

[54] **VARIABLE DISTANCE DOPPLER GENERATOR**

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[52] U.S. Cl. **181/31 B, 181/27 A**

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

[58] Field of Search....181/27 A, 31 B, 31 R; 179/1 J;
84/1.25

[56] **References Cited**

UNITED STATES PATENTS

3,057,430 10/1962 Santi.....181/27 A

3,070,660 12/1962 Ippolito181/27 A
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[57] **ABSTRACT**

A plurality of acoustic pulsato units are mounted in a vertical stack with the axes of the pulsato rotors horizontal in spaced parallel array. Reflector walls on opposite sides not only direct the sound frontally but also serve as the primary means for producing frequency deviations by Doppler effect since the distance between the reflector walls and the mouths of the sound channels changes in accordance with the angular movement of the rotors. Pulsato sound at a high energy level is efficiently radiated.

9 Claims, 9 Drawing Figures

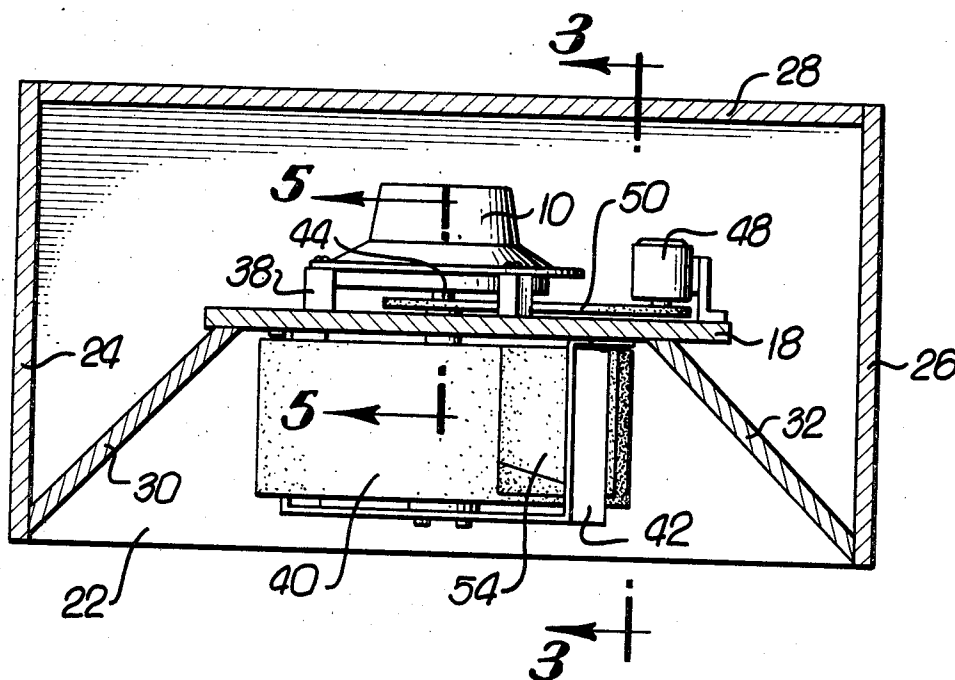


FIG. 1.

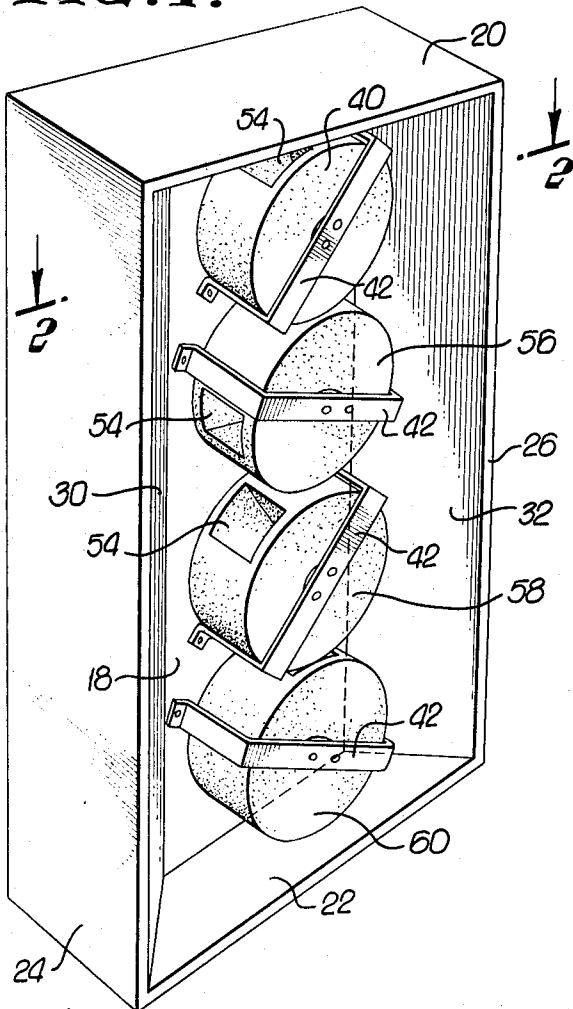


FIG. 2.

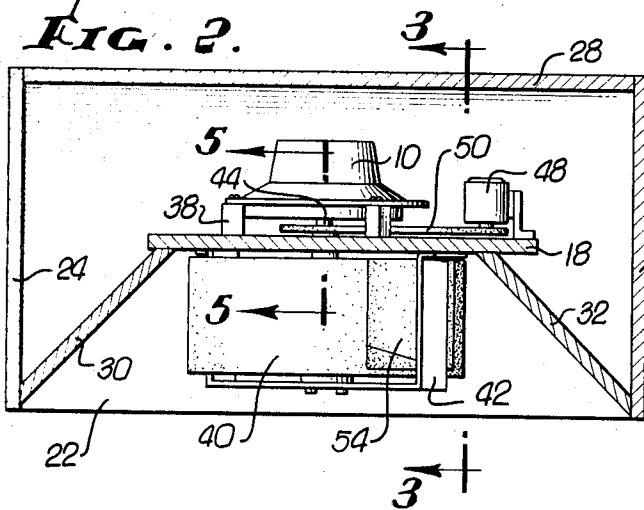
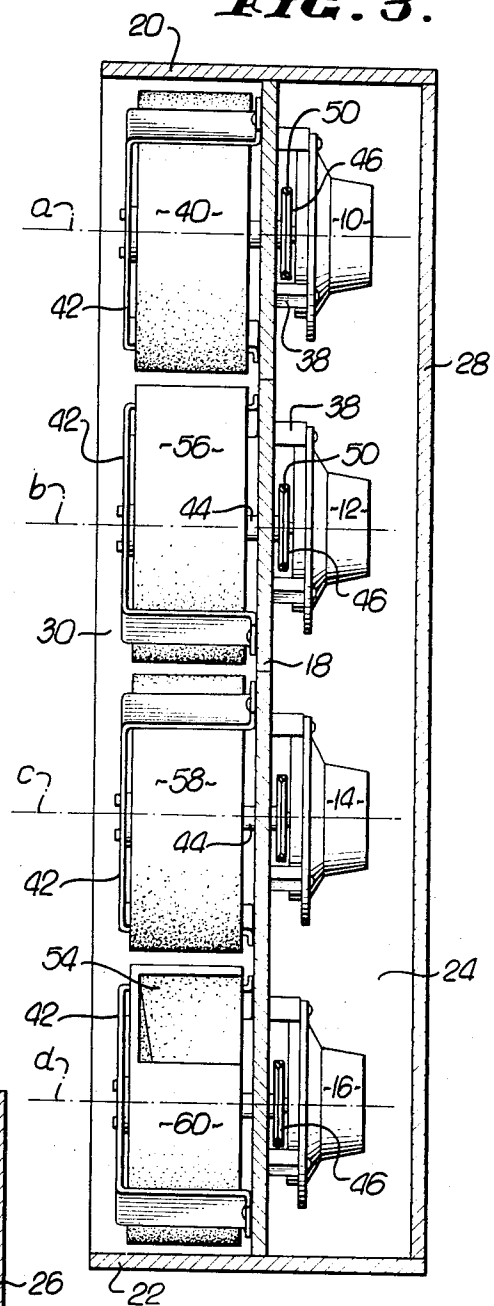


FIG. 3.



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FIG. 5.

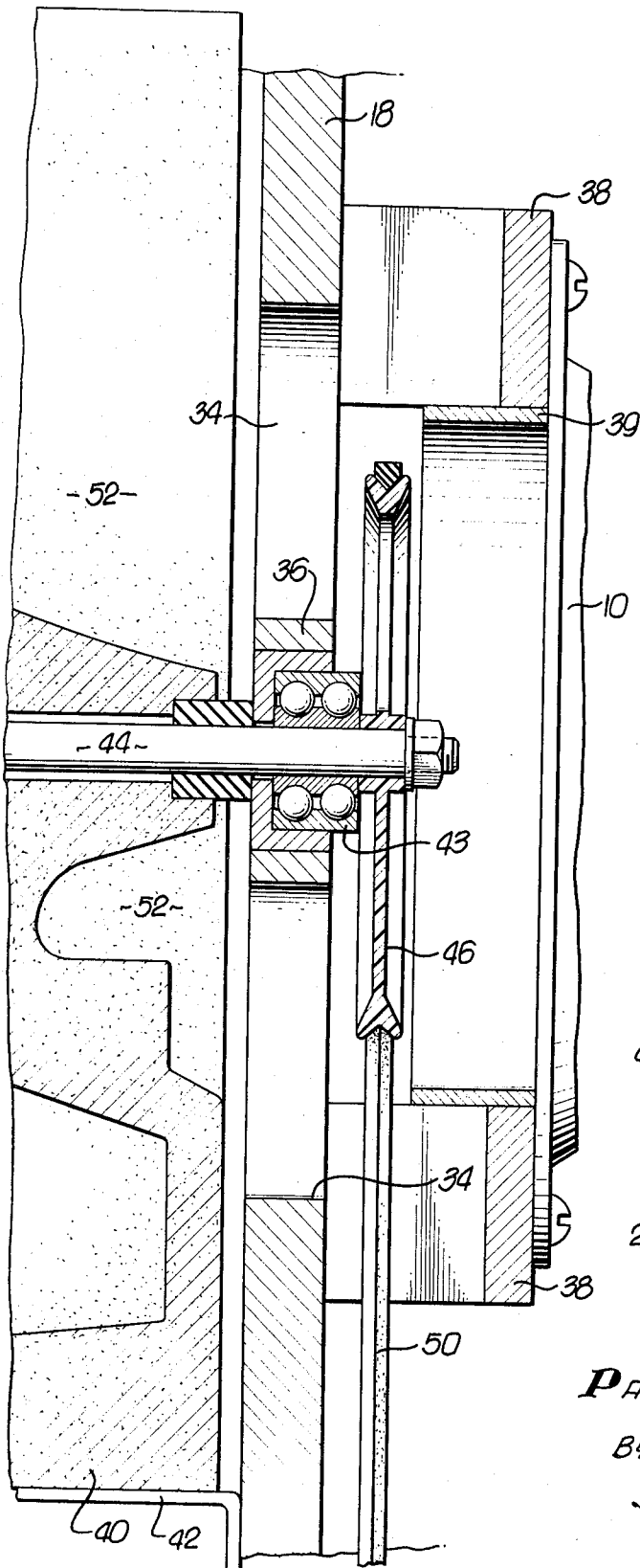
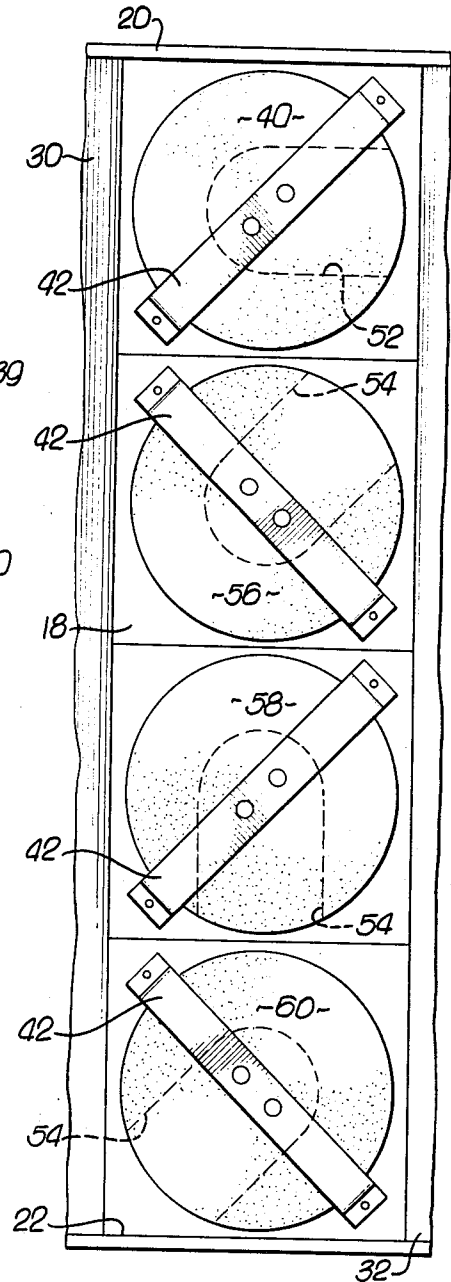


FIG. 4.



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FIG. 6.

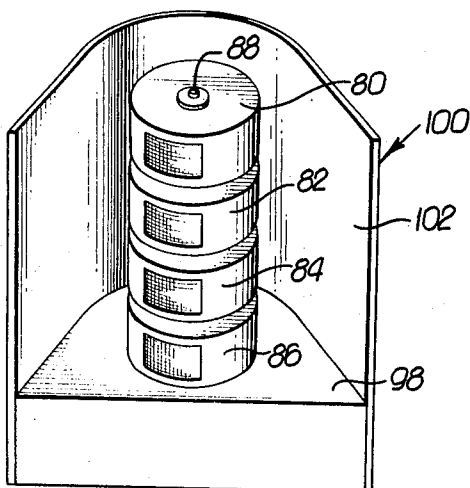


FIG. 7.

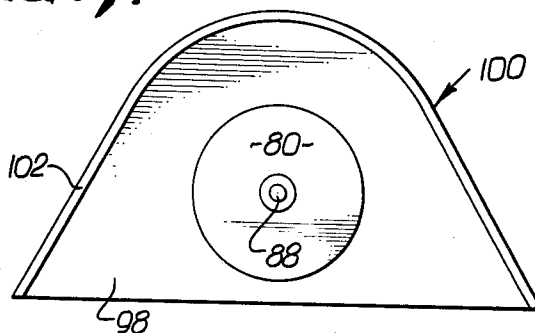


FIG. 8.

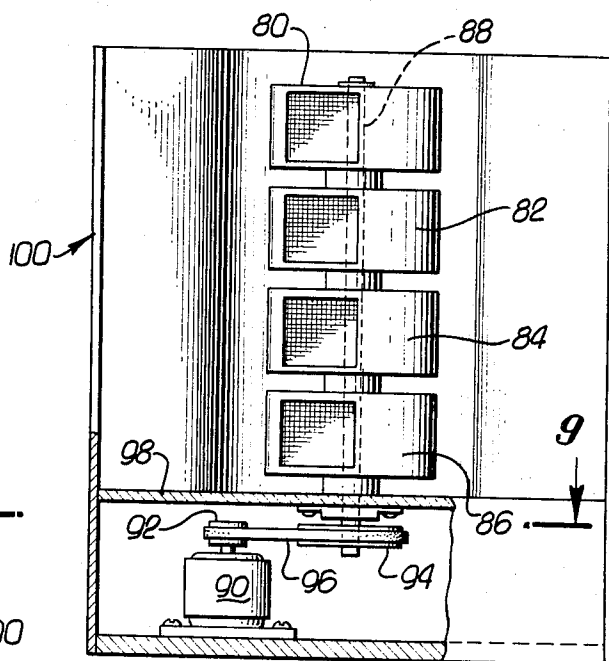
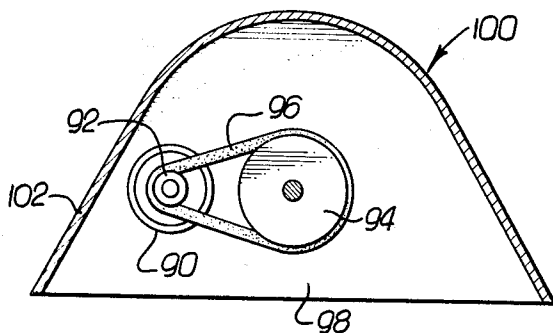


FIG. 9.



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VARIABLE DISTANCE DOPPLER GENERATOR

BACKGROUND OF THE INVENTION

1. Field of Invention

This invention relates to speaker systems, and particularly to high power speaker systems incorporating acoustic pulsato apparatus.

2. Discussion of the Prior Art

Many acoustic instruments such as trumpets and trombones are capable of producing extremely loud sounds. An electronic instrument such as an organ or electric guitar played in concert with an acoustic instrument such as a trumpet, requires a high level of amplification. High powers have been achieved by driving a plurality of speakers from a common high power amplifier. As many as ten speakers may be more or less compactly mounted in a common cabinet.

Performers insist upon using acoustic pulsato apparatus. Such apparatus is not so compact. Thus each speaker must have an associated rotary sound channel. Such rotary sound channels are not efficient in terms of creating high sound levels because the sound radiation pattern is necessarily rotated 360°; consequently sound is distributed all over the room.

OBJECTS OF THE INVENTION

The primary object of the present invention is to provide a relatively compact pulsato speaker capable of efficiently producing high sound levels.

BRIEF SUMMARY OF THE INVENTION

In order to achieve the foregoing objective, I provide a reflector. Whereas a conventional reflector produces a beam from a fixed localized source, the present reflector produces a beam from a moving source with the distance between the reflector wall and the source changing so that a cyclic Doppler or pulsato effect is thereby created. The reflector thus performs a unique combined function of channelling sound energy as well as producing a full vibrant pulsato effect.

The reflector in one form of the invention comprises two wing plates at opposite sides of a speaker mounting panel, the plates being angled at about 45°. The pulsato rotors are mounted in front of the common mounting panel there being a stationary speaker for each rotor mounted in back of the panel. In another form of the invention a plurality of pulsato drums are coaxially stacked along the axis of the reflector. Each drum in this instance carries a speaker for rotation therewith. In both forms, not only is acoustic efficiency maximized, but the pulsato effect is greatly enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

A detailed description of the invention will be made with reference to the accompanying drawings. These drawings, unless described as diagrammatic or unless otherwise indicated, are to scale.

FIG. 1 is a pictorial view of a speaker system incorporating the present invention.

FIG. 2 is an enlarged transverse sectional view taken along a plane corresponding to line 2—2 of FIG. 1.

FIG. 3 is a vertical sectional view taken along a plane corresponding to line 3—3 of FIG. 2.

FIG. 4 is a fragmentary front elevational view of the speaker system showing the stack of rotors.

FIG. 5 is a further enlarged fragmentary sectional view taken along a plane corresponding to line 5—5 of FIG. 2.

FIG. 6 is an isometric view of a modified form of the present invention.

FIG. 7 is a top plan view of the speaker system of FIG. 6.

FIG. 8 is a front elevational view thereof with part of the cabinet structure being broken away and shown in section.

FIG. 9 is a sectional view taken along a plane corresponding to line 9—9 of FIG. 8.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The following detailed description is of the best presently contemplated modes of carrying out the invention. This description is not to be taken in a limiting sense but is made merely for the purpose of illustrating the general principles of the invention since the scope of the invention is best defined by the appended claims.

Structural and operational characteristics attributed to forms of the invention first described shall also be attributed to forms later described unless such characteristics are obviously inapplicable or unless specific exception is made.

Four speakers 10, 12, 14 and 16 are supported one above the other on the back of a mounting panel 18. The panel 18 is enclosed within a cabinet which comprises the top wall 20, a bottom wall 22, and side walls 24 and 26 (see also FIG. 2) and a rear wall 28. The speaker mounting panel 18 is recessed within the frontal opening of the cabinet structure with its top and bottom edges respectively abutting the inner surfaces of the top and bottom walls 20 and 22.

An enclosure for the speakers is completed by a pair of reflector panels or walls 30 and 32. One reflector wall 30, for example (FIG. 2) extends inwardly from the front vertical side edge of the cabinet opening at an angle of approximately 45° to the corresponding side of the speaker mounting panel 18. The other reflector wall 32 similarly extends from the vertical side edge of the cabinet opening to the corresponding side of the panel 18. The sound is accordingly beamed frontally to maximize acoustic efficiency.

The speakers may all be driven by the electrical output of a musical instrument such as an electric organ, electric guitar, or the like. Amplifiers may conveniently be housed in the bottom of the enclosure behind the reflectors 30 and 32.

The axes *a*, *b*, *c* and *d* of the speakers 10, 12, 14 and 16 are horizontal and vertically spaced one above the other, the speakers facing frontally of the cabinet opening. In order to conduct the sounds outwardly, four openings are provided in the panel 18, one of which 34 is shown in FIG. 5. Each opening is a composite, comprising a plurality of smaller openings. The smaller openings together form a circular array providing a spider supporting a central hub 36. The speaker 10 is mounted upon a U-shaped bracket 38 attached to the panel 18 behind the opening 34. A cylindrical section 39 attached to the inside of the bracket 38 channels the sound from the speaker 10 to the region adjacent to composite opening 34.

The sounds passing through the opening 34 are acted upon by a pulsato rotor 40 mounted in front of the speaker panel 18. The pulsato rotor 40 in this instance is of a type shown and described in Schwendener U.S. Pat. No. 3,315,760 issued Apr. 25, 1967, and entitled ACOUSTIC DAMPING DRIVE FOR PULSATO ROTOR.

The pulsato rotor 40 is mounted coaxially of the corresponding speaker 10. For this purpose a pair of bearings are provided for opposite ends of the rotor, one of the bearings (not shown) being mounted upon a U-shaped bracket 42 (FIG. 1) that straddles the rotor, and the other of the bearings 43 (FIG. 5) being mounted at the hub 36 of the composite opening 34. A shaft 44 mounted by the bearings in turn mounts the pulsato rotor 40. In order to impart rotary movement to the rotor, a pulley 46 is carried upon an inward extension of the shaft 34. A motor 48 (FIG. 2) on the inside of the panel 18 drives the pulley 46 through a belt 50.

In order to produce characteristic vibrato and tremolo, the rotor 40 rotates the sound pattern in such manner that the sound pattern is repeated at the rate of 5 to 8 cycles per second. For this purpose, the rotor 40 channels the sound to an opening that moves orbitally.

The pulsato rotor 40 thus has a channel with throat region 52 (FIG. 5) at the rotor side registering with the panel opening 34. The channel has a lateral mouth 54 (see also FIGS. 1, 2 and 4) that describes a circular orbit.

Similar pulsato rotors 56, 58 and 60 are provided for the other three speakers 12, 14 and 16. Each pulsato rotor is provided with its own motor drive located on the inside of the panel. The rotors need not be synchronized.

The orbits of the rotor openings are described about horizontal axes. Unless the listener is located well off center relative to the rotor axes, very little Doppler effect can be expected since the distance between the listener and the mouths of the channels changes only slightly during rotation. It is for this reason that a pulsato rotor is normally mounted for rotation about a horizontal axis whereby the distance between the mouth of the sound channel and the listener changes cyclically by an amount corresponding to the diameter of the rotor. However, the simple panel mounting of the speakers and rotors is highly desirable. A good common rear baffle is provided; the units are accessible for repair.

The side reflectors panels 32 and 34 cooperate with the pulsato rotors to produce a substantial distance deviation even for a listener situated directly in front of the cabinet. Thus, the distance between the mouth 54 and either one of the reflector panels changes cyclically by an amount corresponding to the diameter of the pulsato rotor. Accordingly full rich pulsato effect is restored even though the rotors themselves are compactly oriented and mounted in a simple manner.

DETAILED DESCRIPTION OF MODIFIED EMBODIMENT

In the form of the invention illustrated in FIG. 6 through 9, a plurality of pulsato drums 80, 82, 84 and 86 are mounted for rotation about a common vertical axis by the aid of a shaft 88. Inside each drum is a speaker that provides a radially outwardly opening

sound channel. The shaft 88 is rotated by a motor 90, pulleys 92, 94 and a flexible belt 96 all housed beneath a horizontal partition 98 in a cabinet structure 100.

The cabinet structure includes a reflector 102 having a simple generally parabolic curvature. Like panels 30 and 32 of the previous form, the curved reflector 102 not only beams the sound for maximum efficiency but it also cooperates with the speaker channels to enhance the pulsato effect by virtue of the fact that the distance between the reflector 102 and the opening of the sound channel is cyclically changing. The sound intensity is maximized for a given unit of power.

Intending to claim all novel, useful and unobvious features shown or described, I make the following claims:

1. In a speaker system for acoustic pulsato apparatus:

a. a speaker cabinet having a frontal opening, said speaker cabinet having reflector means at the opposite sides of said opening that are angled with respect to each other for beaming sound waves to an audience;

b. a sound channel rotatable about an axis and having a sound emitting opening spaced from said axis to describe an orbit;

c. means mounting said sound channel within the reflector means so that said sound emitting opening moves toward and away from said reflector means upon rotation of said channel to produce a Doppler effect thereby;

d. motor means for rotating said sound channel at a rate to repeat the sound radiation pattern at a desired rate; and

e. means for acoustically driving said sound channel.

2. In a speaker system for acoustic pulsato apparatus:

a. a speaker cabinet having a frontal opening, said speaker cabinet having reflector means at the opposite sides of said opening that are angled with respect to each other for beaming sound waves to an audience;

b. means forming a plurality of individual sound channels each rotatable about an axis and each having a sound emitting opening spaced from its axis to describe an orbit;

c. means mounting said sound channel means in adjacent relationship within the reflector means so that said sound emitting openings move toward and away from said reflector means upon rotation of said channels to produce Doppler effects thereby;

d. motor means for rotating said sound channel means to repeat the sound radiation patterns of each at a desired rate; and

e. means for acoustically driving said sound channels.

3. The speaker system as set forth in claim 2 in which said sound channels are formed by speaker cones carried on drums stacked together for rotation about a common axis located parallel to and adjacent a focus of the reflector means.

4. The speaker system as set forth in claim 2 in which said sound channels are formed by rotors mounted in front of a panel with the axes of the rotors spaced from each other and directed frontally of said speaker cabinet; said driving means being a plurality of speakers mounted behind the panel.

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5. The combination as set forth in claim 4 in which said reflector means comprises a pair of angled wing panels adjoining the sides of said speaker mounting panel.

6. In a speaker system for acoustic pulsato apparatus: 5
- a. a speaker cabinet having a front opening;
 - b. a speaker mounting panel recessed within the opening;
 - c. a plurality of speakers supported on the back of said mounting panel;
 - d. side reflector panels angularly adjoining the speaker mounting panel for beaming sound waves frontally of said cabinet;
 - e. a plurality of pulsato rotors rotatably supported on the front of said mounting panel respectively in substantial coaxial alignment with said speakers, said rotors each having sound openings facing

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radially outwardly and laterally of said rotors toward said reflector panels:

- f. motor means for rotating said pulsato rotors to repeat the sound radiation patterns produced by each at a desired rate whereby said sound openings move toward and away from said reflectors by an amount corresponding to the orbits of said sound openings.

7. The speaker system as set forth in claim 6 in which said cabinet has a rear wall, said panels completing an enclosure for the speakers.

8. The speaker system as set forth in claim 6 in which said motor means is located behind said panels.

9. The speaker system as set forth in claim 6 in which each rotor has its own motor located behind the mounting panel.

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