

[54] **FOLDED BASS HORN SPEAKER**

[75] Inventor: **Ronald E. Fox**, Dallas, Tex.

[73] Assignee: **Showsound, Inc.**, Dallas, Tex.

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[52] **U.S. Cl.**..... **179/1 E; 181/155**

[51] **Int. Cl.<sup>2</sup>**..... **H04R 1/28**

[58] **Field of Search**..... **179/1 E, 1 F, 1 GA;**  
**181/179, 133, 175, 182, 155, 31 B; 325/310,**  
**352**

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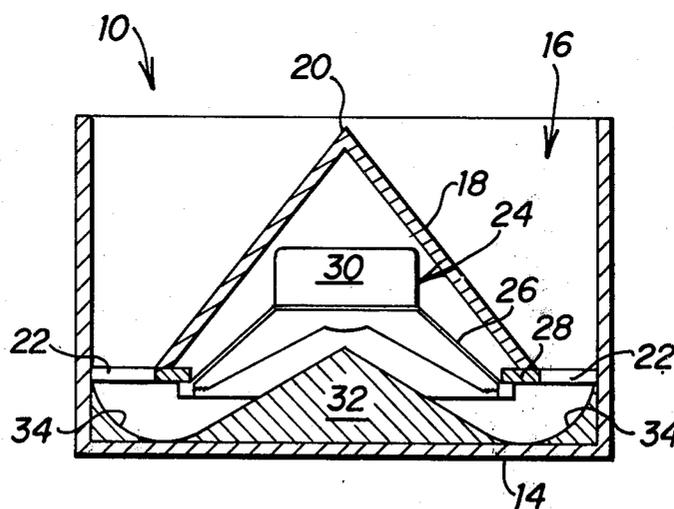
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*Primary Examiner*—William C. Cooper  
*Assistant Examiner*—Tommy P. Chin  
*Attorney, Agent, or Firm*—Richards, Harris & Medlock

[57] **ABSTRACT**

The specification discloses a folded bass horn speaker having a rectangular speaker cabinet with a rear wall and a front speaker opening. A housing having the exterior shape of a pyramid is mounted within the cabinet, with the pyramid base disposed toward the rear wall and the pyramid vertex disposed toward the front speaker opening. A speaker is mounted in the housing to direct sound through the pyramid base. A sound reflector having the shape of a pyramid is mounted at the base on the rear wall, with the reflector vertex being directed toward the speaker. Sound emitted from the speaker is reflected from the reflector and travels between the housing and the interior walls of the cabinet outwardly through the front speaker opening to provide a flat impedance curve and a smooth base response to to approximately 2,000 cycles per second.

**17 Claims, 5 Drawing Figures**



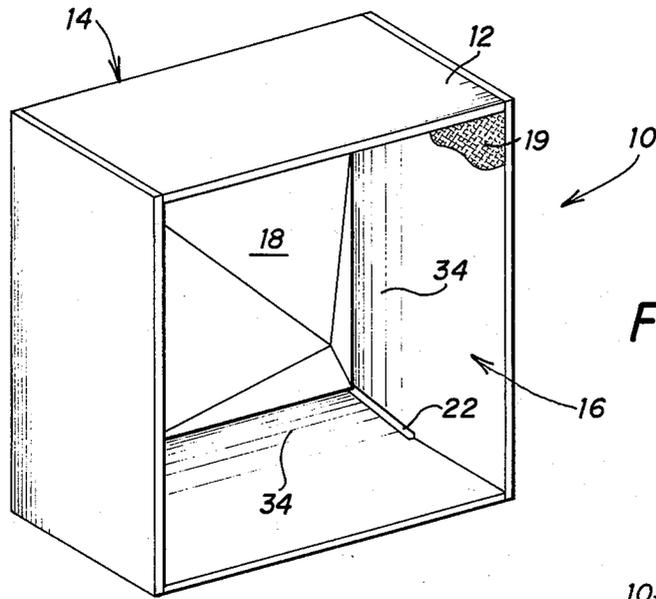


FIG. 1

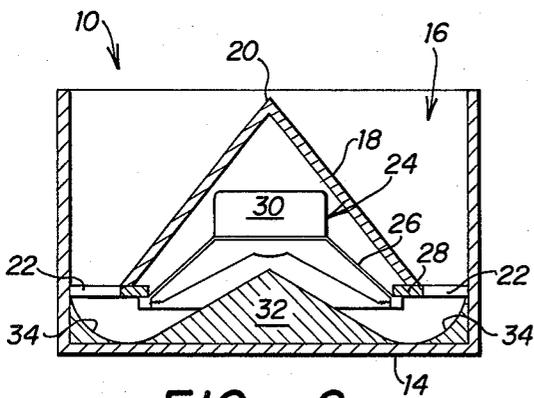


FIG. 2

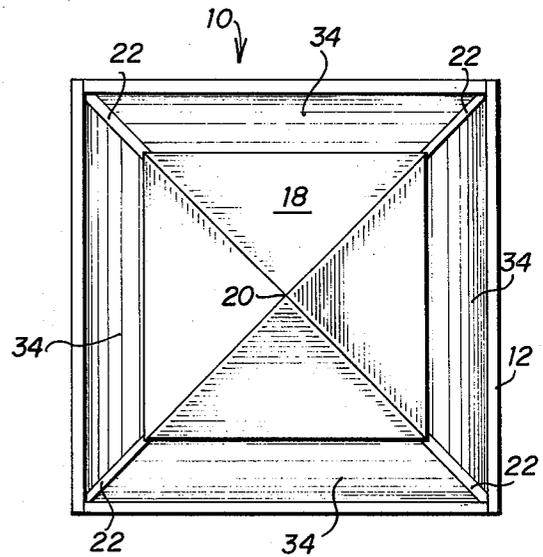


FIG. 3

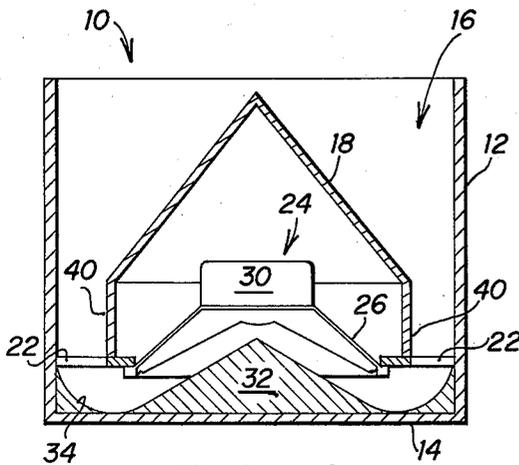


FIG. 4

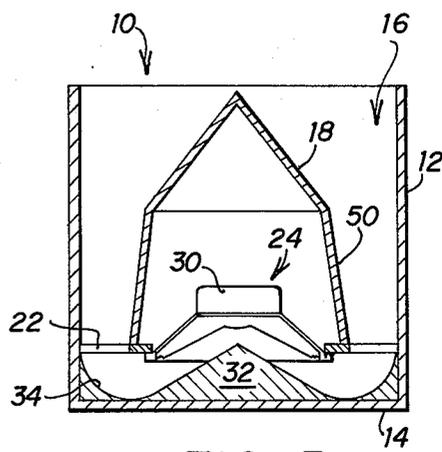


FIG. 5

**FOLDED BASS HORN SPEAKER****FIELD OF THE INVENTION**

This invention relates to speakers, and more particularly relates to folded bass horn speakers.

**THE PRIOR ART**

Large bass horn speakers are commonly used for projection of bass sound at outdoor concerts and the like. Such bass speakers generally comprise a cone speaker having a large horn attached to the front thereof and having a small rear chamber which encloses the back of the speaker. However, the size of such bass speakers is a distinct drawback, as such speakers may often be more than 6 feet wide, 4 feet tall and 8 feet deep. A need has thus arisen for a bass speaker which approaches the efficiency of prior large bass horn speakers, and yet which is relatively small and compact.

It has been heretofore known to provide a folded horn speaker wherein a speaker is oriented toward the rear of a cabinet such that the sound is directed outwardly from the periphery of the speaker through the front of the cabinet. An example of such a prior folded horn speaker utilized a "W enclosure," wherein the rear baffle or reflector was provided with the general shape of the letter W in order to reflect the sound out the front of the cabinet. However, such previously developed folded horn speakers have not provided the desired flat impedance curve to provide a high efficiency enclosure, nor have such prior speakers provided a smooth bass response up to approximately 2000 cycles per second.

**SUMMARY OF THE INVENTION**

The present invention provides a folded bass horn speaker which eliminates the size problems heretofore associated with prior large bass horn speakers and which provides an extremely flat impedance curve and a smooth bass response up to 2000 cycles per second.

In accordance with the invention, the present speaker includes a cabinet having a rear wall and a front speaker opening. A housing having the shape of a pyramid is mounted within the cabinet, the base of the pyramid being open and disposed toward the rear wall and the vertex of the pyramid being disposed toward the front speaker opening. A speaker is mounted within the housing to direct sound out from the open base of the pyramid. A sound reflector extends from the rear wall toward the speaker, such that sound emitted from the speaker is reflected from the reflector and travels around the periphery of the housing and out the front speaker opening of the cabinet.

In accordance with another aspect of the invention, a folded horn speaker includes a rectangular cabinet having a rear wall and a front speaker opening. A housing having a closed end is directed toward the front speaker opening and includes an open end directed toward the rear wall. A speaker is mounted within the housing for directing acoustic energy through the open end toward the rear wall. A reflector having the shape of a pyramid is attached at the pyramid base to the rear wall, with the pyramid vertex being disposed toward the speaker. The reflector is spaced from the speaker such that acoustic energy travels around the periphery of the housing outwardly through the front speaker opening.

In accordance with a more specific aspect of the invention, a folded bass horn speaker includes a speaker cabinet having a rear wall and a front speaker opening. A housing having an exterior shape of a pyramid is mounted within the cabinet, with the pyramid base disposed toward the rear wall and the pyramid vertex disposed toward the front speaker opening. A speaker is mounted within the housing to direct sound through the pyramid base. A sound reflector having the configuration of a pyramid is mounted with the base of the pyramid on the rear wall and the reflector pyramid vertex being directed toward the speaker. Sound is emitted from the speaker and reflected from the reflector and travels between the housing and the interior walls of the cabinet outwardly through the front speaker opening.

**DESCRIPTION OF THE DRAWINGS**

For a more detailed description of the present invention and for further objects and advantages thereof, reference may now be made to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view taken from the front of the present folded bass speaker;

FIG. 2 is a sectional view taken through the center of the speaker shown in FIG. 1;

FIG. 3 is a front view of the speaker shown in FIG. 1;

FIG. 4 is a sectional view of a second embodiment of the present speaker; and

FIG. 5 is a sectional view of a third embodiment of the present speaker.

**DESCRIPTION OF THE PREFERRED EMBODIMENT**

FIG. 1 illustrates a perspective view of the preferred embodiment of the present folded bass horn speaker identified generally by numeral 10. Speaker 10 comprises a rectangular cabinet 12 having a rear wall 14 and a front speaker opening 16. In the preferred embodiment, the front speaker opening 16 is open as illustrated. However, if desired, a fabric cover 19 may be disposed over the front speaker opening.

A housing 18 which has the slope of a pyramid is disposed within the cabinet 12. The base of the pyramid 18 is open, as shown in FIG. 2, and is disposed toward the rear wall 14. The vertex 20 of the housing 18 is disposed toward the front speaker opening 16. Braces 22 are connected at the four corners of the pyramid housing 18 and are connected by bolts or the like to the interior walls of the cabinet 12, as shown in FIG. 3.

Referring to FIG. 2, a conventional bass speaker 24 is mounted within the housing 18 by connecting the outer periphery of the speaker cone 26 to an inwardly directed edge 28 of the housing. The speaker 24 includes a conventional driver unit 30 which generates acoustic energy in the well known manner.

A sound reflector 32 is also provided with the shape of a pyramid, with the pyramid base being rigidly attached to the rear wall 14 and with the pyramid vertex being disposed toward speaker 24. The pyramid vertex of reflector 32 is disposed within the speaker cone 26, but the reflector 32 is spaced apart from the speaker cone 26. The distance between the surface of the reflector 32 and the speaker cone 26 increases gradually toward the periphery of the speaker 24. Curved sur-

faces 34 are rigidly connected along the intersections of the rear wall 14 and the interior side walls of the cabinet 12. The curved surfaces 34 are thus disposed between the base of the reflector 32 and the interior walls of the cabinet 12 in order to provide a smooth travel path for sound generated from speaker 24.

In operation of the speaker 10, sound is emitted from the speaker 24 and is reflected from the reflector 32 and travels outwardly around the periphery of the speaker cone 26. The sound is then reflected upwardly by the curved surfaces 34 and out the front speaker opening 16. The present speaker thus "fold" the bass horn in four directions along the interior sides of the cabinet 12. The distance between the housing 18 and the interior walls of the cabinet 12 increases as the sound moves toward the front speaker opening 16. The speaker thus serves as an impedance matching transformer which couples the heavy diaphragm of the driver unit 30 to the air mass at the front speaker opening 16 of the cabinet 12. The present speaker provides an extremely flat impedance curve to provide a very high efficiency speaker enclosure. The speaker does not cancel out mid bass frequencies and has a smooth frequency response up to 2000 cycles per second.

An important aspect of the present invention is that the housing 18 is provided with the mathematical dimensions of the Great Pyramid in Egypt. The formula for determining the height and apothem of the pyramid shape of the housing 18 is thus as follows:

$$\begin{aligned} \text{Base multiplied by 4 divided by pi (3.1416)} &= \text{height} \\ \text{Base divided by 2 multiplied by 1.618} &= \text{apothem} \end{aligned}$$

When utilizing an 18 inch speaker, the base dimension of the pyramidal shape of housing 18 is thus exactly one Egyptian Cubit which is slightly over 20.5 inches. The angle of the sides of the pyramidal shaped housing 18 is exactly 51.51 degrees. When a 15 inch speaker is utilized, the pyramid base dimension of the pyramid housing 18 is 17 inches. For a 12 inch speaker, the pyramid base dimension is 15 inches and for a 4 inch speaker the base dimension of the pyramid housing is 6 inches. Various size cabinets will of course be utilized for the present speaker depending upon the size speaker required, but speaker cabinets having a depth of 18 to 25 inches and 30 inches by 30 inches square accommodate an 18 inch speaker. Cabinets for smaller speakers will be proportionally smaller.

The pyramidal shape of the reflector 32 is not related to pi, but has a base width equal to approximately the diameter of the speaker and has side walls extending at 30° to the base. In the preferred embodiment, the sound reflector 32 and the curved surfaces 34 are constructed from molded fiberglass.

FIG. 4 illustrates a sectional view of a second embodiment of the invention wherein like numerals are utilized for like and corresponding parts previously shown. The structure of FIG. 4 is generally similar to that previously disclosed, with the exception of rectangular side walls 40 which are disposed between the pyramid housing 18 and the braces 22. The rectangular side walls 40 are parallel to the side walls of the cabinet 12 and serve to lengthen the distance between the speaker 24 and the housing 18. The longer the side walls 40, the more the base response of the speaker is increased. The side walls of the cabinet 12 are required to be sufficiently deep in order to accommodate the increased height of the housing 18. For the embodiment

shown in FIG. 4, the cabinet walls may range from 17 inches to 25 inches deep.

FIG. 5 illustrates a third embodiment of the invention which is similar to the embodiment shown in FIG. 4, with the exception that four side walls 50 are disposed between the edges of the pyramid housing 18 and the braces 22. The side walls 50 are inclined relative to the interior side walls of the cabinet 12 to provide a path for the sound emanating from the speaker 24 which gradually increases in size as the sound passes from the reflector 32 upwardly along the interior sides of the cabinet 12.

It may thus be seen that the present invention provides an improved bass speaker which is substantially smaller than previously used bass speakers, yet which provides an extremely flat impedance curve for a high efficiency enclosure and which has a smooth bass response up to approximately 2000 cycles per second. The present speaker accomplishes this performance in a small package with the utilization of a pyramidal shaped speaker housing and reflector oriented relative to another in the manner described in order to essentially fold the speaker horn in four directions to adapt the circular speaker to a square cabinet.

Whereas the present invention has been described with respect to specific embodiments thereof, it will be understood that various changes and modifications will be suggested to one skilled in the art, and it is intended to encompass such changes and modifications as fall within the scope of the appended claims.

What is claimed is:

1. A folded horn speaker comprising:
  - a rectangular cabinet having a rear wall and a front speaker opening,
  - a housing having a closed end directed toward said front speaker opening and an open end directed toward said rear wall,
  - a speaker mounted within said housing for directing acoustic energy through said open end toward said rear wall,
  - a four sided reflector having the shape of a pyramid with the rectangular pyramid base attached to said rear wall and the pyramid vertex disposed toward said speaker, said reflector being spaced from said speaker such that acoustic energy is reflected from said reflector and travels around the periphery of said housing outwardly through said front speaker opening.
2. The folded horn speaker of claim 1 wherein the edges of said reflector pyramid are parallel to the sides of said rectangular cabinet.
3. The folded horn speaker of claim 1 wherein said housing is shaped as a pyramid.
4. The folded horn speaker of claim 1 wherein the sides of said reflector pyramid extend from the pyramid base at an angle of 30°.
5. The folded horn speaker of claim 1 and further comprising:
  - curved walls disposed between the base of said reflector pyramid and the side walls of said cabinet in order to direct sound outwardly through said front speaker opening.
6. The folded horn speaker of claim 1 and further comprising:
  - braces extending from said housing and connected at the ends thereof to the corners of said cabinet.

7. The folded horn speaker of claim 1 wherein the vertex of said pyramid reflector extends into the cone of said speaker.

8. A folded bass horn speaker comprising:  
a speaker cabinet having a rear wall and a front speaker opening,  
a four sided housing having the exterior shape of a pyramid mounted within said cabinet with the rectangular pyramid base disposed toward said rear wall and the pyramid vertex disposed toward said front speaker opening,  
a speaker mounted within said housing to direct sound through said pyramid base,  
a four sided sound reflector having the configuration of a pyramid, the rectangular base of said reflector mounted on said rear wall and the reflector vertex being directed toward said speaker,  
wherein sound emitted from said speaker is reflected from said reflector and travels between the periphery of said housing and the interior walls of said cabinet outwardly through said front speaker opening.

9. The folded bass horn speaker of claim 8 wherein said cabinet is rectangular and wherein the base edges of said housing and said reflector are parallel to the side walls of said cabinet.

10. The folded bass horn speaker of claim 8 wherein

the vertex of said reflector extends within the speaker cone of said speaker.

11. The folded bass horn speaker of claim 8 and further comprising:  
planar side walls extending from the base of said four sided housing toward said rear wall.

12. The folded bass horn speaker of claim 11 wherein said side walls are parallel to the interior walls of said cabinet.

13. The folded bass horn speaker of claim 11 wherein said side walls are slanted relative to the interior walls of said cabinet.

14. The folded bass horn speaker of claim 8 wherein the distance between said reflector and said speaker increases toward the periphery of said speaker.

15. The folded bass horn speaker of claim 8 wherein the height of said housing pyramid is equal to the housing pyramid base multiplied by four and divided by pi.

16. The folded bass horn speaker of claim 8 wherein the walls of said housing pyramid are oriented at 51.51° to the housing pyramid base.

17. The folded bass horn speaker of claim 8 wherein the horn speaker has a substantially flat impedance curve and a smooth bass frequency response up to approximately 2000 cycles per second.

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