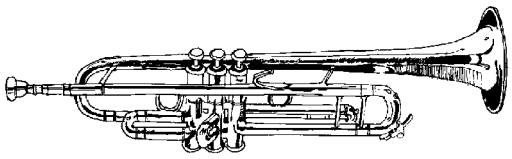
BAND INSTRUMENT REPAIR

BASIC REPAIR PROCEDURES



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REPAIR PROCEDURES

This is not an all-inclusive manual for the repair of musical instruments. The purpose of this booklet is to give an idea of what is involved in repairing instruments, in order to judge if you wish to investigate further any of these procedures. If your curiosity is piqued by any of these, and you would like some guidance, please feel free to contact your local repair technician concerning instruction. At the very least this should give you a better idea of how to advise students who are in need of repair.

PRACTICE THESE PROCEDURES ON JUNK INSTRUMENTS FIRST!

This booklet covers the basic repairs that instrumental teachers and performers should know about in order to keep their instruments in the best playing condition, and to make any personal alterations they may feel are appropriate to get the maximum performance out of their instruments. Certain of the repairs such as the replacement of a tenon cork or a flute head-cork can often mean the difference between being able to play at a performance or not, and such seemingly minor things as key corks can spell disaster if they fall off. The thickness of the key corks can also affect the response and intonation of an instrument -- there are no 100% foolproof answers to such problems -- so the ability and confidence to alter or replace them can vastly improve a mediocre instrument. As with the performance of music, nothing takes the place of practice. It is outside the scope of this workshop to give many hours of guided practice. This workshop covers the basic repair techniques of replacing corks on joints and keys, replacing head corks in flutes and piccolos and neck corks on saxophones, and replacing and adjusting pads. It also covers the replacement and adjustment of springs, but does not cover all the possible variables and situations of spring replacement such as rusted, broken springs which are not easily removed from the post or the key. Major repairs such as that, body work, key work, and anything with which the musician feels less than confident should be left to a competent, trained technician. Some basic brass instrument repair procedures have been included in this booklet, but most brass repairs involve special metal-working skills for which extensive training is necessary. If these procedures do not easily solve the problem take the instrument to a trained technician.

WHEN IN DOUBT ABOUT A REPAIR — DON'T!

SAFETY:

Safety should be the first concern when attempting any of these repairs. The following list of safety items should be on hand and easy to reach in an emergency:

Spray bottle of water -- the kind used to water plants, or spray cleaners will do.

Fire extinguisher -- any kind rated for normal combustible materials. It does not HAVE to be rated for electrical, but if you are purchasing one, it may as well be one that is all-purpose. Purchase a refillable one.

Safety glasses or goggles -- If you already wear glasses, make sure the lenses are safety lenses. If not, either purchase prescription safety glasses, or use goggles that fit around your glasses. For those who do not wear glasses ordinarily, most hardware stores sell safety glasses which have protective shields on the sides, and unbreakable lenses. Safety goggles such as the kind worn in wood and metal shops will do well, also.

Band-aids and Anti-bacterial spray or bottle -- those needle springs and razor blades are sharp, and repair people are always cutting themselves.

Proper clothing -- do not wear shorts and bare feet when performing repairs. The glue stick gets quite hot, and can burn you if it gets on your skin.

Common sense -- nothing can help maintain safety like common sense.

When working with any hardened steel objects, there is always the possibility of them shattering and spraying pieces all over. When cutting the springs to be the right length, the part being cut off can go flying at a considerable speed -- enough to injure an eye. Do not let others watch closely when hammering the springs flat, or when cutting the springs. And when bending the springs on an instrument there is always the possibility that they can snap and go flying off.

When working with burning alcohol, there is always the possibility that the lamp could fall over, spilling burning alcohol on the table-top, or even on your clothes. That is why the spray bottle and fire extinguisher MUST be on hand. Building a rack for the alcohol lamp, or buying one with a faceted glass reservoir that would prevent this from happening is a good idea.

Use the water bottle to cool parts that you have just heated with the lamp. The keys can get quite hot. This spray bottle is usually all that is needed to put out any little flames that may start from glue that gets too hot, or a pad that inadvertently is placed too near the flame.

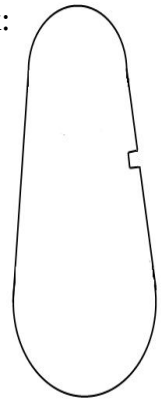
BE CAREFUL USING SCREWDRIVERS
AS THEY CAN SLIP VERY EASILY.
NEVER USE AN EXTREME AMOUNT OF FORCE!

Tools for Common Woodwind Repairs

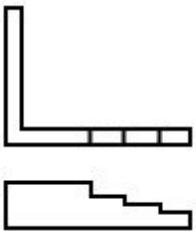
Some tools can be bought at local hardware stores:
6" pliers, smooth, square jaw
6" pliers, bent nose
6" pliers, needle nose
rawhide mallet with a 1" diameter head – if not found locally can be ordered from Ferree's Tools.
Small screwdrivers, preferably with swivel heads.

Some tools can only be purchased through an instrument repair supplier, although many people figure out how to make their own tools which will do the same job:

Pad Slick:

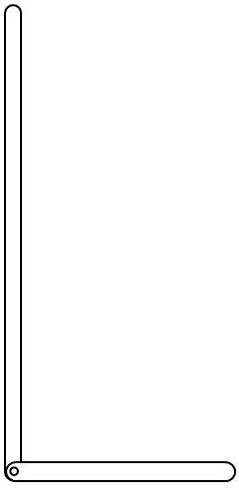


Flute Gauge:



notice the three steps for measuring the proper key heights. The smallest is for the trill keys and the higher C key, the middle is for the rest of the main body keys and the third step is for the foot joint keys.

Sax Key Bending Lever:
This is inserted between the key and the tone hole and the key is levelled by pushing down on the part which isn't over the bending lever.



Spring Hook:
Crochet hooks can be used, especially if A notch is filed in the blunt end to be able to push a spring with.

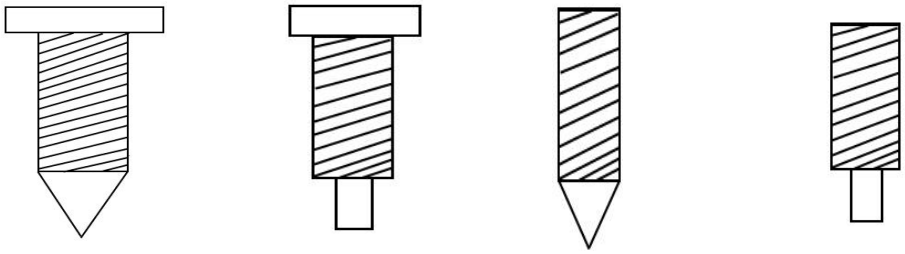
With these few simple tools many woodwind repairs can be accomplished and thus disasters can be averted.

As with any tools, however, be sure to practice with them first on instruments which aren't important.

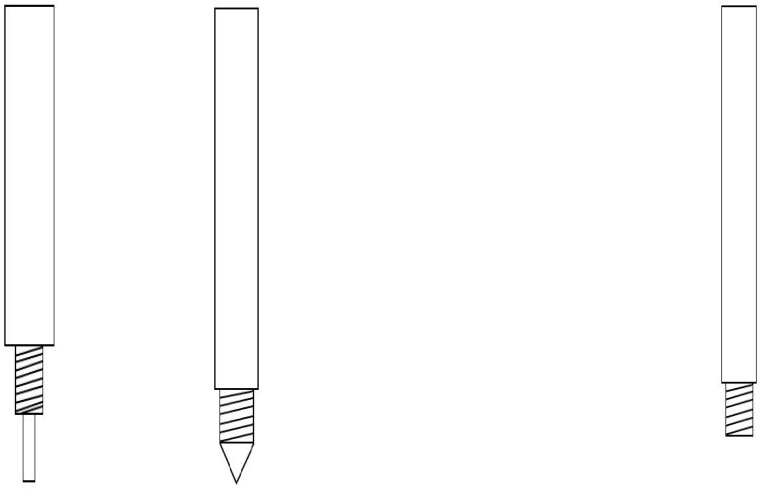
Woodwind Screw Types

There are seven types of screws used to hold the keys onto a woodwind instrument. These fall into three broad categories: Pivot Screw and Hinge Rod and Hinge-Pivot. Within the categories of Pivot Screw and Hinge-Pivot there are two sub-categories: Pointed and Cylindrical. Within each of these two types there are screws with heads and screws without heads. Hinge Rods are all the same – headless and ending with a small section of threads which should be screwed tightly into the post.

Pivot Screws



Hinge Pivot **Hinge Rod**



All of these screws have slots and use a non-phillips-head screwdriver. Great care must be taken when tightening the headless pivots and the pointed hinge-pivot because they have to rest perfectly against the key. If they are too tight the key will bind and either move very slowly or not at all. The pivot screws and the hinge-pivots which have the cylindrical end can be tightened snug against the post. Hinge rods should always be tightened snug against the post.

Cylindrical pivots and hinge-pivots are used on Bundy/Buescher woodwinds and on some models of Yamaha woodwinds. Often these screws seem to cause the key to bind but usually a gentle tap with a rawhide mallet on the key right next to the post will straighten out the problem and the keys will then rotate freely.

Common Woodwind Problems

All woodwinds share certain features and thus share problems associated with those features.

The common features are:
1) keys which have pads to cover tone holes and keys which only serve to activate other keys;
2) springs to open and close those keys;
3) corks on the keys either for adjustment or to silence the contact between key and body or between keys;
4) corks on tenons, mouthpieces and necks which allow for adjustable fit between the different pieces of the instruments.

If keys break or posts come unsoldered from flute and sax bodies, glue will not hold them strongly enough to allow the instrument to work properly. **Do not ever use glue** to try to repair such problems as the use of glue just makes it more difficult for the repair technician to make the proper repair to rebuild the key or to resolder the posts back onto the body of the flute or sax.

If pads come loose from the keys they can be reglued if the surface of the pads are still intact and the pad can be reinserted such that the seat (the ring impression on the pad from the tone hole) can be made to line up perfectly with the tone hole again. Any glue which will allow the pad to stay in the key cup is fine to use, even cyanoacrylic glues such as Crazy Glue. The same goes for pieces of cork which fall off the keys. Great care must be taken in using any sort of glue on a musical instrument so that it doesn't spill on some other part of the instrument and create worse problems.

Corks used for tenons on woodwinds or for the necks on saxophones often shrivel with age and wear, making for a loose fit which can cause intonation problems or can cause misalignment of bridge keys between the joints of oboes, clarinets and bassoons. These neck corks and tenon corks can be augmented through the use of nylon plumbers' tape or paper towel or facial tissues. Anything which makes for a firm fit can be used to ensure proper intonation and proper mechanical linkage. These problems should be repaired by replacing the offending corks as soon as possible.

Corks are used also wherever keys touch the instrument body or other keys. These corks adjust the height the keys open as well as adjusting how far a key moves when another key is pressing against it. It is important that the correct thickness cork (or other emergency repair material) is used to most closely match the original cork thickness. Using a cork which is too thick or too thin is just as bad as not having a cork there to begin with.

Springs on woodwinds serve either of two purposes – to hold keys open or to hold them shut. In either case the amount of pressure the spring puts on the key needs to be just enough for proper action. Springs which are too light don't do their job properly and springs which are too heavy make it difficult to play the instrument. Sometimes spring tension can be increased if a pad isn't making an air-tight seal or if the key isn't being held open firmly, and the spring tension can be reduced if that key becomes difficult for the musician to open or close easily. Springs can break but age isn't the determining factor – rust is usually what breaks a spring. Instruments which are fifty years old and older often have original springs which still work fine while much newer instruments have springs which break.

There are two types of springs used on woodwinds – needle springs and flat springs. One exception to this statement is a brief period of several years when Vito clarinets came with coil springs under the G♯/C♯ key, the register key and the throat A♭ key. Luckily this was a short-lived experiment but disassembling such an instrument when coil springs are unexpected can lead to great frustration when the coil springs fall out and are lost. Needle springs are most commonly mounted in small holes in the posts of a woodwind instrument and flat springs are most commonly attached to keys with very tiny screws. Broken springs are not always easy to remove and replace but fortunately much of the time rubber bands can be made to work in their place.

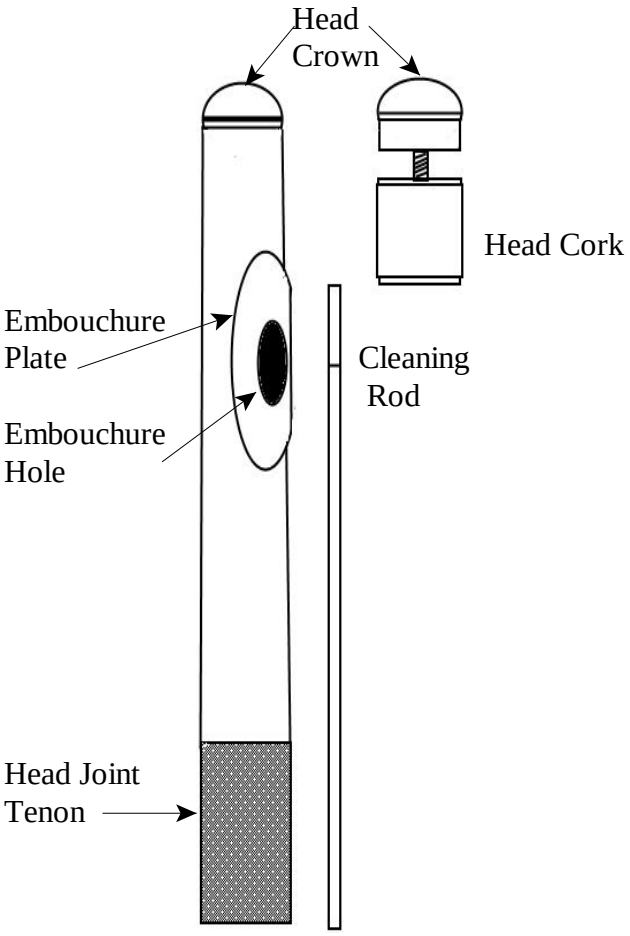
One big problems with springs, especially the needle spring kind, is that it is possible to bend them inadvertently when handling the instrument. Often if someone is wiping fingerprints off an instrument the cloth can snag a spring before the person realizes it and the spring can get bent. Sometimes it is obvious and sometimes not. The spring can simply be pulled to the wrong side of the spring hook on the key but maintain enough tension so that it appears to be doing its job so the only way to detect the problem is to know which side of the key hook the spring should be on. This takes careful observation of instruments which are known to be working properly.

Flat springs often cause problems when the end which presses against the body of the instrument gouges the material over time and then becomes stuck in that gouge and won't properly return the key to the normal position. The repair for this requires the removal of the key from the instrument and then careful reshaping of the contact point where the spring touches the body of the instrument.

Further discussion of springs is on page 17.

Flute Problems

Head Joints cause
a lot of flute problems.



Outside of the normal pad and cork problems which can afflict all woodwinds, there are three main types of problems which can affect flutes. One problem area is the head joint. There are three potential problems with the head joint: the tenon, the embouchure plate, and the head cork.

When all is right with the head joint the tenon will slide into the socket on the body smoothly with no need for any sort of lubricant. Which shouldn't be used at all because it only helps wear out the joint faster as dust gets stuck to the lubricant and acts like sandpaper. The edges of the embouchure hole are not chipped and remain sharp and intact, the edges of the embouchure plate retain the graceful shape which allows the head joint to rest comfortably below the lower lip of the player. The head cork is snug in the head joint and is placed so that when the end of the cleaning rod is held firmly against the bottom of the head cork assembly the line on the cleaning rod is exactly in the middle of the embouchure hole.

The head cork is often called the tuning cork (and that is its purpose) but this is not the mechanism for tuning the cork to other instruments or to a tuner. The head cork assembly must be placed accurately so that the flute will play in tune with itself. To tune the flute to other instruments or to a tuner the head joint must be pulled in or out of the

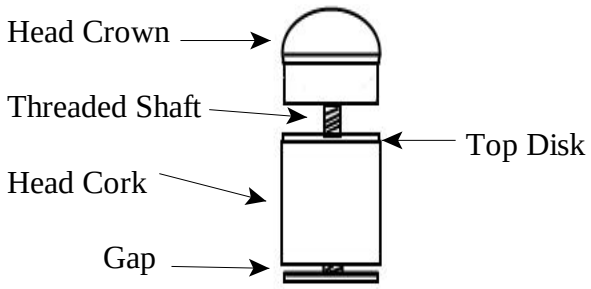
socket on the main body. Most beginner flute players are taught to play flat because they are taught that the head joint should be pushed all the way into the body of the flute, which actually makes the flute sharp so the players have to play flat to be in tune with the rest of the band. Just as with brass instruments which have their tuning slides out some in order to play in tune to the standard A440, so, too, should the flute head joint be pulled approximately 1/4 to 3/8 of an inch out of the body in order to be properly in tune.

The fit of the foot joint onto the body should be smooth and easy like the fit of the head joint into the body. No lubricant should be used on the tenon for the foot joint. This tenon, at the bottom of the body of the flute often gets out of round and the fit of the head joint gets difficult or impossible for two reasons: 1) the player doesn't twist the foot joint back and forth while assembling the instrument but rather rocks it back and forth, bending the tenon either inwards or towards one side or the other; 2) the body gets dropped, bending the tenon which is an exposed fragile part of the body. Repairing these two tenons should only be attempted with the proper tools and a lot of practice on instruments which are not important because the metal of the tenons is fairly soft and easily stretched too far making it difficult to shrink them back to the correct fit.

The head cork can cause problems in several ways, most of which are easy to fix. The first problem is that students keep playing with the head crown. This should be screwed onto the threaded shaft of the head cork assembly such that it is snug against the end of the flute. Students often try to screw it on tight like a jar lid and end up pulling the head cork assembly out of position making the flute play out of tune with itself, and if it is pulled too far out of position it can make the higher notes impossible to play. The position of the head cork assembly should be checked constantly and students should be reminded to keep the head crown snug but not tight like a jar lid.

The second problem head corks can cause is that they become loose as they age, dry out and shrink. It is a simple matter to replace a head cork with a new one. The head crown needs to be removed and the head cork assembly should be pushed out towards the tenon end of the head joint – if the cork has shrunk enough to pull out from the top it can be pulled out that way. Once out of the head joint, the top disk holding the head cork in place needs to be unscrewed, the old cork pulled off the threaded shaft and a new cork of the same length pushed onto the threaded shaft. The top disk needs to be screwed down against the cork very tightly so that there is no room for the head cork to move on the assembly. The assembly is then re-inserted into the tenon end of the head joint (it should not fit at all into the other end with a new cork in place) and then a rod needs to be used to push the head cork assembly up into place, using the cleaning rod to check that it ends up in exactly the correct spot with the indicator line on the cleaning rod in the middle of the embouchure hole.

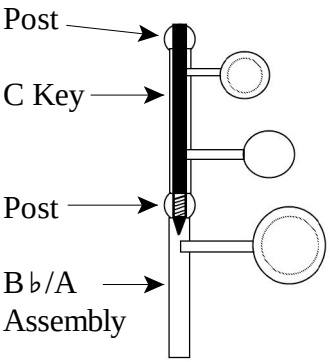
The third problem head corks can cause is harder to diagnose without removing the assembly from the head joint. This problem comes when the student has played around with the head crown, which hasn't moved freely on the threaded shaft, so the threaded shaft moves with the head crown while the head cork remains firmly stuck in place. This often results in a gap between the bottom of the head cork and the bottom plate of the assembly:



The problems which can result from a gap between the head cork and the bottom of the assembly mainly affect the upper notes, high C and above. They either have a bad tone, sound the incorrect pitch with the correct fingering, or are badly out of tune with the rest of the instrument. Very often this can be resolved by removing the head cork assembly, tightening the top disk, and reinserting the assembly into the head joint.

One very common problem with flutes (and the upper joint of clarinets as well) is the hinge-pivot screw which runs through the C key near the top of the body of the flute. Especially with student flutes this is a problem but it is a problem often with professional models as well.

This is a diagram of how a properly fit hinge-pivot screw should interact with the keys:

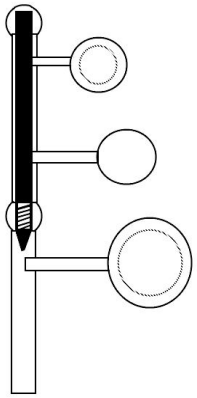


Notice how the hinge-pivot (solid black object) passes through the top post, through the hinge tube of the C key, threads into the second post, and the point rests in an appropriately shaped opening in the key assembly which has the B♭ and A keys on it (open hole flutes also have the G key on this assembly.)

The hinge rod should be screwed in just snug enough that the pivot rests in the opening without causing the B♭ key to move sluggishly or stop moving completely. Notice the two circles within the top key cup and the 3rd key cup in the diagram – these inner circles represent the tone holes which are covered by the pads in those key cups.

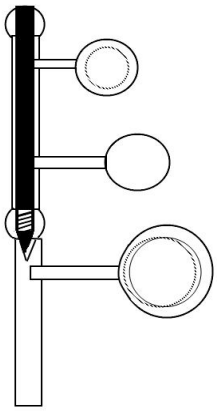
These two diagrams demonstrate what is often a huge problem with a very simple solution:

Improperly built hinge-pivot is recessed into post when screwed in properly.



Improperly built hinge-pivot has worked loose but looks as if it is screwed in properly.

Notice the offset of the B♭/A key assembly and the misalignment of the pad seat with the tone hole.



One other situation can cause the same problem but is more obvious. When a properly built hinge-pivot screw has worked its way loose the end of the hinge-pivot can be seen protruding from the top post.

The repair of this problem is quite simple – screw the hinge-pivot in until the B♭ key won't move, force the B♭ key down onto the tone hole and then back the hinge-pivot screw out very slowly until the B♭ key pops open. Similar problems can happen with the pointed pivot screws at either end of the trill keys or at the bottom post where the right hand key assembly is secured onto the body.

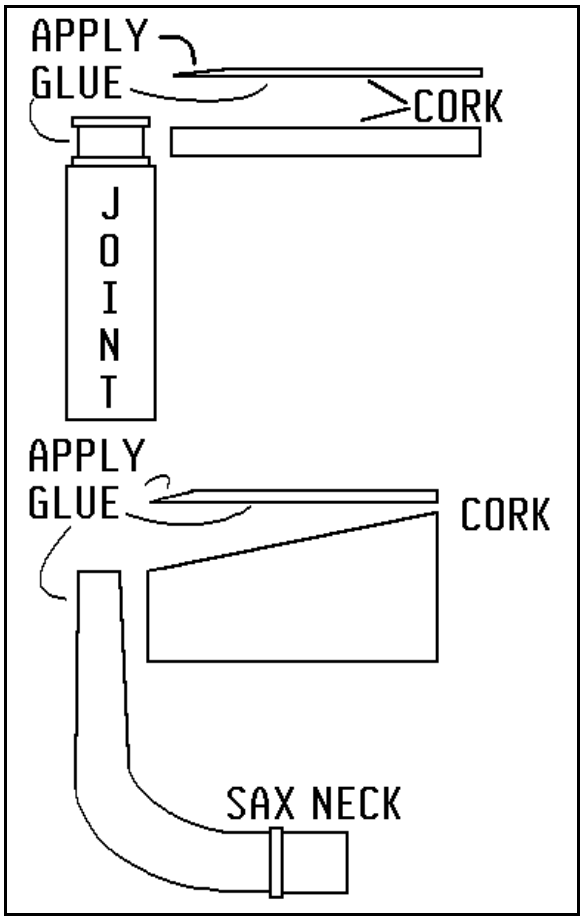
Another problem which is fairly common with flutes – the nylon pad snaps or the pad screws and retaining washers fall out and the pad gets loose. If the nylon pad snap isn't lost it can be reinserted quite easily simply by slipping it back onto the pad and using a flat metal object to press the key against to snap it back into place. Keys need to be taken off the instrument to replace pad screws and retaining washers.

Students and/or their parents seem always to be messing around with the adjustment screws on the keys. There are adjusting screws on the A, F, E, and D keys. Each of these screws affects how the key closes along with one other key. If the screw isn't screwed in far enough, the auxiliary key doesn't close when the main key closes and if the screw is screwed in too far the main key doesn't close when the auxiliary key closes. Careful observation of the action of the keys while adjusting these screws makes it a fairly simple job to get the adjustment just right but if one isn't careful or doesn't know which auxiliary key is supposed to close at the same time as the key being adjusted the whole mechanism can be rendered useless until a knowledgeable person has a chance to readjust it. Sometimes adjustment problem arise when a screw is a bit too small for the hole it is supposed to fit into so it vibrates as the instrument is played and can vibrate in or out, in either event making the affected notes unplayable. Once the screws are adjusted properly, placing a drop of fingernail polish on the screw head can make it so the screw won't vibrate while the instrument is played. This problem of improper fit can be caused by screws which are too small or by a hole which is a bit too large. It's not always possible to simply put in a larger screw since the mismatch in sizes is often too slight to allow for a larger screw. The use of fingernail polish is a great solution because it will adhere to the screw and the hole and yet isn't as permanent as glue would be, making further adjustment possible should it become necessary.

The last problem which can be easily repaired concerns the low C and C♯ keys. This is similar to the problem on clarinets involving the C/F key. Because of the design of the foot joint keys and the way people grab the foot joint to assemble the flute, often excess pressure is put on the finger-tab for the C♯ key such that the finger-tab and the key cup are no longer aligned properly. Usually this means that when the low C roller is pushed, the C♯ key doesn't close as it needs to and the low C won't sound at all or will sound like a very flat D. Since these low notes are almost never used in band music, this problem can often be ignored during rehearsal, but should be attended to soon since solo literature and scale practice make use of those notes. The solution is to place some object beneath the finger tab of the C♯ key and to press gently down slightly on the key cup and then test the repair by pressing the low C roller and noticing whether both pads cover the tone holes at the same time. If the C♯ pad stays off the tone hole, repeat the procedure but push harder on the key cup. If the C♯ pad covers properly but the low C pad is off the tone hole, press down on the C♯ finger tab slightly until both pads cover their tone holes properly. These procedures often need to be repeated several times until the situation is resolved.

CORKS, SAX NECK AND WOODWIND TENON:

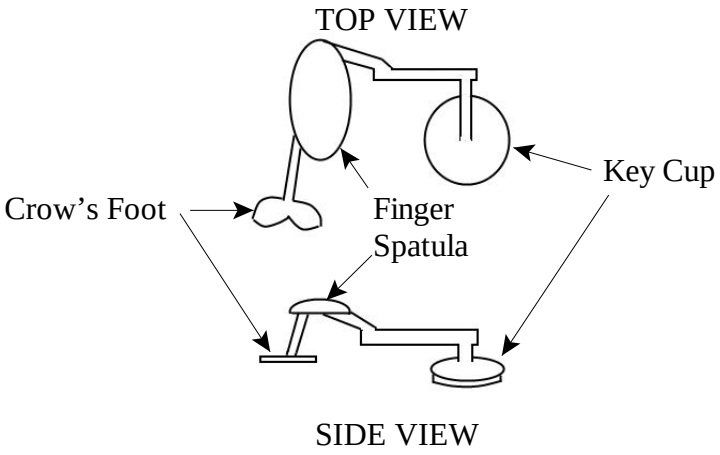
WOODWIND TENON AND SAX NECK CORKS are held on with rubber cement. Usually 1/16th inch thick sheet cork is ideal for both tenon and neck corks. Newer instruments are using 3/64th inch cork for tenons and necks. For either one, be sure to scrape all the original cork out of the tenon or off the neck. For tenon corks, measure the width of the trough the cork sits in and cut a parallel strip four inches long. Bevel one end of the strip and apply rubber cement to the bevel and to the under side along the length of the strip. Apply cement to the trough, and wait five minutes. Put the bevel end in the trough first, with the bevel side up, and wrap the cork right around the tenon. Use a razor blade to cut off the excess. Use an emery board or sand-paper to sand it down to a snug fit. Apply cork grease and it should be usable. The same is true for the SAX NECK CORK, except that the original shape of the cork is different. Measure the width of the original cork, and cut a trapezoid shape with this width as the narrow end. When applying the cork to the neck, begin the cork at a very slight upward angle. This allows for the taper of the neck, and as the cork wraps around on itself, there will be excess above and below the joint with the bevel. Use a razor blade to shape the neck cork, and emery boards or sand-paper to make a snug fit with the mouthpiece.



NECK & TENON CORKS

Clarinet Problems

Clarinets have very few problems which are specific to the clarinet and not simply the same pad and cork issues which affect all woodwind instruments. One problem which is specific to clarinets affects the right hand C/F key. This key has an attachment called a "crow's foot" whereby the key is closed over its tone hole when the B/E key or the C♯/F♯ key is depressed.



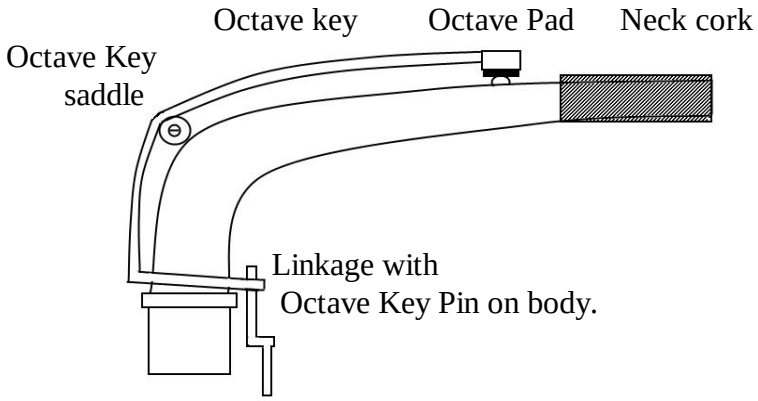
In common with the low C♯ key on flutes, the finger spatula part of the clarinet C/F key often gets bent out of proper alignment with the key cup. This prevents the pad from closing on the tone hole when the B/E key or the C♯/F♯ key is depressed. This can be remedied by inserting something rigid between the crow's foot and the body of the clarinet and pressing down on the key cup portion of the key to bend the key cup down relative to the finger spatula and crow's foot part of the key. If the key cup part of the key gets bent too far down then the pad will close but will prevent the B/E pad or the C♯/F♯ pad from closing. When this happens, inserting something between the C/F pad and the tone hole and pushing down on the finger spatula part of the key can get things back in alignment properly. Each of these procedures might need to be done a couple of times to get the adjustment just right.

One other big problem area for clarinets is the bridge key. If students aren't careful when assembling the instrument, making sure to hold down the D/A key on the upper joint (which raises the upper half of the bridge key linkage), the two halves of the bridge key linkage can hit against each other and either bend out of alignment or break off. Great care needs to be exercised in trying to bend this linkage back into alignment because the piece of metal attaching the bridge linkage parts to their respective keys is very thin and can break easily in some cases. In other cases the metal is very thick and it is difficult to bend back into alignment without removing the keys from the body.

The bridge key linkage often gets bent out of proper alignment up and down, even while staying in proper alignment from side to side. Usually in this case it is the upper piece which needs to be bent back to where it should be for proper closure of the "one and one" fingering for upper register B♭ or lower register E♭. There should be a thin piece of cork on the bottom of the upper bridge key so that when the two parts of the linkage make contact there isn't a clicking sound. This piece of cork often gets knocked off and needs to be replaced. Make sure not to use a piece of cork which is too thick. In an emergency one or two layers of masking tape can provide the right thickness for proper operation of the linkage.

The one remaining major problem which arises with clarinets is the adjusting screw on the throat A♭ key, where it crosses over the A key. Curious students often play around with that and it gets screwed in too far which prevents the A♭ pad from covering its tone hole. Sometimes this is a result of the screw being a bit loose in the hole and needing to be held in place through the use of fingernail polish, once it is adjusted properly. Most of the time, however, it is the result of student curiosity. The correct adjustment of this screw is so that there is a tiny bit of motion on the A key when it is opened before the A♭ key starts to open. Not even a millimeter of motion is necessary but if the screw is adjusted so that both keys open simultaneously then any slight swelling of the A key pad can push the A♭ key open just enough to create problems.

Saxophone Problems



The most common problem for saxophones (and all reed instruments) involves the mouthpiece and/or the reed. The most common intonation problem for saxophones involves using a mouthpiece which is too open or too closed for the ability of the player or using a reed which is too hard or soft for the mouthpiece and player. For younger players the most common complaint is that the instrument is playing flat. This is most often solved simply by moving up one or two reed strengths. Student mouthpieces are often made fairly closed which makes it easier for a novice to produce a tone, but also results in playing flat as the student's embouchure and breath support get stronger. Another problem which sometimes results from this is that teacher simply tells the student to push the mouthpiece further onto the neck to play more in tune (sharper) but this creates problems with the two octave key tone holes (one on the neck and one on the body hidden near the high E tone hole) which are placed to work properly when the vibrating tip of the reed is a specific distance from the neck octave key tone hole. There is a range of about an inch where the tip needs to be, but further in or further out results in serious intonation issues.

The most problem prone area of the saxophone is the neck octave key not working properly, which affects the other octave key as well. The two most common octave key problems are:

1) If the bend in the upper part of the octave key (from the saddle to the pad) gets flattened out because the student squeezes too hard while assembling the instrument, then the neck octave pad will stay open even a tiny bit even when it's supposed to be closed, forcing all the notes to be in the upper octave.

Solution: put thumb or some hard object between the ring at the bottom of the octave key and the neck itself and pressing downward on the key cup which holds the octave key pad.

2) If the lower part of the octave key is bent relative to the upper part of the octave key, the linkage with the octave key pin on the body won't work properly, either forcing both octave key pads open for the notes D through G# when the thumb octave key is pressed or making it so that neither octave key pad will open for those notes when the thumb octave key is pressed.

Solution: if both octave key pads open at the same time, hold octave key pad firmly shut and push from the left of the neck in the diagram on the lower part of the octave key so that there is some space between the octave key pin and the ring at the bottom of the octave key. If both octave key pads remain closed, push on the octave key ring at the bottom toward the neck from the right side of the diagram.

Other common problems of the saxophone

1) octave keys are adjusted properly but still all the notes come out high. Most likely the problem is that one of the left hand palm keys either has a ripped pad or has gotten knocked such that it no longer sits properly on the tone hole or the sax was dropped and the post at the top of the sax body which holds either the high E key or the high F♯ key (if the sax has one) got bent and is not allowing the pad to stay firmly closed.

2) G♯ sounds like G – there are two pads on the saxophone, the G♯ pad and the low E♭ pad, which are held shut with springs which have a lot of tension on them. If anything sticky such as soda or fruit juice is consumed just before playing, quite often a sticky residue builds up and the strong springs holding the pads shut allow the pads to get quite stuck. If the pads can be pried open without ripping, an emery board or sand paper can be used on both the tone hole and/or the pad surface to remove the sticky residue. These pads should be replace as early as possible when this is the cause. Other causes are simply that the dust in the air combines with the moisture in the player's breath to create a similar residue which isn't quite as sticky. Often putting talcum powder on the surface of the pad and then opening and closing the pad a few times will solve the problem and make the current pads able to last for a lot longer.

3) Can't play notes below low C – on most saxophones built since the 1950s (and quite a few from earlier) are made such that the G♯ key will move when any of the left hand pinky keys (low C♯, B and B♭) are pressed, which allows the G♯ pad to open, making rapid motions between C♯/G♯ or B/G♯ or B♭/A♭ easier to play. If the adjusting screw which holds the G♯ pad shut when F♯ on down to D keys are pressed isn't adjusted just right the G♯ pad will open slightly. Great care must be exercised when adjusting this screw because if the screw is screwed in a bit too far, the F♯ pad won't close all the way making it hard to play below the G.

4) the 1+1 B♭ fingering sounds just like B♮ – this is usually a quick adjustment to the other screw on the same bar with the G♯ adjusting screw. Just as with the G♯ adjusting screw, if this is screwed in too far, notes below G won't sound properly or even sound at all.

5) notes from low D on down don't play right but the G♯ and B♭ adjusting screws are set correctly – most likely there is a ripped or simply dried out and therefore not completely closing low E♭ pad. The only repair for this is to replace the low E♭ pad.

6) low B and B♭ don't come out – if the G♯ adjusting screw is adjusted properly and there isn't a problem with the low Eb pad and the upper keys are sealing properly and the lowest couple of notes still don't come out, check to see if the pads are actually hitting on their tone holes completely. Often the bell gets bent out of alignment relative to the rest of the body, which is where the posts which support those keys are located so the tone holes and the keys are no longer lined up properly. The bell needs to be bent back to proper alignment – not for the faint of heart.

7) Yamaha alto saxes – the bis B♭ key doesn't spring back as it should or the G♯ doesn't open properly. Both of these problems are common and easily fixed – the spring for the bis-B♭ key is right next to the spring for the G♯ pad (not the G♯ lever pressed with the left hand pinky), both of which are near the G♯ pad. The B♭ spring is the longer, lower of the two springs and often a student will grab the sax in such a way that the spring will be pressed out of the notch in the key and pushed up to where it interferes with the G♯ spring.

CORKS, WATER KEYS

WATER-KEY CORKS are usually held in with pressure and require no glue. Sometimes, however, if the correct size is not available, a little glue (either melted in as with pads or just using Micro Pad and Cork Cement or even Elmer's Glue) will allow a smaller cork to be used. It is best to use a slightly larger cork, sand it down to the right size, and then force it in with pressure. An emery board or sandpaper is frequently needed to shape the surface of the water-key cork to allow it to seal.

CORKS, WOODWIND KEYS

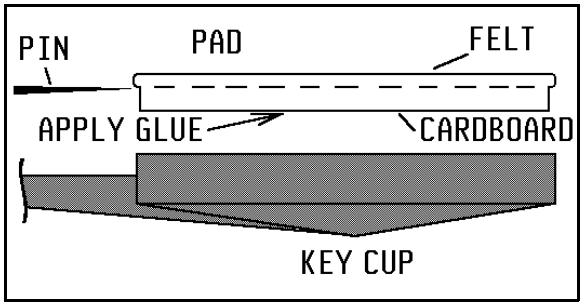
KEY CORKS on woodwinds are all held on with a special rubber cement. DO NOT ATTEMPT TO USE MICRO PAD AND CORK CEMENT FOR KEY CORKS. Use rubber cement thinned down almost to the consistency of water. With most office-supply type rubber cement, this usually means emptying about half the bottle and filling it up with thinner. If possible, remove the key from the body. If this is too frightening a thought, hold the key so that the foot is off the body of the instrument, and apply a thin coat of glue to the foot. Apply a thin coat to the cork, and wait five minutes. Put the cork on the foot and use a razor blade to trim to size. Use an emery board, or sandpaper, to get the cork just the right thickness. Corks that fit between two overlapping keys must be the right thickness to allow simultaneous closing of both pads.

FELTS

SAX KEY FELTS AND BUMPERS are held on with rubber cement or with Micro Pad and Cork Cement. There are felt disks that come pre-glued on sheets of multiple sizes or single sizes for around $2.00/sheet or less at hardware stores. These usually include sizes that are perfect for flute thumb keys and saxophone keys. The thicknesses may vary, so get a sheet of very thin felts. These could be built up by sticking several together to fill in larger gaps. In placing a key felt between two overlapping keys, it is necessary to be sure that the felt is just the right thickness to ensure proper closing of the keys.

PADS

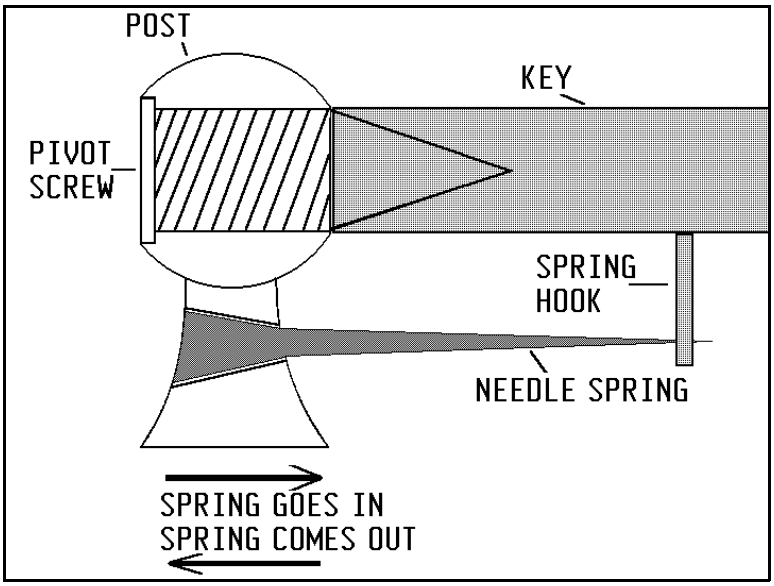
The most common pad repair is simply re-gluing a pad that has fallen out of the key. For best results, the key should be removed from the instrument. If that is too frightening a thought, and you have practiced, the pad can be replaced while the key is still on the instrument. Apply heat to the back of the key, BEING SURE HEAT IS NOT GOING TO REACH THE BODY OR MELT A PEARL FINGER BUTTON (holding key at an angle above the flame) and put pad back in the key cup. BE SURE THAT THE RING SEAT OF THE PAD LINES UP EXACTLY WITH THE TONE HOLE. If the original pad is not found, or is too old and ripped to be useful, find a replacement pad of the same size. For bladder skin pads, use the pin-vise, or a needle, and prick the skin of the pad where the pad joins the cardboard back. Melt some glue onto the cardboard back of the pad, and then heat the key and follow the above procedure. Pricking the skin of a bladder skin pad is necessary to allow the hot air to escape without ripping the surface of the pads. This is not necessary on leather pads. Using Micro Pad and Cork Cement allows the replacement of pads without the use of heat, but the pad is never glued in as well. This does, however, make life easier in the middle of a performance.



WOODWIND PAD

SPRINGS

Broken springs are a major cause of woodwind problems, and are not usually simple repairs. Everybody has rigged a rubber band at some time to function in place of a broken spring. This is a fine solution usually, and can make the instrument work until the spring can be replaced properly. ON SILVER AND SILVER PLATED INSTRUMENTS THE RUBBER BAND MUST BE LEFT ON ONLY AS LONG AS IS NEEDED TO GET THROUGH A PLAYING SESSION. IT MUST BE IMMEDIATELY REMOVED, OR THE SULFUR IN THE RUBBER WILL REACT WITH THE SILVER AND TURN THE SILVER TO A FAIRLY PERMANENT BLACK!!!!! FLAT SPRINGS are usually easy to replace, as long as you have the right length and right thickness spring on hand. Remove the key from the body and unscrew the screw that held the spring onto the key. Discard the remainder of the broken spring and install the new spring. Sometimes the new spring will have to be bent slightly to match the tension of the original spring. NEEDLE SPRINGS present some difficulty. They have been flattened on the end that is in the post, and pressure fit into a tapered hole in the post. The narrow end of the taper is the side of the hole TOWARDS the key. In order to remove the broken part, it must be pushed out AWAY from the side of the post the key rubs against. Once it is removed, try inserting new springs until you find the one that goes all the way through the post, but is not too loose. With it in the post, hold the key against the post as it usually sits, and move the spring until the tip is right at the spring saddle on the under-side of the key. Cut the excess off that sticks out the other side of the post. Using a ball-peen hammer and a steel block, flatten the end of the spring opposite the point. Insert the spring into the post and press it in firmly with pliers. Then determine which direction the spring exerts pressure on the key -- if the key is usually held open, bend the spring towards the tone hole the key is supposed to cover. If the key is usually sprung shut, bend the spring away from the tone hole. Reattach the key, and hook the spring into the spring saddle on the key. There are now stainless steel springs widely used which come with one end pre-flattened and the other end NOT POINTED (so there is less stabbing of fingers). These are fit the same as needle springs as far as diameter is concerned, but they are pressed into the post first and then cut to the desired length while already in the instrument.



WOODWIND NEEDLE SPRINGS

STUCK KEYS

There are four main reasons keys stick — Pads have become gummy on the surface, springs have been bent the wrong way or are about to break, the keys are bent, or dirt and old, dried-out oil have gotten stuck at the pivot points.

STICKING PADS

Check to see that the pad is not stuck to the tone hole. This is a common problem with sax keys that are not used all the time, such as G#, and D#. Putting talcum powder on the pad and opening and closing it a few times will cause the powder to stick to the sticky substances and present a dry surface to the tone hole. Flute pads are notorious for this problem. Cigarette papers or dollar bills held gently between the pad and the tone hole and dragged across the pad are quick-fixes for the problem, but usually don't last and often don't work. This does increase wear on the pad, and so should be done sparingly, and not at all on pads that already show excessive wear.

BENT OR BROKEN SPRINGS
Springs which have been bent the wrong way, or have lost their tension, can usually be bent back the proper way with the proper tension as long as it is done carefully. Broken springs should be repaired as described on page 6.

BENT KEYS
Another cause for stuck keys is that the keys are bent. Only the very brave, or those who have practiced on junk instruments, should attempt to straighten bent keys. The possibility of breaking the key in two is VERY GREAT, so be gentle. Try a little at a time, and do it GENTLY, rather than wrench it. If you can't fix it, it is no worse off than before you tried, and frequently a bent key is a fairly minor (and inexpensive) repair to a person who has a lot of experience working with metal. Replacing or rebuilding a broken key is costly and sometimes impossible on older horns.

KEYS THAT WORK, BUT ARE SLUGGISH
Try applying key oil (automatic transmission fluid) to all the points of contact, and gently move the sluggish key by hand. Loosening the screws a tiny bit will often help. Sometimes completely removing the screw and cleaning it off before replacing it on the instrument is called for. Sometimes it is only dust that has worked itself into the mechanism, or old key oil that has dried out, that is causing the binding. Regular oiling of all key mechanisms is the best protection against this.

STUCK BRASS INSTRUMENT MOUTHPIECES
Operation of a mouthpiece puller is fairly easy, and most come with instructions. In order to prevent continual recurrence of a stuck mouthpiece check the end of the mouthpiece that fits into the receiver. This is frequently not round from being dropped on the floor. Insert the mouthpiece truing tool into the end of the mouthpiece and tap with a mallet to return the shape to round. Make sure all mouthpieces are removed from instruments before being stored after a rehearsal or concert.

STUCK WOODWIND MOUTHPIECES
Although not very common, woodwind mouthpieces do occasionally get stuck. Sax mouthpieces often get left on the neck cork when the student puts the instrument away and after weeks/months of not being moved (once a mouthpiece is in the correct place to be in tune, it never needs to change, right?) The cork grease will dry out leaving a residue which works like glue. Clarinet mouthpieces will occasionally get stuck on the barrel (or joints might actually get stuck together) especially on wooden clarinets due to changes in moisture content of the wood making one part shrink. This is one of the only situations where two people are necessary. Have one grasp the mouthpiece (or one instrument part) firmly in both hands, while the other person grasps the other part. Twisting in opposite directions from each other, sometimes having to stop and start a few times, usually frees the stuck part.

STUCK VALVES
If the valve will not move, don't try to force it out. Without a lot of experience there is nothing you can do. If it is merely sluggish clean the valve and the casing. Re-oil the valve and place it back in the instrument. Check the valve spring: sometimes stretching the spring a little will provide the extra push needed to get through a performance, although this is rarely the real cause of the problem. If none of these has helped take the instrument to a technician. Usually the cause is that the piston has been dropped and is out of round, the trumpet has been knocked against a hard object and there is a nick in the casing, or the trumpet has been knocked/dropped and a valve slide has gotten pushed in (usually the 2nd slide) making the casing not round.

TROMBONE SLIDES

A very common cause for sluggish trombone slides is improper cleaning and lubrication. Using a small rag through the eye of the trombone cleaning rod swab out the outer slide. Wipe the inner slide clean, and apply a thin coating of cold cream. Work this into the outer slide, and then spray the inner slide with water. Move the slide, and if it moves freely, leave it. If it moves MORE freely than before, but still not quite acceptably, remove the inner slide, and wipe it clean again. Put the clean inner slide back into the outer slide and spray water on it. The cold cream left in the outer slide should be enough lubricant to allow the slide to move freely now. The next most common cause is sprung inner slide tubes. GENTLY squeezing the inner slide tubes toward each other can usually solve this problem. DON'T SQUEEZE VERY HARD! If you put a crimp in one of the tubes by mistake, it is a very costly repair to replace the broken tube. The last cause for sluggish slides is a dent in a slide tube. Look first at the part of the slide that is opposite the bell rim when the slide is in first position. There is nothing that you can do about the dents without a lot of practice and some expensive tools, but if you can identify the spots that need attention, you can help the student take better care of the instrument.

WOODWINDS THAT DON'T WORK BUT EVERYTHING LOOKS OKAY

There is only one reason why a woodwind with a good mouthpiece and reed won't work: The holes are not being properly closed and the keys are not moving in correct adjustment. The best way to repair this, or at least to have a better understanding of how involved the repair is, is to have a fairly thorough knowledge of the mechanisms. Everybody had to learn to make basic sounds in their lessons, but very few took the time to examine the mechanisms. A lot of keys activate other keys, but, with a few exceptions, all clarinets work the same, all flutes work the same, etc. Spending a half-hour with each instrument can provide much insight. Most woodwinds have adjusting screws on some keys -- knowing what happens as one of these is turned can mean the difference between an on-the-spot adjustment, and having to pay someone else to turn the screw for you. All woodwinds have corks or felts between the keys and the body, and between keys that activate other keys. Knowing where these corks and felts go can mean the difference between making a horn work fifteen minutes before the concert, and having to do without a solo because a few of the notes don't work. Sometimes the problem with a woodwind is merely that the musician is using too soft a reed -- bad intonation in the upper register on all reed instruments is usually caused by this. A chipped mouthpiece or a bad reed is frequently an overlooked cause of a instrument that does not play well or squeaks. Having a good feeling for all that goes into making a woodwind work can remove a lot of the uncertainty about how to approach a problem. Do not expect to be able to repair every broken instrument that comes along, but with enough patience and practice, most repairs become minor ones.

The repair of musical instruments is often looked on as a secret, magical craft practiced only by a very few people lucky enough to be initiated into the magic. This is not the case, and quite a few musicians do the majority of their own repairs. Just as a beginning musician has many hours of practice ahead before beautiful passages of music will flow out of the instrument, so, too, does a beginning repair-person have many hours of practice before being able to diagnose quickly and repair any problems. The purchase of used instruments, either at a yard sale, flea market or music store presents the easiest means of practicing repairs. Using the only instrument available can often result in quick trips to the repair shop to have mistakes corrected in time for a lesson or a concert. In purchasing a used instrument to practice repairing, check it out to be sure that it is really repairable -- if the screws and springs look like nothing but rust, then pass it by. The pads can look awful (that's one of the major things to practice replacing) but don't buy an instrument that is so far gone it should really be in a junk box.

PRACTICE PRACTICE PRACTICE

GOOD LUCK!

Some Common Problems and their Solutions

FLUTE

Problem: Bb doesn't play properly, either 1&1 or thumb fingering.
Cause: The screw that runs through the C key (l.h. index finger) has worked its way loose and is unable to hold the left hand key assembly in place correctly.
Solution: Screw that screw in so that it is snug. The Bb pad very likely won't move now. Push that pad down so that it is on the hole and then slowly loosen the screw just until that pad pops open. Then move the pad up and down to ensure that it will continue to move easily and freely. If it is still a bit sluggish unscrew that screw a tiny bit more. Piccolos often have this same problem and share the same solution. If either Bb fingering still isn't working properly then very likely a small cork has fallen off.

Problem: the low C doesn't come out clearly (or at all).
Cause: The finger portion of the low C# key has become bent out of alignment with the pad portion of the key.
Solution: put your left thumb under the finger-contact portion of the low C# key and press down on the pad portion of the same key gently but firmly so that the key will regain it's proper relationship between the two parts. Test by pushing down the roller only and the foot joint should be air-tight now. If still not correct, repeat the action. If this still doesn't solve the problem, look carefully at the low C# pad and the low C pad and see which is hitting first. If you have pressed too hard on the pad part of the low C# key, it will hit before the low C pad hits. In this case press firmly on the finger portion of the low C# key to bend it slightly relative to the pad portion of the same key. You may need to repeat both procedures before achieving the proper balance.

Problem: Concert Bb or Concert A are tuned properly but the flute isn't playing in tune with itself. Related problem – the high notes don't come out properly.
Cause: head cork is either out of place or the screw plate is no longer holding the head cork firmly in place against the bottom of the head cork assembly.
Solution: remove the head cork and make sure that the cork is held firmly between the two metal plates on the head cork assembly. Make sure when you re-insert the head cork assembly that it is snugly in place – if it moves easily then it is time to replace the cork. The cork needs to be firmly in place so it won't move and so that when the cleaning rod is held inside the head joint firmly against the head cork, the line is exactly in the center of the embouchure hole.

Other problems than these are much more complicated – don't just start adjusting the adjusting screws without having a clear idea what each one does.

OBOE

There are no simple solutions to oboe problems other than to be sure that the musician is using a good reed which is not too soft. Intonation problems magically disappear (or at least are reduced) when a reed of proper strength is used. For most people other than complete beginners, this is a medium reed or a medium hard reed.

BASSOON

Problem: whisper key pad has fallen off or has gotten shredded from improper assembly or storage.
Solution: if you don't have a proper pad to replace the missing or shredded pad, simply use tape to cover the whisper key nipple on the bocal – this is the same as engaging the whisper key lock and will not significantly hinder most normal band usage of the bassoon. All other bassoon problems are too involved for anybody who hasn't practiced bassoon repair and take too much time to be a “quick fix.”

CLARINET

Problem: high notes don't sound very good and/or are horribly out of tune.
Cause: reed is too soft or mouthpiece is too closed (flat).
Solution: have the musician use a stiffer reed. Far too many clarinet and saxophone students are not properly informed about the importance of reed strength and continue to use the softer beginning reed strength well into their high school years. Simply moving up to a 3 or a 3½ reed usually resolves this problem. If using a harder reed doesn't resolve this issue the musician needs a more open mouthpiece.

Problem: can't play any notes below the throat Ab or G.
Cause: adjusting screw on Ab key is screwed in too far or the clarinet joint has been dropped and the Ab key is bent so that the pad isn't hitting the tone hole.
Solution: the adjusting screw on the throat Ab key is screwed in too far and is preventing the Ab pad from contacting the tone hole when the key isn't being pressed. Loosen the screw until the notes come out. If the screw is loosened too much the A will sound flat.

Problem: can't play notes using the lower joint.
Cause: bent side Eb/Bb key.
Solution: the side Eb/Bb key has gotten bent so that it is being held open slightly by the side F# key (or is holding the side F# key open). Using pliers, very gently bend the side Eb/Bb key so that it no longer contacts the side F# key. BE CAREFUL as this can actually snap off the end of the side Eb/Bb key.

Problem: the joints won't stay together because the cork is too worn down or is missing
Cause: old corks or missing/crumbling corks.
Solution: use nylon plumbing tape to build up the joint to where the instrument will go together and stay together.

Problem: Left-hand low E and left-hand B don't play properly.
Cause: The F/C pad isn't being held down properly.
Solution: Put thumb under the crow's foot attached to the finger portion of the F/C key and then press down gently but firmly on the pad part of that same key to bend the pad part relative to the finger part. This should be done in very small increments until the left-hand E and B come out properly.

SAXOPHONE

Problem: G (low or high) doesn't sound right.
Cause: The G# lever (left-hand pinky key) isn't holding the G# pad shut.
Solution: Hold the G# lever down and press gently but firmly on the bar which contacts the G# pad key so that when you release the G# lever the G# pad is held shut.

Problem: Notes from 4th-line D up to high G don't sound right.
Cause: The octave key assembly is preventing the proper switching between the two octave pads.
Solution: The octave key on the neck is often the culprit since it is frequently squeezed improperly during the assembly of the instrument. The octave key on the neck should NOT open for the notes D through G. If it is opening, the solution is to place the thumb under the ring so the key is held open and then bend down gently but firmly on the pad portion of the key. If this does not resolve the problem, then the proper solution is not simple and may involve bending hard-to-reach sections of the octave key assembly or the replacement of corks on hard-to-reach portions of the octave key assembly.

TRUMPET

Problem: air won't flow clearly and easily through the instrument (and maybe not at all).
Cause: valves are in the wrong place or have not been properly locked into alignment.
Solution: make sure the correct number valve is in the correct place – valve 1 is closest to the mouthpiece and valve 3 is closest to the bell. Also ensure that the valve is locked into proper alignment. Older trumpets sometimes have valve guides with two locking keys, a larger and smaller side and it is very easy to feel these valves are locked into place correctly but in reality the smaller end clicked into place in the larger slot so the valve is backwards. Newer trumpets all have just a single locking key so alignment can be achieved by grabbing the valve's finger button and twisting clockwise until a click is heard and the valve stops rotating.

Problem: tone is unclear and often sounds fuzzy.
Cause: missing or broken water-key cork or broken water key spring.
Solution: put a new water-key cork into the water-key or if that isn't possible, take a tissue and tear off a corner to form into a small pad to insert into the water-key. If the spring is broken, use an elastic band to hold the water-key shut. On some trumpets the water key is the piston-type Amado water-key and the water key sticks open. Use a small screw driver in the small hole at the back side of the water-key housing to push the piston back out. Putting a drop of oil into the water key and working the key back and force with finger and small screwdriver will often get it back to working properly again.

Problem: tone is unclear/fuzzy even though valves are aligned properly and water-keys are working properly
Cause: build-up of sludge in the mouthpiece and/or the leadpipe.
Solution: use a mouthpiece brush while holding the mouthpiece under running water to clean out any buildup of sludge. Remove the tuning slide and push a trumpet snake (flexible brush) through the leadpipe to get out any sludge that has built up. Sometimes this is necessary to do to the tuning slide as well. Hold the trumpet over a trash can or a paper towel and don't do this immediately after lunch. Instructing students on proper maintenance and constant reminders to be sure to do this regularly can prevent this problem.

HORN

Problem: rotors won't turn.
Cause: lack of use and/or lack of lubrication
Solution: try turning the hub by hand or with carefully with pliers. No amount of hammering on the finger levers will get the rotors working and usually accomplishes nothing more than bending the levers and/or breaking the strings. If the rotors will turn by hand, even sluggishly, remove the individual slides for each rotor and put a few drops of rotor oil (different formula from valve oil) down each tube so it can flow onto the sides of the rotor. Continue to move the rotor by hand. This will often get the rotors working properly again. If not, they'll have to be disassembled and cleaned and reassembled.

Problem: tone is muffled and pitches are hard to hit accurately.
Cause: right hand placement inside the bell is incorrect.
Solution: reminding the student that the hand needs constant adjustment for proper pitch and also needs to remain mostly with the backs of the fingers pressed against the metal of the bell so that proper air flow can be achieved.

Problem: there is a gurgling sound in the tone or certain pitches are practically impossible to hit
Cause: condensation/spit buildup somewhere in the horn.
Solution: empty the water. Many people think that simply removing the mouthpiece and flipping the horn slowly bell over leadpipe is sufficient to resolve this problem, but often the water has built up further in the instrument and multiple rotations of the instrument are necessary. Additionally, remove each slide and make sure it is empty.

TROMBONE

Problem: sluggish slide
Cause: dirty slide, dents in the outer slide, lack of lubrication, improper slide alignment
Solution: examine the outer slide for dents – if this is the cause, take the instrument to a professional repair technician. If there aren't any dents or there are minor ripples but not where the slide is sticking, use a cleaning rod and cloth to clean the outer slide, then wipe off the inner slide tubes and relubricate the slide. If this doesn't solve the problem, then carefully and slowly draw the inner slide out of the outer slide and listen/watch to see if the inner slide tubes vibrate as they leave the outer slide. For a variety of reasons, all related to improper handling or dropping of the slide or the completely assembled trombone, the inner slide tubes have lost their parallel alignment. It is possible to achieve proper alignment or at least better alignment which can make the slide usable again by first observing whether the inner slide tube ends are too close together or too far apart. Once that is determined, hold each inner slide tube near the mouthpiece end and either press together or pull apart to remedy the observed problem. Do this gently but firmly and don't try to move them too much at once. Check constantly. It is possible to break the brace on the inner slide so this not for those who lack confidence. Sometimes the slide alignment appears to be correct but the slide still is sluggish or sticks when in first or second position. This is often caused by the hand-slide crook being flattened from repeated bashing against and there is no easy solution – the end crook needs to be replaced, which is a costly repair.

Problem: tone is unclear and often sounds fuzzy.
Cause: missing or broken water-key cork or broken water key spring.
Solution: put a new water-key cork into the water-key or if that isn't possible, take a tissue and tear off a corner to form into a small pad to insert into the water-key. If the spring is broken, use an elastic band to hold the water-key shut. On some trumpets the water key is the piston-type Amado water-key and the water key sticks open. Use a small screw driver in the small hole at the back side of the water-key housing to push the piston back out. Putting a drop of oil into the water key and working the key back and force with finger and small screwdriver will often get it back to working properly again.

EUPHONIUM

Euphoniums share many of the same problems regarding water keys and build up of sludge that trumpets have.

Problem: valve guide appears to be correctly aligned yet the tone is still unclear or it is impossible to get air through the instrument.
Cause: newer euphoniums (and piston valve tubas) from many manufacturers follow Yamaha's valve guide design, which is to place a white nylon valve guide on top of the piston, held in place by the valve stem. On the underside of this valve guide is a tiny protrusion which is supposed to be locked into a tiny hole in the top of the piston. The problem is that if the valve stem is loosened, the valve guide can come out of this locking hole and the valve and valve guide rotate relative to each other. Often the locking pin can fall into the larger hole on the top of the piston, which is actually an air-flow port which allows the valve to move up and down easily and quickly.
Solution: remove the piston from the instrument and unscrew the valve stem and valve guide. Ensure that the locking pin on the underside of the valve guide is placed in the smaller hole on the top of the piston and make sure the metal washer and felt washer are in place and screw the valve stem is screwed securely into the piston. Be careful not to overtighten this because it is possible to shear off the valve stem from the threaded portion which will remain firmly in the piston, resulting in a more costly repair.

TUBA

Piston valve tubas share the same problems with trumpets and euphoniums.
Rotary valve tubas share the same problems with horns.

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Clarinet Maintenance

Supplies:
Swab, cork grease, key oil, talcum powder, mouthpiece brush, polishing cloth. Optional: pad-savers, bore oil (for wooden clarinets)

Cork grease should be applied to the tenon corks (where the instrument goes together) each time the instrument is assembled.

Key oil should be applied to the mechanism, one little drop at a time, where keys rub against either posts or other keys. This should be done about once a month.

For wooden clarinets, a light coating of bore oil can be applied to the inside of the bore about every 6 months to a year. This coating should be allowed to soak into the wood. If it is entirely absorbed, then apply a second (and third and fourth, etc.) coating, finally drawing a swab through to polish the inside of the bore. The barrel and top of the upper joint are especially prone to drying out. There is a lot of controversy these days over oiling the bore, with some people saying it should never be done. I find that it does help improve the tone and aids in preventing a build up of condensation and saliva, so I recommend it, but you should check with your private clarinet teacher also.

The mouthpiece should be rinsed out with warm water (NOT HOT!) and brushed out with the mouthpiece brush once a month, or more often if it begins to look dirty.

The talcum powder is applied only occasionally, when needed, to sticking pads. The key is then closed and opened a few times to get the powder to stick to the sticky part of the pad surface, and the excess powder should then be blown away.

The clarinet should be swabbed out EVERY time the instrument is used. The keys should be kept clean with the polishing cloth.

The optional pad-savers are inserted into the instrument and left there when the instrument is not in use, to help keep the pads fresher and the inside cleaner.

Do not store music inside the case unless there is a separate compartment for it.

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Flute Maintenance

Supplies:
Cleaning rod, polishing cloth, polishing cloth, key oil, talcum powder. Optional: pad-savers

The flute should be assembled with no cork grease or Vaseline where the head joint and foot joint attach to the body.

The cleaning cloth should be placed in the eye of the cleaning rod and used to swab out the inside of the flute, every time the instrument is disassembled to be put away. Pad savers may be inserted in the body for storage to help keep the inside clean and the pads fresh.

Key oil should be applied to the mechanism, one little drop at a time, where keys rub against either posts or other keys. This should be done about once a month.

The head joint can be washed off under warm water, using a soft nylon-bristle brush, as necessary.

The talcum powder is applied only occasionally, when needed, to sticking pads. The key is then closed and opened a few times to get the powder to stick to the sticky part of the pad surface, and the excess powder should then be blown away.

The keys and body should be kept clean of fingerprints with the polishing cloth

DO NOT PLAY WITH THE HEAD CROWN – IT SHOULD BE KEPT SNUG, BUT NOT TIGHT.

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Saxophone Maintenance

Supplies:
Neck cleaner, mouthpiece brush, cork grease, key oil, talcum powder, polishing cloth. Optional: pad-saver.

Neither cork grease or Vaseline should be used to assist in inserting the neck into the body.

Cork grease should be applied to the neck cork each time the instrument is assembled.

The neck should be cleaned with the neck cleaner each time the sax is put away.

The mouthpiece can be washed off using warm (NOT HOT!) water and the mouthpiece brush. This should be done about once a month, or more often as needed.

Key oil should be applied to the mechanism, one little drop at a time, where keys rub against either posts or other keys. This should be done about once a month.

The talcum powder is applied only occasionally, when needed, to sticking pads. The key is then closed and opened a few times to get the powder to stick to the sticky part of the pad surface, and the excess powder should then be blown away.

The neck strap should be removed from the strap ring when the instrument is put in the case.

Keep the outside clean of fingerprints and other grease with the cleaning cloth.

Do not store music inside the case.

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Trumpet Maintenance

Supplies:
Valve oil, slide grease (or Vaseline), cleaning brush (snake), mouthpiece brush, valve casing cleaning rod or brush, polishing cloth

The valves should be oiled every day.

The slides should be lubricated once a month with either slide grease or Vaseline.

The mouthpiece should be washed out using the mouthpiece brush once a month.

The trumpet should be disassembled once a month and given a bath (using a little dishwashing soap in warm--NOT HOT!-- water). Leave the valves in the case, and take the slides all out, unscrew the bottom caps and place the body and the parts (except the valves) in a large sink or bath tub. Use the long flexible cleaning brush (snake) to clean out the inside of the slides and the tubing of the body, use the valve casing brush or cleaning rod with a small piece of cloth to clean out the casings. Rinse everything thoroughly. Apply slide grease or Vaseline to the slides and reassemble the instrument. Rinse the valves off by hand under running water, apply new valve oil and place them in the correct casings.

Empty the spit out of the horn each time before you place the instrument in the case.

Keep the outside clean of fingerprints and other grease with the polishing cloth.

Do not store music inside the case.

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Trombone Maintenance

Supplies:
Cleaning rod, cheesecloth, cold cream, slide grease (or Vaseline), spray bottle with water, polishing cloth

The tuning slide should be lubricated with slide grease or Vaseline once a month.

The outer hand-slide tubes should be cleaned out with a small piece of cheesecloth placed through the eye of the cleaning rod, once a month (possibly more often as slide action suggests.) The inside hand-slide tubes should be wiped off and a small amount of cold-cream should be placed on the bottom 6 inches (the stockings – where the inner slide tube widens just a bit). The inside slide should be placed inside the outer slide and the two pieces should be moved in and out to help spread out the cold cream. Then remove the inner slide and wipe off the excess cold cream. Place the inside slide section back inside the outer slide section and with the inner slide extended most of the way out (think of seventh position) spray water on the inner slide tubes. Work the outer slide in and out to get the best slide action.

Keep the spray bottle of water with you while playing and occasionally spray water on the inside slide tubes as the action becomes sluggish.

Wash out the mouthpiece using the mouthpiece brush one a month (or more often if necessary.)

Keep the outside free of fingerprints using the polishing cloth.

Do not store music inside the case.

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Drum Maintenance

Supplies:
Tuning key, polishing cloth

Drums should be handled carefully to avoid puncturing the heads.

Wipe the drum off with the polishing cloth regularly to keep it shiny.

Drums do not need much maintenance as long as several points are remembered:

1.) Don't play around with the muffler knob. Set it and leave it alone.

2.) Don't play around with the tuning lugs. Once your teacher has helped you tune the drum properly, leave them alone.

3.) Don't play around with the snare strainer adjustment knob. This helps keep the drum sounding tight and proper.

Be careful when placing the drum back in the case so as not to puncture the heads with the snare stand or drum sticks.

There is often room inside the drum case to store lesson books and music but be sure to keep it neat and avoid exerting extra pressure on the drum heads.

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Horn Maintenance

Supplies: Rotor oil, slide grease (or Vaseline), cleaning brush (snake), mouthpiece brush, polishing cloth

The rotors should be oiled once a week. Sometimes they need to be oiled more frequently, but usually once a week will keep them working well. To oil a rotor, unscrew the back cover and apply a drop of oil to the hub, where it rotates in the middle of the back bearing. Move the rotor to work the oil in. Replace the back cover. On the hub where either the string wraps around or the mechanical linkage attaches, place a drop of oil between the rotating hub and the casing. Be careful not to apply too much oil. Again move the rotor to work in the oil.

The slides should be lubricated once a month with either slide grease or Vaseline.

The horn should be disassembled once a month and the slides should be washed out (using a little dishwashing soap in warm-- NOT HOT!-- water). Place the slides in a large sink or bath tub. Use the long flexible cleaning brush (snake) to clean out the inside of the slides. Rinse everything thoroughly. Apply slide grease or Vaseline to the slides and reassemble the instrument. Apply new rotor oil.

The mouthpiece should be washed out using the mouthpiece brush once a month.

Empty the spit out of the horn each time before you place the instrument in the case.

Keep the outside clean of fingerprints and other grease with the polishing cloth.

Do not store music inside the case.

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Flute Maintenance

Supplies:
Cleaning rod, polishing cloth, polishing cloth, key oil, talcum powder. Optional: pad-savers

The flute should be assembled with no cork grease or Vaseline where the head joint and foot joint attach to the body.

The cleaning cloth should be placed in the eye of the cleaning rod and used to swab out the inside of the flute, every time the instrument is disassembled to be put away. Pad savers may be inserted in the body for storage to help keep the inside clean and the pads fresh.

Key oil should be applied to the mechanism, one little drop at a time, where keys rub against either posts or other keys. This should be done about once a month.

The head joint can be washed off under warm water, using a soft nylon-bristle brush, as necessary.

The talcum powder is applied only occasionally, when needed, to sticking pads. The key is then closed and opened a few times to get the powder to stick to the sticky part of the pad surface, and the excess powder should then be blown away.

The keys and body should be kept clean of fingerprints with the polishing cloth

DO NOT PLAY WITH THE HEAD CROWN – IT SHOULD BE KEPT SNUG, BUT DO NOT KEEP TIGHTENING IT.

Repair Books Tools Supplies

Books:

Band Director's Guide to Band Instrument Repair, R.F. "Peg" Meyers, Alfred Publications
Instrument Repair for the Music Teacher, Burton Stanley, Alfred Publications
Band Instrument Repairing Manual, Erick Brand, available from Ferree's Tools
Ferree's Repair Manual, Clif Ferree, available from Ferree's Tools
The Complete Woodwind Repair Manual, Reg Thorpe
Yamaha Band Instruments Repair Manual, available from Yamaha International Corporation

Web Sites:

www.davidbaileymusicstudio.com – my web site
www.napbirt.org – the web site for the National Association of Band Instrument Repair Technicians
www.ferreestools.com – the web site for Ferree's Tools

Suppliers: Ferree's Tools, P.O. Box 1417 Battle Creek MI 49016, 1-800-253-2261 (will sell to anyone.)
Allied Supply, P.O. Box 288 Elkhorn WI 53121, 1-800-558-3226
(you need to establish yourself as a business before Allied will sell to you.)

Tools: (Asterisks mark essential tools for everyone)

Alcohol Lamp and Denatured Alcohol
*Butane Cigarette Lighter
Cork Knife and Replacement Blades
*Cleaning Rods for Flute, Piccolo, Trombone, Trumpet
*Cleaning Brushes for Baritone, French Horn, Trombone, Trumpet
Feeler Gauge
*Flute Gauge
Hammer -- Small Ball-Peen
Jig for Water-Key Springs
Leak Light
Mallets -- Rawhide or Plastic
*Mouthpiece Truing Tool
Mouthpieces / Reeds for All Woodwinds
*Pad Slick
*Pin Vise
Pliers:
- *Box-End, Smooth Jaw, 4" or 5"
- Channelock Pliers, large
- *Curved-Nose
- Diagonal Cutting
- Slide Removing Pliers
- Spring Punching Pliers
- Vise Grips, 8" or 10"

Propane Torch w/ Fine tip (Bernz-o-matic)
*Mouthpiece Puller: 1. Bobcat or 2. Thompson (with collars)
Razor Blades, Single Edge
Screw Block for storing screws and rods
*Screwdrivers:
- small blade reversible,
- set of hobbiest or watchmaker's size.

*Spring Hook (Small Crochet Hook is OK.)
Steel Block

Supplies:

Cheesecloth (for cleaning instruments)
Cork:
- Head Corks for Flutes
- Head Corks for Piccolos
- Sheet Cork -- 1/64, 1/32, 1/16 inch
- Sticks for French Horn rotors
- Valve Washers
- Water-Key Corks

Cork Cement:
- Leblanc Perma-Kork and thinner
- Rubber cement and thinner

Cork Grease
Emery Boards
Felts:
- Valve Washers
- Sax Key Felts
- Sax Key Bumper Felts

Flux:
- Silver Solder Flux
- Soft Solder Flux

Flannel (for polishing instruments)
Lubricants:
- Key Oil (Auto Transmission Fluid)
- Bore Oil
- Vaseline (for tuning slides)
- Tuning Slide Grease
- Valve Oil
- Slide Oil (for trombone slides)
- Rotor Oil
- Cold Cream (for trombone slides)

Pads:
- Clarinet (10, 12, 15.5, 17mm most common)
- Piccolo/Oboe
- Flute
- Sax (also used for alto/bass clarinets)

Pad Cement:
- Leblanc Shur-Stik
- Glue Gun Sticks
- Stick Shellac
- Micro Pad and Cork Cement

Sandpaper
Solder: (DO NOT USE RESIN CORE SOLDER!!!)
- Soft Solder (70-30 alloy solid wire) and liquid flux
- Silver Solder and silver-solder paste flux

Springs:
- Flat
- Needle -- Blue or Stainless Steel
- Valve
- Water Key

String:
- French Horn (45 lb. test nylon braid)
- Snare Drum -- strong twine

Swabs for applying Bore Oil

A BOOK WITH FINGERING CHARTS FOR ALL THE INSTRUMENTS IS VERY HANDY, ALSO!

GLOSSARY

Baritone	A tenor brass instrument resembling a small tuba, the bore of a baritone is predominantly cylindrical. This instrument name is incorrectly applied by many people in the United States, since the instrument which is marketed under the term "Baritone" is actually a euphonium.
Barrel	The short section of a clarinet which the mouthpiece goes into and then attaches to the top of the upper joint. Barrels do not have any keys on them. Often called Tuning Barrels, they are very important for proper intonation. When barrels have to be pulled out significantly for proper tuning, other problems with the air column can occur so barrels of different lengths are made. Tuning rings are sometimes used in place of purchasing longer barrels. Tuning rings are placed inside the barrel where the barrel attaches to the upper joint and/where the mouthpiece goes into the barrel in an attempt to maintain the integrity of the bore and avoid problems with the air column.
Bell	The section of the instrument farthest from where the mouthpiece or reed is. Bells are flared out, resembling handbells, and assist the tone to emanate in a larger pattern than the same instrument without a bell shape. Flutes do not have bells.
Bocal	The curved metal tube on a bassoon to which the reed is attached and which fits into the top of the tenor (wing) joint.
Bore	The bore of an instrument is the diameter of the inside of the tubing where the air vibrates. Some instruments have conical bores, some have cylindrical bores and some have a combination of conical and cylindrical bores. For trumpets and cornets, the bore is measured at the beginning of the inside tubing of the tuning slide. For trombones, it is measured at the bottom of the inner slide tube the mouthpiece is inserted into. For clarinets it is measured at the top of the upper joint. Different sized bores on the same instrument yield different tone colors and different intonation. With few exceptions, the inside of the bore of an instrument must be free of objects and should contain no build-up of dirt and dust. Especially on trumpets and horns, clogged bores create significant degradation in tone, intonation and volume. Dents in brass instruments which result in a significant reduction in the bore are very important to have removed for the sake of the playing quality of the instrument.

Bottom Cap	The cap which screws onto the bottom of the casing for a piston valve. Frequently this also provides the support for the valve spring to press against. On trumpets with top-spring pistons (where the spring fits inside a cylinder which is part of the piston itself) the bottom caps can be removed completely to allow for different vibration pattern of the instrument. The use of a “grime gutter” or other device is necessary to protect the bottoms of the casings so they don't get out of round and prevent the free motion of the piston. Some trumpet and cornet players use rubber O-rings between the bottom cap and the casing so the bottom cap can still remain on the instrument and not be tight against the casing to prevent free vibration of the instrument. Rotary valves usually only have one cap and it is the bottom cap. Bottom caps of piston valve instruments have a hole in them to prevent air compression from hindering the piston's up and down motion.
Brass	1) the family of instruments where the column of air is made to vibrate by having the player blow air through the lips which are held against a cup-shaped mouthpiece; 2) Brass is a metal alloy consisting mainly of copper and zinc. Some lead is used in very small amounts to provide spring so that the instrument part can be longer and still maintain its shape. Trombone outer slide tubes are made of spring brass. Brass is a very malleable metal, easy to work with but also easy to dent. Brass is always worked cold. Heating brass increases its brittleness, making it harder to work with.
Cork	Cork is used in several different ways on instruments. Round cork pads are used in water-keys on brass instruments and on certain woodwind keys (mostly on clarinets and oboes). Sheet cork is used for woodwind tenons and saxophone necks. Small pieces of cork are used on woodwind instrument wherever one key strikes another key or strikes the body of the instrument.
Cornet	Brass instrument resembling the trumpet. The bore of the cornet is predominantly conical, and the bell has a larger flare than the trumpet does. In the mid-to-late 20th century brass manufacturers built cornets which more resembled trumpets, both in bore as well as in physical design. Some cornets are practically indistinguishable from trumpets. For those instruments, the only real way to tell if it is a cornet is to see if a cornet mouthpiece fits properly. By the end of the 20th century more makers were making cornets distinctly different from trumpets in tone once more, reverting to older cornet designs but using modern technology.
Drum Head, Batter	The top head of a drum, where the sticks or brushes or hand strike the instrument. For all drum heads, it is important that there are no holes with the sole exception of a kick-drum in a drum set, which often has a large hole cut to produce a certain resonance.

Drum Head, Bottom	The bottom head of a two-headed drum other than a snare drum. Many drummers remove the bottom heads from the tom-toms.
Drum Head, Snare	The bottom head of a snare drum, against which the snares vibrate. Made of a very thin membrane and easy to puncture.
Euphonium	Tenor tuba. Euphoniums have predominantly conical bores. Many people mis-label this instrument as a baritone horn.
Embouchure Plate	The plate where the mouth is placed on a flute or piccolo head joint.
Felt	Felt is made from short strands of cotton which are pressed together. Some felt is woven and is softer than pressed felt. Thick round pads of felt are used on saxophones as bumpers for the larger keys. Round flat disks of felt are used between several pairs of saxophone keys to provide quiet but firm key action. Some saxophones use small felt disks in addition to key corks on some keys for better key action.
Finger Button	The round piece screwed into the top of the Piston Stem on piston-valve brass instruments, where the finger pushes the piston down.
Flute Gauge	Small L-shaped piece of metal with one end of the flute gauge cut into three steps used to measure the height of the key openings at the side of the pad away from the hinge tube. The two trill keys and the left-hand C key should open to the smallest step of the three. All the other keys on the body should open to the second step of the three. The keys on the foot joint of the flute should open to the largest of the three steps.
Hammer, Ball-peen	Ball-peen hammers have a traditional flat end on one side of the head and have a rounded end on the other side. Ball-peen hammers used in band instrument repair are typically small and are used for flattening needle-spring ends and also used for other small tasks.
Hammer, Dent	Dent hammers are fairly light specially made steel hammers used to pound out dents when a metal instrument body is placed over a mandrel. Some people get confused over the concept of “pounding dents out” since they imagine that hitting a metal instrument will actually make dents, not remove them. But brass is a special metal that can be hammered flat quite easily. Sometimes rawhide mallets are used instead of steel dent hammers.
Head Joint	The top joint of the flute or piccolo, where the Embouchure Plate is attached.
Hinge Rod	A long straight piece of round metal rod around which some woodwind keys and brass instrument water-keys pivot. Hinge Rods have a short threaded section at one end where they screw into one post, and they are slotted at the other end so that a screwdriver can be used to tighten or

loosen them. Mistakenly referred to as “screws.” Some hinge rods extend a bit beyond the threaded section, ending in either a point or short cylindrical shape which serves as a pivot point for another key. Keys which use hinge rods have hollow hinge tubes which can be fragile and at risk if the instrument is dropped. If the instrument is dropped in such a way that it lands on a key with a hinge rod, the key can be deformed such that it will no longer swivel freely on the hinge rod. Hinge rods are not usually transferable from one brand of instrument to a different brand, and are cut to just the right length so they usually can't be interchanged with other hinge rods on the same instrument.

Hinge Tube — The metal tube around which the key swivels. Some hinge tubes are solid and others are hollow. A hollow hinge tube is used on some woodwind instrument keys or brass instrument water-keys and is the tube through which the hinge rod passes, allowing the key to swivel on the hinge rod. Hollow hinge tubes are fragile points on keys because if the instrument is dropped on a key with a hinge tube, the hinge tube can become deformed such that the key will no longer swivel freely on it.

Joint — The sections of flutes, clarinets (of all voices), oboes and bassoons. So-called because they are joined together to make the body of the instrument.

Keyboard — A new designation of instruments gaining in usage as a separate family to include all the instruments (piano, harpsichord, organ, synthesizer) which are controlled by the player pressing white or black keys which are arrayed in a special design to accomodate all the twelve half-steps of the octave. While many band instrument repair technicians can also repair keyboard instruments, including tuning and regulating pianos, most can not, preferring to limit themselves to the instruments commonly associated with concert and marching bands.

Lacquer — Essentially a clear paint which preserves the high-luster shine of the underlying brass. It is four-thousandths of an inch (.004") thick, making for ten times as much extra material on an instrument compared to silver plating. Earliest lacquers were air-dried and required several applications to result in a durable finish. More recently epoxy lacquers were developed which are baked on for even more durable finishes in shorter time. The most recent developments have lacquer being electrostatically applied, where a positive electric charge is applied to the instrument or part and a negative charge is applied to the lacquer as it leaves the lacquer gun so that more of the lacquer sticks immediately to the instrument. This results in less lacquer escaping into the environment and theoretically results in equal amounts of lacquer being applied to all the surface area of an instrument or part. In reality, however, some of the more intricate surfaces toward the middle of the instruments receive less lacquer and what is there gets worn off faster, resulting in tarnish showing through.

Lead-pipe	The section of a brass instrument which has the mouthpiece receiver on one end and leads into the main body. Perhaps the most important piece of tubing on a brass instrument, it should remain free of dents as much as possible in order to allow the best tone production. Pronounced with a long E sound.
Mallet	Mallets are essentially hammers made of rawhide, wood or rubber. With the head not being made of metal, mallets can provide better dent work in some situations. Mallets don't leave the same sort of flattened marks that metal hammers can leave. There are however some dent situations which mallets just can't handle and for which dent hammers are a requirement.
Mandrel	A solid steel tool used on the inside of brass instrument or metal-bodied woodwinds to help shape the metal properly. Used in removing dents.
Monel	A special alloy of nickel and copper with small amounts of iron, supposedly stainless, used in the creation of unplated pistons for brass instruments. Formed into precise shapes the use of Monel reduced the amount of time necessary for instrument assembly when plated pistons are used. Monel often develops a “tooth” (a grain which creates resistance against the casing, slowing the valve action) which needs to be polished away. Monel sometimes reacts with the brass of the casing, creating dark patches on the piston which increase the drag and need to be polished away. The use of monel in the construction of pistons is not viewed by everybody as being a good thing, and some manufacturers have gone back to using plated pistons.
Mouthpiece	The part of a woodwind or brass instrument where the player's mouth is put to create the sound. All mouthpieces need to be kept clean and free of debris for best tone.
Mouthpiece Receiver	The place on a brass instrument where the mouthpiece is inserted.
Mouthpiece Truing Tool	A specially designed mandrel to be used in conjunction with a rawhide mallet to keep the ends of brass mouthpieces (which go into the receiver on the instrument) round to minimize the chances of the mouthpiece getting stuck in the instrument.
NAPBIRT	The National Association of Professional Band Instrument Repair Technicians is a trade organization which works to maintain high standards of work quality and ethics among its members. Through regional workshops and national conventions, as well as hands-on training at national headquarters in Normal, IL, NAPBIRT works to educate its members in the various aspects of repairs. A newsletter keeps members informed of new techniques and tools as well as new models of instruments. NAPBIRT also serves as a resource for the public to use to

	locate nearby technicians who adhere to the professional principles of NAPBIRT. www.napbirt.org is a great resource. Even though the name includes the word "National" there are members from many different countries.
Neck	The part of a saxophone to which the mouthpiece is attached and which fits into a socket on the top of the saxophone body.
Nickel	Nickel is an element which is used in plating parts of instruments. Bright nickel plating is more durable than silver plating but is also harder and so makes for a harsher tone. Woodwind keys are often nickel plated so their shine will last longer than silver plating. Before the advent of Monel and its use in making brass instrument valves, the pistons were nickel plated. Many people still feel that nickel plated valves provide the smoothest valve action.
Nickel Silver	Nickel Silver is an alloy of nickel and copper, sometimes called German Silver. Nickel Silver is sturdy and serves as the basic metal that many woodwind keys are made from.
Overhaul (Brass)	All the old lacquer or plating is stripped. Dents are removed. The instrument is polished to a high luster and then it is relacquered or replated. The instrument is returned looking and working like a brand new instrument.
Overhaul (Woodwind)	For saxophones, all the work of a brass overhaul is done plus all the work of a repad is done. For flutes and other silver-plated woodwinds, in addition to all the work of a repad, while the instrument is disassembled the body and keys are polished to a high luster. For plastic-bodied instruments, in addition to all the work of a repad, the keys and posts are buffed to a high luster. For wooden instruments, in addition to all the work of a repad, the keys and posts are buffed to a high luster, the outside of the body is polished with beeswax and the bore is oiled.
Pad	Pads are used on woodwind instruments to provide an airtight seal with the tone holes. Most pads consist of a cardboard backing, a felt disk on top of that, and then either kidskin or fish bladder skin covering the whole thing and glued onto the back of the cardboard. Flute, piccolo, oboe, clarinet pads are usually covered with fish bladder skin. Saxophone, alto clarinet, bass clarinet, bassoon are covered with kidskin. Saxophone pads, alto clarinet pads and bass clarinet pads are secured in the center by a rivet, and the larger pads also have a metal resonators in addition to the rivet.
Pad Slick	Flat piece of metal used to put between pads and toneholes to help level the keys and to smooth the surface of the pads.

Pearls	Mother of Pearl is a material harvested from the inside of shells, and used for the finger buttons on brass instruments and on saxophones. Some are concave and some are convex. Most instruments these days use plastic which resembles mother of pearl instead of the real thing.
Percussion	Instruments where the player strikes the instrument to create the sound. Most often Percussion is considered to be synonymous with the term "Drums." Technically the Piano is a percussion instrument, although in more recent years a new category called "Keyboards" has begun to be used, and when that category is used the piano is placed in it rather than in the percussion family.
Pivot Screw	Short, small screws used on woodwinds which terminate in either a point or a short cylindrical section which serves as a pivot point for woodwind keys. Usually there is a pivot screw at each end of the key but some keys have a pivot screw on one end and are held in place on the other end by a hinge rod with a pivot end. Pivot screws are usually not transferable from one brand of instrument to a different brand.
Plating, Gold	A very thin coating of gold electronically applied to an instrument or parts of an instrument. Very expensive and used very rarely for an entire instrument. Often applied to flute embouchure plates to provide a warmer feeling than silver plating provides and also for people who are allergic to silver and whose lower lip turns black and develops a rash when playing on a silver or silver-plated embouchure plate. Used on brass instrument mouthpieces by players who prefer the feel to that of silver-plating.
Plating, Nickel	A coating of nickel, usually in a "bright nickel" alloy, electronically applied to an instrument or parts of an instrument. Nickel plating is the hardest and most durable plating and often applied to student woodwind keys as well as to slightly less expensive professional level woodwind keys. Sometimes used on student model flutes in order to retain their shine with less maintenance on the part of the player, but there is a tradeoff in tone quality and most people don't like the sound of nickel plated instruments as much when compared to the same instrument with silver plating. Older piston valves were all nickel plated, which required a lot of labor to properly fit the pistons into the casings. This is still done on larger brass instruments.
Plating, Silver	A coating of silver electronically applied to a musical isntrument or parts of an instrument. Usually Silver Plating is only four ten-thousandths of an inch (.0004") thick, making for approximately 1/10th the amount of extra material on an instrument, when compared with lacquer. Silver plating will tarnish unless the player constantly polishes it with soft cloth. Using silver polish too frequently will wear the plating off, but if players wash their hands and if the fingerprints are wiped off immediately after playing, a silver plated instrument can remain shiny for a very long time.

Playing Condition	The instrument is made to work well. Parts are replaced (pads, corks, springs, instrument parts) as necessary for the instrument to work well. People often mistakenly refer to this as "getting my instrument over-hauled" or "I had my instrument repadded" when in fact only some pads were replaced and the instrument was not fully overhauled or repadded (see appropriate definitions).
Repad	All the keys are removed from the body of the instrument, all the corks are stripped from the keys and the body, all the pads are removed from the keys. The keys and all non-wooden body parts are washed. Any broken or missing springs are replaced. Any broken or missing screws and hinge rods are replaced. All the corks are replaced. New pads are put into the keys. The instrument is reassembled and adjusted. The pads are seated, usually overnight, the instrument undergoes a final adjustment and is play-tested. The instrument is returned to the owner working like a brand-new instrument.
Saxophone	Instrument invented by Adolphe Sax. Frequently misspelled "saxaphone."
Slide, Hand	Trombones and slide trumpets change their pitch through the use of a movable slide instead of valves or rotors. On trombones this is a very vulnerable part of the instrument since it is so long. Hand slides are constructed of 4 parallel tubes, 2 inner slide tubes and 2 outer slide tubes which are connected at the bottom by a crook. All 4 tubes must be parallel and dent-free for proper slide action. Proper lubrication is very important to maintain proper slide action and the hand slides must be cleaned regularly so that a buildup of old lubricant doesn't slow the action down.
Slide, Tuning	The slide on a brass instrument which adjust the overall intonation of the instrument. Flugelhorns don't have tuning slide – instead their mouth-piece receiver can be adjusted for intonation.
Slide, Valve	Each valve or rotor on a brass instrument directs air into a short passage which has its own slide. These can be adjusted for best intonation of notes which use that valve or rotor, and also allow for better cleaning of the instrument. On some smaller brass instruments such as higher-pitched trumpets, the 2nd valve tubing is so short that it is impractical to have a slide.
Snare	The structure of metal wires or gut strings which is attached to the bottom of a snare drum and vibrates against the bottom head when the top head is struck, producing the unique sound of a snare drum. It is important that the snare is attached correctly so that it isn't too loose or the sound of the drum is not ideal and if it is loose enough there is no snare sound at all.

Snare Throw-Off	The lever or other device which controls whether there is tension on the snares or not, so that the snare drum can be used as a snare drum or as a tom-tom.
Soldering	Often misnamed by musicians as “welding,” soldering is what holds the parts of a brass instrument together. There are two types of soldering used on brass instruments: Soft Soldering and Hard Soldering (also called Silver Soldering or Brazing.) When people use the term “welding” it is instantly clear that they are not knowledgeable about repairs.
Soldering, Hard	Hard soldering is also called silver soldering because of the silver content of the solder itself and is also referred to as brazing (which in reality is a form of welding) because the process actually fuses the pieces of metal into one single solid piece. Hard soldering uses very high heat (about 1750ºF) and the metal parts are heated to a cherry red before the silver solder is applied, flowing between the pieces of metal. Hard soldering is used to build braces and keys as well as to provide the seal when a flat piece of brass or nickel is folded over on itself to be formed into a tube or a bell.
Soldering, Soft	Soft Soldering uses fairly low heat (about 350ºF) and a lead/tin alloy. Soft soldering can be thought of as a metallic glue which holds discreet pieces of an instrument together, such as a brace and a piece of tubing. Soft soldering is frequently done with the use of propane torches to heat the metal and the solder. Liquid flux is used, which is an acid that both cleans the surfaces and helps the solder to flow more completely into the joint. “Wave-soldering” has been developed which uses microwaves to heat the parts and the solder is “painted” onto the appropriate surfaces to be joined to speed up the process and to reduce the workers' exposure to lead. Theoretically this should result in more complete solder joints with less time and effort but in reality fequently this means that hardly any solder makes it into the joints, resulting in instruments falling apart even when they haven't been handled particularly roughly. This is especially true of very inexpensive instruments which are purchased through the internet or department stores. The more reputable instrument makers use better and more complete wave-soldering setups to ensure solid joints.
Spring, Flat	Sometimes called “leaf springs” these begin as flat pieces of metal which taper to a narrow end which is what pushes against the instrument body. The wider end is drilled so that a screw can hold the spring onto the key (very rarely onto the body). Flat springs are made of blued steel, phosphor bronze or stainless steel.
Spring, Needle	Springs which are made of blued steel and are sharp like needles. They can be quite dangerous when handling instruments but provide the best spring action. They only need to be replaced when they no longer provide the necessary spring action or are physically broken off. Installing needle

springs is not an easy task as they must be measured precisely and cut off just the correct length, then flattened at the cut-off place so they can be wedged into the post (rarely the key), leaving the very tip of the pointed end to rest in the spring hook on the key.

Spring, Phosphor Bronze — Spring wire used on flutes. Due to the lighter weight of flute keys, a weaker metal than blued steel or stainless steel is all that's necessary for proper key action. Some flutes use white gold springs.

Spring, Stainless Steel — These have replaced needle springs on most student instruments and many semi-professional and professional level instruments. They last longer than blued-steel needle springs and are much easier to install. They come with one end pre-flattened so they are wedged into the post (rarely into the key itself) and once firmly in place the other end is cut off to just the right length to provide the proper spring action on the key.

Spring, Valve — Coiled springs which return the pistons to the top of the casings. Some brass instruments (mainly trumpets but some marching horns) have small diameter valve spring inside a cylinder which is part of the piston itself. Other brass instruments have larger diameter valve springs which sit at the bottom of the valve casing and push the valve up to the top. Valve springs rarely wear out. They usually need to be replaced when they have fallen out and gotten stepped on or when someone has removed them and tried to stretch them in an effort to do a quick repair on a sluggish valve. Valve springs for rotary valve instruments are fitted to the levers, not the rotors, and provide the same sort of leverage as water-key springs provide.

Spring, Water Key — Water-key springs are coiled and bent in a manner which allows them to wrap around the two halves of the hinge tube

Spring Hook — 1) the part of the key that a spring will hook onto to exert pressure on the key; 2) a tool, usually double ended, which can be used to push or pull springs to hook them onto keys or to unhook them from keys. Also used to bend springs so they will exert more or less pressure on the keys.

String, Rotary Valve — The action of depressing the valve lever on a rotary valve instrument is transferred into rotary action by means of a string which is attached to the lever and wound around the hub of the rotor and the string retaining screw in a figure-8 pattern. Less expensive rotary valve instruments use a solid nylon or plastic string which is prone to break more easily than a braided string. Better instruments use a braided string. Some rotary valve instruments have a mechanical linkage in order to avoid the problems resulting from a broken rotary valve string. All players of rotary valve instruments where string is used need to be familiar with replacing the string, although learning how to do that should be reserved for mor advanced levels of study and not introduced at the beginner level.

String, Snare — The string used on many snare drums to secure the snare to the throw-on/throw-off mechanism. One of the primary reasons snare drums don't sound good or work properly.

Strings — The family of instruments which includes violin, viola, cello, bass viol (not bass violin, which is a totally different instrument from the string bass used in the orchestra, jazz band and some concert bands). Some band instrument repair technicians do handle minor string repairs, but many prefer not to, limiting themselves to the repair of instruments traditionally associated with concert and marching bands.

Tenon — The part of a woodwind instrument joint which is inserted into another joint. Except for flutes and saxophone necks, tenons have pieces of cork which maintain the pressure and air-tight seal necessary to hold the instrument together and to allow it to play properly. Flute tenons and saxophone necks have tenons which are metal and simply slide into the proper socket. Metal tenons should never be lubricated as the lubrication attracts dirt and dust which then serve as abrasive material to damage the proper fit of the parts. Tenons which have corks should be greased regularly so that the joints slide together properly and the cork will stay fresher and more supple longer.

Tenon Cork — The strip of cork which fits on a tenon to provide a secure fit between the tenon and the socket and keep the junction between two woodwind joints air-tight.

Top Cap — The cap which screws on the top of a piston valve casing and prevents the piston from falling out. The valve stem passes through a hole in the center of the top cap. Great care must be exercised when screwing the cap on so that the threads, which are very fragile, don't get crossed which would make the top cap not be level and can cause problems in the proper action of the piston.

Trumpet — Soprano valved brass instrument which resembles the cornet. Trumpets have a predominantly cylindrical bore, which produces a brighter and louder tone than the conical-bore cornet. Trumpets are often used in bands even when playing parts specifically marked “Cornet.”

Valve, Piston — Piston valves are cylinders which move up and down and redirect the airflow to make the pitch higher or lower. This has the effect of lengthening or shortening the length of the vibrating column. Piston valves need to remain aligned with the openings in the casings (called Ports) and this alignment is maintained with valve guides. Piston valves have an opening at the bottom of the piston and a small opening on the top of the piston to allow air to flow through the piston as it moves up and down in order to achieve the best speed. The air moving up and down through those openings at the top and bottom of the piston is not part of the instrument's

vibrating column of air. Piston valves are constructed with approximately half-a-thousandth of an inch (.0005") clearance between the piston and the casing so any slight nick in the casing or the piston can create binding which prevents proper piston action. In the case of a piston which is stuck, never ever use a drum stick or a screw-driver to try to push the valve up out of the casing. Stuck valves need special attention and until proper techniques are learned, they are best left to professional repair technicians.

Valve, Rotor

Horns, some tubas and trumpets (rare in the U.S.) use rotary valves. These redirect the air-flow by pivoting to open the pathway into the slide tube or close that pathway and have the airflow bypass the slide tubes.

Valve, Spit

A common name for the Water Key. The use of this term can be disturbing to parents who are new to the musical world and don't like the concept of their children's spit being emptied on the floor. In reality, the majority of what comes out of a “spit valve” is moisture from condensation of the player's warm, moist breath on the cooler material of the instrument and is not specifically saliva.

Valve Guide

The device whereby a piston valve remains in proper alignment so that the ports in the piston itself line up properly with the ports in the casing. Top-spring pistons have a valve guide which sits inside the spring cylinder at the top of the piston. This sort of valve guide remains in contact with a ledge machined into the inside of the valve casing. The ledge has one or two notches (usually two different sizes when two notches are used) into which the valve guide must be “locked” in order to maintain proper alignment. More recently most such valve-guides have used one “key” to fit into one notch, making it much easier for beginners to achieve proper alignment. The other type of valve guide is attached to the piston and slides up and down in a groove machined into the top half of the inside of the valve casing. This fixed type of valve guide can be a small piece of brass, nylon or nickel screwed into a hole on the side of the piston or it may be part of a larger piece of nylon which is held in place at the top of the piston by the valve stem. Usually the nylon valve guide which is attached on the top of the piston has a small knob protruding from the underside of the casing which is supposed to lock into a matching small on the top of the piston itself. It is important to realize that this valve-guide-locking-hole is not the same hole as the air-flow hole previously mentioned, which is usually larger. If the valve guide is loosened and then re-tightened so that the alignment knob is pressed into the air-flow hole, the valve will not be correctly aligned and air-flow will be stopped. This is a common repair problem on Yamaha and Holton (and other low brass instruments these companies have made under subcontracts for other makers) euphoniums, baritones and tubas.

Water Key	The device whereby a brass player (or bari-sax player) empties the accumulated condensation which has built up in the instrument. Most frequently it is a lever with a cork or synthetic pad on one end which closes over a nipple attached to the outside of the instrument. Amado water keys (and cheap imitations) are cylinders of metal which are inside a small housing attached over the opening into the bore of the instrument. That small metal cylinder closes the opening when not pressed.
Welding	Incorrect term often applied to the soldering used to construct or repair instruments.
Woodwind	The family name for instruments with openings along the tube where the pitch is controlled by opening and closing the openings, either with the fingers themselves or by means of keys. Woodwinds fall into two subgroups, the whistle family which includes flutes and recorders and the reed family which use vibrating pieces of cane, either singly or doubly.