HEIKKI POLSO

Bordeaux Pipe – One More Experiment

This decade, the Bordeaux pipe theme has been dealt with in Die Hausorgel magazine several times.[1,2,3] The idea behind the pipe design is the observation that a 30 cm long glass bottle, when blowing, gives an octave lower pitch than an organ pipe in same length. The reason is the narrow neck part of the bottle, which seems to be the only valid explanation for this phenomenon.

Fig. 1: The bottle pipe – section drawing with partition corresponding the bottle neck.

First test pipe

Based on the first article about the bottle pipe written by Klaus Zeidlewicz in Die Hausorgel´s issue 26/2015, I made a wooden trial pipe with dimensions similar to those given in the article. In order to determine the effect of "bottleneck" dimensions on the pipe sound, I made an adjustable lip for the pipe and a movable partition which corresponds the bottle neck.

Fig. 2: First test pipe with an adjustable lip and partitions in four different lengths.

In this pipe, the lip width is the same as the pipe width and the lip is adjustable due to the loose lip part. I made four different length neck partitions. This allowed me to explore some of the possibilities of adjusting the partition and changing its length. The partitions are tight fitted to the pipe body, though it is possible to move them a little bit forward and backwards.

1 Klaus Zeidlewicz, *Flaschenpfeifen.* DIE HAUSORGEL 26/2015, p. 47-48.
2 Hajo Stenger, *Die Bordeaux-Pfeife*. DIE HAUSORGEL 27/2016, p. 73-76.
3 Jurij Sotow, *Hyperbass*. DIE HAUSORGEL 29/2018, p. 38.

Fig. 3: Test pipe with adjustable mouth. The pipe was made for quick testing of the idea of the bordeaux pipe.

I got the pipe to speak in some way, but due to many inaccuracies there was a lot of hiss in the sound. The most notable perception was to get the pipe to speak even slightly more than an octave lower than a gedackt in similar length, when the length of the partition and its distance from the front wall are suitable.

Until now, when I got there, I was forced to leave the experimenting due to the more urgent matters. So far, I have confined myself to follow the development of the bottle pipe by reading the very interesting articles written by others.

Second test

Last spring, I started designing a little continuo positive, and began experimenting with how small space is needed to house the lowest octave of gedackt pipes.

I unearthed the test pipe I had done earlier. It sounded better than I remembered. I even managed to improve the sound by narrowing the lip of the pipe. With that in mind, I decided to take an experiment in which I would compare the sound of the bottle pipe to the sound of the traditional gedackt pipe.

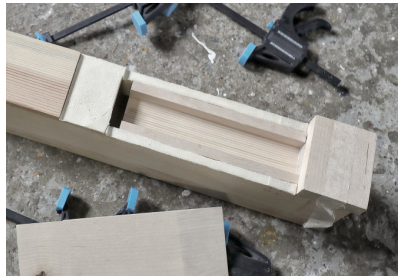

Fig. 4: Opened test pipe with narrowed neck part.

After the first article by Klaus Zeidlewicz, there have been examples of more complicated bottle pipe design with a separate neck but my goal was to try to make the pipe as simple as possible.

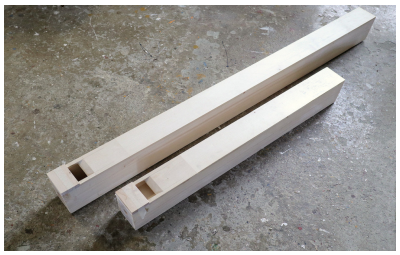

Fig. 5: Traditional Gedackt vs. Bordeaux 8' C pipe in half length. Both of the pipes are made after the 15th century scale from Nuremberg. Materials are Finnish spruce and birch.

As a starting point, I chose the largest C pipe of the 8' stopped register. The scale I used is gedackt scale of the Nuremberg (Hauslaib - Cuntz - Manderscheidt) tradition. The bottom dimensions of the pipe are 60 x 97 mm and the scale is -14 Ht compared to the normal scale by Töpfer. The wall thickness of the pipe is 8 mm and the materials are Finnish spruce and birch. I chose such a pipe because I had prior experience with similar ones and already knew how the pipe should be voiced to get the wanted result.[4]

I also made another pipe with exactly the same scale, but its length became only a half the length of a regular gedackt. In addition to this pipe I made an adjustable partition on the same principle as I did with the first bordeaux pipe I made.

Fig. 6: Both pipes are voiced as identically as possible. The windway is formed by a 0.5 mm thick cardboard cut in U form.

Both pipes were voiced as identically as possible to better evaluate the sound of the bottle pipe compared to the gedackt pipe. The width of the lip is only slightly narrower than the width of the pipe. The height of the lip is 27 mm, which is about 1/2.2 of the width of the lip and about 1/8 of the plate-width. The thickness of the cap is approximately a double of the wall thickness of the pipe.

I pre-made the lanquids (solid blocks of wood) with a table saw before gluing the pipe

4 *A few years ago I made a reconstruction of the Kleingedackt 4' stop after claviorgan by Lorenz Hauslaib in the Museu de la Música de Barcelona. At that time I researched the organ building tradition in Nuremberg a lot.*

body together. Upper lips were pre-made in the right width with router and lip-routing jig and then cut straight in the right height with chisel and sanded a little bit. I didn´t file the windway though it is made only with 0,5 mm cardboard cut in U form. I only slightly rounded the sharp edges in the lanquid.

The voicing was easily done and both pipes spoke clearly at the first try. The most surprising thing is that even the voicing of the bottle pipe is so easy to do.

Conventional gedackt sounds elegantly and has kind a powerful sound with much harmonics. One can feel the resonance of the body of the pipe when blowing.

The sound of the bottle pipe is somewhat muted and doesn´t have as much overtones as in traditional gedackt. The resonance of the body is considerably less noticeable, probably due to its half body length which gives much stiffer body.

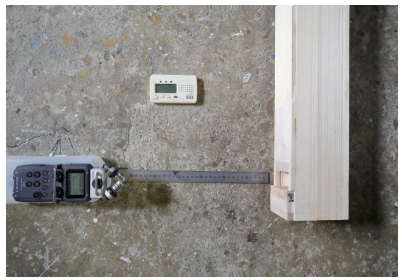

Fig. 7: The spectres produced by both pipes were recorded at 30 cm distance from the mouth. The recorded audio sample was then analyzed with a spectrum analyzer software.

Measurements

To get some more trustworthy data of the sound of the pipes, I measured the spectres produced by both pipes. Recording was made with the Zoom H5 recorder and its standard microphones. The recorded audio sample was analyzed with a free PC-based Visual Analyzer spectrum analyzer software.

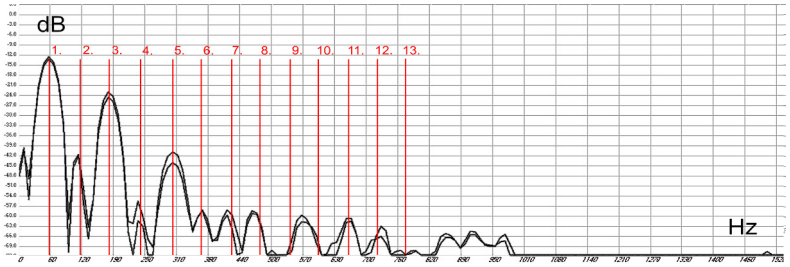

Fig. 8: Typical spectrum of the Gedackt pipe.

In the gedackt pipe, even harmonics are absent but odd harmonics strong. The third harmonic (quint) of the test gedackt rises almost as strong as the fundamental frequency, and the fifth harmonic (terz) is next strongest. The octave (2nd harmonic) and the other octave (4th harmonic) are subdued. The rest of the upper partial tones are even more subdued.

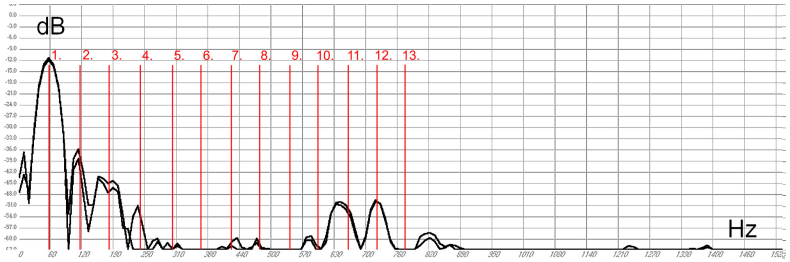

Fig. 9: Typical spectrum of the Bordeaux pipe.

In Bordeaux pipe, the fundamental tone is about as strong as in the gedackt. However, the lack of harmonics relative to the fundamental is remarkable. The octave is more than 20 dB attenuated in all sound samples, the quint and the next octave even more muted. Obviously because of the shorter body of the pipe, the high overtones are quite strong: the 11th and 12th harmonics are emphasized. Naturally, this phenomenon is exacerbated by increasing the wind pressure (activation) of the pipe.

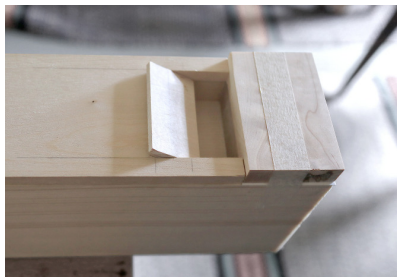

Fig. 10: The temporary wooden wedge for lowering the mouth height of the Bordeaux pipe.

Pipe with lowered mouth height

I did an additional experiment by lowering the lip with a temporary wooden wedge. The lower lip seems to amplify the aforementioned overtones, in extreme cases even beyond the intensity of the fundamental tone, making them clearly heard in the sound of the pipe. Reducing the windway to 0.3 mm clearly reduces the overtone.

With a windway of 0.5 mm and a mouth height of 20 mm or less, the 8th, 10th and 11th (+ 9th harmonic in some samples) harmonics are emphasized, 10th near the level of the base note. When raising the wind pressure (activation), the speech is highlighted, during which e" (10th harmonic) rises briefly above the fundamental tone.

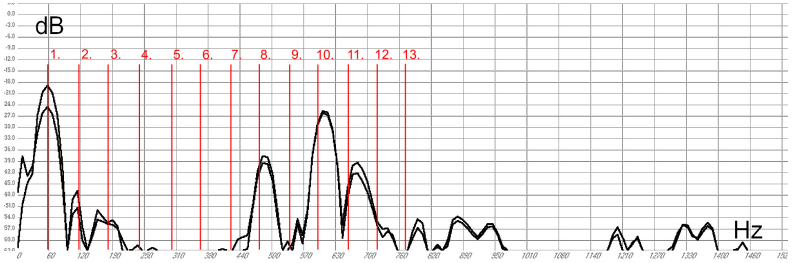

Fig. 11: Typical spectrum of the Bordeaux pipe with lowered mouth height.

Conclusion

My experiment showed that a small volume bottle pipe is possible to make in a very simple way by cutting the usual gedackt pipe in half and fitting it with a partition behind the lip.

However, it would appear that the overtones of the bottle pipe are different from the gedackt, and thus it is impossible to produce a completely similar tone to the traditional gedackt. Due to the short body of the bottle pipe, the quint (small g in C-pipe) characteristic of Gedackt, is attenuated. The difference between bottle pipe and gedackt is heard in roundness, lack of volume, and some lack of presence.

This experiment does not show that the former is appropriate as a direct substitute for all gedackts but if the pipe voiced to produce mostly its fundamental tone is needed, then the bottle pipe could be a space saving option. It would be interesting to experiment further the possibilities of varying the basic timbre of this kind of organ pipe by changing pipe dimensions, voicing etc.

04.09.2019