The Double Reed, Vol. 23 No. 3

A Pedagogy for Finishing Reeds for the German-System (Heckel-System) Bassoon (Amended August 2010)

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While many excellent books and articles are now available detailing preliminary steps for making bassoon reeds (gouging, profiling, shaping, forming the tube, etc.), few go into extensive detail concerning finishing bassoon reeds. The reason for this is quite apparent. While the early steps of forming bassoon reeds can be precisely specified and in many instances may be reduced to a modest number of instructions, the methods for finishing reeds to fit all bassoons and more importantly all bassoon players are numerous.[1] Moreover, the “objective approach” employed by many reed-making textbooks is largely unsuited to addressing the multiple needs of bassoonists. By “objective approach” I mean that the text consists of a series of instructions or directions: do this.., take off x amount here.., etc.[2] This is not to fault reed making texts that mostly use the direction-based approach. Several of them, such as books by Christopher Weait and Mark Popkin and Loren Glickman, Weait are wonderful instruction manuals. I have used these books with my students for years and profited from them myself. These books are exceptionally effective in imparting precise actions, which when properly executed will yield the desired and quantifiable results. However, the objective approach is not as effective when the desired results are more ephemeral: I want a darker sound, I want a louder low register, I want a more dependable high register, etc. Let's call this other approach, one that seeks these less easily quantifiable results, a “subjective” approach.

Let me add a further clarification to the two approaches. Let's define the objective approach as one that centers on the physical evidence: how the bassoon reed appears and its various measurements. Let's define the subjective approach as one that centers on the aural results: how the bassoon reed sounds (on the bassoon) or how one would wish it to sound and how to change the reed for the better. Most if not all experienced reed makers relyupon both objective and subjective approaches. In fact it is not possible to separate the two during reed making and especially reed finishing. When I make bassoon reeds I use an objective approach (the reed is “x” long, the shape is “y” wide, the heart is “z” thick, etc.) to arrive at a reed that is then ready for “fine tuning.” I also use the objective approach when balancing the bassoon reed. Then with a subjective approach I achieve the sound quality and response I want tailored to each reed and the music the reed will perform. The instruction of several bassoon reed makers and years of bassoon reed making and performance have refined my subjective approach, which I will share with you in this article.

As a bassoon reed maker I know what I do and how I achieve a reed I want. But as a teacher, how do I impart this to students? The objective approach to my reed making is the easiest to teach to students. The subjective approach to my reed making, however, is difficult, to impart. This article seeks to address the several aspects of reed finishing and provide concepts for teaching reed finishing. In particular I try to address the subjective aspects of bassoon reed finishing. You will note, for instance, that no reed measurements are included and no model reeds dimensions are given. Students should consult other sources for objective aspects of the craft or for model reed measurements. Below you will find an explanation of the terms used in the article, an introduction to the four reed types, and comments on reed adjustments.

I. A Few Terms and Figures

Please refer to Figure 1 for many of the terms used in this article. Figure 2 presents models of the two types of scrapes mentioned here.

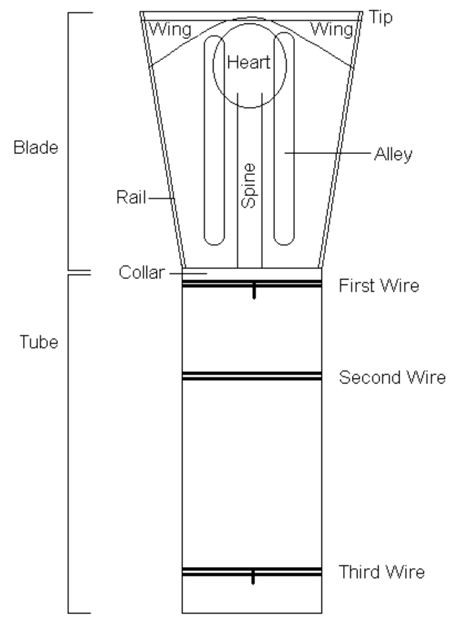


Fig. 1. The lay of the bassoon reed with terms.

Terms (top to bottom): wing, heart, blade, alley, rail, spine, collar, first wire, tube, second wire, third wire.

While there is an infinite variety of reed blade profiles, for our purposes the profile types are classified by their relation to two extremes: 1) the parallel scrape and 2) the sloping scrape.

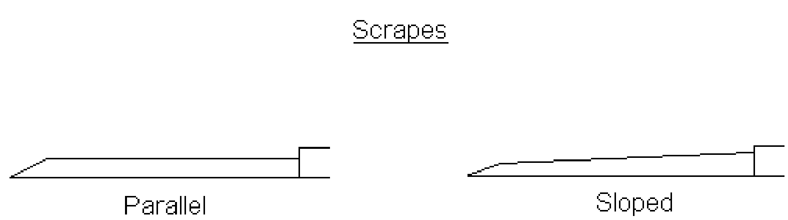


Fig. 2. Two types of bassoon reed scrapes.

In its idealized form, the parallel scrape features a steeply sloped tip area rising to the heart of the reed. The thickness from the heart up to the collar, however, remains the same. In the idealized form of the sloping scrape, the tip area to the heart rises much less steeply than the parallel tip. The thickness from the heart up to the collar gradually increases. Thus, the sloping scrape is heavier towards the collar than the parallel scrape, but lighter in the heart area.

Wire adjustments are described as follows. “Flattening” a wire means to flatten the oval of the tube bringing it closer to the shape it originally had before the forming process with a mandrel. “Rounding” a wire means to make the tube more circular. “Ratios” are the relationship of thickness between the spine and the rails or the heart and wings. A spine that measures twice as thick as the rails has a 2:1 ratio. A 3:1 ratio is greater than a 2:1 ratio; and changing a reed from a 2:1 ratio to a 1:1 ratio decreases the ratio.

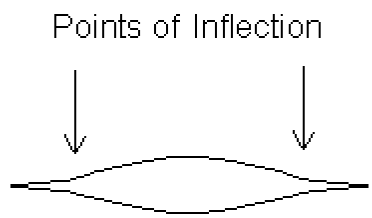


Fig. 3. Points of inflection.

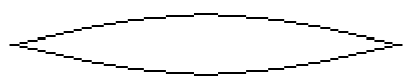


Fig. 4. No points of inflection.

Figure 3 illustrates “points of inflection.” Note that the central part (in front of the heart) of the reed tip has a convex curve; the wing portion of the tip is concave—curving in the other direction.

The arrows in the figure show the points of inflection, the place at which the curve of the reed tip changes from concave to convex.

Figure 4 illustrates a reed tip with no points of inflection. The “aperture height” refers to the distance between the two blades at the tip of the reed (See “A” in Figure 5); the “aperture width” will refer to the width of the aperture, the freely vibrating tip area, between the two blades (see “B” in Figure 5).

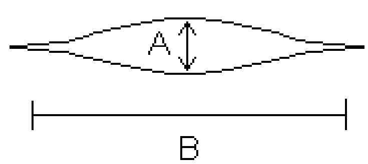


Fig. 5. Aperture height and width.

By the term “aperture” I mean both aperture height and width.

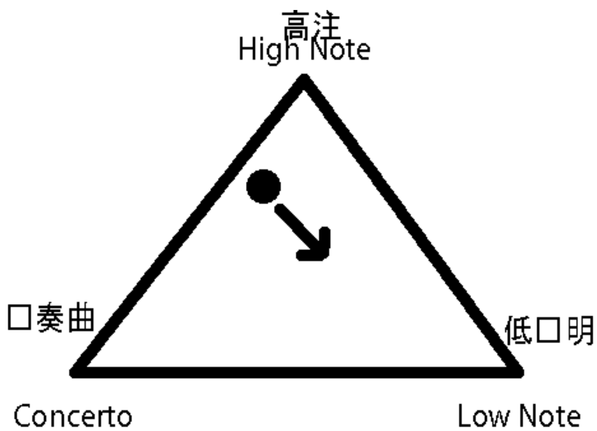
II. The Four Reed Types

I find that the best way to teach reed finishing (especially the subjective part of the craft) is to present the “normal reed type” in contrast with three specialty reeds: high note, low note or pianissimo, and concerto. The normal reed is the student's workhorse, accounting for the type of reed needed 95% of the time, with the specialty reeds employed just for unique situations.

The specialty reeds, however, take on importance not merely for their potential use in demanding musical passages, but also as “conceptual counterpoises” to the normal reed type.

By conceptual counterpoises I mean concepts that counterbalance and define the normal reed type.

Take for example the next figure:



The triangle presents the three reed types, each in corner. The reed represented by the black ball indicates a reed that has some characteristics of high note and concerto reeds, but few or none of the low note reed.

By adding features of the low note reed the student will adjust the reed into better balance, providing a normal reed that is better suited to all styles of playing. In this instance, the student can make proper adjustments by understanding the features of the low note reed. The concepts of the low note reed thus counterbalance the other two concepts.

Similarly if a player wants to improve a reed in the high register, understanding the features of the high register reed will help one to make adjustments in the right direction.

Understanding the fundamental ideas of the three specialty reed types and their relationship to the normal reed type helps equip students to make adjustments to bassoon reeds that bring about many of the subjective results they are seeking. The concept of each specialty reed thus contributes to the balance of the normal bassoon reed.

1) Normal. This reed should be the best possible compromise of the three reed types below. It should possess stable intonation, a pleasing tone, and good enunciation of the high, middle, and low registers at all dynamics.
This reed features points of inflection.

The Specialty Reed Types
(The Conceptual Counterpoises)

2) High Note. In comparison to the normal reed type this reed generally has:

- a narrower shape (especially the throat)
- a shorter blade
- rounded first and second wires
- a greater heart to wings ratio
- a greater spine to rail ratio

This reed features points of inflection, especially when a wide dynamic range and control in the high register is needed. Often the parallel scrape works best for this reed type.

The aperture height tends to be greater than the normal reed type.

(Used for the opening solos in Ravel's *Bolero* and Stravinsky's *The Rite of Spring .)*

3) **Low Note/Pianissimo.** In comparison to the normal reed type this reed generally has:

- a wider shape (especially the blade)
- a longer blade
- flattened first and second wires
- a lesser heart to wings ratio
- a lesser spine to rail ratio with a thinner spine
- a thinner tip

A reed made just for the easy production of low notes need not have points of inflection.

However a reed made for pianissimo playing should have points of inflection. Often the sloping shape works best for this reed type. The aperture height tends to be smaller than the normal reed type.

(Used for the opening solo of Tchaikowsky's Symphony No.6 and the opening of the overture to Mozart's Marriage of Figaro.)

4) **Concerto.** This reed needs to emphasize the louder dynamics with a pleasing sound and excellent articulation in all registers.

In comparison to the normal reed type this reed generally has:

• a wider shape (especially the throat)
• no points of inflection (or very slight ones at the edge of the wings)
• a lesser spine to rails ratio with thicker rails
• a larger aperture height and width (the result of a rounder first wire and/or a wider shape)

This reed may also have a wider shape with a shorter blade.

(Used to perform concerto literature with a large orchestra such as Weber's *Concerto in F* , Jolivet's *Concerto* , etc.) Not every specialty reed (high note, low note/pianissimo, or concerto) will necessarily have each characteristic listed above, but they will draw upon many of the characteristics as components to achieve the desired results.

These characteristics are a bit like ingredients in a stew: more of one ingredient should be added if another ingredient is decreased or even omitted. Each player finds the recipe most appropriate for his or her style of playing.

Now let's try to understand the relation between points of inflection and the reed types. A reed with points of inflection allows for multiple reed apertures due to the spring-like action of the reed.

This spring-like action permits the performer to select varying reed apertures as illustrated in Figure 6.

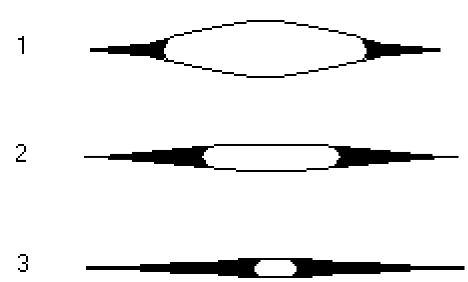


Fig. 6. Varied apertures views from the tip.

A reed with minimal embouchure pressure will have the wider aperture shown in number 1 of Figure

6 and will vibrate in the region under the number 1 in Figure 7.

Note that a portion of the wings and the rails in Figure 7 do not participate freely in this vibration since the blades are in contact in those areas.

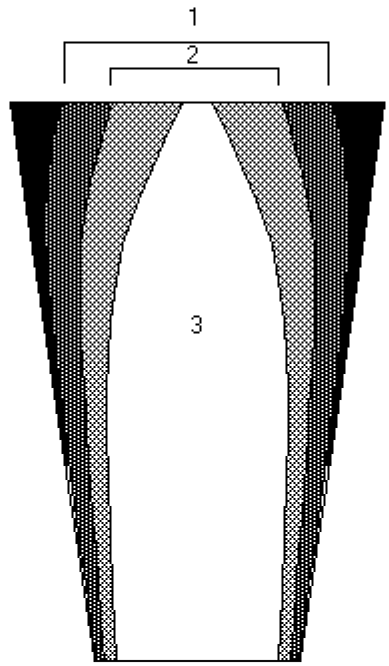


Fig. 7. Varied apertures viewed from the blade.

These areas are shaded in black. The area designated number "2" indicates greater embouchure pressure on the reed such as one might apply for higher notes or for quieter passages. Since larger portions of the reed blades are in contact, less of the reed surface area vibrates freely.
The area designated number "3" (the non-shaded portion of Figure 7) illustrates the vibrating surface of the reed with almost total closure of the aperture.
This illustrates the reed vibration during extreme high notes or pianissimo pianissimo passages.
There is an infinite variety of apertures available between the maximum aperture opening and total closure of the reed tip.
This variety of apertures is ideal for the normal reed type, which is played under the greatest diversity of performance demands—loud, quiet, high, low, etc.
The high note reed favors points of inflection as well since the high notes are played almost exclusively from center portion of the reed.

The smaller vibrating reed surface noted in area 3 of Figure 7 aids in the production of high notes.

The points of inflection also aid the various shading and timbral balancing needed for lyrical high register melodic lines. The low note reed may or may not feature points of inflection. Points of inflection are less necessary for the enunciation of the low register. However if pianissimo playing in the low register is pianissimorequired, points of inflection are quite helpful since the vibrating surface area is reduced. The less reed surface that vibrates, the less noise produced by the reed. In addition the points of inflection allow for greater dynamic nuance, a necessary requirement for playing at quieter dynamic levels.
A reed with no points of inflection yields an “all or nothing” aperture. With additional pressure the aperture height is reduced but the aperture width stays roughly the same until the blades make contact along the entire length of the tip (Figure 8).

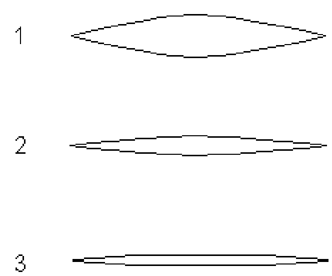


Fig. 8. Varied apertures of reed with no points of inflection.

This is a plus for achieving maximum volume throughout the range of the instrument — often a requirement for performing concertos with a large orchestra. The greater the aperture of the reed, the more the airflow and consequently the louder the reed can be played. Even with the increased embouchure pressure for the high register, the width of the aperture is not significantly reduced.

Now let's further apply these reed types to the pedagogy of reed finishing. For instance, a student who has consistent difficulty with the high register of the bassoon might have a normal reed type that favors the low register. This student should move their normal reed type in the direction of the high note reed type. Adopting one or more of the characteristics of the high note reed moves the student's normal reed in the right direction. For instance, a narrower shape in the throat may be all that is needed. Add to this a shorter blade length and the reed will have an even greater bias towards the high register. Rounding both wires will increase the high register tendencies further, etc. Any one or all of these characteristics will shift the reed in a right direction.

In another example a student who consistently has difficulty with low register pianissimo attacks may have a normal reed type the favors the concerto model. This student should move their normal reed type in the direction of the low note/pianissimo reed type. Making a thinner tip or creating more prominent points of inflection in the reed would aid the low register response. Also flattening the 1st and 2nd wires would move the reed in the right direction. Encourage the students to make changes one by one in order to fully understand the effects on the reed.

They should play the reeds on their instruments after each change.
Naturally there are plusses and minuses with every reed modification, so it is important to understand what each
adjustment does for their reeds on their instruments.
Remember that the normal reed type does not do everything that the specialty reeds do, rather it is a suitable compromise that allows the performer as wide a command of the instrument as possible.

III. Comments on Reed Adjustments

Now that we have set the important concepts in place it is time to turn to practical suggestions on reed finishing.I encourage the reader to ponder how each suggestion below aids in the production of one or more of the four reed types.
Careful consideration of each aspect of reed adjustment will aid you in fine tuning your reeds to produce the result you desire.

An important part of reed making is observation and balancing. I have four principal methods of observation that I use to instruct students. All these methods require a wet reed.
This is because the cane is more supple when wet and it is easier to view the layers of the perenchyma — the wood or grain — when the cane is moist.

Also since the reed is wet when played, we want to observe its tendencies in this state.

1) Visually examine the blade of the reed for symmetry. We can see in Figure 9, for instance, that the reed is unbalanced since the layers of grain on the left side of the reed extend further towards the tip.

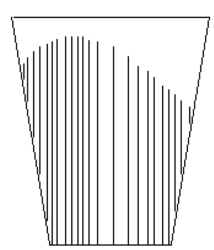


Fig. 9. Unbalanced reed blade.

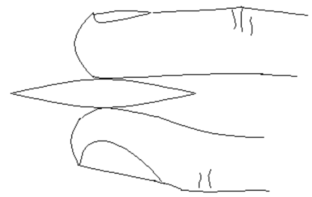


Fig. 10. Reed blade between fingers.

The layers of grain show that the left side of the blade is heavier than the right side. This reed should be balanced before further work is done.

2) The aperture or the "bubble" test is another important way to check the balance of the reed blades.

Observe the aperture of the reed while slowly closing the blades between your thumb and a finger in the same hand (Figure 10).
Carefully watch how the aperture (the "bubble") closes when you apply pressure. The bubble should be centered during all phases of closure (Figure 6).

If the "bubble" is off-center, your reed is unbalanced and needs to be adjusted. The bubble will be largest on the heavier side of the reed. Figure 11 shows the tip of two unbalanced reeds. Think of the blades as arm wrestling each other. The stronger blade portion will push the weaker blade portion away as shown by the arrows in Figure 11.

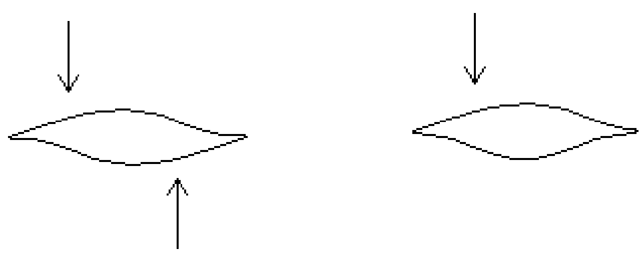


Fig. 11. Two unbalanced reeds.

These heavier portions of the reed will need to be thinned until the blades are in balance similar to the reed in Figure 6. You are seeking to have a symmetrical bubble or aperture in the middle of both blades during the entire test.

3) The "finger" test will also help you to identify the location of heavier or lighter portions of the reed blade. Pinch the reed blades throughout its whole surface between your thumb and a finger of the same hand. With this process move up and down the blade, especially concentrating on the sides and tip portions. The thinner portions of the blade will collapse more easily than the thicker portions.The fingertips are remarkably sensitive and can give a very accurate and quick assessment of the balance of the blades.

4) The “plaque test” helps to identify the thickness of the rails. Insert the plaque so that it slightly separates the length of the rails on one side of the reed (Figure 12). This way you can easily observe whether the rails are balanced and whether they are the desired thickness. Many students are unaware that their rails do not evenly taper from the collar to the tip or the rails are unevenly balanced between the blades. This test gives students an immediate visual check of the rail thicknesses.

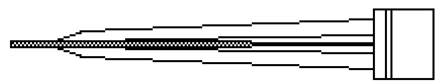


Fig. 12. Plaque inserted between the rails.

You will notice that I have not yet mentioned two common ways of assessing blade thickness. Looking through the blades illuminated by a light can sometimes help in determining unevenness in the blades and the overall profile. However, the age of the reed and the density of cane also affect the translucence of the reed.

Especially it can be difficult to make judgements about the thicker portions of the reed—the heart and spine areas — since these are not well illuminated by a light.

A dial indicator is another excellent way of testing blade thickness. It has two disadvantages however. With the reed intact it is difficult to measure thickness at the rails. Also the machines are costly. I hesitate to emphasize the use of a tool that students will not use when they leave my studio.
Many students are fortunate to be able to purchase
the rudimentary tools necessary for reed making. For most students the expense of a dial indicator is prohibitive. All students, however, can quite easily perform the methods of observation I give above.

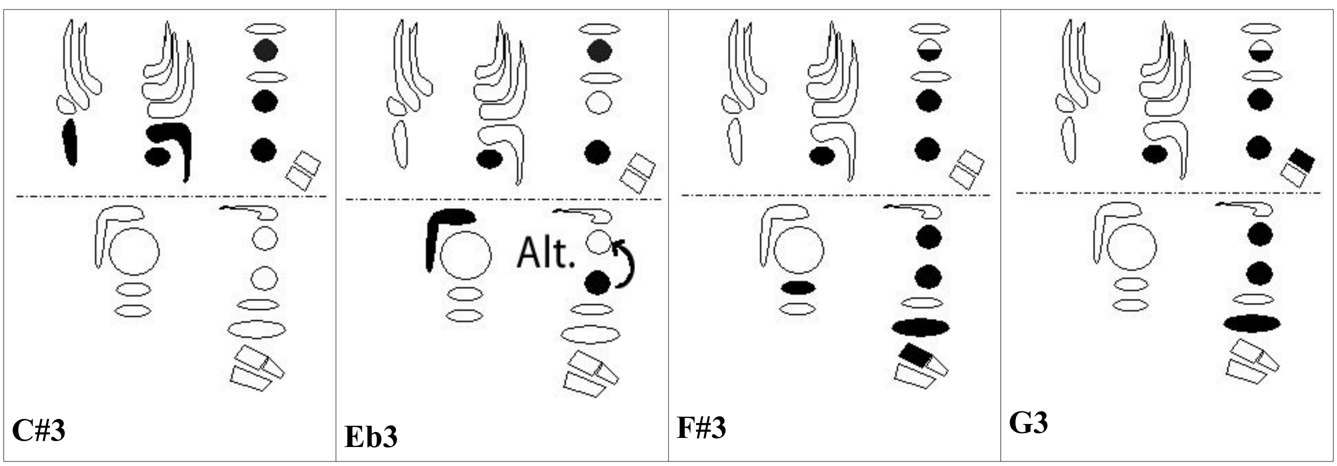
Now let's move on to adjustments of the wires. It is quite important to understand how changes to the 1st and 2nd wires affect the reed. Figure 13 gives a table of the effects of wire adjustments. Rounding or flattening the first wire alone will have varying effects on the pitch depending upon the profile type, blade length and other factors. Opening the first wire creates a larger aperture height and often a larger aperture width, allowing for more air to go through the reed.Rounding both wires together, however, will darken the sound and raise the overall pitch. Flattening both wires together will brighten the sound and lower the pitch. An overly rounded first wire is an indication that other methods of darkening the reed or opening the tip should be used with reeds in the future. Also note that an over-tightened 1st wire will greatly constrict the vibration of the reed. I suggest that students give their first wire the “fingernail” test. Once the reed is soaked in water and played for a bit, they should be able to shift the first wire loops slightly with their fingernails.

Adjustment	Tip Opening	Timbre (Tone)	Pitch Tendencies
Round 1st wire	Opened	Mostly darker (less vibrant)	Varies
Flatten 1st wire	Closed	Mostly brighter (more vibrant)	Varies
Round 2nd wire	Closed	Darker	Higher pitch
Flatten 2nd wire	Opened	Brighter	Lower pitch

Fig. 13. A table of the effects of wire adjustments.

If moving the wire requires excessive force, the wire is too tight. It is quite common for the cane in new reeds to swell up in the first few playing sessions. Keeping the first wire at a proper tension is key to properly assessing further blade adjustments.

The heart to wing and spine to rails ratios have several items in common. In general, higher ratios yield a darker sounding reed; lower ratios give a brighter sounding reed. Carefully study the following list of problems of improper thickness and characteristics of balance between these areas:



A heart that is too heavy (large heart to wings ratio)
• Forked Eb (Eb3), G3 (G above open F) （Eb3），
and F#3 (F# above open F) are too sharp
• The low register is sharp and unresponsive

A heart that is too thin (small heart to wings ratio)
• C# 3 (below open F) and possibly E3

(below open F) drop in pitch • The high register is flat • The reed collapses at loud dynamics.
Wings that are too heavy (small heart to wings ratio) • Reed not responsive at pianissimo
Wings that are too light (large heart to wings ratio) • Corners break off with tonguing • Corners are totally collapsed and therefore do not contribute to vibration of the reed
A low spine to rails ratio with a thick spine and thick rails • A vibrant or bright reed favoring the low register and louder dynamics.
A low spine to rails ratio with a thin spine and thin rails • A nasal or bright reed favoring the low register and quieter dynamics
A high spine to rails ratio (thick spine, thin rails) • A dark reed favoring the upper register. If the rails are too thin, the low register will speak only with difficulty.

There are several ways in which to darken the sound of the bassoon reed beyond the wire adjustments mentioned above. I theorize that bright sounding reeds have several components of brightness.

One is the high frequency brightness or edginess generated by the tip area. Another is the more robust brightness generated by portions of the reed away from the tip towards the heart and spine.
Drawing a piece of fine sandpaper—400 to 600 grit—across the tip width by making contact with both blades at the same time will reducebrightness generated from the tip (Figure 14).

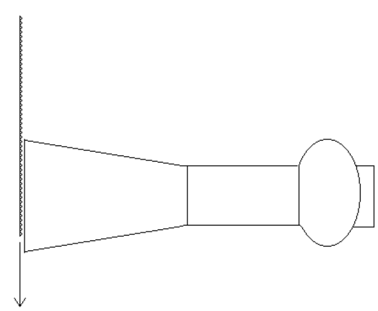


Fig. 14. Drawing sandpaper across the reed tip.

A method of reducing the brightness from the tip area and some from the back areas is done as follows. Insert a single piece of fine sandpaper into the tip opening (as one does with a plaque).

Lightly pinch the blades closed with one hand and firmly pull the sandpaper out with the other. Flip over the sandpaper and repeat the procedure for the other blade.

The best solution for tempering the robust brightness from the middle portion of the bassoon reed comes from increasing the spine to rails by taking off material from the rails. Most often I use a file for this operation. In extreme cases of brightness, particularly with a reed that is flat in pitch, clip the tip or use sandpaper or an emery board to narrow the shape of the reed.

The tone of a reed may be brightened in several ways in addition to the wire adjustments mentioned above. Any decrease in the heart to wings ratio or the spine to rails ratio will brighten the sound. Naturally this means taking material away from the heart or spine of the reed. A thinner tip will add more high frequency brightness or edginess. The tip is an essential component of the reed since it acts much like the spark plug of an engine.

A well-made tip allows the reed to respond in all registers and at all dynamics. For this reason the tip is one of the first adjustments I make on the reed when I finish it. Once the tip is well formed, the condition of the reed can be better assessed and the other adjustments made.

I allow only the concerto type of reed to have a thicker tip, all the other reed types are thin and responsive.

Thinning the alleys (see Figure 1) encourages the points of inflection. In other words, it weakens the reed so that the aperture width contracts when the reed is squeezed by the embouchure. These points of inflection are desirable if one wants greater dynamic control.

I work on the alleys starting at the back of the reed progressing with the grain towards the tip. A curved knife blade is best for this work, allowing the reed maker to take out just a sliver or two of cane material.

Just as we have our meat tenderizers to make the meal more appetizing, taking material out of the alleys acts as "reed tenderizer," making the tone and response more appealing. Taken to the extreme, however, you are left with a reed that plays "like mush."

IV. Conclusion

Once you have carefully studied the material contained in this paper, I encourage you to take the quiz available with the original publication (see *The Double Reed*, Vol. 23 No. 3, p. 107). Naturally this test only ascertains whether you have "head knowledge" of the subjective and objective approaches containedin this article. It is quite another thing to put into practice the concepts contained here. I tell my students that until they have made their first 100 reeds they are novices. Only after they have made 1,000 reeds will they begin to understand the intricacies of sculpting the sound-producing devices we call a bassoon reeds. There is no short cut to the timed onored procedure: scrape it and try it, sand it and try it, adjust it and try it... May your knives be sharp, may your cane be mellow, and may you have something to crow about when all is finished!

End notes
1. One notable exception is Mark G. Eubank's *Advanced Reed Design & Tesing Procedures for Bassoon* , third printing (Portland, Oregon: Arundo Research Company, 1993). This text has some wonderful suggestions for finishing bassoon reeds.
2. Christopher Weait, *Bassoon Reed-making: A Basic Technique* , 2nd edition (McGinnis & Marx Music Publishers, 1980). Mark Popkin and Loren Glickman, *Bassoon Reed Making Including Bassoon Repair, Maintenance and Adjustment and an Approach to Bassoon Playing.* (Evanston: The Instrumentalist, 1969).
3. I am in debt to several teachers for their reed making advice: Arthur Grossman, Norman Herzberg, Sidney Rosenberg, Richard Plaster, and Stephen Maxym. I also acknowledge JM Heinrichs' excellent article "The Bassoon Reed" 7 (1979) *The Journal of the Double Reed Society* : 17-43.
4. Please see Ronald Klimko, *Bassoon Performance Practices and Teaching in the United States and Canada* (Idaho: University of Idaho, 1974); Marc Apfelstadt and Ronald Klimko, *Bassoon Performance Practice, Teaching Materials, Techniques and Methods* (Idaho: University of Idaho, 1993); Terry B. Ewell and Todd A. Goranson, "Double Reed Measurements Part 1: Bassoon Reeds" *Scrapes International* 2 (December 1999): 56-64; and the WWW Bassoon Reed Project on the IDRS web site: http://www.idrs.org/Reed/Reeds.html. Also of interest is Lewis Hugh Cooper and Mark D. Avery's article "Reed Contribution" in *The Double Reed* 13/3 (1991): 59-68.