

The influence of different types of wind chests on the sound formation of flue organ pipes

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Introduction

The influence of different wind chests on the sound of flue organ pipes has been investigated by voicing different Diapason pipes on a slider chest and by measuring them on the slider chest and on a cone chest in the anechoic room of the Fraunhofer-Institute of Building Physics. The attack transients of the pipes in both cases have been analysed. The results show that the speech of the same pipe on different types of wind chests are different. It is assumed that at the very beginning of the attack different partials of the pipe sound have been excited on the different wind chests by the edge tone. The most important characteristics of the attack transients are discussed.

The slider chest and the cone chest

In the slider chest shown in Figure 1, the opened pallet admits wind to each single or multi-rank 'stop' by means of a perforated slip of wood ('slider') running longitudinally in the board between the pipe foot and the groove on the upper level of the chest. The slider can be aligned either to allow wind to pass through ('stop drawn') or to prevent it passing through ('stop pushed in'). In the case of a slider chest pipes with the same pitch are standing on a common groove.

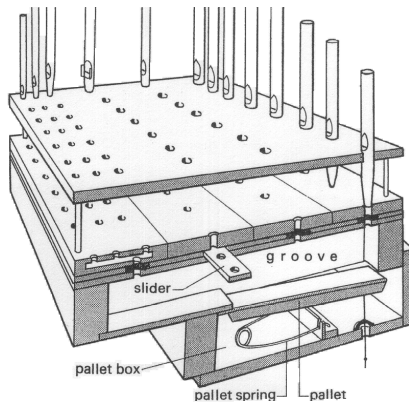


Figure 1: Sketch of a slider chest.

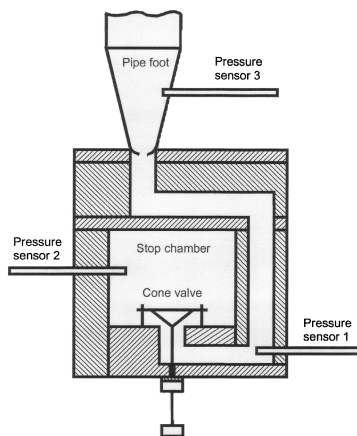


Figure 2: The cross-section of a stop chamber with a cone valve.

The cross-section of a stop chamber with a cone valve is shown in Figure 2. If the stop is switched on, the stop chamber is under pressure. Pressing a key opens the corresponding cone valve. In the case of a cone valve pipes of the same stop are standing on a stop channel, but every pipe has its own cone valve to get to sound.

Influence of different types of wind chests on the attack transient of the flue pipes

The influence of different wind chests on the sound of flue organ pipes has been investigated by voicing different 8 feet Diapason pipes on the slider chest and by measuring them on the slider chest and on a cone chest in the anechoic room of the Fraunhofer-Institute of Building Physics [1]. The attack transients of the pipes in both cases have been analysed [2]. Figure 3 shows the onset of the first three partials of the Diapason pipe on the slider chest. The fundamental starts with a delay while the octave is faster and it becomes temporally evenly stronger. Figure 4 shows the attack transient of the same Diapason pipe on the cone chest.

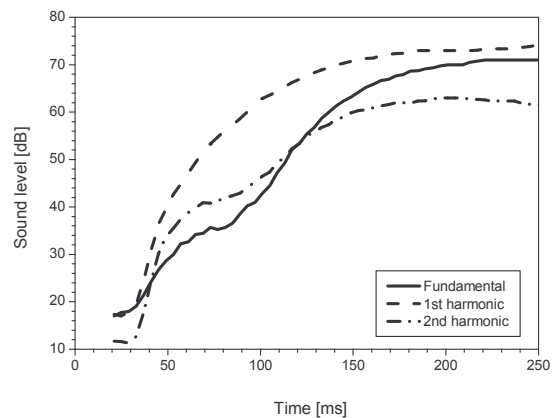


Figure 3: Onset of the first three partials of the Diapason pipe on the slider chest.

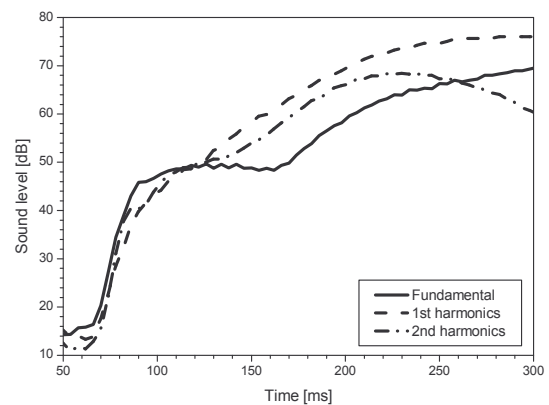


Figure 4: Attack transient of the same Diapason pipe on the cone chest.

The fundamental starts clearly much faster, its increase, however, stops after a short time for about 70 ms, only then it is developing continuously. The octave became slower and

the fifth changed only a little bit. The three-dimensional plot of the analysed attack of the same flue pipe on the slider chest is shown in Figure 5. In this case however 9 partials are presented. The second octave and the third (5th partial) are being built up slowly, whereby the second fifth (6. partial), the seventh and the third octave (8. partial) start very fast.

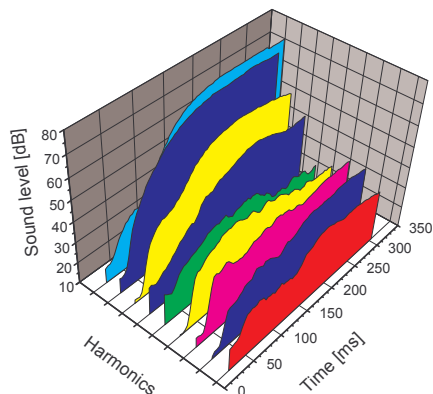


Figure 5: Onset of the first nine partials of the Diapason pipe on the slider chest.

On the cone chest start the 4. and 5. partials (2nd octave and the third) the fastest (Fig. 6.), as an opposite to the pipe sound on the slider chest whereby the 6. and 7. partials (2nd fifth and the seventh) build up slower. On the cone chest the fifth decreases after a while, however it begins again to increase afterwards.

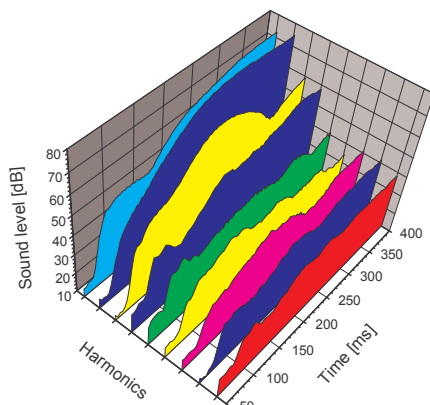


Figure 6: Onset of the first nine partials of the Diapason pipe on the cone chest.

These characteristics show that the two wind chests have dynamically different properties. It is assumed that at the very beginning of the attack different partials of the pipe sound have been excited on the different wind chests by the edge tone. Thus the pipe sounds on different wind chests also differently. According to these differences the pipes on the two wind chests must be voiced differently.

Although the wind pressure in the pipe foot on both wind chests was set to the same value at stationary sound, the dynamic pressure in the foot was smaller for the cone chest, than for slider chest. The sound starts on the cone chest very fast, however the pressure in the pipe foot cannot be developed as fast as it is needed. A possible explanation is that the flow path between the groove and the foot hole is clearly smaller by the slider chest, than that by the cone chest, moreover, the direction of the flow is changed four times between the cone valve and the foot hole.

Summary

By the analysis of the attack transients of different pipes on the same wind chest models similar phenomena were resulted. According to the opinion of some voicers about these measurements the smaller the stop chamber and the shorter the line between the cone valve and the pipe foot, the more largely are the arising differences in the onset of the pipe sound. As the most of the voicers do have generally only a slider chest for voicing in their workshop, they carry out the prevoicing on this chest and they have to adjust the pipe sound to its last sound character in the church on the cone chest. The experiments shown here are an important subject of the 'Crash courses for pipe organ and church acoustics', organized regularly at the IBP [4]. Other aspects according to the different types of slider chest like wind pressure distribution, sound melting, the so called 'Mitnahme-Effekt' or 'carrying along' effect, where the onset of slowly speaking pipes is accelerated by faster ones are discussed in the paper published at the ISMA 2004 in Nara (Japan) [4].

Let's cite the organ builder Christian Scheffler [5]: Both on slider chest or on a cone chest organ a good or a bad concert can be played.

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