United States Patent [19]

Maeda et al.

[11] **3,894,612**

[45] **July 15, 1975**

[54] **SPEAKER ENCLOSURE HAVING IMPROVED WALL PLATES**

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[73] Assignee: **Trio Electronics Inc.,** Tokyo, Japan

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[21] Appl. No.: **417,197**

[30] **Foreign Application Priority Data**

Feb. 9, 1973 Japan 48-17223

[52] **U.S. Cl.** **181/199;** 161/56

[51] **Int. Cl.** **G10k 13/00;** H04r 1/28

[58] **Field of Search** ..... 217/17; 161/56; 181/31 B, 181/199, 148

[56] **References Cited**

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Primary Examiner—Stephen J. Tomsky

Attorney, Agent, or Firm—Gerald J. Ferguson, Jr.; Joseph J. Baker

[57] **ABSTRACT**

A speaker enclosure comprising having a plurality of wall plates where at least one plate comprises a plurality of billets cut along the fibrous direction, the fibrous direction of all billets being substantially parallel to one another, the billets being bound to one another to form a substantially planar wall plate.

4 Claims, 26 Drawing Figures

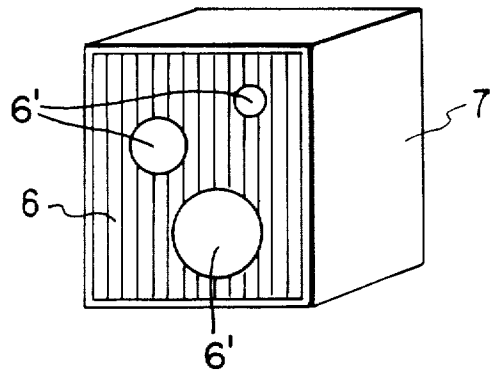


FIG. 1A
PRIOR ART

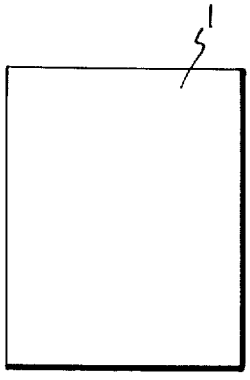


FIG. 1B
PRIOR ART

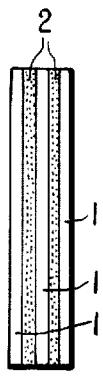


FIG. 1C
PRIOR ART

FIG. 2A
PRIOR ART

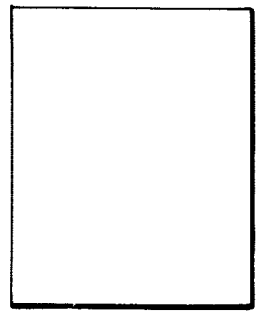
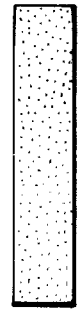


FIG. 2B
PRIOR ART



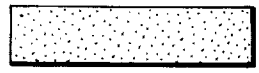
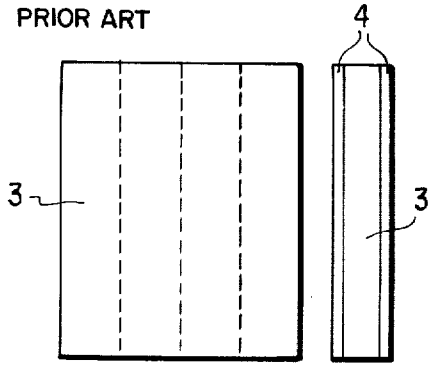


FIG. 2C
PRIOR ART

FIG. 3A
PRIOR ART

FIG. 3B
PRIOR ART



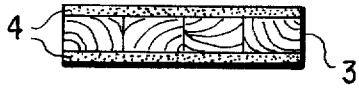
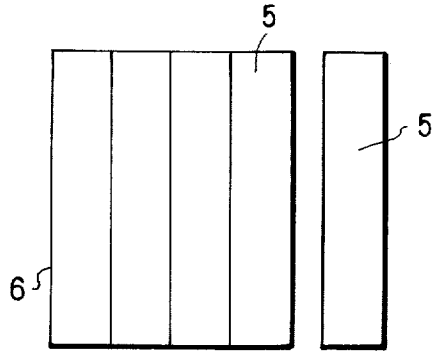


FIG. 3C
PRIOR ART

FIG. 4A

FIG. 4B



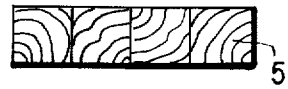
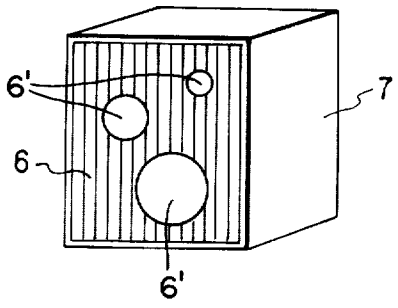


FIG. 4C

FIG. 5



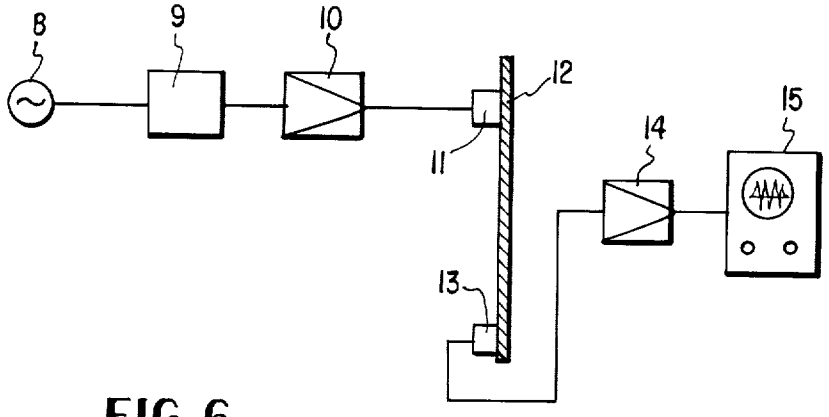


FIG. 6

FIG. 7A

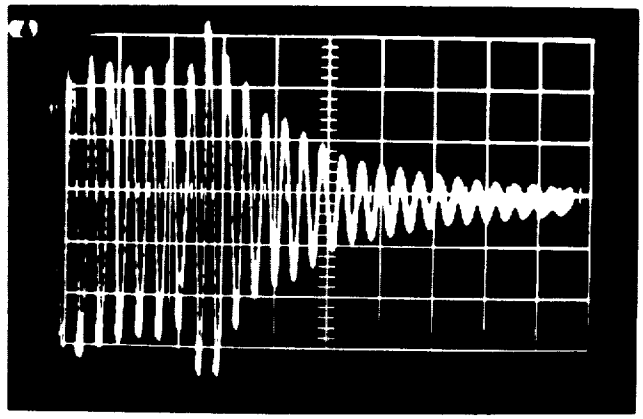


FIG. 7B

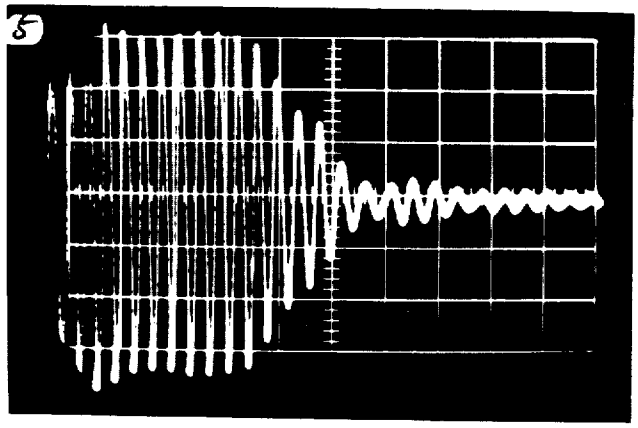


FIG. 7C

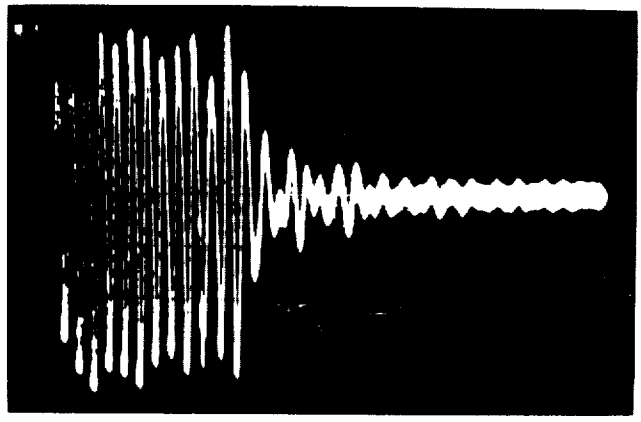


FIG. 8A

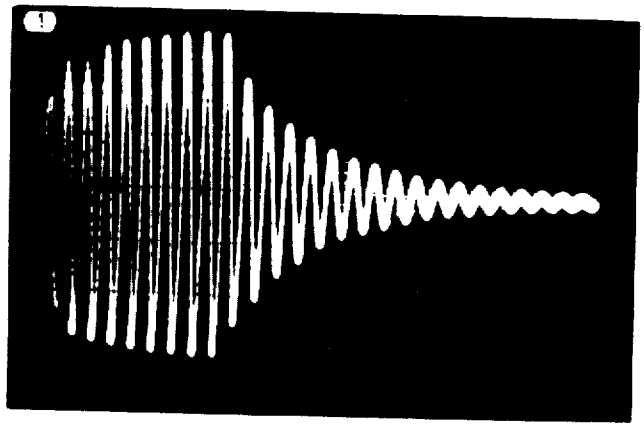


FIG. 8B

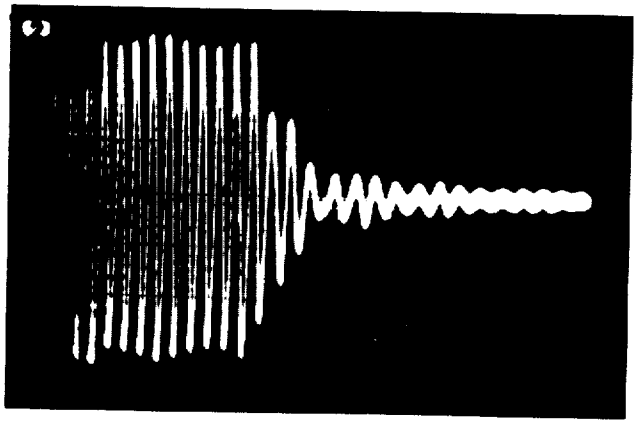


FIG. 8C

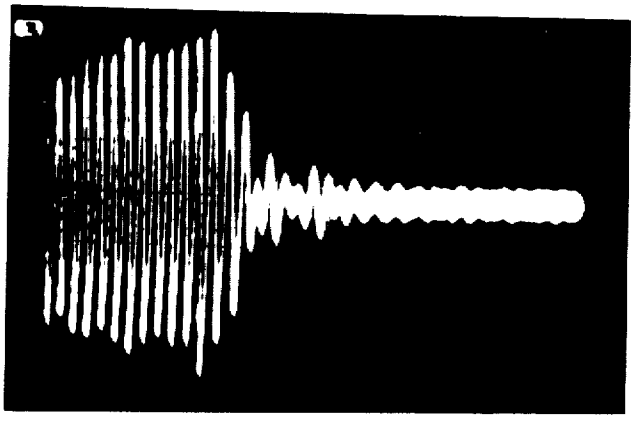


FIG. 9A

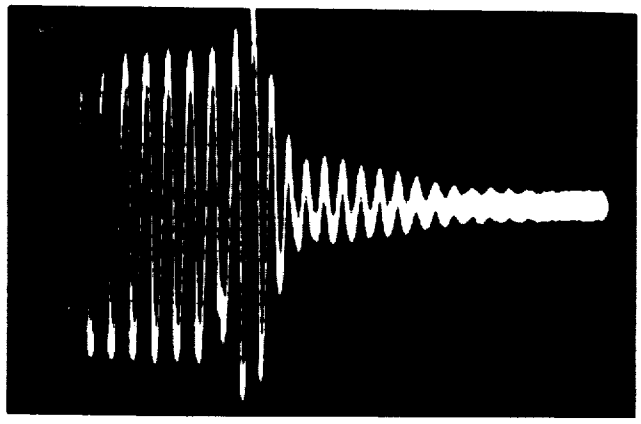


FIG. 9B

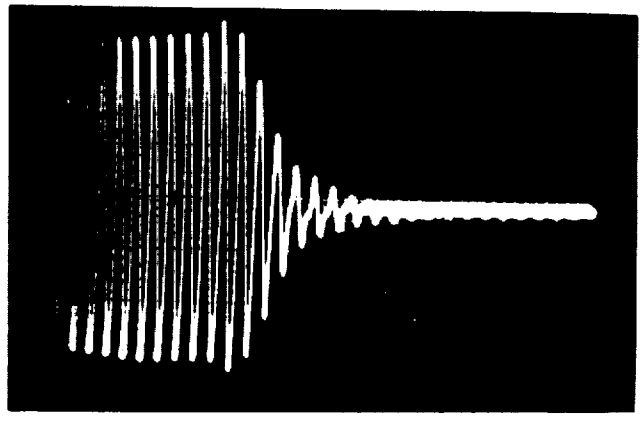


FIG. 9C

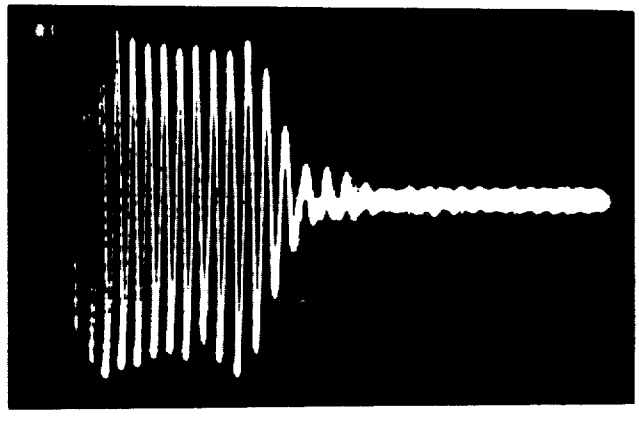


FIG. 10A

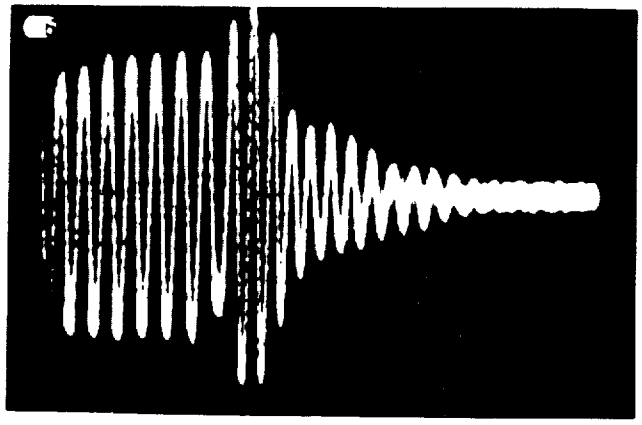


FIG. 10B

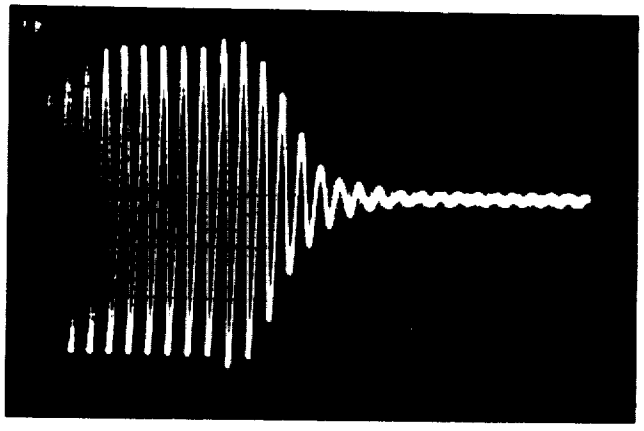
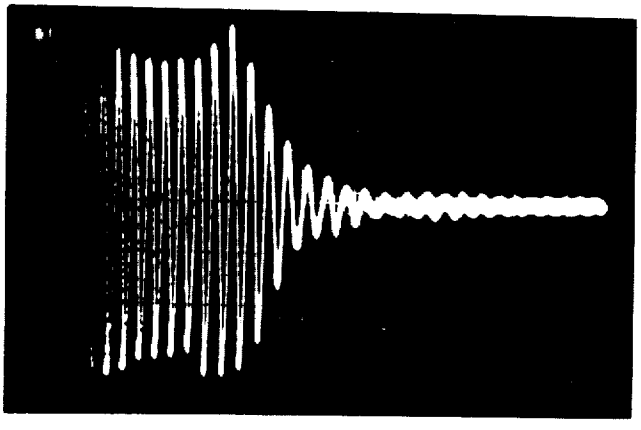


FIG. 10C



SPEAKER ENCLOSURE HAVING IMPROVED WALL PLATES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a speaker enclosure and, in particular, to a speaker enclosure having improved wall plates.

2. Discussion of the Prior Art

There are typically three basic types of wall plates for speaker enclosures. The first is shown in FIG. **1** wherein thin lauan plywood sheets **1** and **2** are alternately laminated so that direction of the fibers of sheet **1** are substantially perpendicular to that of sheet **2.** The second type is shown in FIG. **2** wherein wooden chips are formed into a "particle plate" with a binder. The third type is shown in FIG. **3** wherein wooden billets **3** cut along the fibrous direction are bound to each other to form a core plate and thin wooden plates **4** are bound to both surfaces of the core plate so that the fibrous direction of billets is substantially perpendicular to that of plates **4.** This is known as "lumber core plywood".

The plates of FIGS. **1 – 3,** however, have defects in that the acoustic damping property thereof is not good and deformation is present in the damping wave.

SUMMARY OF THE INVENTION

The wall plate of a speaker enclosure is preferably made not of plywood but of a single plate insofar as the acoustic aspect is concerned; however, a single plate does not lend itself to practical use since it often warps and cracks and is impossible to mass-produce at a low cost.

Therefore, it is a primary purpose of this invention to provide an improved speaker enclosure made from the mutually bound billets, the enclosure exhibiting an acoustic property nearly comparable with that of a single plate enclosure while at the same time being resistant to warping and cracking and producible at a low cost.

Other objects and advantages of this invention will become apparent upon reading the appended claims in conjunction with the following detailed description and the attached drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1**(A) is a front view of a prior art lauan plywood speaker enclosure wall plate.

FIG. **1**(B) is a side view of the wall plate of FIG. **1**(A).

FIG. **1**(C) is a plan view of the wall plate of FIG. **1**(A).

FIG. **2**(A) is a front view of a prior art "particle plate", speaker enclosure wall plate.

FIG. **2**(B) is a side view of the wall plate of FIG. **2**(A).

FIG. **2**(C) is a plan view of the wall plate of FIG. **2**(A).

FIG. **3**(A) is a front view of a prior art lumber core plywood, speaker enclosure wall plate.

FIG. **3**(B) is a side view of the wall plate of FIG. **3**(A).

FIG. **3**(C) is a plan view of the wall plate of FIG. **3**(A).

FIG. **4**(A) is a front view of an illustrative embodiment of a lumber plate according to this invention.

FIG. **4**(B) is a side view of the lumber plate of FIG. **4**(A).

FIG. **4**(C) is a plan view of the lumber plate of FIG. **4**(A).

FIG. **5** is a perspective view of an illustrative speaker enclosure according to this invention.

FIG. **6** is a diagrammatic illustration of an observation apparatus for measuring the acoustic damping properties of various wall plates.

FIGS. **7**A, B, and C respectively illustrate the characteristic curves of the acoustic damping property of 200 Hz, 250 Hz, and 300 Hz of the prior art wall plate of FIG. **1** measured by the observation apparatus of FIG. **6.**

FIGS. **8**A, B, and C respectively illustrate the characteristic curves of the acoustic damping property of 200 Hz, 250 Hz, and 300 Hz of the prior art wall plate of FIG. **2** measured by the observation apparatus of FIG. **6.**

FIGS. **9**A, B, and C respectively illustrate the characteristic curves of the acoustic damping property of 200 Hz, 250 Hz, and 300 Hz of the prior art wall plate of FIG. **3** measured by the observation apparatus of FIG. **6.**

FIGS. **10**A, B, and C respectively illustrate the characteristic curves of the acoustic damping property of 200 Hz, 250 Hz, and 300 Hz of the wall plate according to this invention of FIG. **4** measured by the observation apparatus of FIG. **6.**

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to FIG. **4,** wood stock, such as pine or beech, is cut into billets **5** along the direction of the fibers thereof and the billets are bound to each other to obtain a lumber plate **6,** the fiber lines of each billet being substantially parallel to one another. The billets may be bound together by conventional binding agents such as those described in the book entitled "Wood-Gluing And Adhesive Agents" published by Morikita Shuppan Co., Ltd., Apr. 30, 1968, pages 168, 169 and 241. At least one wall plate of speaker enclosure **7** comprises lumber plate **6,** as shown in FIG. **5,** where plate **6** includes speaker openings **6'** for facilitating the mounting of speakers.

the acoustic damping property of lumber plate **6** may be observed by the apparatus of FIG. **6** where the signal of an oscillator **8** is applied to a tone-burst generator **9** and the output signal of generator **9** is amplified at an amplifier **10** and further applied to a vibration generator **11** to vibrate a specimen **12** corresponding to a wall plate or the like under test. The vibration of specimen **12** is detected by a vibration pick-up **13** provided at the other end of specimen **12,** and the vibration signal is amplified by an amplifier **14** and displayed at an oscilloscope **15** or the like.

FIGS. **7 – 10** correspond to wave-forms observed in the oscilloscope and illustrate the damping states of each vibration beginning when vibration generator **11** stops.

Referring to FIGS. **7 – 10,** reference letters A, B, and C of these figures represent the acoustic damping properties of 200 Hz, 250 Hz and 300 Hz, respectively. The thickness of each of the plates of FIGS. **7 – 10** was 18 mm. and the direction of the applied signal was parallel with the direction of the fibers of the billets **3** of FIG.

3 and parallel with the direction of the fibers of the billets 5 of FIG. 4.

The acoustic damping property of the lumber plate of this invention is shown in FIGS. 10(A) – 10(C) wherein the damping wave is a normal and undeformed wave-form similar to a sine wave as compared with that of the lauan plywood of FIGS. 7(A) – 7(C), the particle plate of FIGS. 8(A) – 8(C), and the lumber core plywood of FIGS. 9(A) – 9(C), the latter three exhibiting damping waves of the abnormal wave-forms having deformations.

The damping time during which the initial voltage of the base wave is reduced to 1/6 is 10/250 sec. for the lauan plywood, 6/250 sec. for the particle plate and the lumber core plywood, and 5/250 sec. for the lumber plate of this invention, as the 1 Hz is 1/250 sec. Accordingly, the damping time of the lumber core plate of this invention is the shortest of the wall plates.

The following table gives Young's modulus and the acoustic communicating velocity of various woods along and perpendicular to the fiber line:

Wood	Specific Gravity	Young's Modulus (Kgr/cm²) E''	E'	Acoustic Communicating Velocity (m/sec.) C''	C'
Pine	0.52	120×10^3	46×10^3	4760	932
Beech	0.73	160×10^3	15×10^3	4638	1420
Linden	0.53	74×10^3	25×10^3	3700	680

In the table, E'' indicates Young's modulus of the wood along the fiber line, E' indicates Young's modulus perpendicular to the fiber direction, C'' indicates the acoustic communicating velocity of the wood along the fiber direction, and C' indicates the foregoing velocity perpendicular to the fiber direction.

It will be apparent from the table that Young's modulus along the fiber direction is about 10 times that perpendicular to the fiber direction, and the acoustic communicating velocity along the fiber direction is about four times that perpendicular to the fiber direction.

As the plywoods shown in FIGS. 1 and 3 are formed by binding and laminating woods having mutually perpendicular fiber lines, the Young's modulus and the acoustic communicating velocity of the plywoods become averaged. The Young's modulus and the acoustic communicating velocity of the particle plate shown in the FIG. 2, which may be fiberless also becomes averaged.

On the other hand, the lumber plate according to this invention is produced by arranging the woods not perpendicularly but parallel with each other so that the favorable physical properties of the woods along the fiber flow can be fully utilized.

Further, the area for bonding the bars 5 is very small compared with the conventional plywoods and thus the change of the acoustic property due to binder is reduced to a minimum.

As particularly described above, the wall plate for the speaker enclosure according to this invention has a favorable acoustic damping property where there is little, if any, deformation of the damping wave and a reduction of the damping time. Further, since the fiber flows of the bars 5 are parallel and the amount of the binder is very small, the sound of the enclosure is substantially improved. Furthermore, since a plurality of wood segments comprise each wall plate, the cost of producing the speaker enclosure is low when compared with enclosures made of solid plate, and the resulting wall plate of this invention does not crack or warp.

Numerous modifications of the invention will become apparent to one of ordinary skill in the art upon reading the foregoing disclosure. During such a reading, it will be evident that this invention provides a unique speaker enclosure having an improved wall plate for accomplishing the objects and advantages hereinstated.

What we claim is:

1. A speaker enclosure comprising at least one speaker, said speaker enclosure having at least one aperture for supporting said one speaker and including a plurality of wall plates where at least one plate comprises only a plurality of billets cut along the fibrous direction, the fibrous direction of all billets being substantially parallel to one another, the billets being bound to one another to form a substantially planar wall plate.

2. A speaker enclosure as in claim 1 where all of said wall plates are formed as said one wall plate.

3. A speaker enclosure as in claim 1 where said one aperture is in said one wall plate.

4. A speaker enclosure as in claim 3 where said fibrous direction is vertically oriented when said enclosure is in its upright position.

* * * * *