Building CPVC and Duct Tape Bagpipes

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Introduction

This semester I wanted to try to build my very own set of bagpipes using common items like tubing, pipes, garbage bags, and tape. Bagpipes are an instrument of interest because they are not very common. I was inspired when I saw a website that gave instructions on how to build smallpipes out of CPVC pipe and duct tape[1]. The website gave pretty decent instructions on the building process and I mostly stuck to the basic outline they provided for construction. There was a great deal of fine tuning involved after the basic pieces were assembled, but once it all came together that rich bagpipe sound was unmistakable. As interested as I am in exploring the properties of an instrument that I've never even been able to hold before, this unfortunately means that I had no idea how to play it. After some research I was able to understand how the bagpipes should theoretically be played, but I am still working on being able to remember all of the different fingering positions and play the instrument fluidly. The next steps will be actually learning how to play Amazing Grace and probably building a shoulder strap out of more duct tape so I can stand up to play.

How Bagpipes Work

There are many different kinds of bagpipes common throughout the world, the most well-known being the Scottish Great Highland Bagpipes and the Irish uilleann pipes, but there are many other varieties. All bagpipes essentially consist of a blowpipe that one breathes into to put air into the bag, a bag that air can be stored in until it is squeezed to release a high volume of air through the pipes, one chanter pipe that can play a set of notes, and then at least one drone pipe that will only play one note.

The bag is big enough to hold up stored air to start playing a song, but because of the large amount of air that must be released to play the pipes it must constantly be refilled throughout playing. It is important for the bag to not be so big that the player cannot easily fill it up, but big enough that it does not constantly require a larger amount of air than the piper can produce while playing. It is a bit of a balancing act with bag size, but the bag helps save the player from total exhaustion while playing and allows songs to flow very smoothly.

The chanter can vary depending on the type of pipes, but for these pipes the chanter is tuned to play like the Great Highland Bagpipes. The scale of the chanter is in Mixolydian mode. The notes on the chanter are called low G, low A, B, C, D, E, F, high G. The notes on the bagpipes are not tuned to be exactly those notes though. There are different ways that the chanter can be tuned, but in the traditional way, the notes are not exactly just intonation. The D and F keys are traditionally a bit sharp, for example. There are a few slight variations from what is normally expected, but it is what helps make this instrument so different and intriguing.

The number of drones is typically two or three depending on the type of pipes. The Great Highland Bagpipes traditionally have three drones. My bagpipes consist of two drones for simplicity sake. One drone is the bass drone, which plays a low note. The other drones, tenor drones, are typically tuned one octave higher than the bass drone. Though drones only play one note, the single note that they play can often be adjusted by changing the length of the pipe or the drone can even be turned off by plugging it up. My pipes can be adjusted, but not plugged up, so the two drones will always play, and they will typically tuned to the traditional notes of low A and A.

Building

Actually putting the bagpipes together was a frustratingly rewarding project spanning multiple weeks and involving many, many trips to the hardware store and an automotive store. Though there were instructions I had found online outlining how to build bagpipes, they were at times very vague. They do not give any kind of exact measurements and so after the initial cutting of pipes there was a lot of guesswork and estimating involved to get the pipes sounding right. The basic construction of all three of the pipes though involved ¾" pipe joined with a ½" tee piece which the air will go from the bag into the pipe through.

On one end of the tee is a coupler that holds a piece of plastic bag that functions as the pipe's reed. There is then a pipe in the other end of the coupler that has a cap on it to control the noise coming out of the pipes and make it quieter. Then on the other end of the tee is the long strip of ½" pipe with some tape wrapped around the top so it can be adjusted to gently lay against the reed and fit snugly into the ¾" pipe.

The pipes shown above were cut longer than they would ultimately need to be so that adjustments could be made later. The overall length of the pipe determines the pitch. For the two drone pipes, another piece of ¾" pipe was placed around the bottom of the pipes and fit snugly with tape so that the notes can be changed and easily adjusted.

Next the blowpipe was put together. It consisted of about a foot length of ½" vinyl tubing which was then attached with tape to a system of ¾" CPVC pipe and reducer couplings which inside of them have a small piece of tubing with holes cut in it (to let air through) which holds in place a rubber bumper that allows air to pass into the bags, but stops it from leaking back out.

Then the bag needed to be assembled. The bag was made entirely of duct tape. The tape was just put layered on top of itself in strips until it created a rectangle 50cmx60cm^2. Then a shape was cut out of that square so it would be in the shape of a typical bagpipe bag that fits under the arm. Holes were cut for the ½" pipe that the drones and chanter would fit onto.

The sides were then finally taped together to form a bag. This bag naturally had very many holes that needed to be found and fixed with more duct tape. This was probably the most frustrating part of the entire building process because it seems like it will be an endless struggle for a long time, until suddenly one day all of the leaks have been covered.

The fully-assembled set of bagpipes look pretty decent, but a great deal of fine tuning is yet to be done to make the sound like fully-tuned bagpipes.

Tuning was a difficult process to get through. It involved first having to shave a lot of length off the end of each pipe to make everything sound higher than it was initially. The drones were a bit simpler because there was a certain amount of leeway with the ¾" adjusting pipe wrapped around. For first drilling the holes into the chanter, essentially an image of a functioning bagpipe chanter was scaled to fit along the pipe and then holes were drilled essentially where they looked like they should be. It was not especially scientific at first, but since I do not have great accuracy with a drill anyway it seemed to be the best starting position. From there it was a matter of shaving off some extra material around the holes and adding tape where the holes were too big. I used a simple tuning app for the phone[3] to make the best measurements of the notes I was able to. It took a lot of fine tuning and patience to make each note play the way it is supposed to. Everything is finally fully-tuned and functional.

Learning to Play

The next step is one that I am still struggling with. Bagpipes are not necessarily an easy instrument to play, and it is not recommended that anyone tries to teach themselves how to play. From looking at instructional beginners websites[456], I now understand the basics: hand positions while resting and playing, and the different configurations for notes.

Low-G

Finger Position/Note	Hole
Left Thumb (A)	Closed
Left Index (G)	Closed
Left Middle (F)	Closed
Left Ring (E)	Closed
Right Index (D)	Closed
Right Middle (C)	Closed
Right Ring (B)	Closed
Right Pinky (A)	Closed

Low-A

Finger Position/Note	Hole
Left Thumb (A)	Closed
Left Index (G)	Closed
Left Middle (F)	Closed
Left Ring (E)	Closed
Right Index (D)	Closed
Right Middle (C)	Closed
Right Ring (B)	Closed
Right Pinky (A)	—Open—

B

Finger Position/Note	Hole
Left Thumb (A)	Closed
Left Index (G)	Closed
Left Middle (F)	Closed
Left Ring (E)	Closed
Right Index (D)	Closed
Right Middle (C)	Closed
Right Ring (B)	—Open—
Right Pinky (A)	—Open—

C

Finger Position/Note	Hole
Left Thumb (A)	Closed
Left Index (G)	Closed
Left Middle (F)	Closed
Left Ring (E)	Closed
Right Index (D)	Closed
Right Middle (C)	—Open—
Right Ring (B)	—Open—
Right Pinky (A)	Closed

D

Finger Position/Note	Hole
Left Thumb (A)	Closed
Left Index (G)	Closed
Left Middle (F)	Closed
Left Ring (E)	Closed
Right Index (D)	—Open—
Right Middle (C)	—Open—
Right Ring (B)	—Open—
Right Pinky (A)	Closed

E

Finger Position/Note	Hole
Left Thumb (A)	Closed
Left Index (G)	Closed
Left Middle (F)	Closed
Left Ring (E)	—Open—
Right Index (D)	Closed
Right Middle (C)	Closed
Right Ring (B)	Closed
Right Pinky (A)	—Open—

F

Finger Position/Note	Hole
Left Thumb (A)	Closed
Left Index (G)	Closed
Left Middle (F)	—Open—
Left Ring (E)	—Open—
Right Index (D)	Closed
Right Middle (C)	Closed
Right Ring (B)	Closed
Right Pinky (A)	—Open—

High-G (common)

Finger Position/Note	Hole
Left Thumb (A)	Closed
Left Index (G)	—Open—
Left Middle (F)	—Open—
Left Ring (E)	—Open—
Right Index (D)	Closed
Right Middle (C)	Closed
Right Ring (B)	Closed
Right Pinky (A)	—Open—

High-A (common)

Finger Position/Note	Hole
Left Thumb (A)	—Open—
Left Index (G)	—Open—
Left Middle (F)	—Open—
Left Ring (E)	Closed
Right Index (D)	Closed
Right Middle (C)	Closed
Right Ring (B)	Closed
Right Pinky (A)	—Open—

However it is still taking some time to master the basics and I cannot yet play a song on the pipes. The first song I intend to try to play is Amazing Grace because it is a very popular and well-known song on the bagpipes and it is considered a beginners level song to play on the bagpipes. The sheet music to me however seems more complicated than the simple music I remember playing on the clarinet in fifth grade.

There are strings of eighth notes that I am not fast enough to play yet, but these are characteristic elements of all bagpipe music. There are typically some very long notes broken up by many different short notes. It is also worth noting that normally when anyone is starting out in learning the bagpipes, they are not just handed a functioning set of bagpipes right away. People learn how to play all of the different notes on a Practice Chanter. This is just a small pipe with the holes and notes the same as the chanter, but you blow directly into it and have it right in front of you instead of having to blow into a large bag which can make it difficult to see the chanter, especially when the bag is a bit stiffer than a normal one might be. The practice chanter allows the person learning the notes to not have to blow a lung out trying to force air through these pipes. A Practice Chanter may be something I consider investing in further if my development otherwise does not go as well as hoped. However I will continue to work on mastering this strange foreign instrument so that someday I may start a quirky indie band.

Conclusions

Building my very own set of bagpipes was perhaps an arduous task. And perhaps it was too much to hope that I could build a fully-functional and perfectly tuned set of bagpipes in a semester and that I could also be able to actually learn to play them by the end of the semester. I do now however have a functional set of bagpipes though that I can continue to make progress on. Some possible improvements and considerations for the near future would be to build a shoulder strap. As the bagpipes are now it is very difficult to stand up while trying to hold onto the bag and play the notes on the chanter. From this point on my task will mostly consist of a whole lot of memorization and building up finger memory, as well as some patience with the current limitations of the bag and my limited lung capacity.

Notes and Sources

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[1] http://www.instructables.com/id/Build-your-own-Smallpipes-for-a-few-bucks-Membra/

[2] Funny story, I was using a tape measure that had inches on one side, so I flipped it over and assumed that that side was centimeters. Long story short I made 50"x60" square of duct tape and have enough for a few extra bags if anyone wants one.

[3] G Strings for Android https://play.google.com/store/apps/details?id=org.cohortor.gstrings&hl=en

[4] http://www.hotpipes.com/practice.html

[5] http://www.bagpipejourney.com/articles/self_taught.shtml

[6] http://www.teachyourselfbagpipes.co.uk/