Subject: Rounded Bends vs. Flat Reflectors in Folded Horns
Posted by Cuppa Joe on Sun, 25 Feb 2007 20:24:28 GMT
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I know there's been some past controversy about this subject on the forum(s), but I'm not really sure what conclusions were drawn. Is there a printed source that specifically addresses the pros & cons of each?

Subject: Re: Rounded Bends vs. Flat Reflectors in Folded Horns
Posted by Wayne Parham on Tue, 27 Feb 2007 00:52:03 GMT
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You're right, we talked about this a bit in the past. I don't think either case is right or wrong, and I think they're both going to act very predictably. It's all a matter of wavelength verses size.
A heretical tip from a heretic.
Bill Fitzmaurice Folding Geometry

Subject: Re: Rounded Bends vs. Flat Reflectors in Folded Horns
Posted by Cuppa Joe on Tue, 27 Feb 2007 06:32:40 GMT
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Yup, those very strands are the origin of my present questions. Re-reading them gives focus to the actual root source of my confusion: real-life, 3-D soundwave propagation. Looking at a simple, 2-D drawing of a single frequency, represented as a series of colliding & expanding dots, doesn't porvide a global veiwpoint of a multi-frequency wavefront as it encounters obstacles in the course of developing and leaving its source.I have the usually recommended books and reprints, but they take up long after my physics education dwindles. (Some of the math is Sanskrit to me. OK, much of it, already!)So, first Q: Is a sound a particle or a wave? Or, both? The two concepts seem to get interchanged according to the theme of a discussion.Question 2 depends upon how we explore the first Q.

Subject: The Movement of Waves and Particles
Posted by Wayne Parham on Tue, 27 Feb 2007 15:02:51 GMT
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The sound wave travels through the medium, air. The medium is made up of individual air molecules that vibrate. So both situations exist. That's the nature of the wave/particle duality, and why it can be described as having properties of both.Wave–particle dualityParticle velocityWave

velocity

Subject: Re: The Movement of Waves and Particles
Posted by Cuppa Joe on Thu, 01 Mar 2007 05:21:06 GMT
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Thanks for the links, Wayne. I hadn't thought to look there! I already had the impression that you'd say sound was both particle and wave, but I wasn't sure whether one property overshadowed the other in application or theoretical discussion. Both properties get equal billing, right?I'm still concerned about my bends vs. reflectors indecision. A wavelength in a horn doesn't just have length, it also has...diameter, I guess. If I want to pass a signal through a W-bin up to (at least) 1kHz via 45 degree reflectors, wouldn't the wave impacting the reflecting surface interfere with itself when it exits toward the mouth?I had a similar concern for a rounded bend in a W-bin. What is there to prevent a frequency leaving a driver's cone from simply shooting across the passage to the outer wall, as opposed to following the horn's inner curve? Wouldn't that cause cancellations as well? I'm not completely understanding how a wavelength's "width" affects its behavior inside a folded horn, especially as the frequency rises.When Bill F. was proposing that a wider radius passes a higher frequency, I think it's because a curve comes closer to approximating a straight wall as its radius increases. Is that about right? So, with a reflector, what does reflector size vs. wavelength mean? That relationship is yet unclear.I also noticed with some of John Sheerin's models showing a soundwave moving through a long 90 degree bend, that higher frequencies tended to adhere to the outer curve as they left the mouth. Could I expect that in a folded horn with rounded bends, where the higher frequencies might cling to the outermost edges of the horn's mouth? Would a reflector fix that problem?

Subject: Re: The Movement of Waves and Particles
Posted by Wayne Parham on Thu, 01 Mar 2007 05:50:01 GMT
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An omnidirectional sound source spreads as a sphere. When constrained, it spreads as a partial sphere. For example, sound radiating into halfspace spreads as a hemisphere. If you have an omnidirectional sound source sitting on the ground, that's the pattern it will make. If the sound source is directional, it will form a sort of 3D pie slice, a cone that represents a fraction of the spherical wavefront. Of course, things can disrupt wave propogation, causing the wavefront shape to change.Think about the wave that travels on the surface of a pool that forms when one rock is thrown in. It travels away from the point of impact as an expanding circle. Throw in two rocks, and interference causes a new pattern to form. Disrupt the wavefront with an object that reflects it, and the returning wave interacts in much the same way. The ripples in the pond let us visualize what's happening.When an object, small in relation to wavelength, is placed in the path of the moving wavefront, it does not act like a reflector. Waves will pass right by as if it weren't there. If an object is large in relation to wavelength, then it acts like a reflector. But the behavior

of a reflector that is spaced nearby acts differently than one that is far away. If a reflector is near -

constructive and destructive nodes cause pockets in space where reduced amplitude nodes form.

single source, but are not cancelling each other strongly either.This explains the behavior of sound through ducts of various shapes and sizes. Sound travels around corners at low frequencies, basically passing right by. At higher frequencies, sound bounces from wall to wall. A reflected sound source acts something like another sound radiator, interacting with the source and other reflections. Remember that low frequencies have long wavelengths and high frequencies have short wavelengths, so what determines "high" or "low" frequency, "long" or "short" wavelength, is the distance to reflectors or other sound sources. You can visualize wave movement using an FEA program or using ripples in water to get an idea what it looks like in 2D space. Then just understand that the same thing you see as a circle on a 2D surface translates to a sphere in 3D space. A checkerboard pattern of nulls in 2D translates to a 3D array of nodes, like a Rubik's cube.

Subject: Re: The Movement of Waves and Particles
Posted by Cuppa Joe on Fri, 02 Mar 2007 04:40:35 GMT
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Thanks, Wayne, for the patient detail of your answers!I already had a grasp of most of your response, but the earlier "bend vs. reflector" controversy left me with the gut feeling that I might be missing a piece of the puzzle. The physics about reflector size and distance from the source in relation to wavelength were new to me. Based upon your input, I'm considering a combination of both: flat reflectors close to the driver for the first 90 degrees of the W-bin, and rounded bends to make the other 90 degrees toward the mouth.If anyone's curious, I could provide some general descriptions of the 3 projects I have in mind. Two are currently on paper, shy of finishing minutia. When I feel like they're all presentable, then they will be posted for the general use of the forum members. That is, IF they're worth modifying or building! Or, maybe just a hearty chuckle....

Subject: Re: The Movement of Waves and Particles
Posted by Cuppa Joe on Sun, 04 Mar 2007 05:15:41 GMT
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Another thought occurs (see how long it took): If I wanted to pass a 1kHz frequency (just for ease of calculation) through a W-horn, how narrow would the initial passage need to be before the 2nd 90-degree turn? I don't want the answer, just the method to get it, please & thank-you! I'm sure

it's related to previous postings about diameter vs. wavelength, or fractions thereof. Perhaps it'll gel if I visit John Sheerin's website again....Is anyone familiar with the old Acoustic 301 W-bin for bass guitar? (I had 2 of those coffins in my Glory Days, as well as a full Ampeg SVT system! Bwa-ha-ha!) If you pulled off the rear access panel, you found a wedge-type reflector built onto the panel itself. The Cerwin-Vega! 18" driver was flush-mounted to that inner panel 180 degrees opposite the mouth. I had thought to keep things as simple as that, with modifications and a 15" cone instead. The reflector would again be mounted onto the rear access panel, but it would be as large and deep as possible without interfering with the cone's excursion. Rounded corners are still under consideration for the other turn toward the mouth (with a twist).If the first section of the passage and the reflector were engineered just right, could they constitute a type of throat? I know, it's a wacky idea....

Subject: Re: The Movement of Waves and Particles
Posted by DMoore on Mon, 05 Mar 2007 17:36:38 GMT
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Take a look at Bruce Edgars "Monolith" article for an explanation of hard-surface full channel reflectors. It can be downloaded from www.volvotreter.de website.DM

Subject: Re: The Movement of Waves and Particles
Posted by Wayne Parham on Mon, 05 Mar 2007 21:29:02 GMT
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Good catch. Thanks for the link to volvotreter.de! That's a very useful collection of articles. I've listed direct links to the Edgar article below, for easy access.

Seems to me, if a folded horn is expected to pass frequencies higher than one wavelength across its cross-section, then diagonal reflectors should be used. Rounded ducts can be used too, but then the wavefront will bounce from side to side. Rounded ducts work better if the cross-section is less than one wavelength. Far below one wavelength, the radius doesn't matter as much, and the curvature of the flare can be approximated with straight sections.Illustrations of reflections in ductsEdgar's article tends to agree with this, as shown in his Monolith horn article:Monolith horn article, page 1
Monolith horn article, page 2
Monolith horn article, page 3
Monolith horn article, page 4
Monolith horn article, page 5
Monolith horn article, page 6
Monolith horn article, page 7

Subject: Re: The Movement of Waves and Particles
Posted by Cuppa Joe on Tue, 06 Mar 2007 02:17:45 GMT
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Thanks, guys! I've visited the Volvotreter site a few times although I drive a Chevytreter myself....Before I dive into the Monolith article, I should mention that the W-horn in mind is intended for midbass applications only, from 100Hz up to 800Hz/1kHz. The mid/high section will be mounted on the front center panel dividing the 2 horn mouth sections. In essence, I'm trying to redesign the ancient MacPherson M1S/M1X stacking full-range cab. I have an old product sheet, however it doesn't reveal any inner details about the driver mount or the horn folding. The M1X isn't even in their archives anymore.

Subject: Re: The Movement of Waves and Particles
Posted by DMoore on Wed, 07 Mar 2007 21:33:05 GMT
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Here is a design I did that uses hard-surface reflection points at the rear fold. See figure 1 for a top-down secional view.DM
215 bass design

Subject: Re: The Movement of Waves and Particles
Posted by DMoore on Wed, 07 Mar 2007 21:37:15 GMT
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Here is a response curve - not too shabby. Impedance stable to 800Hz.Shown against a DBB (double 15" bass bin) reflex-ported direct-radiator cabinet in outdoor brick corner.Jamboree is the design in question, using 2 Crites 15" drivers in parallel configuration.DBB uses dual Klipsch K33E's in parallel.DM
Jamboree test curves.

Subject: Re: The Movement of Waves and Particles
Posted by DMoore on Wed, 07 Mar 2007 21:46:04 GMT
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Aw, heck! here is another attempt at just the curve itself...outdoors in 1/8th space (corner) @ 3 meters, unreferenced.DM
DBB vs. JAMB oudoor 3 meter curve

Subject: Re: The Movement of Waves and Particles
Posted by Cuppa Joe on Thu, 08 Mar 2007 03:26:14 GMT
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Interesting designs, Dana! Are the horn options strictly subs, or can they pass some mids? BTW, I live just a little south of you, in the Fairwood area of Renton.

Subject: Excellent!
Posted by Wayne Parham on Thu, 08 Mar 2007 15:33:08 GMT
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Looks like a good design. How long ago did you file with the PTO, Dana? What was claimed?

Subject: Re: The Movement of Waves and Particles
Posted by Bill Wassilak on Thu, 08 Mar 2007 17:03:00 GMT
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In figure10 second picture, the design is almost the same as the Hill Brothers M3 design that AC/DC used back in the early 80's. The only difference is they used 3-12" woofers and the box was square but the rear of the woofers shot into the horn like yours.

Subject: Re: Excellent!
Posted by DMoore on Thu, 08 Mar 2007 17:40:41 GMT
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Wayne, the complete patent document including the claims is posted somewhere in the same Klipsch thread.About the claims, they may end up being alot more restrictive when all is said and done, rather than as first presented, but I tried for the whole thing.Dana

Subject: Re: The Movement of Waves and Particles
Posted by DMoore on Thu, 08 Mar 2007 18:05:49 GMT
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That's cool! Perhaps a get-together sometime in the future?As for midrange, I wouldn't really want to fold a horn and expect it to pass midrange frequencies, although Bruce Edgar has done an article on a folded midrange horn (if I remember correctly) that is used in a church. It might be possible, but...Dana

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Subject: Re: The Movement of Waves and Particles
Posted by DMoore on Thu, 08 Mar 2007 18:11:22 GMT
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Bill, do you have or can you point me to the Hill Brothers M3 design that you mentioned? I wasn't aware of anything like it - I wonder how it would impact my patent application.Thanks,Dana

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Subject: Re: The Movement of Waves and Particles
Posted by Bill Wassilak on Thu, 08 Mar 2007 19:10:02 GMT
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Give me a little time I might be able to find something, that was 25 years ago that design was out, but I don't think they ever patented it. Hill Brotheers built there own speakers, 3 channel amps to power them, and there own mixing consoles at the time.

Subject: Re: The Movement of Waves and Particles
Posted by Bill Wassilk on Fri, 09 Mar 2007 02:41:58 GMT
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I couldn't find any pictures, but I don't think you have to worry, there box was a full range box about 45Hx30Wx24D. Malcolm Hill retired in 1992 but his son is running rock-tech the links at the bottom. Contact him he should have plenty on the old systems. But here's what I found out on the web so far. From some web-site:The sound contractor for this festival was Malcolm Hill. Hill Audio was a well-known native company based in Hollingbourne, U.K. In the great Tradition of the Times the company was named after, owned and run by Malcolm Hill. Malcolm and his employees designed and purpose-built a great deal of the equipment in his own shop. Speaker cabinets, power amplifiers and mixing consoles were all custom made and proprietary.From Prosoundweb:I guess it works with the Hill PA system(3 12", 2 10" and 1 2" motor on a 60x90 horn and the sub was another 12" in a short box that has the same footprint as the HI/Mid box.
 Rock-Tech

Subject: Thanks Bill
Posted by DMoore on Fri, 09 Mar 2007 19:10:19 GMT
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Actually, it doesn't have to be patented, just published or sold to the public to be considered prior art which could effect the patentability of the "new" design.I think I'm safe, but it's almost impossible to tell these days, with all of the participating nations in the patent system.I ran into a Japanese patent on one of my other applications, how in the world does one search for that?! Doesn't seem to be quite right to me.Dana

Subject: Re: The Movement of Waves and Particles
Posted by Cuppa Joe on Sat, 10 Mar 2007 03:29:23 GMT
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There's a few W-horn designs that can pass a decent amount of mids, but they're not really SUBwoofers either. It seems like you can't really have the best of both worlds in one horn.Sure, let's check out the possibility of a get-together. If you're not too far north, and we have some ideas to kick around, it could be fun! There must be coffee or beer. Or both.

Subject: Re: The Movement of Waves and Particles
Posted by DMoore on Mon, 12 Mar 2007 23:50:10 GMT
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Basically Lynnwood (more or less)...Wait a few weeks, and we'll have a variety of "things" to listen to!Dana