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SOUND-PROPAGATING DEVICE

2,871,971

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Fig 1

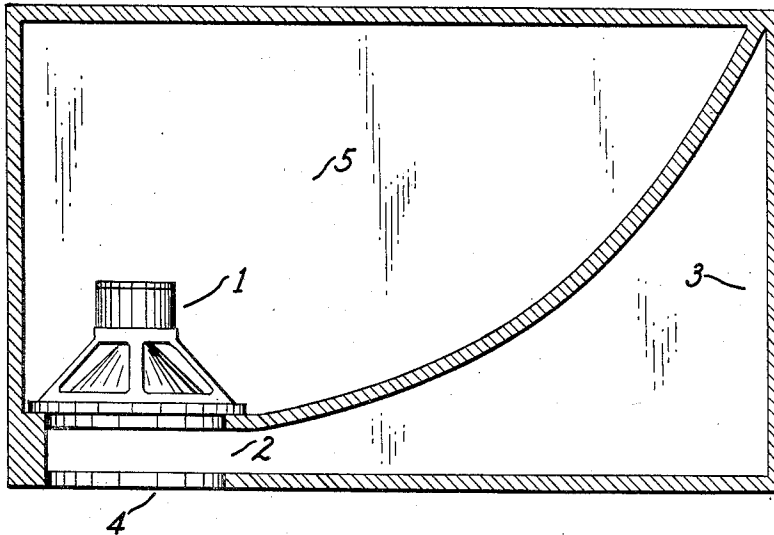
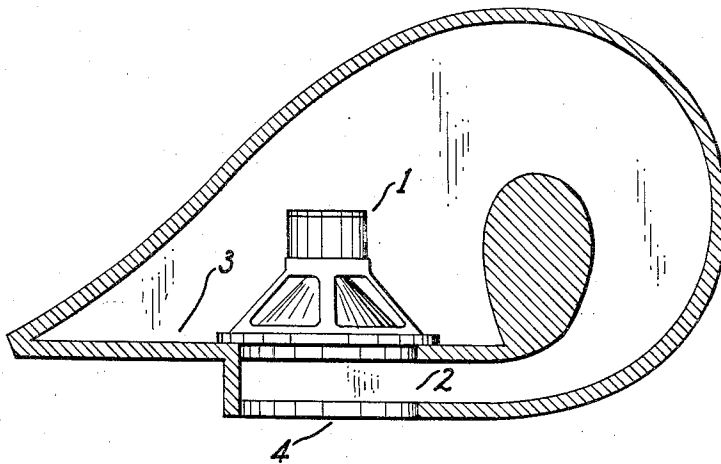


Fig 2



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SOUND-PROPAGATING DEVICE

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1 Claim. (Cl. 181--31)

This invention relates to a new and useful improvement in the method of propagating sound energy.

It is an object of this invention to provide in a comparatively small enclosure means for efficiently coupling the output of a sound source to a sound sink at frequencies the propagation of which would conventionally require enormous volume.

The object and advantages of this invention may be realized in the following manner:

Where the sound source delivers its output to the sound sink, the small end, or throat of a flared path is provided. The large end, or mouth of this path is constructed so as to reflect a substantial portion of the energy reaching the mouth back to the throat.

Sound is emitted at the throat of the flared path. In the conventional use of flared paths for the propagation of sound, energy is introduced at the throat, travels the path, and is emitted at the mouth. The efficiency of the conventional device drops sharply near the so-called "cut-off" frequency, and propagation ceases at this point. In order for sound to be propagated at the lowest audible frequencies, both the area of the mouth and the length of the path must be quite large. The device herein described operates down to frequencies well below this "cut-off" point. A flared path of dimensions very much smaller than conventional may thus be employed.

The mode of operation of this device is:

Energy is fed by the sound source into the throat of the flared path. This energy is transmitted along the length of the flared path to the mouth. Reflection of the incident energy is obtained at the mouth. Over a wide frequency band, this returned energy arrives at the throat in phase relationship with the incident energy such that the two are substantially additive. A build-up of energy is thereby obtained, the theoretical limit being reached only when all of the energy being fed to the sound source is being released to the sound sink. Frictional losses in the path and mechanical losses in the sound source place a practical limit on the efficiency of this device.

In the above-described manner, a relatively small velocity head, as generated by the sound source, may be utilized to produce a velocity head of much greater magnitude. The augmented velocity head produces the large volume flow of air needed at the lower audible frequencies. The physical significance of this action is that a small displacement of the driving mechanism may be used to cause a large displacement of air.

Over the wide band of frequencies in which this device is most particularly effective, the phase relationships at the throat cause the cone, in the case of a loudspeaker, to move at all times toward the region of high pressure. This provides effective acoustic loading for the sound source.

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The relative positions of the sound source and the opening to the sound sink may be arranged so as to permit the direct propagation of sound at frequencies above the operating range of the flared path.

It is possible to shape the path leading from the sound source to the mouth so as to constrict this path at some point between the source and the mouth. This would, in effect, provide a chamber which would in turn feed the flared path at its throat.

This device may be constructed so that the mouth of the flared path is merely blanked off. Alternately, the mouth of the path may be brought to the rear of a sound source such as a conventional loudspeaker. The phase difference between the front and the rear of a loudspeaker cone is 180°. Over the wider frequency band in which this device operates, sound undergoes a phase shift of substantially 180° within the flared path. It is therefore possible to obtain reinforcement of the reflected energy by utilizing the work done by the rear of the loudspeaker cone on the air it contacts.

The details of the invention will become apparent upon consideration of the specification taken together with the accompanying drawing in which:

Figure 1 is a view of a device embodying the invention.

Figure 2 is a view of an alternate device embodying the invention.

Referring now particularly to the drawing, there is shown in Figure 1 a sound source 1 (shown as a loudspeaker), propagating energy at right angles to the throat of the flared path and out through the sound sink 4, and parallel to the throat 2 into the flared path. The mouth of the flared path is denoted by 3 and the flared path lies between the throat 2 and the mouth 3. Energy emanating from the rear of the sound source 1 is absorbed within the totally enclosed volume 5. In Figure 2, there is shown a device similar to that shown in Figure 1, the difference being in the position of the mouth 3, now shown at the rear of the sound source.

Of course, we do not wish to be limited to the exact details of construction as herein shown, as these may be varied within the limits of the appended claim without departing from the spirit of the invention. We refer specifically to the possibility of making the flared path a totalization of two or more individual paths.

What is claimed is:

A sound propagating device comprising a casing defining a flared enclosed sound path having a throat at one end and being closed at the other end and being curved so that the closed end is adjacent said throat, said enclosed sound path having an outlet adjacent said throat, said closed end of said sound path having an opening opposed to said outlet, and a sound source positioned in said sound path closing the opening in the closed end thereof to propagate sound both at right angles to said throat and out through said outlet and parallel to the throat into the flared path.

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