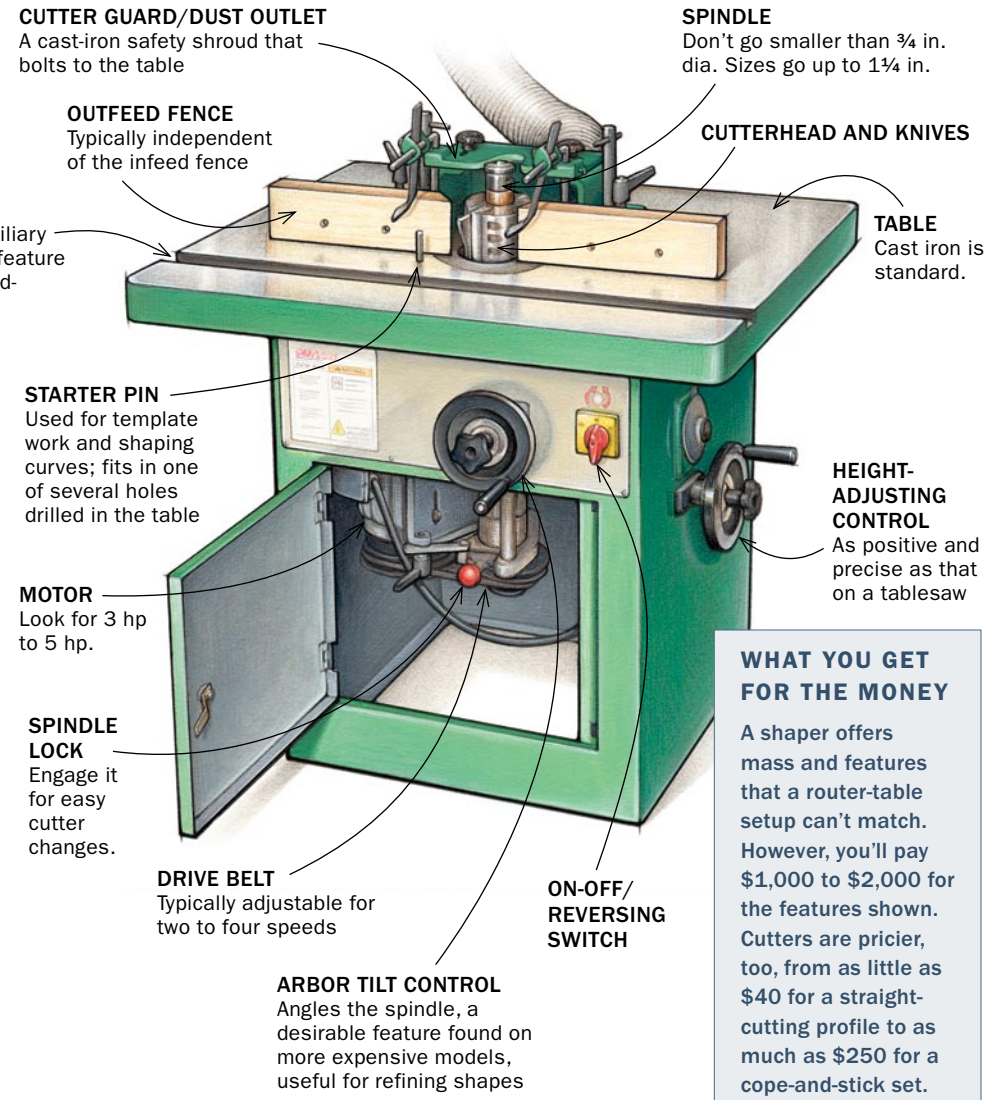
Consider a Shaper

Even if you have a good router table, you may need this powerful machine

BY J. SPEETJENS

Beyond the router. *A shaper will quickly and cleanly cut big profiles in thick stock, such as the cove shown here. With a shaft that's much thicker and stronger than a router spindle, shapers can accept much larger cutters, such as this cutterhead with interchangeable knives. Bearing collars also fit over the shaft.*



Stripped to their essentials, a router mounted in a router table and a shaper are the same—a machine with a vertical, motorized spindle holding cutters to mill wood. As a professional woodworker, I consider both router and shaper indispensable. Sometimes, I choose one machine over the other simply because of the cutters I have available. But often only one of the machines can handle the task at hand. Even though routers and shapers perform the same basic functions, there are some critical differences.

Routers have taken over the hobbyist market, largely because of cost and partly because shapers have a reputation for being dangerous. An antiquated cutterhead system was notorious for firing shaper knives across shops at ballistic speeds. But these cutters, commonly termed slick-back

WHAT YOU GET FOR THE MONEY

A shaper offers mass and features that a router-table setup can't match. However, you'll pay $1,000 to $2,000 for the features shown. Cutters are pricier, too, from as little as $40 for a straight-cutting profile to as much as $250 for a cope-and-stick set.

Shaper cutters and heads

STACKABLE CUTTERS

Mix and match. *Some cutters, like this cope-and-stick set, consist of separate components that slip over the shaper spindle. You can rearrange components for custom profiles.*

REMOVABLE KNIVES

Corrugations and gibs. *Some cutterheads and knives have corrugations that mate like gear teeth. Gibs and setscrews hold things tight. The corrugations let you move knives in or out in even increments.*

CUSTOM GRINDS

One-of-a-kind shapes. *The tool steel for a shaper knife costs only $10 to $20. You can easily create a template for a custom profile (top), then profile each knife on a bench grinder.*

Cut large moldings

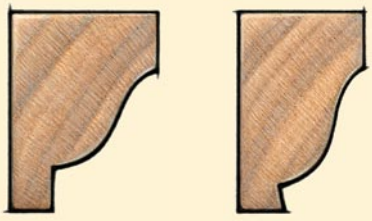
A shaper lets you make large runs of large moldings. A tilting arbor gives you the ability to modify standard profiles.

Keeping the stock in line. *Hold-downs above the fence and bolted to the table (above) apply even pressure to the work. A shaper's power and large-diameter cutters let you make deep cuts (right). For safety's sake, though, don't try to do everything in one pass. A final light pass also cleans up the surface.*

TILTING CAN CHANGE PROFILES

Deliberately out of line. *Some shapers have a tilting arbor, which lets you quickly and easily create custom bevels with a standard cutter.*

One cutter, two shapes. *Tilting the arbor changes the profile, in this case creating a taller, thinner ogee.*



knives, have been replaced by better, safer designs. In my experience, shapers are no more or less dangerous than jointers, planers, routers, or even drill presses.

If you're setting up a new shop or upgrading the machines you already have, you may want to consider adding a shaper to expand the range of profiles you can create. In general, a shaper can make heavier cuts, and can make them much cleaner. A shaper easily handles large runs of moldings, cutting larger profiles than a router as well as a wider range of curves. I'll even use the shaper for small moldings if I want a profile I can't get from router bits. A shaper's miter slot or sliding table makes it easier to cut tenons and cope-and-stick joints. And if your shaper has a reversible motor, you can do template work without worrying about cutting against the grain; the ability to flip some cutters adds to the shaper's flexibility.

Size and heft make for smooth cuts

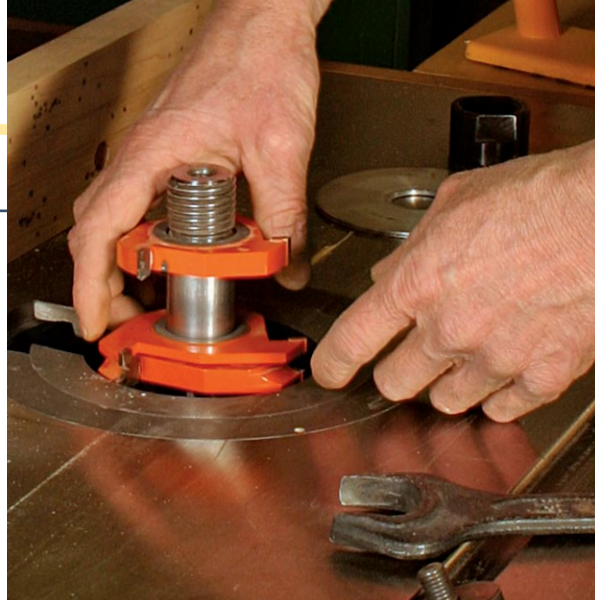
A shaper rated at 3 hp is a much more substantial machine than a 3-hp router. Routers hold their bits with a collet and nut attached to the motor shaft. Shapers are designed so that cutters, bearings, spacers,

Photos: David Heim; drawings: Christopher Mills

Stack cutters for common joints

STILES AND RAILS

Matched sets of stacking cutters and spacers let you make cope-and-stick joints in a range of sizes.



One cutter set, many frames. *Stackable cutters let you resize, reposition, or delete the panel groove for solid panels, glass panes, or no panel at all.*

and guards slip directly onto the motor shaft, held fast with a nut on the top. Where the router has a ½-in. collet, the shaper has a ¾-in. or 1-in.-dia. shaft. The drawing on p. 87 highlights the features that give a shaper its muscle.

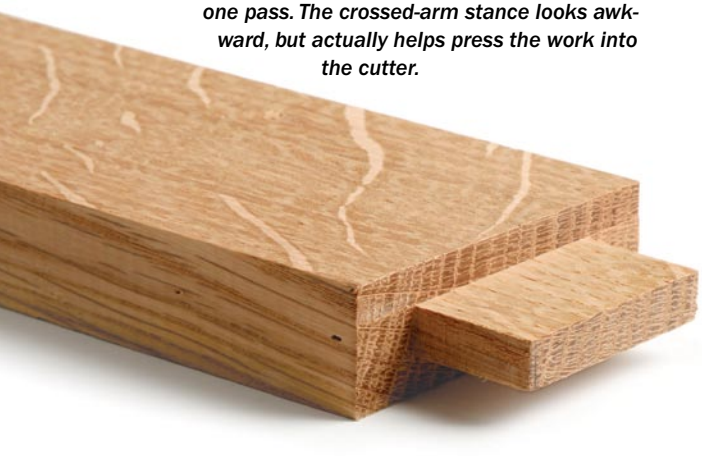
The shaper's larger spindle dictates that a cutter with the same profile as a router bit will have an inherently larger diameter. The larger diameter means that the leading edge of the tool enters and exits the cut at a shallower angle, greatly reducing tearout in woods like hard maple. Also, there are much larger gullets between knives for clearing chips.

Larger cutters also mean that shapers can run slower than a router to achieve the same tool speed. Where router speeds

Cutting the joint. *To make end-milling easy and safe, the workpiece is held against a fence that slides in the slot in the table (left). Once you've set the cutter height for one half of the joint, you can change cutters for the mating half without tweaking the fence or height settings (right).*

TENONS

Quick tenons. *Stacked cutters mill tenons in one pass. The crossed-arm stance looks awkward, but actually helps press the work into the cutter.*



Raise panels

You often can use one cutter, different orientations, and different cutting depths to create complementary profiles—for example, a raised panel and a drawer front.

REVERSING CUTTER AND MOTOR

Take advantage of the ability to reverse the shaper's motor rotation and to re-stack cutters and bearings.

Cutter on bottom. *To shape a drawer front, the cutter and bearing collar are stacked so that the work rides above the cutter.*

Cutter on top. *To give a raised panel a consistent edge thickness, the cutter is flipped to ride above the work, with a bearing collar below. To support the work for the length of the cuts, a single fence replaces the split fence.*

typically range from 8,000 rpm to 25,000 rpm, shaper speeds range from only 3,500 rpm to about 10,000 rpm.

A shaper's substantial mass means less vibration and more consistent power, which yields a cleaner, more efficient cut. To understand how this works, joint the edge of a board using a jack plane and then a block plane. The inertia built up in the heavier plane actually drives the iron though the wood more efficiently. The same is true with larger shaper cutters. Once they get up to speed, their momentum helps power them through the cut.

A wide range of profiles

There's an array of cutters available for shapers, just as for routers. But shapers give you a much greater variety. You can stack multiple cutters on the shaper shaft to create custom profiles. You also can grind your own knives or have them ground, so you can match specific profiles or create unique ones. I pay $75 to $175 to have knives ground. A blank that I can grind myself costs $10 to $20, depending on type and size.

Some shapers are equipped with a tilting arbor, which in effect gives you custom shapes from a stock cutter.

Because you can flip cutters and reverse the motor on a shaper, you often have more than one way to configure the tool setup. For example, a single cutter can shape both the edge of a raised panel and the edge on a drawer face (see photos, left).

Versatile table, fence, accessories

A shaper has a more substantial, durable, and adjustable fence and hold-down system, made from cast iron, steel, and wood. This enhances the shaper's safety, versatility, and quality of cut.

Shapers typically have independent infeed and outfeed fences. That means the outfeed fence can be adjusted to support a fully shaped edge. Hold-downs are typically made from a piece of spring steel bent into a curve that presses against the work. They keep the workpiece steady and help prevent kickback.

A sliding table, optional on most shapers, makes it easy and safe to work on the ends of narrow pieces (for tenoning or cope-and-stick joints, for example) and to back up the cut to prevent blowout.

Another option, the power-feeder, easily mounts to the shaper's cast-iron table, making it easy to run raised panels or cut large runs of molding. However, the feeder's cost and setup time don't make it worthwhile for short runs or occasional use.

Shaping curves and patterns

The benefits that a shaper brings to straight cutting—custom profiles, the ability to profile thick stock in one pass—it also brings to non-linear milling. I've used my shaper to make rails for bow-front chests, arched door casings and raised panels, rocking-chair runners, and curved seat slats.

Template work with a shaper is very similar to template work with a router. In both cases, a bearing ensures that the cut is flush with the template. There are two important differences, though.

First, unlike a router, a shaper allows you to reverse the cutter rotation to deal with contrary grain or to minimize tearout when the grain changes direction. There's no need to make a climb-cut or turn the workpiece and template upside down, as

you would to avoid cutting against the grain with a router. You only have to flip the cutterhead over and move the stock from left to right to take advantage of the shaper's reverse rotation.

Second, the use of a starter pin is much more commonplace with a shaper than a router. The pin, which fits into one of several holes drilled in the shaper table, serves as a fulcrum to support curved stock as you pass it over the cutter. A bearing collar over the cutter also supports the stock. You press the workpiece against the pin, then pivot it into the bearing and move it past the cutter. □

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Shape curves

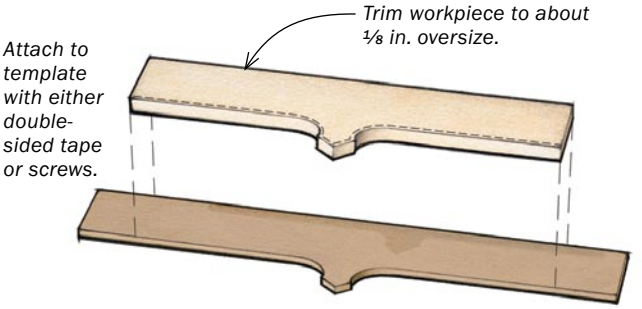
You can use a shaper and templates to make curved edges. The shaper's reversible motor and cutters allow you to work from two directions, minimizing tearout where the grain direction changes.

Starter pin and bearings guide the work. *A starter pin (a bolt works just fine) is essential for starting bearing-guided cuts without the workpiece diving into the cutter.*

Make the pattern long. *Allowing an extra 3 in. to 4 in. at each end of the template is another way to enter and exit bearing-guided cuts cleanly and safely.*

ADD A TEMPLATE

For pattern shaping, bandsaw the workpiece fairly close to the finished shape, leaving no more than ⅛ in. of waste.

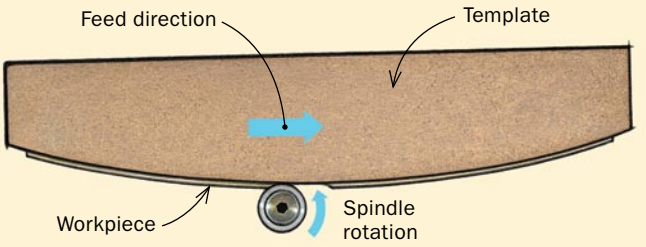


FLIP AND REVERSE TO AVOID TEAROUT

When shaping curves, work from the middle of the curve toward the edge, flipping the cutter and reversing the motor after shaping half the curve. That way, you're always working with the grain.

Start from the right. *When shaping curves with a template, begin by moving the workpiece from right to left, starting at the center of the curve. Then reverse the motor's rotation and flip the cutter to shape the rest of the curve.*

FIRST CUT STARTS AT THE MIDDLE OR HIGH POINT



THEN REVERSE THE CUTTER AND ROTATION