A Primer for Drilling on the Lathe

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(Lead Photo – 0712)

Caption – No caption

Drilling on the lathe is a basic operation that is frequently ignored in woodturning training. Much has been written about the use of a bowl gouge or a spindle gouge, but little information is available about how to drill . This article will cover a number of drilling methods and techniques you find useful when drilling is required. Which method is the "best" will vary depending upon a specific situation. Each method has advantages and disadvantages.

Regardless of the drilling method you select to use, there are some consistent, key elements that are of critical importance.

(Photo #1)- 1001

Caption – As you drill the shavings create a dam behind the drill bit. This dam can cause the drill chuck to separate from the tailstock quill.

Clear the chips frequently

The first key element is to clear the chips frequently. The rotational forces involved in drilling are dependent upon a strong hold by the Morse Taper. The holding power of the two mating services of a Morse Taper is astounding. But that holding power depends upon the two surfaces being in full contact with each other. When chips build up behind the drill bit edge, a dam is created that makes the drill bit harder and harder to retract out of the hole. The dam will cause the drill bit to stay in the wood when the chuck is being retracted, separating the mating surfaces of the chuck arbor and tailstock quill. Separate the two surfaces, and the drill bit revolves with the wood at 500 rpm rather than being held stationary by the tail stock. If that has happened you only have two choices. First, hit the power off button. Second, run! Do not try to grab it. Just not a good experience.

The most important habit one can have when drilling on the lathe is to back the bit out frequently and clear the shavings. My rule of thumb is to clear the chips every four rotations of the hand-wheel. More important than the number of rotations is paying attention to the stream of shavings coming out of the hole while drilling and adjusting as you need to. Frequent is always better.

Condition of the Tapers

(Photo 2 #1039) Caption - Accumulated dust and grime can comprise the holding power of a drill chuck. Quills should be periodically cleaned.

A second key is the condition of the two surfaces that resist the rotation forces. The arbor of the Morse Taper must fully mate with the surface of the taper in the tail stock quill. These surfaces can become compromised by grime building up in the quill.

Always be sure that your tailstock quill is clean and free of dust and grime that will keep the mating surfaces from making full contact. If you find that the quills have been scored or damaged, they may be restored with the use of a MT 2 reamer. Only ream by hand. Done incorrectly, reaming can damage the quill. Arbors are easy to replace, quills are not.

(Photo 3 663 or 664)

Caption – A dinged surface can comprise the holding power of the Morse-Taper.

A second source of comprise is dings on the arbor. Storing or transporting chucks that allow tapers to bump into other steel can leave dings. Dings hold the two mating surfaces apart, comprising the holding power.

(Photo 4 #693 or 0972)

Caption: A drawer organizer

stops the problem of dinging Morse Tapers when the chucks are stored in the drawer.
(Photo 5 #0695 or 0975)

Caption: Modifications to my tool station to protect all my tools with Morse Tapers. A simple storage rack that protects the tapers.

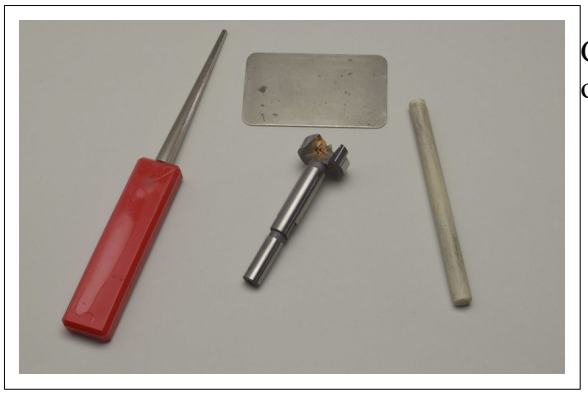
In researching the American Woodturner achieves for this article, I found several excellent references on the subject of Morse Tapers. Leon Olson tells us how to maintain Morse Tapers in the Tool Chatter section of the April, 2004 of the American Woodturner and is a must read. His article made me look closely at my Jacobs Chucks. I found that the tapers had been dinged. Based upon Leon Olson's article, I was able to restore one arbor. After weighing the consequence of a dangerous drilling event versus the cost of a new Jacob's Chuck, I opted to recycle the most damaged arbor. I also no longer store the tools loose in a drawer where they can again be dinged. I also realized that my drawer storage of various tools put the arbors at risk of further damage. Picture 4 and 5 show alternative storage methods that will prevent this in the future.

(Photo 6 #703 or 702)

Caption: A sharp tap on the arbor of the Morse Taper through the open jaws of the Jacobs Chuck releases the arbor. The new arbor is seated with a similar tap, but from the other end.

A new Morse Taper arbor is approximately a third of the cost of a new Jacobs Chuck. A sharp tap to the arbor through the chuck will cause the arbor to release as seen in Picture 6. Close examination of the chuck found a stamped “J33”. With that information I was able to do a search for a Morse Taper Arbor J33 to a MT2 threaded for a 3/8 16 Draw Bar.

(Photo 7 #1092 or 1096)



Caption – A sharp drill bit dramatically improves drilling on the lathe.

Sharp Drill Bits

The third key element is to use sharp drill bits. We all understand the importance of sharp lathe tools. Drill bits are no different. Working with sharp bits makes an amazing amount of difference. Spend the time to understand how to sharpen your bits, just as you have spent time learning how to sharpen lathe tools. An internet search will yield a wealth of information and instructions on sharpening drill bits. One just needs to take the time and learn the techniques.

The metal used in the manufacture of drill bits is not necessarily the high speed steel that is used in today's turning tools. They can lose their temper from the heat generated in drilling. This is one reason to bring down the lathe speed when drilling. If you see color change on the drill bit, the bit has been heated. If the color is a dark blue, the temper has probably gone out of the metal.

The normal response to slowness of drilling is to push harder and to turn up the speed of the lathe. That response is simply wrong. The need to push harder is a sign of a dull bit. Turning up the speed to compensate for slowness in drilling simply increases the heat and causes the drill bit to lose its temper. The correct response is to lower the speed and sharpen the bit. It is astounding what a difference a sharp drill bit makes.

The larger the diameter of a bit, the slower the speed should be. Check with your drill bit manufacturer or other online sources for recommended drilling speeds. Proper drilling speeds are generally slower than one would think. There are also significant differences in recommended speed between hardwood and soft wood. I printed out a table of recommended drilling speeds and have it posted just above my lathe.

Seating the Arbor

Many problems can be avoided by properly seating the drill chuck arbor in the quill. Good practice is to follow this routine. With the lathe off, put the drill arbor into the quill, bring the tailstock up until the bit touches the wood, lock the tailstock, and advance the quill against the wood with the hand-wheel. Back the bit off the wood slightly and start the lathe. This practice insures the drill chuck arbor is fully seated and the full holding power of the Morse Taper is engaged.

Final Key Thought

There are number of other factors not mentioned that can contribute to a drill chuck rotating in the quill. Differences in manufacturing processes in making an arbor and quill, change in the composition and quality of the steel, country of manufacture, or level of adherence to worldwide manufacturing standards, are just some of the factors that come into play.

Common sense becomes important. If you experience rotation of the arbor in the quill, then something is wrong. If it is not your technique, then it is the tool. Arbors can be repaired to some extent. Quills can be cleaned and reamed. But if the tool continues to fail, it should be replaced. This is about staying safe while we all do something that we enjoy.

Drilling Methods

Tradition Drilling Method

(Photo 8 # 0991)

Caption – A traditional way to drill on the lathe. The left hand helps to keep the drill chuck firmly seated. This is the most flawed drilling method reviewed.

Traditionally one has drilled on the lathe with the use of a chuck that is inserted into the tailstock. Lathe speed is turned down to a speed that reflects the size of the bit. The quill is advanced far enough to insure that the taper of the chuck is fully engaged. Then tailstock is advanced to the just off the wood and locked in place on the ways. As the hand-wheel is turned, the drill bit is advanced into the wood. One hand is placed on the chuck to make sure that the arbor stays in full contact with the quill.

Chips are cleared from the hole by turning the hand-wheel counterclockwise until the bit is out of the hole. Caution should be exercised that the quill is not over extended. Again, remember to clear the chips frequently. The bit will become hot with use. It is wise to use a toothbrush to clear the chips that have adhered to the bit.

The traditional method of drilling has the advantage of having the tailstock locked at all times. This results in an accurately drilled hole throughout the entire depth.

The disadvantage of this method of drilling is that it is slow. Having to crank the hand-wheel in and out makes this a tedious method of drilling. Holding the chuck with one hand while retracting the chuck is a dangerous practice because your grip might not be strong enough to prevent the chuck from coming loose — and then you are left holding a spinning chuck and bit! A twirling bit could be on the loose with your hand and arm nearby. Holding the chuck while withdrawing the bit is simply a dangerous practice. Using a glove does not remove that risk.

(Photo 9 # 1017)

Caption – The drawbar being threaded into the drill chuck arbor.

(Photo 10 #1014)

Caption – With a drawbar, a threaded rod holds the drill chuck securely in the tail stock. The drill bit is advanced by slowing pushing on the tailstock.

(Photo 11 #1018)

Caption – Seating the drill chuck in the tailstock with a draw bar leaving a ½ inch of travel helps to accurately start the hole.

Drawbar

Many chucks have a threaded hole at the end of the arbor. A threaded rod can be run through the tailstock, screwed into the end of the chuck arbor, and the chuck is locked in place with a washer and nut just past the hand-wheel. Before pulling the chuck arbor into the quill it is important that you check for dust and grime inside the quill. Tightening the threaded rod can cause dust to be embedded in the side of the quill. Clean first and then tighten.

Drilling with a drawbar insures that the full holding power of the Morse taper will be maintained. But, since the chuck is locked into the tailstock, the hand-wheel can not be used to advance the drill bit into the wood. Instead one unlocks the tailstock and manually pushes the drill bit into the wood.

Using the drawbar solves the potential problem of the chuck's hold in the quill becoming comprised. That makes it safer than the traditional method.

Since the tailstock is not locked in place with drilling, this method can allow the drill bit to wander. The play in the tailstock can cause the initial entry point of the drillbit to be off and changing grain patterns in the wood may cause further wander as the hole is drilled.

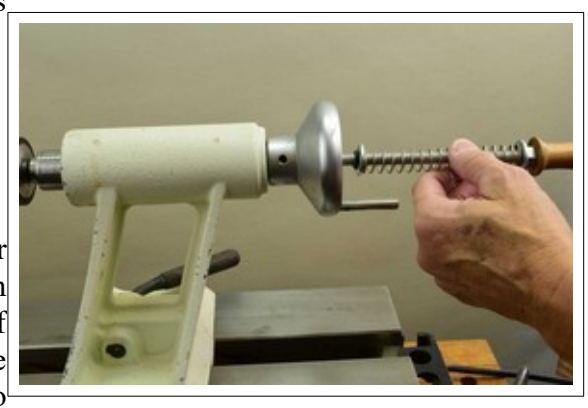
My approach when using a drawbar has been adjust the nut on the drawbar so that the quill can travel about a half inch. I bring up the tailstock, lock it in place, and advance the drill bit to the wood with the tailstock hand-wheel about a half inch. This insures that the drilling begins at the intended point. Next step is to lock the quill then unlock the tailstock, clear the chips, and continuing drilling by pushing the drill into the wood with the drawbar fully engaged and the tailstock moving freely on the ways.

(Photo 12 #0980)

Caption – This picture shows a normal drawbar and one with the addition of a spring.

(Photo 13 #1021 or 1024)

Caption – With a spring loaded draw bar, a spring applies force to maintain the mating of the chuck arbor and quill.



Spring Loaded Drawbar.

The spring loaded drawbar is a variation of the drawbar method. A stiff spring is placed on the drawbar between the back of the quill and the locking nut. The tension of the spring insures that full contact is maintained for the arbor and quill, yet still allow a turning the hand-wheel to push the bit into the wood. The strength of the spring determines the strength of the mating of the Morse taper surfaces. The length of the spring determines the amount of travel. It is still critical that the drill bit be backed out to clear the chips.

As with the drawbar method, it is important that the quill be clean to keep from embedded particles inside the quill.

This method has the advantages of accurate drilling because of locked tailstock, leverage of the hand-wheel, and removes the need to hold the chuck with your left hand while drilling. The disadvantages are that the length of travel of the drill bit is limited to the length of the spring. One needs to exercise caution in the selection of the spring. The spring needs to be sufficiently stiff that it is pulling the tapers together at all times.

Twist Drill Bit Directly in Tailstock

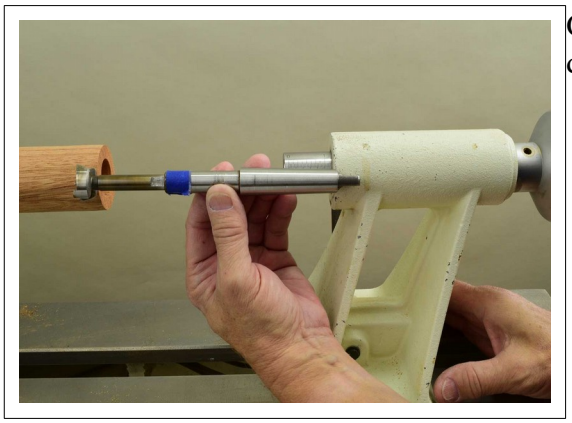
(Photo 14 #1027)

Caption – Drill bits are also available with a MT 2 arbor for directly mounting into the tailstock.

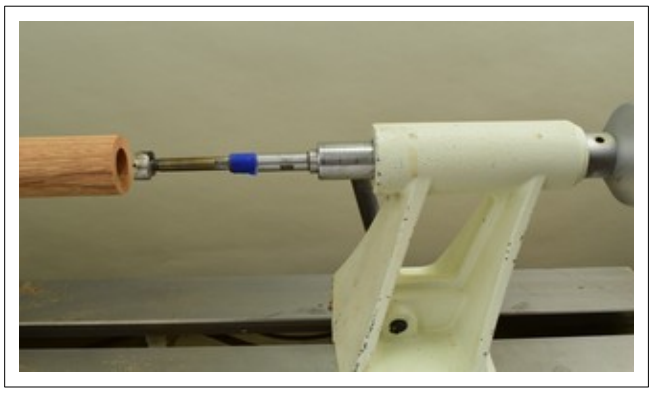
Another system of drilling on the lathe is twist drill bits that go directly into the quill of the tailstock. The left hand is used to maintain contact of the two mating surfaces while retracting the bit. The tailstock can be locked and the hand-wheel used to advance the bit, or one can leave the tailstock loose and push the drill bit into the wood.

This method is my least favorite of the drilling methods reviewed. One's left hand can be badly cut since your hand is close to, or on, sharpened edges. Wearing a glove on the left hand is advised. An advantage of this method is that the shorter length lessens the play while drilling resulting in the consistently straight holes.

(Photo 15 #1031)



Caption – Here a Forstner bit is held in an arbor that goes directly into the tailstock quill.



(Photo 16 #1028)

Caption – Shortening the distance between the tailstock quill and the drill bit decreases play while drilling.

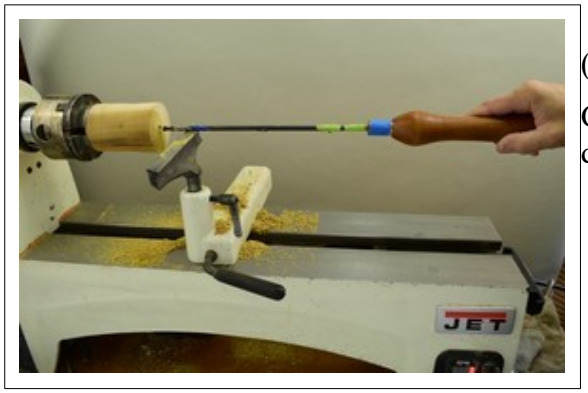
Morse-Taper adapters and extensions

This system is a Morse Taper arbor that accepts Forstner bits and goes directly into the tailstock. A chuck is not used. The length can be increased with the use of extensions. The left hand can still be used, but the cutting edges are not close to the hand. The hand-wheel can be used or the bit can be pushed into the wood.

This is my preferred method of drilling. I seat the arbor and bit into the tailstock and make sure that the quill has been advanced far enough to fully engage the arbor, advance the tailstock until the bit meets the wood, lock the tailstock in for accuracy, use the hand-wheel to advance the bit into the wood. Once the hole is established, I will lock the quill, unlock the tailstock and push the bit into the wood to the target depth. As always, I clear the chips frequently.

The advantages of this system are accurate drilling, no sharp edges to tear at your hand in a mishap, and faster than the traditional method. Disadvantage would be the cost the system and the need to use a sharp bit.

Drilling by Hand



(Photo 17 #1036)

Caption – Drill bits can be mounted in handles and use to drill without a chuck.

One frequent use of drilling on the lathe is to set the target depth of a bowl or hollow form. Making a small diameter hole in the blank to it target depth is a tremendous help in achieving the proper wall thickness at the bottom of a form. A second benefit is that the very center of a form is always the most difficult to remove with turning tools. Drilling out the very center removes this issue.

The diameter of the bit is important. The forces involved increase as the diameter of the bit increases. My kit contains bits of ¼ and 5/16's inch. I make it a point that the handle is sized for easy gripping and good leverage against the turning forces.

Drilling will always generate heat. This is a special problem when drilling in wet wood. The heat causes the wood fibers to swell and "grab" at the drill bit. It is important not only that the chips be cleared frequently, but also that the all shavings be removed from the drill bit. My practice is to tap the drill bit shank on the tool rest to help clear all the shavings from the bit. If necessary, I will use a toothbrush to remove any debris from the bit before continuing.

Begin hand drilling by establishing a center-point with the tip of a skew or parting tool. Mark the target depth with a piece of tape on the drill bit. Set the tool rest below the center-point half the diameter of the drill bit you are using. The intent is to have the tool rest support the drill bit so that it enters the wood exactly on the center-point. The shaft of the tool bit should be held parallel to the ways. Set the lathe to a moderate speed, and push the drill bit into the wood. As always, it is important to frequently clear the shavings.

If you begin to experience wobble as you drill, the drill bit has gotten off-center. This can be cured by turning away the wood until you reach the depth of the drilling and reestablishing the center-point.

(Photo 18 # 1052)

Caption – Small drill bit used for pilot holes in Christmas Ornaments break easily. Using a collet that allows just a small length of bit to be extended stops this problem.

Drill with Small Diameter Bits

A frequent drilling operation is to created pilot holes for eye screws in Christmas Ornaments. This operation should always begin with creating a starting point with a skew, three point tool, parting tool or bedan. The best tool for this is the one closest to your hand. It is the centered starting point that is important, not the tool. A starting point keeps the drill bit from wandering away from its intended starting point. It's a small thing that makes a great deal of difference.

Because the shallow depth of pilot holes, hand drilling without a chuck or even the tool rest, works well. The bit can be held in a shop made handle, locking vise grips, or the collet of a rotary carver hand-piece.

The small diameter of bits are easily broken as you can see from the Picture #18. My preferred method

is to use the hand-piece from my rotary carver to hold the bits. This allows me to only have a small length of the bit exposed which lessens the odds of breaking the bit.

The sidebar of my article “Christmas from the Sea” in the October, 2014 issue of the American Woodturner addresses eye screws and the proper size of bits. It's a good resource for information on drilling pilot holes in Christmas Ornaments.

Conclusion

When we master the fundamentals, woodturning is a great joy. Drilling on the lathe is one of those skills, that when mastered, adds to the enjoyment. When not mastered, it can ruin a project in the final steps.

So remember to clean your quills, mind your dings, keep the bit sharp, and back out frequently to clear the chips.

Dennis Belcher retired from a 30+ year career in the investment world to his lifelong passion of working with wood. He is at member of the Wilmington Area Woodturners Association. Dennis demonstrates for clubs and participates in juried art shows in the eastern half of the country.

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More of Dennis' work can be seen on his website SeaBreezeWoodworks.com

Word count is 3529 with 18 images.