

# **Alphorn Mouthpieces**

## **Interfaces between Our Bodies and Alphorns**

Companion information to March 27, 2024, podcast.

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### Summary

The objective of this discussion is to help fellow alphornists play their instruments by providing thoughts, observations and insight into the mouthpieces of brass instruments, including alphorns. The alphornist's body, including airway, mouth and tongue, and lips, are also discussed because they are crucial to the alphornist in finding a mouthpiece that helps optimize his playing.

### Disclaimer

The mouthpiece of brass instruments, including alphorns, is discussed here by the author, an avid amateur musician (trombonist) and professional engineer with backgrounds and training in biology, physics, mathematics and nuclear, control systems and mechanical engineering. Unless otherwise noted such as by citations of specific references, calculations or similar quantitative evaluations, the statements here are opinions and offered without warranty or liability.

## Observations and Conclusions

The following observations and conclusions are discussed in greater detail:

- (1) The mouthpiece is the interface of two parts of a musical system that consists of the alphorn and musician's body.
  - a. The musician has little control over the horn other than adequately maintaining its joints to prevent air leakage and drying and cleaning;
  - b. The musician's body and mind require training, conditioning and development;
  - c. Practicing is generally accepted as the most efficient way to improve;
  - d. (author's observation) Improving the playing experience is crucial to a musician's growth because the amount of enjoyment a musician experiences from practicing mainly determines if they will practice; and
  - e. (author's belief and basis for this discussion) It is crucial to find an acceptable mouthpiece and to learn to support playing it with good posture, an adequate volume of unconstructed air and appropriate embouchure.
  
- (2) Musician's body is crucial in supporting the mouthpiece:
  - a. Supplies sufficient air pressure, quantity and flow velocity at the lips for any given pitch and volume:
    - i. See Exercise 1, 'Blowing Out Candle at Arm's Length';
    - ii. See Exercise 2, 'Play Long Tones for 3 or More Weeks'
  - b. Optimum positioning of mouth relative to the mouthpiece and for any given pitch and volume;
    - i. See Exercise 3, 'Ping Pong Ball in Mouth for Open Mouth'
    - ii. See Exercise 4, 'Whistle Tunes to Illustrate Positions of Mouth and Tongue for Various Pitches.'
    - iii. See Exercise 5, '
  - c. Minimum pressure of the mouthpiece on lips (greatly affects endurance);
    - i. See Exercise 5, 'Essentially No Contact Pressure with Mouthpiece.'
  - d. The new musician should notice a significant improvement in playing.
  - e. Any musician should revisit exercises 1, 2, 4 and 5 at least weekly, if having difficulty attacking high notes or playing them in tune, and before seriously searching for the optimum mouthpiece.
  
- (3) Optimum versus Perfect Mouthpiece:
  - a. People are so different that there is no universal mouthpiece; no single mouthpiece fits everybody;
  - b. There is no perfect mouthpiece, only optimum.

- c. The optimum mouthpiece is a compromise of which of the musician's needs are better supported than others.
- f. All mouthpieces required establishing and maintaining or improving the musician's skill and physical conditioning (see 2 a, b and c);
- d. The musician must learn to play the mouthpiece by practicing, including the developing coordination and strength required to maintaining body support (see 2 a, b and c);
- g. It has been said that if you don't like your present mouthpiece, play long tones on it for 3 weeks and re-evaluate;
- h. Especially for musicians who are new to alphorns, as skills and conditioning change, mouthpiece needs could also change.

(4) Mouthpiece Components, Sizes, Shapes and Dimensions:

- a. The shapes and dimensions of the rim, cup, opening to the throat, and shank internal and external tapers are crucial and subtle, minute differences between them can make substantial differences in ease of playing and sound and only become apparent by playing the mouthpiece.
- b. (Lindsey Jones observation) Smaller diameter cups make it easier to play high tones.
- c. (Lindsey Jones observation) Smaller depth cups help in playing sharper.
- d. (author's observation) Smaller mouthpieces generally help musicians play higher notes with better response, intonation and endurance but playing low notes might become much more difficult, and vice-versa;
- e. The shape of the mouth and lips, and placement of the embouchure in the mouthpiece are fundamental to the ability to play high and low notes;
- f. Larger mouthpieces tend to have a fuller timbre (sound) and smaller ones more strident.

(6) The Physics of Mouthpieces:

- a. The shape of the cup;
- b. Air flow rate and patterns;
- c. Vibration versus airflow;
- d. Flow from bowl through venturi section.

(7) Placement of Mouthpiece in Alphorn's Receiver ('clocking' the mouthpiece):

- a. The receiver and mouthpiece of brass instruments are generally not uniform, and wooden instruments are also not expected to be uniform;
- b. The rotational position of the mouthpiece in the receiver can have a minor, but for some musicians important, effect on the 'feel' of the horn;
- c. The mouthpiece and horn can feel more 'consistent' by finding and noting the rotational position of the mouthpiece that feels most comfortable, then always returning to the same 'clock position.'
  - i. I place my mouthpiece in the approximate clock position, then rotate it into the final position.

- ii. I don't know if consistently placing the wooden mouthpiece into a wooden receiver will create a wear pattern that could make it more difficult to fit a different wear pattern.

(8) Wooden versus Brass Mouthpieces:

- a. Tradition and sound seem to dictate a strong preference of wooden over brass mouthpieces;
- b. Experienced musicians have spent thousands of hours playing and becoming proficient with their brass mouthpieces;
- c. (author's experience) Some brass musicians initially find it much easier to play an alphorn with their brass mouthpiece;
  - i. Brass mouthpieces have smaller diameter, shorter length shanks and different tapers than wooden mouthpieces and the alphorn's receiver. Wooden adapters accommodate small and large diameter brass mouthpiece shanks and match the different diameters and tapers between the brass mouthpiece and the alphorn's receiver;
  - ii. (author's experience) The sound produced by brass and wooden mouthpieces can be quite different, and wooden mouthpieces are more mellow and more pleasing;
  - iii. A wooden mouthpiece is required to play in Swiss contests.
  - iv. I began by playing a wooden mouthpiece whose cup inner diameter was about the same as the wooden mouthpiece, then after about 3 or 4 months, transitioned to smaller mouthpieces.
- d. Small variations among mouthpieces, even from the same manufacturer and same size marking, can lead to significant variations in response;
  - i. I have two Frantushi 23V mouthpieces and one is much easier to play than the other.
  - ii. I have taken impressions of mouthpiece cups (see photograph, later) and cannot see differences that might explain why they play so differently.
- e. Wooden mouthpieces vary far more in quality than brass;
  - i. The best mouthpieces tend to be the most expensive;
  - ii. 'Cry once' – spend the money on the mouthpiece that fits you rather than trying to save a little money. You'll never regret it. If you buy a cheaper mouthpiece and it doesn't fit as well, each time you play it, you'll probably regret not getting the better one.
- f. The 'wetted' surfaces of a wooden mouthpiece, particularly the lip, cup and throat, must be sealed and very smooth;
- g. Handle mouthpiece respect and great care to preserve its finish and dimensions;
  - i. Never, ever drop a mouthpiece on hard ground;
  - ii. I put my mouthpiece in an empty pocket before moving my horn so

it can't hit walls, doors or other objects or come loose and drop;

- iii. Whenever possible, I play above a soft surface, just in case I drop the mouthpiece.
- h. Mouthpieces should be dried after playing and kept spotlessly clean;
  - i. Brush and floss if you've eaten just before playing;
  - ii. The same buildup that is removed by dental cleaning can occur within the mouthpiece and horn, so clean them while they're still damp from playing.
  - iii. I curl a small part of a paper towel and insert it into the mouthpiece's throat and twist, then use the rest of the sheet to wipe the cup and lip clean.
  - iv. I use part of a sheet of paper towel rather than a rag because it's rough and absorbent, and can be dissolved by water if it gets stuck in the horn or mouthpiece.
  - v. I use a trombone or gun cleaning rod to move the paper towel through the horn (another podcast?); and
  - vi. Wash or sanitize your hands afterwards.

(7) Acoustics of the horn:

- a. Mouthpiece and venturi are crucial;
- b. Bell has little impact on pitch;
- c. Effects of discontinuities in overall internal shape including changes in taper.

### Description of Human/Alphorn System

The alphornist and his (or her) alphorn are the two major components of an acoustic system where the mouthpiece is the interface between them. No part of the acoustic system will operate in isolation. Although people are physically different and approach playing from a wide range of skills, experience and training, some subjects such as shaping the path of air, mouth and lips are so crucial to

A brass instrument is comprised of three components: a mouthpiece; a tube that determines the resonant frequency and harmonics of the instrument and a bell whose expanding shape acoustically amplifies and shapes the instrument's sound. An alphorn has the three components, even though it is generally made from wood, and therefore is classified as a brass instrument.

By itself, a brass instrument cannot create a tone. The instrument requires an input of energy, typically from a human musician, vibrating at the existing resonant frequency of the instrument.

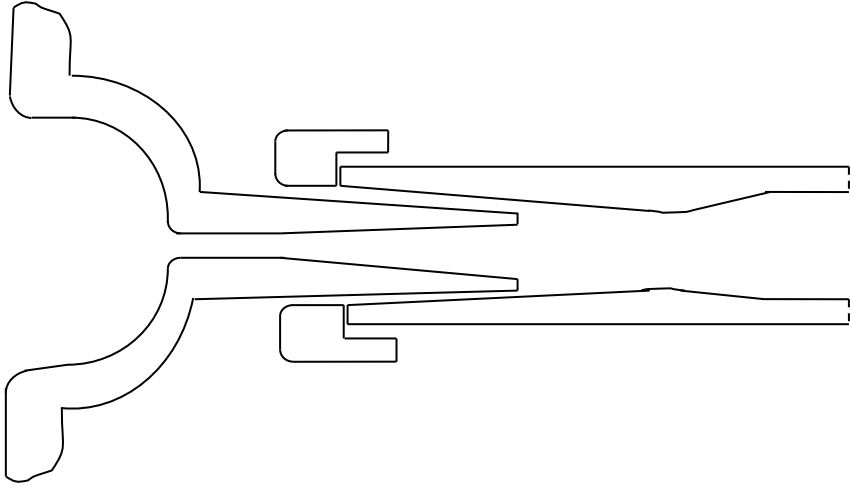
For the purposes of this discussion, the instrument and musician are considered a system that is examined here. The human musician part of the system relies on fine control of many large and small muscles to provide a flow of air at the right pressure and velocity to his lips so they can vibrate (buzz) at a pitch that matches the resonant frequency of the brass instrument. The instrument stores and amplifies the energy in the air. Some of the acoustic energy escapes via the bell where people can hear it.

## Definitions and Terminology

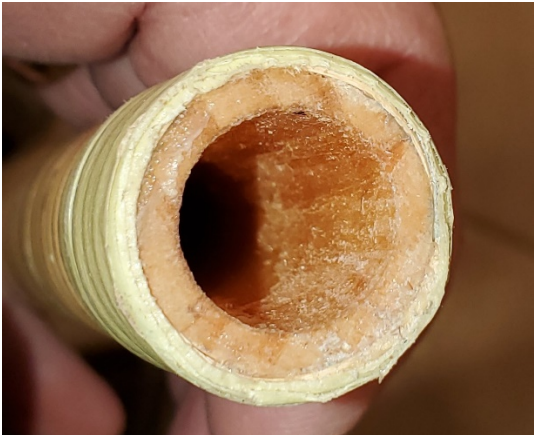
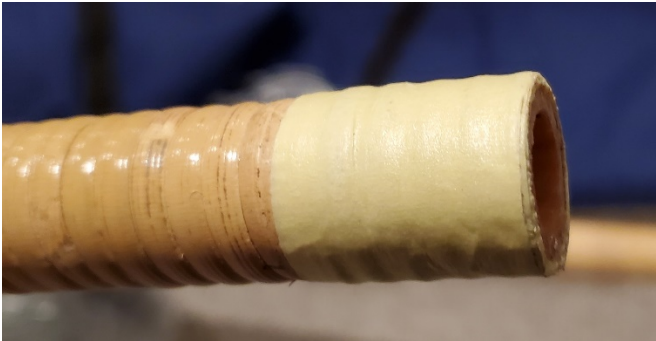
For the purposes of this discussion, the following terminology will be used: *(in progeess!)*

- (1) Bore. The inner portion of a tube such as the tubes of an alphorn or a mouthpiece's shank.
- (2) Mouthpiece. The mouthpiece consists of a shank that is inserted into the receiver section and is the subject of this discussion. It also includes a cup, rim and other parts that are outside the scope of this paper. The manufacturer was identified and his indication of the size of the mouthpiece were printed on each mouthpiece.
- (3) Receiver tube. The receiver tube is the uppermost and narrowest tube in an alphorn;
- (4) Receiver Section. The receiver section of the receiver tube is at the smaller end of the receiver (See Figures 9 and 10, and Figures 11 through 15) and is protected by a large wooden 'cap' (See Figure 7). The caps of the available receivers were made of a dark hardwood.
- (5) Taper. Taper is the change in a tube's diameter for a corresponding change along a length of the tube that is perpendicular to its diameter. The rate of taper is expressed as mm/mm of the shaft's outer diameter is the value in mm diameter per mm change in distance from the smaller (open) end of the shaft. Figure 3 is a sketch of the taper of a mouthpiece's shank.
- (6) F and F# Alphorns. For the purposes of this discussion, all three sections of an 'F' alphorn are pitched in F. The F# alphorn denotes that the F receiver section has been replaced with an F# adapter receiver while the middle and bell sections are still pitched in F.

### Mouthpiece and Receiver Components



### Alphorn Receiver Section





## References:

### 1. Brass Mouthpieces

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- 1.2 'How to choose a mouthpiece?', A guide to Yamaha French horn mouthpieces, [https://www.yamaha.com/en/musical\\_instrument\\_guide/horn/selection/selection004.html](https://www.yamaha.com/en/musical_instrument_guide/horn/selection/selection004.html), Downloaded 13 September 2022
- 1.3 'Ten Questions with Doug Elliott', Doug Elliott, September 01, 1998
- 1.4 'Yamaha Trombone Mouthpieces, Model Number System'

### 2. Physics of Brass Instruments:

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- 2.3 'The Physics of Inner Brass and the Acoustical Effects of Various Materials and Their Treatment', Renold O. Schilke, Schilke Brass Clinic, undated.  
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- 2.6 'Trumpet mouthpiece manufacturing and tone quality' Massimo Zicari, Jennifer MacRitchie, Lorenzo Ghirlanda, Alberto Vanchieri, Davide Montorfano, Maurizio C. Barbato, Emiliano Soldini. *The Journal of the Acoustical Society of America*, November 2013

**3. Video of Mouth and Tongue by Sarah Willis playing in an MRI.** “Horn Exercises, The Inside Story”: <https://www.youtube.com/watch?v=MWcOwgWsPHA>