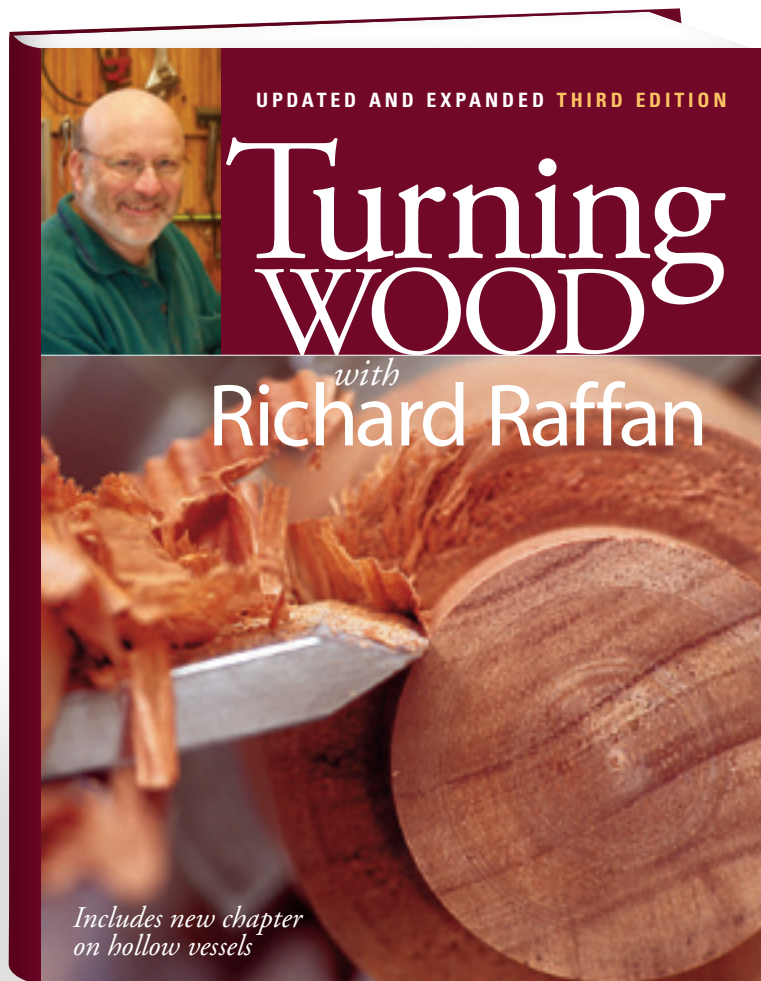


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CHAPTER

6

CENTERWORK

IN CENTERWORK, THE GRAIN of the wood is parallel to the rotational axis of the lathe. The term can be misleading, however, because centerwork jobs are not necessarily turned between two centers. While objects such as lace bobbins, rolling pins, banister spindles, and newel posts are turned between a spur drive and a tail center, items such as boxes and eggcups must be held only at the drive end so the other end can be hollowed.

The straighter the grain, the easier the wood is to work and the smoother the surface you can obtain directly from the tool. Short grain, which runs at a tangent or right angle to the axis, is difficult to cut cleanly and accurately. It is especially awkward to cut with a skew chisel, which is the main centerwork tool. Because short grain is structurally very weak, you should avoid it for long or slender work.

Consider the nature of wood: a bundle of long fibers, all running in much the same direction. The best and the cleanest cut results from slicing those fibers supported by other fibers—a technique often referred to as cutting with the grain. Cutting in the opposite direction, or against the grain, results in a torn surface because each fiber being cut is not fully supported by its neighbors. For a shearing cut, keep

the cutting part of the edge at around 45° to the oncoming wood.

A scraping cut, with the edge parallel to the grain, will leave a torn surface, as the cutting edge levers lengths of fiber from the bundle. If you proceed gently, you might get away with a scraping cut on fine-grained hardwoods, but it is better to learn the shearing cuts. By contrast, scrapers often produce the best surface on end grain, when each fiber is well-supported by others. A delicate scrape on the end grain of many hardwoods leaves a glasslike finish.

In this chapter, I will explain the essential centerwork cuts and lead you through a series of exercises from which you can learn them. Within the chapter are three projects that give you an opportunity to put these skills to work. I encourage you to practice the exercises seriously because they will enable you to develop your technique and give you the confidence you'll need to approach the projects. Don't think of your results as successes or failures. It is experience you are after, and everything you turn will be a step in the right direction.

You will usually learn more from your failures than from your successes. You may find it useful to refer back and forth between the descriptions of tool usage to the exercises and

Tower Series

These boxes have threaded lids and small containing spaces designed to hold rings and small jewelry. They were inspired by Irish and Middle Eastern towers.



MATERIAL: Tasmanian blackwood
SIZE: 3½ in. (90mm)
diameter

the project photo essays as you turn your way through this chapter. Refer to Chapter 3 for further explanation of the types and shapes of tools available and how to grind their edges. If you still feel vaguely uncomfortable, review Chapter 4 for a better understanding of how to approach the lathe and control leverage. But in the end, remember that there is no substitute for practice.

For these exercises you will need a 1-in. (25mm) roughing gouge, a ½-in. (13mm) shallow (spindle) gouge, and a ¾-in. (19 mm) skew chisel.

External Shaping

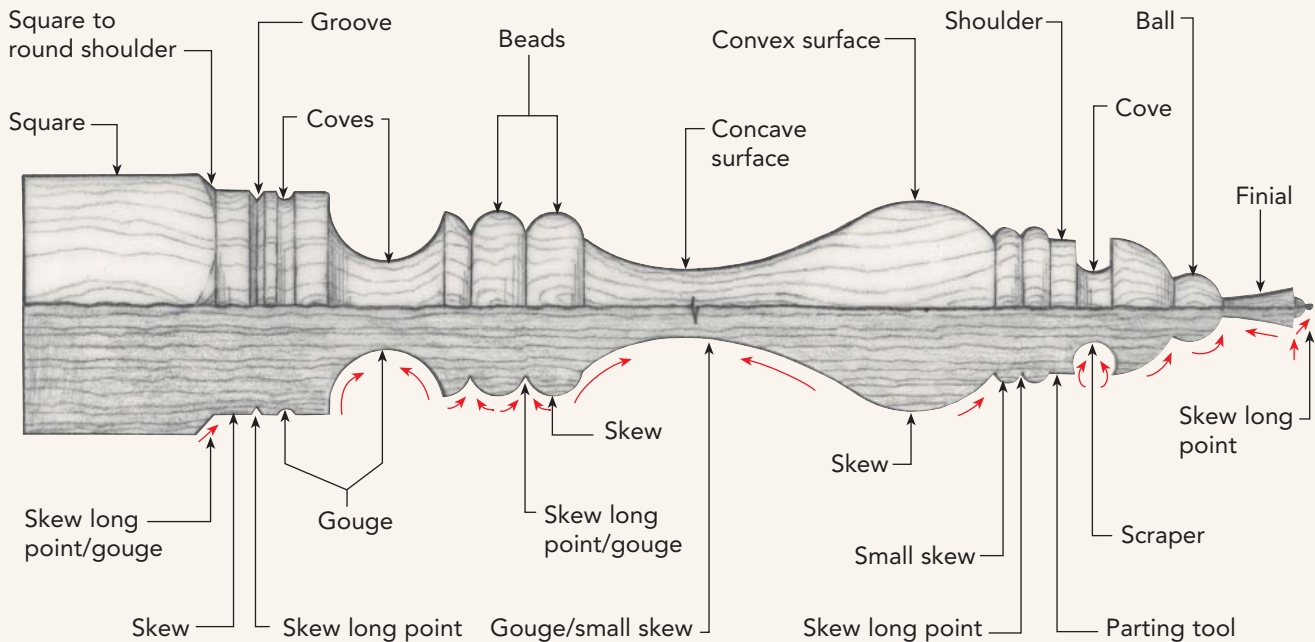
The cleanest cuts come from gouges and skew chisels shearing across the grain, and you can turn almost any spindle shape you want using these tools (see the illustration on the facing page). I use gouges to rough-down square sections to round and to cut coves. Otherwise, I favor a skew chisel, which gives me a superior finish faster and with less effort. The choice is a matter of personal preference—many turners use only gouges and still get satisfactory results. Parting tools, which peel the wood like a rotary veneer knife, are used at 90° to the axis to establish diameters or to cut finished work off the lathe. With a few exceptions, I feel that scraping techniques should be employed for external centerwork only when all else fails, usually on twisted grain or knots.

CHOOSING THE RIGHT GOUGES

Most shallow gouges are useful at some point in centerwork. Heavy 2-in. (50mm) gouges rough-down large square sections to round, while smaller ⅝-in. (3mm) gouges cut tiny coves and areas of twisted grain that are difficult to work with a skew chisel.

Square-ground gouges (see the illustration on p. 47) are commonly used for roughing-down—their shape allows you to use all of the edge (although not at one time)—and for fine cutting

EXTERNAL SHAPES AND TOOLS



Red arrows show the direction of the cuts.

of smooth cylinders and tapers. To cut coves or beads, you'll want a long, symmetrical fingernail edge (see the bottom right photo on p. 57), with no corners to prevent you from getting into tight spots. As a guide, I suggest the following tools for roughing-down squares to round:

- For work less than 1 in. (25 mm) in diameter: ½-in. (13mm) to ¾-in. (19mm) standard gouge or skew chisel.
- For work 1 in. (25mm) to 2 in. (50mm) in diameter: 1-in. (25mm) to 1⅜-in. (35mm) standard gouge or 1-in. (25mm) to 1½-in. (38mm) skew chisel.
- For work 2 in. (50mm) to 4 in. (100mm) in diameter: 1-in. (25mm) to 1⅜-in. (35mm) gouge.
- For work above 4 in. (100mm) in diameter: 2-in. (50mm) long-and-strong gouge.

Refer to the speed chart on p. 102 for all center-work projects.

BASIC GOUGE TECHNIQUES

When turning the cylinders, coves, and beads in the following exercises, ensure that your upper hand is always in contact with the rest. If the wood starts to chatter or flex as it becomes thinner, hold your hand behind it to equalize the pressure of the tool (see pp. 78–79). Set the rest parallel to the work and about ¼ in. (6mm) above center height. By holding the tool rigidly on the rest with your upper hand as you move it along the rest to make your cut, you can keep the cutting edge in the same plane. The rest acts as a reference point, or jig, for the tool edge.

Exercise: Make a smooth cylinder, without bumps and dips. Select a piece of wood between 8 in. (200mm) and 10 in. (255mm) long and

Centerwork Speeds for Even-Grained Blanks

DIAMETERS	LENGTHS					
	6 in. (150mm)	12 in. (305mm)	18 in. (460mm)	24 in. (610mm)	36 in. (915mm)	48 in. (1,220mm)
½ in. (13mm)	2,500	2,100	1,500	900	700	700
2 in. (50mm)	2,000	2,000	1,500	1,250	700	700
3 in. (75mm)	1,750	1,250	1,000	900	700	700
4 in. (100mm)	1,250	900	700	700	700	700
5 in. (125mm)	1,000	900	700	700	700	700
6 in. (150mm)	900	700	700	700	700	700

The figures in this chart are expressed in rpm. For safety, unevenly grained or unbalanced blanks should be started at half these speeds.



Scooping cuts using a 1-in. (25mm) deep-fluted roughing gouge reduce the square section blank to round.

*Don't push the tool hard against the wood:
Let the wood come to the tool.*

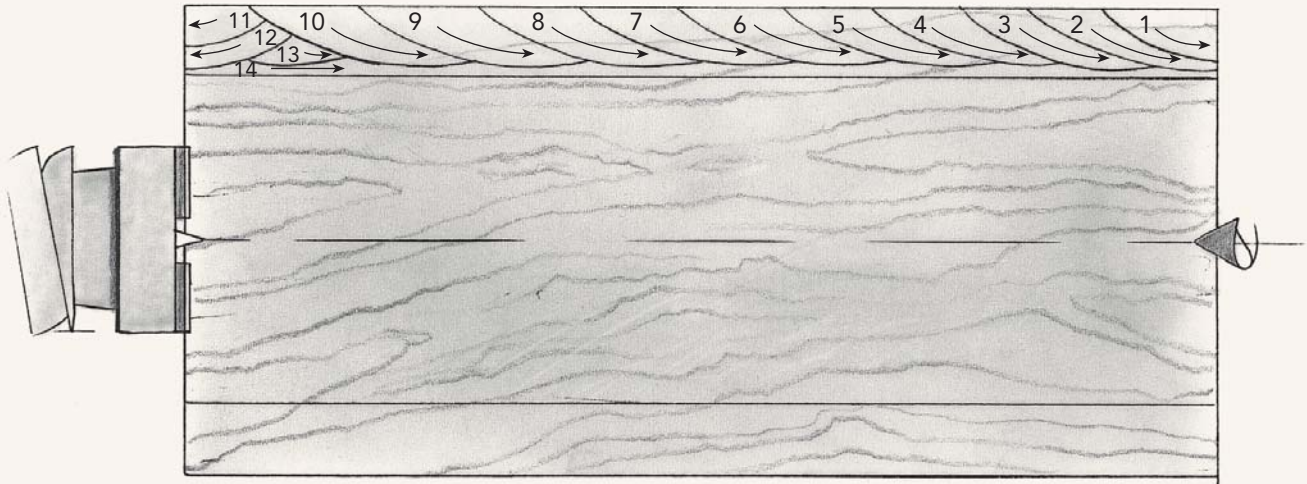
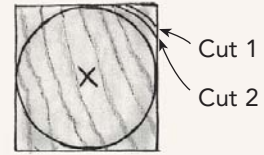
about 2 in. (50mm) to 3 in. (75mm) square. Ensure that the grain is straight, without knots or splits, and runs the length of the piece. Close-grained softwood or green limbwood are ideal. Mount and center the blank between a drive and tail center (see the top and center photos on p. 24), and check that it rotates without obstruction. Be sure that the tailstock is wound in tightly. Adjust the lathe speed to no more than 1,500 rpm to begin.

Start with a 1-in. (25mm) square-ground roughing gouge. The angle of the tool to the wood is dictated by a combination of personal preference, the precise shape of the gouge, and the angle of the gouge bevel. I generally use the roughing gouge almost square to the axis and angled up about 10°.

Rough-down the cylinder in two stages. First, reduce the blank to a rough cylinder, working from one end to the other in a series of short, scooping movements (numbered 1–13 in the top illustration on the facing page, then make a couple of passes the length of the job (cut 14) to refine the shape. Never start roughing cuts in the middle of a blank because you risk a whole

ROUGHING-DOWN A CENTERWORK BLANK

Make a series of short scooping cuts (cuts 1–13), then traverse the full length of the cylinder (cut 14).

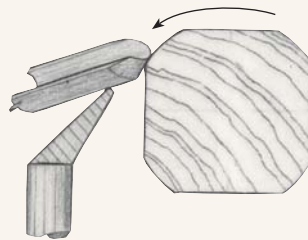


corner splintering away or more if the grain is not absolutely straight.

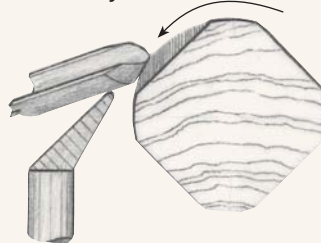
In the photo on the facing page, I use a deep-fluted roughing gouge rolled slightly in the direction I'm cutting (which is to the right). This is a peeling cut, where the portion of the edge cutting lies parallel to the grain and axis. The bevel rubs the wood as the edge pivots into the cut. My upper hand pushes the tool forward into the cut, and I get the typical wide shaving.

Don't push the tool hard against the wood: Let the wood come to the tool. The bevel should rub the wood but not be forced against it. Beware of pushing the tool forward too rapidly and into the shaded area as shown in the illustration at right. Apply your power to controlling leverage. As you start to remove the corners of the blank, you develop portions of a cylinder. When there is no wood to cut, the tool

TURNING SPACE



The bevel should rub the outermost surface of the wood. Do not allow the edge to drift into the shaded area or you risk a heavy catch.



A 1-in. (25mm) shallow roughing gouge is used to smooth the cylinder. I use the rest as a jig, keeping my forefinger firmly against it as my thumb pushes the tool to the right.



must be moved cautiously forward so that as the next corner comes around, the edge takes a fine shaving as the bevel rubs the cylinder surface again. When you turn a spindle with a square section left at both ends, you'll have to be able to move the tool along a definite path, turning space as well as wood. You'll develop that skill while roughing square section blanks to round.

As you make the scooping cuts, proceed down the length of the work. In the photo on p. 102, the scooping movements are made to the right, and after each one the tool moves down the rest to the left about 2 in. (50mm) to begin the next cut. The final scooping cut is made to the left, off the other end of the cylinder (see cuts 11 and 12 in the top illustration on p. 103). Try to avoid starting a cut by coming into the end of the piece from space, but rather work off the end. Because the grain runs parallel to the axis, there is a tendency for the wood to split if you cut into the end grain, and it is difficult to know exactly where the surface of the wood is in relation to the rest and the tool.

Where a cut has to be made from space into the end of a cylinder, make a trial pass just above the surface of the wood before easing the tool forward fractionally to make the cut, rather like a golfer taking a preliminary swing before hitting the ball. Try this when you feel more confident.

As the wood becomes thinner, move the rest closer to the work and drop it slightly so that the tool can still be used at the same angle. As you move the tool along the rest, keep the handle against your body with your elbows in and shift your weight from one foot to the other.

Once the blank is fairly well rounded, move the tool in long, flowing movements along the rest to true the cylinder (defined as cut 14 in the top illustration on p. 103). Beginning just inside one end of the cylinder, make two long, smoothing cuts (one in each direction), working off the ends.

Check the cylinder using a straightedge. A fairly accurate way of judging a cylinder without using measuring tools is to line up the surface with the lathe bed by eye, then check for bumps using your hand. Initially, it is more important to get smooth surfaces than a true cylinder, so if your cylinder tapers slightly from one end to the other, don't worry.

Exercise: Turn a series of identical coves using a ½-in. (13mm) shallow gouge. The gouge needs a long bevel so you don't have to swing the tool handle through too big an arc as you cut in first from one side and then the other. You should not have to change hands to turn these coves: Keep your left hand on the tool blade and the rest and your right hand on the handle near the ferrule. This exercise teaches you how to make entry cuts from space, an absolutely basic and essential skill for all woodturners.

To lay out the coves, use a pencil and a ruler to mark lines about ¾ in. (20mm) apart along the length of the smoothed cylinder. Try to keep the shoulders of the coves well defined, not rounded over.

When cutting a cove, you won't be able to rub the bevel before you start, so catches are likely if the tool is not properly presented and controlled. Use a secure grip to prevent the tool from moving on the rest, and angle the blade up about 10°. By squeezing, pushing, and pulling with the fingers and palm of the upper hand,



When cutting coves, the upper hand keeps the tool firmly on the rest, particularly at the start when the tool must be on its side.

(FAR LEFT) Starting a cut from the left.
(LEFT) Starting a cut from the right.
(BOTTOM) At the bottom of the cove, the tool gauge flute faces up.

you can maintain control of the fulcrum and exert very fine control over the cutting edge.

To start the cut, the gouge must be on its side with the flute facing the center of the cove and the bevel aligned in the direction you want to cut, as shown at Fig. 1 in the illustration on p. 106 and in the photos above and at right. Raise the handle to bring the edge down into the wood, and keep the point of cut just below the center of the tool's nose. Fig. 2 in the illustration on p. 106 shows the order of cuts and how you begin at the center of the cove, then cut in from either side alternatively, widening and deepening the cove as you go. Your upper hand should barely move on the rest as the blade swings from one side to the other. Don't attempt to go down one side and back up the other in the same cut. The wood would splinter away at the top because the grain is unsupported (although you'd have a catch well before then).



CUTTING A COVE

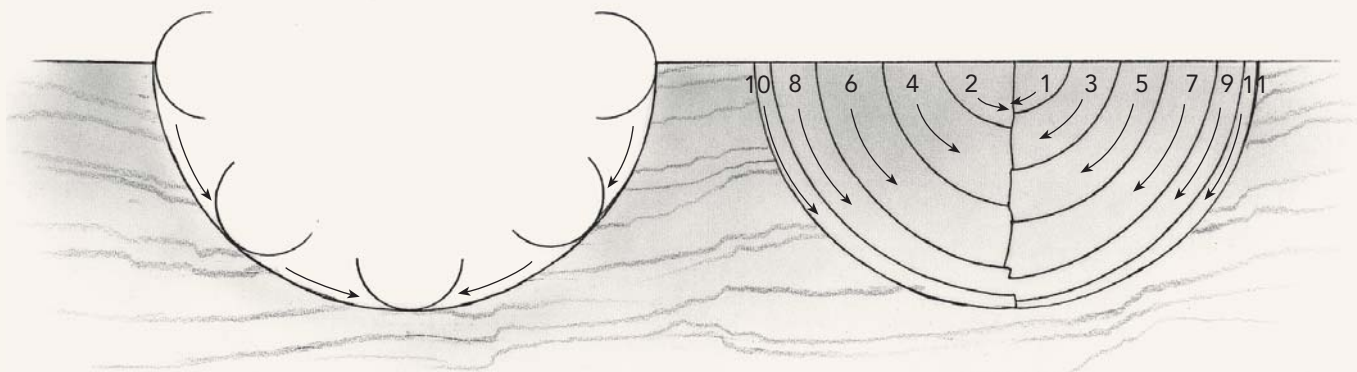


Fig. 1 Always cut from larger to smaller diameter when turning spindles.

Fig. 2 Begin cutting a cove in the center, making alternate cuts from either side.

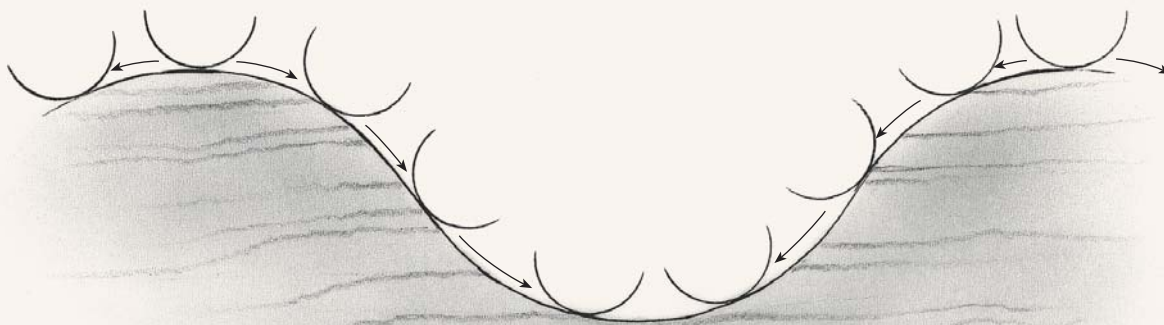


Fig. 3 When cutting undulations, have the gouge flute facing the direction of the cut.

The moment the nose of the tool enters the wood the bevel begins to rub. If you fail to keep the point of cut on the lower side of the nose of the tool, it will catch because the pressure of the wood will be on an unsupported portion of the edge. As the cut progresses, ease the grip of the upper hand slightly, allowing the lower hand to roll the tool evenly until it is flute up at the bottom of the cove (see Fig. 1 in the illustration above). At the same time, push the tool across the rest into the wood, keeping the bevel rubbing on the newly cut surface.

Exercise: Undulations. Once you've achieved a cylinder with a series of coves equally spaced along its length, try rounding over the flat areas to produce an even, undulating surface. With the top of the gouge facing up, let the bevel rub the top of the cove. Then roll the tool in the direction of the cut until the edge produces a shaving, as shown in the top photos on the facing page. Again, the point of cut is just below the center of the edge.

You can use either a hand-over or hand-under grip here. Concentrate on applying your power to prevent kickbacks, and don't force the

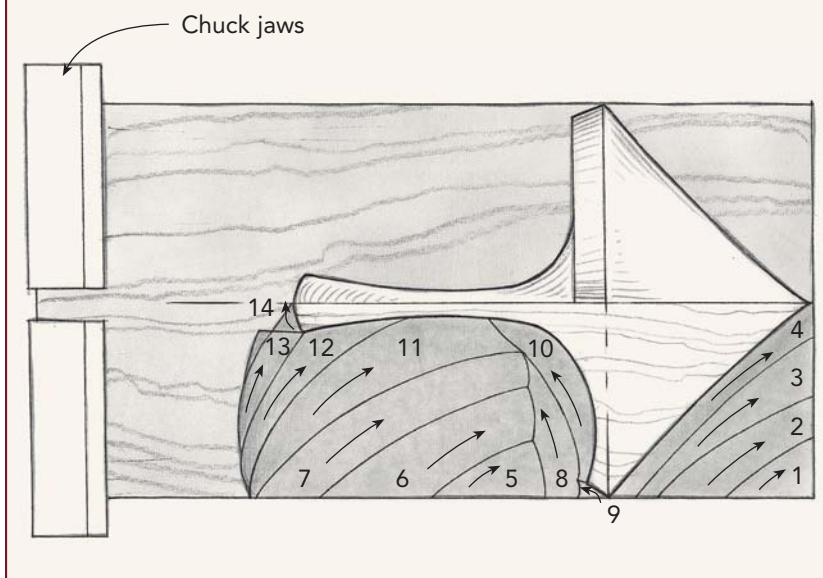


Roll the tool in the direction you're cutting, keeping the cut on the lower side of the rounded nose of the edge. Note that the upper hand barely alters position.



(FAR LEFT) To create a bead, I roll the $\frac{3}{8}$ -in. (9mm) gouge right onto its side at the end of the cut. (LEFT) The torn grain presents no problem as I cut in from the other side.

SEQUENCE OF CUTS FOR TURNING A SPINNING TOP



edge into the wood. Keep your upper hand on the rest to act as a stop that moves forward with the tool as wood is removed. As you cut down the curve, roll the gouge slightly in the direction you're cutting (so the flute faces the cove), as shown in Fig. 3 of the illustration on p. 106. At the bottom, roll it back so the flute ends up facing upward.

You can vary this procedure to make beads. Instead of rolling the tool so that it faces upward at the bottom of the cut, roll the gouge so that it completes the cut on its side. At the bottom of the curve, the point of the cut moves to the nose of the tool (see the bottom left photo on p. 107). The torn fibers are not a problem because these are removed with the next cut from the other side (see the bottom right photo on p. 107). Hold the point momentarily at the end of the cut to define the line between two beads. When you have finished a row of beads, repeat the whole cylinder-coves-beads process to create a slimmer version, and so on until the wood

snaps. You'll soon discover your limitations, which will give you something to build on.

For a more purposeful exercise, use a $\frac{3}{8}$ -in. (9mm) shallow gouge to make spinning tops out of short lengths $1\frac{1}{2}$ -in. (40mm) square mounted in a chuck (see the photo on the facing page and the illustration at left). These tops are excellent for developing tool control and supporting grips, they don't waste much wood when things go wrong, and they make great little prezzies (or should I say gifts) for kids from 8 to 80 (and probably older). You know when they're well made because they spin true.

CHOOSING THE RIGHT SKEW CHISELS

The skew chisel is by far the best tool for working along the grain. It functions best on absolutely straight-grained, knot-free wood. Deft wrist movements can flick the tool from one side to another, from the long point to the short corner, shearing to a near-perfect finish. To make best use of this tool, a great deal of practice is needed, but it's all worth the effort because once mastered the skew chisel provides tremendous satisfaction.

The edge of the skew chisel is ground with a bevel on both sides and angles to a long point. All my chisels are square section with a slightly curved cutting edge. The curved edge allows me to use the chisel for a number of cuts that are nearly impossible using oval- or straight-edged chisels. More important, any catches are less aggressive.

I recommend using the following chisels:

- For work less than $\frac{1}{4}$ in. (6mm) in diameter: $\frac{1}{4}$ -in. (6mm) to $\frac{1}{2}$ -in. (13mm) skew chisel.
- For work $\frac{1}{4}$ in. (6mm) to $\frac{1}{2}$ in. (13mm) in diameter: $\frac{1}{2}$ -in. (13mm) skew chisel.
- For work $\frac{1}{2}$ in. (13mm) to 2 in. (50mm) in diameter: $\frac{3}{4}$ -in. (19mm) to 1-in. (25mm) skew chisel.
- For work above 2 in. (50mm) in diameter: 1-in. (25mm) to 2-in. (50mm) skew chisel.

BASIC SKEW CHISEL TECHNIQUES

Adjust the rest height so that you feel comfortable holding the tool. (With my lathe center just above elbow height, I like the handle dropped slightly below horizontal.) As the diameter of the wood reduces, you will need to lower the rest to keep the handle at about the same angle.

The tool will cut when held in a variety of positions, so your challenge lies in knowing what to strive for. The fattest shaving comes from an edge set at about 45° to the oncoming wood, while a steep edge produces the narrowest shaving (see the top photo on p. 81). When the edge is vertical, it butts right into end grain and won't cut, no matter how hard you push. End grain is tough, which is why it's used for butchers' blocks.

As with all cutting (as opposed to scraping) tools, there are two basic rules. First, keep the bevel rubbing the wood whenever possible. Second, keep your left hand in contact with the rest and tool at all times.

As the bevel rubs the wood, it acts as a jig for the next portion of the cut. If you fail to keep the bevel in contact with the wood, the edge is likely to catch or, at the very least, leave a smooth but ridged surface that is actually a very fine spiral. The bevel shoulder acts as a secondary fulcrum (besides the rest) and helps to control these kickbacks, so if the tool begins to judder, in all likelihood the bevel is not making contact with the wood.

You'll find that the skew chisel requires a lot of practice, but it is all worthwhile. In the hands of an expert, wood is removed and shaped even faster than clay on a potter's wheel. A small scoop handle, for instance, will take no more than 10 seconds to shape, while the whole external shape might take only 20 to 30 seconds. With the right straight-grained wood, the cut is clean, and different techniques flow into another as the wood curls off the tool with a rushing sound. It's a great feeling.

Spinning Tops

These tops are superb for developing your technique and general tool-handling skills using either a $\frac{3}{8}$ -in. gouge or skew chisel.



MATERIALS: Concalvo alves (left and right) and tulipwood (center)

SIZE: 1 $\frac{3}{8}$ in. (35mm) diameter

The skew chisel is by far the best tool for working along the grain.

Scoops

These utilitarian kitchen scoops paid all my basic bills in the 1970s when I made thousands of them. The bowl section is turned as a goblet, which is then cut to make the scoop. To look good, the wall needs to be of even thickness and the depth slightly more than the diameter.



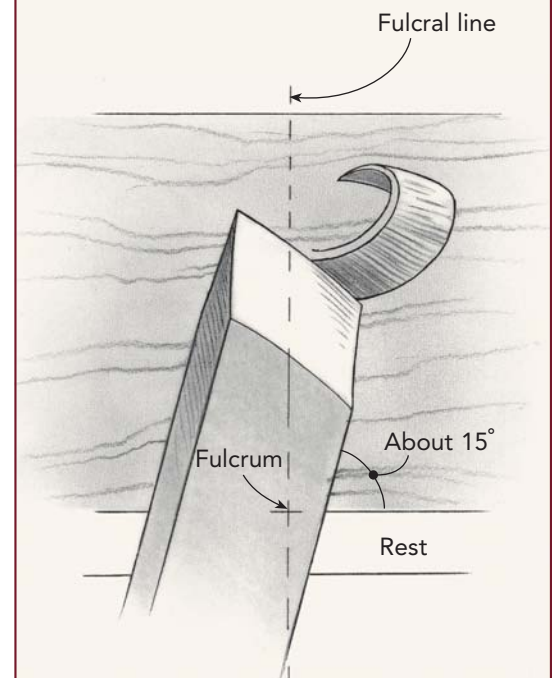
MATERIALS: Clockwise from top:
English sycamore,
Tasmanian blackwood,
gidgee, goldie wood,
radiata pine

SIZES: ¾ in. to 4 in. (20mm
to 100mm) diameter

Exercise: Turning a cylinder. Begin by reducing an 8-in.- (200mm) long by 2-in.- (50mm) square blank to round, using a gouge as described on pp. 102–103. Set the rest just above center height and the speed to about 1,200 rpm. Now smooth the cylinder using the ¾-in. (19mm) skew chisel, held in a hand-over-grip. You can use the skew with the long point up or down. Try both, beginning with the long point up.

When using the skew chisel, imagine a line drawn at 90° to the axis from the fulcrum through the edge (see the illustration below). If you use the lower half of the edge (to the right of the fulcral line), the downward force of the wood against the edge is easily controlled because the handle is on the other side of the fulcrum (to the left of the fulcral line), as shown in the top left photo on the facing page.

USING A SKEW CHISEL



When using a skew chisel long point up, hold the tool at slightly less than 90° to the axis.



(FAR LEFT) The line indicates the position of the fulcrum. If you keep the point of the cut in the lower part of the tool and on the far side of the fulcrum from the handle, you have control of the leverage. (LEFT) If you let the point of cut drift to the upper portion of the edge on the tool handle side of the fulcrum, it will inevitably catch.

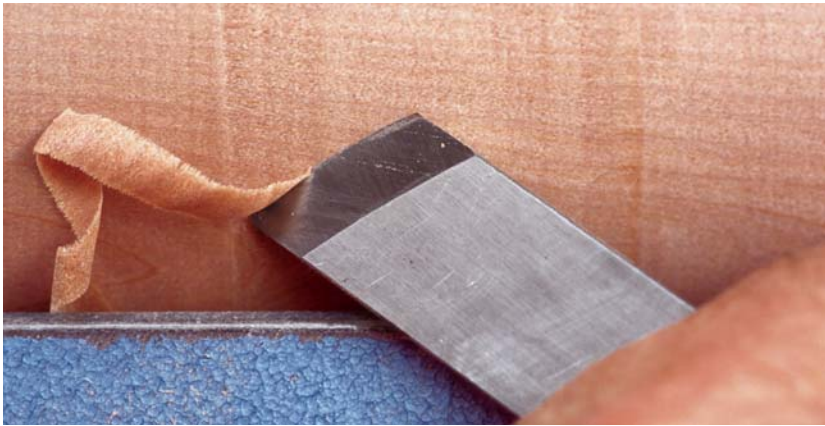
If you try to use the upper part of the edge (to the left of the fulcral line), or the long point, the tool will catch because the pressure of the wood is against an unsupported portion of the edge (see the photo above right). All catches, no matter which the tool, are a variation of this. You must always have the fulcrum beneath the point of the cut. (See also the bottom illustration on p. 74.)

When you use the skew long point up, have the blade at about 15° to the axis, as shown in the illustration on the facing page and in the photo at right. Do not place the tool flat on the rest; instead it should contact the rest only on the corner of the tool between the side and the flat. (This is an exception to the general rule that square-section tools are used flat on the rest.) The cut must be made using only the leading half of the cutting edge, ideally the portion just behind the short corner. If you use the short corner, the action is not so much a shearing as a levering-up of the wood fibers, which is rather inelegant but does leave a clean surface.



When cutting with the long point up, hold the skew at about 15° to the lathe axis and use the lower part of the edge.

To cut to the left, merely flip the tool over so the short corner is to the left. Regardless of the direction, never let the cut drift to the top of the edge near the long point because the unsupported edge will catch every time and scar the wood. If your cut leaves a ridged or slightly serrated surface without torn grain, you did not have the bevel rubbing the wood.



(TOP) Cutting with the long point down allows you to steer the tool in the direction you're cutting. Tool chatter is reduced because pressure against the axis is minimal, and any force in the cut is absorbed by the headstock. (BOTTOM) If the tool is pointing in the right direction but with the long point up, it won't cut because the vertical edge butts into end grain.

When you use the skew long point down, the tool should be pointing in the direction of the cut (see the top photo above). Have your right hand near the ferrule and the handle aligned along your forearm so the skew becomes an extension of your arm. Because the force is behind the chisel, it is easier to direct, especially along a cylinder. With the fulcrum well behind the edge, the tool is also less likely to catch than when the long point is up. As the tool cuts, any forward pressure exerted by the edge is parallel to the axis and absorbed by the drive center. If you have the tool pointing in the

right direction but are having problems cutting, the edge might be the wrong way up (long point up) as shown in the bottom photo at left, where the edge is at too steep an angle to slice the fibers.

Being right-handed, I use the skew long point down only when cutting from right to left. I find changing hands and going left to right altogether too difficult and I would not recommend it. I tend to use the skew with the long point down to rough-down most centerwork less than 2 in. (50mm) in diameter: It's an excellent thrusting cut for rapid waste removal. Take scooping cuts similar to those shown in the top illustration on p. 103, only working from left to right.

Exercise: Turn a row of grooves. Having successfully smoothed a cylinder, mark centers for the grooves 1 in. (25mm) apart. Aim to achieve a straight-sided V, about $\frac{3}{8}$ in. (10mm) deep. A straight side will give you a goal that is easily defined and measurable.

To cut grooves, use the skew long point down so you can see what you're doing as shown in the top left photo on p. 114. Begin with the tool held at 90° to the work, and pivot the point of the skew into the center mark of the groove (see Fig. 1 in the illustration on the facing page). With the bevel aligned in the direction you're cutting, bring down the point through an arc into the wood. (Don't push it straight in as if you're using a billiards cue. The skew cuts with a softer sound and with less effort if brought through an arc.) This marks the center of the groove to which the side cuts will be made.

Next, cut from either side to the bottom of the center mark to develop the V as shown in Fig. 2 of the illustration on the facing page. (These are arcing cuts as well.) The angle of the bevel dictates the angle at which the tool lies to the wood, here about 30°. Only the bevel side and point of the tool contact the wood. Keep the edge clear, or it will catch because the pressure of the wood will be on an unsupported part of the edge.

CUTTING GROOVES

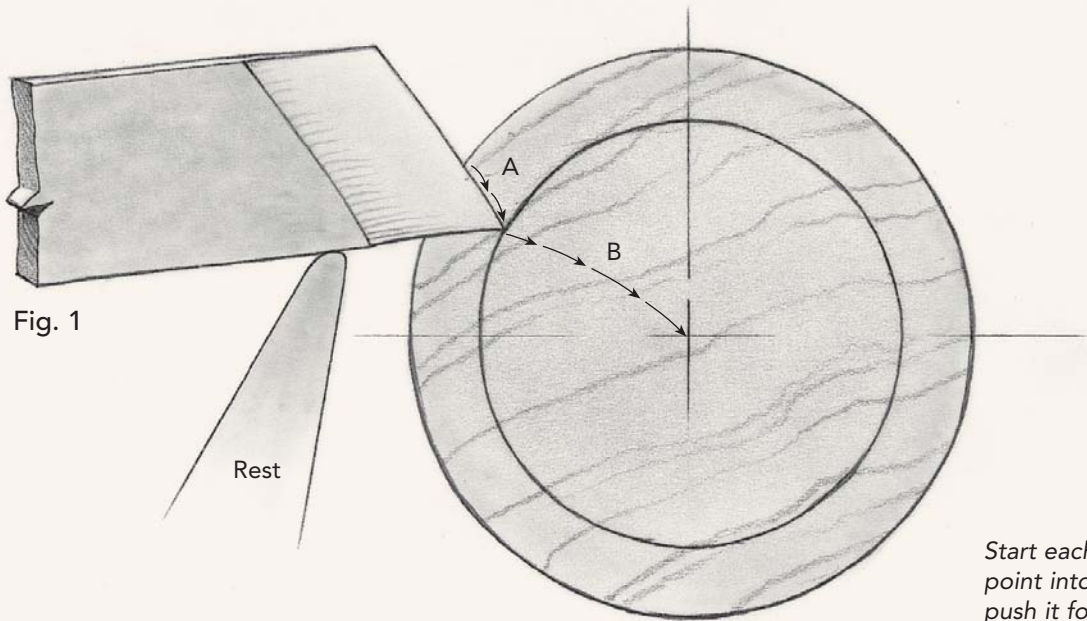


Fig. 1

Start each cut by arcing the point into the wood (A), then push it forward on a line (B) dropping toward center.

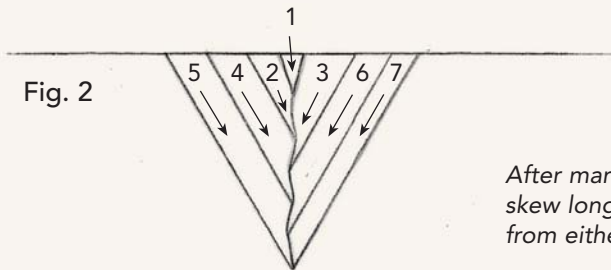


Fig. 2

After marking the middle of the groove using the skew long point (cut 1), take arcing cuts alternating from either side (cuts 2–7).

When cutting grooves, it is critical to keep the bevel side rubbing. If the sides of your groove are uneven or bumpy or if the tool isn't cutting properly, it is for one of two reasons. Either you are levering the point clear so it cannot cut (see the bottom left photo on p. 114), or you don't have the bevel side rubbing so the edge scores and tears the surface because it doesn't have the stabilizing contact of the bevel (see the bottom right photo on p. 114). With practice, you will sense when the bevel is rubbing and be able to align it properly each time without having to look or even think about it.

As you turn the V groove, your hands should hardly move (see the top photos on p. 115). For the entry cut, you need to pin the tool to the rest until the long point enters the wood. Then you can relax somewhat because the bevel side contacts the wood and acts as a jig for the rest of the cut.

You'll use this same technique for cutting end grain when you retain a square shoulder, except you'll also have to contend with turning space as well as wood (see the bottom left photo on p. 115 and the bottom illustration on p. 103). You need to move the edge smoothly through space regardless of what is or isn't

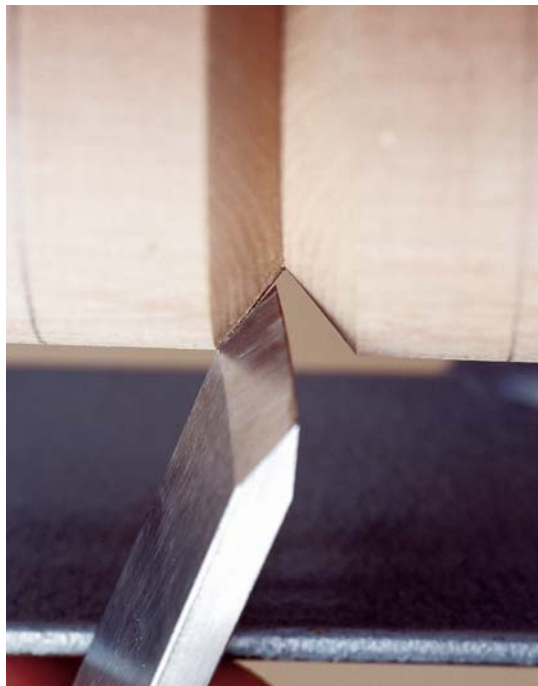


Use the skew chisel long point down when cutting grooves.

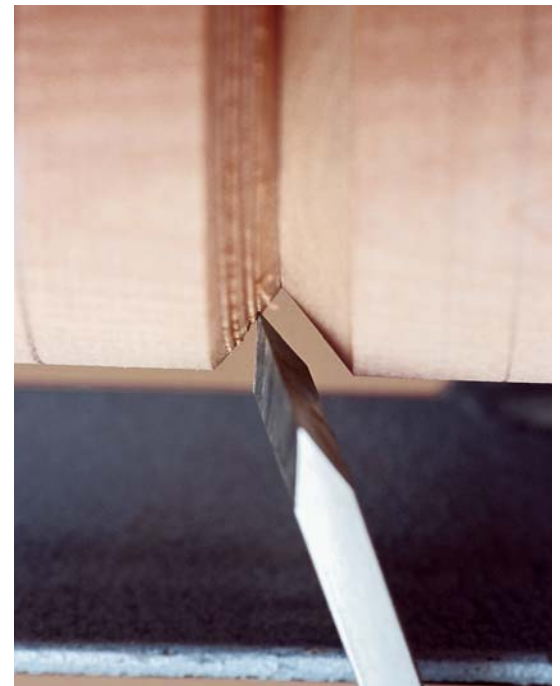
When cutting grooves, it is critical to keep the bevel side rubbing.



When cutting a groove, only the bevel side and the long point of the skew chisel should contact the wood.



If you lever the long point away from the shoulder, you cannot cut anything.



If only the long point contacts the wood, you'll get a scored and torn surface.



Note that the hands barely alter position as the tool cuts one side then the other.

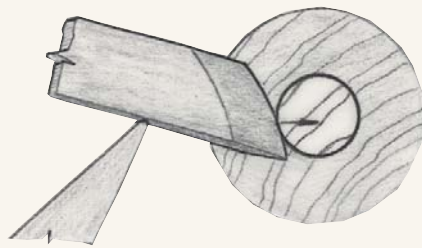


To retain a square section on a spindle, you must move the edge steadily through space regardless of what is or isn't there.
(FAR LEFT) A skew long point cuts a simple square to round a shoulder.
(LEFT) A 1/2-in. (13mm) shallow gouge cuts an ogee.

Freezing the action, we see there is little difference between the gouge-cut surface to the left and the skew-cut shoulder to the right.



SHEARING CUT



Position the rest at center height (or slightly below) and about $\frac{3}{8}$ in. (10mm) away from the wood. Then drop the point below a line from the center to the rest. The edge cuts (above the point) on a straight line toward center.

there. The trick is to let the wood come to the tool. Don't push the tool into the gap between the shoulders because that will break the corners. If you want a rounded shoulder, cove, or ogee as shown in the bottom right photo on p. 115, imagine you are cutting a whole bead or cove, even though you are mostly turning space. If you go steadily, the fibers should not break away on the corners.

Once you feel comfortable cutting grooves, you can learn to get an even smoother surface using the edge (rather than the long point) to turn a cone. For practice, mount a short cylindrical blank in a chuck so you can work the end grain. (You can prepare your blank between centers or in the chuck.) Making an entry cut with the edge is difficult, so take the point through an arc into the wood (as usual). Continue to raise the handle so the point of cut moves from the long point slightly up the edge, then push the tool forward. When you get this right, you'll get frilly conical petal-like shavings as shown in the top photo on the facing page. This shearing cut works well using any skew chisel on convex end grain. For flat end grain, you'll need a slightly curved skew because there's no clearance for a straight edge.

If you find yourself having difficulties with any of these techniques, forget about grooves and simply make cuts in one direction across the grain. When you achieve a satisfactory cut that feels easy and produces a good surface, repeat the action in the same place again and again. Do nothing else for 10 minutes or longer until you can do it every time.

When you've mastered one action, try it in the other direction. Then go back to the grooves. And don't be intimidated by the fact that there's a whole row to do. Just take each groove one at a time, forgetting what's to come and what's gone. Try to resist doing only a couple of grooves and instantly moving on to a bead. The best approach is to develop some expertise in one area before going on to the next.

Exercise: Turn grooves into beads using the short corner of the same skew chisel. For this exercise, first turn grooves 2 in. (50mm) apart with a center line between each. To do this, lay out the cylinder with lines 1 in. (25mm) apart, then turn grooves on every other line.

Start the cut with the tool set at about 90° to the axis and the bevel riding on what will be the top of the bead. It's very difficult to start cutting a bead with the long point down because the angle of the tool to the wood requires you to swing the handle through a wide arc, whereas using the skew long point up only involves just a roll of the wrist. Once you've positioned the tool, roll it very firmly in the direction of the cut until the short corner picks up a shaving (see the bottom left photo). Continue on to cut one side of the bead.

This technique requires the good coordination of both hands. Your lower hand rotates the



When shearing end grain, move the tool straight across the rest as you would cue a pool shot. Using the edge (rather than the long point), you should get frilly conical shavings.



(FAR LEFT) While I prefer the hand-under grip for cutting beads, a hand-over grip (LEFT) provides more support near the end of the blade when cutting left.

Spillikin Sticks

The game of spillikins, also known as pick-up sticks, is a wonderful game for kids of all ages (8 to 80+). The box is the difficult bit and should be made first so you can turn the sticks to fit. Grip the sticks at the drive end rather than mounting them between centers. The flat sections, which are cut on a sander, don't have all the beads on the same position because the sticks won't fit in the box.



MATERIAL: Cocobolo
SIZE: 7 in. (180mm) long

tool, and your upper hand moves the short corner into the wood. Your lower wrist should move in a smooth, flowing motion. The upper hand acts as a moving backstop to prevent kickback and to provide fine control while easing the tool forward with gentle pressure. The tool will move a very short distance along the rest while staying at 90° to the axis. One-half of a bead should take only a second or two. The tool should feel almost spongy on the wood, encountering little resistance and cutting cleanly.

I prefer the firm underhand grip for turning beads, but it is not that secure when cutting to the left. It offers no support behind the top of the tool, and catches are more likely. If you are having difficulties cutting to the left using the underhand grip, change to an overhand grip so your little finger is located where support for the blade is needed.

Often you'll be left with a thin frill of wood at the bottom of a bead, especially where a pair of beads meets. When removing this, it is easier to see what's happening if you turn the chisel over and use the long point as if cutting a groove. Flip the tool over and bring the bevel side in to rub the surface just cut. Use the long point to finish the bead as if you're cutting a V groove. Don't use force to remove the frill—a delicate touch is all you need.

Once you've achieved a row of beads, use the same skew chisel to reduce the spindle to a smaller cylinder. To do this, begin cutting at the top of the bead at one end of the cylinder with the long point down. Move the tool along the rest evenly, be it through space or wood. Don't allow the edge to jump forward into the spaces between the beads. This is a good opportunity to practice moving the tool evenly on a predetermined course regardless of what is or isn't there. It'll become easier as the beads are reduced in size.

When the cylinder is smooth, repeat the process, making a row of grooves first and then

beads. No matter what size chisel you use, the same rules apply. The smaller the tool, the more precise your technique needs to be. I use a $\frac{5}{16}$ -in. (8mm) skew for my salt scoops, but generally you can do almost any small spindle with a $\frac{1}{2}$ -in. (13mm) tool. When each cycle is completed, do it again until the spindle breaks or, if you manage a very thin spindle, you might want to start making a set of spillikins (see the photo on the facing page). They're very good practice and make a nice heirloom. Make the box first, so you know what they'll fit into.

Once you have reduced a number of spindles to the breaking point using this cylinder-grooves-beads-cylinder process, it is sensible to move on to making something useful. I developed my skew chisel technique by making rolling pins, meat bashers, honey dipper, and knobs for window blinds or light-pull cords. These and other skill-building objects are detailed in my book *Turning Projects* (The Taunton Press, 1991). Or try the spinning tops detailed in the illustration on p. 108 and the wok stirrers shown in the photo at right.

The advantage of such objects is that they need not be identical, which is just as well when catches and general lack of tool control will probably demand an alteration to your initial concept. At first, keep your shapes simple and develop your repertoire of cuts gradually. When you make a clean cut, do the same thing again and again until you can do it every time as you want (and not as the wood or lathe dictates).

As you master each cut, go on to others. I recall that my early spindles had few rounded beads but plenty of long curves and V-shaped grooves. The rolling pins had square or conical ends that were easier to duplicate until my skill and confidence grew and I could make them rounded with buttons. Keep the lathe speed down around 1,200 rpm to start. As your confidence grows and catches become less frequent and the finish from the tool improves, raise the

Wok Stirrers

You need nonmetal spatulas for nonstick pans. Wood has to be a better choice than plastic, and hand-turned wood has to feel better than mass-produced. These stirrers are turned from wedge-shaped blanks cut to conserve material. The thin, flared blade end is held in a chuck with the fatter squared handle end supported by the tail center. This is a good skew chisel exercise. When turning the blade, there will be more air than wood, but you'll get nicely curved and radiused sides to the spatula. The fat handle fits nicely into the palm.



MATERIAL: Elm
SIZES: 8½ in. to 11 in.
(215mm to 280mm) long

VASE

For this project, you need a blank about 6 in. (150mm) long and 3 in. to 4 in. (75mm to 100mm) in diameter. The idea is to complete the lower portion of the form so it fits your chuck, then remount it for completion. One advantage of modern chucks

is that you can rechunk the job and alter it if you're not satisfied with what you've made.

The chuck used here is a Vicmarc with Shark jaws. The tools are a $\frac{3}{4}$ -in. (20mm) skew chisel, a $\frac{1}{2}$ -in. (13mm) shallow gouge, and a spear-point scraper.

1 Before truing the end grain with the gouge, make an initial cut to see how the wood will work and if the bark will stay on. This 5-in. (125mm) length of dry branchwood (mulga) has great color and contrast between the sapwood and heartwood. The end grain will be the base, so it needs to be slightly concave to sit flat.



3 Further shape the form using peeling cuts with the skew chisel.



2 Because the chuck will grip on a groove, cut the curve so that the base is smaller than the gripping diameter of the chuck. The dividers burnish the wood, indicating the approximate position for the groove.



4 Use a shearing cut to clean up the surface in preparation for the grooves.

5 Cut two grooves roughly where the burnish marks are: The jaws will fit snugly over one of them. I use this technique a lot on bowls, so I am used to gauging where to put the grooves by eye. If you're not comfortable with that, you might want to measure again.



7 Rechuck the vase with the jaws fitting snugly around whichever groove fits best.



8 After some initial shaping, drill a depth hole by hand. If you want to insert a glass vase tube, just drill a hole the required size. For drills bigger than 1/4 in. (6mm), mount the drill on the tail center.

6 To complete the lower section of my vase, I detail the base by rebating the central area so the vase will sit on a rim of about 3/8 in. (5mm). Then sand and polish the bottom half of the vase.



9 Use the gouge to cut the inside of the rim. I prefer a simple curve here, but you can easily add some grooves using the spear-point scraper.

VASE (continued)



10 Although the gouge-cut surface is more than adequate, here I use the spear-point to shear-scrape the surface. This requires an exceedingly light touch, otherwise the vibration will leave chatter marks that might even be bad enough to be decorative. At this stage, you can hollow the form if you want. I generally make the vase with just the depth drill hole so there is plenty of weight in the base and a narrow interior space to keep the grasses I envisage in them upright.



11 Finally, complete the outside turning, then sand and polish the upper section to blend in with the lower part that was completed earlier.



If you think the form (TOP LEFT) lacks a little something, or rather has a little something too much (as I did), put it back in the chuck for modification. I thought that looked pretty good, but I still couldn't resist a further modification (BOTTOM RIGHT).

speed to as high as 1,800 rpm. When you find it reasonably easy to smooth a cylinder and to cut grooves and beads, it's time to examine several other useful functions of the skew chisel.

USING A SKEW CHISEL AS A ROTARY PEELER

By holding a skew chisel flat on the rest with the edge parallel to the axis, you can reduce a diameter drastically in an instant. This technique is especially useful when turning a goblet stem, scoop handle, or other spindle where a great deal of waste has to go quickly. It's wonderful in production.

The angle at which the cutting edge is presented to the revolving wood is crucial. Get this right and your problem may be in removing too much too quickly, with virtually no effort. Get it wrong and you lever the wood right out of a chuck just as quickly. To peel effectively, the cutting edge must be kept just below the surface of the wood. Should it drop, the action becomes a slow, heavy scrape that badly tears the grain.

As with any cutting tool, the bevel should ride the wood first. But as you bring the cutting edge down by raising the handle, you must slide the blade back across the rest slightly until the edge is just beneath the surface of the wood and producing a very fine shaving as shown in the photos above right. The moment the edge starts peeling, push the tool forward, maintaining the edge position relative to the top surface of the wood.

Deftness is required to keep the cutting edge peeling toward the center accurately. All the movement is controlled by your lower hand; your upper hand simply holds the tool on the rest. Shavings should come off the wood in a continuous paper-thin ribbon that breaks up as it leaves the tool. The surface will need to be cleaned up with a final shearing cut. This is not a technique for general use on square-section wood because the edges will splinter.



(TOP) You can reduce a cylinder rapidly by using a rotary-peeling action. Keep the cutting edge just below the surface of the wood. **(BOTTOM)** As the edge peels, raise the handle while pushing the edge forward to maintain the relationship of the cutting edge to the wood.

USING A SKEW CHISEL FOR PEELING AN ANGLE

This variation of the previous cut is a quick, effective way to rough-out deep V-grooves, but you will need a final shearing cut to smooth the surface. Hold the tool as if for a conventional shearing cut, with the long point leading. Raise the handle diagonally while pivoting the tool on the rest. The long point of the tool moves through an arc deep into the wood and the edge peels a thin ribbon (see the left photo on p. 124),

much the same as above when the tool was held flat on the rest. Having reached the required depth, pivot the tool on its point so that the edge of the tool is moved out of the cut.

In this cut you do what you try otherwise to avoid: You cut using the point and adjacent portion of the edge, which is entirely unsupported. The wood will grab the edge given the slightest chance. You need a firm grip, and you must rotate the edge clear of disaster before the wood realizes what's happening. As with the peeling cut, deftness is required and you cannot make this cut slowly. The main power comes from the lower hand, but the upper hand adds firmness to counteract possible catches. It's a normally disastrous situation, but under control it's used to great effect.

USING A SKEW CHISEL FOR LOW-PEELING CUTS

Using this cut very delicately is often the best way to deal with twisted grain on centerwork or whenever you have little margin for error and don't want to risk the grain picking-up as on a

box flange when fitting a lid. The low-peeling cut is very similar to the peeling cut, only the edge is presented slightly above the center-to-rest line and below the peeling position.

You need a slight curve on the edge of the skew chisel so that you can move the point of the skew sideways into a corner without touching the surface just cut (see the photo below right). The tool must be moved in very gently to avoid tearing the grain (a vibration-free lathe is essential for such an operation). The bevel doesn't get a chance to rub and the edge strokes the surface only lightly. There should be no shavings—only fluff. Control the movement with your upper hand while your lower hand provides stability. Stand well balanced. (You might want to hold your breath for this cut as well.)

PARTING TOOL TECHNIQUES

Parting-off is the process of cutting across the grain to remove a turned piece from the lathe while it's still running. Parting tools are also used in confined spaces where a skew or a gouge



The skew chisel can be used to rotary-peel on an angle by pivoting the tool into the wood diagonally. To avoid a catch, you must be quick to rotate the edge clear at the end of the cut.



A curved edge skew is particularly useful for delicate low-peeling cuts. Here the long point reaches into the corner without touching the rest of the surface.

cannot operate effectively or in conjunction with calipers to establish diameters in spindle work (see p. 90). The tool is held at 90° to the axis so that the edge is parallel to the axis and will peel off a ribbonlike shaving in exactly the same way as a peeling skew chisel. Care must be taken not to let the edge drop too far into the wood too quickly, or it will begin scraping rather than peeling.

When parting-off small jobs, the last part has to be done with the tool held in your lower hand while your upper hand catches the piece (see the photos at right). The lathe keeps running and the work spins off into your waiting hand. Note how I keep my thumb on the rest to protect the job when it comes loose.

If a large or long job is parted-off while the lathe is still running, there is always the risk that you'll fail to catch it properly and it will bounce off the rest and be damaged. If you can stop the lathe just as you've finished cutting, this won't happen. (I can lean on the stop button or bar on my lathes, so it's possible to stop the machine at the last moment.) Try not to touch the piece until it is actually parted. The least pressure can cause the last bit of grain to spin and pull out of your finished piece.

Alternatively, you can cut in with the parting tool, leaving a slender portion between the waste and the spindle, then use a small saw to cut the work free.

While parting tools are often used to remove work from the lathe, the long point of a skew chisel leaves a cleaner surface.

SCRAPER TECHNIQUES

Scrapers and scraping techniques are not recommended for spindle turning or any centerwork other than end grain or hard hardwoods, where they can be used to produce complicated shapes in one pass, as on a chess piece. Scraping techniques are also generally not suitable or that efficient for roughing-down, especially on spindles. The surface obtained by using a



When parting-off, be sure to catch the work so it is cut, rather than pulled, off the lathe.

scraper along the grain bears no comparison to what you can achieve with a good shearing cut from a gouge, let alone a skew chisel. In spindle work, scraping action tears off lengths of wood fiber, so the finish is always poor.

Scrapers can be used with better results on end grain. Many dense or oily woods, such as ebony, sandalwood, cocobolo, African blackwood, mulga, and gidgee, definitely prefer



A ½-in. (13mm) skew chisel makes an ideal scraper on box lid detail. Use only a small portion of the edge at one time. Never use it all at once.

being scraped on end grain as shown in the photo above. Here, a very, very light touch can produce a glasslike surface, superior to the shearing cut of a skew chisel or gouge. But be warned that the slightest excess pressure spells disaster, with the tool often pulling lumps from the end grain.

Hollowing

You cannot hollow end grain with the work held between centers. It must be held in a chuck so the end is exposed. You can mount a drill in the tailstock and wind it into the wood to create a hollow, a method often used for boxes, scoops, eggcups, and goblets. Although this is a safe way of hollowing, it is comparatively slow. But, more important, you'll always get a poor surface (especially in the bottom) and the straight sides are uninteresting. Moreover, any spur bit will leave a mark at center. You can get a much cleaner surface much faster using gouges and scrapers.

For practice, I suggest using blanks about 6 in. (150mm) long and 2 in. (50mm) to 3 in. (75mm) square. Choose a close-grained

timber—open-grained woods such as fir are almost impossible to cut cleanly on the end grain. Unseasoned wood will be easier to turn, and a small, straight branch is ideal provided it isn't split.

Be sure to always true the blank. This is a good habit to develop, and it ensures that you get rid of everything you don't want in the final object, such as saw marks from the original squared section. Even though I've been turning wood for nearly 40 years, I still take the opportunity to practice difficult cuts.

HOLLOWING END GRAIN WITH GOUGES

The best tool for hollowing end grain is a shallow ½-in. (13mm) gouge with a long bevel (about 30°) and fingernail edge. The edge should be a full curve, without any flat sections, as shown in the bottom right photo on p. 57. Adjust the rest so that the nose of the horizontal tool is at center height. You can use this tool in two ways to remove the bulk of the waste.

In the standard approach, take a series of cuts from the rim to center (cuts 1 to 5 shown in the lower half of the illustration on the facing page). Start each cut with the gouge on its side and the bevel against the end grain, then pivot the nose of the tool into the wood, rolling the tool very slightly counterclockwise for a faster shaving as the cut proceeds.

Alternatively, there's the much faster back-hollowing technique (which I prefer), where the tool cuts on the far side of center and almost upside down—against all normal rules and expectations. I've used this method to make tens of thousands of scoops and small boxes. To shear cleanly, you need to cut from the center outward (see the illustration on p. 83).

Start the tool on its side just left of center. Instead of stopping cut 1 at center, push the tool into the center of the wood, cutting in about ⅛ in. (3mm). (Any pressure you apply here will be absorbed by the headstock.) Then

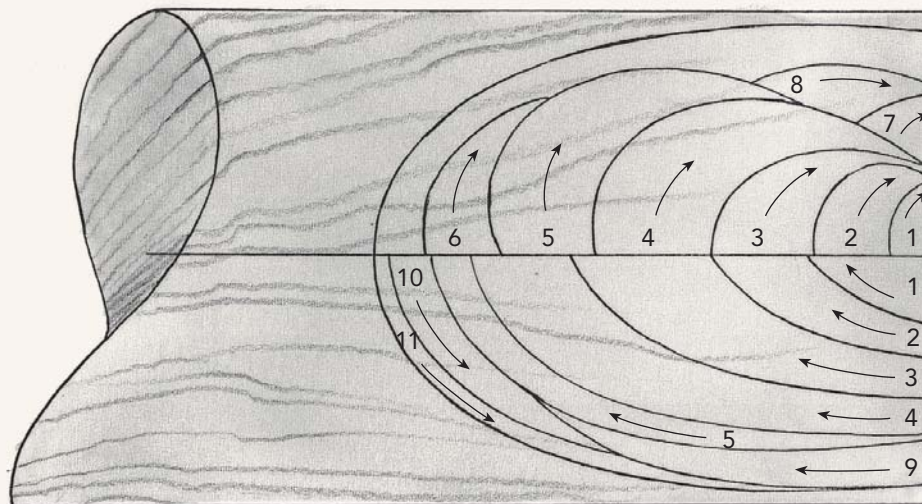
pull your lower hand back toward your body so that the tool starts cutting on its upper left edge, moving away from center at 1 o'clock to 3 o'clock, removing wood as it revolves upward. As you pull back the handle, roll the tool slightly to the right to maintain the optimal cutting angle of 45°, remembering to keep the bevel rubbing (see the photos on p. 128). Use a hand-over grip to provide a firm backstop and fulcrum while preventing a runback. It is not possible to see what is happening most of the time while back-hollowing, especially when starting a cut at the bottom of the hole, so don't even try. You have to feel it.

The idea with the initial cut is to create a small opening, the diameter of cut 1, that will



Hollowing end grain from the rim.

OPTIONS FOR HOLLOWING END GRAIN USING A ½-IN. (13MM) SHALLOW GOUGE



Cuts 1–8: Back-hollowing cuts shear away from center.

Cuts 1–5: Standard hollowing cuts shear from the rim to center.

Cuts 9, 10, and 11 are made using a round-nose scraper.

*Even though I've been turning wood for nearly 40 years,
I still take the opportunity to practice difficult cuts.*



Start the back-hollowing near center to create a small opening.

be maintained until cuts 7 and 8 finally widen it. For the intervening cuts, you use the rim as a fulcrum and start the cuts from center (see the top photos on the facing page). Maintenance of a good fulcrum is important. In addition to the rest, you should use the rim of the opening as an additional fulcrum against which to lever the tool. Seemingly, the upward-moving wood will lift the edge, but in practice there is enough downward pressure against the blade where it contacts the rim to keep it on the rest.

This technique demands a fine sense of balance because the pressure put on the cutting edge must be offset precisely against the rim. Failure to do this can hook the block from the chuck, split the wood, or at least knock the block off-center. If you keep the mouth of the opening small until the internal space is hollowed, you get better leverage than if the hole were larger. It also helps you keep the tool cutting nearer to parallel to the axis, making it easier to control.

As the tool begins cutting on the far side of the hollow, it unavoidably begins to lie across the axis. If the entry hole is wide, as the edge nears the rim the tool will be cutting close to 90° to the axis, where it's very likely to catch or kick back. As you make cuts 7 and 8, the edge is likely to catch. If it does, that's probably a sign that you've gone as far as is practical with the gouge and that it's time to use the scraper.

If the rim becomes damaged and uneven, turn it true or you'll have an eccentric secondary fulcrum and cutting will be difficult. Hold the tool very firmly on the rest and gently raise the handle to pivot the edge against the rim.

From the position at the end of the cut you can perform the action in reverse (like running a video backwards), taking the edge back to the center and removing more waste as you go. The surface will not be as smooth near the bottom of the opening, where the curve sweeps back toward the center, because the tool will be cutting into end grain. But you do move a lot of wood in a hurry.

Often a central cone will develop as you hollow, and on subsequent cuts this can enlarge if you fail to locate the point of the cone accurately (which is almost unavoidable). When beginning a cut, feel for the center at the bottom of the hole, then locate the cutting edge by rolling the tool. Pull back on the handle only when you feel the edge actually cutting. Beware of rotating the tool too much and pushing the



Back-hollowing cuts start at center and heads away at 1 o'clock to 3 o'clock.



A typical back-hollowing shaving.

tool blade clear of the rim (it should be against the rim for the entire cut).

This is not an easy technique to learn—mainly because you have to feel, rather than see, what is happening—but once mastered, this is a very rapid method of making holes. The bulk of a 2-in.- (50mm) diameter box or scoop can be removed in 3 to 4 seconds. But it is not particularly smooth, and the job is finished with scrapers.

INTERNAL SHAPING WITH SCRAPERS

Once the bulk of your hole is removed, use scrapers to finish the hollowing. I use two different scraper shapes for this process. The size used depends on the opening. Square-edge scrapers are for the sides and bottoms of cylinders (see the photo at right). Scrapers ground with a long, curved left edge are for the sides and bottoms of curved hollows. To minimize vibration, I always use the biggest scrapers I can for end-grain hollowing. For practice, make two different forms: a rounded hollow and a flat-bottom cylinder, each at least 2 in. (50mm) deep. When you've turned what you consider a satisfactory hollow, break the piece in two and



A $\frac{3}{4}$ -in. (20mm) square-edge scraper is used to cut a cylindrical flange in a box lid.

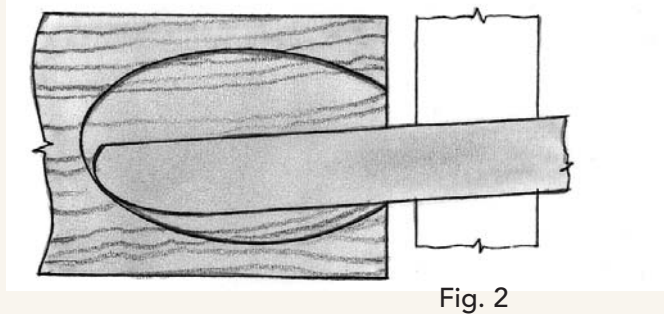
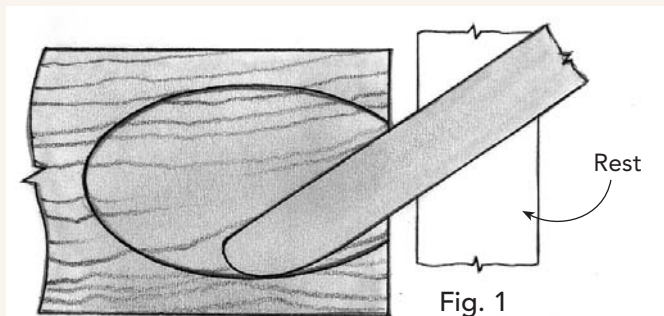
examine the cross section: At first it's rarely what you hope for.

For most work and woods, I find that an edge straight from a light touch on an 80-grit grinding wheel is ideal. For tough hardwoods, a honed edge is less aggressive.

Internal curved surfaces are finished using a radiused scraper (see the illustration on p. 130). Because I always work on the inboard side of the headstock, all my curved scrapers have long left-hand edges. After selecting a tool that has a

You won't obtain a good internal line jabbing at the wood with a blunt round-nose scraper.

CURVED-EDGE SCRAPERS



Use curved-edge scrapers on curved hollows. Adjust the rest to the same height as for square-edge scrapers so the tool cuts just above center. Make sweeping strokes inward from the rim (Fig. 1) and outward from the bottom (Fig. 2) so the grain will be supported.



slightly tighter radius than the curve I want to cut, I make a series of sweeping cuts, moving outward from the bottom of the hollow and inward from the rim. (In this way, the grain is supported as much as possible, as described on p. 83.) If the shape flows outward only, as in an



A 1½-in. (35mm) round-nose scraper finishes an internal curve. Note how the thumb provides a lateral fulcrum on the side of the tool while the fingers dampen any vibration.



You should get these typical shavings when hollowing end grain with a scraper.

open cup, then the cuts are made entirely from the bottom out.

Initial shaping can be forceful, but the final cuts must be light, producing only fluff. Vibration is a particular problem when cutting internal curves because tool pressure is away from center against thin and structurally weak grain. To reduce vibration, you'll need to support the work using your hand as shown in the photos above.

Cutting in from the rim, I start with the tool angled upwards as shown in the top photo at right. This has two benefits. First, there is an element of shear scraping because the edge is at an angle to the grain. The second benefit has to do with cutting a smooth curve. As the cut proceeds, I have to raise the handle to bring the edge toward center, and if I do this smoothly as I move the tool forward, I cut a smooth curve whether I want to or not. I always want to.

To cut away from center in the bottom of the hollow, start with the edge tilted down as shown in the bottom photo at right so that it cuts slightly below horizontal. Set the tool rest less than the thickness of the scraper below center height or about $\frac{1}{8}$ in. (3mm). To cut a smooth curve across the base, all you need do is lean on the end of the handle. As the edge sweeps away from center, it automatically cuts a smooth curve as the edge moves through an arc. If you push the tool forward, you'll create a small bump, which is removed by swinging the edge through it from below as shown in the top illustration on p. 132.

Remember when scraping internal curves that flowing shapes come from flowing movements. You won't obtain a good internal line jabbing at the wood with a blunt round-nose scraper. Use a sharp tool and sweeping, light cuts, and you'll end up with a reasonably clean surface without bumps or ridges.

If you have a slightly ridged surface, a couple of swipes with coarse abrasives will smooth the surface (I use old 60-grit power-sanding discs), but they won't get rid of the bump at center.

Internal cylinders are roughed out with a gouge, then completed using a square-ground tool with a long bevel. As with all my nominally square-ground tools, the edge actually curves slightly, in this case back from the left corner. This is to avoid presenting the whole edge at once to the wood, especially 2 in. (50mm) or



The large round-nose scraper is tilted upwards to shear-cut as I begin smoothing an internal curve.

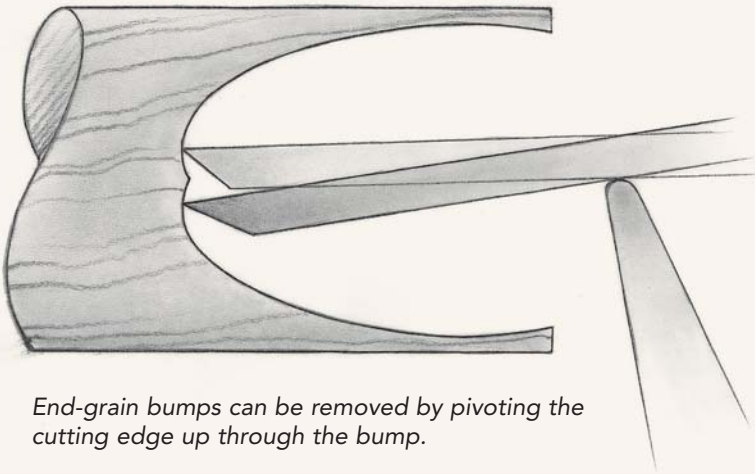


Using scrapers on end grain, raise the tool rest so that as you start a cut at center, the tool tilts down a few degrees. For a flowing internal curve, ease your elbow down on the handle and don't move the tool forward on the rest.

more away from the rest, when a heavy, damaging catch would be almost inevitable. Use about one-quarter of the cutting edge (the shaded area in the bottom illustration on p. 132).

Whenever you use a scraper to cut the long, straight wall of a deep cylinder, it is vital to set the rest high (see Fig. 3 in the bottom illustration on p. 132) so that the lower side of the tool doesn't ride against the portion just cut by the top edge. If the rest is too low and the lower side of the tool rubs (see Fig. 1 on p. 132), it

REMOVING END-GRAIN BUMPS



will force the cutting edge toward the center, tapering the internal form.

Push the tool in firmly but not too fast. If you use too much pressure, the slightly brittle, hollow sound will be replaced by a vibrating, high-pitched noise, and you'll tear the end grain. It is important that your first scraping cut be accurate because the tool will be guided into the hollow by the cylindrical upper wall. (Ensure accuracy by cutting in about 1 in. [25mm] with the scraper and checking the opening with internal calipers.) You need to keep the tool horizontal in order to maintain an accurate side. If you tilt it up, your opening will be dovetailed and widen the deeper you go. If

SQUARE-EDGE SCRAPERS

Grind the edge of a square-edge scraper so it curves gradually from an 89° left corner.

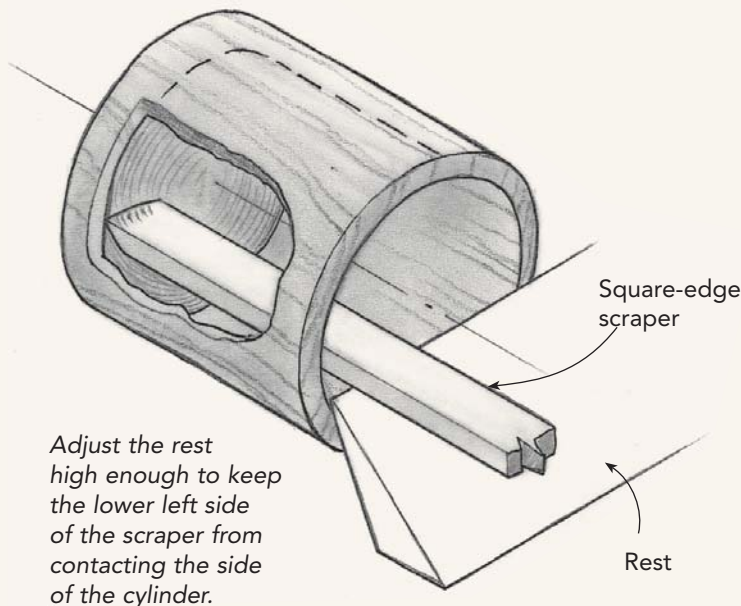
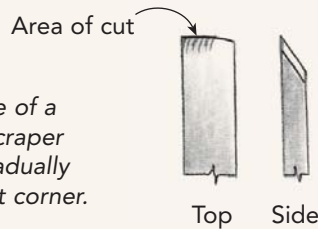
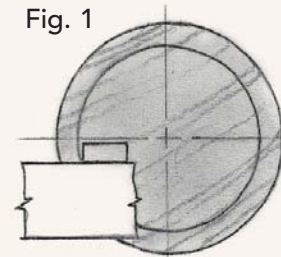
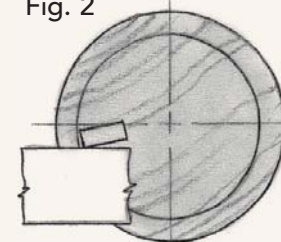


Fig. 1



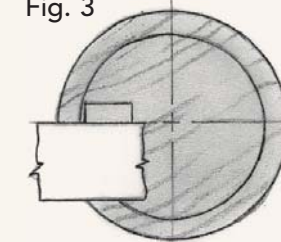
The rest is too low and the edge can't get into the corner.

Fig. 2



Don't tilt the tool to cut into the corner. Scrapers must be held flat on the rest or they'll catch.

Fig. 3



With the rest at center height, the left corner of the edge can cut cleanly into a corner.

you tilt the edge down, the opening will narrow toward the base.

The further away from the rest you cut, the smaller the shaving should be. The leverage is tremendous, and a catch at the bottom of a deep hole is usually disastrous. (While you should escape injury, you will probably tear the end grain or split the work.) Align the tool handle along and under your forearm to counteract its tendency to catch, and keep it flat on the rest. Don't tilt the edge above horizontal on the end grain at the bottom of the hollow. As the cut nears the solid wood in the base, you'll hear the sound of the cut change, warning you that the end grain is very near. Slow the rate at which you push the tool forward to avoid the catch, which occurs when you hit end grain and are not expecting it.

If you want to go deeper than you can rough-hollow with a gouge, say, 4 in. (100mm) deep, 2 in. (50mm) diameter, first drill a hole the required depth using a drill in the tail center. Then use the 3/4-in. (20mm) square-edge scraper for a series of cuts, using no more than 1/4 in. (6mm) of the edge to widen the drilled hole to the required diameter.

You can do all sorts of decorative detailing on end grain using scraping techniques, typically on the inside or on top of box lids. I have a few old tools that I grind as I need them, but mostly I use a small skew to get into odd corners or along the surface as shown in the photo on p. 126. Grind or hone the under bevel of the chisel lightly to produce a small burr. Keep the skew flat on the rest with the edge at center height and the burr on the top. Use only a small portion of the edge at one time but all of the edge at some time. On a convex surface, pivot the tool on the rest so the point of cut moves along the edge. On very hard end grain, honed scrapers used very gently will give you an exceptional finish right off the tool.

Pots

The ash pots in front are among the first objects I ever turned back in 1970. Behind the horizontal scrub bark box is the bottom half of a failed spillikins box long used for pencils. The elm pot made for these pages is deeper than usual for a production item normally 4 in. (100mm) tall. That extra bit adds too much risk and takes the edge right off the profit.



MATERIALS: Horizontal scrub (with bark), voamboana (feathers), elm (chopsticks), ash (dice)

SIZES: 1 1/4 in. to 3 3/8 in. (45mm to 85mm) diameter

PENCIL POT

Hollowing end grain is not easy, so you should try a small version of what is shown here before going on to deeper things. The further you work over the rest, the greater the difficulty, so don't be overambitious during your early attempts at hollowing end grain.

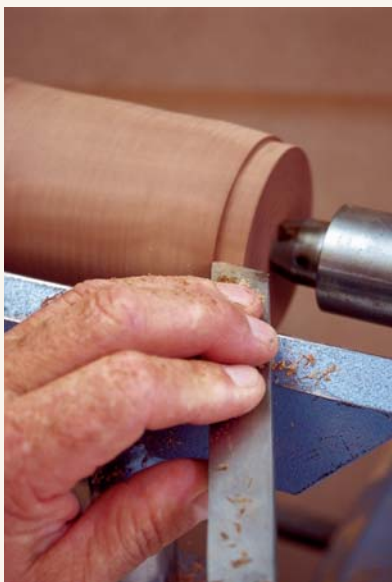
Pots provide good practice for hollowing end grain and they sell reasonably well, since people always

need to contain all manner of long, thin objects. It's difficult to have too many dotted around the house, and they make great gifts. The skills you develop as you work through this exercise are essential for making boxes. You need a blank $2\frac{1}{2}$ in. to $3\frac{1}{2}$ in. (65mm to 90mm) in diameter and about 3 in. to 4 in. (75mm to 100mm) long.

1 Mount the blank between centers, then use a roughing gouge and a $\frac{3}{4}$ -in. (20mm) skew chisel to reduce the squared blank to a rough cylinder.



2 Use the skew chisel to peel a short tenon so there's a shoulder to sit against the rim of the chuck jaws. Remove just the minimum to make the tenon a true cylinder. At this stage, don't worry about removing all flat areas on the larger diameter.



3 Use the skew long point to true the end grain. This is an opportunity to practice a difficult cut, but it also trues the end grain so it seats accurately in the chuck.



4 Fit the tenon into the chuck. (This will be the top of the pot.) In this case, the blank was marginally wider than the chuck jaw and the tenon fits the chuck almost perfectly. Thus, I can gauge the diameter of the base by eye, rather than using calipers. The base will need to be only slightly narrower.



5 Use the skew chisel to true the cylinder and end grain.



6 Check that the base is slightly concave by using a straight-edge. If you want to decorate the end grain with a bead or lines, now is the time to do it.



7 Turn the foot to fit the chuck and the rest of the profile as close to the chuck as you dare. (Remember that the grinder is there if you get too close.) Shear-cut when you can and use the low-peel technique on the uphill slope to the bead at the base.

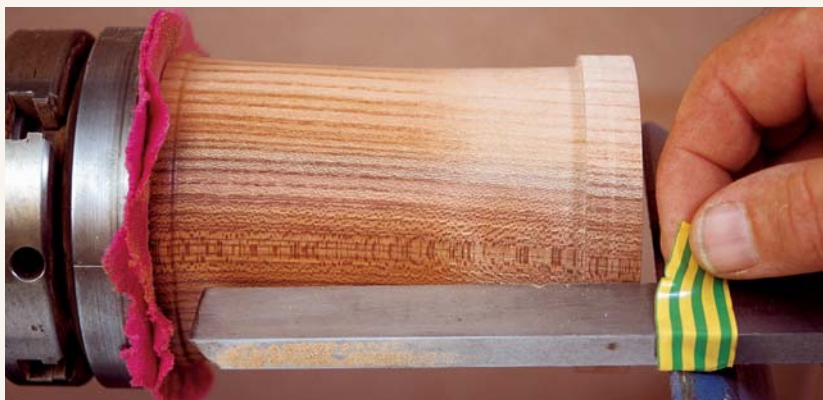


8 Sand using 150-, 240-, and 360-grit abrasives. Finish with oil and wax before reversing the job in the chuck for hollowing.

PENCIL POT (continued)



9 With the pot now gripped around the foot, true the rim and end grain. Remove as little wood as possible around the rim. The band at the rim will be detailed later; meanwhile, it strengthens the form as hollowing proceeds.



11 Complete the hollow using a $\frac{3}{4}$ -in. (20mm) square-edge scraper. Even if you've drilled a depth hole, it pays to mark the depth you want on the blade of the scraper. A pencil line is okay, but plastic tape is easier to see and you can feel it under shavings. As you increase the depth, complete a series of internal bases so you get several chances to practice smoothing the end grain some distance from the rest.



10 Begin the hollowing process using a $\frac{1}{2}$ -in. (13mm) shallow gouge. Although back-hollowing is faster, conventional cuts from the rim are less risky. When you get more confident handling the square-edge scraper a long way over the rest, you'll find it is faster to drill a $\frac{1}{2}$ -in. (13mm) depth hole first and complete the hollow using just a scraper as a borer.



12 Be very cautious easing the edge against the end grain, especially working well over the rest. Keep the tool horizontal to cut a cylinder accurately. Having smoothed a base at, say, 2 in. (50mm), push the scraper firmly into the base to bore in another $\frac{1}{2}$ in. (13mm) or so, then finish another base at that level, and so on. The leverage starts getting really difficult to control at about 3 in. (75mm).



13 Using internal calipers, check the internal dimensions. Aim for a cylinder and do not be satisfied with less. A slightly dovetailed hollow is okay but not a tapered opening narrowing from the rim, which limits the number of whatever it is you hope to contain in the pot.



16 In preparation for oiling and finishing, blow out the dust using compressed air. Lovers of the old-fashioned methods can use a short length of hose and their own lungs, while those better equipped can have their compressors buzzing away, consuming the world's valuable energy.

14 This interior is slightly dovetailed. The end grain is cut cleanly and the small ridges on the sides will sand away easily using an old 60-grit sanding disc if 100-grit doesn't do the job (it did). If your fingers can't reach the bottom, use a sanding stick (see p. 186).



15 With the inside turned and sanded, turn the rim using a $\frac{3}{8}$ -in. (9mm) shallow gouge. Here I have the material, so I turn a couple of beads, then decide the lower would look better as a cove.

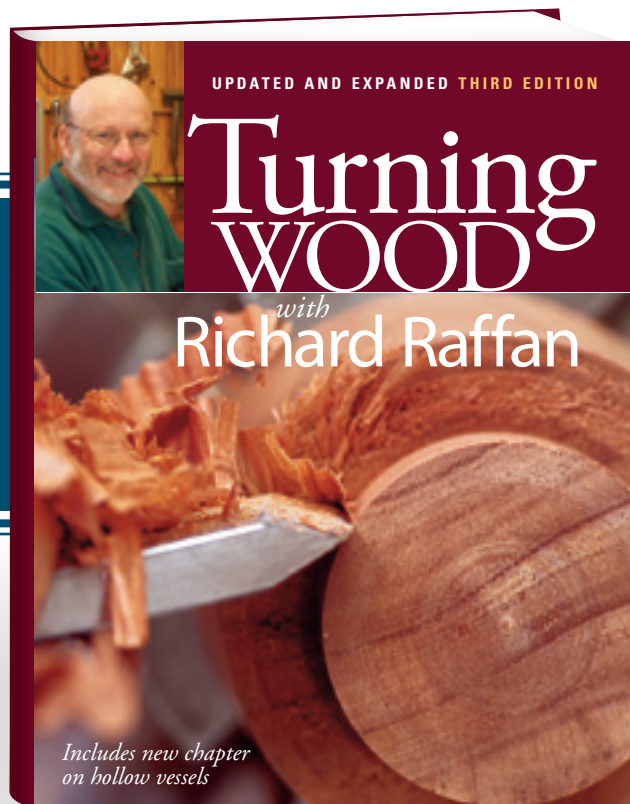


Pencil pot, elm, $4\frac{3}{4}$ in. by $3\frac{3}{8}$ in. (120mm by 85mm).

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