Sharpening Handbook

Because *sharp enough* … usually is not

Chapter 20

Reference Materials

Dictionary of Sharpening Terms	20-2
Files & Filing	20-9
Hand File Identification	20-11
Knife Sharpening Research	20-15
Tool Maintenance	20-17

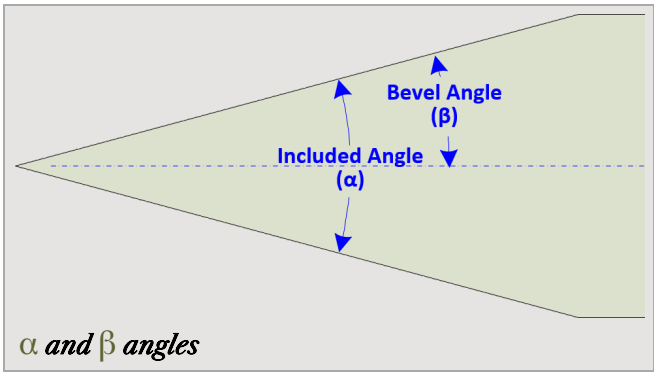
SharpeningHandbook.info

The full handbook, and the latest version of this chapter, are on the web at **SharpeningHandbook.info**. This chapter: November 2026.

Dictionary of Sharpening Terms

A

α - alpha. Indicates an angle.



α *and* β *angles*

1. The general use in this Sharpening Handbook is to denote the **included angle**.

2. In some cases, **α** and **β** may both be used for included angles, but the two are used to denote that they are different parts of the same tool. In such cases, α_1 vs. α_2 would not be sufficient for explaining what needs to be done.

See also, Hive Tools (see Chapter 5).

B

β - beta. Indicates an angle.

1. The general use in this Sharpening Handbook is to denote the bevel angle (i.e., 1/2 of the included angle, **α**).

For single-bevel cutters (e.g., Japanese marking knives (see Chapter 6) and grafting blades & pruning blades on pocket knives (see Chapter 6)), this is the total bevel angle for sharpening.

2. In some cases, **α** and **β** may both be used for bevel angles, but the two are used to denote that they are different parts of the same tool. In such cases, β_1 vs. β_2 would not be sufficient for explaining what needs to be done.

Bevel Angle - With double-edge cutters (i.e., pocket knives), this is half the angle measured across both sides. The picture above to the right outlines this well.

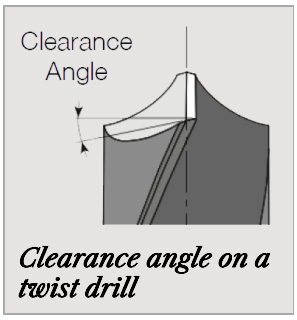
This is also called, “Degrees per Side” or DPS.

The typical denotion for this is **β**.

C

Clearance Angle - This term is the angle between the primary and secondary facets on a drill. The ground area allows for clearing out swarf as it is generated during the drilling process.

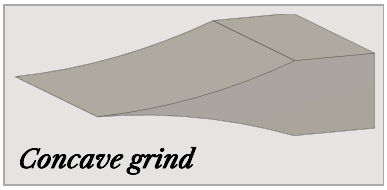
See also, Twist Drill Bit (see Chapter 7).



Clearance angle on a twist drill

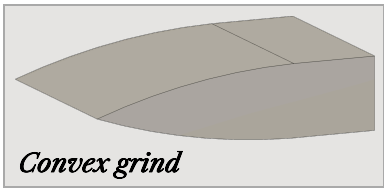
Concave Grind - a grinding profile where the edge has a concavity cut into it by a round grindstone. This profile is sometimes called a "hollow grind".

More details are at Grind Profiles (see Chapter 1)


Concave grind

Convex Grind - a grinding profile where the edge has a convex surface. This is often preferred for axes and some carving tools.

More details are at Grind Profiles


Convex grind

D

Deburring - Remoeval of burrs along the side of a cutting edge. This is commonly associated with saws and garden tools.

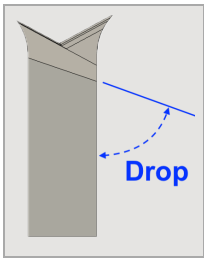
Deburring is called Stoning by some authors.

Degrees per Side - see Bevel Angle.

DPS (Degrees per Side) - see Bevel Angle.

Drop Angle - measure of the angle the file is positioned down from horizontal. This is a measurement needed when sharpening hand saws (see Chapter 6) & saw chains (see Chapter 8). The picture to the right shows drop as seen from the end of the saw's blade.

Drop is called Slope by some authors.



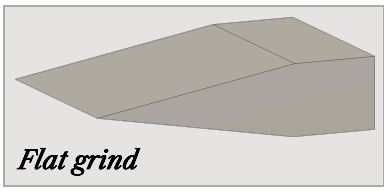
F

Facet - a side, particularly one which gets ground.

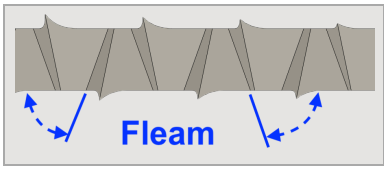
File Card - a file card is a special brush used for cleaning a machinist's file.

Flat Grind - a grinding profile where the edge is completely flat. Also known as a Scandi grind.

More details are at Grind Profiles.



Fleam Angle - measure of the angle the file is positioned from the saw blade's edge. This is a measurement needed when sharpening hand saws. The picture to the right shows drop as seen from the top of the saw's blade.



G

γ - gamma. Indicates an angle.

1. The general use in this Sharpening Handbook is for the skew on an cutting edge.

   See also, Skew Chisels (see Chapter 17).

2. In some cases, it is also used where there is a need for a third angle to be referenced.

   See also, Pyramid Point Tools (see Chapter 17).

Grind Profile - The way the edge is ground when sharpening. Typical profile shapes are a Flat Grind, Concave Grind, or Convex Grind. These can also have a micro-bevel or secondary grind added to them.

More details are at Grind Profiles.

H

Hollow Grind

1. Another term often used for a Concave Grind in grinding the cutting edge.

2. Some authors denote grinds used to make sharpening easier and faster as hollow grinds (as they leave "hollows" in the surface). In the Sharpening Handbook, these are called Relief Grinds.

Honing - A process by which an edge is refined. This is usually different from stropping. Honing may be done on a very high grit grindstone (e.g., a Japanese waterstone); whilst stropping is done with an edge-trailing action using some other form of grinding media.

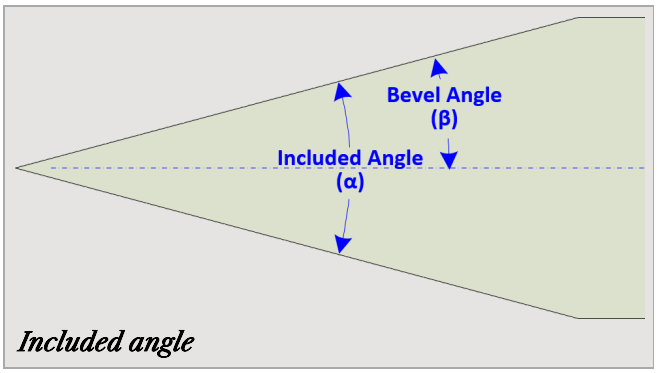
Honing is usually proceeded by sharpening, and sometimes followed by stropping.

More details are at General Information on Sharpening Woodworking Bench Tools.

I

Included Angle - With double-edge cutters (i.e., pocket knives), this is the angle measured across both sides.

The typical denotion for this is **α**.



Included angle

J

Jointing - A process for making a surface or edge flat and true. This is a process used when sharpening hand saws

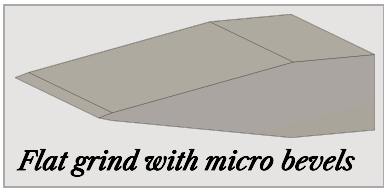
JS - Jig Setting.

K

Kerf - The width of a saw's cut. This is determined by the saw's Set.

M

Micro Bevel - An additional edge added to the primary cutting edge to make resharpening faster & easier. The micro bevel also strengthens the cutting edge as it is not as acute.


Flat grind with micro bevels

The angle for the micro bevel is typically 2˚ to 5˚ higher than the edge angle.

More details are at Micro Bevels (see Chapter 1).

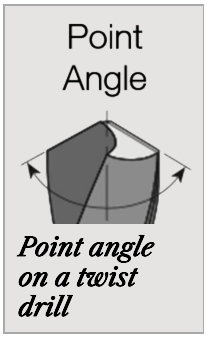
P

Point Angle - This term is the angle of the two facets at the end of the drill.

See also, Twist Drill Bit.

This term is also used for the angle at the nose of the cutter. This is typically used when discussing knives, especially marking knives.

See also, Marking Knife.



Point angle on a twist drill

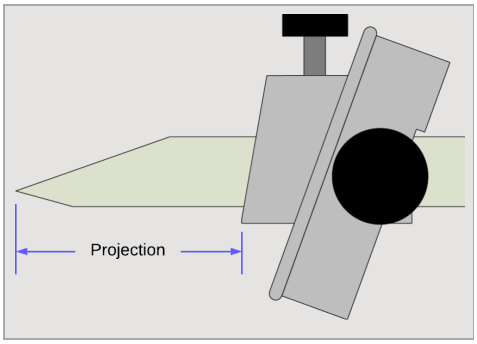
Primary Bevel - The edge grinding performed first. This is a common term applied to the use of a round grindstone when first setting the angle on a chisel or plane blade. *(See also, Secondary Bevel)*

Profile (Grind) - The way the edge is ground when sharpening. Typical profile shapes are a Flat Grind, Concave Grind, or Convex Grind. These can also have a micro-bevel or secondary grind added to them.

More details are at Grind Profiles.

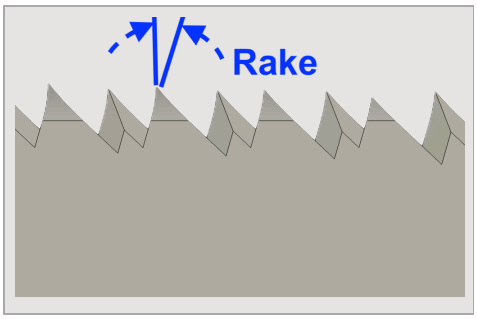
Projection - The distance a tool projects beyond the jig holding the tool.

The typical denotion for this is **P**.



R

Rake Angle - the measure of the cutting edge away from vertical. Based on the picture to the right, a positive rake angle has he teeth leaning towards the left, and a negative rake angle has the teeth leaning to the right. This is a measurement needed when sharpening many tools. The picture to the right shows drop as seen from the side of a saw's blade.



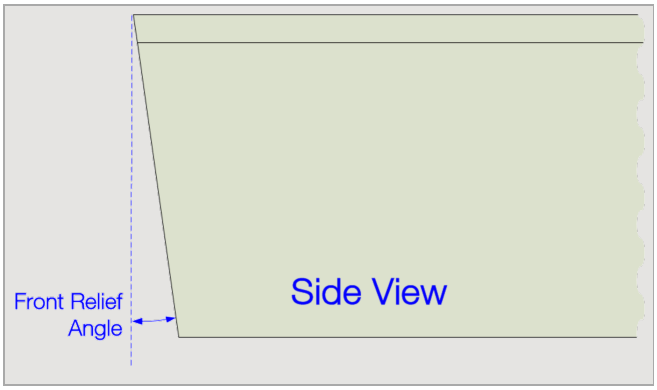
A negative rake scraper (see Chapter 17) employs such an angle for the top edge.

Such angles are also quite critial for metal lathe tooling.

Relief

1. A grind added to a cutting edge so that the tool has room to work without an unused part of the tool getting involved. The picture to the right shows a metal lathe cuttoff tool and the relief ground into the front edge.

   See also, Wood Lathe Bowl Gouges (see Chapter 17) & Metal Lathe Tools (see Chapter 11).



2. A grind added to a larger surface to make the resharpening easier and faster. This is very typical with the backs of Japanese Wood Chisels (see Chapter 18). Garret Hack recommends this for traditional wood chisels (see Chapter 18) also.

   See also, Woodturning Vortex Tools (see Chapter 17).

S

Saw Jointer - a tool used to file the tops of a saw's teeth to ensure they are all aligned. This is a tool used when sharpening hand saws. Lee Valley sells a good Jointer/Edger made by Veritas.

Saw Set - a tool used to bend the teeth on a saw, to set the angle. This is a tool used when sharpening hand saws. *(See also, Set)*

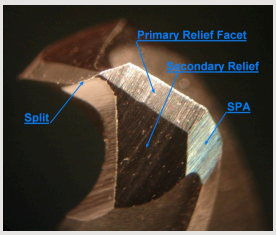
Saw Vise - a tool used when sharpening a hand saw. A good one holds the saw rigidly, preventing it from vibrating when files are used to sharpen the saw. This is a tool used when sharpening hand saws. Gramercy Tools makes a 14" Saw Vise which is quite good.

Scandi Grind - *see Flat Grind*.

Secondary Bevel - The edge grinding performed second. This is a common term applied to the use of a flat grindstone when setting the edge angle on a chisel or plane blade. (See also, Primary Bevel)

Sometimes this is a term used to mean the micro bevel.

Secondary Point Angle (SPA) - For tougher materials, an SPA is useful for reducing the stress on the outside cutting lip corners. SPAs can be added to extend drill life, improve hole finish and minimize the exit burr on through-drilled holes.



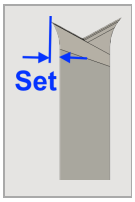
SPAs

Experience in using larger drill bits shows that SPAs help to reduce wander when drilling deep holes. These extra facets cause the drill to have a stronger self centering action and the sharp outer point on the cutting lip is eliminated so the drill remains sharp longer. The chip is weakened by the difference in cutting action between the primary and SPA facets so long spirals are less common because the chips are prone to break. (...) When through drilling the SPA reduces or eliminates the exit burr on most materials.

(Click on the picture to the right to see a larger version.)

See also, Twist Drill Bit.

Set - measure of the amount that a saw's tooth is bent away from the line of the cutting axis. An increased set increases the width of a saw's cut (the kerf). This is a measurement needed when sharpening hand saws.



Shaping - A process by which tool's edge is made to be substantially different (e.g., grinding it from 90˚ to 45˚). Shaping is usually only done once in a tool's life; however it may be necessary if the tool's cutting edge is badly damaged.

Shaping is usually followed by sharpening.

See also, General Information on Sharpening Woodworking Bench Tools.

Sharpening - A process by which an edge is made ready for use. This step gets repeated often as a sharp tool work better and safer.

Sharpening is typically followed by honing.

See also, General Information on Sharpening Woodworking Bench Tools.

Slope - *See Drop*.

Stoning - *see Deburring*.

Stropping - A process by which an edge is polished. This is usually different from “Honinga>” and is the final step in making a highly sharpened edge. Honing may be done on a very high grit grindstone (e.g., a Japanese waterstone); whilst stropping is done with an edge-trailing action using some other form of grinding media. Examples of such media include diamond powder added to a felt wheel, or grinding rouge added to an MDF shape.

Stropping is usually proceeded by Honing.

See also, General Information on Sharpening Woodworking Bench Tools.

Files & Filing

These documents are excellent references about hand files and their use.

- **File Facts** (on the web site) from Simonds.
- **The Guide to Files and Filing** (on the web site) from Nicholson.

Some other reference videos are noted below.

File Handles

You should always use a file handle when using a file. Accidents happen quickly, and as noted in the picture to the right, a file handle could help prevent you getting significant damage to your hand, or at least minimize the injury.

File handles are not expensive; they are significantly less cost than a visit to the emergency room.



Always use a handle when using a file
National Safety Council of Australia



Wooden file holder

Wooden File Handles

Some hardware stores and some online sellers carry them. These can also often be found at used tool sales: garage & yard sales, flea markets, etc.

There is one style where the file's tang is "screwed" into the handle. Other types have the file's tang pressed into the handle and the file is held using friction.

I'm a fan of the screw-in approach, and the brand I use is Scroozon from JTS Lutz. These are easily found with a quick search on the Internet.

If you have a wood lathe, they are easy to make, and the ferrule can be made using a piece of copper tubing. A good source for the shape of a handle is The Wood Turner's Handy Book (1887), by Paul N Hasluck (see pg. 67, fig. 40).



Plastic file handle

Plastic File Handles

These have the file's tang pressed into the handle and the file is held using friction.

Some files come with attached to a plastic handle. This is convenient.

Hardware stores and big-box vendors carry these, as do many online vendors.



Husqvarna's saw chain file handle

Saw Chain File Handles

A spring-loaded part in the center of the handle is pressed down, and then the file's tang is pressed into the handle. The two angled edges are at 25° and 30° so it is easy to use that as a reference for the fleam angle.

I prefer this handle style for sharpening chainsaw saw chains over the wooden file handles.

Hardware stores and many big-box vendors carry these, as do many online vendors.



Solid Handle File *- handle is a part of the file*

Solid Handle File

Some files have a handle made as a part of the file (instead of a tang), like the one shown here. They are convenient, especially if you want to have one readily available for use (such as in a gardening tool bag). But they are not as comfortable to use.

I have seen these files sold as a *"handy file"* or a *"farmer's file"*. Hardware stores and many big-box vendors carry these, as do many online vendors.

More Information

Videos & Presentations

- **File Terminology**
  - Hand Filing 101 - Gear Up with Gregg's (YouTube video).
- **Using Files**
  - Fundamentals Of Filing (1942) (YouTube video). Gives beginners in shop work the information that will enable them to select the right file for the right job. Defines the terms used, distinguishes the various kinds of files, and indicates the general type of work that each kind of file does best.
  - 8 Old School Tips For Better Hand Filing (YouTube video)
- **Making File Handles**
  - How I Make Copper Ferrules (YouTube video).
  - Making File Handles (YouTube video).
  - Turn a File Handle with a Copper Pipe Ferrule (YouTube video). This has a different handle shape, but it looks nice.
- **Sharpening Files**
  - Can you sharpen a dull file in Acid? Sharpening metal files - Experiment (YouTube video). This one is great as he tries both sulfuric acid and vinegar.
  - How to Sharpen Metal Files (YouTube video)

Hand File Identification

This was published 16 January 2012 at KMS Tools' web site in a blog they have. It is so well done, I've captured the text for it here to ensure it does not get lost.

The lowly hand file, relied upon since the Stone Age, has been the tool of choice to smooth, hone, clean and deburr all kinds of materials for thousands of years.

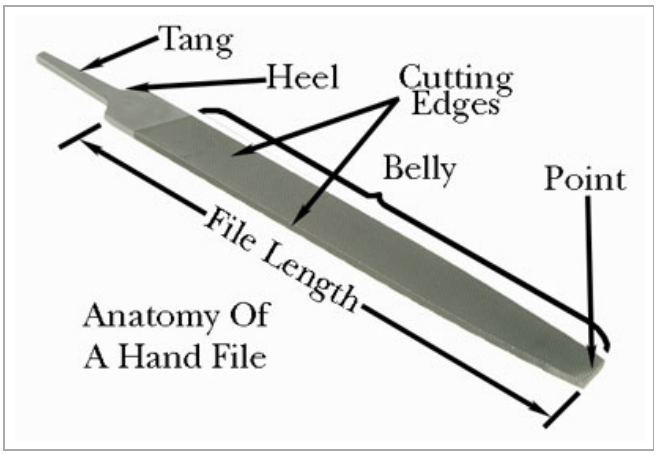
Records show that ancient civilizations used handmade metal files and stone rasps. Leonardo da Vinci was among the first to design a machine to manufacture files. While da Vinci's design was unsuccessful, Chopitel produced machine-cut files in France in the 18th century. At that time, files were made of soft iron and heated to harden or carburize the teeth.

Through the later work of men such as Bernot, Grobet, Nicholson, Whipple and Weed, machine-made files developed to the point where they were better than those produced by hand. Today, there are dozens of manufacturers producing hand files for both general and specific applications. Check out this file identification chart (on the web site) or keep reading to learn more about hand files

Looking for a new hand file? KMS Tools has a great selection. Shop now.

Hand File Anatomy

Several parts make up a file. The tang is the pointy end. It's where you attach a wooden or plastic handle. Some files have built-in handles moulded over the tang. Others, like a farmer's file, have wide, flat tangs that serve as handles. At the base of the tang is the heel. This is where the body of the file begins.



The next section is the belly or face, where all the cutting action happens. Some files have more than two bellies or faces, and can feature different tooth patterns on each. Similarly, the edges of a file can be smooth or have teeth. Smooth edges are also called safe edges. Depending on its shape or profile, a file can have flat edges, tapered edges or round edges.

Opposite the tang is the point. Strangely enough, the point is often quite square and rarely pointed. Yet the point is, in fact, the end you point at the work.

A file's length is measured from the base of its heel to the end of its point. The tang or handle is not included when determining the length.

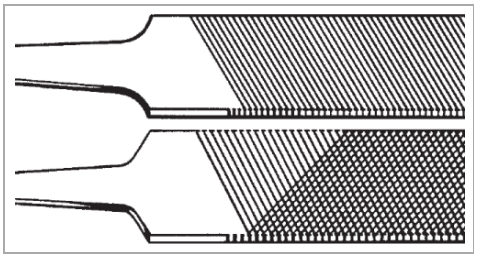
Cuts

Most hand files are classified as Swiss Pattern or American Pattern.

- American Pattern files are available in three grades of cut: Bastard, Second Cut and Smooth. The length of a file also affects the coarseness, regardless of the cut. For example a 6” Bastard Cut is a lot finer than a 12” Bastard Cut. This is because shorter files are generally used for finer work. Overall, the finest would be a 4” Smooth file and the coarsest would be a 16” Bastard file. The relationship between the grades of coarseness for each length remains the same.
- Swiss Pattern files, on the other hand, are available in seven cuts, ranging in coarseness from ØØ to No. 6, with No. 6 being the finest cut. Made to exacting measurements, these files are smaller

and finer than American Pattern files. Swiss Pattern files are usually between 3” and 6” long, and are available in a wide range of fine cuts. With teeth that extend to the edge and narrow points for working in tight areas, Swiss Pattern files are ideal for detailed work, often used by jewellers, watchmakers, model makers, and tool and die makers.

A file's face can be single cut or double cut. A single cut file has one set of teeth; a double cut file has two. Some files are single cut on one face and double cut-or even smooth-on the other.



Single cut files (top) have one set of teeth. Double cut files have two (bottom). Hand files are also categorized by profile, that is the shape of the file. Examples include flat, round, square, tapered, etc.

Choosing The Right Hand File

Although there are numerous sizes, shapes and types, files generally fall into one of the categories listed below. Within these categories, there are standard variations, each with a particular design. Remember, don't feel limited by the listed applications-use whatever file works for your project. Check out our file identification chart to see how many different files are available.

American Pattern Files

Machinist's Files

Generally, machinist's files are double cut for rapid, maximum stock removal. These files are used in numerous applications and on most metals and are available in a variety of profiles and cuts.

Saw Sharpening Files

Saw files are usually single cut to deliver a smoother finish. They are suited to sharpening saw blades and dressing tool edges, especially where a finer, sharper edge or smoother surface finish is desired.

Special-Purpose Files

These are file-like tools that have been developed over time for specific applications or materials. Examples of special-purpose files include wood rasps, foam files and body filler files. Shape, tooth pattern and other material-specific criteria determine the optimum use for these files.

Swiss Pattern Files

Die-Sinker Files

Mini versions of machine and knife files, die sinker files are designed to dress and finish dies. They're available with tangs for small handles and often come in sets that include a variety of profiles.

Die-Sinker Rifflers

Somewhat resembling dentists tools, rifflers have uncut middle sections, making them safer and more comfortable to handle. Rifflers have slender, narrow ends to facilitate fine detail work. There are two types of riffler files-die-sinker rifflers and silversmith rifflers, both available in a variety of patterns and shapes. Die-sinker rifflers tend to be smaller and finer-the tools of die-sinkers, jewellers and instrument makers. Silversmith rifflers have longer middle sections and wider ends.

Needle Files

Needle files feature a double cut pattern. Used by jewellers, die makers and other detail craftsmen, needle files come in 12 different shapes and feature long, knurled handles. Because of their diminutive size, some needle files have integrated plastic handles to decrease finger cramping, cuts and abrasions.

Filing Techniques

Filing is an industrial art. It's not just rubbing the file back and forth. Every stroke should count and move you one step closer to a smooth, polished finish without gouges or abrasion marks.

There are three elemental filing techniques.

1. Straight filing is pushing the file lengthwise down the workpiece in a straight or slightly diagonal position. The cutting stroke is the push stroke. Done correctly, the return stroke shouldn't touch the workpiece. Straight filing can deliver maximum material removal or smooth final finish. Sometimes, the shape of the material can make straight filing difficult or awkward.
2. Draw filing is another popular filing method. This involves holding the file at both the tang and the point, and pulling it across the workpiece towards you. Like straight filing, draw filing can provide maximum material removal or a smooth finish.
3. The third technique is lathe filing and, just as its name implies, is the process of stroking the file against a workpiece that is revolving in a lathe. This can be useful when truing a workpiece or for removing material. As with any application involving your hands and face, and revolving tools, lathe filing requires with much care and attention.

Filing Different Metals

Because different metals vary greatly in properties, consider the nature of the metal you're working with when choosing the right file for the job. Soft, ductile metals require a keen edge and light pressure. Harder materials require duller teeth and more pressure.

Aluminum	Soft and difficult to file, aluminum easily clogs. Use an aluminum file, with a special cutting edge that breaks up the filings, prevents over filing, and helps reduce chattering. Apply a shearing stroke to the left for the best finish.
Brass	Brass is difficult because it's softer than steel, but tougher and harder than aluminum. Filing brass requires a sharp file with sturdy teeth and a cut that prevents grooving and running. Use a specifically designed brass file, and apply moderate pressure.
Bronze	Similar to brass but dependent on the content of alloying elements. Cross the direction of the cutting stroke to avoid grooving.
Lead	Wear a Respirator! Soft materials such as lead, babbitt, and copper present distinct filing conditions. Use a short, single cut file with stubby teeth. Apply normal pressure.
Plastic	Hard plastic requires a file with high, sharp teeth. Soft plastics are filed in shreds, so a shear tooth file should be used in this application, as well as in other soft materials like aluminum, copper, hard rubber and wood.
Stainless	Tough, dense and abrasive, stainless steel requires a file with good wearing qualities. Apply light pressure and a slow, steady stroke.
Wrought Iron	Wrought iron is soft and ductile and does not require a very sharp file for good results.

Hand File Care

There are a number of simple steps you can take to ensure your files last a long time.

- *Keep the pressure off.* Apply only enough pressure to allow the file to do the work. Feel the teeth biting into the workpiece. Your movement should be fluid and smooth. Applying the correct pressure will also result in the fastest removal of material, even if it takes a few more strokes to get the

job done. Soft material such as aluminum can clog cutting teeth, even when you use a file designed for aluminum and soft metals.

- *Protect the teeth*. Tossing your files in with all your metal tools is not a good idea! Ideally, hang them up or keep them in a drawer with non-metallic dividers and enough room to fit without a lot of contact. Store them away from water, dirt, grease and filings.
- *Keep it clean and clear*. Get a file card and use it while you file and after you're done. A file card has rows of small, stiff wire that cleans debris from a file's teeth. Remember that filing creates heat and filings are sharp. Cleaning your file by hand is one way to pick up a metal sliver. Instead, use a file card, which clears away filings before they get stuck in the file-or in your finger.

Knives: Additional Information

Research Articles

- The Dutchman's guide for Grinding Angle Adjustment for the Tormek is a great resource for easily setting very accurate angles for sharpening.
- Dr. Vadim Kraichuk at KnifeGrinders (knifegrinders.com.au) has published a number of really great articles on his web site. In them, he's done a great job balancing presenting the science behind what happens with the sharpening process, but I a way that does not require a degree in metallurgy or materials science to understand it. I especially like how Vadim balances:

  knife sharpening research vs practical assessments with professional butchers at meat packing houses

  Some of the notable publications on this site are:

  - The Proprietary 7-Carcasses Edge (knifegrinders.com.au): a proven method for sharpening knives by a group which does it for meat packers and many others.
  - The KnifeGrinders (knifegrinders.com.au) sharpening method: Sharper Than a Razor, for Knifemaker Lawrence Cheng (on the web site).
    - **Summary:** This method uses tools (including their computer program) to deliver a process which is proven to produce repeatable, amazing results without requiring a long training program for the sharpener.
  - Knife Deburring: Science behind the lasting razor edge (on the web site).
    - **Summary:** There are 37 pages here that I can't summarize easily. He also does a great job incorporating pictures (including some from a scanning electron microscope) to demonstrate his concepts. Read it.
  - Edge Rolling in High Vanadium Knives Sharpened with Aluminium Oxide versus CBN/Diamond (bessex.com) on the BESS EXchange (bessex.com).
    - **Summary:** For blades where the vanadium is > 3%, use a CBN or diamond wheel for sharpening.
  - Sharpening Procedures for Ceramic Blades (knifegrinders.com.au). Notes on other styles of blade materials and shapes are available from links on this page.
- Todd Simpson has a great site Science of Sharp (scienceofsharp.wordpress.com) that's a very worthwhile read.
- The Cutlery and Allied Trades Research Association (CATRA) published an article titled Maximizing Edge Retention - What CATRA Reveals about the Optimum Edge (knifesteelnerds.com). This article looks at a number of variables for edge retention:
  - Edge Angle
  - Hardness of the Metal
  - Effect of Edge Thickness
  - Effect of Cryogenic Processing on the Metai
  - Grit of the Sharpening Tool
  - Powder Metallurgy vs. Conventional Ingot Steel

Other Information

- Werner Noli (AKA, "Drilon") and many others recommend the **Vetako** (sharpeningtool.eu) **laser goniometer** (sharpeningtool.eu). A laser goniometer is a very helpful in identifying the knife's edge

angle, and this one looks to be good at a very fair price.

- Tony Whitfield (AKA, "Y-Not") posted an additional recommendation regarding the **knife sharpening platform**, in that he recommended putting a drop of mineral oil on the knife blade and the platform. This was posted in 2018 on the Tormek Forum.
- The Society for Culinary Arts and Letters has a forum page on Knife Maintenance and Sharpening that is good.
- A catalog of the Jigs, Fixtures, & Modifications (see Chapter 3) that I've catalogued.

General Tool Maintenance

New Tools

A good, well-maintained tool will last a lifetime (or maybe more; I have many tools I've inherited from my father and grandfathers which are still quite useful). And as we all know that each new tool is that last piece you need to finally be the perfect ____ (you get to fill in the blank), keeping it in good stead it is a good idea.

When you get a new tool,

1. Remove all the glued-on labels
    - Glued-on labels hold bacteria.
    - Handles get sticky over time.

> Lighter fluid works well for removing labels, but one must be sure that the area is well ventilated.

2. Do not be afraid of modifying tools
    - Flat cutting edges or overly large angles can be re-ground to sharpen the tool and make it more useful.
    - The overall shape of cutting tools can be re-ground.
    - Rough or sharp edges on handles can be sanded to make them smoother.

Summary: Modify the tool as you feel best so that it becomes an extension of you.

Maintaining Existing Tools

Tool maintenance is an important task to ensure the life of the tool is long and useful.

1. **Sharpen tools before you think it is needed.**
    - Sharp tools are easier to use.
    - Sharp tools are safer to use.
    - Sharp tools cause less damage to the material they are cutting.

2. **Never use damaged tools.** Repair any problems they have.
    - Remove nicks from the cutting edges.
    - Replace handles when needed, or replace the tool. In some cases, I've found that a new tool was cheaper than replacing the handle, and I had no sentimental attachment to that tool, so I replaced the whole tool.

3. **Clean tools after use.** A tool should be stored in the state you will need it to be the next time you go to use it.
    - Mud causes rust
    - Plant residue, sap, & soil can transfer diseases
    - And it is easier to clean a tool right after its use than later (also, you are already dirty from the activity where you used the tool!)

> A green scrub pad works well for removing many stuck-on materials

   Sap can be removed using a solvent. Acetone works well, but be sure to wear protective clothing as this is not kind to your body, and be sure the area is well ventilated. Isopropyl alcohol also works well, and is less harsh.

   Another recommendation is to use Crean Mate which is a small block used for cleaning resin, rust, and other gunk from your tool. A green scrub pad also works well for removing many stuck-on materials.

   Do NOT use bleach or trisodium phosphate. Both are oxidizers which will cause your tools to rust.

4. **Sharpen tools before putting them away.** This way, they are ready for use when you need to use them.

5. **Coat unpainted surfaces with a light coating of oil.**

    - Woodworking and Gardening tools: I like the spray bottle of camellia oil sold by Tools for Working Wood (toolsforworkingwood.com). In lieu of camellia oil, jojoba oil or cedar oil are recommended by some. At least one person noted that olive oil can also be used, but that tends to build up a caked-on surface, so it is not recommended.
    - Machinists tools: I prefer a light oil like 3-in-One or sewing machine oil. WD-40 is not recommended as it will evaporate over time, leaving the surface unprotected.

    Do NOT use boiled linseed oil (BLO). Some advocate using BLO, but BLO often has heavy metals or other bad chemicals added for drying agents, and these are not good for you to handle, nor would they be good for the plants on which you might use this tool.

6. **Store your tools where they should go**: *"A place for everything and everything in its place"* is more than an old colloquialism: it makes the job easier next time. You cannot do an efficient, fast repair work if you have to stop and look around for each tool that you need.

At the End of the Season

Prepare the tool for longer storage. Tools in storage should be:

1. Clean
2. In good repair. Consider painting the exposed metal surfaces, at least those which are not sharpened nor used for impact.

Paint can help protect your tool from rust; I generally use a rust-resistant spray paint.

3. Sharp
4. Coated with a light coat of oil (not BLO). In very humid environments, petroleum jelly may be a better alternative.
5. Stored where they will not get damaged nor wet