Finishing Tool Making: An Economical Approach

By Brien Beidler

Description

Students in this workshop will learn the basics of making finishing tools. For centuries, the primary way to finish a covered binding was to compose patterns and designs with an assortment of small decorative stamps set in wooden handles. Though primarily used on leather surfaces, these tools can be used on cloth, paper, and even wood.

Beginning with brass stock, students will cut, drill, and file seemingly basic designs that can then be used to create a surprising range of patterns. They will learn to durably mount their newly cut tools into wooden handles. Thermodynamic considerations and tool blank fabrication options will also be discussed.

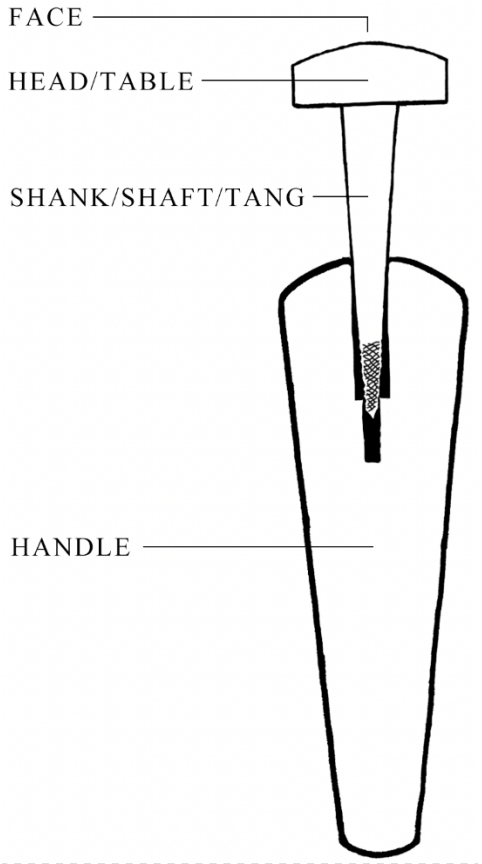
Finishing tools are expensive and difficult to find, so being able to make one's own is an asset to any binder. In addition to potential savings, there is the added advantage of having a unique and personal catalog of tools. We will focus on developing tool designs that can be repeated in interesting ways to build up a variety of patterns.
Be prepared for a lot of hand filing of metal!

Overview

This handout is intended to serve as a foundation that gives you the knowledge you need to get started. The following information highlights general approaches and helpful tips accumulated over the course of my own pursuit of making finishing tools for myself and other binders. The last page contains a tool and material source chart. Happy toolmaking!

Background

At its most basic, a finishing tool is a short segment of metal rod that has a design worked on one end and the other end set into a wooden handle. The most common metals used for these tools are bronze (traditionally copper and tin) and brass (traditionally copper and zinc), though those two generic names cover a huge range of alloys which often feature different amounts of both tin and zinc.



Historically, finishing tool blanks were most often cast before being cut by hand with techniques such as filing, engraving, drilling, and so on. Today, most finishing tools are made of brass (with the exception of Maison Alivon in France), and many modern tool manufacturers use more industrial techniques and machinery to cut their tool designs. We'll be using brass in this workshop but shall rely on a few simple hand tools and our hands and eyes.

Materials

Copper alloys (brass and bronze in this context) are favored metals for finishing tools for a few reasons: they hold heat well, are corrosion resistant, are soft enough to be made economically, and are durable enough to withstand repeated use. Mild steel works well in a pinch, but it's tendency to rust makes it less ideal.

I would emphatically avoid using metals such as aluminum (bad heat retention and is too soft/sticky to be worked easily) or stainless steel (bad heat retention and will gum up and dull your tools). The only reason I mention them here is since they are widely available and you might be tempted to give the a try.

A brief note about brass: There are a dizzying array of commercially available brasses. In the context of finishing tools, the brass alloy I'm referring to (and use most often is C360, also known as 'free-cutting' or 'free-machining brass.'

Below is a chart summarizing the pros and cons of different metals and their suitability for finishing tools according to my experience.

Material	Pros	Cons
Bronze	• Durable • Good Heat Retention • Workable • Beautiful • Corrosion Resistant	• Hard to source in a convenient form* *Commercial bronzes are typically only available in round rod, and most modern alloys aren't as workable as more basic bronze alloys containing only copper/tin
Brass (alloy 360)	• Durable • Good heat retention • Very Workable • Corrosion Resistant • Widely Available • Attractive	• Colloquially has worse heat retention than bronze (in truth only about 15% difference) • Colloquially not as durable as bronze (at least in terms of withstanding repeated polishing)
Mild Steel	• Very Durable • Good Heat Retention • Somewhat Workable • Widely Available	• Prone to Rust • More Difficult to Work than brass or bronze
Aluminum		• Bad heat retention • Very Soft • Gums Up Files
Stainless Steel		• Bad heat retention • Gums up files • Dulls and chips files and gravers • Very Hard to Work

For handles, almost any hardwood will do. Most hardware stores are stocked with one or two options of hardwood dowels (typically poplar or red oak), both of which work fine and are readily available. From what I've seen, ash, maple, beech and oak are the most common handle materials on older finishing tools, but use what is available.

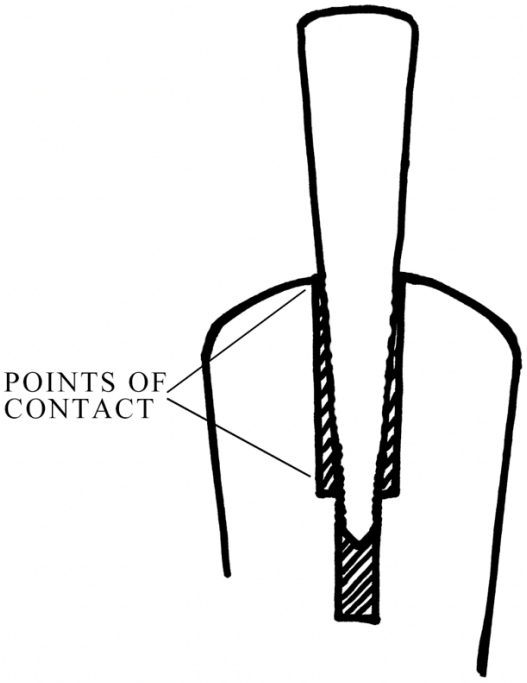
The main thing you want to avoid are sappy or oily woods like pine or certain imported tropical hardwoods (which you most likely shouldn't be using anyway). As the tools are used hot, the heat from the tool can burn the sap or oil releasing noxious fumes and posing a fire hazard (speaking from personal experience).

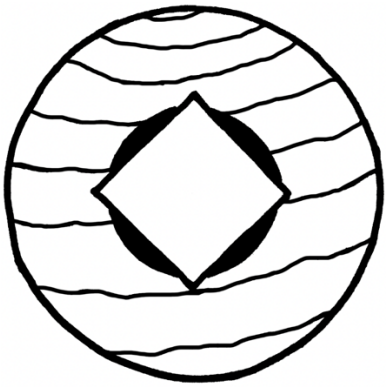
If you have access to a lathe, you can turn your own handles, which adds an element of fun and the ability to customize. If you're interested in tapered handles, besides myself there is one source I'm aware of (listed on the last page) that sells tapered handles in the US.

Form and Function

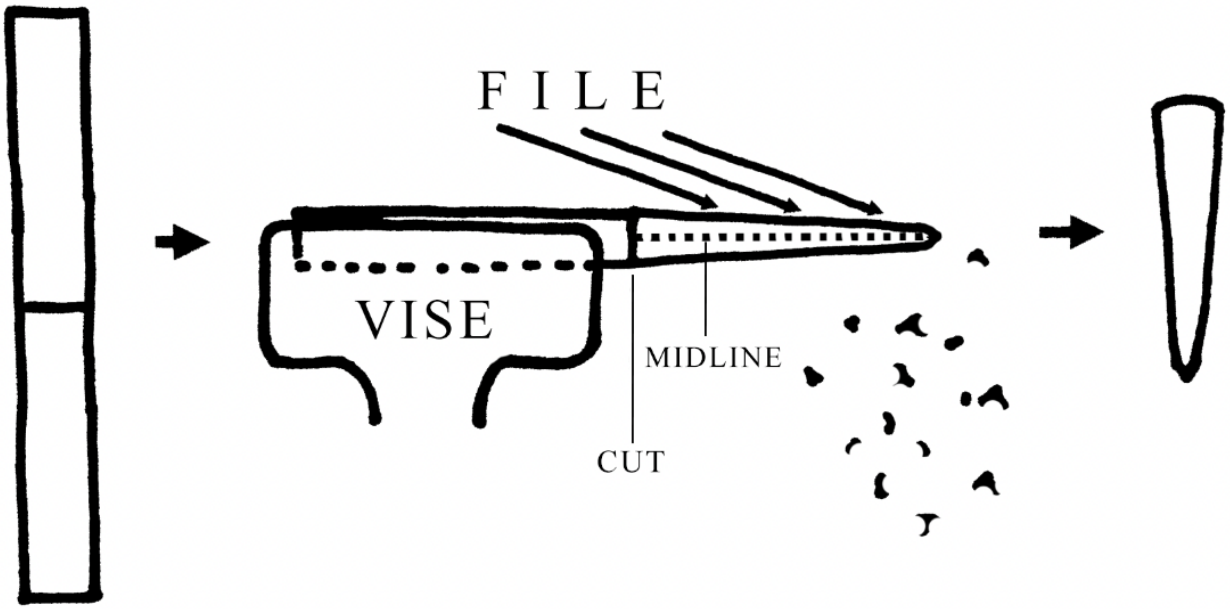
While not strictly necessary, I recommend tapering the brass stock. With continued use, finishing tools with a tapered profile tend to stay in their handles longer than their straight counterparts. This is because even if the hole gets burnt out (as happens from time to time, or so I've heard ;)), the tool can be pushed deeper into the hole, wedging it securely back in place. Additionally, using a square rod for the tool stock (as opposed to round, see bottom image) and leaving a coarse surface on the handled portion of the shank (from a coarser file) both help keep the tool snugly handled.

Handles range from slim segments of dowels to thick, turned tapers. Slimmer, straighter handles take up significantly less storage space, while thicker, tapered handles are generally considered more comfortable to use for extended periods of time. Thicker handles are often rounded off at the tool-end for better visibility. There's really no better or worse handle shape so long as it holds the tool well and is comfortable to the user.





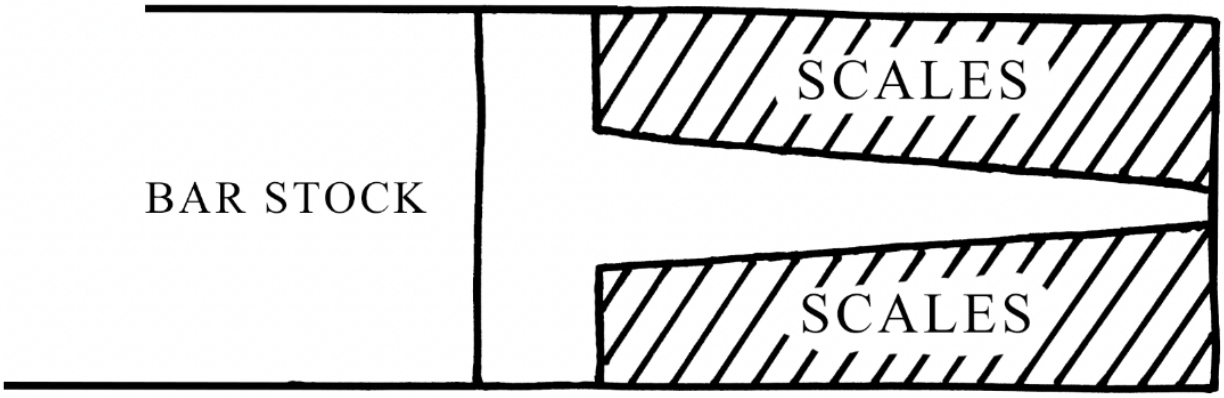
Square stock biting into perimeter of round hole in handle



Shaping the Blank

For the most part, my tools are about 2.75- 3" long. To form the taper, cut a portion of stock that is at least twice the length of the tool blank you are fashioning. I often cut a length of stock that is five or six tool-lengths, cutting off the finished tapers as I go with a hacksaw. This gives the vise plenty of material to clamp. Using your coarse file, work one side down to the midline at a gentle slope from where the face of the tool will be and rotate. I like to work opposite sides, as it helps maintain symmetry. It is important that you don't file your taper away into oblivion. We aren't making metal golf tees, and the more mass it has the better the tool will hold heat while in use.

For larger designs (≥ 3/8"), the tapered blank is cut with a hack saw or metal cutting band saw so that a 'table' remains on the top of the tool. That way the taper isn't too thick to practically set it in a handle. Care must be taken to cut the taper so that it is centered under the table. The 'weight' of the table can vary, but ¼" or so is a good thickness to aim for from an aesthetic and thermodynamic perspective. Furthermore, the two widest scales, or offcuts, can often be worked to make two additional finishing tools.



A Note on Files

Files are cut so that they only work in one direction. If you are holding the file by its handle (or tang, which is the tapered point inserted into a handle, ***the file only cuts as you push it forward***. Filing back and forth does not do nearly as much work as filing with smooth even strokes in a forward motion, and it can dull the file depending on the type of metal you are working. I find that champagne corks work especially well for quick and dirty file handles.

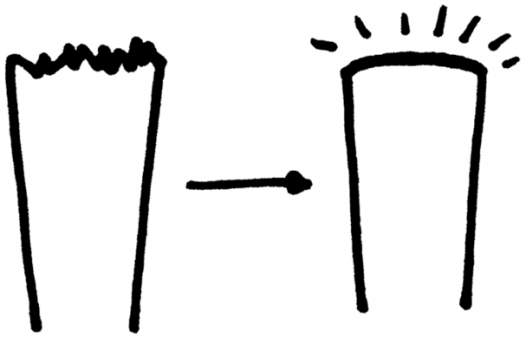
At a minimum, I recommend purchasing a large (8-12") half round bastard file, a finer half round jewelers file (Swiss cut 2 or similar), and a set of needle files (Swiss cut 2 or similar). However, as with finishing tools, one can never have enough! Files come in all shapes, sizes and cuts (ranging from coarse to very fine).If you are having trouble accessing a certain spot with what you have on hand, chances are it's time to look for a new file. Sources for files can be found on the last page of this handout.

Doming and Polishing the Face

Once the taper is finished and cut from the bar stock (I just use a hack saw), you'll need to dome and polish the face. From my experience, domed faces make it significantly easier to get a crisp impression. Most historic tools also have this feature. Domes help get a cleaner impression because they allow you to apply more precise and concentrated pressure at each point of the tool's face.

However, the domes need not be extravagant, and especially not for smaller tools. In fact, anything less than 1⁄2" in diameter really only needs the suggestion of a curve, if that.

I normally start with a file to remove the saw marks (except for the last inch or so of the taper, for handling), even out the surface, and establish the gentle dome. After that, I systematically polish the face by rubbing it over successively finer grades of sandpaper mounted to bookboard (80μ/200grit → 45μ/400grit → 15μ/1200grit → 5μ/4000grit). Take care that you don't change the shape of the dome during the polishing process.



Transferring the Design

Once you've polished the face of the tool, you're now ready to transfer your design. This can be accomplished by freehanding the design with a felt tip pen such as Sakura Pigma Micron (sizes 005 or 01 are my preferred sizes) or a fine point permanent marker. Micron ink can be wiped away easily, which is handy when you need to change a line, but care must be taken to not smudge your design later while working on it. Fine point permanent markers do not smudge, but you must be more exact during layout.

Alternatively, there are products available that let you print your designs out on a clear plastic film and transfer the exact design onto the surface of your tool. This product is listed and linked on the material source page.

Executing the Design

For the most part I execute my designs from the outside in.* Once the design is transferred, I file to the outside perimeter. The interior details are then executed using whatever means necessary as dictated by the design. See chart below.

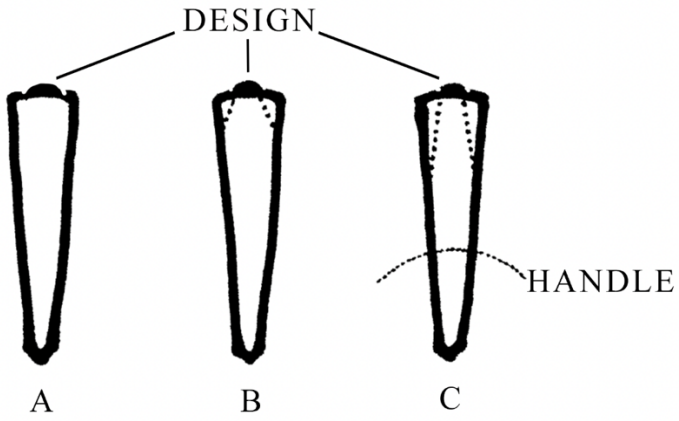
*One exception to this is if I'm making a 'halo' or 'ring' design. In that case, I drill the hole first, and then file around the hole until the ring is the desired thickness.

At the outset, working closer to the face of the tool makes correcting mistakes a bit easier, as filing or sanding the face quickly 'erases' any problem areas (see 'B' on the next page). If you make a mistake, it's best to correct it by removing the least amount of material possible. I do this by polishing the face of the tool beginning with the finest sandpaper, and if that doesn't work, I jump to the next finest, and so on until the mistake is gone.

Below is a table detailing most of the tools I use to execute designs, and in which applications I find them most useful.

Tool	Applications
Files, various sizes, shapes, and cuts	Shaping the blank, working the outer perimeter of the design
Jeweler's Saw (various blades)	Cutting small lines across the width of the design
Drill Bits (used with a rotary tool such as a Foredom Flex Shaft or Dremel, drill press, or 'egg beater' hand drill)	Drilling holes as part of the design, or initial negative space removal
Bur Bits (used with a rotary tool such as a Foredom Flex Shaft or Dremel)	Negative space removal
Square or 110 ° Graver	Cutting the outer border of design (before filing), general line work, details
Flat Graver (several sizes)	Background removal, cutting the interior 'walls' of the design
Onglette Graver	Extra fine shade lines

Tapered and tabled tools have the advantage of better sighting, as the widest point of the tool is the exact edge of your design. However, if your design is smaller than the width of the tool blank (A), you'll need to file the sides of the blank to meet the edge of the design. However, be sure not to carry the slope so far back that it nullifies the advantage of having a tapered shank to sink into the handle. (C)



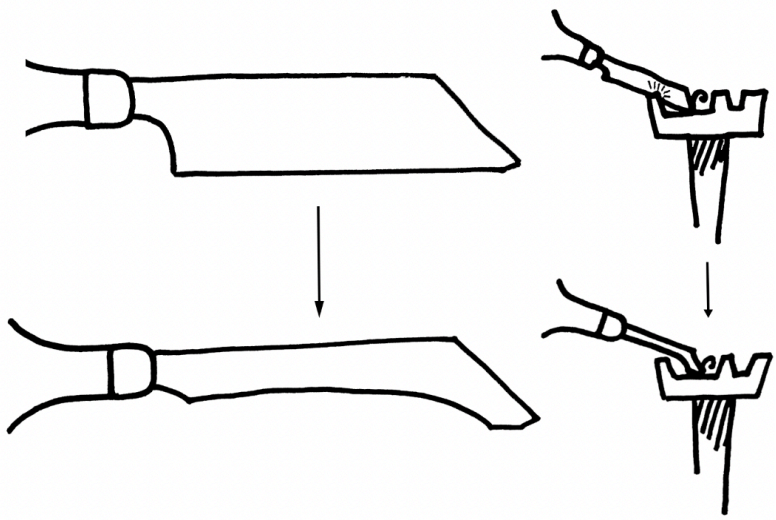
A Note on Engraving

From an approachability standpoint, I'd recommend avoiding engraving until you feel comfortable with all the other available options (see table above). Engraving is simple from a theoretical standpoint but challenging in practice. If you have really caught the toolmaking bug and know you want to incorporate engraving regularly, I'd recommend taking a short course (I took mine at the GRS Training Center in Emporia Kansas). That being said, I acknowledge that the decorative possibilities offered by engraving techniques are often what inspire people to make their own tools to begin with. While a detailed tutorial is out of the scope of this handout, I'll include a few introductory statements as well as some YouTube videos for general orientation.

Hand engraving is accomplished by forcing a small, steel cutting tool, called a graver, to cut grooves across the surface of metal in a controlled and intentional way. The force can come from hand pressure (hand-push engraving), gentle hammer taps (hammer and chisel engraving), or compressed air (pneumatic engraver). Gravers come in lots of different shapes, and the shape combined with the angle you use it results in different line characteristics. See table above for suggested applications of a few common gravers I often employ.

For work holding, a rotating engraver's vise (known as a block) is essential if you plan to pursue engraving in a regular capacity. It allows you to rotate your work rather than your body while you make cuts, which results in smoother lines. Otherwise, I'd recommend situating your vise so that you can move around it easily.

Magnification is also key to good engraving. Without being able to see what you're doing, it's nigh impossible to get satisfying results or to identify the cause of any issues. At the very least, I'd recommend getting Optivisors with the highest magnification money can buy. Digital microscopes can be had relatively inexpensively, and there are also professional-grade microscopes specifically designed for engraving, but these are very expensive.



Unlike ornamental surface engraving, the negative space of a finishing tool design needs to be cut comparatively deep to ensure a crisp impression. In order to ensure that the underside (belly) of your tool doesn't damage the surface of the design (top image), it's often helpful to grind away a portion of the belly of the graver to give it additional clearance (bottom).

Here are a few links to different YouTube videos I'd recommend to get acclimated.

Subject	Video Title	Link
Graver Anatomy	GRS University: Graver Anatomy	https://www.youtube.com/watch?v=TJtL-lpAFIg
Graver Sharpening	Hand Engraving 101 - Graver Sharpening for Beginners	https://www.youtube.com/watch?v=G3lRhvegkZ0
Engraving Basics	Hand-push hand engraving	https://www.youtube.com/watch?v=YwMhEOx8Zj8
Example of high-clearance gravers	Engraving Signet Ring	https://www.youtube.com/watch?v=TGGxJdg3Yx0

Making the Handle

For a dowel-based handle, first select a hardwood dowel of the desired thickness. I teeter between ¾-1" for my dowel diameters. Using a handsaw, cut off a suitable length, taking care the saw cut is perpendicular to the length of dowel. There's no 'right' length for a tool handle, but 5-6" generally gets the job done. Round off the edges of the dowel with a coarse file, pocketknife, or sandpaper.

Mark the center of the dowel with a pencil, and, using either a spring-loaded center punch or a hammer and a nail, make a small indention. This will give the drill bit something to grab. Next, wrap the dowel in a thick piece of leather or felt and clamp it in a vise, taking care that it is perpendicular to the ground. Using either a small electric hand drill or an 'egg beater' drill (my

preferred method), drill a small pilot hole using an 1/8" drill bit. Measure the diagonal thickness of your tool taper about 1" up from the bottom point, and select a drill bit with approximately that diameter. Widen the pilot hole using the larger bit, drilling about ¾-7/8" deep. This two-hole method gives the taper two points of contact inside the handle, helping keep your tool in place more securely (see top image on page 4).

Handling the Tool

I've tried tons of different techniques ranging from simply pounding the tool into a dry handle, to getting out my propane torch and burning it in, but my current process more or less follows the instructions provided by the French finishing tool making firm Maison Alivon.

1. Soak your handle in water until well saturated, drilled side down (15-20 minutes)
2. Insert tool shank in the handle and push it in until snug with hand pressure
3. Flip the tool over and position the face of the tool on a square of thick leather
4. Snug the tool in place with more hand pressure and a bit of body weight
5. If needed, gently tap what is now the top of the handle with a light wooden or rubber mallet (any light but hard implement will do) until the tool is firmly situated
6. Let dry, then sand handle with 220 grit sandpaper (optional)
7. Get tooling!

MATERIAL/TOOL SOURCES

Source	Material/Tool
Hardware Store (Lowes, etc.)	Hardwood dowels, coarse half round bastard file, spring loaded center punch, rubber/wooden mallet, bench vise, aluminum angle irons (for work clamping), sandpaper, drills and bits, hack saw and blades, metal cutting band saw
www.onlinemetals.com	Brass 360 stock
www.dickblick.com	Micron pens, fine point permanent markers
www.grs.com	Tiny bur bits, gravers, graver handles, hammer and chisel kits, graver sharpening jigs, engraver's block, magnification options, anything to do with engraving
www.riogrande.com	Jewelry grade files of all shapes and sizes, fancy sandpaper (3M adhesive backed microfinishing film for polishing tool faces), optivisors, jewelers saw and blades, foredom flex shaft
www.binderytools.com	Commercially available tapered handles
https://twdesignshone.com/	Transfer solution and film