CHASING THREADS IN WOOD

by Fred Holder

One of the ancient turning techniques that has been gaining in interest over the last few years is the art of hand chasing threads. I first became interested in this almost forgotten turning technique when I began reading Bill Jones' column in Woodturning magazine (the UK publication). I had never even heard the term before. Thus, began a search, in fact, almost an obsession to learn more about this topic and also to learn how to do it. I've been making threads in metal with tap and die for many many years, but the thoughts of freehand cutting threads on a lathe intrigued me. The road from hearing about thread chasing to actually chasing a successful thread was not an easy one, but the journey has been an interesting one.

The first stage of my journey was John Jacob Holtzapffel's book, Hand or Simple Turning, where he devotes a section to the tools for chasing threads and how to use them in making threads on hardwood and ivory items. I read the sections on making and using chasers and tried to make my own, an outside chaser, but it didn't work. Finally, I found a location that had a supply of used chasers for sale, G & M Tools in England. They sold them for $6.00 each or $12.00 per pair. I ordered several pairs and wound up with chasers for 11 tpi, 16 tpi, 19 tpi, and 24 tpi. They didn't work either. I decided it must be the speed, my lowest lathe speed was 500 rpm. I even tried using my Carba-Tec lathe and turning it by hand to get the speed down to a manageable level. Nothing seemed to work. I was almost to the point of giving up.

I re-read Holtzapffel's book, he says that chasers are used to cut threads in hard woods and ivory. He says, that a different technique was required for cutting threads in softwoods, I didn't see this at first, or at least it didn't regester. I began to rethink my definition of hard woods. I had been using maple and apple woods, considering them "hard wood." I had some cocobolo on hand, so I chucked up a piece onto my Carba-Tec. Turning the lathe by hand, I tried the 11 tpi chaser, thinking that the coarser thread would be easier to cut. I was wrong about that, but it worked anyway. I was elated and the journey continued with a search for more answers. I purchased one of Dennis White's videos that included a section on thread chasing and James Lukin's book, Turning Lathes, which also has a good section on thread chasing. Anytime I had some spare time to play and a piece of suitable hardwood, I cut a few threads. Incidentally, that chaser I had made in the beginning now worked also. I'm afraid my main problem was in the definition of what is "hard" wood.

I wanted to share what I had learned, so two years ago, I wrote an article on this subject for the British Magazine, Woodturning. That article was published in their June 1997 issue and reprinted in Useful Techniques for Woodturners, one of "The best from Woodturning Magazine" series. In that article, I described chasing threads on a Carba-Tec lathe by turning the lathe with my left hand while I held the chaser with my right hand. It worked very well and I've cut a lot of threads in that manner.

Both Holtzapffel and Lukin were using treadle lathes. Before treadle lathes, turners had used springpole lathes. So, I graduated to my foot powered lathe, it is a spring pole type with a lathe spindle and a full three revolutions per downward stroke. Wow, this was even easier than turning the Carba-Tec by hand, I now had both hands to work the tool. I began to feel confident. Enough so that when I agreed to demonstrate my foot powered lathe at the January 1997 meeting of The Seattle Chapter of AAW, I included thread chasing. Since then, I often demonstrate this technique at craft shows when people ask how I cut the threads in one of my threaded boxes. I have now progressed to chasing threads at 500 rpm. I will admit, however, that a speed of 100 or 200 rpm would make it a great deal easier.

I share the above with you to explain how I got from hearing about thread chasing to actually doing it successfully. I'm sure the journey would have been much shorter had I been able to watch Bill Jones or Allan Batty demonstrate the technique. A chance that didn't come about until after I had finally learned to chase threads on my own.

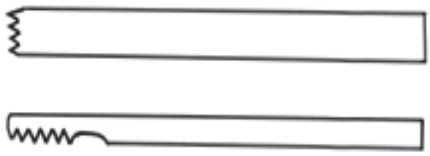

Fig. 1. Chasers have a cutting section that is very similar to an inside section of a threading die. They are made by pressing the cutting section of the chaser against a rotating mandrel that is similar to a large tap of the given thread and pitch. The outside chaser (top) has the cutting section on the end of the tool and the inside chaser (bottom) has the cutting section on the side of the end of the tool. Normal wooden handles are generally added to these tools.

First, you have to have a pair of thread chasers, one for the inside and one for the outside, as shown in Fig. 1

(This was a more difficult task when I began my journey, now you can buy them from Craft Supplies USA, in Provo, Utah.). Incidentally, when it comes time to sharpen that chaser, hone or grind on the very top only. Bill Jones and Allan Batty both recommend grinding on the top of the chaser - never , ever grind on the face. I sometimes grind the top and sometimes use a diamond hone, either works well.

You also need a suitable supply of "hard wood". Wood that is hard enough for thread chasing is generally wood that will cut cleanly with a scraper: lignum vitae, boxwood, Osage Orange, desert Ironwood, redheart, African Blackwood (the best). I've also cut threads in oak, black locust, and mesquite. I've even used a bit of Red Lable Hot Stuff CA Glue to harden apple wood enough to cut threads in it, but I don't recommend the softer woods. The key is a dense hard wood that will take and hold fine detail. This defined, let's get to making threads.

In all of the literature I read there was no definition as to which you should make first, the inside (female) thread or the outside (male) thread. Bill Jones didn't seem to think that it mattered, but Allan Batty says to make the inside thread first. He says that the inside thread is more difficult to make, because you can't see what is going on inside the hole. I agree with him. A lot of my thread chasing practice has been to take a 16 tpi chaser and make a thread to fit a 3/4" x 16 tpi nut. This was always a trial and error situation until I watched Batty demonstrate at Provo in June of 1997. He said to make your inside thread first and then on the end of the external thread to make a short tenon that just fits into the inside thread. This tenon is then the bottom of the external thread, when your chaser marks this area, your nut or box top will screw on. Therefore, we'll make the inside thread first.

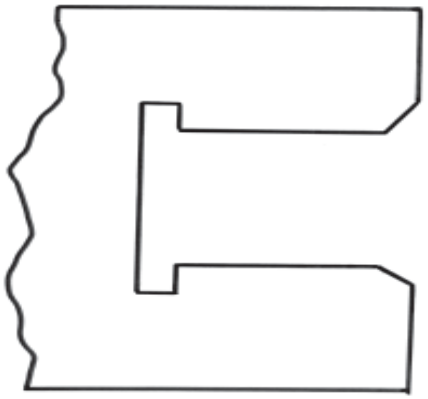

Fig. 2. The hole for an inside thread must have sides that are parallel with the axis of rotation and a recess at the bottom of the hole to allow the chaser to fully cut the thread before coming in contact with the bottom of the hole. A rounded or at least chamfered section at the opening helps preventing a sharp edge from catching a tooth of the chaser and creating circles rather than a thread.

Prepare your hole for your internal thread like that shown in Fig. 2. The only limiting factor for the diameter of the hole is that it must be large enough to enable your chaser to be properly entered into the hole. The sides of the hole must be parallel to the axis of rotation unless you want a tapered thread. Use a straight edge, pencil, or something to lay along the cylinder and compare this to the lathe bed. The entrance to the hole should be beveled or rounded to prevent the chaser teeth from catching on a sharp edge and the recess should be cut at the back of the hole to allow the chaser to cut clean before it hits the bottom of the hole. One nice thing about turning the lathe by hand, you can feel when you've hit the bottom of the hole, at 500 rpm, this is not the case. When the chaser cuts into this recess, you must lift the chaser clear and return it to the beginning. Bill Jones refers to this as a sort of figure eight motion, I consider it sort of a loop.

Holtzapffel says to start cutting your thread on the beveled part as shown in his drawing, Fig. 3. Your first cuts are along the curve a-b and then along the curve c-d, until you are cutting along the parallel of the cylinder. Lukin says, "Personally, I have found it quite as easy to begin at once upon the end of the cylindrical part...". I agree with Lukin and proceed as shown in Fig. 4.

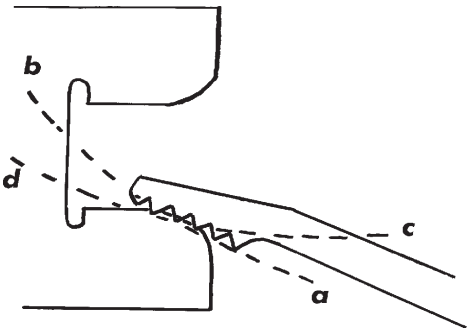

Fig. 3. This is an illustration from the Holtzapffell volume, Hand or Simple Turning, which illustrates his method of striking the thread. I haven't found it necessary to start the thread on the bevel, but rather commence directly. He says that the first pass should be a to b and the next pass should be c to d and then you go down the parallel section.

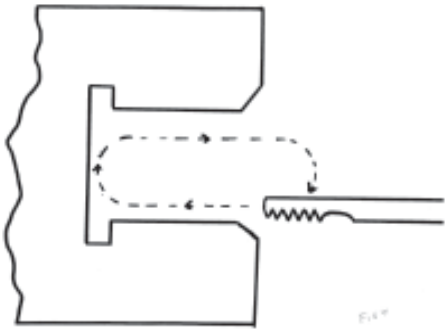

Fig. 4. This is the motion that I make with the inside chaser to cut the threads. The chaser should just cut clean into the recess and must be lifted clear before the chaser end hits the bottom of the hole. This is why it is more difficult to chase threads with fewer teeth per inch. The chaser is moving so much faster it is difficult to lift clear before the bottom of the hole is encountered.

First, I try to have the heel of the chaser ride on the cylinder. It doesn't cut but tends to move the tool along at

the rate of speed necessary. A few practice motions like this allows you to get the feel for the speed. The more teeth to the inch the easier it is to handle the chaser, because you are progressing slower. Once you feel you have the speed down, allow it to cut lightly and move it evenly and smoothly (not faltering) at the desired speed. This is called "striking the thread". Once you have grooves cut deep enough to guide the chaser, you no longer have to move it, but you do have to lift it out of the grooves before it reaches the bottom of the hole. You must exert care to insert the tool into the grooves each time, miss and you may cut a double or triple thread, not good!

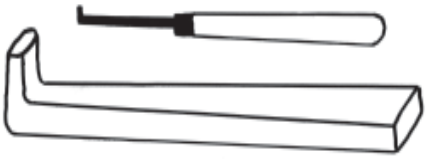

Fig. 5. The armrest is a smooth steel shaft about seven to nine inches in length and about 1/4 inch thick. The face is about 1/2 inch wide at the handle and less than 1/4 inch at the end where it is turned up at 90 degrees. The handle will be from 13 to 15 inches long with a hole drilled for a string. The string is long enough to allow the armrest to hang down your left side, but still be manipulated to hold the metal end on the tool rest and the handle under the upper arm and pressed against the side. The left hand grasps the tool rest and the left thumb presses the tool down onto the armrest and the entire assembly down onto the tool rest. The tool rests against the hook on the armrest so that side pressure can be applied as the threads are cut.

Until recently, I turned the "T" across the face of the area to be threaded, wrapped my fingers around the tool rest and hooked my index finger over the chaser to apply pressure against the cylinder during cutting. I recently acquired an "arm rest" , Fig. 5, which considerably aids in cutting inside threads. You place the handle under your left arm, the arm rest on the "T" and the chaser on the arm rest with the hook (turned up part) touching the chaser. The arm rest is then tilted up and down as necessary to position the chaser and is pulled back to exert pressure during the cut. It makes cutting the inside thread much easier. Both Bill Jones and Allan Batty consider the armrest indespensible for internal thread chasing. I say it is a lot easier, I was making threads without it.

Make additional passes until the thread is deep enough and clean. If you have a specific size that you are trying to achieve, you can measure the inside with calipers and if necessary shave off a little bit with a side cutting tool, make sure the sides remain parallel to the axis of rotation and do not remove all of the thread, leave enough to guide the chaser for additional passes. Then make more passes until you have a good thread again. I do not hesitate to rotate the lathe by hand and make a few passes with the chaser at this very slow speed as final touch up. If you were to slice the finished piece in half, you should have a thread that appears to be very similar to that shown in Fig. 6.

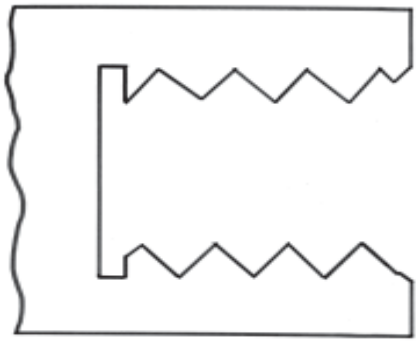

Fig. 6. If you were to slice your newly cut threaded section into half, the threads should look something like this. Note that the recess allows the thread to be cut clean at the bottom of the hole.

Now, prepare the outside thread area similar to that shown in Fig. 7. The

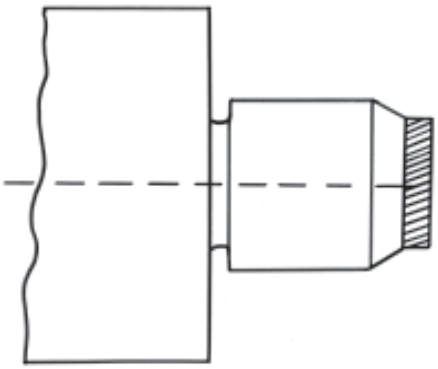

Fig. 7. The section prepared for cutting an external thread should appear similar to this drawing. Again the recess is to allow the thread to be cut cleanly at the rear of the section. There is a tapered section at the beginning to prevent the chaser from catching on a sharp edge. There is also a little tenon (shaded section) that is the size of the bottom of the thread. This section is removed after the thread has been cut. The minimum diameter of the threaded area is equal to twice the depth of the thread plus the diameter of this little tenon.

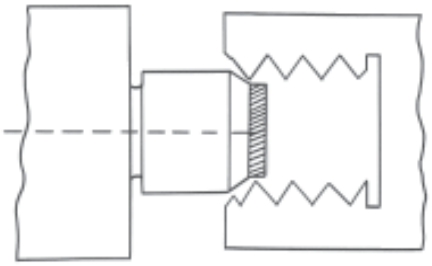

Fig. 8. This drawing illustrates how the tenon on the end of the section to be threaded is sized. The inside thread should just fit over the tenon. Thus, you have created a marker for the bottom of the outside thread. When the chaser marks the tenon, the inside thread should screw onto the outside thread.

sides of the cylinder must be parallel to the axis of rotation, there must be a recess cut at the end of the threaded area, there must be a bevel or rounded area at the beginning of the threaded area, and there must be a little tenon (shaded area in the figure) that will just fit inside the female threaded area, see Fig. 8. The outside of the cylinder must be at least twice the depth of the threads larger than this area; i.e., if the thread depth is 0.025" then the diameter must be greater

than 0.050" larger than the tenon as a very minimum. I recommend that it be a bit larger to allow for mistakes in getting started. This is especially important when learning this technique.

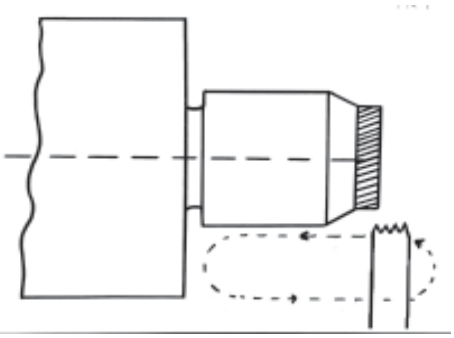

Fig. 9. This drawing illustrates the movement of the chaser as it cuts the thread. The chaser should just cut into the recess and then be lifted clear of the wood before the chaser comes in contact with the shoulder. When the chaser just marks the shaded tenon, the thread should be ready to receive the inside threaded piece.

Before actually starting to move the chaser along the tool rest, it is important that the rest be dressed smooth, any nick or rough spot can stop or cause the chaser to falter and create problems with your thread. Again, with the area below the cutting edge rubbing on the wood get a feel for the rate of feed that will be necessary. Make a few trial passes before allowing the tool to start cutting. Then move the tool along evenly at the determined speed allowing the edge to cut lightly as shown in Fig. 9. As the cutter moves into the recess at the end of the thread area pull it away from the wood and reapply at the beginning. Your chaser should be moving from right to left. Repeat this operation until the thread is well formed. If the chaser hasn't started to make scratches on the small tenon (shaded area on the illustration), use a square end scraper and take a light cut on top of the threads. Then cut the threads deeper until the chaser just cuts on the small tenon. If

This set of Ray Iles thread chasers are the best that I've used. Bottom is outside chaser, middle is inside chaser, and top is recess cutter for inside threads.

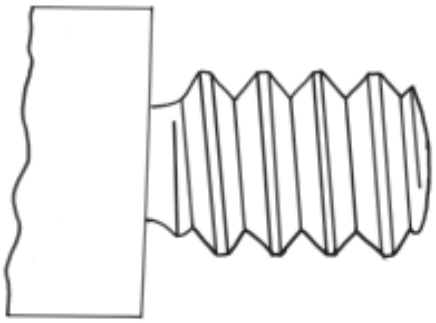

Figure 10. Your finished outside thread should look something like this. You want good sharp "V" bottoms to your threads, but you do not want a sharp "V" on the top of the thread. Each thread should have a little flat. A sharp edge is easy to chip.

everything was done properly, i.e., the threaded area was parallel to the axis of rotation and the threads are cut to the correct depth, the female thread should screw onto the threads you've just cut. You may still have to relieve this a bit. I generally turn off the lathe and rotate it by hand while making some final passes with the chaser. Then try your nut or lid again. If it screws on fully, but is a little stiff, apply some soft wax and work it a bit. If that still doesn't free it up, then take another pass with the chaser while rotating by hand. When everything fits, your thread should look something like the thread shown in Fig. 10.

Clean the threads with a soft cloth and apply a light coat of soft wax as a finish. Work the threads a bit to burnish them.

Well that is about all there is to it. As Bill Jones says, "start making little boxes with threaded lids, by the time you've made half a gross, you'll be a thread chaser." Once you have the tools and the inclination and a little bit of know how, all that remains is a lot of practice. Remember, a lathe with a speed of 100 to 200 rpm would be best. Lacking that, try chasing threads while hand turning the lathe. Start with a fine thread (16 tpi to 24 tpi) in the beginning and use a good hard wood. One of the best that I've used isAfrican Blackwood, it is a bit pricey but it sure makes a nice thread.

Source for Ray Iles Chasers:

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