These are just my opinions about tools and methods for sharpening. Diagrams have been shamelessly borrowed from many sources.

SHARPENING TURNING TOOLS

INTRODUCTION: Sharpening might be the most confusing topic a new turner faces. Perhaps this is why so many newcomers ignore it and put up with dull tools and a lot less fun than they should be having at the lathe. In this session we will go over some of the basic information a turner needs to make decisions about how to sharpen tools. When to sharpen is easy. When do you need to sharpen your tools? Before you think you need to sharpen them.

To be covered:

1. Tool steel and the effect it has on methods of sharpening.
2. Types of grinding wheels and sharpening systems.
3. How tool shape effects sharpening.
4. Mechanics of sharpening and what is sharp.

Tool steel: Why is steel such an important topic for woodturners? Cutting a two inch diameter piece tuning at 1,000 rpm, a turning tool will cover 1 mile in about 10 minutes. Try planning a mile even with a good quality plane iron. Tool steel is all about the steel crystal. Tool steels have very small crystals.

The American Iron & Steel Association divides all iron and steel into three large groups:

Pot metals are made by melting smelted iron and producing a finished steel specification by adding non-metallic material (carbon and sulfur for the most part) in a single pot.

Alloyed steels are made by melting iron and steel and adding metallic and non-metallic material to reach a specific composition. Almost all steels fall somewhere in this classification.

Powdered metal alloys (or sintered steels) are specialty steels that are made by combining base steel (alloyed) in a powdered form with powdered alloys, compressing into a shape then heating under a controlled gas environment to produce the desired composition. This process is very expensive and requires significant expertise but creates remarkable materials. A powder metal tools with Chinese steel is an oxymoron.

Woodturning tools are made from all three types of steel.

Older tools are made from a pot metal referred to as “carbon steel”. This pot metal is doped with graphite to produce small steel crystals which allows formation of a very sharp edge but the lack of alloys makes it soft. Also, these tools are easily burned during sharpening. Once burned, the temper is gone and the burn must be ground out.

Modern lathe tools are made from tool steel; a subset of which is referred to as High Speed Steel (HSS). These are all alloyed steels. Carbon is generally cooked out and metallic alloys are added to once again control the size of the crystal. *Smaller crystals, sharper edges.* The alloys make steel harder so it holds an edge longer. Manganese, Tungsten and Molybdenum are the most common alloy in tool steel but small amounts of vanadium and tungsten are also used. M2 (Sorby and about everybody else) is the most commonly used steel in this class although A2 and D2 tools steels are also used now and then in scrappers. M42 is becoming popular recently and produces a sharp, durable edge

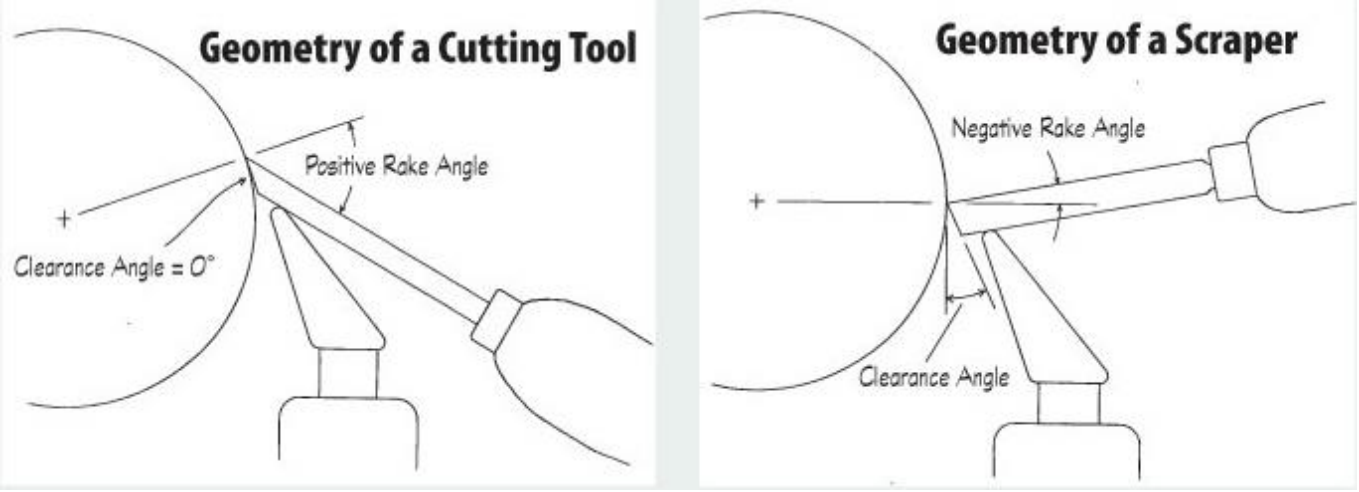
Carbon steel and alloyed steel tools can be sharpened with traditional aluminum oxide ceramic wheels. They are frangible enough not to burn carbon steel, if you keep your wits about you, and hard enough to mill the harder, alloyed steel tools.

Powdered metal tools are reasonably new in the market place. OneWay has made powdered metal (M4) tools for a number of years and Crown and Hamlet have made powdered metal tools for about 10 years. The Pro-PM (Crown) and 6030/6060 tools from Hamlet have outstanding edge holding capacity because the powdered metal method produces tiny steel crystals and the additional vanadium and tungsten make them very hard. 10V, 15V, 42V (rare) also fall in this category. You can expect the edge on a powdered metal too to last three to six times longer than on an M2 tool. Powdered metal tools really should be sharpened with CBN (cubic boron nitrite) wheels to get the best use of the steel.

An excellent review of tool steels, edge production and grinders has recently appeared by Tom Wirsing (American Woodturner, 2018, 33(3):38-41, JUNE 2018).

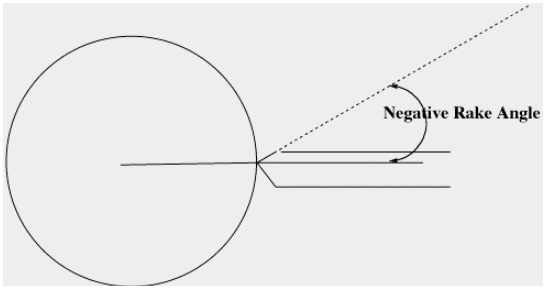
Sharpening scrapers: The scraper is probably the easiest tool to sharpen; the shape is simple and the steel is thick so heat buildup is dissipated. Sharpening a scrapper produces a cutting edge, a burr, by either pushing the steel back when sharpening in a standard orientation or pushing the steel down when sharpening inverted. Either way, a thin cutting edge is produced that will give a clean cut for a very short time (Figure 3). A more durable cutting edge can be produced by burnishing the edge of a scrapper. It is just like sharpening the edge of a card scraper, the edge is bent by a harder metal (Figure 4). The ticketing gauge, as the tool is called, comes from several sources; Don Derry Tools in Ellensburg, WA and Veritas (through Craft Supply, Packard Woodworks and sometimes Woodcraft).

What is a negative rake scraper? By the strictest definition, any tool cutting with a negative rake angle is a negative rake scraper (since it is not actually possible to cut with a negative rake angle).



A negative rake scraper now describes a tool with metal cut away from the point of compression

A "negative rake scraper" can be held in a horizontal position with better tool support and still generate a large clearance angle for easier wood removal with less force.

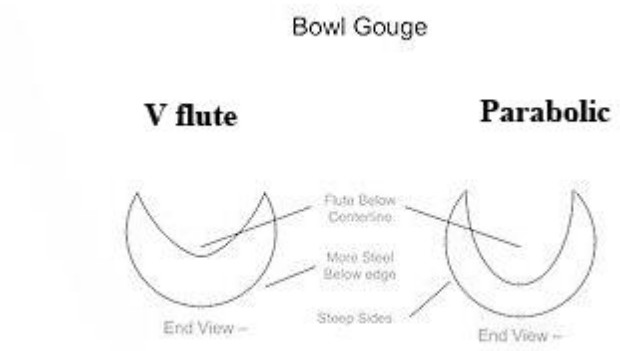


Sharpening Gouges*:* The family of gouges is differentiated by the depth of the flute. From the shallowest, the detail gouge to the spindle gouge to the bowl gouge to the deepest, the spindle roughing gouge the depth of the flute defines function and impacts sharpening significantly.

The spindle roughing gouge is the only one not routinely sharpened with sweep so it is pretty easy to do. Because the flute in the spindle and detail gouge is so shallow, the variance in wall thickness doesn't really present a problem. The fingernail grind on the bowl gouge is the most common problem. Part of that has to do with the shape of the flute. Bowl gouges are made with one of three shapes: V-shaped, U-shaped and parabolic (sometimes called elliptical) shaped flutes. One Way, Sorby, Hamlet (the Glenn Lucas line at Craft Supply is a good example) and Henry Taylor Super flutes are parabolic. D-way and Thompson can be U, parabolic or V-shaped. Parabolic is becoming more common now.

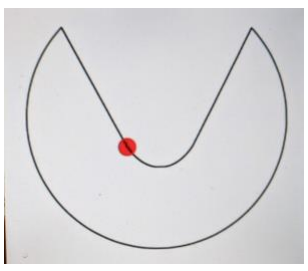
Shape dependence comes from the distribution of metal around the flute. Grinding swept wings with a V-shape means moving a lot of metal on the sides with a thin section at the nose. It is easy to break through the nose before getting the wings set. But the V-shape is more stable due to a thicker bottom. The U-shaped flute has a more uniform distribution of metal around the flute making shaping easier but the bottom is thinner and can lead to chatter. The elliptical shape is a little of both and as a result is probably the most forgiving flute shape with which to work.

The benefit of one flute shape over another is what you want the tool to do. Example: an across the bottom gouge sharpened to more than 60 degrees needs to be stable so a V-shape might be a good choice. Your workhorse bowl gouge ground to 40-55 degrees needs to move wood and cut clean. An elliptical (parabolic) shape will can do both because of the ease of wood clearance through the flute but enough steep to support the edge. A U-shape would be a good choice for a roughing bowl gouge because the open flute allows shavings to move away from the edge faster (like a spindle roughing gouge). The distribution of steel can also make sharpening more difficult (see below).

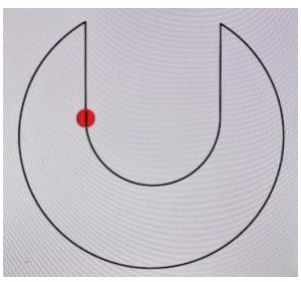


Flute shape can influence sharpening. Distribution of steel in the V and U-shaped flute produces areas of thicker (U) or thinner (V) material around the perimeter of the flute.

The Vshaped flute has a thin spot close to the tip.



This can result in a dip in the line of the wing, sort of a tooth look to the tip, if this area is ground too long. Sharpening both wings first,



then minimal time grinding the tip to blend the edges can avoid this problem. The U-flute has the same problem, though not as acutely. The parabolic flute has a more even distribution of metal and is less likely to produce these sharpening problems.

How do we begin?

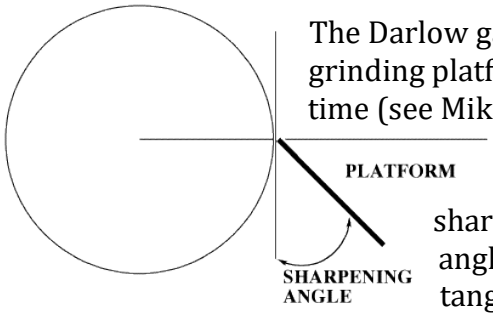
First, if this is a new tool (always sharpen new tools before you use them) or a major regrind, set the bevel angle on the grinder to get a uniform starting point.

Fig 2 – Measuring edge angle

a. This can be done by measuring the included angle of the gouge sharpened and moving the platform till you get what you want but that would take several tries.

b. Set the grinder platform to match a tool you have already sharpened. This will work but every time you sharpen you will alter the angle of the tool. The Heisenberg Principle is in effect here.

c. Set the platform by some unchanging standard. We will cover two ways to do that.



The Darlow gauge allows you to set the grinding platform to the same position every time (see Mike Darlow's DVD on sharpening in the club library for templates). The desired sharpening angle is between the angle of the platform and the tangent to the wheel at the point that the platform touches the wheel. The Darlow gauge touches the wheel at two points so it is not dependent on the size of the wheel. There is a separate guage for each angle.

The Stuart Batty Angle Gauge is another way to set the grinding platform. Each gauge as several angles milled into it and allows reproducible setting of the base grinding angle.

Grind a flat segment on the nose of the gouge by which you can establish the angle and set the jig.

Second, bowl gouges can be sharpened freehand or by using a sharpening jig. The jig is by far the easiest to master.

The most common sharpening system is the Wolverine Sharpening Jig with the Varigrind gouge jig from Oneway. The Vari-grind uses three parameters to shape the grind: 1. The protrusion of the gouge from the jig . 2. The distance of the V-base from the wheel. 3. The angle of the leg relative to the shaft of the gouge. An equation in three variables seldom

has a single, finite solution. Sorry. The problem with sharpening is that nobody can tell you what you like. It takes experimentation to determine the best shape for you and the way you can get that reproducibly.

There is also a Vari-grind 2, which uses the Wolverine tracks but a different method of holding the gouge. Instead of rotating in the V-bracket, the jig is held in a slot and rotates around that central axis. This might represent a more stable base for the jig. The same parameters are in play here: protrusion, leg angle and base distance. The advantage is that motion is restrained in two dimensions (side to side and pivot). The cutting edge moves in a cylindrical motion around the adjusting rod. According to Oneway this allows for a more accurate grind regardless of the bevel angle. As an aside, it also requires that the tracks be installed very accurately to keep the point of the too in the center of the wheel.

The Sharp Fast jig is a variation on the Vari-grind 2. Rotation around the base is held securely by the ring. It will have all of the advantages of the Vari-grind 2. It comes with it's own bracket but fits the Wolverine bracket also. Plus, it usually costs less.

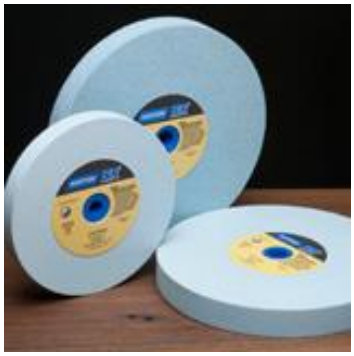
Sharpening with a jig: It is important to understand that the jig doesn't control the final shape of the tool. It is up to you to control the process with regard to wing sweep and nose radius. There are a couple of suggestions to keep in mind.

1. Sharpen the wings first. The sides will have the most metal to work with and breaking through the nose means you start over. Sharpen the nose last then blend the sides.
2. The wings should be straight or slightly convex, ***never*** concave. That is a much too aggressive shape.
3. Make sure the jig is well seated. It is easy to let is slip out and disrupt the tool rotation.
4. Don't forget to cool the tool during sharpening; even good steel can be disturbed by prolonged heating.

Sharpening angles: There is no single best angle. Scrappers will always have larger included angles, 50 to 80 degrees, spindle gouges will always have smaller angles 25 to 45 degrees. Bowl gouges will be whatever is currently popular. The range is between 40 and 60 degrees, depending on the cut to be made. It depends what you like, what fits your turning style and what you are making.

Grinders: Two types are seen commonly; the high-speed grinder running between 2500 and 3000 rpm, and the slow-speed grinder running at about 1700 rpm. Formerly, the slow speed was the usual choice for turners to avoid burning tools. New metals sort of set that aside but the slow speed still seems to be favored. Both work just fine.

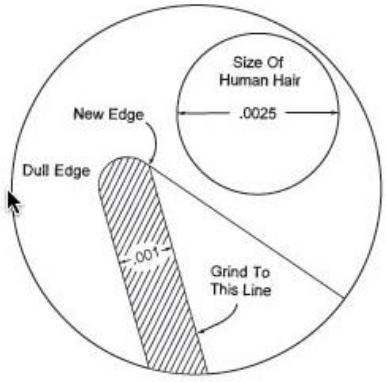
Both styles come in six and eight in diameter wheel sizes. Aluminum oxide is the most common ceramic grinding medium. There are many hardness and grit selections. A course wheel (40 to 60 grit) and a fine wheel (80 to 180 grit) is a common arrangement on a bench grinder. Wheels come in many colors, identifying different properties. *Make sure you know what you want.*



The most significant development in sharpening in recent years has been the availability of CBN (cubic boron nitride) wheels. Made to mill tool steel, these wheels will last far longer than the ceramic wheels and do a superb job. They are wider and prebalanced. They cut so cleanly that there are very few sparks, the metal doesn't get hot enough to burn. They won't last forever but you should get ten years of superior sharpening out of a set. They are available several places; D-Way Tools is the closest northwest vendor, Woodturners Wonders (http://woodturnerswonders.com/) has very good prices ($249.95 for a set of 80 and 180 grit 8" wheels).

The Tormek sharpening system is a different approach sharpening. This uses a wide water-cooled wheel turning at a much slower speed. Tools are held in different jigs to sharpen. The Tormek is not the system for those that are searching for angles and tool shapes. But, if you are not reshaping often, it is very fast, and reproducible (a very important consideration). There are work-arounds that allow use of the Tormek jigs and gauges to be used with grinders. A little ingenuity is all it takes, or the TORBMG100 Bench Grinder Mount Kit . CBN wheels are available for the Tormek systems.

A short discussion of what constitutes sharp is in order. If your tools are sharp enough to cut you without you knowing it (it happens), they are probable sharp enough. The edge of a tool is very fine, and begins wearing away as soon as you touch the wood. It takes very little wear to begin to round the edge. Observe the drawing showing the tool edge relative to a human hair. If you wait until you feel the tool acting dull, you have waited too long.



SHARPEN EARLY, SHARPEN OFTEN

The last page is the sharpening guide published by Thompson Tools for use with a Wolverine sharpening jig. This set-up will give you a good starting point to determine what you want your grind to be like. The angles and jig settings will give you a good cutting edge and moderate wing length for gouges. Want more wing? Move the stand arm farther up jig body (make the angle between the stand arm and the shaft of the tool more acute).

THOMPSON LATHE TOOLS

Sharpening

The tools come sharp and ready to use, to duplicate this grind here's what you need.

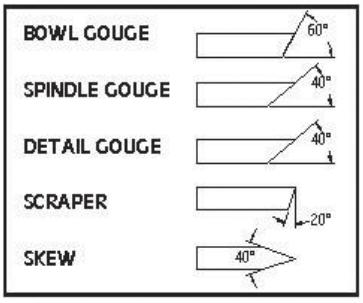
The Oneway Wolverine Grinding Jig and Vari-Grind attachment. This is the best sharpening system on the market and all the gouges will be sharpened with this system. If you don't own one go to www.oneway.on.ca or your favorite catalog and purchase one. Why? Because it works!

Use an 8 inch high speed or slow speed grinder.

Set the arm on the Vari-Grind to the same angle shown in the picture.

Extend the tool 1-3/4 inches out from the jig.

Set the nose angle.




Bowl Gouge


Spindle Gouge


Detail Gouge

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