

[54] **MULTIPLE SPEAKER ENCLOSURE
WITH SINGLE TUNING**

[72] Inventor: **John Virva**, Chicago, Ill.
[73] Assignee: **Admiral Corporation**, Chicago, Ill.
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[58] Field of Search.....181/31 R, 31 B

[56] **References Cited**

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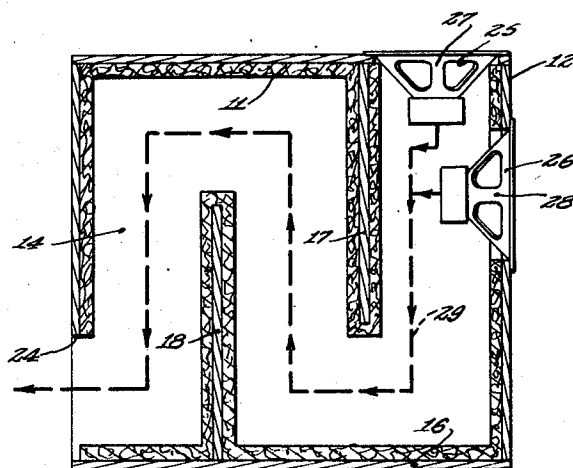
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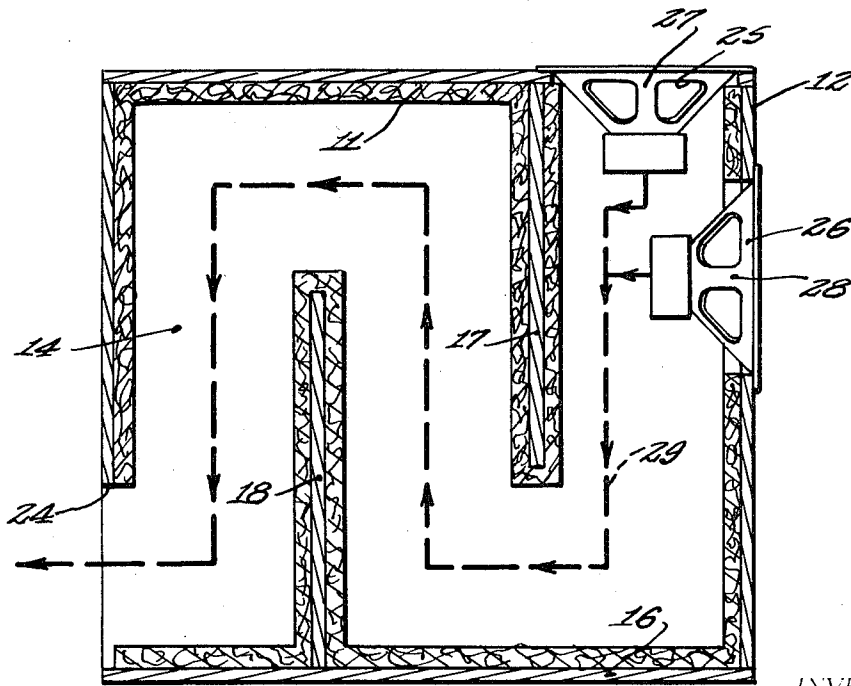
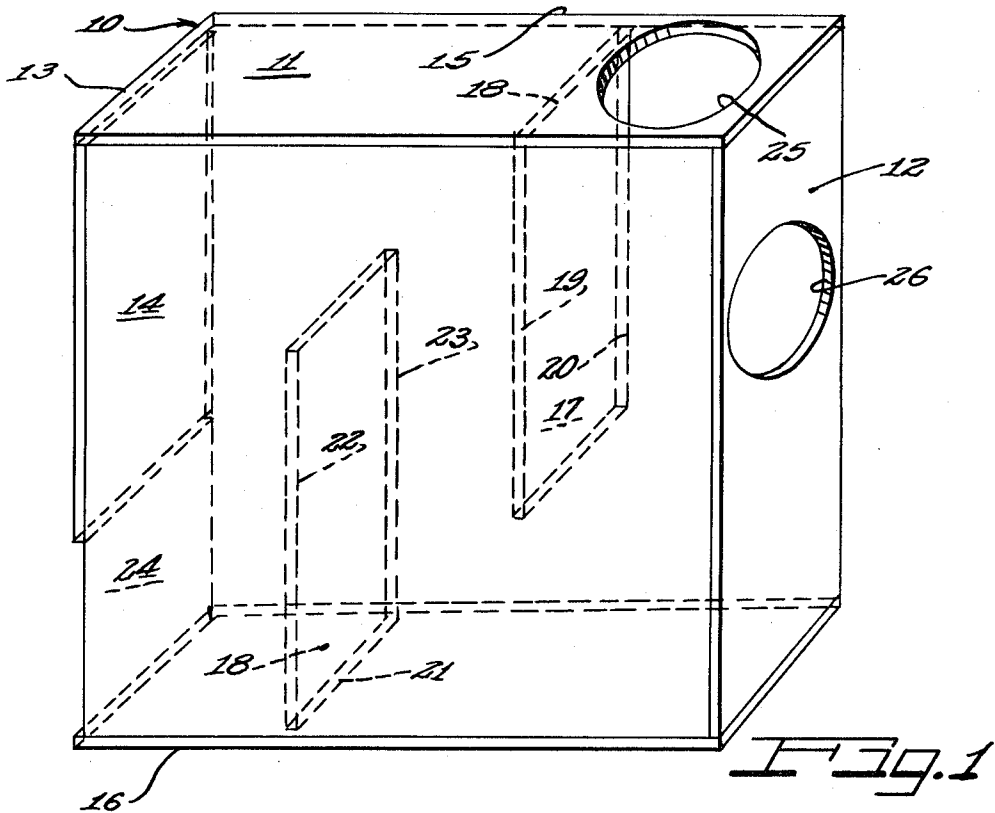
Primary Examiner—Stephen J. Tomskey
Attorney—Hill, Sherman, Meroni, Gross & Simpson

[57] **ABSTRACT**

A combination of a plurality of high compliance speakers and a rigid single tuned enclosure. The speakers are mounted on different walls at one end of the tuned enclosure, and all of the speakers have their low frequency response augmented by the loading effect of the enclosure. The tuned enclosure has a folded path which is substantially equal to one-quarter of the wave length of the in-air resonance of the speakers. The enclosure is open-ended and has a cross sectional area which is substantially equal to the cross sectional area of the cone of one of the high compliance speakers. The enclosure walls are lined with a sound absorbing medium. By this arrangement sound may be effectively dispersed without employing a high volume speaker enclosure.

6 Claims, 2 Drawing Figures





INVENTOR.

Fig. 2

John Virva

BY Nicholas A. Camasto

ATTORNEYS

MULTIPLE SPEAKER ENCLOSURE WITH SINGLE TUNING

BACKGROUND OF THE INVENTION

1. Description of the Prior Art

My co-pending patent application Ser. No. 847,791, filed Mar. 4, 1968 now U.S. Pat. No. 3,523,589 and entitled "High Compliance Speaker And Enclosure Combination" relates to a speaker system having a single speaker mounted in an enclosure which has a cross sectional area approximately equal to the area of the cone of the speaker. This arrangement yields excellent performance and greatly improves the low frequency response as compared to prior art speaker enclosure combinations. It was believed that speaker enclosures should have a cross sectional area approximately equal to the area of the cone of the speaker, and accordingly as the speaker size increased, the cross sectional area of the enclosure increased. This rule generally still applies. However, a greatly improved dispersal of sound can be obtained by the arrangement of the present invention wherein the same tuned column of air can be used to provide a loading for more than one speaker mounted at the closed end of the column.

2. Field of the Invention

The field of art to which this invention pertains is speaker and speaker enclosure combinations and especially to the combination of an acoustical open-ended enclosure and a high compliance speaker having a relatively small volume and an improved sound dispersal characteristic.

SUMMARY OF THE INVENTION

It is a principal feature of the present invention to provide a loud speaker system having an improved frequency response and sound dispersal characteristic.

It is another feature of the present invention to provide an improved combination of a speaker and enclosure utilizing high compliance speakers.

It is a principal object of the present invention to provide an open-ended speaker enclosure for a of high compliance speakers to achieve improved sound dispersal in a room or similar area.

It is another object of the present invention to provide a rigid acoustic enclosure having means for mounting a plurality of high compliance speakers therein with each of the speakers having a cross sectional area approximately equal to the cross sectional area of the speaker enclosure.

It is an additional object of the present invention to provide a speaker enclosure for high compliance speakers which includes an open-ended tuned column having a length which is approximately equal to one-quarter of the wave length of the in-air resonance of the speakers wherein more than one high compliance speaker is mounted at the same end of the enclosure oppositely of the opened end and wherein the speakers have their axes disposed at substantial angles with respect to each other.

These and other objects, features and advantages of the invention will be readily apparent from the following description of a certain preferred embodiment thereof, taken in conjunction with the accompanying drawing, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevational view of the speaker enclosure constructed in accordance with the features of the present invention prior to the mounting of the speakers therein and omitting the sound absorbing medium for simplicity.

FIG. 2 is a sectional view of a high compliance speaker enclosure according to the present invention showing the positioning of the speakers in the enclosure and the positioning of the sound absorbing medium along the walls of the enclosure, and illustrating further the folded character of the tuned column from the speakers to the open end thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention relates to a combination of a speaker enclosure and a number of high compliance speakers mounted in the enclosure to provide an improved frequency response and improved power output without requiring the speaker enclosure to be enlarged to correspond to the combined cross sectional area of the speakers.

It has been desired to provide a lower cost speaker system having an improved low frequency sound output, and in addition it has been desired to provide a speaker system which has a lower physical volume to occupy less space in a room.

My co-pending patent application, Ser. No. 847,791 relates to such a sound system. In that application, a single high compliance speaker is shown mounted in a tuned open-ended column which is contrary to the prior teachings of using high compliance speakers in generally sealed volumes such as is disclosed in the Electronics World article of Aug. 1966 beginning on page 25 entitled "Enclosures for High Compliance Loud Speakers" by Roger H. Russell. In that article, high compliance speakers are defined as being characterized by heavy magnets, very flexible cone surrounds, long-throw voice coils, and low cone resonance. The arrangement shown in my co-pending application provides a means for obtaining a higher power output with a lower power input and improving the frequency response well below the in-air resonance of the high compliance speaker.

Previously, it was believed that a larger speaker diameter would require a larger cross sectional area, and further that the combined cross sectional area of the speaker cones, however many cones were utilized, should approximate the cross sectional area of the enclosure. However, I have discovered that by the arrangement of the present invention, an improved sound dispersal can be obtained by using a plurality of high compliance speakers which have substantially the same in-air resonance by mounting such speakers in a single enclosure which has a cross sectional area substantially equal to the area of the cone of one of the speakers.

Referring to the drawing in greater detail, FIG. 1 shows an enclosure according to the present invention having a provision for two speakers. The speaker enclosure in FIG. 1 is shown without the sound absorbing lining for simplicity and without the speakers mounted in the respective openings.

The speaker system shown in FIG. 1 includes an enclosure 10 having a top panel 11, front and rear panels

12 and 13 respectively, side panels 14 and 15 and a bottom panel 16.

The panels may be formed of Coresote, wood or other material which may later be lined with a sound absorbing medium or the panels may be formed directly of a sound absorbing material such as Tuflex. The panels may be riveted together or secured by other suitable means to make the speaker enclosure substantially rigid.

First and second partitions 17 and 18 are disposed within the enclosure. The partition 17 is secured to the top panel along a line 18 and is secured to the side panels 14 and 15 along lines 19 and 20 respectively.

Similarly, the partition 18 is secured to the bottom panel 16 along a line 21 and is secured to the side panels 14 and 15 along lines 22 and 23 as shown. The rear panel 14 has an opening 24 formed at the lower section thereof to make the enclosure open-ended.

Two speaker apertures shown in FIG. 1 are identified by reference numerals 25 and 26. The aperture 25 is formed in the top panel 11 and is generally in line with a portion of the column which is defined by the partition 17 and the front panel 12.

The aperture 26 is formed in the front panel 12 and is generally perpendicularly oriented with respect to the aperture 25. The aperture 26 is also perpendicularly oriented with respect to the column which is defined by the front panel 12 and the partition 17.

The details of construction of the enclosure are not critical although the enclosure should be generally sealed and the various members fastened together in accordance with good acoustical design techniques.

The resulting enclosure defines a folded column which is generally serpentine in configuration extending from the end which is adjacent to the openings 25 and 26, around the partitions or baffles 17 and 18, to the opening 24 in the rear panel 14.

The path length of the column is generally equal to one-quarter wave length at the resonant frequency of the speakers which are to be mounted in the apertures 25 and 26. As explained, all inside surfaces of the enclosure should be treated with acoustically absorbing material to prevent spurious resonances or standing waves from developing within the enclosure.

Typical internal dimensions for a speaker enclosure such as that shown in FIG. 1 for a four inch diameter high compliance speaker mounted in each of the apertures 25 and 26 would be as follows:

The length of the top panel 11	13"
The width of the top panel 11	4 1/4 inches
The height of the front panel 12	12 inches
The length of the partitions 17 and 18	7 1/2 inches
The spacing between the partitions and between the partitions and the rear and front panels.	4 1/4 inches

In FIG. 2 the speaker enclosure of FIG. 1 is shown complete with sound absorbing material and with a pair of high compliance speakers mounted in the associated apertures 25 and 26. Reference numerals have been taken from FIG. 1 to FIG. 2 to identify like portions of the speaker enclosure.

In particular, a high compliance loud speaker of the type disclosed generally in the Electronics World article identified above is indicated by the reference numeral 27 and is mounted in the aperture 25 as shown.

In addition, a further high compliance speaker 28 is mounted in the aperture 26. Both of the speakers 27 and 28 require loading to operate effectively and both of these speakers utilize the same tuned column of air provided by the serpentine or folded path illustrated by the arrows identified by the numeral 29.

The speakers 27 and 28 are mounted so that their axes are perpendicular to one another and are both mounted at the same end of the tuned column so that the effective path length from the respective speakers to the opening 24 at the rear of the enclosure is approximately one-quarter wave length of the in-air resonance of each of the speakers.

In the above way, improved power handling capability can be achieved while obtaining the important low frequency advantage of the high compliance speaker and enclosure combination described in my above-identified co-pending application. In addition improved sound dispersal is obtained without increasing the volume of the speakers enclosure.

I claim as my invention:

1. In combination; a rigid acoustic enclosure having a series of panels defining an open-ended tuned column; sound absorptive means in said column, first and second high compliance loudspeakers having low natural resonances, means mounting the first of said high compliance loudspeakers in one panel of said rigid acoustic enclosure adjacent one end of said column, means mounting the second of said high compliance loudspeakers in another panel of said rigid acoustic enclosure also adjacent said one end of said column, the axes of said first and second loudspeakers forming an angle approximately a right angle with one another, the mean path length of said column being chosen to augment the low frequency response of each of said high compliance loudspeakers, and provide substantial loading therefor, whereby said loudspeakers may be effectively operated at frequencies well below the frequency of said natural resonance said column being folded and having a cross-sectional area which is approximately equal to the cross-sectional area of the cone of one of said high compliance loudspeakers.

2. The combination as set forth in claim 1 wherein said high compliance loudspeakers are mounted at right angles to each other.

3. The combination as set forth in claim 2 wherein said high compliance loudspeakers have substantially the same diameter.

4. The combination as set forth in claim 1 wherein said high compliance speakers have substantially the same natural resonance.

5. The combination of first and second high compliance loudspeakers, an open ended rigid acoustic enclosure having means defining a column for augmenting the low frequency response of said high compliance loudspeakers, said rigid acoustic enclosure being formed of plane walls arranged substantially at right angles to each other and being acoustically lined, each of said high compliance loudspeakers being mounted at adjacent angularly disposed walls at the same end of the enclosure, said column having a cross-sectional area which is approximately equal to the cross-sectional area of the cone of one of said high compliance loudspeakers, the mean path length of said column being chosen to augment the low frequency response of

each of said high compliance loudspeakers and provide substantial loading therefor, whereby each speaker is operable at frequencies well below the in air resonance of said speakers.

6. The combination as set forth in claim 5 wherein the path length of said column is substantially one-quarter wave length of a frequency which approximates the in-air resonance of said high compliance speaker.

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