The following article is the second in a series by L. Hugh Cooper (1920-2007). He was a Professor Music (Bassoon) at the University of Michigan from 1945 to 1997, and a charter member of the International Double Reed Society.

Slippage: Reed Making's Most Benevolent Fault

L. Hugh Cooper with Mark Avery and Mark Clague
Decatur, Illinois

Reed blade slippage represents the scissor-like lateral displacement of the two opposing reed blades. Its extent and directionality is pre-determined during the tube forming stage of the reed making process. This useful phenomenon is often falsely maligned as a major reed-making fault; however, if properly understood and controlled several of its resultants may serve as useful components of successful reed design. Besides, the author for one, after seeing thousands, has never observed an individual reed produced by any reed maker that is totally devoid of slippage. Logically it follows that if slippage is so difficult if not impossible to eliminate, why not recognize and use its positive attributes in a constructive manner?

FOUR BENEFICIAL EFFECTS OF SLIPPAGE

Appropriate reed blade slippage creates a pseudo "movable shackle"-like lateral excursion at the rails. The reed blades' vertical oscillatory motion is analogous to that of an old fashioned, laminate leaf buggy spring, whose "moveable shackles" provide the obligatory lateral motion when the spring is vertically flexed (see Figure 1).

Figure 1

Reed blade slippage acts in a similar manner to facilitate the lateral motion required to sustain the reed blades' vertical oscillation. As the tip cycles close, its width increases. This inverse proportional relationship is maintained throughout the reed's vibratory cycle. This phenomenon applies to both laterally damped and undamped tip openings (see Figure 2). Clamp the leaf spring's ends to the buggy frame or fully impinge the reed rails and regardless of their innate flexibility either will break before they vertically flex.

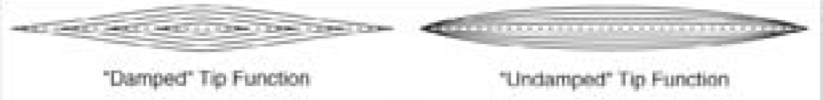


Figure 2

Although not directly related to blade slippage, further consideration shows that the stepped laminar construction of a leaf spring mimics the action of a reed blade's lateral tapers (see Figure 1). The longest spring leaf serves to sensitively absorb the bumps of minor roadbed irregularities, while successively shorter spring leaves are incrementally added to absorb increasingly deeper potholes. A reed blade's lateral tapers respond in a similar fashion while responding to a wide range of playing pressures (*pianississimo* to *fortississimo*).

In addition, the pseudo moveable shackle effect dramatically reduces the muscular effort required to vary the tip aperture contour and resultant reed cavity's static volume. Selective embouchure manipulation used to achieve desired register shifts and/or subtle shading of timbre, pitch, and dynamics become easier to achieve on these more flexible slipped reeds. Resistant rail-impinged reeds requiring an iron-man embouchure to control become the nightmares of the past.

A second, more obvious slippage function helps to create better hermetic seals along the rail junctures separating the two opposing reed blades. Simply put it is easier to match mechanically an edge to a plane than to match an edge to an edge (see Figure 3). As a result, all else being equal, slipped bladed reeds are as a whole hermitically tighter than those reeds with little (or no?) observable lateral slippage.

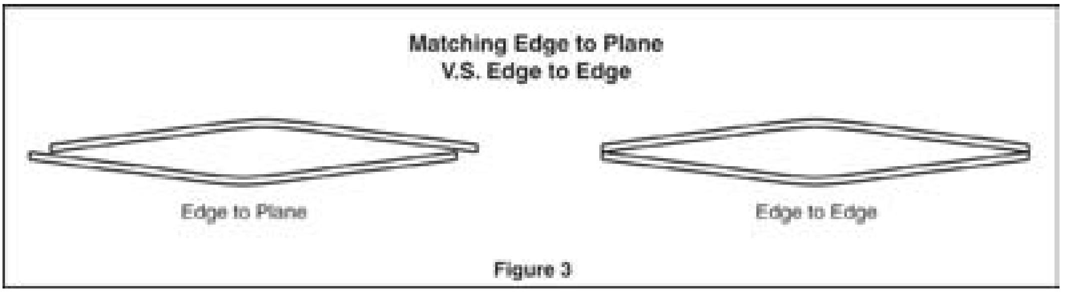


Figure 3

A third slippage advantage serves to relieve the "basic embouchure set" of its initial burden by "damping out" the loud raucous (schawm-like) noise generated along the reed blades' rails. Rails, whose impinged edges are joyfully beating one against the other, produce obnoxious unmusical periodic noise. There are two viable ways to control this problem.

1. The most difficult way is to use a hard, jaw supported iron-man embouchure in conjunction with stiff resistant reeds that have sufficient strength to resist collapse under extreme vertical embouchure pressure (see Figure 4).
2. While an easier more efficient approach utilizes lateral blade slippage to "damp out" the offending blade areas with little additional embouchure involvement — if it isn't there, it don't need fixing (see Figure 5).

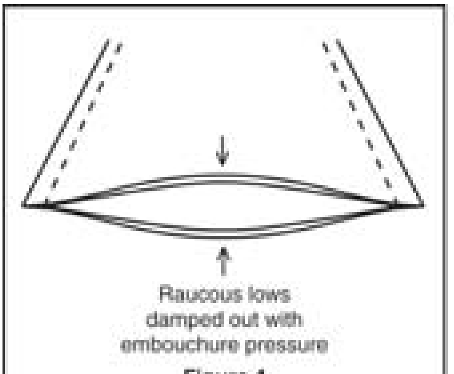


Figure 4

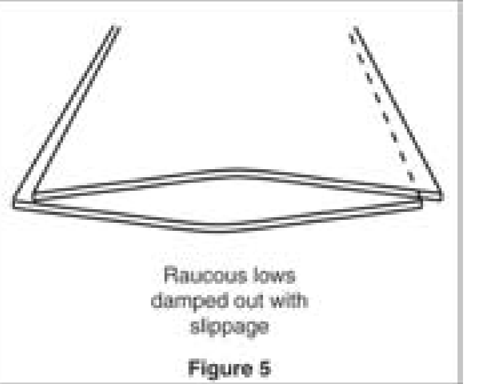


Figure 5

An additional aspect of the second approach is that when using a variable soft, lip-supported embouchure with flexible slipped reeds the degree of slippage and its resultant damping is variable during actual performance. A slight torquing motion of the head can influence the output of a reed that is producing the timbral equivalent of an acoustic buzz-saw to increase its slippage and purr like a kitten.

A fourth truly remarkable aspect of blade slippage is that within reasonable limits, the degree of blade excursion and its numerous resultants not only remain variable, but are reversible, even at the finished reed stage. This useful reed adjustment capability is readily implemented by firmly grasping the sides of the reed tube at the first and second wire positions with the thumb and index finger of one hand. Then, with the other hand twist the Turk's head wrapping in a direction opposite to the lateral blade motion desired.

Note: Twisting the Turk's head clockwise (from a posterior [rear] perspective) will result in a scissor-like clockwise lateral displacement (when viewed from an anterior [frontal] perspective) of the opposed reed blades at the reed-tip aperture, and visa-versa (see Figure 6).

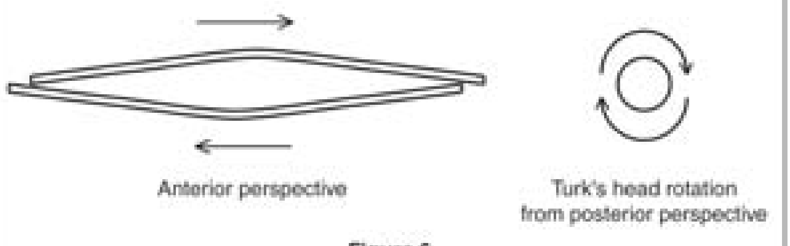


Figure 6

However, the blade excursion is limited to the original right or left over-lapping of the two opposing blades. This allows a finite amount of slippage to literally be "dialed" "in" or "out" simply by twisting the Turk's head in the desired direction. Not only will previously described slippage functions be impacted but an additional major resultant takes place that is worthy of additional discussion.

Torquing the Turk's head offers one of only two reed adjustment techniques that allows an accomplished reed maker to within reason increase or decrease the inner capacity of the reed cavity (static volume) of a finished reed. The other readily reversible reed adjustment technique involves the use of reverse wire function.

This phenomenon is the structural equivalence of changing the width of the shaper after the reed has been constructed.

1. More slippage = narrower blade width.
2. Less slippage = wider blade width.
3. If results exceed needs, simply "dial" back to square one and try again.
4. If more change is needed, simply turn the Turk's head a little more.

Reed makers who use DUCO or another equivalent cement on the reed tube under the wrapping are largely denied the benefit of this useful reed adjustment technique.

NOW FOR THE "DARK SIDE" OF SLIPPAGE

Slippage of some type and degree is inevitable.[1] If not controlled and left to chance, four distinct slippage configurations will emerge (sometimes within one batch of reeds). These four types fall into two modes—*scissored* or *embraced* (see Figure 7, *following page*). Two out of the four types are structurally unacceptable. They are also uncorrectable, so don't waste time just pitch them. While the other two represent directional variants of an acceptable form. Yet only one of these two acceptable variants will be compatible with any single individual's embouchure idiosyncrasies. Such an uncontrolled random approach guarantees a reed failure rate ranging from 50 to 75 percent, even before the tube is removed from the forming mandrel.

Causes of unacceptable forms include: 1) inaccurate center folding of cane shaped on a straight shaper, 2) inaccurate shaper contour, 3) major crack that extends down only one side of the tube into the blade area.

With such an appalling batting average it is no wonder that slippage has acquired a dismal (but undeserved) reputation.

CONTINUED ON NEXT PAGE

1 Slippage originates and often lies hidden up in the reed tube where it is difficult to observe, especially if the blade rails have been planed; however, its influence will still prevail.

ARTICLES

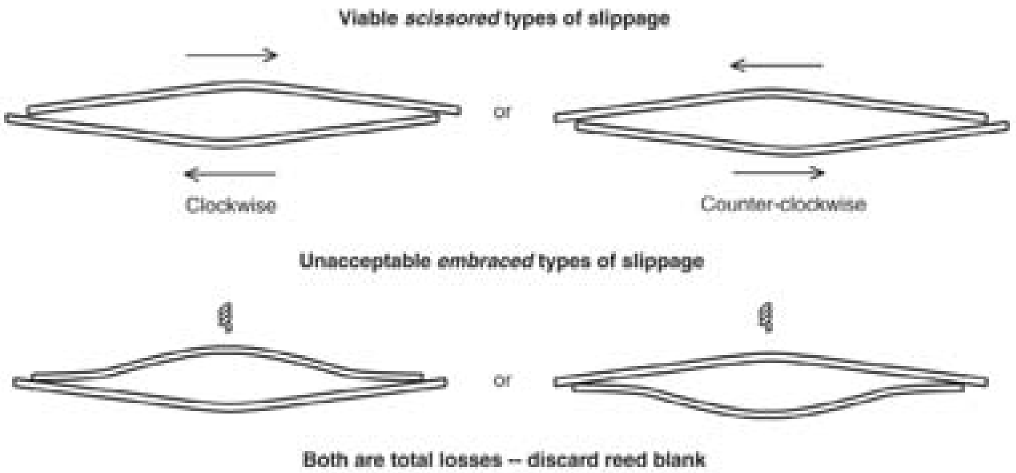


Figure 7

The problem is not with slippage but rather with uninformed makers who have not yet learned to avoid the "dark side" by pre-determining the optimum type and directionality of slippage prior to placing the first and second wires on the folded, shaped, beveled, and scored unrounded tube.

To ensure consistent positive resultants one must first determine the directionality of an individual's embouchure control mechanism, by:

1. The use of a mirror or outside observer to determine the rotational "cant" of the embouchure in its relationship to the reed (often it is the reed that is "canted" on the bocal), or a combination of head and reed torquing that is used in controlling musical nuance, thus achieving maximum resultants with minimum embouchure pressure.
2. If the top of the head is rotated to the right (clockwise, most common), the upper blade of the reed tip aperture must be slipped clockwise to the right (see Figure 8a).
3. While if the head is rotated to the left (counter-clockwise, least common) the upper blade must be slipped counter-clockwise to the left (see Figure 8b).

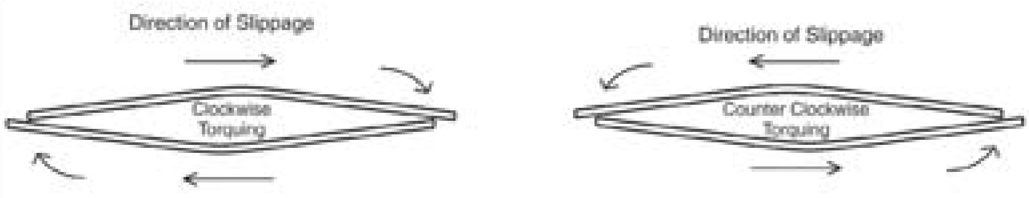


Figure 8a Figure 8b

Another method of confirming directionality is to examine the accumulated past reed triumphs to ascertain if there is a consistent slippage directionality trait revealed. Chances are that the great majority of these successful reeds will be slipped in a similar manner. However, there may occasionally be one or two aberrant "comedy of error" reeds that played quite well or were used in desperation when all else failed. Don't let these lucky exceptions cloud the issue. "The proof of the pudding is in the eating." If most of the superior reeds are slipped in like manner the answer to optimum slippage directionality is already revealed. Don't question it; go with it.

Once the individualized slippage direction is established its consistency must be maintained by physically "locking" it in prior to the placement of any wires, but after appropriate beveling (if any) and/or scoring procedures (see Cooper, L. Hugh. “Beveling: The Magic of Insignificant Splinters,” *The Double Reed*, Vol. 28, No. 4, 2005).

Following any needed beveling and/or scoring procedures, consistent directional slippage may easily be predetermined by off-setting the two opposed “Butt” end halves of the folded and shaped cane, prior to placing any wires. The two following opposite type displacements (seen from a posterior [rear] perspective) will also result in two opposite slippage directionalities at the reed tip aperture.

1. To ensure clockwise slippage at the tip aperture, displace the upper butt end to the left (see Figure 9).
2. To ensure counter-clockwise slippage at the tip aperture, displace the upper butt end to the right (see Figure 10).

The apparent disparity evident in the initial lateral overlapping of the two butt ends will automatically self-correct to concur with the appropriate scissoring displacement when the tube is rounded out.

With the profiled, folded, shaped, beveled (if needed), and scored cane-halves overlapped to ensure the desired directionality of reed slippage, position the first (front) wire (22 gauge soft brass) on the skewed reed blank. Then after tensioning, tightening, and locking the first wire securely down on the still unrounded blank, repeat the wiring process with the second (middle) wire. However, to equalize stress, position its twist on the opposite side of the tube.

Figure 9

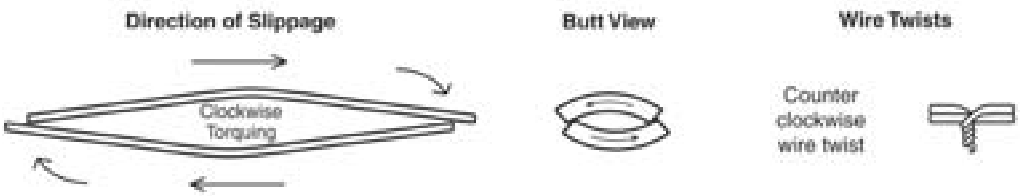
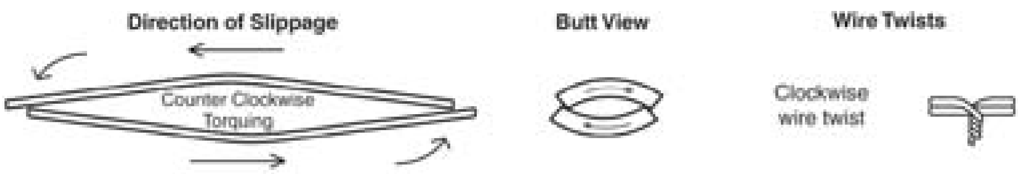


Figure 10



Direction of slippage must be compatible to rotational direction of embouchure torquing.
Also, direction of wire twist should correctly reinforce blade slippage.

Here ends the quest for consistent controlled directional reed slippage. With both the first and second wires firmly tensioned, tightened, and “locked”-down on the two laterally displaced halves of the as yet unrounded, folded, and shaped reed blank, form the tube. Both the slippage type and its directionality have already been irrevocably pre-determined in any resultant reed. This statement is valid regardless of what subsequent tube forming methodology is used or the skill level of the maker. For already at this early stage in the reed making process — “What you see is what you get.”

SUMMARY

The author, on behalf of the many fortunate individuals who have, over the years, experienced the “bright side” of consistent, controlled reed slippage hopes that this brief paper has effectively championed their usage of slippage as a desirable reed making technique. While to those individuals who continue to experience the “dark side" of inconsistent, uncontrolled slippage, the author fervently hopes that the arguments put forth in support of this useful technique have shed sufficient light on the matter to entice the uninitiated into the fold.

Finally, to those remaining individuals who are still convinced that slippage is a fatal fault that not only must but can be eliminated from reeds, the following observations should be noted. Slippage originates and often remains hidden up in the reed tube, with its lateral pivot-point locus scissoring at the second wire position. As a result even with little or no lateral displacement apparent in the blades and/or the tip-aperture, the structural influence of the tube's directional torquing remains mechanically dominant!

Prima facie evidence in support of this phenomenon is that the blades of a finished reed (with or without visible slippage) may be laterally skewed a little more or less only within the directional modality of the tube displacement. Turn the Turk's head wrapping of any reed in a clockwise and then counter-clockwise direction. Depending on the type of slippage, one direction will augment the scissoring effect of the blades while the opposite direction will diminish any apparent displacement. However, when blade slippage is reduced by this method to near zero, further torquing becomes unproductive. For the reed will balk at any attempt to force it beyond "dead-center" to reverse the fundamental directionality that is already locked-in at the tube by the first and second wires.

Such preferential unilateral directionality is proof-positive that some type of slippage is to some degree imbedded irrevocably within the reed's mechanical structure. While a hypothetical non-slipped conceptual version with its imagined perfectly aligned tube and rails would theoretically be completely unbiased in its directional preference. As such, a "magical" reed capable of sliding smoothly from clockwise to counter-clockwise modality without hesitation, and a surefire formula for reed instability! Fortunately, the author has never had to cope with this mythical reed form. For like an Arundo Donax Sasquach it is often reported, but like "Big Foot" never actually seen.

CONCLUSION

Based on the above evidence and personal observation of countless reeds during a lifetime spent as a performer and teacher, it is the author's considered judgment that: 1) slippage in conjunction with its structural influence is mechanically present whether it is visible or not, and 2) as such slippage represents an inevitable (or at the very least a pre-dominant) consequence of reed making.

As an integral aspect of all reeds, slippage must be consistently controlled to maximize its positive characteristics and minimize the dark uncontrolled negative resultants. With the why and how of slippage now revealed… give it a chance. Try it! Slippage will prove to be the most benevolent reed "fault" yet encountered. ◆