Headjoint Design

It is with great pleasure that I present a series of articles intended to increase the level of understanding of the flute, as regards its acoustic and mechanical aspects.

In keeping with the major common concern of flautists the first article deals with the perennial favourite: head-joints and embouchures. Scales and various other topics will be dealt with in later articles.

Head-joints: How They Work

This article is a guide to facilitate a better understanding of how modern head-joints work, and of what the various variables and their effects are. When a head-joint is made, a number of variables are manipulated to achieve a specific effect. A true hand- made head-joint is matched to both the player and the specific instrument.

it should be understood at the outset that this article is not meant as a guide to modifying head-joints. Attempts of this nature usually result in the spoiling of the head-joint, as the balance between the design variables is usually not understood, and the integrity of design and consequently performance are invariably spoilt by inexpert attempts at improvement. (This warning means, don't mess around with your own head-joint. Ed.) The article should rather be seen as assisting in understanding why head-joints differ, and also as an aide to the conscious and educated choice of a head-joint. In order to facilitate understanding a pictorial glossary is included.

Head-joint Taper

The parabolic taper of the head-joint controls the pitch of the third register. This narrowing may be varied very slightly depending on whether the flute has a modern (short) scale or a traditional (long) scale. (Flute scales will be the subject of a later article in the series.)

Embouchure Size

A small embouchure hole favours the third register while a large embouchure hole favours the lower register. The small hole will generally be more flexible and make more tone-colours than a large embouchure hole, while the large embouchure hole is generally louder and more powerful, and usually makes a darker sound.

Embouchure Depth

A deep embouchure hole favours the lower register while a shallower embouchure favours the higher register.

Overcut

Overcut refers to the beveling or rounding of the top of the sides of the embouchure hole; it enhances response and dynamic control in the third register.

Undercut

Undercut refers to beveling the cutting away of the bottom of the sides of the embouchure hole. Material is removed from the riser and tube. This favours the lower register. Undercut and overcut must be run in parallel to achieve balance between the three registers. The greater the degree of

combined overcut and undercut the less the resistance of the head-joint - thus necessitating greater diaphragm control. In general, heads with a large degree of overcut tend to have a paler sound and be more flexible, while heads with a larger degree of undercut tend to have a warmer sound and be less flexible.

Strike Edge

This is the edge over which the air stream is directed. A very sharp edge (razor edge) favours the bottom register, where it has a very quick response and is very loud. It can, however, create a thin sound in the middle and top registers as well as extraneous noise in all registers. The third register may in addition be stiff and inflexible. These comments apply to a less-than-excellent player. However, for a virtuoso performer with excellent lip control, who has micro-control over the air stream, the razor edge is the very best strike edge.

A sharp, but very slightly less edged strike edge, is suitable for the majority of players. It is sharp enough to respond quickly and clearly in fast passages, and wide enough to sing in legato.

Lip-plate Curvature

This refers to the amount of dip, or curvature in the lip-plate measured across its length, from shoulder to shoulder (side to side).

Given similar embouchure holes there will be tonal differences in a head-joint, dependent on the degree of lip-plate curvature. A head-joint which has a very flat or straight lip-plate, or near straight lip-plate, will demand less lip contact and less lip pressure to sound. This means that the embouchure will be able to create as one of its tonal options, a pale and even an unformed sound. By contrast a curved lip-plate demands more lip contact and thus pressure, consequently producing a more focused and formed sound. A straight lip-plate can produce the same sound upon the application of similar lip contact and lip pressure.

The problem with the curved lip-plate being that it is relatively difficult to produce a pale sound. The straight or near straight lip-plate is thus more flexible and expressive.

Material

Headjoints tend to improve and become more expressive as the density of the material increases; allied to decreasing wall thickness. (Silver is more dense than nickel. Gold is more dense than silver) Nickel silver tends to be loud and bright. The tone quality, however, tends to be coarse and inflexible as the material tends to reject attempts at fine shades of expression. Silver is truly a material for all seasons. It is powerful, responsive and very expressive. When a well designed head is executed in silver it has a very wide dynamic range. From a design point of view silver head-joints can be made ranging from very dark sounding, through to very bright sounding. Silver tends to favour the bottom and middle registers. Gold and platinum head- joints are very demanding and exacting to play. They do not have the forgiving qualities of silver. The golds (9K and 14K) have a luminous quality and wonderful clarity to their sound. 14 karat is unrivaled for warmth. 9 karat is unrivaled for its combination of sparkle, warmth and projection. Gold favours the middle and, especially, the upper register.

Crowns

Crown design has a subtle effect on head-joint performance. As a single variable it may not be very effective, however, when it is taken in conjunction with other variables a crown can make a difference.

In general terms the following effects are possible: - A thin, pressed, domed crown will make a flute more bright. A heavy cast crown will make a flute darker, an open dome crown will add resonance.

The most frequently used type of crown has a solid base, which decreases upper chamber volume and thus decreases resonance. Some makers drill holes in the base to increase resonance.

In the writer's opinion a cast, heavy, dome crown is best. The material weight favours the fundamental, while resonance is improved by the increase in upper chamber volume.

0-Rings

The cork unit in an O-Ring is a replacement unit for the head-joint of flutes. The O-Ring makes a head-joint more resonant, responsive and louder through a combination of factors, namely, reflector plate curvature and increased rear chamber volume. O-Rings are in general best for older, standard style head- joints.

Lip-plates

The most effective method of improving a head-joint is to replace the lip-plate. It is however, the most expensive. When this is done all variables can be interrelated to optimize the result. Typically the following are considered:

- The player's stylistic requirements.
- Compensation for and strengthening of the player's weak points.
- Enhancement of strong points.
- Suitability of embouchure hole to the player's physiology.
- Interrelationship between flute design and head-joint design.

The intonation of traditional scale flutes can be improved through a combination of head-joint taper and embouchure hole size.

Conclusion

It is usually possible to effect dramatic improvements on flutes through rebuilding head-joints. The effect is usually enhanced even further when tone hole undercutting is carried out and the flute is overhauled.

The intonation of traditional scale flutes can be improved through a combination of headjoint taper and embouchure hole size.

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