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Safety Warning

PLEASE READ THIS WARNING

Knifemaking, like just about anything else you do with your hands, involves some risks. Throughout this book specific techniques include relevant precautions, but I'd like to say a general word or two right here at the beginning.

All the instructions in this book assume common sense and sober judgment on the part of the reader. Knifemaking involves sharp tools and powerful machinery; there's just no way around it. Before starting to work, mentally break each process into its component parts and examine it for potential dangers. A problem foreseen is a problem averted. This list of basic safety rules applies in all situations and is given as a reminder.

Read this page often. This is for your safety.

- Never work when drowsy, preoccupied, or intoxicated.
- Always wear goggles when using a power grinder, sander, or drill.
- Never wear loose clothing when using power equipment. This includes hats and scarves.
- Always read labels and understand fully the ingredients and dangers of every chemical in your shop.
- Never startle or interrupt another worker at a power machine.
- If you’re teaching someone, don’t assume they know these safety rules. Explain them and insist on their use.
Introduction

It is not hard to imagine that a knife was the first tool to be made by our primitive ancestors. In every corner of the globe, at every period of recorded history, every civilization has built up a rich tradition of knives. The study of blades tells anthropologists a great deal about a culture, but the interest that brings you to a book like this is probably less academic.

A knife is a direct extension of the hand and the will. Perhaps this accounts for the attraction that knives have for so many people. Knives combine beauty and utility in a wonderfully human scale. They are a practical example of the harmonizing of many elements into an object of lasting value. The history and diversity of knifemaking is vast and includes not just the camping and fighting knives that receive popular attention, but their hardworking siblings like paring knives, gardener’s knives, and fancy pen knives.

Because you are reading this book, I’d guess that you already know how appealing knives can be. You might also know of the special magic that comes from making a knife. There is a rare pleasure in successfully orchestrating technical and design elements to create an object that is personally meaningful. If you’ve never made a knife, this book can get you started. If you’ve had some experience, you’ll find enough diversity here to ensure some fresh ideas for your work.

This book provides practical instruction on many aspects of knifemaking. It is my intention to open this experience to a wide audience. The directions given here, seasoned with a little common sense, will allow any reader to discover the pleasure of making a knife.
In many ways this book is like a cookbook. Even experienced cooks use cookbooks, but as skills increase, personal variations are introduced. I hope that readers of this book will feel free to move beyond the “recipes” given here, mixing, matching, and inventing original components in their knives. Like many cookbooks, this text gives much attention to details, opening the field to students with little background. Those readers with some experience will easily pass over these details without losing the impact of the lesson.

To cover a lot of material in an efficient way, this book is designed around a series of projects. Ten very different knives are made here, each one introducing new techniques and design challenges. Together they comprise a survey of knifemaking skills. The projects are arranged in a logical sequence, beginning with the simplest and increasing in complexity with each project. Because some readers will have had experience with knifemaking, the text is cross-referenced. In this way a reader can jump in at any point in the progression, flipping back as needed to information provided in preceding chapters.

I have started each of the projects from scratch. Each knife is an original design, cut from stock materials and worked into a knife entirely under my own hands. It’s possible to buy precut parts and blades that have been ground and heat-treated. Those readers who favor this approach will be able to bypass the sections of text that do not relate to their project. If there’s any point I’m trying to make, though, it is that anyone can make a knife from scratch. There’s a great pleasure in conceiving and executing a completely original object. I hope you’ll give it a try.

Each chapter begins with a brief Overview of the construction of that particular knife. For some, this will provide enough information to get started. Matters of form and function are briefly examined in a short section called Design Considerations. This is followed by a detailed description of the steps and
techniques used for that project. This section is called Process Detail. Novice knifemakers are advised to start at the beginning and work through each project. Those who have an independent nature will find they can choose any project and search out the information they need.

The first five chapters are important for anyone learning to make knives. The information covered in these chapters will apply to most knives and provides a foundation on which proper knifemaking can be built. Chapter 1 deals with the tools used by the knife handcrafters. Chapter 2 describes the metallurgy of tool steels and includes a handy synopsis of steels that are popular among knifemakers. The third chapter describes the shapes of knives and presents a glimpse of their rich history. The fourth chapter describes sheathmaking and gives examples of three kinds of sheaths. Chapter 5 describes a makeshift forge and provides an introduction to blacksmithing.

Knifemaking has undergone a renaissance in the past several decades. Increased interest, education, and expanding markets have encouraged knifemakers. Several dozen full-time professional handcrafters have contributed photographs of their work to be included here to inspire your creative efforts. Their fine work indicates the high caliber of craftsmanship and the wide range of innovative design seen in knifemaking today.

Whether your interest is in making a masterpiece or a simple household tool, the best way to learn about knifemaking is to roll up your sleeves and get to work. With care and perseverance, you'll be able to share in the rich tradition and genuine rewards of knifemaking. Good luck!
Tools

I should say right away that I have a bias toward simple tools. The idea of buying a lot of expensive tools might discourage a person from getting started in knifemaking. If I keep it simple, you may find that you already have many of the tools you'll need.

For the beginner simple tools are usually less dangerous and easier to control than more complicated ones. And because they are simple, they are easier to learn to use. You'll spend less time learning the tools and more time making knives. Because this book is not aimed at full-time production knifemakers, I won't go into detail about the equipment that is available for the manufacturer. Readers who become involved to that degree will acquire larger and more complicated tools in a natural evolution. As they do, they'll also pick up the knowledge needed to use those tools.

One more reason for preferring simple tools is the unique irregularity they give to the work they do. A typewriter, for instance, is a dandy tool but it conveys nothing of the personality that makes handwriting so interesting. The irregularities that result from using simple tools are not blunders that detract from an object. They are human marks that give it life. It is not my goal to make the same kind of knife I can buy in a hardware store. Therefore I'm not interested in investing in machines that will erase my personal gesture.

For this same reason I will not describe the use of each tool too meticulously. I hope you will develop your own ways of working. It's here, I think, that a lot of the pleasure lies.

Keep in mind, too, that there is no "right" way to equip a workshop. The following recommendations are my own.
I offer them only as a starting place for your collection. If you talk to a dozen knifemakers you’ll get a dozen different ideas about what tools you’ll need. Common sense and the progress of the work will be your best guide.

**CUTTING TOOLS**

Let’s start at the top of the line. Probably the best cutting tool for the knifemaker is a *band saw*. The correct machine will have a slow speed (about 800 feet per minute) and a heavy-duty motor. It will be fitted with a metal-cutting blade that has small teeth, probably something around 25 teeth per inch. These saws can be bought through hardware stores or tool supply companies. You can expect to pay about $350 for a new machine. Occasionally a used machine comes on the market, especially through the consolidation of small factories or schools. Many cities have dealers who specialize in used equipment. A look in the Yellow Pages can be worthwhile.

Band saws made for woodworking can be used to cut metal but the speed must be slowed down, and the blade must be changed. If the machine is not equipped with a series of pulley wheels, it is possible to rig up the necessary adjustment yourself. A good hardware store or industrial supplier can help with the materials and the know-how.

An alternative is the *hacksaw*. The principal limitation of the hacksaw (besides the fact that it runs on effort instead of electricity) is that it makes only straight cuts. A hacksaw is a handy tool to have around the house, but its shortcomings will become apparent and frustrating to a knifemaker.
Another tool that makes only straight cuts is the cut-off wheel. This is a thin disk of very hard material that is mounted on a motor spindle. It cuts very rapidly but will not go around corners. The cut-off wheel can be dangerous if the metal is not held perfectly straight. Because of the wheel's thinness it is fragile and can break apart violently if not properly used. In factory situations where jigs and guards are used to guide the workpiece, cut-off wheels provide a useful tool but I don't recommend them for the home workshop.

My favorite cutting tool is the jeweler's saw, a light tool that looks at first glance like a coping saw. It has a thumbscrew at each end of the blade and a similar screw along the back, used to adjust the blade tension. Frames are available at some hobby shops or from a jeweler's supply company (see list of suppliers at the end of the book). In my experience, sawframes costing less than $10 are too frail and imprecise to be worthy investments. Because a sawframe will literally last a lifetime, it is worth spending the few extra dollars needed to get a good one.

Frames are sized according to the throat, or distance from the blade to the back of the frame. Something around 4 inches is a handy all-purpose size.

The sawframe is used with jeweler's sawblades. These are available from any dealer that sells frames. Their sizes are described in a number system that goes from 8/0 at the small end of the scale through 3/0, 2/0, 1/0, 0, 1, 2, 3, and so on up to 8 at the large end. Something around size 4 or 5 is appropriate for the ⅛-inch and thicker stock typical in knifemaking. For help in using the sawframe, see chapter 6.

This is one of the many styles of belt sanding machines popular among knifemakers. This unit, called the Square Wheel Grinder, can be set up in many configurations.
SHAPING TOOLS
The tools listed above are used to cut out the outline or silhouette of a knife. The next job is to shape the blade and the other parts of the knife like the guard and the handle, and so on. This is really where the character of the knife is formed, so these tools are very important. Again, let's start by looking at the best tool for the job.

A sanding machine that drives a belt of abrasive paper is the most versatile and efficient tool for shaping a knife blade. These machines are available in several styles, the differences usually being in the width and length of the belt, the configuration of the machine, and the size of the motor. A 2 to 4-inch belt is usually preferred by knifemakers. It allows a broad enough cut to avoid carving furrows into the steel, but is small enough to be controlled. Sanding machines are designed to combine several important features. These include ease in changing belts, accessibility to the work area, and versatility of function (like having both a hard and a flexible pad against which to work). Each professional knifemaker will have his or her preference, based on individual style and work methods. The cost of a good sander starts at $500 and goes up from there. This is of course a worthwhile investment for the professional and is a reasonable price for a well-made tool. Beginners may be assured that more modest equipment is also available.

A bench grinder is a small motor (usu-
ally ¼ or ½ horsepower] that has grinding wheels mounted on its spindles. These wheels are thick disks of a tough abrasive, usually fused together within a ceramic material. They are available in several grades of coarseness and can be bought in many diameters. A 6-inch wheel is a popular size.

A bench grinder can be improvised from motors and attachments that fit on drills, but I do not recommend going about it this way. A jerry-rigged device can be dangerous. The wheel must be shrouded by a cast-iron or steel sleeve over the top and should have a small rest in front of the wheel upon which the workpiece is held. A grinding wheel should never be used without these safety precautions. Once you go to the trouble of installing them you will have spent more money than the cost of a proper bench grinder. Remember too, that safety goggles must always be worn while working on any power grinder or sander.

For safety, control, and low cost, the tool I prefer for shaping knives is the file. The ten projects in this book were shaped almost exclusively with files. It will come as no surprise, then, when I say that files are among the most important tools in the workshop.

You'll need a couple large files in a couple different shapes. That sounds like an easy order, but it quickly gets complicated.

Imported files are indexed by number, with the lower numbers representing coarser cuts. The system runs from 00, the coarsest, through whole numbers to 8, the finest. A knifemaker might want to have a 00, a 1, and a 3.

Traditional American cuts are described by names, and unfortunately the names don't give much clue about the file's cut. The coarsest category is called bastard. These are used for radical stock removal. Files with medium-size teeth are called second cut. The finest tooth size is the smooth cut, which gives the finest finish.

Some American manufacturers also produce a line of better-quality files that copy the European number system. These are known collectively as Swiss Pattern Files. These files are generally smaller than those just mentioned and are often a better-quality file. They cost more but in my opinion their cost is justified by their longer life, better control, and neater cut.

Also available are files with unusual cuts that have been developed for special uses. Several of these are particularly good at removing a lot of tough material fast. This makes them just the thing for knifemaking. Some that I have found useful are the Super Shear, the Whiscut, and the Magicut. These are available from many of the suppliers listed in the back of this book and can be tracked down through local hardware stores.

Though files are made in many shapes, you will probably need only two or three. The most commonly used shape is the flat file, a rectangular piece of steel with teeth on all sides. For maximum control, one of the narrow edges should be smooth. If the file you buy doesn't have this safe edge, make one side smooth by grinding it. If grinding, remember to quench the file in water as soon as it becomes too hot to hold. The file will lose its strength if it is heated to the point where it shows a blue color. Don't forget to dry your file well or it will rust.

Another shape you'll need is a half-round file. This has one flat side and one
curved surface. Most half-round files taper to a point, so the curve offers a range of radii as the point tapers. Having a flat and a half-round file in a coarse and a medium tooth (e.g., 0 and 2, or bastard and second cut) will be a good start on a file collection.

Beyond these you might find use for a triangular, a square, and a round file.

The need for these and other shapes will depend on the designs you create for your knives and on your personal working style.

A file is a hard object but one of the things that will cut it is another file. Care in storing files will lengthen their life considerably. Keep the files in a divided drawer or silverware tray so they don't rub against one another. If your workshop is damp, spray the files with a rust inhibitor such as WD-40 or buy antirust paper and line the storage drawer with it. A good file is a pleasure to use and can be a surprisingly effective tool. If you buy top-quality files and take care of them, your money will go much farther than if you settle for the economy brands.

**DRILLING TOOLS**

It's a rare knife that doesn't have at least one hole drilled in it. To equip your workshop properly you will want at least a small set of drill bits, such as a set that runs from 1/8 to 1/4 inch (2 to 6mm) and includes about a dozen bits. Avoid buying the absolute cheapest bits. These tend to wear out very quickly.

For the tool that spins the bit, you have several choices. The top of the line in this category is the drill press. This is a machine that includes a motor, a vertical spindle equipped with a chuck to hold the bit, and a platform on which the work is set. Presses are sold as floor or bench models. The choice depends on your available space more than anything else. These are large pieces of equipment and can run into a lot of money. Recently, moderately priced models have appeared on the market for about $150. This makes them affordable to the serious knife-
maker and they are a handy tool to own. A big advantage of the drill press is that it holds the bit perfectly vertical, guaranteeing a straight hole exactly where you want it. Because the tool is mounted, the press also frees up the user's hand and makes it easier to hold onto the workpiece.

The next best choice is a hand-held power drill. These look like a fat gun and are available from hardware and discount stores in a wide range of prices. I recommend getting a good model. This is a versatile tool that will see a lot of use. I advise buying an industrial-grade, variable speed drill with either a \( \frac{1}{4} \)-inch or \( \frac{3}{8} \)-inch chuck. You can expect to pay between $25 and $40.

FINISHING TOOLS

Once the blade has been cut out and shaped, it is necessary to remove the marks made by the rough tools. This process is called finishing. Most of this work is done with abrasive papers, either by a machine or by hand.

Knifemakers equipped with the sanding machine described a few pages back can use the same machine to finish the blade. In fact, when the belt sander is used, the process of shaping flows into the finishing process without any clear dividing line between the two.

Attachments are available for electric drills that aid in the finishing process. These are wheels of various diameters that have abrasive papers either on their edges (circumference) or on the face of the disk. Many brands, sizes and configurations are made. The choice is really one of personal preference and availability. Your best bet is to pick up a variety and make your own decision about how effective each one is. The only rule that applies to all of these tools is that you must wear goggles when you use them.

ABRASIVE PAPERS

In any finishing operation the process is a progression from coarse to fine abrasives. Individual experience is the best guide to the specific grits preferred, but a typical selection would run from \#80 through \#100, \#240, to \#360. The paper I recommend is coated with particles of silicon carbide, a very hard, man-made material. This is glued onto papers and belts and is available through most hardware stores. It is sold in 9 x 11-inch sheets and in a variety of belt sizes. Some knifemakers, particularly those working on a production scale, prefer to make up their own belts and buy abrasive strips in large rolls.

A very effective tool called a sanding stick can be made by wrapping sandpaper around a short flat stick as shown. Any wood slat can be used. If you are going to a lumberyard, ask for lattice stripping. A piece about a foot long is used for each grade of paper. Lay strips of masking tape along the grit side of each piece, allowing about half of the tape width to hang over the edge. Set this onto the stick and scratch a line along the edge of the wood so the paper will make a crisp bend there. Roll the stick over onto the paper and score the paper again. Continue doing this until all the paper is wrapped around. Cut off any extra. This stick provides backing for the paper, which ensures a flat surface, while the wrapping makes it possible to tear off each layer as it wears out.
To get the best control and leverage with abrasive papers, make a sanding stick like this. Use a strip of wood about 1 foot long and 1¼ inches wide. Corners are made crisp by scoring the fold with a blunt point, as shown.

Silicon carbide paper is surprisingly tough and lasts longer than most people expect. It can clog as you use it but this can be corrected by wiping it on a rag.

Another finishing material that I've found useful around the shop is a plastic pad called Scotch-Brite. This is a substitute for steel wool and has the advantage of being water-resistant and free of oil. It can be bought in hardware stores, automotive supply companies, and even in the grocery store, where it is sold as a pot scrubber. Use this after abrasive papers have removed all the scratches and file marks from a piece to make a frosted finish. I also use it to clean metal before glueing and soldering.

A mirror finish can be given to metal with a buffing stick if fine abrasive papers have correctly prepared the surface. This is a simple tool you can make yourself. A piece of leather is glued onto a flat stick and saturated with a polishing compound. I've found an inexpensive source for leather strips in old straps and belts bought at a flea market or thrift shop. Use epoxy to glue these onto a stick, and after the glue has set trim off any overhang with a sharp knife.

The leather can be treated with any abrasive compound. You'll find many available from hardware stores, jewelry supply companies, or automotive suppliers. A few traditional choices are Tripoli, White Diamond, Zam, Bobbing, Stainless Compound, and Crocus. These are rubbed into the leather periodically as the stick is used. Before long the leather will become saturated with the compound.
A Damascus boot knife by Don Campbell. This knife has an ivory spacer, Damascus guard and butt. The handle is of fossilized "oosik." [Photo by Gene Fletcher Brownell]

If you continue in knifemaking you'll soon be tempted to progress to a machine to help with the job of making the metal shiny. One option is to clamp the electric hand drill mentioned above into a jig as shown. For portability you might want to fasten the holder to a board that can be clamped to the workbench for use and moved around as needed. This system is faster than buffing by hand and will give an idea of the feel of power buffing, but I see it as a stopgap solution. One objection to this arrangement is that it lacks the supports and safety features of a larger machine. Also, it puts a strain on the small motor of the drill and will soon wear it out.

A better solution is called a buffing machine. For occasional use a simple buff can be rigged up from a common ¼ horsepower motor that runs at 1,725 RPM. This is the same motor used in most washing machines, dryers, refrigerators, and heating systems. This is to say, it's a common machine, available through equipment distributors or used, through secondhand shops.

To set up the buff it must be mounted

An electric drill can make an improvised buffing machine. Notice how the setup has been mounted on a board that is clamped to the workbench. This makes it possible to move the machine easily. The rig is set on rubber feet to prevent sliding on the bench and to reduce noise.