MAKING AND MASTERING WOOD PLANES

David Finck

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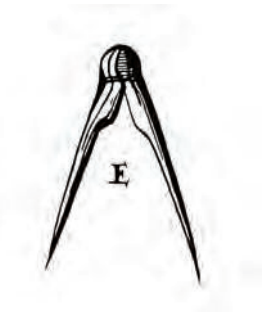

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There would be no book without James Krenov. The planes described and illustrated in the following pages were inspired by him. To him and all the teachers and students in the College of the Redwoods Fine Woodworking Program, my profoundest thanks. Most of what I know about planes and woodworking was learned there. I hope I've done justice to the subject of planes and Jim's spirit toward woodworking.

After leading numerous workshops on plane-making over the years, it is clear that I am deeply indebted to my students. I thank them all for the insights that come from questioning the "obvious" and demanding greater clarity of presentation.

I'd like to express my gratitude and love for the grandfather I never knew, my namesake. He started my father working with wood—and it is my father who then inspired me. And to Paula, my mother, who nurtured the artist in all her children, and then, as a business partner, nurtured my career. Also to my sisters Amy and Tina, partners in childhood arts and crafts adventures, who always set the bar way over my head.

More thanks for the invaluable efforts of those who reviewed my manuscript: good friends David Esposito and Bojan Petek, Tina Casey (my sister), James Krenov, Marie Hoepfl (my wife), and especially Henry Finck (my father). Through their efforts this book was much improved.

To my wife, Marie, and two young daughters Ledah and Willa: It has been a long and rather lonely road. I have missed you! As I write these words, I look forward to more time spent with all of you and less time in front of a computer.

Finally, I dedicate this book to my father, Henry Finck. He has taught by example from my earliest years that a job worth doing is worth doing well. He has been a limitless source of knowledge and support, and an inspiration in so many ways. It is a debt that cannot be repaid. I can only hope to pass the gift along.

Contents

Foreword

by James Krenov

The way that some of us work includes our emotions, our hopes, all the feelings that we have. In cabinetmaking, there are different ways of leaving one's spirit—or one's feeling about the material—in the completed object. All these processes involve an intimacy—a closeness to the wood, a closeness to the tools—and an awareness of what you're doing, of the possibilities and the limitations of the tools, and of your skills.

Certain tools that we use are classics; they have been around as long as woodworking—the chisel, the spokeshave, and certainly the plane are some. A long time ago, when I went to school, we had the classic European hand plane, which was made of pearwood with a lignum vitae sole. It had a long iron, a big, tall knob in the back, and a horn in the front. Now, it was a good plane, and people around me were using it and there was nothing that they found wrong with it. Certainly, if well cared for and properly used, they were, are, and will continue to be fine tools, just as a very fine-tuned metal plane can be. But I found the classical knob and horn plane very limiting, because you could only comfortably hold it in one way, and it wasn't very good for small work. So, just out of curiosity I made this small plane. That was about fifty years ago. Many readers and people working with wood are familiar with it; it sort of assumed my name, which is all wrong, because I didn't invent anything. I just changed the shape and size of a plane that was already made, used a shorter iron, and made the whole thing very comfortable and very versatile. You could hold it with two hands, you could hold it with one, you could do large-scale work, and you could do very fine details.

I think it's very important that you be patient and thorough. Let the first plane you make be a reasonable success. When we make something and we do not succeed, then we're not very likely to continue to make a second and a third. It's like making a guitar that has no tone, or a very bad tone. You put it up on a wall and you say, "Well, I made a guitar but it's not worth playing, so I don't think I'll make any more guitars; I'll buy one instead." Well, these very personal hand planes, as far as I know, can't be bought, and you probably shouldn't try. You should enjoy the making of them, and let some of that enjoyment give you energy to use them properly, and make a second and a third. Different sizes, different shapes.

Really, my simple message is that if you're going to approach woodworking with sensitivity and maybe refinement, planes are a good way to begin. They're a start to improving the rest of your tools that need improving. After all, the hand plane is the first part of the woodworker's aria. And what I'd like to see happen, through this book that David has written, is for you to make a plane or planes that will, in turn, make fine music.

Introduction

The distinctions between an object that is merely "crafted" and one that is "*finely* crafted" become apparent some time after the hum of the power tools has faded away. Think of power tools as apprentices that handle the drudgery that would otherwise sap the energies required for more refined work. For example, they excel at turning rough lumber into dimensioned stock. The magic happens at the workbench, though, with the use of hand tools. It comes down to wanting to go beyond the ordinary. Among all hand tools, few can take one farther than a good plane.

Swift strokes from a hand plane transform a machined surface to silky smoothness. Planes can join boards seamlessly and flatten any size surface. They polish end grain quickly and beautifully, trim boards to width and length, and can be used to fit the components in various joints, drawers, doors, and lids—all with a highly satisfying level of accuracy. Of course, power tools are commonly used for all these ordinary tasks, but with predictably ordinary results. Hand planes can elevate your efforts to a new level of craftsmanship.

Author David Finck

There is another compelling side to hand planes. For many, woodworking is not about rushing to get things done. Perhaps you are drawn by the romance of working with wood. Maybe you have yet to even lift a plane or turn a plank. Your mind paints images of a lone craftsman planing heaps of gossamer-thin shavings, at one with the wood. Hold on to that vision, for it is surprisingly accessible.

But, likely as not, you have tried your hand at planing, and the romance has dwindled. Instead of shavings, frustrations have piled one atop another. You find sharpening plane irons to be tricky and time-consuming, and are uncertain if the blade is sharp enough. Setting the depth of cut is a tedious procedure that often produces inaccurate and unpredictable results, and the depth of cut is often altered when you can least afford it. It seems that the plane will make only thick shavings or none at all. Surfaces meant to be smooth have digs and ridges, and squaring an edge is all but impossible. The plane feels heavy and clumsy. And then, when everything is adjusted properly, the blade becomes dull after a few minutes' work. This means the entire procedure has to be started over again. Eventually the plane is placed back on the wall rack, where it collects dust with cruel irony.

But using hand planes does not have to be so frustrating. Shop-made wooden hand planes can revive that romantic vision. Few metal, factory-made planes can rival the performance of those

made out of wood in your own shop. Wooden planes can accommodate extra-thick blades of superior tool steel that simplify sharpening and stay sharp longer. The blade is adjusted with a wedge-and-hammer system that is slop-free, extremely precise, and holds the setting tenaciously. The plane can have the smallest possible throat opening (the gap where shavings enter the body of the plane), greatly enhancing its performance on figured woods like curly or bird's-eye maple.

Additionally, these shop-made wooden planes are shaped for the comfort of your own hands. These simple shapes can be held several ways—which is very helpful for different planing tasks. In all, planing with a well-made wooden plane is a very pleasant experience.

With the information supplied in Chapter 4, it should take you a day and a half to make your first plane. With some practice, making a plane will take only a few hours. In short order, you can create a collection of planes impossible to duplicate with factory planes, on the basis of performance or cost. Specialized planes can also be made that expand your capability for work beyond ordinary tasks.

With the plane in hand, the obvious next step is learning to use it accurately and efficiently. Chapter 5 discusses proper techniques. However, experience also plays an important role. You will develop sensitivities which amount to an ongoing conversation between you, the plane, and the material being planed by monitoring the shavings flowing from the plane, listening for telltale sounds, and lightly brushing fingertips over the surface. It soon becomes second nature to respond to these cues. Sometimes this will mean simply tapping with the hammer to produce lacy shavings that will shoot through the plane. There are subtleties to attend to along the way: when to sharpen the blade iron and when to stop sharpening it; how much to arc the blade for polish-planing; setting the blade precisely; and what to listen for when tightening the wedge. These tuning and sharpening skills are discussed in Chapters 2 and 3. You also need to know when to use specific planes, and should have an arsenal of techniques to meet the various challenges that typically arise.

Don't expect to master it all overnight—it takes practice. It's like learning the guitar: at first it's a mystery and your fingertips ache from pressing the strings, but soon you learn a few chords and your fingertips toughen. Woody Guthrie said he could play any song using just three chords. Planing is like that too: learn the basics and you will be amazed by how much can be accomplished.

Odd as it may seem, a book on hand planes is incomplete if cabinet scrapers are neglected. Scrapers, which are discussed in Chapter 7, are part of the plane family. Although overshadowed by the hand plane, they have their own unique and important qualities. Chief among these is their ability to quickly smooth nearly *any* wood, no matter how wild the figure. Scrapers can take tissue-thin shavings and leave a surface ready for sanding with finest-grit sandpaper. Stock is removed more quickly than by hand-sanding, and with considerably less dust and more accuracy than when a portable sander is used. Thus, whether you are confronted by an entire tabletop of impossible-to-plane wood, or merely need to repair a small blemished area, scrapers are the solution to the problem.

In writing this book I offer up the information gleaned from my teachers, from my own endeavors, and from working with students, in as richly detailed a form as I can muster. I hope that makes the difference between things working out or not, or between things working very well or merely working. But there is a danger of overburdening the reader with information to the point of distraction. I suggest that the different chapters be studied one at a time. Reread the sections you are unfamiliar with, try the techniques or procedures, and then read the text again to verify that everything has been done properly.

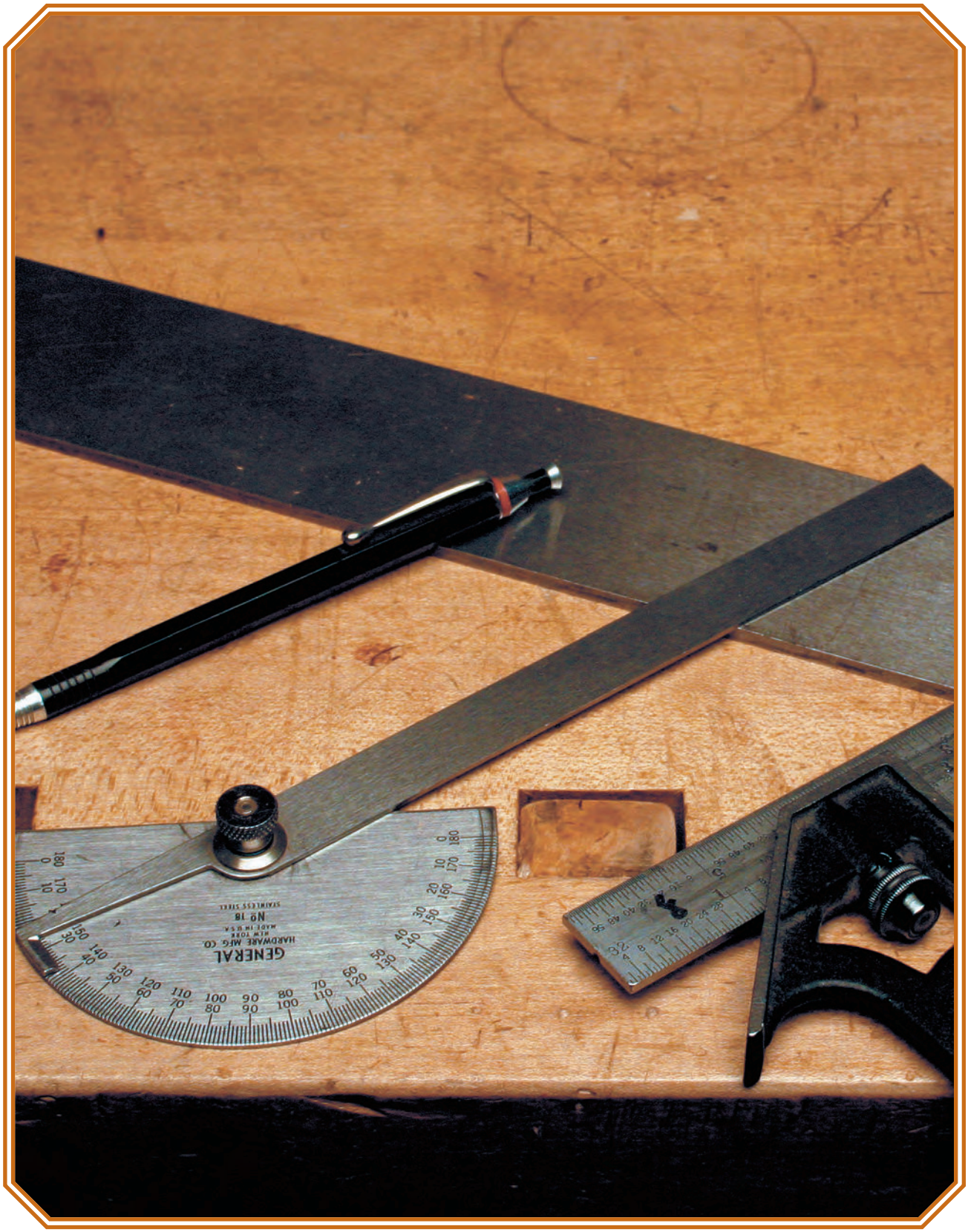
Without an experienced observer looking over your shoulder, you must be your own observer—a difficult task.

I have kept assumptions that the reader has an advanced knowledge of planes to a minimum, to help ensure the success of those with limited experience. In fact, the process of plane-making serves as an elegant framework for teaching many of the fundamentals of fine woodworking. It is also a vehicle for illuminating many of the little "tricks" that help yield clean and accurate work. To preserve the flow of the process, and prevent the more experienced among you from being bogged down, most of the ancillary information appears in boxes separate from the main text.

My sincerest hope is that the information that follows will be a bridge to a way of working that gives you great satisfaction, while positively influencing the quality of the work. With increased reliance on planes, you will also enjoy a quieter, safer, and cleaner shop. I do not mean to say that this approach is for everyone, but nearly anyone willing to try can have great success making and using planes. I hope to leave you brimming with the confidence to handle the numerous tasks that planes excel at and to get you started on amassing a collection of the finest planes available: the ones you make yourself!

David Finck

Ledah, age 3 1/2, planing a cherry tabletop.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CHAPTER FIVE

Planing Techniques

Those first lacy shavings that shoot from your plane are inspirational. Now it's time to move on from the making of shavings to expertly performing an array of techniques with planes. Be aware: This tool, which can do so much so well, may also confound and frustrate. A successful job—a melding of the process itself and the final product—is dependent on close observation and involvement in the interaction among the craftsman, the plane, and the wood. If your efforts turn sour, often it's because the plane needs to be resharpened, have its bottom trued, or be adjusted for a finer setting. Pay attention to the demands of the plane. Revisit Chapter 4 for information concerning these procedures.

The information in this chapter explores basic techniques for joining edges, truing and smoothing surfaces, trimming and squaring stock, and shaping profiles (5–1). Follow the text while performing each exercise on a length of practice stock. Each task will require a certain amount of sensitivity to the process.

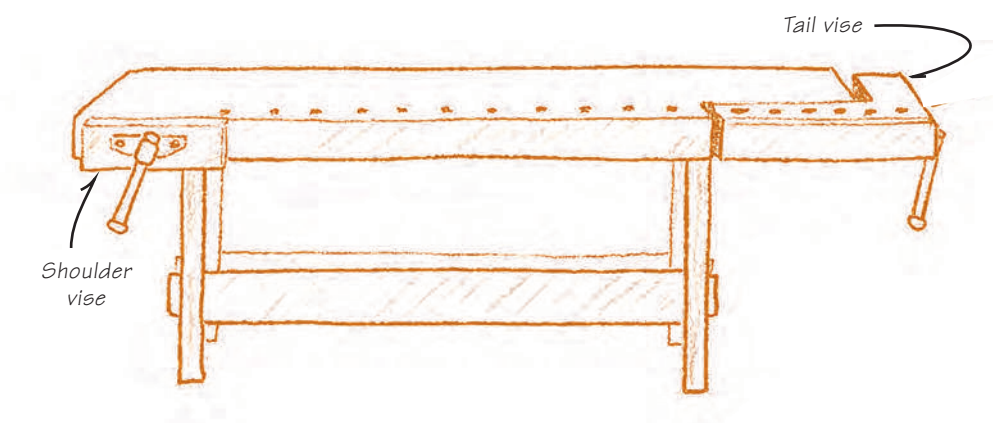
5–1. Planing using a push grip.

PREPARING TO PLANE

The Workbench

For a woodworker using planes, the workbench is an extremely important tool capable of enhancing and supporting the efforts or causing lots of annoyance and difficulty. The European style of cabinetmaker's workbench is ideally suited for planing for two reasons: its weight and its clamping systems (5–2). The weight provides stability—an anchor against the push and pull of planing. The clamping systems provide a variety of ways to reliably secure the stock in a manner convenient for planing.

At the core is the tail vise working in concert with movable bench dogs inserted in the bench top. The dogs can be placed along the length of the bench to accommodate any size stock within that limit. They can be raised up and down to handle thicknesses from about 1/8 inch on up, allowing an obstruction-free path for planing (5–3). The tail vise accepts a dog and provides the clamping power for holding boards to the bench top. Select proper dog holes to keep the opening of the tail vise as small as possible, to provide the workpiece with optimal support. The use of spacing blocks between the bench dog and workpiece is helpful in this regard.



5–2. European-style workbench.

5–3. European workbench with board dogged to it.

Make your own wooden bench dogs. Accidentally running into a metal one—a distinct and unpleasant possibility, especially when planing thin stock—tears up the blade and plane. A spring made of thin wood, screwed to the dog, provides some friction to keep the dog at a chosen height instead of letting it flop back into its hole (5–4).

5–4. Wooden bench dogs.

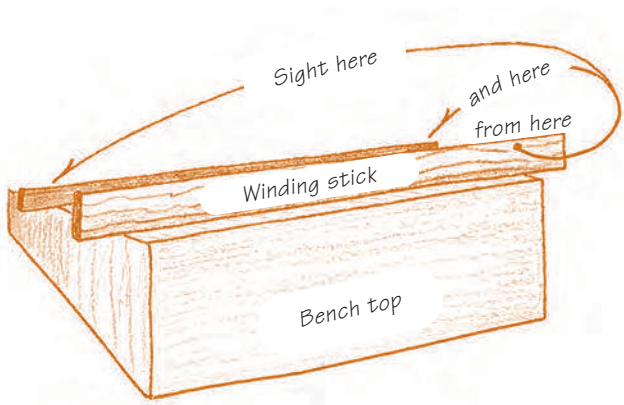
Flattening and Truing the Bench Top

A bench, like any other tool, must be properly tuned to perform its best. The major requirement is a flat and true top. Any stock that is thin enough to flex more than a few thousandths of an inch under the pressure of planing will start to conform to the irregularities of an uneven bench top; therefore, the bench should be as flat as possible. Refer to the section below on flattening technique if the top needs attention.

For a long bench, a six- or seven-foot length of aluminum "U" channel may suffice for an overall check. Work with a standard three-foot straightedge for greater accuracy over a smaller area. Check the length of the bench along the front, back, and middle. Check the width at both ends and the middle and then check both diagonals. The size of the bench makes the task seem daunting, but it is just a matter of methodically applying the same principles used for smaller surfaces. Also, you can cheat a bit and concentrate the most critical efforts on the zones that receive the most use: the length of the front of the bench and the full width of the half of the bench that includes the tail vise, where work is done most frequently. Wait until you have gone through the planing exercises in this chapter and gained some confidence with the planes before trying this.

A bench top that is flat and free of wind can also serve as an on-the-spot standard to try against any smaller surface being worked on. Assess the bench top with winding sticks. Winding sticks may be any pair of straight sticks with parallel edges. For checking the bench top, mill a pair as long as the bench's width, about $^3/_8$ inch thick and $1^1/_2$ inches wide. Sticks of contrasting colors aid the process because one stick is sighted against the other to reveal the presence of wind. A stroke of black marking pen along one edge does the trick.

If the bench is longer than three or four feet, gauge it in two locations: from one end to the middle, and then from the middle to the other end. Lay one stick on edge across the end of the bench where most of the work is done. Lay the other across the bench about three feet away. Step back a few feet and bring your head down so your eye is level with and sighting across the tops of the sticks. Concentrate on the outer ends. Move your head up and down until the tops of both sticks near one end line up. Sight across the sticks at the other end, without changing the elevation of your head, and see if the tops are aligned or if the back stick appears higher at that end (5–5). Reverse the order, sighting across and aligning the ends of the sticks you finished with last time, and compare the opposite ends.



5–5. Sighting across winding sticks to assess a bench top.

Two readings are taken because the front stick obscures the back one if the back stick happens to give a low reading at one end. There is no wind if the sticks are level for both sightings; if they appear out of level, there is wind to that same degree. The top and base of the workbench may have some flexibility. It is worth a try shimming under the bench legs, seeing if that corrects the situation. If it does, trim the legs appropriately and add braces to the bench for a more permanent fix. To plane out the error, skip ahead to Flattening and Truing Surfaces on pages 139 to 143 for information on correcting wind.

Vise Faces

It is important that the opposing faces of the vises be parallel and flat. To determine this, lightly clamp a sheet of paper that is as wide as the vise and see if the paper is gripped firmly all across. If it is not, remove a little wood from a face where the paper is tight. Clamping a sheet of carbon paper leaves a mark showing precisely where to concentrate the efforts. Keep the faces flat. When the faces of the vise mate properly, trued stock can be held securely with a minimum of pressure. Consider gluing a covering of 1/8-inch high-density rubber (available at hardware stores) to one face, to further guard against pivoting or to take up any minor imperfections. Glue it with contact cement.

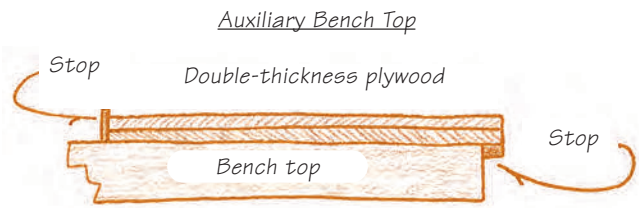
Good Lighting

Good lighting is essential. A pair of swing-arm desk lamps mounted on the bench will find constant use. A strip of wood with several holes drilled to accept the lamps, mounted to the back of the bench, works well and allows for easy removal of the lamps when they are in the way.

Working with the Workbench at Hand

If the workbench is something other than a European cabinetmaker's bench, it can still be quite serviceable as long as it is flat. If the bench top cannot be flattened for whatever reason, an auxiliary top for planing (essentially a large planing hook as described in Chapter 6) may be the way to go, short of getting a new bench. Fashion one from two thicknesses of flat 3/4-inch sheet stock, such as particleboard, MDF (medium-density fiberboard), or plywood, glued together. The stiffness of the lamination helps average out the inaccuracies of the bench top. If you can't glue up this flat yourself, seek out a shop with a veneer press to do the job.

Make two tops to cover most planing situations: one about 24 x 42 inches and one about 6 x 72 inches. If the bench has dogs, use them to secure the auxiliary tops. If not, screw a length of 3/4 x 1-inch stock underneath the auxiliary tops, along an edge, to hook on a corner of the bench while you plane (5–6). The far side of the auxiliary tops requires a stop that will trap the stock being planed. Screw on a strip of 3/8-inch plywood to the edge; it should protrude above the top about 3/16 inch. In essence, these are extra-thick "planing hooks" as described below.



5–6. Side view of auxiliary planing tops showing location of stops.

If the bench top is flat, but lacks a convenient method for clamping the stock to be planed, the stock can be held by forcing or stopping the workpiece up against a board clamped to the bench top. Plane in the direction of the stop and all will be fine. If there is a need to plane diagonally (a technique for truing a surface), additional stops on the sides are required. A planing hook—as above—made from a *single* thickness of sheet stock (for lighter weight) is another possibility. The advantage is doing away with clamps for straight-on planing.

A typical woodworking face vise mounted on the end of the bench can be used to simulate a tail vise.

This requires the type with an adjustable (up-and-down) stop as part of the outer half of the vise. Clamp stock to the bench top, pinching it between the vise and a board firmly clamped across the bench top. Now planing can be done diagonally without the stock sliding away.

Another option that allows for planing to be done diagonally is to drill holes for bench dogs. Align a series of 3/4-inch holes with the center of the vise, along the front edge of the bench top, to accept simple bench dogs made from 3/4-inch dowels. Space them four to five inches apart. Angle the holes so that the bench dogs will lean slightly toward the vise. This helps keep the clamped stock down on the bench. Cut a flat at the top of the dowel to register on the board. To prevent the dowels from slipping down the holes, insert small bullet catches (spring-loaded ball bearings) in radially drilled holes placed near the bottom. Also, always use a spacer board that completely bridges the opening of the vise, allowing the clamped stock to lay fully supported on the workbench.

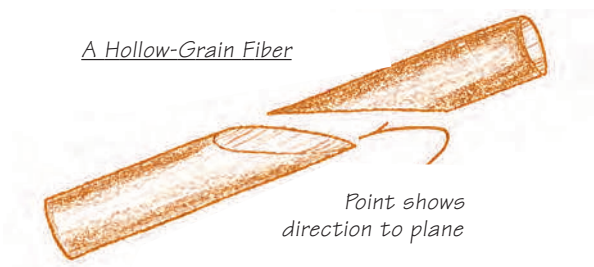
Practice Stock

Select an 8-inch-wide 4/4 (1-inch-thick) board of straight-grained hardwood that is free from knots. Cherry, walnut, oak, maple, ash, etc., will do fine. Crosscut a 20-inch length and true the faces and edges with a jointer and planer.

"Reading" Wood Grain for Planing

To avoid tear-out, you probably determined the grain run-out direction before using the jointer and planer, as discussed in Chapter 2. When planing, always be aware of grain direction, moving in the direction that smoothes the fibers down rather than lifting them out of the surface (tear-out). Often a quick glance at the edge adjacent to the face being planed indicates everything needed to know: the slant of the grain is obvious. Sometimes this area is difficult to read though. Lightly brushing your fingers up and down the board, as is done when determining the back and front of the plane blank, may reveal run-out. The wood fibers will catch your skin in one direction, as was described in Preparing the Plane Blank in Chapter 1.

A close examination of the surface of open-pored woods such as oak, ash, and walnut can also show which way to plane. Hollow vessels run up and down the tree, in a direction parallel to other types of wood fibers. These tubes may run parallel on the face of a board cut from a log (no run-out) or intersect the face at some angle (resulting in run-out). If the board has run-out, the opening of the tubes, seen on the surface of a plank, are oval, the tapered end pointing out the direction to plane (5–7). The more elongated the opening, the less run-out there is. This knowledge is especially helpful when the edges of a board are obscured, or to reveal areas of run-out reversal within a board.



5–7. If a board has run-out, the hollow fibers of an open-pored wood are cut obliquely at the surface. The point of the resultant teardrop shape indicates the planing direction.

Look at the end of the practice stock and examine the end grain. The orientation of the annual growth rings, with respect to the face of the board being planed, affects the planing characteristics of different species of wood to varying, sometimes opposing, degrees. For example, extra vigilance and attention must be given to the sharpness of an iron when planing a cherry quarter-sawn face. Medullary rays, a physiological component situated radially and horizontally in the tree, are visible as small opalescent flecks on the quarter (notably in quarter-sawn oak). If care is not taken, these may pull from the wood while planing, leaving a roughened surface.

Cherry that is *flat-sawn* is much easier to plane; this is because the medullary rays are firmly integrated into the structure of the wood. My experience with some ash planks is just the opposite. The flat-sawn face is trickier to plane to perfection, as the stringy, very open-pored flat-sawn surface is more susceptible to tear-out than the tighter-grained quarter-sawn surface.

With experience, you will become familiar with the characteristics of the different woods; this knowledge will prove helpful when planing them.

EDGE-JOINING TECHNIQUES

A power jointer can do a decent job of edge-joining if it is set up very precisely and the blades are very sharp. Optimal conditions are hard to maintain, though: tables lose alignment, fences go off square, the knife edges may not be concentric, and very quickly the knives lose their sharpness. Soon the wood is not only cut by the knives, but pounded and compressed as well. Joints may look good dry, but when they are glued up compressed fibers swell, exposing an evident glue line. A *planed* surface is sheared smoothly; there is no fiber compression. It can be drenched with water, even steamed indefinitely, only to reveal a silky-smooth surface when dried; glue has no adverse effect on the quality of the joint as observed when dry-fit.

Consider the jointer as a tool for rough truing and squaring boards and parts. Final smoothing is done with a plane for dead-on squareness, straightness, and virtually undetectable joinery.

The plane chosen for joining boards together should be close in size to the length of the boards: the closer it is, the easier it becomes to plane a straight edge. A flat plane cannot work an appreciable dip into the edge of a board that is the same length. Looked at from the other way: if the plane is shorter than the board, the shorter the plane, the more of a dip that can be planed into that edge. It is not advantageous, merely clumsy, to use a plane that is longer than the boards being joined. On the other hand, a jointer plane 18 inches long is quite capable of making flawless joints 6 feet long if handled carefully.

It is of utmost importance that the plane be well flattened prior to beginning. Any time you are having extended difficulty and can't quite get the joint to fit, that is the first thing to check. Also, the plane iron must be sharpened straight across, with no hint of an arc. The cut must be set extremely fine, producing very thin, cottony-soft shavings.

It is helpful to have two planes available: one set coarse to remove the milling marks, and one set fine to fit the joint. The blade must also be set perfectly parallel to the bottom. If it takes a slightly heavier cut off one side, each pass of the plane lowers that side of the edge of the board, quickly putting it out of square. Set up the plane with a trued piece of scrap.

The Basic Strokes

Set the practice board edge-up in a face vise, with the grain on the face of the board rising to the left. Set the front of the plane on the edge of the board and slide it forward until the blade just contacts the wood. The front (left) hand plays a very important role, maneuvering the plane laterally and centering pressure over the wood. Its four fingers wrap underneath the body of the plane with the fingertips on the bottom and brushing the face of the board. The thumb is arched on top of the plane, positioned so that the tip is directly over the center of the edge of the board being planed (5–8). Sometimes the thumb will be in the center of the plane, and sometimes to the left or right of center if partial-width shavings are desired. The thumb is important for balancing the plane and the pressure transmitted to the blade. The slightest wobble produces an incomplete shaving and a flawed surface. The back hand rests lightly on the back of the plane.

5–8. The grip for edge-joining.

It is a universal law of planing that when the stroke is started, pressure is on the front of the plane; then pressure is transferred equally to the front and back when the plane is fully on the board; and finally pressure is exerted on the rear of the plane as the front of the plane leaves the board. At the end of the stroke, when the shaving has parted from the board, the motion of the plane is stopped while the rear of the plane is still registered flat on the board. All of these elements are essential to accurate planing. And how much "pressure" is needed? Very, very little. The weight of the plane is sufficient. You mainly supply forward thrust and control.

Practice Shavings

If the blade is set fine enough, the first two or three shavings will reflect the scalloped quality of the surface left by the jointer: they appear rippled and discontinuous. Then you should start producing continuous shavings the full width and length of the edge. This must be done time after time to get good results in edge-joining.

A properly flattened and adjusted plane, a light touch, and well-centered pressure from the thumb are the keys for edge-joining success. Any time the shaving is discontinuous, a flawed joint will result. Unfortunately, the opposite is not always correct: a continuous shaving does not guarantee a good joint.

If continuous shavings are not forthcoming, check the usual suspects: the sharpness of the iron and plane flatness. It takes just a small amount of practice to acquire the necessary finesse to get consistent, continuous shavings. In the meantime, if the edge of the board has been knocked out of true by the initial efforts, it will be difficult to get satisfactory results. Reestablish a true edge with the power jointer and try again.

Squaring and Straightening the Edge

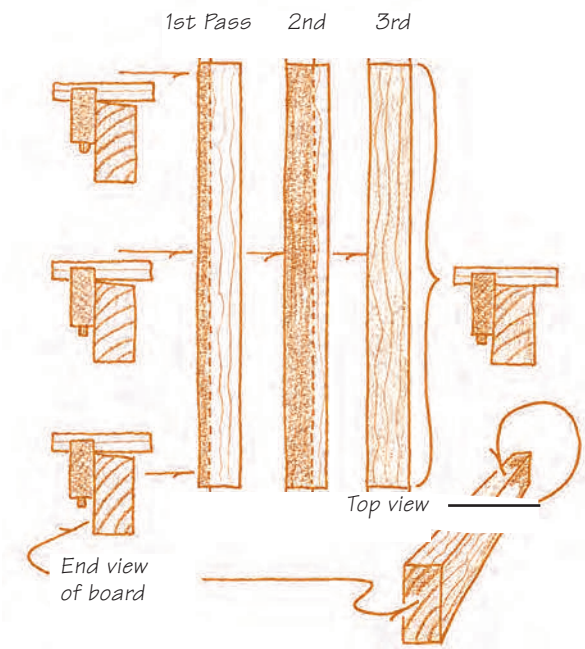
Carefully plane off the jointer marks. Release the board from the vise and check the edge for square. Sight toward a bright light to get a good reading with the combination square. Check both ends and the middle. Register the handle off the same face each time, for consistency. Is it square all the way across, or out of square all the way or only at one end? It may even be out of square in opposite directions at either end.

Let's assume there is a problem. Take the same approach here as when truing the ramp of the plane: namely, plane the high spots and avoid the spots that read low. Take partial shavings with the appropriate corner of the blade while the plane is flat on the stock. Steer the plane using the fingertips of the front hand like an adjustable fence against the face of the stock, and keep your thumb

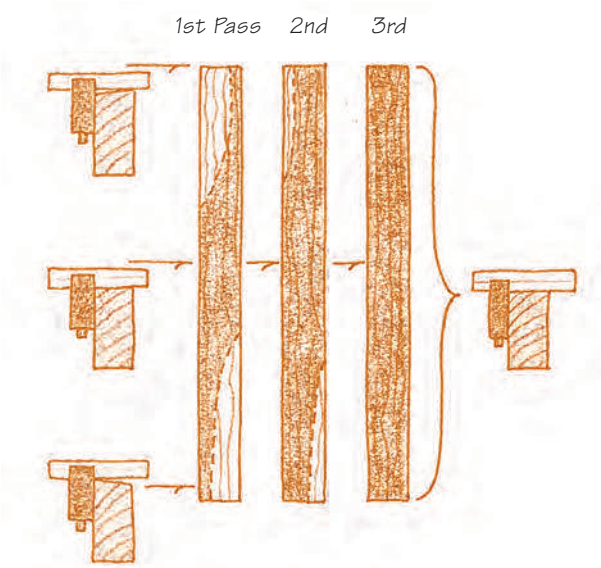
centered over the edge being planed. For instance, if the edge reads high all along the left side, let the right corner of the blade take a shaving off the left edge only that is one-third the full width of the edge. On the next pass, take a shaving that is two-thirds the width, and then one that is the full width (5–9). If it was way out of square, start with a one-quarter- or one-fifth-wide shaving and work progressively across to full width. Check for square and repeat if necessary.

For an edge with a wind, take a full-width shaving where the edge is square and move the plane over to take a partial shaving from the edge where it reads high. This is accomplished in one smooth stroke of the plane, navigating left and right with the aid of the left-hand finger/fence as you go. Repeat the process taking wider partial shavings and then, finally, a full-length, full-width shaving (5–10). The motion of the plane must be fluid as the width of the shavings is adjusted (5–11).

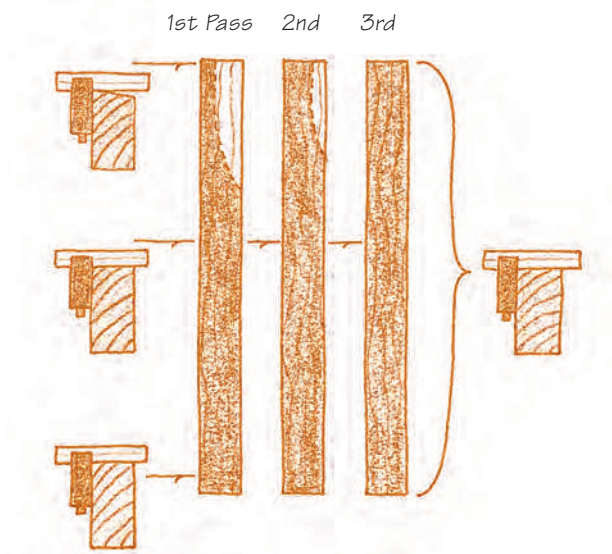
Before long you will effortlessly guide the plane



5–9. Squaring the edge of a board that is high on the left. The shaded portion corresponds to the width of the shavings made. The squares show the readings at the ends and middle of the board.



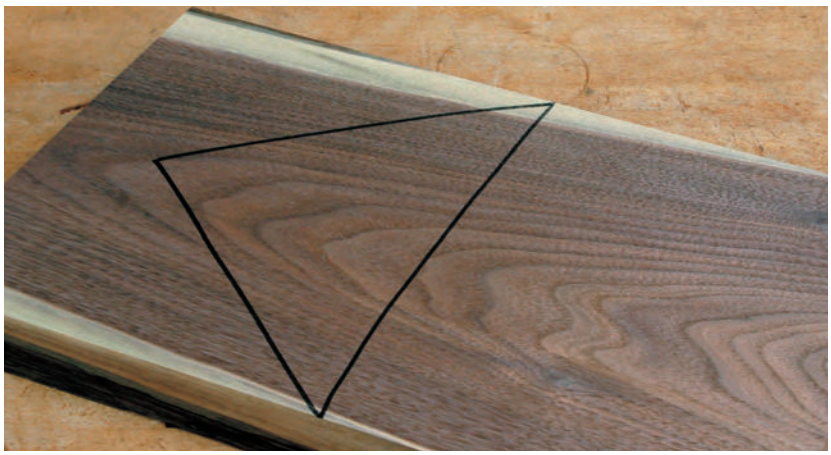
5–10. Squaring the edge of a board that has wind.



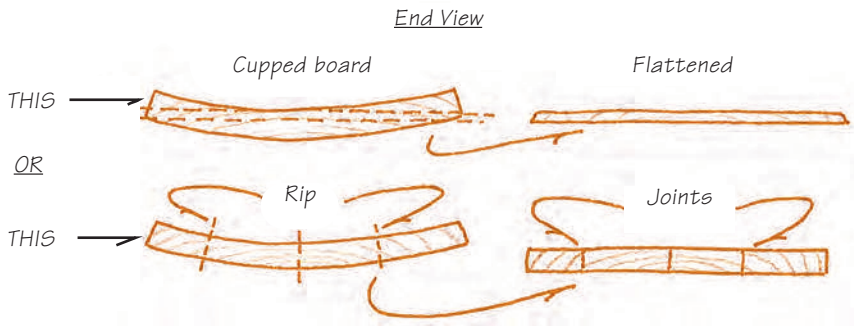
5–11. Squaring the edge of a board that is low at one end.

along an edge, steering it right where it needs to go. Having squared up the edge, try taking it purposely out of square, or putting a wind in it, and then restoring squareness again. If you are feeling comfortable controlling the plane and achieving a square edge, it's time to practice straightening it. After all, a perfect edge joint is square and straight.

Draw a cabinetmaker's triangle on the center of the board in preparation for sawing it into two pieces (5–12). This exercise involves ripping the



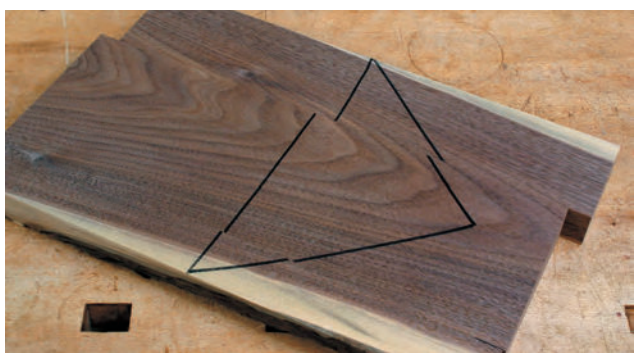
5–12. A practice board with a cabinetmaker's triangle drawn on it. When the board is ripped into two pieces, it will be easy to relocate them with the aid of the reference mark.



5–13. Above is a cupped board that has been left intact and then flattened. Below is a board that has been ripped into staves that are individually flattened and then rejoined. Note the difference in final thickness.

board and then seamlessly joining it back together. That may appear to be simply an academic activity, but, in fact, this capability opens up an exciting avenue for utilizing wide boards. Wide stock can be ripped into pieces narrow enough to fit the jointer and planer, dimensioned efficiently, and then joined back to a unified whole, with no glue lines betraying the process that occurred. The difference between the visual impact of harmonious grain patterns on large surfaces and the inevitable disjointedness that occurs from joining disparate boards is stark. Of course, a wide plank can be flattened with planes, but the process is laborious and even wasteful. If a board is cupped across its width, a significant amount of thickness can be lost while it is being flattened. Cutting it into narrow strips minimizes the loss of thickness (5–13). Be aware that the board will lose some width due to the saw kerfs, jointing, and planing.

I always prefer ripping on the band saw. Absence of kickback danger is a big plus and so is the narrow saw kerf. If the same pieces of wood will be glued back together again, it is important to preserve the grain pattern by taking a minimal saw kerf. It is also easier to match the grain and hide the joint if the saw cut falls in an area of straight grain. If the grain pattern is angling across the saw cut, it will be necessary to offset the ends of the board to match the grain lines, and sometimes a perfect match is not even possible (5–14). For this reason, always leave a

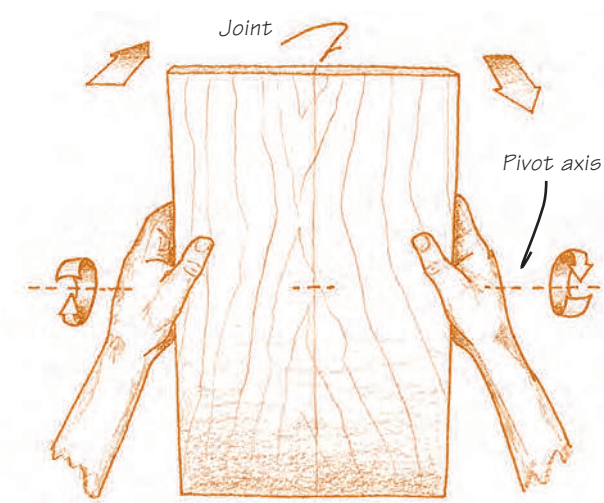


5–14. Saw cuts in straight and angled grain areas of a board. Notice the degree of offset at the ends of the boards required to match the grain when the cut is made in an area with angled grain lines.

little extra length for boards that will be sawn and reglued. In any event, rip the practice stock into two pieces and true the sawn edges on the jointer.

Squaring Each Board and Testing It for Straightness

For stock less than 1/2 inch thick, the mating edges can be planed simultaneously, but the task is best done with a shooting board (see Chapter 6). Here, work on the edges one at a time. Once squared, try the boards together. Use the cabinetmaker's triangle to quickly orient the pieces. One quick test will indicate right away if there is more fitting to do. While holding the planed edges together with light pressure, rotate the pieces in opposite directions—the top of one board moving toward you and the other away (5–15). If they pivot easily at the center, it's likely that both boards are humped. If there is some resistance to pivoting, the ends of the two pieces are making contact, which is good.



5–15. Pivoting test for tight board ends.

One of the real challenges for novice edge-joiners is getting a tight joint at the ends. There is a natural tendency to make a slightly heavier cut at the beginning and end of each stroke. The cumulative effect is to create a hump in the center of both board edges.

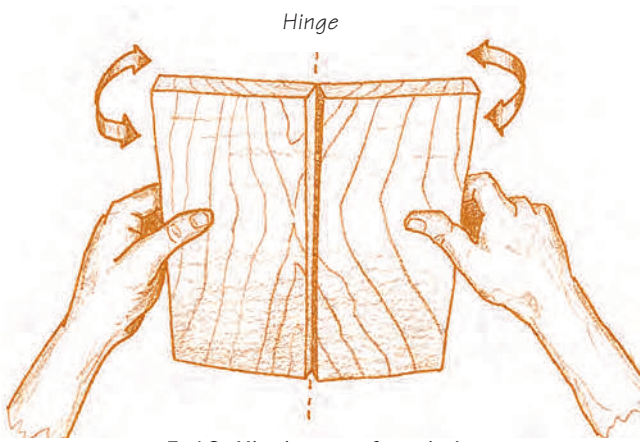
If the boards pivoted, sight the joint against a light and you will see the gaps at the ends. The goal is to methodically remove the hump without altering squareness. Place one piece back in the vise. Envision the length of the edge divided into fifths. Take successive partial-length shavings—first from the central fifth, and then from the second to the fourth, followed by a full-length stroke. Try the joint again. If the boards still pivot, repeat the steps on the other piece. Continue in like manner until the joint can be felt locking at the ends. If the plane is nearly the same length as the board, stick to partial-length shavings until no shavings are forthcoming from the center. This indicates that the edge is as flat as the plane. Take a full-length shaving, and then try the joint for the first time.

Beware of creating a dip in the central portion of the edge. Some craftsmen do intentionally create a small gap there and call it "springing the joint." This puts pressure on the ends of the joint once it is glued up, the thought being that since edge joints usually fail at the ends first, tension should be used in the rest of the glue surface to hold them tight. But it is easy to end up with an overly stressed joint, prone to wholesale failure, or just a poor-looking joint. The best joint fits perfectly, from end to end, without stressing the boards.

For boards small enough to be taken in hand comfortably, check the fit by sighting against a bright light. If the boards are too large, they may be laid flat on the bench or one held in a vise and the other stacked on edge on top of it. Do not mistake shadow lines for gaps. Wherever a gap is perceived, check that the surfaces are flush or oriented so that no misleading shadow is cast.

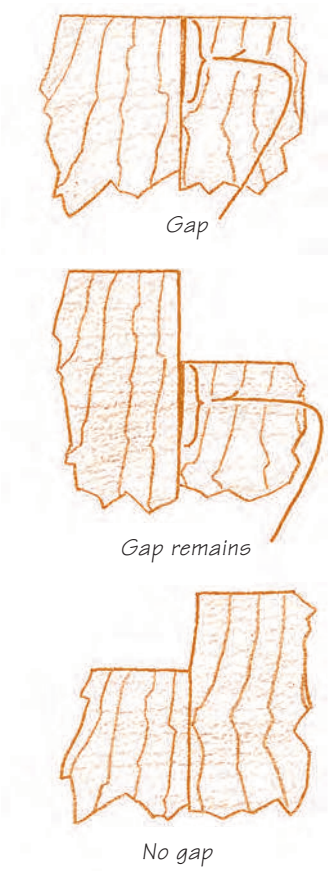
Testing for Wind

This time, while mating the boards forming the joint, cock the wrists very minimally toward yourself and then away (5–16). If overdone, the effect would be to hinge the joint open lengthwise, on the side facing you, and then away from you, but that is not the intent. Instead, try to feel if the joint



5–16. Hinging test for wind.

remains firm, or if there is any rocking within the joint betraying the presence of a wind. If it feels firm, the board is in good shape. If a small amount of motion is felt, look closely along the joint while racking it in the same way. Check the front and the back. At some point you will see a small gap opening and closing. That area can be checked for square, but simply sliding the ends out of register with each other may indicate which edge is drooping.



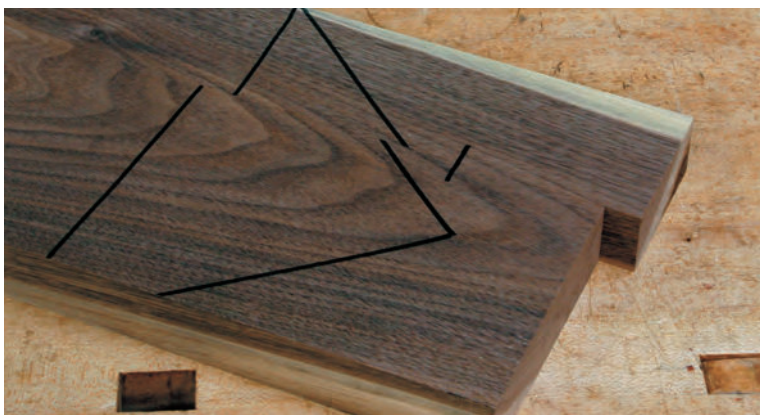
5–17. Offsetting ends to identify a board with a defective end.

For example, perhaps a gap was discovered at the top of the joint. If raising the left-hand piece does not close the gap, but raising the right-hand piece does, it can be surmised that the wind is in the right-hand piece (5–17). Take the previously described steps for re-moving wind, and then try the joint again.

If the adjustments to the joint keep creating gaps in different locations, the shavings are probably too thick. Each time an adjustment is made, you are overcompensating and causing a new problem. Adjust the plane. Give yourself a break and use the jointer to get back to square one if you have become frustrated. With a little practice, it all comes together: the board comes off the jointer, a few strokes of the plane clean off the milling marks, the joint is tried, a few adjustments are made, the joint is tried again, and the board is ready for the clamps.

Matching Grain

Lay the pieces on the bench in their original orientation. Match up the grain lines for the most harmonious appearance across the joint. A pencil line across the joint indexes the parts, so there is no need to fumble with this decision while gluing; merely line up the pencil mark and clamp (5–18).

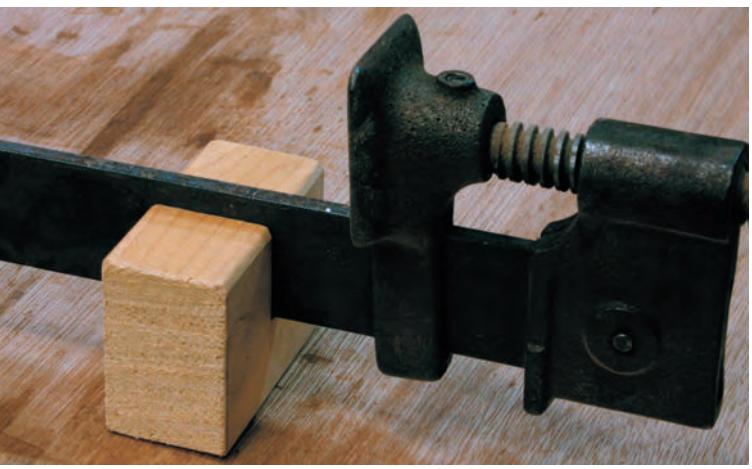


5–18. Aligning grain and indexing with a line. Notice the offset of the pieces at the end of the joint.

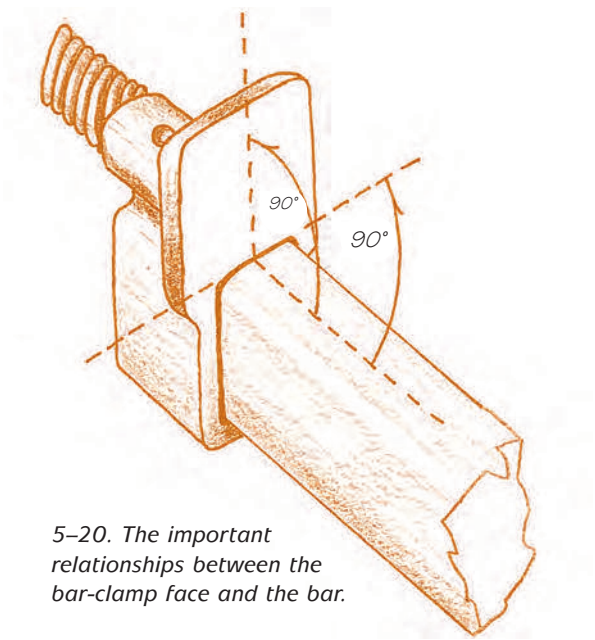
Clamps

Literally any clamp that opens wide enough can do the job, but generally choose bar or pipe clamps for edge-gluing. The sizes of the clamp ends are geared for the typical thicknesses encountered, and they

come long enough for gluing up wide surfaces. They should rest securely on a bench top with the jaw opening facing the ceiling. If the clamps are wobbly, fashion a series of uniform blocks to support them—only one per clamp is needed (5-19). The method shown in 5–21 places all the clamps beneath the boards being glued (rather than staggered under and over). It is helpful if the horizontal centerline of the clamp screws is the same height off the workbench. Keep the bars free of dried glue to prevent scratching the wood.



5–19. Bar clamp support block.

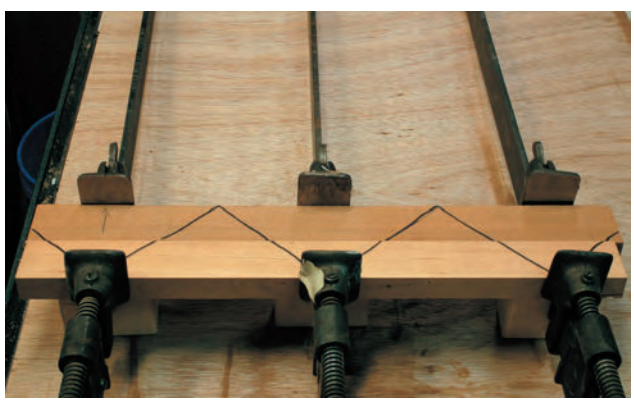


5–20. The important relationships between the bar-clamp face and the bar.

The faces of the clamp heads should be flat, smooth, and square to the bar in both directions—that is, in line with and across the length of the bar (5–20). Lumpy or misaligned clamp heads exert pressure at an angle to the bar, skewing the boards as pressure is applied. The effect is greatly magnified when glue lubricates the joint. If the clamps need attention and you cannot do the work, have it done by a machinist.

Determining the Number of Clamps Needed

The number of clamps used on the boards depends on the length and strength of the boards being glued. While developing a sense for what is required, apply this technique: envision or lightly sketch a zigzag of 45-degree lines across the face of a board, starting at the center and working out to the edges (5–21). If the boards are of different widths, use the narrower one. Each apex on the edge of the board opposite the glue line indicates one clamp. Alter the distribution and/or add an extra clamp for even spacing along the length of the joint. If joining narrow boards, which will not transmit the clamping pressure far along the glue line, cut down on the amount of clamps needed by adding cauls (stiffeners) to the outer edges of the boards. Add the width of the caul to the width of the board while estimating the amount of clamps.



5–21. Forty-five-degree lines have been drawn across the face of the board to approximate how many clamps to use when edge-joining boards.

Preventing Glue Drips

Protect the bench top from glue with a sheet of polyethylene film or an appropriately sized sheet of 1/8- to 1/4-inch waxed Masonite. Glue does not adhere to either, so the coverings can be used over and over. With experience and care, you will apply just the right amount of glue, avoiding drips, and dispense with the coverings.

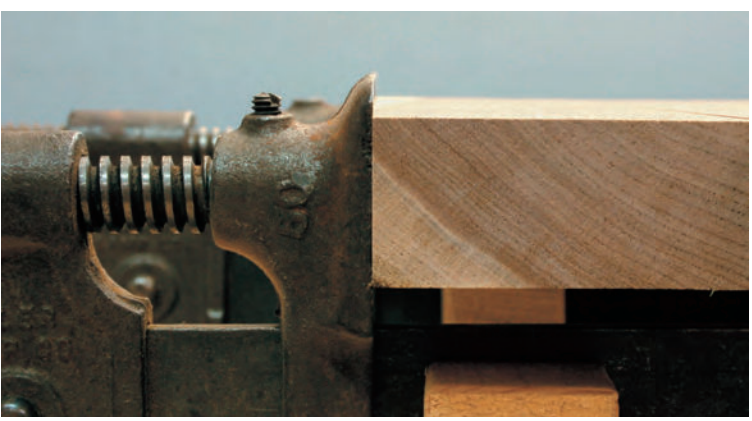
Guidelines for Successful Edge-Gluing

The primary difficulty with edge-gluing boards is that they slide and cup under clamping pressure, causing misaligned surfaces and partially opened glue joints.

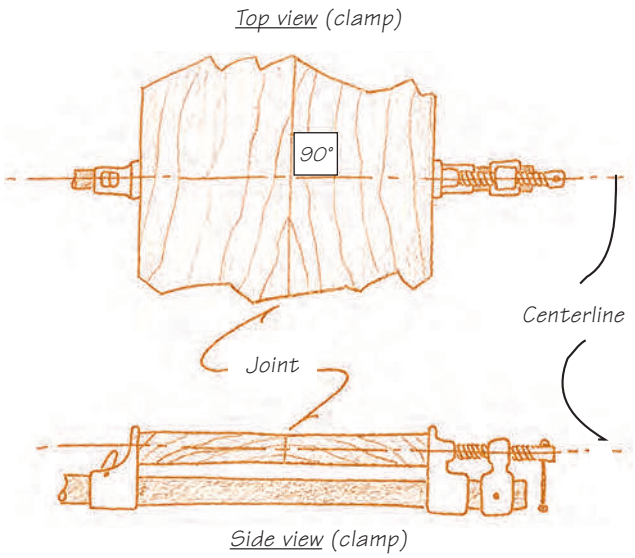
Make sure that the following conditions are met:

1. The clamp heads are properly machined.
2. The boards and clamps are aligned.
3. The correct amount of glue is used.
4. The correct clamping pressure is used.

The importance of using properly machined clamp heads is discussed above. It is also important to align the centerline of the clamp screws with the centerline of the thickness of the boards (5–22 and 5–23). Also, the surface of the boards must be placed parallel to the clamp bar and the bar perpendicular to the glue joint. Skew the bar in relation to the glue joint and the boards will shift along the joint to bring the bar back toward perpendicular. Place the centerline thickness of the boards above the centerline of the clamp screw and the joint will want to hinge open upward. The opposite occurs when the centerline thickness sets below the clamp-screw centerline.



5–22. Aligning the centers of the thickness of the board and the clamp screw minimizes skewing of the joint during glue-up.



5–23. Proper alignment of clamp and boards.

Surplus glue creates a cleanup chore and causes the boards to slip around excessively as the clamps are tightened. Think of the porosity of the wood being glued: the more porous, the more glue the joint requires. Lay a bead of glue down on one edge. With the pad of the pinky, start in the middle of the joint and stroke the glue out firmly toward each end. Wipe off excess glue on the finger with a damp paper towel. If the surface seems too dry, add some more glue; if it seems too wet, squeegee off the extra glue with your finger before clamping up.

After clamping, assess the glue squeeze-out along the joint and make a mental note for next time. Small, evenly spaced beads indicate a good job. Dripping gobs show an overabundance of glue, and no, or sparse, squeeze-out indicates a potential lack of glue.

Excessive pressure may cup the boards, making it difficult to align the joint and actually opening it up

rather than bringing it together. There is also the possibility of starving the joint of glue by squeezing it all out. If the joint fits well, only gentle pressure is needed to bring it home. The boards will not be distorted, and aligning them is a snap.

Dry-Clamping

Dry-clamping presents an opportunity to calmly prepare for the glue-up and make a final check on the quality of the joint. Perform this ritual before *every* glue-up. Arrange the clamps on the bench and the wood on the clamps. Distribute the clamps evenly, with the outer clamps near the ends and the bars perpendicular to the glue joint. Adjust the threaded end of the clamps so that about 3/4 inch of the shaft extends from the "nut" toward the boards, to minimize shaft wobble. Pinch the boards with the sliding part of the clamp, and then back off the threaded shaft one turn for clearance.

Starting at one end, support the boards with the index finger below the boards and the thumb above. Lower your head so that it is level with the clamp screw, and lift that end until the screw is lined up with the center of the thickness of the boards. See that the boards are parallel to the clamp bar and feel with the finger and thumb that the boards are flush with each other at the joint.

Now tighten the clamp just enough to hold the boards in position. Then shift to the other end and do the same positioning. Lightly tighten that clamp as well. Gently snug any interior clamps that remain. If dealing with boards that are not perfectly flat, rather than clamp at both ends first, work your way across the joint, starting at one end, aligning the boards flush, and clamping while proceeding.

Lay a straightedge across the joint at a spot where the boards are perfectly flush. Check to see that the surface is flat widthwise (5–24). Correct any deviation using the plane to slightly angle the edge of one board in the direction that will compensate for the error. Examine the joint for gaps, especially at the ends. Tighten the clamps a bit more to prevent

5–24. Checking for flatness across the boards with a straightedge.

them from falling off; then turn the assembly over and check the back side. Lightly mark any problem areas with a pencil. Make all corrections using your recently acquired arsenal of planing techniques. Resist the temptation to mash out gaps by bearing down on the clamps—the final results will be disappointing. Dry-clamp again if any alterations have been made.

Glue-Up

Carpenter's yellow glue works well for edge-gluing. It is easy to work with, capable of leaving invisible glue lines, and very strong, and it sets up fast. It must be fresh—smooth and runny—to give good results. Stay away from thickened, lumpy glue. Have on hand glue in a bottle, a dampened paper towel, and a sharp one-inch-wide chisel.

Apply glue in the prescribed manner and lay the boards in the clamps. Line up the grain as indicated by the pencil mark. With the boards lying directly on the clamp bars, gently tighten them up to squeeze out most of the excess glue (5–25). Scrape off the squeeze-out, holding the chisel perpendicular to the boards and wiping it clean with the towel each time it becomes loaded with glue.

Loosen all the clamps and reset them as was done when dry-clamping, aligning the clamp screws with

the centerline thickness of the boards. If the boards shift slightly, loosen the clamps and make adjustments to the boards while proceeding, making sure that the adjacent surfaces are flush and the pencil line indicating grain matching is properly aligned. Do not overtighten the clamps. With the glue cleaned off, you should be able to see that the joint is together. Additional force may starve the joint for glue. Once you are satisfied with the clamping, stay with it a moment longer; some glue may continue to ooze out, which can be cleaned off now.

Carefully turn the assembly over to clean up the back. Do not worry about contaminating the surface with glue, because the first swipe of the plane will remove any residual glue in the pores of the wood. Pencil the time at the end of the glue-up on the boards. Remove the boards from the clamps in one hour and gently scrape off any glue that remained on the back side. You may continue working the boards at any time now.

5–25. Squeeze-out as seen from underneath the board. It is a little heavier than need be.

Troubleshooting Guidelines

Edge-joining can be tricky. There are many components that need to be correct. Scan this list to determine why good-quality edge-joined boards have not been produced:

- The plane shavings are too thick.
- The blade is not sufficiently sharp.
- The cutting edge of the blade is not straight.
- The plane bottom is not flat.
- An improper planing grip has been used, causing an imbalance in hand pressure.
- An improper stance or body positioning was used, causing the same as above.
- The square was used improperly (including the use of it on a defective reference surface).

Joining Multi-Board Surfaces

Glue up the boards in adjacent pairs. Then join these wider surfaces to pairs also, until the entire surface is complete. In this manner the accuracy of each joint can be carefully controlled. Since the boards are worked gently and returned to a compressed state, half an hour in the clamps is sufficient before working the next joint. A few extra clamps allow you to work and glue the joint on the following pair of boards after the first joint is done, and keep rotating along.

To prevent glued-up surfaces from cupping, always store them so air can circulate on both sides. If mistakenly laid flat on a bench top overnight, the sides will curl up, resulting in a cupped surface. Flipping the distorted surface over and leaving it overnight may or may not alleviate the problem.

FLATTENING AND TRUING SURFACES

Now it is time to flatten and true the edge-glued practice stock. Saw the ends square if they are out of register. As with edge-joining, a larger plane flattens a larger surface with greater ease than a smaller plane will, but too large a plane is awkward to use on a small surface. For this relatively small board, a jack or even a polishing plane is a good choice. The sharpness of the iron is, as always, important, but the shape of the edge is not critical.

Set the plane for a thicker shaving than done for

5–26. Side grip.

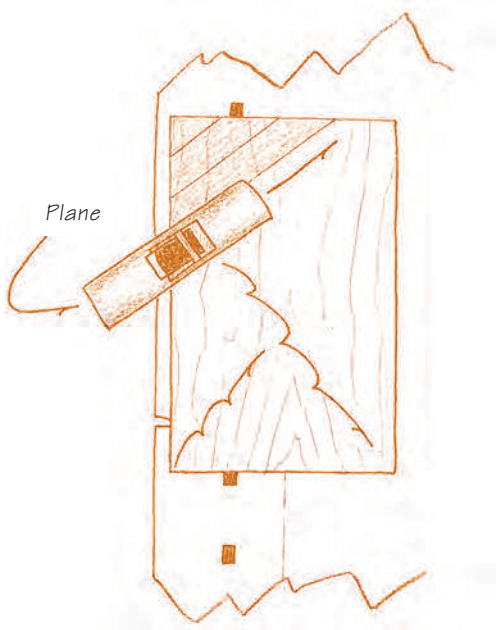
edge-joining. The thicker the shaving, the harder the plane is to push and the greater the likelihood of tear-out, so shaving thickness is limited by your strength and the response of the wood. Start with a thinner shaving and gradually increase the depth of cut to establish the most efficient setting.

The Side Grip

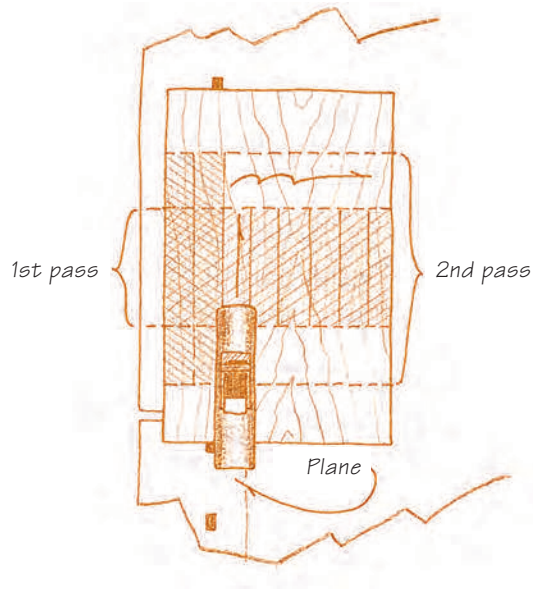
Two ways of holding the plane have been described: the basic push grip (refer to 5–1) and the modified push grip used for edge-joining. What I term the "side grip" is a third useful way of holding wooden planes (5–26), and my favorite for longer planing sessions. Whereas you stand behind the plane using the first two methods, with the side grip you are positioned at the *side* of the plane. The legs are spread somewhat more than shoulder-width (24 inches or so), with the knees and waist slightly bent. You should feel springy and loose, and should be able to sway left or right comfortably. As you get into the rhythm of the work, you will find yourself rocking from side to side, transferring body weight from one foot to the other and using the whole body to do the work—planing can be done this way for a long time if need be.

Dog the board to the workbench. It usually rises off the bench a bit in the process. Tap the dogs down slightly, to anchor the board. If only stops are being used to capture the board, they should be added at the sides as well as the end to control it. Temporarily screw low battens to the planing hook or clamp extra stops to the bench top. Place any clamps well out of the way, to avoid crashing into them.

Level the surface and remove all milling marks by methodically planing from corner to corner at about a 45-degree angle to the grain and then coming back the other way, as shown in 5–27, creating a cross-hatched pattern. The strokes should still be trending "uphill" with respect to run-out. Repeat until the surface is cleaned off and each stroke produces a shaving from start to finish. This is a good way of handling the unevenness at the glue joint and dealing with overall inaccuracies. Planing at an angle to the grain also minimizes tear-out when taking thick shavings, but does leave a roughened surface. When the smoothing stage is reached, the surface should plane quickly to a nice polish. If it takes many strokes to remove gouges and tear-out from this leveling stage, the plane was set to remove too much wood.



5–27. Primary leveling of a surface.

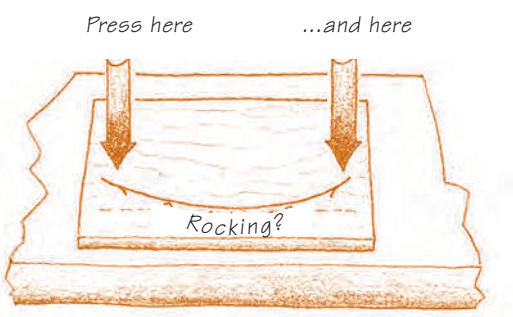


5–29. Correcting a lengthwise hump.

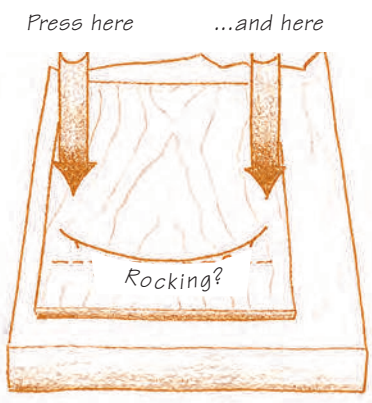
Checking the Surface for Hump and Wind

An accurately flattened workbench is a great aid, acting as a built-in reference surface to gauge the workpiece against. Flip the board over so that the newly planed surface is facedown. With your hands placed broadly across the width at the ends of the board, try rocking the board end for end (5–28). If it rocks, there is a lengthwise hump. Remove it the same way humps on the plane ramps were removed (refer to Chapter 4). Adjust the plane for a lighter cut. Take partial-length shavings, perhaps one-third the total board length and centered over the hump. Work all the way across the width. Follow with two-thirds-length shavings (5–29). Test again and repeat as necessary until the board rests steadily. Speed or slow the pace of change by adjusting the depth of cut or altering the length of the strokes. Finish with full-length strokes.

Next, place your hands on the sides of the board and try to rock the board from side to side to reveal the presence of a widthwise hump (5–30). Look again to your ramp-truing experience as described in Chapter 4 if there is a problem. Take a stroke down the center at position one as shown in 5–31,

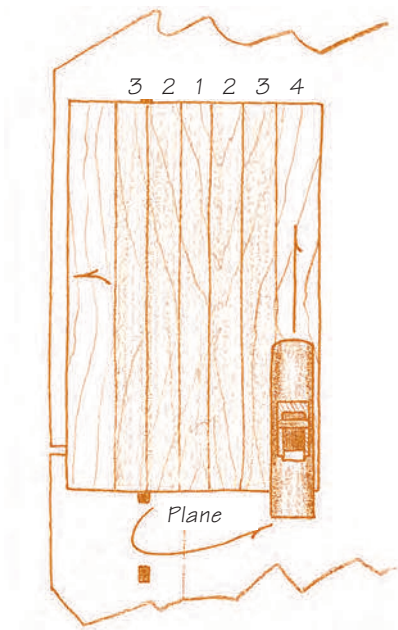


5–28. Checking a surface for a lengthwise hump.



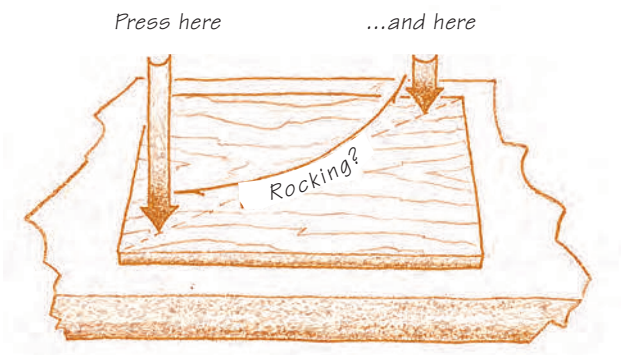
5–30. Checking a surface for a widthwise hump.

and then one to either side at position two. Next, plane at positions one, two, and three. Continue the pattern until the sides are reached. Check the board again and repeat as necessary.



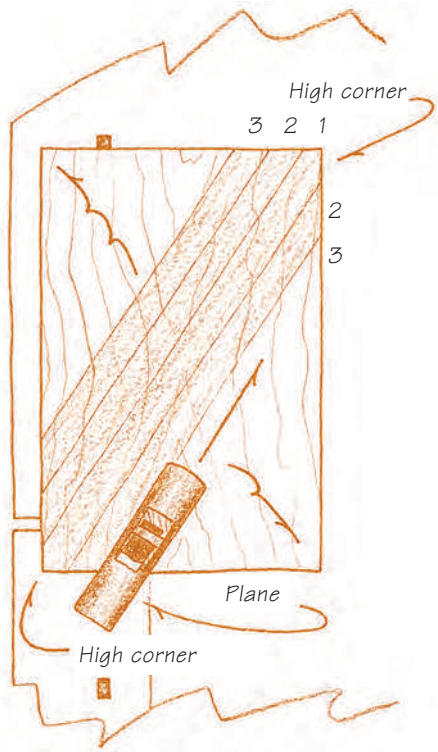
5–31. Correcting a widthwise hump.

The test for wind is similar. Alternately poke a pair of diagonally opposite corners with your index fingers, attempting to rock the board (5–32). Try the other pair of corners. If the board remains perfectly steady, then it is trued. Should the board rock, the corners being poked are relatively low and the other pair of corners are relatively high, acting as pivot points. The board has a wind. Note the high



5–32. Checking a surface for wind.

corners, flip the board back over, and clamp it. Again, the remedy uses the same methodical approach used to correct wind on the plane ramps. Plane a stroke from high corner to high corner at position one as shown in 5–33 and then at both locations of position two. Go back to position one for a stroke, to position two, and then to position three. Continue expanding this pattern until the low corners have been reached. Flip the board and check for wind again.



5–33. Correcting wind.

If the work surface is not adequately flattened (and that is something that should be done after a bit of this type of practice), use a straightedge and winding sticks to assess the practice board. Gauge the ends and middle across the width of the board with the straightedge, then the sides and middle along the length, followed by the diagonals. Use winding sticks as described in Flattening and Truing the Bench Top on pages 127 and 128 to identify the "high" corners.

Final Flattening

First consider how the wood has responded to planing. If there has been little tear-out, maintain the current depth of cut. If the wood is prone to tear-out, use a lighter setting. Err on the side of a lighter cut to avoid tear-out, as it may be time-consuming to eliminate in the smoothing stage of planing.

Finish off the flattening by planing with the grain. Start at one side of the board and work your way across, slightly overlapping each pass. Stroke your hand on the wood in the direction being planed to check for tear-out. The fingers should glide smoothly over the surface; any catching or roughness indicates tear-out.

Another essential diagnostic tool is the bench lamp. Plane toward the light and set it inches above the board and just off to the side. Projecting strong, low-angle light places any irregularities of the surface in stark relief by creating shadows.

It is important to flatten the opposite face, if it has wind, before proceeding to the polishing or smoothing stage. Otherwise, the board may flex while being planed, interrupting the flow of shavings and leaving an imperfect surface. In fact, if the stock is appreciably out of true to begin with, it is possible both faces will have to be worked back and forth to accurately true it. If you started with trued stock and did little other than remove milling marks with the initial planing on the first face, treat the opposite face in like manner.

On the other hand, if the first face required substantial planing, there is the concern of maintaining uniform thickness as well as correcting wind as the opposite face is planed. Trim off any projecting ends and flatten the second face approximately. Use a marking gauge to reference off the flattened face and scribe the desired thickness on the ends and side of the board (5–34). Plane down to the mark—with harder woods a discernible ridge may be revealed while planing the face, saving the need to maneuver around to look at the edge (5–35). The knife of the marking gauge should be sharpened to a curving knife edge, rather than a pencil point, to cut effectively.

5–34. Scribing the thickness of a board.

5–35. The scribe line marked on the edge is revealed on the face by planing. Note the fuzzy-looking inner edge.

POLISHING SURFACES

Perhaps the most satisfying aspect of hand-planing is perfecting a surface to shining brilliance using nothing other than the plane and a wad of fine shavings. The work is pleasant, engaging, and satisfying. The final surface may be so alluring you are tempted to dispense with finishes altogether. And this may be done, where appropriate, to benefit from the wood's lovely natural aroma and subtle colorations, typically obscured by finishes.

Polishing Plane

A polishing plane (also called a smoothing plane) should be eight to nine inches long. The shorter length allows an extra stroke or two to be taken in areas requiring added attention. Too short a plane may produce an undulating final surface. The plane should carry an iron $1^{3}/_{4}$ to 2 inches wide. A $1^{3}/_{4}$-inch blade yields a nice shaving width and the plane will fit the hand of most people. Since the width of the plane used increases with the blade's width, anything over two inches wide is cumbersome for most people with average-sized hands.

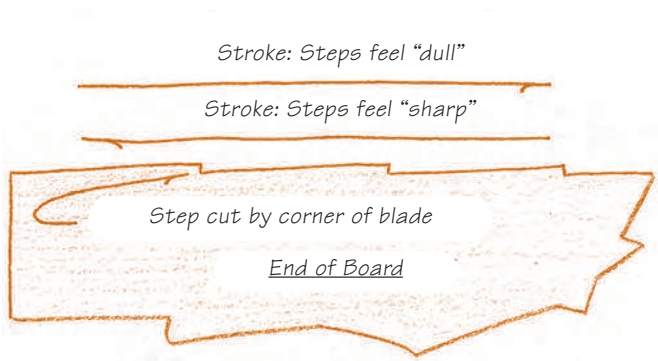
The blade must be arced very precisely to yield a shaving nearly its full width yet not allow the corners to dig when the plane is set for a very fine cut. It is a matter of trial and error. If the shavings are full width and very thin, and corner digs are left in the wood, there is not enough arc, so it is necessary to go back to the 800-grit stone and add more arc. If the shavings are too narrow, use the 800-grit stone to flatten out the arc. Of course, the blade must be rehoned on the 8,000-grit stone also. When very thin and wide shavings are produced—for example, shavings slightly wider than $1^{1}/_{2}$ inches from a $1^{3}/_{4}$-inch-wide blade—the plane is performing well.

Planing Technique

It is important to start with a flat surface, whether it is obtained by planing or by machine. Set the plane for the finest cut. Methodically plane the entire surface. Start at one edge and work your way across, slightly overlapping the strokes. Pay attention to the shavings coming out of the throat of the plane. Do they seem to come off the center of the blade, or from one side or the other? Tap the blade over a bit if they are off to one side, reducing the cut on that side and increasing it on the other. Cover the entire surface two times.

Check your progress visually and tactilely. Scrutinize the surface for tear-out using the bench lamp for assistance as in the final stage of flattening. Brush your fingers across the grain from side to side in both directions. This is to check for sufficient blade arc and a properly adjusted plane. The surface should feel very smooth, perhaps with a hint of undulation caused by the arced blade. If sharp steps are detected that head in one direction, but the surface feels smoother coming back the other way, the corner of the blade is digging. The plane may be maladjusted, the blade insufficiently arced, or both.

The direction the hand moves to feel the sharp ridges also indicates which corner of the blade is digging: it's on the side of the plane you would be moving toward if the plane were on the board ready to make a shaving (5–36). Adjust the plane to lessen the cut on that side while increasing the cut on the other side. If the blade continues to dig on one side or the other, try setting for a finer cut. Failing that, go back to the 800-grit stone and develop a bit more arc on the blade.



5–36. Feeling the steps left by the corner of the blade indicates how to adjust the plane.

When the surface has been planed free of ridges, make a final check for tear-out. It may be necessary to go over the entire surface a couple of extra times to achieve a flawless surface. Finally, remove the board from the bench top and sight along its length toward a bright light. The surface should be smooth and shiny, but there will also be a series of highly polished streaks going across the board. Those streaks are burnished by the bottom of the plane to

either side of the blade. Clamp up the board. Gather a good handful of only the finest shavings and vigorously burnish the surface, rubbing them back and forth with the grain and bringing the entire surface up to a uniform gleam.

If defects are noted that cannot be eliminated, the proper course of action is to omit the burnishing stage and go to scraping, followed by light sanding (see Chapter 7 for information on scraping). In time, you will be able to judge visually or after a few strokes whether the wood chosen is amenable to planing without much difficulty, if it will be challenging, or if scraping and sanding is the best approach.

5–37. End-grain shavings.

SQUARING END GRAIN

Due to the structure of wood, squaring, or simply planing, end grain holds a special challenge. No longer does the slicing occur parallel with the wood fibers; instead the cut is across the ends of the fibers. The wood offers considerably more resistance and, indeed, demands the sharpest blade edge for planing effectively. If end grain is planed without the proper precautions, the inevitable result is cracking and chipping at the end of the cut. Most woodworkers have experienced this frustration and may have also noticed that instead of shavings, the result is more like dust. A well-tuned and sharpened wooden plane will slice beautiful end-grain shavings (5–37), allowing the ends of boards to be squared and trimmed with little difficulty.

Continue on with the practice board. Check the end of the board for square in both directions (from a face and a side). Even if the board reads true, doubtless there are saw marks and an out-of-focus or blurry look to the grain. Planing the end grain gives it sharp clarity, but the surface will remain a little fuzzy. A few swipes with 400-grit sandpaper, backed by a sanding block, knocks off the fuzz, leaving a perfectly smooth surface.

Avoiding Split-Out at the Completion of an End-Grain Cut

There are several approaches to avoiding splintering at the end of a stroke. If the end of the board is simply being cleaned up and accuracy is not a major concern, one way is to entirely avoid planing off the end of the board. Plane to the middle of the board and stop. Pick up the plane, turn it end for end, and plane into the center from the other end with a pulling stroke toward your body. Pulling the plane may feel awkward at first, but when the hands become accustomed to their reversed roles, it is rather more convenient than flipping the board or moving your body around to plane in from the other direction.

Another useful method, when precise squareness is a concern, is to lightly chamfer the corner of the board where the end of the stroke occurs (5–38). The chamfer can be formed with a chisel, file, or plane. In this way, the last fibers contacted by the blade are supported by other fibers nearer the edge of the board. The size of the chamfer required is directly related to the depth of cut: a small chamfer

5–38. Chamfering the corner of the board.

is good for light cuts, and a heavier cut needs a larger chamfer. A 45-degree chamfer yielding a flat about 1/16 to 3/32 inch wide safely allows several light passes with the plane. Each stroke of the plane reduces the size of the chamfer. Continue too long and the error is heralded by a sharp cracking sound. Rub in some glue, tape the splinter shut, and set the board aside until it is dry. The disadvantage of this method is the presence of the chamfer in the finished product and that very element of uncertainty.

After chamfering the corner, reverse the board in the vise so that the chamfer is away from you. To minimize chatter and the potential for pivoting the stock in the vise, clamp the board as low to the vise as possible without endangering your fingers while planing. Set the iron for a fine cut. You may find that the blade must protrude a bit farther than when planing side grain to produce a continuous shaving. Also, more downward pressure is required when planing end grain; use the minimum necessary to get good results.

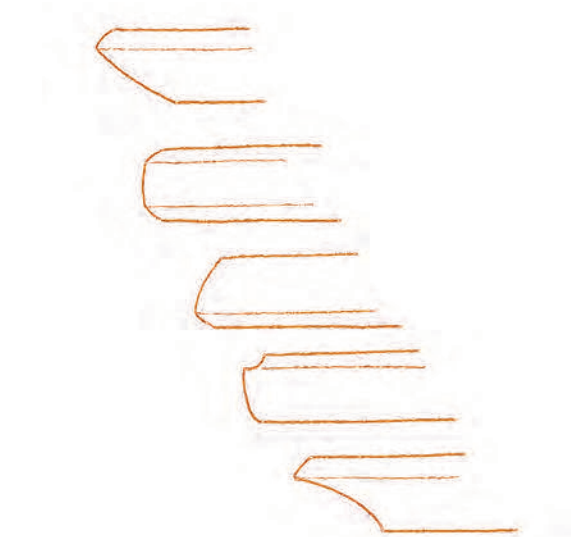
Plane off any saw marks and then check the end for square. Correcting an out-of-square condition perpendicular to the *face* of the board is the same as squaring the edge of a board for edge-joining: plane away the side reading high, taking progressively wider, partial-width, full-length shavings. Correcting an out-of-square condition perpendicular to the *sides* of the board is handled by taking progressively longer full-width shavings, starting from the end that is high. Humps or dips in the center are removed, as you are now accustomed to, by simply planing away the high spots and avoiding the low spots.

Correct each of these faults, one at a time, rather than trying to figure out the stroke that will redress all at once. Always end up with one full-length, full-width, continuous shaving. Keep an eye on the chamfer and restore it whenever it gets too small.

Another method of planing end grain employs an aid called a "shooting board," a simple device, yet truly wonderful in its many uses. Shooting boards, along with a variety of specialized aids and techniques, are covered in Chapter 6.

PROFILING

Hand planes can create a variety of pleasing profiles for the ends and edges of boards. Chamfers are easily accomplished in any size. Roundovers are as clean and slick as a hand-planed surface, with the lively addition of minute faceting. Done carefully, a reasonable uniformity is not difficult to achieve, but still the finished element is easily distinguished from the rigid product of a router or shaper. Break away from these basic shapes and a whole range of possibilities opens up, freeing you to explore shapes other than what come off the shelf (5–39). You may even be inspired to make a simple round-bottomed molding plane to further expand your horizons (5–40).



5–39. Some ideas for planed profiles. The lower two require a round-bottom molding plane or have to be carved.

Finish up the practice board by planing various chamfers, roundovers, or other shapes into the edges and ends (5–41). To avoid splintering when planing profiles across end grain, hold the plane skewed and trend the direction of the stroke in the direction of the side grain while exiting the cut.

FINISHING HAND-PLANED SURFACES

Applying a finish to a hand-planed surface need not be different from applying one to a surface prepared in any other manner. Water-based finishes are easier to handle, since little if any grain-raising occurs when they are applied. Frequently, planed and burnished surfaces are so appealing "in the white" (unfinished) that the wood begs not to be

5–40. Some shop-made round-bottom molding planes.

5–41. A planed chamfer and round-over in end grain.

smothered in a thick coating. Consider thin finishes, like very diluted shellac, a light application of oil, or perhaps just a coat of furniture wax that is wiped on, buffed out with a natural bristle brush (to get the wax out of the pores), and then polished with a soft cloth.

Canned shellac has a limited shelf life; it won't cure properly if used after its expiration date. Mixing your own shellac from flakes will result in a successful shellac finish (5–42). A cup or so of shellac flakes placed in a 16-ounce glass jar and dissolved in about two cups of alcohol is a good starting point for a stock solution. Denatured alcohol works fine, but I prefer grain alcohol obtained from a liquor store. There's an appeal to working with food-grade finishing materials, but don't be tempted to imbibe. Swirl the mixture every few hours, and then leave it over-night. The shellac should be completely dissolved and ready for use in the morning.

Strain some shellac into a small-mouthed container, like a wine or beer bottle, that can be stoppered with a cork. Dilute it with an equal amount of alcohol, and then apply a little to the thumb. Rub with the index finger and blow until the alcohol flashes off, leaving the resin behind. It should feel only slightly tacky. If it's stickier than that, dilute with more alcohol and test again. Apply the finish with a cotton, lint-free cloth, like an old T-shirt. A

5–42. The products and materials needed for a shellac finish include shellac flakes, a jar of shellac stock solution, an applicator bottle with diluted shellac, grain or denatured alcohol, and an applicator cloth.

little pad can be made by covering up a few cotton balls with the cloth or by just folding the cloth a few times on itself. Wet the cloth and stroke the finish on, but don't attempt to rub it in. Do a few coats in quick succession, and then let it rest for a few minutes. Repeat this five or six times, giving a longer rest between each application before proceeding.

If the finishing is done well, with properly thinned shellac, there should be no need for sanding between coats. If needed, a quick buff with stearate-coated 400-grit sandpaper (sold at automotive stores) will do. Stop when a sheen starts to develop. Let the finish dry overnight and then burnish it lightly with fine shavings to bring out a very pleasing gloss.

Practicality dictates a durable film for tabletops and the like—something much tougher than shellac or oil finishes. Chances are, though, that the varnish or lacquer goes on with regret; with every layer of finish, something is diminished as contact is lost with the wood itself.