FABRICATING LONG REAMERS AND LONG TAPS

by Lars Kirmser

There are times when we all may be tempted to take hasty shortcuts, especially when a sensitive task requires that we must stop to fabricate a special tool or jig. It requires a disciplined technician to resist these temptations. However, if one spends the time and effort to anticipate our needs, and gather those tools and devices **ahead** of time, we can often avoid these temptations altogether. Such is the case with a complete set of 18" long reamers (tap drills) and long taps.

We routinely find ourselves having to conform to a variety of standards and specifications in the process of drilling-out frozen pivot screws and hinge screws, or chasing the damaged threads of a post. And naturally, the target post is often located well within the mechanism of a metal-bodied woodwind such as a flute or saxophone. This is the reason for the 18" length I have specified for the below taps and reamers.

In preparing for fabricating a National - Unified set of long taps and reamers, you will require the following materials: Seventeen (17) 18" lengths of 1/8" solid brass stock, along with one pilot drill and one tap of each size represented in the National – Unified chart below. For a metric set, you will require twelve (8) 18" lengths of 1/8"solid brass stock along with one pilot drill and one tap of each size represented in the metric chart.

National – Unified System of Taps and Dies:

Tap Size	Major Diameter	Tap Drill
0 – 80 UNF	0.060"	3/64"
1 – 56 UNC	0.073"	#54
1 – 64 UNC	0.073"	#53
1 – 72 UNF	0.073"	#53
2 – 56 UNC	0.086"	#50
2 – 64 UNF	0.086"	#50
3 – 48 UNC	0.099'	#47
3 – 56 UNF	0.099"	#45
4 – 32 UNC	0.112"	#45
4 – 36 UNC	0.112"	#44
4 – 40 UNC	0.112"	#43
4 – 48 UNF	0.112"	#42
5 – 40 UNC	0.125"	#38
5 – 44 UNF	0.125"	#37
6 – 32 UNC	0.138"	#36
6 – 36 UNC	0.138"	#34
6 – 40 UNF	0.138"	#33

If you choose to fabricate a set of metric taps and reamers, the following chart indicates the eight most common sizes, which are used in the international music industry.

Metric Standard of Taps and Dies:

Tap Size	Major Diameter	Tap Drill
1.7 - .35 mm	0.067"	56
2.0 - .4 mm	0.079"	52
2.3 - .4 mm	0.091"	49
2.5 - .45 mm	0.098"	47
3.0 - .45 mm	0.118"	40
3.0 - .6 mm	0.118"	41
4.0 - .7 mm	0.157"	30
4.0 - .75 mm	0.157"	30

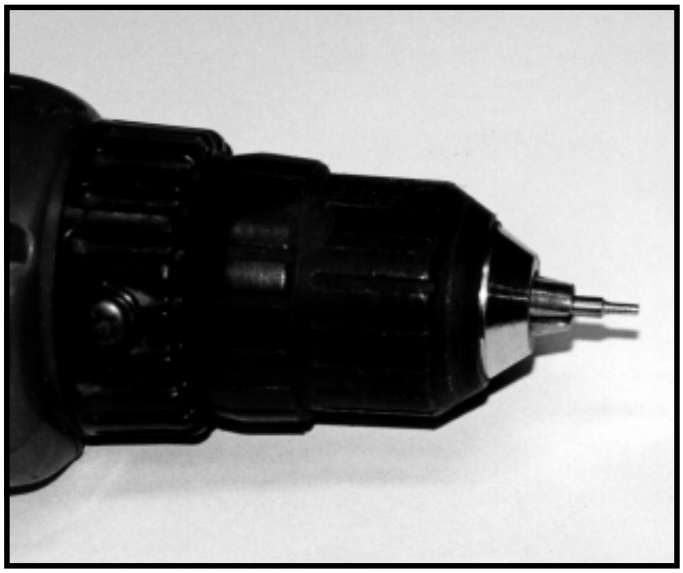
You will *braze* a tap on one end of the brass stock and its relative pilot drill on the other end. (Do not make the mistake of trying to soft solder them, as soft solder simply will not hold.) Generally speaking, and in most musical instrument repair settings, you will rarely require long taps and reamers larger than those having a first number designation greater than #6 of the National – Unified standard, and 6 mm on the metric standard.

After you gather one tap for each of the sizes below, along with its relative sized reamer (pilot drill) you may proceed to prepare the shanks of each drill and tap, and then braze the tap and drill sets on to the ends of the brass stock. When you are finished with each set, you may want to file a small "flat" near each end of the brass stock and mark the drill size and tap size for reference.

FABRICATING THE TOOLS

Both, the reamer and the tap will be prepared in much the same manner. You will begin by preparing the shanks of the drills and taps. The lower 1/8 to 3/16th of an inch of the shank will be reduced to approximately .075". I do this by first securing the drill bit (or tap) in the chuck of my hand held (cordless) drill. I then symmetrically reduce the outside diameter of the shank as close to .075" as I can (measure as you go with your caliper or micrometer). For this I use a resonated/fabric cut-off wheel. **DO NOT** attempt this process with a conventional grinding wheel. After the shank of the bit is reduced, measure its exact outside diameter and select the drill bit, which exceeds this dimension by 2 or 3 thousands of an inch. As an example, if your final O.D. is .073", then select a #55 drill (.076").

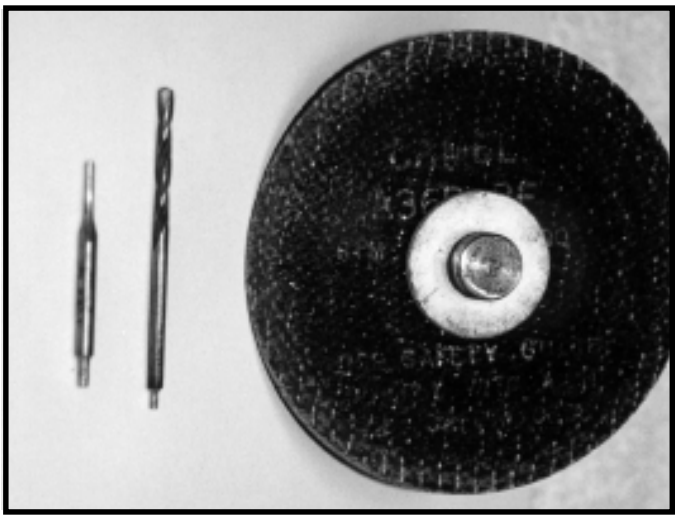
Grinding the shank down to approximately .075"



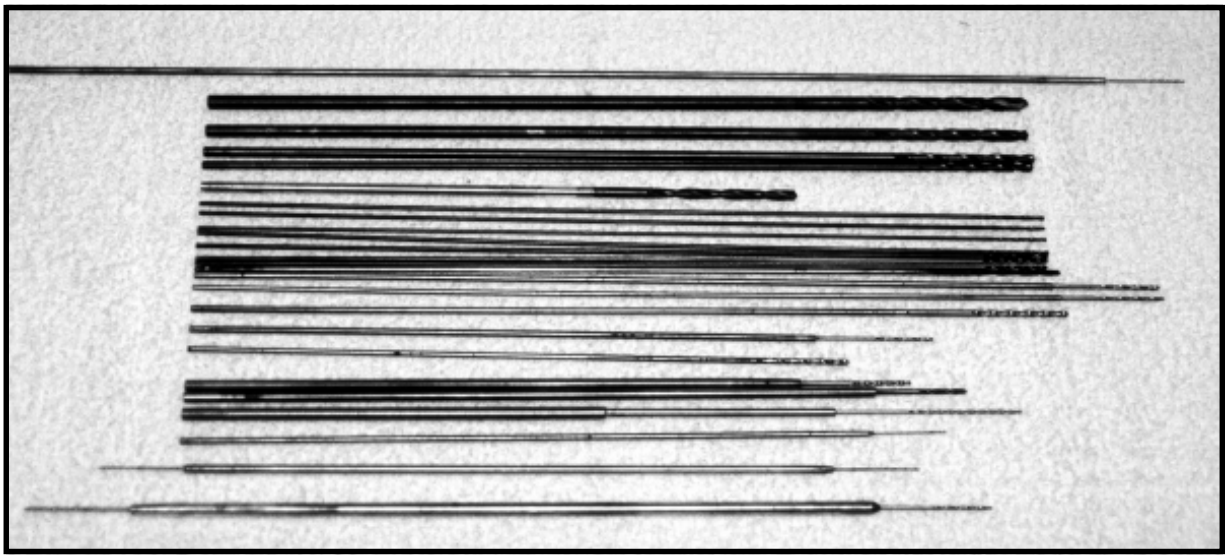
The prepared shank of the bit.

Next, select the 18" brass stock and secure it in the 3-jaw chuck of your bench motor. Allow approximately 1/8" to exceed the jaws of the chuck. Next, face the end of this tool steel and center punch a mark exactly in the center of this faced end. You may now drill a hole approximately 1/8" hole into the brass rod. This hole will be 2 or 3 thousands of an inch larger than the reduced shank of the bit you have just prepared. Remove the brass rod from the bench motor.

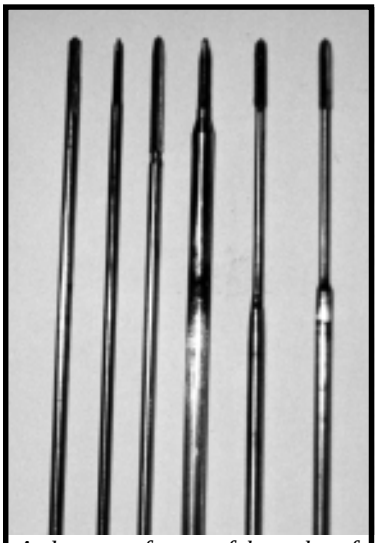
You will now proceed over to your soldering station. Place some brazing flux into the hole in the brass stock and on the reduced shank of the bit. Fit the bit securely into the hole and proceed to silver braze the bit into place. I secure the tool steel in my soldering jig (in a vertical position) and hold the bit into position as I slowly heat the joint to red heat with my striker. If you do not hold the bit in place, it will want to pop out of its hole as you heat up the pieces (air/flux expands as it gets hot). As a precaution, sneak-up slowly with the heat, so that you do not overheat the shank of the bit. If you



A prepared tap, drill, and Resin/Fiber cut-off wheel
(do not attempt this process with a conventional grinding wheel!)



Some of the long reamers I've collected over the years.



A close-up of some of the styles of long taps. Note, several styles allow you to enter the threaded post via the opposite non-threaded post.

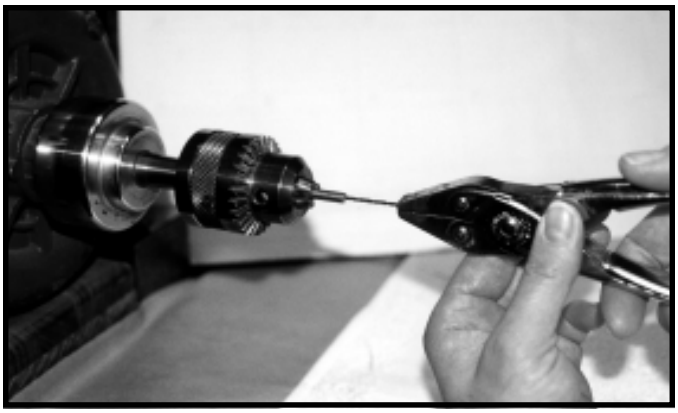
allow too much of the bit to become red hot, you may disrupt the temper of the cutting portion of the tool.

Once the proper heat has been reached (glowing red) apply the silver-brazing alloy judiciously to the joint and allow the entire piece to cool slowly (do not quench in water). Allow the piece to cool, and then clean up the brazed joint by carefully filling away any extra brazing material and flux. Check the bit for alignment by securing the rod in your bench motor. If the bit is slightly off center, you may straighten its alignment in much the same manner that you would straighten a bent long screw, that is, by eccentrically drawing the small hole (in the end of the handle of your bench hammer) across the brazed joint, as the motor rotates. Do not apply excessive force, as the brazed joint may be easilybroken at this point, which will send you back to square one.

FABRICATING WOODWIND SPRING HOLE REAMERS

Another application requiring long reamers would be drilling or reaming a spring hole in the fixed posts of woodwind instruments. The fabrication of these reamers is similar to the previous technique. The only difference would be the absence of having to reduce the shank of the drill bit. Instead, you will use the size of the drill required, to drill directly into the center-punched end of the 1/8th inch brass stock. Turn the bit around, pre-flux, and braze it into the hole you have just drilled, it's that simple. I would further recommend that you braze only one bit per brass rod (rather than one bit at each end, as done earlier).

Center Punching the end of the brass stock.



Counter-drilling the end of the brass stock.

Heating the piece up to brazing temperature, while holding bit in place.

The range of springs on woodwind instruments is roughly .018" - .070", thus establishing the range of potential reamers that may be required over time. My recommendation would be to fabricate these reamers as needed, rather than making up a complete set (ranging from drill bit #50 thru #80). Also, these bits are rather fragile due to their small diameter, and as a result get broken fairly easily, so you may expect to be fabricating these more often than the tap and drill reamers addressed initially.