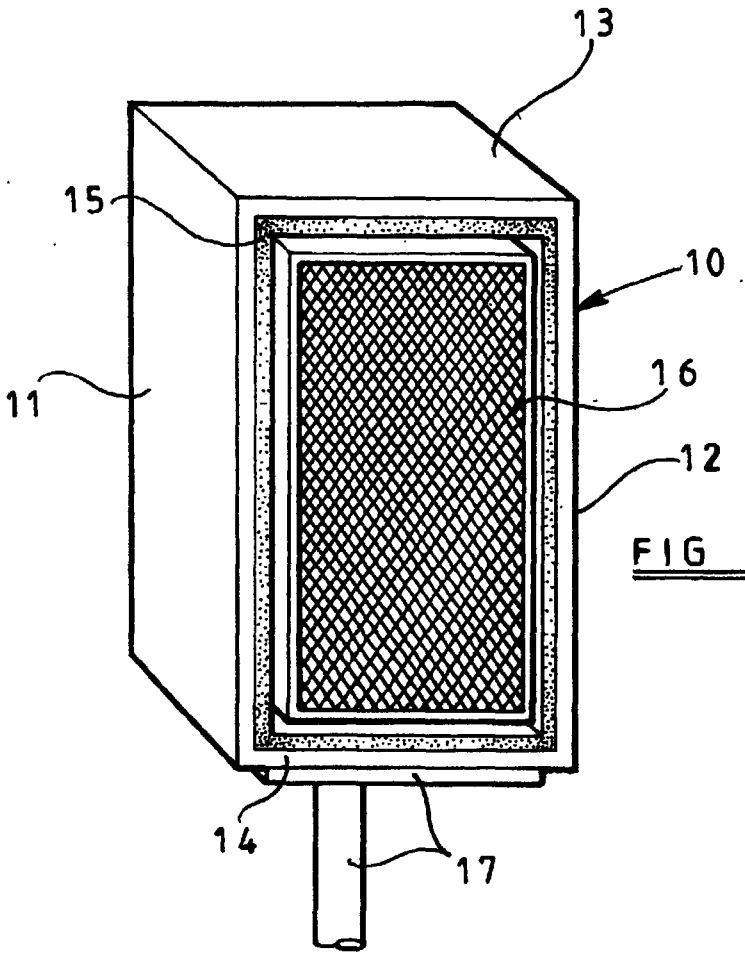


FIG 1

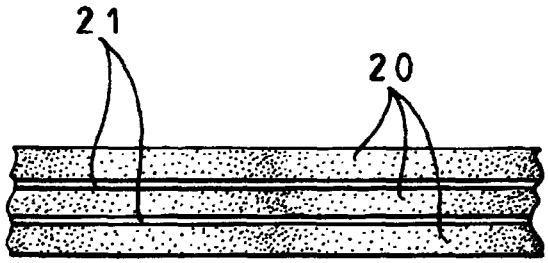


FIG 2