

Fundamental Properties of Reeds

by R. J. Weisenberger

A reed is basically an air driven relaxation oscillator, producing a fundamental tone plus a high degree of harmonic development of both even and odd harmonics. The basic waveform at the reed is roughly a sawtooth wave of low to moderate intensity before it reaches the resonator.

The resonator can take on many forms to produce the desired effect on this basic waveform by presenting an almost infinite variety of acoustical loads at various bandwidths to the reed, and greatly contributing to overall efficiency.

In general, when speaking of horn type resonators such as those used in tubas, trumpets, etc., the strength of the fundamental is largely determined by the length of the horn and the diameter at the mouth. Large mouth horns produce stronger fundamentals than horns having small mouths. (Note the difference between a tuba and a post horn.) The fundamental is strongest in any resonator when the length is tuned to the pitch of the reed.

The most critical factors to harmonic development in horns are their throat diameter and the rate of flare.

Horns with small throat diameters followed by rapid rates of flare have the most harmonic development. This explains the prominence of high order harmonics in stops such as the post horn or brass trumpet.

Resonators other than horns, such as the type used on the vox humana are not even tuned to the fundamental frequency of the reed at all, but to a harmonic itself. The mouth, being restricted, makes the resonator behave as a bandpass filter, to imitate tonal qualities of the human voice, from which this stop derives its name.

This does not begin to describe the complexity actually involved in the design of reed stops, but gives a

rough idea of some of the reasons why certain reeds have their characteristic tonalities.

Variations in construction of the tongue and shallot will have effects primarily on the operating pressure, frequency, efficiency, and the development of the highest order harmonics.

There is still a lot of room for additional acoustical research along these lines, the variables being almost endless.

My next article will look briefly at the art of voicing, and the less predictable aspects of pipes.

Definitions:

Mouth — The speaking end of a resonator (bell).

Throat — The end of a resonator connected to the reed block.

I sincerely hope that my research into organ pipe acoustics has already been of help to those involved in the building and restoration of pipe organs, and that it may create a renewed interest and increase the desire for greater knowledge in this long neglected art.

I will be glad to answer any technical questions concerning the material covered in my past six articles.

I also hope that my research will create an interest in the pipe organ by others in acoustically related fields to continue further research along these lines, so that future builders of pipe organs will no longer be limited to a purely historical knowledge of their art, but to an up-to-date and ever expanding scientific knowledge.

One of our main goals as ATOS members is to promote a greater understanding of the pipe organ. We can do this and more by helping to shed some light on the shadows of the past with the aid of today's technology. As history has been our link with the past, science will be our hope in the future. □



the letters to the editors

Letters to the Editor concerning all aspects of the theatre organ hobby are encouraged. Send them to the editor concerned. Unless it's stated clearly on the letter "not for publication," the editors feel free to reproduce it, in whole or part.

Address:

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Editor
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Dear Editor:

First of all, I'd like to add to the accolades your roommate has been receiving upon her retirement as membership/circulation manager; how fitting the lines that start with "Well done, good and faithful servant" When she took on the job, Vi must have looked at the records of her predecessors and thought, "What am I doing following acts like those?" Well, Vi did a fantastic job, and we are all grateful to her.

My Chief Wife, Jan, and I have enjoyed the articles by Stu Green on Hector Olivera, and were especially thrilled to read about and see pictures of his earliest days. Our first ATOS Convention was the one in 1972 when Ray Brubacher "unveiled" the Fantastic One, and we have followed his career with great interest ever since.

As always, Lloyd Klos has done a "bang-up" job with his article on the Eastman Theatre Austin and its main honcho, Bob Berentsen. Bob and his wife, Ruth ("Pinky"), were very dear friends of ours. Jan and I both took voice lessons from Bob, and Jan took a few organ lessons from him; and, of course, he played for our wedding.