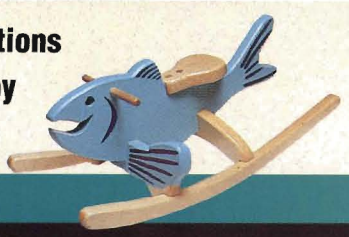
- How to steam bend wood: Easy, step by step instructions
- Use our full size patterns to make a great rocking toy
- Plus: A classic steamer trunk design you can build



Issue 29 ■ $3.95

TODAY'S WOODWORKER™

PROJECTS, TIPS AND TECHNIQUES

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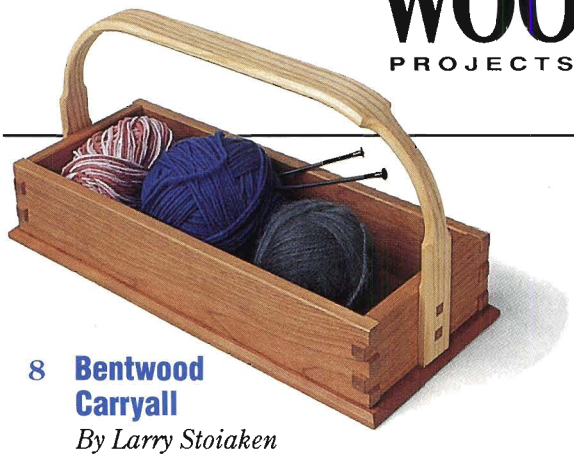

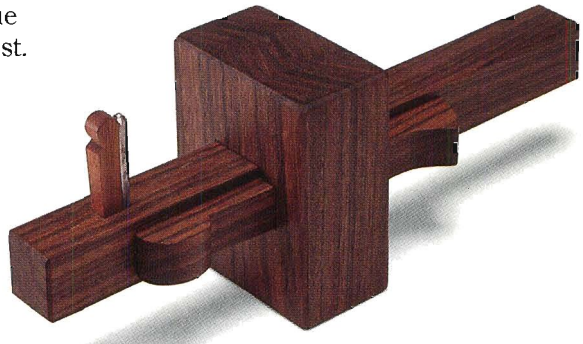

Safety First
Learning how to properly operate power and hand tools is essential for developing safe woodworking practices. For purposes of clarity, necessary safety guards have been removed from the equipment shown in some of the photos and illustrations in Today's Woodworker. We in no way recommend using this equipment without safety guards and urge readers to strictly follow manufacturer's instructions and safety precautions.

SEPTEMBER/OCTOBER 1993
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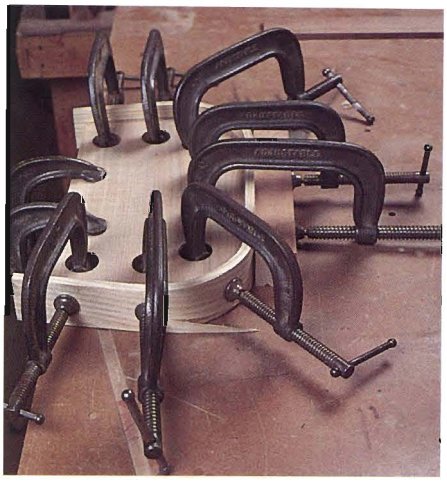
50,000 and Growing

Sometime during the past few months our 50,000th subscriber came on board. That's a lot of woodworking warriors to tend to! We're all very proud and delighted to be your host every couple of months and want you to know that we take the responsibility very seriously.

A couple of issues ago I talked about our new contributing editors, Tom Caspar, Peter Korn and Richard Starr. Now I'd like to introduce our editorial advisors —Nordy Rockler, Steve Krohmer, Rick White and Al Wolford. About once a month the regular staff lures the advisors into our office with coffee and donuts and we sit around talking shop, reviewing your survey comments and planning out future issues of the magazine.

Nordy is chairman of the board of Rockler Companies (parent of both Today's Woodworker and The Woodworkers' Store) and was talking shop with woodworkers when the rest of us were still in diapers. Steve Krohmer, who spent eight years with Woodsmith Magazine, now stays busy developing new products for The Woodworkers' Store while keeping the rest of us up to date on the market. And many of you already know Rick White, who builds one large project in each issue and is famous around here for what everyone calls "White magic". Somehow he manages to solve every head scratchin' challenge our designers can come up with.

This brings me to our newest editorial advisor, Al Wolford. You may have talked with Al lately and not even have known it. You see, Al is the technical service manager for The Woodworkers' Store and in that job he talks with a lot of you every day. Whenever a woodworker is having trouble installing new hardware guess who gets the call. Likewise, the Today's Woodworker staff has always turned to Al for help with our Hardware Hints department. Well, now we've formalized the relationship and Al will be writing the column each issue, answering the most commonly asked hardware questions, reviewing the latest gadgets and offering hints for easy installation. Feel free to drop Al a line with your questions. He'll be glad to hear from you and we'll enjoy watching him grapple with your stumpers. Welcome aboard Al!

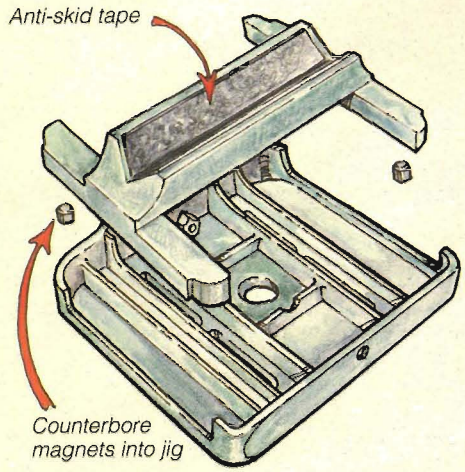


As they say, "you have to break a few eggs to make an omelette" ...or was it "you have to bust some ash to make a basket."

As you may have already guessed from the photo above, I've been hearing a few jokes about "busting my ash" lately. In spite of the minor setbacks I experienced on the way to building the bentwood carryall featured on page 8, I can recommend without hesitation that you take the time to learn the surprisingly easy technique of steam bending wood. First read Peter Korn's article on page 6, then try your hand at our weekend project on the following pages. You'll find that a steam box is easy to set up and the process of bending wood is fascinating and rewarding.

Larry N. Stoiaken

Tool Enhancements



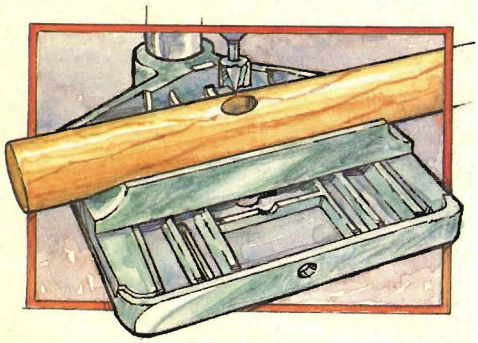
Ever Ready V-Block

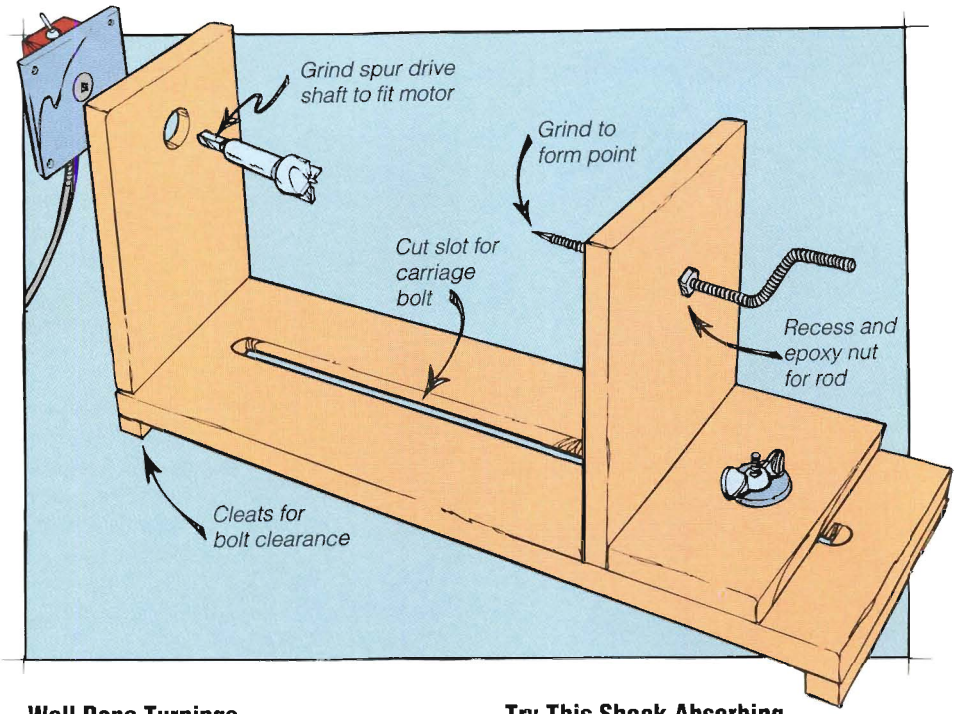
I no longer search for a V-block every time I want to drill a hole in a dowel. And I no longer have to struggle with its alignment, or worry about it slipping either.

My V-block is conveniently mounted on the underside of my drill press table. For a base, I laminated two pine blocks and machined them to fit perfectly into the two outside cavities in the cast iron ribbing of the table. I then laminated three pine boards and made them into a V-block long enough to span the width of the table. I curved both ends of the V-block so it's less conspicuous when the table is turned upright. Once the V-block was aligned perfectly under the drill press chuck I glued it to the two pine blocks in the cavities.

Removal of the V-block is easy since there are no screws or bolts. Instead I embedded four ring magnets in the base to hold the V-block securely in place. They work perfectly. A coat of grey paint and some anti-skid tape in the V-block completed the job.

Dick Dorn
Oelwein, Iowa





Well Done Turnings

A motorized barbeque turning at about five rpm is ideal for finishing turning projects. I mount my turnings on homemade centers and apply a finish. As the piece rotates the finish levels out and dries, and even if a run occurs it eventually evens itself out. A bonus is that my lathe is free for my next project.

Lt. Ray Kraft, USN, RET
Madisonville, Louisiana

Put Your John Hancock Here

Want to leave your mark on your woodworking projects? You don't absolutely need a branding iron.

Have your local printer or copy shop make a transparency (like those used for overhead projectors) of your signature or logo. Next, to get a mirror image of your logo, place the transparency face side up in a photocopier, which also allows you to reduce or enlarge it to suit your project.

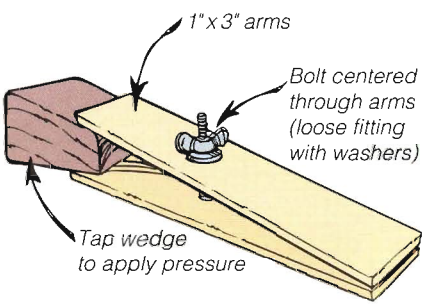
Now place the photocopy on your project and apply heat with an iron or woodburning pen to transfer the toner. For the best results the wood must be sanded as smooth as possible .

L.K. Bolay
Oak Harbor, Ohio

Try This Shock Absorbing Scroll Saw Mount

Mount your scroll saw on suction cups, like those commonly found on car luggage racks, for quiet, shock free operation.

Howard Schide
St. Charles, Missouri



A Long Arm Clamp

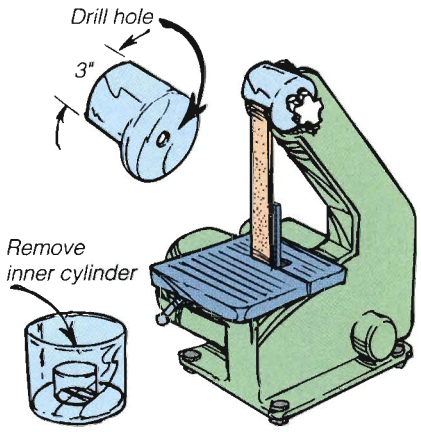
I often need to clamp work that regular clamps can't reach. To make a long arm clamp, I cut two lengths of a 1" x 3" board and fasten them together through the center with a loose fitting bolt. Then I cut a wedge to use between the boards for adjusting pressure on the workpiece.

Howard E. Moody
Upper Jay, New York

Flush Cuts for Plugs and Dowels

I have an improvement for the trick in the November/December 1991 issue of *Today's Woodworker*. For cutting dowels off flush, just grind the set off the teeth on one side of a hacksaw blade. The blade flexes so you can get right down to the wood surface without scratching or cutting the workpiece.

Bernard Resh
Lancaster, Pennsylvania



Stop Taking It On The Chin

Many of the 1" x 30" three wheel belt sanders have no dust shield over the top wheel. In use, sanding dust, sometimes in big globs, comes flying out of the top directly into the operator's face. A simple homemade shield over that top wheel will stop the problem right away.

I cut a plastic cap from a typical spray can and mounted it to the top of the sander. The diameter of the spray can cap closely matches the top wheel. If you want to use the top wheel to sand an inside concave surface, just remove the new dust shield.

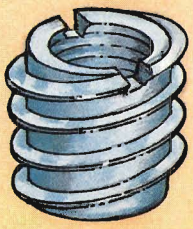
Happy sanding.

Douglas C. Mertz
Meredith, New Hampshire

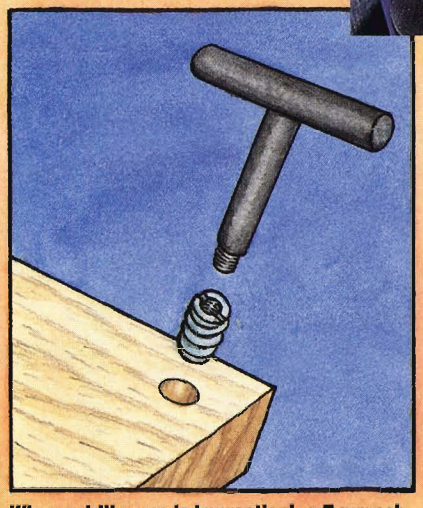
Today's Woodworker *pays from $35.00 (for a short tip) to $150.00 (for each issue's "Pick of the Tricks") for all Tricks of the Trade published. Send yours to Today's Woodworker, Dept. T/T, Rogers, MN 55374-0044.*

Threaded Inserts

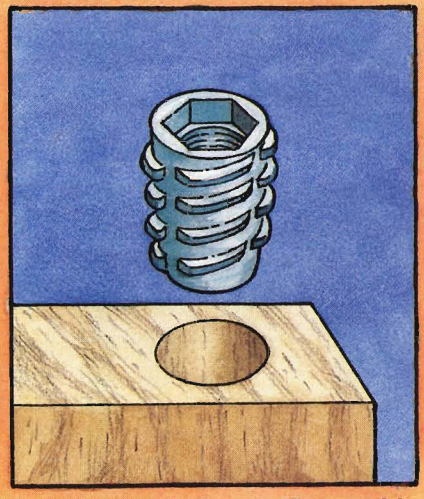
By Al Wolford



Try a drill press the next time you want to install a threaded insert. Just use a bolt and two nuts to drive the insert by hand.



When a drill press is impractical, a T-wrench is the next best choice. A screwdriver will also work, but it's much more likely to slip and mar your wood. You also run the risk of a crooked installation.



For end grain applications, an Allen wrench is used to install a special insert with deeper threads and a tapered body.

I get a lot of calls from people building projects that may have to be disassembled more than once. "Will wood screws work?" "Do I have to use elaborate knockdown hardware?" "Isn't there a simple way to go about this?"

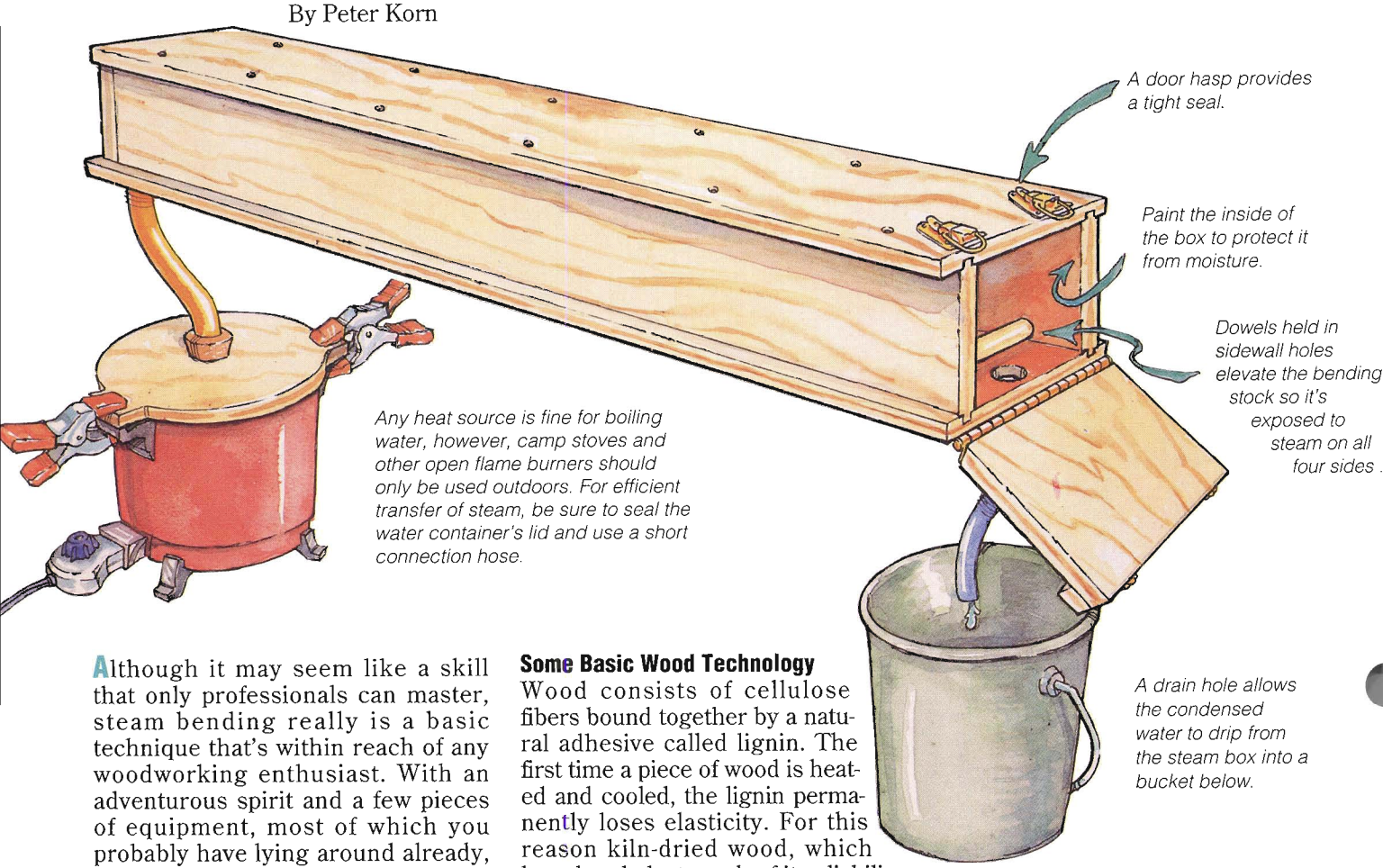
The answer to the first two questions is yes —depending on the application. But if you're looking for a simple approach to disassembly, threaded inserts are the way to go. I particularly like to recommend them when the hardware in the project is hidden from view.

These little metal cylinders are threaded on the inside for a machine screw and coarsely threaded on the outside for driving into wood. Once the insert is seated in a pilot hole, you can install or remove the machine screw as many times as you like without giving up any gripping ability.

Steel and brass threaded inserts come in several sizes for standard applications, and a special steel insert is available for end grain, as shown at left. A nice little trick for installing an insert is demonstrated in the photo above. This technique keeps the insert square to the wood as you turn the chuck by hand. (Just don't try this with the power on!) If using a drill press is impractical, then standard inserts can be driven into the wood with a screwdriver and end grain inserts can be installed with a hex (Allen) wrench. No matter which method you choose, the real key is a properly sized pilot hole.

Steam Bending Basics

By Peter Korn



Although it may seem like a skill that only professionals can master, steam bending really is a basic technique that's within reach of any woodworking enthusiast. With an adventurous spirit and a few pieces of equipment, most of which you probably have lying around already, you can get started.

Wood bent after using steam to make it pliable is generally strong since its grain follows the length of the curve. By comparison, curved components cut out of solid planks tend to contain weak sections of short grain **(See Figure 1)**. Look out for lumber with severe grain runout, however, for even with steaming methods this wood is likely to crack.

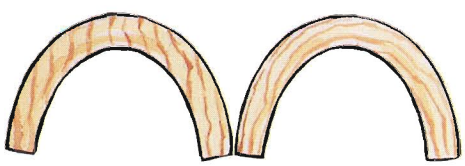


Figure 1: A curve bandsawn from solid wood (left) usually has significant grain runout, which weakens the piece. The grain lines on a steam bent piece (right), on the other hand, are continuous, making it the stronger alternative.

Some Basic Wood Technology

Wood consists of cellulose fibers bound together by a natural adhesive called lignin. The first time a piece of wood is heated and cooled, the lignin permanently loses elasticity. For this reason kiln-dried wood, which has already lost much of its pliability in the kiln, is not your best choice for steam bending. Air-dried wood is the ticket: when it's steamed and bent, the lignin helps lock the new curve in place. Green wood is also bendable, but has two disadvantages. First, it can take months to dry and second, the wood cells are often so full of water that hydraulic pressure bursts them open as they compress.

Wood subjected to steam in an enclosed container heats up and absorbs moisture, dramatically increasing the flexibility of its fibers. When it reaches sufficient pliability, the wood should be rapidly bent onto a form. After cooling and drying the wood will retain its new shape, although varying degrees of springback can occur, depending on the character of the wood, the amount of steaming, and the rapidity with which the hot wood was bent to the form.

Some species of wood lend themselves to bending more readily than others. For example, white oak, red oak and hackberry are particularly good **(see box at right)**, while mahogany and hard maple are unsuitable. Whichever wood you choose, select straight grained pieces to reduce the likelihood of fracturing.

Building a Steam Box

Making your own steam box is easy, as shown in the illustration above. A typical design incorporates a plywood box, a heat source, and a water container connected to the box by some sort of hose. When building a box, consider the size of wood you'll be bending. An efficient box shouldn't be too big, yet it must allow enough room for steam to circulate freely. For most bending needs, an exterior dimension of about 7" x 7" x 60" will

Steam bending results depend in part on the woods you choose. Selecting species with a better record of success will improve your chances.

Ash	67%
Beech	75%
Birch	72%
Elm (soft)	74%
Hackberry	94%
Hickory	76%
Maple (hard)	57%
Red Oak	86%
White Oak	91%
Pecan	78%
Walnut	78%

From The U.S. Forest Products Laboratory *Wood Handbook*

be more than sufficient. If you decide to give it a try, be sure to incorporate the following guidelines:

- Use exterior grade plywood for the box since its waterproof glue won't degrade from the steam.
- Apply paint to the box's interior to protect the plywood.
- Space a line of dowels across the box's width to elevate the wood above the condensation runoff and to promote the flow of steam.
- Seal one end of the box, and hinge the other end for easy access.
- Drill a small hole through the bottom at one end to drain condensed steam.
- Drill a second hole, at the other end, for the steam hose entrance.

The heat source for your steamer can be an electric burner, a wood fire, a camp stove, or whatever you have that will boil water. For safety's sake, remember to use your equipment outside if it generates a flame or has exposed hot coils.

The water container should hold several gallons and have an access hole small enough to be plugged with a large cork or rubber stopper. If the container is made of iron, make sure it's galvanized or enameled, otherwise the steam will probably stain your wood. By drilling a hole through the stopper you can hold the connecting hose in place. The hose should be made of rubber, plastic, or copper of at least 1/2" in interior diameter. Thin walled plastic tubing is not recommended as it collapses when the steam runs through. In use, be sure to set the steam box at a slight incline so that condensation flows out the drip hole.

Steaming Your Wood

The first step in steaming your wood is to fire up the burner and boil the water. Once steam begins filling the chamber, put the wood in the box and close the lid. Steam the wood until it's pliable, then, wearing gloves for protection, remove the hot wood and rapidly bend it to the form.

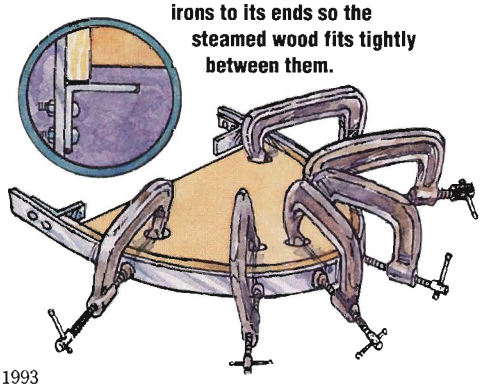
How long should wood be steamed? There is no precise answer, so it's a good idea to include a couple of test pieces in the box for experimentation. Species, moisture content, and the intensity of the steam environment are all factors. Here are three rules of thumb for steaming air-dried lumber as laid out by Michael Fortune, a master woodworker and experienced steam bender from Toronto, Canada:

- Keep wood with a moisture content below 20% in the steam box for about an hour and a quarter per inch of thickness.
- Steam wood with 20 - 30% moisture content for 45 minutes per inch of thickness.
- Wood with a moisture content in excess of 30% needs only about 1/2 hour of steaming per inch of thickness.

When pulling hot wood from the box, work rapidly to place it in the bending form. The wood begins to cool instantly, and it's amazing how quickly flexibility diminishes. If possible, leave the wood clamped in the form for several days. If you need to store the bent wood for a while or reuse the bending form, clamp the stock to a jig to prevent the bends from straightening.

There are a variety of designs for bending forms. The most common is a one piece form, usually built with layers of plywood, to which the steamed wood is clamped **(See Figure 2)**. Another type of form consists of two mating parts between which the work is sandwiched. I've also bent wood simply by wrapping it around and through pegs protruding from a board. Since steamed wood almost always has some springback, I often cut the form to a slightly more severe bend than I want to end up with. However, springback is unpredictable, so until actual test bends are made, the exact amount of over-bend required is anyone's guess.

Figure 2: Make a banding strap using metal between 1/16" and 3/32" thick, and bolt angle irons to its ends so the steamed wood fits tightly between them.



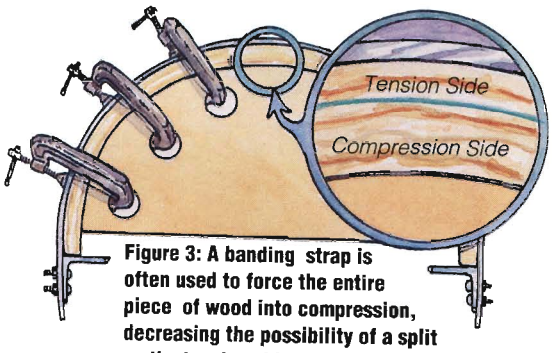


Figure 3: A banding strap is often used to force the entire piece of wood into compression, decreasing the possibility of a split on the tension side of the bend.

When you bend a piece of wood, an imaginary line up the center stays constant in length **(See Figure 3)**, while the outside of the curve gets longer (tension) and the inside becomes shorter (compression). Wood is fairly good at compressing, but splits apart readily under tension. It's the tension factor that limits the degree of curvature in a simple bend. Many woodworkers reduce the chance of splitting on the tension side of the wood by using a bending strap —a flexible steel strap about 1/16" thick and as wide as the bending stock, with end stops spaced to enclose the exact length of the workpiece. As soon as the wood is pulled from the steam box, the strap is fitted to the tension side of the stock. With the outside curve unable to expand, the entire piece of wood is forced into compression, minimizing the chance of splitting.

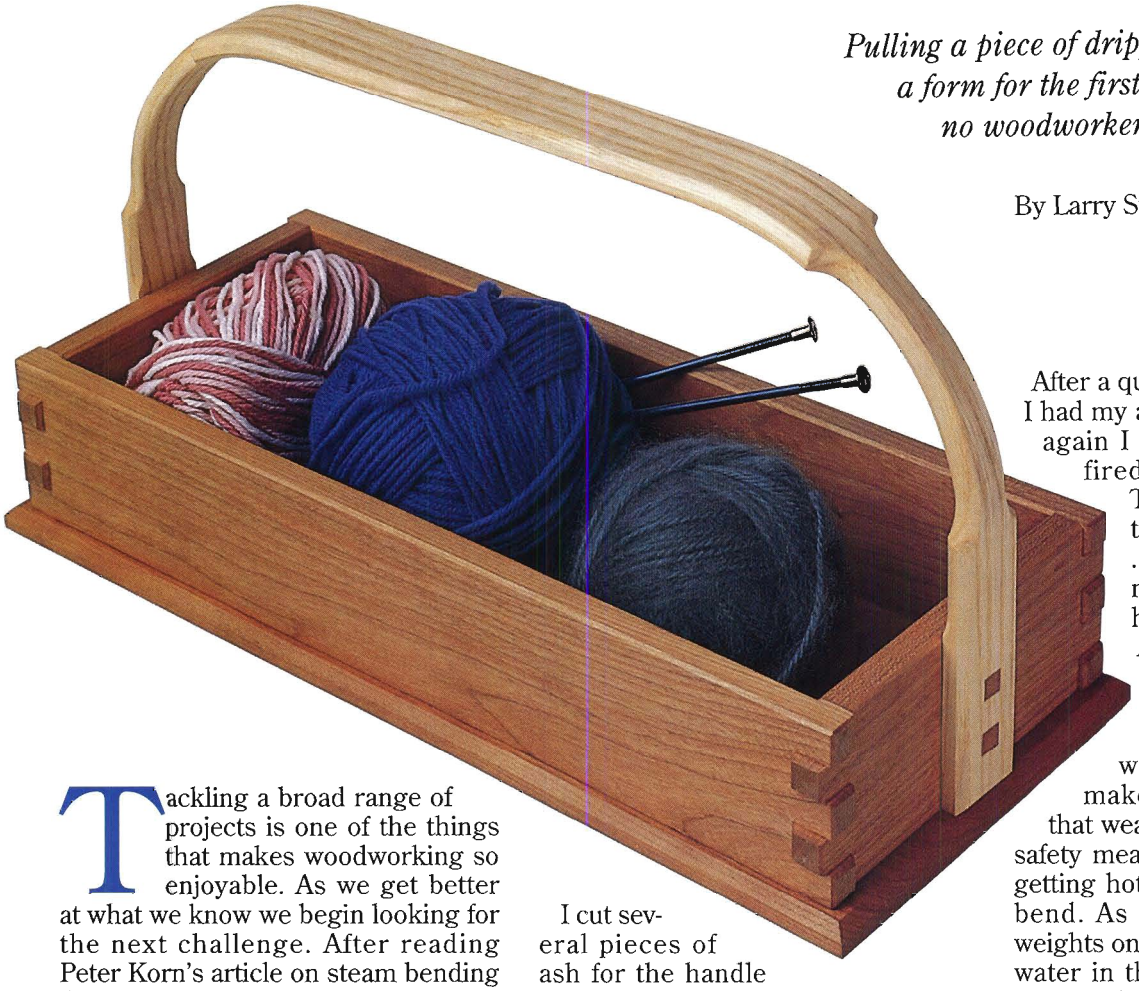
Steam bending is an accessible, low-tech process which broadens the range of design options available to a woodworker. Once you master the basics by following these simple steps, you'll find all sorts of uses for your new skill.

Peter Korn is a contributing editor for Today's Woodworker and operates The Center for Furniture Craftsmanship in Camden, Maine (207-594-5611).

A Bentwood Carryall

Pulling a piece of dripping hot wood around a form for the first time is an experience no woodworker should miss out on.

By Larry Stoiaken



Tackling a broad range of projects is one of the things that makes woodworking so enjoyable. As we get better at what we know we begin looking for the next challenge. After reading Peter Korn's article on steam bending (see *Techniques* on page 6), I knew I had to try my hand at a simple bentwood project.

Since I had no prior experience with steam bending I opted for a project with just one bent piece. The all-purpose basket I chose to make was otherwise straightforward in design and construction. I used a little 1/2" and 3/8" cherry from my scrap pile for the box and less than a board foot of 3/8" thick ash for the handle.

Bending the Handle

After setting up the equipment for my steaming operation, I made the form for bending the handle (piece 1). The form is shown in this issue's **full size pattern** insert. You'll notice that the last few inches at each end of the form toe in about 20°. This allows for the natural springback of the handle after it's removed from the form. The ends on the final handle shape will be close to straight. Keep in mind, however, that the amount of springback will vary from one piece of wood to the next.

I cut several pieces of ash for the handle stock (just in case this step didn't work out right away) and steamed them for several hours. With high anticipation I drew my first piece out of the steam box and pressed it against the form. It snapped. My second piece cracked. Then my third, fourth and fifth pieces failed. What was I doing wrong? After carefully rereading Peter's article I realized my error. I was using kiln dried lumber and what I needed was air dried material.

Figure 1: Once the steamer was working properly our ash bent quite easily —a bending strap wasn't even necessary.

After a quick trip to the lumberyard, I had my air dried ash in hand. Once again I cut the stock to size and fired up the steam chamber. Two hours later I attempted to bend my first piece and ...it cracked. This was definitely not the way things happen on Norm Abrams' *New Yankee Workshop*.

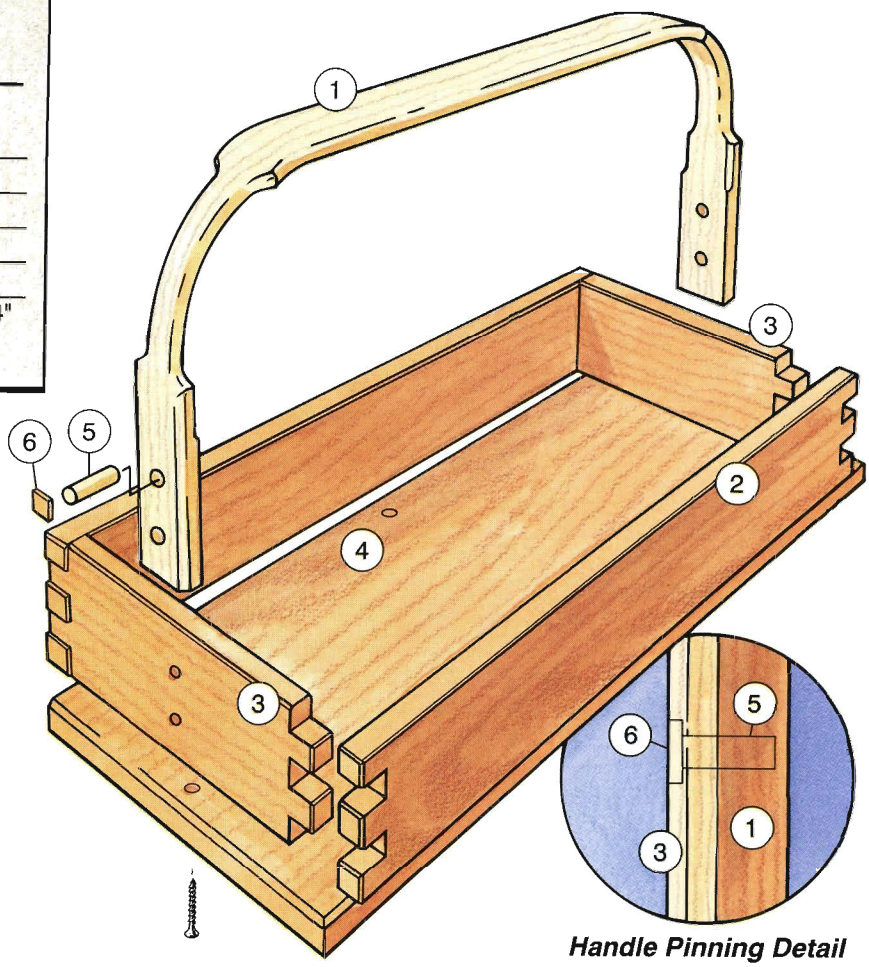
In thinking back over the process it occured to me that I had handled the wood without gloves. Peter makes the point in his article that wearing gloves is an important safety measure. My wood just wasn't getting hot enough or wet enough to bend. As a remedy I placed heavy weights on the lid to seal the steaming water in the pot and, for good measure, I shortened the copper tubing from the pot to the chamber so the steam wouldn't have a chance to cool off. After a few minutes the huffing and puffing noises coming from my box assured me that I had solved my problem. And sure enough, on my very next attempt I easily bent the wood around the form by hand and held it in place as two helpers tightened C-clamps and a block of wood to the flat area of the form first, then added clamps around the curved sections of the form **(See Figure 1)**.

Finger Jointing the Box

While the ash dried in the form for a couple of days I got busy making the cherry box. First I cut the stock to size for the sides, ends and bottom (pieces 2, 3 and 4), then I got out my trusty finger joint jig for the table saw. (See **Figure 2** to make your own jig if you don't have one.) For a special touch I decided to cut the fingers extra long so they'd stick out a little when the box was assembled.

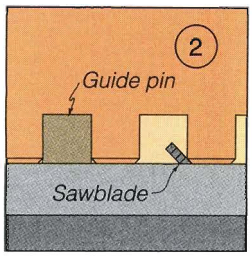
MATERIAL LIST

	T x W x L
1 Handle (1)	3/8" x 1½" x 29"
2 Sides (2)	1/2" x 2½" x 14¾"
3 Ends (2)	1/2" x 2½" x 6¼"
4 Bottom (1)	3/8" x 6½" x 15⅜"
5 Handle Pins (4)	1/4" x 5/8" Dowel
6 Square Pegs (4)	5/16" x 5/16" x 1/4"



Handle Pinning Detail

Chamfering the side edges of each finger was a snap using my finger joint jig. I just tilted the blade 45°, raised it just above the saw table, and repositioned the jig on my miter gauge to align the tip of a finger with the blade, as shown in the drawing at right. Then I just followed the same procedure for chamfering as I did earlier when cutting the fingers. To chamfer the faces of the fingers I removed the jig and used the miter gauge to push the stock over the tilted blade. And while I was at it I went ahead and cut 1/8" deep chamfers on the top edges of the bottom panel.



Spreading glue in these joints was done with a small, stiff bristled brush. Prior to spreading the glue however, I sanded the sides and ends to 150 grit and applied a coat of oil finish, carefully avoiding the inside surfaces of the joints. This made cleanup really easy after I was done clamping the box.

I waited until the glue became rubbery, then used a 1/4" chisel to slice it off the oiled wood. Once the glue dried completely I drilled four slightly oversized countersunk holes to secure the bottom to the box with wood screws. Even though the bottom is only 6½" wide, a little movement is possible. The oversized holes will keep the bottom from splitting.

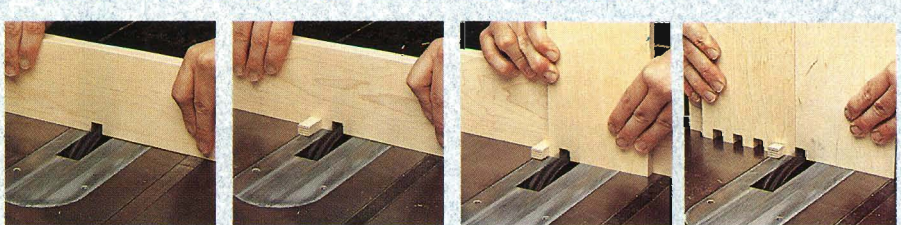
Attaching the Handle

A variety of tools were used to shape the handle after tracing the **full size pattern** onto the bent stock and cutting the ends to length on the table saw. First I roughed the handle to shape by sawing outside the layout lines with a coping saw, then I worked with a cabinetmaker's file and sandpaper to complete the shaping and chamfer the edges.

The handle is pinned to the box with short 1/4" dowels (pieces 5), and these pins are covered with square pegs (pieces 6). Using a 1/4" drill bit with a stop collar, I drilled two 3/4" deep holes through each end of the handle right into the box ends. I then squirted a bit of glue in each hole and used a longer dowel to drive the pins to their full depth. Once the glue dried I removed the clamps and chiseled the ends of the dowel holes square to accept my decorative pegs. A final light sanding followed by a second coat of oil wrapped up a nice weekend of work in the shop.

My experience at steam bending reminds me of the old saying about needing to break a few eggs to make an omelette. I'm confident that I now have the skills to try a much more difficult project, but I don't think I'd feel this way without my little collection of cracked handles!

Figure 2: Four easy steps for making finger joints



STEP 1: Install a 1/2" dado blade and a tall miter fence. When you're sure the fence is square to the blade make one pass with the blade raised to 9/16".

STEP 2: Glue a 1/2" x 9/16" x 2" guide pin in the dado you just made and reposition the fence 1" to the right. Make a second pass, leaving a 1/2" gap between cuts.

STEP 3: Position the box side as shown above to make the first cut. Then keep placing the cut you just made over the guide pin to make the next cut.

STEP 4: After the last cut in the first side piece, place the mating end piece tightly against it and continue cutting fingers. Repeat this procedure for the other side and end.

Holy Mackerel! What A Fish Story

Follow our full size patterns to make this weekend project —the perfect holiday gift for a lively toddler.

By Richard Starr

Kids never stop moving, which is why rocking toys are great fun for them. They can put that bottomless tank of energy to use without getting into too much mischief. For centuries, rocking toys of all shapes and sizes have entertained kids and their parents. But don't think you have to build a complex three dimensional toy to get your child's attention; profile shapes can be just as much fun. The technique I used for building my fish is adaptable to any shape you can imagine, from cars and airplanes to turtles and dogs. You could even make a rocking horse if you want to.

My rocking fish is sized for toddlers, although you could easily rescale the project for an older child. If you build a larger rocking toy, be sure to make the rockers considerably wider and use a sturdy hardwood like oak or maple rather than the softwood that mine requires. I've designed the rocking fish so that all its parts can be cut from a single 2" x 12" x 10' piece of framing lumber and one 3/4" diameter dowel rod.

Jumpin' James Jacobson puts our wobblin' walleye through its paces.

Choosing Your Wood

Finding good framing lumber requires a little searching through your local supplier's stacks. Most framing stock is western lumber, usually spruce and fir. While many woodworkers disdain these coarse species, they do have their applications in quality woodworking shops. Certain kinds of spruce, for example, are favored for soundboards on pianos, violins and guitars. Douglas fir, a lovely pinkish wood, is preferred by some western cabinetmakers for its delicate color and fine grain pattern. I've found quality examples of both species in stacks of cheap lumber.

When choosing wood for the rocking fish, look for a board with vertical grain and annual rings that are perpendicular to the surface. A board like this is called quartersawn, and can often be spotted in a stack of lum-

Figure 1: Layout the fish body and the other shaped pieces so they avoid knots in the lumber, then cut them with a band saw or saber saw.

ber by looking for the distinctive annual ring pattern on the board ends **(see below)**. For this project you're probably in luck since wider lumber usually comes from near the center of the tree and is therefore more likely to contain vertical grain. If possible, choose knot free wood or wood with small tight knots for your rocking fish. Be discriminating, but be sure to leave the lumber stack as neat as you found it.

Building the Fish

Building yourself a rocking fish is very simple. There are only six major pieces, held together with lag bolts, and all the shaped pieces are shown on the **full size pattern** insert. While I like my fish design very much, my primary intent is to show a basic method for making a rocking toy. With this construction technique you can make virtually any figure or shape you want.

If you do design your own rocking toy, here are a few things to keep in mind. First, carefully avoid any sharp edged shapes that could hurt a child. Second, make sure any shaped pieces with short grained sections are beefy enough so that a kid can't break them off. For example, look at the top end of the back fin on the rocking fish. Since the grain runs across that section you could break it easily if it were narrower. Third, plan the curve of the rockers with your child's safety in mind. I consider the curve on my rockers to be a middle of the road design. Flatter rockers will slow the toy down, whereas a greater curve will speed the action and add a little more excitement.

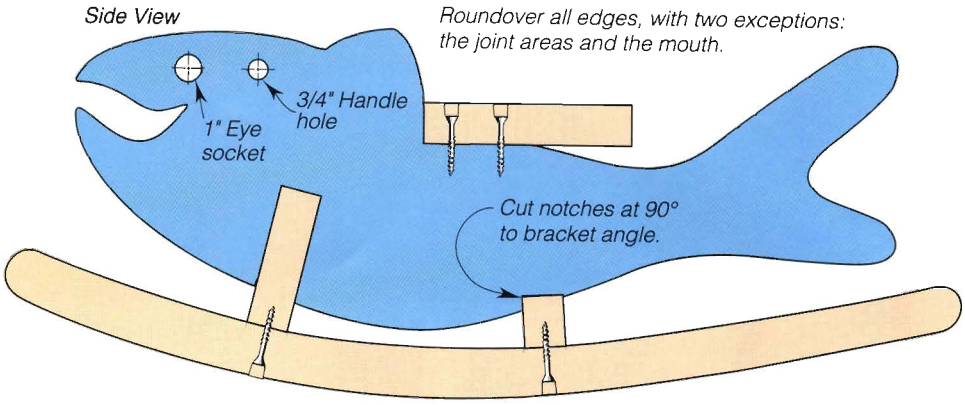


Figure 3: You can alter the bracket positions to suit your child's leg length, just be sure to cut the notches square to the brackets for stable joints.

Cut out the **full size patterns** of the fish body, the front and rear brackets, the seat and the rockers (pieces 1 through 5). Trace the patterns onto your stock, making sure to mark the eye and handle locations. Now use a band saw or saber saw to cut your pieces to overall shape **(See Figure 1)**, but don't cut the center notches in the brackets or the bottom notches in the fish body just yet. Next, to avoid any tearout, place some scrap material under the fish body as you drill the eye and handle holes **(See Figure 2)**.

Sand the surfaces and edges of all the pieces to remove mill and saw marks, then cut the center notches in the brackets for a snug fit. Be sure to saw inside the pattern lines and check the fit of the notches on the body, trimming or filing them slightly if necessary. A snug fit looks good and holds the body more securely.

You may want to change the bracket positions on your rocking fish to suit your child's leg length. To do this, mock up the rocking fish body, the brackets and the rockers in the positions I've indicated on the full size pattern. Next, slide the brackets to wherever you want (without going too far from the pattern layout) and trace around them on the fish body and rockers. Now draw in the shoulders of the notches on the fish body so they're square to the entry angle of the brackets, as shown in **Figure 3**, and cut these notches with a handsaw and chisel.

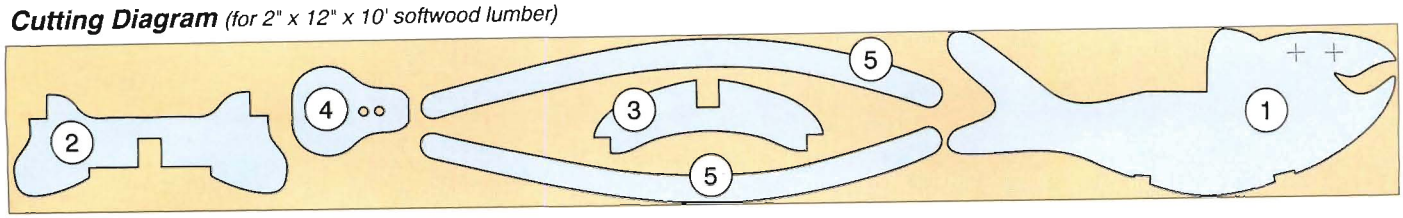
Figure 2: To prevent tearing out the exit side of the eye and handle sockets, back up the fish body with scrapwood while drilling the holes.

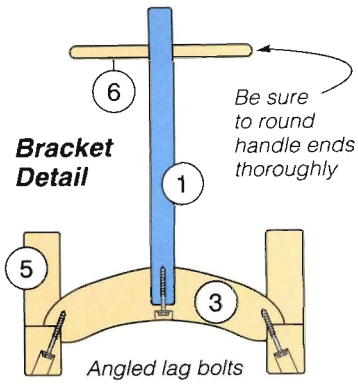
Roundover all edges of the pieces except in the joints, which should be left square for a better fit. The mouth on the fish also looks better if it's just softened a little with sandpaper.

To secure the seat to the fish body hold it in position and drill counterbored pilot holes for the lag bolts and washers (pieces 8 and 9). I used a 5/8" bit for the counterbore, drilling to a depth of 1/2", and a 3/16" bit for the pilot holes. Once the lag bolts are tightened and the seat is secure, fill the counterbores with 5/8" plugs (pieces 10). If you have a plug cutter make your plugs from scrap, otherwise cut them off a dowel rod.

Now you're ready to attach the brackets. Clamp the fish upside down in a vise and set the brackets in position, then drill counterbored pilot holes for the lag bolts. No plugs are needed here since these holes will be out of sight on the completed project. Now clamp the rockers to the brackets, holding them lightly in place with bar clamps reaching from rocker to rocker. Sight down your drill to estimate the best angle as you drill the

Cutting Diagram *(for 2" x 12" x 10' softwood lumber)*





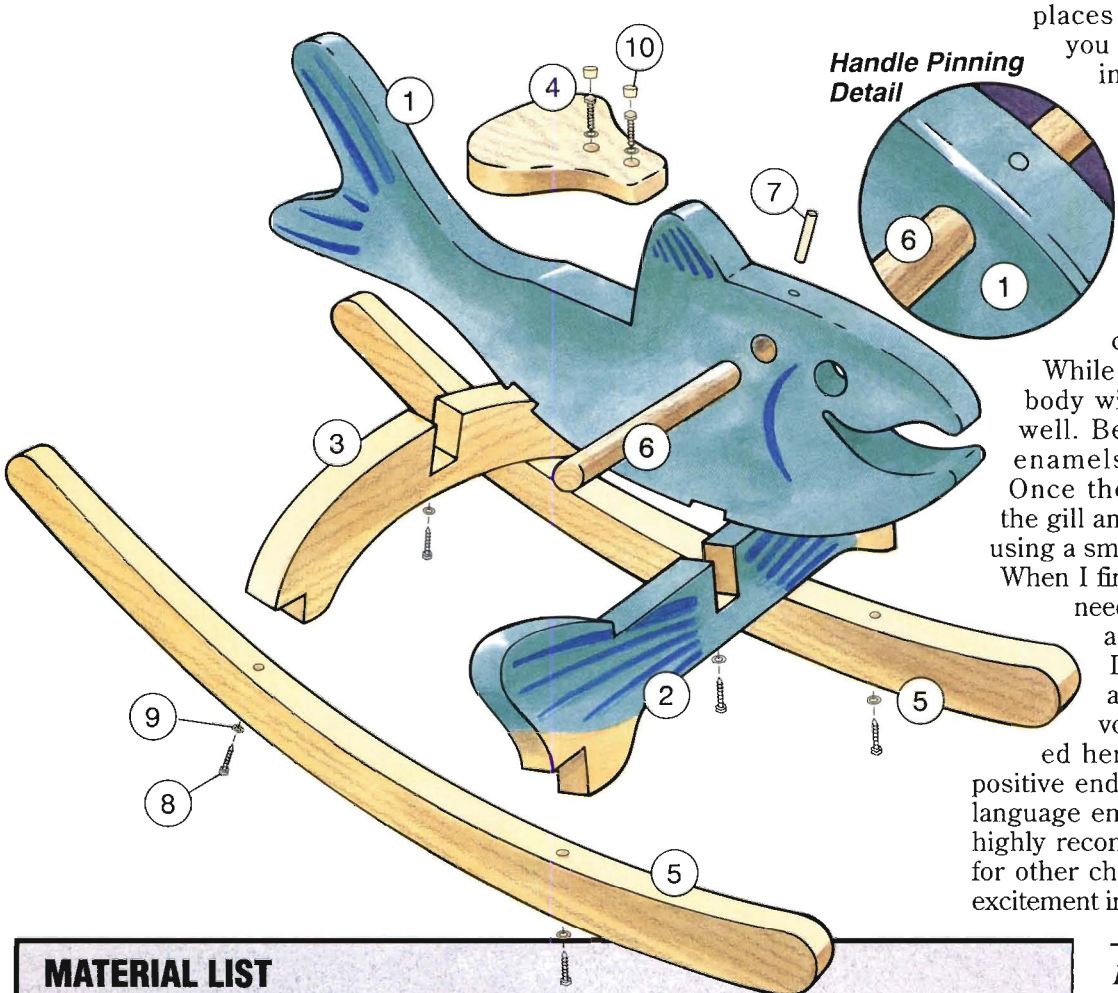
counterbored pilot holes into each bracket **(see bracket detail at left)**. Again, there is no need to plug these holes since they'll be out of sight.

The handle (piece 6) is pinned to the fish body with a short piece of dowel (piece 7). Begin work on the handle by cutting it to length and sanding it smooth (be sure to round the ends). Next, center the handle in the appropriate fish body hole, then drill a 1/4" hole into the top edge of the fish and through the handle **(see handle pinning detail below)**. Squirt a bit of glue in the hole and drive in the short piece of 1/4" dowel. Cut off the excess and sand it flush.

Finishing

The rocking fish looks great in a variety of finishes, from a simple coat of varnish to wild paint colors done in unique patterns. I prefer a contrast using clear varnish in some places and paint in others. If you choose the same finishing technique that I did, start by coating the fish with an oil based sanding sealer, then one coat of varnish. Next, draw the paint pattern outline on the brackets and fill in these areas with two coats of aqua paint. While your at it paint the fish body with two coats of aqua as well. Be sure to use oil based enamels for a durable finish. Once the base coats dry, paint the gill and fin details royal purple using a small artist's brush.

When I finished this project I felt it needed exhaustive testing by a qualified expert. Emma Lumley, my 18 month old assistant, has a limited vocabulary, but I interpreted her delighted squeals as a positive endorsement, and her body language emphasized the point. She highly recommends this rocking fish for other children looking for a little excitement in their lives.



Handle Pinning Detail

MATERIAL LIST

	T x W x L		T x W x L
1 Fish Body (1)	1½" x 11¼" x 32"	**6** Handle (1)	3/4" x 8"
2 Front Bracket (1)	1½" x 8" x 19"	**7** Pin (1)	1/4" x 3"
3 Rear Bracket (1)	1½" x 5" x 16"	**8** Lag Bolts (8)	1/4" x 3½"
4 Seat (1)	1½" x 6½" x 8¼"	**9** Washers (8)	For 1/4" lag bolts
5 Rockers (2)	1½" x 2" x 36"	**10** Plugs (2)	5/8" diameter

Richard Starr is a contributing editor for Today's Woodworker magazine. He also teaches and writes about woodworking, and is the host of the PBS television series, **Woodworking For Everyone**.

The Low Down on Oil Finishes

By Bob Flexner

Of the many varieties of oil, only linseed oil and tung oil can be used as wood finishes. Other oils, such as mineral oil, olive oil, and motor oil, lack the ability to cure from a liquid state into a solid. Used straight, however, even linseed oil and tung oil provide only marginal effectiveness as finishes.

Linseed oil is an extract from the seeds of the flax plant, and in its raw state it takes many days to cure. Once finishing manufacturers add metallic driers (not including lead) to create a product called boiled linseed oil, curing time is shortened to about one day.

With the exception of wax, linseed oil is the least protective of all finishes. It's too soft and thin to provide a significant barrier against scratching, and it's easily penetrated by water and water vapor (humidity). Water will work through a linseed oil finish and cause a smudge within 5 to 10 seconds. Water vapor will pass through as if the finish weren't there at all.

Tung oil, which comes from the nuts of the tung tree in China, has been used for centuries, although its use in the West developed only in the last one hundred years. Despite being more expensive than linseed oil, tung oil is popular with paint and coatings manufacturers for making high quality varnishes with superior water-resistance.

Straight tung oil, however, is seldom used as a finish in its own right. It can become fairly water-resistant after five or six coats but, like linseed oil, it's too soft and thin to resist scratching or water-vapor exchange. It's also a difficult finish to make look nice. The first three or four coats appear flat and blotchy, and feel rough. Only after five or six coats, sanding between each one, can you get a consistent satin sheen (even then, the finish will not appear as smooth as linseed oil).

Although many finishes use names that imply they're tung oil, they're really not. Some are actually varnish diluted with paint thinner, and some have no tung oil content at all.

In terms of curing time, tung oil is slow, falling somewhere between raw and boiled linseed oil. In fact, other than water-resistance, about the only advantage tung oil has over linseed oil is that it yellows the wood less.

Debunking Oil Myths

As noted, linseed oil and tung oil cure very slowly compared to all other finishes, and to a much softer film.

Slow curing allows the oil to penetrate deep into the wood by capillary action, just as liquids move through live trees. The longer a liquid stays wet on the surface, the deeper it will penetrate.

There is a widespread myth that rubbing an oil finish will force it deeper into the wood. Actually the opposite is true. Rubbing an oil finish warms it, which accelerates the curing rate. The faster the oil cures, the quicker it seals the pores, which prevents further penetration. None of this matters though, since deep penetration won't increase the level of protection or enhance the appearance of the wood.

Many products are mixtures of varnish and linseed or tung oil, with a dose of paint thinner to make them easier to apply by hand. With these finishes be sure to wipe off any excess before it begins to cure.

The softness of cured oil finishes makes it necessary to wipe off any excess before it begins to set up. If excess oil cures on the wood's surface, your finish will remain sticky and will scratch and smudge easily. You should not try to build up a straight oil finish.

Much confusion exists about this last point, due in large part to manufacturers who dilute varnish with paint thinner and market it as an oil finish. Varnish is made by cooking a curing or semi-curing oil with a hard resin. This produces a finish that cures much faster and harder than oil alone, and can be built up on the wood as thickly as you want. Varnish mixed with paint thinner until it reaches a wiping consistency is actually a wiping varnish, not an oil. You can make wiping varnish yourself by thinning any varnish or polyurethane about half-and-half with paint thinner. Wiping varnishes yield a higher gloss finish and can build to a thicker film if desired.

Manufacturers also mix oil and varnish and market it as an oil finish. These mixtures cure faster and somewhat harder than oil alone, but not hard enough to build up on the wood, so you still must wipe off all the excess after each coat. Oil/varnish blends produce the same satin appearance as straight linseed oil or tung oil, yet they cure faster, are more protective, and they're easy to use. You can make your own oil/varnish blend by mixing any varnish or polyurethane about half-and-half with linseed oil or tung oil (or both for that matter) and diluting with paint thinner until the mixture can be applied easily with a rag.

Bob Flexner makes and repairs furniture in Norman, Oklahoma. He is the author of a book that is due out in October entitled Understanding Wood Finishing (Rodale Press, 1-800-848-4735).

Build Your Own Steamer Trunk

Stow away your treasured belongings in this authentic looking camelback steamer trunk.

By Rick White

Remember the wonderful old road movies with Bob Hope and Bing Crosby? These two zany characters travelled from one exotic locale to another, creating chaos wherever they went. Aside from their antics, one of the images I remember most from those movies was that whenever Bob and Bing disembarked from their ships they were surrounded by steamer trunks plastered with stickers from their many ports of call. Those classic camelback trunks captured all the excitement and wonder of faraway places and unusual cultures.

My steamer trunk will probably never see the baggage hold of a steamship, but I still wanted it to have an air of authenticity. That's why I settled on the camelback top, the extensive use of brass hardware and the walnut "strap" design. The curved top makes for a slightly more challenging project, but don't be scared off by this feature. All the curved pieces are shown full size in the pattern insert.

This classic steamer trunk makes a perfect storage locker for extra blankets and sweaters.

Start with the Corners

The framework provides the real strength in this project's construction, while the thin panels merely serve to enclose the box. Since the corners (pieces 1) link the four frames together, this is the best place to start. Rip the pieces 1/16" oversize, then joint their edges square and to the correct width. Now cut the pieces to length.

Sort your eight corner pieces into four pairs, watching for color and grain similarities, and mark the top of each pair with its position in the trunk construction. This helps eliminate confusion during the building process. To cut the groove in one edge of each piece, chuck a 3/16" straight bit in your router table and layout the stopping point for each groove, as shown in the **corner detail at right.** Stopping the groove short of the top leaves a little meat above the rail tenon when the trunk is assembled, resulting in a stronger load bearing joint for lifting the completed project. (NOTE: I'm recommending a 3/16" bit since 1/4" plywood usually isn't a full 1/4" thick. With this bit I make a first pass to form the mortise, then take a second pass to shave the mortise about 1/32" wider. Once I get a snug fit for the plywood I cut the rail tenons to fit the mortises.)

Planning Ahead: The Steamer Trunk Project

Building the steamer trunk will take about 30 hours to complete. Nearly all the joints are some variation on the tongue and groove, which will require extensive use of a table saw and router. Varnish is the recommended finish.

- ☐ 25 bd ft of 3/4" rift sawn red oak
- ☐ 3 bd ft of 1/2" rift sawn red oak
- ☐ 2 bd ft of 5/16" walnut
- ☐ A sheet of 1/4" rift red oak plywood
- ☐ A half sheet of 1/2" red oak plywood
- ☐ Steamer Trunk hardware kit

Now use a piece of scrapwood that's the same thickness as your corner pieces to test your router table set up. You want to be sure that the bit is exactly centered when you rout the 3/8" deep grooves. Don't miter the other edge of the corners until after the panels are fully assembled.

Forming the Rails

With the corner grooves completed you can build the rest of the framework for the trunk. Following the dimensions provided in the material list, cut your stock to size for all the rails (pieces 2 through 9), and label each piece with its position in the assembly. Take the rails over to your router table to cut the mortises **(see front and side assembly drawings on pages 16 and 17)** in all the appropriate edges (i.e., wherever a panel will be inserted).

After routing grooves in the rails, step back to your table saw and cut material for the lid front, back, sides and supports (pieces 10, 11 and 12). The sides and supports feature curved top edges, but for now just cut the material to the overall dimensions provided in the material list.

All of the rails for the box portion of this project join the corner pieces with tenons. In addition, the lid supports join the lid front and back with short tenons. To cut these tenons, set up a 3/8" dado blade in your table saw and clamp a protective wood face to the saw's fence. Raise the blade a hair over a 1/4" and adjust the fence so it grazes the blade. Now use your miter gauge to pass a test piece over the blade, then test the tenon's fit with the grooves in the corner pieces. Once the tenon on your test piece fits well go ahead and cut the tenons for the rest of the rails and supports.

Don't forget that the tenons on the upper rails (pieces 2 and 3) need a 1/2" shoulder at their tops so they'll sit flush with the corners **(see front and side assembly drawings)**.

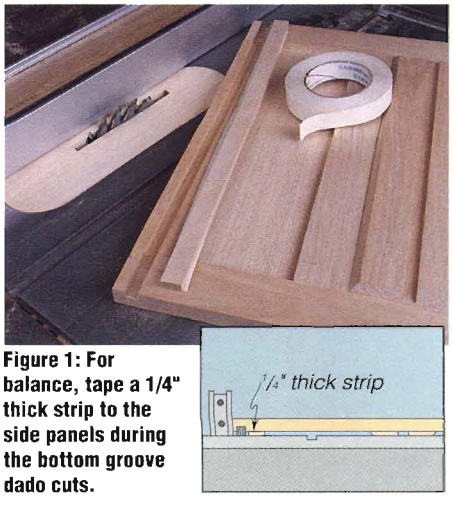


Figure 1: For balance, tape a 1/4" thick strip to the side panels during the bottom groove dado cuts.

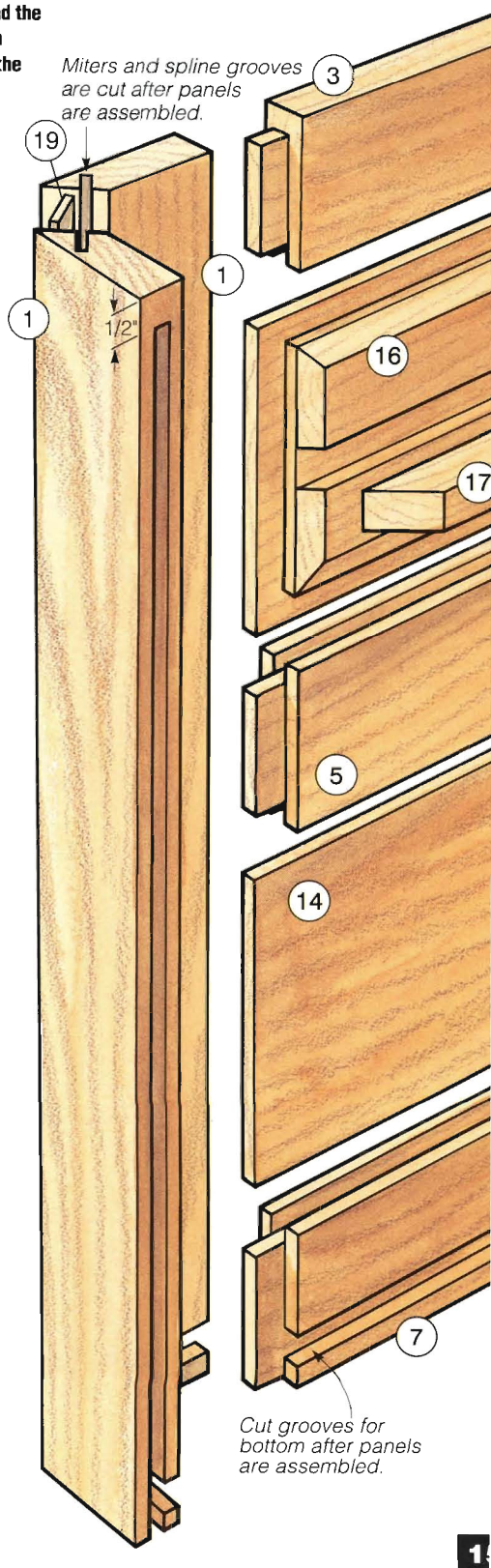
Cutting the Panels

All but two of the panels in the trunk are cut from 1/4" thick rift sawn red oak plywood (pieces 13 through 15). The two upper side panels (pieces 16) are made of 3/4" solid stock for extra strength, as these pieces secure the handles and carry the load of the trunk when it's lifted off the ground, in addition to supporting the tray inside the trunk. Cut the plywood panels to the sizes specified in the material list, and find some matching 3/4" stock for the upper side panels.

The plywood panels will fit right into the grooves you made earlier, but the 3/4" upper side panels will require a little extra machining. Start with a 3/8" dado blade to rabbet the back of each panel, as shown at right and in the **side assembly drawing** on page 17. The tongues remaining after the rabbets are cut must fit comfortably in the rail grooves. Switch to a 3/4" dado blade to cut the grooves for the tray support ledgers (pieces 17) and then chamfer the edges. When chamfering, be sure your blade is set low so it doesn't contact the tongue.

Corner Detail

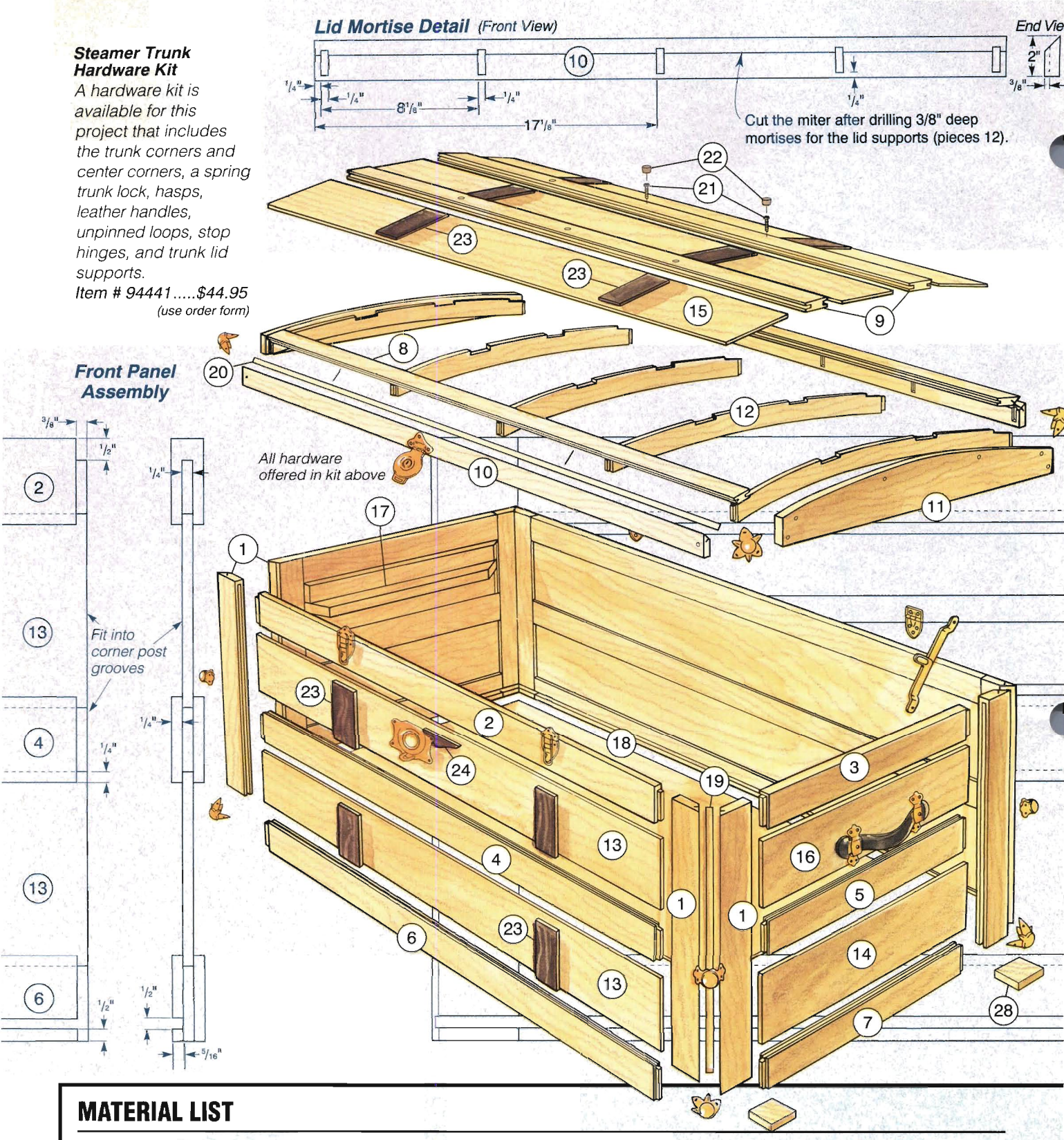
The corner joints provide structural strength for the steamer trunk, and the 1/2" bit of wood at the top of each mortise helps alleviate stress on the glue joints when lifting the trunk.



Steamer Trunk Hardware Kit

A hardware kit is available for this project that includes the trunk corners and center corners, a spring trunk lock, hasps, leather handles, unpinned loops, stop hinges, and trunk lid supports.

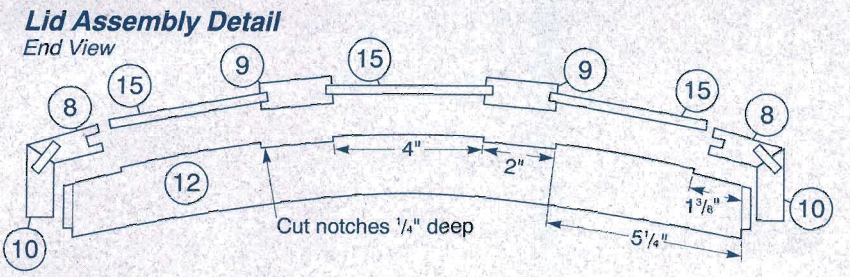
Item # 94441.....$44.95
(use order form)

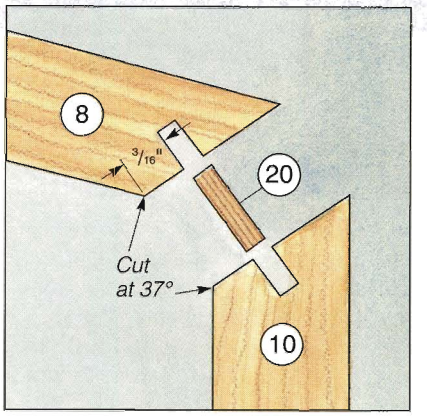


MATERIAL LIST

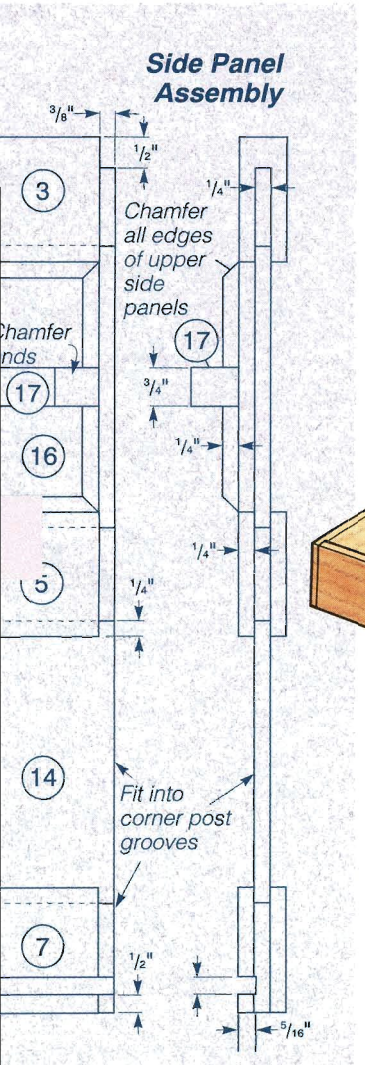
		T x W x L
1	Corner Posts (8)	3/4" x 2" x 14"
2	Upper Front and Back Rails (2)	3/4" x 2" x 32¾"
3	Upper Side Rails (2)	3/4" x 2" x 16¾"
4	Middle Front and Back Rails (2)	3/4" x 2" x 32¾"
5	Middle Side Rails (2)	3/4" x 2" x 16¾"
6	Lower Front and Back Rails (2)	3/4" x 2" x 32¾"
7	Lower Side Rails (2)	3/4" x 2" x 16¾"

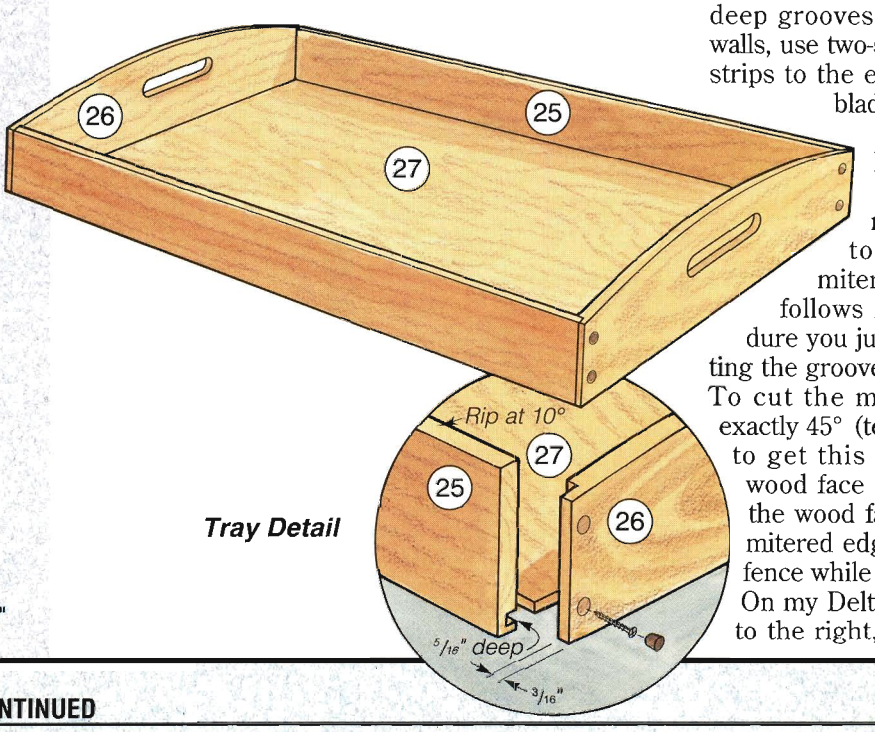
		T x W x L
8	Lid Front and Back Rails (2)	3/4" x 2" x 34½"
9	Lid Middle Rails (2)	3/4" x 2" x 34½"
10	Lid Front and Back (2)	3/4" x 2" x 34½"
11	Lid Sides (2)	3/4" x 3⅜" x 20"
12	Lid Supports (5)	3/4" x 3" x 19"
13	Front and Back Panels (4)	1/4" x 4⅝" x 32⅝" (Ply)
14	Lower Side Panels (2)	1/4" x 4⅝" x 16⅝" (Ply)





Lid Corner Detail





Tray Detail

Assembling the Box

For the most part, the pieces for the box portion of the trunk are completed, so now you can begin assembling each wall of the project. Do a dry run without any glue first to check the fit of all the parts. While you're at it, make sure the upper and lower rails are flush with the ends of the corners and that the middle rails are exactly centered. Mark each of these joints so that reassembly will be easier.

Take apart each wall and put glue on the tenons and in the grooves where the tenons will be inserted. Reassemble the parts and draw each wall tight with bar clamps. Don't forget to measure diagonals to ensure squareness.

Clean up any glue squeeze out and sand the joints flush. The bottom (piece 18) will be held in grooves **(see side assembly drawing at left)** in the front, back and side walls. These grooves are easily cut on your table saw with a 1/2" dado blade, but you'll need to balance the end walls on a couple of 1/4" strips during the cut to compensate for the extra thickness of the upper panels. After cutting the 5/16" deep grooves in the front and back walls, use two-sided tape to secure the strips to the end walls and raise the blade another 1/4" to make the cuts, as shown in **Figure 1** on page 15.

The four walls are now ready to be joined together with splined miters. Cutting these joints follows much the same procedure you just completed when cutting the grooves for the bottom panel. To cut the miters, tilt your blade exactly 45° (test cut some scrapwood to get this perfect) and clamp a wood face to your fence. Without the wood face the tip of your first mitered edge might slip under the fence while making the second cut. On my Delta Unisaw the blade tilts to the right, and most of my avail-

MATERIAL LIST CONTINUED

	T x W x L		T x W x L
15 Lid Panels (3)	1/4" x 4⅝" x 34½" (Ply)	**22** Plugs (30)	3/8" Diameter (Walnut)
16 Upper Side Panels (2)	3/4" x 4⅝" x 16⅝"	**23** Bandings (2)	5/16" x 2" x 36" (Walnut)
17 Tray Support Ledgers (2)	3/4" x 7/8" x 16"	**24** Shim (1)	1/4" x 4¼" x 1½" (Walnut)
18 Bottom (1)	1/2" x 19" x 35" (Ply)	**25** Tray Front and Back (2)	1/2" x 3¾" x 32¾"
19 Splines (4)	1/8" x 3/4" x 14" (Ply)	**26** Tray Sides (2)	1/2" x 4¾" x 17¾"
20 Splines (2)	1/8" x 3/4" x 34½" (Ply)	**27** Tray Bottom (1)	1/4" x 17⅛" x 32¾"
21 Screws (30)	#8-1½"	**28** Feet (4)	1/2" x 2" x 2"

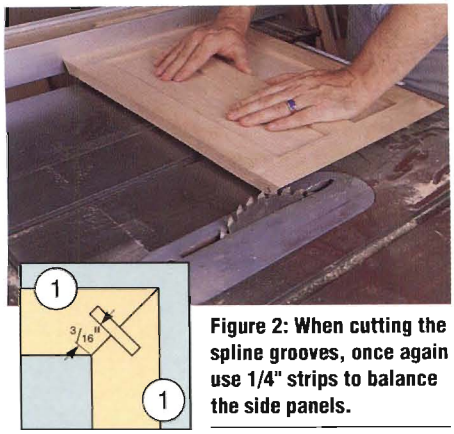


Figure 2: When cutting the spline grooves, once again use 1/4" strips to balance the side panels.

able table surface is also to the right of the blade. Given this situation I cut the miters with the outside surface of the walls against the saw table. If you have a saw whose blade tilts to the left, you'll have to cut the miters with the inside surface of the walls riding on the saw table. Since the upper side panels stick out 1/4", you'll have to use the 1/4" strip method on the end walls to keep these pieces balanced during the cuts.

Once the miters are completed, set up your saw for the spline cuts **(see Figure 2 above)**. Since all of these cuts must be made with the inside surface riding on the saw table, you'll have to continue using the 1/4" strips on the end walls. Keep the blade tilted 45° and adjust the blade height and fence position to make the cuts. First make the spline groove cuts in the front and back walls, then readjust the fence and raise the blade to make the end wall cuts.

Using 1/8" plywood, rip four 3/4" wide splines (pieces 19) for the corner joints. Dry assemble the four walls with the splines and the bottom panel in place to make sure everthing fits and then glue the box together. You'll notice during the dry assembly that the bottom panel prevents the splines from going all the way to the bottom of the joint. Just butt the spline into the bottom panel and let the excess run out the top for now. And don't worry about the exposed spline groove showing at the bottom —it will be covered by the brass corner hardware later on.

Making the Lid

You cut tenons on the lid supports (pieces 12) earlier, but you still need to cut the mortises in the lid front and back (pieces 10). Layout these mortises as shown in the **lid mortise detail** on page 16, then chuck a 1/4" brad point bit in your drill press and drill out the waste in each mortise to a depth of 3/8". Don't bother cleaning up with your chisel yet because in the next step your miter cut will remove the tops of these mortises. They'll be a lot easier to cleanup at that stage.

As noted, the front and back of the lid (pieces 10) meet the front and back rails (pieces 8) with another spline mitered joint. However, due to the curve of the lid, the miters aren't exactly 45°. Tilt your saw blade 37° and rip the top edge of the front and back pieces and one edge of each rail. Once the pieces are ripped, lower the blade (keeping it at the same angle) and adjust the fence to cut a spline groove in each edge.

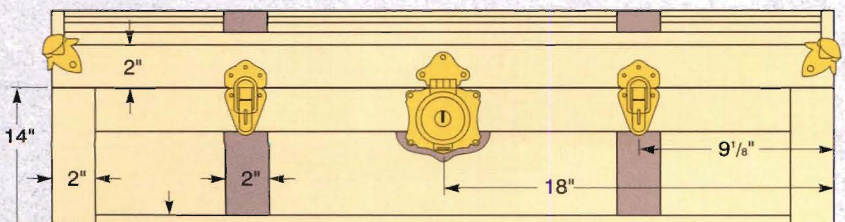
Rip two 1/8" thick splines (pieces 20) and glue each set of mitered pieces together. I recommend using band clamps to hold the narrow lumber at this odd angle.

The lid supports are curved and have a series of notches along their top edge to accommodate the rails in the lid. Cut out the **full size pattern** of the lid support and sides (pieces 11 and 12) and trace the shape onto your stock. Bandsaw the sides and supports to shape, checking the fit of your rails in each of the support notches before proceeding. The width of the rails should fit snugly into the notches and the lower wall of the rail mortises should be flush with the top of the support. Before you glue and assemble the lid, be sure to test the fit of the front and back subassemblies that you just glued together. These two pieces should fit nicely into the end notches on the supports, as shown in the **lid assembly detail** on page 17.

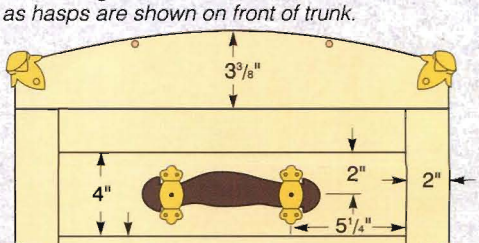
Once it's clear that all the lid pieces fit together, drill counterbored pilot holes to secure the front and back subassemblies to the lid supports and spread a little glue in each mortise in the front and back pieces. Slip the lid support tenons into the mortises and clamp the subassemblies to the five support pieces.

Fitting the rest of the lid is just a matter of popping everything into place. Loosely assemble the three lid panels (pieces 15) and the two middle rails (pieces 9), then flex this assembly to get the outside panel edges to start sliding into the front and back rails. Once the edges are all aligned, press down on the arched center of the assembly to force the panels into the grooves. You may need to adjust the rails a little to slip them into the support notches. When all the pieces

Hardware and Banding Locations



Mount hinges on rear of trunk in same locations as hasps are shown on front of trunk.



fit well and are firmly seated on the supports, drill six counterbored pilot holes **(see exploded view)** to secure the rails to the supports and cover the screws with walnut face grain plugs (pieces 22). Now simply add the sides. Counterbore pilot holes where each rail meets a side piece and drive your screws, then fill the holes with walnut plugs.

Walnut Strapping and a Few Details

The top of my chest arches just a little bit, but it's not necessary to steam bend the walnut strapping (pieces 23) to get a good fit. Instead, start with 5/16" thick pieces, cut to fit between each rail, and sand one face slightly with a drum sander until they match the curve of the lid panel. After fitting all the curved sections of banding, spread glue on the walnut and press them into place. You can sand the tops after the glue dries so they conform to the arch. Apply the straight pieces to the box when you're done with the lid and plane them flush with the rails. Be sure to line up the walnut strapping on the box with the walnut on the lid.

Earlier you cut a groove in each upper panel in the side walls for mounting the ledger strips (pieces 17). These strips will support the tray when it's completed in the next phase of the project. But for now, cut the ledger strips to length, chamfer their ends and glue them into place.

Mounting the main latch for the trunk hardware requires a shim (piece 24) so that it sits level with the upper rail on the front wall. Using the **full size pattern**, trace the shape onto some 1/4" thick walnut and cut it with a band saw. Sand the edges smooth, center the piece on the upper front panel and glue it into position.

One final detail to take care of is to glue the small feet (pieces 28) to the bottom corners of the trunk. These feet provide solid backing for screwing the bottom corner hardware into place.

At this point I'd suggest sanding the whole project to 220 grit and wiping it down with mineral spirits to find any glue spots that need to be removed.

Building the Tray

The tray is a simple structure that fully uses the space in the arched lid. Begin by cutting the front, back and sides (pieces 25 and 26) to the sizes in the material list. Don't cut the sides to shape until after the joints are formed. Install a 1/4" dado blade in your table saw and cut 5/16" deep grooves along the entire length of the front, back, and sides to accommodate the bottom piece **(see tray detail on page 17)**. As long as the dado blade is installed, go ahead and rabbet the ends of the side pieces. Next, cut out the **full size pattern** of the tray side, trace it onto your stock, and bandsaw the sides to shape. To form each handle, drill an access hole first, then cut the opening with a saber saw. To get the front and back pieces to conform to the shape of the sides, I ripped the top edge of both pieces to final size with the blade set at a 10° angle.

Cut the bottom (piece 27) and dry fit the tray parts to check their fit.

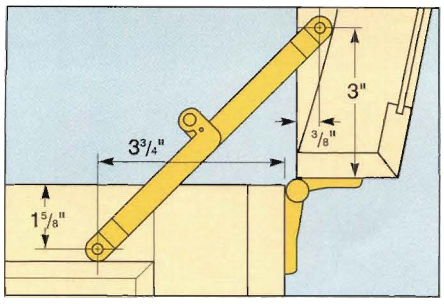


Figure 3: Due to the construction of the steamer lid, the lid supports must be installed differently from the instructions provided with the hardware.

When they all go together well, put glue in the bottom grooves and drill the counterbored pilot holes in the corner joints for the screws. Drive the screws, fill the holes with walnut plugs and sand the tray to 220 grit.

Final Details

Steamer trunk hardware has a unique look about it. It's somewhat oversized and durable, perhaps still reflective of a time when its primary purpose was to protect the trunk from burly baggage handlers. Start installing your hardware by mounting the hinges (be sure the strapping stays lined up!) and then move to the lock mechanism, the handles, the lid supports **(See Figure 3)** and finally the corner pieces (all 12 of them). It's pretty straightforward, except for the top corners, which have to be slightly stretched outward to accommodate the curved top.

I recommend using a durable finish like varnish or polyurethane. First apply a coat of sealer, then sand it smooth, following with two more coats of finish, sanding between coats to remove any dust nibs or rough spots. After the last coat of finish dries, reinstall all the hardware and get busy planning your next big trip.

Rick White, a professional woodworker, serves on the editorial advisory board of Today's Woodworker.

The structure of the camelback lid makes it as interesting to look at as the outside of the steamer trunk, and the curved top of the tray takes full advantage of the extra space.

Trapped Wedge Layout Gauge

A finely cut joint begins with an accurate layout, and no layout tool is more precise than this one.

By Tom Caspar

Half the challenge of cutting tight dovetail or mortise and tenon joints is getting them laid out precisely. A standard marking gauge featuring a sharp pin for a marker does a fine job scribing lines that follow the grain, but tends to tear the wood when going across the grain. For a better cross grain line I've made a marking gauge with a knife tip rather than a sharp pin. The knife cleanly severs the wood fibers to establish a precise shoulder, which helps guide my chisel or saw during the joint cutting process.

Besides the knife cutter, another unique feature of my cutting gauge is the use of a trapped wedge, which allows for quick, one handed adjustments and eliminates the need for special hardware. Many hand tools constructed 150 years ago, when hardware was costly and more difficult to come by, utilized the trapped wedge.

Most of the machining for this project is completed on the table saw and, since many of the pieces are small, it's important that you use holding devices to safeguard your fingers. I also recommend that you make a new plywood throat plate for your table saw to reduce the chance of cutoffs falling down beside the blade and shooting back out at you.

Traditionally, rosewood is the wood of choice for gauges of this type. It resists wear exceptionally well, any interlocking pieces operate smoothly, and it's very pleasing to hold. Just remember that when you glue rosewood the surfaces must be fresh for a good bond, so always sand or plane the mating edges just prior to gluing up. This project requires less than one board foot of 3/4" stock, and I've found that an ideal material for the cutter is a 1/4" spade bit, which you can purchase locally and regrind in your shop.

Start Your Cutting

It's always safer to cut smaller pieces from larger ones, so begin making your cutting gauge by ripping a slice of rosewood for the splines (pieces 1). These will eventually slip into a saw blade kerf, so cut a saw groove in some scrap to test the fit. Next, rip a 1/4" thick by 8" long strip that will be used later for the beam insert and the small wedge (pieces 2 and 3), and a 1/2" thick strip for the large wedge (piece 4). Sand off the saw marks and cut the splines and large wedge to length.

I cut the beam (piece 8) so that its width and thickness are unequal. This may seem odd, but through experience —meaning goof-ups— I've learned to avoid the age old headache of fitting parts together the wrong way. By cutting the beam in this manner it will fit into the gauge head correctly every time. Rip the beam to size, then rip a 1¼" wide piece for the parts that make up the head assembly (pieces 5, 6 and 7). Trim all the pieces 1/4" longer than their finished sizes.

Arrange the head pieces for assembly, matching their grain patterns so they appear to be one piece, and mark the front face of the assembly so you can reorder it again later. Next, separate the pieces and rip a 3/16" deep groove in the center of each adjoining edge for inserting the splines. For perfect alignment, be sure to always run the front face of each piece against the saw fence during these cuts.

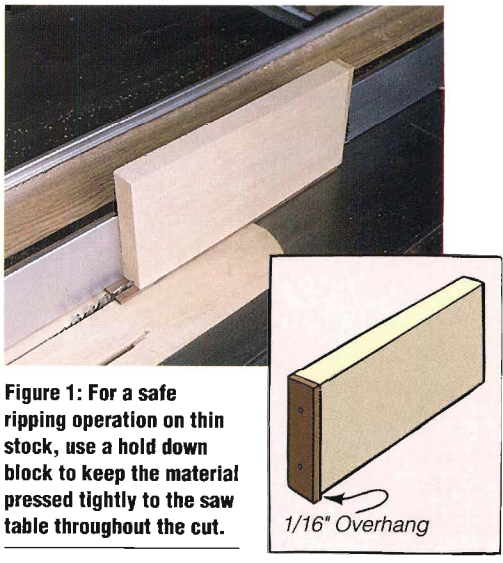


Figure 1: For a safe ripping operation on thin stock, use a hold down block to keep the material pressed tightly to the saw table throughout the cut.

Ripping the splines to their final size requires a special hold down block. Cut a block measuring 3/4" x 4" x 9", and screw a thin, narrow piece to its back end as shown in **Figure 1** above. Set the blade height at 3/8" and rip your spline, using the block to hold it tightly to the table. Next, crosscut the strip into four segments (pieces 1) and check their fit in the head piece grooves you just made.

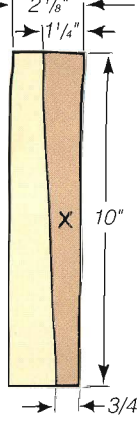


Figure 2: Begin making the jig for cutting a tapered dado by laying out a 1:20 slope on a 3/4" x 2⅛" x 10" piece of scrapwood, then label the measured wedge with an "X".

Cutting the Head Dado

The bottom of the dado in the side head (piece 5) is tapered to fit the large wedge. The tapered dado jig for making the cuts is built from softwood scraps. First, draw the pitch for the wedge taper, then mark this measured wedge with an "X" **(See Figure 2)**. Next, cut a 1/4" x 1½" x 12" piece of plywood and nail it to the wedge stock so it's aligned with the pitch line and covering the side marked with the "X". With your fence set at 1½" rip the wedge stock while the plywood rides against the fence, as shown in **Figure 3**. Trim the wedge ends so they're identical. Complete the jig by nailing the wedges to a 3/4" x 3½" x 14" board **(Figure 4)**, and nailing a fence block on top of the wedges.

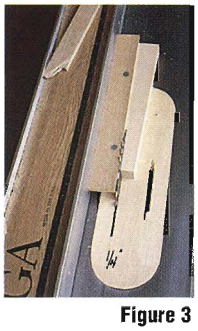


Figure 3

To use your tapered dado jig just raise your table saw blade 1" and set the fence 1¼" away. Push the jig into the blade until the center of the blade just passes under the front of the

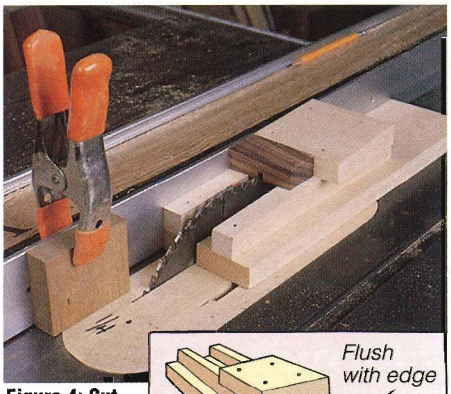
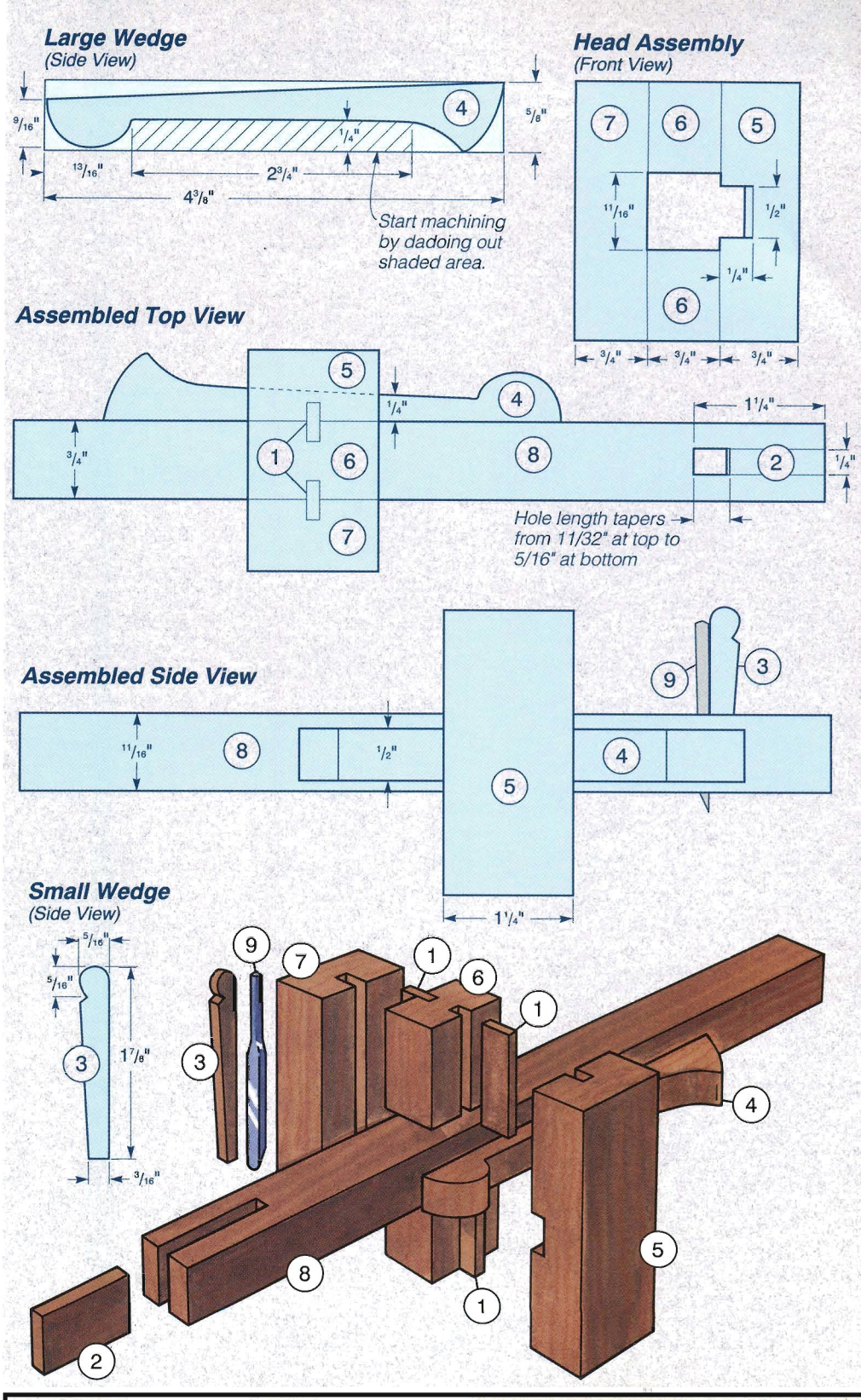


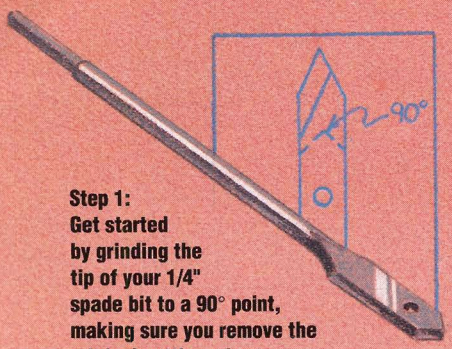
Figure 4: Cut the tapered dado in several passes, moving the fence a little for each pass.



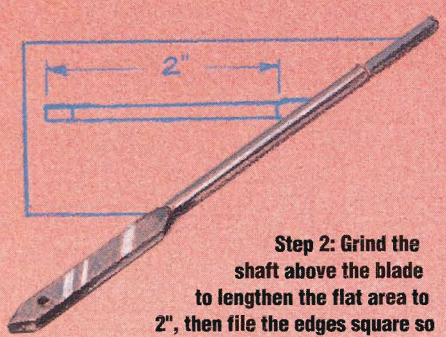
MATERIAL LIST

	T x W x L		T x W x L
1 Splines (4)	1/8" x 3/8" x 1⅛"	**6** Center Heads (2)	3/4" x 1¼" x 1"
2 Beam Insert (1)	1/4" x 3/4" x 4"	**7** Side Head (1)	3/4" x 1¼" x 2¾"
3 Small Wedge (1)	1/4" x 5/16" x 4"	**8** Beam (1)	3/4" x 11/16" x 8"
4 Large Wedge (1)	1/2" x 3/4" x 4⅜"	**9** Cutter (1)	1/4" Spade bit
5 Side Head (1)	3/4" x 1¼" x 2¾"		

Four Easy Steps To Grind The Cutter



Step 1: Get started by grinding the tip of your 1/4" spade bit to a 90° point, making sure you remove the original cutting edges.



Step 2: Grind the shaft above the blade to lengthen the flat area to 2", then file the edges square so the bit is just under 1/4" wide.

Step 3: Hone the back of the blade on your sharpening stones, then, while rounding the end into a fingernail shape, grind a 25° bevel.

Step 4: Hone the bevel with a slipstone and finish up by hacksawing the cutter off the shaft 2" from the tip.

fence block. At this point, clamp a stop to the saw fence in front of the jig, as shown in figure 4. Draw a line on the front edge of the fence block 1/4" from its bottom and raise the saw blade to hit the line.

Make your cut by placing the side head (piece 5) on the jig with its marked front facing the fence block and one end bearing against the saw fence. Make your first pass, then continue moving the saw fence to make several more passes until the dado is 1/2" wide. Be sure to fine tune the last pass so the dado fits the large wedge precisely, then smooth the dado's angled bottom with a file.

Assembling the Head Pieces

Sand any saw marks off the beam and dry assemble the head pieces and splines around it, sanding the 3/4" dimension of the beam, if necessary, so it slides through the opening.

To prevent the beam from bonding to the head, coat its first 2" with paraffin wax. Now glue the head and spline pieces together and, while pinching the assembly with your fingers, quickly clean out the excess glue in the opening. Slip the waxed end of the beam into the head assembly and clamp everything tight in both directions (top to bottom and side to side). Later, when the glue has dried, you can sand the beam's 11/16" dimension so it slides in the opening easily, trim the head to final size and chamfer all its edges and corners.

Making the Trapped Wedge

Begin making a the trapped wedge (piece 4) by ripping the stock you cut earlier to 5/8" wide and cutting a dado as shown in the side view of the large wedge on page 21. Once the dado is cut remove one of the wedges from the tapered dado jig and nail a stop to its wide end to make a tapering jig for the large wedge **(See Figure 5)**. Set the wedge against the taper jig and rip the piece, splitting the lead corner with the blade. For safety, use scrapwood to press down on the wedge as you cut. Now center the wedge in the dado to see if its back edge is flush

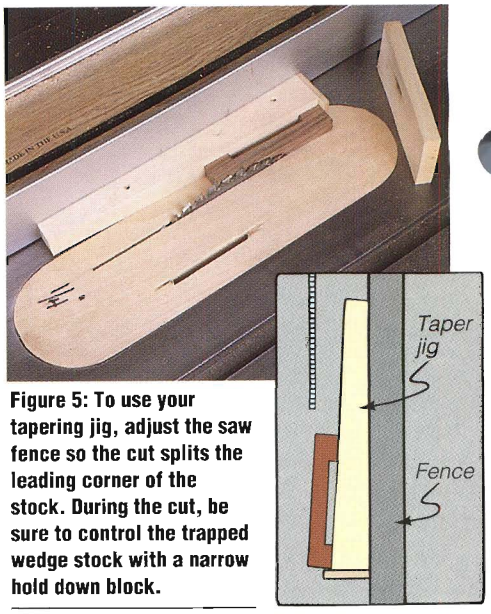


Figure 5: To use your tapering jig, adjust the saw fence so the cut splits the leading corner of the stock. During the cut, be sure to control the trapped wedge stock with a narrow hold down block.

with the shoulder of the larger hole. If the fit isn't right, continue trimming the wedge in very small increments, then shape the ends of the wedge with a coping saw and a file.

Cutting the Beam Slot

The hole in the beam that holds the knife and small wedge is tapered on its forward edge. It sounds unorthodox, but this is easily done on the table saw. Make the jig shown in **Figure 6**, then use it to cut a 1/4" wide by 1¼" deep slot in the end of the beam (remember, the beam isn't square, so be sure to cut into its wider edge).

Earlier you cut a 1/4" thick strip for making the small wedge and the beam insert. To cut the strip in half, set your tapering jig against the table saw's miter gauge, then place the

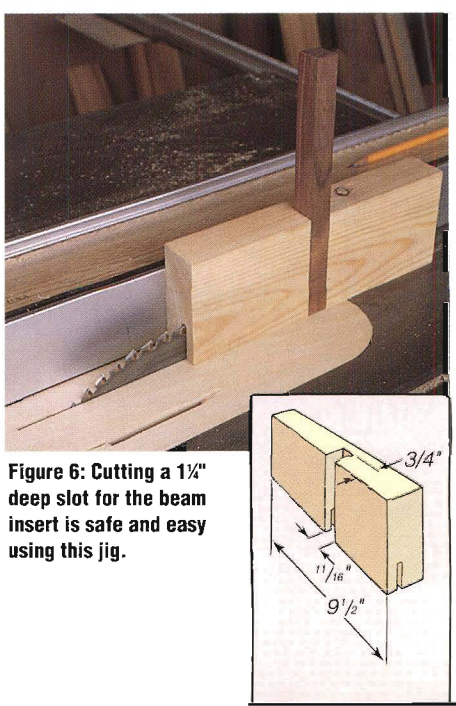


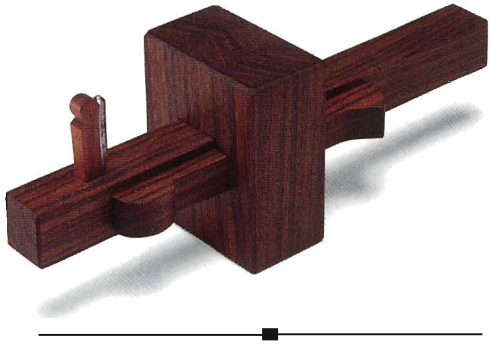
Figure 6: Cutting a 1¼" deep slot for the beam insert is safe and easy using this jig.

strip against the jig. The resulting angled cut is just what you need for the end of the beam insert. Sand one of the pieces to fit into the slot in the beam, then glue it into place with the angled end pointing into the beam and leaving a 5/16" long hole on the bottom side for the cutter and the small wedge. Trim off the excess when it's dry, and chamfer the ends of the beam.

I prefer a stout knife blade (piece 9) that's easy to resharpen, and have found that regrinding a 1/4" spade bit is ideal **(see sidebar at left)**. In use, the knife's bevel should always face the waste side of the work as this snugs the gauge against the board as you scribe the line, leaving a square shoulder on the proper side of the cut.

Use the remaining 1/4" thick piece for the small wedge (piece 3). First taper one edge on the table saw with the tapering jig, then plane the piece to width and cut it to length (see **small wedge detail** on page 21). Shape the top of the wedge with a file and smooth any saw marks.

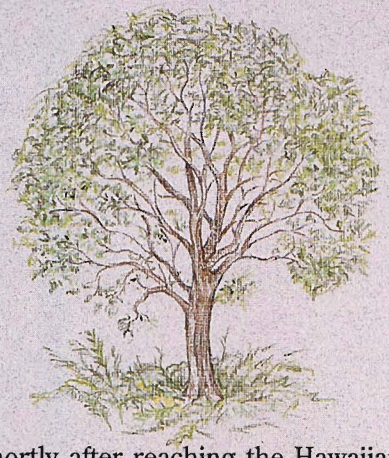
Now slip the cutter into the beam hole and install the small wedge. Trim the end of the wedge so it's flush with the bottom of the beam, then pull it back out to chamfer the end with a file. Coat the gauge with an oil type finish and put a little more wax on the beam so it slides easily. You'll quickly find that the trapped wedge locks with slight hand pressure to maintain the exact position you set it at.



Tom Caspar is a contributing editor with Today's Woodworker magazine and a professional woodworker.

Koa (Acacia koa)

By Gordon Hanson



Shortly after reaching the Hawaiian islands in the late 1800s, Portuguese sailors discovered koa —a wood with high resonance qualities that was perfect for making the sailors' favorite instrument, the four stringed ukulele. In addition to the quality of sound it produced, the Portuguese found that koa's beautiful grain could be sanded to a glassy smoothness and finished to a lustrous sheen. Today, these features continue to rank koa among the most desirable of all woods for making a variety of musical instruments.

Koa trees thrive in all regions of Hawaii, although the most highly figured wood comes from the mountains. While mature specimens can reach heights exceeding 100 feet, the average koa grows to about 70 feet with trunk diameters ranging anywhere from five to eight feet. Koa is an evergreen with yellow springtime flowers. The heartwood is golden brown with wavy streaks of red, orange, black or yellow. An interlocking grain is responsible for much of koa's dramatic figure (often a fiddleback pattern), and contributes to the wood's high shock resistance and good bending characteristics. These qualities make koa a favorite for gunstocks.

Early native Hawaiians searching for the perfect dugout canoe wood must have been delighted when they tried this species for the first time. In fact it was these seafaring adventurers who came up with the name "Valiant Soldier" (pronounced koa-ka in Hawaiian) to describe this extremely decay resistant wood. Koa is often resinous, which effectively repels insect and fungus attacks, but sometimes interferes with the bonding properties of glues. When adhesion problems occur, it's best to reinforce the joint with screws, dowels or biscuits.

Working the wood is generally favorable for both hand and power tools, although planing can be rough with a cutting angle over 20 degrees, especially on curly figured areas. Screwing or nailing into koa yields excellent results with very little splitting or splintering. Koa is also a fine wood for carving and turning, making it popular for jewelry and art objects. As a matter of fact, working with koa reminds many people of walnut. The wood is slightly open grained, even textured and has a moderate weight. It's one of the easiest woods to dry by kiln or air and, once it's dry, koa is quite stable and exhibits relatively little movement.

Transportation costs and increasing demand make koa a fairly pricey wood, commonly sold in the range of $7.00 to $10.00 per board foot. Yet someday, when you're making a special project, it may be worthwhile to say "aloha" to koa.

Oiled Koa

Unfinished Koa

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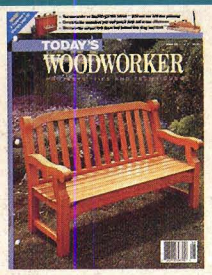

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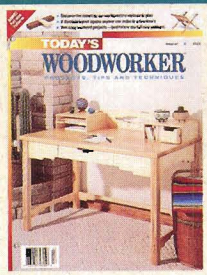

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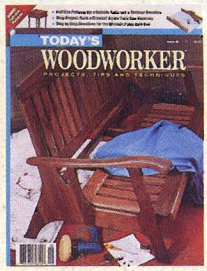

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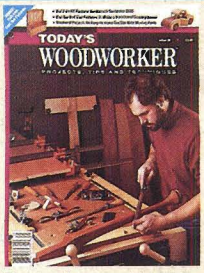

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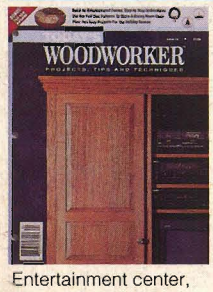

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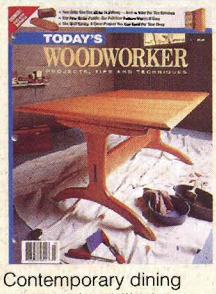
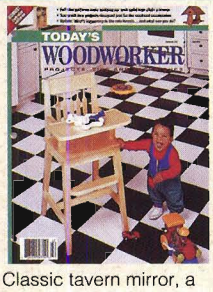
Item 79707 .....$3.95

23



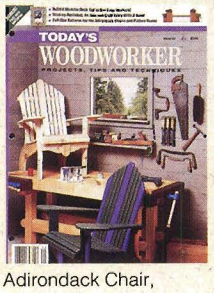
Contemporary dining room table, drill bit cabinet and three weekend gift projects.
Item 79699 .....$3.95

22



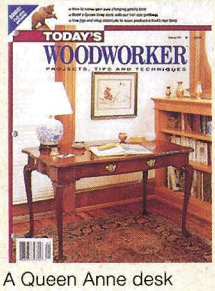
Classic tavern mirror, a high chair for the ages, display case and a weekend bird feeder.
Item 79681 .....$3.95

21



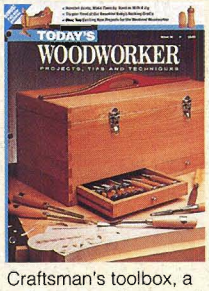
Adirondack Chair, easy to make deck set, scroll saw project and a sofa table.
Item 79673 .....$3.95

20



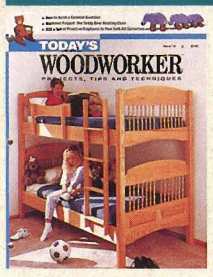
A Queen Anne desk with cabriole legs, carved grizzly bear and a table lamp.
Item 79665 .....$3.95

19



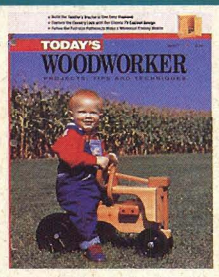
Craftsman's toolbox, a swinging cradle, turned salt and pepper shakers and a simple bookcase.
Item 79582 .....$3.95

18



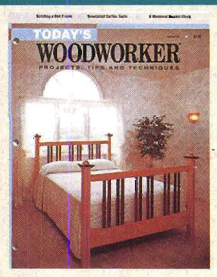
A sturdy bunk bed, crafting folk elephants, a Teddy Bear chair and a Shaker table.
Item 72199 .....$3.95

17



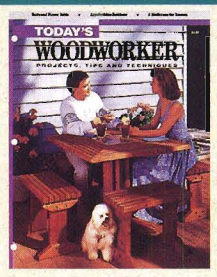
Country TV cabinet, an elegant bureau caddy, the angler's mobile and a toddler's tractor.
Item 72161 .....$3.95

16



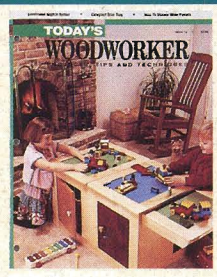
Crafting a maple bed frame, a contemporary mantel clock and a dovetailed coffee table.
Item 71639 .....$3.95

15



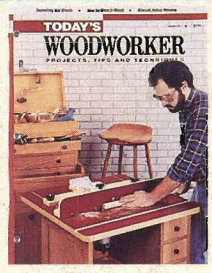
Picnic table for four, a birdhouse for turners, a simple dulcimer and a joiner's mallet.
Item 66878 .....$3.95

14



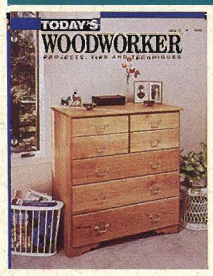
A craftsman style rocking chair, brightly colored toybox and a compact disc holder.
Item 66860 .....$3.95

13



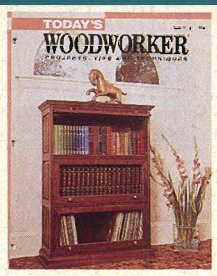
Precision router table, a swiveling bar stool and tips on buying a new biscuit joiner.
Item 68700 .....$3.95

12



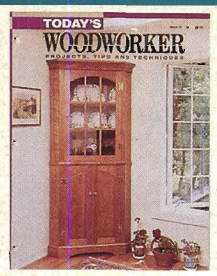
Butternut bureau, a Shaker swivel mirror and deep-reach hand screw clamps.
Item 38521 .....$3.95

11



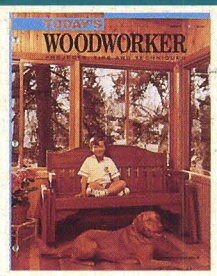
Barrister's bookcase, spinning string tops, a kid's step stool and an easy to make desk tray.
Item 38513 .....$3.95

10



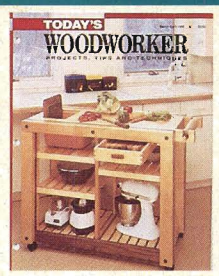
Classic corner cabinet, bent lamination fishing net and a white oak trivet scrollsaw project.
Item 38505 .....$3.95

9



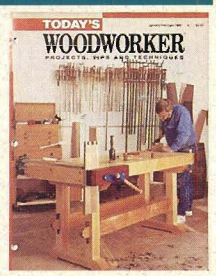
A porch glider for two, continuous grain box, Chippendale mirror and spoon carving tips.
Item 38497 .....$3.95

8



Kitchen work station, Shaker candlestand table, baker's rolling pin and a step stool.
Item 38489 .....$3.95

7

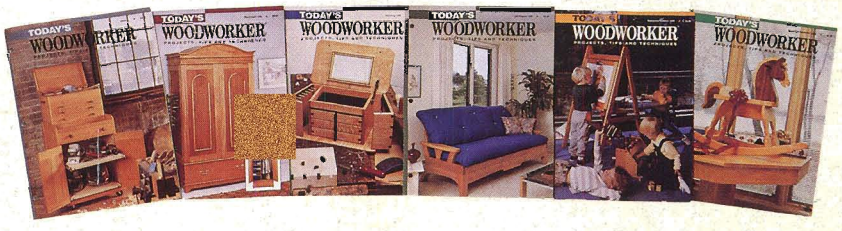


European workbench, turned stamp holders, bandsawn heart box and a breakfast tray.
38471 .....$3.95

Binders
60962.....*$7.95*
(2+ - $6.95 each)

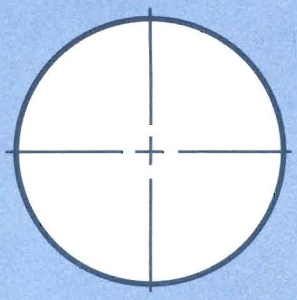
Stoneware Mugs
88329.....*$5.95*

Issues 1-6 described on order form.



To order Back Issues, Binders, Hardware Kits or Craftplans, please use the order form on page 12.

Top of form



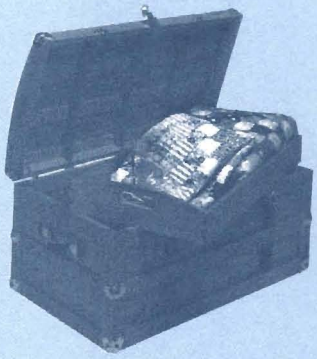
Bending Form
or Carryall Handle

diameter
ng holes

℄

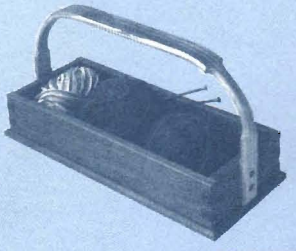
Fu...-Size Patterns

- Open staples carefully, remove pattern and fold staples back in place.
- Use graphite paper (available at most art supply stores) or cut and trace the pattern onto your stock.



Steamer Trunk
Includes patterns for the camelback lid supports and sides, the lock shim, and the tray sides with a handle opening.

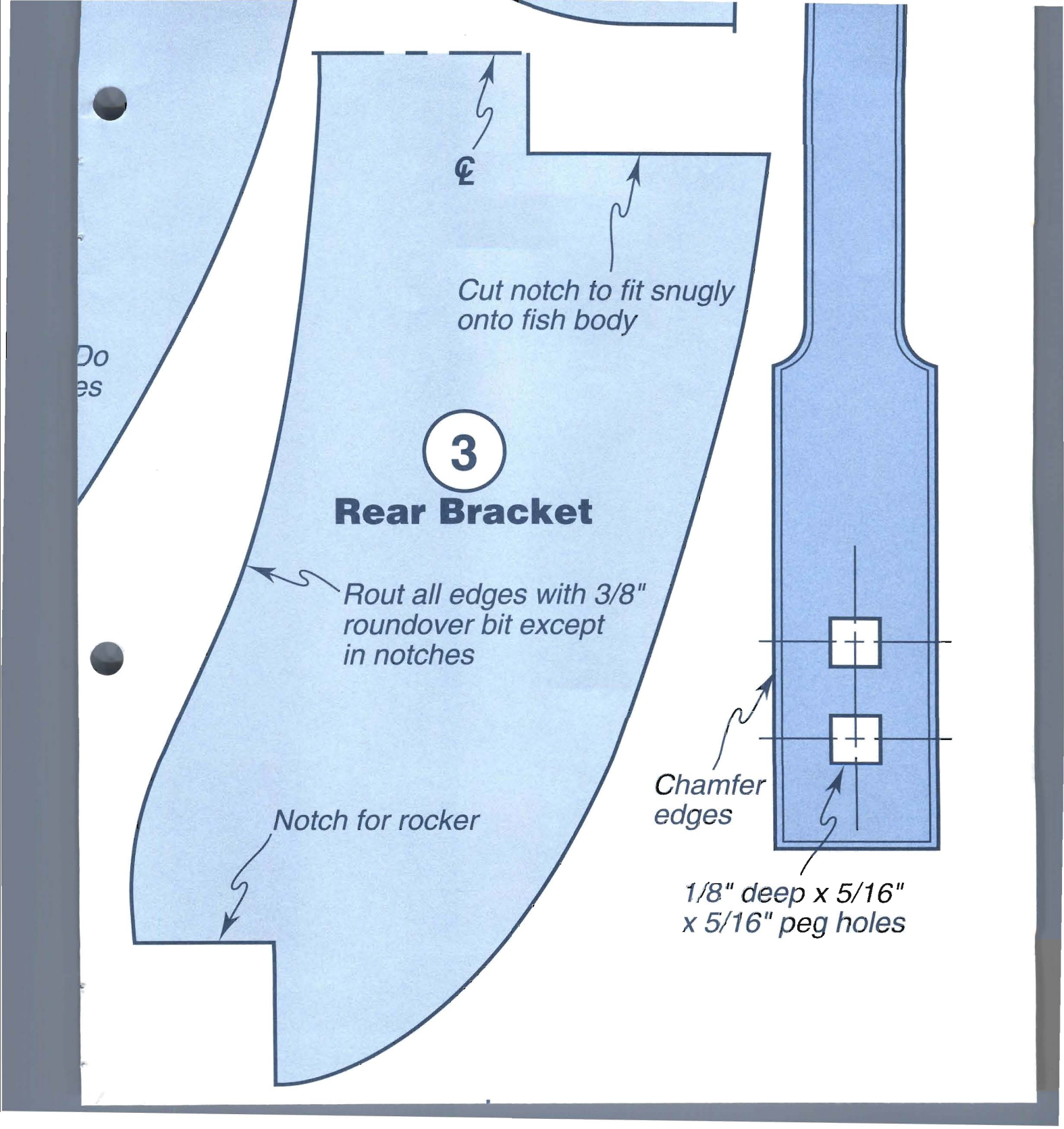
Rocking Fish
Includes patterns of the fish body, the front and rear brackets, the seat and the rockers.

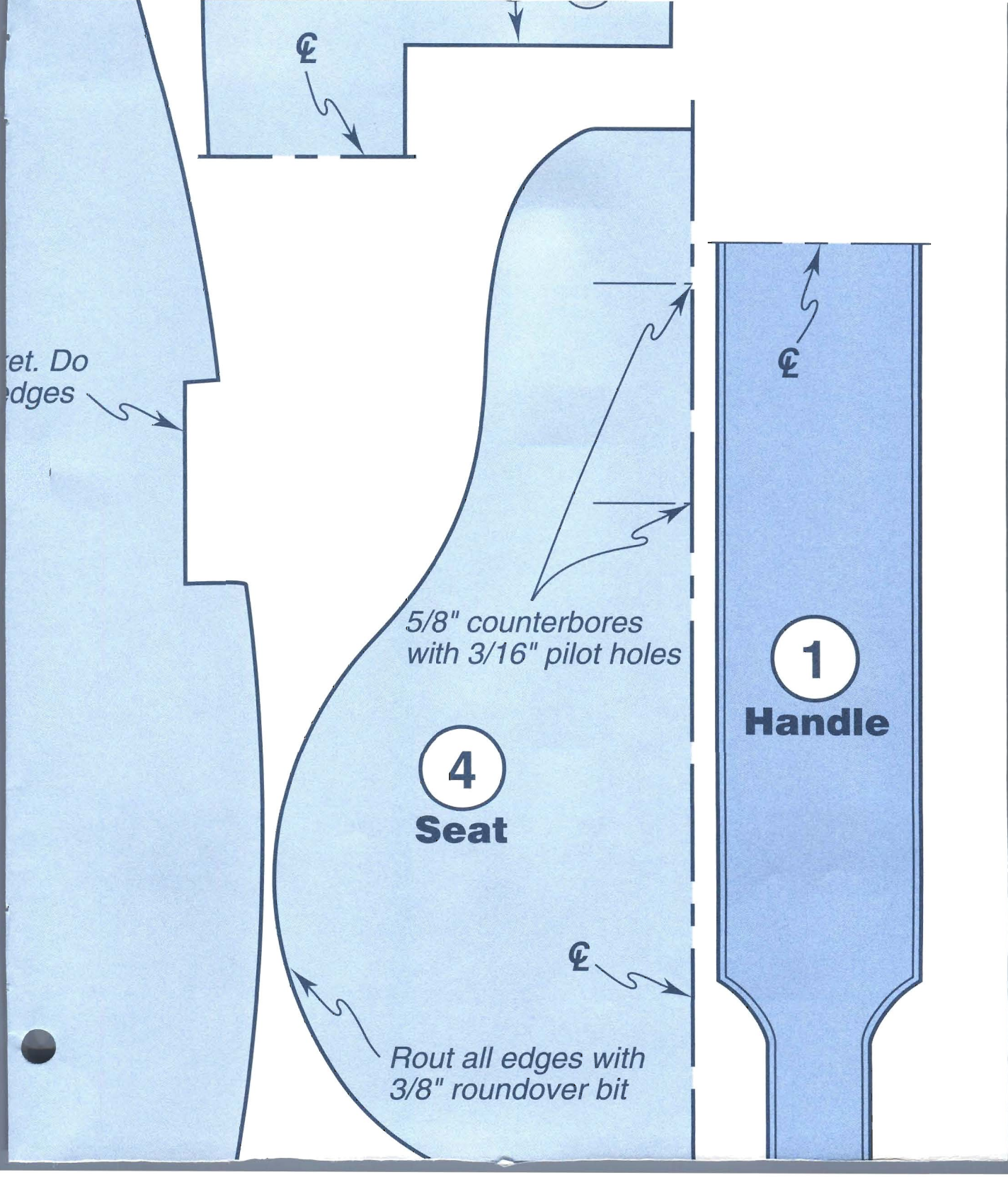


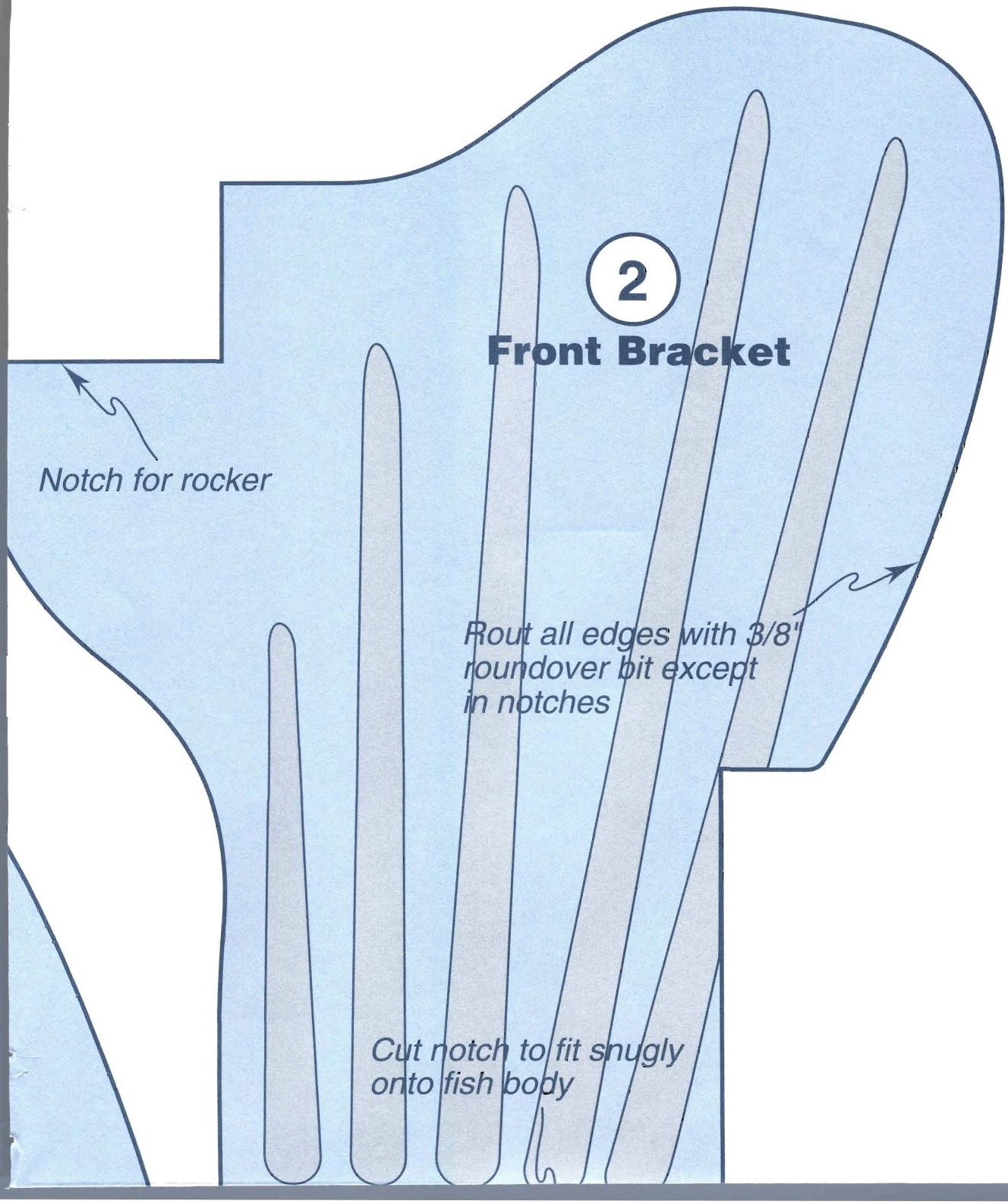
Bentwood Carryall
Includes a pattern for making the handle bending form and another for shaping the steam bent handle.

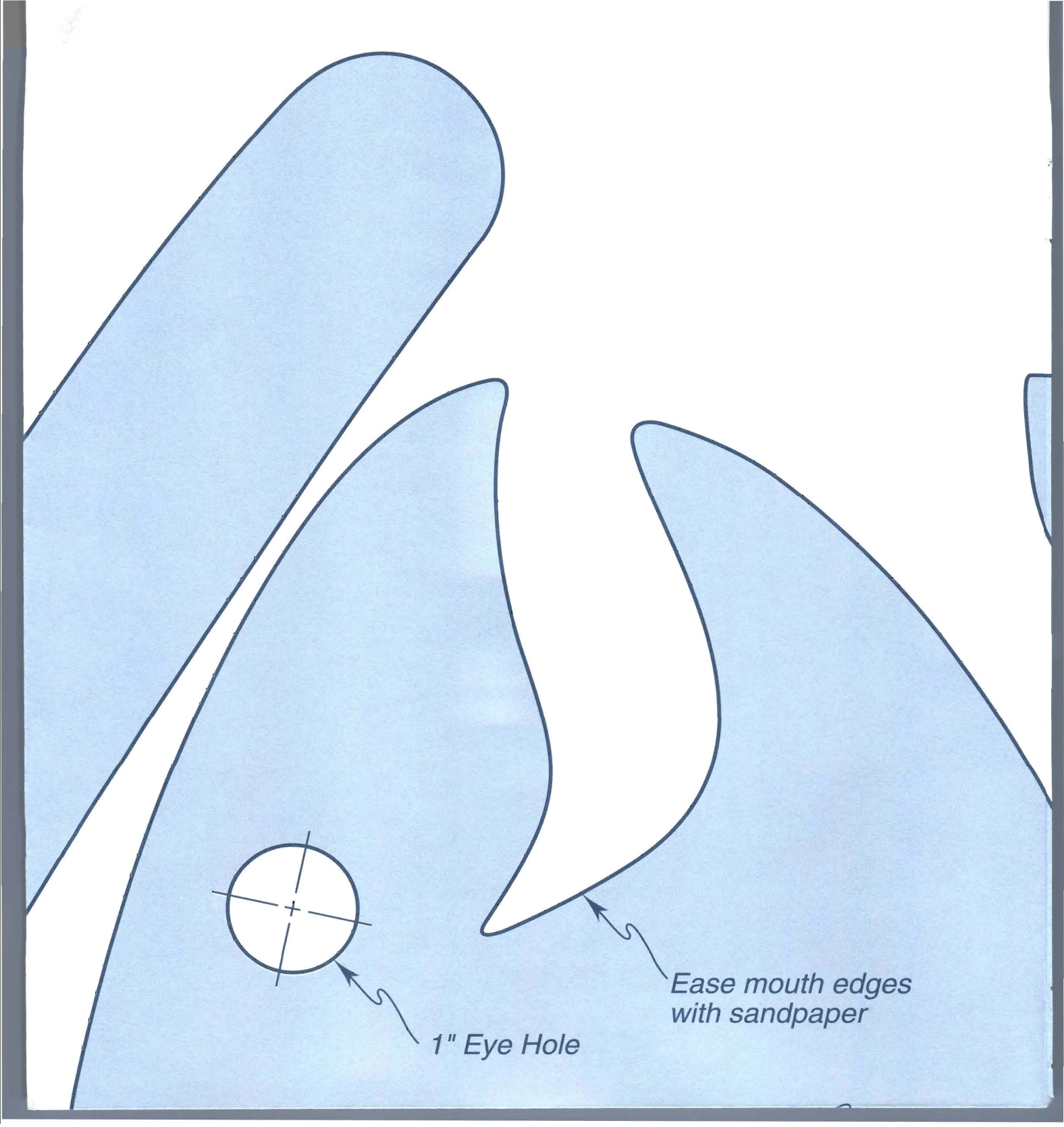
TODAY'S
WOODWORKER™

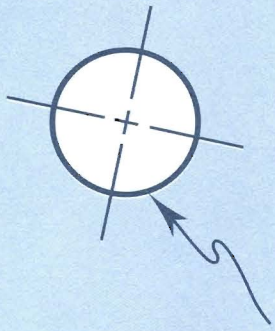
Today's Woodworker, Box 44, Rogers MN 55374.


℄
Cut notch to fit snugly onto fish body
3
Rear Bracket
Rout all edges with 3/8" roundover bit except in notches
Chamfer edges
Notch for rocker
1/8" deep x 5/16" x 5/16" peg holes


et. Do
dges
5/8" counterbores
with 3/16" pilot holes
4
Seat
1
Handle
Rout all edges with
3/8" roundover bit


2
Front Bracket
Notch for rocker
Rout all edges with 3/8" roundover bit except in notches
Cut notch to fit snugly onto fish body


Ease mouth edges
with sandpaper
1" Eye Hole

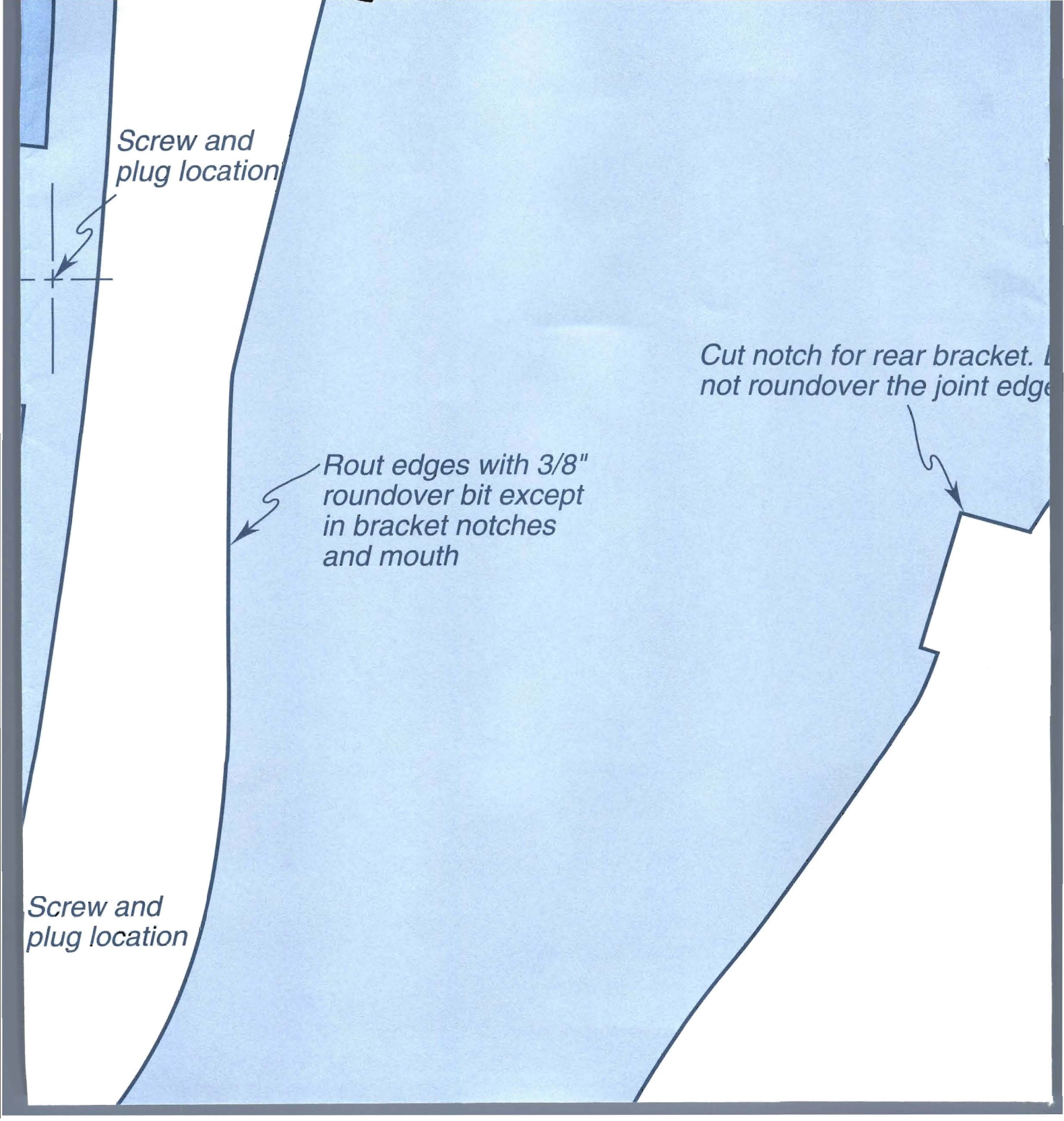


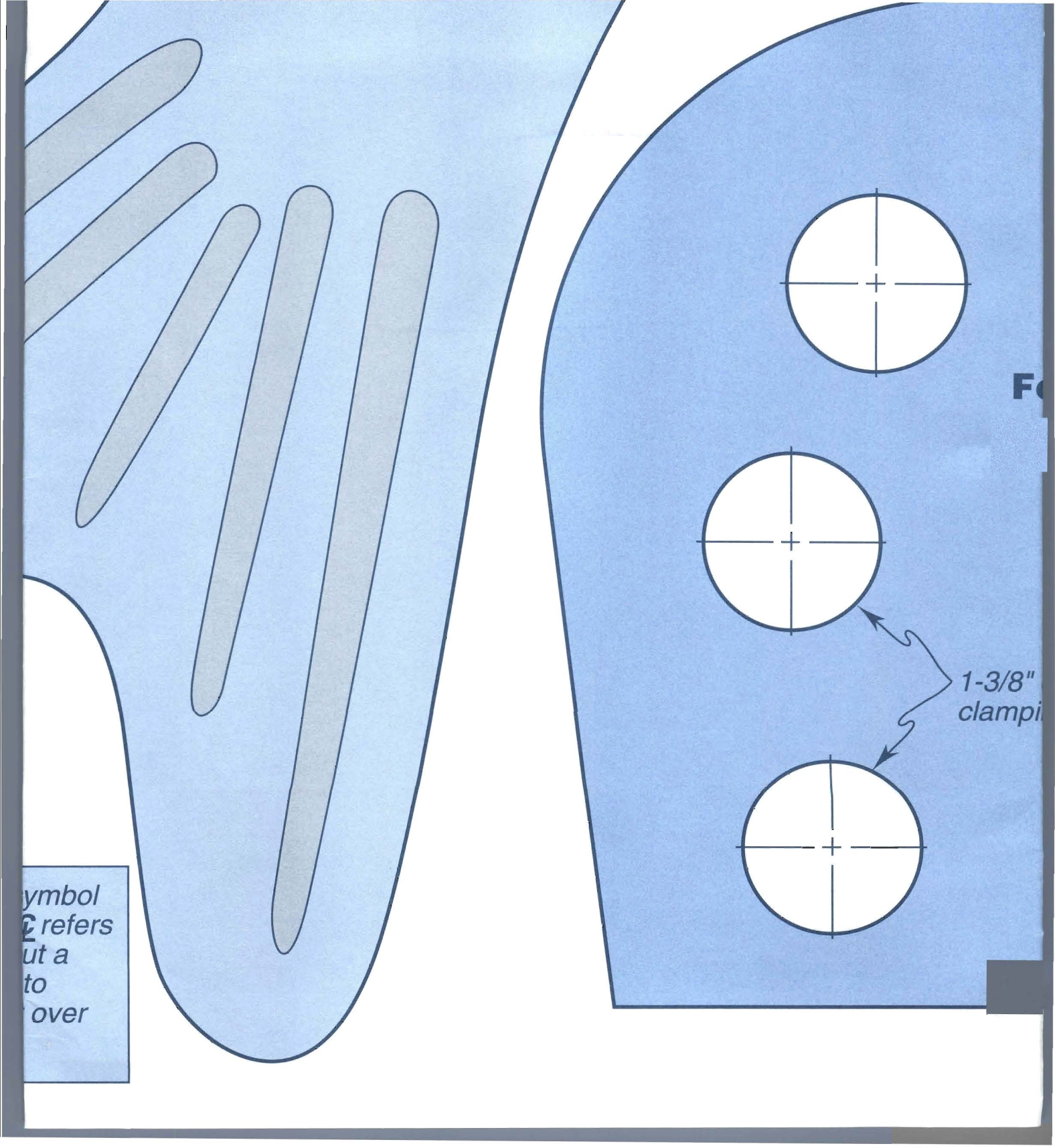
3/4" Handle Hole

Cut notch for front brack
not roundover the joint e

1

Fish Body


Screw and
plug location
Cut notch for rear bracket.
not roundover the joint edg
Rout edges with 3/8"
roundover bit except
in bracket notches
and mouth
Screw and
plug location



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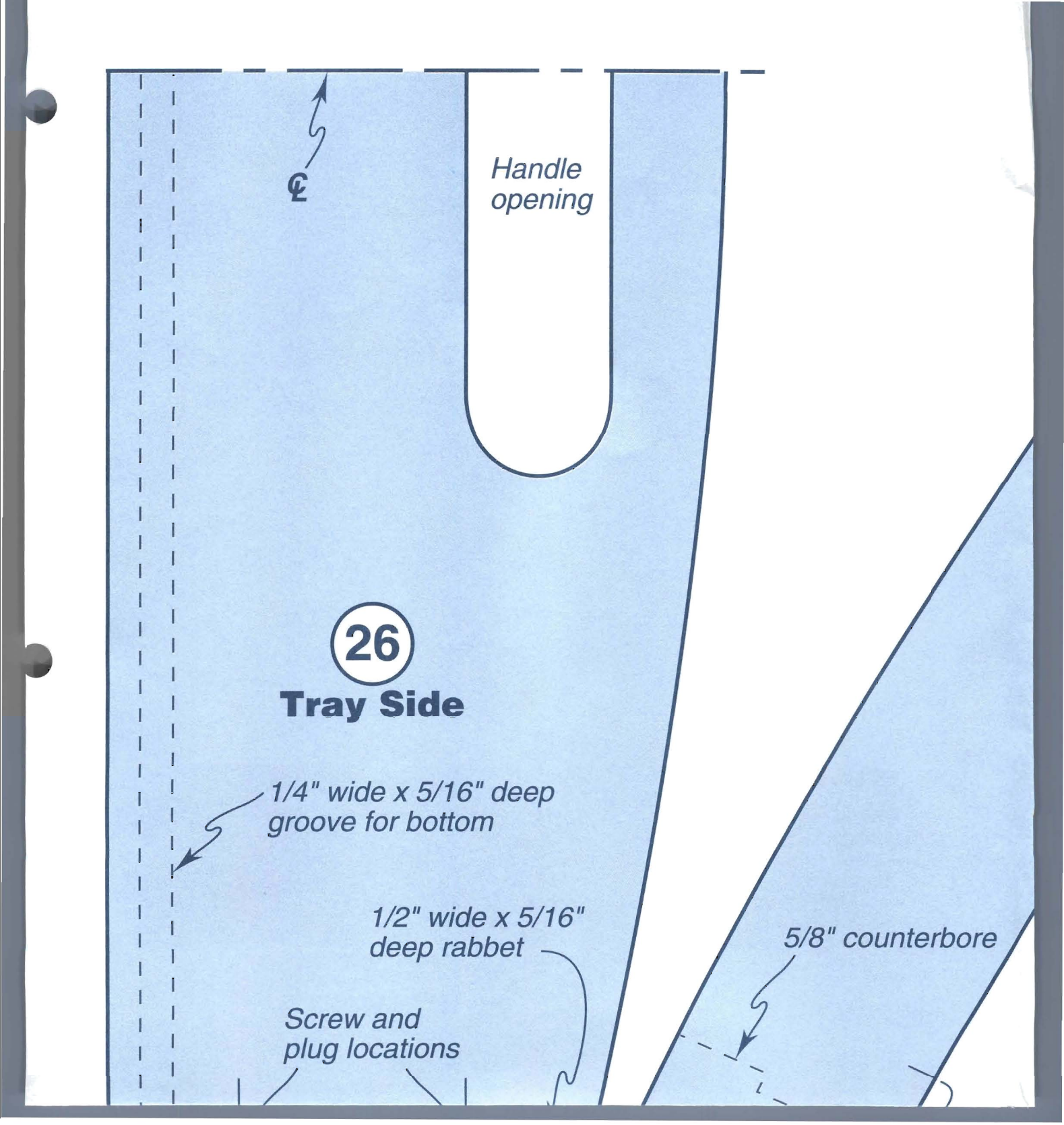
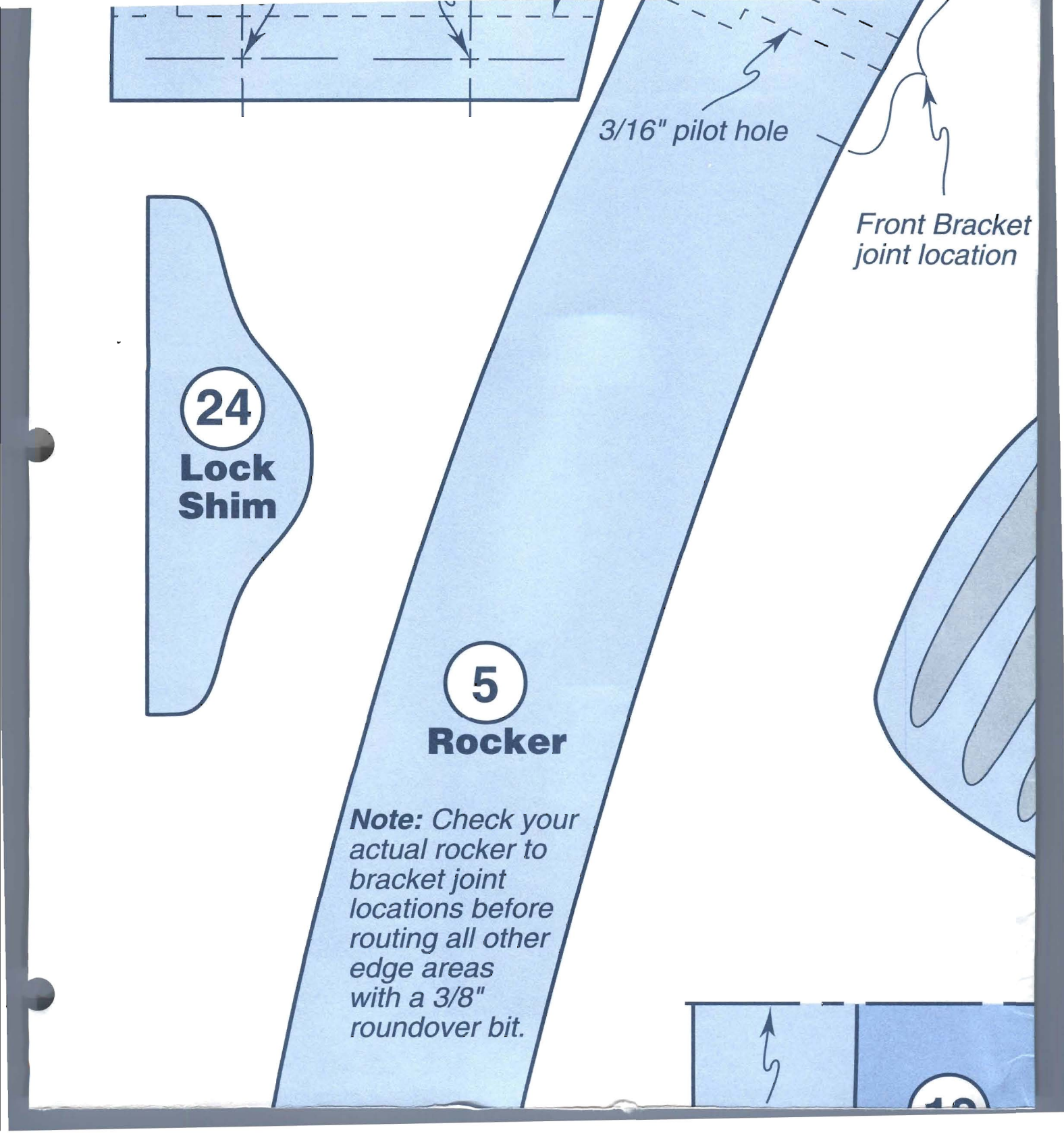
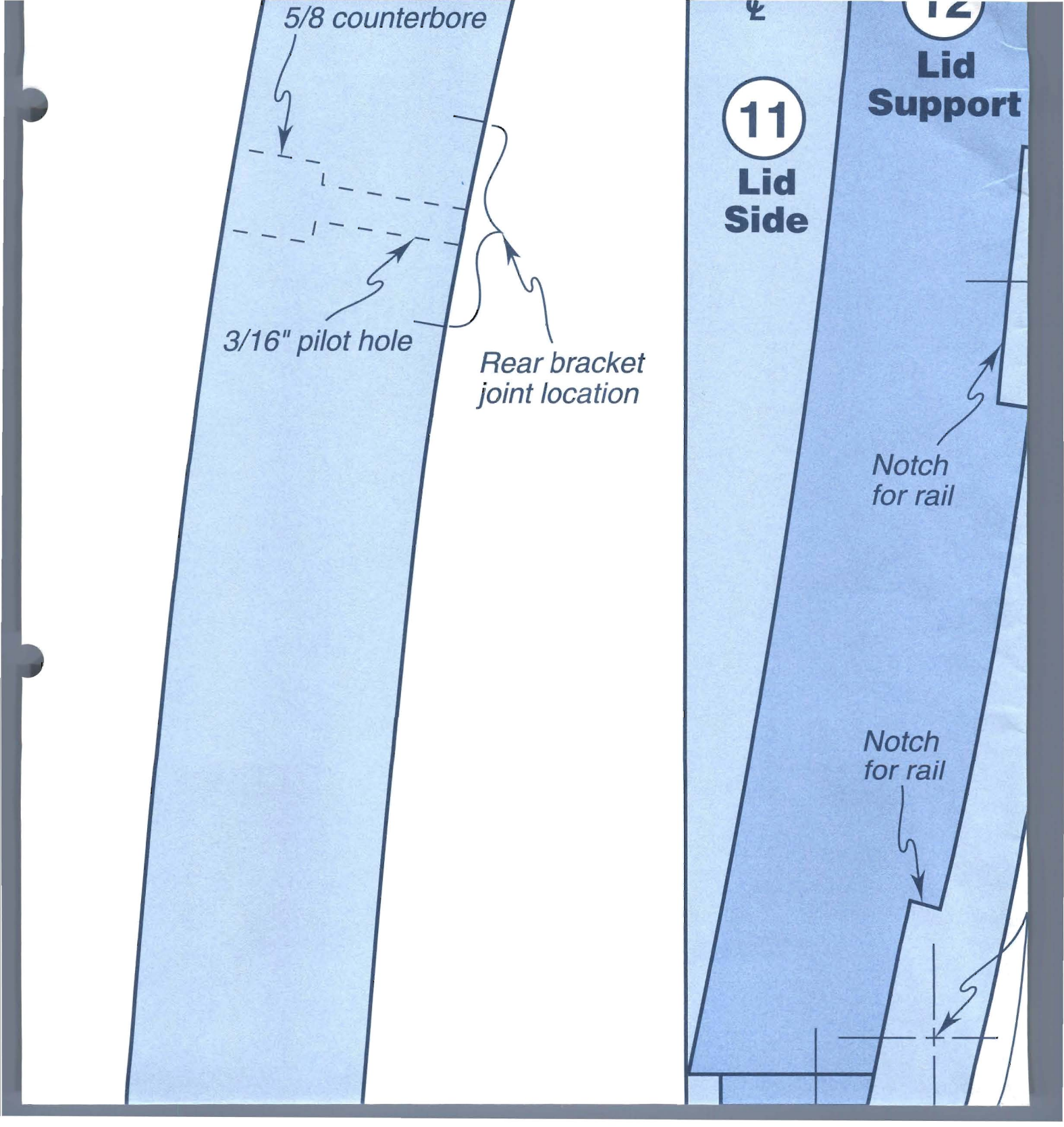
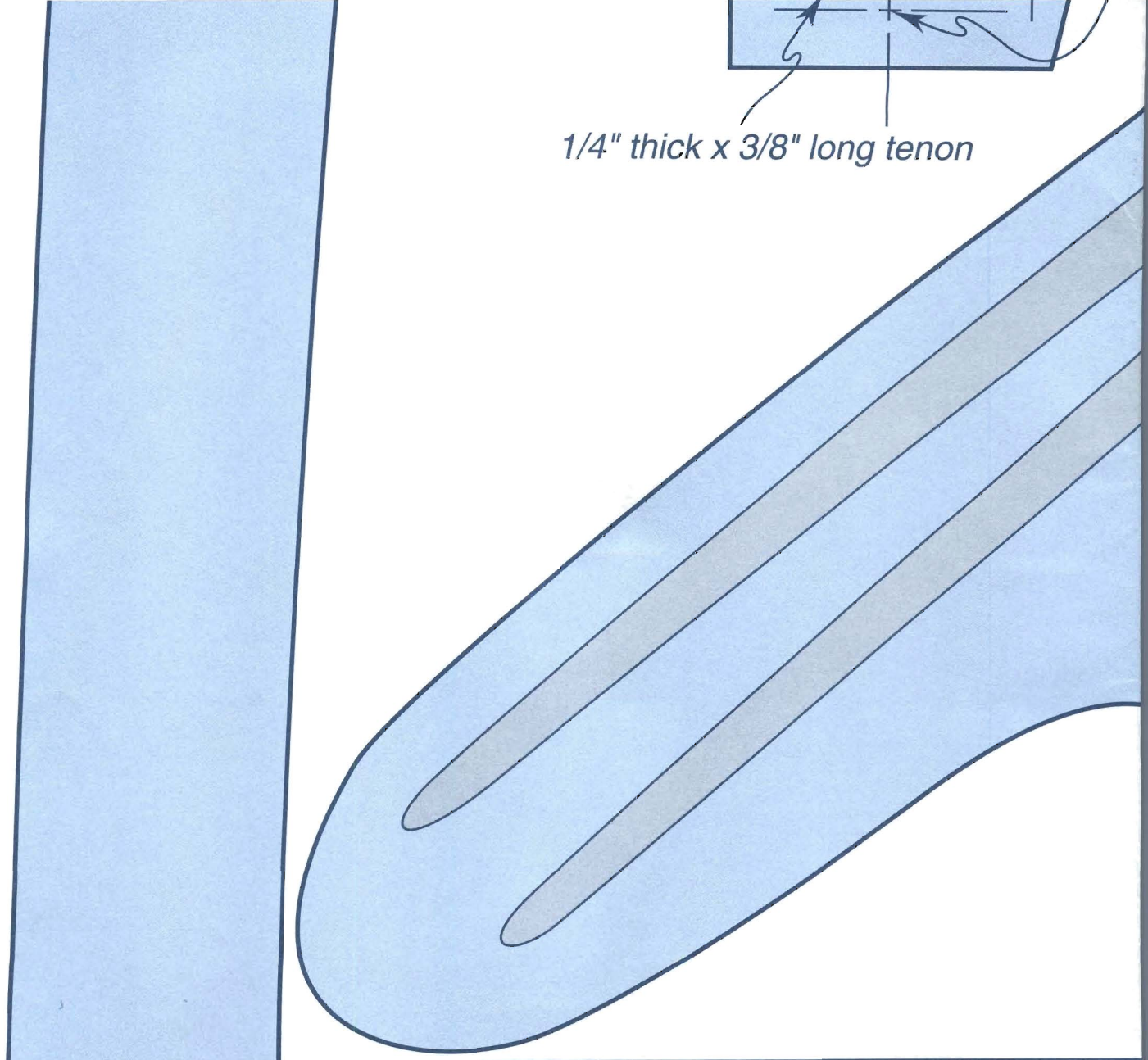

℄
Handle opening
26
Tray Side
1/4" wide x 5/16" deep groove for bottom
1/2" wide x 5/16" deep rabbet
5/8" counterbore
Screw and plug locations


3/16" pilot hole
Front Bracket joint location
24
Lock Shim
5
Rocker
Note: Check your actual rocker to bracket joint locations before routing all other edge areas with a 3/8" roundover bit.


5/8 counterbore
3/16" pilot hole
Rear bracket joint location
11
Lid Side
12
Lid Support
Notch for rail
Notch for rail



℄ **NOTE:** *Each pattern containing the ℄ s is showing half of the complete shape. to the center line of the pattern. To layo complete shape on your stock, be sure trace around the half-pattern, then flip i to trace the second half.*