Removing Frozen Hinge Screws

by Lars Kirmser

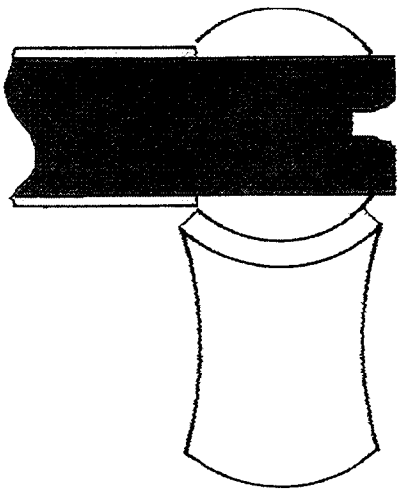
When a woodwind instrument fails to receive regular preventive maintenance, it is only a matter of time and circumstance before it falls prey to any number of maladies. Corrosion within the key mechanism is one of the more common problems that beset the middle-aged and older instrument. An occasional lubrication of the key mechanism is very important, since corrosion is difficult to detect in its early stages. That is, unless one is willing to completely disassemble the key mechanism periodically. It is, as a general rule, better to lubricate a woodwind key mechanism more frequently with smaller amounts of a good quality key oil, than to use larger quantities of oil only once or so a year. And, depending upon the person playing the instrument, the amount of actual use the instrument receives, and the environment in which it is played, most woodwind instruments should be lightly lubricated from three to four times a year.

Usually, the first real indication that a key mechanism has become dry and/or corroded, is when the key action becomes somewhat sluggish, noisy, or fails to respond crisply to its normal spring load. If one key or set of related keys has become corroded, it is likely that the entire key mechanism will also require attention. At this stage, it will not be enough to simply apply oil to the sluggish hinge, as this will only forestall the problem for a short period of time. Instead, the key hinge and the hinge screw must be removed, cleaned and relubricated. With the advent of stainless steel hinge screws, the problem of corrosion is not as pronounced as it once was. Nevertheless, a dry hinge, whether it is fabricated of tool steel or stainless steel, can be just as big of a problem.

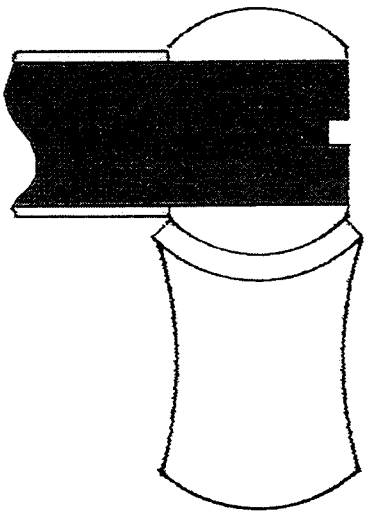
Below, you will find several techniques, which may be used to relieve/remove frozen hinge screws. These techniques are presented in a more or less progressive order, i.e. from the simpler less invasive processes to processes which may be more aggressive in nature. The specific method you use will be chosen by progressively applying the process which corrects the problem and imposes the least potential damage to the instrument. Secondly, your decision may be dictated by the ease of access to the problem areas.

Technique #1

At the first indication a hinge screw is sluggish, begin by applying some of Ferree's J88 Corrosion Cracker (or comparable penetrating oil) to the affected hinge and post thread. Be careful not to get this oil on the adjacent parts of the mechanism (e.g. wood body, pads, corks, felts, etc.) Next, heat the affected key or lever by holding the heated tip of a soldering gun against the hinge and threaded post. Personally, I prefer to avoid an open flame when heating the hinge tubes. Also, when using the solder gun as your heat source, be careful not to overheat the hinge where you damage lacquered or plated surfaces. (If, after applying lubrication and heat, the key fails to move at all, proceed directly to Technique #4.)



Illus. 1A Damaged hinge screw prior to refacing.



Illus. 1B Hinge screw after refacing.

Continue by checking the general condition of the screw slot. The screw slot should be relieved of any buildup of extraneous material, and be free of damage (crisp clean edges). If the slot is in rough shape, and in fact exceeds the post (projects out), you may reface it by carefully filing or grinding the exposed damage, but be careful not to grind onto the post. (See Illus. 1a and 1b) Usually, if the post is accessible, I will carefully relieved the damaged area on the side of my 4" X 1/8" grinding wheel; be VERY careful when using the side of your grinding wheel. Otherwise, I will use a small pillar file. After refacing the screw slot, and if enough of the slot remains, you may proceed by placing a screwdriver blade (which has been made to fit per-

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fectly in the slot) and tap the end of the blade gently with a soft-faced hammer. The percussive nature of this tap will often break loose any metal-to-metal adhesion (electrolysis) that may have developed within the hinge tube itself. CAUTION: do not strike the end of the blade with so much force that you might loosen posts on wood and plastic bodies, or drift a post out of alignment on a metal body. The chance of damaging the post may be avoided by bracing the opposite post against a stable surface prior to striking the blow. In doing this you are focusing the brunt of the force on the hinge screw itself, and not on the posts. The screwdriver handle should be removed when striking the blade, however, if the handle is permanently fixed to the blade, you may fabricate an special screwdriver blade (without a handle) especially for this purpose. On the one I routinely use, I have brazed a flat, striking plate on the end of the blade to prevent the marring of the face of my hammer.

CHEAP TRICK:
Some repair tech's will take this opportunity to deepen the slot by drawing a jeweler's saw blade across the existing shallow slot, thus cutting into the post and permanently damaging it in the process. In my opinion, this is a cheap trick and should definitely be avoided. It results in a tacky-looking job.

If enough of the original slot remains, you may proceed by selecting an appropriately sized jeweler's screwdriver, having a tip that fits fully and snugly into the screw slot. Stabilize the instrument against something rigid, such as your bench motor block for support. Next, with the screwdriver set firmly in the slot, and with your forearm (screwdriver arm) stabilized on your workbench, apply repeated short, abrupt, forceful counter-clockwise twisting motions. Use this type of motion, as opposed to a single persistent counter clockwise force. Be sure to use the widest blade that will fit perfectly in the slot, otherwise you will only damage the slot further. Again, it is very important that you anchor the instrument against a stable part of your work bench as you perform this technique. In addition, it is VERY important that you keep your opposite hand and arm out of the path of the screwdriver blade, should it slip. This is where anchoring the forearm of your screwdriver hand on the workbench will minimize the amount of uncontrolled forward motion, should your screwdriver slip out of the slot. Needless to say, many are the technician (me included) who adorn battle scars reminding them of the times they performed acupuncture on themselves with a dull screwdriver blade. If after employing the short, firm, counter-clockwise twists with your screwdriver, and the screw fails to loosen, you might try the following: As you apply a constant firm counter-clockwise force on the screw, have an assistant gently tap the end of your screwdriver handle. This will in effect, become a poor-man's reverse hammer drill. In the event that not enough slot remains to perform this technique, or the technique has failed to loosen the screw, proceed to the next process.

Technique #2
Failure of technique #1 demands that more drastic measures be taken. At this point, it is important to determine whether the screw is *binding within the key hinge,* or instead, *frozen in the threaded post.* It is unlikely that the screw will be frozen in both the hinge tube and the posts since the rotation of the key will require that it be free at one point or the other. If, when the key is rotated, the screw remains stationary (observe the screw slot), this would indicate that the hinge screw is frozen at one of the posts (usually the threaded post). Conversely, if the screw rotates along with the hinge, this would indicate that the screw is frozen within the key hinge. By localizing this point of adhesion, we will be able to carry on the following procedures more effectively.

For cases where the screw is frozen at the threaded post, it helps to take advantage of the leverage that may induced by the key hinge against the hinge screw. This may be done in the following manner: While applying a counterclockwise rotational pressure with your screwdriver, rotate the hinge clockwise. As you maintain the counterclockwise pressure on the screwdriver, now rotate the key hinge in a counterclockwise direction at the same time initiating a "binding" within the hinge tube. This you may do by applying pressure (pushing down) to the center of the key hinge. Often, the leverage of the binding hinge will break loose the adhesion and cause the screw to turn in the post, and eventually be backed-out by repeating this action. If this technique fails, or if the screw is bound in the hinge, proceed to the next technique.

Technique #3
This technique involves the nearly identical procedures of #2, except that we must devise an alternative means of delivering a counterclockwise leverage (lacking an adequate screw slot). This we do by center-punching a mark exactly in the center of the faced hinge screw. Then, carefully drill a .046" hole (#56 drill) to the depth of approximately 3/16" into the end of the screw shaft. (see Illus. 2) This step is performed with a drill that has been silver-brazed to an 18" length of .044" drill rod. (See description of "How to Make a Long Drill – Reamer") This hole will provide the means by which the tip of a narrow 3-corner scraper, or Ezy-Out bit is wedged, and with a firm counter clockwise leverage, rotated in much the same fashion as was the screwdriver in Technique #2. The following points are important to remember:

1. Get the hole exactly in the center of the screw shaft.
2. Drill the hole deep enough, so that the scraper or Ezy-Out bit does not bottom out.
3. Once the sharp edges of the 3-cornered scraper are set into the hole, make every effort to keep them from slipping (loosing their bite) and causing the hole to become chamfered. If that happens, proceed to Technique #4.

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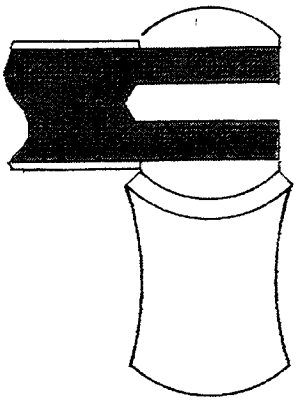


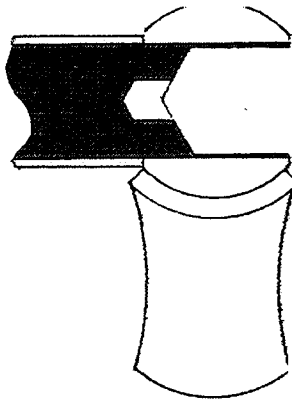
Illus. 2 - Hinge screw drilled out with #56 drill

Technique #4
This technique works well in cases where a single long hinge screw supports a number of keys and/or levers between more than two soldered posts (e.g. the right hand stack of a saxophone). In this configuration, the technician exposes a small portion (1mm) of the hinge screw by gently tapping one of the terminal posts with a drifting tool (4" or 5" aluminum rod with a wedge-shaped tip). By strategically tapping the post away from the hinge, one is able to provide room enough for a jewelers saw blade to be easily drawn between the post and the hinge. The hinge screw is then carefully cut through, thus allowing the adjacent key or lever to be carefully pried up and subsequently removed. With this key or lever removed the technician is then able to manually back the remaining screw out of the remaining post with a parallel-jaw pliers. Naturally, a new screw must be fabricated, and all posts and keys must be straightened and realigned after using this technique.

Technique #5
On instruments where the posts are soft soldered directly onto the body of the instrument (e.g. saxophones) it is possible to utilize a technique where the non-threaded post is carefully unsoldered from the body of the instrument. This post is then removed from the hinge screw, thus providing an exposed section of the screw, allowing access for removal of the other keys and levers. This may be done by rotating the exposed screw shaft with a smooth-faced parallel-jaw plier.

Care should be exercised when unsoldering the post so as to avoid burning adjacent pads, corks, felts, springs and lacquer. On many contemporary Saxophones having an epoxy coating (vs. nitro-cellulose lacquer) this technique, may be performed leaving virtually no evidence of the procedure. After the frozen screw has been effectively removed, it is a simple procedure of resoldering the post, cleaning, straightening, lubricating and rehanging the key(s) and levers that were originally frozen.

Technique #6
In cases where it is not possible to unsolder a long multi-keyed screw the following technique may be employed. This method involves carefully drilling out the screw shaft from the post. If you have a choice, it is usually best to perform this procedure on the non-threaded end (i.e. that which supports the screw slot end). It will be necessary to drill out the threaded post if direct access to the non-threaded post is impossible. Since we have already center-punched and drilled the screw shaft on the previous attempt to remove it (technique #3), it is now a relatively simple task to select a drill of a corresponding size to that of the screw shaft (.005" undersized is preferable) and drill it through to the other side of the post. To determine the size of the frozen screw, select an adjacent screw having an identical hinge and measure both its outside diameter and the thread size. Care should be taken to drill as straight as possible so as to avoid removing any metal from the post itself. (see Illus. 3) Once the post is drilled out, it is usually a simple process of carefully prying the key upward so that it may be removed from the hinge screw. Needless to say the hinge screw will be destroyed in the process and will need to be replaced. Often, to complicate the process further, the steel will usually break off right at the point where the thread enters the opposite post as you attempt to pry the key up for removal. This requires that you proceed to Technique #7 to remove the remaining threaded portion in the threaded post.



Illus 3 - Drilling the damaged hinge screw from post

Technique #7
This technique should be employed in the event that you are forced to drill out the threaded end of the screw (prior to prying the key up as in technique #6). It may also be employed when the threaded portion of the screw breaks off in the post, as described in technique #6. Begin by determining the thread size of the screw. Again, this may be done by measuring an identical screw that you have already removed from the instrument. In the absence of an identical screw, make an intelligent guess. Once you know the thread size, you may refer to your Machinist's Handbook to determine the minor diameter of your thread. This will be the size of the drill, which we will use to drill out the remaining threaded portion. Begin by center-punching the end of the screw (in the exact center!). Next, carefully drill out the remaining thread. You may be able to use a short drill (if you are able to access the post) or, you may have to use one of your long reamers (in the event the post is buried in the middle of the instrument). Often, as you are drilling, the threaded portion will magically unthread out the opposite side, leaving you with a perfectly undisturbed post and thread, "Voila!" However, if the force isn't with you, and you destroy the thread and post during the process, then you must either replace the post from your "bone pile", or, heaven forbid, braze a plug in the damaged post, then re-drill and re-tap the post.

Technique #8
If you have still been unable to free the frozen screws, then technique #8 (which involves dynamite) will be saved for a later edition. BTW, if you have other methods, or variations of these techniques, please send them to the WWQ and I will share them with you all in future articles.

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