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Fine WoodWorking

December 1992, No. 97
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Plunge router review

Sunburst Windsor

12
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Fine WoodWorking®

November/December 1992 No. 97

DEPARTMENTS

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On the Cover: Sunburst Windsor *chair, made by Arthur Mitchell, is at home alongside a cherry secretary by Lincoln Clapp. There's another view of these two pieces on p. 64. Photo: Dennis Griggs.*

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Last words on locknuts—The item on locknuts in the "Letters" section of *Fine Woodworking* #96 causes me to respond immediately, for safety's sake. Here's the way they work: Initially the large nut screws against the job followed by the thinner locknut that snugs against the top of the large nut, but that's not the end of it all. The following steps must be taken to ensure that the nuts cannot possibly unscrew together, thus allowing the job to come loose.

1. Tighten the major nut against the job a trifle more than is required. Use a torque wrench if possible for greater certainty.
2. Tighten the thin locknut against the top of the major nut with the correct amount of torque (i.e. less than that of the large nut).
3. Hold the locknut steady with a wrench, and with another wrench undo the large nut against it. There will be an imperceptible amount of slackening of the large nut but only until the correct amount of torque is reached—remember that you overtightened it initially.

To undo the nuts, hold the top locknut and tighten the large nut a fraction, and hold it while the top nut is undone.

—Joe Moore, Brockville, Ont. Canada

Store planes on their sides—I can still remember an admonition of my shop teacher a half-century ago to never lay a plane on its working surface; lay it on its side, so the cutting edge can't be damaged. As a good student, I still store my few planes on their sides in a drawer. Beautiful tool cabinets, such as the one in the October 1992 issue, that for compactness need the planes upright, might have a little groove cut under the blade, so they aren't resting on the cutting edge.

—James H. Blackburn, Cave Creek, Ariz.

Panels on the move—Christian Becksvoort's excellent article on wood movement in *FWW* #94 has raised a couple of points I do not understand.

He states that a 31-in.-wide board could expand and contract as much as ¾ in. with normal swings of humidity and that the frame-and-panel construction will only have movement in the stiles. It would seem to me that the back itself will also move more than the ¼-in. total allowed for movement and that the stiles will be forced apart.

He also describes the sliding joint allowing movement between the sides and the top molding. It would seem to me that if the molding were installed flush with the back when humidity was high, it could project from the back as much as ½ in. in periods of low humidity.

One final note—I am surprised that Becksvoort did not use dust panels in what looks like an expensive piece of furniture.

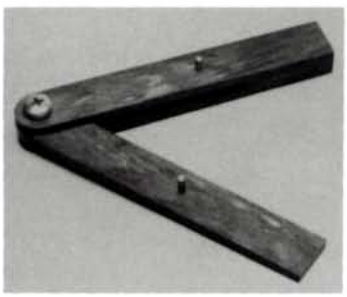
—Werner C. Steinle, Roanoke, Va.

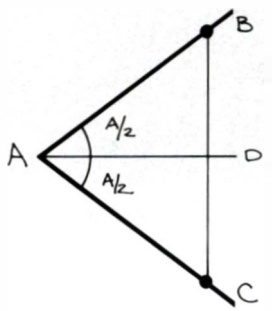
Chris Becksvoort replies: My apologies for a slight inaccuracy. A flatsawn panel of cherry 31 in. wide, shrinking from 14% moisture content (m.c.) to 6% m.c. (average annual indoor range, not taking wood finish into account) would shrink about ⅝ in. This is based on the fact that flatsawn cherry has an approximate shrinkage rate of 7.1% from green to oven-dry. That's why I use frame-and-panel construction with a quartersawn cherry frame (shrinkage rate is only 3.7%). So the two outer stiles at 2¼ in. each have a total shrinkage of 3/64 in. from 14% m.c. to 6% m.c. That amounts to only a bit more than 1/64 in. on each side, easily accommodated by normal compression of the wood fibers. Each of the back panels is 11¾ in. wide and shrinks just under ¼ in. The case side, at 19 in., shrinks just about ⅜ in. Please

remember that very seldom do I actually work with 6% or 14% wood moisture content. Most of the year, it is in the 8% to 10% range so that the molding, for example, would protrude 3/16 in. in winter and be shy of the back by 3/16 in. in summer.

I don't use dust panels to save weight. I will add them at the customer's request, but I don't feel they have much merit in a closed case.

Sine bar not so precise—Regarding the article "Simple Instrument Sets Precise Angles" (*FWW* #95), the method shown is neither simple or precise. Making a sine bar with exact 10 in. spacing between rolls is improbable if not impossible by the method described. The first difficulty is measuring 10.000 in. on a scale. Plus/minus .005 is the best that can be done even with a magnifier. Now picture the difficulty of centering a drill exactly on the mark. Plus/minus 1/64 would be fantastic. The distance is then 10.000 plus/minus .020, leading to an angle-setting error of about 1/4°. A good quality protractor of reasonable size would be more accurate. For anyone doing even moderately accurate work, an absolute must is a 6-in. dial caliper. These measure to .001, and they cost about $20.





Shown above is a really precise and simple instrument for setting or measuring angles. As you can see, it resembles the common bevel but has two accurately spaced measuring pins. In the sample, they are spaced exactly 3.000 in. from the pivot, but the exact spacing is not terribly important so long as the pins are at the same distance from center. This can be assured by drilling the holes with the pieces together and keeping them in that orientation on assembly. Distance across the pins is measured with a dial caliper. The geometry is shown above where A is the angle to be set .

As an example, to set A = 90° with a length of AB = 3.000 and a .125 diameter of the measuring pins:

sin 45° = BD/AB = BD/3 = BC/6

or BC = 6 sin 45° = 6 x .7071 = 4.2426

caliper reading = 4.2426 + .125 = 4.3676.

If the measuring pins are not exactly 3.000 from the pivot, then determine their distance by setting the bevel at 90° with a square and measuring the distance between pins.

I have made several of these bevels and use them both for setting and measuring angles. *—Charles J. Kennedy, Malibu, Calif.*

More square tricks—I enjoyed the article on the use of the combination square (*FWW* #96), especially since it featured a Starrett square like the one I got 23 years ago when my grandfather passed away. That tool is now 80-plus years old. Though you wouldn't judge me to be a woodworker, except maybe by the standards applied to a beaver, I thought I'd pass along a couple of my own tips.

First, author Ben Wild suggests using the square to gauge dimensions rather than to measure them. I know from countless measuring errors that he is right. Still, I have found one way to accurately and reliably transfer real measurements to a workpiece: I use a dial caliper to set the head of the combination square. I also use the dial caliper to measure dimensions that I have lifted from a workpiece with the combination square.

Second, if you've got any money left after buying your Starrett combination square (the three-head model shown in issue #96 is about $160), you might consider buying a second square head. With the two heads fitted to a single rule, you've got a large capacity caliper that is robust enough for heavy-duty scribing. *—Andrew Mawhinney, Fullerton, Calif.*

Don't stain that repair—I have a problem with Scott Lawrence's technique in his article on French polishing for restoration work (*Fine Woodworking* #94). Scott is shown repairing large patches of missing dark finish on a barrister's bookcase. The wood showing through the patches is a light oak, very likely fumed when the piece was built. Before he starts to build the missing finish, he first stains the bare wood to match the old finish.

Ten or twenty years from now, the person who decides to refinish this piece will discover a most unpleasant surprise. Scott's dark stain will have sunk well into his bare patches, and the rest of the bookcase will be the light oak. At that point, the only reasonable solution will be to stain the whole piece to match the dark patches, and the fumed oak original will never be seen again.

I don't see much sense in trying to preserve such a dirty, degraded finish, but if Scott chooses to do so, he should color his finish rather than the wood. Then, anything he does is reversible.

I'll never understand why nearly everyone who refinishes antique furniture is so eager to stain the piece between stripping and refinishing. The people who built this furniture knew what they were doing; they chose the color they wanted the piece to be, that color is intact under the old dirty finish, and we should

Editor's Notebook

Tool Forum appears for the first time in this issue of *FWW* on p. 116. We have created this new department to help you stay ahead of the clamorous woodworking marketplace. Our plan is to pass new products along to savvy woodworkers to try in their shops and then to print what happens—good and bad.

The stories in "Tool Forum" will be brief first impressions, not rigorous tests, so they won't replace our regular comparative reviews. And we'll have to be somewhat selective because there'll never be enough space to review every new gizmo or can of goo.

The man in charge of deciding what tools to review, and of choosing tool reviewers, is assistant editor Vincent Laurence.

Alone and lonely—A lot of woodworking you just have to do by yourself, so woodworkers get the blues about not knowing any like-minded souls nearby. In the past 15 years, the advent of local woodworking guilds and clubs has done a lot to break down this isolation. Guilds serve as information exchanges and educational forums, but more than anything, they help woodworkers get in touch with one another.

It's been more than five years since we last published a directory of woodworking guilds and clubs, so it's time to make an up-to-date list. If you're an officer of a guild of woodworkers, please drop us a note about what your group does, and include a contact address and telephone number that we can publish. *—John Kelsey, editorial director*

leave that color alone. Take off the old finish using a method that doesn't raise the grain, don't sand, don't stain, put on a new finish that is itself strippable. You have just restored the piece, you've done no damage, and I'll bet you like the color.

–Grey Doffin, Duluth, Minn.

First, remove the wax—Having experienced frustrating (and expensive) failures of glued lapped joints in professionally assembled sanding belts, I was interested to see Bill Skinner's piece on epoxied butt joints in the May/June 1992 issue of *Fine Woodworking*.

At my next visit to my local supplier, I mentioned that I was intending to try the method, and to my surprise, he told me he has been using this method for some time. He also threw in a useful tip: the cloth belting is dressed on its back with a waxy substance that prevents good glue adhesion; this should be removed and the surface roughed with sandpaper prior to gluing with epoxy resin. *–J. Michael Hayman, N.S.W., Australia*

Masking tape for tires—Here is an alternative to the difficult job of installing rubber bandsaw tires (*FWW* #95). For the last 20 years, I have used masking tape on my 20-in. Davis/Wells and 14-in. Delta saw wheels with great success. Both of these saws have seen extensive running time in a metalworking production setting.

The rim of my saw is 1 in wide. In order to build in the crown, I use three wraps of ½-in. filament tape in a straight line ending at or short of the beginning so as not to create a bump. Over that I add 15 wraps of 1-in.-wide good-quality masking tape that provides about .075 in. of thickness, which I have found is adequate. The whole process should take no more than 10 minutes per wheel. I have had no problem with ¼-in. to ¾-in. blades in tracking or in blade life. Masking-tape tire life should be five-plus years. Also, I have found it does not matter which direction the tape is applied. *–Stephen B. Wheeler, Newport Beach, Calif.*

Epoxies are soluble—As a frequent user of epoxy glues, I would like to correct a statement in Chris Minick's article about adhesives (*FWW* #96) that uncured epoxies are not soluble in common workshop solvents. Epoxies are soluble in denatured alcohol, and it should be added to the woodworking-adhesives properties chart as a cleanup solvent.

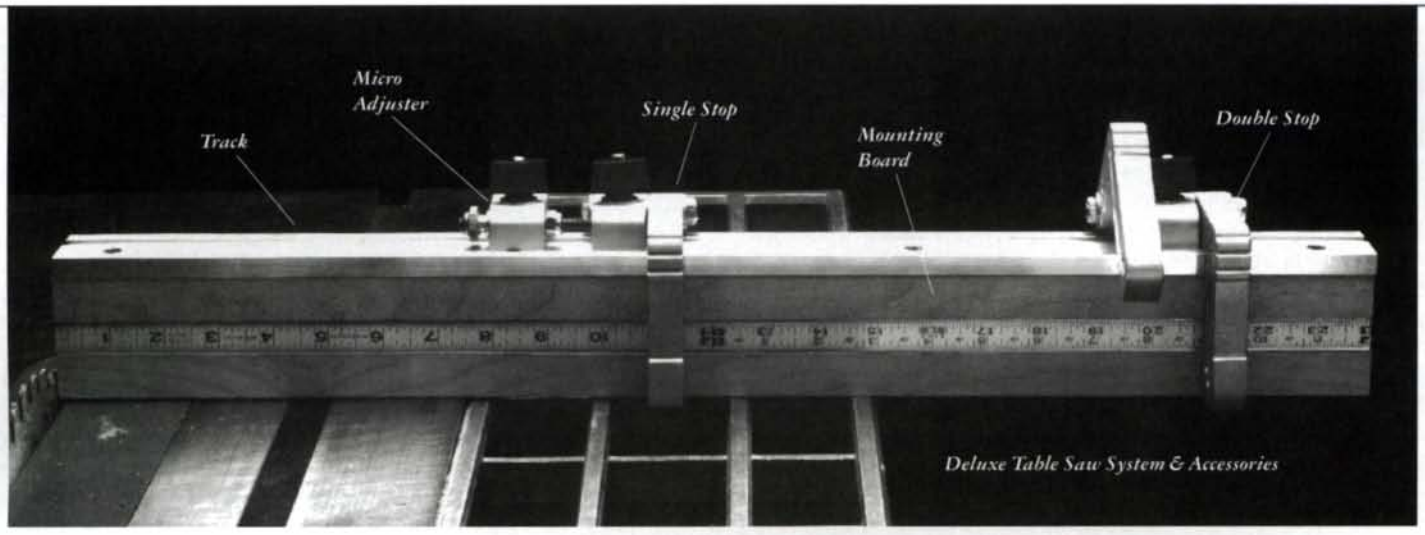
–John R. McCann, Sandy, Utah

Drying oak rounds—In your August 1992 issue of *FWW*, a reader had a question about drying large, thick slabs of white oak without their cracking. From my experience, I believe that his problem would best be solved by treating with ethylene glycol antifreeze, not polyethylene glycol (PEG).

Back about 1985, the Cape Fear Museum had a reproduction 24-ft. whaleboat given to them. The boat had been in the water and when placed in dry storage, opened up its seams badly. I treated the boat with antifreeze three times. The seams tightened up and have stayed that way.

In 1988, I had two 14-in.-deep by 2-in.-thick slabs cut from a hickory tree. I treated one with antifreeze by painting it on nearly daily until it had picked up about 20% antifreeze. By this time, the control had cracked badly. I set the slabs aside and sort of forgot them. Eight months later, I found a massive growth of fungus on the untreated, split control while the treated slab was, and still is, sound.

Undiluted ethylene glycol antifreeze acts rapidly at room tem-



How to make your table saw better than it already is.

FastTrack® Improves Machine Accuracy & Productivity

Although the mitre guide is the most important positioning fixture on any woodworking machine, virtually every machine sold comes with a guide that just doesn't measure up.

The FastTrack System was designed and developed by professionals to work in *real world, real shop* situations – as an inexpensive and simple solution to many table saw and other machine jigging problems. It really works.

The system is like an Erector Set, because you can assemble its various elements to meet your own special needs. Made of precisely cut and finished aluminum extrusions and solid Brass fittings, each system and accessory comes with the necessary screws, knobs, and instructions.

FastTrack For Table Saws

The Basic Table Saw System includes a 24″ Track, and a Single Stop. You make a mounting board to attach the track to your mitre guide. The Deluxe System includes the above plus a 24″ Mounting Board, with a fully adjustable, right-to-left reading 24″ Rule set into it.

67K04.01	Basic Table Saw System	$35.95
67K04.02	Deluxe Table Saw System	$71.00

FastTrack For Radial Arm Saws & Chop Boxes

This system, comprised of a 48″ Track and Single Stop, makes a superb cut-off jig.

67K07.01	Radial/Chop Saw System	$46.35

The FastTrack Track

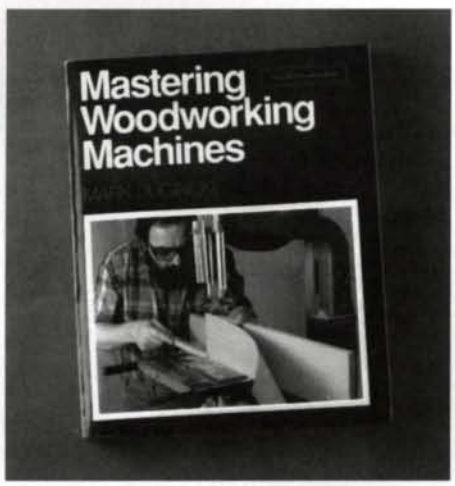
The foundation of the system is the Track, a ⅜″ thick by 1½″ wide precision extrusion with a T-slot that fits the head of a ¼″ hex-head bolt. These bolts hold all of the accessories and fittings to the Track, which is attached to a mounting board. Any length of Track can be cut to fit, or butted end-to-end.

67K08.01	6″ Track	$ 7.75
67K08.02	12″ Track	$10.30
67K08.03	18″ Track	$13.15
67K08.04	24″ Track	$15.45
67K08.05	36″ Track	$20.60
67K08.06	48″ Track	$25.75

Single & Double Flip Stops

In the down position, the pivoting Flip Stop acts as a positioning guide, fixing the distance between the end of a board and the saw blade. It flips easily out of the way when not needed. The Double Stop provides two settings 2″ apart.

67K09.01	Single Stop	$20.60
67K09.02	Double Stop	$25.75



Other Accessories

The Micro Adjuster screws into the side of a Single or Double Flip Stop or Microbase, allowing precise adjustment in .004″ increments. It is recommended for use with either Stop.

The Mitre Mount (includes a 12″ section of Track and a short piece of die board) lets you slide the Mounting Board freely left or right on the mitre guide. We recommend installing one with every FastTrack Table Saw setup.

The right-to-left reading 48″ Rule is marked in 1/16″. It fits into a dovetail-shaped flat extrusion which is set into a 14° dovetail dado you cut in your mounting board. The Deluxe Table Saw System already has the Rule set into it.

Suggested accessories for the Table Saw System are the Micro Adjuster, additional Track, Double and extra Single Stops, a 48″ Rule, and Mitre Mount. For the Radial Arm Saw, you can use a second 48″ Track, a Micro Adjuster, a Double or an additional Single Stop, and the 48″ Rule.

67K10.03	Micro Adjuster	$12.35
67K10.04	Mitre Mount	$19.30
67K10.05	48″ Rule	$19.25

Mastering Woodworking Machines

Mark Duginske, author of the famous *Band Saw Handbook* has written the *very best* guide on woodworking machinery set-up, tuning and use. Filled with professional insight and tips. If you have only one book on machinery, this should be it. 246 pages, soft cover.

91L01.08	Machinery Book	$24.95

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perature because it is so similar to water, but it does not evaporate. It is also an effective fungicide and insecticide in the treated wood.

If the white oak slabs were mine, I would stack them flat with stickers between them and treat by spraying all of the faces with antifreeze, keeping the surfaces visibly wet. I would use a garden sprayer as I did with the turpentine logs (antifreeze is more viscous than water, so you have to bore out the nozzle on the garden sprayer to get a good, heavy spray). This treatment would probably take several months. Collect the excess spray on a plastic film tray under the pile and reuse it.

To check completion, let the surface of the top slab go dry. If it shows any signs of checking, resume treatment. While PEG does not penetrate oak well, ethylene glycol antifreeze penetrates rapidly, including even our native live-oak.

—David W. Carnell, Wilmington, N.C.

A manufacturer replies—I would like to thank assistant editor Vincent Laurence for taking the time to review the TS-Aligner in the July/August issue of *Fine Woodworking*. Some clarification is needed.

TS-Aligner was designed with the assistance of mechanical engineers, consultants, and machinists. TS-Aligner is designed and built to remain accurate. Molded plastic, stamped sheet metal and die-cast zinc alloy are not only less durable but are not suitable materials for a precision measurement instrument.

TS-Aligners shipped since January 1992 have been modified to eliminate any bearing or dust problems. Customers are welcome to have their units upgraded free of charge (as some already have).

Distinguishing between blade flatness and arbor/flange problems is easy with TS-Aligner. It's covered in the manual (sec. 5.2) and, if needed, a phone call will provide further information and technical assistance.

The manual clearly explains that there is no need to hold on to the aligner while checking for blade flatness. The rotational force is only required when sliding the tool down the miter slot.

Machining costs being $55 per hour, TS-Aligner is very much worth the original price of $190. Our recent price decrease to $179 reflects the purchase of machinery to do most of the work ourselves.

I am disappointed that Laurence didn't comment on the aligner's accuracy and ability to precisely align a tablesaw quickly. His suggestion of using a combination square and feeler gauges or a dial indicator and magnetic base leads me to believe that he ignored much of TS-Aligner's functionality. Perhaps he can explain how these tools can be used to accurately and quickly set blade tilt or miter-gauge angle. Our customer surveys indicate a very high degree of satisfaction with TS-Aligner.

—Edward J. Bennett, Boise, Idaho

About your safety:
Working wood is inherently dangerous. Using hand or power tools improperly or neglecting standard safety practices can lead to permanent injury or death. So don't try to perform operations you learn about here (or elsewhere) *until you're certain that they are safe for you and your shop situation.* We want you to enjoy your craft and to find satisfaction in the doing, as well as in the finished work. So please keep safety foremost in your mind whenever you're in the shop.

—John Lively, publisher

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334	QUIKSAND W/STIKIT, DUSTLESS	CALL
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7518	3 1/4 HP FIXED BASE ROUTER-5 SPEED	259
7519	3 1/4 HP FIXED BASE ROUTER-SINGLE SP	224
7536	2 1/2 HP FIXED BASE ROUTER	198
7537	2 1/2 HP FIXED BASE "D" HANDLE ROUTER	208
7538	3 1/4 HP PLUNGE ROUTER-SINGLE SPEED	224
7539	3 1/4 HP PLUNGE ROUTER-5 SPEED	259
7545	XTRA HVY DUTY DRYWALL DRIVER,VSR	109
7549	TOP HANDLE BAYONET SAW	143
7649	BARREL GRIP BAYONET SAW	143
9118	PORTA PLANE KIT W/CASE,CARBIDE BLD	199
9314	4 1/2" TRIM SAW KIT	148
9315	7 1/4" BUILDERS SAW KIT	137
9345	SAW BOSS 6" CIRCULAR SAW KIT	122
9367	3 1/4" PLANER KIT	152
9548	WORM GEAR BAYONET SAW KIT	201
9617	7 1/4" BUILDERS SAW KIT	136
9637	TIGER SAW VAR SPEED RECIP. SAW KIT	138
9647	TIGER CUB RECIP. SAW KIT	114
9652	VERSA-PLANE KIT	279
9653	12 V, 3/8" CDLESS KIT, VS KEYLESS CK	148
9653S	SAME AS ABOVE BUT W/2 BATTERIES!	174
9654	12 V, 1/2" CDLESS KIT,VS W/GEARED CK	158
97310	LAMINATE TRIMMER KIT W/4 BASES & CS	187
97751	1/2" VS, 2 SPD HAMMER DRILL KIT	145

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T40S	ROOFING STAPLER	299
N12B	ROOFING NAILER	417
N60FN	FINISH NAILER-1 1/4" TO 2 1/2" CAP	335
MIII-812	T-NAILER-9/16" TO 2 1/4" CAPACITY	429
T28-5	FINISHING STAPLER-1 3/16" CAPACITY	264
T31-3	FINISHING STAPLER-1" CAPACITY	159
MIIIFS	FLOORING STAPLER	539

Panasonic

EY571BC	9.6V, 3/8" CORDLESS KIT, VSR W/ 2 BATTERIES, CHARGER & CASE	149
EY6205BC	12V, 3/8"KEYLESS CK, VSR CRDLESS DRILL W/15 MIN CHARGER & CASE	177
EY6900BC	12V 3/8" CORDLESS HAMMER DRILL W/15 MIN CHARGE & CASE	199
EY503B	CORDLESS SCREWDRIVER	69

BOSCH

1194VSR	1/2" VSR, 2 STAGE HAMMER DRILL	$144
1195VSR	3/8" VAR SPEED, REV. HAMMER DRILL	129
1581VS	TOP HANDLE JIG SAW,VS	139
1581DVS	SAME AS ABOVE BUT DUSTLESS	169
1582VSC	CLIC BARREL HANDLE JIG SAW,VS	139
1582DVS	SAME AS ABOVE BUT DUSTLESS	169
1272D	3" X 24" DUSTLESS BELT SANDER	179
1273D	4" X 24" DUSTLESS BELT SANDER	186
1273DVS	4" X 24" VS DUSTLESS BELT SANDER	199
1347A	4 1/2" MINI GRINDER	95
1370DEVS	6" VS DUSTLESS RANDOM ORBIT SNDR	224
1420VSR	DRYWALL DRIVER, 4.8 A,0-4000 RPM	84
1600	2 1/4 HP "D" HANDLE ROUTER	258
1601	1 HP ROUTER	109
1602	1 1/2 HP ROUTER	134
1603	1 1/2 HP "D" HANDLE ROUTER	142
1604	1 3/4 HP ROUTER	134
1608	LAMINATE TRIMMER	84
1608U	UNDERSCRIBE TRIMMER	117
1609K	INSTALLERS KIT WITH 3 BASES	174
1609KS	DELUXE INSTALLERS KIT W/4 BASES	197
1613	1 3/4 HP PLUNGE ROUTER	163
1613EVS	2 HP VAR SP PLUNGE ROUTER	183
1614	1 HP PLUNGE ROUTER	127
1614EVS	1 1/4 HP VAR SP PLUNGE ROUTER	148
1615EVS	3 1/4 HP VAR SP PLUNGE ROUTER	254
1654	7 1/4" CIRCULAR SAW	99
3050VSRK	9.6V, VSR CORDLESS DRILL W/2BAT,CS	134
3258	3 1/4" PLANER	136
3282DVS	5" VS DUSTLESS RANDOM ORBIT	98
11203	1 1/2" ROTARY HAMMER W/STOP ROT	429
11304	THE BRUTE BREAKER HAMMER	1218
11305	DEMOLITION HAMMER	659

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SFN1-2	FINISH NAILER-1" TO 2" CAPACITY	258
SFN2B	FINISH NAILER-1 1/2" TO 2 1/2" CAP	378
SKS	FINISH STAPLER-5/8" TO 1 1/2" CAP	248
LS5	PINNER, 1" TO 1 1/2" CAPACITY	257
LS2	PINNER, 5/8" TO 1" CAPACITY	247

DELTA

31-050	1" BELT SANDER	78
31-080	1" BELT/5" DISC SANDER	93
31-460	4" BELT/6" DISC SANDER	129
40-560	16" SCROLL SAW, 2 SPEED	183
11-990	12" BENCH TOP DRILL PRESS	208
22-540	12" BENCH TOP PLANER	398
28-180	BENCH TOP BAND SAW	167
33-060	NEW SIDEKICK 6 1/2" FRAME & TRIM SAW	369
40-640	20" BENCH TOP SCROLL SAW	324
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M12V	3 HP VAR SPEED PLUNGE ROUTER	223
TR12	3 HP PLUNGE ROUTER	167
C7BD	7 1/4" CIRCULAR SAW	119
C12FA	12" DELUXE MITER SAW	305
C8FB	8 1/2" SLIDE COMPOUND MITER SAW	438
CJ65V2	TOP HANDLE JIG SAW W/CASE	139
F20A	3 1/4" PLANER, 3.4 AMP	89
F30A	3 5/8" PLANER, 8.3 AMP	189
P50	6 5/8" PLANER, 11 AMP	329
G12SA	4 1/2" MINI GRINDER, 6.9 AMP	79
M8V	VAR SPEED PLUNGE ROUTER, 1/4"	154
TR6	LAMINATE TRIMMER	92
P12R	12" PORTABLE PLANER	729
P12RA	12" PORTABLE PLANER,6" JOINTER	929
W6V2	DRYWALL DRIVER, VSR	89

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FT2000E	3 1/4 HP PLUNGE ROUTER, VAR SPD	205
FRT2000	ROUTER TABLE-WOOD	169
EB100	EDGE BANDING SYSTEM	216
LM72M010	10" X 24T FLAT TOP RIP BLADE	36
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LU84M010	10" X 50T ATB COMBO BLADE	38
LU85M010	10" X 80T ATB FOR MIRROR FINISHI	55
LU87M010	10" X 24T RIP BLADE THIN KERF	37
LU88M010	10" X 60T CROSSCUT THIN KERF	43
LU89M010	10" X 72T TCH NON FERROUS METAL	64
LU91M008	8 1/2" X 48T FOR COMPOUND MITER	43
LU91M010	10" X 48T FOR COMPOUND MITER	54
LU92M010	10" X 80T TCH-BEST FOR LAMINATES	67
LU96M010	10" X 80T TCH LAMINATES OR WOOD	67
TK206	10" X 24T THIN KERF RIPPING	25
TK306	10" X 40T THIN KERF COMBINATION	25
TK906	10" X 50T THIN KERF CROSSCUT	27
TK406	10" X 60T THIN KERF FINISHING	34
WC104	4 PC WOOD CHISEL SET W/CASE	39
WC106	6 PC WOOD CHISEL SET W/CASE	49
WC110	10 PC WOOD CHISEL SET W/CASE	83
CS106	6 PC CARVING SET W/CASE	79
CS112	12 PC CARVING SET W/CASE	139
TT108	8 PC TURNING TOOL SET W/CASE	113
FB107	7 PC FORSTNER BIT SET W/CASE	55
FC107	7 PC CARBIDE FORSTNER BIT SET	72
SD306	6" SAFETY DADO WITH CASE	112
SD308	8" SAFETY DADO WITH CASE	116
91-100	13 PC ROUTER BIT SET, 1/2" SHANK	185
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0222-1	3/8" VSR DRILL, 3.5 AMP, 0-1000 RPM	108
0224-1	3/8" VSR DRILL, 4.5 AMP MAGNUM	114
0225-1	SAME AS ABOVE BUT W/KEYLESS CK	114
0228-1	3/8" DRILL, VSR, 3.5 AMP, 0-1000 RPM	102
0230-1	3/8" DRILL, VSR, 3.5 AMP, 0-1700 RPM	114
0375-1	3/8" CLOSE QUARTER DRILL	125
0379-1	1/2" COLSE QUARTER DRILL	143
0395-1	9.6 V CORDLESS DRILL KIT, VSR W/CSE	159
0402-1	12 V CORDLESS VSR DRILL KIT, KYLESS	173
3002-1	ELECTRICIANS RIGHT ANGLE DRILL KIT	202
3102-1	PLUMBERS RIGHT ANGLE DRILL KIT	202
3107-1	1/2" VSR RIGHT ANGLE DRILL KIT	207
3202-1	PLUMBERS RIGHT ANGLE DRILL KIT	202
3300-1	1/2" VSR RIGHT ANGLE DRILL KIT	184
5353	1 1/2" EAGLE ROTARY HAMMER KIT	510
5370-1	1/2" VSR, 2 SPEED HAMMER DRILL	166
5371-1	SAME AS ABOVE BUT W/CASE & BITS	188
5397-1	3/8" VSR HAMMER DRILL W/CSE & BITS	137
5399	"D" HANDLE 1/2" HAMMER DRILL KIT	179
5455	7" POLISHER, 1750 RPM	134
5660	1 1/2 HP ROUTER	182
5680	2 HP ROUTER	199
5925	3" X 24" BELT SANDER WITH DUST BAG	235
5936	4" X 24" BELT SANDER WITH DUST BAG	235
6012	1/3 SHEET FINISHING SANDER	115
6014	1/2 SHEET FINISHING SANDER	120
6016	1/4 SHEET FINISHING SANDER	50
6017	1/4 SHEET FINISHING SANDER W/BAG	55
6140	4 1/2" MINI GRINDER, 5/8-11 SPINDLE	91
6142	4 1/2" MINI GRINDER KIT COMPLETE	112
6170	14" CHOP SAW, 15 AMP	274
6215	16" ELECTRIC CHAIN SAW	173
6256	TOP HANDLE JIG SAW	143
6365	7 1/4" CIRCULAR SAW, 13 AMP	120
6366	6365 WITH FENCE & CARBIDE BLADE	126
6367	SAME AS 6365 BUT DOUBLE INSULATED	117
6368	6365 W/FENCE, CARBIDE BLADE & CASE	137
6377	7 1/4" WORM DRIVE SAW	182
6378	8 1/4" WORM DRIVE SAW	187
6460	10 1/4" CIRCULAR SAW WITH CASE	257
6507	VAR SPEED SAWZALL W/ BLADES & CSE	139
6508	SAME AS 6507 BUT W/PERMANENT CRD	139
6511	2 SPEED SAWZALL W/BLADES & CASE	129
6527	SUPER SAWZALL W/BLADES & CASE	164
6528	SAME AS 6527 BUT W/ PERMANENT CRD	164
6540-1	CORDLESS SCREWDRIVER W/BITS & CS	91
6546-1	2 SPEED CORDLESS SCREWDRIVER KIT	78
6747-1	DRYWALL DRIVER, VSR 0-2500, 5 AMP	101
6749-1	DRYWALL DRIVER, VSR 0-2500, 4.5 AMP	120
6750-1	DRYWALL DRIVER, VSR 0-4000, 5 AMP	91
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8975	2 TEMP. HEAT GUN, 570 & 1000 DEGREE	51
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BT3000	10" TBL SAW W/SLIDNG TABLE W/STAND	$ 589
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1605-02K	BISCUIT JOINTER W/CS, 200 BISC	125	1870	2 1/4 HP PLUNGE ROUTER	159
2736-04	12V CRDLS VSR KYLS W/2 BAT, CS	133	1875	2 1/4 HP EVS PLUNGE ROUTER	174
77	7 1/4" WORM DRIVE CIRC SAW	145	5860	8 1/4" WORM DRIVE CIRC SAW	168
1575	3 3/4" PLANER WITH CASE	119	7484	5" RNDM ORB SANDER, DSTLS	99

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WC106	6 PC WOOD CHISEL SET W/CASE	49	FC107	7 PC CARBIDE FSTNR BIT SET	72
WC110	10 PC WOOD CHISEL SET W/CASE	83	SD308	8" SAFETY DADO W/CASE	116
CS106	6 PC CARVING SET W/CASE	79	91-100	13 PC RTR BIT SET, 1/2" SHNK	185
CS112	12 PC CARVING SET W/CASE	139	94-100	CABINET DOOR SET, 1/2" SHNK	164

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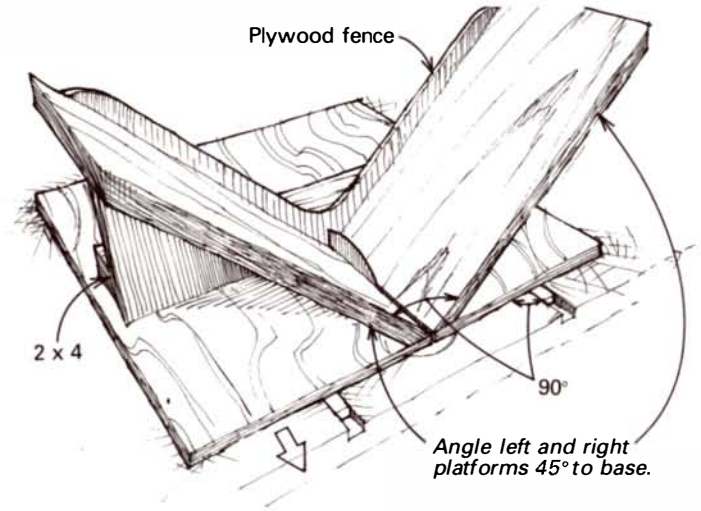
READER SERVICE NO. 124

edited and drawn by Jim Richey

Two-sided miter jig

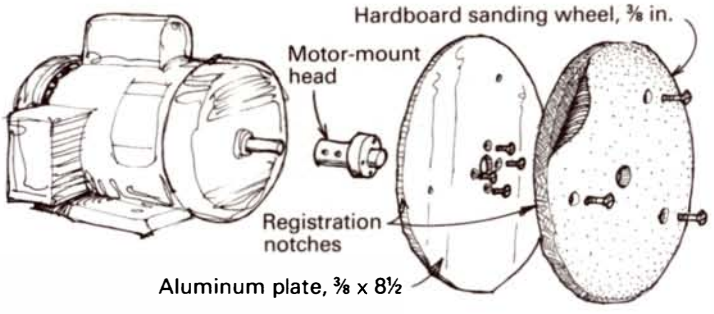


I'd like to thank Ken Wall, whose single-sided vertical miter jig (*FWW* #80, p. 16) inspired this double-sided version. The two-sided jig is even better because its accuracy is permanently established by the slanted platforms mounted 90° from each other, not by the angle between the blade and the jig, which could change. If you cut one of the mitered pieces on the left side of the jig and the other on the right, they're sure to form a 90° angle. The jig has proved excellent for small boxes, frames and most trim work.

To make the jig, start with a 20-in.-sq. plywood base. Attach hardwood runners to the underside to slide in the miter-gauge slots on either side of the blade. Mount the left platform to the base at a 45° angle. Then mount the right platform using a large framing square and shims to place it at a perfect 90° to the left platform. Install fences to the back of both platforms. The fences, along with the extra support of the long platforms (10 in. minimum), provide plenty of stability without having to use quick-action clamps. To keep the jig from being cut in two, leave plenty of room at the back of the base and install a 2x4 behind the fence. The 2x4 not only adds strength but also protects your thumbs from the blade. Make sure the front of the jig is square to the table's miter groove, so you can make 90° cuts against the jig. Using the jig's base like a miter gauge saves a lot of cranking the blade over and back.

—Dave Heffler, Lakeview, N.S., Canada

Quick-change disc sander



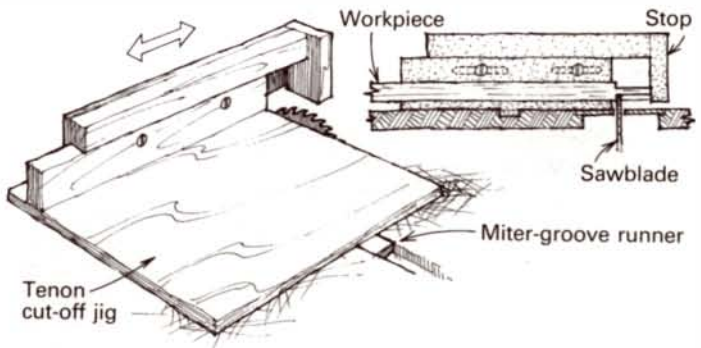
My work with burl boxes, which I hand shape and smooth on a disc sander, requires several progressively finer grit papers. Commercial sanders, aside from being expensive, make the job of changing grits a chore. So a machinist friend and I designed this disc sander with quick-change sanding wheels. My unit cost was about $180, most of which was the motor. There are four parts to the machine: a 1½-HP, 1725-RPM motor, a head that slides onto the motor's shaft, an aluminum support plate and a selection of hardboard sanding wheels—one for each grit I need.

Commission a machinist to turn the head from a single piece of 2½-in.-dia. steel and to turn the ⅜-in.-thick aluminum support plate. Attach the plate to the head with machine screws, and then lock the whole unit onto the motor shaft with setscrews. The nipple on the head should extend through the plate about ⅛ in. or so to align the sanding wheels. Tap three equally spaced sanding-wheel mounting holes near the rim of the plate, and then file a registration notch near one of the screws. For the sanding wheels, use some ⅜-in. tempered hardboard or plywood, and bandsaw blanks about ¼ in. dia. larger than the finished size. Drill a ¾-in.-dia. hole in the center of each wheel to accept the end of the head. From the back side, mark the three mounting holes, and then drill and countersink each hole on the front side.

Attach the sanding wheel to the support plate with flat-head screws, and with the motor running, shape the wheel with a belt sander until the wheel is perfectly round. Be sure to make a mating registration mark on the sanding wheel, so you can reinstall the wheel the same way every time. Mark the positions of the sanding-wheel mounting holes on the back of a sandpaper disc, and then cut screw access holes at these points. Adhere the disc to the wheel so the holes match, and you're ready to mount the sanding wheel on the aluminum plate. I have four wheels, one for each of the four grits I use. Changing wheels takes about a minute.

—Randolf Mateer, Detroit, Mich.

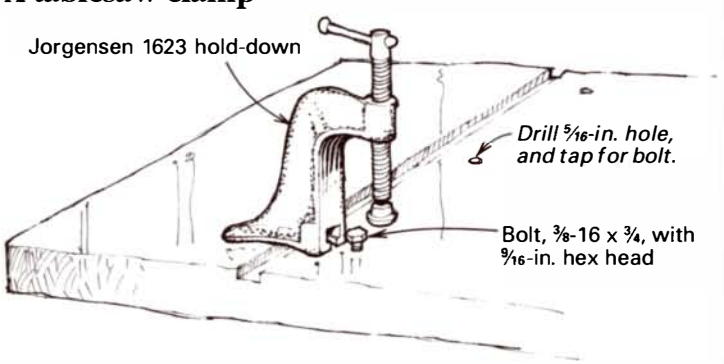
Adjustable stop for cutting tenons



Here is a simple stop-fixture that I use to cut perfect tenon shoulders. The device, which is attached to my cut-off jig, prevents tenon-cheek waste from jamming against the fence, as often happens when using the rip fence as a stop. I just cut the workpiece to the right length, and the stop does the rest.

—John W. Williams, Bellevue, Wash.

A tablesaw clamp



Because space has always been a concern in my small shop, the top of my tablesaw has often served second duty as a workbench. I found that by securing removable Jorgensen model 1623 hold-down clamps to the saw table, I could make the saw into a workbench without affecting its intended use. Four tapped holes in a saw table allow a surprisingly versatile choice

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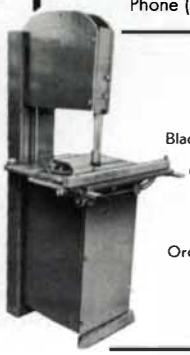

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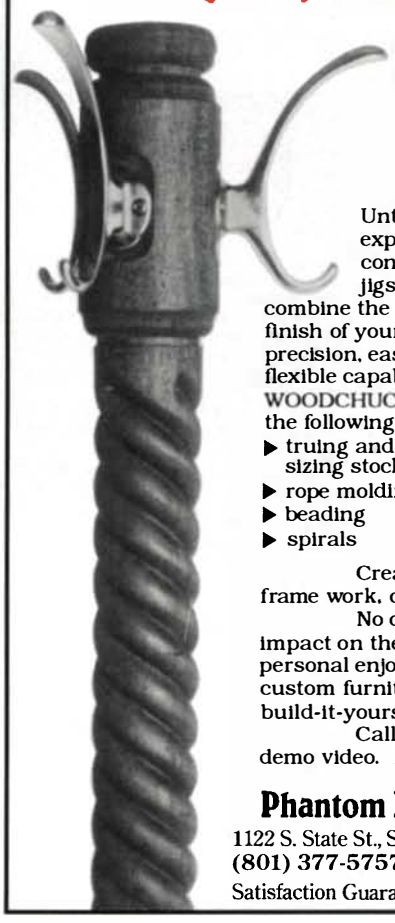

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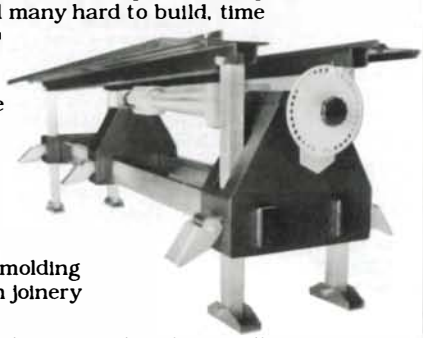

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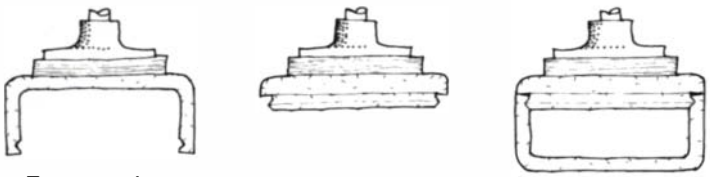
of clamping positions. I also use the holes to bolt a protective piece of plywood to the saw table for chisel work, to attach a router table and to secure featherboards and other tablesaw jigs and fixtures.

When locating the clamp's hole positions, be sure to avoid the cast reinforcing ribs in the table's underside. Center punch each hole location, and then drill with a sharp 5/16-in. bit. When tapping the 3/8-in. bolt threads, rotate the tap a half turn in, then back it out a quarter turn, and so on. This action will break up the chips and keep the tap cutting freely. Don't force the tap, and when you're done, chamfer the hole to keep any sharp edges from scratching your workpieces. Screw a 3/8-in. bolt with a 5/16-in. hex head into the threaded hole. Leave the head of the bolt slightly above the table, so the slot in the clamp can be slid over it. The size of the slot just fits the head on the bolt and thus becomes a sort of wrench for tightening the bolt.

–Steve Acker, Arlington, Texas

Pop-on lid for turned container



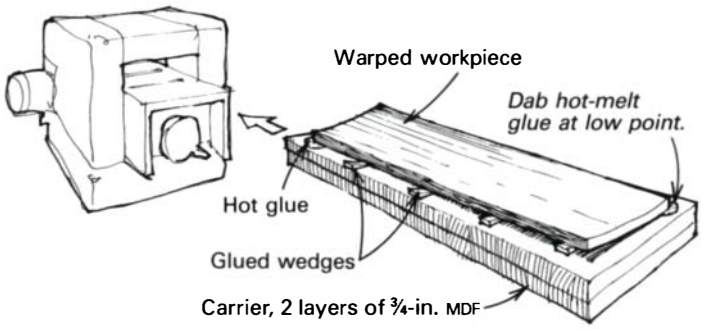
Turn container with groove near top. *Turn lid with V-ridge.* *Sand ridge until lid pops onto groove of container.*

When I was asked to make a turned container with a removable lid that would not come off, I accidentally devised the following system. Mount the workpiece blank with the grain running parallel to the axis of the lathe. This grain orientation will reduce moisture-change distortions. Turn the outside and inside of the container. Before removing the container, put the tool rest into the opening, and cut a slight recess just inside the opening.

Next, mount the container top on the lathe, and turn it with a V-shaped ridge around its bottom. Size the ridge to just start into the bottom's opening. Gently round off the point with sandpaper until the lid will pop into the container. To complete the container, put the two pieces together, and blend their profiles on the lathe. To make a tight joint, I undercut the outer edges. I wax the joining surfaces to ease the lid attachment and cut down on long-term wear.

–J. Harvey Baker, Waynesboro, Tenn.

Salvaging warped scraps



Almost all woodworkers hate to throw away short lengths of twisted or warped wood. But sending these boards through a thickness planer usually doesn't eliminate the problem—the wood only gets thinner. However, by temporarily securing the deformed board to a carrier surface with wedges and hot glue

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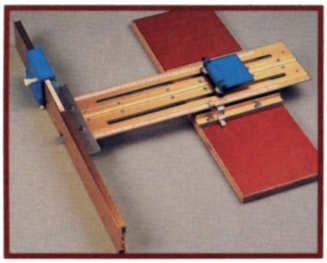

▲ INCRA JIG PRO

The INCRA JIG PRO, shown here with the 28" INCRA PRO Fence System, makes a truly superb fence for the table saw or router table. (INCRA JIG PRO and INCRA PRO Fence System sold separately.)

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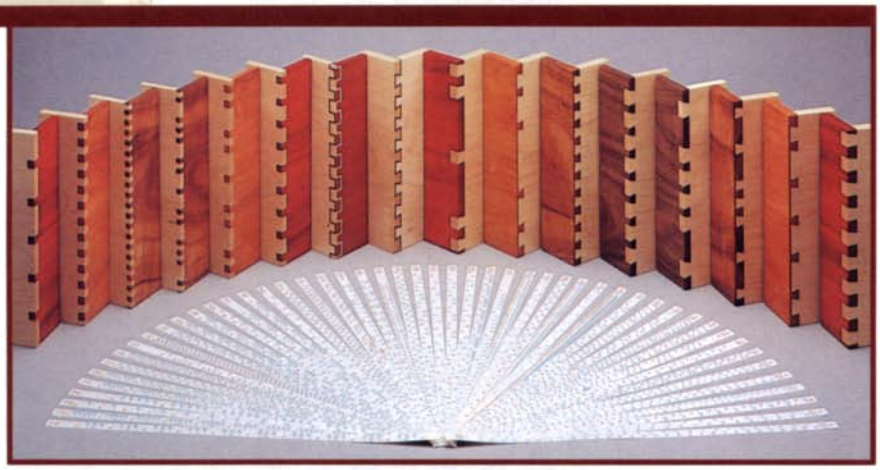

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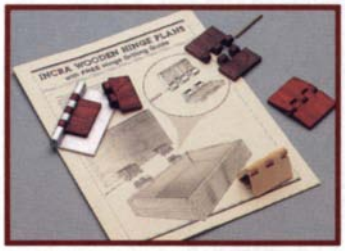
50 genuine 16" long INCRA templates for use with INCRA JIG or INCRA JIG PRO. Includes templates to make all of the joints shown here and much more, plus a complete range of fixed increment templates. Comes with full sized plans for each joint. A great supplement for the INCRA JIG Handbook and Video.



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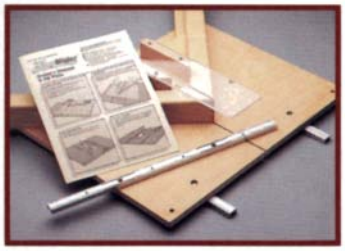

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The INCRA System

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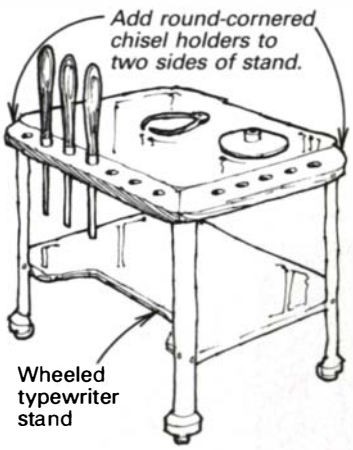
and then sending both carrier and board through the planer, you can rescue the board.

For the carrier, I prefer two ¾-in. layers of glued-up medium density fiberboard (MDF). I mount a warped board to the carrier using 50-cent sized dabs of hot-melt glue at the low corners. Then, every 6 in. or so, I wedge shims under the board and secure them with hot-melt glue. The wedges support the edges of the board and prevent it from rocking while in the planer. After the glue has set, I send the assembly through the planer to flatten the top side. Then I separate the board from the carrier, scrape off the glue residue and plane the other side.

–James R. Myers, Dallas, Texas

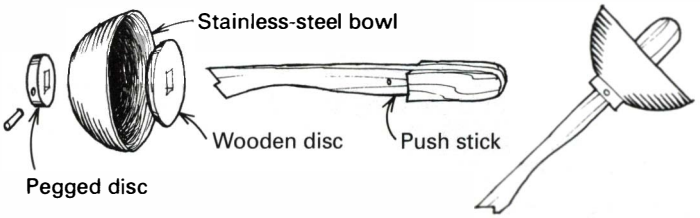
Portable stand for lathe tools



This portable lathe-tool stand is made from an old, wheeled typewriter stand. These stands are easy to come by now that computerized word processors have pushed typewriters out of many offices. Just attach drilled boards on two sides to provide a place to hold your turning chisels. Round the corners of these tool racks to avoid gouging your hips. The stand can be rolled within reach, and its table is ideal for storing faceplates, chucks, gauges and glue. The stand is especially useful for turners like me who work on several lathes in a day. And at the end of the day, the whole thing moves quickly out of the way to speed cleanup. I still have lathe-tool racks attached to the wall, but I've moved them across the shop where they aren't always festooned with shavings and sawdust.

–Stephen H. Blenk, Sequim, Wash.

En garde push stick



I designed a special tablesaw push stick after we experienced a 43-stitch kickback in our shop where we manufacture magic props. The guard protects the fingers and hands, which are most exposed to potential damage during a kickback.

To make the push stick, I started with a stainless-steel custard bowl about 5 in. or so across, and then I added two turned wooden discs, one inside and one outside the bowl. A mortise through the discs accepts a removable push stick, which locks into place with a dowel pin. Yeah, it looks like overkill—but remember, we only have ten fingers.

–Carl Williams, Pasadena, Calif.

Quick tip: While browsing in a bike shop, it struck me that the quick release cams used on the front hubs, handlebars and seats of bicycles would make effective clamps for locking the moving

A CONVERSATION WITH BILL BIESEMEYER...

The President of Biesemeyer Manufacturing responds to the most commonly asked questions regarding their Home Shop T-Square® saw fence system:

Q. What is the difference between the Home Shop system and the industrial system?

A. The Home Shop system does the same job as the industrial system. It allows you to cut just as precisely but it won't stand the punishment given woodworking equipment in the industrial shops. Yet, the all-steel construction makes it the strongest system on the market today.

Q. Will the Home Shop system fit my tablesaw?

A. Yes. The T-Square Home Shop saw fence system will fit any table saw. It is not a requirement for either your dealer or for us to know what make and model you will be using the system on as long as you are using the Home Shop system for home shop projects.

Q. Can I get the Home Shop system in longer cutting capacities?

A. The Home Shop system comes in three different sizes: 28, 40 and 52 inches. Plus, they all have 12 inches of cutting capacity to the left of the blade.

Q. Is the length of the Home Shop fence the same as the industrial model?

A. The industrial fence is 42 inches long, while the Home Shop fence length is 36 inches. The fence is, however, long enough for the smaller home shop table saws. You can install the Home Shop system on any tilting arbor saw as long as it is dedicated to home shop projects.

Q. Does the fence clamp or ride on the back rail?

A. No. The fence locks to the front guide only using a three-point locking system. When the locking handle is lowered, the fence automatically aligns itself exactly parallel to the blade providing an extremely clean cut. And, you can fully depend on the hairline pointer to provide accuracy to the thousandths.

Since there is no back lock, a back table supported by the rear rail can be installed flush to the back of your table saw. This completely eliminates the gap required by other fence systems. The benefits of our three-point lock on the front of the saw provide a distinct advantage over other systems.

Q. Do I need an extension table?

A. Yes. The fence is supported by the front guide *and* the extension table. You are provided with a drawing and complete instructions on how to easily build an extension table. Or, you can purchase one directly from your T-Square dealer. The extension table needs to be made long enough to meet the solid cast iron part of your tablesaw. This will eliminate using extension wings with webbing or depressions. However, we do make a Home Shop system that can be used with wings of that design. But, for good clean cutting, we recommend the use of flat tables.

Q. Does my system need support legs?

A. Yes. On any of the longer systems you must have support at the end of the extension tables. You can easily make wooden legs, or adjustable steel legs can be purchased from your T-Square dealer. If you have your saw on rollers, you can pick your saw up wheelbarrow-style to place it in any desired position.

Q. Does the Home Shop system have the same guarantees as the industrial system?

A. Yes. It carries all of the same guarantees. You can even use it for two weeks, and if you don't like it for any reason, return it for a complete money-back refund...we'll even return your freight charges. And, no matter what dealer you purchase your system from, you must be completely satisfied or Biesemeyer Manufacturing will give you your refund. And if you need anything exchanged or replaced, call us for immediate assistance.

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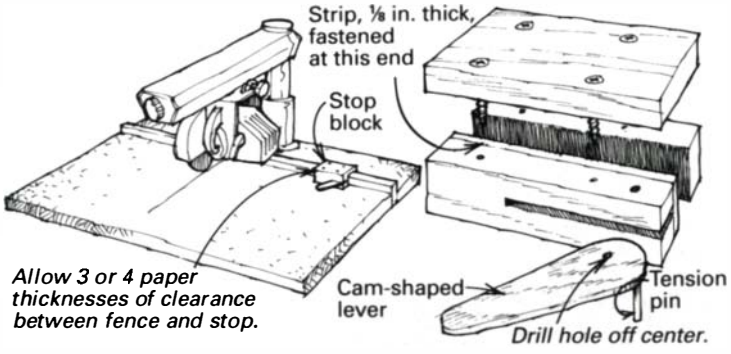
parts of jigs. So I used one of the cams to secure the two parallel sliding surfaces of a tenoning jig. *—Henry Hewitt, Plano, Texas*

Stop for a radial-arm saw fence



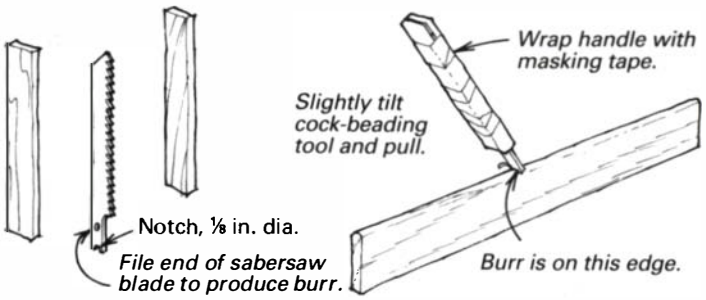
A fence stop for a radial-arm saw should be quick to set, reset and remove. It should be inexpensive to make, immovable when locked and unaffected by packed sawdust. The fence stop illustrated above, which operates on a cam-clamp principle, meets all of these criteria.

To make the stop, I recommend using solid oak or maple. Start by roughing out the top, front and back. Set the dimensions of the fixture so that the front and back ride above the saw table a bit to allow for sawdust. Cut a slot for the cam lever in the front, and then make the ¼-in.-thick cam lever with a 1⅛-in. semicircle on one end tapering to a ⅜-in. semicircle on the other. Drill the cam's pivot hole off center (5/32 in. or so), and install it with a tension pin. Then attach a ⅛-in.-thick face strip (glue and screw a pair of tiny, flat-head screws at one end). The strip should be free along half its length. Secure the front piece to the top using glue and a pair of screws, and place this assembly on the fence. Using three or four sheets of 20 lb. paper to allow clearance, glue and screw the back piece to the assembly. The fixture should slide over the fence smoothly, but grip the fence when the cam is turned. To complete the fixture, trim both ends to 90° using the radial-arm saw.

—John B. Moon, Mount Vernon, Wash.

Quick tip: For starting screws in tight corners and other hard-to-reach locations, attach the screw to the screwdriver blade with a dab of rubber cement.*—Howard E. Moody, Upper Jay, N.Y.*

Scraping cock beads with a sabersaw blade



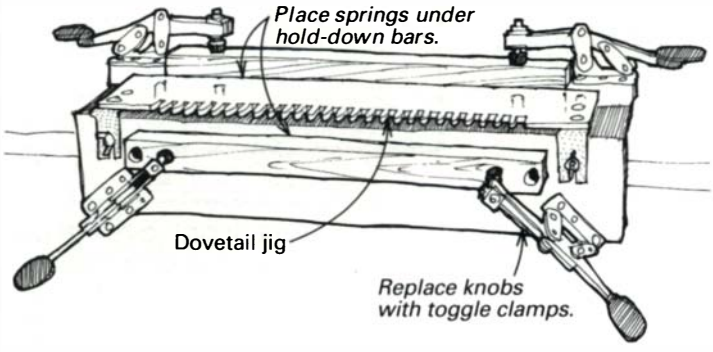
After I had resigned myself to handmaking a scratch stock blade to scrape a rounded profile onto ⅛-in.-thick cock-bead stock, I suddenly realized I already had the perfect scratch-stock blade in my toolbox—a sabersaw blade.

I sandwiched the blade between two thin pieces of wood and wrapped the makeshift handle with masking tape. After sharp-

ening a semicircular notch in the blade with a tapered sharpening slip (or needle file), I ran the tool's notch over the edge of the stock several times, tilting the tool slightly in the direction of movement to let the sharpened edge do the cutting. The result was a perfectly rounded cock-bead molding.

—Richard Glaczier, Gulfport, Miss.

Improved dovetail jig

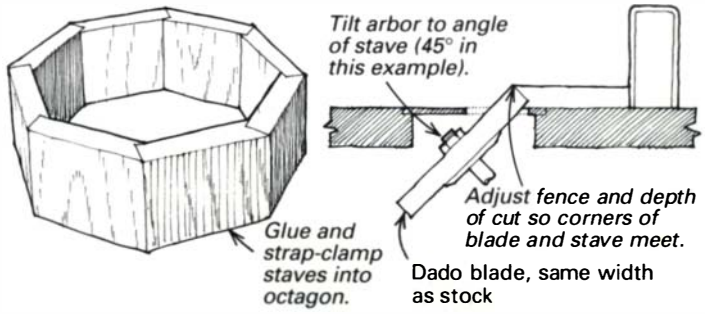


To speed up routing of dovetail joints, replace the screw knobs on your jig with fast-acting toggle clamps. Place springs under the hold-down bars, so they raise when the clamps are released.

—Jon Matthiae, St. Paul, Minn.

Quick tip: So that I could apply more force to my adjustable clamp handles, I slipped tight-fitting rubber automotive hose over the painted handles. To install the hose, I first lubricated the handles with hydraulic brake fluid, and then I tapped them on. *—David W. Carnell, Wilmington, N.C.*

Making a staved cylinder



I picked up this clever technique to produce a staved cylinder from an antique pedestal table I restored in my shop. To make the joint, first cut the staves to their finished length and width. Then install a dado blade the same thickness as the stock in the tablesaw, tilt the arbor to 45°, for example, to produce an octagon, and plow a groove along one edge of each stave. Adjust the depth and fence distance so that the corner of the dado blade meets the corner of the stave, as shown in the drawing above.

When the grooves are completed, glue up the cylinder using strap clamps to apply pressure. Because the joint is self-locking and aligning, assembly is virtually foolproof.

—Colin W. Robertson, Rosemont, N.J.

Methods of Work buys readers' tips, jigs and tricks. Send details, sketches (we'll redraw them) and photos to Methods, Fine Woodworking, *PO Box 5506, Newtown, Conn. 06470-5506. We'll return only those contributions that include an SASE.*

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READER SERVICE NO. 301

What's the best voltage to run a 115v/230v motor?

What is the deal with the dual voltage motors on most stationary tools? If I have both 115v and 230v available, is it better to run the motor on 230v? I can see from the motor's nameplate that the amperage is halved by running it on 230v, but does that mean that the motor will run more efficiently? Do I have more power available with 230v? Will the motor last longer? ***—Tom Albrecht, Wilmette, Ill.***

Ed Cowern replies: It is easy for manufacturers to build capacitor-start motors (installed on most stationary power tools, such as tablesaws, shapers, joiners and drill presses) as dual voltage units. This gives the customer the option of running these motors at either 115v or 230v, and the question of which voltage is better comes up quite often. Perhaps the easiest part of the question to answer is the issue of economy. For any given amount of output (horsepower), it costs the same to run the motor at either voltage.

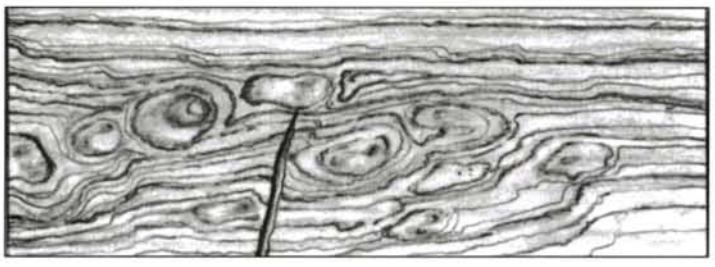
With regard to performance and voltage, there is a small difference. During heavy cutting, the voltage drop in the feed line to the motor is less at 230v, and the motor's performance will be somewhat better than if it were wired for 115v.

Beyond these considerations, choosing motor voltage is a matter of motor size. My rule of thumb is motors ¾ HP and smaller can be easily run on 115v. The convenience of being able to plug these tools into 115v allows more flexibility because the average shop (or converted garage or basement) usually has more standard 115v outlets. Machines with motors of 1½ HP and larger should be run on 230v because the amperage of these larger motors run at 115v is high and calls for larger gauge wire than is normally run residentially. One-HP motors can be wired to run either way, so it comes down to a matter of convenience and individual preference. In the ideal workshop, it's best to have the proper outlets for both 115v and 230v requirements.

[Ed Cowern is an electrical engineer and president of EMS, a company that distributes Baldor electric motors.]

Cracks in a board across the grain

I recently purchased a piece of ¾-in. white oak, with a beautiful burl-like grain, to make a box lid. However, after cutting the piece to size and sanding it, I discovered a very small crack running across the grain (exaggerated in the drawing below) not with the grain as typically occurs. This crack goes almost through the thickness of the board. Please explain this unusual defect. ***—Carl Gore, Oak Park, Mich.***



Bruce Hoadley replies: Without being able to directly examine your piece of white oak, I'll try to offer some possible explanations for the surface failure. Your letter suggests that the wood involves some very irregular grain orientation. Distorted grain will often involve some combination of cross-grain and reaction wood (in oak, this would include tension wood fibers). Either case would result in excessive longitudinal shrinkage or some degree of uneven shrinkage. During the drying process or during subsequent changes in moisture content, this condition could cause stresses that would result in cross breaks in the piece.

Another possibility is mechanical damage when the tree was processed into finished lumber. The felling of large trees can result in tremendous impact stresses in the wood with resulting internal failure to the wood tissue; minute failures caused in felling may not show up until the wood is finished.

Pieces with distorted grain may warp during drying; sometimes minute seasoning checks open along the large rays. If accompanied by extreme cross-grain (spiral grain), a seasoning check could show up as a cross break on a radial surface. You could easily check out this possibility by noting whether the failure seemed to follow the placement of the large visible rays in the wood. Failures may also occur when boards are run through a planer for final surfacing as the feed rolls force the board flat.

[Bruce Hoadley is professor of wood technology at the University of Massachusetts at Amherst and a contributing editor to *FWW*.]

Keeping your safety goggles from fogging up

When I work on power equipment, I wear ear and eye protection. But when I add a dust mask of any kind, both my bifocals and goggles fog up so badly that I can't see a thing. My shop is unheated, and the humidity here in Seattle is high year round, so the problem is constant. Any suggestions or voodoo chants would be appreciated.

—Ray Higgs, Seattle, Wash.

Sandor Nagyszalanczy replies: I find very few things as annoying in woodworking as safety equipment that offers more hindrance than protection. I don't wear eyeglasses, but I've had to contend with fogged goggles. One of the best and simplest solutions I've come up with is anti-fogging spray that's originally designed for ski goggles. I buy it at my local ski shop (it's only open during the winter season, so I stock up then), and spray it on the insides of my goggles. It does a pretty good job, but I usually need to reapply it once or twice a day. Once, in desperation, when I had run out of anti-fogging spray, I donned my ski goggles: Mine are impact-resistant and form a tight seal around my nose to keep out moist, warm breath and offer better side ventilation than many regular woodshop goggles do.

Probably the most effective solution to fogging eyewear is to buy a powered air respirator. These space-age-looking devices completely enclose the face and provide a steady flow of clean air through a flexible hose that's attached to a small box worn either on the belt or like a backpack. The box contains a small fan that pulls air through a filter. Not only does the helmet give a woodworker non-fogging eye protection (the steady flow of air prevents condensation from your breath) but the filtration system protects the wearer from wood dust. Most helmets work just as effectively if the user has a beard or wears eyeglasses. There are several different companies that manufacture and sell powered air respirators including Airstream Dust Helmets (16 Division St. W., Elbow Lake, Minn. 56531; 800-328-1792) who produce the air helmet and Vortec (10125 Carver Road, Cincinnati, Ohio 45242; 800-441-7475). The only real drawbacks to wearing a helmet are convenience—it takes more effort to don or remove one than just flipping up a pair of goggles—and price—typically, powered air respirator systems start around $300 and go up from there.

[Sandor Nagyszalanczy is senior editor of *Fine Woodworking*.]

Using router bits in a shaper

I have a light-duty shaper in my workshop that has a special collet adapter that allows me to use router bits. However, I suspect that the shaper's 10,000-RPM spindle speed is too slow to give a smooth cut. For the smoothest cut, what is the ideal speed for bits of various diameters?

—Lonnie Webber, Concord, Calif.

Mark Duginske replies: You're correct in assuming that your shaper's standard speed is too slow for router bits. Smaller bits

are designed to rotate at approximately 20,000 RPM to 25,000 RPM. Because your shaper's speed is 10,000 RPM, a small router bit is only going about half the speed it was designed for. You could slow down the feed rate of the stock to improve the quality of the cut, but it's probably best to just save these cuts for the router table.

However, slow shaper speed could be an advantage when using larger diameter router bits, such as for panel raising. These bits, which are commonly 2½ in. to 3½ in. dia., are too large to run in most routers. (Remember, the bigger the circumference of the bit, the higher the tip speed of the cutter.) Many woodworkers buy heavy-duty variable-speed routers that can be dialed down as low as 10,000 RPM just to run big bits. This might turn out to be the best use for your special collet adapter and shaper. At any rate, experimentation is very important. You may find that some cutters operate quite well at this speed while other cutters won't. One factor may be the angle of the cutter's flutes. You may find that two cutters have exactly the same circumference, but depending on the angle, you may get quite a different finish. The material that is cut also makes a difference: Cherry burns less at lower speeds, but the finish on pine may not be very smooth at a low speed.

[Mark Duginske is a contributing editor to *Fine Woodworking* and a woodworker, teacher and author living in Wausau, Wis.]

Dating antiques made with plywood

As an antique restorer, I many times face the situation of determining whether or not a piece of furniture is an antique. Sometimes knowing about the materials used in a piece can help me set its age. This leads to two questions: When was plywood introduced to furnituremaking in America and Europe? And what are the earliest times veneers were used in furniture? ***—Gildo Trevino, Matamoros, Mexico***

Bruce Schuettinger replies: As a furniture conservator, I often face the task of trying to figuring out how old a piece is, a task that is even more difficult with objects I know have been reproduced or duplicated. My method of determining an object's authenticity is to use numerous investigative techniques. One such technique is to analyze the method of construction, the type of metal fasteners used, the overall form of the object, any tool marks and the decorative treatment of the object to see if it matches a known period example.

In answer to the first part of your question, it has been my experience that a similar construction to what we know of as plywood was used in Europe and the United States in the 1890s through the Colonial Revival period for such furniture members as drawer parts, tops and backs. This early plywood was either a modified lumber core or consisted of lesser numbers of plys than we are now accustomed to. The first patent for plywood was awarded in America in 1865, and special plywood-making plants were established as early as the 1880s. But Thomas Sheraton, in his 1791 directory, suggested that for light fretwork, the construction should consist of three thin layers of wood with the center's grain running perpendicular to the others. This suggests that the concept of plywood existed long before its actual manufacture. Toward the end of the 19th century, a great deal of study was conducted in mechanical veneer cutting, molding and laminating methods. However, even with this study and improved methods, plywood didn't establish itself as a viable material until World War II.

In answer to the second part of your question, the practice of veneering existed in the time of ancient Egypt and Rome. How-

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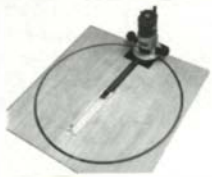

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ever, the art disappeared until the Renaissance in the 16th century. The decorative practice of veneering the entire show surface of a piece of furniture was popularized by the Dutch in the early 17th century followed by the French, Italians, Germans, English and Americans. This veneering practice led to all types of marquetry, parquetry and inlay with numerous materials and styles. The veneer of the 17th and 18th centuries was all cut by hand and thus was much thicker than today's veneer—often as much as 3/16 in. thick.

[Bruce M. Schuettinger is Wooden Artifacts Conservator at the firm of Antique Restorations, Ltd. in New Market, Md.]

Safely spraying water-borne finishes

Due to the numerous environmental concerns at our public schools, we feel the water-borne finishes currently available may help to improve the air quality and safety in our shop-finishing areas. However, before we make the changeover to water-borne finishes, there are a number of questions we have regarding their use. What type of protection should be worn when spraying these finishes? Does the finishing area need a spray booth, and, if so, is there any need or requirement for explosion-proof wiring and sprinkler heads?

—Jeffrey H. Geisel, Parkland School District, Orefield, Pa.

Chris Minick replies: Waterborne finishes are designed to be "safer" for the environment than conventional solvent finishes. But this does not necessarily make them safer for the user. Waterborne finishes are alkaline mixtures (pH 8-8.5) of finishing polymers, solvent, various additives and, of course, water. These finishes can irritate sensitive skin and damage the eyes if not handled correctly. And breathing difficulties may result from inhalation of the mists created during spraying operations. As you can see, waterborne finishes are far from benign.

The same safety precautions afforded solvent-base finishes must also be applied to waterborne finishes. Your students should wear protective eye goggles, a vapor respirator and gloves when working with any finish regardless of the carrier solvent. Additional safety information for your particular finish can be obtained from the product Material Safety Data Sheet (request one from the manufacturer of your finish).

When spraying water-borne finishes, a spray booth is not just a luxury but is a vital piece of safety equipment. This is especially true if your spray equipment is the conventional high-pressure compressed-air type. High-pressure spray equipment in inexperienced hands can contaminate the entire area, including the user, with unwanted finish overspray. A good spray booth is necessary to contain this overspray. The decision to construct the spray booth with explosion-proof wiring and fire protection is really up to your local fire marshal and insurance carrier. Contact both of them for the pertinent regulations in your area. Be aware, though, a spray booth constructed to handle only waterborne finishes cannot be used for solvent-base finishes of any kind.

[Chris Minick is a product development chemist and amateur woodworker in Stillwater, Minn.]

Safe woods for smoking pipes

I am making a number of smoking pipes and plan to use a variety of woods. I am concerned that some might be toxic due to inhalation or lip contact. Can you advise?

—Marc Shapiro, Alexandria, Va.

Jon Arno replies: While I can understand the artistic merits of a one-of-a-kind, handmade pipe, the concept of "safe" woods

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for pipemaking is a bit of an oxymoron. No device that facilitates smoking, no matter how pure the materials it is made of, could be considered safe. With very few exceptions, the wood used to make the pipe will contribute substantially less to the long-term dangers of smoking than the tobacco burned in it. Most woods are far less toxic than is tobacco. Furthermore, smoking tobacco is made from the leaf, and the toxic alkaloids and resins in plants tend to be most plentiful in the foliage, bark and fruit rather than in the wood. Also, as a pipe is used, the wood in the bowl plays a progressively minor role in fueling the combustion. Once the pipe becomes "broken in," the tobacco is burned in what amounts to a crucible of charcoal, which actually helps to absorb some of the harsh and bitter juices released by the tobacco. As a result, over time, the toxins involved in pipe smoking are almost exclusively the product of the tobacco.

This is not to say that all woods are perfectly safe for making pipes. For example, the twigs of oleander, *Nerium oleander,* have proven fatal when used as barbecue skewers and camp kitchen utensils. The smoke given off by burning wood from some members of the cashew family, Anacardiaceæ, such as poison ivy, poison oak and poison sumac, while not usually fatal, has been known to cause severe discomfort. Also, there are numerous tropical woods coming into the market these days that have not been thoroughly tested, and we simply don't know enough about their potentially toxic compounds.

A number of tropical woods that have been on the market for many years, such as rosewood, ebony, teak, iroko and silky oak have proven to contain phenols, volatile oils and other compounds that are toxic, at least to the extent they cause skin irritation and/or respiratory problems. Perhaps as many as several hundred woods fall into this category, but those mentioned are among the worst. A rosewood pipe stem, for example, could prove very unpleasant to some individuals, even if they never lit up. This wood is often used in musical instruments, and there are numerous reports of it causing skin irritation. In the final analysis, while the wood used in pipes usually runs a distant second as a source of toxins to the tobacco some people consume in them, pipemaking is not a field where experimentation is totally free of risk. If smoke a pipe you must, much can be said for a well-shucked corn cob. And by the way, I don't just offer advice on the perils of tobacco, I use it myself.

[Jon Arno is a wood technologist and consultant in Troy, Mich.]

Dealing with stubborn sandpaper discs

I use 3M PSA (pressure-sensitive adhesive) discs on my Porter-Cable random-orbit sander and have found out the hard way that a disc left on the tool is very difficult to remove. I've also found that if new discs aren't used soon after purchase, they just don't stick well or stay on the sanding pad. Should the discs be stored in a sealed plastic bag until use? Must discs be removed after every use? —Peter J. Sapienza, Big Bend, Wis.

Chris Minick replies: PSA sandpaper is a great invention, it makes sanding a lot easier but does have some problems. Sometimes the adhesive sticks when you don't want it to stick and doesn't when you do. Both problems can be very irritating, but fortunately, they are easily avoided if you know a few basic tricks. The biggest problem with PSA sandpaper is its tendency to stick aggressively to the sanding pad and refuse to come off. Fortunately, a stubborn disc can be easily removed: Just sand with it on some scrapwood for a few minutes. The heat generated during sanding softens the adhesive layer and the spent

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sandpaper can then be removed cleanly. It's best to avoid the problem altogether by removing the used sandpaper before the sanding pad cools down. If you want to keep the used sandpaper, stick it to a sheet of clean waxed paper. The waxed paper prevents contamination on the adhesive layer, and the sandpaper can be reused.

Dust contamination is another common problem. The adhesive layer easily picks up dust and dirt and then refuses to stick to the sanding pad. Keeping your unused discs in their original package or in a plastic bag will go a long way to prevent this problem. The sander's pad should be free from dust, too. Wipe it with a lint-free cloth before each use. Stubborn dirt and adhesive residue can be removed by wiping the pad with a rag dampened with mineral spirits. Be sure not to saturate the sanding pad with solvent because this can cause other problems and may void your tool's warrantee.

PSA sanding discs are designed to stick best at room temperature. When the temperature is low, about 50°F or colder, the adhesive layer loses some of its tack. As a result, the sandpaper just won't stick to the sanding pad and flies off as the tool speeds up. If your shop is unheated, store the discs at home or in a heated space during cold weather. Make sure the sanding pad is warm before mounting a disc; even warm PSA sandpaper won't stick to a cold pad.

[Chris Minick is a product development chemist and amateur woodworker in Stillwater, Minn.]

Evening up color variations in cherry

While building a library from solid cherry and cherry veneer, I've acquired material from several sources that shows variations in color from light pink to deep red-brown. I wonder if there are fuming or dying techniques I can use to achieve a uniformity of color as well as that deep red-brown color typical of aged cherry wood. ***—Andrew Pate, Greenwich, N.Y.***

Christian Becksvoort replies: It's the age-old dilemma of the diversity of a natural material vs. our expectations of conformity. Cherry can be fumed with ammonia, stained, dyed, exposed to U.V. lamps or treated with lye. All of these processes will darken cherry's color to some degree, creating the appearance of age. The major problem is that each of these treatments is progressive, in other words, light pieces will darken, but the dark pieces will also progressively darken. Ideally, each piece should be individually treated or hand toned. Even then the heavily treated pieces will look different from the untreated pieces even if you use the best of aniline dyes. The shade may be similar, but the tone will not.

My suggestion would be to hand-match individual boards for their color when gluing up panels and frames. Use paint thinner on freshly planed lumber to help you see and evaluate exactly what color the finished wood will be. Sapwood should be eliminated because it only compounds the problem. Once the matching is done and the panels are glued up, use only panels of similar color adjacent to each other. Correct matching can do more to eliminate the butcher-block look than anything that comes out of a can.

[Christian Becksvoort, a professional furnituremaker in New Gloucester, Maine, is a contributing editor to *FWW*.]

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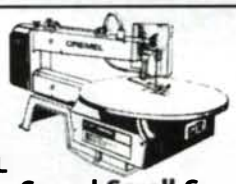

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1993 Woodworking & Construction Catalog

48 pages of high quality tools for jobsite, home, fine woodworking, or shop use. The best selection and the best prices available. Please send $1.00 for postage and handling.

PORTER-CABLE

NEW Quicksand Random Orbit Finishing Sanders

These new sanders put random orbit efficiency in the palm of your hand and will set new performance standards for finish sanders. Available either with standard pad which uses PSA paper, or in a dustless version which uses hook & loop paper.

#332 Random Orbit Sander **$68.**

#333 Dustless Random Orbit Sander **$78.**

NEW 10" Miter Saw With Laser Line-Of-Cut Indicator

A glowing red laser line shows exactly where the kerf of cut is going to be, reducing set-up time to seconds, increasing the accuracy of the cut, and reducing the amount of spoiled work---saving time and money. Quiet belt drive operation, electric brake, large cutting capacity, and 13 amp motor ensure premium performance. #7700, List ~~$634~~.

Introductory Sale $395.

Makita

WHILE SUPPLIES LAST!
CORDLESS DRILL KITS WITH FREE EXTRA BATTERY PACK

VSR Cordless Driver/Drill With Keyless Chuck

Our most popular 9.6 volt cordless drill. While supplies last, a free extra battery is included in this kit. #6095DWE

$149.

NEW!

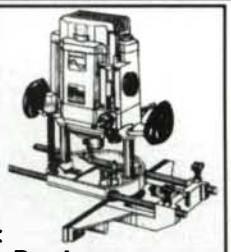
High Torque Cordless Drill With Improved Keyless Chuck

Improved motor construction gives this 9.6 volt drill 174 in./lbs. of torque while the new keyless chuck features positive lock which helps eliminate loosening or overtightening of bits. While supplies last, a second battery is included free of charge. #6201DW, List ~~$298.~~

Introductory Sale $169.

Free Freight On All Portable Tools *in Contiguous USA*

Elu WOODWORKING TOOLS BY BLACK&DECKER

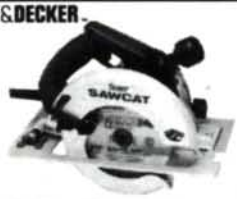


2-1/4 HP Electronic VS Plunge Router

One of the finest routers available. Features: full-wave electronic speed control which is infinitely variable from 8000 to 20000 RPM and is maintained constantly under load by electronic feedback circuitry; soft start; rack and pinion depth adjustor, micro-adjustor and easy to read magnified scale; 12 amp] motor. #3338, List ~~$475~~.

Sale $299.

BLACK&DECKER



7-1/4" Super Sawcat Circular Saw

This circular saw is designed with the professional in mind. Unique depth adjustment system allows change from maximum to minimum depth of cut while barely moving gripping hand or handle orientation. Other features include: 13 amp motor; electric brake; 50o bevel capacity; parallel shoe adjustment; carbide blade. #2694,

List ~~$258.~~

HOLIDAY SALE 137.

WEDGE INNOVATIONS

24" Pro Smart Level With FREE Case

Smart Level's sensor module measures level, plumb, or any other angle through 360°, Also calculates degree of slope, grade, and pitch with the push of a button. #SMPR24-201 **Sale $89.**

Other Smart Levels:

SL209	Series 200, 9"	$44.
SL224	Series 200, 24"	$54.
SL248	Series 200, 48"	$64.

SKIL

10" BENCHTOP TABLESAW

This powerful and lightweight saw is perfect for jobsite or home shop use. Features include: Accu-Lign self-aligning fence; 13.0 amp motor; die cast aluminum table; and ABS base for strength and durability. #3400, List ~~$249.99~~

Sale $189.

Record

Quick Release Speed Clamps

Fast acting, heavy duty thick steel bar clamps feature a drop handle for extra leverage and a swivel shoe for positive location on uneven surfaces. All sizes have 4-3/4" throats.

Opening

Capacity		List	Ea.	6 Pk
132/300	12"	~~24.97~~	16.65	89.
132/400	16"	~~25.60~~	16.95	92.
132/500	20"	~~27.56~~	18.35	99.
132/600	24"	~~29.47~~	19.65	106.
132/800	32"	~~32.05~~	21.35	115.

Record

Blue Chip Bevel Edge Chisel Set

This six piece set features hard wearing polypropylene handles, quality Sheffield steel blades, and a wooden storage box. Includes: 1/4",3/8",1/2",5/8",3/4", & 1" sizes. #444586

An Exceptional Value At This Price! **44.**

Record

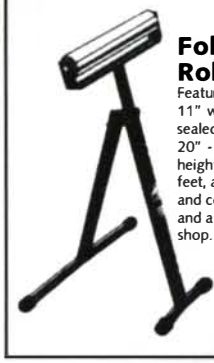
Professional Woodworking Vises

Three sizes available, all with a quick release mechanism that allows the front jaw to slide quickly and easily to and from the workpiece.

	Size	Sale
#52ED	7" (With Retractable Dog)	79.
#52-1/2ED	9' (With Retractable Dog)	105.
#53E	10-1/2" (Without Dog)	115.

FREE 16" Speed Clamp Included With Every Vise Purchase! (offer expires 12/31/92)

Record



Folding Roller Stand

Features a 2" diameter x 11" wide steel roller with sealed-for-life bearings, 20" - 40" adjustable height, non-slip rubber feet, and legs that pivot and collapse. Stable, rigid and a must for every shop. #RPR400S

SALE 37.95

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READER SERVICE NO. 110

HOLIDAY SALE

FREE FREIGHT ON ALL PORTABLE TOOLS IN CONTIGUOUS USA

Elu / BLACK & DECKER

1/4 Sheet Dustless Palm Grip Sander

High speed (14500 OPM) and small orbit (1/16"), plus a durable, low vibration design adds up to long hours of production sanding that is fast and smooth. #2714, List ~~$94~~.

Sale 59.

NEW! PORTER+CABLE

Pocket Cutter

This new portable tool eliminates the need for drilling fixtures or costly stationary pocket cutters. Unique design enables pocket and screw hole to be perfectly parallel to front face of material, eliminating problems of screw torque mis-aligning pieces being joined, or of screw tip "breaking through' front face of piece. #550

INTRODUCTORY SALE 209.

SKIL

3-3/4" Professional Plane

Powerful 7.0 amp motor will allow you to remove up to a full 1/16" depth of cut, or a rabbet cut up to 7/8". Comes with reversible carbide blades. #1575, List $188.

Holiday Sale 115.

BLACK & DECKER

3/8" Super Cyclone Dual-Range VSR 12v Drill/Driver Kit

Deluxe features include: 11-position Versa-Clutch; pressure activated clutch; ClutchLock, which allows changing from screwdriving to drilling without changing clutch setting; and fan cooled, 140 watt high torque motor. #2665K, List ~~$284~~.

Sale 169.

#98050 12v Battery Pack Reg. ~~$54.95~~ **Sale 29.**

Elu / BLACK & DECKER

Jointer/Spliner

Designed to not only perform plate joinery work, but can also be used for grooving, scribing or for trimming and cutting material to size. #3380, List ~~$470~~.

Sale 289.

PORTER+CABLE

24" Omnijig Dovetail Machine

Designed for rapid production routing-out of half-blind and other dovetail joints for furniture and woodworking applications. The unit accepts stock up to 24" wide and from 1/2" to 1" thick. #7116.

Introductory Sale 299.

RACK MANUFACTURING NEW! Outfeed Roller Table

Designed for job-site table saws, this ball bearing roller table with adjustable support leg mounts quickly and easily and supports material to 48" from center of blade. Fits Makita, Delta, Ryobi, and Skil models. (Please specify). #RX4B

99.

BOSCH

3050V5RK	3/8" Cordless Driver/Drill, 2 bat.	$139.
3051V5RK	Cordless Driver/Drill w/keyless chuck	$149.
1000V5R	3/8" VSR Drill, 0-2100 RPM	$79.
1021V5R	3/8" H.D. VSR Drill, 0-1100 RPM	$99.
1194VSR	1/2" VSR Hammer Drill	$159.
1347A	4-1/2" Mini Grinder, 5/8"-#11 spindle	$95.
1348AE	5" EFC Mini Grinder, 5/8" -#11 spindle	$118.
11212VSR	3/4" VSR SDS Bulldog Rotary Hammer	$195.
11214VS	1-3/4" EFC VS Rotary Hammer	$629.
11215DVSR	3/4" Dustless Bulldog VSR SDS Hammer	$299.
11304	Brute Breaker Hammer	$1229.
11305	Demolition Hammer	$689.
3258	3-1/4" Planer	$137.
1942	Heavy Duty Heat Gun	$72.
1604	1-3/4 HP Router	$135.
1604K	1-3/4 HP Router Kit	$165.
1606	1-3/4 HP D-Handle Router	$159.
1608LX	Laminate Trimmer w/Deluxe Guide	$109.
1608T	Tilt Base Laminate Trimmer	$105.
1609	Offset Base Laminate Trimmer	$125.
1609K	Installers Trimmer Kit	$179.
1609KX	Deluxe Installers Trimmer Kit	$229.
1615EVS	NEW! 3-1/4 HP EFC VS Plunge Router	$265.
1272D	3"x24" Dustless Belt Sander	$179.
1273D	4"x24" Dustless Belt Sander	$188.
1273DVS	4"x24" VS Dustless Belt Sander	$219.
1370DEV5	6" VS Random Orbit Sander w/Access.	$299.
3270D	3"x21" Dustless Belt Sander	$145.
3283DVS	5" Dustless Random Orbit Sander	$105.
1581DVS	VS, Var. Orbit Jigsaw, Dustless	$189.
1581VS	VS, Var.Orbit Jigsaw. D-Handle	$145.
1582VS	VS, Var.Orbit Jigsaw w/CLIC	$145.
1632VSK	VS Panther Recip. Saw Kit	$145.
1654	7-1/4" Circular Saw	$118.
1420VSR	VSR Drywall Driver, 0-4000 RPM	$85.

DELTA

UNISAW, SHAPER, JOINTER & FINISHING MACHINE SALE!

34-761	10", 1-1/2 HP Unisaw	*$1149.
34-763	10", 3 HP Unisaw, 1 PH	*$1369.
34-764	10", 5 HP Unisaw, 3 PH	*$1369.
34-781	10", 1-1/2 HP Unisaw/Unifence	*$1329.
34-782	10", 3 HP Unisaw/Unifence, 1 PH	*$1549.
34-783	10", 5 HP Unisaw/Unifence, 3 PH	*$1549.
31-730A	6" Belt/12" Disc w/Electricals	*$939.
37-350A	8" Long Bed Jointer w/Electricals	*$1275.
43-375	3 HP HD Two-Speed Shaper	*$1459.

(Prices include $100. mfg. mail-in rebate, good thru 3/31/93)

CONTRACTOR SAW, BANDSAW & JOINTER SALE!

28-283	14" Bandsaw w/Encl. Stand, 3/4 HP	*$639.
34-445	10" Contractor's Saw w/Unifence	*$699.
37-154	6" Long Bed Jointer w/Electricals	*$989.

(Prices include $50. mfg. mail-in rebate, good thru 3/31/93)

11-090	32" Radial Bench Drill Press	*$279.
11-950	8" Bench Drill Press	*$145.
11-990	12" Bench Drill Press	*$209.
14-600	Hollow Chisel Mortiser	*$469.
17-900	16-1/2" Drill Press	*$339.
22-540	12" Portable Planer	$399.
22-661	13" DC-33 Planer	*$1089.
23-700	Wet/Dry Grinder	$159.
28-245	14" Bandsaw w/stand, 1/2 HP Motor	*$529.
31-460	4" Belt/6" Disc Finishing Machine	$145.
32-100	Plate Joiner	$265.
33-055	Deluxe Sawbuck w/Legs	$589.
33-990	10" Radial Arm Saw	*$549.
34-444	10" Contractors Saw, 1-1/2 HP	$615.
36-220	10" Compound Miter Saw	$238.
36-755	10", 2 HP Tilting Arbor Saw	*$840.
40-560	16", 2-spd Scroll Saw	$195.
40-640	20" Bench Scroll Saw	$325.
43-355	1-1/2 HP, 3/4" Shaper	*$655.
43-505	1/2" Bench Router/Shaper	$279.
46-700	12" VS Wood Lathe	$419.
50-179	Dust Collector	*$329.

Call For Quotes On Machines Not Listed

MILWAUKEE

0402-1	VSR 12v Driver/Drill w/Keyless Chuck	169.
6539-1	Cordless Screwdriver	75.
6546-1	Cordless Screwdriver, 2-spd	79.
0222-1	3/8" VSR Drill, 0-1000 RPM	108.
0224-1	3/8" Magnum Holeshooter, 0-1200 RPM	115.
0230-1	3/8" Pistol Drill, 0-1700 RPM	112.
0234-1	1/2" Magnum Holeshooter, 0-850 RPM	119.
0238-1	1/2" Pistol, 0-650 RPM	119.
0239-1	VSR Keyless Chuck Drill	125.
0244-1	1/2" Magnum Holeshooter, 0-600 RPM	119.
0375-1	3/8" Close Quarter Drill	129.
0379-1	1/2" Close Quarter Drill	149.
0567-1	Drain Cleaner Kit	235.
1676-1	Hole Hawg Kit	245.
3002-1	Electricians Rt. Angle Drill Kit	195.
3102-1	Plumbers Rt. Angle Drill Kit	195.
3107-1	VS Right Angle Drill Kit	199.
5371-1	1/2" Rev. Hammerdrill Kit	185.
5397-1	3/8" VS Hammerdrill Kit	139.
5192	Die Grinder, 4.5 Amp	175.
5455	7"/9" Polisher, 1750 RPM	140.
6072	9" Sander, 5000 RPM	130.
6140	4-1/2" Angle Grinder	99.
6141	5" Angle Grinder	109.
5352	1-1/2" TSC Eagle Rotary Hammer	455.
5362-1	1" TSCR Hawk Rotary Hammer	319.
8975	Heat Gun	59.
5680	2 HP Router	219.
5925	3"x24" Dustless Belt Sander	238.
5936	4"x24" Dustless Belt Sander	228.
6012	1/3 Sheet Finishing Sander	116.
6014	1/2 Sheet Finishing Sander	119.
6016	1/4 Sheet Finishing Sander	52.
6126	6" Random Orbit Sander	129.
6215	16" Electric Chainsaw	174.
6365	7-1/4" Circular Saw	120.
6377	7-1/4" Wormdrive Saw	175.
6460	10-1/4" Circular Saw	259.
6507	VS Sawzall w/Quik-Lok	132.
6508	VS Sawzall	132.
6511	2-spd Sawzall	129.
6527	VS Super Sawzall w/Quik-Lok	175.
6528	VS Super Sawzall	169.
6750-1	VSR Drywall Driver	94.
6754-1	VSR Magnum Drywall	119.
6798-1	TEK Screwdriver	109.
8911	9 Gal. Wet/Dry Vac, H.D. Steel	329.

FREUD

LM72M008	8"x24T Rip	$35.
LM72M010	10"x24T Rip	$37.
LU73M010	10"x60T ATB	$45.
LU81M010	10"x40TTCG	$39.
LU84M008	8"x40T Combination	$44.
LU84M011	10"x50T Combination	$39.
LU85M008	8"x64T ATB Fine Cut Off	$49.
LU85M010	10"x80T ATB Fine Cut Off	$58.
LU85M014	14"x10BT ATB Fine Cut Off	$105.
LU85M015	15"x10BT ATB Fine Cut Off	$105.
LU87M008	8"x22T Thin Kerf	$42.
LU87M010	10"x24T Thin Kerf	$39.
LU88M008	8"x48T Thin Kerf	$47.
LU88M010	10"x60T Thin Kerf	$45.
LU91M008	8-1/2"x48T Miter Saw Blade	$42.
LU91M010	10"x60T Miter Saw Blade	$49.
LU98M010	10"x80TTCG	$68.
TK103	7-1/4"x16T Decking Blade	$13.
TK203	7-1/4"x24T Framing Blade	$16.
TK204	8-1/4" x24T Framing Blade	$23.
TK303	7-1/4"x40T Finish Blade	$23.
TK304	8-1/4"x40T Finish Blade	$24.
TK406	10"x60T Cut Off Blade	$35.
TK906	10"x50T Combination Blade	$32.
SD308	8" Dado Set	$117.

JET

JJ-6CS	6" Long Bed Jointer	$419.
DC-610	1 HP Dust Collector	$224.
J8S-14CS	14" Bandsaw, 1 HP	$399.
JCS10A	10" Tilting Arbor Saw, 2 HP	$895.
JDP-17MF	16-1/2" Floor Drill Press	$379.

BLACK & DECKER

1166	3/8" VSR Drill, 4.0 amp	65.
2750	4-1/2" Angle Grinder	83.
5053K	Spitfire Rotary Hammer w/Univ Chuck	219.
2700	7-1/4" Wormdrive Saw	149.
79-034	Workmate 400	105.

AEG

HBSE7SS	3"x21" VS Belt Sander	$169.
VSRE500K	5" VS Random Orbit Sander Kit	$149.
VSRE600K	6" VS Random Orbit Sander Kit	$155.
BSPE100K	VS, Var.Orbit Jigsaw Kit	$159.
OF550	1 HP Plunge Router	$169.
V2.5WD	16 Gal. Wet/Dry Vac	$159.

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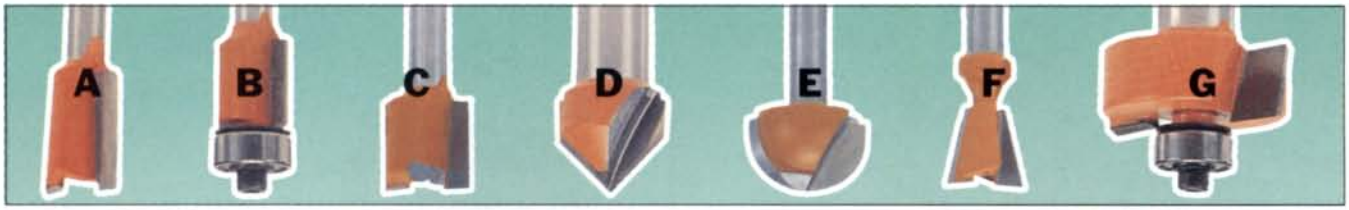
READER SERVICE NO. 110

At CMT Only Our Service Exceeds Our Quality

What is CMT quality? It's baked-on Teflon , anti-kickback design, Fatigue-Proof Steel & mirror-finish micrograin carbide
What is CMT service? It's a courteous, knowledgeable staff, fast shipping & delivery and the industry's best warranty!



A. Carbide Mortising Bits

ITEM #	SHANK	DIA.	CUT LGTH.	PRICE
801-127	1/4"	1/2"	3/4"	$10.70
801-127B	As above with top bearing			$17.90
801-158	1/4"	5/8"	3/4"	$16.60
801-158B	As above with top bearing			$22.30
801-627	1/2"	1/2"	3/4"	$14.30
801-817	1/2"	1-1/4"	1/2"	$20.90
801-817B	As above with top bearing			$27.20

Many more sizes available, call 1-800-531-5559

B. Carbide Flush Trim

ITEM #	SHANK	DIA.	CUT LGTH...	PRICE
806-095	1/4"	3/8"	1"	$16.40
806-096	1/4"	3/8"	1/2"	$16.00
806-127	1/4"	1/2"	1"	$16.40
806-128	1/4"	1/2"	1/2"	$14.20
806-627	1/2"	1/2"	1"	$16.10
806-628	1/2"	1/2"	1/2"	$17.40
806-629	1/2"	1/2"	1-1/2"	$18.40
806-630	1/2"	1/2"	2"	$25.50

C. Carbide Straight Bits

ITEM #	SHANK	DIA.	CUT LGTH..	PRICE
811-064	1/4"	1/4"	3/4"	$14.80
811-081	1/4"	5/16"	1"	$12.30
811-096	1/4"	3/8"	1"	$12.30
811-127	1/4"	1/2"	3/4"	$14.40
811-158	1/4"	5/8"	3/4"	$15.40
811-191	1/4"	3/4"	3/4"	$14.20
811-564	1/2"	1/4"	3/4"	$15.30
811-595	1/2"	3/8"	1"	$14.20
811-628	1/2"	1/2"	1"	$15.20
811-660	1/2"	5/8"	1"	$18.40
812-690	1/2"	3/4"	1-1/2"	$21.40

Many more sizes available, call 1-800-531-5559

D. Carbide V-Groove Bits

ITEM #	SHANK	DIA.	CUT LGTH.	PRICE
815-064	1/4"	1/4"	5/16"	$17.40
815-127	1/4"	1/2"	1/2"	$20.50
815-660	1/2"	5/8"	1/2"	$23.40
815-690	1/2"	3/4"	5/8"	$23.00

E. Carbide Round Nose Bits

ITEM #	SHANK	DIA.	CUT LGTH. ...	PRICE
814-032	1/4"	1/8"	3/8"	$17.80
814-064	1/4"	1/4"	1/2"	$14.30
814-095	1/4"	3/8"	1/4"	$20.40
814-127	1/4"	1/2"	3/8"	$22.40

Many more available, call 1-800-531-5559

F. Carbide Dovetail Bits

ITEM #	SHANK	DIA.	LGTH.	ANGLE..	PRICE
818-128	1/4"	1/2"	1/2"	14º	$16.90
818-628	1/2"	1/2"	1/2"	14º	$19.10

Many more available, call 1-800-531-5559

G. Carbide Rabbeting Bits

ITEM #	SHNK	DIA.	DEPTH ...	LGTH..	PRICE
835-317	1/4"	1-1/4"	3/8"	1/2"	$20.90
835-350	1/4"	1-3/8"	1/2"	1/2"	$23.00
835-817	1/2"	1-1/4"	3/8"	1/2"	$26.90
835-850	1/2"	1-3/8"	1/2"	1/2"	$29.60

H. Carbide Cove Bits

ITEM #	SHANK	HEIGHT	RADIUS	PRICE
837-222	1/4"	1/2"	1/4"	$26.00
837-286	1/4"	1/2"	3/8"	$26.10
837-350	1/4"	5/8"	1/2"	$26.20
837-722	1/2"	1/2"	1/4"	$27.40
837-850	1/2"	5/8"	1/2"	$29.60

Many more sizes available, call 1-800-531-5559

I. Carbide Roundover Bits

ITEM #	SHANK	HEIGHT	RADIUS	PRICE
838-254	1/4"	1/2"	1/4".	$24.30
838-317	1/4"	9/16"	3/8"	$24.70
838-380	1/4'	3/4"	1/2"	$27.90
838-754	1/2"	1/2"	1/4"	$24.30
838-880	1/2"	3/4"	1/2"	$34.90

Many more sizes available, call 1-800-531-5559

J. Carbide Chamfer Bits

ITEM #	SHANK ..	DIA.	HGHT.	ANG.	PRICE
836-130	1/4"	9/16"	1/2"	15º	$21.50
836-190	1/4"	3/4"	1/2"	25º	$21.50
836-420	1/4"	1-5/8"	3/4"	45º	$27.70
836-920	1/2"	1-5/8"	3/4"	45º	$26.90

K. Carbide Roman Ogee Bits

ITEM #	SHANK	LGTH.	RADIUS	PRICE
840-270	1/4"	1/2"	5/32"	$28.40
840-350	1/4"	3/4"	1/4"	$31.50
840-770	1/2"	1/2"	5/32"	$30.30
840-850	1/2"	3/4"	1/4"	$31.10

L. Carbide Slot Cutter Assemblies

Cutters have 1-7/8" diameter and a 7/8" ball bearing. Depth of cut 1/2". Choose 1/4" or 1/2" arbor.

ITEM 1/4" ARBOR		ITEM 1/2" ARBOR		CUT HT.
822-316A	$23.10	822-316B	$25.90	1/16"
822-320A	$23.10	822-320B	$25.90	5/64"
822-324A	$23.10	822-324B	$25.90	3/32"
822-332A	$23.10	822-332B	$25.90	1/8"
822-340A*	$23.10	822-340B*	$25.90	5/32"
822-348A	$23.10	822-348B	$25.90	3/16"
822-360A	$23.10	822-360B	$25.90	15/64"
822-364A	$23.10	822-364B	$25.90	1/4"

*Cuts slot for biscuits

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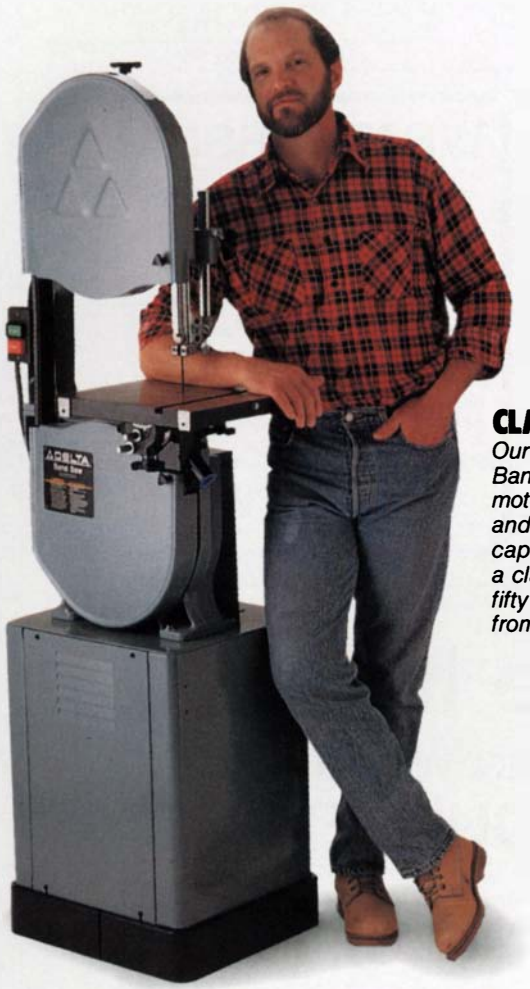

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READER SERVICE NO. 14

Big Plunge Routers

Look for comfortable controls, smooth action and sturdy bearings

by Robert M. Vaughan

Mortising or cutting into the middle of a panel is inconvenient at best or even risky with a conventional router—lifting the base off the work while the bit's whirring away just isn't a good idea. The plunge router, a handy device that allows the user to safely and precisely lower a spinning bit anywhere along a workpiece, was invented decades ago. But early models were heavy, expensive machines, intended primarily for commercial applications. By instituting the plunge feature on the already-popular portable router, manufacturers created a tool that can do all the jobs a regular router can plus cut clean mortises, make stopped cuts and template-guided cutouts.

Due to their popularity, there are dozens of plunge routers currently on the market, too many to include in an in-depth evaluation. Instead, this article will examine just the larger plunge routers with power ratings of at least 1½ HP (about 10 amps), capable of taking ½-in. shank bits—nearly two dozen units, most of which are shown in the photos running along the bottom of this and the facing page. The specifications and features of all of the routers are summarized in the chart on p. 49. The chart also includes data on the Sears Craftsman 27505 and 27506 that should be on the market by the time you read this, but weren't available in time for this review.

Plunge router anatomy

All the models for this article have the same fundamental design. The router's motor assembly is housed in a carriage that rides on a pair of steel guide posts fixed to the base. Handles on the carriage allow the user to plunge the motor-driven bit into the workpiece. One or two springs return the carriage to the top of the stroke after plunging. A plunge lock lever allows the carriage to be fixed at the desired depth after plunging. A stop rod and scale and pointer mechanism allow plunge depth to be precisely set, and a

***The plethora of plunge routers** evaluated in this article include the models below (clockwise from bottom right): Freud FT2000 E, Hitachi M 12V, Elu 3338, Bosch 1615EVS, Bosch 1613EVS, Hitachi TR-12 and Makita 3612BR. On the opposite page (clockwise from bottom right): Porter-Cable 693, Porter-Cable 7539, Ryobi RE-600, Sears Craftsman 27504, Ryobi R-501, Ryobi R-500 and Skil 1875.*

Photos: Sandor Nagyszalanczy

depth-stop turret provides quick and easy changes in cutting depth. The motors on some models are controlled by a sophisticated electronics package called EVS (electronic variable speed), which allows the user to select the right RPM to suit the size of the bit and the material being routed (see the sidebar on p. 52).

Plunge action

Both the smoothness of plunging and the force it takes to plunge the bit vary considerably among the models I tried. To plunge any model smoothly, you must hold and apply equal pressure to both hand grips; otherwise, the carriage can bind on the guide posts. Further, a router won't plunge smoothly if its base isn't evenly supported, such as when working on or near the edge of a board. Among the models in this sample, the Elu 3337/3338 models were the only routers that continually plunged smoothly, regardless of how the base was riding on the workpiece. The least smoothly operating plungers were the Sears 27504 and the Ryobi RE-600 (which are virtually the same—Ryobi Motor Products manufactures for Sears). These routers often bound mid-plunge when the base was partially supported. To keep dirt and sawdust from fouling its plunging action, the posts on both Bosch 1613 models feature thermoplastic dust boots like the ones that protect the front forks of motorcycles.

The amount of effort it takes to depress a router's return springs during plunging varies tremendously. The hardest to depress are the Porter-Cable 7538/7539 routers. While these springs will surely retract the bit without fail, plunging them regularly will just as surely tire you out. At the other end of the scale, the springs on the Makita 3612BR and Hitachi models seemed a bit weak. While these routers are effortless to plunge, their springs might be inadequate in situations such as when deeply mortising sappy woods where there's a chance the bit may become mired in the workpiece.

Maximum plunge capacity varies from 2 1/16 in. for the Bosch 1613/1613EVS up to 3 in. for the Porter-Cable 7538/7539. Be sure to take this into consideration if you plan to rout extra deep mortises or do a lot of template routing where the depth you need must include the thickness of the template. Also, if you plan to use the router with a big panel-raising bit, check the maximum diameter bit the base can accommodate (see the chart on p. 49).

Hand grips, on/off switches and plunge locks

Because the user must control plunging action during cutting, the location, fit and feel of basic operating controls are all very important. These controls include the unit's hand grips, on/off switch and plunge-locking lever. Be sure to check the size, type and placement of controls before buying because these vary significantly from model to model (see the top photo on p. 48). There seems to be no standards for how these controls are laid out, and subjective preference might lead you to choose one model over another because it simply feels better.

Manufacturers have several different approaches to the design and placement of hand grips. They must fit your hands, especially if you plan to do a lot of plunging. For me, large pistol-style grips like those on the Skil 1870/1875 and the Porter-Cable 7538/7539 offer the best comfort and control—the tall grips on the Bosch 1613 models run a close second for comfort. The Hitachi M 12V/M 12SA features unique, adjustable handles that can be set to any one of three positions for better comfort and control depending on whether you're working at a high bench or on the floor. I found the Elu hand grips a bit awkward: Their slight outward splay put pressure on my finger tips instead of my palms during plunging.

The Porter-Cable 7538/7539, Ryobi 501 and all Bosch and Skil models use trigger grips on the handles, which allow switching without losing a grip on the handle. These switches feature a small button that will lock the switch on, so you don't have to hold it during long routing sessions (the Ryobi 501's button must be depressed before the trigger will work). The Freud FT2000 E, Hitachi M 12V/M 12SA and all Elu models incorporate sliding switches that are operated with finger or thumb. I found the Elu's switch surprisingly stiff. A small lug protrudes below the handle when the switch is off; inadvertently setting the router down on clutter could

Choose operating controls that best suit you. *The Skil 1875 (left) has a left-hand plunge-lock lever and trigger switch on the right; the grips adjust to three positions on the right-hand operated Hitachi M 12SA (center); and the Porter-Cable 693 (right) is entirely left-hand operated.*

accidentally turn the router on—a dangerous possibility. The rest of the routers employ toggle switches that may require you to remove a hand from the grip, which is inconvenient at best.

All plunge routers have some form of locking lever that keeps the carriage from moving when you don't want it to. The levers on the Bosch and Porter-Cable models were easiest to operate, neither requiring that you release or compromise your grip on the tool before or after plunging. These levers are always locked: You must pull them before plunging. Simply releasing the lever on a Bosch locks the unit adequately for most routing (nudge the lever with your thumb before doing any heavy cutting). The molded locking levers on the Elu and Skil models are operated with the fingers; the Skil lever's angle is adjustable, a nice touch. I found the stamped-steel locking levers on the Sears 27504, Freud and all Hitachi and Ryobi models acceptable but a little harder on the fingers than the contoured levers on other models.

Plunge depth stops and limiters

All plunge routers incorporate some means of limiting travel both on the upward and downward stroke. The plunge stop rod is essential for getting a consistent depth of cut for grooves, rabbets or mortises. Stop rods on most machines slide up and down and lock with a thumbscrew. Freud and Makita have threaded stop rods: An ingenious spring-loaded half nut allows quick gross adjustments, the half nut is then screwed up or down for fine adjustment. All plunge routers also have some sort of plunge limiter that stops the *upward* travel of the carriage. This device is useful in situations where you're taking a shallow cut with a short bit; you don't have to plunge the full travel of the guide posts for each cut.

The plunge limiters on the majority of routers are threaded rods and a pair of hex nuts. The Elu models have spring-loaded half nuts that can be depressed for rapid gross movement and then turned for fine adjustment. Limiters also allow a carriage to be fully locked at any position, so the machine can be used like a regular fixed-base router. The plunge limiters on the Sears 27504, Freud, Bosch 1613/1613EVS and 1615EVS and all Ryobi models are top-mounted hand knobs that allow setting and fine adjustment of the bit's depth of cut. But all these knobs (except on Bosch models) have the annoying habit of popping off (there's a spring inside) when set too near the top of their range. The small knobs on the Bosch 1613 models are calibrated in sixty-fourths of an inch, great for precise settings without need for further measurement at the bit. This is especially handy in the router table—you can raise or lower the bit without having to plunge the inverted carriage—an awkward proposition.

All plunge routers incorporate some sort of depth scale and

Performance test: cutting through the horsepower hype

The performance of the plunge routers *was compared by timing how long it took each unit to cut through a 12-in.-wide piece of ¾-in. plywood. Vaughan checks the time while* FWW *editor Sandor Nagyszalanczy does the routing, monitoring the motor's power draw on an ammeter.*

To reach beyond the inflated claims that pervade practically all tool advertisements, we decided to conduct an informal series of tests to compare the power and performance of the plunge routers in this article. After fitting each machine with a brand-new carbide two-flute straight bit (½ in. dia.), we clocked the time it took the router to through-cut a 12-in. length in ¾-in. birch plywood; two or more runs were done for each unit and the times were averaged. As a control, we monitored the motor's amperage with an ammeter and controlled the rate of feed so that the reading was between 80% and 100% of the unit's nameplate-rated amperage (see the photo at left). The average time results are listed in the chart on the facing page.

While these tests weren't scientifically rigorous, the results can be helpful in evaluating and contrasting various routers' work capacities. Generally speaking, these findings reflect that the higher the amperage rating of the motor, the faster the router is able to gobble up stock. The fastest runs were turned in by two 15-amp routers: Ryobi R-600 and Porter-Cable 7538, with average times of 2.85 and 3.17 respectively. Though cutting performance is usually proportional to motor size, there were some interesting exceptions: Hitachi 12.2-amp TR-12 turned in slightly faster times than its larger 15-amp cousin, the M 12V. Also, the 10-amp Porter-Cable 693 ran more than 3.5 seconds slower than the 10.4-amp Bosch 1613—a huge difference.

We found that EVS circuitry noticeably affected a router's all-out cutting performance but not in the way we had hoped for. In six out of seven cases, non-EVS routers beat their EVS equivalents in our tests (see the sidebar on EVS on p. 52). While all of these results are worth noting, remember that cutting speed is only one aspect of a router's overall performance. Unless you need a plunger that'll constantly run full bore in a cabinet production shop, don't reject a router you like, in terms of size or features, simply because it isn't the fastest. *—R.V.*

Plunge router specifications and features

Make/model	List price ❐	Motor amps	No-load RPM	Cutting speed in test (sec.) ❖	Weight (lbs)	Maximum plunge depth (in.)	Number of depth stops	Maximum bit diameter (in.)	Accessories included/ optional ✣
Bosch 1613	$286	10.4	22K	7.76	9½	2 1/16	8 fixed	1¾	E/A,C,D
Bosch 1613EVS▲	$320	11.3	12K-22K	8.39	9¾	2 1/16	8 fixed	1¾	E/A,C,D
Bosch 1615●	$395	14	25K	4.72	12½	2 13/16	8 fixed	2⅝	B,E/A,C, D,F,I,J
Bosch 1615EVS▲●	$460	15	12K-19K	3.51	13	2 13/16	8 fixed	2⅝	B,E/A, C,D,F,I,J
Elu 3337	$379	12	20K	4.07	12	2½	3 adj.	2 9/16	A,B/C, D,E,J
Elu 3338▲●	$427	12	8K-20K	5.46	12¼	2½	3 adj.	2 9/16	A,B/C, D,E,J
Freud FT2000 E▲	$350	15	8K-22K	4.95	11⅓	2 13/16	3 adj.	2 7/16	—-/A,B,C
Hitachi M 12SA	$403	14.6	22K	4.01	12	2 9/16	1 fixed/ 2 adj.	2½	A,B,C,E, H/D,I
Hitachi M 12V▲	$447	15	8K-20K	4.75	12¼	2 9/16	1 fixed/ 2 adj.	2½	A,B,C,E, H/D,I
Hitachi TR-12	$347	12.2	22K	4.38	11½	2⅞	1 fixed/ 2 adj.	1 15/16	A,B,C,E,F, G,H/D,I
Makita 3612BR/A◆■	$370	14	23K	4.70	12½	2½	1 fixed/ 3 adj.	2 7/16	E/A,B, C,F,G
Porter-Cable 693	$295	10	23K	11.39	10½	2¼	3 fixed/ 3 adj.	1 3/16/3¾✪	E/A,C, E,F,I
Porter-Cable 7538✱	$410	15	21K	3.17	16¾	3	3 fixed/ 3 adj.	1 3/16/3 7/16✪	E/A,C, E,F,I
Porter-Cable 7539▲	$475	15	10K-21K✚	3.34	16¾	3	3 fixed/ 3 adj.	1 3/16 / 3 7/16✪	E/A,C, E,F,I
Ryobi R-500/R-501◗	$331	13.3	22K	4.35	10⅓	2 1/16	3 adj.	1⅞	A,B,C, E,F,G/
Ryobi R-600	$398	15	22K	2.85	14	2¼	3 adj.	2½	A,B,C, E,F,G/
Ryobi RE-600▲	$444	15	10K-22K	3.64	14	2¼	3 adj.	2½	A,B,C, E,F,G/
Sears Craftsman 27504▲	$225	15	10K-22K	3.71	14	2¼	3 adj.	2½	A,B,C, E,F,G/
Sears Craftsman 27505	N/A	12	25K	N/A	11	2½	3 adj.	N/A	N/A
Sears Craftsman 27506▲	N/A	15	10K-25K	N/A	13½	2½	3 fixed, 3 adj.	N/A	N/A
Skil 1870	$270	12	23K	6.49	9½	2⅜	3 adj.	2⅞	E/A,B, C,F,I
Skil 1875▲	$319	11.5	10K-23K	7.06	9⅔	2⅜	3 adj.	2⅞	E/A,B, C,F,I

▲ Router has EVS circuitry
✱ Has soft start and thermal circuit breaker
◗ Difference between models is handle/switch configuration
● Also available in 220v model
◆ New model 3612BRA has an electrical brake
■ Model 3612B comes with a square base
❐ Selling price is typically 20% to 50% lower
✚ Five-position speed selector
✪ Second number is maximum diameter with subbase removed
✣ All routers include ½-in. collet and wrench(es)
❖ Cutting test explained in sidebar on p. 48

A Auxiliary fence
B Template guide-bushing adapter
C Guide bushings
D Dust-collection system
E ¼-in. collet or adapter sleeve
F ⅜-in. collet or adapter sleeve
G Roller edge guide
H Straight carbide bit
I Tool case
J Plunge-limiter fine adjuster
N/A Information not available

Comparison of bearing sizes

A router's bearings take the punishment of side loads during routing, so bearing size is a good indication of how durable a router will be. This chart is arranged so that routers with larger bearings are toward the top, smaller toward the bottom. Motor amps are included, so you can compare a particular model's bearing size to its power rating.

Model(s)/motor amps	Bottom bearing*	Top bearing*
Elu 3337,3338/12	25 x 52 x 15	12 x 32 x 10
Porter-Cable 7538,7539/15	25 x 47 x 12	15 x 35 x 11
Freud FT2000 E/15	25 x 47 x 12	12 x 32 x 10
Bosch 1615/14,1615EVS/15	25 x 47 x 12	10 x 30 x 9
Makita 3612BR/14	20 x 42 x 12	10 x 30 x 9
Ryobi R-600,RE-600/15	20 x 42 x 12	10 x 30 x 9
Sears Craftsman 27504/15	20 x 42 x 12	10 x 30 x 9
Bosch 1613/10.4,1613EVS/11.3	20 x 42 x 12	9 x 26 x 8
Skil 1870/12,1875/11.5	20 x 42 x 12	8 x 22 x 7
Porter-Cable 693/10	15 x 35 x 11	8 x 22 x 7
Hitachi M 12SA/14.6,M 12V/15	12 x 32 x 10	10 x 30 x 9
Hitachi TR-12/12.2	12 x 32 x 10	10 x 30 x 9
Ryobi R-500,R-501/13.3	12 x 32 x 10	10 x 30 x 9

*(metric sizes, ID x OD x width, in millimeters)

pointer (see the photo at right) so that plunge depth can be accurately determined and set. The pointer assemblies on the Hitachi M 12V/M 12SA and all Elu, Porter-Cable and Bosch models are most convenient because they can be zeroed. First, plunge and lock the carriage with the end of the router bit flush with the subbase. Then set the pointer to zero on the scale. Now set the bit's depth of cut by raising or lowering the stop rod until the desired depth shows on the scale. The Hitachi M 12V/M 12SA and the Elu have the slickest mechanisms, featuring a rack-and-pinion device for setting the scale (the knob does double duty on the Hitachi models; it pulls out for zeroing the pointer). Depth stops on the Makita, Hitachi TR-12, Sears 27504, Ryobi and the Freud are more trouble to use: Each has a scale, but because their pointers can't be zeroed, you must do some math before knowing where to set the rod.

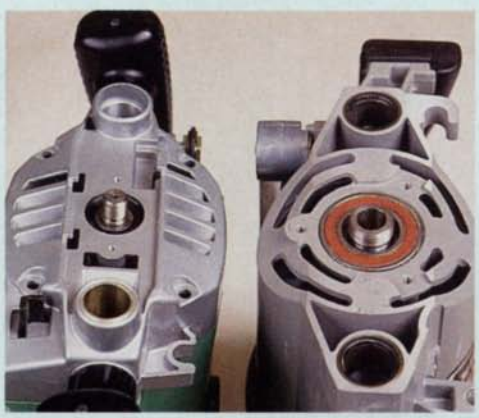
To set several predetermined plunge depths without having to reset the stop rod each time, each router has a revolving depth stop. Just rotate the turret-like device (detents hold it at each position) so that the desired stop falls under the stop rod. All models incorporate a minimum of three stops, at least two of which can be fine-tuned as needed, such as for shaping odd-sized tenons. The exceptions are the Bosch models which feature non-adjustable, eight-position revolving turrets that allow plunge depth to be changed in precise ⅛-in. increments through a ⅞-in. range.

Look inside: durability depends on sturdy guts

Beyond a router's raw performance, most woodworkers ask the same question I do: How much hard use can the tool take and still keep working? In lieu of actually running these routers under workshop conditions for several years, internal construction is probably the best indication of how well a router can maintain its peak performance. Therefore, I took apart each router in the survey (only one in the case of identical EVS/non-EVS models) and examined its motor housing, bearings, armature and brush assembly. Here are some of the high points of what I discovered.

The majority of plunge routers—as well as other portable power tools—have a plastic body attached to a metal lower housing. This housing holds the router's large bottom bearing, which must absorb most of the work load. The smaller top bearing on most plunge routers is housed in a plastic socket. The exceptions are the Porter Cable 693, which has an all-metal main housing and the Porter-Cable 7538/7539, the Ryobi R-500/R-501 and all three Hitachi models, which have a metal insert for the top bearing. Metal doesn't distort like plastic from the intense heat a failed bearing creates. Hence, a metal socket allows much easier repairs if a bearing burns out.

Generally, the larger a router's bearings the more work load, such as stress from running large bits or taking heavy cuts in dense woods, the machine can handle over time. While all plunge routers use ball bearings, top and bottom, their size varies



The size of a router's bottom bearing matters because it must absorb most of the work load. The bottom bearing and shaft on the Porter-Cable 7539 (right) is massive in contrast to the Hitachi M 12V (the housing covers up its outer race) even though both routers have 15-amp motors.

enormously from model to model, as shown in the chart above. (I won't get into bearing quality here because most of the bearings I examined were not stamped with standard grading specifications.) Routers with larger motors typically employ larger bearings; however, this isn't always the case. The Porter-Cable 7538/7539 and the Hitachi M 12V and M 12SA models are both 15-amp machines, but the Porter-Cable's bottom bearing is *considerably* larger than the Hitachi's bottom bearing (see the photo above). The Porter-Cable 693 and both Skil models have disappointingly small top bearings—the same size used in skateboard wheels, much smaller than top bearings found in other similar sized plunge routers.

Upon examination of the motor armatures, I was pleased to see that most models have the armature winding wires punched flush into the commutator bars (punch crimp) rather than being wrapped around small tabs protruding from the commutator bars (tang crimp). These tabs are more susceptible to being ripped out when a wood chip enters the housing and inadvertently gets caught between the commutator and brushes. Surprisingly, I found tang-crimped armatures on the otherwise well-constructed Porter-Cable 693 and the Bosch 1613 and Elu models (in Bosch and Elu's defense, their tangs are heavily made and bear a protective coating of epoxy). Another practice that can lengthen the life of a router is wrapping and coating the armature windings below the commutator. I was surprised to find this touch on the low-priced Skil models.

To save expense and downtime, the brushes on all the plunge routers can be changed by the owner. But some models require removing the motor cap to gain access to the brushes plus a little fooling around with the screws that secure the brush wires. I like the outside access brushes used on all the Hitachi, Sears and Ryobi models as well as the Makita 3612BR and Porter-Cable 693. These provide the quickest and easiest brush replacement. —*R.V.*

***An auxiliary fence allows grooves to be routed** at a set distance from the edge of the work. The nicest fence, included with both Elu models, is a clean alloy casting, which rides on steel rods and features a micro-adjuster for fine-tuning cutting distance.*

***The plunge-depth stop rod and scale and pointer assembly** allow the user to set how deep the bit will plunge. The stop system on the Hitachi M 12SA, right, includes a rack-and pinion adjuster knob that allows plunge depth to be set to the scale after zeroing the bit. The stop rod on the Ryobi RE-600, left, can't be zeroed, and the scale has unlabeled divisions, making depth setting tedious.*

Spindle locks and self-releasing collets

To make bit changes easier and faster, all the routers (except the Hitachi TR-12, the Ryobi R-500/R-501 and all three Porter-Cable units) now feature some form of spindle-locking device, which allows the collet to be loosened with a single wrench. Skil models have a handy wrench holder molded into the top of their plastic bodies. I found the Bosch spindle locks easiest to operate and the clear plastic dust shields on the 1613 models flip out of the way for better wrench access. I didn't care for the spindle locks on the Sears and Ryobi routers; they were difficult to depress.

Most plunge routers (except Skil and Hitachi) now feature a self-releasing collet. Loosening the nut draws the collet out of its socket, making the router bit easier to remove and preventing it from getting stuck. On the down side, you must turn the collet an extra couple of times with the wrench to extract or insert the bit.

Fences, template guide bushings and dust collection

Many plunge routers feature a straight side cast into the base that makes fence-guided routing more stable. But an auxiliary fence increases a router's versatility, allowing you to cut grooves or mortises at a consistent distance from the edge of a workpiece. The majority of plunge routers have serviceable pressed-metal fences, which are either standard or optional equipment (see the chart). Beautifully made cast-alloy fences with micro-adjusters are included with both Elu models (see the photo at right above).

Template guide bushings, essential for routing jobs such as flush trimming and template-shaping parts, are available for most plunge routers. The Freud FT2000 E and all Elu, Hitachi and Skil models have adapter plates that accept universal-sized guide bushings (the Porter-Cables don't need an adapter). Freud makes a nice set of seven guide bushings. The Bosch 1613/1613EVS machines feature a spring-loaded quick-change mechanism built into the base: Press a small lever and snap the bushing into place.

Dust-collection systems for these high dust-producing machines are still surprisingly scarce. They're only available for the Hitachi M 12SA/M 12V and the Bosch and Elu models. Each system consists of a small shroud that bolts to the router's base plate, surrounding the bit for better dust and chip extraction. A port on the shroud gets connected to a small-diameter flexible hose (not available for the Hitachi models) that attaches to a portable or stationary vacuum.

Which one to buy?

Before you rush out to buy any plunge router, first consider what the majority of your routing needs will be. If you plan to do mostly edge shaping, non-stopped cuts or inverted table routing, the height and large size of most plunge routers can make routing terribly awkward on the edges of stock, where half of the router hangs unsupported. Fooling around with plunge locks and depth stops might be more trouble than it's worth, and you might do better buying a conventional router. Alternately, the Porter-Cable 6931 and Sears 25500 are accessory bases that transform a regular router into a plunge machine with many of the same depth-stop features as a dedicated machine.

If you're sold on buying a plunge router, you'll be happy to know that all the makes and models reviewed in this article are capable of doing a good job at what they're designed for. However, each make and model has a different price and set of attributes that will fit some user's needs better than others. If I were running a commercial shop and had to do extremely tough routing jobs, such as plunging deep mortises in hardwood door frames, I would choose the power and durability of the Porter Cable 7538/7539 or the Bosch 1615/1615 EVS (these Bosches also come as 220v models). If my routing needs were less demanding and I were on a limited budget, I'd pick the amply featured Skil 1870/1875 or Bosch 1613/1613EVS models, all of which pack a decent punch into a very light package; they're also two of the lowest-priced machines in the group. If I could have only one router and cost were no object, I would buy one of the Elu models (also available, the 220v model 3338-2), which are the smoothest operating and most solidly built plunge routers I've tried. □

Robert Vaughan is a contributing editor to FWW *and a woodworking machinery rehabilitation specialist in Roanoke, Va.*

Electronic controls: variable speed is safer

by Sandor Nagyszalanczy

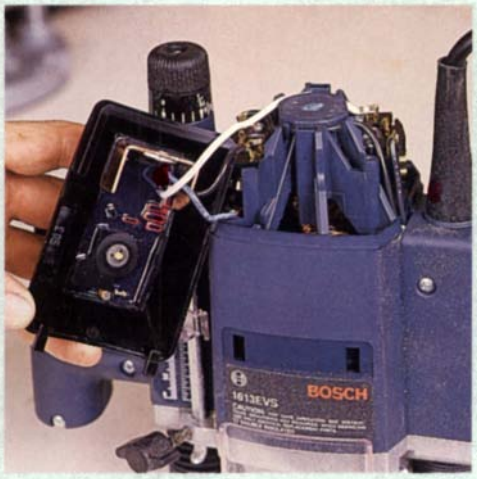
Many new routers now incorporate sophisticated electronics, collectively referred to as EVS (electronic variable speed). But more than just providing a router with a range of speeds, EVS circuitry offers other advantages, including soft start and electronic feedback, that can enhance performance and make a router more versatile and user friendly. But these pluses come at a price—an EVS router is typically priced $35 to $65 higher than its non-EVS equivalent—and a burned-out EVS unit can cost anywhere from $36 (the Bosch 1613EVS) to more than $90 (the Elu 3338) to replace, not including labor. Therefore, consider if you really need all the electronic wizardry described below before you buy your first—or next—plunge router.

Variable speed

You can usually spot an EVS router by a single hallmark: the presence of its variable speed selector dial near the top or the on/off switch. Choosing a lower setting causes the EVS unit to reduce the voltage to the motor, hence lowering its RPM. Speed ranges vary from model to model, with a maximum of 23,000 RPM (the Skil 1875) and a minimum of 8,000 RPM (the Elu 3338, Freud FT2000 E and Hitachi M 12V). In lieu of continuous control, the Porter-Cable 7539 has a five-position speed switch.

There are several applications where it's desirable to slow down the rotational speed of the router: for example, when using large-diameter (2½-in. to 3½-in.-dia.) bits, most of which are raised panel cutters. The tips of these big bits can achieve alarming rates of speed (250 MPH plus), which could cause the router and bit to self-destruct if it suddenly hit a knot. Further, the slightest imbalance in a large bit, due to manufacturing defects or chipped carbide, is accentuated at higher speeds, which could also lead to disastrous consequences. These bits also remove a wide path of material—even during a shallow pass—and a router's shaft and bearings are subjected to tremendous strain. Slowing down the bit speed alleviates all these problems.

How much should you slow down router speed when using a large bit? Brad Witt of Woodhaven, sellers of router bits and accessories, offers this rule of thumb for determining maximum router speed: The tip speed of the bit should not exceed 11,500 feet per minute. To calculate appropriate bit speed, take the bit's diameter and multiply it by pi (3.14) to get its circumference. Then divide 138,000 (maximum inches per minute of tip speed) by bit circumference to obtain the maximum speed setting. For example, a 2¼-in.-dia. bit has a circumference of approximately 7$^{1}/_{16}$ in.; 138,000 ÷ 7.0625 = 19,500 RPM. While slower speeds allow you to use shaper-size bits more safely, *Fine Woodworking* contributing editor Mark Duginske offers the reminder that a plunge router isn't a shaper and shouldn't be expected to perform the same jobs as a heavy stationary machine.



***Electronic variable speed circuitry** (or EVS) provides a router, such as this Bosch 1613EVS, with more than just speed control.*

Another good application for variable speed is to slow the bit down when plunging deep mortises into hard stock, such as birch or maple. Brad Witt uses spiral-fluted end mills running at around 15,000 to 16,000 RPM and says that it decreases the tendency of the bit to heat up thus increasing its life. The resulting cut isn't as clean as a higher speed would yield, but this is a moot point on the inside of a joint.

Another factor that variable speed provides is adjustment for the nature and density of material; in most cases, slower rotating bits are less apt to burn dense woods or tear out wild-grain woods. But despite handy reference charts included in some EVS router manuals, Brad Witt says there are too many variables, such as how resinous the wood is and whether routing is done across or with the grain, to make generalizations about ideal routing speeds. Witt advises experimentation on scrap material before routing actual workpieces.

Soft start

When you switch on any high-speed motor, the armature comes up to full speed almost immediately. The resulting jerk can be quite startling, and it can even make you feel like you're momentarily losing control of the tool. Soft-start electronics are designed to "ramp up" the tool's RPM gradually, increasing control and safety. As an added bonus, soft-start electronics prolong the life of a router's on/off switch, brushes and bearings by reducing the start-up current surge and torque. All EVS plunge routers incorporate the soft-start feature, and interestingly, it's also included in the non variable-speed Porter-Cable 7538.

Electronic feedback

Another feature that's inherent in EVS-controlled power tools is electronic feedback, which helps a universal motor maintain a more constant RPM during cutting. Here's how it works in plunge routers: When the motor slows down due to the work load, an electronic sensor instructs the feedback circuit to supply more voltage to the motor to maintain the selected speed. The circuit keeps the motor from bogging down excessively during a heavy cut and helps maintain cutter speed, for cleaner results. The slower the speed the router is set at, the wider the power band of available feedback. Hence, slower-run bits will turn at more consistent RPMs. even when pushed very hard. While all EVS routers have a maximum limit for how much additional voltage the feedback circuit will supply to keep the motor at speed, not all EVS units have overload protection. However, the non-EVS Porter-Cable 7538 has a thermal circuit breaker to prevent motor burn out.

While feedback circuitry clearly improves the lower speed performance of an EVS router, there's a slight drawback when operating them at full speed. In the cutting tests Bob Vaughan and I conducted (see the sidebar on p. 48), we observed that when otherwise identical EVS/non-EVS models were run all out at full speed, most EVS units cut through stock slightly *slower* than their non-EVS counterparts. David Peot, director of electrical engineering at Ryobi Motor Products, related that placing an EVS unit in a motor circuit results in a slight power reduction, hence the actual RPM of an EVS-controlled motor set to full speed is slightly lower than the same motor without EVS. The exception in our tests was the Bosch 1615EVS, which cut about 25% faster than the non-EVS model 1615. Although the 1615EVS has a 1-amp edge on the 1615, a talk with Chris Carlson, product manager at Robert Bosch Power Tool Corp., convinced me that there are too many variables involved, such as optimum speed vs. the design of the cutter, to fully explain the discrepancy. In any case, such small performance differences shouldn't matter to all but the most demanding users. □

Sandor Nagyszalanczy is managing editor of Fine Woodworking. *Thanks to electrical engineer Gene Holladay for his technical assistance in preparing this article.*

Designing a Captain's Bed

Launching a commission with the right details and hardware

by Arnold d'Epagnier

Ten years and ten moves later, Gail's captain's bed is still the safe haven for her that it was when I built it. When she commissioned the bed, Gail was going through a difficult period in her life. Listening to her describe the bed she wanted me to build, I began to realize that she wanted something more than just a queen-sized bed with some storage space below. She was asking for an embodiment of permanence and stability. Reading between the lines of a customer's requests and getting to the essence of what that person really wants is never easy. But I felt confident with this commission because I knew Gail well and because I already had a design in mind that would meet all of her requirements—both voiced and implied.

I'd been thinking about captain's beds for a while, waiting for an opportunity to bring together in wood the vague elements of the bed as it existed in my mind. I sketched a bed with high headboard and footboard and sides sweeping up to meet them. Its shape evoked a cabin-like atmosphere, cozy and secure. I showed Gail those rough sketches, we discussed them and I made some minor revisions. After working through some final details, I came up with drawings for, and then built, the bed shown in the photo below. Although the stormy seas have long since subsided (Gail's happily married now, with a baby daughter), the warm hue of the mahogany and the bed's cradling curves still beckon, offering solace and peaceful repose.

***Massive but refined,** this captain's bed achieves its grace through simple but effective details. The bed combines a well-built, inconspicuous drawer system with bold, shopmade hardware and subtle stylistic details that evoke nautical images.*

Design challenges

This project had three design challenges: I needed to lighten the bed visually to counterbalance its mass and solidity with a little grace; I needed a means of connecting the massive frame-and-panel headboard to the side rails that would take into account their differences in wood movement; and I needed a durable, convenient drawer system that would look integral to the bed rather than added on.

One of my main influences as a furniture designer is the simple, elegant work of Charles and Henry Greene, early 20th-century architect-builders whose work has come to define the Arts and Crafts movement in America. The Greene brothers' overall sense of proportion and the characteristic soft, radiused edges of their furniture strike me as quietly dignified, having a well-bred self-assurance. Because I was building a captain's bed, I wanted to lighten the bed's visual mass and to add some nautical influence to my Greene and Greene design vocabulary. I designed the headboard as a frame-and-panel unit with the panel consisting of a number of beveled-edge tongue-in-groove boards reminiscent of lapstrake wooden boats. Also, because the panel is composed of a number of parts, rather than one large panel, its apparent mass is diminished. The middle board of the panel, though beveled along its edges and grooved to appear multipartite, is actually one long board tenoned into the frame, adding rigidity.

I was able to lighten the feel of the bed further, and to soften its geometry, by sweeping the sides down from headboard and footboard and by scalloping the bottom edge of the rails, headboard and footboard. This also adds top-to-bottom symmetry to each part of the bed and provides ventilation for the mattress and bed linens. The human body gives off roughly a quart of water each night, some of which evaporates and some of which is absorbed by the mattress and linens. Adequate ventilation makes for a better rest and a longer mattress life. The routed slots in the bed's sides and footboard also help with ventilation, reassert the Greenes' influence and lighten the bed's look.

***Three angles hold the headboard** in and one keeps the rail in place. Unable to find any satisfactory off-the-shelf hardware, the author made his own. Using conventional woodworking equipment, he cut and shaped the brass angle to come up with this unique bed hardware system. He mortised the brass wear plates on the inside to prevent injury or discomfort resulting from rubbing up against blunt brass edges.*

Shopmade hardware resolves design dilemma

Given the headboard's height (over 3 ft.), a single bed bolt at each corner would have been inadequate. I didn't want to use two or three bolts at each corner because that would've made the bed a pain to assemble and disassemble, and I didn't trust the drop-style rail connectors with so large and heavy a headboard and footboard. Seizing upon the situation as an opportunity rather than a dilemma, I decided to make my own brass hardware. Although many suppliers aren't interested in selling small quantities of brass, generally you can find a cooperative company or get some through a scrap yard. I purchased my brass angle from C-S Metals Service, Inc. (7325 Washington Blvd., Baltimore, Md. 21227; 410-796-5661); they will also sell you stainless steel, aluminum and other metals in small quantities.

After a little head scratching, I came up with the solution in the photo at left. I sandwiched the headboard between the shoulders of vertical rabbets in the rails and three brass angles bolted through the rails. I mortised the brass plates on the inside (which function as washers) flush with the wood (see the photo below) because bodily contact with the brass is likely, and I didn't want any hard or sharp edges exposed.

The top angles at either end of the headboard are screwed into the back of the headboard; they hold in the top of the rails. Dovetailed support slats (for a box spring or a firmness board) drop into the ledger strip to hold the rails at the proper distance (see the photo below). The footboard, a single, large glued-up board, is connected to the rails with angles similar in appearance to those used at the headboard, but the angles are simply bolted through both rails and footboard because their grain is oriented horizontally.

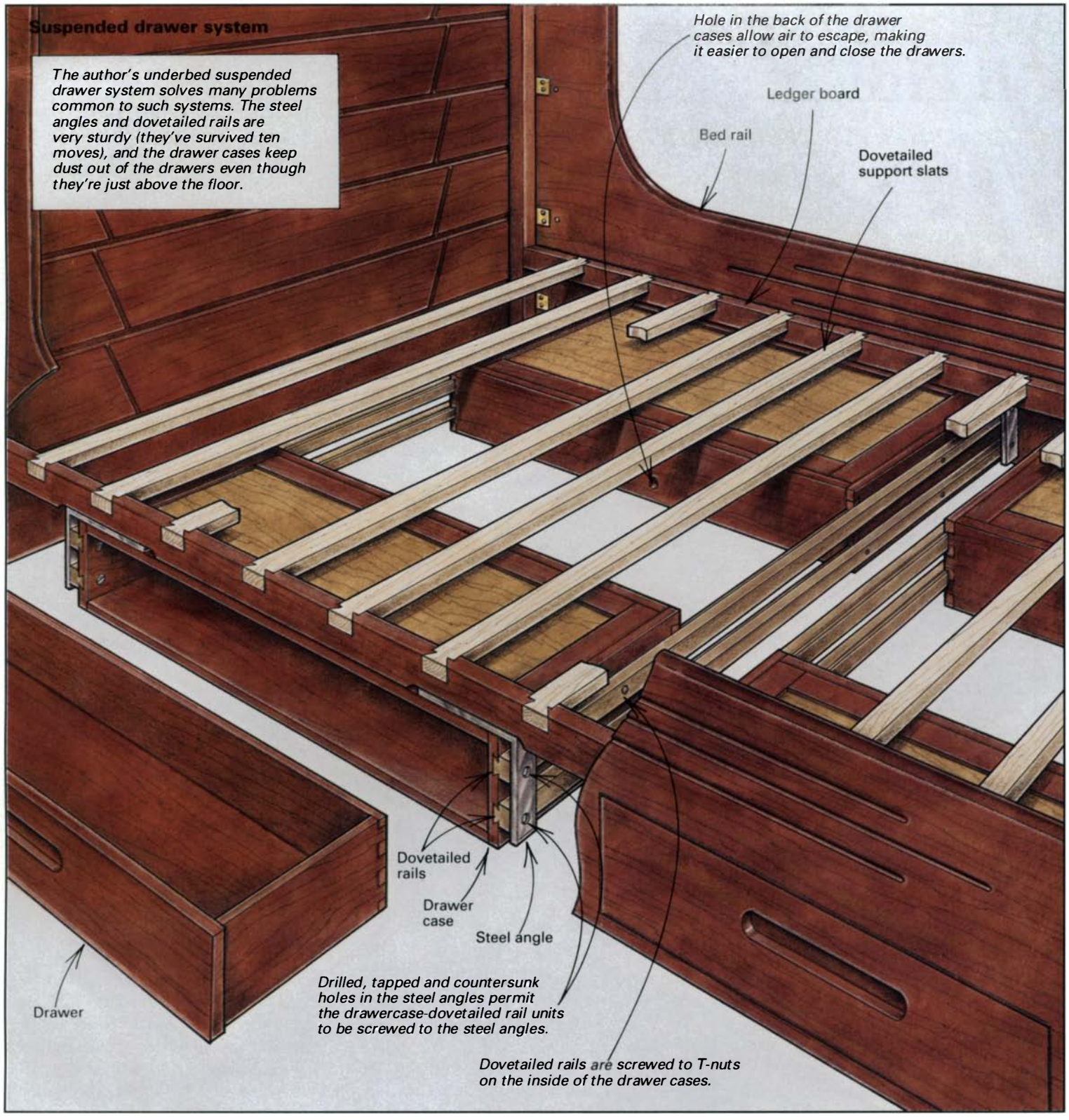
Brass is soft enough to machine with woodworking tools. I used my tablesaw (with a carbide-tipped blade in it) to cut the angle to size and a bandsaw with a bimetal blade to cut the arcs at the angle's ends. Be absolutely sure to wear eye protection when working brass (preferably a full-face shield) and long sleeves as well. After cutting the brass angle to size and cutting the arcs, I ground off all the sharp edges and filed the sides and edges smooth. I marked the locations for screw holes using a template and a steel transfer punch and then drilled the holes with a standard steel bit. The net effect of my shopmade bed hardware system is a rigid, sturdy frame, which allows for wood movement and enhances the nautical motif suggested by the headboard.

Underbed storage

I wanted the drawers beneath the bed to be as inconspicuous as possible, so I cut the drawer fronts from the middle board in the main part of each rail, thus keeping the grain unbroken except for the width of the sawkerf. The width of this board determines the height of the drawer. When gluing up the rails, I used waxed paper to keep glue off the edges of the drawer fronts and duct tape to hold them in place.

To keep the contents of the drawers relatively dust-free (partic-

Photos: Vincent Laurence; drawings: David Dann



ularly because they're so close to the floor), I housed the drawers in cases rather than using simple runners or a web frame. The drawer cases are slid onto dovetailed rails and screwed into place, flush against the inside of the bed rails. The drawer cases are ⅛ in. smaller all around than the opening in the bed rail, and the drawer front extends ⅛ in. past the drawer sides, so the cases act as flush stops for the drawer fronts.

Pairs of dovetailed runners on either side of the four drawer cases are screwed to steel angles, which I tapped (see the drawing above) for ¼-20 machine screws. I screwed the angles into shallow mortises on the bottom of the ledger strip on both sides of the bed.

Little details can make the difference between a merely satisfied customer and one who will commission furniture from me again. I try not to overlook any small touches. I made sure to drill holes in the backs of the drawer cases to allow air to escape. Otherwise, it could be difficult to open or close the drawers. Also, I made a drop-in toe kick (four boards with half-laps cut near their ends) to cut down on dust buildup beneath the bed. Finally, and in the same vein, the last thing I did before finishing the bed with a few coats of oil was to sign it. I carved my name discretely into the back side of the headboard, satisfied to let posterity be the judge of my handiwork. □

Arnold d'Epagnier is a custom furnituremaker in Colesville, Md.

A Hand-Rubbed Oil Finish

Proper surface preparation underlies its beauty

by Tom Wisshack

Thomas Sheraton, the 18th-century English furniture designer, recommended making a paste of linseed oil and ground brick dust and rubbing it into mahogany with a piece of cork. The result, enhanced by innumerable polishings with beeswax over the years, is the beautiful patina we see on many treasured antiques.

Oil finishes still have much to offer today's craftsman. An oil finish will accentuate the grain, color and figure of the wood rather than obscure it, as many coats of a surface finish (such as varnish, shellac or lacquer) are prone to do. Additionally, an oil finish will never chip, peel, develop fisheye or orange peel. And dust contamination is not an issue with oil finishes, making them a good choice for the craftsman without a separate finishing space. If dust lands before the piece is dry, simply wiping it down with a soft, clean cloth takes care of the problem. Finally, and perhaps most importantly, because an oil finish penetrates and bonds with the wood, rather than forming a film atop the wood, renewing the finish is as simple as rubbing in some fresh oil.

As simple and beautiful as oil finishes are, however, it would be a mistake to view oil finishing as a quick, easy solution or a cover-up for bad workmanship. On the contrary, there is quite a lot of work involved in preparing a surface for an oil finish, and an oil finish will magnify any imperfections in the wood. Also, an oil finish is only moderately resistant to water and alcohol, so it may not be the best choice for a dining room or kitchen table, but for a piece of furniture subject to less spillage and daily wear, it may be ideal. For many craftsmen, the beautiful, rich patina that an oil finish develops over time far outweighs the care needed to maintain it. In this article, I'll discuss preparing for and finishing new furniture as well as rejuvenating previously oil-finished pieces.

Surface preparation

Someone once said that you could put used motor oil on a perfectly prepared wood surface and it would look good. As shocking as that may sound, the statement points out a fundamental truth: An oil finish is only as good as the surface to which it's applied. You may be able to get by with a less than perfectly prepared wood surface if you plan to varnish or lacquer because these finishes form a relatively thick coating. But with an oil finish, any flaws in the unfinished surface will only become more evident when oiled, so you need to take extra care preparing the surface.

Some craftsmen prefer a handplaned or scraped surface to one that has been sanded a great deal. A surface finished by a cutting tool rather than sandpaper possesses a different tactile quality and will respond quite well to an oil finish. Most of us, however, find it necessary to sand at least a bit; how fine a grit you stop at is largely a matter of personal taste. A surface that has been sanded to 1,000-grit will respond as well to an oil finish as one that has been handplaned only, but the characters of their surfaces will differ.

After planing or scraping to remove any mill marks or other imperfections from the wood's surface, you should raise the grain with a sponge or rag soaked in hot water. This will make any unseen flaws in the surface evident, so you can scrape or sand them out. It will also make your project easier to repair if it comes into

Photos: Vincent Laurence

Achieving an open-pored look is as simple as eliminating all the intermediary sanding and jumping straight from plane or scraper to 600- or 1,000-grit sandpaper. More open-pored woods, such as the wenge in this tabletop, lend themselves better to this treatment than do cherry or maple.

contact with water after it's finished.

I usually begin sanding with 220-grit wet/dry sandpaper on an orbital sander or hand-held sanding block. I follow up with 320-, 400- and 600-grit paper, always sanding in long, straight strokes with the grain. A pine block faced with sheet cork (available from art-supply stores) will keep you from creating valleys as you would if you held the sandpaper in your hand; this is more important with the coarser grits because of their greater cutting effect. By the time you finish with the 400-grit, you'll start to see the wood grain and color come into focus. With the 600-grit, you're actually burnishing the surface. You may wish to use intermediate grits, or follow the 600-grit with finer automotive sandpapers, but I find the above routine generally sufficient.

After attending to all flat surfaces, I take a piece of worn 600-grit paper and gently round any sharp edges and corners. This will prevent finishing rags from catching and will also give the piece of furniture a slightly used or worn look. If you wish to retain a more open-pored look, or would like handplaning marks to be evident in the finished piece, skip straight from plane to 600- or 1,000-grit paper to polish the surface quite beautifully without filling all the pores (see the photo above).

It's important either to vacuum or to clean the surface thoroughly with compressed air after each successive grade of sandpaper to avoid scratching the surface with particles left over from the previous, coarser grit. I also check the surface with a strong light between each sanding and again when I think I'm done. This will often reveal minor flaws I might otherwise have missed. The wood's surface, ready for oil, should have a sheen and be glass-smooth even before any finish is applied.

I like to let a piece of furniture sit for several weeks after preparing its surface and before I apply any oil. This time allows the surface to oxidize somewhat, giving it a head start on the rich color it will acquire with age. Cherry, for example, will look rather greasy and anemic and may have an unpleasant orangey tone if finished with oil right away. By letting the wood mature prior to finishing—even for just a couple of weeks—a richer tone results and the patina will build up more quickly. Not all woods respond to this waiting period, and not all craftsmen can afford to wait or are willing to do so. For me, the results are well worth it, and because I normally have several projects going at once, time isn't a problem.

Repairs and rejuvenation

An oil finish needs to be maintained. I'll refurbish one of my own pieces every couple of years, or sooner if it's damaged. To rejuvenate a surface that is intact (no scratches, water marks or abrasions), I simply rub my homemade oil finish into the surface for a couple of minutes and then remove all traces of oil with a dry rag. Finally, I rub the surface with another dry, clean rag until the surface has a satiny sheen.

If the surface is scratched or otherwise blemished, it's usually possible to remove the blemish by rubbing it out with a pad of 0000 steel wool soaked in the oil finish. Sprinkling a little rottenstone (a gray, abrasive powder much finer than pumice) onto the wood surface while rubbing will restore its original sheen. If you're removing a blemish from one area, in order to keep the same color and sheen over the whole piece, it's important that you not forget to rub the whole piece out. With each rubdown, the wood gets more beautiful and begins to form a patina. A table I made about ten years ago has had its top rubbed down about six times and is quite striking in appearance.

If a blemish doesn't respond to rubbing out with the steel wool, you may need to use wet/dry sandpaper with the oil solution. Although it depends on how deep the scratch is, as a rule, I don't use anything coarser than 320-grit for repairs. I use a sanding block (to prevent my fingers from digging into the wood) and follow the grain of the wood. Once I've removed the blemish, I work my way through the various grades of sandpaper until I have a perfect surface again, and I finish up with 0000 steel wool and rottenstone. I'm very careful not to sand too deeply because this would expose the underlying (nonoxidized) wood color, necessitating a much more extensive repair. Using the finest grade of sandpaper you can get by with will generally keep you out of trouble.

If you need to repair a piece of furniture but don't want to darken it, rub the piece down with mineral oil instead of a finishing oil. I have a walnut writing table that the sun had started to fade. I liked its color and wanted to retain it, but the tabletop needed some attention. Using the mineral oil just as I've used the homemade finish on other pieces (with a pad of fine steel wool and some rottenstone), I was able to repair the table without changing its color.

***The hue of sun-bleached walnut** suited the author, but the tabletop needed work. Using mineral oil and rottenstone, he rubbed out numerous minor scratches and scuffs, as well as gave the surface a new shimmer, without changing the color of the wood.*

Choosing and applying oil

As I've tried to stress already, the kind of oil you use isn't nearly as important as the preparation prior to the actual finishing. I generally use a homemade oil finish (see the sidebar on the facing page), but there are also a host of commercially available oil finishes. Danish oil finishes are among the most popular because they're simple to apply and the results are predictably successful.

Second in popularity to Danish oil finishes are tung oil finishes. The working properties of these finishes are similar to the Danish oil finishes, although tung oil generally cures faster and offers a bit more protection than most of the Danish oil products. (Keep in mind, however, that there is tremendous variability in formulation, drying time and working properties from one manufacturer to another. I've used tung oil finishes that have gone on like Mazola and stayed that way and others that started to tack up almost immediately upon application.) I find tung oil finishes too shiny, and in some cases, streaky for my tastes, especially with more than two coats, but a final rubdown with fine steel wool will generally both even out the finish and tone the gloss down to a satiny sheen.

My application procedure is similar for Danish oil and tung oil finishes. I brush on a first coat—liberally—and allow it to soak into the wood—about 10-15 minutes for Danish oil finishes but only 2-3 minutes for the tung oil finishes. Then I wipe up all oil remaining on the surface with a clean rag. I let this first coat dry for a few days (for either finish), and then I apply subsequent coats with a rag, wiping in a circular motion. Again, I eliminate all traces of oil remaining on the surface, using a clean, dry rag. Although there's no definite rule on how many coats you should apply, I usually give my pieces three to five coats. It's important to wait as long as possible between coats to avoid the greasy, hurried look that is characteristic of so many oil finishes.

Something to keep in mind, particularly with the more heavy-bodied oil finishes such as the tung oil finishes (although it's true to some degree with all oil finishes), is that the more coats you apply the more you lose the open-pored look. To retain this look on some of my contemporary pieces, I've applied only one coat of oil, and then followed that up a couple of weeks later with a coat of quality paste wax.

In instances where I want to finish a piece with oil, but a greater level of protection is required, I use Formby's Low Gloss Tung Oil Finish. The combination of tung oil and alkyd resins provides considerably more protection than most oil finishes, and the Formby's finish dries quickly and reliably. □

Tom Wisshack makes and restores fine furniture and is a wood-finishing consultant in Galesburg, Ill.

Homemade linseed-oil mixture rubs in best

Although there are a host of commercially available premixed oil finishes, I prefer to make my own. Call it part nostalgia, but it's the best oil finish I've used. I use this finish only on new furniture. If you're asked to restore an antique, you should seek the advice and expertise of a conservator before proceeding. Although eminently repairable, an oil finish is not removable save by sanding to bare wood.

I mix three parts boiled linseed oil (it must be boiled) to one part turpentine or high-quality mineral spirits and add a few drops of japan drier (generally available through commercial paint supply stores)—about two percent by volume. For the first coat, I warm the mixture in a double boiler or electric glue pot, being *extremely* careful to avoid spilling any. I work a liberal amount onto one surface at a time using a natural bristle brush. Then I let the oil sit and soak into the wood for about 30 minutes. Next, I sprinkle the wood surface with a small amount of rottenstone and rub with burlap until a paste develops. I continue rubbing into the wood's surface for several minutes (see the photos at right). Then I wipe all traces of oil and rottenstone off of the piece, using clean, dry rags. Remember that rags saturated with linseed oil are extremely flammable: submerge them in water immediately after use, or spread them flat outdoors to dry, and then be sure to put them in a closed garbage can outdoors at the end of the day.

I try to let the first coat dry in a well-ventilated, relatively warm area for about two weeks. If any oil beads appear on the surface during this time (they'll usually show up in the first couple of days), I wipe them off with a clean piece of terry-cloth towel. I apply the second coat more sparingly with a soft cotton cloth. After letting the oil soak in for about 15 minutes, I wipe off any oil remaining. I wipe until the rags come off the surface clean and dry and then give all surfaces a brisk rub. Two weeks later, I apply the third coat in the same fashion. If I'm going to apply a fourth or fifth coat, I'll wait another couple of weeks.

The drying time of this finish will vary tremendously depending on atmospheric conditions. The longer you can wait the better. It's possible to add more japan drier to the mixture to ensure drying, but the actual curing of an oil finish takes months and cannot be hastened chemically. Applying too many coats of oil in a short amount of time results in a greasy, slightly transparent tone. It's best to wait until the finish has begun to cure and form the beginnings of a patina before passing the piece on to a customer or gallery. *—T.W.*

Burlap, rottenstone and the author's homemade linseed-oil mixture *combine for a finish that's second to none. Although the paste formed by the rottenstone and oil mixture looks as though it would darken the wood, as long as there are no cracks, the paste will all come off.*

Machines on Wheels

Hinges, handles and casters make tools roll to save space, but stay put when in use

by Jim Boesel,
Drawings by Jim Richey

***Moving tools around** is a fact of life for woodworkers with restricted shop space. The setup shown here, two lawn mower wheels mounted on the back of the tool's base, works great for moving tablesaws. The handles are placed at a good height for lifting and pivot out of the way when not in use.*

Every woodworker would love to have enough space so that every machine could be set up and ready to go at all times. In reality, most shops don't provide that luxury. As often as not, woodworking machines have to share a garage with, of all things, a car. And even if the shop space is sacred unto itself, tool collections have a way of outgrowing space the way kids outgrow clothes. For many woodworkers, the only solution is to move a machine into whatever open space is available when they need to use it and then stow it away again to make room for the next machine to be used. Unfortunately, most floor-model machines are designed to be heavy and stable; ease of movement is a minus not a plus, so woodworkers have had to figure out how to make machines mobile when necessary while keeping them stable when they're in use.

In a letter to the editor in *Fine Woodworking* #93 (March/April 1992), Charles Klaveness of Hempstead, N.Y., asked other readers for ideas about how to stabilize tools on wheels. In response, we received more than 20 letters with suggestions ranging from sources for commercial locking casters (see the sources of supply box on p. 63) to tried-and-true methods used in the theater to move scenery and props quickly and efficiently. Here is a distillation of the best of these ideas.

Tip onto two wheels

One of the most direct approaches was sent in by Dean Stevick of Herndon, Va. (see the drawing at left). Stevick attached two lawn mower wheels to the back of his tablesaw, so the tool still sits solidly on the floor but can be moved by lifting its front end. The wheels were mounted on an axle made from a ½-in.-dia concrete anchor bolt with a 90° bend in one end. The metal brackets that hold the axle were bolted to the saw's base. Stevick recommends the wheels be mounted no more than ⅛ in. above the floor when the machine is standing upright. And he advises against using this method on top-heavy machines like a drill press or bandsaw.

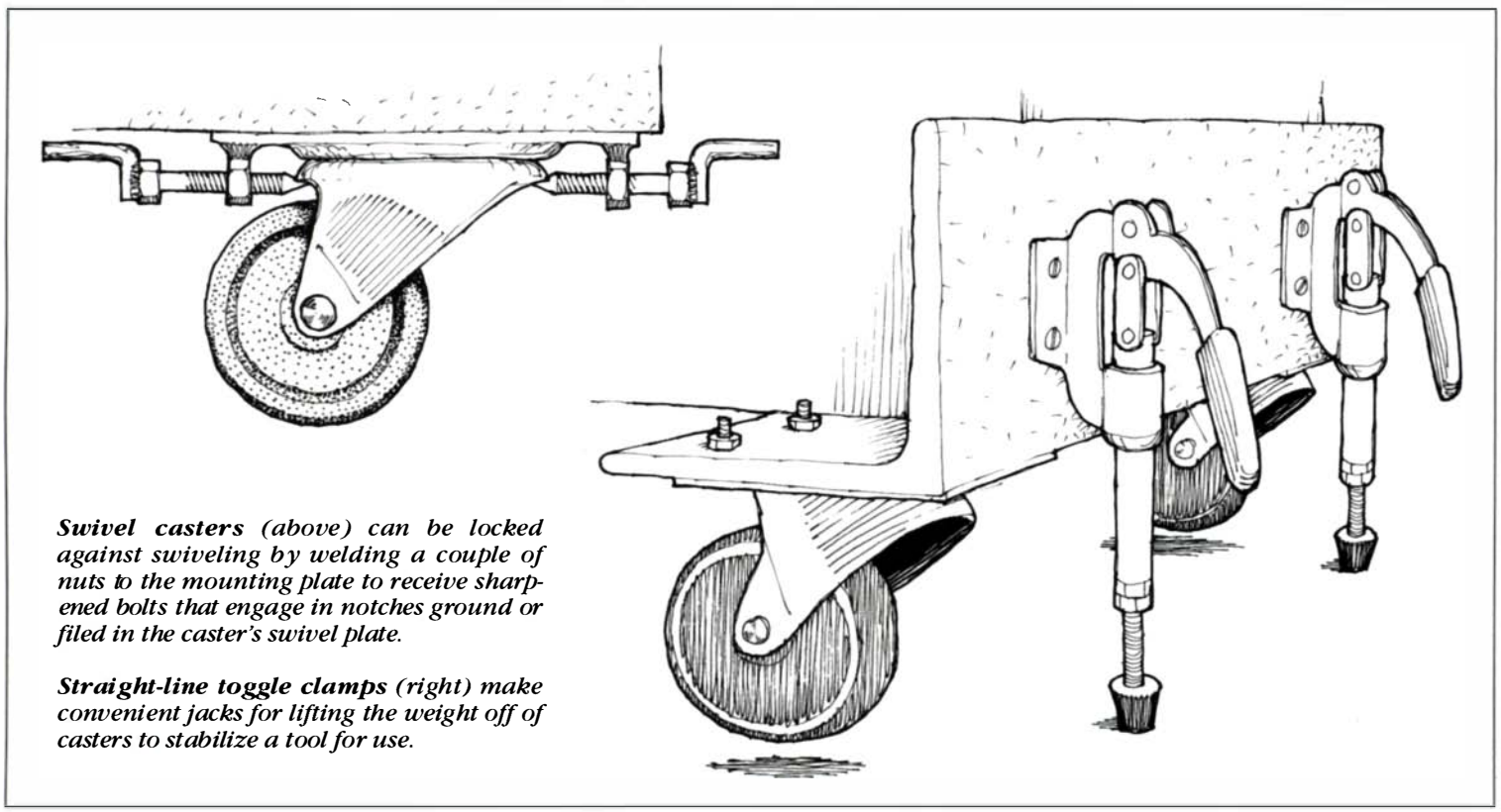
Mounting wheels on the back side of a machine works well as long as you can lift one end without too much difficulty. J. Rufford Harrison offered a similar method but added two oak handles that make lifting a heavy machine much easier on the back (see the drawing at left). The handles are bolted to the machine's base or stand so that they normally hang vertically alongside the machine and out of the way. When the handles are pivoted up to the horizontal position, they bump into another bolt that prevents further rotation and provides the leverage to lift the machine. The handles can be placed at a height that gives the most leverage and that makes it easy to roll the tool around like a wheel barrow.

Stabilizing swivel casters

The above method is fine if you have the room to manuever the machine forward and back on two wheels when making sharp turns, but what if you, like T.L. Manley Jr. of Coraopolis, Pa., have to turn your bandsaw on a dime to move it around a cramped shop? Manley mounted his bandsaw on four swivel casters for optimal manueverability and then bolted two straight-line toggle clamps to the angle iron used to mount the casters, as shown in the drawing at right below. The toggle clamps, or "thrust jacks" as Manley calls them, lift the weight of the tool slightly and act as brakes. Instead of using four jacks, one for each wheel, Manley used only two, but he has devised a way to lock the swivel mechanism on the other two casters to prevent any wobble at that end of the saw. He welded nuts on opposite sides of the caster base to receive small "crank" bolts that are sharpened to a point, so they will jam in notches ground in the caster's turntable (see the drawing at left below).

To align the wheels, he rolls the machine forward just before throwing the jacks down. This situates the wheels at a right angle to the force of the thrust when the saw is in use. Then he screws the crank bolts into the notches to eliminate any chance of the wheels changing position.

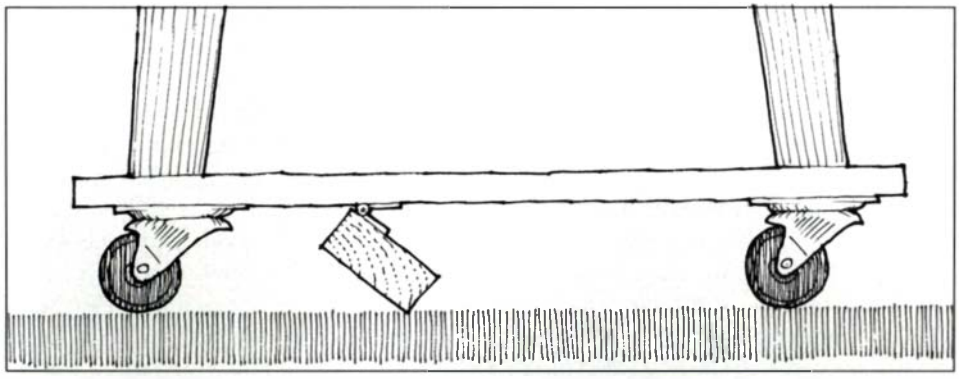
Another type of brake for a tool mounted on four casters was sent in by Pete Russell of Hilton Head Island, S.C. Russell simply

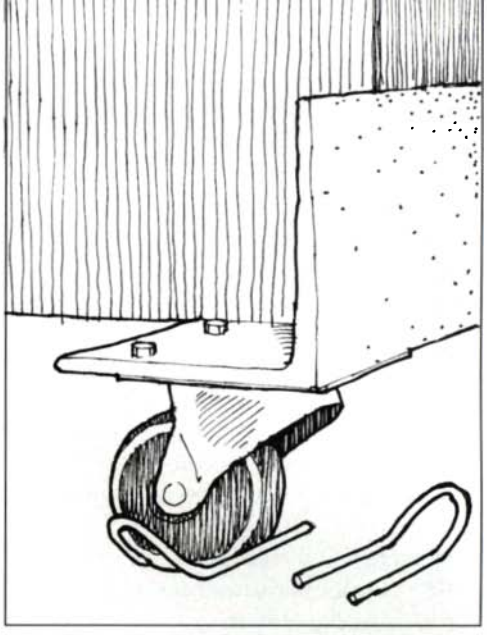


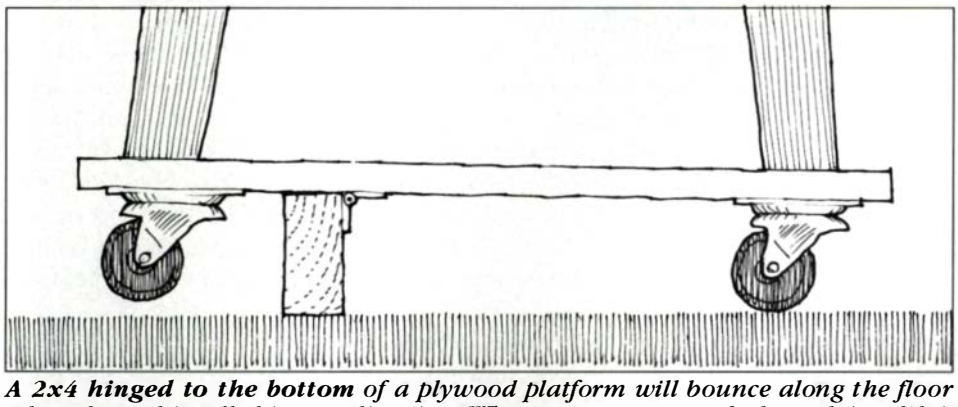
***Swivel casters** (above) can be locked against swiveling by welding a couple of nuts to the mounting plate to receive sharpened bolts that engage in notches ground or filed in the caster's swivel plate.*

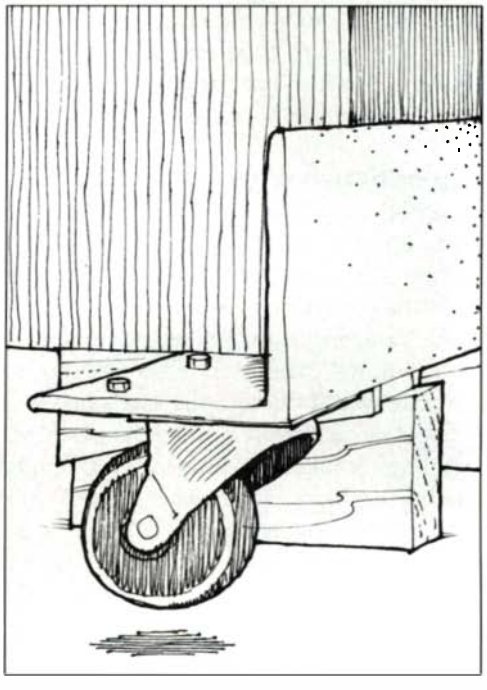
***Straight-line toggle clamps** (right) make convenient jacks for lifting the weight off of casters to stabilize a tool for use.*

It doesn't take much *to stop small diameter casters from rolling. Bent-wire stops slipped around each wheel (right) will do the job. Or raise the load off the wheels by driving opposed wedges against wedges attached to the underside of the machine's base (below).*



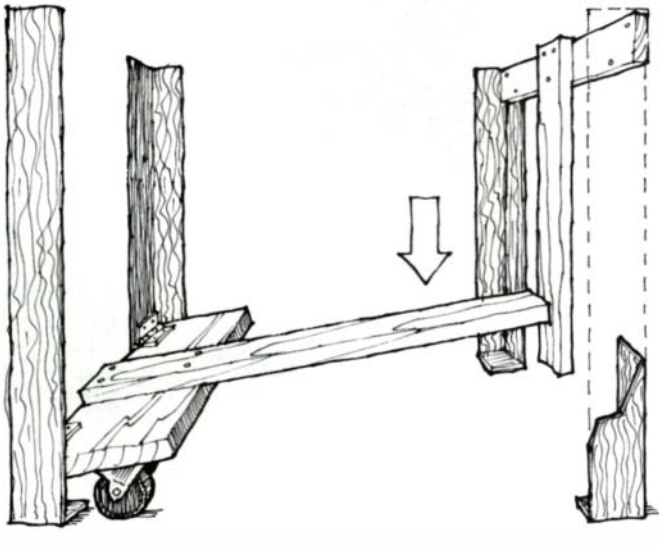




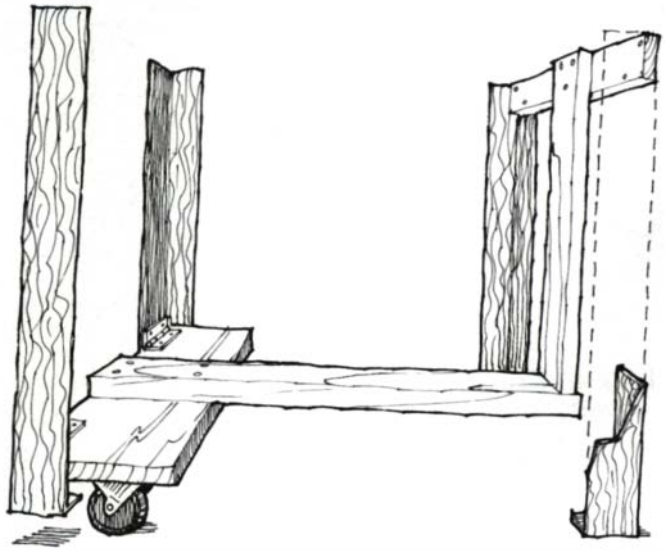


A 2x4 hinged to the bottom *of a plywood platform will bounce along the floor when the tool is rolled in one direction. When you want to park the tool, just lift it slightly, and then rock it up onto the 2x4. Hinge the 2x4 so that the hinged joint resists the thrust of feeding material.*

Hinged dollies *are what stagehands use to move props and scenery. The basic method is to attach the wheels to a plywood plate and then to hinge the plywood to the base or legs of the machine. Two versions are shown below.*



A simple latch activates this two-wheel dolly. The horizontal lever is screwed to the hinge plate. The vertical latch is screwed to a crosspiece or to the machine itself.



Pressing down on the lever deflects the latch. When the lever clears the latch, the latch springs back and locks the wheels in the down position.

hinged a 2x4 to a plywood platform (see the top left drawings on the facing page). When moving the saw, he pushes or pulls it front end first and the 2x4 bounces along the floor. When he wants to use the saw, he simply lifts the front end of the saw slightly and rocks it up onto the 2x4; the hinge joint jams to resist the thrust when feeding material from the front of the saw. If your floor is concrete, the weight of the saw provides enough friction to keep the 2x4 from sliding along the floor when the saw is in use. But Russell suggests that you could increase the friction, if necessary, by adding a rubber strip to the 2x4's bottom edge.

Hinged dollies facilitate a change of scenery

Hinges are also an integral element in the methods shown in the bottom drawings. According to a couple of the readers who sent in variations on this method, hinged dollies have been used for years to move theatrical scenery and props on and off stage in a hurry. Brian Ganter of Foxborough, Mass., mounts two heavy-duty casters on each of two pieces of plywood, which are then hinged to the machine's base or legs. A long arm is securely bolted to one of the plywood dollies so that it extends to the front of the machine and serves as a foot pedal. When you step on the pedal, you cause both sets of wheels to push down and to raise the machine an inch or two off the floor.

David Rogers of Thornhill, Ont., Canada, uses one two-wheel dolly with a simple spring latch to hold the wheels in the down position. The dolly is hinged to two legs as in Ganter's method, but the foot pedal (or lever) doesn't extend quite as far. Instead, the lever is just long enough to deflect the latch mechanism—a 1x2 extending down from a crosspiece attached to the other two legs of the machine's base. When the lever clears the 1x2 latch, the latch springs back and prevents the lever from moving back up. To lower the tool stand back to the floor, Rogers disengages the latch with a "deft little sideways kick, which leaves my foot in position to control the upward motion of the lever and to prevent the tool from dropping heavily."

Bob Thayer of Barnstable, Mass., another reader who credits his theatrical experience for similar methods, points out that leverage is increased by mounting the casters close to the hinge pivot point. He can lift his bandsaw equipped with hinged dollies with "only finger pressure." Thayer also recommends two books, *Scene Design and Stage Lighting* by Parker and Smith (Holt, Rinehart and Winston, Inc.) and *Scenery for the Theatre* by Burris-Meyer and Cole (Little, Brown and Company), as good sources for variations on these methods.

A couple of low-tech approaches

Of course you could keep things really simple and just take Don Greenfield's advice. Greenfield, of Crofton, Ky., makes stops by bending a 9-in. length of ⅛-in.-dia. solid wire around a ¾-in. pipe clamp. He then takes the U-shaped wire and bends the curved end up at about 20°. Sliding one of these stops under each caster locks the wheels when the tool is in use, and the 20° bend makes it easy to pull them out when it's time to roll the tool away. Similarly low-tech is Scandia, Minn., woodworker Keith Hacker's idea for stabilizing mobile tools with wedges, as shown in the top right drawings on the facing page. □

Jim Boesel is a woodworker and writer living in Vancouver, Wash. Jim Richey, of Katy, Texas, edits and draws FWW*'s Methods of Work.*

Sources of supply

The following companies carry casters or mobile bases for heavy machine tools. (The yellow pages for most large cities will also list caster suppliers.)

Delta International Machinery, 246 Alpha Drive, Pittsburgh, PA 15238; (412) 963-2400. (Locking mobile base.)

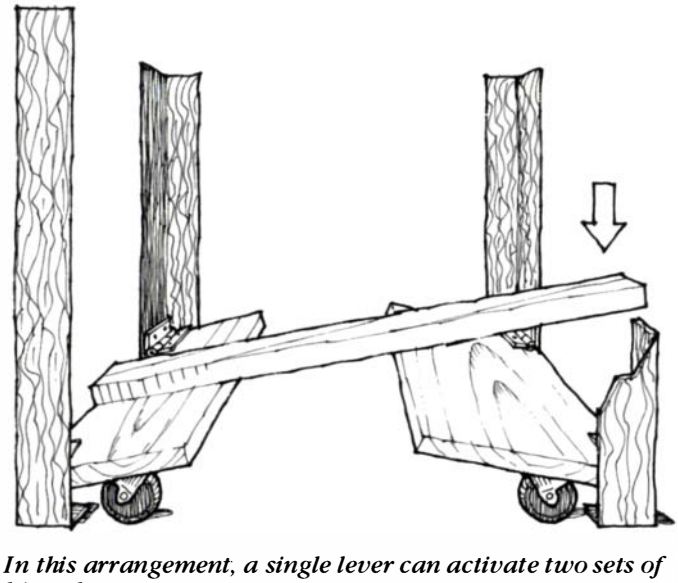
Garrett Wade Company, Inc., 161 Avenue of the Americas, New York, NY 10013; (212) 807-1155. (Rigid plate casters and locking swivel casters.)

Grizzly Imports, Inc., PO Box 2069, Bellingham, WA 98227; (206) 647-0801. (Locking mobile bases.)

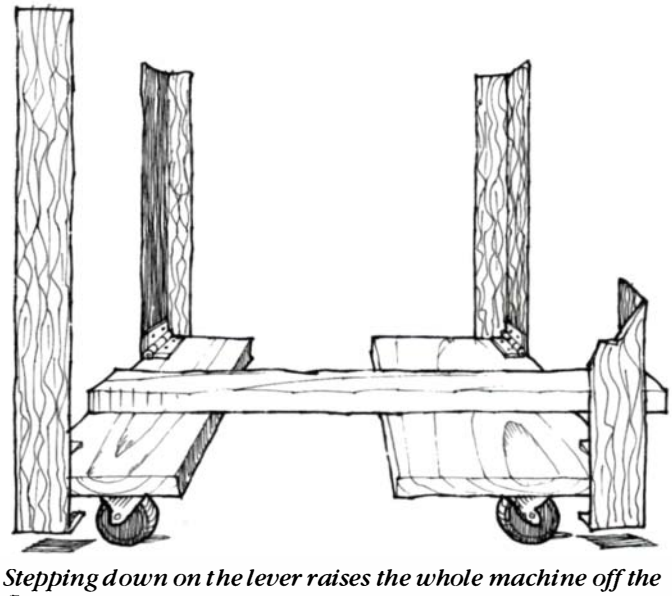
HTC Products, Inc., PO Box 839, Royal Oak, MI 48068-0839; (800) 624-2027. (Locking mobile base.)

Payson Casters, Inc., 2323 Delaney Road, Gurnee, IL 60031-1287; (312) 336-6200. (Wide variety of locking casters.)

Shopsmith Inc., 3931 Image Drive, Dayton, OH 45414-2591; (800) 762-7555. (Retractable casters adaptable to any stand or base.)



In this arrangement, a single lever can activate two sets of hinged casters.



Stepping down on the lever raises the whole machine off the floor.

***The Guild of Maine Woodworkers'** first juried show features 26 pieces made by 22 of the guild's members. The diverse array of woodworking includes Stephen Zeh's brown-ash basket, which is based on the Mic Mac Indians' potato-harvest basket. Also in the show are Cecil Pierce's matched pair of cocobolo smoothing planes. Pierce, who is 86, has been making and using planes for 50 years.*

Touring Show Heralds Maine Guild

Showroom and referrals promote craftsmanship and sales

by Vincent Laurence

Even in the best of times, eking out a living is the best many craftsmen attain. Seldom is it their workmanship that relegates these artisans to a bare-bones existence. Almost universally, it's a lack of marketing savvy, of knowing where and how to sell their handiwork, that leaves so many struggling to make a decent living.

As of this writing, 78 Maine woodworkers—from basketmakers to turners, and every denomination in between—have banded together as the Guild of Maine Woodworkers. The Guild's goals are to market their members' skills and products collectively and more effectively, to educate potential consumers about custom woodworking and to leave a legacy of fine craftsmanship. They are also working on setting up an apprenticeship program to promote woodworking as a career.

Concrete steps toward attaining some of these goals have thus far included assembling a directory of Guild members, establishing a showroom next to one member's shop, providing a referral service to put consumers in touch with appropriate members, maintaining a portfolio of members' work on display in the showroom and sponsoring, together with Thomas Moser Cabinetmakers and Maine's Office of Business Development, a traveling show. The juried show originated at Moser's Portland, Maine, showroom and will be on display in its Alexandria, Virginia, showroom through November 28. The work on these three pages, photographed in Portland, should serve as a worthy introduction to the Guild. □

Vincent Laurence is an assistant editor at Fine Woodworking.

***Ted Ney's* Gloucester Side Chair** *and Gregory Payeur's book stand (originally designed to permit a knitter to read while knitting) are among the contemporary pieces in the show. Ney's chair, in bird's-eye and hard maple, is finished in clear and black lacquer.*

Payeur's book stand is made completely of apple, which he cuts himself. His source of apple—old trees destined for the firewood heap—is an orchard in Indiana that is reputed to have been planted by John "Johnny Appleseed" Chapman. The book stand adjusts up and down in its octagonal base, swings through an arc of 65° and pivots through 270° on the end of the horizontal boom.

"God is in the details," *architect Mies Van Der Rohe once said. Payeur's book stand bears witness to that statement. Delicately carved support and adjustment pieces and a sensitive use of the wood's color and figure make the piece a pleasure to behold.*

Spectacular figure, simple, clean lines *and traditional hardware draw one's eye to Lincoln Clapp's cherry secretary. As with Robert Newton's clock (at right) and Arthur Mitchell's* Sunburst Windsor *(above left and on the cover), Clapp's secretary is an interpretation, not an imitation. Tradition and innovation meet in these pieces to establish a new, contemporary Yankee aesthetic.*

A ***smart mix of old and new,*** *Robert Newton's tall clock is a hybrid that draws on many traditions without slavishly imitating any. The escutcheons and the lower door's sash both recall a Charles Rennie Mackintosh clock Newton once saw, and the clock's overall form derives from the Shakers. The eight-day, brass weight-driven movement is traditional, but Newton had to improvise for the face. Looking for a material that looks like porcelain but without its fragility or expense, Newton settled on a synthetic solid-surface countertop material called Fountainhead (manufactured by Nevamar). He cuts and dresses the Fountainhead and then screenprints the numbers and his logo onto the clockface.*

Photos: Susan Kahn

***To simplify a production run of Yorkshire chairs** with contoured hardwood seats (inset), Dan Trimble devised a seat duplicator. The jig's cutterhead, an angle grinder fitted with a wood-carving wheel, dishes out the central seat blank, reproducing the shape of the two seat patterns that are located left and right of the blank. When copy carving a seat (10 minutes from start to finish), Trimble wears long sleeves and an air helmet.*

Photo: author

Sculpting Chair Seats with a Shop-Built Duplicator

Angle-grinder drives this high-production jig

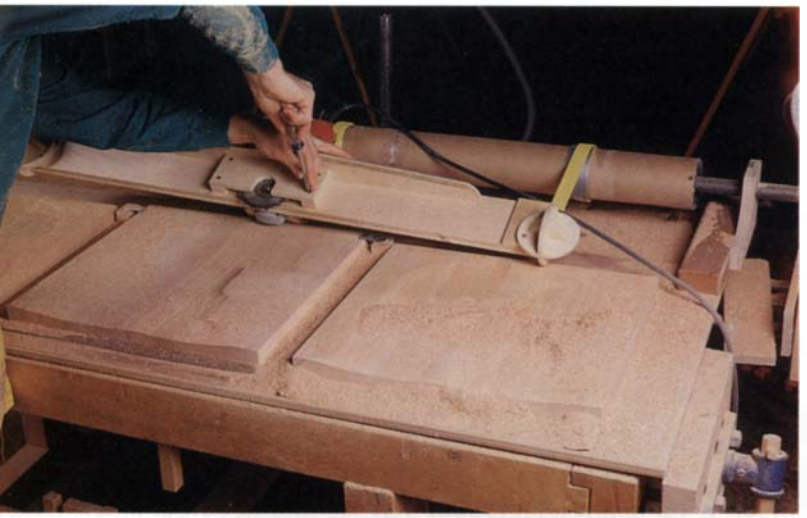
by Dan Trimble

Shaping a flat slab of wood to fit the human behind is nothing less than sculpture. Doing it 30 times the same way is production sculpture. This was one of the tasks I faced when asked to reproduce more than two dozen Yorkshire-style chairs (see the inset photo above) for a new restaurant. Although I had built lots of chairs before, these were the first with contoured solid seats. Hand-chiseling the seats was out of the question, and I wasn't ready to invest in a designated machine for one run of chairs. So I set out to find a more practical way to carve the seats.

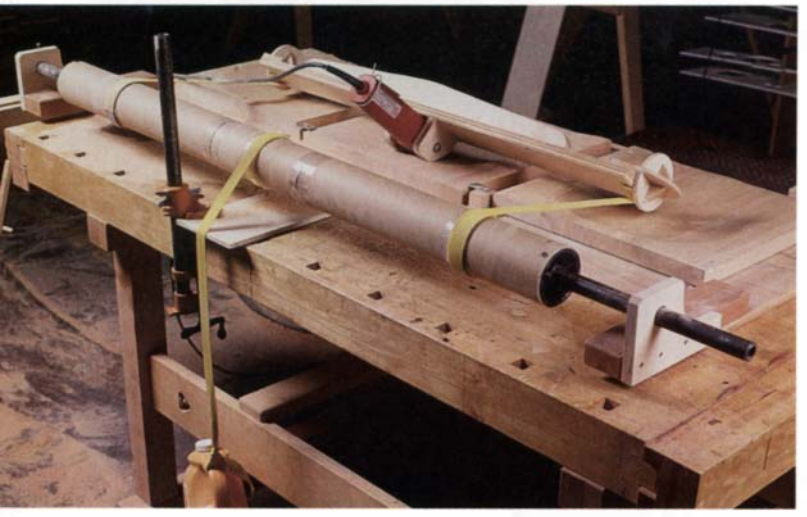
I knew that a chainsaw could do the job and remove wood rapidly, but control was questionable. I also knew about a power-carving wheel that had chainsaw-like teeth and fit a standard angle grinder (see *FWW* #87, p. 124). I reasoned that a less-aggressive version of this cutter would be just the ticket. I rushed an order off to King Arthur Tool, 3225 Earl Dr., Tallahassee, Fla. 32308; (904) 893-8550. After receiving the 22-tooth Lancelot cutter, I mounted it on my angle grinder and experimented on a piece of wood. The wily little tool surprised me with its effortless cutting, removing stock both in line and side to side. But controlling the cut for 30 exact copies still presented a problem. Necessity being the mother of invention, I built a duplicating jig using this power carver and two pattern followers (see the photo above).

Making a linear carving duplicator

Based on three points on a line, I figured that when two outside points followed identical patterns, a center point would trace the matching contour on a blank. Allowing 3 in. between the patterns and a 17-in.-wide blank put the distance between the blank centerline and the center of each pattern at 20 in. To assemble the patterns and jig, I mounted a plywood base on a large worktable.



***When duplicating a seat, Trimble moves his jig** with the grain, taking ¼ in. at a pass. In actuality, the carving wheel cuts across the grain. To minimize grain tearout, Trimble makes an initial L-shaped swath with the cutter, which reveals the seat's pommele. Here, part way through a seat, he adjusts the guard.*



***At the back side of the jig, a pair of nylon straps** wrapped around a tube keep the two followers parallel to the front edge of the patterns. This alignment ensures that the cutter copies the contour on the blank. The tube spins around an axle (¾-in. iron pipe) that is supported by two yokes. A counterweight (water jug) suspended at the end of a central strap puts tension in the system.*

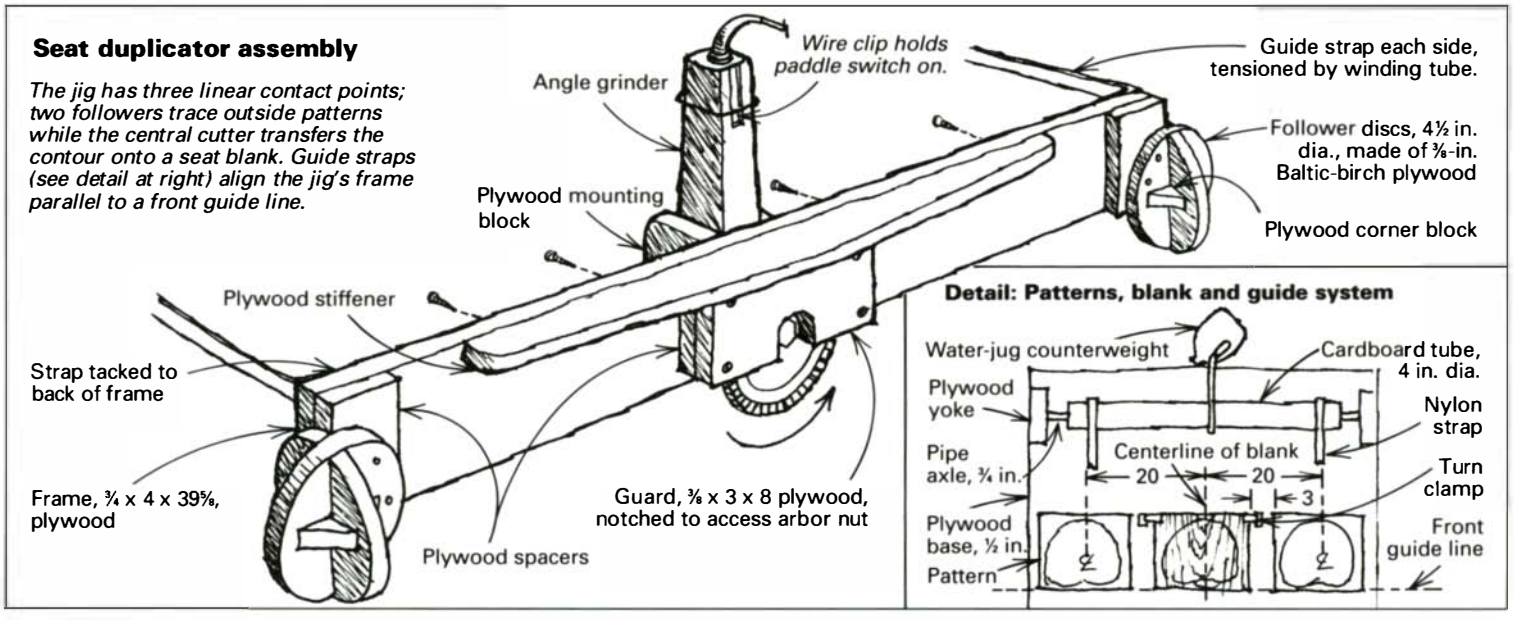
Frame and cutter—I made the jig's frame, which holds the followers and angle grinder, from a piece of ¾-in. cabinet-grade plywood. To straighten the frame, I added a plywood stiffener to go along its top edge. The neck on the head of my grinder fit nicely into a 1¾-in.-dia. hole drilled in the frame. To hold the grinder (with its screw-on handles removed) in place, I bolted a couple of ¾-in. plywood blocks to each side of the grinder reusing the tool's handle holes. Then I screwed on a piece of plywood to act as a guard for the cutter, as shown in the photo at left. I also notched the guard so that I could access the arbor nut of the grinder.

Pattern followers—To transfer the patterns correctly, I made round followers the same diameter as the cutter wheel. I cut two 4½-in.-dia. discs of ⅜-in. Baltic-birch plywood and added pairs of 4½-in.-dia. semicircles at right angles to the sides of the discs (see the drawing below). To keep the discs aligned and rigid, I glued on some corner blocks. Then I shimmed the discs in line with the cutter wheel. I screwed the sphere-like followers to the frame's ends, so the bottom of the discs were tangent with the edge of the cutter and 40 in. apart, center to center. The discs don't roll. Instead, they slide over the contour, much like the stylus of a lathe duplicator, pushing wood chips out of their way as they go.

Parallel guide system—The line between followers has to stay parallel to the front of the seat patterns and blank (see the drawing detail below); otherwise, the three-point follower/cutter principle fails. I originally thought I could hold the duplicating jig in line by hand but quickly found this very hard to do. So I came up with a system for guiding the jig using non-elastic straps attached to the ends of the frame. I used a pair of 4-ft.-long nylon straps rolled around a 5-ft.-long cardboard tube (see the photo at left). I ran a 5½-ft. length of ¾-in. iron pipe through the 4-in.-dia. plugs on each end of the tube to act as an axle. Supported on two plywood yokes that were screwed to blocks fixed onto the base, the tube spins on its axle and winds the straps in. When the straps are adjusted taughtly, the jig stays parallel to the front of the base. To tension the straps, I wrapped another strap in the opposite direction at the tube's center and weighted the other end of this strap with a plastic jug of water, letting it hang off the back of the table. To make the guide system operate more smoothly, I simply adjust counter balance by putting more or less water in the jig.

Seat duplicator assembly

The jig has three linear contact points; two followers trace outside patterns while the central cutter transfers the contour onto a seat blank. Guide straps (see detail at right) align the jig's frame parallel to a front guide line.



Photos except where noted: Alec Waters; drawing Maria Meleschnig

Laminated patterns and topographic prototypes—In my initial attempt to make seat patterns, I built two frames for plaster-of-paris molds. The pair came out fine, but after I applied a coat of varnish to harden their surfaces, the molds were still too soft, and the followers scored them easily. (I've since found that a thick piece of Baltic-birch plywood makes an ideal prototype material; the even layers produce rings that resemble topography lines, which let you know when the two halves of the seat are symmetrical.) Luckily, my plaster molds lasted long enough for me to copy carve (duplicate) two laminated maple patterns that work superbly. Because my blanks were thicker (1 3/16 in.) than the patterns, I used the contact points of my jig as a guide and shimmed the patterns at their corners until the cutter just grazed the blank. While I was at it, I measured my cutter wheel and found that it was slightly out-of-round. I marked where the high spot was so that in the future, I'll always use the same reference point when leveling the patterns. Once shimmed, I just screwed the two patterns to the base. Then, to hold the blank down, I made a pair of turn clamps from blocks of scrap and some metal clips.

Copy carving and finish-sanding the seats

Thinking that I should carve blanks in their grain direction, I first set up the patterns with the seats facing sideways. I plowed into a blank and got a fairly smooth cut using a to-and-fro motion while taking about ¼ in. at a pass. But after shaping a few oak blanks, I found that I couldn't keep the grain from tearing out excessively on the uphill cuts. So to make the cutterhead carve cross-grain, I removed the patterns, rotated them 90° and remounted them perpendicular to a front guideline (see the drawing on p. 68). I then cut an L-shaped swath (down the left side and across the bottom), which prevents the cutter from tearing out grain on subsequent passes.

To use the jig, I hold one hand on each follower (see the photo on p. 67). Because this position places me near all the dust, I wear a respirator/face shield (available from Airstream Dust Helmets, Highway 54 S., Elbow Lake, Minn, 56531; 218-685-4457). I also wear a long-sleeved shirt—the chips come off the cutter at a hellish speed, giving a good sting to bare flesh.

The jig is quite forgiving when cutting cross-grain, and in less than ten minutes, I can produce an accurate seat shape. I've found that I can smooth out any slight imperfections and give a flowing seat contour through sanding. I first rough sand with a pneumatic orbital sander using a 24-grit disc that's mounted to a soft pad. Then it's on to finish-sanding with a sequence of 40-, 80-, 120- and 220-grit discs. After the sanding is done, even a sharp eye (or a sensitive behind) cannot detect variation from seat to seat. □

Dan Trimble runs a woodworking business in Indiana, Penn.

Depth holes guide consistent seat carving

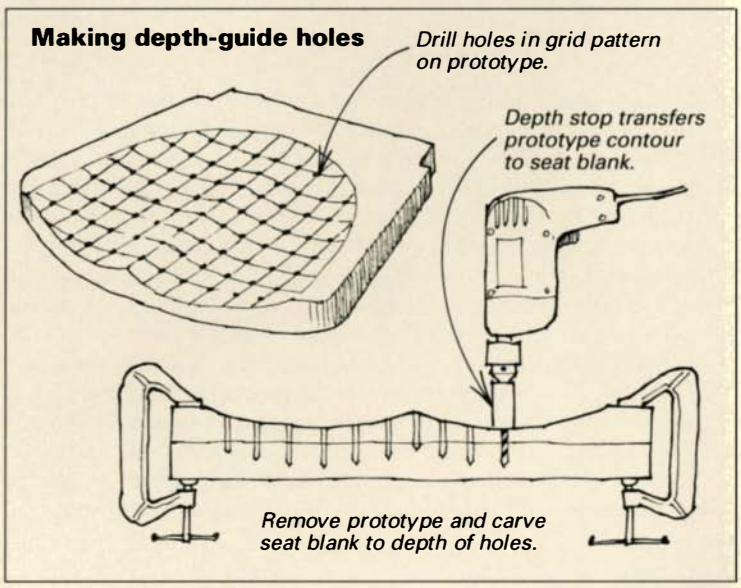
by Alec Waters

Confronted with six time-consuming Windsor chair seats, Bill Turner of Stonington, Maine, came up with a method that transfers a seat shape from prototype to blank using depth-governed pilot holes. He first lays out and drills a 1-in. grid of holes through a prototype pattern (see the drawing at right). With the prototype clamped atop a seat blank, he drills through a hollow spacer back through each hole. The resulting hole depths conform to the seat contour. To remove wood in a connect-the-dots fashion (see the photo at right), both Turner and Canadian furnituremaker Mac Campbell use grinders with chainsaw-tooth cutters. (Cutters are available from Woodcarver, c/o Ryobi America Corp., 1424 Pearman Dairy Road, Anderson, S.C. 29625; 800-323-4615.)

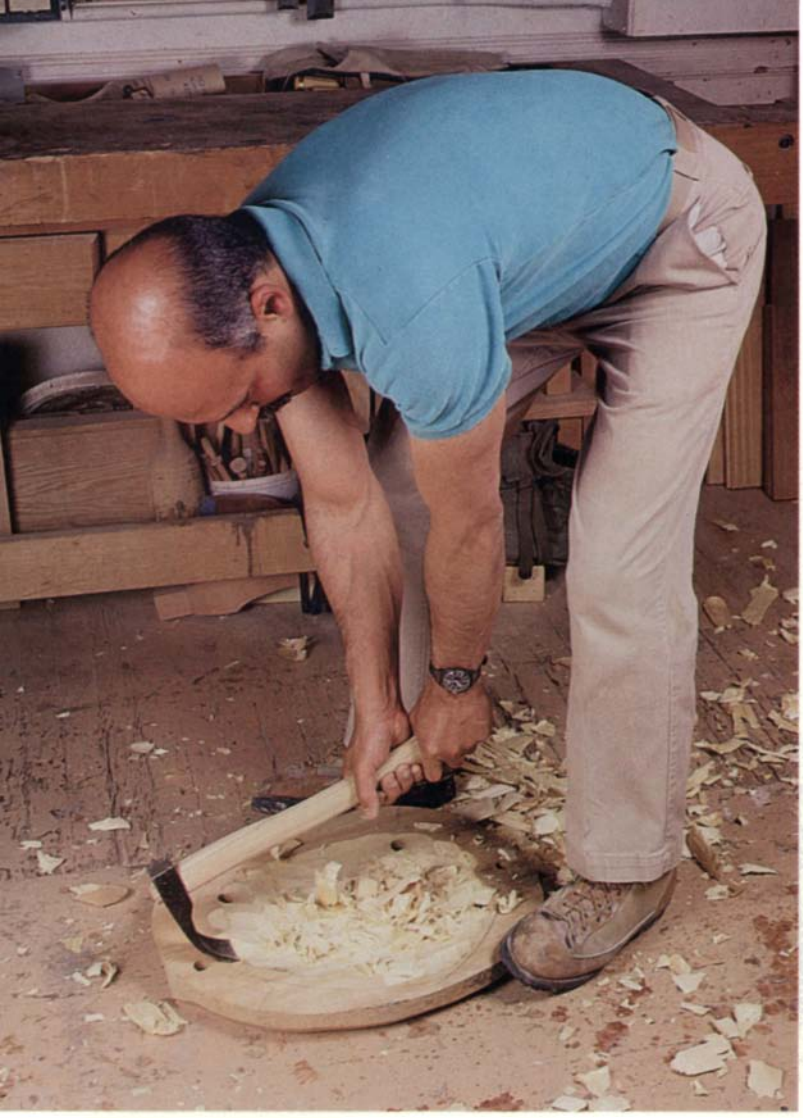
Freehand power carving: When carving with his grinder, Campbell shifts the tool's safety guard to a 45° angle to its axis. After he clamps the workpiece to his bench, he power carves up to about ¼ in. away from a pencil guide line that he marked at the back of the seat. To maintain control, Campbell orients the cutting wheel at a 90° angle to the work while holding the tool's auxiliary handle. To deflect chips, he wears a glove and face shield. Starting at the back of a seat, Campbell moves toward the front, scooping to a 1 in. depth about 3 in. from the rear of the carved area. Unlike traditional Windsor chairmakers, Campbell slightly rounds his seat's front edge to give more comfort to the back of a sitter's legs. After the seat is sanded, he also eases the bottom edge with a rasp or roundover router bit. □

Alec Waters is an assistant editor for FWW.

***Both Bill Turner and Mac Campbell use depth holes** to guide them when roughing out seats. Campbell modified the shape of this pattern (left) several times by adding fiberglass auto-body compound and grinding away wood. As he's carving, he periodically checks the seat's profile with a centerline template.*



Drawing: Jim Richey



Step 1: Rough the seat hollow with an adze.

Step 2: Sculpt concave area with an inshave.

Step 3: Shape convex surfaces with a drawknife.

Hand tools shape a traditional seat

by Mario Rodriguez

For the sake of authenticity, when I'm reproducing an 18th-century chair, I use traditional hand tools and techniques. This is especially true when I'm scooping the chair's seat. I conduct workshops on making traditional-style seats, and people are often surprised that I can hand-shape a Windsor, or any other style chair seat, in 40 minutes or less. Here's how I do it.

Most antique chairs have seats carved from a single piece of wood. For my seats, most of which are to be painted (see the photo of the Connecticut comb-back Windsor chair on the facing page), I begin with a 2-in.-thick slab of pine that's sound and relatively clear, except for maybe a few small knots. First, I bandsaw the pine blank roughly to shape (use a bowsaw if you're a pure traditionalist). Then I mark out the pattern to be carved on the blank's top and an edge guide line at the circumference. I also drill holes for the legs and arm posts (stumps) at this time.

1) Adze: To begin roughing out a seat, I use a long-handled adze. I straddle the blank, so I can hold it down with my feet (clad in steel-toed boots) while I swing the adze (see the photo above left). Using shallow cuts and fairly short strokes to break up and shorten the grain, I hollow the center of the seat (well within my outline) to about ¾ in. deep.

2) Inshave: Next I clamp the seat to my bench and use an inshave to smooth out the seat cavity that's splintered and rough from the adze. Along the edges, I cut to within ¼ in. of my pencil line, easing the transition to the ¾ in. depth at the middle. To avoid tearing out grain, I shave from the rim down to the hollow (see the top photo above). For clean cuts, I keep my inshave sharp and my strokes light. I also keep tuned to the grain direction and restrict my shaving to the seat's concave area.

3) Drawknife: I use a drawknife to shape the seat's raised curved areas. The drawknife leaves an attractive faceted surface (see the bottom photo above) that needs little further work. I also use the knife to shape the seat's convex underside and back, working to the perimeter guide line.

4) Spokeshaves: I have two spokeshaves for seat-shaping work: One has a flat bottom and the other is round. I use the round-bottom shave to smooth out the curved surfaces, removing un-

Photos except where noted: Alec Waters

Step 4: Remove gouges and ridges with spokeshaves.

Step 6: Smooth the seat contour with sandpaper.

Step 5: Carve definition and details with gouges.

wanted ridges and tool gouges (see the top left photo above); with the flat-bottom shave, I smooth the seat's front and back edges and its underside. Both spokeshaves leave a silky surface with slight tool marks such as those found on original Windsor chairs.

5) Carving gouges: A carving gouge is great for fine detail cutting, carving knotty areas and getting into tight places where other tools won't. I prefer shallow gouges (#2 and #3 sweep) for carving down from the rim outline into the seat. I use ½-in. and 1-in.-wide gouges, as shown in the bottom photo above. If a chair design calls for a rain gutter, I'll go to a ¼-in. veining gouge.

6) Hand-sanding: Finally, I use sandpaper to give the seat smooth flowing contours. I start with 60-grit to remove any grain tearout and finish up with 100-grit for a paint-ready surface. In keeping with the 18th-century chair look, I sand only the seat's top and front edge while keeping the edge crisp (see the top right photo above). On the seat's back edge and underside, I leave the tool marks showing. □

Mario Rodriguez is a cabinetmaker and 18th-century woodworking consultant. He teaches toolmaking, furnituremaking and antique restoration in New York City.

Photo of finished chair: David Arky

***A base frame simplifies the connection between** a carcase and bracket feet. Both the feet and the carcase can be screwed to the base frame individually through oversized holes or slots that allow screws to move. The ogee bracket foot shown above has a baseboard molded to a classic S-shape; then it's sawn to an elborate scrolled pattern. A second decorative molding section is nailed to the carcase frame.*

Bracket Feet for Case Pieces

Separate base avoids cross-grain destruction

by Norm Vandal

As a cabinetmaker specializing in furniture reproductions, I've experimented with several techniques for making and attaching traditional bracket feet. I've always admired the stylistic effect of these feet, but I want to avoid the joint failures and cracked carcase sides found on so many period pieces. I've devised a separate-base system that avoids the problem of cross-grain construction.

Cabinetmakers have been wrestling with these structural problems since the advent of central heating. The 18th-century workers got away with attaching moldings cross-grain to sides and with other cross-grain constructions because their homes didn't experience such drastic humidity changes. I don't want to sacrifice the historical integrity of my reproductions, but I don't want the pieces to self destruct either.

My separate-base system provides adequate support and maximum allowance for wood movement. I joined the case with half-blind dovetails, rather than the easier-to-cut through dovetails, so that I wouldn't have to hide the visible tails behind a molding as the early makers did. This meant I could locate the base molding lower on the case side as part of a separate base upon which the chest can sit.

I also began attaching bases, moldings and drawer runners by using a specialized, but common, router bit called a picture-hanging bit. This bit, available from most woodworking supply houses, cuts a T-shaped slot, as shown in the top photo on the facing page, which forms a perfect mate to a #10 Phillips pan-head sheet-metal screw. After slotting the back sides of moldings or drawer runners, I could screw these pieces snugly to a case side and still allow critical wood movement. Also, the frames of bracket bases can be similarly slotted to fit screws fastened in the case bottom—again a good, strong connection that allows wood movement.

Although the separate bases I'll discuss in the article were developed for traditional bracket feet designs, like the one in the photo above, you can apply the same principles to other styles of carcases where you must balance the need for strength with a way to accommodate seasonal wood movement.

Why bracket feet fail

Plain bracket feet are cut from a narrow board long enough to wrap around the carcase. The long grain of the board runs at a right angle to the grain of the case side. This is cross-grain construction. Because seasonal changes in humidity make the wood shrink and expand in width and thickness, but not in length, front miters are liable to separate and case sides to crack. The more

Photos: Jim Boesel

high-style ogee feet, which are cut from a board stuck with the classic S-curve profile, are nailed to the case bottom and sometimes to a base molding and then reinforced with glue blocks. This construction reduces wood movement concerns, but makes it likely the feet will shear off if the piece is dragged across the floor. Another problem stems from the fact that the chest doesn't sit directly on its feet. Both types of bracket feet are attached precariously close to the outside plane of the chest, so the feet cannot adequately support the weight.

To add support to the case and strengthen the miters, cabinetmakers applied glue blocks to the inside corners of the feet, as shown in the bottom photo, but this only creates another cross-grain construction. Some period cabinetmakers were savvy enough to use segmented glue blocks running horizontally with the grain. These feet seldom cracked, but my separate-base system still offers a better solution.

Building a base frame for plain bracket feet

My typical base frame is constructed of ⅞-in.-thick hardwood stock (2½ in. wide) mortised and tenoned together, as shown in figure 1 on p. 75. The two side members run full length from front to back and are mortised to accept the two adjoining members. The base dimension must be slightly larger than the chest bottom to allow for movement of the case sides, so I build the frame after assembling the carcase. It's important to note that the lowest drawer sits and slides directly on the case bottom.

After determining the base size, I cut the mortises and respective tenons. The top surface of each side member is grooved with the picture-hanging router bit. A router table or a fence on the router facilitates this operation. Several #10 sheet-metal screws will later be driven into the case bottom to mate with the T-shaped slot.

The baseboard from which the feet are cut is then molded along the top edge. Typical baseboards are from ¾ in. to ⅞ in. thick. An ovolo/cove molding is quite standard and can be cut with two common router bits: a ⅜-in.-radius roundover bit for the ovolo and a ⅜-in.-radius core box bit for the cove. Next, I miter the molded baseboard to fit around the base frame. I prefer to spline the miters, both for strength and ease of gluing. Splines must be blind at the top, so they won't show. You also could use a biscuit jointer. Leave the two side-molding pieces a bit long, so they can be trimmed to final length after you perfect the miters.

Once all miters are cut, and the two sides trimmed to length (flush to the back of the base frame), cut the two rear angled brackets and join them to the side baseboards with half-blind dovetails. Check the baseboard for correct fit, remove it and layout the feet with a template. Bandsaw out the feet, and sand or scrape the sawn edges clean before fastening the baseboard to the base frame. I simply nail it in the traditional manner. Note in the drawing how it extends above the base frame to house the chest and conceal the horizontal seam between the carcase and base. The rear brackets are glued at the dovetails and glued and nailed to the base frame. Cut glue blocks with the grain running horizontally, butter them with glue and simply rub them into the four corners.

With the case sitting on its top, set the base into position. Mark the location of the two T-shaped slots and drill holes for the screws that will fasten the case at the front edge. These screws will keep the chest tight to the base molding at the front; any movement will be noticeable solely at the back edge. Remove the base and drive the sheet-metal screws into the case bottom. Set the screw depth to fit snugly in the groove. Now the base frame can be slid onto the case bottom and the front screws driven home.

You can also use the same T-slot system to fasten a cornice molding to the case sides. Leave the slot blind at the back ends, so the method of attachment won't show. Glue the miters only along the first couple inches, so the glue does not restrict wood movement.

Frames for ogee feet

My system for ogee feet also uses a mortised-and-tenoned frame, with T-shaped slots for attaching the carcase. But, because the base molding for ogee brackets is not part of the board from which the feet are cut, you must attach a separate piece of molding to the edges of the base frame, as shown in figure 2 on p. 75. This molding is set flush to the bottom of the frame and forms a lip at the top into which the chest drops. The molding must be taller than the thickness of your base frame, and the carcase must be half-blind dovetailed. After mitering the molding, I attach it to the base frame with glue and/or nails.

The next step is to mold the ogee stock before cutting the miters and sawing out the individual feet. Period cabinetmakers often used boards as thin as ¾ in., but I prefer thicker stock, usually around 1¼ in. to 1½ in., so that I have room to cut a rabbet to accept the horizontal corner brackets. These horizontal brackets are not found on period pieces, but I feel they significantly strengthen the setup. The 2$^{1}/_{16}$-in.-thick feet in the drawing are particularly robust. Feet can be laminated, but only if the glue joint falls under and is concealed by the base molding. Be sure to allow enough extra length for the miters. Period cabinetmakers formed the large ogee contour mainly with molding planes (see the top photo on p. 74), but the profile also can be roughed out on the tablesaw (see the photo on p. 75) and then scraped and sanded smooth.

***An invisible and effective system** for attaching carcases to bases and for handling other potentially destructive cross-grain constructions is based on a common picture-hanging bit, which cuts a T-slot that mates perfectly with a #10 sheet-metal screw.*

***Plain bracket feet were reinforced** with wood blocks glued into each corner. Often the block was applied with its grain running at a right angle to the baseboard. This cross-grain construction often caused the feet to crack.*

The author molds the ogee pattern on a base frame with a cornice plane. The plane is wide enough to cut the entire pattern.

I spline the miters for strength and ease of assembly before bandsawing the foot profile. I set the molded face down on the bandsaw table with the foot pattern traced on the flat back side, shimming to level.

The top edge of the feet must be rabbeted for the horizontal corner bracket that caps the feet and will fasten them to the base frame. A router table setup with a common straight bit allows you to leave the rabbets blind at the ends, so the brackets won't show. The rear feet have angled return brackets, like those for plain bracket feet, and they are half-blind dovetailed into the rear feet before being glued and nailed into the base frame.

Glue up the components of the four foot units, right and left, for both front and rear. Attach these components to the underside of the base frame with common wood screws. Their movement will be minimal, and permanent attachment shouldn't pose any problems. Cut and glue the horizontally grained glue blocks into place.

Through dovetails and ogee feet—Because through dovetails are easier to cut than half-blind dovetails, I've developed a system for attaching the feet without a base frame so that I can use that joint. The four separate feet are individually attached to the chest bottom, as shown in figure 3. There isn't much of a problem with seasonal movement in the feet themselves, and they can be rigidly attached.

The only real problem is attaching the base molding to allow for movement of the case sides. Here again, I rely on the T-slot system. The front molding is permanently fastened and the miters are glued together. The side moldings are slid onto the screws from the rear of the chest, tight to the miter at the front.

The feet are attached directly to the case bottom by screws driven through the horizontal corner brackets. The bracket holes can be left slightly oversized or slotted if you're worried about movement of the case bottom. I've simply screwed them tightly in place, and I've

The evolution of the chest: from bootjacks to bracket feet

Bracket feet were first used to support carcases early in the 18th century shortly after the common six-board blanket chest evolved into a chest of drawers. Six-board chests were the primary form of household storage from ancient times until late in the 17th century and are still popular today. The early chests were constructed by nailing wide boards together at the corners. The two ends, with their grain running vertically, extended beyond the bottom of the chest to hold it above the damp and dirty floor. The ends were generally decorated by a scrolled cutout at the center, creating four separate feet. The ends resemble a bootjack, like the chest in the photo at right.

In the 17th century Jacobean and William & Mary periods, sliding drawers were first built into six-board chests. Drawers improved the deep well storage of a six-board chest in two ways. First, the top needn't be cleared off and lifted up every time someone went into the chest. Second, the drawers allowed for more organization and classification of contents.

About this time, cabinetmakers sought new techniques for joining the chest carcase. Since the sides were only nailed to a bottom board housed in shallow dadoes cut in the sides, the cases often separated in this area.

To strengthen the chests, they applied a technique used on another contemporary storage chest, the sea chest, which didn't have feet and could be stacked in the hold of a ship. Unlike the typical six-board chest, the grain on the side of a sea chest ran horizontally all around, and the four corners were dovetailed together. The cabinetmakers found this approach enabled them to make a much more solid chest of drawers. However, feet had to be constructed separately and somehow attached to the chest bottom.

***The sides of early chests** were decorated with scrolled cutouts, which created four separate feet. The pieces were called bootjack chests because the sides resemble a common implement for removing footwear.*

Chests of drawers popular in the late Jacobean and early William & Mary period were set on large, turned feet, called ball feet or bun feet. These were round-tenoned directly into the chest bottom, and the tenons often snapped when the chest was slid across the floor.

The exposed tails at the bottom and top edge of these chests were usually hidden with an applied molding, which restricted the inevitable seasonal expansion and contraction of the case side. The usual result was a separated miter at the front corner and a loose molding. In extreme cases, the case sides cracked. Early chests abound with these common defects.

Early in the 18th century, cabinetmakers created a new style of feet that could be decorated with popular scrolled patterns and attached to the bottoms of dovetail-joined chests of drawers. Today, these innovations are called bracket feet, or bracket bases, and are a standard feature of Chippendale furniture. —*N.V.*

never experienced a problem. Segmented glue blocks are obviously required. This method is less tedious and, therefore, much quicker than making a joined base frame, but a base-frame method is marginally sturdier, particularly for extra-large case pieces like chests on frames or desk/bookcases. The greatest advantage comes from being able to use through dovetails for joining the carcase, a substantial time-saver.

***Ogee patterns** can be roughed out on a tablesaw and then refined with handplanes, scrapers and sandpaper. The author runs molding stock across the blade at an angle to cut a concave shape.*

***Molded base frames**—*You can also construct ogee bracket feet so that the base molding is actually part of the front and two side members of the base frame. The front corners are spline mitered, as shown in figure 4, and the rear brace is tenoned between the two side frame members. The frame has to be the same thickness as the height of the molding, and the front and two side pieces must be of primary wood.

The chest carcase, which must be joined with half-blind dovetails, sits directly on top of the frame and creates a horizontal joint between frame and carcase. As in other systems, a T-slot and screw setup is used to attach the base to screws in the chest bottom. Screws in slotted holes will serve as well. The chest's front edge is fixed in position with screws driven through the base frame.

The ogee feet are assembled as typical units, having horizontal brackets, segmented glue blocks and angled brackets on the rear feet. They're screwed to the underside of the frame.

I've used this system with no adverse effects, but it's my least favorite alternative. I don't care for the horizontal joint because this joint is always vertical on original period pieces. There's potential for across-the-grain movement in the front and side rails, which could cause the miter to separate. Perhaps the best feature of this method is that the base molding can't come apart. □

Norm Vandal makes period furniture in Roxbury, Vt.

Methods for attaching bracket feet

When the wood grain of bracket feet runs side to side, while the grain of the case side runs up and down, something has to give. This contradiction is the reason for joint failures and cracked sides on many antique pieces. Making the base as a separate unit and slot-screwing the carcase to it averts cross-grain destruction.

Fig. 2: Ogee bracket feet with half-blind dovetail case

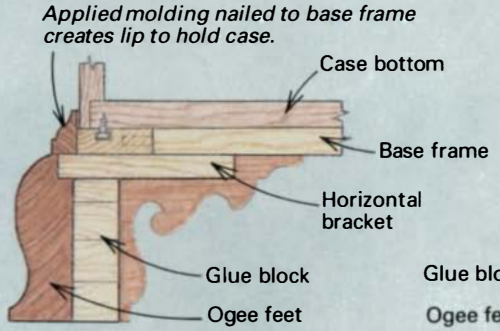


Fig. 3: Ogee bracket feet with through dovetail case

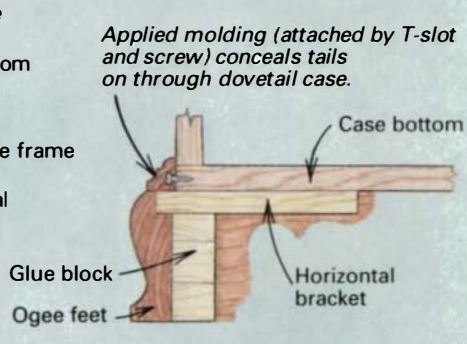


Fig. 1: Plain bracket feet

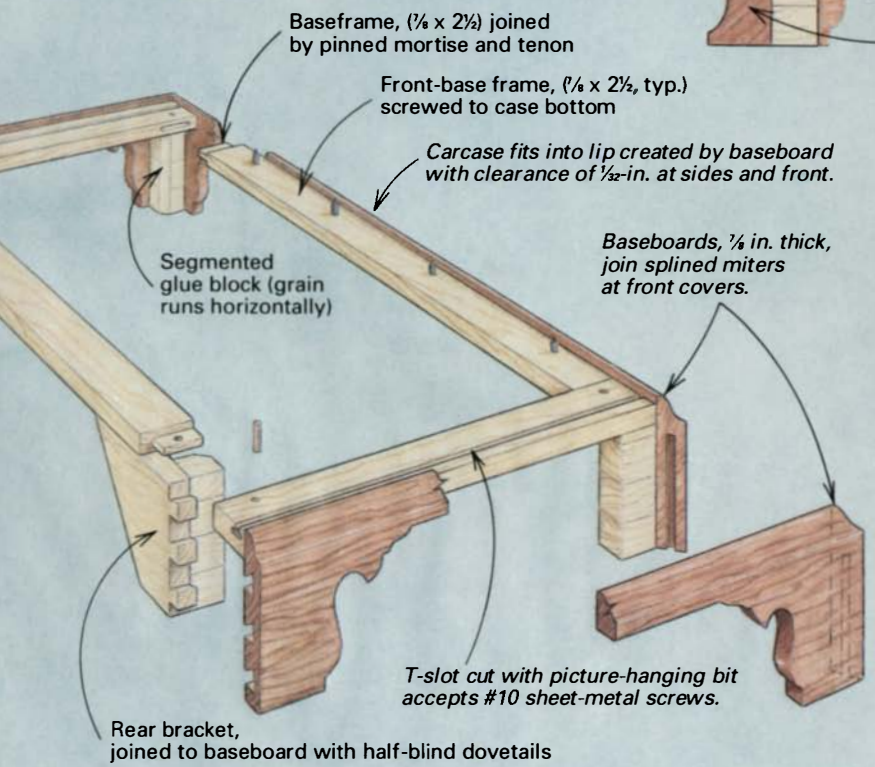
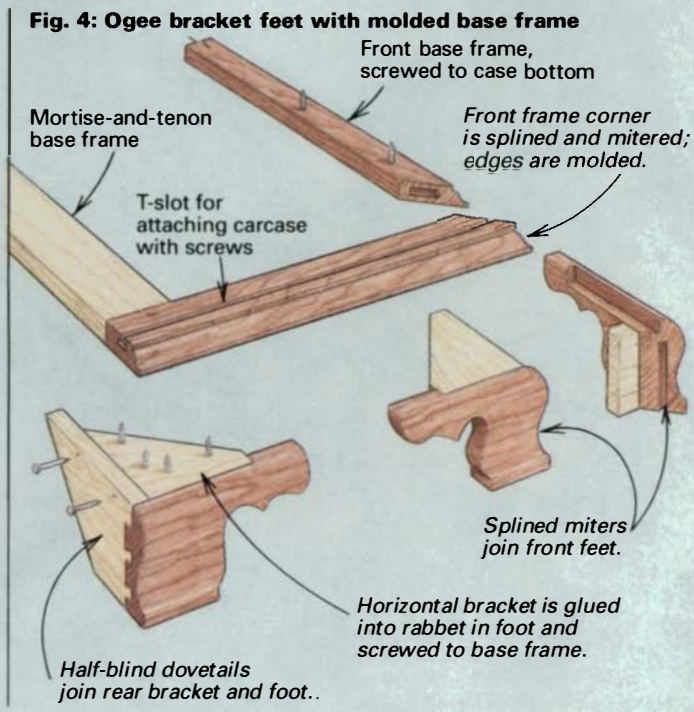


Fig. 4: Ogee bracket feet with molded base frame



Drawing: Heather Lambert

Making a Stamp Box

Five pieces, carefully crafted and assembled, become a block that reels off postage

by Abijah Reed

I've made a few dozen stamp boxes like the one shown above, and people love them. Because everyone uses stamps, the boxes make great gifts, especially when loaded with a full roll of stamps. The boxes look like they've been fashioned from single wooden blocks, so people are relieved once they realize the boxes open. To get the block effect, I make my boxes from five pieces (see the drawing on the facing page): top, upper, lower, bottom and liner. I cut, drill and assemble the pieces carefully because small errors will detract from appearance and function. After all, you can be assured that these boxes will be inspected for fit.

Design and roughing out the pieces— I'll describe procedures for making a single box, but I recommend that you make them in batches because they are so small and it's much more efficient. You need to work to close tolerances for a good fit, but you can modify the dimensions to suit your own taste, as long as you allow enough room for the stamp roll (see the drawing).

If you want your box's grain to match, rough the pieces out of an oversized blank of hardwood, and then plane and sand the pieces to final dimension. Lay out the box's four layers together, so they measure 1¾ in. sq. Bandsaw off a 3/32-in.-thick top piece, a 11/32-in. upper piece, a 23/32-in. lower piece and another 3/32-in. piece for the bottom. Prepare the pieces so opposing surfaces are flat, parallel and smooth.

Upper, lower and liner— The thickness of the upper plus lower pieces is 1 1/16 in. (23/32 and 11/32), which allows clearance for a 1-in.-high roll of stamps. The photo at left below shows how to bore a cavity in the upper and lower pieces for the liner. To make the liner, bandsaw off a 3/64-in.-thick by 15/16-in.-wide slice of clear wood (about 4 in. long) with its grain running in the 15/16-in. direction. Dip the liner stock in a pot of boiling water for about 30 seconds. Then wrap the stock around a broom handle or dowel, and secure the liner with tape until the wood dries thoroughly.

With a chisel, trim the liner to fit the lower piece's hole (see the center photo below). Withdraw the liner from the lower piece, except for about 1/8 in. Spread a thin coat of yellow (aliphatic resin) glue around the exposed part of the lower piece's hole and push the liner home. If you've made a good liner fit, you won't have to use any outward clamping pressure.

The pin, stamp slot, top and bottom— The registration pin, which aligns the upper and lower portions of the stamp slot, is pressed into a slightly undersized hole in the lower piece and fits into an oversized hole in the upper piece (see the photo below). Cut a 1 1/16-in. length of metal rod for the pin. I used a .059-in.-dia. brass piano center pin (the pivot for the piano-key action). I fit the upper piece onto the lower and drill a #54-bit hole (.055 in.) through the upper piece and about 5/8 in. into the lower piece. If you'd rather use a wire brad or piece of a

Photo: Hank Cohan

To create a space for a liner *plus a roll of stamps, tape the box's upper and lower pieces together, clamp them to the drill-press table and then bore through both at once using a 1¼-in. Forstner bit. The next step will be to saw the five pieces apart.*

After the liner has been bent *to approximately the right diameter, trim one end square with a sharp chisel. Then carefully trim the other end until the ends butt, and the liner just slides into the hole in the box's lower part.*

Drill the registration pin's hole *through the upper and 5/8 in. into the lower parts. Remove the top and enlarge its hole, so the pin fits comfortably but not loosely. Then press the pin into the box's lower piece, leaving 3/32 in. protruding.*

***At first glance, stamps appear to extrude out the side** of a walnut cube (left). Upon closer examination, though, an opened cherry stamp box (right) reveals a 100-stamp roll housed neatly inside a thin, circular liner. The liner fits a precise cavity bored within the lower part of the box. The box's lid and stamp-exit slot stay aligned via a brass registration pin.*

paper clip for the pin, just experiment with drill-bit sizes to get the correct fit.

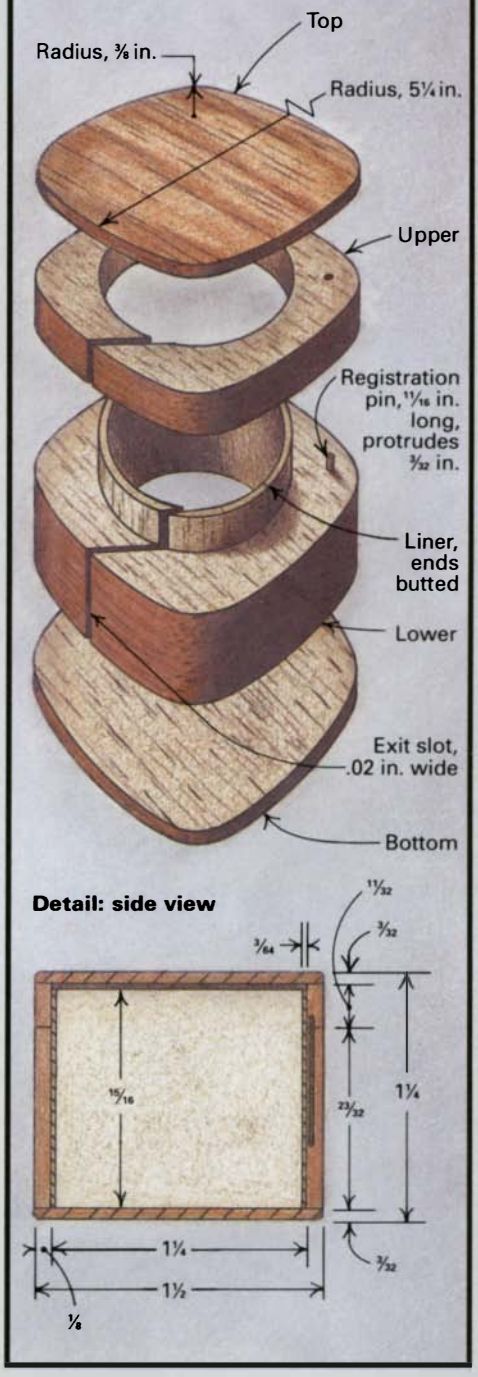
You can make left- or right-handed stamp boxes. I cut a central stamp slot on one side of each box, so the stamps unroll clockwise and emerge right-side up (see the photo above). After you draw the slot line (tangent to the inside of the liner), scroll saw the line (see the photo below). Next, mark vertical lines on the four sides of the upper/lower assembly. Align the marks with the center of the liner hole. Finally, glue on the top and bottom, but don't allow any squeeze-out to get into the stamp slot (see the center photo below).

Contouring and finishing—To create the box's shape, first make a paper template with the "rounded square" contour shown in the drawing. You can vary the arcs, and then draw just one of the box's quadrants on some graph paper. Copy the curve to get the rest of the outline. I plot the curve four times oversize, then shrink the drawing using a variable-reduction copier. Next, draw horizontal and vertical axis lines, so you can align your template with the marks you've made on the box's sides. Apply a light coat of glue to the top, and press the template onto the top. When the glue is dry, bandsaw and beltsand to the contour line (see the photo below right). Remove any sanding marks and ease the edges by hand-sanding with 120-grit and then 220-grit paper.

I used to finish my boxes with oil. But to avoid staining stamps, I now brush on two light coats of thinned polyurethane, smoothing the dried coats with 0000 steel wool. To prevent capillary action from drawing finish between mating pieces, I finish the box's two parts separately and brush only on the outer surfaces. After the topcoat, I lightly wax the outside of the box and put a roll of stamps inside. □

Abijah Reed is a mechanical engineer in Newton Centre, Mass. He builds musical instruments and does woodworking part-time in his 800-sq.-ft. shop.

Stamp-box assembly



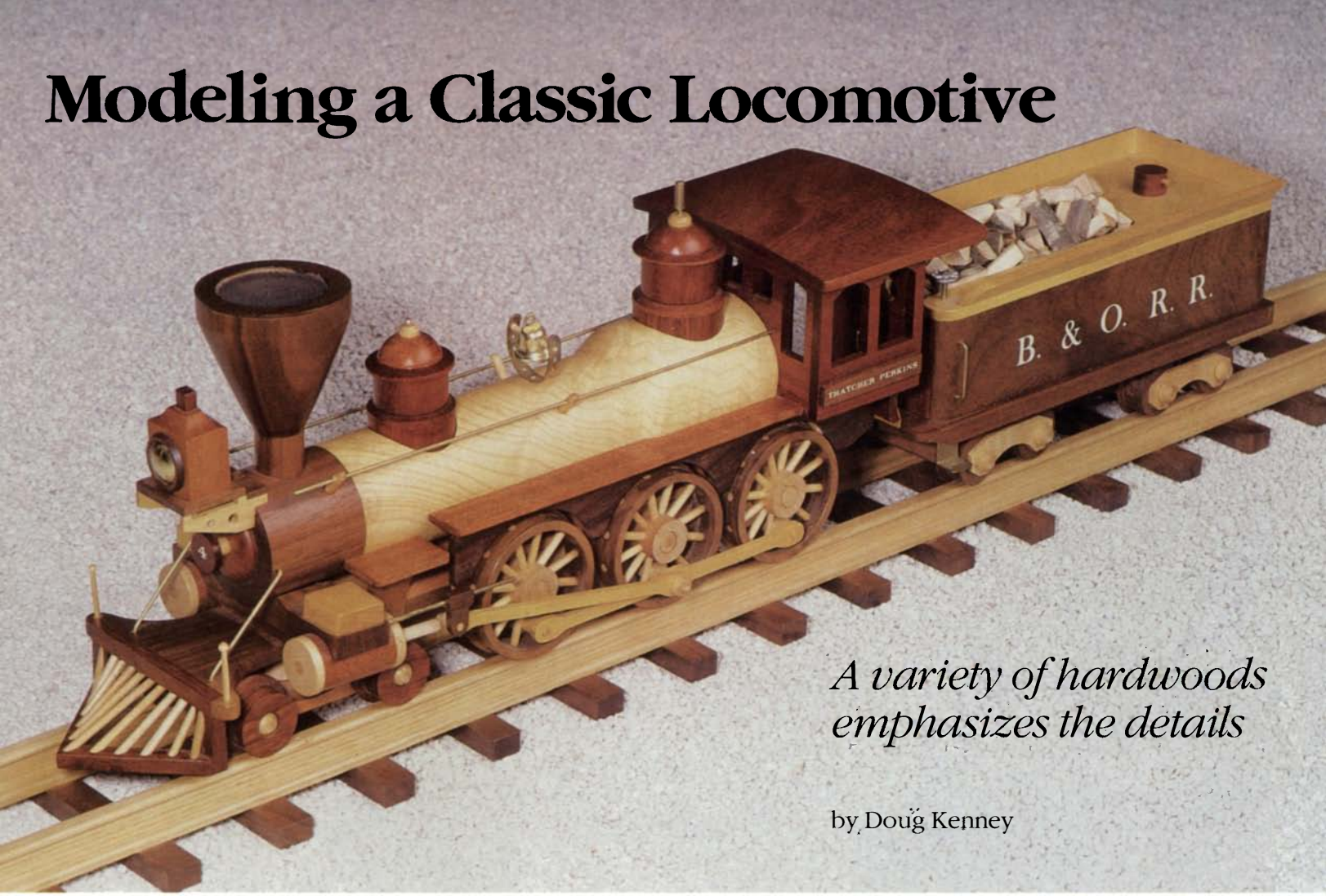
***With the upper, lower and liner pieces** assembled and registered by the pin, Reed scroll saws the stamp-exit slot using a blade that cuts a .02 in. kerf. The angle of the cut determines which way the stamps will unroll.*

***Reed glues and clamps all the layers** together, being careful the pieces don't slide around. Passing a slip of cardboard in and out of the stamp slot wipes off the glue squeeze-out (shown here defining the box's top and bottom pieces).*

***The author bandsaws and beltsands** to the contour line of a paper template glued to the top of a fully assembled box. Vertical and horizontal axes marked on the template keep the outline aligned (via four viewing holes) to the workpiece.*

Photos except where noted: Alec Waters; drawing: Bill Jurgens

Modeling a Classic Locomotive



A variety of hardwoods emphasizes the details

by Doug Kenney

***The Thatcher Perkins,** named in honor of its designer, was built at the end of the wood-burning era in 1863 at the B & O yards in Baltimore, Md. This was the first 10-wheel (4-6-0) locomotive designed to move passenger trains over the steep grades of the Allegheny Mountains through Maryland and West Virginia. A variety of woods enhance the beauty of this 26-in.-long model.*

The symmetry, grace and powerful lines of the 1863 Thatcher Perkins locomotive make it a perfect choice for a model. The design can be simplified enough to ease the construction while retaining enough detail for visual appeal. At ¼ in. scale, the locomotive stands out from across the room. The natural colors of a variety of wood species avoid the need for stain or paint. For the locomotive shown in the photo above, I used walnut, satinwood, jarrah, ash, mahogany, birch and rosewood.

Despite its complex appearance, the locomotive is not hard to build. The drawing on pp. 80-81 shows the construction details, and I'll explain some processes and special techniques I've developed to speed construction. The only special tools you'll need are a pin vise for drilling holes in tight spots, hole saws, a set of numbered drill bits and a couple of Forstner bits.

I built the Thatcher Perkins from a full-scale engineer's drawing, mixing exact reproduction with artistic interpretation. Because I was making 13 units, I set up an assembly line to make the parts for the following subassemblies: the track, the wheels, the base, the cab, the boiler and the tender. I then combined the subassemblies to complete each model. I kept one and sold the others at $500 each for the locomotives and $200 apiece for the tenders.

Laying down the track

I prefer white ash for making track, which I shape on a router table with a 5/16-in.-dia., carbide-tipped, straight bit set for a ¼-in.-deep cut. After plowing grooves down the middle of both sides to form an I-beam, I shave ⅛ in. off each edge at the top of the I-beam. Then, gently rocking the top rail back and forth on a belt sander quickly rounds over the edges.

Making the wheels

Train wheels can be difficult to make because the rim has a flange that encircles it much like the brim of a hat. The flange rides inside the rail to keep the train on track. I make the flanged wheels on a drill press by boring walnut stock with hole saws. First, I cut the outside diameter of the flange and then the outside diameter of the rim. For the drive wheels, a third cut is necessary to form the inside diameter of the rim. About 500 RPM is a good speed for safe cutting with the large diameter saws. Setting the stops at 1/32 in. less than the thickness of the wood for the flange cut and the inside rim cut leaves a thin layer of wood that anchors the wheel blank in the stock for making the outside rim cut. The rim cut stops 3/16 in. shy of the stock thickness to create the flanged rims. To remove the wheels from the board, I sand away the bottom 1/32 in. of stock with 50-grit paper on a stationary belt sander.

For the drive wheels, I use a 2¾-in.-dia. hole saw to cut the outside flange, a 2½-in.-dia. saw for the outside rim cut and a 2-in.-dia. saw for the inside rim cut. The leading wheels and tender wheels are all cut with a 1⅜-in.-dia. hole saw for the flange and a 1⅛-in.-dia. saw for the rim.

The key to making spoked wheels is aligning the holes in the hub with those in the rim. To simplify this task, I've developed the jig shown in the bottom photo on the facing page. One part of the jig, an outer ring with brass-tube drill guides inserted so it re-

Photos: Sandor Nagyszalanczy

sembles a ship's wheel, holds the rim. The second part of the jig is a donut-shaped spacer that holds the hub in place inside the rim. I drill the spoke holes with a #30 bit by raising the jig, rim and hub assembly into the bit on my drill press. The bit should penetrate 3/16 in. into the hub. After pinning this hole with a 3-in.-long brass rod, I bore and pin a second hole opposite the first hole. I repeat the process, drilling and pinning holes at the two o'clock and ten o'clock positions before boring the remaining eight holes. Index marks on the hub and rim ease assembly. Enlarging the rim spoke holes with a #29 bit prevents the spokes from binding.

To assemble the wheels, slip two opposing spokes at a time through the rim and seat them in the hub with a pair of water-pump pliers. After centering the hub, soak the wheel in lacquer or polyurethane, and let it dry to hold everything in place—no glue is needed. I mount each wheel on a spindle and sand the perimeter of the rim and flange on a strip sander before finish-sanding the front and back surfaces on a stationary belt sander.

The base assembly

When I build a model, I like to start from the base and work up. If the wheels and base match up, everything else can be adjusted to make the model look right.

A technique I've found helpful in modelmaking is sanding concave radiuses on the idler drum of my 48-in. belt sander. I've used this trick to shape all the concave surfaces including the cherry leading-wheel truck, the cab roof and the front and rear boiler cradles.

To make the jarrah and birch pilot, or cow catcher, requires mitering both ends of 11 dowels. The task is not quite as difficult as it seems because dowels, except for the center bar in the pilot, can be made in pairs. I clamp a wooden guide fence to my strip sander, determining the angle by trial and error. Once set, I miter all the dowels I need at that angle. I then glue each dowel in place with a spot of yellow glue before adjusting the fence for the dowels in the next position.

Complete the base assembly by gluing together the pilot, the forward platform, the cherry base connector, the drive-wheel truck, the cherry cab base, the two walnut cradles and the steam chests.

The cab assembly

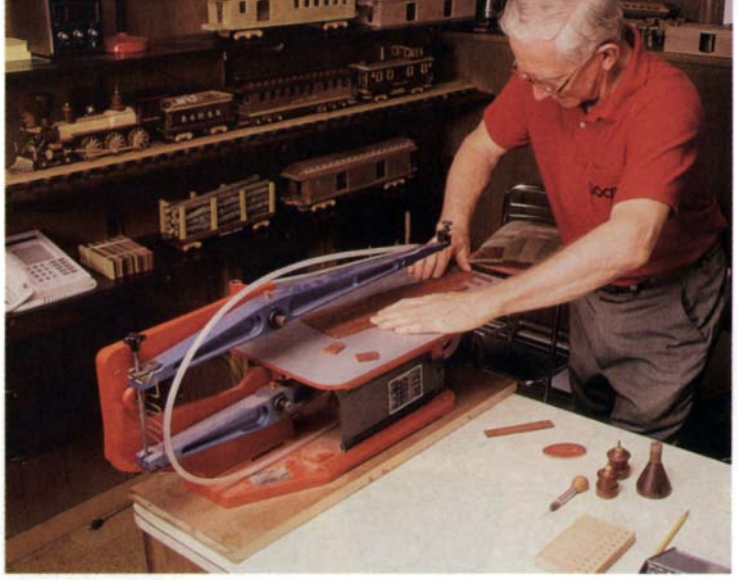
The cab, of Australian jarrah, is easily glued together as shown in the drawing. Rather than spending the time to drill a hole and then threading my scroll-saw blade through it, I cut horizontally at the bottom of the windows, as shown in the drawing on the following page, and then glued the cutoffs back in place after sawing out the windows, as shown in the top photo. After assembly, I pre-finish the cab with two coats of polyurethane before gluing the cab in place.

Making the boiler assembly

The white-ash boiler provides a contrast, making the walnut smoke box and the mahogany steam dome, sandbox, lantern, catwalks and cylinders stand out. I used rosewood for the wheel-trim panels.

Turning the boilers and drilling them for the accessories is the most difficult task of this subassembly. I turn two boilers at a time from a 3-in. by 18-in. blank to the shape shown in the detail in the drawing. Once turned, I sand the bottom of the large diameter of the double boiler flush with the small diameter using 50-grit paper on the belt sander. Also, the sides of the large diameter section are blended into the smaller diameter on the belt sander.

To be sure I properly align all the details for the boiler, I clamp the blank in a V-block and draw a reference line along the top center. Forstner bits leave flat-bottom holes for the smokestack, sandbox and steam dome. A Forstner bit also is used to bore the hole in the top center of the smokestack. With all the holes bored, I cut the boilers apart, square up the ends and finish-sand where necessary.



***To make quick work** of cutting window openings, the author first cuts the cab side in half at the bottom window line. The three other sides of the window are then easily sawn out, and the bottom of the side is glued back in place to complete the opening.*

***This spoke-hole drilling jig** ensures that the rim and hub holes will be aligned. The walnut outer ring holds the rim in place, and a donut-shaped spacer positions the hub. Brass tubes pressed into the outer ring act as bushings to guide the drill bit.*

Only the flared portion of the smokestack is turned; the straight section is cut from dowels and is glued to the bottom after the flared section is complete. I turn six or seven stacks from a single blank in the same fashion as the boilers and then cut them into individual pieces. A 2-in. round piece of fiberglass window screening sandwiched between a thin ring of walnut and the top of the stack simulates a spark arrester.

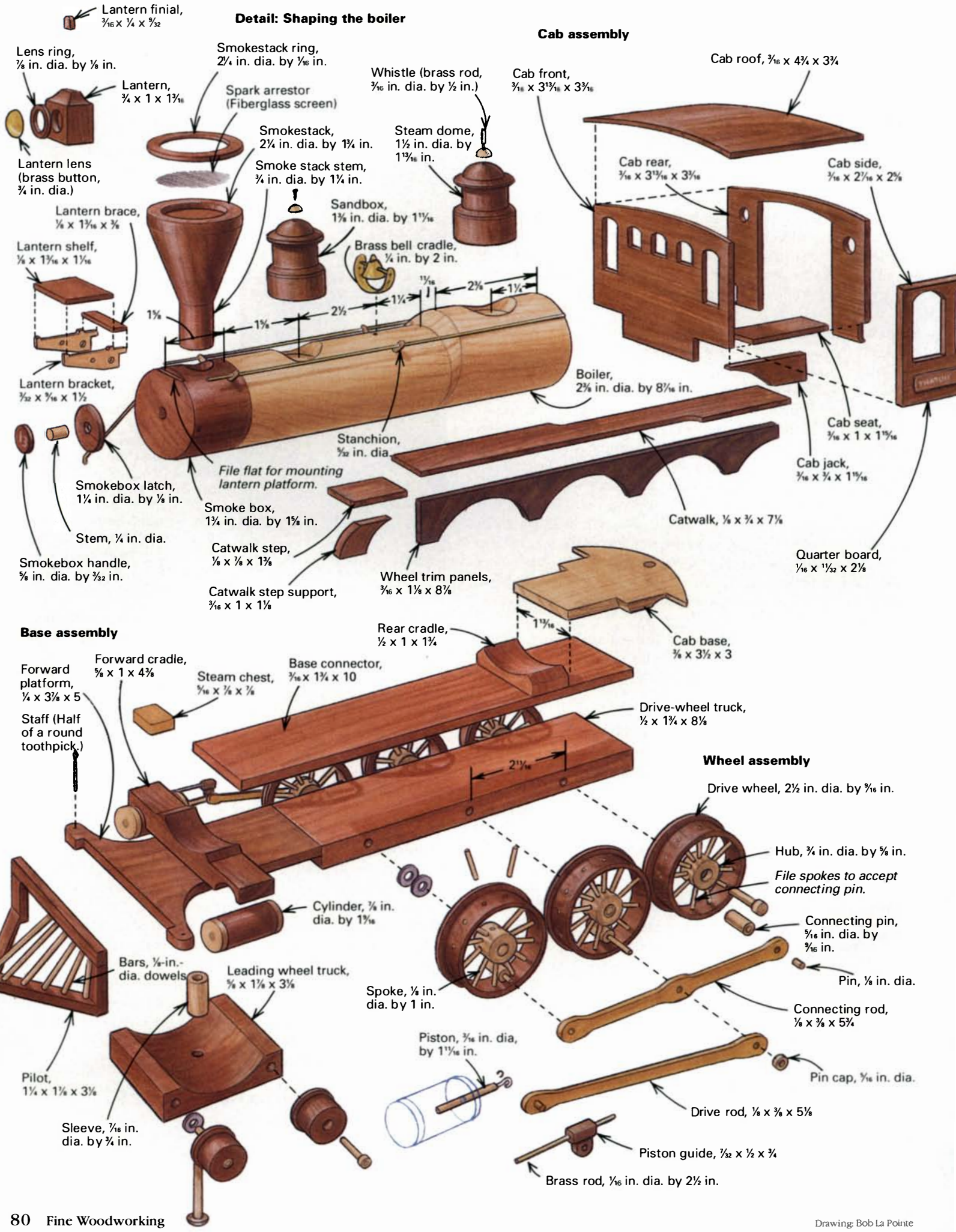
Steam domes and sandboxes can be pieced together with a variety of species of turned stock to simulate detail, or you can turn the entire piece from a single blank. I shape the domes for these pieces on my router table by turning the stock on its long axis while pushing it into a bearing-guided radius cutter. I use ½-in., ¾-in., and 1-in. radius cutters depending on the diameter of the stock. The guide bearing of the cutter must ride on the center of the blank.

The only difficult part of putting together the lantern is making the thin trim ring around the lens. The ring is a ⅛-in.-thick walnut disc cut with a 1-in. hole saw. Mount the disc temporarily on a spindle, and bevel the outside edge by spinning it against a strip sander at a slight angle. Next, spot glue the disc to a scrap of veneer to support it while drilling out the center with a ¾-in. brad-point bit. Remove the veneer by carefully sanding it off.

Assembling the locomotive

Begin assembling the locomotive by attaching the cab and all 10 locomotive wheels to the base assembly. Glue the wheel-trim panels to the left and right jacks supporting the cab, parallel to the base assembly. Temporarily place the boiler assembly on the cra-

Fig. 1: Thatcher Perkins locomotive



Drawing: Bob La Pointe

dles of the base assembly, and make sure everything fits properly, looks right and turns freely. If there are no problems, trim the catwalks to fit the boiler sides, and glue them to the top edge of each trim panel. Glue the catwalk steps to the forward platform, halfway between the steam chest and wheel-trim panel.

I connect the drive mechanism before gluing the boiler assembly in place. Because the spacing of the connecting-rod holes is critical for the free turning of the drive wheels, I drill these holes to match each three-wheel set. The drive-rod holes are not critical. Eye-ball the front of the boiler assembly when gluing it to the base-assembly cradles to ensure the smokestack is vertically aligned.

Tender construction

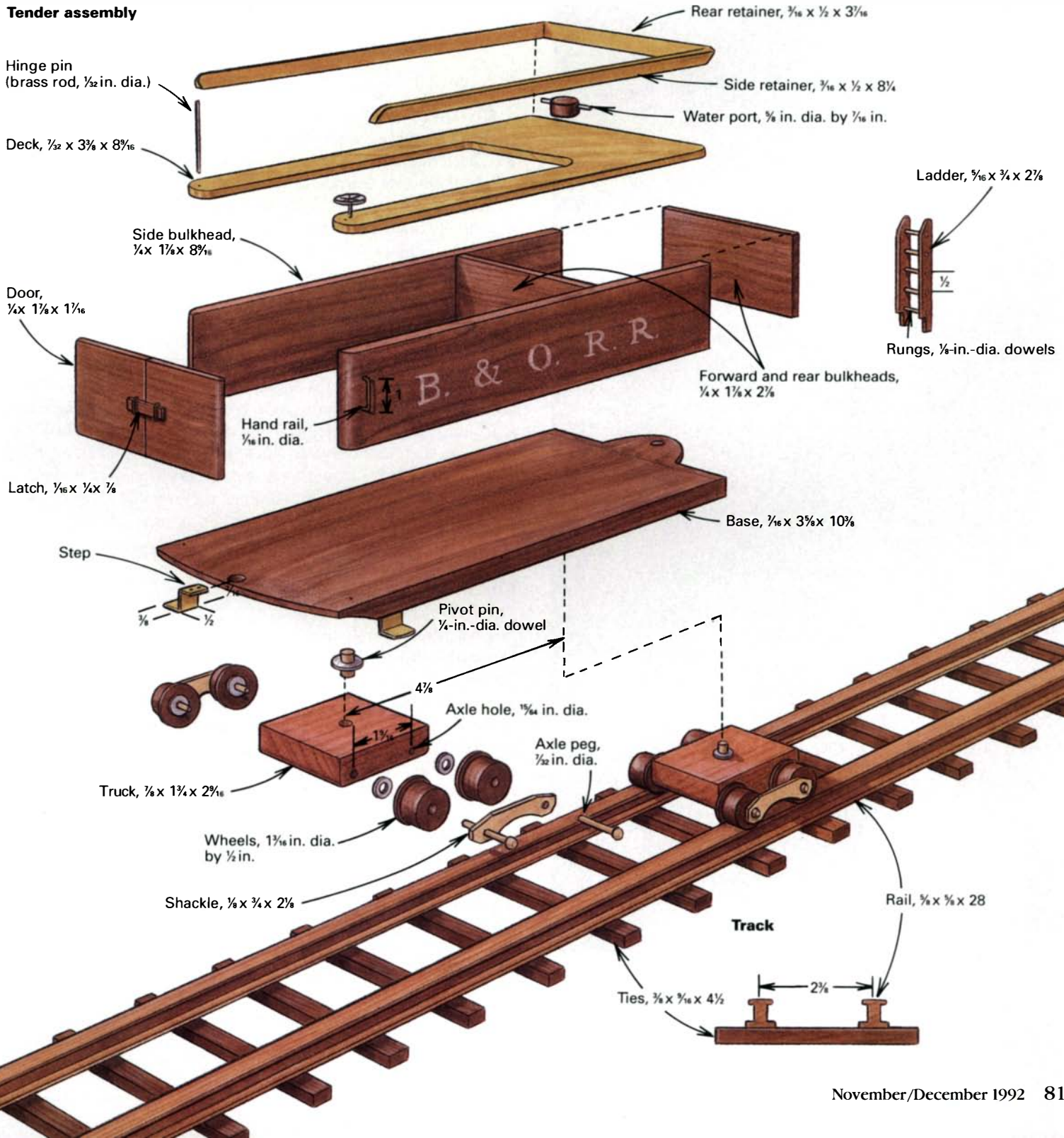
Assembling the tender is fairly straightforward, as shown in the drawing. Everything is walnut, except the satinwood deck and retainers, the cherry trucks, maple shackles and the jarrah and birch ladder. After gluing the four bulkheads together, I add the decking and then beltsand the deck flush to the bulkheads and round over the corners. I bevel the retainers on the strip sander using a wooden fence clamped to the table to get the proper angle. I make a couple of ¾-in. by 12-in. ladders and then cut off lengths as needed.

The miniature logs that fill the tender are simply ¾-in. to 1-in.-dia. oak branches that I cut into 1-in. lengths and split into quarters with a small chisel.

The lettering on the train is white, rub-on transfer decals available from most hobby stores. Three coats of satin varnish protect the wood, and clear nail polish prevents the brass from tarnishing. □

Doug Kenney builds vintage trains and fire engines in South Dennis, Mass.

Tender assembly



Evan Kern built a vacuum table to hold down thin stock when he's rotary planing with his drill press. To increase the table's suction, he covers holes ahead of the cutter with cardboard. Here, Kern advances the cardboard with a walnut workpiece as he guides it along a fence that's clamped to the table.

Vacuum Powered Hold-Down

Look ma, no clamps

by Evan Kern

As an avocational instrumentmaker, one of my challenges is planing resawn wood to less than ¼-in. thick. My attempts to thickness wood with a conventional planer usually result in hopelessly warped or shattered pieces of wood. Although an abrasive planer can do the job, one of those machines is well beyond my financial means. And since my needs for thin stock are modest, I bought a Wagner Safe-T-Planer, which is an inexpensive rotary planer that I chuck in my drill press.

The only drawback I encountered while rotary planing stock was the tendency for the wood to lift up, especially at the beginning and end of a pass, resulting in pieces that were unevenly thicknessed. To solve this problem, I built a vacuum hold-down table for my drill press, as shown in the photo at left. The hold-down surface's holes go through the tabletop and into a labyrinth (vacuum chamber), which is connected to an ordinary shop vacuum. The vacuum holds thin stock flat against the table, enabling me to plane pieces down to 1/32 in. and up to a ½-in. maximum thickness. Although I use my hold-down table for planing, I suspect that with a few modifications to clamp it to a benchtop, the table could be used for light routing and sanding.

Constructing the hold-down

The hold-down table consists of a ¾-in.-thick medium-density fiberboard (MDF) tabletop mounted to a hollow base. The drawing shows the size and pattern of the holes to bore through the top. Three pieces of ¾-in. plywood—the center one being the labyrinth—make up the base. A ½-in. plywood bottom is screwed to the base to provide ears for clamping. Two requirements that may be different for other drill-press tables and shop vacuums are the size of the bottom (mine is 15 in.) and the size of the vacuum opening (mine fits a 1⅛-in.-OD PVC coupling).

Labyrinth—In addition to joining the holes in the table to the vacuum source, the labyrinth supports the workpiece beneath the cutter. The suction from even a small vacuum can distort the table if it's not adequately supported. After scroll sawing out a labyrinth (see the pattern in the drawing), cut out the other two base pieces and sandwich and glue the labyrinth between them. After the glue has dried, drill a hole for the vacuum hose.

Adding a control gate and a fence—If all the holes in the hold-down table are covered by a workpiece, there will be no relief for

Photos: Alec Waters; drawing: Mark Sant'Angelo

the vacuum and, as a result, your vacuum's motor may overheat. You can eliminate this problem by making a vacuum-control gate, which allows air to enter the labyrinth. I made a simple gate (see the photo at right) out of ¼-in. plywood. The gate slides over a pair of ½-in. holes bored in one side of the base. I can open the gate fully or partially to equalize the pressure in the labyrinth and regulate the degree of suction at the hold-down surface.

To guide stock when planing, I made a plywood fence that I spring clamp to the tabletop. The fence has a recess that lets the Safe-T-Planer overlap the edge of the work. I faced the underside of the fence with 1/32-in. plywood to cover the holes that would otherwise be exposed by the recess and to provide an edge for the workpiece to ride against at the recessed area.

Rotary planing on the hold-down table

A Safe-T-Planer consists of a shaft connected to a 3-in.-dia. disc that holds three circular cutters (see the photo at right). Because the cutters only project about 1/64 in. from the disc, these rotary planers are quite safe. The planers, which will also work in most radial-arm saws, are manufactured by G & W Tool, Inc., P.O. Box 691464, Tulsa, Okla. 74169; (918) 486-2761 and are available at most woodworking supply stores. When using a rotary planer, the length of stock that can be planed is limited only by your shop space. The stock width is limited to your drill-press swing.

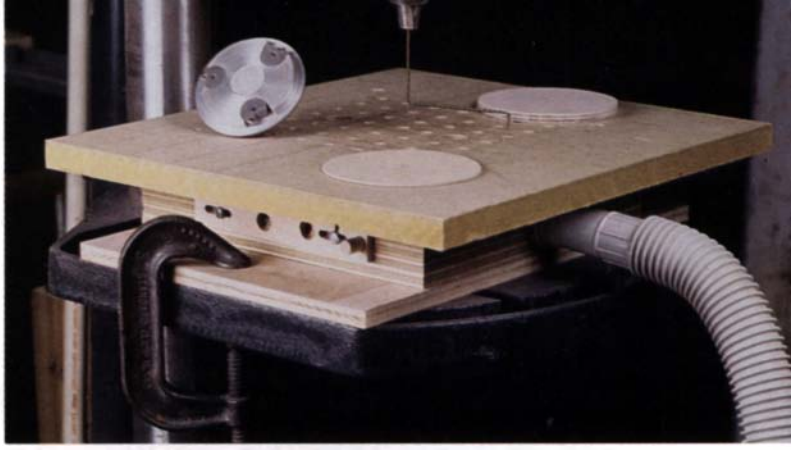
Squaring the table and setting the cut—To make sure the hold-down table is perpendicular to the drill-press spindle, I made a gauge by bending a heavy piece of wire into a Z-shape. After I mount the wire in the chuck, I rotate the chuck by hand and observe the gauge and the table's top. The gauge's tip should just touch the table's surface throughout its rotation (see the photo above).

I use 3-in.-dia. plywood discs as thickness gauges to set the height of the planer's cutter above my hold-down table. I bandsaw the discs from sheets of modelmaker's plywood (available at most hobby shops), which comes in precise thicknesses from 1/64 in. to ½ in., in 1/64-in. increments. After placing a disc of the desired (planed) thickness on the table, I adjust the quill until the cutter just touches the gauge, and then I lock the quill.

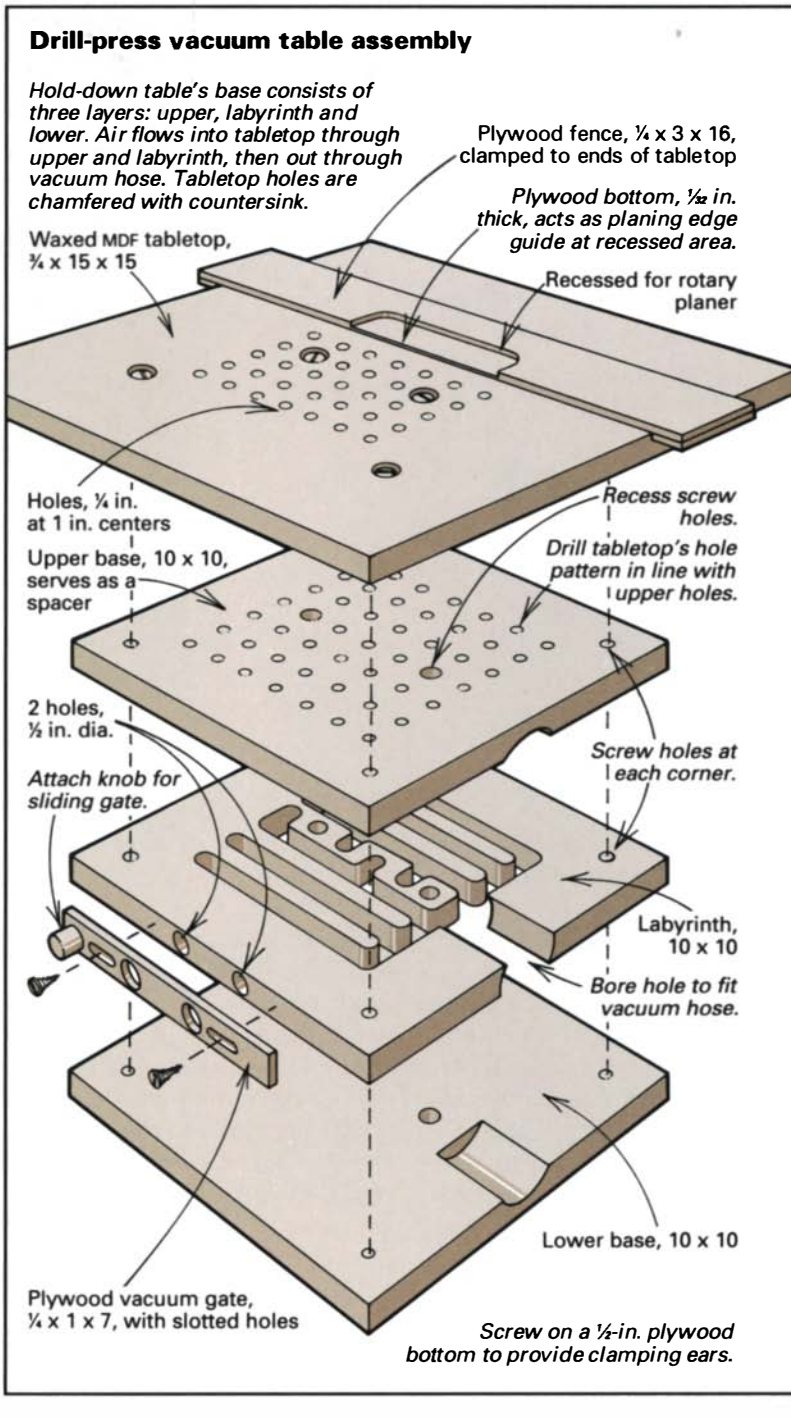
Feed and cutter speed—After lightly waxing the tabletop, I hook up my shop-vacuum hose and turn my drill press on. If the wood is wider than the planer, after an initial pass, I reverse it end for end and continue passes, moving the fence in toward the drill-press column until I've planed the entire width of the board. I feed stock at a rate of approximately two to three square feet of wood per minute. At this rate, I've never had to sharpen the cutters, even though the manufacturer supplies instructions for this. Although the planer's maker recommends speeds of 3,000 RPM to 6,000 RPM, I've found that 2,300 RPM helps prevent the cutters from burning the wood during those inevitable feed pauses.

Regulating the suction—When I'm feeding narrow strips of wood into the planer, most of the hold-down table's holes are uncovered, and as a consequence, there's an insufficient vacuum. I resolve this by covering exposed holes with pieces of cardboard or stiff plastic. Feeding work against the planer cutters (from left to right) pushes the covers out of the way (see the photo on the facing page). As the end of a board is reached, I reintroduce another cover so that the holes in the table are continuously covered to maintain a vacuum. □

Evan Kern is an author and a retired dean of Kutztown University. He builds stringed instruments and puzzles in Kutztown, Pa.



***Before mounting his Safe-T-Planer,** the author chucks in a bent piece of wire to level the hold-down table. While hand-turning the chuck, he observes and shims the table until the wire's tip grazes the surface for a full revolution. After connecting the vacuum's hose to the front of the table's base, he opens the vacuum-control gate on the base's side. Then, using discs of modelmaker's plywood to gauge thickness, Kern will set the planer's depth of cut.*



Although this sectional couch was designed in 1988, *it may well have originated in 1911 from the same Prairie School architects, Purcell, Feick and Elmslie, who designed the house in which it sits. All the elements of the couch are based upon an architectural style that was first developed by Louis Sullivan but made internationally famous by Frank Lloyd Wright.*

An Eighty-Year Collaboration on a Prairie-Style Couch

Comfortable seating echoes architectural elements

by Scott Dickerson

In 1911, the architectural firm of Purcell, Feick and Elmslie designed a bungalow for Harold C. Bradley on the Crane Estate in Woods Hole, Mass. In 1988, Max Burger, the current owner, contracted me to design and oversee the making of a couch for the residence. Thus began a collaboration between the owner, a contemporary furniture designer, a woodworker, an upholsterer and the architects—whose voices, long stilled, nevertheless spoke eloquently from the style of the house and the record of their work.

Purcell, Feick and Elmslie was one of the most vigorous firms advocating the Prairie School, a style that was originated by Louis Sullivan and led to international recognition by Frank Lloyd Wright. This dynamic style brought American architecture out of the repetitious, derivative designs of the 19th century into a bright, transcendent redefinition of form and space. The spiritual and intellectual energy of the Prairie School architects initiated modern expression in American buildings. Purcell, Feick and Elmslie took a very active role in this evolution of ideas and materials. The firm's commissions were diverse and many including the execution of over 70 banks, courthouses, residences, churches and other buildings from 1909 to 1920.

The commission for the Bradley bungalow specified a modest seasonal home, but it has become the best known of the Purcell, Feick and Elmslie residences. The site is on the knoll of a narrow, grass-and-juniper covered peninsula that defines the eastern side of the Great Harbor of Woods Hole. The dramatic setting, regal in its view of the sea and islands, is also the dominant view of seafarers. In keeping with the site, the architects created a corresponding visual statement. The strong symmetrical breadth of the roof overhanging the crisply cut upper floor and semicircular living room, defines a lifting form that appears to float above the knoll. Because of its appearance, the bungalow soon became known as the "Airplane House."

Wood is the principal material of the interior. Cypress paneling on the walls and ceilings of the semicircular living room has aged to a rich golden hue. Exposed roof beams, purlins and rafters are decorated with small, fretsawn panels. The board-and-batten walls

Photos: Susan Kahn; drawings: Vince Babak

are punctuated by the distinctive slat-and-block lattices of heating registers and stair balusters. The floors are a darkly stained, quartersawn white oak.

A window seat lighted by casement windows follows the semicircle of the room perimeter. Each of the windows is glazed with a border of leaded, stained and clear-textured glass, which can be seen in the photo on p. 86, as are the doors to the adjoining built-in bookcases and those leading to other rooms. The effect brightens the absorbent darkness of the dominant wood.

At the base of the semicircle is a massive fireplace, laid in long, thin blond bricks, as shown in the photo on the facing page. The radially bricked arch of the large open hearth repeats the semicircular plan of the room. On the back face of the fireplace is a cypress shelf with attached lamp fixtures on sawn-wood pedestals.

Establishing design parameters

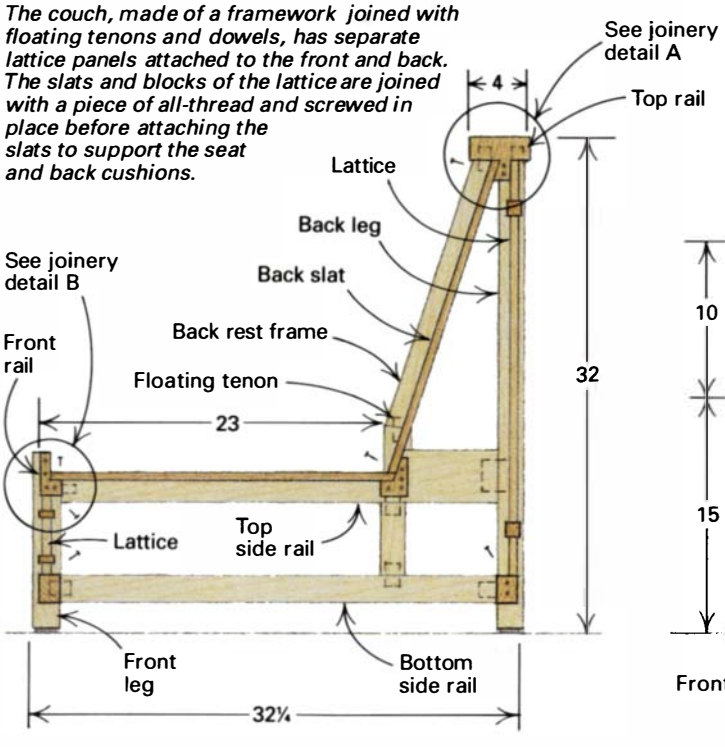
Any furniture that might have been designed by the architects for the house has long since departed. Burger, the owner, told me my task was to create a seating design for the room that would be "as if Purcell, Feick and Elmslie had made it but more comfortable." The reference to comfort is a reflection of Prairie School philosophy that emphasized the visual statement of the seating rather than the ergonomic details.

We sat through the evening on the casual sofas that then served the living room, discussing the house, the architects, the materials and eventually, the form of the seating. Burger conceived the plan view of the seating to be like the Greek letter omega, with the open side of the letter facing the fireplace. The seating would be composed of six units, each of two-person capacity, which could be separated into different arrangements or assembled into the continuous omega. Some sections of the couch should be long enough for lying down. He also wanted built-in lighting and table surfaces between the sections that included hidden storage. To be sure the seating blended with its surroundings, Burger thought the sections should be made of oak or cypress and should include some of the design details of the house.

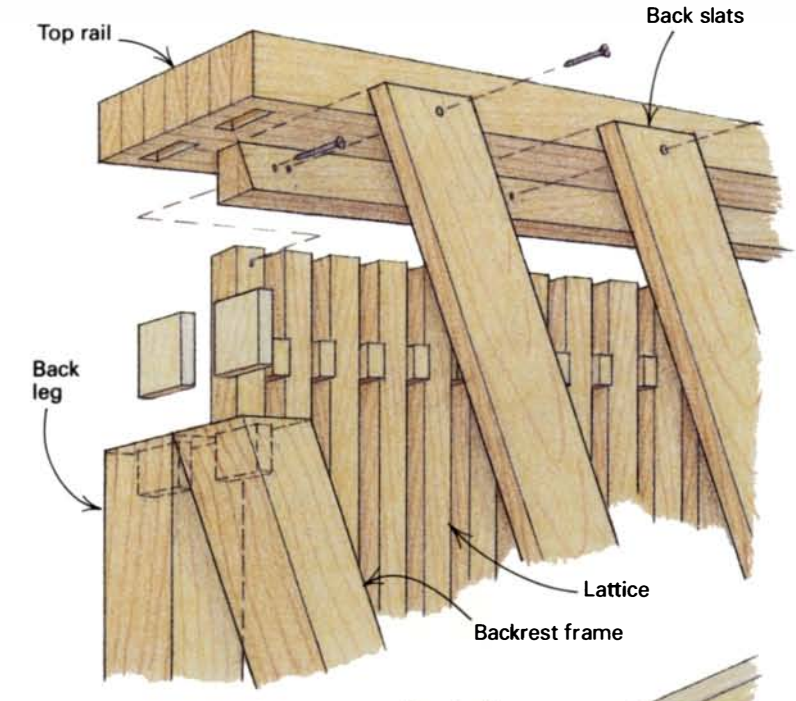
In the morning, I measured the room and all the appropriate ar-

Prairie school style couch

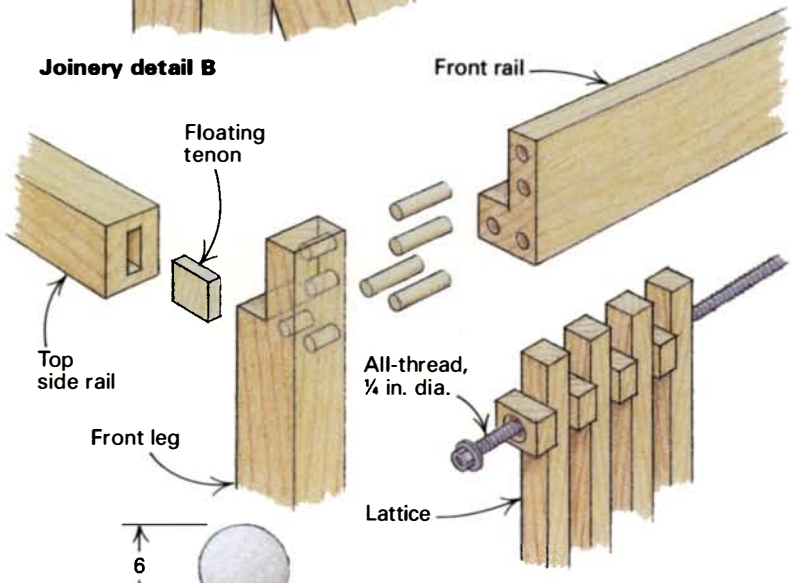
The couch, made of a framework joined with floating tenons and dowels, has separate lattice panels attached to the front and back. The slats and blocks of the lattice are joined with a piece of all-thread and screwed in place before attaching the slats to support the seat and back cushions.

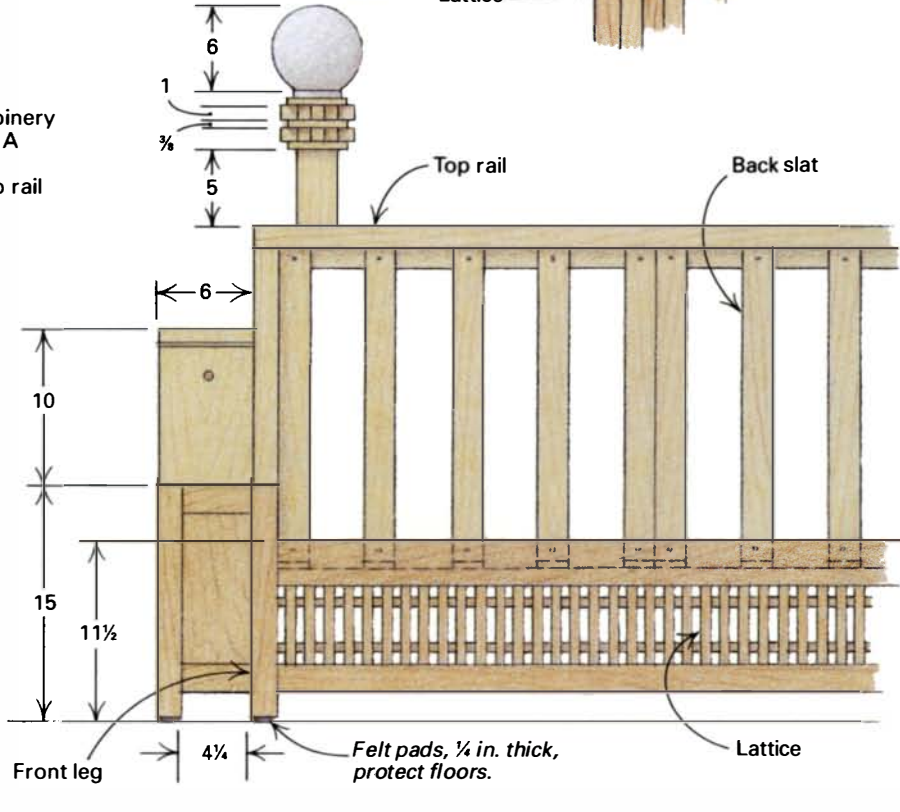


Joinery detail A



Joinery detail B





chitectural details that could become part of the seating design. I also photographed the house, both inside and out. We then arranged a series of chairs in the omega shape in front of the fireplace, which gave us a good perspective on the scale of the proposed seating. It was evident that the seating should reflect the semicircular room plan and the arch of the fireplace opening with the open end of the omega running the full width of the hearth. We also discovered that the dimensions Burger had in mind were too large for the scale of the room and would not create a compact seating arrangement conducive to conversation.

Designing for harmony and comfort

Working with these concepts, I distilled our discussions to a few essential, spare forms consistent with the architectural style of the house. The omega form superbly mirrored the arch of the fireplace and the semicircular plan of the room. It also met the request that the couch have some portions available for lying down and others that would bring people together for conversation. Although the reduced scale of the omega precluded making the units in front of the fireplace large enough for lounging, I was able to include space under the seats for occasional storage.

Original Prairie School seating designs are rigidly angular, with proportions, forms and materials serving the eye of the architect more than the comfort of the user. To satisfy the architects' perspective, I designed the exterior faces of the couch in a vertical, rectilinear style. The design and proportions were based on measurements I had taken of the slat-and-block lattices of the stair balusters and heat registers. The top rail on the back of the couch reflected the tops of the adjacent bookcases, the window sills and a fireplace shelf that had built-in lamp fixtures. By incorporating all these elements, the couch design, as shown in the photo on p. 84, reflects the design motif of Purcell, Feick and Elmslie.

Comfort was created by designing support cushions that fit inside the couch frame with the proper proportions, geometry and materials. The seat cushion is low enough to allow legs to be comfortably stretched in a semireclined sitting postion. Thighs are fully supported by the depth of the cushion, but it is not so deep that the backs of the knees are pressed by the front rail. The seat is a bit narrow for lying down, but it's still acceptable, and if more room is needed, the back cushions can be removed. The seat cushion has a firm foam core that gives even support, and a top layer of polyester fiberfill to provide a soft surface texture.

The couch retains the rigid angularity of the Prairie School style, but seating is quite comfortable thanks to modern high-density foams that Dickerson specified for the cushions. The design features of the couch, such as the open lattice work, top rail and built-in lighting, repeat architectural elements of the house.

The 17-in.-high back cushion is tall enough to support the sitter to the shoulders, and the 18° angle of recline creates a relaxed posture suitable for reading and conversation. Lumbar support is provided by using two different densities of foam in the cushion core: a firm foam in the lumbar region and a softer foam above and below that area. Because the firmer foam resists compression more than the softer foam, the cushion automatically conforms to the proper curvature to support the spine. As with the seat cushion, a layer of polyester fiberfill gives the back cushion a soft surface texture.

The cushions are supported in the couch frame by wood slats, which, unlike rubber or fabric straps, are almost permanently durable. If one does break, it is easily replaced. Wood slats also provide a controlled resilience that does not change over time.

With the visual features and the comfort of the couch accounted for, I turned my attention to the accessories that were to be included. I designed couch lights, as Burger had requested, based on the built-in fireplace shelf lights. The couch lights are a little shorter to maintain the appropriate scale and to reduce their exposure to damage. I located two fixtures, controlled by individual rheostat switches, on each seating unit to provide good reading light at each seat.

To add the table surfaces and storage that Burger wanted, I designed two different cabinet styles. The cabinet between the two quarter-circle couch units is freestanding, but the other cabinets are built onto the ends of each straight unit. Slanting compartments in one of the cabinets provides a hidden wine rack. The top shelf of each cabinet is 7 in. below the top rail of the seating units and is a perfect display shelf for Burger's bonsai juniper, a plant that reflects the house's location, Juniper Point.

Building the couch

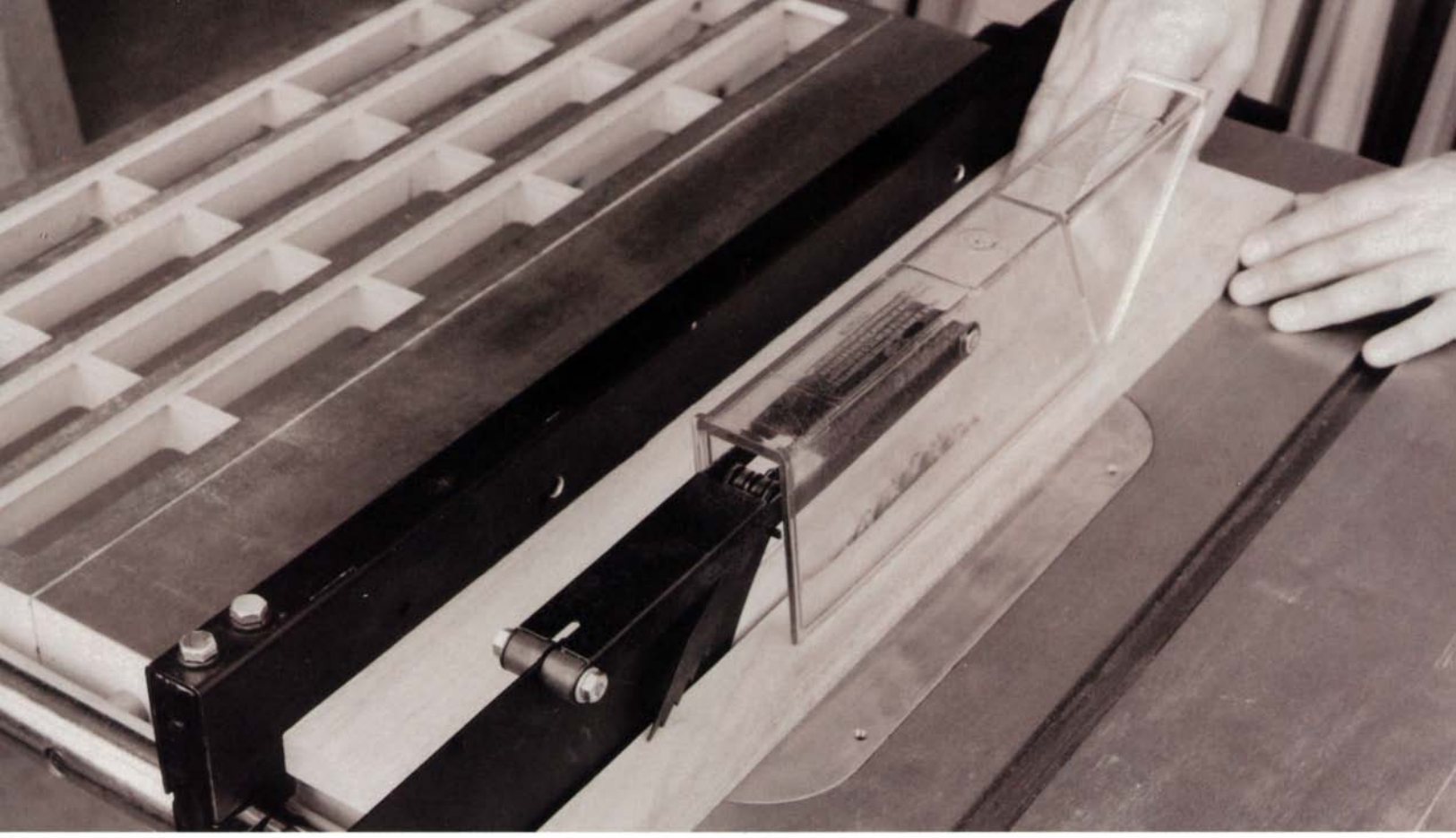
Dennis Saindon, of Deer Isle, Maine, admirably executed my designs, and he did more than just put together the 2,540 pieces to make the couch. He also developed techniques that made construction more efficient and the couch more durable, such as floating tenon joinery and all-thread to join the lattice, as shown in the drawing on p. 85. The construction process took 37 weeks and consumed more than 630 board feet of white oak.

We chose oak instead of cypress because oak's superior strength, durability and workability provided a stronger frame that's more resistant to wear. Although I think staining oak overemphasizes the grain pattern, Burger wanted the couch to match the floors. And, I'll admit, the darker finish is consistent with the Prairie School style of finish.

The final design detail was choice of upholstery fabric. F. Schumacher and Co. (79 Madison Ave., New York, N.Y. 10016-7878; 800-523-1200) produces the Frank Lloyd Wright Collection of fabrics patterned on authentic designs created by Wright. "Storer House Matelasse" is the name of the rich, dark indigo fabric with intersecting woven diamonds of varying textures that Burger chose.

The upholsterer, Newt Tyler of Blue Hill, Maine, did an excellent job of matching the striking pattern of the Wright fabric to the series of irregularly shaped cushions. For the curving back cushions of the quarter-circle units, he ordered the specified foam for the cores to be laminated into oversized blocks and then bandsawn to the proper radius to fit the couch. This unusual technique resulted in a superior and consistent fit of these cushions. □

Scott Dickerson divides his time between chair design and land-use planning. He lives in Harborside, Maine.



The tablesaw is both a saviour and a demon. *It's unmatched for accurately ripping stock to width or crosscutting pieces of nearly any size and also can be used to cut tenons, dadoes and finger joints. Unfortunately, the tablesaw also is responsible for many injuries, most of which could be avoided with blade guards and an understanding of the fundamentals of tablesaw use.*

Mastering the Tablesaw

There's a way to be safe in every cutting situation

by Mark Duginske

The tablesaw is the heart of most woodworking shops. With a standard blade, you can make virtually any straight cut, and when fitted with a dado head, the tablesaw is the tool of choice for cutting grooves, dadoes and rabbets. When equipped with shopmade jigs, the tablesaw is the most efficient tool for finger joints, tenons and even dovetails.

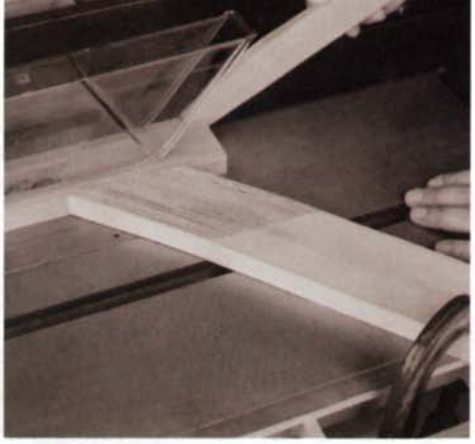
Although undeniably versatile, the tablesaw also has its dark side. It is probably responsible for more injuries than any other woodworking tool. Many of those injuries could be avoided if woodworkers used blade guards and splitters (see the sidebar on p. 93) and if they took the time properly to set up and to align the rip fence and miter gauge (see the sidebar on p. 90). But above all, for safe operation of a tablesaw, you must understand the fundamentals of ripping and crosscutting.

Using the rip fence

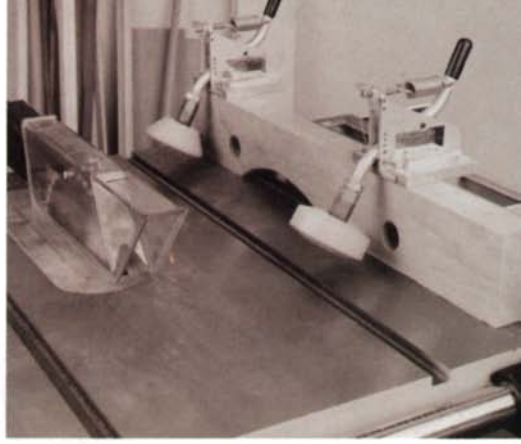
The rip fence is a straight edge aligned parallel to the blade that slides along a bar at the front of the saw table. When the fence is locked to the bar, the distance between the blade and the fence determines the width of cut. To rip safely and accurately, the workpiece must lie flat on the table with a straight edge against the rip fence. If the edge is not straight, joint it straight before making the cut or make a jig to hold the wood securely while making a straight cut. One option is to screw or nail a wooden straight edge to the workpiece. If the wood is not flat, face-joint it to establish a flat surface or position the workpiece so that it doesn't rock during the sawcut. Never rip a badly twisted board because it will bind and may kick back. Sometimes you can salvage a badly twisted piece of wood by cutting it into smaller lengths first.

To ensure that the fence locks parallel to the blade, always adjust the fence toward the blade rather than away from it, and then apply pressure on the front of the fence before it is locked in place. Periodically, check the alignment of the fence to the blade by measuring from the fence to the front of the blade and then to the back

***Use two push sticks** to rip narrow stock. To avoid kickback, don't allow the push stick that applies the side pressure to move past the front of the blade.*



***A shopmade featherboard** can be used to hold the workpiece against the fence while the stock is guided past the blade with a push stick.*



***Commercial spring-loaded wheels** attach to a fence or to a board mounted on the fence and hold the work both down on the table and against the fence.*

of the blade. The distance should be no more than 1/64 in. greater at the back of the blade. A faster and more accurate way to check whether the blade and fence are parallel is with sliding wedges, as shown in figure 1 below. To accommodate different width workpieces, make pairs of wedges for each of the following widths: 6 in., 9 in., 12 in. and 18 in. For cutting widths wider than 18 in., you can use more than one pair of wedges.

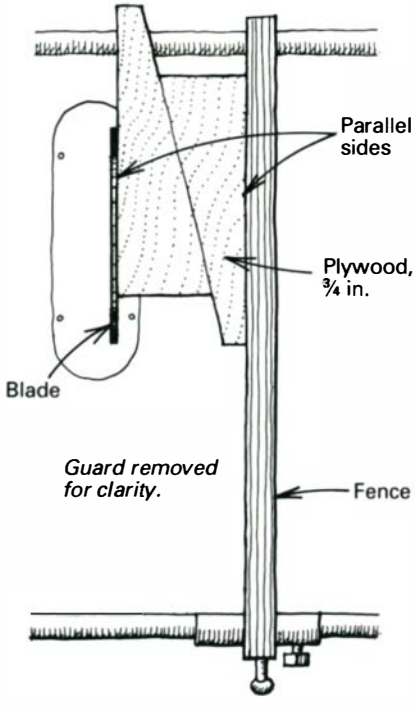
Ripping on a tablesaw

Before making either a ripcut or a crosscut, raise the blade so that the highest sawtooth is positioned about ¼ in. above the work. With carbide-tipped blades, the entire carbide tip on the highest tooth should be above the work. The guard should be in place and functional.

Most woodworkers prefer to rip with the fence to the right of the blade, so the illustrations show it in that position. If you prefer the fence on the left side of the blade, reverse the arrangement. Never stand in line with the sawblade. Stand to the side of the saw opposite the fence, as shown in figure 2. This position may seem awkward at first, but it is a good habit to form because it may keep you out of the way of a violent kickback someday.

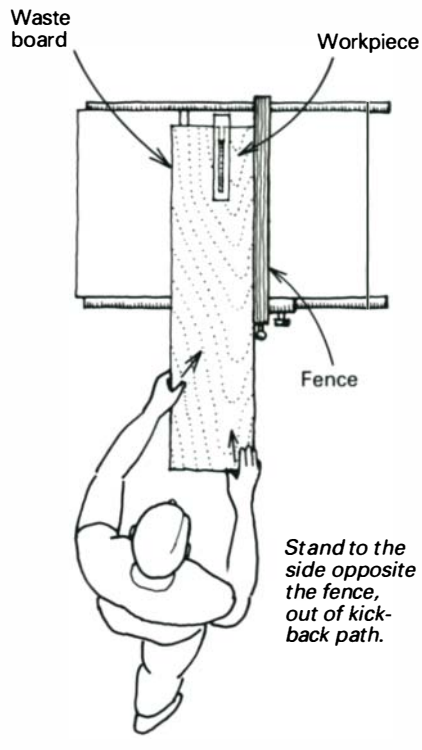
Start by pushing the work along the fence with both hands, applying forward pressure on the workpiece with your right hand and sideways pressure against the fence with your left, as shown in the photo on the previous page. As you near completion of the cut, continue to push the workpiece past the blade with your right hand, but remove your left hand from the work. It's a good idea to have your pushing hand in contact with the fence to en-

Fig. 1: Testing for parallelism



Slide the pair of wedges between the blade and fence to test if they are parallel.

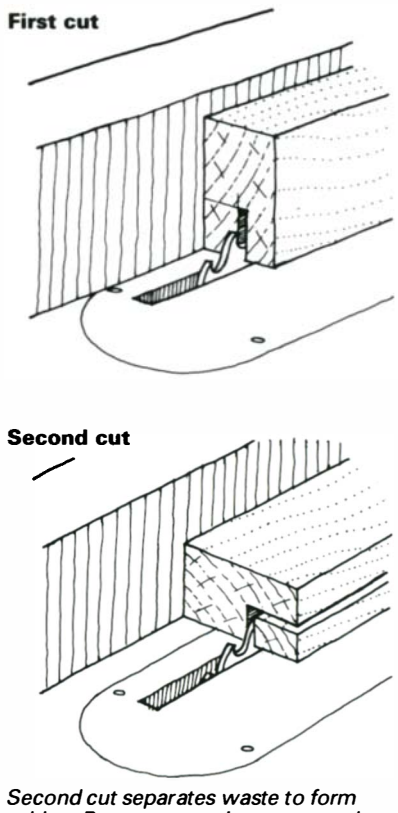
Fig. 2: Techniques for ripping



Push into fence with left hand.

Advance work forward with right hand.

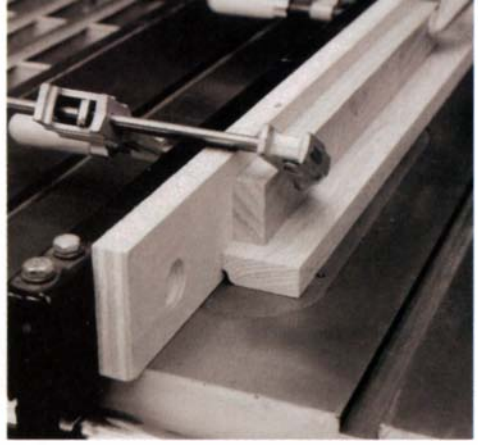
Fig. 3: Sawing rabbets



Second cut separates waste to form rabbet. Be sure waste is not trapped between blade and fence.

Photos: author; drawings: Vince Babak

A low, L-shaped auxiliary fence provides clearance for your hand and the push stick when ripping narrow pieces and when tilting the blade.



When rabbeting or cutting molding, use an auxiliary fence that has an arc cut in it to house the unused portion of the cutter. Clamp a hold-down board to the fence.

sure that your hand is as far away from the blade as possible.

The left hand should not touch the waste board at the completion of the cut, and you should never reach past the front of the blade with your left hand. Resist the temptation to try to control the workpiece or the waste piece at the back of the blade. If you fumble with the wood at the conclusion of a cut, an accident might happen: A kickback could pull your hand into the back of the blade.

Long boards must be supported at the back of the saw. A support keeps the board from falling off the table or from binding between the blade and guard or fence. Stand-alone roller units and fold-down roller systems that attach to the back of the saw are available. An auxiliary table is a good option, too—if you have the floor space. Both rollers and auxiliary tables are commercially available, or you can build your own. The simplest solution is a sheet of plywood on a pair of sawhorses.

Sawing rabbets safely—Although a rabbet can be cut with a dado blade or with multiple passes over a standard blade, it is often faster to make two intersecting cuts to remove the waste (see figure 3). When taking the second cut, which separates the waste, make sure the waste piece is on the side of the blade opposite the fence. If the waste were between the blade and the fence, it could bind and eject backward with lightning speed.

Push sticks—If the distance between the blade and the rip fence is less than three inches, always use a push stick rather than your hand to guide the workpiece past the blade. As a new push stick begins to pick up the inevitable war wounds, you really start to appreciate it. Push-stick designs are quite varied, but all have a notch that hugs the corner of the workpiece and that allows you to push the workpiece forward while also holding the back of the workpiece down on the table.

Before ripping a board, set the push stick on the saw table to the right of the fence. When there's about six inches left to cut, pick up the push stick with your right hand and complete the cut. However, when picking up the push stick, be sure your left hand is behind the workpiece; never let go of the workpiece with both hands, or the force of the blade will pitch it back at you.

On narrow boards, finish the cut with two push sticks, as shown in the top left photo on the facing page: one stick for sideways pressure and one for forward pressure. Never allow the push stick that applies the side pressure to move past the front of the blade because you would be applying side pressure on the blade, which could cause a kickback. For short boards, you may want to make a long-nosed push stick that holds down the front of the board (see figure 4). This kind of push stick counteracts the upward force from the back of the blade, which tends to lift the board off the table.

Featherboards—A featherboard is a shopmade device that is clamped to the saw table or rip fence and that applies sideways or downward pressure to the workpiece. Featherboards not only hold the piece against the rip fence, or down on the table, they also prevent kickback. When used to apply sideways pressure to keep the workpiece against the rip fence, the featherboard should be clamped to the table so that light pressure is applied just in front of the sawblade. No part of the featherboard should extend past the front of the blade, or it will pinch the waste board against the blade's side. I prefer softwood featherboards with the "feather" cuts spaced about ¼ in. apart to provide flexi-

Fig. 4: Push-stick design

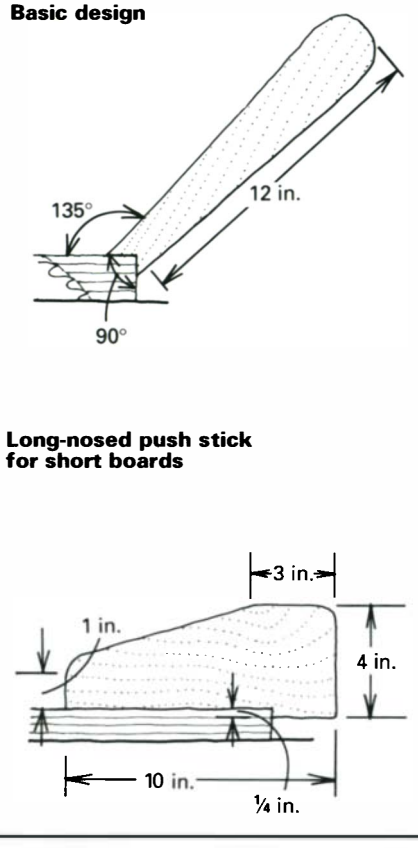
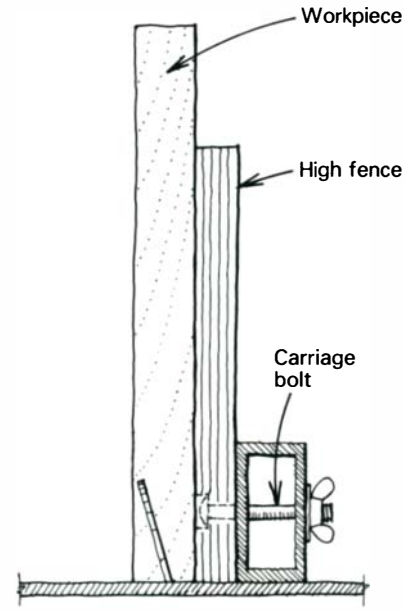


Fig. 5: The high fence



A high fence is used when cutting the edge of a board.

bility and to allow some latitude for adjustment. You can use a featherboard and a push stick together, as shown in the center photo on p. 88 or two featherboards in tandem: one clamped to the table and one to the rip fence.

Wheel hold-downs—Commercial spring-loaded wheel hold-downs attach to a fence or a board mounted to the fence (see the top right photo on p. 88). The spring tension is adjustable for the height of the workpiece, and the wheels rotate in only one direction to provide protection from kickback. Although hold-downs are purchased in pairs, I like to install just one at the back of the saw. The single hold-down controls the wood at the back of the saw and allows me to use a push stick at the front.

Auxiliary fences

The sawblade must not come in contact with the metal fence, so it's a good idea to make a wooden fence that protects both the blade and the stock rip fence. Most standard fences are drilled so you can easily attach a wooden fence with bolts or screws. It's best if the auxiliary fence is made of plywood or another manufactured product that won't warp. If you use solid wood, choose quartersawn rather than flat-sawn wood because it's more stable. Finish both sides to prevent warping, and apply plastic laminate to provide a good wear surface. Wax the fence often.

Occasionally, the metal fence is twisted. By attaching a wooden fence and shimming it with paper, you can make the setup perfectly straight and accurate. Check the relationship of the fence to the table with a square, and check its straightness with a straight edge.

A standard auxiliary fence that covers your stock fence will serve you well for most cutting operations, but there are some special cuts that require different types of auxiliary fences.

High fence—When running a board on edge through a tablesaw (such as when beveling raised panels, as shown in figure 5 on the previous page) it's safest to use a high plywood fence to support the work. Position the fence and raised panel so that the blade tilts away from the fence. If you are making a cut that separates a small piece, it should not be captured between the blade and the fence.

Low fence—Although you should always tilt the blade away from the fence when ripping a bevel or a chamfer, this is not always possible. When you must bevel a piece with the blade tilted toward the fence or when ripping any narrow piece between the blade and fence, it's a good idea to use a low, L-shaped fence. This fence can be a separate two-piece fence or a board that is attached to your standard auxiliary fence. Because the workpiece is trapped between the fence and the blade, a kickback is likely, so use a long push stick to move the workpiece completely past the blade. The low fence gives you

Start by aligning the miter gauge and rip fence

To ensure safe and accurate cuts, you must make sure that the rip fence and miter gauge (used for crosscuts) are set up properly and in alignment with the blade and the miter-gauge slots. Because you'll be using the miter gauge to check the alignment of the blade to the miter-gauge slots and of the rip fence to the blade, you will first need to make sure the miter gauge is set up properly.

Fit bar to slot: The miter-gauge bar usually fits too loosely in the table slot to yield accurate crosscuts. To adjust the bar to fit more snugly, dimple the side of the bar with a center or prick punch. The dimples expand the metal around each indentation, effectively making the bar wider. The bar should slide smoothly along the length of the slot without hanging up and without side-to-side play.

Square miter head: Square the head of the miter gauge to its bar. To do this, I lay pennies in the miter-gauge slot to elevate the bar slightly. I loosen the lock knob on the protractor head, butt the handle of a combination square against the bar of the miter gauge and then align the protractor head with the blade of the square. Although you may be tempted to square the miter head to the sawblade, it won't do you any good until you align the blade to the miter-gauge slots.

Align blade to miter-gauge slots: To test for this alignment, raise the blade as high as it will go, and clamp a 15-in.-long 1x3 to the miter gauge. Crosscut this test piece and unplug the saw. Now, slide the miter gauge with the test piece still clamped to it next to the front of the sawblade. Rotate the blade by hand-turning the belt or using a motor pulley. Don't grab the blade because your hand may deflect it. As you rotate the blade, one or two teeth will rub against the wood harder than the others and make a louder sound. Mark those teeth, and slide the test piece to the back of the blade. The same teeth should rub against the blade at the back and make the same sound. If the sound is the same, the table slot and the blade are aligned, and you will not have to adjust. If you get a different sound at the front and the back, the distance between the blade and the slot will have to be increased or decreased accordingly.

Realigning the blade to be parallel to the miter slot is fairly straightforward. On typical contractor saws, you simply loosen a few bolts and rotate the trunnions relative to the table. When doing so, you must be sure that the two trunnions stay in alignment. For a complete discussion of this, see my article, "Tuning-Up Your Tablesaw," in *FWW* #78 (Sept./Oct. 1989), or consult your owner's manual. On larger cabinet-shop saws, just loosen the bolts that hold the table to the cabinet, and rotate the table slightly.

After making a slight adjustment, repeat the sound test with the saw unplugged. When you are satisfied, tighten the bolts, plug in the saw and make another test cut. It may take several attempts, but stay calm and take your time.

Rip-fence alignment: In theory, the rip fence should be perfectly parallel to the blade. In practice, however, it's best if the fence is slightly canted away from the back of the blade. This prevents the wood from binding between the blade and the fence, particularly if the workpiece warps slightly as it is ripped.

You can set the rip fence with the same test piece you used to check for crosscut alignment. First, lower the sawblade below the table, and loosen the bolts that lock your fence's angle relative to the guide rail. Then move the miter gauge with the test piece to the front of the saw, and lock the rip fence against it. Tighten the bolts, but not all the way—allow for slight movement at the back end of the fence with firm pressure. Now, slide the test piece forward until it's over the back of the saw's throat plate. There should be about 0.015 in. (about 1/64 in.) clearance between the piece and the fence. To gauge the amount of clearance, slide a feeler gauge or a dollar bill folded over twice between the fence and the test piece. Finally, tighten the fence bolts, and recheck the settings before making a test cut.

—M.D.

more room to manuever your hand and the push stick past the blade (see the top left photo on p. 89).

Short fence—An auxiliary fence that extends the entire length of the rip fence makes it easier to cut sheet goods. Because they are dimensionally stable, pinching or spreading after the cut is not usually a problem. However, when cutting solid wood, there is always the possibility that the wood will either pinch together or spread apart during the cut. The splitter that is standard equipment on most guards is designed to eliminate the problem of the wood pinching the back of the blade. A short auxiliary fence will eliminate the problem of the wood spreading apart after it's cut. The short fence should end at the back of the blade to allow space for the wood to spread without forcing the workpiece away from the fence. A short fence also makes a good stop when crosscutting multiple small pieces to the same length using the miter gauge (see figure 6 below).

In this case, the fence should only extend to the front of the blade, so you can bump the workpiece into the fence at the beginning of the cut, but not have the cutoff trapped between the fence and blade at the end of the cut.

Dado and molding fence—The dado blade and the molding head often cut the edge of a board, which means that the cutter or blade is near the fence. The auxiliary fence for these cuts should have an arc-shaped recess to provide clearance to house the cutter. Because of the danger of kickback, you should never cut a rabbet or make a molding with the workpiece between the fence and the cutter. Molding heads and dadoes require more downward pressure than a regular blade, so it's a good idea to add a hold-down strip to the wooden fence for rabbeting and molding, as shown in the top right photo on p. 89. Always cut the molding profile on the edge of a wide board, and then rip the desired width of molding from it.

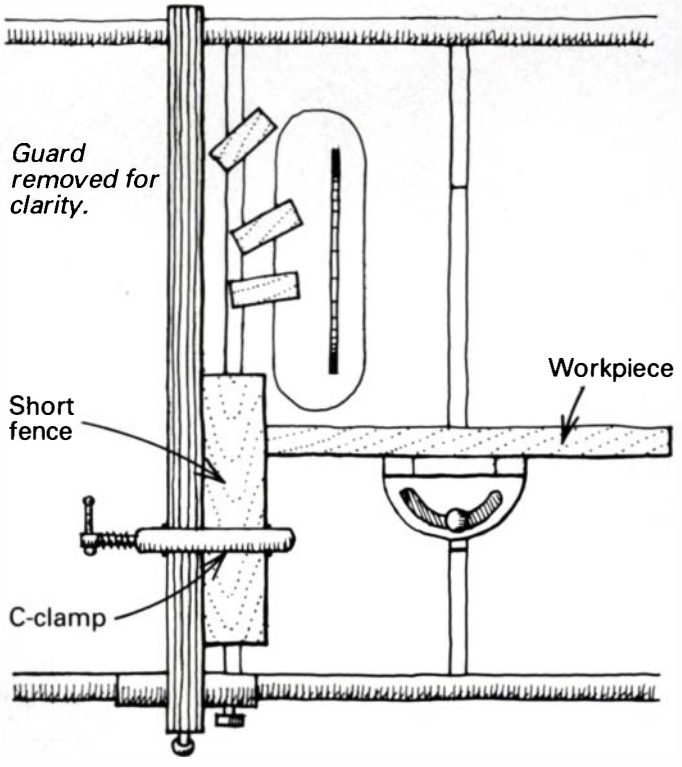
Crosscutting with the miter gauge

The miter gauge is an adjustable protractor that slides in the miter slot and supports the work as it is crosscut. The face of the miter gauge remains square to the bar for square and bevel crosscuts but is angled in relation to the blade for miter and compound-miter cuts.

To crosscut, press the workpiece against the face of the miter gauge and down onto the miter bar. After making sure your fingers are clear of the blade, advance both the gauge and the wood into the blade. Most people prefer the left miter slot for crosscutting, but either slot works. When the blade is angled, use the slot opposite the direction of the tilt.

Use both hands to control the wood and the gauge, and hold the wood tightly against the face of the gauge so that it doesn't slip during the cut. Once the wood is cut into two pieces, stop the forward movement of the miter gauge, and pull the wood and the miter gauge backward to the front of the saw. As you back up the

Fig. 6: The short fence as a cutoff stop block



The workpiece should touch the short fence at the beginning of the cut, but not at the end.

Fig. 7: Making dadoes with the two-stop system

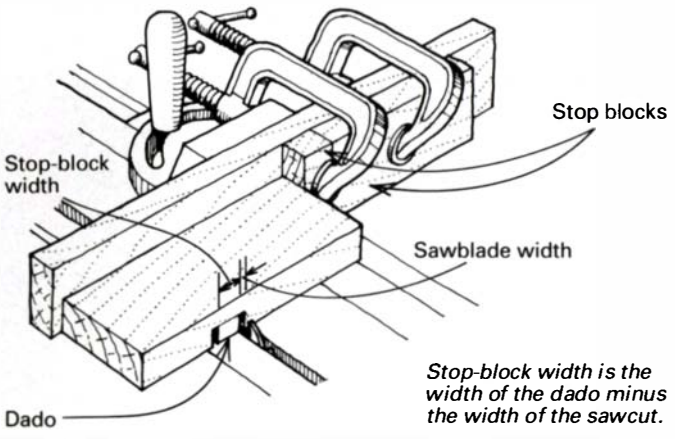
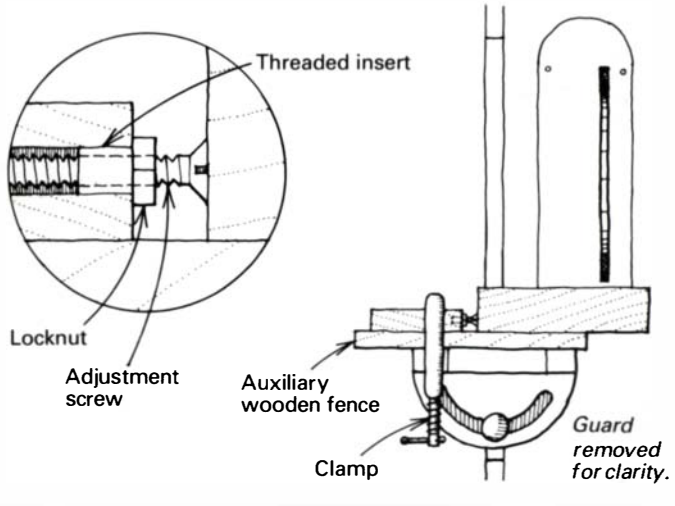


Fig. 8: A shopmade microadjustable stop



wood and the gauge, maintain the same pressure that you used as you cut; relaxing too soon can cause accidents. Never touch a cutoff piece while the saw is running. A safety precaution when cutting small pieces: Clamp them to the miter gauge.

The auxiliary miter fence—Most miter gauges have holes so that a wooden fence can be screwed to the face of the miter head. A longer auxiliary fence gives the workpiece more support. Use plywood for the auxiliary fence because it is more dimensionally stable than solid wood. Let the fence extend past the blade, and then crosscut it to establish the exact location of the sawblade (see the bottom right photo).

Marking the work—When making individual crosscuts, it's best to mark the edge of the board because the edge contacts the blade first. Then the workpiece can be positioned, so the mark lines up with an outside tooth of the sawblade. Alternatively, you can scribe a line on the back of the board and align it with the sawcut on the auxiliary fence.

Miter-gauge stops—A stop block clamped to the wooden fence automatically measures the required length of board. This simple technique offers both efficiency and accuracy, particularly when you need several pieces exactly the same length. Keep gentle pressure against the stop as the wood is fed into the blade. After the cut is made, maintain the pressure against the stop as the wood and miter gauge are being retracted to lessen the likelihood of contact with the blade.

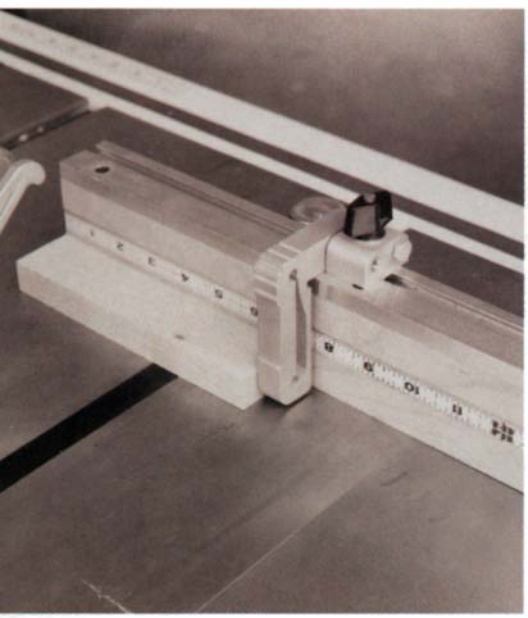
Dual stops—Sometimes it may be desirable to have several precise stops. For example, when cutting several boards that must first be squared up and cut to exactly the same length, two stop blocks are efficient. The stop nearer the blade is the finish stop; the stop farther from the blade is the rough stop. If your miter gauge doesn't have hinged stops, two wood pieces clamped to the fence work almost as well. Cut a piece of wood about 2 in. long for the finish stop, and clamp another piece opposite the blade for a rough stop. When you need to use the rough stop, just unclamp the finish stop block.

Another job for the two-stop system is to make the two outside cuts of a dado with a standard blade instead of a dado head (see figure 7 on p. 91). The first stop locates the right edge of the dado and the second stop, which must be as wide as the dado minus the width of the sawkerf, determines the dado's width. Once these two cuts are made, the waste in between can be removed in several passes.

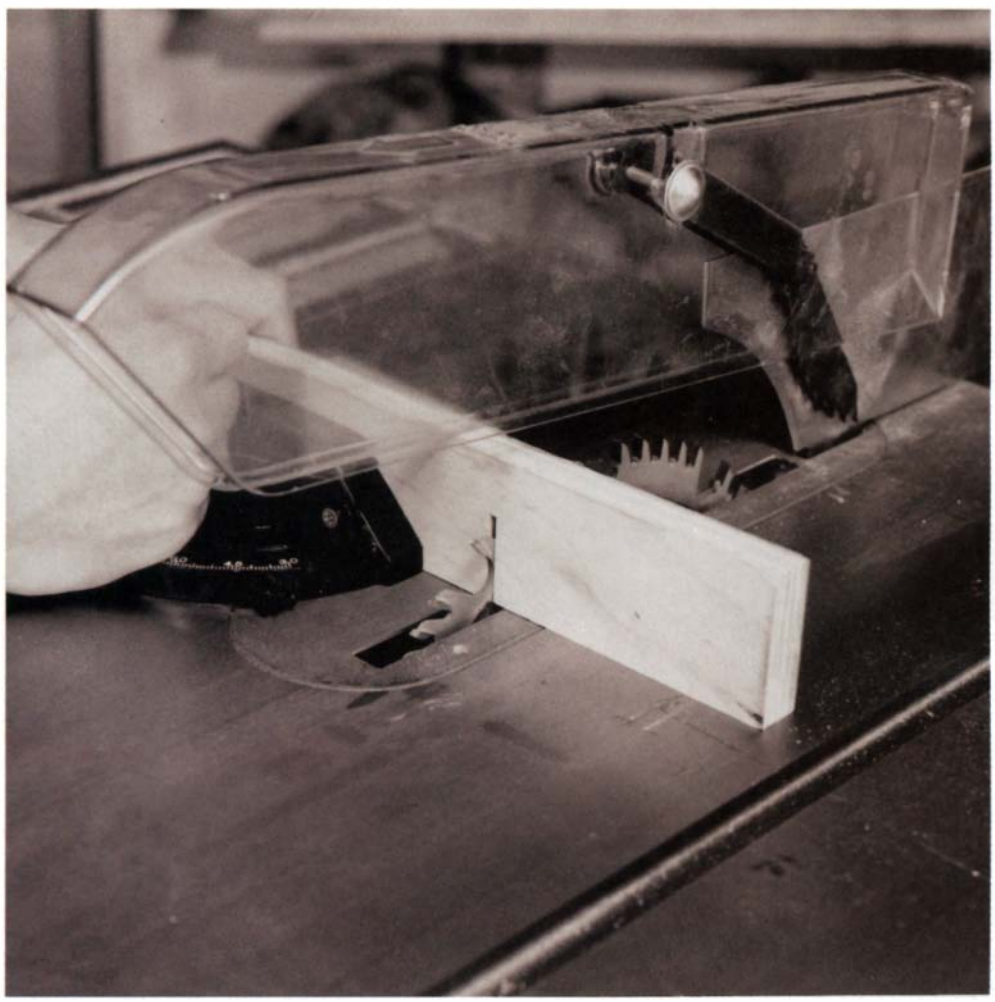
Microadjustable stops—For very precise work, it's essential to be able to make very fine adjustments of the stops. One low-tech approach is to put paper shims between the rough stop block and the finish stop block. A dollar bill or sheet of typing paper is 0.004 in. thick, a dollar bill folded twice is about 1/64 in.

Another technique is to make a block that has a threaded insert and an adjustment screw, as shown in figure 8 on p. 91. Every full turn of a 1/4-in., 20 threads-per-inch machine screw adds or subtracts 0.05 in. to the length of the stop block. The locknut makes this measurement reliable for repeated operations. □

Mark Duginske is a contributing editor to Fine Woodworking. *This article was adapted from his new book,* Mastering Woodworking Machinery, *published by The Taunton Press, 63 S. Main St., P.O. Box 5506, Newtown, Conn. 06470-5506.*



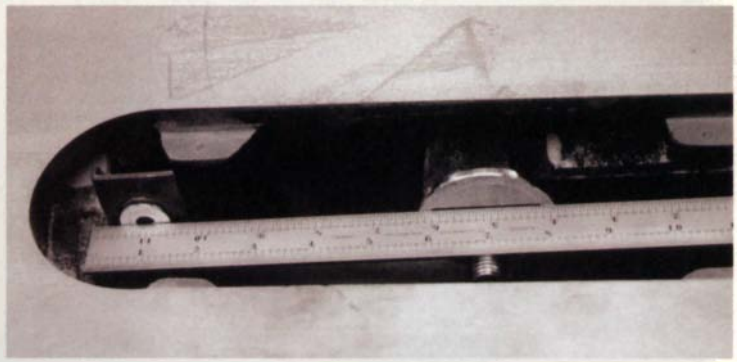
Some after-market miter gauge fences, *such as the FasTTrack shown above, have flip-up stops like those that have been standard equipment on European saws for years.*



A plywood auxiliary fence *screwed to the face of the miter head increases its surface area and supports the workpiece. If you let the fence extend past the blade and then cut it off as shown at right, you can then use the sawkerf to align pieces that you are crosscutting.*

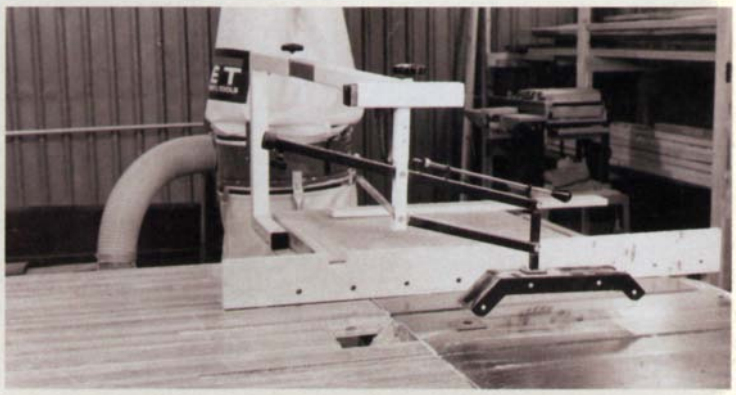
Don't dump your saw guard, adjust it

***The Delta Uniguard,** which features a retractable splitter (inset), is a European-style overhead guard.*



***When mounting a North American-type guard** where the mounting bracket is actually the splitter, the mounting bracket must be perfectly aligned with the arbor flange.*

***The Biesemeyer overhead guard** can be installed on any tablesaw and features an alarm that sounds if a cut is attempted without the guard in place.*



Tablesaw manufacturers spend hundreds of thousands of dollars to develop safety guards, but no tool guard is a guarantee of safety—constant vigilance is always your best safety equipment.

The saw guard: Most tablesaws sold in North America are equipped with a cage guard, which is a see-through plastic or metal guard with a sheet-metal spine that also serves as a splitter to keep the kerf from closing and pinching the blade (see the photo on p. 87). The spine is connected to the saw in two places, directly behind the blade and to the back trunnion, which allows the guard to tilt when the blade is tilted. A toothed antikickback mechanism hangs from the guard and rides on the workpiece.

This type of guard offers protection against kickback while also keeping your fingers away from the blade, but it is unwieldy in some situations. For example, it's hard to rip narrow pieces, or slide a push stick past the guard if the fence is close to the blade. And sometimes when crosscutting thick stock, the workpiece will wedge under the antikickback teeth. In addition, because the splitter is part of the cage guard, the entire guard must be removed when making a cut that does not sever the board, such as a dado or rabbet cut. The guard must also be removed when the workpiece is held vertically against the fence, such as when cutting tenons with a jig. Because these guards are time-consuming to remove and replace, they are often left off the tool, in spite of the operator's and manufacturer's best intentions.

The Delta Uniguard, as shown in the photo above, is similar to overhead guards found on many European saws. The splitter used with this type of guard is a small piece of metal that is attached to the back trunnion. Sometimes the splitter is entirely independent from the guard, and in other cases, the guard is mounted on top of the splitter. The Delta splitter is retractable, so it can be pulled up when needed and pushed out of the way below the table's surface for partial cuts (see the inset photo at left). These guards can be easily lifted out of the way for cuts that require more clearance and replaced just as easily afterward.

When either type of guard is removed, you should take a few minutes and devise a method to keep your hands from coming in contact with the blade. For example, when tenoning with the workpiece upright against the fence, simply clamping a 4x4 to the saw table alongside the blade will make it nearly impossible for you to drop your hand into the blade should something go wrong.

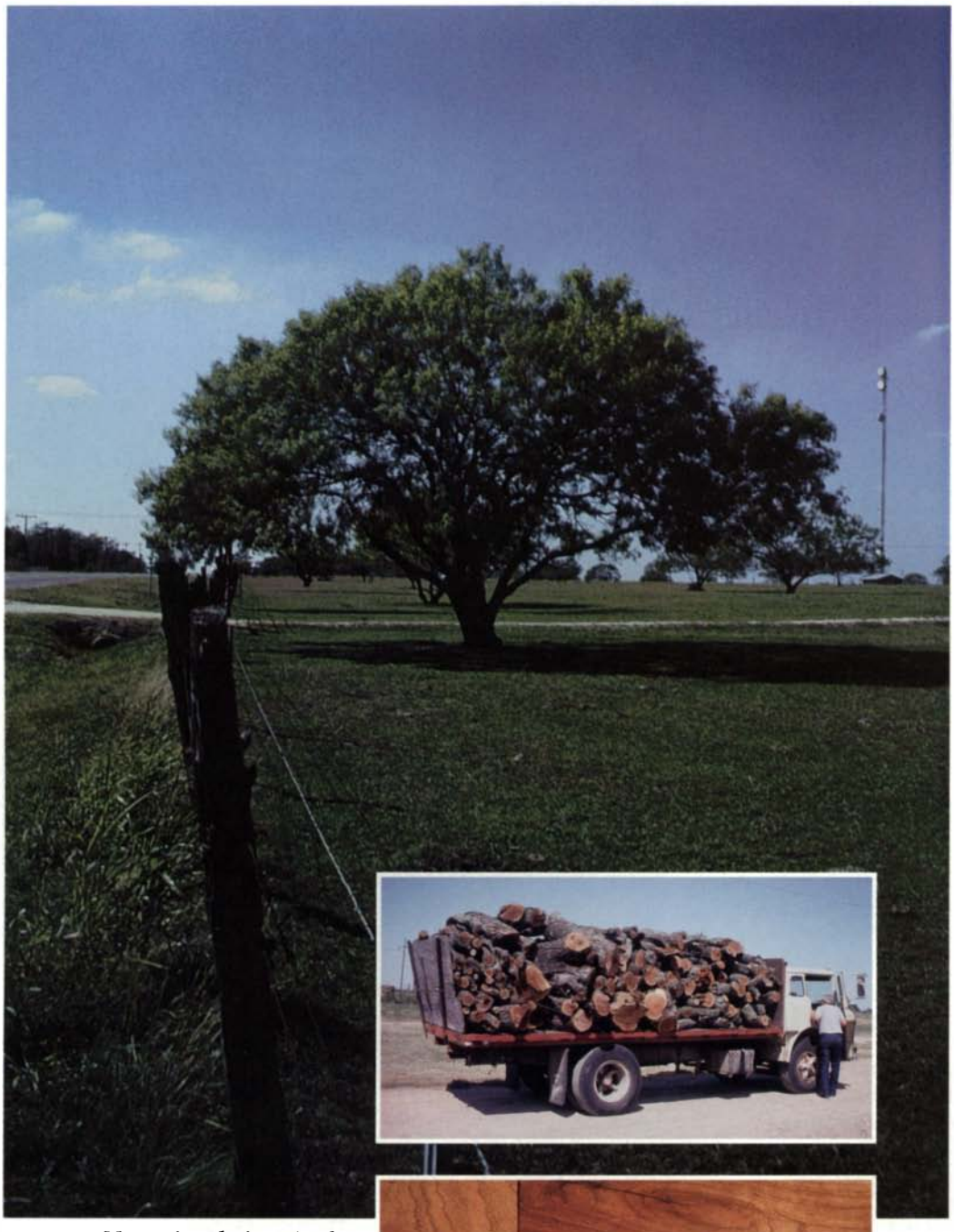
Optional guards: You can purchase high-quality guards to retrofit older machines. Most of these guards are similar to the overhead European design. The Biesemeyer guard (see the bottom right photo), for example, is a suspended guard with an alarm that rings if the guard is not in place during a sawcut. The Brett guard is clear plastic and also functions as a hold-down. Either guard can be wired into the switch, so you can't start the saw if the guard isn't in place.

Adjusting the guard and the splitter: The guard and splitter must be perfectly adjusted, or they will make the tablesaw more difficult and dangerous to operate. On North American-style guards, the flange, splitter and guard bracket must lie in the same plane as the blade, as shown in the top right photo. When mounting this type of guard, leave the adjustment nut on the back support loose while you check the alignment of the blade and the guard plate (splitter) using a straight edge, then make the final adjustment of the back support and tighten the guard in place. Finally, check that the guard plate is square to the table. *—M.D.*

Mesquite: A Hardwood with Character

Why we love these twisted, cracked and buggy little boards

by D. Herbert Nordmeyer



***Mesquite thrives** in the scrublands of Texas and New Mexico. The harsh climate, plus the depredation of grazing cattle, produces a short, twisted log and lumber with plenty of character.*

Photos this page : Ken E. Rogers and Herb Nordmeyer.

When I talk about mesquite, I'm likely to hear such comments as "Mesquite, that's barbecue wood," and, "I've been fighting mesquite all my life." Recently, I mentioned mesquite to an intarsia artist who replied that people who use the wood are worse than religious fanatics. With remarks like these being made in the center of the mesquite tree's range, is it any wonder that most woodworkers have never heard of mesquite lumber? Those of us who know and love this hardwood dream of the day it replaces cocobolo. We think it is a wonderful and beautiful wood that's rich with character, and we want to tell the world about it.

The honey mesquite *(Prosopis glandulosa)* is native to northern Mexico and southern Texas; therefore, it is not exotic in the conventional sense. Mesquite originally grew near streams and rivers. When grass fires set by Indian hunters were controlled, the mesquite spread onto the prairies. It then spread north with the cattle drives and today continues to be spread by cattle that eat the beans.

Over much of its range, mesquite is cursed by ranchers, fought by the government, cut for firewood and shredded for barbecue chips. Yet, unlike the tropical exotics, the mesquite continues to spread. Around 1950, there were 44 million acres of mesquite in the United States. By the late 1980s, we had about 78 million acres.

Only in its native range or in ideal soil does one find mesquite of a size suitable for lumber. Until recently, there were no sawmills in the mesquite regions of Texas, and mesquite logs are too heavy to transport long distances to be milled. Most commercial sawmills cannot handle mesquite logs, which are often no more than 2 ft. long, so the would-be sawyer must build his own mill or modify some commercial model. Currently, mesquite lumber is available in small quantities from about a dozen sawyers (see the sources of supply box on p. 97). One source, San Pedro Mesquite of Benson, Ariz., is slicing mesquite veneers.

The mesquite is a tough tree that thrives in an extremely harsh climate, and people respond emotionally to it. After fighting the mesquite for years, ranchers and other Texans find this scruffy tree to be a worthy adversary. When these people discover the beauty of the wood, they fall in love with it.

The virtues of mesquite

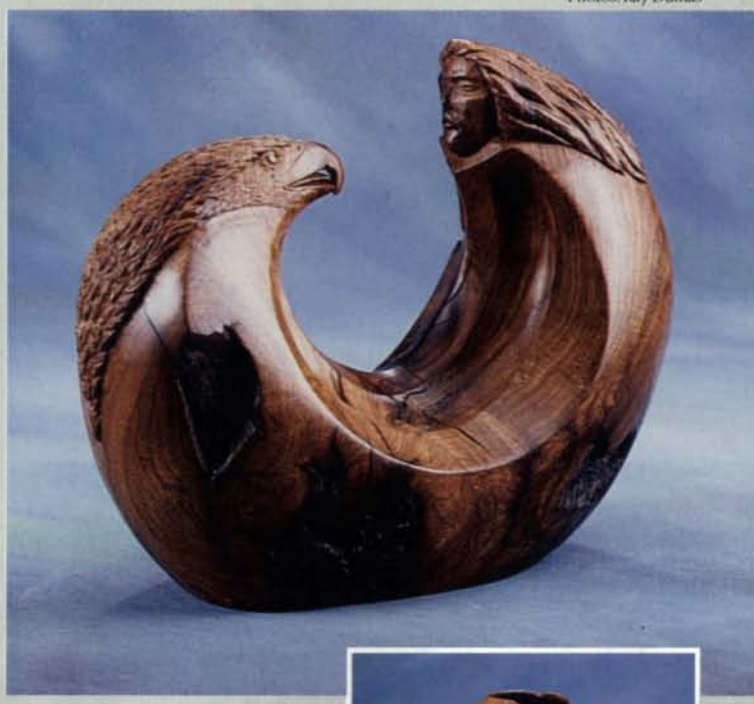
Mesquite wood displays fascinating, fantastically twisted grain patterns. The mesquite tree typically develops multiple trunks after cattle graze off the terminal bud. These trunks spread sideways for several feet, and then they begin to grow vertically again. Further grazing and wind storms knock the trunk down again. Consequently, much of the tree consists of crotch wood and reaction wood, twisted and intergrown.

Mesquite wood is hard, dense and dimensionally stable (see the chart on p. 96). Not only does mesquite shrink less than other hardwoods, but the ratio between radial and tangential shrinkage is very close to unity, which means there's less warp in flatsawn boards and fewer problems when joints are exposed to humidity changes. Because it is about twice as hard as hickory, mesquite resists scratches and abrasions, and it makes excellent tabletops and flooring.

The color of mesquite wood varies with the region in which it was grown and with the soil type. In general, freshly cut mesquite heartwood is a reddish-tan to reddish-brown, with yellow and black highlights. Exposure to light usually intensifies the reddish-brown color. Within this generalization, the color of the wood can range from the lightness of pecan to purple.

Mesquite lumber has many defects, which we like to call "char-

Photos: Ray Dumas



Delights from the touring Wyndham Mesquite Collection include Kindred Spirits (above) ***by Charlie Boren of Burleson, Texas, and*** Vesuvius (right) ***by Joel Lee of Reagan Wells, Texas.***

Friends of the jewel of the Southwest

by Ken E. Rogers

Los Amigos del Mesquite is an organization of more than 300 persons from eight states and six countries. The members are united by their obsession with the mesquite tree, which many of them call the jewel of the Southwest. One cannot get together with more than a couple of the amigos without the conversation turning to the most recent mesquite project or to some new technique for working and finishing the wood.

Los Amigos del Mesquite holds a meeting every September with a program that includes visits to mesquite sawmills and workshops, scientific papers on the tree and its uses, technical demonstrations and a trade show. The event features mesquite barbecue and jelly made from the mesquite bean.

Three years ago, the organization sent blocks of mesquite to well-known woodworkers, turners and carvers throughout the country, asking each to create an object that brought out the best in the wood. The resulting collection of 23 pieces, known as the Wyndham Mesquite Collection, will tour the Southwest until September of 1993.

For more information about Los Amigos del Mesquite, contact Ken E. Rogers at the Texas Forest Products Laboratory, P.O. Box 310, Lufkin, Texas 75901.

***Because of its hardness** and dimensional stability, mesquite is an excellent substitute for tropical hardwoods, as in this rolltop desk by Jim Butcher of Bulverde, Texas.*

acter." The defects include wind shakes, borer tunnels and bark inclusions. Most mesquite craftsmen fill the defects with epoxy, either black or mesquite-colored. Some craftsmen fill defects while the mesquite is green or air-dried, but I get superior results by waiting until the wood has been kiln-dried to 8% to 10% moisture content. Many people assume that the epoxy fillings are natural mineral streaks. Some sawyers have been known to charge extra for character; I am regularly accused of selling the clear lumber and making works of art from the rejects.

Mesquite is not oily, so it glues well with ordinary yellow glue or with epoxy, and it accepts all types of finishes, including paste wood fillers, lacquers and varnishes. A common finishing technique in southern Texas is to sand smooth and apply several coats of tung oil. Under lacquer, the rich look of mesquite may take six months to develop. To counter this, one furniture builder applies tung oil and after it has dried a minimum of three days, applies a lacquer finish. The wood can be bleached and stained to cut back its reddish color if that's what the customer wants.

The trouble with mesquite

Mesquite wood is not readily available. When I built my sawmill four years ago, the Texas Forest Service estimated that about 5,000 board feet of mesquite lumber were being sold each year. Now there are at least three mills that each produce more than that, but even so, our industry is microscopic.

Not many woodworkers know about mesquite. Some of my mail-order customers are displaced Texans (Texans are the only people who buy Texas souvenirs). Others are woodworkers seeking a replacement for exotic hardwoods. Once I sell some wood into an area, others see it and decide to try it.

Mesquite boards are small, rarely longer than 6 ft. nor wider than 6 in. Once in a while, you can find clear eight-footers that are a full 12 in. wide, but this is rare. Normally, the larger the board, the more serious its character. There is no uniform grading system. What one sawyer calls grade 1, another may call grade 3 and another may call premium grade.

Powder-post beetles love mesquite sapwood. Beetle-control methods include microwaving, heating to 140°F for 24 hours and freezing to 0°F for 24 hours. Some people believe that several coats of polyurethane will keep the beetles out while others believe in a soaking in dilute boric acid. All of these methods work occasionally, but the only certain way to prevent reinfestation is to cut off the sapwood.

How to buy mesquite

Now that you have been introduced to mesquite, how can you resist buying a few hundred board feet (see the sources of supply box)? Before you buy, ask about the grading system. Expect to pay $10 per board foot for mesquite lumber that is essentially clear on both sides and more if you need planks wider than 8 in. or longer than 6 ft. Expect $3 to $4 per board foot for sound lumber with defects on both sides. If the price is under $3, the wood is probably green or contains excessive sapwood and bark.

Working with mesquite wood will be an experience you'll never forget. And you can save the scraps for a Texas barbecue. □

Herb Nordmeyer makes mesquite furniture and craft objects in Knippa, Texas. He also operates a mesquite sawmill and sells mesquite lumber by mail order.

Properties of mesquite

Species	Density (lbs./ft.^{3})	Compression parallel to the grain (p.s.i)	Compression perpendicular to the grain (lbs./in.^{2})	Side hardness (lbs./in.^{2})	Radial Shrinkage (%)	Tangential shrinkage (%)	Volumetric shrinkage (%)
Mesquite	45	8220	3360	2336	2.2	2.6	4.7
White oak	37	7440	1070	1360	5.6	10.5	16.3
Pecan	41	7850	1720	1820	4.9	8.9	13.6
Black walnut	34	7580	1010	1010	5.5	7.8	12.8
Cherry	31	7110	690	950	3.7	7.1	11.5

The fact that radial shrinkage about equals tangential shrinkage means the wood dries flat, without warping, and stays flat when the humidity changes. Compared to other hardwoods, mesquite is denser, harder and more stable. Low volumetric shrinkage means the wood does not shrink much when drying.

Photo this page: Herb Nordmeyer

Working with mesquite

by Leslie Mizell

At first glance, the texture of mesquite wood is somewhat rough, with worm holes, checks and cracks, and defects that would warrant throwing away any usual wood. But this is all due to the extreme climate in which mesquite grows, which causes it to yield beautifully figured grain. The arid environment makes mesquite a slow growing tree and the density of the lumber is near a third greater than that of red oak.

Normally, these features would be undesirable when designing a high end piece of furniture and would lend the wood usefulness only in rustic settings, but for me, these only add expression to the piece.

I've worked with a lot of different woods, but the first time I tried mesquite I could only guess about how difficult the task would be. From the reddish color of the wood and its weight, I assumed that it would be like bubinga: gummy stuff that chips and tears. To my most pleasant surprise, the opposite was true.

Because mesquite trees grow in such an arid environment, the wood dries with very little movement and absolutely no gummy moisture. The wood can virtually be ripped with a crosscut blade without pinching. The only problem is an occasional separation of grain, which makes some boards useless until you glue the splits closed.

Mesquite is probably one of the best carving woods. Its density allows me to carve the finest details with no tearout. I don't necessarily try to select the straightest grain for carving, I just use what I think looks the best. Even using wild grain patterns, the wood chips off the edge of the carving tool with ease.

When it comes to sanding, there's absolutely no doubt about it, mesquite wood sands easier than any wood I've ever touched. A rasp can do wonders on sculpting a piece, and a single piece of sandpaper can sand a mile of mesquite. I use a small piece of 80-grit on a dowel or block to do fine rasping and then finish it with 220-grit. I guess it's the dryness of the wood that lets the sandpaper cut so easily and last so long.

From here the piece is ready to finish. I begin with a light coat of linseed oil diluted with mineral spirits, which I let dry overnight. Next I apply diluted sanding sealer and top-coat with a few coats of diluted lacquer. I use it heavily diluted so as not to leave a built-up finish. I want a finish that looks like oil but which still gives protection to the piece, so it will stand daily use. Finally, I steel-wool it with #0000, and then I wax it.

***The long drive to a mesquite sawmill** inspired Leslie Mizell to design and build his Texas Chippendale chair, which features the lone star carved on the back splat, a crest-rail armadillo and the silhouette of the Alamo at the base of the splat.*

At this point, the wood colors range from honey-brown to pink, and may appear to be mismatched, even though these colors may all appear in the same board. Now the magic begins: I set the finished piece in direct sunlight, which allows the ultraviolet rays to blend the colors of the wood. It begins to happen within a few minutes. The wood darkens and eventually becomes a deep, rich, beautiful red. This will also happen in indirect light, but will take a lot longer. A full day in direct sunlight can make a tremendous difference. □

Leslie Mizell makes furniture in Cleveland, Texas.

Sources of supply

ECC Shop, Inc., Evan J. Quiros, 2105 Galveston St., Laredo, TX 79040; (512) 723-7151

Hardwood Lumber Co. of Dallas, 10551 Goodnight Lane, Dallas, TX 75220; (214) 869-1230

Mesquite Lumber and Crafts, Herb Nordmeyer, Box 68, Knippa, TX 78870; (512) 934-2616

Mesquite Production Company, Route 1, Box 68-B, Hondo, TX 78861; (512) 426-3000

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Mesquites Unlimited, Cameron Harrison, Route 4, Box 322, Wichita Falls, TX 76301; (817) 544-2262

Frank Paxton Lumber Company, PO Box 17968, Austin, TX 78760; (512) 443-0777

Jim Prewitt, PO Box 269, 111 General Cavasos Blvd., Kingsville, TX 78363; (512) 592-5948

San Pedro Mesquite Co., Benson, AZ 85602; (602) 622-4307

Wallace Seabolt, Route 2, Box 171A, Alleyton, TX 78935; (409) 732-5663

South Texas Molding, PO Box 549, Alamo, TX 78516; (800) 444-2881

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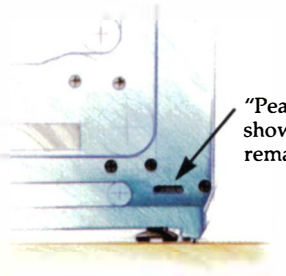

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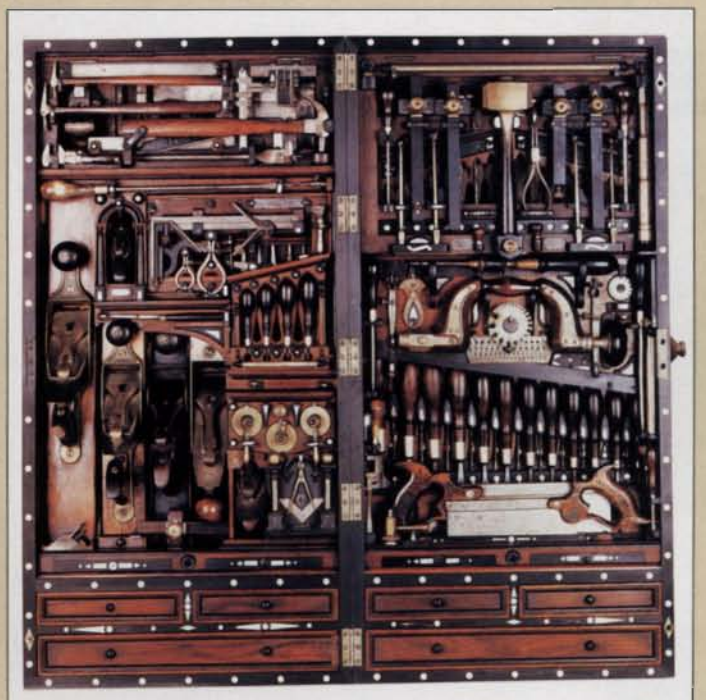

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31-050	1" Belt Sander 2.0 amp	104	78
31-460	4" Belt\6" Disc Sander	198	135
31-340	1" Belt/8" Disc Sander	268	188
31-080	1" Belt/5" Disc Sander	134	94
40-560	16" 2 speed Scroll Saw	266	179
11-990	12" Bench Drill Press	276	209
11-090	32" Radial Bench Drill Press	399	285
43-355	3/4" Shaper 1-1/2 HP	964	709
43-505	1/2" Bench Router/Shaper	399	279
22-540	12" Bench Top Planer	595	389
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DW610	1-1/2 HP 2 handle Router	250	138
DW411	1/4 sheel Palm Sander, 1.7 amp	87	54
DW705	12" Compound Mitre Saw	555	339
DW704	12" Mitre Saw	480	289
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DW250	4.5 amp Drywall Gun, 0-4000 rpm, rev	146	89
DW254	4.5 amp Drywall Gun, 0-2500 rpm, rev	146	89
DW124K	1/2" joist & stud Drill with case, rev	504	295
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J-12	12"	13.74	10.55	59.39
J-14	14"	16.50	10.99	62.00
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#2/0	7"	3-1/2"	17.10	10.35	58.95
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#2	12"	8-1/2"	24.95	14.95	80.95
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Item#	Jaw Length	List	Sale	Box of 6
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3712	12"	10.92	6.75	37.75
3718	18"	12.05	7.25	40.75
3724	24"	13.16	8.19	43.75
3730	30"	14.70	9.10	49.75
3736	36"	16.05	10.19	55.75

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Item	Jaw Length	List	Sale	Lots of 6
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4524	24"	33.55	21.75	123.99

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Model	Description	List	Sale	Lots of 12
50	3/4" Black Pipe Clamps	13.61	7.89	84.99
52	1/2" Black Pipe Clamps	11.37	6.50	69.50
53	Double 3/4" Pipe Clamps	38.50	24.45	274.00

JORGENSEN STEEL "I" BAR CLAMPS

Model	Size	List	Sale	Lots of 6
7224	24"	31.46	18.45	107.00
7236	36"	33.77	20.19	115.45
7248	48"	37.12	22.19	126.95
7272	72"	42.71	26.79	149.95

ELU BY BLACK & DECKER

3338	2-1/4 HP var. speed Plunge Router	427	255
3304	1 HP variable speed Plunge Router	292	164
3375	3-1/8" Univ. Planer 7.2 amp	313	155
3380	Biscuit Jointer with case	542	248
4024	3 x 21 variable speed Belt Sander	322	184

BLACK & DECKER

1166	3/8" Drill 0-2500 rpm 4 amp	100	65
1180	3/8" Drill 0-1200 rpm 5 amp	188	104
2600	3/8" Drill 0-1200 rpm 4.5 amp	142	89
1703-1	10" Mitre Saw with 73-770 blade	313	179
4011	1/4 sheet Palm Sander	82	59
79-034	Workmate 400	175	105
1349-09	1/2" Timberwolf Drill 2 speed	489	279
1180	3/8" Drill rev. 0-1200 rpm 5 amp	182	104
2037	Drywall Gun 0-4000 5.0 amp	175	97
2038	Drywall Gun 0-2500 rpm 5 amp	175	99
3157	Orbital varspd Jig Saw 4.5 amp	220	145
2665K	NEW 3/8" cdls 12V Cyclone Drill	280	165
5045K	MACHO Rotary Hammer Drill	742	409
5071	3/8" Hammer Drill with case	239	144
5073	1/2" Hammer Drill with case	282	163
2054	Tek Gun 0-2500 5.0 amp	269	152
2660	Drywall Gun 0-4000 4.5 amp	142	77
2700	7-1/4" Worm drive Saw 13 amp	250	142
1321	1/2" Spade hdle Drill 450 rpm 7 amp	292	165
2750	4-1/2" Grinder 10,000 rpm 6 amp	149	83
2694	7-1/4" Super Sawcat Circular Saw	248	137
2695	8-1/4" Super Sawcat Circular Saw	271	153

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Model #	Diameter	# Teeth	List	Sale
73-715	5-1/2	16	13.70	7.99
73-716	6-1/2	18	13.70	7.55
73-756	6-1/2	36	28.10	16.85
73-717	7-1/4	18	13.90	7.99
73-737	7-1/4	24	17.20	9.29
73-707	7-1/4	35	26.45	15.85
73-757	7-1/4	40	31.30	16.89
73-718	8	22	19.95	10.95
73-758	8	40	40.45	24.25
73-759	8-1/4	40	44.65	24.99
73-719	8-1/4	22	19.65	11.95
73-739	9	30	29.85	17.50
73-710	9	45	59.90	35.95
73-769	9	60	72.75	39.89
73-704	7-1/4	18	21.00	11.59
73-740	10	32	32.98	17.95
73-770	10	60	67.02	33.95
73-711	10	50	65.08	33.95

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Model	Size	Weight(lbs)	Sale
W394	4'	21#	44.00
W395	5'	26#	53.00
W396	6'	32#	60.00

WOODEN STEP - TYPE 1- 250# RATING

W384	4'	20#	36.00
W385	5'	24#	42.00
W386	6'	29#	48.00

ALUMINUM STEP - TYPE 1A- 300# RATING

404	4'	16#	64.00
405	5'	20#	73.00
406	6'	24#	85.00

ALUMINUM DOUBLE STEP - TYPE 1A-300# RATING

T404	4'	21#	90.00
T405	5'	25#	105.00
T406	6'	30#	120.00

FIBERGLASS STEP - TYPE 1- 250# RATING

6004	4'	13#	50.00
6005	5'	16#	60.00
6006	6'	18#	65.00

FIBERGLASS STEP - TYPE 1- 250# RATING

6004-S w/pail shelf	4'	15#	55.00
6005-S w/pail shelf	5'	18#	65.00
6006-S w/pail shelf	6'	20#	70.00

FIBERGLASS STEP - TYPE 1A- 300# RATING

6204	4'	14#	65.00
6205	5'	18#	75.00
6206	6'	20#	80.00

ALUMINUM FLAT STEP TYPE 11- 225# RATED EXTEN.

Model	Size	Working Length	Weight(lbs)	Sale
D1216-2	16'	13'	22#	115.00
D1220-2	20'	17'	27#	130.00
D1224-2	24'	21'	33#	145.00
D1228-2	28'	25'	42#	175.00
D1232-2	32'	29'	53#	200.00
D1236-2	36'	32'	62#	239.00
D1240-2	40'	35'	73#	265.00

ALUMINUM FLAT STEP TYPE 1- 250# RATED EXTEN.

D1316-2	16'	13'	26#	125.00
D1320-2	20'	17'	32#	145.00
D1324-2	24'	21'	39#	165.00
D1328-2	28'	25'	50#	195.00
D1332-2	32'	29'	62#	235.00
D1336-2	36'	32'	77#	270.00
D1340-2	40'	35'	85#	295.00

ALUMINUM FLAT STEP TYPE 1A- 300# RATED EXTEN.

D1516-2	16'	13'	31#	139.00
D1520-2	20'	17'	37#	159.00
D1524-2	24'	21'	45#	179.00
D1528-2	28'	25'	56#	215.00
D1532-2	32'	29'	66#	239.00
D1536-2	36'	32'(250# rating)	79#	279.00
D1540-2	40'	35'(250# rating)	89#	309.00

ALUMINUM FLAT STEP TYPE 1A+ 300# RATING

D520-2	20'	17'	42#	199.00
D524-2	24'	21'	49#	230.00
D528-2	28'	25'	66#	265.00
D532-2	32'	29'	74#	305.00
D536-2	36'	32'	89#	350.00
D540-2	40'	35'	99#	389.00

FIBERGLASS FLAT STEP TYPE 1A- 300# RATING

D6116-2	16'	13'	34#	175.00
D6120-2	20'	17'	40#	195.00
D6124-2	24'	21'	53#	225.00
D6128-2	28'	25'	60#	259.00
D6132-2	32'	29'	74#	298.00

FIBERGLASS FLAT STEP TYPE 1A- 300# XTRA HEAVY

D7116-2	16'	13'	37#	198.00
D7120-2	20'	17'	43#	229.00
D7124-2	24'	21'	58#	269.00
D7128-2	28'	25'	66#	298.00
D7132-2	32'	29'	79#	359.00

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Model	Description	List	Sale
VSRE500K	NEW v/spd 5" Random Sndr w/cs	279	149
VSRE600K	NEW v/spd 6" Random Sndr w/cs	284	155
HBSE75S	3 x 21 variable speed Belt Sander	299	168
ABSE15S	1/2" cdls 12 volt Drill complete w/cs	389	235
FSPE100	Barrell Grip v/spd Jig Saw	265	149
BSPE100K	Top Hdle v/spd Jig Saw w/cse	275	159
EZ560	3/8" cordless 7.2 volt Drill 2 speed	205	139
OFS50	1HP Plunge Router	299	175

HITACHI TOOLS

Model	Description	List	Sale
C7SB	7-1/4" Circular Saw	214	109
DTC10	3/8" 7.2 volt cordless Drill	138	78
C7BD	7-1/4" Circular Saw with brake	230	127
M12V	NEW 3 HP variable speed Router	447	225
TR12	Plunge Router 3 HP	354	174
F1000A	12" Planer/6" Jointer	2835	1535
P12R	12-9/32" Planer	1361	699
P12RA	Planer/Joiner	1797	875
C10FA	10" Deluxe Mitre Saw	538	274
C12FA	NEW 12" Mitre Saw	632	305
C8FB	8-1/2" Slide Compound Saw	899	445
FREUD LU91M0088-1/2" carb. blade 48 tooth		68	43
C15FB	15" Mitre Saw	745	379
FREUD LU85M01515" carb. blade 108 tooth.		180	105
F20A	3-1/4" Planer 3.4 amp	172	99
G12SA	4-1/2" Grinder 6.9 amp	147	79
M8V	Variable speed Router 1/4" collet	278	155
DS10DVAK	NEW 12 volt Cordless Drill Kit with 2 batteries	385	199

Hitachi Air Tools

NR83A	Framing Nailer 2 - 3-1/2 Full Head.	680	398
NR83AA	Framing Nailer 2 - 3-1/2 Clip Head	740	419
NT65A	16 ga. Brad Nailer 1 - 2-1/2	590	318
NT45A	18 ga. Brad Nailer 13/16 - 1-3/4	484	275
NV45AB	Coil Roofing Nailer 7/8 - 1-3/4	740	425
NV83A	Coil Nailer 2 - 3-1/4	740	419
NV50A1	Coil Nailer 1-1/4 - 2	534	305
N5008AA7/16"	Stapler - 16 ga. 1 - 2 lgth	578	315
N3824A	1" Stapler 16 ga. 1/2- 1-1/2	626	329
N3804A	1/4" Stapler 18 ga. - 1/2 - 1-1/2	520	299

DREMEL TOOLS

Model	Description	List	Sale
3950	Moto Tool Kit with bits & case	129	79
3952	Super Moto Tool Kit with bits, case, & accessories	145	95
1671	16" Scroll Saw - 2 speed "Best buy"	278	159
1571	15" Scroll Saw	139	79
290	Electric Engraver with point	2415.50	
8508	Cordless Moto Tool Kit with case	104	68
1731	5" Disc\1" x 30" Belt Sander	178	114

DAVID WHITE INSTRUMENTS

Model	Description	List	Sale
LP6-20	Sight Level package - 20x	310	198
L6-20	Meridian Level - 20x	290	189
LT8-300	Level Transit - 26x	650	445
LT8-300P	above Level with optical plum	769	525
LT6-900	Level Transit - 20x	389	245
ALT6-900	Automatic Level - Transit - 18x	549	385
ALTP6-900	above Level with tripod & rod	600	438
AL6-18	Automatic Level - 18x	439	319
ALP6-18HD	above Level with tripod and rod	550	372

ELECTRICAL CONDUCTOR EXTENSION CORDS

Model	Wire	Type	Length	Wire 125 volt rating	List	Sale
01617	12/3	SJEOW-A	25'	15A	22	12.85
01618	12/3	SJEOW-A	50'	15A	38	22.49
01619	12/3	SJEOW-A	100'	15A	70	40.95

above cords are Polar\Solar - insulated all weather - all condition cordage

PASLODE IMPULSE GUNS

Model	Description	List	Sale
IM250	Tripulse Finish Nailer Kit complete drives 3/4" - 2-1/2" brads	849	615
IM325	Impulse Framing Nailer Kit complete drives 2" - 3-1/4" nails	849	615
402500	Extra battery	Sale	42.95
402502	No-Mar Work contact element	Sale	19.25

Paslode Nailers not available in MN, WI, IA

SENCO AIR NAILERS

SFN1	Finishing Nailer 1" - 2"	377	275
SFN2	Finish. Nailer 1-1/2" - 2-1/2"	571	395
SN325	Nailer 1-7/8" - 3-1/4"	665	455
SN4	General purpose 2" - 3-1/2"	685	468
LS2	Pinner 5/8" - 1"	351	255
SKS	Stapler 5/8" - 1-1/2"	351	255
LS5	Pinner 1" - 1-1/2"	399	285
SPS	Stapler 1" wide - 3/4" - 1-1/2" length.	460	335
PW	Stapler 1" wide - 1/2" - 1-1/4" length.	505	345
M2	Stapler 1/16" wide - 1-3/8" - 2" length	490	345

Not available in all states

TROJAN WORK SUPPORTS

Model	Description		
TWC-24	Workcenter package	Sale	98.00
TS27	27" Height Sawhorse leg brackets	Sale	27.95
TS35	35" Height Sawhorse leg brackets	Sale	32.95

RECORD WOODWORKING VISES

Model	Jaw Width\Opening		List	Sale
53E	10-1/2"\15"	Quick release	189	105
53P	10-1/2"\15"	Plain Screw	174	100
52D	7"\8"	Quick release w/dog	137	84
52-1/2D	9"\13"	Quick release w/dog	175	99

REMINGTON POWER FASTENING TOOLS

Model	Description	List	Sale
75707	476 Power Hammer with case	35	28
77550	480 Power Driver with case	169	109
78480	482 Multi Driver with case	369	235

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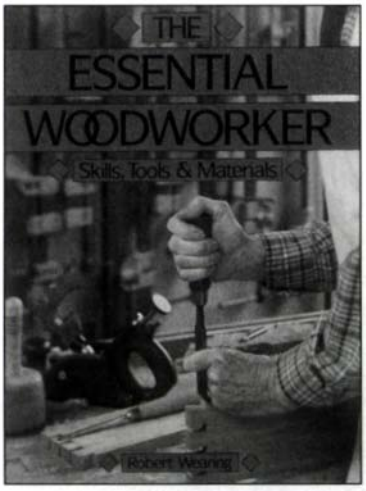
The Essential Woodworker by Robert Wearing. *B.T. Batsford Ltd. Distributed by Trafalgar Square, North Pomfret, Vt. 05053; 1988. $39.95, hardback; 159 pp.*



As it did for me, I suspect this book will bring on a pinch of nostalgia for many readers, but not because it contains any particularly poignant literary imagery. In fact, the text is rather dry and to the point, but the topics covered seem to come right out of the typical high school shop manual, circa the mid-1950s. This is undoubtedly intentional. As stated in the preface, the author's objective is to provide a reference guide on the most basic woodworking skills for woodworkers who have not had the benefit of formal training or tutelage under an experienced craftsman. Wearing holds to his charter with remarkable tenacity.

In the first of four sections, almost 20 pages are spent describing how to sharpen and set a plane, the correct posture and grip on the tool while planing and how to use the plane to true up a board. The remaining three sections examine the essential design features and optional joinery for constructing basic furniture: the table or stool; carcase or case goods; and doors, drawers and boxes. Although furniture examples are used to illustrate joinery applications, this is not a project book in the sense of providing complete plans for specific pieces. Technically, the book is well organized, with black-and-white photos or line art appearing on virtually every page. The terminology, however, is definitely British and this may force the American reader to do some mental translating. The subject matter, though, tends to compensate for this potential problem in that it is so simple there is little risk of serious confusion.

Personally, I didn't find this book all that "essential," but it would make a great gift for teenagers who are expressing an interest in woodworking, especially if they are not yet ready for the unsupervised use of power tools. *—Jon Arno*

Furniture and Cabinet Construction, by William P. Spence and L. Duane Griffiths. *Prentice Hall, Englewood Cliffs, N.J. 07632; 1989. $71, hardback; 638 pp.*

This excellent book is a gold mine of information for the woodworker interested in modern techniques of furniture and cabinet construction. The book is written for "the professional woodworker, the advanced home craftsman or student." The emphasis is on power tool and machine methods.

There are 50 well-organized chapters covering just about everything you would want to know about the field. Specific directions and tips gained from experience are given to guide the reader trying to perform unfamiliar operations. There is an emphasis on safety that is important to everyone, but especially to students. Each chapter has a vocabulary list at the beginning and a list of study questions at the end that would be helpful to those using the book as a school text.

The chapter on custom cabinets and modular casework is detailed and exhaustive. It has a section on standard sizes as suggested by the Architectural Woodwork Institute, and this includes cabinets designed for the handicapped. There is a section on the European 32mm carcase system. The section on mechanically joined casework shows numerous hinges, screws and special locking devices with sources for the various items.

A few things could be improved in the book: A scroll saw cutting-speed chart has been included and still lists asbestos and brake lining—certainly not materials safe to cut that way. In addition, the veneering section would be improved by including hammer veneering with hide glue. The section on scarf joints should mention the need to pin or secure the stock to prevent side slip when clamping.

Overall, this book is accurate, thorough and organized in a way that makes it easy to locate needed information.

—Jerry Blanchard

Making Wood Bowls with a Router & Scroll Saw by Patrick Spielman and Carl Roehl. *Sterling Publishing Co., Inc., 387 Park Avenue S., New York, N.Y. 10016-8810; 1992. $14.95, paperback; 168 pp.*

Beautiful wooden bowls can be made without a lathe using the techniques revealed in this book.

The key to the author's method is to stack laminate concentric tapered rings sawn from a single piece of wood and to then sand this roughly shaped bowl to final form with specialized but simple-to-make sanding tools.

Author Roehl developed these techniques over a period of about ten years. Co-author Spielman takes the reader through Roehl's shop, his methods and his considerable know-how in a clear and orderly manner. The basic concept is explained, and then the various simple shopmade jigs, fixtures and tools required are detailed one at a time so that a ten-year old child could probably make most of them.

The appeal of this particular bowl-making technique lies in its simplicity and moderate cost, coupled with results that exceed in variety those that can be readily achieved on a wood lathe. Fluted bowls can be made on a wood lathe, no doubt, but Roehl's approach is almost certainly simpler and can readily be duplicated by any interested reader without the need to first be able to make or buy the highly specialized tooling that would enable such work to be done on a lathe. *—Guy Lautard*

Circular Saws by Dave Plank and Eric Stephenson. *Stobert & Son Ltd. of London, Priory House, Priory St., Heortford SG14 1RN, England; 1972. £7.95, paperback; 152 pp.*

Very few books are written on the subject of circular saws. Even fewer go into very much detail or depth. I was pleased to have been introduced to an exceptional book on the subject.

Circular Saws was written by two of England's leading authorities in the field of wood-cutting circular saws. Plank and Stephenson have done an excellent job explaining the theory and practical application of circular-saw blades. The text is short and to the point, every page full of information. The book was written primarily for the saw service shop, but it is clearly written in an easy style and there is enough technical information that the book can be readily understood by an apprentice. It gives an explanation as to the function of the saw service shop and the steps that should be taken to restore a dull blade back to maximum sharpness and so it runs true. The section on leveling and tensioning circular blades is excellent—information that many saw service shops do not possess or put into practice.

Circular Saws covers sawblade design, tooth styles, tooth bite, rim speeds, arbor RPM and feed rates, all of which is essential information for choosing the most efficient sawblade for the job. There's useful information for troubleshooting sawing problems in the woodshop, giving clues that indicate if the problem is in the blade, the machine or both, and if the machine is causing the problems for the blade. *—Dave Snook*

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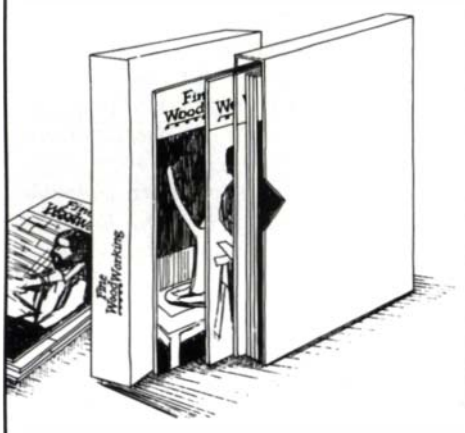

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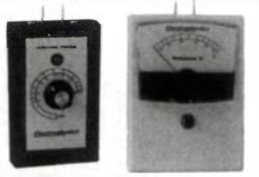

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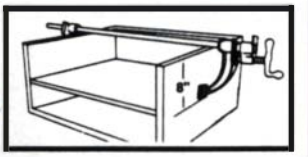

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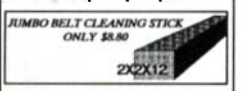

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2-1/2 x 24	7.75
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6"	2.25
8"	3.50

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5"	80	.46	6"	80	.63
	100 thru			100 thru	
5"	320	.45	6"	320	.62

PSA DISC ROLLS (White) silicon carbide for D A sanders

Size	Grit	Price/Roll	Discs Per Roll
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Note: *Fine Woodworking Editorial Nov./Dec. 1988 No. 73, pg. 65,S.N. recommends high alternating top bevel (ATB) thin kerfs and large blade stiffeners for smoothest cuts on RADIAL SAW, etc.*

Jim Forrest, President and designer microscoping cutting edge.

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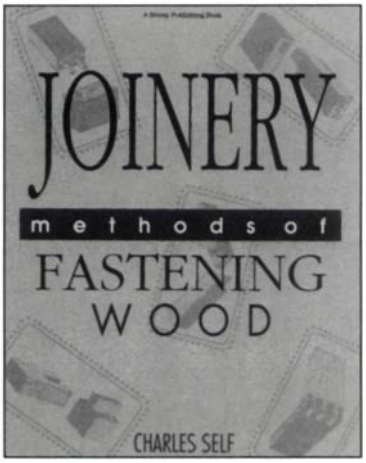
READER SERVICE NO. 134

Joinery: Methods of Fastening Wood by Charles Self. *Storey Communications, Inc., Pownal, Vt. 05261; 1991. $12.95, paperback; 213 pp.*



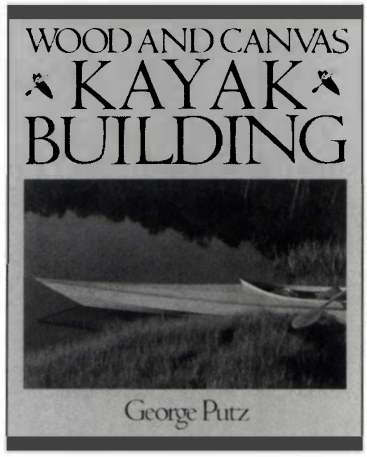
The rising popularity of woodworking as a hobby has unleashed a flood of books on the subject, and just when you thought it was safe to go back in the water comes yet another volume on woodworking joinery. This book is geared toward woodworking novices, with occasional forays into more complicated territory; but it comes up short for both groups in comparison to other books on the subject.

The book opens with an easy-to-understand chapter on wood as a material, which would be a good primer for beginners but contains little for the experienced woodworker. This is followed by an introduction to the basic types of joints and their use. The terminology is explained as well as the general look and purpose of such joints as miters, tongue and grooves, dovetails, box joints, mortise and tenons, dowel and biscuit joints.

The bulk of *Joinery* is devoted to chapters on using a router, power saw or hand tools to make basic joints. Arranging the book's chapters by tool use, rather than joints, makes the book hard to use as a reference.

Missing from *Joinery* are such important subjects as hollow chisel mortising, coped mortise and tenon joints, and window sash joinery, which makes for a far from complete look at the subject. The book tends to hop from subject to subject without covering any area (except dovetail router jigs) well. I found some of the text confusing to follow, and many of the photos and drawings look like they are straight from tool manufacturer's manuals. In fact, there are so many brand names thrown around in the photos and captions that the book could be given away for advertising. *—Ben Erickson*

Wood and Canvas Kayak Building by George Putz. *International Marine Publishing. Distributed by TAB Books, Blue Ridge Summit, Pa. 17294; 1990. $17.95, paperback; 133 pp.*



I've always liked kayaks. The first boat I ever built was a kayak, and it took weeks to rip out the longitudinal stock with a dull handsaw. The lumber had been salvaged from a bombed building, and so it was full of nails. Well, I just wish I'd had a copy of George Putz's book beside me during that ordeal—it would have saved a lot of grief.

Putz has written an entertaining and detailed account of building a 17-ft. Eskimo

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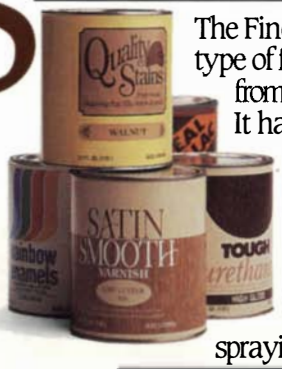

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kayak. These southeast Greenland craft were traditionally built from pieces of driftwood and bones lashed together, covered with animal skins. Putz uses this same model but has substituted dimension lumber, metal fastenings and canvas.

Putz begins his book with an introduction to skin boats and goes on to talk of tools, materials and the workshop. Next, he explains the construction, the names of the various parts, and then he describes the entire building process step-by-step. Included is a section on oars and paddles plus some useful hints on repairs and maintenance. In the final chapter, he introduces the reader to books and other kayak-related material.

George Putz is not didactic about any of this but often pauses to give the reader a choice. Throughout the book he gives a lot of sensible advice on such subjects as buying tools, making your own sawhorses, not losing pencils, sawing lumber, what shoes to wear and how to deal humanely, but firmly, with the idle curious.

—Simon Watts

The Amana People and Their Furniture by Marjorie K. Albers. *Iowa State University Press, Ames, Iowa, 50010; 1990. $12.95, paperback; 220 pp.*

Like the Shakers, the Inspirationists were a separatist, immigrant religious community for whom woodworking was a source of needed furnishings and a means of expressing their beliefs. Unlike the Shakers, the Inspirationists are largely unknown outside of the south-central Iowa communities where they lived and worked in the second half of the 19th century and where they are known as the Amana people.

Plentiful forests permitted the Amana communities to frame and sheath their buildings with oak and (better sit down for this) black walnut. They cut, milled and dried their own hickory, willow, birch, elm, ash, butternut, oak and walnut. An abundance of wood and men with a strong work ethic produced a great deal of woodworking.

An odd and sharp difference exists between the severe simplicity of church benches and some cabinets (which on the whole are cruder and clunkier than Shaker equivalents) and the personal belongings which individuals either brought over from Germany or made themselves, reproducing European designs or borrowing from Victorian and American Empire ideas. While the church officially preached against adornment for its own sake, the chairs and tables its members made included turned legs and spindles. This example suggests the kind of corrupting outside influences that finally weakened the communal communities and forced them in the 1930s to separate the church from its business enterprises.

Lacking technical information, such as scale drawings of original work, the book is of little practical use to woodworkers. The only wooden thing the author appears to have made herself is this prose. Still, it is overall an informative look inside a community of doers, of movers, if not Shakers, and sheds a little light on the pedigree of contemporary reproductions.

—Richard Ewald

Jon Arno is an amateur woodworker in Troy, Mich. Jerry Blanchard is a woodworker, metalworker and industrial-education teacher in Monterey, Calif. Guy Lautard lives in West Vancouver, B.C., Canada. David Snook owns a saw service shop in Salem, Oreg. Ben Erickson is a woodworker in Eutaw, Ala. Simon Watts teaches boatbuilding in San Francisco. Richard Ewald is a freelance writer in Westminster West, Vt.

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1604	1¾ H.P. Router 10 amps	$236	$132
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READER SERVICE NO. 93

Photo: Sandor Nagyszalanczy

The Modulus scoring saw attachment mounts on a regular tablesaw's arbor and attaches to the blade guard bracket at rear. The smaller scoring blade is belt-driven and revolves in the direction of feed, cutting a clean, splinter-free, shallow kerf ahead of the main blade.

Scoring saw attachment turns ordinary tablesaw into panel saw

Woodworkers who cut a lot of sheet goods on the tablesaw—especially hardwood plywoods with thin face veneers or coated products such as Kortron or Melamine—all have the same problem: splintered and chipped-out edges. One solution is to buy a special scoring tablesaw or panel saw that has a small-diameter, thin-kerf blade just ahead of the main blade. The small blade penetrates the surface of the sheet, through the face veneer or coating, before the main blade slices through the sheet, thereby reducing or eliminating tearout. Scoring saws are a major investment, however, well beyond the budget of most small shops.

Now, Canadian Michele Letendre has designed an affordable solution. The Modulus scoring saw attachment (suggested list price is $442.95) is a self-contained unit that mounts on an ordinary tablesaw and effectively turns it into a scoring saw (see the photo above). The attachment replaces the regular sawblade with a unit having two carbide-tooth blades: a 2⅛-in.-dia., 14-tooth scoring blade and a 6¼-in., 40-tooth, thin-kerf (.110 in. thick) main blade. Each blade is mounted on its own ball-bearing arbor, the scoring blade ahead of the main blade, and the arbors are set into an arm-like cast-iron body.

This entire assembly slips onto the tablesaw's arbor. The arbor nut holds the attachment on, and special fittings that attach to the saw's blade-guard assembly bracket hold the rear end of the attachment's body in place. The tablesaw's arbor drives the main blade directly while a narrow pulley carrying a toothed belt powers the scoring blade. This drive system rotates the scoring blade in the opposite direction of the main blade—with the feed, just like dedicated scoring saws—for clean scoring.

After unpacking the Modulus from its box, I removed my General tablesaw's blade-guard assembly and bolted on the special guide-pin fittings that secure the rear of the Modulus' body. (These fittings vary with different makes and models of tablesaw; you must order the attachment specifically designed for your saw.) I reinstalled the guard but had to grind the ribs on the bottom of the throat plate to provide clearance. Once I made these minor modifications, mounting and removing the Modulus didn't take much more time than changing a regular blade. With the arbor fully raised, the attachment slipped on easily. Then I lowered the arbor so that the rear end could be slipped into the fittings on the guard bracket and, finally, tightened the arbor nut.

Adjusting the Modulus to score and cut correctly took considerably more time. First, I had to adjust a special shaft locknut to fine-tune the lateral position of the scoring blade, so it was correctly aligned with respect to the main blade. Then I had to raise the arbor to set the height of the scoring blade. This revealed a clever aspect of the attachment's design: Each scoring-blade tooth tapers from base to tip; raising its height makes the scoring cut slightly wider, lowering it makes the cut narrower. Determining the proper height for the scoring blade involves making a series of trial-and-error cuts in scrap stock until you find the cleanest cut. This height adjustment must be repeated each time you mount the Modulus on the saw.

How well does it work? I first tried the device on some ¾-in. imported walnut plywood with incredibly thin, delicate face veneers (I call it "breath of walnut" plywood). It did a marvelous job—especially on crosscuts. I needed a hand lens to see any tearout on the cut edges. The Modulus also made perfect crosscuts in ½-in. oak plywood, which is notorious for splintering. Because of the scoring blade's tapered teeth, when a large panel lifted slightly during a cut, the score was slightly underwidth, resulting in some tearout. To keep the stock absolutely flat during cutting, you may need to rough-cut a full-sized sheet into slightly oversized pieces, and then trim them to exact size with the Modulus. A power feeder would probably eliminate this problem.

Cutting cabinet parts from Melamine wasn't quite as successful. While the edges were still as clean as I get with the best fine-tooth regular sawblade I own, perfect edges eluded me. Without a perfect edge, it's just not possible to get a flawlessly edgebanded border. While this relatively minor shortcoming might make the Modulus inappropriate for those who exclusively cut and edgeband coated materials, I think the Modulus is an economical and valuable device for most woodworkers who cut delicate sheet goods. The Modulus scoring saw attachment is distributed by Sisco Supply (102 Kimball Ave., South Burlington, Vt. 05403; 802-863-9036.)

—Sandor Nagyszalanczy

Hand-forged bench chisels work well, hold a keen edge

As an owner of five different sets of chisels, my first thought when asked to review these chisels was "Why another set?" For starters, these Barr chisels are like no others available; they are made by hand. Called cabinetmaker's chisels by their maker, they are in fact bevel-edged socket firmer chisels. They are not mortising chisels (which usually have a square cross section), but because the bevels are relatively small, the side edges remain large enough to provide stability for mortising work. Yet this same feature makes them difficult to use for dovetail work where an extra-wide bevel and almost no side edge is ideal. For general bench work, mortising, paring and even cleaning long French dovetails, they are ideal.

The blades are about 5 in. long, with a well machined, flat undersurface. The socket impressed me the most. Each one is a welded cone (the weld is invisible outside) a full 2½ in. deep, which really seats the handle well and transfers a firm, stiff blow directly to the blade (see the photo below). The finish is a mirror polish, much

Photo: Vincent Laurence

Barr Quarton's cabinetmaker's chisels are ideal for most bench work, including paring and mortising, although their nearly parallel sides make them awkward for cleaning out dovetails. Their 2½-in.-deep sockets seat the handles well and transfer mallet impact directly.

smoother than factory chisels, which are usually only ground to 120-grit. Yet even with this polish, you can feel slight irregularities, a hallmark of a handmade tool that in no way detracts from its use. The only visual distraction was the less-than-perfect turning job on the walnut handles (each with a steel hoop). This is easily remedied by five minutes of work on the lathe. Or, if you are a real individualist (and this is a big advantage of socket chisels), you can turn your own handles of any wood you choose.

I used the Barr chisels for six weeks, and they kept their edge the whole time. They are forged from S160 carbon steel and tempered to a Rockwell hardness of 60c, which is just right for bench chisels. Anything softer tends to curl or lose its edge while anything harder can chip under stress.

The Barr cabinetmaker's chisels are available as a set of four (¼ in., ½ in., ¾ in. and 1 in.) for $225. That's about twice the price of factory-made tools; however, bevel edged socket firmers are just not available commercially any more. Barr cabinetmaker's chisels are available directly from their maker, Barr Quarton (Barr Specialty Tools, P.O. Box 4385, McCall, Idaho 83638; 208-634-3645). *—Christian Becksvoort*

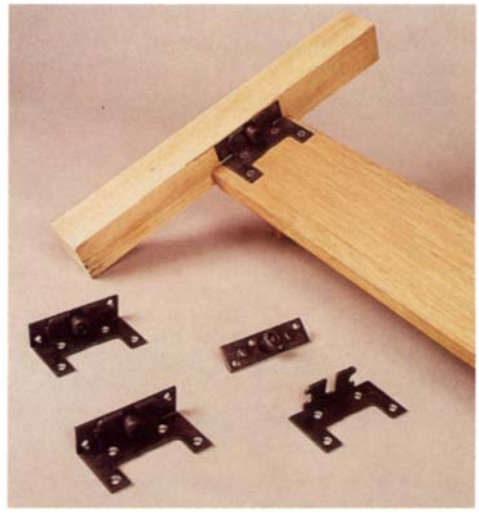
Screw-together bed rail fasteners provide a firm connection, are easy to install

The two most common kinds of bed hardware—bed bolts and drop-style rail fasteners—both have drawbacks. Drilling for bed bolts can be difficult without a radial drill press or a lathe fixture to align the bed rail for drilling with a bit chucked into the headstock. Though simple to install, the drop-style fasteners generally loosen over time, resulting in a bed with a bit of sway.

Now there's an alternative. Called simply a bed rail fastener, it consists of a stamped-steel right angle that screws to the bed rail and the corresponding part, a flat piece of stamped steel that screws to the bed post. A tapped hole in the center of the piece that attaches to the post accepts a large hex head machine screw that holds the two pieces (and the bed) together.

Indexing bumps on the flat piece and notches on the angled piece determine the fastener's position, similar to a shallow mortise with a conventional bed bolt setup. In this way, a very rigid connection is possible with much less hassle than bed bolts. A set of four fasteners is $12 (Woodworker's Supply, Inc. 1108 N. Glenn Road, Casper, Wyo. 82601; 800-645-9292). *—Vincent Laurence*

Photo:Vincent Laurence



***Bed rail fasteners** from Woodworker's Supply are a lot less work to install than bed bolts and allow a more rigid connection than the drop-style rail fasteners.*

Sandor Nagyszalanczy is senior editor of Fine Woodworking *magazine. Christian Becksvoort is a contributing editor to* FWW *and a custom furnituremaker in New Gloucester, Maine. Vincent Laurence is an assistant editor of* FWW.

Listings of gallery shows, major craft fairs, lectures, workshops and exhibitions are free, but restricted to happenings of direct interest to woodworkers. We list events (including entry deadlines for future juried shows) that are current with the time period indicated on the cover of the magazine, with overlap when space permits. We go to press three months before the issue date of the magazine and must be notified well in advance. For example, the deadline for events to be held in March or April is January 1; for July and August, it's May 1, and so on.

NATIONAL & INTERNATIONAL: **Conference**–World Turning Conference, April 21-25. Wilmington, Delaware. Contact Albert LeCoff, Wood Turning Center, PO Box 25706, Philadelphia, PA 19144. (215) 844-2188.

ARIZONA: **Juried show**–Redefining the Lathe-Turned Object, Dec. 13-Jan 31. For info, contact Arizona State University Art Museum, Nelson Fine Arts Center, Tempe, 85287-2911. (602) 965-2787.
Show–Fourth annual Grand Canyon State Woodcarvers Desert Festival Award Show & Sale, March 12-14. Phoenix Civic Plaza, Phoenix. National competition in woodcarving open to all woodcarvers. Contact Geo. Hendrix, 10926 E. Regal Drive, Sun Lakes 85248. (602) 895-7036.
Seminars–Advanced carving seminars with John Burke. Feb. 8-10, carve an Indian head in butternut; Feb. 11-13 carve a cowboy-style head. Maximum of 12 students. For further information, contact Dave Rushlo, Woodcarvers Supply, 2530 N. 80th Place, Scottsdale, 85257. (602) 994-1233.
Exhibit–Women Wood Turners, Dec. 3-31, Joanne Rapp Gallery/The Hand and the Spirit, 4222 North Marshall Way, Scottsdale, 85251. For further information, contact Louise Roman at (602) 949-1262.

ARKANSAS: **Meetings**–Woodworker's Association of Arkansas meets the first Monday evening of each month at 7:00 at Woodworkers Supply Center, 6110 Carnegie, Sherwood 72117. For more information call, (501) 835-7339.

CALIFORNIA: **Shows**–San Diego Woodworking Show, Nov. 13-15. Del Mar Fairgrounds, 2260 Jimmy Durante Blvd., Del Mar; Southern California Woodworking Show, Nov. 20-22. Long Beach Convention Center, 300 East Ocean Blvd., Long Beach; Northern California Woodworking Show, Dec. 4-6. San Mateo County Fairgrounds, 2495 S. Delaware St., San Mateo. (800) 826-8257.
Exhibition–Classical Chinese furniture, thru Nov. 1. San Francisco Craft & Folk Art Museum, Fort Mason, San Francisco, 94123-1382. (415) 775-0990.
Workshops–Woodworking for women. Furnituremaking with hand tools using traditional joinery, weekends. Call for schedule: Debey Zito, (415) 648-6861.
Solicitation–New artists wanted for the Los Angeles Craft & Folk Art Museum Research Library. Used by collectors, curators, architects, designers. For info, contact Craft & Folk Art Museum Library, c/o the May Co., 6067 Wilshire Blvd., Los Angeles, 90036. (213) 934-7239.
Workshops–Various workshops including Japanese woodworking, joinery and sharpening. Contact Hida Tool Co., 1333 San Pablo, Berkeley, 94702. (415) 524-3700.
Exhibition–Native America: Reflecting Contemporary Realities, thru Jan. 31. Craft & Folk Art Museum, 6067 Wilshire Blvd., Los Angeles 90036. For more info, contact Denise Wakeman or Jean Miao (213) 937-5544..
Exhibition–Tables from the Garden by Paul Schürch, Small tables inlaid with precious woods and stones, Nov. 14-Dec. 14. Michael Arron Gallery, 1030 State St., Santa Barbara, 93101. (805) 568-1848.
Exhibition–Inland Woodturners, Nov. 1-25. Fine Arts Gallery, Mt. San Jacinto College, 1499 North State St., San Jacinto, 92583

COLORADO: **Show**–Colorado Woodworking show, Nov. 6-8. National Western Complex, Expo Hall, Humboldt St. & E. 47th Ave., Denver, 80216. (800) 826-8257.
Juried exhibition–Eighth annual Woodworkers Guild of Colorado Springs, Nov. 7-Dec. 6. Deadline: Oct. 30-31. Colorado Springs Pioneers Museum. Contact John Lewis, 918 N. Royer St., Colorado Springs, 80903. (719) 632-8548.
Classes–Woodworking and related classes, year-round. Red Rocks Community College, 13300 W. 6th Ave., Lakewood, 80401. (303) 988-6160.
Seminars–Woodworking seminars, Sept. thru April. Contact Schlosser Tool and Manufacturing Co., 301 Bryant St., Denver, 80219. (303) 922-8244.

CONNECTICUT: **Exhibition**–Turned and Fabricated Forms by Bob Stocksdale and Kay Sekimachi, thru Nov. 23. Brown Grotta Gallery, 39 Grumman Hill Road, Wilton. For info, call (203) 834-0623.
Exhibition–37th annual Wesleyan Potters show, Nov. 28-Dec. 13. Wesleyan Potters Craft Center, 350 South Main St., (Route 17), Middletown, 06457. (203) 347-592.5
Workshops–Inlaid wood turning, veneers for woodworking, more, thru Nov. Brookfield Craft Center. (203)-775-4526 or (203) 853-6155.
Exhibition–14th annual Holiday Festival of Crafts, thru Dec. 24. For info, contact Holiday Festival of Crafts, Guilford Handcrafts, PO Box 589, Guilford, 06437. (203) 453-5947.
Juried exhibition–24th annual Celebration of American Crafts, Nov. 9-Dec. 24. Creative Arts Workshop, 80 Audubon St., New Haven. For further information, call (203) 562-4927.
Exhibition–15th annual holiday craft sale, Nov. 20-Dec. 24. Brookfield Craft Center, Route 25, Brookfield and at Brookfield Craft Center, 127 Washington St., Norwalk. For more information, call (203) 775-4526.
Call for entries–Juried Exhibition of Lathe Turned Objects in conjunction with the A.A.W.'s national symposium in June 1993. Slide deadline: January 30th. For more information, contact New Horizons Gallery, 42 West Putnam Avenue, Greenwich, 06830.

DISTRICT OF COLUMBIA: **Show**–Fifth annual Washington Crafts Expo. Nov. 20-22. Sheraton Washington Hotel, 2660 Woodley Road at Connecticut Ave., NW, Washington, D.C. For more information, contact Public Relations Partnership at (410) 757-0391 or (410) 280-9055.

FLORIDA: **Exhibition**–41st Florida Craftsmen Statewide Exhibition, Jan. 15-March 14. For info, contact DeLand Museum of Art, 600 N. Woodland Blvd., DeLand 32720-3447.
Meetings–Central Florida Woodworkers Guild, second Thursday of every month, Winter Park. For information, contact Ed Harte (407) 862-3338.
Meetings–Sarasota Woodworking Club. Second Thursday of every month. For info, contact Tom Clark, 3544 Oak Grove Drive, Sarasota, 34243. (813) 351-9059.
Festival–30th annual Coconut Grove Arts Festival, Feb. 13-15. For info, contact Coconut Grove Arts Festival, PO Box 330757, Miami, 33233-0757. (305) 447-0401.

GEORGIA: **Workshops**–Japanese woodworking by Toshihiro Sahara. One Saturday each month, year-round. Contact Sahara Japanese Architectural Woodworks, 1716 Defoor Place N.W., Atlanta, 30018. (404) 355-1976.
Courses–Various woodworking courses, Feb. thru May. For info, contact Chris Bagby, Highland Hardware, 1045 N. Highland Ave., N.E., Atlanta, 30306. (404) 872-4466.
Meeting–Woodworkers Guild of Georgia, 7:30 PM second Tuesday of every month. Atlanta Area Technical School, 1560 Stewart Ave., Atlanta. Contact John McCormic (404) 623-9145.
Classes–Woodworking classes, throughout the year. Woodworkers Guild of Georgia, PO Box 8006, Atlanta. For info, contact John Gorrell (404) 460-1224.

ILLINOIS: **Show**–22nd annual Midwestern Wood Carvers, Nov. 7-8. Belleville Wood Carvers Club. Belle-Clair Exposition Hall, 200 South Belt East, Belleville. Contact Don Lougeay, 1830 East D St., Belleville, 62221. (618) 233-5970.
Show–North Suburban Carvers Artistry in Wood show, Nov. 7-8. Chicago Botanic Garden, Lake Cook Road, Glencoe. For more information, call (708) 835-8215.
Show–Second annual Woodworking World, Feb. 26-28. Illinois State Fairgrounds, Eighth St., & Sangamon Ave., Springfield.

INDIANA: **Classes**–Various woodworking classes and workshops including general woodworking, lathe and router seminars. Woodworking Unlimited, 6038 E. 82nd St., Indianapolis, 46250. (317) 849-0193.

KENTUCKY: **Workshops**–Woodturning and joinery instruction. One-day to one-week courses. For info, contact Jim Hall, Adventure in Woods, 415 Center St., Berea, 40403. (606) 986-8083.
Meetings–Kyana Woodcrafters Inc., first Thursday of each month. Bethel United Church of Christ, 4004 Shelbyville Road, Louisville, 40207. (502) 426-2991.
Workshops–Traditional Windsor chairmaking instruction. One-week courses. Contact David Wright, 503 Prospect, Berea, 40403. (606) 986-7962.

LOUISIANA: **Juried show**–Lafayette Art Association annual art competition, March 9-April 8. For info, contact J.K. Sommer, Lafayette Art Gallery, 700 Lee Ave., Lafayette, 70501.

MARYLAND: **Juried exhibitions**–18th annual Autumn Crafts Festival, Nov. 19-21. Montgomery County Fairgrounds, Gaithersburg; 16th annual Winter Crafts Festival, Dec. 10-12. Montgomery County Fairgrounds, Gaithersburg. For info and applications, contact Deann Verdier, Sugarloaf Mountain Works, 200 Orchard Ridge Drive, Suite 215, Gaithersburg. (301) 990-1400.

MASSACHUSETTS: **Show**–22nd annual Christmas show, Nov. 27–29. Boston Bayside Expo Center, Boston. For info, contact Fieldstone Shows, 6 Deerfield Drive, Medfield, 02052 (508) 359-6545.
Classes–Woodworking classes, throughout most of the year. Boston Center for Adult Education, 5 Commonwealth Ave., Boston, 02116. (617) 267-4430.
Exhibition–Restoration 93, Dec. 6-8, Hynes Convention Center, Boston. For more information, call (617) 933-9699.
Workshop–Wood Identification with Drive R. Bruce Hoadley, Jan. 19-22. For more information, contact Alice Szlosek or Trudie Goodchild, Div. of Continuing Education, Room 608, Goodell Bldg., Univ. of Mass., Amherst, 01003. (413) 545-2484.
Call for entries–The Domestic Object: Articles for Everyday Living. All media, juried. Entrants may submit up to three works, maximum two slides per work. $10 entry fee. Send a SASE to Domestic, Worcester Center For Crafts, 25 Sagamore Road, Worcester 01605. (508) 753-8183.
Show–Northeast Wood Products Expo '93, March 11-13. Contact Pat Lee, Exposition Manager, Drysdale Lee & Associates, 6 Abbott Road, Wellesley Hills, 02181. (617) 237-0587.

MICHIGAN: **Seminar**–Build a Sack-Back Windsor Chair with Mike Dunbar, Nov. 7-11. Woodcraft Supply 14695 Telegraph Road, Redford. For more info, contact Joseph Hoover: (313) 537-9377
Show–Wood Expo, Michigan Woodworkers' Guild, Nov. 8. Royal Oak Senior/Community Center. For more information, contact Michigan Woodworkers' Guild, PO Box 40673, Redford, 48240, or call (313) 345-6722.
Show–Fourth annual Woodworking World, Feb. 5-7. Grand Rapids Jr. College Fieldhouse, 111 Lyon NE, Grand Rapids, 49503.

MINNESOTA: **Classes**–Woodcarving classes year-round. Also, seminars on woodturning, chair caning and whittling. For info, contact the Wood Carving School, 3056 Excelsior Blvd., Minneapolis, 55416. (612) 927-7491.
Show–Third annual Woodworking World Twin Cities, Jan. 29-31. Minneapolis Convention Center, 1301 South Second Ave., Minneapolis 55403.

MISSISSIPPI: **Classes**–Various classes. Allison Wells School of Arts & Crafts, Inc., PO Box 950, Canton (800) 489-2787 or (601) 859-5826.

NEW HAMPSHIRE: **Workshops**–Various woodworking workshops thru Dec. 5. Canterbury Shaker Village, 288 Shaker Road, Canterbury. (603) 783-9511.
Classes–Fine arts and studio arts. Manchester Institute of Arts and Sciences, 114 Concord St., Manchester, 03104.
Classes–Various woodworking classes, year-round. Including antique repairs, carving canes & walking sticks, small boxes, kitchen utensils, lathe-turning, hand-carving, more. Contact The Hand & I, PO Box 264, Route 25, Moultonboro, 03254. (603) 476-5121.
Auctions–Antique and craftsman's tool auctions, year-round. For more information, contact Richard A. Crane, Your Country Auctioneer, 63 Poor Farm Road, Hillsboro, 03244. (603) 478-5723.
Conference–1993 North Country Studio Conference, March 18-22. Shaker Inn & Conference Center, Enfield, 03748. For further information, contact Ellwyn F. Hayslip, Conference Coordinator, 205 N. Main St., Concord, 03301. (603) 224-3375.
Exhibition–Guild of New Hampshire Woodworkers, thru Nov. 15. Killian Gallery at the Sharon Arts Center, Route 123, Sharon/Peterborough. (603) 924-7256.

NEW JERSEY: **Exhibition**–Carvings of Gary Giberson, thru Jan. 3. Noyes Museum, Lily Lake Road, Oceanville. (609) 652-8848.
Juried festival–Waterloo Arts & Crafts Festival, May 1-2. Deadline: Jan. 15. Waterloo Concert Field, Waterloo Road, Stanhope. For application, call (201) 384-0010.

NEW MEXICO: **Classes**–Woodworking classes. Northern New Mexico Community College, El Rito, 87520. For info, call (505) 581-4501.
Classes–Fine woodworking classes, Santa Fe Community College, Santa Fe 87502. (505) 438-1361.

NEW YORK: **Show**–Third annual ESCA at Syracuse Fine Crafts Market, Nov. 20-22. Jefferson Street Armory, Syracuse. Contact Linda Faulkner (518) 584-1819.
Exhibition–Third Craft Art, thru Nov. 29. Burchfield Art Center, State University College at Buffalo, 1300 Elmwood Ave., Buffalo.
Classes–Various beginning and advanced woodworking classes. Constantine, 2050 Eastchester Road, Bronx, 10461. (212) 792-1600.
Meetings and classes–New York Woodturners Association, first Tuesday of each month. Woodturning techniques, exhibits, more. The Craft Student League, YWCA, 610 Lexington Ave., New York City.
Classes–Various fall classes. Warwick Contry Workshops, 1 East Ridge Road, Warwick, 10990. (914) 986-6636.
Show–Third annual Woodworking World, Jan. 8-10. Hofstra Univ., 100 Fulton Ave., Uniondale.
Fair–International gift fair, Feb. 21-25. Jacob K. Javits Convention Center, New York. For more info, contact George Little Management, Inc., 2 Park Ave., Suite 1100, New York, 10016-5748. (212) 686-6070.
Competition–American Craft Council Logo competition. Entry deadline: December 31, 1992. Competition open to all, $15 entry fee. For more information, contact Helise Benjamin, ACC Logo Competition, 21 Sout Eltings Corner Road, Highland 12528. (800) 724-0859.

NORTH CAROLINA: **Workshops**–Nutcracker, Nov. 1-7; bentwood boxes, Nov. 8-13; Shaker oval boxes, Nov. 29-Dec. 5; hand hewn bowls, Dec. 13-19. For info, contact John Campbell Folk School, Route 1, Box 14-A, Brasstown, 28902. (800) 562-2440.
Meetings–North Carolina Woodturners, second Saturday of every month. Also, woodturning workshops for all levels. For info, contact Eric Hughes, Route 3, PO Box 300, Conover, 28613. (704) 464-5611.
Classes–Woodworking, design business marketing, associates degree program. Haywood Community College, Freedlander Drive, Clyde, 28721. For more info, contact Wayne Raab (704) 627-2821.
Classes–John C. Campbell Folk School Special Classes: Woodturning by Roger Jacobs, Jan. 24-30; Basic Woodworking with Jim Rittman and Wood Carving with Tom Wolfe, Jan. 3-9; Woodcarving with Helen Gibson, Jan. 31-Feb. 13. For more information, contact Campbell Folk School, Route 1, Box 14A, Dept. FW, Brasstown, 28902. (800) 562-2440.

Video course–Wood Technology, 6-lesson correspondence course on the wood industry. Contact Ms. Vann Moore, Dept. of Wood & Paper Science, N.C. State Univ., PO Box 8005, Raleigh, 27695-8005. (919) 737-3181.

***NORTH DAKOTA:* Show**–Second annual Woodworking World, Jan. 15-17. Bismark Civic Center, 601 East Sweet Ave., Bismark, 58502.

***OHIO:* Meetings**–Cincinnati Woodworking Club meets at 9:00 the second Saturday of January, March and May at the Reading High School. Those interested in attending should contact the club at PO Box 428525, Cincinnati, 45242 for more information.

***OKLAHOMA:* Show**–Eastern Oklahoma Woodcarvers Association's Eighth annual Wonderful World of Wood, Nov. 6-7. Eastland Mall, Tulsa. For more info, contact Tom Ferguson, Show Chairman, 3421 South 95th East Ave., Tulsa 74145. (918) 627-5169.
Show–Eighth annual Woodworking World, Jan. 22-24. Veteran's Memorial Hall, 300 W. Broad St., Columbus 43215.

***OREGON:* Show**–Holiday gift show, Nov. 5-Dec. 24. Hoffman Gallery, Oregon School of Arts & Crafts, 8425 Southwest Barnes Road, Portland, 97225. (503) 297-5544.
Student sale–Holiday student sale of crafts, Dec. 11-13. Oregon School of Arts & Crafts, 8245 Southwest Barnes Road, Portland 97225. (503) 297-5544.
Meetings–Guild of Oregon Woodworkers, third Friday of every month. For location, contact the Guild at PO Box 1866, Portland, 97207. (503) 293-5711.
Meetings–Cascade Woodturner's Association, third Thursday of each month. For location, contact Cascade Woodturners, PO Box 91486, Portland 97291.

***PENNSYLVANIA:* Show**–Fourth annual Woodworking World Central Pennsylvania show, Nov. 20-22. Pennsylvania Farm Show Complex, West Bldg., 2301 North Cameron St., Harrisburg. (800) 521-7623.
Show–Woodworking World Pittsburgh show, Nov. 6-8. Expo Mart, 105 Mall Blvd., Monroeville. (800) 521-7623.
Show–Philadelphia craft show, Nov. 5-8. Philadelphia Civic Center, 34th St. & Civic Center Blvd., Philadelphia. For info, contact Philadelphia Museum of Art (215) 787-5431.
Classes–Windsor chairmaking, all levels, weekly and weekends. Contact Jim Rendi, Philadelphia Windsor Chair Shop, PO Box 67, Earlville, 19519. (215) 689-4717.
Show–Buyers Market of American Crafts, Feb. 19-22. Philadelphia Civic Center, Philadelphia. For more info, contact Laura W. Rosen, Buyers Markets of American Crafts, Suite 300 Mill Centre, 3000 Chestnut Ave., Baltimore, MD 21221. (410) 889-2933.
Call for papers–ASC's 1993 spring Raw Materials seminar, March 27-31 in Pittsburgh. Abstracts not to exceed 150 words and can be mailed or faxed to ASC office. Contact ASC at (202) 452-1500 or by fax at (202) 452-1501.
Show–Market Square Traditional Wholesale, Feb. 13-15, June 12-14. Valley Forge Convention Center, King of Prussia. For more information, contact Robert Goodrich, PO Box 220, Newville, 17241. (717) 776-6989.
Classes–Woodturning with David Ellsworth. Limit 4 students. Nov. 6-7 and Nov. 20-21. For more information, contact David Ellsworth, Fox Creek, 1378 Cobbler Road., Quakertown 18951. (215) 536-5298.

***RHODE ISLAND:* Call for entries**–Woodworking exhibition at the Museum of Art at Rhode Island School of Design (Providence). Entry deadline: April 1. For further information, send SASE with two 29-cent stamps to: Seth Stem, Box 4-14, Rhode Island School of Design, 2 College St., Providence 02903-2784.

***SOUTH CAROLINA:* Show**–Second annual Woodworking World, Feb. 19-21. Exchange Park, Highway 78, Ladson, 29456.

***TENNESSEE:* Call for entries**–Pattern: New Form, New Function. Entry deadline: Jan. 4, 1993. Limit 3 pieces; judged from 35mm slides. $18 non-refundable entry fee should accompany slides. Exhibition dates: Feb. 26 thru May 15. For a prospectus, write to Arrowmont School, PO Box 567, Gatlingburg, 37738. (615) 436-5860.

***TEXAS:* Show**–Seventh annual Rio Grande Valley Woodcarvers, Inc., Jan. 13-24. Contact Dorothy Chapapa, Route 2, Box 150, McAllen, 78504. (512) 581-2448.

***VIRGINIA:* Exhibition**–Guild of Maine Woodworkers, thru Nov. 28. Thos. Moser Galleries, 601 South Washington St., Alexandria. Contact Jack Versery (207) 829-6650.
Show–Sixth annual Woodworking World, Jan. 8-10. Norfolk Scope. Corner of St. Paul and Brambleton, Norfolk.
Exhibitions–Student Gallery Retrospective, thru Nov. 6; Cutting Edge, Nov. 17-Jan. 2. Crestar Bank Gallery, 500 Main Street, Norfolk.
Show–Ninth annual Woodworking World show, Feb. 12-14. Hyatt Regency Crystal City, Jefferson Davis Hwy., Arlington.
Show–17th annual Richmond Craft and Design Show, Nov. 20-22. Richmond Centre for Conventions and Exhibitions. Contact Hand Workshop, 1812 W. Main St., Richmond, 23220. (804) 353-0094.

***WASHINGTON:* Show**–12th annual woodcarving show, Nov. 7-8. Western Washington Fairgrounds Expo Hall, Ninth and Meridian, Puyallup. Write: Northwest Carvers Assoc., PO Box 6092, Federal Way, 98063-6092.
Meetings–Northwest Woodworkers Guild, last Wednesday of each month. For more info, contact John Gruenewald 622 Ninth Ave., Kirkland, 98033. (206) 827-8012.
Workshops–Boatbuilding workshops and seminars yearround. For more information, contact Northwest School of Wooden Boatbuilding, 251 Otto St., Port Townsend, 98368. (206) 385-4948.

***WISCONSIN:* Show**–Third annual Milwaukee show, Nov. 13-15. Waukesha County Exposition Center, NI W 24848 Northview Road, Waukesha, 53188. (800) 521-7623 or (603) 536-3768.

***CANADA:* Classes**–Furnituremaking, carving, lathe turning, router and more. Tools 'n Space Woodworking, 338 Catherine St., Victoria, B.C., V9A 3S8. (604) 383-9600.
Workshop–A weekend with Michael Dunbar—Building a traditional chair, Nov. 13-15. Atlantic Woodworker's Association, PO Box 3501, Halifax South, N.S. B3J 3J2.
Meetings–Blue Mountain Woodworking Club, throughout the year. Third Wednesday of each month. For more info, contact Glenn Carruthers, PO Box 795, Stayner, Ont., L0M 1S0. (705) 444-1752.
Meetings–West Island Woodturners Club meetings, second Tuesday of each month. Also, woodturning courses. Contact Eric Webb, 61 Devon Road, Beaconsfield, Que., H9W 4K7. (514) 630-3629.
Meetings–Northern Alberta Woodcrafters Guild meetings, third Thursday, Sept. thru June. Contact Douglas Lobb, 121 Healy Road, Edmonton, Alberta, T6R 1W3. (403) 430-7391.

***ENGLAND:* Classes**–Woodworking classes. Smith's Gallery, 56 Earlham St., WC2. Contact Laetitia Powell, Parnham, Beaminster, Dorset, DT8 3NA. (0308) 862204.

***GERMANY:* Fair**–Ligna Hannover '93 World Fair for Machinery and Equipment for the Wood and Forest Industries, May 19-25. Hannover Fairgrounds, Hannover. For further information, contact Hannover Fairs USA, Inc., 103 Carnegie Center, Princeton, NJ 08540. (609) 987-1202.

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695	1-1/2 Hp Router-Shaper Table	335	203
696	Router-Shaper Table	185	122
693	1-1/2 Hp Plunge Router	295	165
6931	Plunge Router Base	120	75
7518	3-1/4 Hp 5 Speed Router	475	259
7519	3-1/4 Hp Router	410	224
7536	2-1/2 Hp Router	355	199
7537	2-1/2 Hp D. Handle Router	375	209
7538	3-1/4 Hp Plunge Router	410	224
7539	3-1/4 Hp V/S Plunge Router	475	262
59381	Door Hinge Butt Template Kit	240	159
5008	Dovetail Jig	110	85
5116	Omni-Jig 16" Dovetail Jig	400	259
7116	Omni-Jig 24" Dovetail Jig	470	289
7310	5.6A Laminate Trimmer	150	88
7312	5.6A Offset Base Lam. Trimmer	215	124
7319	5.6A Tilt Base Lam. Trimmer	170	105
7399	5.6A Dry all Cutout Unit	145	85
97310	Laminate Trimmer Kit	345	192

SANDERS

332	Palm Grip Random Orbit	109	64
333	Above Sander w/ Dustbag	125	74
351	3"x21" Belt Sander w/o Bag	245	140
352	3"x21" Belt Sander w/ Bag	255	142
352VS	3"x21" Belt Sander w/ Bag V/S	280	164
360	3"x24" Belt Sander w/ Bag	330	178
361	3"x24" Belt Sander w/o Bag	310	174
362	4"x24" Belt Sander w/ Bag	345	188
363	4"x24" Belt Sander w/o Bag	330	184
503	3"x24" HD Belt Sander w/ Bag	550	345
504	3"x24" HD Belt Sander w/o Bag	535	335
330	Speed Bloc Sander 1/4" Pad	102	58
505	1/2 Sheet Pad Sander	210	114
7334	5" Random Orbit Sander	210	119
7335	5" V/S Random Orbit Sander	230	129
7336	6" V/S Random Orbit Sander	235	134
73333	New Dust Collection System	30.95	24.50

CORDLESS DRILLS

9853	12V Drill w/Case & Keyless Chuck	275	159
9854	12V 1/2" Drill w/Case 0-360 RPM	280	165
8500	12 V Battery For The Above Drills	62	39

DRILLS

621	3/8" HD V/S Drill 0-1000 RPM	170	99
666	3/8" HD V/S Drill 0-1200 RPM	200	125
6614	1/2" HD V/S Drill 0-750 RPM	220	122
6615	6614 w/Keyless Chuck	220	122
6640	0-4000 Drywall Screwdriver 5.5A	190	112
6645	0-2500 Drywall Screwdriver 5.5A	195	114

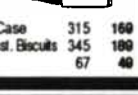
SAWS

315-1	7-1/4" Top Handle Circular Saw	210	118
9315-1	315-1 w/Case & Carb. Blade	240	137
617	7-1/4" Push Handle Circular Saw	210	119
9617	7-1/4" Push Hdle w/Case & Carb. Blade	210	137
314	4-1/2" Trim Saw	240	138
9314	4-1/2" Trim Saw w/ Case	265	148
345	6" Saw Boss 9A	180	102
9345	6" Saw Boss w/Case	220	124
9647	Tiger Cub Recip Saw w/Case	195	119
9637	Recip. Saw V/S w/Case 8A	250	138
7549	Top Handle Jig Saw	250	149
7649	Barrel Grip Jig Saw 4.8A	250	159
7700	10" LaserLoc Miter Saw	634	339

PLANERS

9367	3-1/4" 6.5A Planer w/Case	295	149
9118	Porta Plane Kit	360	199
9652	Versa Plane Kit	460	299
102	Door Hanging Kit	490	315

PLATE JOINERS



555	Plate Biscuit Joiner w/Case	315	169
9555	Plate Joiner w/Case & Asst. Biscuits	345	189
5556	Adjustable Tilt Fence	67	49

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11-090	32" Radial Drill Press	399	289
11-950	8" Drill Press	199	144
14-600	Hollow Chisel Mortiser	668	445
22-540	12" Bench Top Planer	595	389
23-680	6" Bench Grinder 1/4" Hp	86	75
23-700	Wet/Dry Grinder	234	159
23-880	8" Bench Grinder 1/2"	151	115
28-180	NEW Bench Band Saw	232	167
31-050	1" Belt Sander	104	78
31-080	1" Belt/5" Disc Sander	134	94
31-340	1" Belt/8" Disc Sander	268	188
31-460	4" Belt/Disc Sander	198	135
32-100	Plate Joiner	422	265
32-200	Boring Machine w/13" Spindle	1595	1179*
34-080	10" Miter Saw	308	198
34-330	Deluxe 8-1/4" Bench Saw	343	235
36-220	10" Compound Miter Saw	350	235
40-150	15" Scroll Saw	179	119
40-560	16" 2 Speed Scroll Saw	266	183
43-505	1/2" Bench Router/Shaper	399	279
34-897	50" Delta Unifence	525	279
34-915	30" Delta Unifence	385	239
50-179	3/4 Hp Dust Collector	483	329

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17-900	16-1/2" Drill Press	478	329
20-330	4" x 6" Horizontal Band Saw	410	275
22-661	13" Planer 2Hp, Deluxe Stand, Tableboards	1633	1075
28-245	14" Band Saw Open Stand	779	489
28-283	14" Band Saw w/ Enclosed Stand	965	659**
31-730	6" Belt / 12" Disc Sander	1393	1039*
33-055	Deluxe Sawbuck w/ Legs	854	529
33-890	Deluxe 12" Radial Arm Saw	1908	1289
33-990	Deluxe 10" Radial Arm Saw	818	549
34-444	10" Contractor's Saw	923	575
34-445	10" Contractor's Saw w/ 30" Unifence	1203	715**
34-782	10" Unisaw w/ 52" Unifence and motor cover.	2206	1625*
36-751	10" Cab. Saw w/30" Unifence	1487	1025
36-752	10" Cab. w/52" Unifence	1702	1125
37-154	6" Precision Jointer w/ stand	1420	999**
37-350	8" Precision Jointer w/ stand	1870	1399*
40-601	18" Variable Speed Scroll Saw	1025	689
43-275	Onsrude #2003 Inv. Rtr.	3335	2575*
43-355	1-1/2 Hp Wood Shaper	964	639
43-375	3 Hp HD Two Speed Shaper	2086	1589*
46-700	12" Variable Speed Wood Lathe	548	369
50-180	1 Hp Dust Collector	611	399
50-181	2 Hp Dust Collector	885	579

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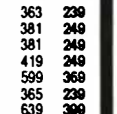

LS-2	Pinner 5/8"-1"	363	239
LS-5	Pinner 1"-1-1/2"	381	249
SLP-20	NEW Pinner 5/8"-1-5/8"	381	249
SFN-1	Finish Nailer 1"-2"	419	249
SFN-2B	Finish Nailer 1-1/2"-2-1/2"	599	369
SKS	Narrow Crown Stapler	365	239
SN325+	Framer 1-7/8" - 3-1/4"	639	399
SN4	Framer 2"-3-1/2"	713	469

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AM39 HC4V-	3/4" Hp Compressor	499	279
AM78 HC4V-	1-1/2" Hp Compressor	514	299

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1604	1-3/4 Hp Router	236	128
1604K	1-3/4 Hp Router Kit	287	165
1606	1-3/4 Hp D-Hdle Router	273	148
1608	Lam. Trim Router	149	88
1609K	Lam. Installers Kit	309	175
1609KX	Lam. Installers Kit w/Underscribe	361	199
1611	3 Hp Plunge Router	386	199
1611EVS	3-1/4 Hp V/S Plunge Router	448	231
1613	New 1-3/4 Hp Plunge Router	286	164
1613EVS	New 2 Hp V/S Plunge Router	320	184
1615	New 3 Hp Plunge Router	395	228
1615EVS	New 3 Hp V/S Plunge Router	460	255
90300	3-1/4 Hp Router	556	349

SANDERS

3270D	3"x21" Belt Sander w/Bag	260	142
1272	3"x24" Belt Sander	308	177
1272D	3"x24" Dustless Belt Sander	329	184
1273DVS	4"x24" V/S Belt Sander	370	195
3283DVS	5" Random Orbit Sander	169	99

CORDLESS DRILLS

3050VSRK	3/8" V/S/R Cordless Drill Kit w/2 battery packs	256	133
3051VSRK	3050VSRK w/Keyless Chuck	266	145

SAWS

1591VS	Top Handle Jig Saw	265	136
1582VSC	New Clic Barrel Jig Saw	265	136
	Bosch Metal Case for above Jig Saws	34	30
1632VSK	V/S Orbital Recip. Saw Kit	247	145
1654	7-1/4" 13 amp Circular Saw	205	99

PLANERS

3258K	3-1/4" HD Planer Kit	265	149

DRILLS

1021VSR	3/8" Drill 4.8A 0-1100RPM	180	95
1023VSR	1/2" Drill 4.8A 0-550RPM	199	109
1194VSR	1/2" V/S/R Hammer Drill	264	141
11212VSR	3/4" SDS Bulldog Rotary Hammer	370	199

MISCELLANEOUS

1347	4-1/2" Mini Grinder	160	95
1942	Heat Gun	111	69

Milwaukee

0222-1	3/8" Drill 3.5 amp, 0-1000 RPM	185	105
0228-1	3/8" Drill 3.5 amp, 0-1000 RPM	179	102
0234-1	1/2" Drill 5.4 amp, 0-850 RPM	219	118
0375-1	3/8" Close Quarter Drill	219	129
0379-1	1/2" Close Quarter Drill	249	147
5371-1	1/2" V/S Hammer Drill Kit	335	188
5397-1	3/8" V/S Hammer Drill Kit	239	139
5660	1 1/2 Hp Router 10 amp	325	185
5680	2 Hp Router 12 amp	355	205
5925	3 x 24 Belt Sander w/ Bag	419	228
5936	4 x 24 Belt Sander w/Bag	419	228
6014	1/2 Sheet Orbital Finish Sander	209	116
6368	7-1/4" Saw, fence carb. blade and case	239	139
6508	2 Speed/V/S Sawzall w/case	249	135
6528	VS Super Sawzall 8A w/case	295	164
9975	Heat Gun 570° & 1000°	89	65
9977	Var. Temp. Heat Gun 212-1000°	114	75

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27	3 Hp 1 Ph Mag. Start Shaper w/3/4"-1/2" Spindle	
50	6" Precision Jointer 3/4 Hp	
60	8" Precision Jointer 1-1/2 Hp	
100	12" Planer 3 Hp, Mag. Start	
180	18" Planer w/Knife Grinder 1 Ph/5 Hp 230V	
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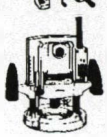

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C7BD	7-1/4" Circular Saw w/ Brake	230	119
C7SB	7-1/4" Circular Saw	214	105
C8FB	8-1/2" Slide Compound Saw	899	434
C10FA	10" Miter Saw	538	269
C12FA	12" Miter Saw	632	295
C15FB	15" Miter Saw	745	369
M8	7.3 amp, 1/4" Router	215	114
TR-12	3 Hp 1/2" Router	347	166
M-12V	3-1/4" Hp V/S Router	447	224
SV-12SA	4-3/8" Orbital Sander	80	48
D10-DFK	3/8" Cordless Driver Drill 9.6 V	280	135
D10-DFKBE	Same W/ Extra Battery.	300	148
D10-V1	3/8" V/S Reversible Drill	148	89
D13V	1/2" VS Reversible Drill	198	99
W6VA2	0-2600 Drywall Screwdriver 5.5A	161	85
W6V2	0-4000 Drywall Screwdriver 5.5A	149	79
DV20V2	3/4" VS Hammer Drill w/case	257	135
DH38YE	1-1/2" Rotary Hammer w/case	753	379
G12SA	4-1/2" Disc Grinder	145	79
PDL180A	7" Disc Grinder	212	109
SP18V	7" Disc Sander/Polisher EVS	274	145
F-20A	3-1/4" Planer	172	89
F30	3-5/8" Planer 8.3 amp	319	179
P-50	6-5/8" Planer 11 amp	563	299
CR-10V	V/S, Orbital Recip. Saw	241	125
CC14	14" HD Cutoff Saw	358	189

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CB75F	14-1/2" Band Saw	3070	1499
F1000A	12" Planer/6" Jointer	2835	1425
P12R	12" Portable Planer	1185	610
P12RA	12" Planer/Jointer	1555	810

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LU84MO11	10" Combination	76	42
LU85MO10	10" Ultimate Crosscut	112	59
LU98MO10	Ultimate 10"	125	69
SD306	6" Dado-Carbide	215	109
SD308	8" Dado-Carbide	229	117
JS-100	Biscuit Joiner	333	169
JS-100	Biscuit Joiner w/ 1000 asst. Bisc.	369	189
FT2000E	3-1/4 Hp Plunge Router V/S	410	219
90-100	15 Pc. 1/4" Router BitSet	324	169
91-100	13 Pc. 1/2" Router BitSet	324	169
94-100	5 Pc. Cabinet Door Set	319	165

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Woods of the Pacific Coast

In May of this year, a unique showing of fine furniture was on exhibit in the rejuvenated Old Town section of Eureka, Calif. The show was cosponsored by the Humboldt Woodworking Society, the Association of Woodworkers Advocating Respect for the Environment (AWARE) and Ambiance, the fine furniture and hand-crafts gallery that housed the show.

The show was called Pacific Coast Woods '92, and its unusual aspect was the sponsors' mandate that all the wood used in the juried submissions be of hardwoods grown on the Pacific North coast. To those unfamiliar with coastal Northern California and Oregon, this mandate might not have much significance. But to these woodworkers, the challenge of the show was not only to develop designs and to learn to work these relatively unknown hardwoods, they also had the task of simply finding enough quality stock to work with.

Though this region encompasses vast timberlands, some of it still virgin forest, it is a land where the harvest of softwoods, such as Douglas-fir and the infamous old growth redwood, reigns supreme. For nearly a century, the tan oak, white and black oak, maple, arbutus (madrone), bay laurel (also known as pepperwood or myrtlewood) and other indigenous hardwoods have been perfunctorily relegated to the cutter's burn piles. Only very recently have mills such as Beaver Lumber of Arcata, Inc. (1220 Fifth St., Arcata, Calif. 95521; 707-822-4623) and Wild Iris Forestry, Inc. (P.O. Box 1423, Redway, Calif. 95560; 707-923-2344) and outlets such as Almquist Lumber Co. (Blue Lake Industrial Park, P.O. Box 875, Blue Lake, Calif. 95525; 707-668-5652) begun providing local hardwoods in commercially viable quantity and quality.

The show's sponsors had two goals. The

***The Pacific Coast Woods gallery show** challenged local woodworkers to create their pieces using only native hardwoods of the Pacific Northwest. John Shannon answered the challenge admirably with this table set (above) in quilted Pacific maple, Port-Orford cedar and indigenous walnut.*

***This quilted Pacific maple chair** (far left) by Anthony Kahn received the show's "best craftsmanship" award.*

***The beautiful panel in the door** of this wall cabinet (near left) by George Monroe was rescued from a burn pile. The cabinet of bay laurel was awarded "best of show."*

Photos this page: Jim Tolpin

first was to stimulate the woodworking community to get to know these woods and to develop quality products from them. The second goal was to show the public the beauty and versatility of these former trash woods. Many people, locals included, had never seen or even heard of some species featured in the show.

Judging from the craftsmanship and beauty of the exhibited pieces, I'd say that the woodworkers did indeed rise to the challenge. *—Jim Tolpin, Arcata, Calif.*

Photo: Jim Tolpin

***The comforter chest** by George Monroe was awarded "most original." The white oak was grown and milled in Miranda, Calif., and the black walnut was harvested from an orchard in Ettersburg, Calif.*

Announcements

Furniture refinishers form new association

Several well-established furniture restoration centers across the country are forming the National Association of Furniture Repair and Refinishing Specialists. Association membership is open to all individuals in the stripping, repairing, refinishing, restoration or service field. The main objective is to promote productivity, profitability and professionalism of members through sales and marketing advice, trade shows, training seminars and a certification program. For more information, contact John Rybski, Woodmasters Furniture Service, Inc., 321 S. Houghton, Milford, Mich. 48381; (313) 684-6411.

New York volunteers seek funds for carousel

The Empire State Carousel, Inc. (ESC) is a non-profit organization dedicated to the creation of a full-sized operating carousel slated to become a traveling museum of New York state history and culture. Although original costs were projected at $1.1 million, volunteer help and contributions of material have trimmed this figure to about $600,000. Cash contributions to date have left ESC about $400,000 shy of its goal. If you would like to contribute time, materials or money, contact Empire State Carousel, Inc., P.O. Box 565, Islip, N.Y. 11751; (516) 277-6168.

Krenov honored by English group

James Krenov, founder and lead teacher in the fine woodworking program at the College of the Redwoods, Eureka, Calif., has been named the winner of the 1992 Silver Medal of the Society of Designer-Craftsmen, headquartered in London, England. Founded in 1888, the Society of Designer-Craftsmen traces it roots to John Ruskin and William Morris, founders of the Arts-and-Crafts movement.

Today, the society includes many of the foremost craftsmen and women in the United Kingdom. Krenov, Russian-born and the author of four classic books on fine cabinetmaking, worked and wrote for 20 years in Sweden before coming to California to found the College of the Redwoods program in 1981.

Celebration of American crafts

Creative Arts Workshop hosts the 24th annual Celebration of American Crafts, a national juried and invitational exhibition and sale of the best in contemporary crafts by more than 300 craftspeople from all over the United States. Items range from several dollars to several thousand dollars with a wide variety of moderately priced items to choose from. Admission to the sale, which will be held from November 9 through December 23, is free. For more information, contact the Creative Arts Workshop, 80 Audubon St., New Haven, Conn. 06510; (203) 562-4927.

—Charley Robinson

Twelve favorite books for holiday gifts

Every year the "gift" holidays rush at us, and we're pressed for time to find tokens of affection that are meaningful, useful, affordable and UPS-able. This year, we've decided books are a nice change from the usual neckties and lathes.

The following list of our 12 favorite books, arguably arranged in order of desirability, covers a disparity of intellectual, philosophical and creative interests. No complete woodworking library should be without these landmark publications.

Tage Frid Teaches Woodworking: Joinery (The Taunton Press, Inc., 1979) combines entertaining writing with get-the-job-done information. Spanning the interest of amateurs and professionals, Frid starts simply and moves on to more difficult techniques.

In *A Cabinetmaker's Notebook* (Sterling Publishing Co., 1991), James Krenov's insistence on developing a personal vision and being true to it has inspired many to become woodworkers. *The Fine Art of Cabinetmaking* (Sterling Publishing Co., 1992) then introduced the materials, tools, techniques and design philosophy to get these fledgling woodworkers started.

Ernest Joyce's classic, *Encyclopedia of Furniture Making* (Sterling Publishing Co., 1989), is about as complete as a woodworking reference can be, covering the essentials of wood technology, design and construction with no wasted space. The illustrations include clean-lined, modern work. This is the book we turn to before trying out a new technique or to brush up on something we haven't done in a while.

Too few woodworkers understand their medium. The top book on our "must own/should read" list, *Understanding Wood* (The Taunton Press, Inc., 1982) by R. Bruce Hoadley delivers what the title promises in readable fashion. The practical examples and illustrations of how wood's properties affect construction can improve designs.

Making Authentic Shaker Furniture: with measured drawings of museum classics (Dover Publications, Inc., 1992) expresses the heart and soul that went into the creation of the style that rivals jazz in its American originality and world importance. The pristine Scandinavian design of Krenov's and Frid's work echoes the Shaker style of more than 150 years earlier. After describing the time, place and beliefs of the Shaker people, John G. Shea pairs his excellent measured drawings with photos of the original.

Chinese influence mixes with Georgian, Adam and Gothic Revival throughout Thomas Chippendale's *Gentleman and Cabinet-Makers Director* (Dover Publications, Inc., 1966). The unique title signaled his interest to create a catalog for buyers and a manual for builders. Around the time of the 1762 publication of the third edition, the Chippendale style took Philadelphia by storm and became what many of us think of as American Classic furniture. The crisp measured drawings in this reprint are filled with heavy-handed frou frou, but when today's designer strips away the extraneous ornamentation, Chippendale's mastery of lines and proportions can be used to good effect on furniture of any style

Integrating cultural traditions and personal philosophy into woodworking is the focus of George Nakashima's *The Soul of a Tree* (Kodansha International Ltd., 1988). This coffee-table book is lushly illustrated.

INDEX TO ADVERTISERS

The simplicity of Nakashima's designs makes them seem easy to build, but the purity of form demands the same attention as the harshest Zen master. Nakashima movingly discourses on the spirit of wood and sensitivity to discovering and revealing what each piece of wood wants to say.

Sam Maloof: Woodworker (Kodansha International Ltd., 1983) is the best photographed woodworking book of all time. Maloof has said "I can't worry about what a particular piece of wood has to say; there are too many pieces of wood in my future." But these incredibly personal works don't point to any lack of heart on the part of this founder of the modern American woodworking movement. We like that Maloof accepts any technique that will do the job and produces prolifically without compromising the flow and grace of his designs.

Two more books that seem almost too readable to be real references are *The Workbench Book* (The Taunton Press, 1988) and *The Workshop Book* (The Taunton Press, 1991). Scott Landis' reputation for good writing, good illustrations and a worthy topic are exemplified in these works, which explore two of our most basic requirements. *The Workbench Book* details the essential relationship between our benches and our style of work, illustrating a great variety. *The Workshop Book* extends the focus to the workspace. Both books concentrate on the specific ideas and solutions of individual woodworkers and provide ideas to incorporate into benches and shops.

Last, but certainly not least, Tim Snyder's *Shelving and Storage* (Rodale Press, 1992) is a practical how-to book that can get you out of the theoretical world of books and into actually building something in the shop. The 25 projects keep zooming at you because Snyder throws in the "Shop Savvy" and "Alternative Methods" in separate highlighted text.

We're sorry you're not here to lobby for your best loved books. We know that some of our favorite books that couldn't get past our two-man committee would be shoo-ins with another voter.

—Skip (Sven) Hanson and Derek Roff, Albuquerque, N.M.

Photo: Lorna Ocker

***The cherry helical coil spring** support for this chair contains no metal parts and will support over 300 lbs.*

Spring in his seat

Whether it's artiture of fun-iture, this wooden spring chair was a project Russell Kotlin had been told by fellow students and instructors alike wouldn't work. Kotlin, a fifth year student at the Cleveland Institute of Art, built the chair as an industrial design project. The chair contains no metal parts, and the spring is constructed out of 38 identical pieces of solid cherry. The spring compresses 2 in. to 3 in. in use and will support over 300 lbs.

—Charley Robinson

Are you ready for fun-iture?

I agree with some of Jeremy Singley's (*FWW* #93, p. 6) apparent feelings toward juries judging woodworking as art. When I see that a show has a jury of "professional artists," I figure chances are slim that my work will be reviewed knowledgeably, let alone understood. But I think the problem isn't, to paraphrase Mr. Singley, that "real woodworkers don't do art," but the opposite. If more woodworkers saw themselves as artists, more artists in wood would be apt to sit on juries, ultimately benefiting all woodworkers, self-described artists or not. I've about decided that it's easier to tell people that I'm an artist than to say I'm a woodworker. Either way, their perception of my occupation is equally inaccurate and, as an artist, I won't get so many calls to fix garden gates.

Second, if real woodworkers don't do art, then the notion that they don't or shouldn't do humor can't be far behind. That bothers me because most of my recent efforts have focused on "fun-iture" (see the photos below) as opposed to artiture or architure.

—Keith Allen, Cedar Grove, N.C.

Photo below and right: Keith R. Allen

***Lobbying for fun-iture** as a distinct category of woodworking, the author offers two examples; the photo at left is his rendition of a Windsor chair, and the photo above is a shaker bench.*

Notes and Comment

Do you know something we don't about the woodworking scene in your area? Please take a moment to fill us in. Notes and Comment pays for stories, tidbits, commentary and reports on exhibits and events. Send manuscripts and color slides (or, black-and-white photos—preferably with negatives) to Notes and Comment, Fine Woodworking, *PO Box 5506, Newtown, Conn. 06470-5506.*

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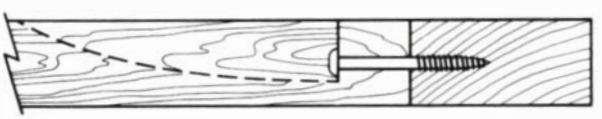

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Photo: Ken Showell

OX FROM THE PLANET WHIMSEY

New York City multimedia artist Rodney Greenblat describes his painted pine-and-plywood *Treasure Ox* as "a mythological object at the center of some enchanted fable." Beneath the lid (which contains a diorama depicting the ox emerging from a spacecraft) is a trove of street junk: broken appliances, jewelry, a bowling trophy—all spray painted gold and silver and lit from below. The roadway base is designed to make the 57-in.-tall ox seem gigantic.