Knife Making 101 – Stock Removal

My name is Kenneth Kailey (Avalon, Lord of House Draco in Amtgard and Temur Baras of the SCA). I have been making Stock Removal knives and swords off and on for over ten years. I am still a novice, by my own reckoning, and have much more to learn, but I am here to give you some insight into how to make your own stock removal knife.

This class is only an hour and there is WAY too much info to cover to do it justice. I am going to give a brief overview of the process as well as a pretty comprehensive resource list of where you can go to get more information. I also teach a four-part class on stock removal knife making in my shop. Talk to me about this if you are interested. Students leave the class with a completed 12” dagger and sheath.

At the end of this presentation is a listing of web based and non-web based resources that you can tap into to find out more about knife making. It isn’t by any means complete but it is a very good start. If you are looking for something specific, ask me either in person or by emailing me at moorcat@moorcat.com.
Methods of Knife Making

There are as many methods of knife making as there are knife makers. Some do knife making for a hobby, some do it for a second job and some do it as their only source of income. I started knife making to replace a broken sword, and got so into it that it has been a second source of income off and on since then. I will probably do it until they plant me six feet under. I hope one day to retire and do knife making as a full time occupation. Few make a lot of money making knives but many make a living at it.

A. Finishing a pre-made blade -

One of the most common ways to start knife making is to purchase a pre-made blade that has already been heat-treated and then finish it. Don't discount this as a viable way to get started. Some people do nothing but finish pre-made blades. Finish work is often the thing that a lot of knife makers slack on and a well-finished blade that was pre-made and then finished, can often outsell a blade made from scratch that is poorly finished. There are many resources that sell pre-made blades for reasonable prices and it is a cheap way to begin. You need much less in the way of tools – basically a drill, a set of files, and anvil to hold your work, some small clamps and some sandpaper. Of course, there are tools that will make the job easier, but you don't need much more than that.

Pre-made knives usually come to you already heat-treated, polished, and ready to mount the hardware on. A basic pre-made blade can be finished in under 10 hours total time and you don't need a shop to do it. I finished my first pre-made blade in under 8 hours and I used a corner of my kitchen table with a clamp-on vice (I was living in a basement apartment at the time and had no shop).

B. Forging a knife

"Forging" is the process of heating steel to a plastic state and hammering it to shape. This process is much more involved and requires some pretty expensive tools. You can make do with makeshift tools but the results are harder to obtain. This is the way most knives and swords were made in medieval times.

Medieval smiths used coal forges to heat the metal to temperature. Today, most smiths use propane forges. The heat is more controllable and there is less of a chance to "burn" the carbon out of the blade. The knives are still finished the same way a stock removal knife if finished, though.

Damascus, or folded steel is made by forging. The metal is heated, lengthened out, and then cut. The pieces are forge welded together and then the process repeats. Some medieval smiths folded their blades till there were literally
thousands of layers of steel in the blade. This has the effect of making the blade stronger as well as sharper. The edge has a microscopic serration to it that adds to the ability of the blade to cut. Pattern welded Damascus is folded steel that has been folded in such a way as to leave a pattern. This type of steel is usually folded less than 600 layers, because after that, the pattern becomes invisible. Usually, this involves layering two or three different kinds steel. One is usually a low carbon steel for strength and a high carbon steel for hardness. Japanese steel was actually many kinds of metals including silver. Japanese blades were incredibly strong because of it.

Forging requires some kind of a heat source or forge and some kind of an anvil or large piece of heavy metal to act as an anvil. My first forge was a coal forge made from a truck wheel and the blower from a hair dryer. My first anvil was a length of railroad track that had been ground flat. While this worked for simple forging, I am currently setting up to purchase a nice Venturi propane forge and a 260# anvil. Be careful about setting up a forge, though. Many towns and cities have very strict noise and fire ordinances that would prevent you from operating a forge. It would really be painful to spend about a thousand dollars on a forge and anvil and then not be able to use them.

C. Stock Removal knife making -

What I am here to talk about today is Stock Removal knife making. This is the process of grinding a flat piece of steel into shape and then cutting in a blade. Most knife making today is done by stock removal. Since most modern steels are vastly superior to the steels that were being used in medieval times, a stock removal knife is usually just as strong as a forged knife. Forging can be used to add carbon to a blade, but most steels today don't require any extra carbon added. I will talk more about this later.

A stock removal knife starts as a bar of high carbon steel. A design is transferred to the steel and then the knife is “profiled” or cut to shape. Once the knife is cut to shape, a scribe line is etched in the blade and the maker cuts in the blade. The knife is semi-polished, heat treated and then re-polished. The handle and guards are cut and affixed, and then the knife is final shaped. A final polish finishes the knife. A sheath is then made so that you can carry it. The last step is to sharpen the knife for use.

I will go over each of these steps in detail so that you will have a pretty good understanding about how to make your own knife. I have learned some of these steps the hard way and will try to emphasize the mistakes I made so that you don't have to. I will also give you some tips about tools that you can make or modify to make it easier.
This presentation is aimed at the starting maker without a lot of money. I will talk about some of the higher end tools that you can use but for the most part, I will try to explain how to do this with the minimum expenditure. I made my first knife with less than $100 worth of tools. It can be done with a set of files, an anvil, a drill, some sandpaper and a lot of elbow grease. I wouldn’t recommend it, but it can be done that way...

2. Setting up a Shop or Work Area

Let’s talk about tools for a little bit. As I said before, it doesn’t take a lot of tools to make a knife. There are some people that do knife making using a minimum amount of tools and are very happy doing it that way. I am lazy and enjoy using my “toys”. Let’s start with the basics. Remember that garage sales, thrift stores, pawn shops and auctions are your friends. I will quote what the tools will probably run you new and if I know where you can get them, I will list it but you can save a bundle by either making your tools (plans are available for a lot of them – check the resources…) or buying your tools second hand.

A. Basic Tools -

The first thing you will need is a place to work. If you are making your own knife verses finishing a pre-made blade, you will need a work area. Remember that knife shops are called “dust factories” for a reason. Your significant other will probably kill you or worse if you fire up a grinder in her kitchen. Knife and handle material dust will pervade everything in the area of where you work. I highly recommend a semi-dedicated area. My first shop was 10’ X 10’ in the back of a one-car garage. I wouldn’t recommend storing the car in the garage while you work, though, unless you really enjoy washing it.

An important thing to keep in mind, when knife making, is ventilation. Knife making produces an inordinate amount of airborne dust even when using hand tools and sandpaper. Some handle materials are even toxic. My shop is cross-ventilated with a large box fan and two open windows. A lot of professional knife makers install dust collection systems. For the beginning maker, a simple box fan mounted in a window pulling the dust out of your work area is probably adequate.

Next you need a place to work on. A large table is probably adequate but a workbench is pretty easy to build and provides a steady work area. I built an 8’ X 2’ workbench out of $26 worth of materials. My current shop has 5 of those as well as an 8’ X 4’ free-standing workbench. It still isn’t enough for me but I am REALLY into tools...
To do decent work, you need a vice. It holds your work steady for most of the operations that you will be doing and it acts as a second set of hands. You can usually find a small 3.5” vice that you can mount to a workbench for around $10 at most cheap tool places like Harbor Freight. You won’t need much more than that. If you want, mount a second one vertically on the side of your workbench for holding blades horizontally.

Files are cheap and you can never have enough of them. The big “bastard cut” files work well on steel and the smaller files can be used to shape your handle material. I bought a cheap set of files for about $10 at a local tool store. Needle files (really small files in various shapes) work really well for cutting slots in guards, shaping tang holes in through tang knives and for general touch up work around the guard. Again, you can usually find cheap sets of these at most discount tool stores. If you are going to do any kind of curved work on blades (serrations on the blade or guthooks), I highly recommend chain saw files. Few round files cut as well on blade steel.

Next you will need “C” clamps for gluing your handle material to your knife blade. These are easy to find and really cheap. Usually, they run less than $2 and you can find them almost anywhere – including the dollar store.

About the only power tool that you absolutely need is a hand drill. A hand drill is invaluable to knife making. You use it to drill your pin holes in the tang of the knife for affixing the handle or guard, with sanding drums, you can shape finger cutouts, with polishing wheels, you can polish your knife or knife handle, you can use it to make sewing your sheath easier as well as about a hundred other things that come to mind. You can even build a cheap plywood stand and mount buffing wheels to it for buffing your knife. Drills are cheap too. You can usually find one at the local second hand or pawn shop for under $10. I have three of them as well as my drill press and I am constantly using them.

Other things you will need include sandpaper of various grits, a carbide scriber for marking your blade, a metal cutting hacksaw, a small metal ruler for measuring and marking your guard and an automatic center punch for marking your pin holes.

B. Advanced tools

Now we get into some of the “nice to have” things. These will all make the job easier but they can run some serious dollars. I would recommend that you at least give knife making a try before running out and buying a couple thousand dollars worth of tools. As with anything, you will usually get what you pay for. A really nice variable speed 2” X 72” grinder kicks ass on a little 1” X 30” grinder. It all depends on how much you want to invest and how much you will use them.
First let's talk about grinders. While you can shape a knife with a set of files, it isn't much fun. That is where power belt grinders come in. They can range from a simple 1” x 30” 1/5th horsepower grinder to a monster 2hp variable speed 2” x 72” grinder. If you are serious about knife making, I urge you to get the best grinder that you can afford. I am currently looking into a big 2” X 72” grinder for me. I have outgrown the grinder that I have and need a much more powerful grinder to keep up with my demand.

A simple 1” X 30” grinder will run about $50. It will do the job on smaller knives if you have patience. Since it is low powered, it is really easy to stop but over time, it will cut a decent blade. The advantage is that it is slow, so that the beginning maker can learn the basics about making a blade. These grinders also work really well on handle materials and for rough sharpening of blades. I have two in my shop and I use both constantly.

A nice middle step is a 1” x 42” belt grinder. The belts are easy to find, and it cuts blades in very nicely, even on some of the larger blades. Mine is a ½ horsepower grinder and it works very well for cutting the blades on my knives. I paid about $100 at a discount tool store for it.

Another nice middle step is a larger 2” x 48” belt grinder. Mine is a JET grinder and I paid about $200 for it. It is ½ horsepower but the larger belt makes it better for profiling blades. One advantage to the JET is that 2” x 48” belts come in more styles and grits than the 1” x 42” grinder belts.

The Cadillac of knife making grinders is the 2” X 72” grinder. They range from $300 for a cheap Grizzly knifemaking grinder to $2000 for a 2hp variable speed Hardcore grinder. There are all kinds of advantages to using the bigger grinder. The first is that the contact wheel is large enough to do hollow grinds. The second is that it is powerful enough to hog off steel without slowing down (or even stopping) the grinder. A nice compromise is purchasing a Coote grinder. It comes without a motor attached. They run around $400 and you can usually find a single speed 1 hp motor for under $100. For around $250 you can get a variable speed motor and end up with a really nice variable speed grinder for under $800. This is the route that I am looking at now for me. I have used quite a few 2” x 72” grinders and I really like the Coote. Your mileage may vary. If you do decide to do knife making professionally, you will absolutely NEED a big, powerful grinder.

The next tool to talk about is the bench wheel grinder. This is a really nice tool for buffing your blades and handles and it is often used to bring out that mirror finish that Stainless Steel is so famous for. It is also absolutely the most dangerous tool in the shop. I will talk more about this later.
I myself don’t have any use for the abrasive wheels that usually come with this grinder. Other than removing the slag after plasma cutting my blades (and even then the belt grinder usually works better), I don’t use them very often. What I have used is a belt wheel, though. Since I do not have a big belt grinder, I cannot do hollow grinding. I purchased an 8” wheel that accepts 2” strips of abrasive paper. I can use this on my 8” buffer to cut hollow grinds in my blades. I do not hollow grind often, but occasionally I get an order for a hollow ground knife.

The advantage to bench grinders/buffers is that they are cheap. A 6”, ½ hp bench grinder runs about $36 at the local discount tool store. The 8” model runs about $50.

Another nice thing to have is some kind of drill press. Small bench models start at about $40 and go up from there. The nice thing about a drill press is that the holes you drill for your pins will be straight and perpendicular. No matter how steady a hand you have or how good your eye is, it is virtually impossible to do that with a hand drill. A tight fitting pinhole will hold on your handle slabs better and make a longer lasting knife. A drill press can also be used with a rotary tool attachment to do finish work on your knife or a sanding drum attachment to cut finger grooves and cutouts.

One tool that many knifemakers use is a large disk sander. This is really useful for profiling knives. Mine is 1 hp and will actually profile most of a knife faster than my belt sander. For small knives, you can actually cut in your blade on a disk sander. The benefit is that the blade will be perfectly flat ground, something that is somewhat difficult to do with a belt sander without a lot of practice. Mine ran me about $100 at the local discount tool store.

Recently, I have had access to someone with a plasma cutter. This is a wonderful tool but kind of spendy. The cutter was $500 and the air compressor that the cutter needs was another $200. The nice thing about the plasma cutter is that it saves an amazing amount of time and belts when profiling knives. I highly recommend this route if you are going to do a lot of knives, especially if they are oddly shaped.

I could go on for a long time on other tools that make the job easier but these are the basic tools to get the job done. Anything else just cuts time off the process and for the most part, is a personal preference thing.

4. Shop Safety

While we are on the subject of tools, lets talk about safety. Shop safety cannot be stressed enough. You only have one set of eyes, ears and lungs (as well as
fingers, toes etc) so it behooves you to protect them. Let’s not beat around the bush here. We are talking about making sharp pointy objects out of steel. This involves power tools, dust production and basic shop safety.

A. Basic Shop Safety

The cardinal rule is to protect everything. Wear gloves on your hands, safety glasses over your eyes, and a dust protector over your mouth and nose. Wear cotton clothing in the shop whenever you are working on your knife, even when you don’t think that you will be grinding. A friend of mine wore a rayon shirt into the shop one day to do some hand sanding and decided on the spur of the moment to grind a spur off a blade he was working on. The burned rayon had to be cut out of his skin. It wasn’t pretty.

Gloves are a pain in the butt to wear when you are working. They seem to get in the way and make handling everything harder. What you have to remember is that you are grinding STEEL. Anything that will remove steel, will remove skin a lot faster. I can show you where I slipped and hit the grinding belt with my gloves. If I hadn’t had my gloves on, it would have been my hand. Grinding also heats that steel. It doesn’t take long before the steel of your blade is too hot to handle.

The reason for the dust mask is simple. Most grinding abrasives are silicon Carbide. In dust form, Silicon Carbide can lead to Silicosis, a condition that can kill you. Also, a lot of handle materials are toxic. One of the most famous of these is Cocobolo, a very popular knife handle material. Never work on unfamiliar materials without a mask, even by hand. Hand sanding can kick up an amazing amount of dust.

I highly recommend a full front apron, preferably made of light leather or heavy cotton denim. This serves a lot of purposes. The first is that it protects your clothes from dust, hot sparks and sharp materials. The most important is that it protects your body from those things as well. I had a knife grabbed out of my hand and thrown back at me. The heavy denim apron I was wearing caught the knife and kept it from cutting me. It cut the apron, but not me.

This brings up one of the most important aspects of safety that is all too often overlooked. Common Sense. Never work tired or distracted. Keep in mind the safety tips for all the tools you use. Never rough house or grab-ass in a shop, especially around power tools.

B. Power tool safety
Power tools make knife making a lot easier but they are also a safety risk. Many of the tools used in knife making are powerful, aggressive and dangerous. The most dangerous tool in the shop actually appears to be the most benign but to the unwary, it is VERY dangerous. Remember that anything that is used to remove steel will remove skin.

I want to spend a little time talking about the buffer. Too often, this tool is overlooked when people talk about power tool safety. This is actually a very dangerous tool. Used improperly, this tool can actually grab a knife out of your hand and throw it back at you at amazing speeds. I’ve had one knife actually embedded in the floor between my feet by doing something wrong on the buffer.

The key to using the buffer is to only work on the bottom front quadrant of the wheel. This keeps the work piece in a position that if it does get grabbed by the wheel, it will either be thrown down or away from you.

5. Anatomy of a Knife

By now, you are probably really bored listening to me talk and are going “Alright, when is he going to start talking about KNIVES?” Well, that time has come. Let’s talk about what a knife is and what the parts of a knife are.

A. Types of knives

There are all kinds of knives for all kinds of purposes. Remember that a knife is nothing more than a tool and as such, each type of knife is designed to fill that function. There are knives for hunting, skinning, eating, working, survival, tactical situations, and then there are some knives that serve no other purpose but killing. Each type of knife has qualities that make it what it is. There is no such thing an “all around” knife. A knife that is used to skin wouldn’t be much use as a camp knife. A tactical fighting knife wouldn’t be much good for ranch use.

The basic types of knives are usually listed as; hunters – knives that are used for hunting and fishing, Camp knives – large knives, usually with large guards, that are used for camp chores such as cutting down small trees and opening that pesky can of beans, Skinning knives – usually classified as having a large thin flat blade that is sharpened to a razor’s edge, Survival knives – usually large fighting style blades with serrations, saw blades or wicked attachments, Daggers – usually double-sided straight blades (often medieval reproductions), Fantasy knives – anything from medieval reproductions to monstrous fighting gloves with 20 or 30 separate blades, fighting knives – usually medium to large blades, often slightly curved, and folders – knives that fold in some manner.
I have at one point or another made all of these blades. I am not too keen on folders, but that is my personal taste. I also tend to stick with large fixed blades. Each person is different and everyone has an innate sense of what they like in a blade. The key is finding what works for you and going for it. It is also important to match the blade to the purpose for which it is intended. You don’t want to make a skinning knife out of ⅛” steel stock. It is just too thick and you will never get a truly good edge for skinning. By the same token, you don’t want to make a camp knife less than 3/16th thick or your customer won’t be able to cut down that tree that is bothering him in the middle of his camp. It is a balancing act but once you have figured out what you want to use the knife for, it makes it easier to figure out how to make it. I will discuss this a little more when we talk about designing your knife.

**B. Basic slab handled knife**

This is probably the easiest knife to make. It has a basic blade to which you attach two knife handle slabs. This drawing shows using a special kind of bolt for attaching the handle slabs but it could just as easily be pins. The handle material is held to the knife blank by an epoxy-type glue and by the pins.

**C. Slab handle with Bolsters**

Not much different than a slab handled knife except that two metal bolsters are added. These do not absolutely need to be pinned but if you don’t, even with soldering, the bolsters will eventually come off.

**D. Slab handle with guard**

Again, very similar to a basic slab handled knife. The guard is soldered or glued on and again pinned.

**E. Stub tang**

This is a form of “hidden tang” knife. Made correctly, this is almost as strong as a full hidden tang knife. This form of knife is commonly used when using an elk or stag crown for handle material. The tang hole is drilled into the crown and then the tang is glued in place. The notches are to provide more hold for the epoxy. A small hole is drilled in at the base of the hole to allow air to escape and the epoxy to fill the hole. When the tang is inserted, the small hole fills with epoxy and in antler, disappears. Usually, this type of knife has a guard.
F. Full hidden tang

Like a stub tang, the tang of the knife, is hidden by the handle material. The difference is that the tang extends the length of the handle material. The end of the tang is threaded and the pommel of the knife is screwed on the end, holding the knife handle together.

6. Materials for Knife making

Knives are made out of all kinds of steels, and all kinds of materials are used for handles, guards, bolsters, and pommels. I will discuss the most common ones.

A. Knife Steels –

I could spend days talking about the different kinds of steels used for knife making. Don’t worry, I won’t bore you with that discussion. Instead, I will stick to the real basics. Knife steels are broken down into the High Carbon Tools steels, Stainless steels and the exotics like Talonite and Satinite.

All knife steels have one major thing in common. They have at least 5% carbon as part of their makeup. This is important. Anything less than 5% carbon will not get hard enough to hold an edge. It is the carbon content that separates the mild steels from the tool steels. Tools steels will harden when heat-treated.

High carbon tool steels include 1095 and 1084 tools steel, O-1, D-2, W2, and 5160. This isn’t all of them, but they are the most common that you will find. 5160, 1095, and 1084 are all fairly easy to find and are relatively cheap. O-1, D-2 and W-2 are a little harder to find and tend to be more expensive. All are good steels for making knives. In a lot of ways, they are superior to the stainless steels for knives in that you can heat-treat them harder without making them brittle. The majority of knives that I make are 1095 or O-1.

The stainless steels such as 440C, 440V, ATS34, and 154CM are used a lot by the production knife makers. The knives that are made with these materials are usually shinier and easier to care for due to the steel having things like Chromium and Vanadium added to the alloy. This is also this type of steel’s weakness. When you add impurities like Vanadium or Chromium, you can’t make the steel as hard before it gets brittle. Don’t misunderstand. A 440C stainless blade at a Rockwell of 58 will still hold a decent edge for a long time. It is just that a 1095 blade heat treated to 61 will hold an edge longer. For every point above 56 you go, you increase edge-holding capability by about 25%. The trade off is a knife that you can polish to a mirror finish that you don’t have to clean as often.
The exotic steels like BG32, Satinite and Talonite are new Crucible steels. These steels are produced by the high-tech Crucible Steel Company and are truly amazing. Even though they are extremely expensive and hard to work with, they produce some of the most amazing knives I have ever seen. I have one Talonite knife that has a Rockwell hardness of 63 and is pretty much indestructible. I have real problems just trying to sharpen it. In the six years that I have owned the knife, I have only sharpened it once and it still shaves hair off my arm.

**B. Guard materials**

For guards and pommels, there are a lot more choices. The most common is brass. It is easy to work with and takes a beautiful shine. Another common material is nickel silver and mild stainless.

**C. Handle Materials**

The sky is the limit on handle materials. Common materials include exotic woods, pakkawood (a wood laminate), Micarta (a resin polymer), natural materials such as antler, bone and petrified wood, stabilized wood (wood impregnated with a polymer resin under a vacuum), and stone. I tend to work with pakkawood because it is easy to work with, lasts forever, is probably the least expensive of the handle materials, and comes in about any color you can imagine. I also use a lot of Micarta. I rarely use antler or bone because it is extremely fragile, difficult to work with and doesn’t last well.

7. **Making Your Blade**

Well, you have managed to make it this far and we are actually going to talk about the meat of the subject – making the knife. We have our piece of steel and are ready to begin. The question is where...

**A. Designing your knife**

Remember a while ago when I was talking about the different types of knives? This is where all that comes in. First ask yourself, “What am I going to use this knife for?” For most of us, that means that we are going to carry it around for looks at events and occasionally eat with it so we can show everyone how much of a Barbarian we are. Well, at least that is what I am going to use mine for...

Before the steel ever hits the grinder, you should already know what you are going to make. I always make a pattern for every knife that I make. First I decide what design I am going to use based on what I want the knife for, and then I draw it on paper. If I like the design, I transfer it to 1/8” or 1/4” pressboard. After profiling the pressboard knife, I look at it again to make sure it
is what I want. Then and only then do I transfer the pattern to steel. The added benefit to this is that if someone else wants that same kind of knife, I already have the pattern ready.

**B. Cutting the Steel and profiling the knife**

So you have your pattern and you want to start to cut steel. First trace your pattern onto the steel with a carbide scriber. If your steel has a lot of mill scale (that ugly grayish scale on the outside of hot rolled steel), you might first want to sand that off until you have a bright shiny surface to work with. Another thing that you can do is take black pattern dye and dye the surface of your piece first. The scribe lines will then show up better.

Now you have your pattern scribed onto the steel. Before you start profiling the knife, you should first drill out your pin holes. This gives you solid edges to hold the piece in the drill press or vice when you cut the pin holes. If you profile first, it is really difficult to hold the piece solidly in a vice. NEVER attempt to hold a piece in your hand when you are cutting pin holes. You might get away with it a few times, but eventually, the drill bit will catch in the steel and you suddenly have a thin piece of metal whirling around like a weed eater. Imagine what that will do to your hand if it is in the way. Use a vice. Save your hands.

Now you are ready to “profile” the knife. This means that you are going to cut the metal shape. If you have access to a plasma cutter, this will make your job much easier. If not, you need to start grinding.

Initially, grind to within about 1/16 of your scribe line. Constantly check your piece and see what you have left to do. Once you have come to within 1/16th of the grind line all around, finish profiling to your line. Depending on the complexity of the knife and the power of your grinder, this can take awhile. Profiling is probably the longest operation, short of final finishing.

**C. Marking your centerlines.**

Once the knife is profiled, you have to mark your centerline on your blade. The idea is to cut in your blade evenly to the centerline. It helps to know where that is. Attempting to measure the center of a 3/16th inch thick blade with a metal ruler is a joke so I designed a little tool to help me do this.

It is actually nothing more than a 2” square piece of oak that I have drilled a small hole into a little above 1/8” above the bottom in the middle of one side. In this hole, I have glued a carbide scribe point from my carbide scriber. On the other side of the block, I drilled and tapped a hole to accept a ¼ - 20 bolt. I inserted a 1 ½” ¼ - 20 bolt through the block to adjust for depth. I adjust the
screw so that on a flat table, the scribe point is at the middle of the blade. I slide
the scribe up the blade, marking the centerline. I then turn the blade over and
do it again. If my measurement was off, I now have two lines with the centerline
between them. This is OK, because you don’t want to grind completely to the
centerline anyway. You want to grind to within about 1/32” of the centerline.
That way, the edge won’t be destroyed by the heat-treat process.

D. Grinding your blade

There are basically three blade configurations that you can grind to. I have
mentioned a couple of them so far. The first is a Hollow grind. This is actually a
concave grind done on a round wheel grinder. The benefit of this grind is that
the blade maintains a much sharper edge for a longer time and it is easier to
return the blade to a razor’s edge. The disadvantage is that the edge is weaker
and easier to nick. Repeated sharpening wears the blade down faster.

The second configuration is the flat grind. This is a pretty good all around grind.
It is easy to return the blade to sharpness and yet the blade lasts longer with
repeated sharpening. It isn’t so easy to obtain, though. Even with a flat platen
on your grinder, it is still difficult to cut a truly flat grind without a lot of practice.

The third is the convex grind or Moran Grind. Most decent camp knives and
knives that take a lot of abuse have this type of grind. You end up with a really
strong edge that takes a lot of abuse without serious damage. The disadvantage
is that it won’t take the kind of razor’s edge that a hollow grind will.

Unless you have an 8” contact wheel on your grinder, hollow grinding is probably
out. It is pretty, but difficult to do even if you have the right equipment. The
easiest grind to attempt with limited equipment is the flat grind. If you have one
of the longer belt grinders, you can do a Moran grind above the platen on the
slack belt. For the purposes of this discussion, we will stick with the flat grind.

Should you grind with the blade up or the blade down? Ask 10 makers and you
will have about 60% say blade up and 40% will say blade down. I am of the
“blade up” school because I can see my centerlines when I am grinding blade up
and I don’t trust myself enough to grind blade down. I have also found that I
can keep my grind lines more even and my grind flatter when I grind blade up.

Start with a new belt in your grinder. I know that money can be tight, but you
have to think in terms of belts being free. If not, you will use belts beyond their
ability to cut correctly and end up messing up your piece. A new belt cuts
cleaner, and produces less heat. This isn’t as important now but after the piece is
heat-treated, it can make a huge difference.
At this point, you have a sharp 90-degree edge on the blade. To maximize belt life, bring the blade into the belt at a 45-degree angle and grind off the sharp edge. It doesn't take much and you will find that your belts last longer.

Now it’s time to grind the blade. Starting at the ricasso area of the knife, start grinding away that steel, moving slowly toward the tip. It is important that you hold the knife steady and at the angle you want your blade. Once you have done this a few times, you will “feel” when you are at the right angle. The blade will begin to heat up. Have a small bucket of water near your grinder to dip the blade into occasionally. Your hands will thank you for it. Slowly work the grind in until the depth of the blade is what you want and the blade has been ground almost to the centerline. Turn the blade over and grind the same way on the other side. Check your work often. Don’t be afraid to make adjustments to the angle you are grinding at. Eventually, you will get a feel for it and it will come naturally.

Once your blade is ground in and you are happy with it, it is time to polish it for heat-treat. Starting with 80 grit sand paper, hand sand the blade until all the major grinding scratches are gone. Move to 220 grit and do it all over again. Move to 330 grit and do it again. What you should end with is a satin finish. Use a hardwood block behind the sandpaper so that the grind lines stay nice and sharp.

If you have a buffer, you can use a brush-on compound and buff to 300 grit but this will dull your grind lines unless you are extremely careful.

As a last step, use some Acetone to remove any oils or contaminates from the blade prior to heat-treat.

8. Heat treating your blade

Wayne Goddard, probably the one of the most gifted knife makers alive today, once told me that the Heat-treat is the heart and soul of a knife. A beautiful, poorly heat-treated knife is worthless. A shitty looking well heat-treated knife is still a knife. Makes sense.

A. What is heat-treating anyway?

Heat-treating is actually a three-step process. First the knife is normalized (heated to a critical temperature and then allowed to sit to remove any internal stresses), then heat-treated (hardened to full hardness), and finally tempered (softened to a usable hardness).
Hardness is the opposite of Strength. To achieve one, you must compromise the other. If you make a knife too hard, it holds an edge forever, but if you bend it wrong, it breaks. If you make a knife too soft, you can bend it into a pretzel but it won’t hold an edge. For most steels, the compromise lies between 58 and 60. At this point, the steel will hold an edge well and yet you can bend it to a 90-degree angle without it breaking.

Heat-treating is a science. I have in my library four different books devoted strictly to heat-treating. It requires a heat source, some way to measure the temperature of the steel, and some way to rapidly cool the steel to lock the hardness into the steel.

My suggestion to you is to have your first couple of pieces professionally heat-treated. Though I have done my own heat-treating in the past, I still use a professional service to do my heat-treating. I have included a quick and dirty heat-treating cheat sheet with the other resource information but I don’t recommend it unless you are really comfortable working with hot steel and have the right equipment.

Different steels have different methods and temperatures of heat-treating. Some are air-quench steels, some are oil-quench and some are water-quench. Stainless steels require a higher temperature to heat-treat as a rule than high carbon steels.

9. Putting on the handle and the guard.

The blade is now heat-treated and you have it back in your hot little hand. What do you do with it now?

A. Polishing the blade

Unless the Heat-treat involved using Salt pots, you will have a black and gray scale all over your blade. This is caused by oxygen in the heat-treat process and must be removed. It will be hard and difficult to remove and you have to do it carefully so that you don’t heat the blade enough to destroy the temper of the blade. Work slowly either with a buffer and brush on 150-grit compound or by hand with 220-grit paper. It will be slow and irritating but necessary. Once the scale is gone, use progressively finer grits of sandpaper until all the sandpaper scratches are gone. I usually go to a 600-grit myself. If you are using Stainless and you want that mirror finish, you might want to go to 1000-grit.
B. Making and attaching your guard.

Now that your blade is polished, it is time to do the guard. If you are making a through-tang knife, you need to cut a slot in the guard to fit the tang through. If you are making bolsters, you need to cut them to shape and drill the pin holes.

To cut a slot for the tang, measure the tang area where the guard is to go, and mark the slot on the guard piece. Using a drill slightly smaller than the tang thickness, drill a series of overlapping holes in the guard where the slot will be. Use a needle file to clean up the slot and slightly enlarge it to the size of the tang. Test the fit often. The fit should be tight enough to hold position on its own. The knife should butt up solidly against the guard.

There are two methods of attaching the guard to the knife. One is to solder the guard in place. Using silver solder and flux, heat the guard area evenly until the solder flows freely. Remember to heat sink the blade area of the knife to prevent the temper from being destroyed. Do not overheat the area. Allow the solder to flow between the guard and tang, filling all the gaps completely.

The second method is to use a metal adhesive such as JB Weld or Devcon’s Titanium Metal epoxy. This is not quite as strong as soldering the guard in place but usually fills the gaps better and is much easier. It also has the advantage that it will not heat the blade, so the possibility of ruining the temper doesn’t exist.

The method of attaching bolsters is similar. Rough shape the bolsters to the desired shape. If you are using epoxy, apply the epoxy to the bolsters and then pin the bolsters in place. Use a clamp to hold the bolsters tight to the blade but do not over tighten. When the epoxy has set, peen the pins. If you are soldering, apply flux to the bolsters and blade area. Insert the pins and peen them. Heat sink the blade and then heat the bolster area until the solder flows freely filling all the gaps.

C. Making your handle or handle slabs.

Once your guard is on, it is time to make the handle slabs or to drill the handle for the tang. If you are working with a through tang knife, this is simple. Measure the tang and drill a hole through the tang big enough to accept the tang.

If you are working with a slab-handled knife, it is a little more complicated. First, mark the handle shape on the handle slabs and rough profile the handle slabs. This makes them easier to work with and also has the benefit of making finishing the knife easier.
Now it is time to use another trick I have learned. Get yourself some double-sided carpet tape. This stuff is great. Cut off a piece big enough to fit on one side of the handle. Using the double-sided tape, affix one of the handle slabs to the handle. Insure that the handle material is firmly up against the bolster or guard and that no gaps exist between them. If there is, sand the adjoining handle material until it fits snugly against the guard or bolster.

With the handle material affixed to the blade, drill your pin holes using the knife blank as a guide. Try to drill the holes as straight as possible.

Using the carpet tape, repeat the procedure with the other handle slab. Ensure that the pins fit in both sides of the handle material and that the handle slabs are still tight against the bolster or guard. Remove the double-sided tape and rough up the side of the handle slabs that fit against the knife so that the epoxy has a stronger grip. Apply the epoxy to the handle slabs and affix them to the knife blank. Insert the pins and then use “C” clamps to hold the handle slabs to the knife blank. DO NOT OVERTIGHTEN.

For a through-tang knife, you have to finish the pommel first. Drill and tap the pommel to the proper thread and then you are ready. Before assembling with epoxy, test fit all the pieces together and make sure everything fits well. Then reassemble filling the handle piece with epoxy. Put some epoxy in the pommel as well and then thread the pommel onto the tang until the handle and pommel are tight. Clean up any excess epoxy at this point.

10. Finishing the Knife

Now the handle has been assembled and your project is actually beginning to look like a knife. It is time to finish it off.

A. Finishing the handle

Remember that blade that we worked so hard to mirror polish? We want to protect that polish while we finish the handle and guard. The best way to do that is to take masking tape and wrap the blade with it. This will protect the blade somewhat from anything we do to the handle or guard.

Now that the blade is protected, you need to start working on shaping the handle and guard. This is purely a matter of personal preference. The more work you did prior to assembling the knife, the less you have to do now. What shape you leave the handle and guard is up to you. When you get it close to the final shape you want, start working with progressively finer grits of paper. Eventually
you want to be to at least a 400-grit. This is a boring and sometimes time-consuming process so don’t get discouraged. The end is worth the work.

Once you reach 400-grit, you should have a pretty smooth and almost polished looking handle. If you have a buffer, touch up the polish on the buffer. This will bring out that glassy shine.

B. Polishing Tips –

When you are polishing, remember that you don’t want to overheat the material. Some materials like ivory and bone are really easy to overheat. Pakkawood and Micarta are much harder to overheat but it is still possible.

Also, use a clean buff with white polishing compound. Anything else is way too aggressive to polish handles. This will leave a white film on your handle but it is easily removable with WD40 and a clean rag. Use a final polish with a clean rag and either paste wax or knife polish.

When the handle is polished and ready, remove the tape from the blade. Some of the adhesive will remain but can be easily removed with Acetone. Do a final polish of the blade to bring back the shine and your knife is completed.

That’s it. Knife Making 101 is done. If you are still interested and would like to attend the four-day class that I teach on knife making, contact me and I will give you a schedule on when it is going to occur.

Good luck and remember, this is a craft that takes skill not talent. There are those that have talent but any skill can be mastered with perseverance.