July 14, 1970 C. A. ROSS 3,520,559

ROTATING LOUDSPEAKER

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Fig. 1.

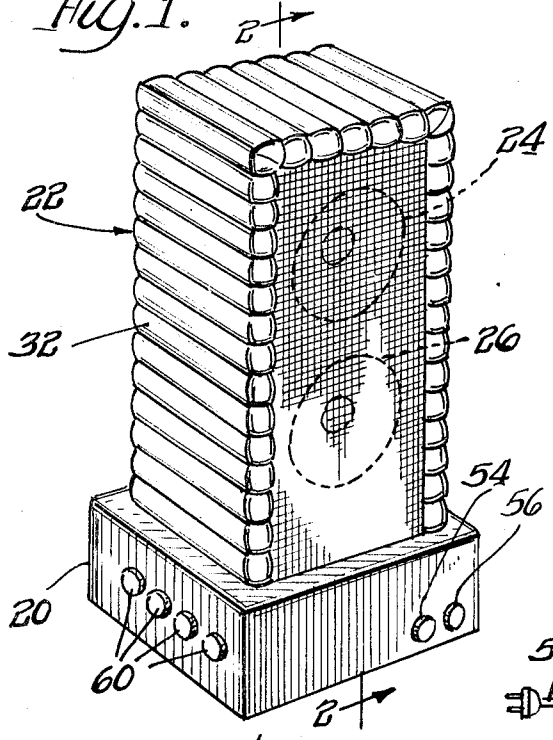


Fig. 2.

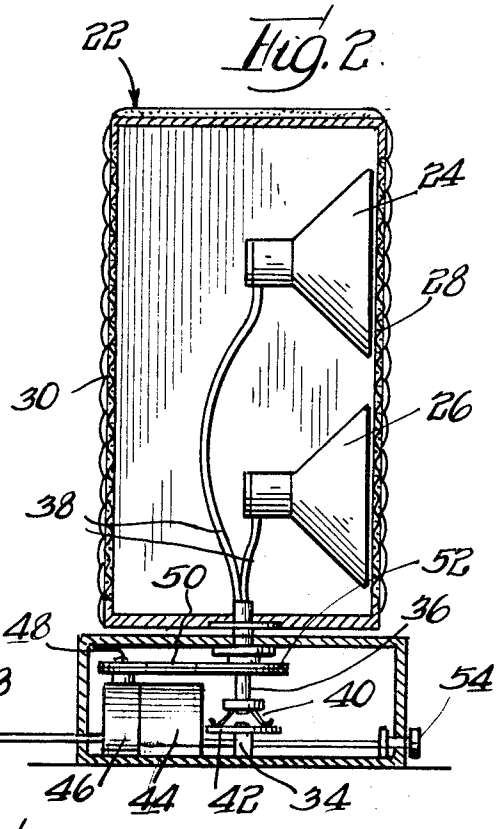


Fig. 3.

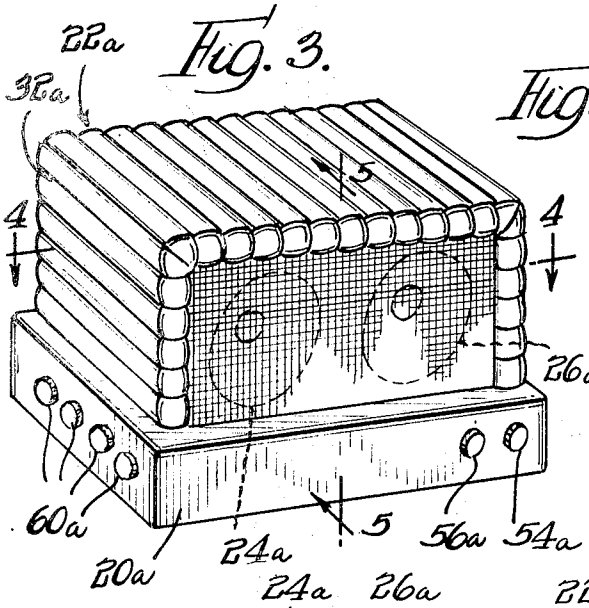


Fig. 4.

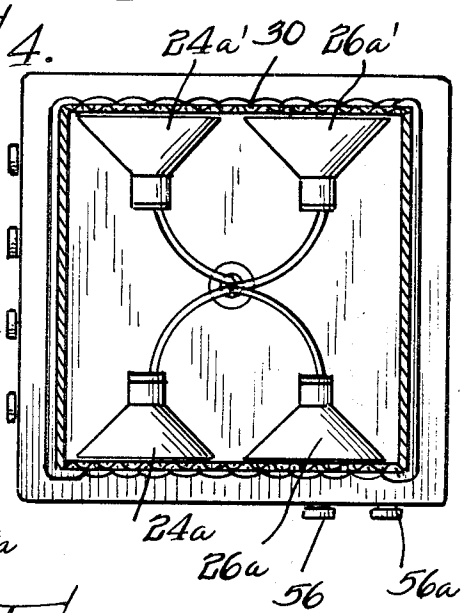
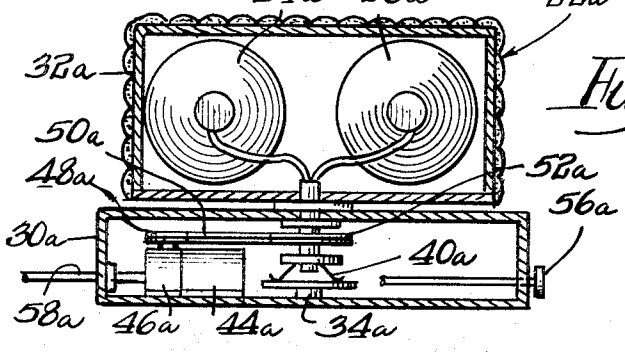


Fig. 5.



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Fig. 6.

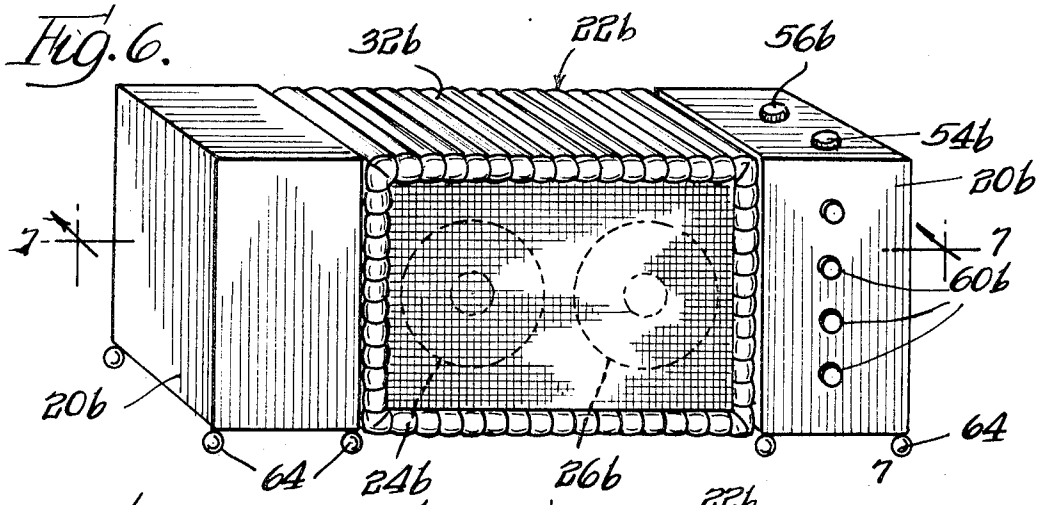


Fig. 7.

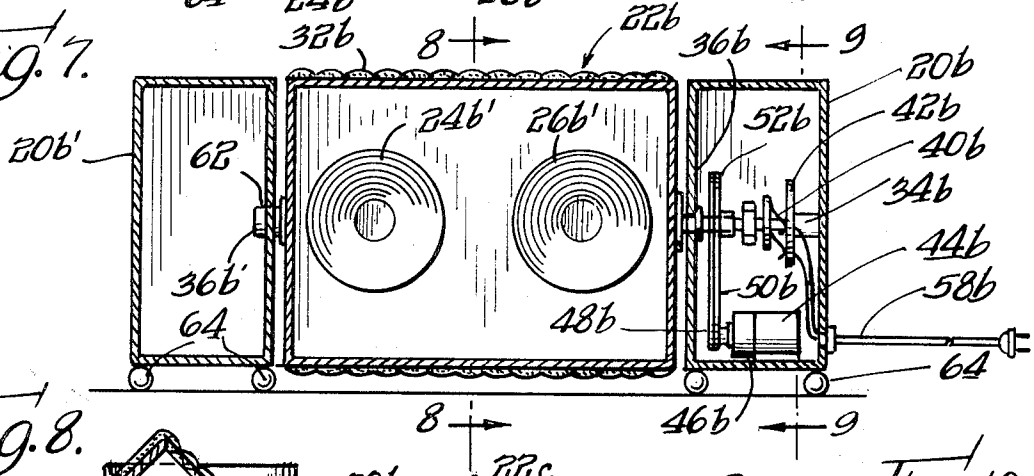


Fig. 8.

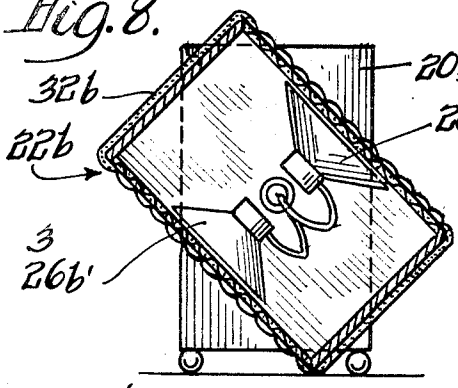


Fig. 10.

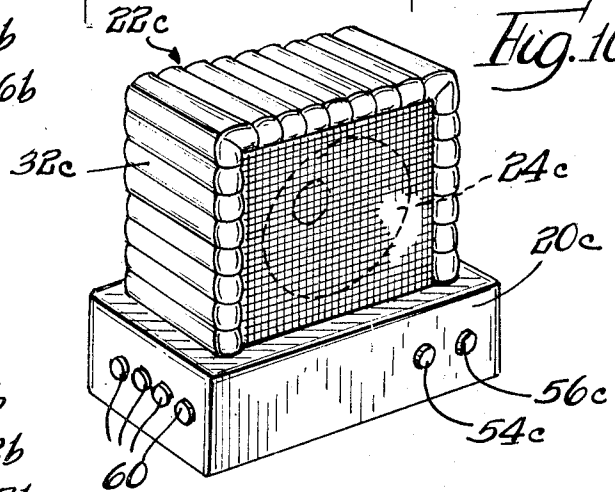
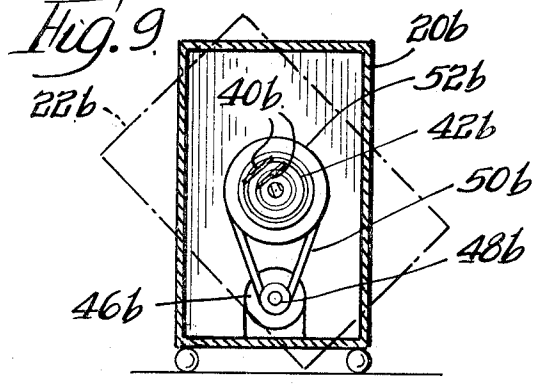


Fig. 9.



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3,520,559

ROTATING LOUDSPEAKER

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Int. Cl. H04r 1/20, 1/28
U.S. Cl. 181—31 1 Claim

ABSTRACT OF THE DISCLOSURE

The entire loudspeaker enclosure, including the loudspeakers therein, rotates relative to a fixed base. Rotation of the loudspeakers produces a Doppler effect, and hence a true frequency effect vibrato. The vibrato effect is enhanced by visual observation of the rotation.

This invention relates to the art of loudspeakers and enclosures, particularly as used in connection with musical instruments, electric guitars being exemplary.

OBJECTS OF THE INVENTION

The primary object of the present invention is to provide apparatus for producing a true frequency shift or phase shift vibrato in which the aural effects are psychologically enhanced by visual observation of the sound source.

Specifically, it is an object of this invention to provide a rotating loudspeaker system wherein the enclosure and the loudspeakers rotate as a unit.

A further object of the present invention is to provide a rotating loudspeaker and enclosure system wherein visual aspects of the frequency shift vibrato produced thereby are enhanced by the particularly attractive enclosure design.

Other and further objects and advantages of the present invention will be apparent from the following description when taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a perspective view of a rotating loudspeaker system constructed in accordance with the principles of the present invention;

FIG. 2 is a vertical longitudinal sectional view therethrough as taken substantially along the line 2—2 of FIG. 1;

FIG. 3 is a perspective view of a modified form of the invention;

FIG. 4 is a horizontal cross section as taken substantially along the line 4—4 in FIG. 3;

FIG. 5 is a vertical longitudinal section as taken substantially along the line 5—5 of FIG. 3;

FIG. 6 is a perspective view of another modified form of the invention;

FIG. 7 is a vertical longitudinal sectional view through the apparatus of FIG. 6 as taken substantially along the line 7—7 in FIG. 6;

FIG. 8 is a vertical transverse sectional view as taken substantially along the line 8—8 in FIG. 7;

FIG. 9 is another transverse sectional view as taken along the line 9—9 in FIG. 7; and

FIG. 10 is a perspective view of a further modification of the invention.

Various apparatus are known in the art in which a loudspeaker or sound channel is rotated to produce a Doppler effect vibrato. Among these are the apparatus

shown in A. D. Arsem et al., U.S. Pat. No. 3,069,958, and any of several patents in the name of Donald J. Leslie, Re. 23,323 being exemplary. In each of these, and in all other prior art devices known to me, the rotating loudspeakers are hidden inside the cabinet which remains stationary. Although a very good Doppler effect, frequency shift vibrato is produced, the listener has no idea of what is causing this, and is sometimes bemused thereby. I have found that by rotating the entire loudspeaker system, including the cabinet and speakers, not only is there a very effective Doppler effect, frequency shift vibrato produced, but that the effect is enhanced in the mind of the listener by seeing the entire system rotate. This effect is further enhanced by the ornamental surface configuration of the enclosure, all as set forth hereinafter.

Turning now to the drawings in greater particularity, and first to FIGS. 1 and 2, there will be seen a base **20** which is shown as being generally square, and of rather shallow height. On top of the base there is positioned in vertically upstanding position a rectangular speaker enclosure **22** housing loudspeakers, shown at **24** and **26**. The precise number of loudspeakers, and the exact construction thereof, is not of particular importance in the present invention, but the loudspeakers must be capable of reproducing the entire gamut of the source connected thereto. The front of the enclosure **22** is covered with the usual grille cloth **28** to permit emanation of sound from the front of the loudspeakers. The enclosure **22** may be sealed, in accordance with the well known acoustic suspension speaker properties, or it may be vented in accordance with the usual construction for bass reflex enclosures, but in the present instance it preferably is open in the back, although grille cloth **30** preferably covers the back to preclude the entrace of dirt and possible physical damage to the loudspeakers. As will be seen, particularly in FIG. 1, the exterior of the enclosure **22** is covered with a pleated material **32** arranged in horizontal pleats running from front to back of the enclosure. Alternatively, the pleating can run vertically, but it is preferred that the pleating be horizontal for purposes that will appear shortly. As an example of the type of material I have in mind, the pleated material **32** may comprise a padded, fabric backed plastic such as polyvinyl chloride.

Within the base there is a support **34** in which an upstanding shaft **36** is journaled by suitable bearings. The shaft **36** extends through the top of the base **20** and rotatably supports the speaker enclosure **22**, including the speakers **24** and **26** therein. Wires **38** to the loudspeakers **24** and **26** lead down through the shaft **36** to brushes **40** bearings on a slip ring structure **42** on the support **34**.

A motor **44** and speed reducer **46** drive a pulley **48** which is coupled by a suitable drive belt **50** to a pulley **52** fixed on the shaft **36**, whereby to rotate the shaft **36** and the speaker enclosure, including the loudspeakers. The drive speed for optimum vibrato results is such that the speaker enclosure **22** rotates on the order of 6 to 8 cycles per second. However, I have found that interesting effects can be obtained by rotating the speaker enclosure at a higher speed, and I have also found that a somewhat wavering, or wandering sound source effect can be produced by rotating the speaker enclosure at a much lower speed. Accordingly, controls are provided for varying the speed of the motor **44**, and it will be appreciated that these can be in the nature of rheostats or any other suitable control means known in the art. Thus, in FIGS. 1 and 2, I have shown an on-off switch or control **54**, and a

speed control **56**, suitably connected with one another and the motor **42**, and with an electric supply cord **58**.

I have further found that interesting effects can be prouced by rotating the enclosure at a non-constant speed, or even intermittently. Thus, in some instances the speed reducer will include the necessary mechanism for producing such results, and, by way of example, I mention the well known Geneva drive. The Geneva drive or movement is so well known as to require no illustration. However, by way of example, it is shown on page 393 of Elements of Mechanism by Schwamb, Merrill, and James, revised by Doughtie, John Wiley & Sons, Inc., 6th Ed. (1948).

As will be understood, it is common practice in certain types of musical instrument amplifiers, electric guitar amplifiers being typical, to provide a single box or enclosure having both an amplifier and loudspeaker means. Since this is a prime use of the present invention, I prefer to provide an amplifier within the base **20**, and various controls **60** are shown therefor in FIG. 1, such controls being for on-off, volume, tone, reverberation, electrical tremolo, etc. As will be apparent, the amplifier is connected to an input jack or the like for connection to an electric oscillation source, such as a guitar, and the output of the amplifier is conventionally connected to the slip rings.

As will be apparent, rotational movement of the loudspeakers **24** and **26** produces a Doppler effect, and hence a frequency or phase shift vibrato. This is markedly enhanced psychologically by the ability of the listener to see the enclosure **22** rotate at the same time as the sound source moves. Furthermore, the horizontal disposition of the pleating **32** tends to leave a series of horizontal rings in the vision of the observer, and this also tends to enhance the effect of the phase shift vibrato, and serves as a particularly attractive feature of the present invention.

Turning now to FIGS. 3–5, an embodiment of the invention is shown which differs somewhat from the one just described, but which has sufficient similarity that I am avoiding duplication of description by utilizing similar numerals with the addition of the suffix *a* to identify like parts. The essential difference in the present invention is that the enclosure **22***a* is substantially squat in configuration as opposed to the prior embodiment. That is to say, the enclosure is wider in both directions relative to its height than in the first embodiment. This has some advantage in that, for a given volume of enclosure, the loudspeakers can be spaced a greater distance from the center of rotation, and hence produce a somewhat greater Doppler effect and phase shift vibrato. Furthermore, in the present embodiment of the invention, I provide loudspeakers facing in opposite directions in the enclosure rather than merely at one face thereof. In other respects the present embodiment of the invention is similar to the one previously detailed.

In the first two embodiments of the invention as shown and described, there is an underlying base, and the loudspeaker enclosure rotates about a vertical axis. In the embodiment of the invention as shown in FIGS. 6–9, there are two bases respectively identified as **20***b* and **20***b'*. Indeed, in each instance like numerals with the addition of the suffix *b* are used to identify similar parts, and thereby to obviate prolixity of description. However, in the present embodiment of the invention, the loudspeaker enclosure **22***b* is intermediate the two bases **20***b* and **20***b'*, and rotates about a horizontal axis. Thus, in addition to the support **34***b* and the rotatable shaft **36***b*, there is at the opposite end of the enclosure **22***b* a shaft **36***b'* received in a suitable bearing structure **62** carried by the second base **20***b'*. Also, as will be seen, casters **64** are provided beneath both bases for aid in moving the assembly about. (Note that casters could be used in any of the illustrative embodiments.) As will be observed, the predominant effect of the pleating **32***b* is on the top and bottom surfaces, extending from front to back, and hence in the direction of rotation, again optically to enhance the rotation. Also, it will be observed that in the present embodiment of the invention there are loudspeakers facing both to the front and to the rear, although, as will be understood, this is not essential. The necessary drive mechanism and controls are disposed within the end housing **20***b*, similar to the description set forth in connection with the initial embodiment of the invention. Furthermore, whereas the first two embodiments of the invention have a substantially square cross section, it will be seen in FIG. 8 in particular that in the present embodiment of the invention a rectangular cross section is preferred.

In each instance heretofore, a plurality of loudspeakers has been shown. It is to be understood that the invention is equally useful with a single loudspeaker, and to this end a further embodiment of the invention is illustrated in FIG. 10, like numerals again being used, this time with the addition of the suffix *c*, again to avoid prolixity of description. Most of the parts are similar to those heretofore shown and described, but there is only a single loudspeaker **24***c*. To this end, the vertical and horizontal dimensions of the enclosure **22***c* are more nearly equal, and indeed may be exactly equal, as compared with the previous embodiment of the invention. Again, it will be observed that the predominant direction of the pleating is in the direction of rotation.

In each of the embodiments of the invention, the pleating is applied to the rotating loudspeaker enclosure, generally tangential to the direction of rotation. The bases have been shown as plain, primarily by way of contrast. It will be understood that it is, however, within the contemplation of the present invention that the bases might also be quilted on the exterior.

Each embodiment of the invention as herein shown and described produces a highly desirable Doppler effect, phase, or frequency shift vibrato. As observed heretofore, this effect is psychologically enhanced by the visual opportunity to observe rotation of the entire loudspeaker enclosure. Due to the difference in radii of different parts of the enclosure, there will be optically an in and out rotary movement or a satellite blur with a discrete radial dimension, depending on the speed of rotation. An unusual effect is produced in the embodiment of FIG. 6 et seq. in that there is some apparent vertical movement of the sound, instead of horizontal, and this can be particularly effective in a hall or room with a high ceiling.

The loudspeaker enclosures specifically shown herein are square or rectangular, and it has been found in practice that quite noticeable air currents are set up by the rotating loudspeaker enclosure, particularly at the higher speeds of rotation. The air currents can, and often do, present interesting and frequently beneficial effects, such as cooling of a guitar player, wafting away of tobacco smoke, etc. However, such air currents are not in every instance desirable, and it is within my contemplation that other shapes of enclosures, such as cylindrical or spherical, would avoid air currents and would have other interesting effects of their own. Furthermore, I also contemplate that different types of surfaces or surface ornamentation could be provided, such, for example, as a barber pole effect.

The specific examples of the invention as herein shown and described are for purposes of illustration only. Various changes in structure will no doubt occur to those skilled in the art, and will be understood as forming a part of the present invention in so far as they fall within the spirit and scope of the appended claims.

The invention is claimed as follows:

1. Sound reproducing equipment comprising base means, loudspeaker means, a free-standing enclosure housing said loudspeaker means and visible to a bystander, means rotatably supporting said enclosure from said base means, and means including non-constant drive means for rotating said enclosure and said loudspeaker means at a non-constant speed relative to said base

means, said enclosure having a rectilinear polygonal section transverse of the axis of rotation, said enclosure and loudspeaker means producing a Doppler-effect vibrato which is visually enhanced.

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STEPHEN J. TOMSKY, Primary Examiner

U.S. Cl. X.R.

181—27