

Tenons

Chip Owen

Broken Tenons:

The most severe form of tenon problem is a tenon that is broken off. This is usually immediately obvious. However, sometimes the nature of the break allows someone to stick the parts back together, either with or without glue, making the break temporarily less obvious. Be assured that the break will soon become obvious again. There is no glue that will successfully bond the broken pieces back together. There is simply too little good glue surface for success.

Bass Joint Tenons are the most commonly broken tenons on bassoons with the boot end more common than the bell end. These tend to break often due to an excess of leverage causing traumatic breakage. In addition, these tenons also tend to have the greatest problems with splits which will eventually lead to full breakage. Split tenons can and should be fixed while it is easy to do.

Wing Tenons almost always break from sudden force. It is rare for a wing tenon to deteriorate over time and break.

Split Tenons:

Both tenons of bass joints are very vulnerable to splitting. It should be normal procedure during any inspection procedure to check the tenons for splits. When only one or maybe two splits exist, and the edges line up perfectly, it may be adequate to mend the splits with super glue. When several splits exist in a tenon or if the edges no longer line up, or if the tenon is otherwise distorted, the tenon needs to be restored.

Restoring a split tenon is preferable to waiting until the tenon must be replaced. It is possible to restore a split or distorted tenon to new condition without replacing the tenon. This involves a special technique of grafting new wood over the old tenon. It can be done with almost no visible evidence of the repair, except that the tenon looks new.

Splits also occur in wing tenons. Because of the tenon cap and the bore liner these splits are not visible until the cork or thread wrapping is removed from the tenon. These splits cause a degradation of the performance of the instrument and need to be eliminated. It may be adequate to fill the gap with super glue and maple dust, however the proper repair involves turning most of the wood off on a taper, down to the bore liner, and grafting on new wood. This

project will also require fabrication and installation of a new tenon cap.

Out of Roundness, and Other Distortions:

Some degree of out of roundness is common and should be ignored. Bores that are obviously oval may need some attention. Split tenons often are accompanied by out of roundness and also by split edges that don't line up. Before a split tenon can be restored these distortions should be reduced.

The method for restoring roundness requires a mandrel with the taper of the bore. This mandrel should be short, about six to eight inches, as joints are rarely straight enough to tolerate a mandrel filling the full length of the joint. The mandrel is heated up, the end of the joint is dipped in water, and the mandrel inserted into the joint. The resulting steam softens the wood and the distortion reduced. This may require several applications and the joint should be allowed to cool on the mandrel for several hours. Take care not to be too aggressive as too forceful an insertion of the mandrel or too much heat could cause other damage to the joint, the tenon, or the finish.

Another common form of distortion is the shrinkage of the bore under a tenon. This occurs in all wooden jointed wind instruments. It occurs because the wood has been thinned and pressure applied at the thinned section. In general, don't be too concerned about this unless it develops to an unusual magnitude.

(One of my favorite amusements is modern makers of historical instruments. They carefully study every detail of an instrument's design ascribing all sorts of reasons for the original maker to have made certain design details, all the while ignoring the forces that may have generated those details. Shrunken tenon bores are an example of such details.)

Old Tenon Replacements:

I have seen many tenon replacements that have been done very badly. The two common reasons for bad replacements are the use of inappropriate materials and the failure to restore proper dimensions. The use of metal or plastic tenons can destroy a joint. A tenon replacement that does not reasonably restore the original bore may cause considerable performance problems.

A few years ago I removed a replacement tenon from a Heckel bassoon. It was nicely made from a piece of brass tubing. The bore is one inch in diameter throughout its three inch length. There was no taper to the bore where there should have been a ta-

per. Apparently, the only objective of the replacement tenon was to facilitate the assembly of the instrument. No consideration was given that the use of the wrong material might damage the joint, nor was any consideration given that there might be any importance to the bore dimensions. Apparently, there was no awareness that the objective of replacing the tenon was to restore the instrument, in its entirety, to its proper condition.

Dissimilar Materials:

The use of dissimilar materials for replacement tenons can cause serious problems. Wood moves as a result of changes in its moisture level and to different amounts along the longitudinal grain, the radial grain and the tangential grain. Metal and plastic move omni-directionally according to temperature. Sooner or later the movements of the dissimilar materials will come into conflict and cause damage to the instrument.

The worst examples of dissimilar material damage usually occur in the wing joint. Inevitably, when a broken wing tenon has been replaced with a tenon made from plastic or metal there will be a split up the groove of the wing. Some repairer reasoned that since the wing joint is already lined then it should be okay to use a tenon replacement of plastic. This doesn't work. The thin walled liner within the wood body of the wing joint does not constitute enough volume of non-wood material to become a problem. However, when the thick walled plastic tenon insert is installed the volume of plastic is sufficient to cause damage. The thin section of original wood remaining between the bottom of the groove and the counterbore for the replacement tenon is not able to withstand the movement of the plastic insert.

Replacing the Bore:

The bore taper of any wind instrument is important to the performance of that instrument. Replacing a segment of that bore without also replacing the bore itself leaves something missing. In reality, it is impossible to perfectly replace the bore that existed before a tenon was broken. Not even the original maker can do that. Too many forces have conspired over time to alter the bore in that tenon. However, a conscientious repairer can restore the bore to what is reasonably and approximately what that bore would have been.

Binding Sockets:

A problem that occurs primarily in new instruments and mostly in warm and humid times of the year is when the tenon and socket bind, making the instrument difficult to assemble and disassemble. Joints that may have fit fine when the instrument was

made (probably in the winter) have taken on humidity and swollen enough that wood is binding on wood.

It could be either the tenon or the socket or both that have changed enough to cause the problem. The solution is to simply remove some wood. Since the area of greatest change in a piece of wood is at the ends the best areas to relieve are also at the ends. The opening of the socket can be scraped out with a triangular scraper and the end knob of the tenon can be filed down. Do as little as necessary to accomplish the objective and try to do it with minimal visible effect. Remove wood over as broad an area as possible so that the original taper of the tenon or socket is maintained. Take care not to bevel or round over the edges.

The worst part of this problem is that it most often occurs to new instruments. The new owners are terrified of the problem and the idea of anyone going near their new and expensive instrument with a cutting tool is even more terrifying.

Corked Tenons vs. Threaded Tenons:

The primary reason for the use of thread wrapped tenons on bassoon is for strength. The boot end tenon of a bass joint is rather thin and must withstand quite a bit of stress. Cork provides no reinforcement. Thread adds strength.

Of course, nothing so simple remains simple for long. There are performers who feel that thread wrapping inhibits their instrument's ability to vibrate properly. For them nothing but corked tenons can possibly work properly. Corked tenons are also more practical for those instruments with straight (rather than tapered) tenons as corked tenons are easier to get into straight sockets.

In a modern world more familiar with corked tenons on most woodwinds, the use of thread wrappings on bassoon tenons seems wrong to many persons. Actually, the problem is that the other woodwinds need to use cork.

Threaded tenons are the "original" way of lapping a woodwind tenon. This goes back several centuries when only large instruments were made with joints. Small instruments were usually made in one piece and the question of tenon wrappings didn't exist. As the need for breaking smaller instruments down into joints arose the problem of where the joints should occur also arose.

Old instruments with irregular tone hole spacing were not too much of a problem for locating a tenon. Modern instruments with logically spaced tone holes leave little room for tenons. Oboes are probably the worst example of this. With such a short space available for a tenon the use of cork is more effective for sealing the tenon against air leakage.

Bassoons are still made the old way with irregular tone hole spacing, in addition to being large instruments. As a result there is a lot of room available for tenons. A bassoon's tenons are long because structurally they need to be and because there is plenty of room available. Thread wrapping works well for bassoons.

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More On Threaded Tenons:

Using the correct type of thread can become important on bassoon tenons. The proper thread is cotton or linen thread. It is more important to avoid using the wrong type of thread. The worst type of thread for use on tenons is polyester. Polyester thread can destroy a tenon!

Polyester thread is too strong and elastic. When polyester thread is wrapped onto a tenon the sum total of all the tension can dramatically shrink a tenon. This can occur within a day or two.

A number of years ago at Fox we were searching for a new source of supply for tenon thread. Someone picked up some polyester thread at a local store to try. The day after it was applied to a joint another person, unaware of the difference, noted that the bore was undersized and had it reamed up to size. The thread was subsequently removed and the wood in the center of the tenon was now so thin that light and shadows could be seen through it.

Plastic Bassoon Tenons:

Fortunately, tenons on plastic instruments don't break as often as those of wood instruments. But when they do they are more difficult to repair and joint replacement is often necessary.

Fox and Renard plastic bassoons are made of polypropylene which cannot be solvent bonded. There is no glue that will bond polypropylene! The use of epoxy for body repairs to polypropylene bassoons is doomed to failure.

It is possible to replace broken wing tenons by making use of the thermal expansion factor of the plastic. The replacement tenon is made larger than the counterbore by about .012". Then the tenon is placed in a freezer while the body is heated in hot water. The tenon shrinks, the body enlarges, and the tenon is quickly inserted into place. When the temperature of the joint returns to normal the tenon will be held tightly in place. The bore will need to be reamed to dimension and finished. This job is best done at the factory where the properly tooling for completing the bore is at hand.

Bass joint tenons are not replaceable. The trick that works well on wings fails on basses. There just isn't enough mass of material to make it work properly.