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# Popular Woodworking

January 1998 #100

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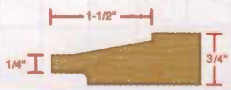


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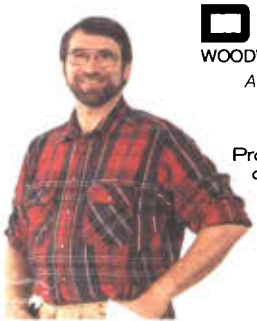

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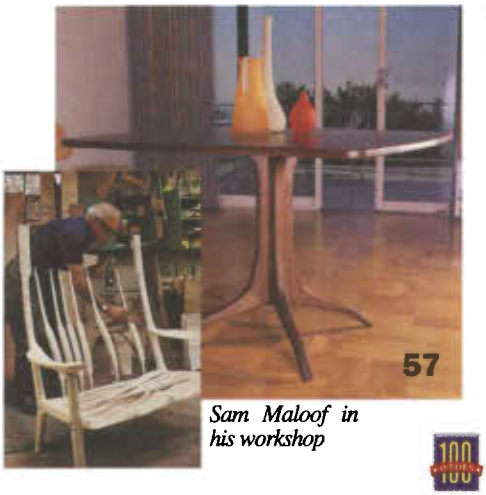


*Sam Maloof in his workshop*

# Features









# Project File

*This special section, exclusive to* Popular Woodworking, *features building basics for six projects.*



## Safety Note

**Safety is your responsibility. Manufacturers place safety devices on their equipment for a reason. In many photos you see in *Popular Woodworking*, these have been removed to provide clarity. In some cases we'll use an awkward body position so you can better see what's being demonstrated. Don't copy us. Think about each procedure you're going to perform beforehand. Think ahead. Safety First!**

## Columns



*Cover photo: Pam Monfort/Bronze Photography*

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*January 1998, Vol. 17, No. 6*

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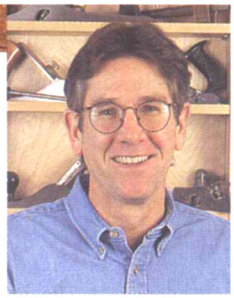

IN THE LETTERS SECTION of the September 1997 issue I responded to a note from Richey Wallis, a reader who wanted to see the return of the "Master Craftsman" projects. My reply resulted in a heap of mail. I appreciated hearing from *everyone*. A sampling of these letters appears in the letters section.

First, I'd like to apologize to Mr. Wallis and those who thought I took him to task. That wasn't my intention.

Second, the issues raised by these letters caused me to think again about the objectives of *Popular Woodworking*, especially as we prepared this 100th issue. Here's what I tell people when I'm asked about the magazine: Each issue has about 15 projects to serve readers' varied skills. These range from novices, to intermediates and include a fair number with advanced skills. We choose many projects because they aren't very time-consuming, although some are not easy to build. We also run a couple time-consuming projects for those who have the time. Most importantly, we show you practical building techniques that result in quality work.

One letter from Mr. Doug Green suggests I underestimate the skill of advanced readers. If so, I stand corrected. I welcome photos of our readers' finished projects. More photos from readers will help me evaluate skill levels better so I can set the bar appropriately. And I invite all readers to suggest projects they'd like to see.

Mr. Green also argues that master craftsmanship *always* requires the use of fussy, time-consuming joinery (my words). He says, and I understand his point when viewed narrowly, that rabbet joints are no substitute for dovetails.

I take issue with this notion. The current belief that there's no substitute for old-time joinery is founded on some incorrect assumptions. It overlooks the performance of modern glues and low-cost fasteners.

Cabinet makers have always embraced new methods without sacrificing quality. For example, in the 18th century the dovetail became widespread only when tall case pieces needed a stronger joint using lighter materials.

For those who wish to use hand-cut joints in their projects, fine. Just don't look down on those who don't. Sure, some might lack the skills, but others have the skills but don't use these joints for legitimate reasons. The snobbery associated with dovetail joints, et al, is presumptuous, unwarranted and a disservice to woodworkers, woodworking and the public at large.

I'll defend the practice of *good* woodworking (the use of well-cut, common joints) as equally legitimate as the practice of *fine* woodworking, which can be wonderful, although it is sometimes pretentious.

Looking through the first 99 issues of *Popular Woodworking*, we were surprised at how it has changed but in some fundamental ways stayed the same. The first issue stated it would serve the interests of the small cabinet shop owner and carver. A few years later we looked like woodworking magazines do today. Later, we introduced the PullOut™ Plans, a first among wood magazines. Last year, we changed again to our strong emphasis on project building. The changes reflect an evolution to better serve an evolving readership. But the underlying fundamentals have remained consistent, practical and down to earth.

We intend to sit squarely in the front row of the *good woodworking* school of thought and provide you ample projects built using practical techniques. We want you to enjoy your woodworking, both the process of building and the fruits of your craft. **PW**

Steve Shanesy

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# *From the* **PW** *Mailbag . . .*

**We welcome your comments about *PW* or anything related to woodworking. We'd also like to see color pictures of what you're building. Send your input to: Infeed/Outfeed, *Popular Woodworking*, 1507 Dana Ave., Cincinnati, OH 45207. Our e-mail address is: popwood@earthlink.net. Letters may be edited for publication.**

***— Steve Shanesy, editor, PW***

***Editors' note:*** *Many readers responded to September 1997's letter from Richey A. Wallis who complained about the lack of "Master Craftsman" projects in* Popular Woodworking. *Other readers responded to Editor Steve Shanesy's response to that letter. Here are some of the more interesting letters. To read Steve's thoughts on the issue, see his "Out On A Limb" column on page 6.*

## Magazine is Good For Weekend Hobbiests

I'm afraid I have to agree with the opinion of Richey A. Wallis (September 1997 "Infeed/Outfeed"). *Popular Woodworking* definitely emphasizes projects for the weekend hobbiest. Don't get me wrong, there's nothing wrong with that. Your magazine fills a niche and does so quite well.

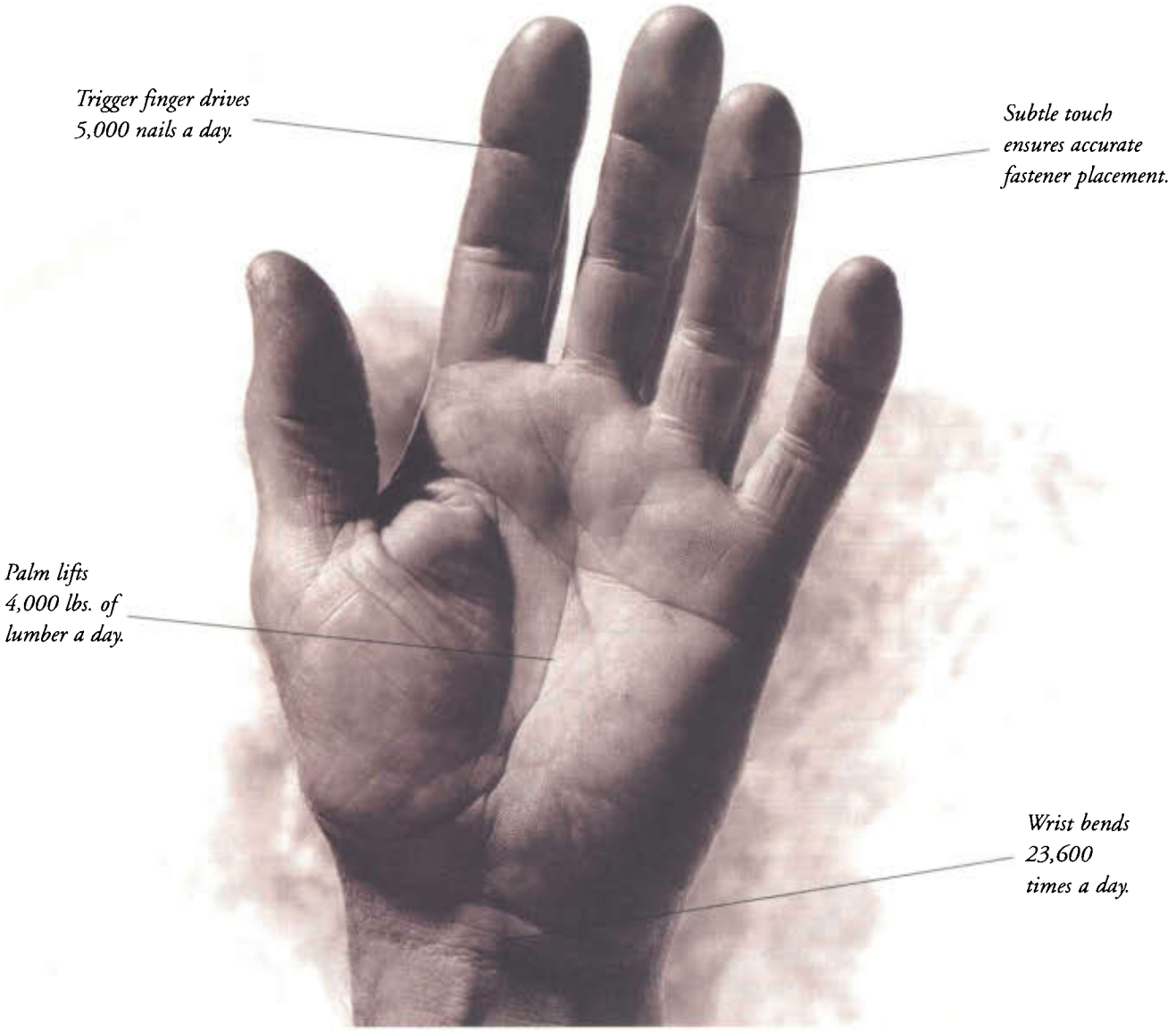
But please, let us speak realistically. My subscription renewal came yesterday, and I've just spent the last hour reviewing the value to me of this magazine. When you say you present projects that "challenge the skills of [your] more advanced readers . . . [and] keep the best hands busy and challenged" you are either overestimating the difficulty of your best projects or underestimating the skills of your advanced readers. I agree with you that master craftsmanship entails expert skills producing works of enduring quality. However, based on what I've just reviewed, I disagree with your definition of what constitutes "enduring quality."

By the very definition of the term, if you truly want to produce "enduring quality" you simply must use the techniques that time alone has proven to be truly enduring. There is no shortcut. Rabbets are not a substitute for dovetails. Dowel joints are not in the same league with mortise-and-tenon construction. Anything less than the best technique, regardless of how the joinery is accomplished, is something less than the best. And anything less than the best is certainly not "master craftsmanship." What your "best" projects lack is an attention to detail in both design and particularly in joinery — that's right, those "fussy" details that distinguish true craftsmanship from the wood-butchering weekend wanna-be.

***Doug Green***
***Boulder, Colorado***

*Continued on page 12*

# To understand something completely, you have to know how to read between the lines.

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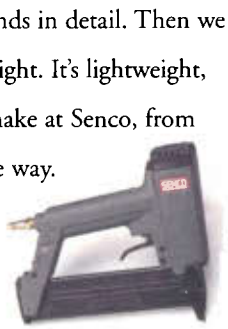

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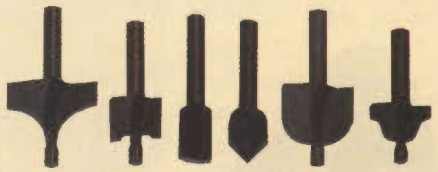

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| 1/4" Rabbeting | 51118-2SHA | $3.99 |
| 45° Chamfer | 51119-2SHA | $3.99 |
| 1/2" Straight | 51120-2SHA | $2.49 |
| 3/4"Straight | 51121-1SHA | $2.49 |
| 3/8" Straight | 51122-2SHA | $2.49 |
| 1/2" V-groove | 51123-1SHA | $3.99 |
| 3/8" Corner Round | 51125-2SHA | $3.99 |
| 3/8" Cove | 51126-2SHA | $3.99 |
| 3/8" Core | 51168-2SHA | $1.49 |
| 1/4"Core Box/Veining | 51195-1SHA | $3.99 |
| 5/32" Roman Ogee | 51196-1SHA | $3.99 |
| 3/8" Hang Slot(keyhole) | 51198-1SHA | $3.99 |
| 1/8" Straight | 51271-2SHA | $2.49 |
| 1/4" Beading | 51273-3SHA | $3.99 |
| 1/4" Straight | 51277-1SHA | $2.49 |
| 1/2" Core Box | 51279-2SHA | $3.99 |
| 1/4" Corner Round | 51292-1SHA | $3.99 |

## CENTRAL MACHINERY

NO MORE LOST CHUCK KEYS!

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**DRILL PRESS WITH KEYED CHUCK** **$48.99**
ITEM 05901-0SHA

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### 2 PC. 3/4" HEAVY DUTY PIPE CLAMP SET

Constructed from heat-treated cast iron, these durable clamps keep your work rock steady. Just screw the handle side onto a 3/4" threaded pipe and slide the spring loaded end on. You're ready to go! Pipe not included.

- Handle screw operating range: 2-1/8"
- 1-1/2" throat depth
- Weight: 2-7/16 lbs.

ITEM 31255-8SHA **$3.49**

**1/2" PIPE CLAMP**
- 1-1/2" throat depth
- Weight: 1-4/5 lbs.

ITEM 37056-2SHA **$2.99**

## CHICAGO Electric Power Tools

### HEAVY DUTY 4-1/2" DISC GRINDER

- High powered 10,000 RPM
- 5/8" spindle with 7/8" arbor adapter
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- High power to wt. ratio
- 11-7/8" long
- Spindle lock

ITEM 31135-6SHA **$19.99**

**4-1/2" x 1/4" GRINDING WHEELS (PACK OF 10)** **$8.99**
ITEM 06674-0SHA

**CARVING DISC** **$29.99**
ITEM 07697-2SHA

**4" DRY-CUT DIAMOND BLADE** **$9.99**
ITEM 34441-6SHA

## CHICAGO Electric Power Tools

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High voltage, heavy duty battery gives long run times between charges. T-handle design makes this drill easy to use.

- Jacobs® keyless chuck • 6 torque settings
- Variable speed, reversible; 0 to 600 RPM
- Includes 6 pc. drill bit set, 6 pc. screwdriver bit set, magnetic extension bit, charger, battery, keyless chuck, and carrying case

ITEM 34793-3SHA ~~$54.99~~ **$49.99**

**14.4V BATTERY** **$29.99**
ITEM 34794-0SHA

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Hardwood jaws distribute pressure evenly, and easily adjusts for non-parallel surfaces and odd shapes. Wood construction helps eliminate workpiece damage.

| JAW LENGTH | OPEN JAW CAPACITY | ITEM | PRICE |
|---|---|---|---|
| 8" | 4-3/4" | 04852-3SHA | $3.99 |
| 10" | 6" | 04853-4SHA | $4.99 |
| 12" | 8-1/2 | 04854-5SHA | $5.99 |

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### MORTISING MACHINE

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- 10-7/8" x 7-3/4" base
- 13-3/8" x 6" table • 60 lbs. shipping wt.
- 3580 spindle speed • 5" throat
- 5" maximum workpiece height
- Accepts .745" chisel shanks
- 1/2 HP, 110V, 2.3 amps

ITEM 35570-1SHA **$169.99**

NEW!

### 7-1/4" ADJUSTABLE DADO BLADES

Carbide steel tips last up to 50 times longer and can be resharpened. High speed steel blades are denser and stronger for greater impact resistance. Does not have to be removed from saw to adjust cutting width. 4500 max. RPM; 1" arbor with 5/8" adapter

**CARBIDE DADO BLADES**

| TEETH | ITEM | PRICE |
|---|---|---|
| 24 | 36911-1SHA | $19.99 |
| 40 | 36912-1SHA | $24.99 |

**HIGH SPEED STEEL DADO BLADES**

| TEETH | ITEM | PRICE |
|---|---|---|
| 24 | 36913-1SHA | $12.99 |
| 40 | 36914-2SHA | $15.99 |

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LIMITED QUANTITIES


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ITEM 36402-1SHA ~~$82.99~~ $69.99

**SANDING BELT CLEANER**

- 8-1/2" x 1-1/2" x 1-1/2"

ITEM 30766-1SHA $4.99

DELTA®
Delta 36-220

LIMITED QUANTITIES

**10" COMPOUND MITER SAW**

2-1/2 HP, 15 amp motor. D-handle with trigger switch for positive control. Electric brake automatically stops blade in seconds. Includes dust collection bag, 10" blade with 5/8" arbor, and retractable blade guard.

- Blade speed: 4900 RPM @ no-load
- Capacities: 2-3/4" x 5-3/4" crosscut; 2-3/4" x 4-1/8" 45° right & left miter; 1-3/4" x 5-3/4" 45° left bevel; 1-3/4" x 4-1/8" 45° x 45° compound
- Table diameter: 10-1/2" • Tool wt.: 60 lbs.
- Factory reconditioned, factory perfect

ITEM 06125-0SHA $159.99

Makita®
Makita 6221DWE

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**3/8", 9.6V CORDLESS DRILL WITH KEYLESS CHUCK**

Another step forward in drill design – the same power in only 3-1/8 lbs. Only 8" overall length handles easy and gets into tight spots. Features 0 to 700 RPM reversible variable speeds and 6 stage torque settings for a variety of applications. Electric brake stops chuck fast! Includes 1 hour charger, TWO batteries, battery cover & carrying case.

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- Contains: 1/4", 1/2" and 3/4" gouge; 1/2" and 1" skew; 1/2" spearpoint; 1/2" parting tool; and 1/2" round

TRIPLE TEMPERED

ITEM 03793-1SHA ~~$12.99~~ $7.99

CENTRAL MACHINERY

**16" SCROLL SAW**

- Precision milled 14-1/2" x 8" table tilts 0° to 45° • 1750 SPM blade speed
- Uses pin end blades, 5-1/2" long
- Heavy duty cast iron frame and base reduce vibration • 7/8" blade stroke
- 1/8 HP, 110V, .83 amps

ITEM 34618-5SHA ~~$69.99~~ $54.99

**5 PC. 5-1/2" SAW BLADES**

- Pin end type

ITEM 35024-0SHA $4.99

CENTRAL MACHINERY

**10", 2 HP BENCH TABLE SAW**

Die cast aluminum table 25-3/4" x 16", has adjustable 17-7/8" x 2" rip fence and inch/metric scale for precise cutting.

- Max. depth of cut at 90°: 3-1/8"; at 45°: 2-1/2" • Blade sold separately, below
- Motor: 2 HP, 115V, 60 Hz, 10 amp, 4500 RPM • Shipping weight: 36 lbs.
- Miter gauge adjusts 0° - 60° left and right
- Blade capacity: 10" with 5/8" arbor

~~$199.99~~ $89.99

ITEM 35715-3SHA

**10" CARBIDE TIP SAW BLADE**

- 5/8" arbor • 40 tooth

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| MAXIMUM CAPACITY | ITEM | PRICE |
|---|---|---|
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| 5 ft. | 35896-0SHA | $14.99 |

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Drill a 3/4" hole in any wood topped work bench and install the holdfast. Acts as a clamp without being rigid. 8-1/8"L x 3/4". diameter.

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ITEM 02410-1SHA

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Electric Power Tools

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- 1/4" collet • 8-1/2" overall length
- 4 lbs. tool weight

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CENTRAL MACHINERY

**DOVETAIL MACHINE**

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ANANT

NEW!

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ITEM 31799-4SHA $5.99

**C. 9-1/4" x 2" ADJUSTABLE IRON BENCH PLANE**
ITEM 31798-1SHA $9.99

CENTRAL MACHINERY

- VARIABLE SPEED
- BIG 12" THROAT
- 3/4 HP

**12" BANDSAW**

Precision three-wheeled design cuts material up to 12" wide and makes bevel cuts from 0° to 45°. Electronic variable speed from 0 to 2645 feet per minute. Includes miter gauge. Blade sold separately.
115V; Table: slotted cast aluminum:13-1/2" x 13-1/2"; Work cap.: 12" x 4-5/8"H; Requires 62" blade; Overall dim.: 25"L x 13-1/2"W x 23-3/4"H; Shipping wt.: 32 lbs.

ITEM 01629-1SHA ~~$116.99~~ $99.99

**BANDSAW BLADE**

- 6 TPI

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## INFEED/OUTFEED

*Continued from page 8*

### Mr. Wallis Responds

Boy, did I touch a nerve. I simply made an observation. Nothing personal was intended.

"Master craftsman" is not my term. It was featured in my first issue of *Popular Woodworking* (May 1994). If you will read the editor's comments in "Turnings" in that issue you will see my point of reference. I am not a master craftsman. I said so in my first letter. I do not own quality hand woodworking tools. I do not know how to use them. My "handmade" dovetails are router-assisted.

My basic point is that there has been a continued emphasis on quantity in your magazine since the July 1996 issue. Every cover has featured from eight to 24 projects.

Woodworking is a source of pleasure for me. Therefore, there is no rush to complete a project, large or small. There is pleasure in the *doing* just as there is pleasure in the finished article. I'm aware that there are other woodworking magazines on the market. I subscribe to some. I may take your invitation to leave *Popular Woodworking*. However, I would prefer to have some articles and projects that interest me.

***Richey Wallis***
***Mount Juliet, Tennessee***

### Don't Lose Your Cool

Boy, Richey A. Wallis sure pushed your button! So much so, in fact, that you lost your cool. From my point of view you are doing a satisfactory job. Your magazine fits within a niche of woodworking periodicals, and as a reader should I choose to undertake the "Master Craftsman" projects I would turn not to you, but to *Fine Woodworking*. I would advise Mr. Wallis to do the same.

The reason for this letter is to say to you that I believe you stepped out of bounds in your response to Mr. Wallis. Deriding a reader in print is no way to win friends and influence your readership. You would demonstrate equanimity and demonstrate good character traits, therefore, if you would apologize to Mr. Wallis in print. This may not pacify Mr. Wallis, but it would reveal to other readers that we are not dealing with a hot-headed editor.

***Dr. Gerald R. Ogden***
***El Dorado Hills, California***

### Editor Did the Right Thing

I want to shake your hand for defending your magazine against the writer from Mount Juliet, Tenn.!

Here is a bored reader who complains of not seeing plans suitable for a master craftsman, yet states clearly that he is not a master craftsman. I'd like to be a plastic surgeon, but I can't seem to locate enough quality "how-to" videos.

Keep up the good work!

***Steve Veal***
***Dallas, Georgia***

### Bring Back 'Scrap Solutions'

With respect to your magazine, one word describes it: excellent! But I think it's time that you reinstated "Scrap Solutions" from the early 1990s.

I recall the reason that it was cancelled but I don't feel it's fair to punish everyone because of one cheat.

While I do enjoy woodworking I am not very creative in the design aspect and did enjoy and looked forward to "Scrap Solutions" rather than bagging up my scraps and donating them to another fireplace.

***Mack Cameron***
***Brooklin, Ontario***

*Editor's note: As some of you might remember, we started a "Scrap Solutions" contest in November 1991 that let readers send in designs for projects made from scraps. Unfortunately, some readers' entries were plans from other publications and the contest was cancelled. However, we still think the contest is a good idea and are thinking about ways to resurrect it.*

*Continued on page 14*

# Create Classic Raised Panel Doors

## with your 1/4" or 1/2" Router, or your 1/2" or 3/4" Shaper.

Our professional production quality router bits make it quick and easy to produce attractive raised panel doors. Our reversible combination bit makes a matching rail and stile frame. The panel raising bit with ball bearing guide makes a perfect raised panel every time!

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**Includes instructions and Professional Tips!**

| RAISED PANEL DOOR SETS | | | |
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| #1301 | 1/4" Shank Router | * 2" | $69.95 |
| #1302 | 1/2" Shank Router | * 3-1/2" | $79.95 |
| #1303 | 1/2" & 3/4" Shaper | 4-5/8" | $99.95 |

*Ball bearing included

*Raised Panel Router Bit

*Reversible Combination Rail & Stile Bit
Works with stock from 11/16" to 7/8".


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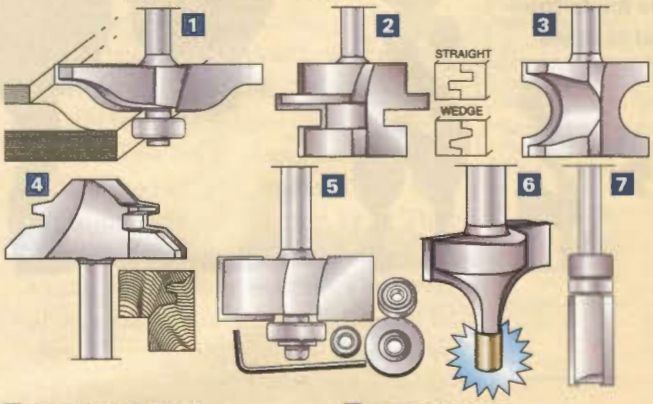
## 1/4" Shank Carbide Tipped Router Bits

*Professional Production Quality Guaranteed!*




**1 OGEE RAISED PANEL**
**#1423** 2" Large Diameter .....**$29.95**

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**#1333** Straight .....**$29.00**
**#1335** Wedge .....**$29.00**

**3 BULL NOSE**
**#1330** 1/2" Dia. of Circle .....**$16.00**
**#1331** 3/4" Dia. of Circle .....**$21.00**

**4 LOCK MITRE BIT**
**#1433**
2" Dia.,Stock thickness: 1/2"-3/4" ..**$37.50**

**5 RABBETING KIT**
Ball bearing guides allow 4 depth of cuts: 3/8", 7/16", 5/16", 1/4". Set: 1/4" shank rabbeting bit, 4 bearings (3/8", 1/2", 5/8", 3/4") & hex key.
**#1425** 1-1/4" Large Diameter....**$25.00**

**6 BRASS PILOTED**
Rout into tight spaces and sharp corners. These bits have Brass Pilots, measuring only 5/32" in dia., instead of the usual 1/2" ball bearing.
**#1428** 1/8" R Round Over .....**$16.00**
**#1429** 1/4" R Round Over .....**$17.00**
**#1430** 3/8" R Round Over .....**$19.00**

**7 PATTERN/FLUSH TRIM**
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1/2" Dia., 1" Cutting length. ....**$15.00**
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3/4" Dia., 1" Cutting length .....**$17.00**

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**METAL CASE & BIT HOLDER INCLUDED!**

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Bit sizes from 1/8" to 1/2" by 1/64" increments. Bits are deep fluted to clear chips quickly.

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***5/32" Slot Cutter-1/4" Shank and 250 #20 Biscuits***

"Biscuit Joining with your Router", Instructional sheet included.

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Set includes: 4 Round Over Bits with 1/2" OD bearing: (1/8", 1/4", 3/8", 1/2"), plus 3/8"OD bearing & allen wrench.


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This production quality set includes 4 Cove Bits: (1/8" R, 1/4" R, 3/8" R, 1/2" R).


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## INFEED/OUTFEED

*Continued from page 12*

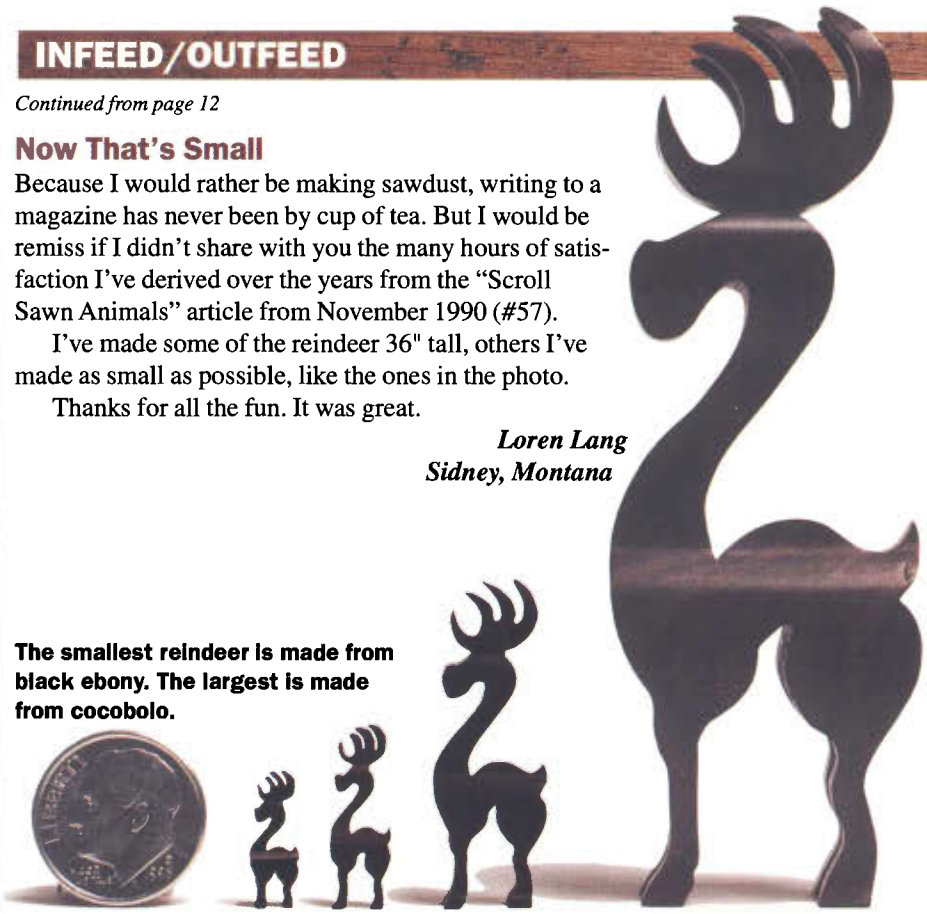
### Now That's Small

Because I would rather be making sawdust, writing to a magazine has never been by cup of tea. But I would be remiss if I didn't share with you the many hours of satisfaction I've derived over the years from the "Scroll Sawn Animals" article from November 1990 (#57).

I've made some of the reindeer 36" tall, others I've made as small as possible, like the ones in the photo.

Thanks for all the fun. It was great.

***Loren Lang***
***Sidney, Montana***



**The smallest reindeer is made from black ebony. The largest is made from cocobolo.**

### Advice on the Circle-Cutting Jig

For the past several years I have been making wood and metal wind chimes for gifts and to sell. The most difficult part of making them was cutting the two or three circles of wood for each set. Finally, I "cobbled-up" a simple band saw circle jig, which was only marginally accurate, not really what I wanted.

Then I picked up the September 1997 issue and saw the band saw circle jig article on page 52. After reading the article and studying the drawings it became apparent that a couple of important things had been overlooked in the construction and use of the jig.

Nowhere is it mentioned that the pivot-pin slide bar must be positioned precisely perpendicular to the side of the saw blade. If this is not done, the work piece could pinch and possibly break the blade.

Also, in using the jig, the pivot-pin must be aligned with the blade tooth gullets in order to cut smooth accurate circles. Aligning the pin with the front of the teeth causes the work piece to pull the blade toward the center pin, cutting a spiral and possibly breaking the blade. I know, it happened to me.

Since reading the article, I have built my own version of the jig that gives me the accuracy I need, and I can cut circles anywhere from $1\frac{1}{2}$" to 53" in diameter by just reversing the slide bar in the jig and providing extra off-table support for the larger work pieces. Thanks much for the help. I enjoy your magazine. It's one of the best. Keep up the good work.

***Harold H. White***
***Madison, Wisconsin***

## More Ways to End "Glue-Up Voodoo"

Your editorial "An End to Glue-Up Voodoo" summarized the sorts of problems caused by the inconsistencies of articles about woodworking. Your summary of the operations was excellent but incomplete. When I attend special project classes at the local community college, I observe several problems with the work of entry-level woodworkers. They would get cleaner work by:

**1.** When gluing wide boards, glue only one joint at a time. Maintaining good alignment of boards when more than one joint is glued seems to be difficult for most people.

**2.** Align the projected axis of the screws of the clamps with the center plane of the boards being glued. Boards tend to push up or down if the projected axis differs greatly from the centers of the boards.

**3.** Use much less glue. Excess glue is difficult to remove completely.

Your series the "Little Shop That Could" provides a very useful service to entry-level woodworkers. The series shows non-trivial projects that can be done successfully by entry-level woodworkers. I don't recall seeing such articles in other magazines, but beginning woodworkers certainly need them.

*Harold A. Hubbard*
*Berkeley, California*

### Important Notice to Readers

In our last issue (Oct./Nov. '97, No. 99) we ran a project providing dimensions and construction methods for building an earring rack on page 45. After the issue was distributed, we learned that the project design may be protected under one or more U.S. patents. Beware that building this project for yourself or others could be a violation of the patent. We regret any inconvenience this may have caused. **PW**

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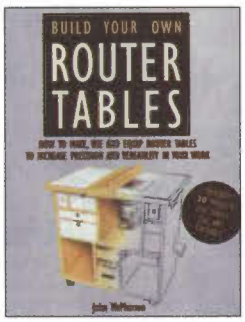


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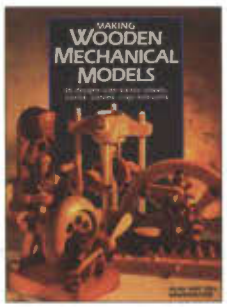


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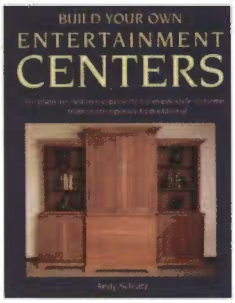


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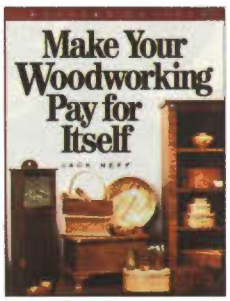


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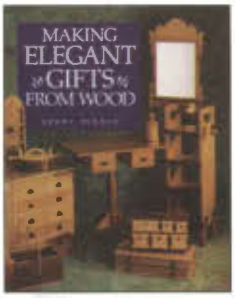


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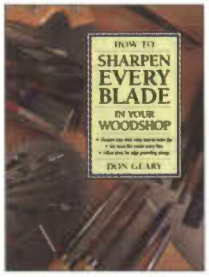


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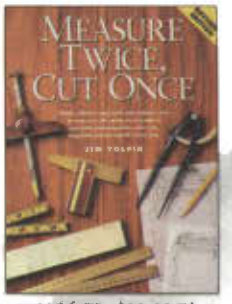


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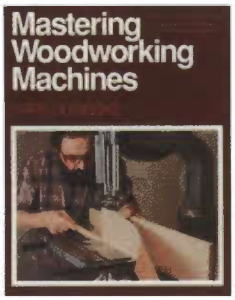


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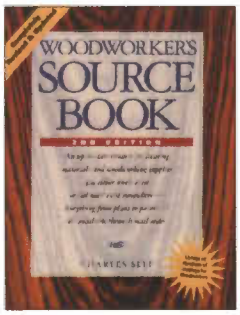


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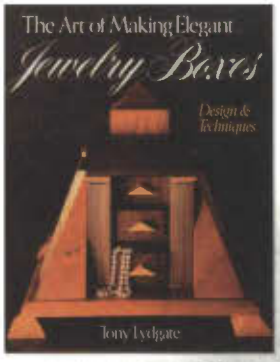


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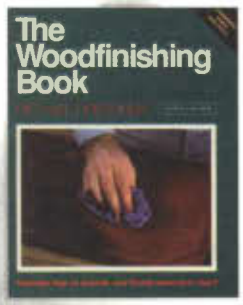


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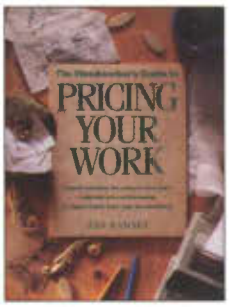


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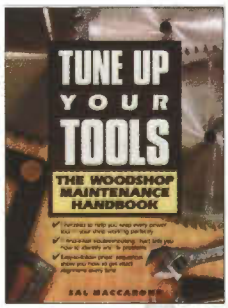


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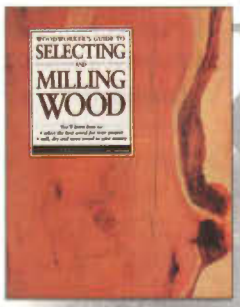


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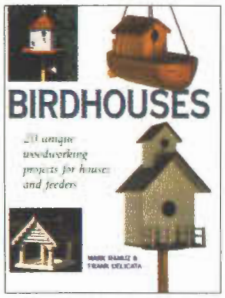


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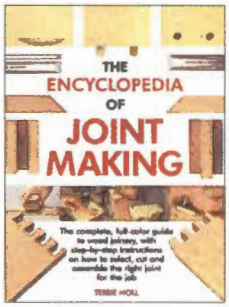


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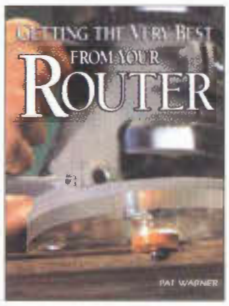


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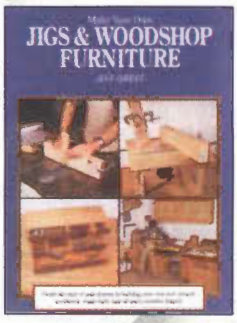


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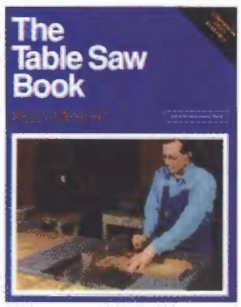


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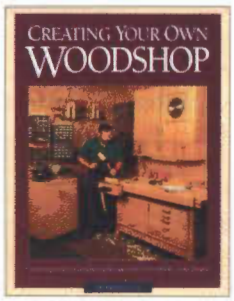


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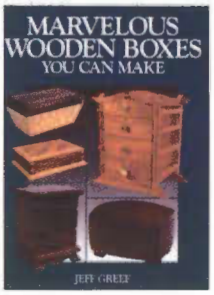


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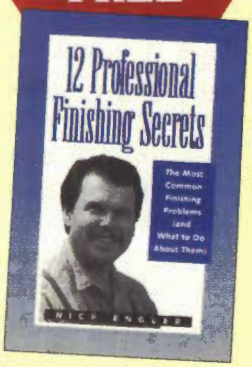


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ONE OF THE MOST INTRIGUING experiences in woodworking is watching a rough board emerge from a thickness planer. Magically, the true character of the wood's surface is revealed **(photo 1)**. The same can be said for seeing a piece of rectangular stock emerge as an intricate moulding profile.

There was a time when home-shop woodworkers who needed to smooth a number of boards would truck them to a local lumber yard where an employee ran them through a monster machine for a fee — negating the bargain of buying lumber in the rough. We yearned for the day we would be able to transform rough lumber into finished stock in our own shop. And the concept of making our own moulding simply was unthinkable.

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While operating this machine doesn't require expertise, there are essential rules to follow to ensure quality results.

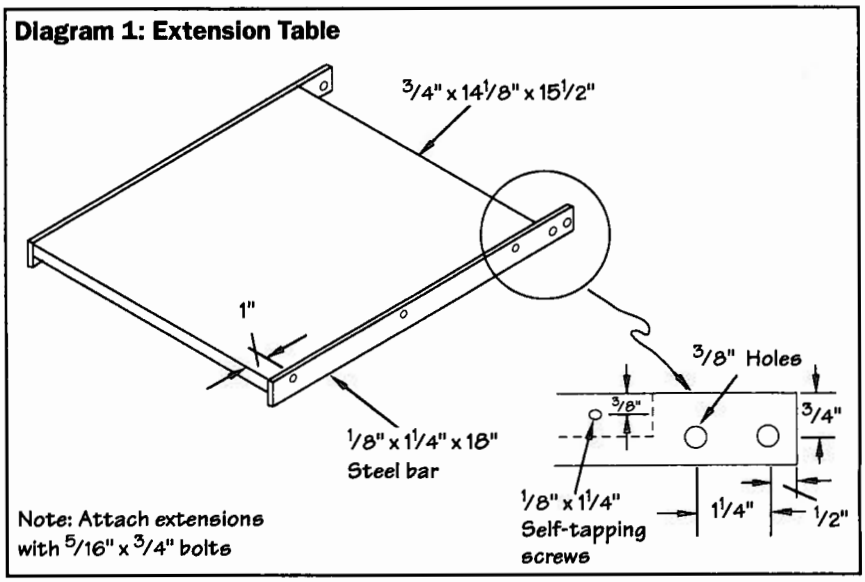
## Planing

Planing refers to smoothing a board or reducing its thickness while producing a plane that is parallel to the opposite surface. The board is moved smoothly into the infeed end of the machine until it is gripped by a feed roller that auto-

*Continued on page 20*

**1 It's "hands off" as soon as the work makes contact with the infeed roller. The machine takes over, moving the work from start to finish. It's important that the tool be equipped with extension tables both fore and aft to avoid planer troubles such as "snipe."**

**Diagram 1: Extension Table**



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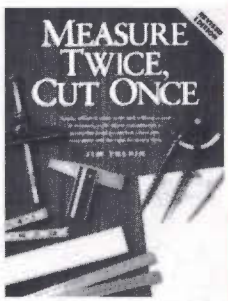


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*Fine Woodworking Magazine test Oct. 96 page 43*

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*Continued from page 18*

## Moulder/Planers At A Glance

| COMPANY | JET | SEARS | RBI | WOOD-MASTER | WM. & HUSSEY | BELSAW |
|---|---|---|---|---|---|---|
| MODEL# | JPM-13 | 23383N | 812 | 712 | W7 | 985-5 |
| HP | 1½ | 2½* | 2 | 5 | 2 | 5 |
| CUTTER RPM | 4,500 | 4,500 | 5,500 | 4,200 | 7,000 | 4,200 |
| SPEED (FPM) | 10/20 | 13/26 | 11 | 0-16 | 15 | 12/20 |
| # OF KNIVES | 3 | 3 | 2 | 3 | 2 | 3 |
| WIDTH CAP | 13" | 12½" | 12¼" | 12¼" | 7" | 12⅜" |
| THICKNESS CAP. | 6⅛" | 5" | 8" | 6¾" | 8" | 6¼" |
| RETAIL PRICE | $789 | $679 | $949 | $1,353 LIST | $1,819 LIST | $1,579 |
| CONTACT # | 800-274-6842 | 800-377-7414 | 800-487-2623 | 800-821-6651 | 800-258-1380 | 800-468-4449 |

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matically moves it past the cutterhead where a second roller helps move the work and to keep it flat on the planer bed. Always feed stock so the knives are shaving with the grain of the wood. Grain direction might not be obvious when working with rough wood, but you can usually determine it by making a slight rip cut along the edge of the board.

All thickness planers have limits to the depth they can cut. On the Jet, a ⅛" cut is allowable on stock that is narrower than 5½", but 1/16" is the maximum cut on wider stock. In all cases, you get the

*Continued on page 22*

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DC-650 Dust Collector
$15
Rebate

JJ-6CSX Jointer
$20
Rebate


JWP-12 Planer
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Rebate

JTAS-10 Left or Right XACTA Saw
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JDP-17MF Drill Press
$20
Rebate

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*Continued from page 20*

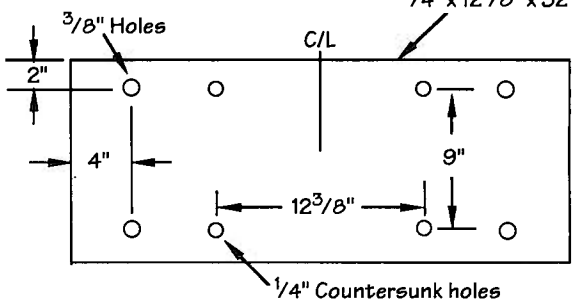
best results by making a few light cuts rather than a single heavy one. Your board must not be shorter than 14" or less than 1/2" thick. We'll talk a little later about ways to get around these restrictions.

Keeping the board flat throughout the pass is very important. "Snipe" — a thickness planer bugaboo that is actually a slight depression on either end of a planed board — is usually caused by failing to support the work on a true plane throughout the pass. Snipe can occur, for example, when the weight of a board entering or leaving the planer tilts the board up into the cutterhead so more wood is removed at the end of the pass.

That's one reason that extending the length of your planer bed is a must. Accessory extension tables are available, as are free-standing roller stands. I made my own extension table shown in **diagram 1**. If you duplicate the idea, have the steel bars bolted in position and secure a long board on the planer bed by raising the table so the feed rollers grip the board. Then clamp the extension to the board before installing the self-tapping screws. Lock each extension with four bolts. If you remove one bolt from each side and loosen the others, the extensions can fold down for storage **(photo 2)**.

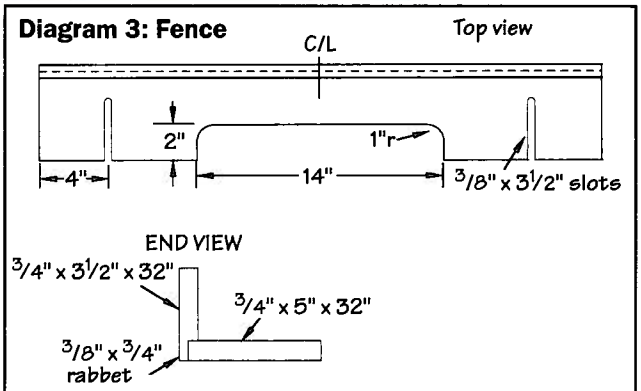
**2** **The extension tables pivot down to minimize storage space. I made my tables with medium density fiberboard. It's a good idea to seal all edges and surfaces before installing the pieces. Keep them bright and smooth with an occasional application of paste wax.**

**Diagram 2: Bedboard**



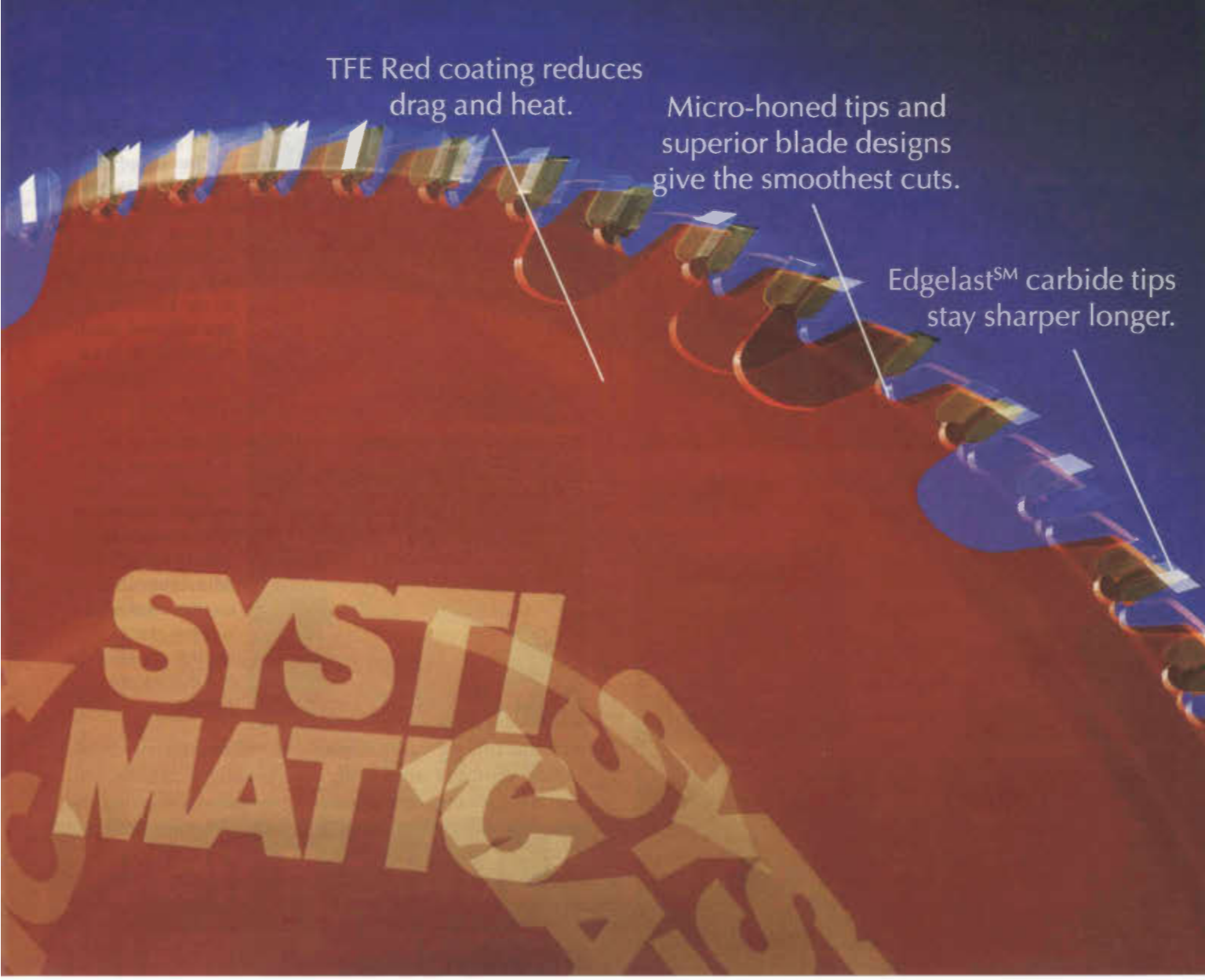

**3** **Tall fences keep the work vertical when planing edges and when using moulding knives to form glue joints or tongue-and-groove joints. The jig adjusts to accommodate various stock thicknesses.**

**Diagram 3: Fence**




You need a "bedboard" that's secured to the planer bed for moulding operations. If you design it like the one shown in **diagram 2**, it also will serve as a base for attaching jigs that add convenience and accuracy to particular op-

*Continued on page 24*

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## CRIS CUTS

*Continued from page 22*

**4** **A gauge is furnished so moulding knives, which come in sets of three, can be correctly aligned. Allow the machine to run down for a few minutes when you're done, then check all the locking screws.**

**5** **Strips to be moulded must be guided to move straight and in line with the knives. The jig I made is adjustable so it can be used with various stock widths. Be sure the guides are parallel.**

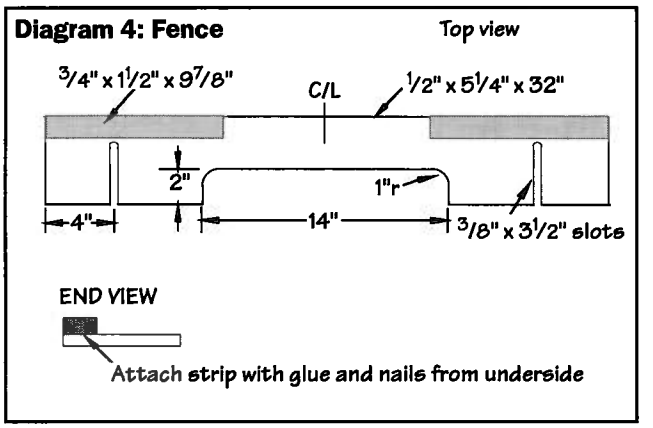
erations. One jig shown in **photo 3**, ensures the boards will be held vertically when doing edge-planing or jointing. This also is the set-up to use when using moulding knives to form glue joints or tongue-and-groove joints. The reason for not gluing the upright — or fence — to the jig's base **(see diagram 3)** is so you can supply a fence of a different height if you need one.

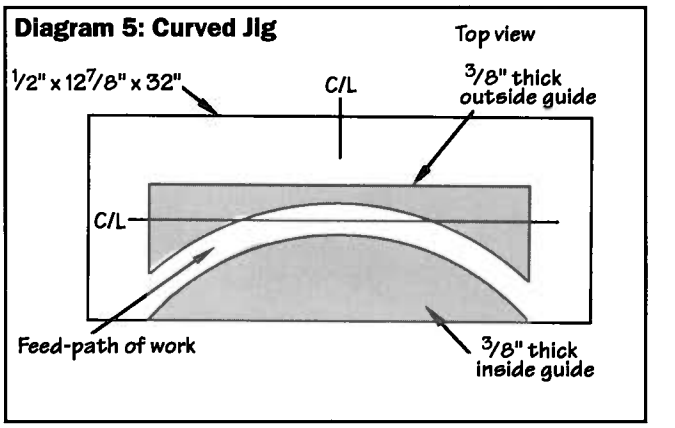
### Moulding

Moulding knives are available in shapes ranging from quarter-round to crown moulding. Large ones are installed in place of the planer knives, but ones that are 2" or less in width can be used without removing the planer knives in the Jet. The moulding knives, in sets of three, must be aligned in the cutterhead. To ensure this, a gauge, which is shown in **photo 4**, is furnished. With one knife in place, the others are installed so they barely touch the gauge when the cutterhead is turned by hand. Incidentally, this is one area of woodworking where you should wear tight-fitting gloves. Planer and moulding knives are sharp.

Wood to be moulded must be aligned with the knives and guided in a straight line throughout the pass. One way to ensure this is to form a tunnel by clamping parallel strips of wood to the bedboard. A better way is to make an adjustable jig that will accommodate different widths **(see photo 5 and diagram 4)**. In some cases, depending on the size and style of the knives, the feed rollers have to be lowered. Because this is covered in the manuals, there's little point in repeating it here.

It's always a good idea, especially when working with a new knife set-up, to make a trial cut on scrap material. And, as always, you get better results by making several light cuts.




## Curved Moulding

It might seem strange to think you can produce curved moulding with a planer, yet it's a practical application. The possible radius of the curve depends somewhat on the size of the machine, but you'll find that smaller radii are more limited than large. The procedure is fairly simple but calls for a precise jig setup like the one shown in **diagram 5**. "Inside" and "outside" guides that suit the exact curve of the work are secured to a base that in turn is clamped to the bedboard so the intersecting centerlines of the jig and moulding knives are exactly aligned. This can be established visually by making the set-up with the dust hood temporarily removed.

Once you are organized, feed the work through the jig just as you would a piece of straight stock. One thing is certain: If you can't move the work smoothly through the guides by hand, don't expect the machine to do it.

## Other Techniques (diagram 6)

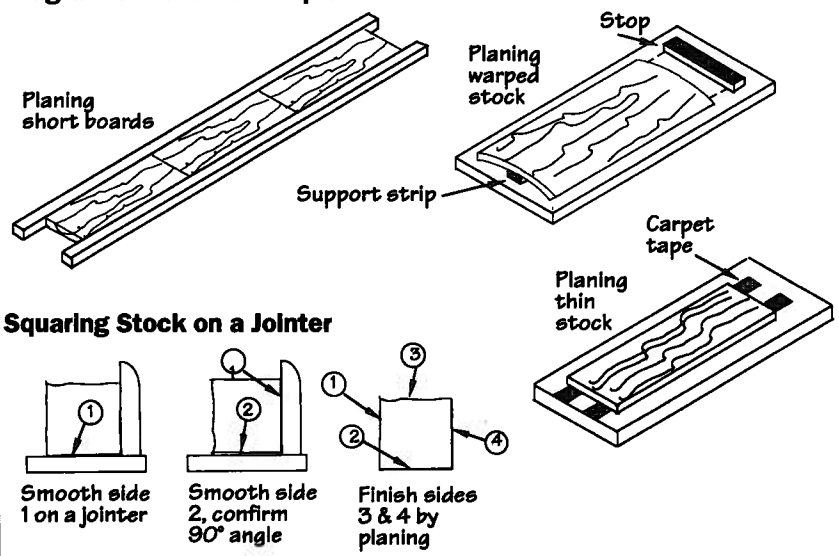
Boards that are too short to be fed through the planer can be butted end-to-end with other boards so they can be processed like they were a single piece. A fellow woodworker connects the boards by gluing them — not a joint I would recommend, but it serves the purpose. After he planes them, he snaps the boards apart or cuts them on the glue line.

Feed rollers flatten warped stock

*Continued on page 26*

*Continued from page 25*

**Diagram 6: Other Techniques**




as it goes through the planer, but because of wood's inherent springback, the warp will return when the pass is complete. Narrow thick pieces might resist the temporary flattening, but not wide ones. One way to get around this is to flatten the convex surface on a jointer so you'll have a flat face to put down on the planer bed. Another system involves placing the warped board on a larger flat board, with shims under the warp. This will remove warp, but with considerable loss to the thickness of your wood. So face it, extreme warp cannot be cured. It's better to rip the board into several pieces, each of which can be planed and then reassembled with glue.

To square stock precisely, it's best to smooth two adjacent sides on a jointer and then finish on the planer.

Planing stock thinner than the machine normally allows can be accomplished by securing the work to a thicker board and passing them together through the planer. Carpet tape has enough bond to keep the pieces together. If you have a lot of these thin boards to plane, it might be worth your while to "veneer" your larger support board with 150-grit (or coarser) sandpaper. **PW**

***R.J. DeCristoforo** is the author of more than 30 how-to books including* Jigs, Fixtures and Shop Accessories *(McGraw-Hill) and is a member of* Popular Woodworking*'s editorial advisory board.*

# The 10 BEST Tricks from our first 100 ISSUES

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**Each issue of *Popular Woodworking* offers tips and tricks for the home woodworker that we've accumulated from readers, contributors and from our own workshop and woodworking experiences.**

**We want to encourage the free exchange of these time-saving and safety ideas for all woodworkers. If you have a good trick, we'd love to hear about it. Send your trick, whether it's one your father taught you or one you came up with on your own, to *Popular Woodworking*, Tricks of the Trade, 1507 Dana Ave., Cincinnati, OH 45207.**

NOVEMBER 1992

## Sandpaper Alignment Aid

How many times do you stick and peel the hook-and-loop sandpaper to align the holes? If they're not properly aligned, you defeat the dust extraction system. After a bit of frustration, I devised this tool. Lay out the hole pattern using a sanding disk for your model, and size the dowels to fit into the holes in the pad your sander.

*Anthony Anello*
*Buffalo, New York*

MAY 1994

## Filling Small Gaps

I've heard many times it's a good idea to keep a little sawdust from each project you make. If the project is damaged in the future and needs wood filler, there is nothing better than making your own from the original sawdust. Mixing sawdust with glue works well for filling small imperfections and gaps. Recently I mixed sawdust with varnish, and the results were even better.

*Bill Buckwelder*
*Horseheads, New York*

MAY 1995

## Handy Drill Storage

I don't know about other woodworkers, but I really appreciate having my drills, both corded and cordless, near at hand and ready to use. I solved this by mounting a ready-made scabbard on the wall right over my bench where most of the use takes place.

*Albert Beale*
*Littleriver, California*

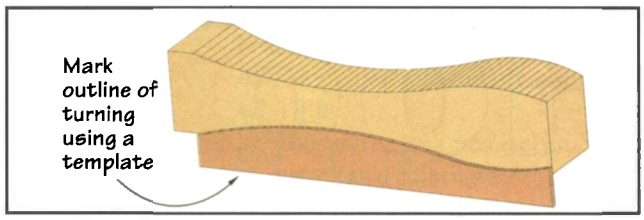
*Continued on page 28*

## TRICKS OF THE TRADE

*Continued from page 27*

JULY 1989

### The "Ghost" in Your Lathe

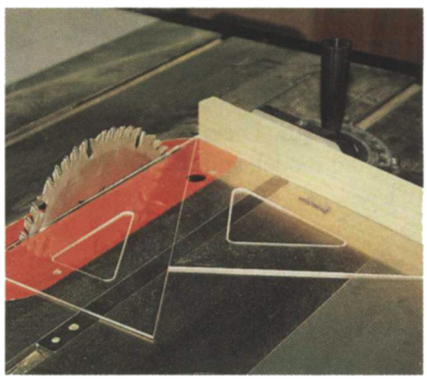



Here's a great way to make duplicate parts on the lathe. Lay out the pattern on two perpendicular sides of each piece. Carefully band saw to the pattern lines on one side and then tape the sawn pieces back onto the stock with masking tape, so you can cut out the pattern on the other side. Discard the waste and mount the stock on the lathe. When the wood is spinning, the outline of the pattern will show up as a "ghost" line against the squareness of the stock. Carefully turn the pattern. This works best on thicker spindles, but it can be used on any diameter.

*Don Kinnaman*
*Phoenix, Arizona*

NOVEMBER 1996

### Drafted For Accuracy



To set up the miter gauge on your table saw to exactly 15, 30, 45 and 60 degrees, first purchase two drafting triangles, one 12", 45/90 degrees, and one 14", 30/60 degrees. They're available at most large office supply stores. With one edge of the triangle against the miter gauge, and the other lined up along the miter gauge groove (parallel to the saw blade, of course), you can use these to double check and fine tune the desired angle. To get the 15 degrees setting, you need to use both triangles side by side. These triangles are also handy for checking blade tilt angles, including 90 degrees.

*Joseph G. Zweck*
*Madison, Wisconsin*

MARCH 1995

### Dado Gauge

A stack-type dado blade can be time consuming to set up each time a particular width dado is needed. To solve this, I keep a strip of hardwood hanging near my saw. Each time I set up my dado blades for a different width, I make a shallow dado cut on this strip. I then record the number of chippers and any shims used for each dado cut. The strip provides a handy future reference.

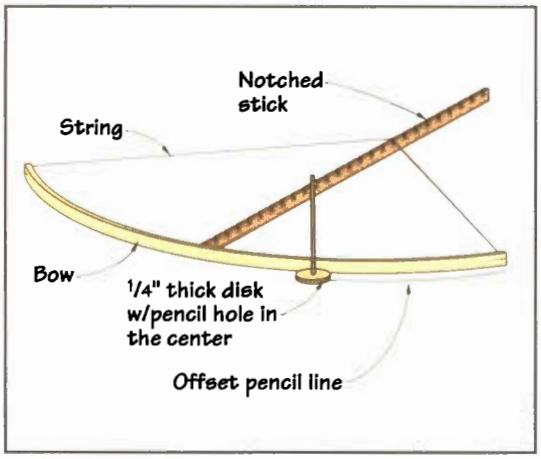
*Daniel Cassidy*
*Medway, Maine*

MAY 1996

## Wascally Rabbets!

Rabbets and moulded edges like those used for picture frames are difficult to cut safely and accurately on small frames for pictures or photographs when using a router. I make moulded frame sides without trouble if I do the router work on the edge of a wide board, then cut that piece off on the table saw. Then I repeat my router cut on the new edge and so on until I have enough pieces for my frames. This wide board gives me a good bearing surface for the base of the router so I can cut the rabbet from one side and my moulding from the other without fear of the router wobbling and spoiling the wood.

*John Clarke*
*Venice, Florida*




JANUARY 1992

## Laying Out Large Curves and Arcs

This simple jig results in a sharp, clean layout line when drawing large curves and arcs. It consists of two parts that I call the "bow" and the adjustment "arrow." The bow is made from stock 3/16" to 1/4" thick and 3/4" wide. The length can vary depending on the size of the curve needed. The one I use the most is 32" long. Cut a thin slot in each end, run nylon string between the notches, and secure it with a knot at each end. Make the 12" to 14" long adjustment arrow from 3/8" x 3/4" stock. Narrow one end of the arrow, and cut slots every 1/2" to permit different curvatures of the bow. To use the device, place the arrow in the bow with the string in a notch that bends the bow into the curve you want. Note that by changing the position of the arrow in relation to the center of the bow, different shapes can be created.

Here's another simple device you can make if you want to draw a curve exactly parallel to a curve drawn with the "bow and arrow" jig. Simply turn a 1/4" thick disk with a radius equal to the distance you want between the two parallel curves. Drill a hole in the center just big enough to accommodate a pencil tip. With the pencil inserted, hold the disk against the bow and allow it to turn as you move it. The line will be parallel to the curve of the bow.

*Robert Colpetzer*
*Clinton, Tennessee*

*Continued on page 30*

*Continued from page 29*

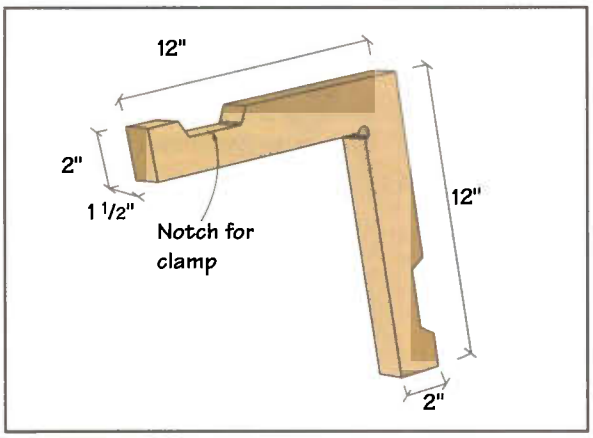
JANUARY 1990

## Scrap Wood Framing Clamp

All shops accumulate large amounts of plywood, often in hardwoods such as birch, ash, oak, etc. We often don't want to throw out even 10" to 12" square chunks because we might have a need for them later. Here is your need for them right now.

This is a corner clamping aid to be used with C-clamps, hand screws or bar clamps. These aids are designed to "squeeze in the corners" of bookcases, picture frames, or other hard-to-clamp projects. The hole on the inside corner permits the perfect fit of a 90-degree mitered joint, and prevents any oozing glue from sticking to the aid.

The notches on the top and side are for positioning C-clamps for a tight fit, or they can be used with bar clamps to pull the corners on each end toward each other. Make these aids from two or three thicknesses of 3/4" plywood for extra strength. The measurements shown here are not critical; make them to suit your own needs.




*Don Kinnaman*
*Phoenix, Arizona*

JANUARY 1989

## Routing Oak

While making a display cabinet of oak and glass, I needed to cut 1/2" rabbets in the oak. Despite my sharp router bit, I found myself splintering the oak. To avoid this, I first knocked off the sharp corners of the oak down to a depth equal to the rabbet (1/2") with a 45-degree chamfer cutter. Then I went back over it to cut the rabbet, and got no tear out. **PW**

*Kingsley Hammet*
*Santa Fe, New Mexico*

## CAPTION the CARTOON

RYOBI

*illustrated by Bob Rech*

#28


**Submit your caption(s) for this issue's cartoon on a postcard to *Popular Woodworking*, Cartoon Caption #28, 1507 Dana Ave., Cincinnati, OH 45207 by Dec. 19, 1997. Winning entries will be chosen by the editorial staff.**

**The winner will receive a Ryobi 14.4-volt 3/8" cordless drill/driver. The drill features a Jacobs industrial keyless clutch, a 24-position adjustable clutch and an electric brake. A fan-cooled motor produces high torque — 275 inch pounds. It also comes with two screwdriver bits, a carrying case, two battery packs and a one-hour diagnostic charger.**

**The two runners-up will each win a one-year subscription to *Popular Woodworking*.**


**The winner of our "Caption the Cartoon Contest #26" from the September issue and recipient of the Ryobi drilling system is:**
**Bob Chastain, from Bedford, Texas.**

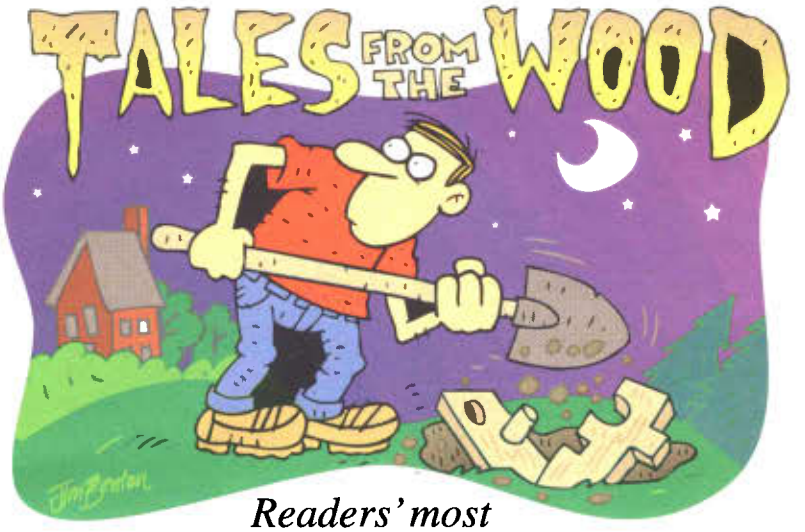
**The runners-up receive a one-year subscription to *Popular Woodworking*:**

**Gary W. Martin, from Hanson, Kentucky, for:**
***"I know how ya feel, I thought it would drill more holes than that, myself."***

**Jim Gorman, from Thousand Oaks, California, for:**
***"No, it's OK... It says right here it's reversible."***

#26


***"It still doesn't have as many holes as the current tax bill."***




*Readers' most amazing stories from their workshops.*

## WINNER!

## It's Perfect — Except For One Small Detail

One day my wonderful wife remarked, "What we need is a side table with a divider." For 35 years we had spent late evening hours sitting side-by-side in our loungers, surrounded by books: oversized books, an atlas and photo albums that needed organization. So I built a 20" x 22" x 24" side table with two levels for books. The bottom shelf was flush to the bottom of the legs and had a "pass-thru" to house huge tomes, while the upper shelf was divided for personal effects. Because we vacuum and clean the carpets frequently, I made the bottom of the table as slick as the polyurethaned top. This gave the table stability and made it easier to slide. (No wheels for me!) I patterned the top to match the arms of the chairs.

After a week's work, I placed the finished product on end for my wife's inspection. Her reaction: "It's perfect!" Then she tipped the table upside-down, slid it into place and filled it with our largess.

Oh well! It looks fine. "Bottoms up," as they say in English pubs.

*Louis J. Finkle*
*Surfside Beach, South Carolina*

## Share Your Story & Win!

**Turn your favorite tale from the woodshop into a $150 gift certificate from Lee Valley Tools in *Popular Woodworking*'s "Tales From the Wood" contest. We're looking for your funniest, most embarrassing or incredible story. And if we can learn something from your yarn — even better.**

**Each issue, our editors choose the best tale and print it here. Runners-up receive a Veritas Sliding Square (shown at right) from Lee Valley Tools, the catalog company that features an impressive array of quality woodworking tools, supplies and accessories. One final rule: Please, no stories about people getting hurt. That's not funny.**

**To make things easier, you don't even have to write your story down. Just call our hotline anytime at (513) 531-2690 ext. 587 and leave your tale and daytime phone number. Or you can e-mail your story to us at popwood@earthlink.net or mail it to: Tales From the Wood • Popular Woodworking • 1507 Dana Ave. • Cincinnati, Ohio 45207**

## Where Do You Hide A Roll-Top Desk?

A few years ago I decided to surprise my wife by building her something she had always wanted: A roll-top desk. After working on it for two months she still didn't know about it, despite the piles of sawdust.

One Saturday I was cleaning up the shop when my wife came waltzing into the shop with some cookies straight from the oven for me. I stood directly in front of her because if she looked over my shoulder, she would see the incomplete desk and the surprise would be ruined. As I ate the first cookie, I shuffled in a circle, gently guiding her to follow. As we talked, I started moving her toward the doorway. Eventually she sensed this and asked if I wanted her to leave. I said yes, and she went back to the house with small puffs of smoke coming out of her ears. Luckily she soon forgot about the incident.

Every Christmas Eve we open one gift each. I asked my wife if she wanted her big gift or her little one. She said the big one. She was so surprised she could not believe her eyes. Then we had a big laugh about the cookie incident.

*Tom Verity*
*Pensacola, Florida*

## When Your Joints are *Too* Flush

Sometimes you just can't anticipate how a project is going to turn out. A few years back I made a cherry toy box for my two children. The top was made from four pieces of solid cherry and was perfectly flush with the box's sides.

Too flush, in fact. To my dismay I quickly discovered that my children were unable to open the box. They had nothing to hold on to. A knob or handle would have been easy to add, but it would have detracted from the appearance of the box.

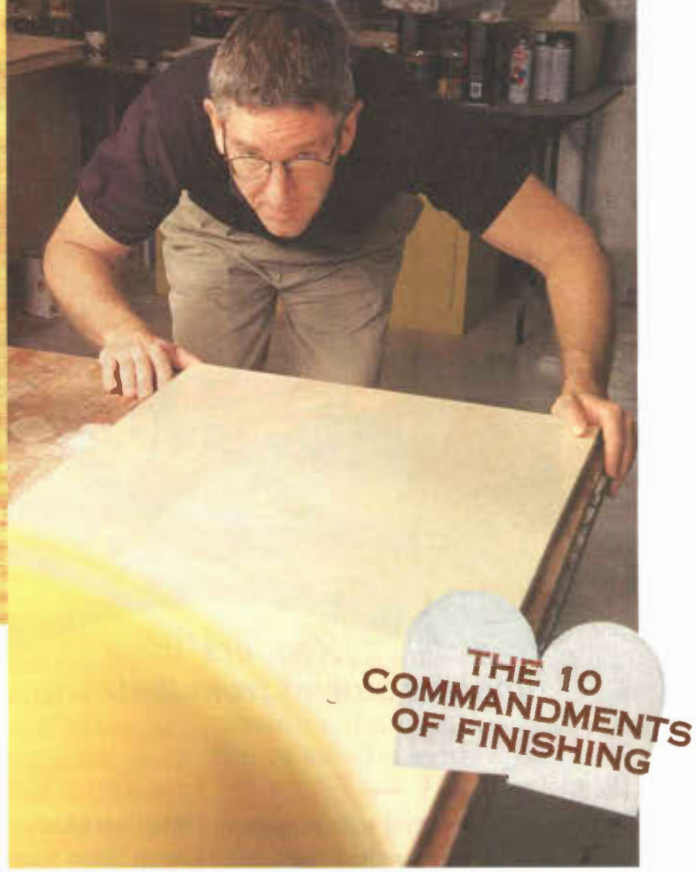
So I took the top off. Then I ripped it back into four pieces and reglued the top, adding several strips of 1/8" walnut and maple between the cherry boards. This gave the toy box a 3/8" overlap on the front: perfect for the children, and it gave a striking appearance to the finished project.

*Paul E. Hurwitz*
*Rockville, Maryland*

# WOOD Preparation:

## Thou shalt make it easier on thyself

*The second in our series on finishing shows you the best way to handle an unpleasant (but essential) job.*




**Getting your wood ready to finish is perhaps the most important step to a beautiful finish. Here I'm examining a board for dings, scratches and gouges by looking at it from a low angle. The light fixture in the bottom left corner of the photo really makes these defects jump out.**

WHEN DOES THE finishing process begin? After the project is fully assembled? Wrong. When you presand the parts before assembly? Wrong again. Actually, the time to start the finishing process is before you even begin. Your finishes will improve and you'll get immediate results when you consider two important factors:

- **Wood Selection —** When you plan to color your project with stain or dye, choose wood species that don't blotch. (I'll cover this topic in the next installment.) Once you select a wood type, match as closely as possible the color of those boards that line up side by side.
- **Finish Selection —** Will your project get an all-paint finish; a natural, stained or colored finish; and will the final finish be oil or some type of clear top coat such as polyurethane, shellac, varnish or lacquer?

These factors, along with preparing the surface before applying any finish, are the important first steps in the finishing process.

### Finish No Wood Before It's Time

Because our first commandment for finishing involves wood preparation, it's time to have an attitude check. Much of wood preparation is sanding, and we can agree that sanding is near univetsally hated. It's boring, it's tedious and if there's more then 20 minutes worth, it's hard work.

The good news is you're probably working too hard at sanding, and there's a good chance your next sanding job might get easier if you just read on.

First, let's look at what we want to accomplish during wood preparation. This includes removing dents, gouges and errant dried glue, removing washboard marks left from planing or jointing the wood, fixing router bit burn marks, and sanding to prepare the surface to accept the finish.

It's important to eliminate these imperfections. The eye is drawn to dips, dents, dings and gouges — those flaws that otherwise break an uninterrupted flat surface. A good finish requires as flat and smooth a surface as possible.

### How to Eliminate Flaws

Let me say straight out that there is more than one way to go about all this, and there are sure to be some who don't entirely agree with my methods. It's a case of what works for you; but believe me, what I recommend *will* work for you, and it is entirely practical and efficient.

Here's how I do it: It's best to rid your materials of mill marks, those tiny bumps or lines caused by machinery, before you assemble your projects. Do this with the material flat on your bench, working on it at a convenient height.

Eliminate them by sanding or using a scraper. If you are among the initiated who know how to sharpen or put an edge on these tools, use them. But if you are among the 19 out of 20 woodworkers who don't, you'll be sanding those miniature peaks and valleys flat. We'll get into sanding a little later; but the point is, get rid of the machining marks while it's easy on you, before assembly. Like so much in woodworking, always think ahead!

Dents and gouges can happen during the building process. A dent — a depression where no wood fiber is broken or lost — can be easily fixed if not too severe using a hot iron and damp rag. A gouge, on the other hand, consists of torn or missing fibers and is a larger problem. If superficial, say less than 1/64", you can sand (or scrape) it out. If deeper, you'll need to use some sort of filler.

Using filler is a compromise because you rarely match the color of the wood. The other problem, of course, is that stain never takes to putty in the same way it is absorbed by the wood. When applying filler, always use a putty knife


Some of the products you can use to fill small holes.

## How to Fill Small Holes

For small filling jobs, like a set nail, it's often best to wait until the finish job is complete and then use a wax crayon (even your child's crayons can do the job in a pinch). At this stage you know what the final wood color is so the guesswork is taken out of matching the filler color to the wood. Filler used before finishing not only fills the gouge or hole, it also fills the grain surrounding the gouge. So if you must use a filler, handle it carefully and apply it only in the opening needing repair.

## Why Dustless?

Aside from the convenience and health benefits of keeping dust out of the air you're breathing, these sanders with dust-collection work more efficiently and increase the life of the sandpaper you use. By extracting the sanding dust from the surface, the sandpaper doesn't load up with dust (when this happens you are sanding the dust, not the wood surface). These machines also vacuum up pieces of broken-off abrasive, which if left behind when you switch to the next finer grit of sandpaper, will impart coarser scratches to the wood surface when the loose grit gets under the the sanding pad. That's one reason to sweep or blow off all the dust from your project when you switch to the next finer grit sandpaper.

## Steaming Out Dents

If there are minor miracles in the world, steaming a dent out of wood is surely one. Here's how to do it. Simply take a clothes iron set to its highest setting, wet a clean rag, place it over the dent and apply the hot iron. Hold it in place for at least 10 seconds to allow the iron to force the steam into the wood fibers below. Chances are you can swell the crushed fibers that made the dent and restore the surface to its original, undented state. If your first attempt doesn't work, try it a second or third time. Fortunately, wood fibers have a memory, and as long as the fibers are intact, they can return to their original state.

and force the material into the opening. And always leave it a little proud of the surface so it can be sanded flush later.

### Get the Glue Out

Even after what you think is a thorough sanding, you might find glue near joints or smeared on a surface after you've started staining or top-coating. First use an ounce of prevention and be careful not to allow glue to get smeared on your work. When it does, clean it up right away with a clean wet rag. And make sure you wash the area completely, not just wipe it off, which could compound the problem by smearing the glue even more.

I've had more than one honest disagreement with other woodworkers about the water and rag clean-up method. I still recommend it, and here's why: If you wait until the glue is dry you risk either tearing out wood fibers when scraping, or just making the sanding harder. If you scrape the glue when it's soft, you fail to remove the partially dry glue that has soaked into the wood. I think those who have not successfully used the water and rag method have simply not been thorough or aggressive enough.

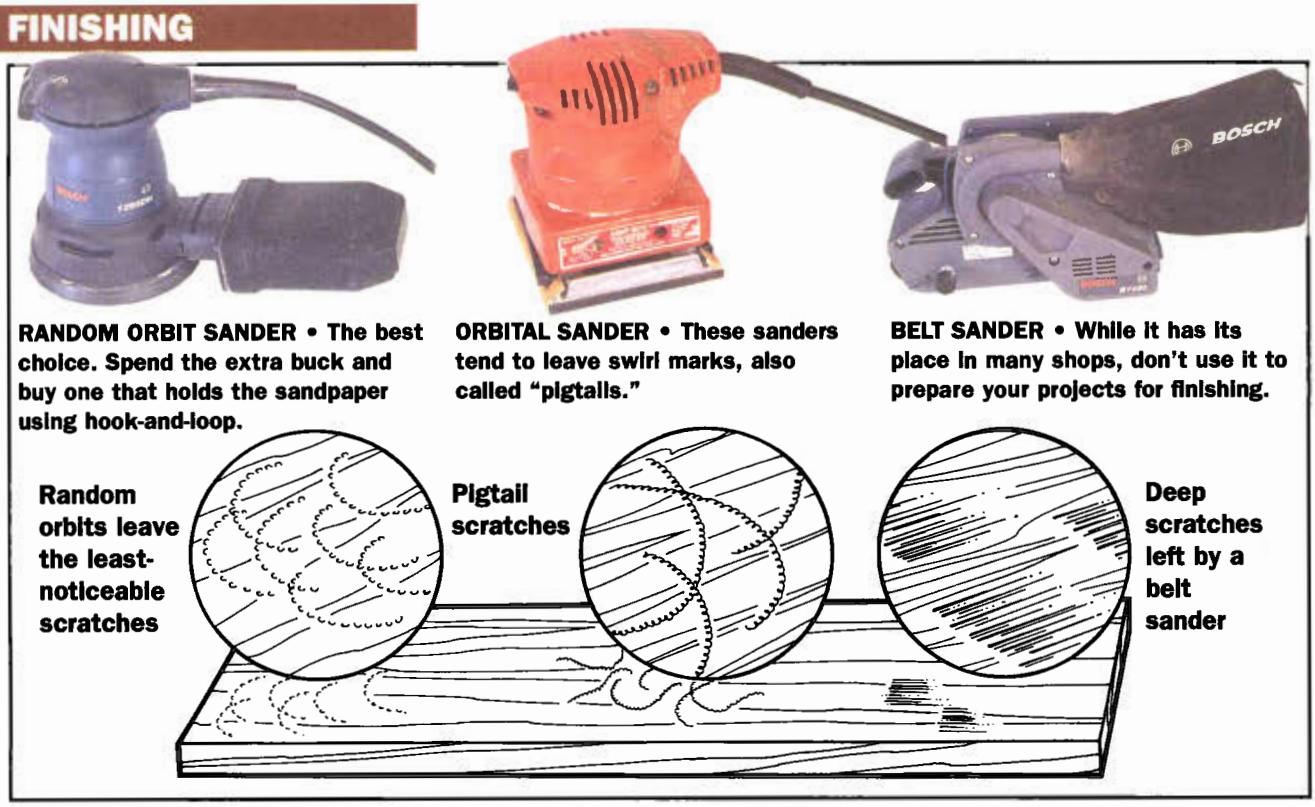
If you put yourself in the sloppy category, or if you just want to make darn sure you haven't left any glue behind, wipe down your entire project with a wet (but not dripping wet) rag before sanding. The water will reconstitute the glue to its pre-dried milky white color, making it easier to find. To locate these problem areas, however, you must carefully inspect the piece a few minutes after the water has been wiped on. After you've identified a spot, dampen more until the glue is soft enough to remove. I like to use a single-edge safety razor blade to scrape off the softened glue. Then clean the area with the wet rag.

### Choosing Hand-Held Sanders

Power sanding machines have made the unwelcome chore of sanding much easier. When used properly, you'll get good results. Of the three common types of sanders, belt, orbital and random orbit, you should choose the latter. Why? Because random orbit sanders are more aggressive and efficient than an orbital sander and they don't leave obvious swirl marks. Also, the random orbit sander is not as aggressive as the belt sander, which is almost always too aggressive and can ruin a project in the blink of an eye.

Belt sanders are great for removing stock quickly doing rough work, but don't use one on a surface that will be finished! That said, there are *some* woodworkers who know how to keep this powerful tool absolutely flat while applying uniform speed and pressure. If you don't like playing fast and loose with your projects, keep your belt sander on the shelf and use it for other work. It's too easy to oversand, leaving what I call a dished, or hollowed-out look.

Orbital sanders tend to leave swirl marks, sometimes called pigtails, in a geometric pattern that call attention to themselves because the pattern of the wood grain is so random. Pigtails create real havoc when applying stain because the stain highlights the scratch pattern in the wood




**RANDOM ORBIT SANDER • The best choice. Spend the extra buck and buy one that holds the sandpaper using hook-and-loop.**

**ORBITAL SANDER • These sanders tend to leave swirl marks, also called "pigtails."**

**BELT SANDER • While it has its place in many shops, don't use it to prepare your projects for finishing.**

and, being darker, sticks out like a sore thumb. If you own an orbital sander and don't feel like trading it for a random orbit machine, check the owner's manual for tips on using it. The speed of the orbit, which can vary greatly from one machine to the next, has a direct relationship with the recommended speed you move the sander over the work. As a general observation, most people move them much too fast. You should always sand with the grain when using an orbital sanding machine.

The movement of the pad on a random orbit sander breaks up the swirl pattern created by the orbital action. The pad rotates free in relation to the orbiting action. And unlike its orbiting cousin, the random orbit can sand in any direction of the grain. When using the random orbit sander, start the machine with it resting on the work to prevent the fast-spinning pad from striking the wood surface. By the way, the opposite is true for the regular orbital sander. Start it first, then place it on the work surface.

Should any of this advice prompt you to shop for a new sander, look at the so-called dustless sanders. They work best when a shop vac and hose can be attached to the sander; bags work less well but are still a big improvement.

### Sandpaper and Sanding

Now that you've removed the mill marks, dents and gouges from your project, and you've wiped it down with a damp rag and inspected it for errant glue smudges, it's finally time to begin sanding. For sanding raw wood, choose garnet (the orange colored abrasive if you can find it) or aluminum oxide, which is usually brown. If you sand by hand, use a sanding block that has a $\frac{1}{4}$" thick piece of cork or felt glued to the bottom. A right-sized block will use a quarter sheet of sandpaper with just enough paper returning up the sides to give you some paper to grip. Whether you sand by hand or machine, start sanding with 100 grit, and increase to 120 and 150. If you are using a finish that forms a film on top, like polyurethane, lacquer, varnish or shellac, stop at 150. If you're using a penetrating oil finish, sand to 180; and if you just love sanding or think the project is really special, go one grit higher and stop. You're done.

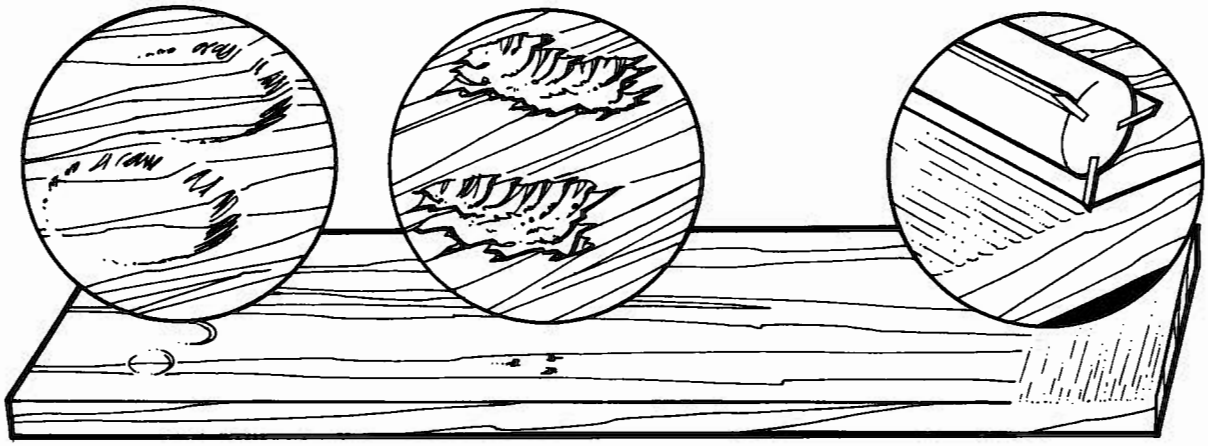
What about raising the grain with water? It's a good idea if your finish plans call for any water-based stains or dyes, or if you are planning a water-based film finish like water-based polyurethane, lacquer or varnish. But just raise the grain slightly with a damp, not wet, rag. If you wet the surface too much, you'll ruin all the good sanding you've already done. If you raise too much grain you must sand too much to knock it down. In effect, you sand through the nice surface you spent so much time preparing. Think of it this way: When you sand off raised grain, it's like shaving off a 5 o'clock shadow, not a two-day growth. Further, when you resand your project after raising the grain, be sure the wood is dry and use the same grit you finished with, or one grit finer.

### Other Ways to Remove Glue

**You can also use solvents such as acetone, xylene and toluene to dissolve glue. These chemicals won't swell or raise the grain of the wood.**

**I've never found raising the wood grain to be that much of a problem, so I stick with the water method. Yet another approach is to simply sand or scrape the area thoroughly. This is a bit of a guessing game because you never know how much sanding or scraping is necessary.**

**Types of Damage to Woods**




You have to pay attention to how you are sanding, especially if you will be staining or coloring the wood. Always sand every area, every piece, the same way. Use the same pressure, the same amount of time, the same pattern with the machine, the same number of passes and lap each pass the same way. Sand every area the same amount. This will provide a consistent surface that the stain or dye will react to in the same way. I'd go so far as to say that I'd rather see a piece sanded consistently but inadequately than one that is sanded thoroughly but inconsistently.

Change sandpaper regularly. Once the sharpness of the abrasive is gone, you're not only wasting your time and energy, but you're sanding inconsistently. I wish I could give you the benchmarks for when to change to fresh sandpaper, but I can't. You'll just have to pay attention and occasionally feel the paper, inspect for bald spots on the sheet where the abrasive material is altogether gone, and get a feel for the action of the machine on the wood.

### How Much Sanding is Enough?

The first sanding with coarse grit should be complete enough to give all the surfaces of the project a uniform abrasion, removing slight imperfections not dealt with in other preparations. Once this first sanding is complete, the sole purpose of all other sandings with progressively finer grits is to remove the coarser scratches left from the previous grit. Just as soon as those coarser scratches are removed, move on to the next finer grit. Sure, it's hard to see the tiny scratch marks, but a careful inspection, especially when aided with a strong light source from a low angle across the surface of the work, will help a lot. In fact, using the light will aid the discovery of all kinds of little problems on the surfaces throughout the whole surface preparation process. If you're past age 50, the raking low-angle light source is an indispensible aid.

It might seem logical to continue sanding beyond the 150 grit to eliminate these scratches, then the 180 grit scratches, the 220 and so on. For all film finishes, the benefit of sanding past the 150 grit stage is almost imperceptible. Further, if your finish plan calls for stain, sanding beyond 150 grit starts to interfere with the stain's ability to be absorbed by the wood surface.

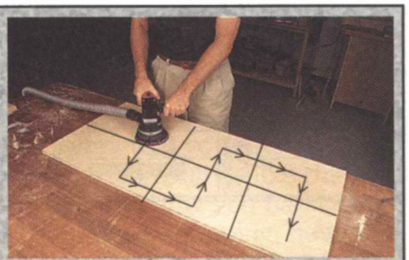
Of course you need to "break" or "ease" the sharp edges of the project as a final step before moving on to applying color or the final clear finish. Do this quickly with 120 grit paper, removing most of the material, then follow up with a fast once-over on the edges only with 150 grit. Again, do this uniformly, taking equal amounts from all edges.

Lastly, begin the coloring and finishing process within a day of your final sanding. If you wait longer, resand with the last grit you ended with. This is because humidity in the air will raise the grain slightly. Freshly sanded fibers take stain more consistently.

Thorough preparation will make the application of color and clear finish easier and result in a greatly enhanced finish appearance. The best way to make the chore easier is to make a real effort to do "clean" work throughout the cutting and assembly process. Treat your parts gently, be neat with glue clean-up, fit adjoining pieces so they don't require a lot of work sanding them flush. These are work habits that make less work for you in the end. And remember, don't oversand, and don't skip sanding steps. The right amount is just enough, which may very well be less than you've been sanding in the past. **PW**

*—Steve Shanesy, PW staff*

## Sanding Large Surfaces

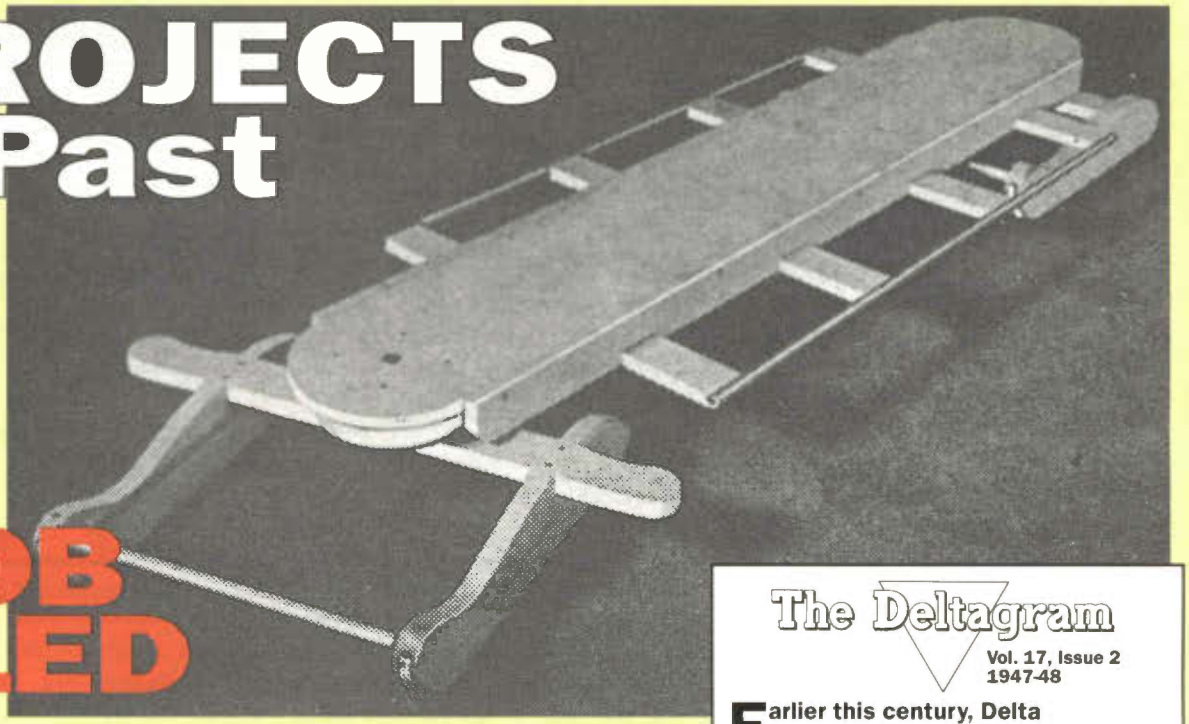


To help you sand a large surface consistently, like a table top, create a kind of grid pattern in your mind for the piece. Sand one square grid section, then move to the adjacent square, then the next, etc. Then move to the next row of squares until the large piece is complete.

# PROJECTS *from the* Past

**This issue's project**

## EASY TO BUILD BOB SLED



THE ENTIRE SLED is built from hardwood such as maple or oak. The body of the sled is braced with edge frames and cross frames, which also act as foot rails and hand rail supports.

Cut the runners from 1 1/8" stock. Band saw to shape and then cut the "V" in the underside of each to receive the 1/2" steel round stock. Runners are drilled near the ends and held in the "V" grooves with round head wood screws. The rear runners are screwed to the underside of the rear ends of the sides. The front runners are pivoted on the 6" carriage bolt as shown in the drawing. The front ends of the runners are kept rigid by a hardwood dowel glued through the front end of the runners and locked with screws from the top.

The sled is guided by the foot pedals and a rope passed through the holes in the front runners. Seal all lumber with shellac or polyurethane and paint sled to suit. **PW**

### The Deltagram

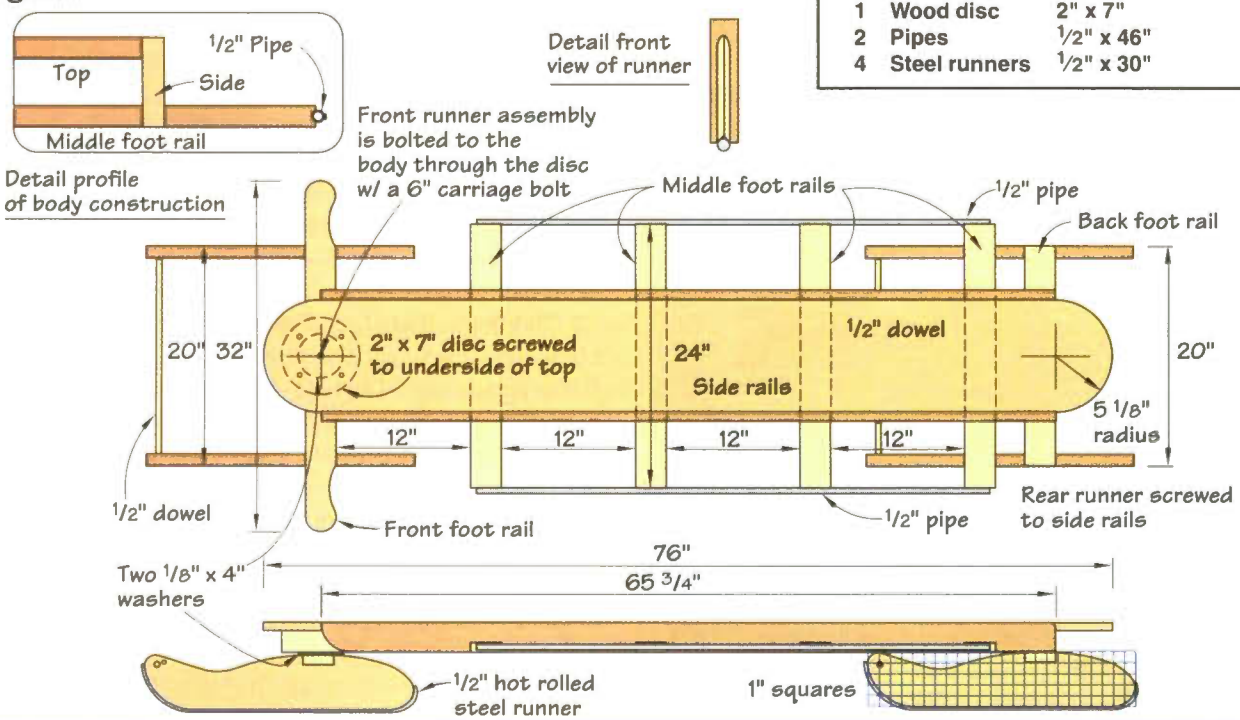
Vol. 17, Issue 2
1947-48

**Earlier this century, Delta Machinery published a magazine filled with woodworking projects. These magazines are more than nostalgia — the plans are still darn good! In the interest of history, we're happy to offer this issue's project from yesteryear. — PW**

**Bill of Materials**

| | | |
|---|---|---|
| 4 | Runners | 1 1/8" x 5" x 24" |
| 1 | Frnt. foot rail | 1 1/8" x 2 3/4" x 32" |
| 1 | Back foot rail | 1 1/8" x 2 3/4" x 20" |
| 2 | Dowels | 3/4" x 20 1/2" |
| 1 | Top | 3/4" x 10 1/4" x 76" |
| 2 | Side rails | 7/8" x 2 3/4" x 65 3/4" |
| 4 | Mddl. foot rails | 7/8" x 2 3/4" x 24" |
| 1 | Wood disc | 2" x 7" |
| 2 | Pipes | 1/2" x 46" |
| 4 | Steel runners | 1/2" x 30" |

**Diagrams**



**$50 REBATE**
*Deluxe Edition 14" Band Saw* with enclosed stand, includes mobile base, 18" Rip Fence and Cool Blocks™ Model #28-280Z

**$50 REBATE**
Delta Sanding Center® Belt/Disc Sander. Model #31-280

**$50 REBATE**
*Deluxe Edition Contractor's Saw®* with 30" Unifence®, includes table board and legs, cast iron wing and 50-tooth combination blade. Model #34-445Z

**$50 REBATE**
15" Planer with free stand and extension wings. Model #22-675Y

**$50 REBATE**
Delta Q-3 18" Variable Speed Scroll Saw. Model #40-650

**$50 REBATE**
Delta Contractor's® Saw with Jet-Lock® Fence Model #34-444
*(10" Contractor's Saw® II is not part of rebate offer.)*

# The check's in the mail.


Every tool you see here comes with a $50 check in the mail from Delta. Opportunities like this don't come along every day. So if you've been wishing you had Delta Quality in your shop–you might want to get shopping, now. (August 1 through December 31, 1997.) You'll also find that we've snuck in a few extras on our 15" Planer and the Deluxe Editions of the Contractor's Saw and 14" Band Saw. Machines that will still be proving their worth for years to come. Call for the name of your nearest participating Delta dealer. Delta International Machinery Corp., 800-438-2486. www.deltawoodworking.com

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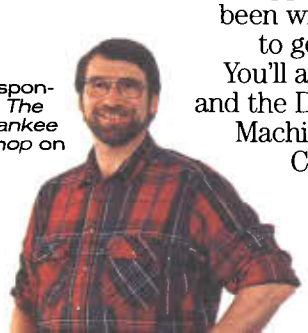


Circle #114 on Resource Directory Coupon

# Doll Dinette PUZZLE

This might be the only dinette set in the world you really can make in a weekend. Not only is this an interesting puzzle, it's also servicable doll furniture.

**STEP ONE:** Start with a 1½" x 1¾" x 4" block of scrap wood and cut out the inside piece of the large table on your band saw. Be sure to leave a small lip on the bottom legs of the table to hold the other pieces of the puzzle in place. Put the table aside.

**STEP TWO:** Cut the interior block into two chair-shaped pieces as shown in the diagram below.

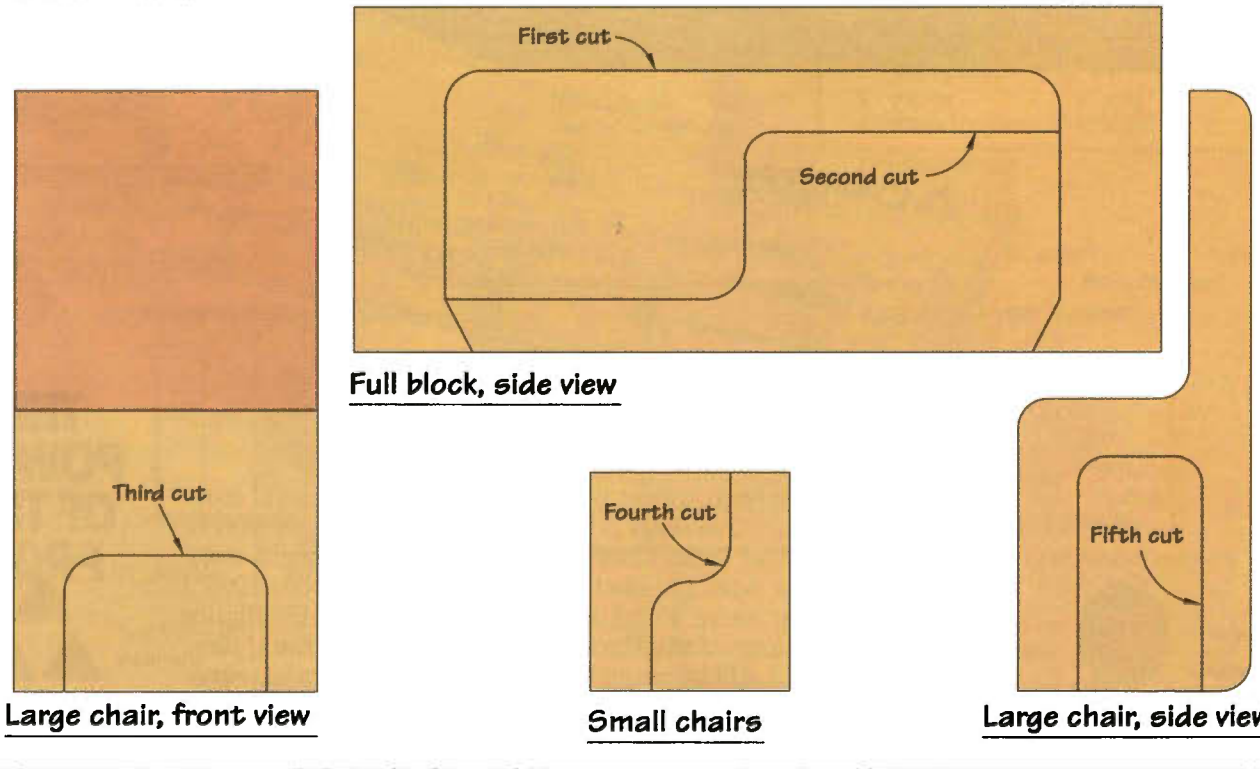
**STEP THREE:** The two smaller sets of chairs are cut from the larger chairs. On each chair, cut a small block below the seat that runs from the front to the back of each chair. Cut that block into two chairs. Then set the chairs aside.

**STEP FOUR:** On each large chair cut out a larger block from below the seat that runs from side-to-side. These make the smaller tables.

**STEP FIVE:** Sand as needed and break the edges to remove splinters. Finish as desired.

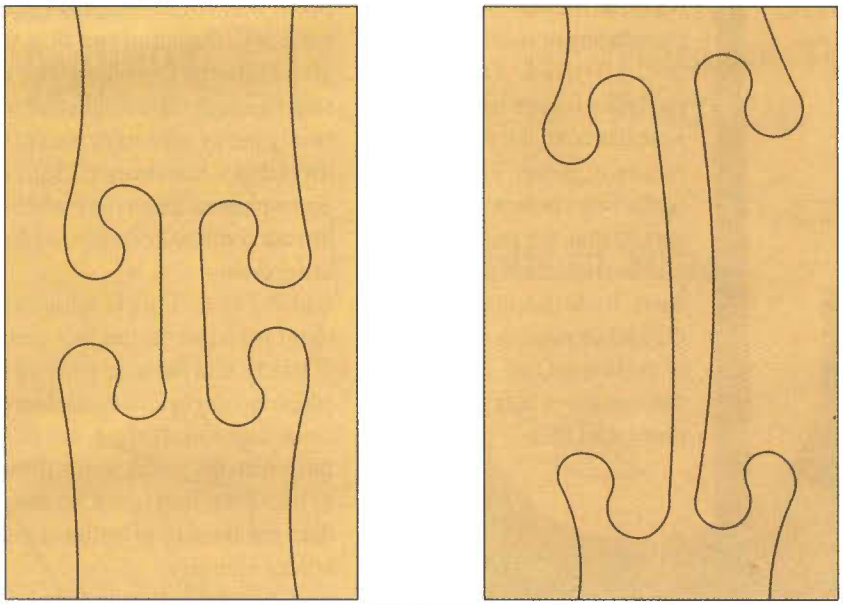
*—Edward Coombs*

**Full-Size Diagram**



# Grandpa's WONDER PUZZLE

**Full-Size Diagram**



People love to receive puzzles as gifts. I've made this box for years, and it never fails to delight the recipients.

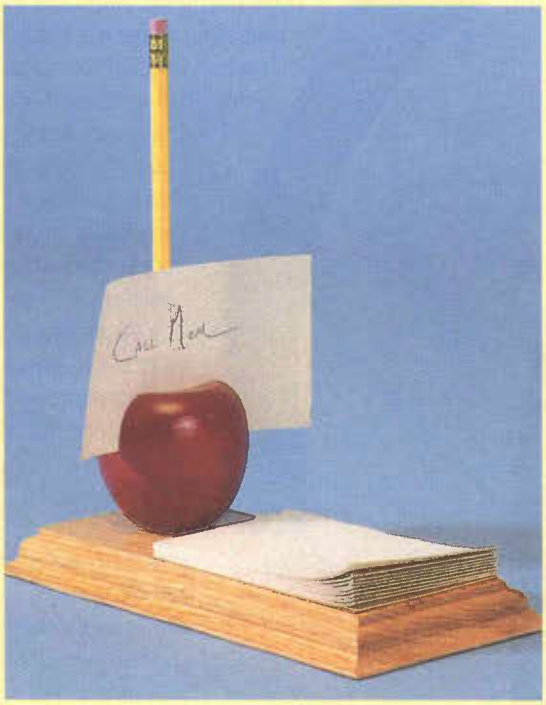
This puzzle is made on the band saw; and once you get the hang of it, you can knock out more than a dozen in an hour.

**STEP ONE:** Start with a $1\frac{3}{4}$" x $1\frac{3}{4}$" x 3" block of scrap wood and mark the two patterns shown in the diagram on adjoining sides.

**STEP TWO:** Make both cuts on one face of the block, then hold the block together as you cut the pattern on the other face.

**STEP THREE:** A little sanding will clean up the saw marks, and you can finish the puzzle however you like. You can even leave it unfinished.

*—Edward Coombs*



# An APPLE for Teacher *(or Mom)*

This project is perfect for the young woodworker who wants to make something nice for teachers at school or family members at home.

As a bonus, you need only a couple power tools for this project, including a router mounted in a table and a drill press.

**STEP ONE:** Begin with a piece of $\frac{3}{4}$" x $4\frac{1}{4}$" x $9\frac{1}{4}$" scrap wood for the base. Rout a profile on all four edges. Make it as fancy as you like (or as your collection of bits will allow).

**STEP TWO:** You can buy the apples at a local crafts store or through catalogs (see our story on catalog shopping in this issue). Drill two or three $\frac{3}{8}$" holes in the top of the apple to hold pencils. Cut the $1\frac{1}{4}$" deep slot for notes with a coping or back saw. A piece of leather from a shoestring works nicely as the apple's stem.

**STEP THREE:** Sand the base and apple. Paint the apple red and put two coats of clear finish on the base. Then screw the apple to the base. Attach a note pad to the base with two-sided tape.

*—Edward Coombs*

# FOLDING CANDLEHOLDER

From birthdays to power failures, we have all come across a time when candles were a necessity. This candleholder can be used as a centerpiece for a candlelight dinner or as a simple decoration in any room. Its pivoting legs allow it to be set up in different ways, and it folds flat for storage.

For this candleholder, I used 4/4 purpleheart. Nearly any wood will work, but quartersawn is great because it's less likely to warp. Buy candles before picking the wood — this could save you a headache later. Depending on the size of candles you have, you might want to go with a thicker piece of wood.

**STEP ONE:** Begin by gluing up your material to 12" long x 9" wide. Attach candleholder diagram from the PullOut™ Plans to the wood with spray adhesive and cut it out on the scroll saw or band saw. When you're cutting it, leave some extra material at the feet. This will come in handy later when you're assembling the pieces to make the stand level.

**STEP TWO:** After you've cut out the pieces, sand and check the fit of the legs. I had to do some extra sanding on the insides of all the pieces before they could be rotated without rubbing or sticking.

**STEP THREE:** Drill the holes for the hardware that holds the three pieces together. Line up the holes as best you can so that the pieces are flush and can swing apart. To do this, clamp the middle piece on top of the bottom one, drill through the middle piece and then drill just enough into the bottom piece so that you can see where the hole will go. To line up the top piece with the middle one, I used a doweling jig. Then drill the top piece from the bottom, about halfway up. You need to counterbore the bottom piece about 1" in from the bottom. See the PullOut Plans for the drilling locations and measurements.

**STEP FOUR:** Next, attach the pieces together. There are a number of ways to do this, but I opted for a 1/4" threaded rod that was glued into the top piece. The rod runs through the middle and bottom pieces and screws into a threaded t-nut inserted into the bottom piece. Peen the end of the threaded rod to keep the rod from unscrewing.

**STEP FIVE:** This is where that extra material on the feet comes in handy. Cut the base piece of the candleholder to size and insert the t-nut and rod. If the t-nut is not flush with the wood, you will need to leave the feet just a bit longer than the base to give the candleholder stability.

**STEP SIX:** Drill 1/2"-deep holes for your candles according to their diameter. Sand the candleholder while it's lying flat and check that the pieces are flush with each other. You can either break the edges or you can give them a roundover. For the finish I used a couple coats of clear topcoat.

You might consider using drip cups around your candles to better protect the wood. **PW**

*— Designed by Warren Asa; constructed and written by Jamie Doan. This story first appeared in January 1990.*

**See the PullOut Plans for a full-size diagram of the folding candleholder.**

PullOut™ Plans • January 1998 #100

# Popular Woodworking

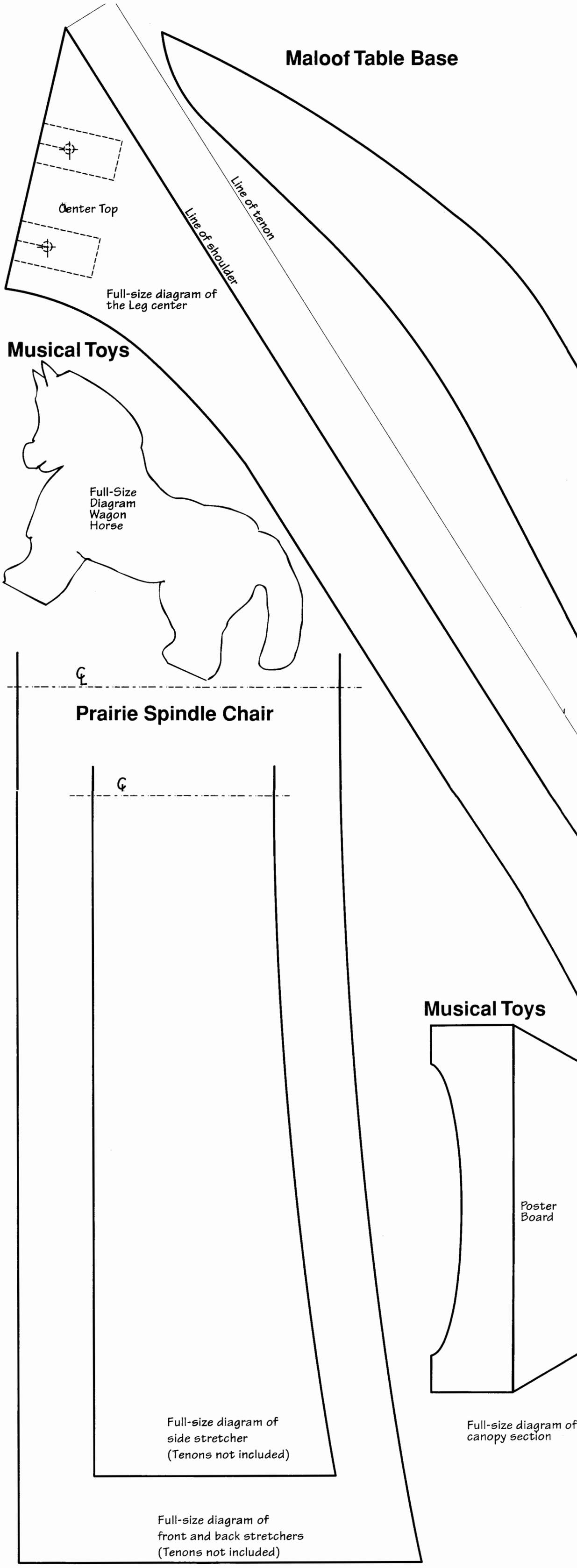
*Carefully open staples to remove plans, then bend them closed again.*

## INSIDE

*Note: We had so many projects this issue we had to put some of the PullOut Plans on page 49*



## Maloof Table Base




## Musical Toys



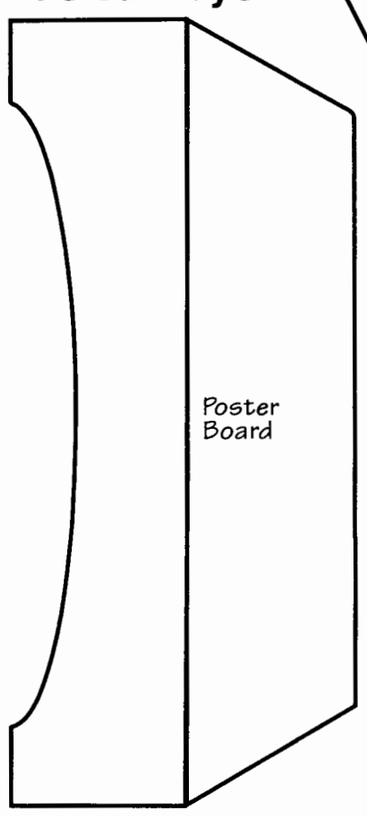

## Prairie Spindle Chair





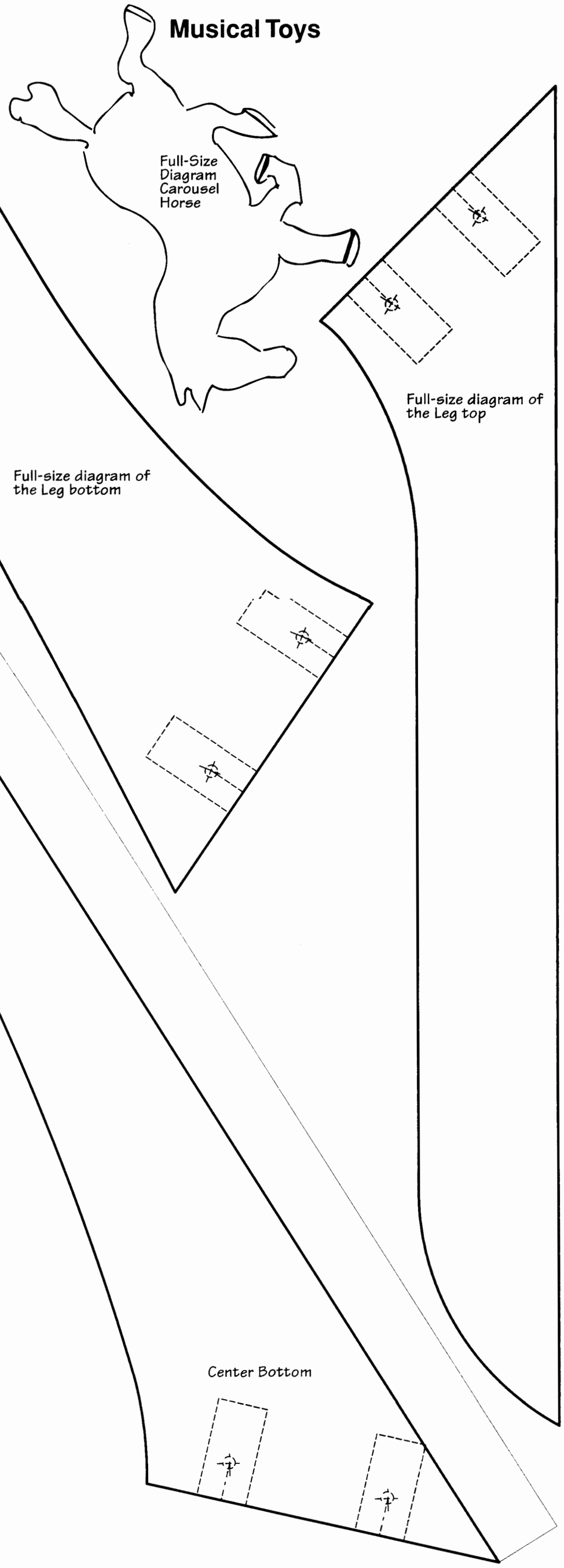


## Musical Toys




Full-size diagram of canopy section

## Musical Toys



Handle

Basket

## Band Sawn Basket

Full-size plan of basket and handle cut out.

## Prairie Spindle Chair

Full-size diagram of corbel

## Sawyers Whirligig

Full-size "Jerry" parts

Arm

Body

Jerry

Leg

Pocket

## Sawyers Whirligig

Full-size diagram of tail fin

## Sawyers Whirligig

Full-size "Luke" parts

Leg

Arm

Pocket

Body

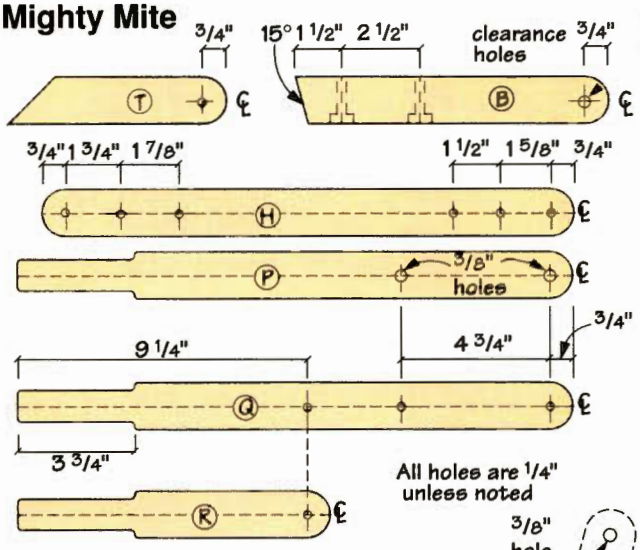
Luke

## Folding Candleholder

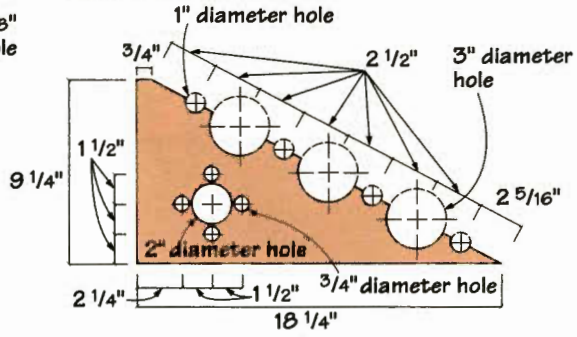
Full-size diagram of candleholder parts and drilling layouts

# Supplement to PullOut™ Plans

## Mighty Mite

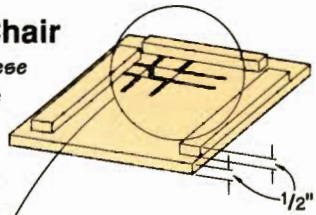


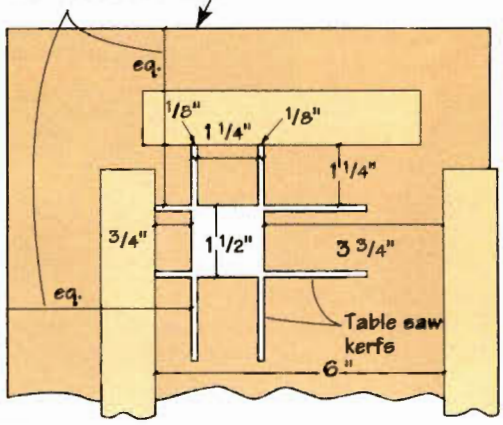

## Victorian Mailbox



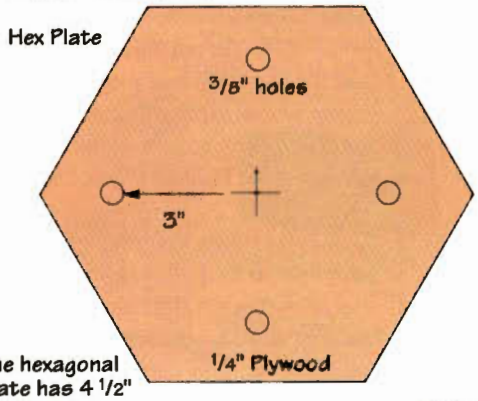

## Prairie Spindle Chair

Important: By making these dimensions the same, the saw setup is the same for each dimension and therefore square! Always use these edges to fence.

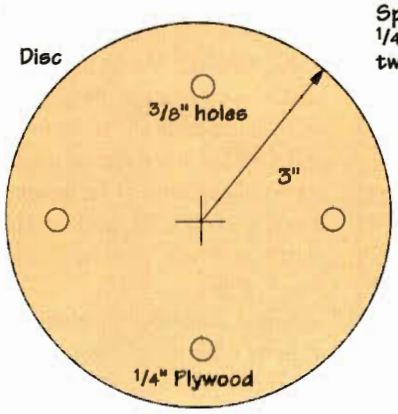



## Musical Toys

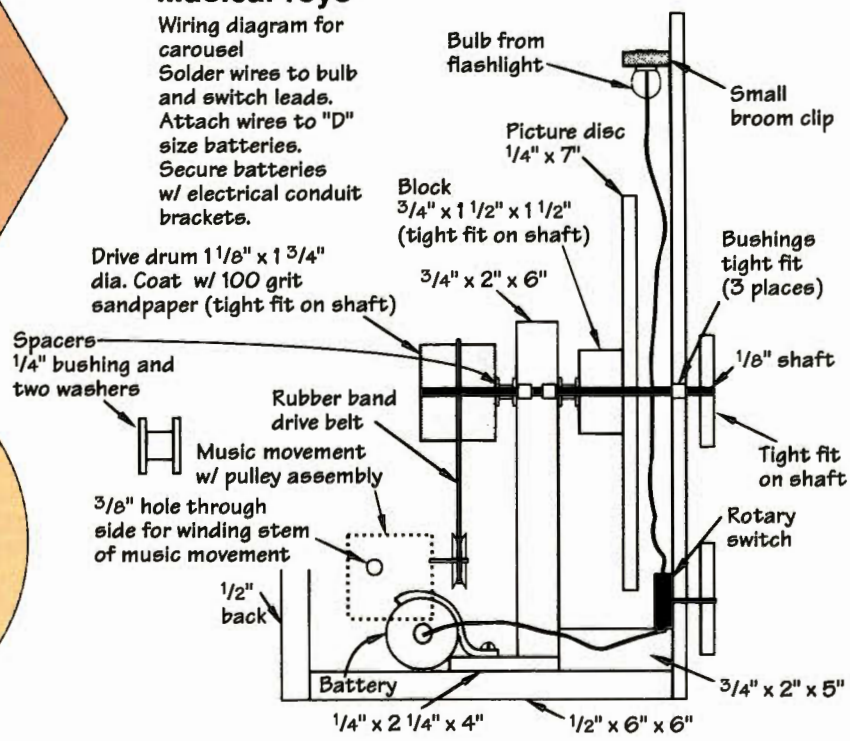



The hexagonal plate has 4 1/2" sides




## Musical Toys

Wiring diagram for carousel
Solder wires to bulb and switch leads.
Attach wires to "D" size batteries.
Secure batteries w/ electrical conduit brackets.



# Band Sawn BASKET



Baskets come in all shapes and sizes, and they are made of many different materials. This basket is unique because it folds up for storage and can be made out of almost any wood.

**STEP ONE:** First choose a straight-grained, knot-free 3/4" hardwood that measures about 7" x 13". Sand the top and bottom surfaces.

**STEP TWO:** Lay out the pattern from the PullOut™ Plans on your wood. You can trace the pattern using carbon paper, or you can photocopy the plan and use spray adhesive or rubber cement to attach the pattern to the wood.

**STEP THREE:** Use a band saw or scroll saw to make your cuts. I used a band saw because the scroll saw was a lot slower when cutting 3/4" material. With the table of your saw flat, cut the outside edge of the basket's handle, making sure to stay just outside the line. Then sand the edges down to the line.

**STEP FOUR:** Cut the inside surface of the handle and sand the exterior of the basket. Set the handle aside.

**STEP FIVE:** Set your band saw's table to 6 degrees and begin cutting the outer arc. Cut right on the line as much as possible. When you get to the end of the cut, turn off your band saw and back your blade out.

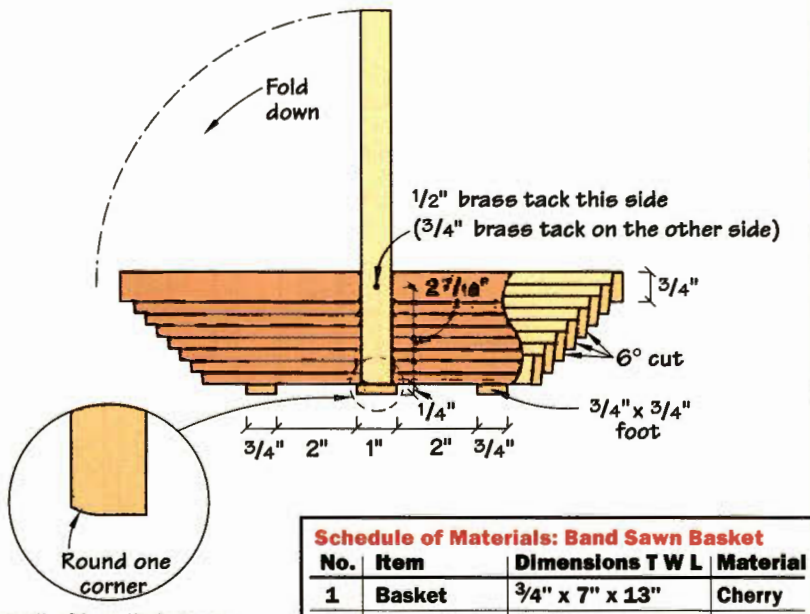
**STEP SIX:** Cut out the large base piece and the two small base pieces from some scrap wood. Glue these pieces to the bottom of the basket in the locations shown in the PullOut Plans. Clamp and allow to dry.

**STEP SEVEN:** The part of this project that takes the longest is the sanding. I used a small rotary tool with a sanding head to remove the burn marks made by the saw blade. I then sanded the whole basket, inside and out, with 150-grit sandpaper.

**STEP EIGHT:** Attach the handle to the basket using brass brads. Use a 3/4" brad on the side where you started your cut and a 1/2" brad on the other. Sand one corner of each end of the handle to make it easier to open the basket. Then complete your basket with two coats of clear finish. **PW**

*—John A. Nelson is the author of dozens of books, many of them dealing with scroll saw projects. This article first appeared in August 1988.*

**Diagram**




**Schedule of Materials: Band Sawn Basket**

| No. | Item | Dimensions T W L | Material |
|---|---|---|---|
| 1 | Basket | 3/4" x 7" x 13" | Cherry |
| 1 | Large Base | 1/4" x 1" x 7" | Cherry |
| 2 | Small Bases | 1/4" x 3/4" x 3/4" | Cherry |

# Victorian Mailbox Post

Normally we don't run outdoor projects in the winter issues, but this one requires you to be outside just long enough to dig a hole. We recommend using a weather-resistant wood such as redwood, cedar, cypress or pressure-treated lumber.

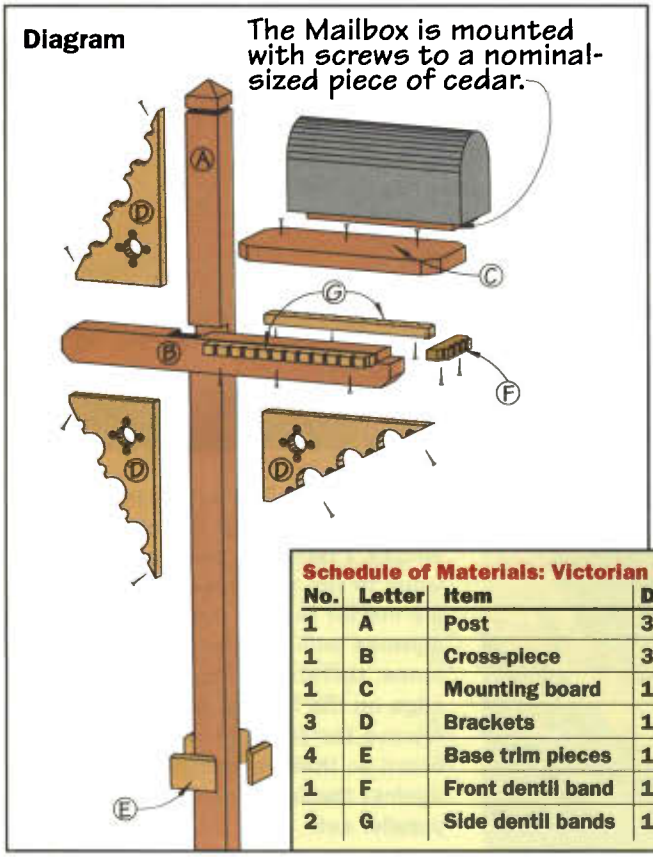
**STEP ONE:** The basic sizes for all the pieces are listed in the Schedule of Materials. The base trim pieces for the post have a bevel cut on one edge that is easier to cut while the board is still long. Make 45-degree angle bevel, leaving an 1/8" flat at the top. Cut all the pieces to size as specified.

**STEP TWO:** The pattern in the PullOut™ Plans shows the hole center locations for the bracket pairs. Lay out the locations and drill the holes with a drill press. Spade bits work for the smaller holes, while the 2"- and 3"-diameter holes will require a jigsaw, holesaw or a fly-cutter. With the holes cut, split the brackets diagonally.

**STEP THREE:** Cut 45-degree bevels on the ends of the cross-piece and the corners of the mounting board. Then use a 1/4" roundover router bit to ease the edges of the mounting board and brackets.

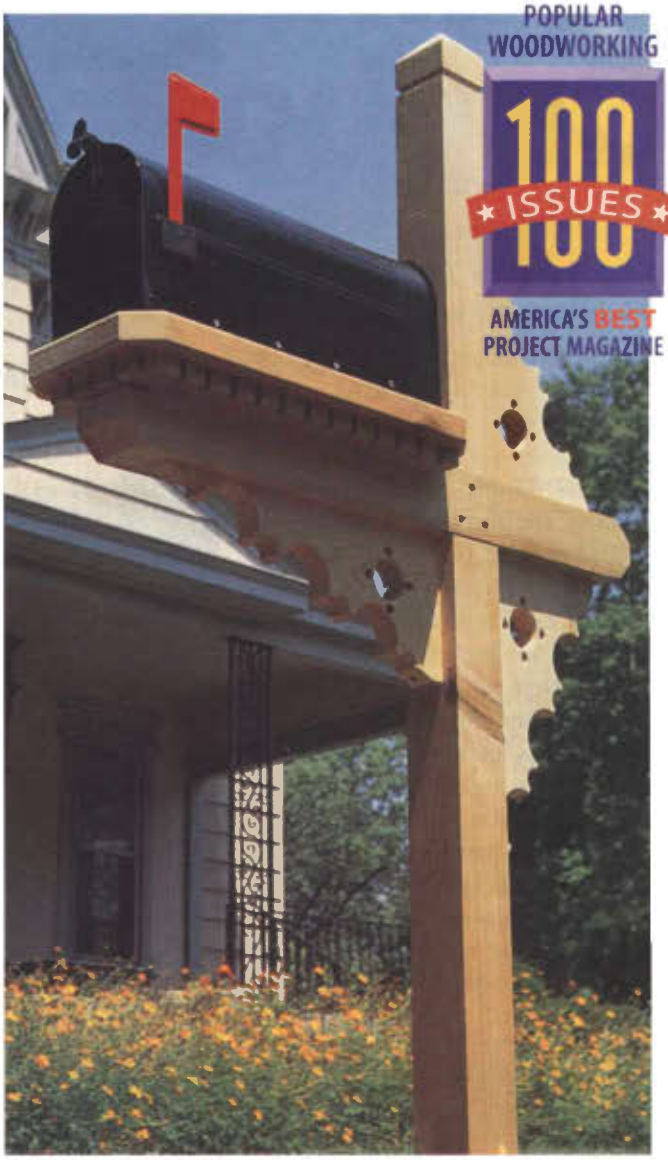
**STEP FOUR:** Cut the 1/2"-deep teeth in the dentil bands with a 3/8"-wide dado stack in the table saw. Lay out the teeth locations to determine the best spacing.

**STEP FIVE:** Still using the dado stack, cut a 1" x 1 1/8" rabbet in the front edge of the cross-piece. Then cut a 3 1/2" x 1 3/4" deep dado for the cross-lap joint in the cross-piece and post to form the half-lap joint.




**Schedule of Materials: Victorian Mailbox Post**

| No. | Letter | Item | Dimensions T W L |
|---|---|---|---|
| 1 | A | Post | 3 1/2" x 3 1/2" x 96" |
| 1 | B | Cross-piece | 3 1/2" x3 1/2" x 36" |
| 1 | C | Mounting board | 1 1/2" x 9 1/4" x 22" |
| 3 | D | Brackets | 1 1/2" x 9 1/4" x 18 3/4" |
| 4 | E | Base trim pieces | 1 1/8" x 4 5/8" x 8" |
| 1 | F | Front dentil band | 1" x 2" x 7 1/2" |
| 2 | G | Side dentil bands | 1" x 2" x 18" |




**STEP SIX:** You can purchase the 4 x 4 post with a top finial detail pre-cut, or you can cut an alternative top as shown using a 45-degree angle on your table saw.

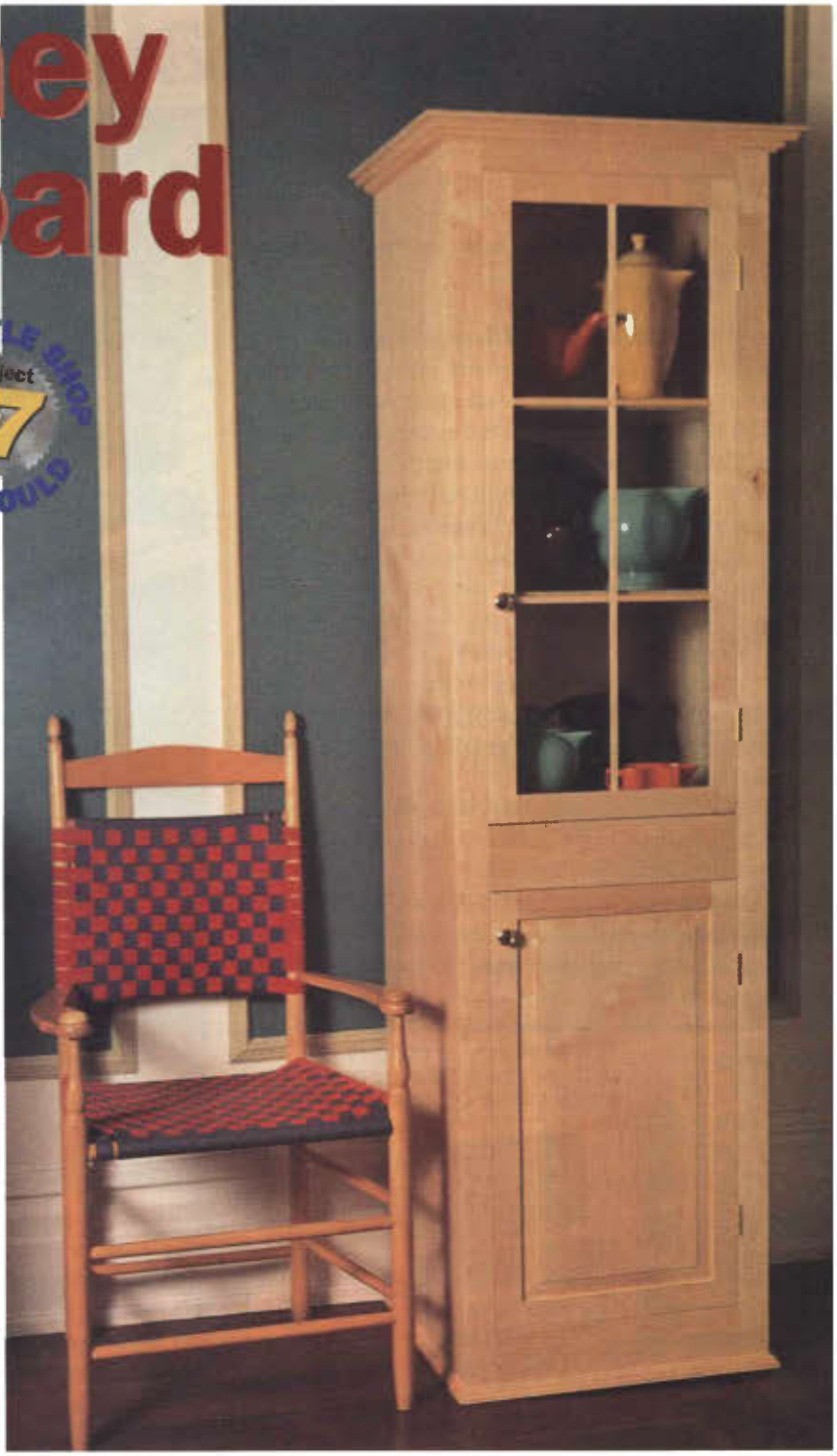
**STEP SEVEN:** Assemble the post by first attaching the front and one of the side dentil bands to the bottom of the mounting board. Place the cross-piece against these parts to locate the position for the remaining dentil and attach. Next, join the cross-piece to the mounting board and join the cross-piece to the post. Finally, attach the brackets.

**STEP EIGHT:** The base trim is attached once the appropriate height of the mailbox is determined (check with your post office). When digging the hole for your post, remember that the post should be at least 18" below grade. **PW**

*—Phil Keller's original article on the Victorian Mailbox Post was published in the July 1990* Popular Woodworking. *It is offered here in an abbreviated form. Phil continues to be a woodworker and writer in Pompton Plains, New Jersey.*

# Chimney Cupboard

*A few tricks make this cabinet easier for woodworkers with limited tools.*



BUILDING this chimney cupboard using the limited tools in the "Little Shop That Could" is a bit of a challenge. The hardest part is routing the boards to get an edge good enough to glue up slabs for the sides. The only other challenge is setting up the table saw to make the door parts. Even that isn't as hard as learning the patience to make sure it's right by using scraps before cutting your good parts.

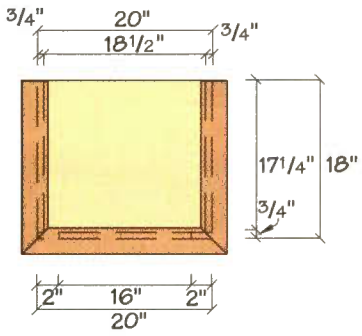
I used solid maple for the visible exterior parts. The shelves, top, bottom and back are plywood. I purchased the maple hardwood already surfaced to 3/4", and I picked four flat boards.

## Editor's Note

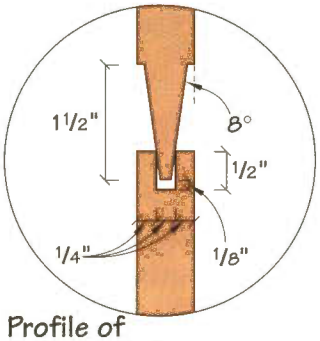
**In issue #91, I built this workshop on wheels, which folds in half for storage. Then I outfitted it with $498 in tools and equipment. Reckoning many of you work in small shops with limited tools, I wanted you to know that we can work that way, too. "Little Shop" projects are designed to be built simply. For a copy of issue #91, send $4.50 to Popular Woodworking • Back Issues • 1507 Dana Ave. • Cincinnati, OH 45207 • Ask for #58066.**

**1 STRAIGHT TRICK • To put a straight edge on the rough-edged lumber, I tacked a piece of 1/4" plywood to the work piece. It's a simple matter then to run the straight plywood edge against the table saw fence, thereby cutting a straight edge on the lumber. After this cut, remove the plywood and flip the board so that its straight edge is against the fence and simply rip a parallel cut.**

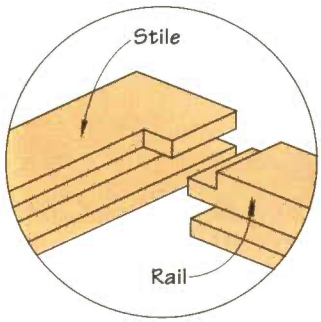
# CHIMNEY CUPBOARD



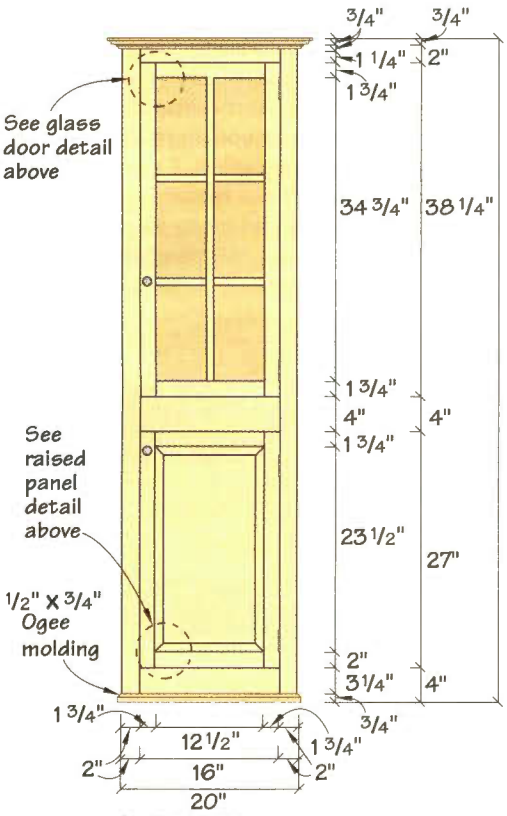

Plan



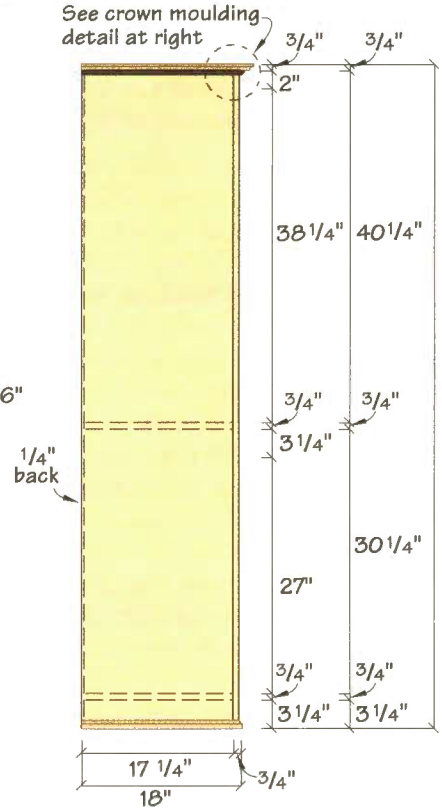

Profile of raised panel layout



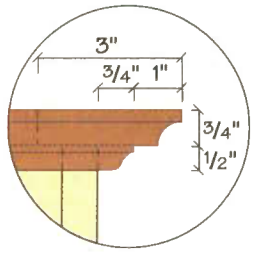

Detail of glass door assembly



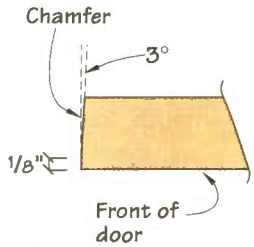

Elevation




Profile




Detail of crown moulding




Plan of door chamfer on closing side

**Schedule of Materials: Chimney Cupboard**

| No. | Item | Dimensions T W L | Material |
|---|---|---|---|
| 2 | Sides | 3/4" x 17 1/4" x 75 1/4" | Maple |
| 1 | Bottom | 3/4" x 17" x 18 1/2" | Maple |
| 1 | Top | 3/4" x 17 1/4" x 19 1/2" | Maple |
| 2 | Top Stretchers | 3/4" x 3" x 19 1/2" | Maple |
| 1 | Fixed Shelf | 3/4" x 17" x 18 1/2" | Maple |
| 1 | Back | 1/4" x 19 1/2" x 71 3/4" | Maple |
| 4 | Shelves | 3/4" x 16 3/4" x 18 7/16" | Maple |
| **Face Frame** | | | |
| 2 | Stiles | 3/4" x 2" x 75 1/4" | Maple |
| 2 | Rails | 3/4" x 4" x 16" | Maple |
| 1 | Top Rail | 3/4" x 2" x 16" | Maple |

| No. | Item | Dimensions T W L | Material |
|---|---|---|---|
| **Upper Door (Glass)** | | | |
| 2 | Stiles | 3/4" x 1 3/4" x 38 1/4" | Maple |
| 2 | Rails | 3/4" x 1 3/4" x 13 1/4" | Maple |
| **Lower Door (Panel)** | | | |
| 2 | Stiles | 3/4" x 1 3/4" x 27" | Maple |
| 2 | Rails | 3/4" x 1 3/4" x 13 1/4" | Maple |
| 1 | Panel | 3/4" x 13 1/4" x 24 1/4" | Maple |

**Moulding**

Base - 1" x 3/4" x six lineal feet maple

Top - 3/4" x 3" x six lineal feet maple

Top - 3/4" x 1" x six lineal feet maple

Mullions - 1/4" x 3/8" x six lineal feet maple

**2 ANOTHER TRICK • To make a joint good enough for edge-to-edge gluing, use a router with a straight bit and bearing mounted on the bottom. Secure the lumber to a straight edge — a really straight edge — so the lumber overhangs the straight edge no more than 1/32". Rout the edge with the bearing following the straight edge and remove the overhang. If your edge is true, you should achieve a smooth, straight edge on the lumber that's suitable for glue up.**

**STEP 1 Rip Your Stock** • Start by selecting enough solid maple to glue up the sides and door panel, then rip the stock for the door frame, stiles and rails. The edges for the sides and panel were rough, so I had to straighten them. Without a jointer, this can be tricky, but the method shown in the photo does the job.

**STEP 2 Smooth Your Edges** • Before gluing the sides and door panel, you need to put a better edge on the boards than you can get on the small bench top table saw. The photo shows a way around that problem using a router. If there is too much gap where the boards meet after truing the edge, check the straight edge board, which must be perfectly straight for this technique to work. When satisfied, glue and clamp the pieces together.

**STEP 3 Make the Face Frame** • While the sides are drying, cut out the bottom, top and fixed shelf. The panel squaring jig as described in the first "Little Shop" series (issue # 91) is helpful for this step. Next rip out the stiles and rails for the cabinet face frame and door parts. Cut the face frame parts to length, then join the stiles to the rails using biscuits as

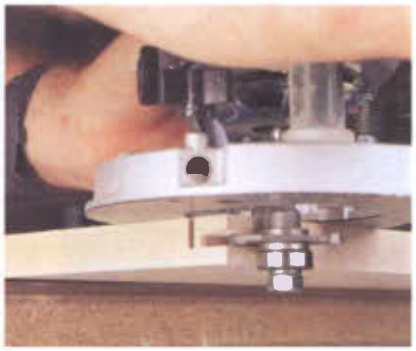
**3 BISCUITS WITHOUT A BISCUIT JOINER • The face frame stiles and rails are joined using biscuits, but since the "Little Shop's" budget doesn't allow a biscuit joiner, a router equipped with a slot cutter does the trick, and does it well. Make slots on the ends of the rails and their adjoining locations on the stiles.**

shown. Carefully lay out the position for the intermediate rail. When done, glue and clamp the face frame together.

**STEP 4 Rabbets for the Carcass** • Next, rout the rabbets on the top and back edges of the sides. The side top rabbet is 3/4" x 1/2" wide, while the back rabbets of the sides and the back edge of the top are 1/4" x 1/4". I made these smaller ones using the table saw, making two passes with the blade set 1/4" above the table. The sides were too unwieldy to stand on end to make the second rabbet cut on the table saw, so I used the router instead.

Next, nail the carcass together. Because the top edges of the bottom and fixed shelf must align with the top edge of the lower and intermediate face frame rails, carefully lay out their location. I drilled pilot holes through the sides for the nail locations (don't worry about nailing, we're going to make the cabinet look old later by filling the nail holes a special way). Nail the bottom and fixed shelf through the sides, then attach the top by nailing down through the top and into the sides.

**STEP 5 Add the Face Frame** • To nail the face frame on, lay the cabinet on its back and position the face frame on the carcass. Check for the alignment of the bottom and fixed shelf, then remove the frame and drill pilot holes for 2" finish nails through

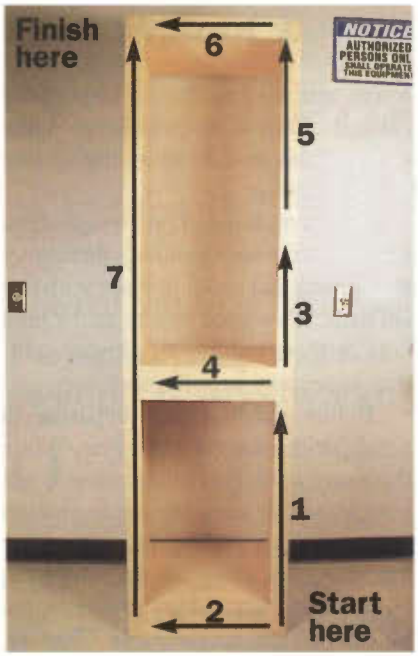


**4 HOW TO MILL THE RABBETS • Milling the rabbets on the top edges of the sides required a few steps. The first cut was made on the table saw crosscutting the top edge with the fence set to establish the 3/4" depth. Next the router and slot cutter established the 1/2" rabbet width (above). As you can see, however, the slot cutter didn't cut deep enough to complete the job. To complete the rabbet, I used a chisel to snap off the remaining waste stock (below) and clean up the corner of the rabbet. Although it sounds time consuming, it wasn't.**

the face frame. Put the face frame back on and nail it in place following the nailing pattern shown in the photo.

**STEP 6 Doors at the Table Saw** • Now make the doors. All the joinery for the upper and lower doors is done on the table saw. All the stiles and rails receive 1/4" wide by 1/2" deep grooves centered exactly, as they will also serve as mortises. It takes three passes on my saw using a narrow-kerf blade. These grooves run all the way through all the pieces.

**STEP 7 Stopped Rabbets** • The upper door requires a rabbet to hold the glass. While the rabbets in the rails can be run all the way through, the ones in the stiles are stopped. To make the stopped cuts, first raise the saw




**5 NAILING PATTERN • When attaching the face frame to the case, it's important to make sure the face frame openings remain square or else hanging doors later will be a big headache. To make sure the openings remain square, use the nailing pattern shown above and check the opening frequently. Use clamps to pull the case to square if need be.**

blade to 1/2", the depth of cut you want. As shown in the photo, mark lines on the table saw fence where the front and back of the blade first project above the saw table insert. Now mark lines where you must start or stop your cuts, that's 1 3/4" or the width of the rails. With the stile edge against the fence (which is set 3/8" from the blade) rest the end away from the blade on the saw table and slowly lower the stile until the pencil line on the fence becomes visible but before the blade begins to cut. Align the fence and stile pencil marks, then proceed to slowly lower the stile onto the blade and begin the cut. Push the stile until the the pencil mark on the other end of the stile aligns with the pencil mark at the front of the blade. While holding the piece firmly in place, turn the saw off and hold the piece until the blade stops moving. The waste piece is left on the stile until the door has been glued up. Once supported by the tenon after assembly, remove the waste stock and square up the corner with a chisel.

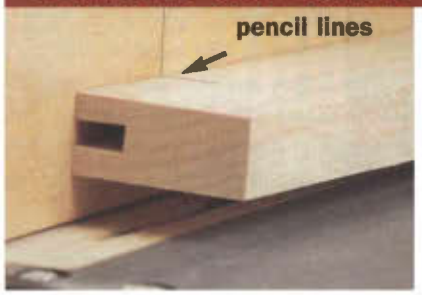
**6 GROOVES AND RABBETS • The door stiles and rails require a groove for the lower raised panel and a rabbet for the upper glass. The groove also serves at the mortise at the top and bottom of the stiles. Set the fence to 1/4", cut the outside cuts first, then move the fence to clean up the center portion.**

**STEP 8 Tenons for the Doors** • Next cut the tenons on the upper and lower rails, carefully fitting them to the grooves you've cut. It's best to use some fall-off from the rails and make test cuts. First define the length of the tenon by cross cutting the rail ends on both sides. Use your slot miter gauge with the end of the rail up against the fence to index the cut. The fence should be set to 1/2" to the outside, not inside, of the blade.

**STEP 9 Raise the Panel** • If you haven't already, cut the glued up panel for the lower door's raised panel to finished size. Now "raise" the panel by cutting all edges on both sides using the table saw with the blade tilted to an 8-degree angle (see diagram). Again, use a piece of scrap to test your set-up before cutting the actual piece. Remember, the set-up not only raises the panel, but also defines how deep it fits in the stile and rail grooves. It also forms the shoulder at the point where the bevel meets the flat of the panel faces.

After raising the panel on both the front and back, test fit the panel in the stiles and rails. When satisfied, glue up the lower door and upper door frame. When the upper door frame assembly has dried, square up the corners where the stiles and rails meet and remove the waste strip of wood on the stiles that will fully form the rabbets.

## CHIMNEY CUPBOARD




**7 STOPPED RABBET CUT • The stiles of the upper door require a stop cut to form the rabbet and leave the cheek of mortise at the top and bottom. The stopped cut is made by lowering the piece onto the running blade, using pencil marks on the and stile to indicate start and stop points.**

**8 TENONS ON THE RAILS • Finish cutting the tenons by running the rails on their ends over the saw, assisted by a back-up block. The tenons are centered on the rail ends so set your blade to the appropriate height and fence to leave the 1/4" thick tenon. With the fence set appropriately, one pass on each side of the rail will center the tenon.**

**STEP 10 Door Details** • Check the doors for fit and make any trim cuts that may be necessary. A properly fit, flush inset door should have a 1/16" gap around the door edges. To make the door close without hitting the stile opposite the hinge side, use the table saw to make a 3-degree bevel cut on the handle side stile so that the bevel is to the inside of the cabinet and you leave about 1/8" flat on the stile edge (see diagram detail).

Before mounting the hinges, first mark their locations; then use your router and mortise the hinge leaf on the door about 1/16" deep. Set the hinge in place and mark the hole locations, then start the hole with an awl, and drill a pilot hole for the screws.

Put the screws in by hand. If you use a drill or screw gun you'll likely snap the screw head off. After marking and routing the hinge location on the cabinet, follow the same procedure to fasten the hinge to the cabinet.

**STEP 11 Add the Moulding** • The top moulding is made from two separate mouldings nailed together. The top molding is made using a cove bit, and the lower piece uses an ogee profile. Run the top moulding first using the dimensions given in the Schedule of Materials. Cut the mitered front corners and glue up. Next cut the lower mould. Miter the front corners, then nail it in place on the upper piece. When done, the upper piece should rest on top of the cabinet with the lower surrounding the top edge of the cabinet. Fasten the moulding using screws through the top moulding into the cabinet top.

Rout a ogee detail on enough stock to make the base moulding, then miter the corners and nail it in place with finish nails. It's a good idea to drill a pilot hole in the moulding to prevent splitting, especially near the ends.

Before sanding and preparing to finish, drill holes for shelf pins. While the lower cabinet shelf location is not critical, you'll want the upper shelves to rest directly behind the glass door mullions. Speaking of the mullions, these pieces are simply glued to the outside of the single piece of glass, which is installed after finishing. Make the mullion strips at this time, but leave them long for cutting to length after finishing.

**9 YOU DON'T NEED A SHAPER • The table saw also raises the panel for the lower door. Tilt the saw blade to 8 degrees. Set the fence so that your cut will give you the dimension given in the detail drawing in the diagram. Make the cuts running the panel on edge and remember the panel is raised on both the front and back. Concentrate on keeping the panel perpendicular to the saw table using hand pressure against the fence.**

**10 INSTALL THE HINGES • Use a router to mortise the doors' edges for the hinges. The relief should be about 1/16" but can vary depending on the thickness of your hinges' leaves. After mounting the hinges on the doors, lay each door in its opening exactly in position and carefully mark the hinge locations on the cabinet face frame. Remove the door and rout these locations for the hinge as well.**

**11 A LOOK AT THE TOP • Make up the two-piece crown moulding and attach to the case later. Shown here upside down, the top moulding has a coved profile and the lower piece an ogee. Glue the top miter pieces together, then nail the lower piece in place. The completed assembly rests on the top of the case and is secured by screws.**

**12 A NAIL TRICK • First set the nails as you normally would. Now take the head of a square concrete cut nail and make a second square or rectangular "countersink" mark over the round depression left from the nail set. Putty the old-fashioned square mark, leaving the impression that the cupboard was constructed with cut nails.**

**STEP 12 Age Your Project** • One way to make the cupboard look old is to follow the directions in the photo.

Now give the entire piece a good sanding. I used a random orbit sander and started with 100-grit, followed by 120 and 150-grit. Hand sand the mouldings and ease or break all edges. You really need to sand the interior to only 120-grit, but be sure the upper section will look good through the glass. Brush on two or three coats of clear finish. To make a really smooth surface, sand lightly between each coat using 360-grit paper.

The finishing touches include installing the glass and mullions. Use 1/8" or double-strength plate glass, or if you can find a piece of old glass with all its imperfections, use it to further impart the look of an old cupboard. I held the glass in place using glazing points and glazing compound. Then add the mullions, setting the long vertical one first, centered in the opening, then set the shorter horizontal ones, taking care to place them so they match the shelf locations. Glue the mullions in place using a few dabs of two-part epoxy. Lastly, rehang the doors then install the pulls and your cabinet is complete. **PW**

*— Steve Shanesy, PW staff*

# Sam Maloof's Sculpted-Base TABLE

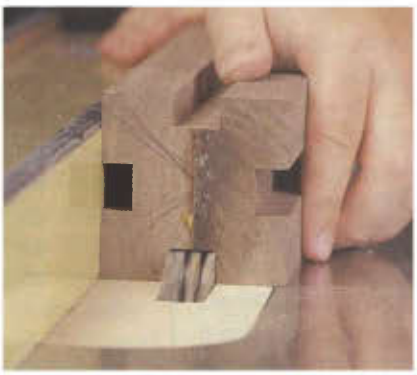

*One of the first "how-to" projects ever to appear in* Popular Woodworking.

ONE OF THE EARLIEST "how-to" projects in *Popular Woodworking* (which at the time was called *Pacific Woodworker*) had the distinction of being a table by renowned woodworker Sam Maloof. While the article was not an actual step-by-step explanation (indeed, there weren't even dimensions offered), the process for constructing the distinctive table base was described. Using that article, I built this Maloof-style table. And while this isn't a weekend project, it's not a particularly difficult piece. More importantly, this table will remind you of why you love to work with wood.

If you're concerned about copying another person's design, keep in mind what Maloof said in his book "Sam Maloof, Woodworker" when asked about those who copy his furniture:

"This reminds me of an anecdote about Hamada, the Japanese potter. When someone asked Hamada if imitations of his work bothered him, he replied, 'When I'm dead, people will think that all of my bad things were made by the other potter, and they will think that all of his good things were made by me.' "

*"A craftsman must respect his material...How much more meaningful it becomes if one wears a bit of humility that allows him to acknowledge that it is truly God who is the Master Craftsman. He uses us. Our hands are His instruments."*
*— Sam Maloof*



**1 CENTER THE GROOVES • The 3/4" x 3/4" grooves must be centered in the width of the post to make the fit (and the sanding) acceptable. A careful setup with a dado set makes this quick work.**

**2 MAKE CAREFUL COVES • Getting the cove cuts to align with the edges of the leg centers makes sanding and the final finish easier. If anything, allow the cove cuts to be a hair wider than necessary so that the sanding to fit occurs on the leg centers, not in the cove cut.**

**STEP 1 Starting at the Post** • The first step is roughing out and shaping the base's center post. The post measures 3" x 3" x 23", and unless you're very lucky you'll have to glue up a couple boards to achieve this dimension. Using 1 3/4" thick material, I was able to glue up two 3"-wide pieces with room to spare.

If you've ever tried to glue two flat pieces together you know that glue works like butter, and the wood wants to slip apart. Drill two dowel holes on the matching faces and use dowels as guide pins during gluing so you won't fight with your pieces.

Next run the post down to 3" x 3". You should leave the post longer than the finished 23" for now to allow for fitting. The first milling procedure is to use a dado stack to cut grooves the length of the post on all four faces.

**STEP 2 Forming the Inside Curve** • With the post grooved to accept the leg tenons, make cove cuts on the four corners so that the shape flows into the legs. I accomplished this with a 3/4" cove bit. This bit is a $50 necessity. There is no other tooling that provides the control given by a router and bit set up in a router table.

As shown in the photo, the location of the cove cut is critical to how easy it will be to assemble the base and how good it will look. Use two passes of increasing depth to put less stress on your router.

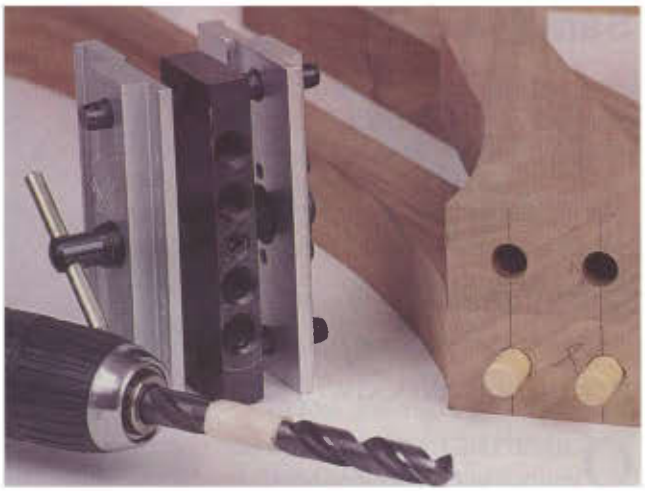
**STEP 3 Quite a Joint!** • With the post essentially complete, it's time to make the legs. You will be making four duplicate leg sections, each made of three pieces. The templates for the three pieces are in the PullOut™ Plans.

Cut the pieces to rough size, being careful to mark the 45-degree angle location exactly. On each leg's top and center pieces you still have a flat edge to use as a guide to cut the angles on your table saw, or power miter box. On each leg's bottom you'll need to make the cut with the band saw or a hand saw and sand the face flat. These are critical joints that determine how flat your table will sit, so pay special attention to making them meet correctly.

With the pieces roughed to shape, make the two rabbet cuts on the leg centers to leave a 11/16" x 3/4"-wide tenon. Check the fit with the grooves in the post. It should be a hand-tight fit.

Next sand the leg pieces to match the templates. A spindle sander is great for this step, but a drum sander chucked in your drill press will work, too. When you sand the shapes, leave a couple of inches to either side of each joint wide of the line. The joints should be shaped to match after the leg pieces have been glued together to ensure a smooth transition.

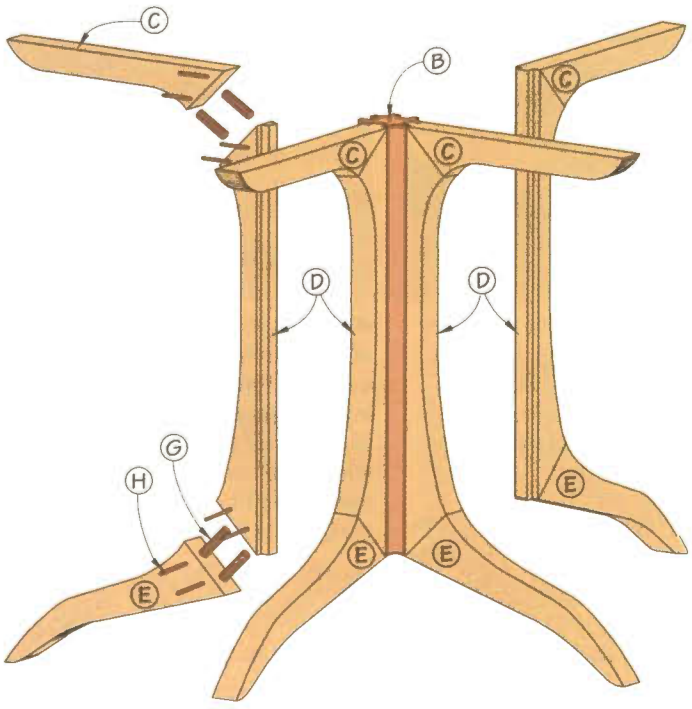
Lay out the locations for the 1/2" dowels as shown on the PullOut Plans and in the photo.



**3 DOWEL THE LEGS • Use dowels to join the leg tops and bottoms to the leg center. I used 1/2" dowels, which were later pinned through the side of the legs with 1/8" dowels. A self-centering doweling jig like the one shown in the photo takes some of the measuring out of this step.**

**STEP 4 Clamping Ballet** • The glue-up of the leg components is tricky, but the photo shows a method that worked well for me. Next, again look to the PullOut patterns for the locations of the 1/8" dowels used to pin the larger dowels. Drill completely through the leg and dowel, but use a backing board to avoid tear out on the exit side. Then add some glue to the

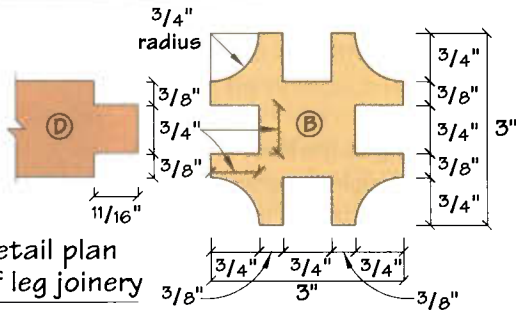
Diagrams



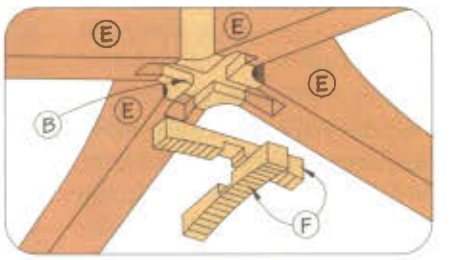

Pedestal Base Exploded Diagram

**Schedule of Materials: Maloof Table**

| No. | Letter | Item | Dimensions T W L | Material |
|---|---|---|---|---|
| 1 | A | Top | 7/8" x 42" x 42" | Walnut |
| 1 | B | Post | 3" x 3" x 23" | Walnut |
| 4 | C | Leg tops | 1 3/4" x 2 1/2" x 13 1/2" | Walnut |
| 4 | D | Leg centers | 1 3/4" x 2 3/4" x 23" | Walnut |
| 4 | E | Leg bottoms | 1 3/4" x 3 1/2" x 14 1/2" | Walnut |
| 2 | F | Cross bands | 3/4" x 3/4" x 5" | Maple |
| 16 | G | Dowels | 1/2" x 2" | Maple |
| 32 | H | Dowels | 1/8" x 2" | Maple |




Detail plan of leg joinery




Detail of Crossbands

**4 CLAMP CAREFULLY • Properly gluing and clamping the leg sections is awkward. The clamp arrangement shown here glued two leg sections at the same time with only four clamps. The block between the leg bottoms kept the clamps from sliding on the sculpted leg.**


**5 DETAILS • The half-lapped pieces of maple are shown in place (top), shaped, screwed and plugged. The process was more time consuming, but the finished appearance is dramatic. The photo at left shows a recessed screw slot to attach the top to the base. Maloof's pieces would have been screwed then plugged.**

2" dowel lengths and tap them into place so the dowel protrudes on both sides. When the glue dries, sand the dowels flush.

With the pinning done, use a 1/2" roundover bit with a bearing guide to ease all the edges of each leg — except the tenon edge and the top edge. Be careful while routing because the grain is likely to change direction, especially at the joint, and tear out.

After routing, glue the legs to the center post. Definitely dry-fit the base assembly, clamping the legs in place. Make sure the base sits flat without rocking, and mark the center post to cut it to length to match the legs. After that, glue and clamp the base.

## A Maloof Finish

**Mix one-third semi-gloss polyurethane varnish, one-third pure tung oil and one-third boiled linseed oil. You can substitute linseed oil with another third tung oil if it is polymerized (pure tung oil dries too slowly). Apply this mixture three times at one-day intervals.**

**For a final coat, heat a 50/50 mix of pure tung oil and boiled linseed oil (or 100 percent polymerized tung oil) in a double boiler. Grate solid beeswax and add it to the heated mix until it is the consistency of heavy cream (about two double-handfuls of wax per gallon of mix). Let cool. The wax in the cooled mixture will stay in suspension and has a good shelf-life. This is applied a minimum of three times, vigorously rubbing in the mixture each time.**

**STEP 5 Strength and a Decorative Touch** • Before sanding, there is one detail Maloof adds to his sculpted-base tables that adds strength, as well as a nice touch.

The half-lapped maple cross pieces are added to provide strength across the base, tying the opposing legs together with the center post. Chisel the 3/4" wide x 5" long grooves for the pieces to a depth of 1/2" at the center of the "X" and allow the bottom of the groove to level out into the legs. This leaves the trench about 5/8" deep at the ends of the grooves.

Next cut the half-lap joint in the two maple pieces and fit them into the two grooves. Then drill four 1/8" pilot holes, 1/2" in from the ends of the pieces. Then drill 3/8" x 3/8" deep holes to allow the screw heads to recess into the maple. After inserting the four #8 x 2" flathead screws, plug the holes with 3/8" diameter walnut plugs.

After that, the rest is rasping and sanding. Maloof's pieces are known for their contours and smoothness of transitions. I honestly spent about six hours shaping and sanding the base through to 220 grit. It was worth the effort.

It seems silly, but the most visible part of the table took the least amount of effort. The 42" square/round top was made of four 7/8" x 11" walnut boards. I didn't want to use more than four boards for the top, so I had to buy 8/4 lumber to get the width I needed — the result was that after resawing the boards on the band saw I had some nice 3/4" walnut for another project.

While Maloof makes no bones about using sapwood on his tops as long as it's stable, I prefer a more consistent appearance — though I did leave a little sap as a nod to Maloof the master.

The top was edge-glued using six #20 biscuits per joint. To shape the top, mark a point 2" in from each corner, and locate the center of each edge. Bend a strip of 1/4" maple across the center point of each edge in toward the 2" marks and mark the curve for the top edges.

Complete the top (except for sanding) with a 1/4" roundover on the top and bottom edges.

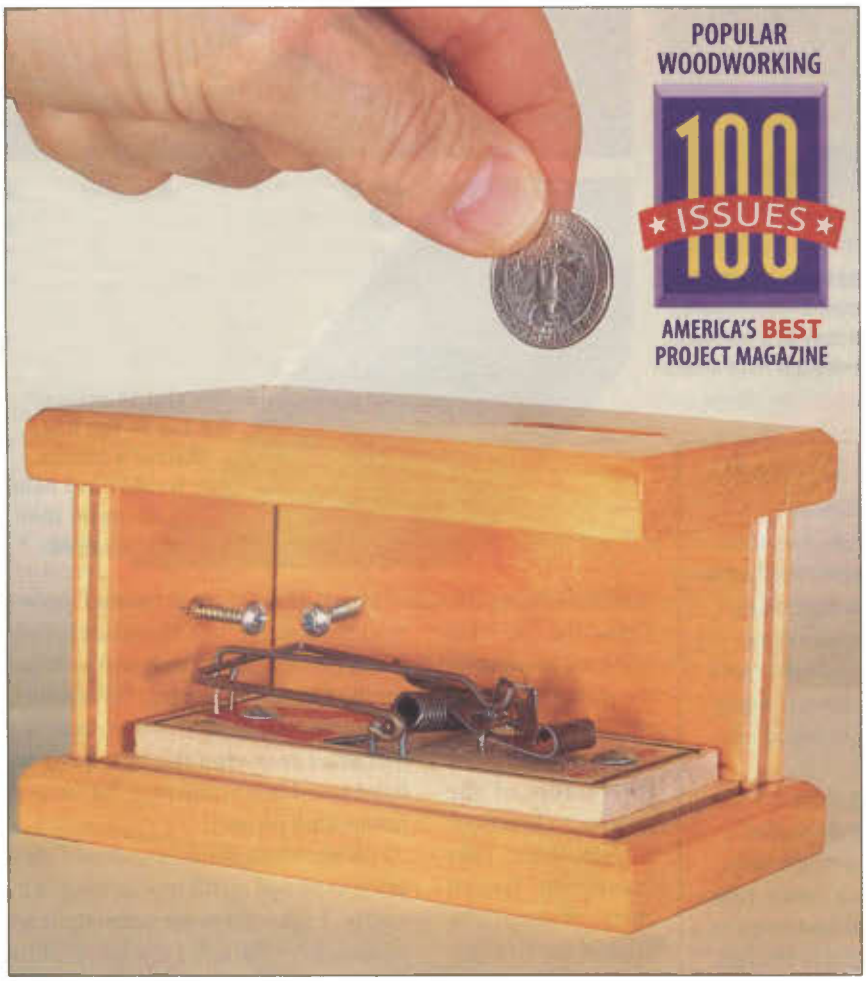
To finish the table, I used Sam Maloof's line of finishing products offered through The Woodworker's Store (800-279-4441). These reproduce the Poly/Oil and Oil/Wax formulas mentioned in "A Maloof Finish" at left. **PW**

*—David Thiel, PW staff*

*This project originally appeared in the July 1982 issue of* Pacific Woodworker.

# Exploding "Bank"

*Your friends will get a big kick out of making a deposit!*




**Shown in action, the exploding bank can make a very dramatic impression on the unwary. Any coin should work, just make sure the breakables aren't sitting right next to your "trap."**

HERE'S A PROJECT for plenty of fun. If you make it out of pine or scrap wood, the cost is close to nothing; and you can make at least 15 of them in a day. Believe me, you'll need that many once your friends see them! They make great gifts and craft show items.

The top and bottom of the bank shown here are 1/2" maple; the sides and ends are 1/4" birch plywood. The only essential tool is a router with a 1/4" straight bit, but a table saw also comes in handy.

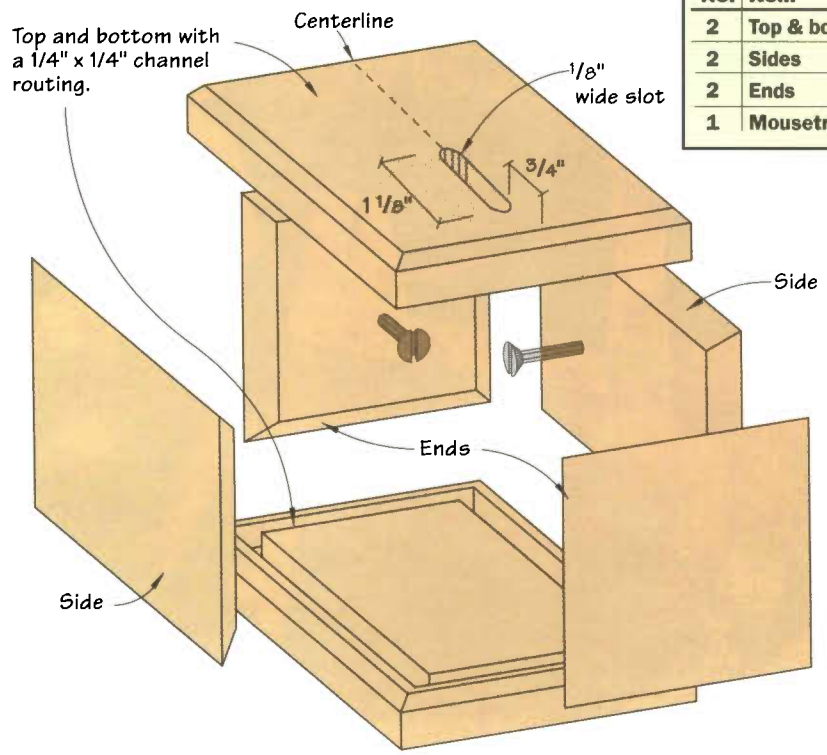
Begin by cutting the top and bottom pieces to 3" x 5". Then cut the 1/4" plywood into a 2 1/2"-wide by about 16"-long strip. Each 16" strip will yield the two sides and two ends necessary to make one bank. Next, angle the saw blade to 45 degrees and bevel both long edges of the strip. Then, again using a 45-degree angle, cut the side and end pieces to 4 1/2" and 2 1/2" lengths respectively.

Using a 1/4" straight bit, set up your router and table for a 1/4" deep cut, 1/4" in from the edge of the piece. You'll want to make guide marks on the router table 1/4" from each edge to set the start and stop points for each cut. Another option (especially if you're making a lot of banks) is to make a jig as shown in the photo on the next page. The guide strips are located according to the diameter of your router base. A plunge router works exceptionally well for this and the next step.

After routing the 1/4" x 1/4" trench on the underside of the top piece, and the top side of the bottom, change to a 1/8" straight bit. Reset the fence or jig guides to cut the 1 1/8" coin slot in the

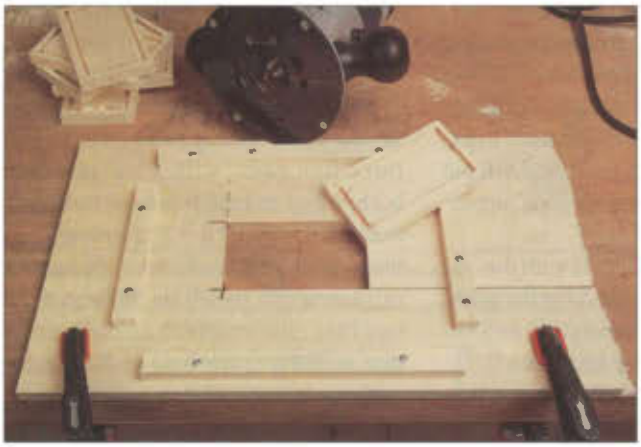
## EXPLODING BANK

**Diagram (exploded view)**

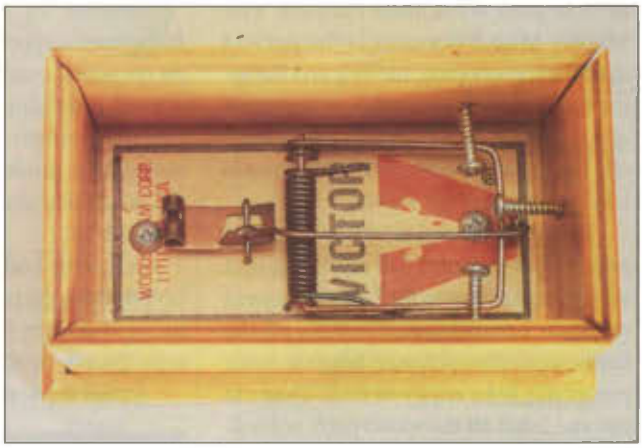



**Schedule of Materials: Exploding Bank**

| No. | Item | Dimensions T W L | Material |
|---|---|---|---|
| 2 | Top & bottom | ½" x 3" x 5" | Maple |
| 2 | Sides | ¼" x 2½" x 4½" | Birch plywood |
| 2 | Ends | ¼" x 2½" x 2½" | Birch plywood |
| 1 | Mousetrap | | |



**The routing jig was made from a scrap piece of ½" plywood and a few strips of poplar. The jig itself is two "L" shaped pieces to allow adjustment for a tight fit against the piece to be routed.**




**With the mousetrap and screws in place, the top is carefully lowered into position. You may want to tinker with the sensitivity of the mousetrap or it will end up going off prematurely.**

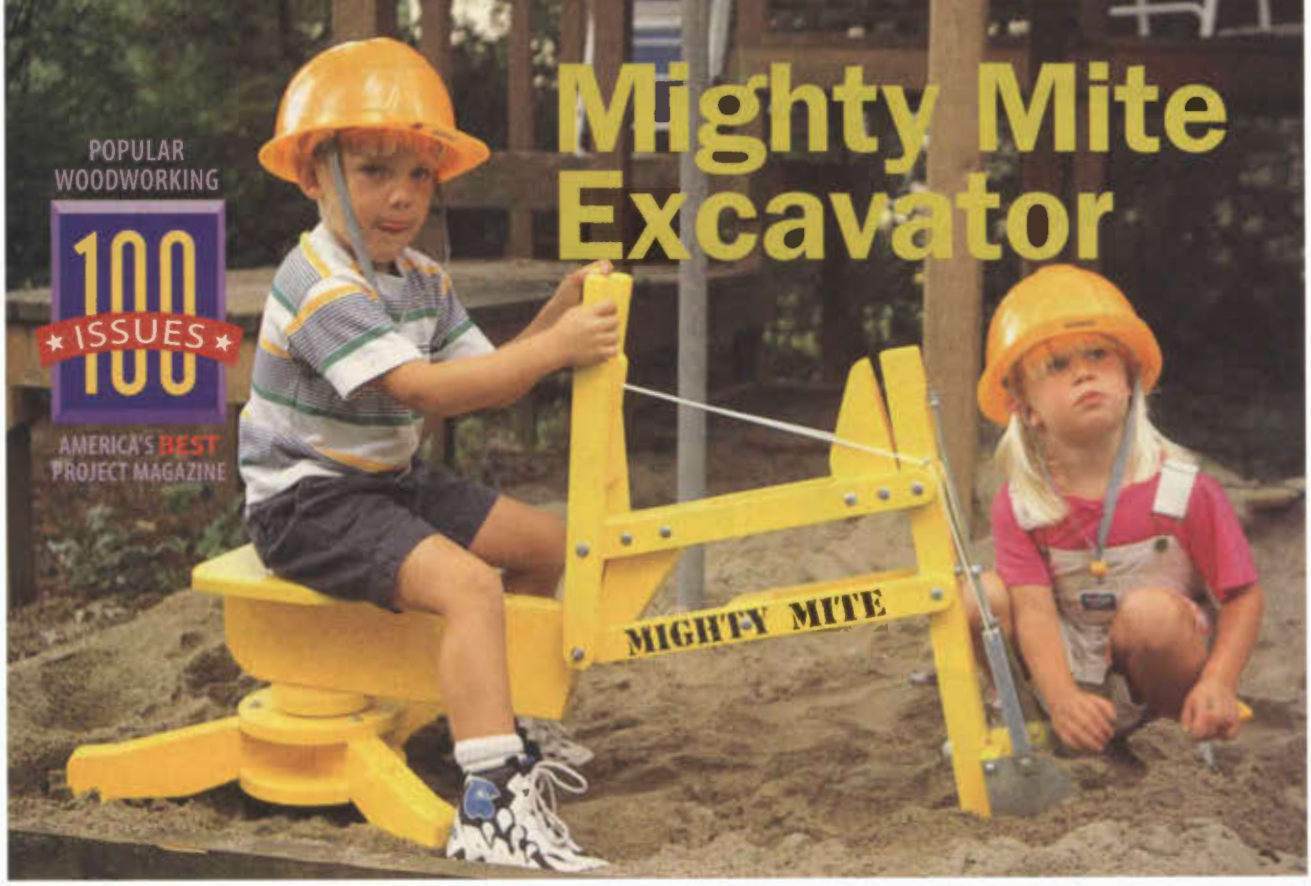
center of the top, starting 3/4" from one edge. For a finishing touch, cut a 45-degree chamfer on the top edge of both the top and bottom pieces.

Now you're ready to assemble the sides, top and bottom. For the bank to explode with sufficient gusto, the parts must be fitted somewhat loosely. With the top removed, each side piece should lean outward about 30 degrees. You might need to sand the top and bottom beveled edges, especially the edges on the end pieces.

Now partially insert a #6 x 3/4" screw into the center of one end piece and into both side pieces centered from top to bottom and 1" in from the end. These screws send the parts flying when the trap spring is released. Finally nail, screw or glue the mousetrap to the bottom. I recommend Victor mousetraps because they have enough spring tension to cause a good explosion.

After applying a finish to the bank, set the mousetrap, assemble the pieces and ask a friend to make a small deposit. Then stand back! **PW**

*—Frank Longmore works wood in Olathe, Kansas. This article first appeared in the March 1992 issue of* Popular Woodworking.




# Mighty Mite Excavator

IF YOU CAN'T AFFORD to buy a full-sized steamshovel for your children to play with, then read on. The Mighty Mite Excavator is the perfect machine for scooping, moving and dumping back yard sand — without the mess and fuss that come with real steamshovels. Best of all, the Mighty Mite is much less expensive.

I built this version from pine and poplar, but you can use anything that will endure many "jobs" and inclement weather. I recommend buying all the hardware before you start because some pieces might be tricky to find. Then cut out and label all the wood parts according to the Schedule of Materials.

**STEP 1 Central Sub-Assembly** • After cutting all the parts to size, start with the central sub-assembly. It is made using the body, the boom support and the body support pieces.

First, drill a 1/2" diameter hole in the body as shown in the PullOut™ Plans, counterboring the upper end for a flat washer and a 1/2" nut. Then drill a 1/2" diameter hole through the center of the body support.

Attach the boom support to the body, as shown in the diagram, using 1/4" x 5" lag screws and waterproof glue. Counterbore the lag screw holes enough to recess their heads and a flat washer.

Drill the 3/8"-diameter bearing hole in the boom support as shown. Depending on the actual outside diameter of the 1/8" x 1 1/2" pipe nipples (which will function as bearings), you might have to experiment to produce a press fit. Drill out the inside diameter of these pipe nipples to a full 1/4".

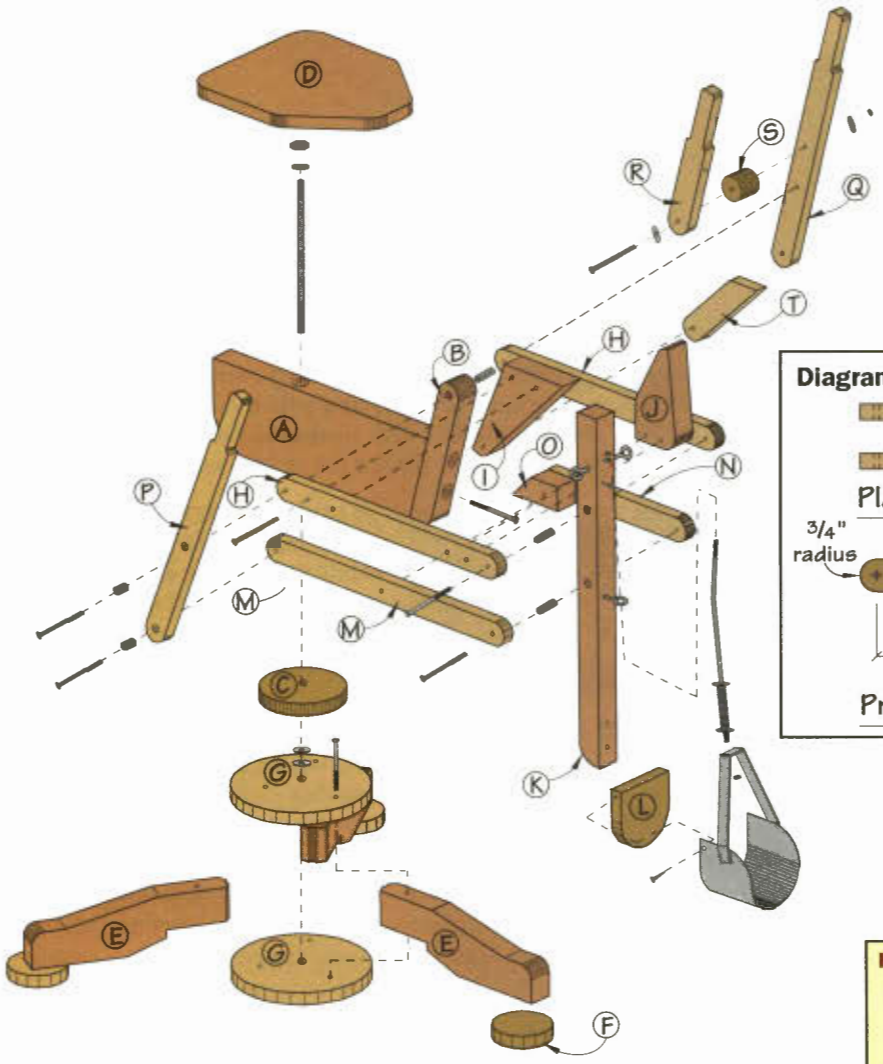
Align the body support with the 1/2" hole through the body, (keeping the grains at right angles for strength), and secure the two with glue and screws.

Install the vertical axle and its washer, then fasten the seat to the top of the body with flat head wood screws. The sub-assembly is now complete and can be set aside.

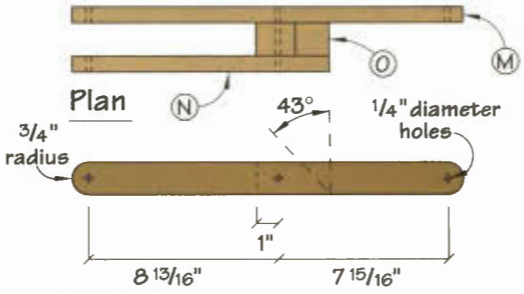
**STEP 2 Base Sub-Assembly** • The base sub-assembly includes three legs, three foot pads (with a 1/4" radius on both sides) and the two base reinforcement discs. Drill a 1/2" diameter hole through the center of one of the base reinforcements, then glue the legs to the two base reinforcement discs. Place the disc with the center hole on the bottom, with the grain of the two discs at right


**1 GET YOUR PARTS IN A ROW • Lay out all drilling locations on the cut parts before you drill the first hole. Tape parts H together so they can be drilled at the same time.**

## Diagrams




### Diagram of the Boom Actuator




**Schedule of Materials: Mighty Mite Excavator**

| No. | Letter | Item | Dimensions T W L | Material |
|---|---|---|---|---|
| 1 | A | Body | 1½" x 5½" x 16½" | Pine |
| 1 | B | Boom Support | 1½" x 1½" x 10" | Poplar |
| 1 | C | Body Support | ¾" x 5" diameter | Poplar |
| 1 | D | Seat | ¾" x 10" x 11¼" | Poplar |
| 3 | E | Legs | 1½" x 3½" x 12" | Pine |
| 3 | F | Foot Pads | ¾" x 3½" diameter | Poplar |
| 2 | G | Base Reinforcement | ¾" x 8" diameter | Poplar |
| 2 | H | Boom Members | ¾" x 1½" x 17" | Poplar |
| 1 | I | Boom Stop | 1½" x 3" x 7" | Pine |
| 1 | J | Boom Stop | 1½" x 3" x 6½" | Pine |
| 1 | K | Bucket Beam | 1½" x 1½" x 21¾" | Pine |
| 1 | L | Bucket Bottom | ¾" x 4 " x 4" | Poplar |
| 1 | M | Boom Actuator (Long) | ¾" x 1½" x 18¼" | Poplar |
| 1 | N | Boom Actuator (Short) | ¾" x 1½" x 12" | Poplar |
| 1 | O | Spacer/Stop | 1½" x 1 9/16" x 3 7/16" | Pine |
| 1 | P | Boom Control Lever | ¾" x 1½" x 17¾" | Poplar |
| 1 | Q | Boom Control Lever | ¾" x 1½" x 17¾" | Poplar |
| 1 | R | Bucket Lever | ¾" x 1½" x 10" | Poplar |
| 1 | S | Spacer/Bearing | 1⅛" x 1¼" diameter | Maple |
| 1 | T | Brace | ¾" x 1½" x 7" | Poplar |

**Hardware Schedule: Mighty Mite**

| No. | Hardware |
|---|---|
| 1 | ½" x 10" vertical axle |
| 3 | ½" fender washers |
| – | ¼" fender washers |
| 2 | ⅛" x ¾" iron pipe |
| 3 | ⅛" x 1½" iron pipe |
| 2 | ¼" x 4" lag screws |
| 2 | ¼" x 4" carriage bolts |
| 1 | ¼" x 3½" hex head bolts |
| 4 | ¼" x 5" hex head bolt |
| 1 | ¼" x 3" hex head bolt |
| 1 | ¼" x 2" hex head bolt |
| 5 | ¼" x 3½" carriage bolts |
| 15 | ¼" id flat washers |
| 2 | ¼" id x 1" od flat washers |
| 17 | ¼" hex nuts |
| 1 | .062" x 4" x 10½" sheet metal |
| 1 | .062" x ½" x 12" sheet metal |
| 1 | ¼" x 11½" iron rod |
| 3 | ¼" id screw eyes |
| 1 | ¼" x 2" eye bolt (⅝" id eye) |
| 1 | ⅛" cable clip |
| 1 | Compression spring |
| 1 | ⅛" x 4' nylon rope |
| 2 | 3/16" rivet |
| 2 | #10 x ¾" RH wood screws |

**2 BASE CONSTRUCTION • Hand fit the legs where they come together in the center to a point. They should be 120 degrees apart. You can see in this photo where I used positioning marks on the legs.**

**3 TEST FIT • To connect the central sub-assembly and the base sub-assembly with the ½" threaded rod, I used a nut with a lock washer and applied Threadlocker™ to the end of it. Tap the rod at both ends.**

**4 LEVERS TOGETHER • Tape the actuating assembly parts together to drill them at the same time. The position of the parts shown here is not correct, but it made it easier to drill them together.**

angles to each other.

Drill for the three ¼" diameter x 4½" hex bolts, washers and nuts, then attach the legs to the discs. Turn the base sub-assembly over and use the center hole in the lower disc to drill the ½"-diameter hole for the vertical axle through the legs and the upper disc. Finally, glue and screw the foot pads in place.

To continue assembly, lay out the hole locations from the PullOut Plans on one of the boom members, then stack them and drill through both pieces. Clamp the boom stops between the boom members using two ¼" bolts through the end holes as alignment pins. Once these parts are correctly aligned, drill through the boom members and both boom stops. Temporarily assemble these components using four ¼" x 3½" carriage bolts, flat washers and hex nuts. It may be necessary to use fender washers as spacers during the final assembly.

To attach the hardware to the bucket beam, locate and drill the holes for the two bearings and the three screw eyes as located in the diagram on the next page. Cut out and permanently install the bucket bottom onto the lower, front surface of the beam. The radius of the bottom should be flush with the beam. Locate and drill pilot holes for the two wood screws that serve as retaining hinge pins for the sheet metal bucket.

**STEP 3 Check for Fit** • Temporarily install the central sub-assembly onto the base sub-assembly on the vertical axle rod. Use two large flat washers between the two sub-assemblies. Install the main boom sub-assembly onto its support bearing in the boom support with a ¼" x 5" hex head bolt. Then install the bucket beam onto the front of the main boom sub-assembly with a ¼" x 3½" carriage bolt through the upper beam bearing.

**STEP 4 Actuating Lever Assembly** • This assembly consists of the two boom actuators and the stopper. Glue them together then drill the three ¼"-diameter holes as indicated on the diagram on the previous page.

Fit the right hand lever with two bearings as shown in the PullOut Plans. The spacer is next glued to the bucket lever.

Next, temporarily install the levers onto the main bearing bolt and the actuating assembly in place on the right hand lever. Drill one 3/16" hole through the bucket lever for the actuation cord, then attach the front end of the actuating assembly onto the lower bearing of the bucket beam. Tighten all hardware to a snug condition and check for freedom of movement and extent of travel for all wood parts and their bearings. This is where you will determine how many fender washers will be needed, and where, for clearance between the moving parts.

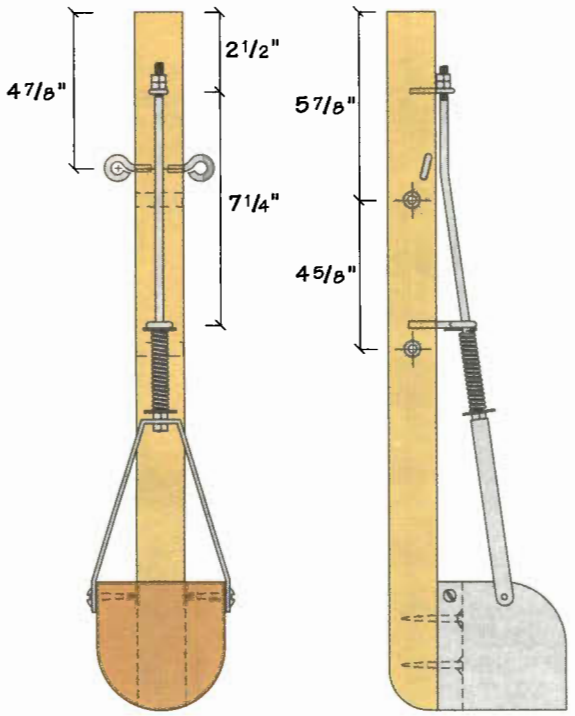
Set the two outer levers parallel to each other, with the bucket beam resting against the stop of the main boom assembly. Then bolt the brace piece between the left hand boom control lever and the boom stop. Then run a deck screw through the brace and into the left-hand boom member, and check again for correct operation. Install the bucket lever and spacer onto the left hand lever using a ¼" x 3" hex head bolt, fender washers, a ¼" lock washer and a ¼" hex nut.

Once the proper travel and freedom of operation has been found, disassemble all the sub-assemblies and note the number and location of all the fender washers.

Sand all the exposed surfaces and apply an appropriate outdoor paint. Then re-assemble the finished components, again checking for freedom of movement as you assemble. Add a nut and washer to the lower end of the ½" vertical axle.

**STEP 5 Make and Install the Bucket** • Form the sheet metal bucket by tightly wrapping it around a 3½" diameter can. Its inherent spring back will bring it to about 4" diameter. File smooth all sharp edges and attach it to the buck-

**Diagram of the Bucket Release Mechanism**




**5 BUCKET ASSEMBLY • After inserting the eyebolts into the arm, attach the connecting rod to the handle, which has been riveted to the bucket, and attach it to the shovel (top). Then, after reassembling the arm assembly, go ahead and string the shovel. Use a thin piece of wire to fish the doubled 1/8" nylon cord through the 3/16" hole (left), Bring enough cord through the hole to just wrap around a pan-head sheet metal screw. The screw is drilled into the opposite side of the bucket lever (bottom).**

et bottom with two #10 x 3/4" screws and flat washers.

To form the bucket handle, drill a 1/4" diameter hole through center and on the centerline. Then, drill 3/16" holes through both ends, 3/8" in from the ends and on the centerline. Also, drill two 1/8" diameter holes in the upper "v" of the bucket handle, which will be used during the rigging of the bucket.

Next, form the handle so that a 1" flat surrounds the center 1/4" hole. Then bend each end a few degrees 1" in from the ends. Attach the handle to the bucket with 3/16" rivets and flat washers to allow for freedom of movement.

To form the bucket release mechanism, cut 3/4" long, 1/4-20 threads on both ends of a 11 1/2" length of 1/4" diameter rod stock. Then make a 5-degree bend 2" from the upper end of this rod and install two 1/4" hex nuts, as shown in the diagram. These will be adjusted on final rigging.

Thread the 1/4" rod through the hardware as shown in the diagram above and then tighten the lower hex nuts securely in place.

Adjust the upper hex nuts so that they stop the bucket in its exact closed position (no gap, no overbite). Next, pass a 1/8" nylon cord through one of the drilled holes in the handle and knot it securely on the underneath side. Then pass the free end of the cord through the appropriate screw eye on the upper end of the bucket beam, through a clip (or screw) located on the bucket lever, back through the opposite screw eye in the bucket beam, and again through the opposite hole in the handle. Temporarily knot the cord.

With the bucket fully open, and the bucket beam against its stop, secure the bucket lever in parallel position with the right-hand and left-hand levers. Tighten the nylon cord and knot it securely just below the remaining 1/8" hole in the drilled washer. Tighten the set screw on the lever.

The Mighty Mite Excavator is now assembled and rigged for many hours of service-free operation on the most demanding of contracts. **PW**

*— Designed by Howard French; constructed by Jim Stuard. The Mighty Mite Excavator first appeared in the November 1993 issue of* Popular Woodworking.

# PRAIRIE SPINDLE CHAIR



*This Arts & Crafts reproduction will last a lifetime (or more).*

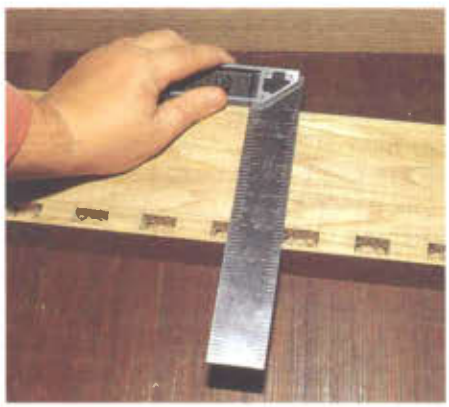
MANY Arts & Crafts enthusiasts consider the cube chair the stylistic peak of the Arts & Crafts movement. This version borrows heavily from a chair made by the L. & J.G. Stickley company, but the narrow spindles are characteristic of architect Frank Lloyd Wright's designs. Traditional quartersawn white oak and solid construction techniques make it true to Arts & Crafts principles.

Though the chair isn't complicated, there are a lot of repetitive steps in milling the many mortises and tenons. Begin by cutting the lumber to the sizes given in the Schedule of Materials.

**STEP 1 Getting Ready to Make the Mortises** • There are 82 mortise and tenon joints in the chair. A mortiser was my tool of choice, though a plunge router using a ½" straight bit is another option.

Each leg receives two ½" wide x ⅞" deep x 4" long mortises for the stretchers between the legs. These mortises start 10" up from the bottom of each leg, so this is a good time to determine the legs' orientation, making sure the best quartersawn figure faces out where it can be seen. The ½" wide x ⅞" deep x 1½" long apron mortises are next. The rear legs receive apron mortis-

**1 14 MORTISES • Except for the through mortises in the arms, I used a bench top mortiser to cut all the mortises. If you don't have one, this project is a great excuse to buy a $250 tool.**



**2 66 MORE • Time spent carefully laying out the mortise locations will pay off during assembly. If one or two of the mortises are off just a little, things go downhill quickly.**

es on the same two faces as the stretcher mortises, while the front legs receive only one apron mortise per leg, located on the side facing the back legs. These mortises start 1/4" down from the top so the aprons will be flush to the leg top.

**STEP 2 Making More Mortises** • Once you've completed the leg mortises, move to the side stretchers and aprons and mark each for the 11 1/2" x 1" x 5/8" deep mortises for the spindles. The mortises nearest the legs should be marked starting 1 1/4" in from each end — a 3/4" allowance for the stretcher tenon yet to be cut, plus 3/4" spacing between the leg and the first spindle. Allow a 1" interval between each spindle, and this will provide even spacing.

The back stretcher and apron are marked similarly, but the first mark is made 1 3/4" in from either end and then every inch. Cutting the through mortises in the arms will be among your final tasks, so you're through with mortises for now.

**STEP 3 Making the Tenons** • The next step is to make all the tenons. Whichever piece you start with, the stretchers, aprons or slats, the process will be the same steps with just slight dimension adjustments.

I prefer to form the cheeks first and define the shoulder last. This method prevents the saw-kerf from being seen on the shoulder, and prevents a waste piece from being trapped by the blade where it can be thrown back at you. In our case, the waste on most pieces is all sawdust, so there's less risk of throwback, but it's still a good thing to be aware of.

**3 TENONS • A jig attached to the miter gauge keeps the slat tight against the rip fence. The rear board should be 1/16" to 1/8" away from the rip fence to avoid binding.**

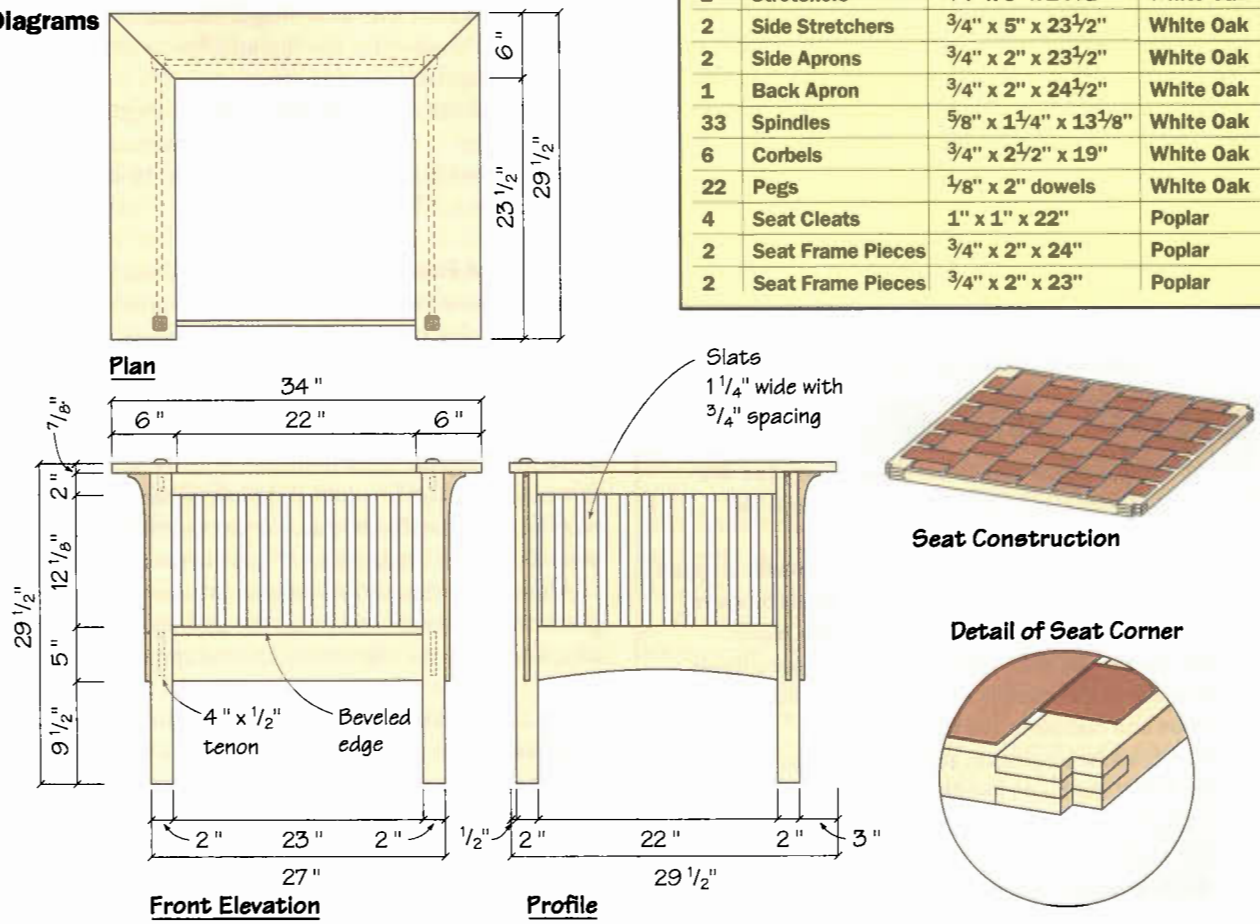
I started with the spindles and set my rip fence for about 5/8" and the blade height for 7/16". By running the spindle through with one face against the fence, then turning it and running the opposite face against the fence, I was certain my tenon would be centered.

When the setup was a good fit for the mortise, I attached a guide block to my miter gauge to keep my fingers away from the blade while making sure the slat didn't wobble during the cut. Two passes on each end of each spindle, and I was

**Schedule of Materials: Prairie Spindle Chair**

| No. | Item | Dimensions T W L | Material |
|---|---|---|---|
| 2 | Front Legs | 2" x 2" x 29 5/8" | White Oak |
| 2 | Rear Legs | 2" x 2" x 28 5/8" | White Oak |
| 2 | Arms | 7/8" x 6" x 29 1/2" | White Oak |
| 1 | Back Top | 7/8" x 6" x 34" | White Oak |
| 2 | Stretchers | 3/4" x 5" x 24 1/2" | White Oak |
| 2 | Side Stretchers | 3/4" x 5" x 23 1/2" | White Oak |
| 2 | Side Aprons | 3/4" x 2" x 23 1/2" | White Oak |
| 1 | Back Apron | 3/4" x 2" x 24 1/2" | White Oak |
| 33 | Spindles | 5/8" x 1 1/4" x 13 1/8" | White Oak |
| 6 | Corbels | 3/4" x 2 1/2" x 19" | White Oak |
| 22 | Pegs | 1/8" x 2" dowels | White Oak |
| 4 | Seat Cleats | 1" x 1" x 22" | Poplar |
| 2 | Seat Frame Pieces | 3/4" x 2" x 24" | Poplar |
| 2 | Seat Frame Pieces | 3/4" x 2" x 23" | Poplar |

**Diagrams**



**4 SHAPE THE SHOULDERS •** A stop block makes the 168 cuts to shape all the shoulders easier, but it's still pretty monotonous. Keep your wits about you, this is the place where accidents can happen!

**5 ASSEMBLY •** Start the first tenon into the first mortise and tap it into place, then start the second and so on, until all are started. Then either tap the tenons home, or use a clamp to pull the assembly tight.

**6 SIDE ASSEMBLY •** It's easy to get a little confused during assembly once you start the gluing process, so make sure you're using the correct pieces to maintain the most attractive grain pattern facing out.

**7 DOWELING THE TENONS •** The dowel holes are drilled 3/8" in from the edge and at the center of the apron tenon and 1" in from each stretcher tenon's width (left). After gluing the dowel in place, the 1/2" of dowel protruding from the hole is then trimmed flush to the leg, and sanded (right).

ready to cut the tenons to width. I readjusted my simple miter gauge jig and completed the cuts.

**STEP 4 Crisp Shoulders •** The final cut on the tenons defines the shoulder of the 1/2"-long tenons. The shoulder depth is cut using a stop block clamped onto the miter gauge as shown. Again, two passes are made on each end, then the blade depth is reset and the width passes are made. These same steps are used to form the tenons on the stretchers and aprons.

The through tenons on the front legs are made last. Again, the same three steps are used, with the final tenon size being 1 1/2" x 1 1/2" x 1". Before you begin sanding, cut the profile on the corbels, or arm supports, and to cut the arch on the bottom of the side stretchers. Full-size templates are provided for both in the PullOut™ Plans. I used a band saw to make the cuts wide of the pencil lines, then I sanded many of the saw marks out with a sanding drum chucked into my drill press. Final sanding for the curved edges is done with a random orbit sander.

Another detail prior to sanding is the 45-degree bevel on the top front edge of the front stretcher. This attractive detail will keep your legs from going to sleep! I made the cut on the table saw, leaving a 3/8" face on the top edge.

## SHOP TIP

**The center of a piece can be safely cut away (as with the arm jig template) without cutting through the perimeter of the piece.**

**Mark the cutout location, then (with the blade stopped and lowered below table height) adjust the rip fence to place an edge of the cutout directly over the blade.**

**Turn the saw on and, while holding the piece down firmly (clear of the blade), slowly raise the blade up into the piece and complete the cut.**

**When the saw intersects the marked lines of the cutout, lower the blade (while still running), below table level; then turn the saw off. Repeat the steps to complete the cutout shape.**

**This tip is suggested for MDF or plywood only. Solid wood may cause dangerous kickbacks.**

**STEP 5 Picket Fence... •** With the sanding done, you're ready to assemble. Start with one set of side aprons and stretchers and 11 slats. Test the tenon fits for any problems, and use a chisel to adjust the fit if necessary. To assemble the side, I clamped the stretcher into my front bench vise and applied glue to all the mortises. Make sure you use enough glue, but remember that too much may keep the tenon from seating all the way in. My tenon fit was tight enough to require just a little persuasion with a deadblow hammer, but if your tenons require more than a friendly tap, you risk bulging out the thin, 1/8" sides of the mortise.

After all the tenons are seated in the stretcher, remove the piece from the vise and place the apron in the same position, and insert the slat tenons into the apron mortises.

**STEP 6 ...And Fence Posts •** Next, dry-fit the tenons of the assembled side into the mortises on the front and back legs. When the fit is good, glue the mortises, assemble and clamp.

**STEP 7 Doweling the Joints •** While the sides dry, drill the legs for pinning the tenons and then insert the pegs. Use mask-

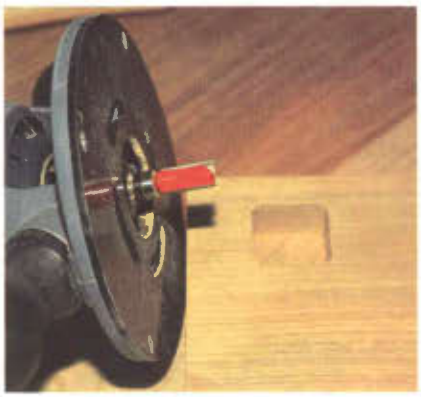
**8 SQUARED UP • It takes only a few clamps to complete the assembly process. But while the glue is still soft, check for square, and if necessary, add a clamp diagonally to adjust the frame until it's true.**

## WOOD WORDS (wood´wurds) n.

**medullary ray:** a vertical band or plate of unspecialized tissue that radiates between the pith and bark in the stems of trees.

**Stickley, Leopold:** (1869-1957) younger brother of Gustav Stickley; founded L. & J.G. Stickley Co. with brother John George. Precursor to the current L. & J.G. Stickley Inc.

**Prairie Style:** A school of architecture and furniture design pioneered by Frank Lloyd Wright. Prairie style is considered by many scholars to be one of the styles of the Arts & Crafts movement at the turn of the century.



**9 THE ROUT STUFF • After clamping the template back on the arm, use a router with a flush cutting bit with a top-mounted bearing to mill the rest of the mortise.**

**10 THE LAST CLAMPS • With the arms glued in place, check for glue squeeze-out and take your measurements for your seat's frame.**

ing tape to mark the 1/8" drill bit at a depth of 1 1/2" and drill two holes at each stretcher tenon and one hole at each apron tenon.

Cut the oak pegs to 2" lengths and then sand a chamfer on one end to allow it to slip into the hole easily. After putting a small amount of glue into the peg hole, tap the peg home, making sure the peg's end grain runs opposite the grain of the leg.

**STEP 8 A Square Chair** • After the sides are dry, use the same procedure to assemble the rear slat assembly. Then glue it and the front stretcher between the sides and clamp. You should also check for square at this time, using a clamp to adjust. If your clamps allow it, the corbels can be glued in place at this time. If you've got clamps in the way, wait till the glue on the chair frame is dry and then glue the corbels in place. It's important to center the corbel on the leg and keep the top flush with the leg top on the back leg and the tenon shoulder on the front leg.

**STEP 9 Through Mortises In the Arms** • Next cut the through mortises using the router template shown in the PullOut Plans. Use a table saw to make the template, and simply tack some 3/4" x 3/4" strips to the underside as indexing guides. These guides provide correct mortise placement, while allowing you to use only one clamp to hold the template in place during routing. (See the Shop Tip for more information on cutting the template.)

Once the template is ready, fit it over one of the arms and mark the location of the mortises. Unless you want to make two templates, you'll have to work from the underside of one of the arms, so pay attention to which side displays the best figure.

Use a 1 1/8" boring bit chucked into the drill press to clear away most of the waste from the hole, then rout, and square out the mortises' corners using a chisel.

The 45-degree miter joints at the back corners of the arms are then glued together using biscuits to align and strengthen the joint. But before gluing, gently tap the arms into place over the tenons and mark the height of the arm on the tenon with a pencil. Then carefully remove the arms, and use a biscuit joiner and glue to fasten the mitered arm pieces together.

While these dry, bevel the top of the leg tenon by marking a square centered 3/8" in around the top of the tenon, then use a random orbit sander to form a chamfer around the top of the tenon. This gives the chair an elegant finishing touch.

**STEP 10 Final Assembly** • Once the arm assembly dries, apply glue to the entire top edge of the chair aprons and corbels and place the arms over the tenons.

To finish the piece in an appropriate style for an Arts & Crafts piece, apply a brown aniline dye to the raw wood, then spray on a coat of lacquer, or shellac. When that has dried, apply a warm brown glaze, wiping off the excess until you have achieved a uniform color. After allowing the glaze to dry overnight, apply finishing coats of lacquer or orange shellac for a very warm color.

We went to an upholsterer for the seat, using a simple foam cushion mounted on a flat poplar frame. The sizes for the frame are given in the Schedule of Materials. The seat is then simply dropped onto four cleats mounted to the inside of the chair frame. We also had the upholsterer work up a back cushion at the same time.

After that, the chair is ready to put to important work. Ease down, wiggle into a comfortable position and read *Popular Woodworking* while you plan your next project. **PW**

*—by David Thiel, PW staff. This article first appeared in the May 1996 issue of* Popular Woodworking.

# Musical TOYS

These toys play tinkling tunes while providing action that adds to a youngster's play. They're fun to build, and there's the added pleasure of watching the kids enjoy them as the toys come to life.

## CAROUSEL

Start the Carousel by assembling the base. Make the corners by cutting a 1/2" x 1/2" groove in the center of a length of 3/4" square stock, then cut the pieces to length. Bore a 3/8" centered hole through the top and install the music box movement so its winding stem is centered in the hole.

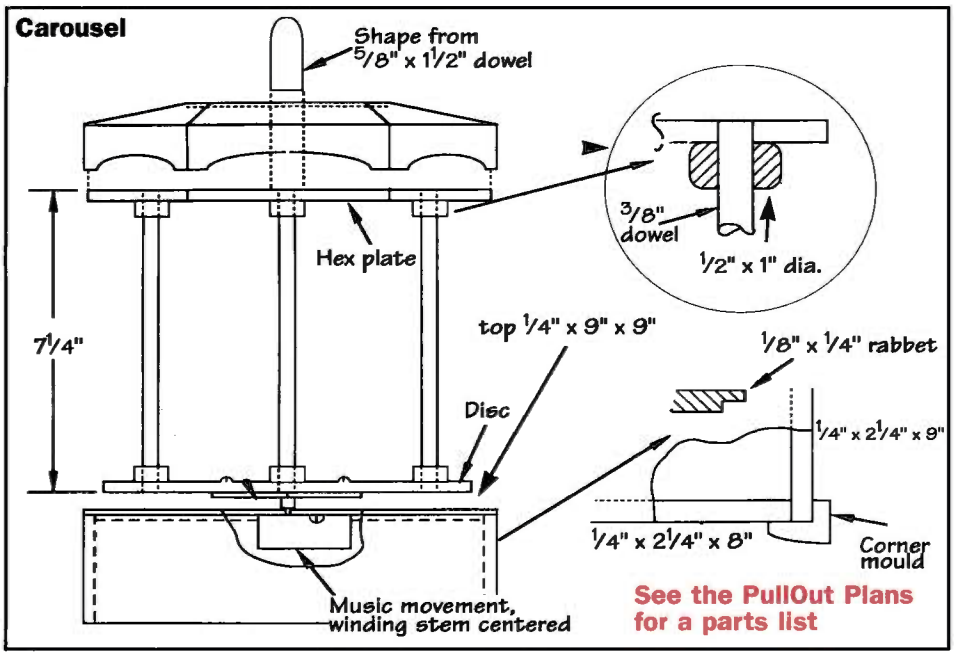
Next, make the bottom disc and the top hexagonal plate (see the PullOut™ Plans) and hold them together while drilling the holes for the posts. Attach a 3 3/4" plastic turntable at the center of the disc using small machine screws.

Use the full-size template in the PullOut Plans to lay out and cut the two halves of the posterboard canopy. Then carefully fold the pieces on the score lines and use adhesive tape on the inside so the canopy will hold its correct shape. Mark the hexagonal shape of the canopy's top on another piece of posterboard using the assembled canopy as a template. Bore a 5/8" hole through the center of this part and attach it with tape. Conceal the joints of the canopy with wide plastic tape and add a "finish."

Next, cut the posts to length and make the knobs that are installed at the top and bottom of the posts. The knobs are made from 1/2" thick slices of 1" dowel. Grip the pieces with a hand screw or vise and form the holes on a drill press. Slip the knobs on the posts and assemble with glue. Attach the canopy with hot melt glue and press it down over the hex plate. Then coat the bottom area of the top spindle with glue and pass it through the hole so it contacts the hex plate.

A full-size pattern for the horses is given in the PullOut Plans. After cutting to size, attach the horses to the posts with glue and 1/2" brads. The music movement is wound by rotating the disc or by turning the top spindle.

The carousel turns at a fair clip because of the diameter of the bottom disc mounted to the music movement.



# BAND WAGON

The Band Wagon is designed so the music movement drives the wagon by rotating the left rear wheel. The diagram shows the construction details for the wagon, while the PullOut Plans provide full-size patterns for the side of the wagon and the horses.

Make the sides first by bonding two pieces of 1/4" plywood or medium density fiberboard with carpet tape so they can be scroll sawed as a unit. Next, enlarge the left-rear axle hole to 3/8" and mount the movement so the winding stem is centered in the hole. See "Attaching the Musical Movements" for tips on this step.

The drive wheel is attached with hot melt glue to a metal disc key that fits the winding stem of the movement. (See supply source at the end of the article).

Mount the right-rear axle block to the second side of the wagon and drill it so it will provide a snug fit for the wheel's 1/8" diameter axle. Now make the end pieces and assemble the sides and ends. Complete the wagon body by making a sub-assembly of the top and seat area and installing it with glue.

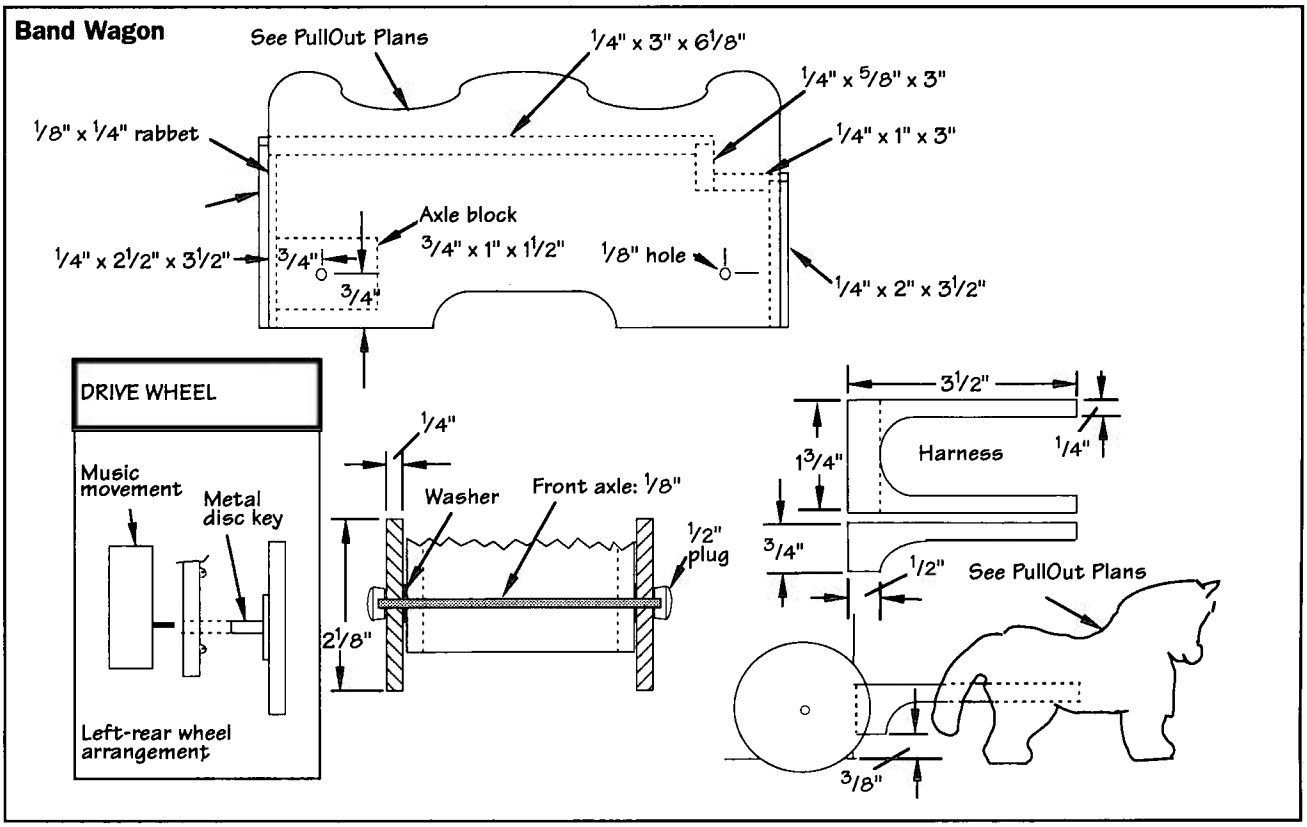
The front wheels, which should rotate freely on the the axle, are held in place with 1/2" round head plugs, press-fit on the axle. The best way to form the holes in the plugs is to grip them in a small hand screw or in a vise and then drill them on a drill press.

Shape the harness and glue it to the wagon and clamp. The horses, made by scroll sawing a pad of two pieces of 1/4" plywood or medium density fiberboard, are the last step. Attach them to the harness with glue and 1/2" brads. Note that the horses' feet are suspended a little above the ground to allow the wagon to move more freely.


The band wagon won't win a race, but it moves enough to add to a youngster's pleasure. The driver is a store-bought figure.

## Attaching the Musical Movements

You need special screws that are not easily available to secure the musical movements, but one of the following methods will get the job done with minimum fuss. First enlarge the hole in the base of the unit with a 3/32" drill bit and then drive in a #4 x 1/2" machine screw so it forms its own thread. The material in the unit's base is soft enough to permit this. Or open the holes to 1/8" and use #6 machine screws with nuts.



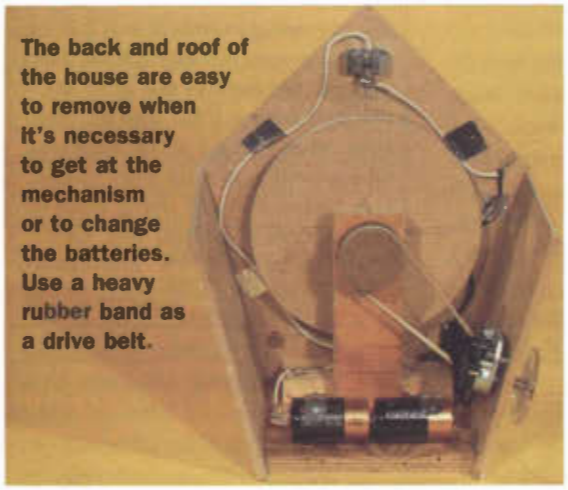
# PICTURE HOUSE

In addition to playing music, the Picture House features a rotating disc with small decals that are visible through a view hole in the front of the project. A flashlight bulb, powered by a pair of D-cell batteries and controlled with a small rotary switch, illuminates the "pictures."

Start the house by making the base, front and back parts (see the diagram). Because the front and back are similar, make a pad of 1/2" and 1/4" material so they can be shaped as a unit. I found it easiest to lay out the shape on the top piece, band saw or scroll saw close to the lines, and then finish by sanding on a stationary belt or disc sander.

Separate the two pieces and use a hole saw or a fly cutter to form the 2" view hole in the front part. Mark the locations of the three discs and drill 3/8" bottom holes. Next, assemble the base, support block and front with glue and 3/4" nails.

Make the mechanism parts and install them before continuing with the house assembly (see the PullOut Plans). Be sure the holes through the shaft support and the front of the house are on a common, horizontal line and that the drive drum and the picture disc are a tight fit on the shaft. Before final installation, paint the front face of the picture disc and apply decals of your choice on a radius that permits them to be seen through the view hole. Attach a small broom clip to hold the bulb with hot melt glue.



The back and roof of the house are easy to remove when it's necessary to get at the mechanism or to change the batteries. Use a heavy rubber band as a drive belt.

Hand turn the drive drum to make sure all is well, then make the sides for the house and install them with glue and small nails. Attach the music movement so its pulley is approximately centered with the drum. The winder is a 2 1/4" plastic turntable. Finally, make the two roof parts and join them with the ridge block. Attach the back to the base with two screws, then attach the roof assembly to the back. Using screws — no glue — allows you to easily remove the back and roof so the batteries can be replaced and should the mechanism ever require adjustment (see photo). **PW**

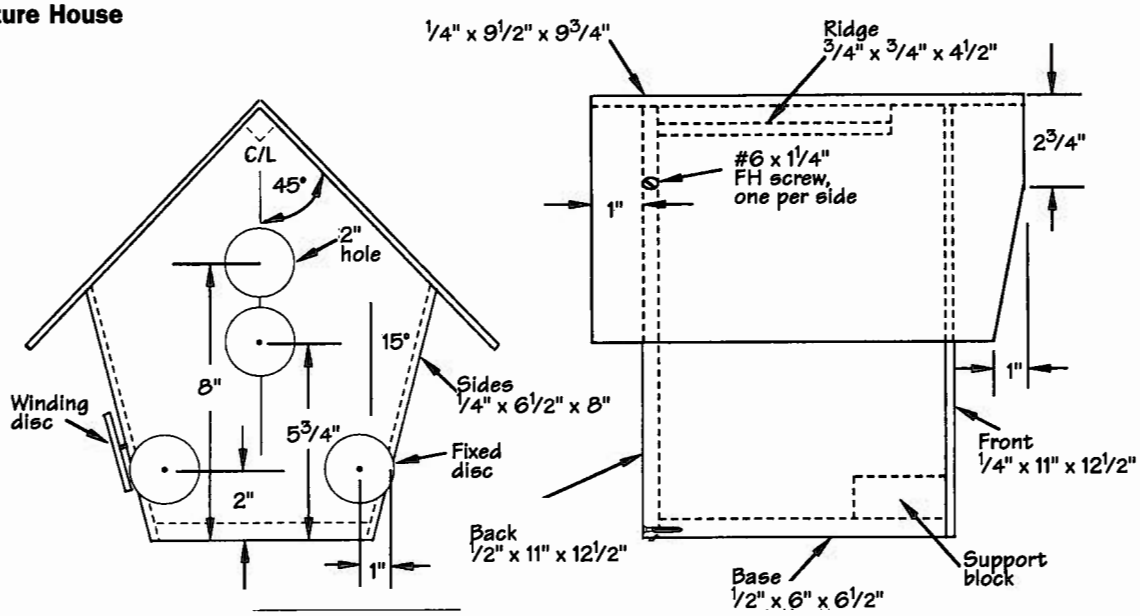
*R.J. DeCristoforo is the author of more than 30 books and is on the editorial advisory board of* Popular Woodworking.

**Source of supply:**

**Crafter's Mart • 800-999-3445**

**All three projects use a disk key music box (prices start at about $4 each). The Picture House also needs an accessory shaft (about 40 cents) and a pulley assembly (about $1). Call for exact prices and musical tunes available.**

**Picture House**



# The Sawyers Whirligig

*If you love cutting wood, you'll be blown away by this contraption.*

POPULAR WOODWORKING 100 ISSUES

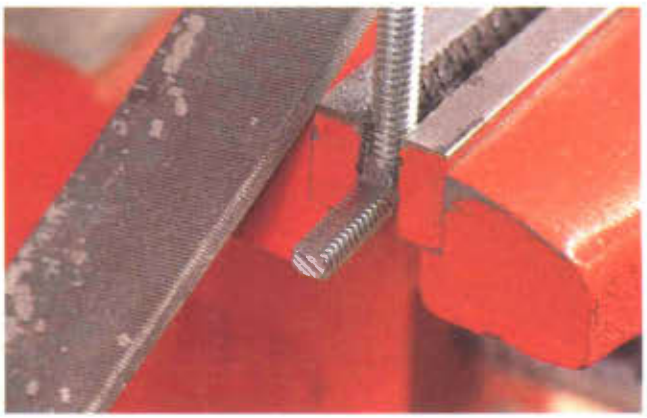
IN THE NORTH COUNTRY, amazing feats of lumbering are a daily occurrence. This whirligig honors woodsmen (and woodswomen) and the pioneers who cleared the land for adventurous homesteaders.

This particular whirligig has quite a pedigree because it was designed and originally built by Anders Lunde of Chapel Hill, N.C., who was commissioned by the Smithsonian Institution to build up to 30 whirligigs for their "Toys of All Ages" show and who is the author of two excellent books on whirligigs. Whirligigs that feature a person chopping or sawing wood are a common theme in Canada and the United States.

This air-powered animation is easy to make from wood you can find around the shop. The base was made from cedar (though other outdoor woods will work) and the figures were built from 1/4" Baltic birch, though CDX plywood would also work well.

STEP 1 **Build the Base** • First cut out the base piece, then glue and nail the pivot support piece 4" in from the propeller end of the base. In the middle of this piece, drill a 3/8" hole 1 3/4" deep and insert a piece of brass or copper tubing as a bushing (the copper pipe used to attach ice makers is the perfect size). Place a metal "cap" in the bottom of the socket made from a 1/4" section of a 20d or 30d nail. Next attach the two angle irons to the propeller end of the base. The front one should poke about 1/8" over the end of the base; The rear one is attached with the upright 3 1/2" from the front.

Make a 2 1/2"-long cut with a coping saw at the end of the base for the tail, which you can cut from sheet aluminum or lightweight galvanized (old ductwork works nicely). Tack it in place with some short finishing nails.

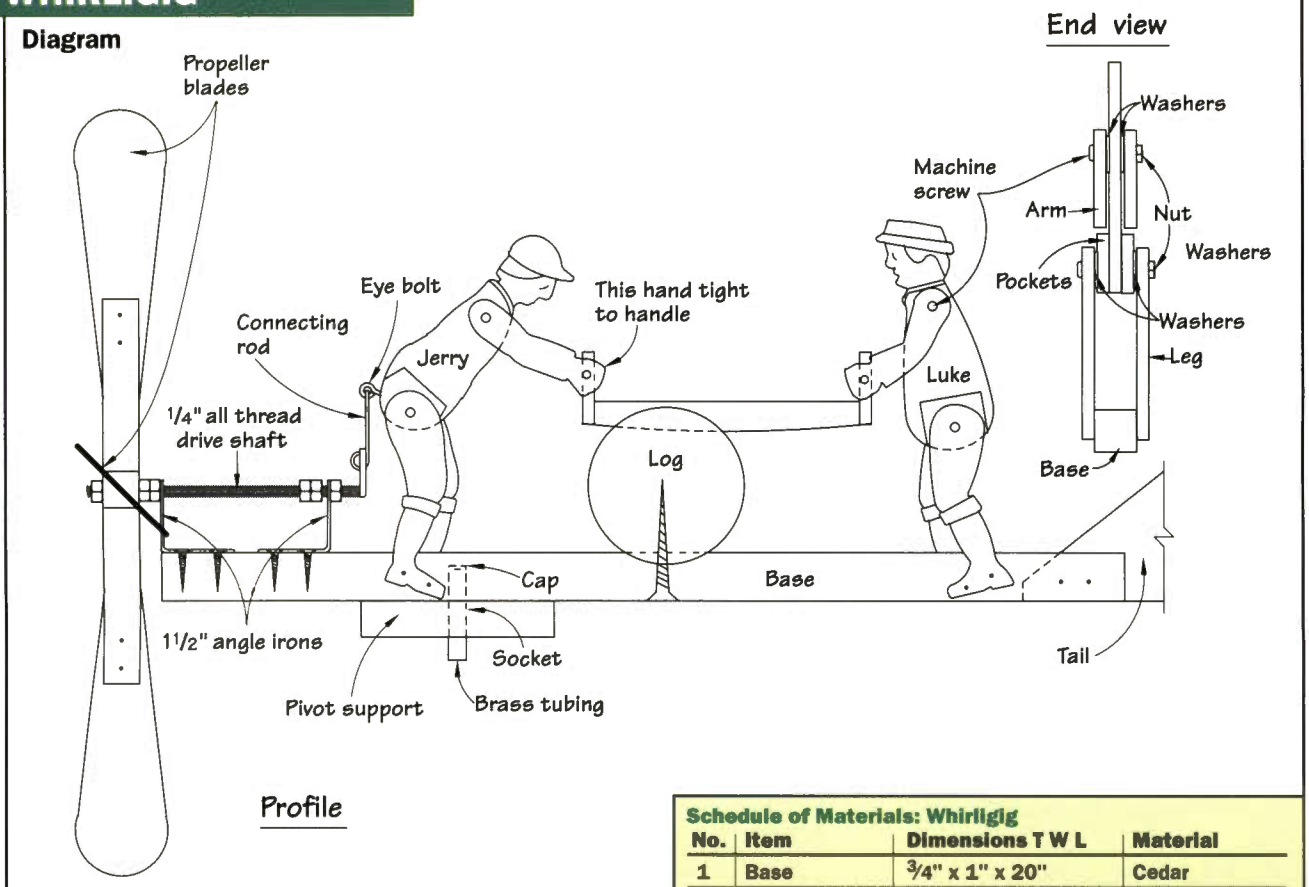


**1 DRIVE SHAFT • To make my drive shaft, I used a length of 1/4" pre-threaded rod. Stick the rod in a metal vise with about 1/2" sticking up above the jaws. Slowly and somewhat gently tap the rod with a hammer until it bends at a right angle. To flatten the end of the rod so you can drill a hole for the connecting rod, file down both sides as shown in the photo using a mill bastard file.**

One way to make the drive shaft is from a 6 1/2" length of 1/8" drapery rod or welding rod. You'll have to thread the end to attach the propeller and then put two right angle bends on the other end and then thread that end. Another option is to

## WHIRLIGIG

**Diagram**




**Schedule of Materials: Whirligig**

| No. | Item | Dimensions T W L | Material |
|---|---|---|---|
| 1 | Base | 3/4" x 1" x 20" | Cedar |
| 1 | Pivot support | 3/4" x 1" x 4" | Cedar |
| 1 | Log | 1 1/2" x 3 1/2 diameter | Pine |
| 2 | Saw handles | 3/8" dowels x 1 1/2" | Hardwood |
| 1 | Figures | 1/4" x 12" x 12" | Baltic Birch Ply. |
| 2 | Cross pieces | 3/4" x 3/4" x 8" | Cedar |

**Hardware Schedule**

| | | |
|---|---|---|
| 1 | Socket liner | 3/8" x 2" brass tubing |
| 2 | Angle irons | 1 1/2" x 1 1/2" |
| 1 | Drive shaft | 1/8" or 1/4" wire or bolt x 6 1/2" |
| 1 | Saw blade | 5/16" x 6" light aluminum |
| 2 | Hip joints | 1 1/2" machine screws, nuts, washers |
| 4 | Other joints | 1" machine screws, nuts, washers |
| 4 | Prop blades | 3 1/2" x 6" light aluminum |
| 1 | Screw eye | 1/4" screw eye |
| 1 | Tail | 5" x 7" light aluminum |
| 1 | Connecting rod | 14-gauge wire |

**2 SCROLL SAW • Each figure needs two arms, two legs and two "pockets," which make the body fit nicely on the base piece. Photocopy the pattern and attach it to your plywood with a spray adhesive. Sand the edges of the figures after you cut them out.**

buy the copper rod used in toilets to attach the float. It is threaded on one end, bends easily and won't rust.

If you're not fond of threading metal, you can use my method shown in the photo that uses a 6 1/2" length of already threaded rod. Drill a 1/8" hole in the bent section of rod. The closer to the end the hole is, the more vigorous the sawing motion will be. (It can be a little too vigorous. My first drive shaft made poor Jerry slam his head against the log.)

**STEP 2 Making the Figures** • Make the log from a scrap piece of 2x4 cut in a rough circle, about 3 1/2" in di-

ameter. Cut a 3/4"-wide groove in the bottom of the log so it will fit snugly against the base. Cut a 1/2"-deep 1/4"-wide groove on the top of the log for the saw blade to run in. Drill a hole in the base that's 10 1/2" in from the propeller end and glue and screw the log to the base.

Make the saw blade from a piece of lightweight aluminum (the full-size drawing for this is in the PullOut™ Plans) and two 3/8" dowels for handles that have been cut to 1 1/2" lengths. Cut 1/2"-long slots in the handles and attach the handles with brads. Drill a 1/8" hole near the top of each handle to attach the hands.

Next cut out the pieces for the two sawyers, Jerry and Luke (see the PullOut Plans). I used a scroll saw, though a coping saw will do fine. Some whirligigs feature a woman in Luke's place. This can be easily accomplished by giving Luke a flared skirt, a few more curves and some extra hair.

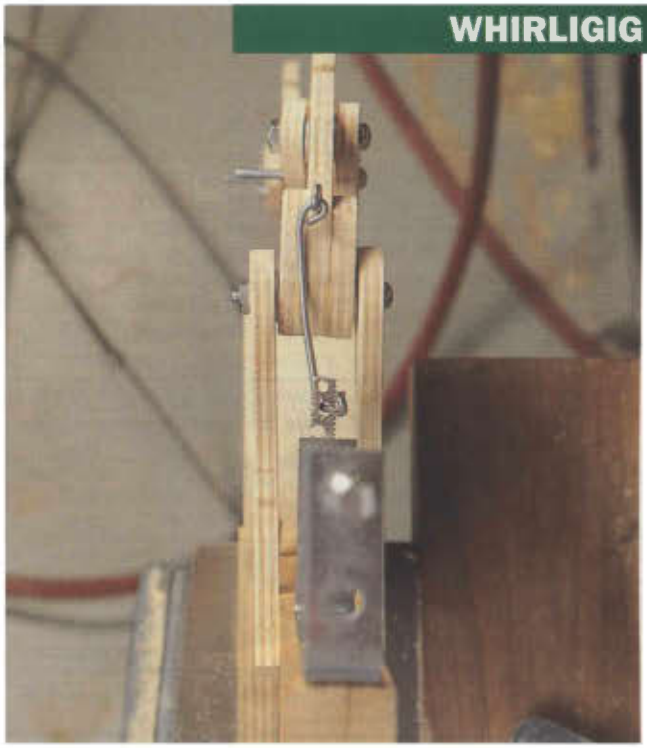
**STEP 3 Assembly** • Glue the "pockets" on the figures and then drill 1/8" holes for all the joints according to the diagram. Attach the sawyers' arms with 1" machine screws and washers. The machine screw through Jerry's legs should be positioned about 5 1/4" in from the propeller end and 3" above the base piece. Clamp Jerry's feet in this position, attach a screw eye to his rear and then connect the drive shaft to the screw eye with 14-gauge galvanized wire. Try different lengths until Jerry bends forward but doesn't slam his noggin against the log. Then glue and nail his feet into place.

Position Luke's hip joint 16 1/2" from the propeller end and 2 1/2" above the base. Attach the saw to their hands with 1" machine screws to see if everything moves smoothly. The only screw that needs to be really tight is the one connecting Jerry's hands to the saw. The others can be left loose. When things are working right, nail and glue Luke's feet to the base. Disassemble the figures, paint them (I used a set of $3 acrylics I found at a hobby store) and then coat them with an outdoor urethane or spar varnish. Indoor urethane will flake off when exposed to the elements. When you reassemble the figures, you might want to use some sort of metal-locking solution to make sure the bolts stay in place. (I used a brand called Threadlocker™.)

**STEP 4 Propeller** • There are many ways to make a propeller. Here's how I made the one shown in the photo: Cut the 3 1/2" x 6" pear-shaped blades from aluminum or lightweight galvanized metal. Cut the two cross pieces to size and then cut 3/4" x 3/8" dadoes in the center of each piece to form a half-lap joint. Using a coping saw or band saw, cut a 2"-deep diagonal slot in the each end of the two pieces. The diagonal slots need to run in opposite directions on each piece. For example, if your slot runs from the top left to the bottom right on one end of the piece, it should run from the top right to the bottom left on the other end. Otherwise, your propeller won't turn well (if at all).

Round the ends of the cross pieces with sandpaper, then insert the blades into the slots and attach them with brads. Drill a hole in the center of the two cross pieces and attach the propeller to the drive shaft. Use nuts and washers to space the propeller far enough from the base to keep the blades from striking it. Pound a 30d nail into a post, cut off the head, stick your whirligig on it and enjoy watching these two go to work. **PW**

*—Whirligig designed by Anders S. Lunde; construction by Christopher Schwarz. This article originally appeared in the March 1987 issue of* Popular Woodworking.



**3 GET THE MECHANICS RIGHT • This photo shows where I put the screw eye on Jerry's backside. As you can see from the drive shaft, I tried several different locations for the hole to attach the connecting rod. Don't forget to use washers between the legs and the pockets to reduce friction and wear on your sawyers.**

**4 PROPELLER • Metal snips are useful for cutting the propeller parts and tail piece. Protective gloves don't hurt, either. After you cut out the metal, pound the edges flat with a hammer and then sand or file them smooth.**

## NEW PRODUCTS

***Popular Woodworking*** **wants to provide readers with accurate, useful information on the newest woodworking tools and products, so we test most of the products presented here in the *Popular Woodworking* workshop. We've considered cost, design and benefit, and added our comments about the tested items to help you make decisions about future purchases.**

### Jacobs® RouterChuck™ Eliminates Wrenches

**Contact:** The Jacobs Chuck Manufacturing Co.
864-654-5926

**Availability:** As feature on some manufacturer's tools in early 1998; available as after-market in mid-1998.

**Features:**
- Replace a router bit by hand by releasing the sleeve, replacing the bit, and snapping the sleeve back into place
- Offers tool-free bit changing, simplifying consumer use, and also potentially reducing manufacturers' production expenses by not requiring spindle lock mechanisms or "on-board" storage of wrenches
- Simplifies use of table-mounted routers by eliminating need to remove router to change bit

*For more information, circle #170 on the Resource Directory Coupon.*

*"Very smooth table movement, up-front slide release and soft-start motor all enhance the high-quality cut."— PW*

### Makita's 10" Dual-Slide Compound Miter Saw — It's Loaded!

**Contact:** Makita USA
714-522-8088

**Retail Price:** $669

Available through Makita dealers and catalogs.

**Features:**
- Twin-linear ball bearings on both rails and an angular-mounted motor allow bevel cutting 0° - 45° to the left and right
- Pivoting fence supports tall stock and moves clear of cut quickly without tools
- Single machined aluminum turning base remains flat and offers positive stops at 0° and on the left and right sides at 15°, 22.5°, 30° and 45°
- Dual-position depth-adjustment knob allows for preset depth setting for dado work
- The 13-amp motor with replaceable external brushes produces a 87.5 dBA noise level

*For more information, circle #171 on the Resource Directory Coupon.*

### First Fein Tools Cordless Drill/Driver

**Contact:** Fein Power Tools
800-441-9878

**Retail Price:** $245

Available through Fein distributors.

**Features:**
- 12 -volt drill offers two battery locations, (as shown, or at the base of the handle) to let the tool adapt to the job
- Includes 2 batteries, a one-hour charger and a 12-position keyless chuck
- Two speed options offer 0-340 and 0-1,200 rpm ranges
- Weighing 5 lbs., it delivers a maximum 230 in./lbs. of torque

*For more information, circle #172 on the Resource Directory Coupon.*

# NEWS FLASH!

## Makita Offers First Nickel Metal Hydride-Powered Cordless Tools

Touted as the first major advancement in high-drain battery technology in the last 20 years, Nickel Metal Hydride (NiMH) batteries provide higher capacities than Nickel Cadmium (NiCd) batteries, which is the current traditional power source for high drain applications such as cordless drill/drivers.

NiMH also represents an environmentally preferable energy solution and, as NiCd batteries are reaching their maximum capabilities, NiMH is seen as the next generation power source for the power tool industry.

At the 1997 Chicago Hardware Show, Makita unveiled the new battery technology powering a cordless drill. Ken Hefley, assistant vice president of marketing for Makita USA said the new battery technology will likely be available by spring of 1998.

## Storehorse's 20-Minute Plywood Workbench

**Contact:**
Storehorse
800-555-9753

**Retail Price:** $40

Available at home center stores.

**Features:**

- Using one 4'x8' sheet of plywood and six 2'x4's the StoreBench provides an 8'-long workbench with 36"-deep work top and back plate for tool storage
- Supplied parts and your materials make a sturdy workbench in less than 20 minutes
- Storehorse also offers a number of other helpful shop items such as the StoreStool shown in the photo

*For more information, circle #173 on the Resource Directory Coupon.*

*"Bosch's jigsaw has been the industry standard for years, so it's quite fitting to celebrate it with a special anniversary edition. If you don't have one, now's the time" — PW*

## Bosch Celebrates 50 Years of Jigsaws


**Contact:** S-B Power Tools
773-286-7330

**Retail Price:** $165, available at home center stores.

**Features:**

- Anniversary model 1587AVSK includes a steel carrying case, and gold anodizing of the cast components on the saw
- Standard features include variable-speed orbital action, "clic" tool-free blade installation, and foot plate that adjusts to 45 degrees left or right
- Saw offers 1" stroke length, and operates between 500 and 3,100 strokes per minute

*For more information, circle #174 on the Resource Directory Coupon.*



Circle #129 on Resource Directory Coupon



Circle #112 on Resource Directory Coupon

# NEW PRODUCTS

*"JET's reliable woodworking machinery has now made a strong move into the home woodshop at a more easily affordable price. By offering well-built woodworking machines for a practical price, JET is moving quality home woodworking to an affordable level." — PW*

## JET Offers Six Shopline Tools

**Contact:** JET Equipment & Tools
800-274-6842

**Retail Price:** See each item. Available at home center stores in early 1998.

### JSL-14DP Drill Press - $299

- This full-featured floor-model drill press offers a 14" swing, while the ½" chuck offers a 3¼" spindle travel
- The ⅓hp, 1 phase, 115/220v motor offers 12 speed options from 250 to 3,100 rpm

### JSL-10TS Table Saw - $399

- 10" direct-drive table saw operates with a 15 amp, 115 volt motor
- The cast iron table measures 22¼" x 20⅜" with two 9" x 22¼" stamped steel wings
- Cut capacity is 3" max. at 90° and 2⅛" at 45°, and a 14½" rip capacity to the left of the blade and a 27" rip to the right
- The JSL-10TS also includes a T-style precision fence, stand and carbide-tipped blade

### JSL-6J Jointer - $399

- This open-stand jointer offers a 6" x ½"cutting capacity using 3 knives at an operating speed of 4,850 RPM
- The cast iron table measures 7⅜" x 46" with a cast iron fence that tilts to 45°
- The JSL-60SJ includes a ¾hp, 1 phase, 115v/230v motor and a 4" dust port

### JSL-12BS Band Saw - $299

- 12" width and 6" depth cutting capacity using 82" blades from ⅛" to ½" widths
- The ½hp, 1 phase, 115 volt motor provides 2,750 SFPM blade speed
- The band saw comes with stand and a 2" or 4" dust port

### Bench Grinder

**PLUS:**

- Also included in the Shopline set is a 1hp, 610 CFM, single-stage dust collector for $199 and a 6" or 8" two-wheel bench grinder with ¼hp or ½hp motor for $59, or $109 respectively

*For more information, circle #175 on the Resource Directory Coupon.*

# White Oak

***(Quercus Alba)***


**Other Common Names:** Swamp Chestnut, Chestnut Oak, Overcup Oak.

**Growing Regions:** USA, Canada and Mexico.

**Characteristics of Tree:** A moderately sized tree, it can reach a height of 100 feet with a trunk diameter of 3 feet in good growing conditions.

**Characteristics of Wood:** A straight-grained wood that varies in color from pale yellow-brown to pale brown, sometimes with a pinkish tint; sapwood is creamy white. When quartersawn, oak shows silvery ray flakes. The wood has a medium-coarse to coarse texture.

**Workability:** The wood works well with both sharp hand and machine tools. It takes nails and screws well, but its gluing properties vary.

**Common Uses:** Building construction, interior joinery, furniture and cabinetmaking, flooring, tight cooperage, boat and ship construction, pews and pulpits, ladder rungs, wagon bottoms, coffins, plywood, veneer, whiskey barrels.

**Availability:** Readily available.

**Wood Movement:** Dries slowly with a tendency to check, split and honeycomb. There is medium movement in service.

**Finishing Characteristics:** The wood accepts stain well and can be polished to a good finish.

**Special Features:** This wood is virtually rot-resistant. Green white oak has excellent steam-bending properties. Many people are allergic to slightly green oak, so long sleeves and a good ventilation system may be in order.

**Midwest Pricing:** $4 per board foot, surfaced. **PW**

## Abrasives

**ECON-ABRASIVES.** Econ-Abrasives custom makes abrasive belts up to 52" wide in any size and grit. Sandpaper is our specialty; we can help you answer any questions you may have on product applications. Call now for your free catalog; it contains hundreds of abrasives and woodworking accessories, including: safety equipment, velcro®-backed discs, wood clamps, wood glue, drawer slides, hinges and much, much more! **Circle #111.**

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**DELTA INTERNATIONAL MACHINERY CORP.** manufactures woodworking machinery and accessories for home workshops, building and construction trades, industry and schools. Quality line includes table saws, miter saws, band saws, jointers, scroll saws, wood lathes, planers, belt/disc sanders, grinders and more. For the name of your nearest Delta distributor, or to order free Delta machinery catalogs, call toll-free (800) 438-2486. **Circle #112, #113 & #114.**

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**ARROW FASTENER COMPANY,** Inc. is one of the oldest American hand tool manufacturers. In addition to its world famous line of all-steel staple gun tackers and staples, Arrow also produces a full line of Brute steel rule measuring tapes, rivet tools, hot melt glue guns and supplies. Arrow...the standard of excellence by which all others are judged. **Circle #109.**

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POPULAR WOODWORKING 100 ISSUES AMERICA'S BEST PROJECT MAGAZINE

# SHAKER Wall Clock

*A classic design from one of America's most famous clockmakers.*

ONE OF THE BEST Shaker clockmakers was Isaac Benjamin Youngs. Although he built mostly tall case clocks, his most well-known work is this small wall clock. It's particularly interesting in that the backboard was also the backplate for the gear movement. The clock was made of pine and had a light exterior stain and a dark-stained interior. As with any project that has hardware involved with it, you should acquire all of the hardware for the clock first. The company S. LaRose sells a kit for this project that includes the movement (mechanical or electrical), the face, pendulum, hands, hinges, pulls and door catches.

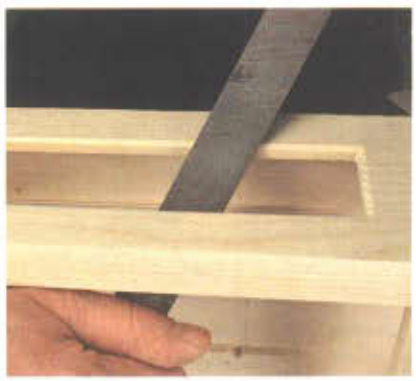
**STEP 1 Build the Case** • Cut the case parts to the dimensions given in the Schedule of Materials. Next, cut rabbets on the ends of the sides, top and bottom (see diagram detail), and cut the 1 1/2" x 7 3/4" windows at the top of each side piece. Using a rabbeting bit, cut a rabbet on the inside of the window opening, and finally, rout a 1/16" deep x 5/8" wide x 2" dado on the inside of both sides to capture the divider.

Cut and shape the hanger as shown in the diagrams, then cut a 5/16" x 5 1/4" notch in the cap to mount the hanger flush to the case back. Cut a 7/16" wide x 2" notch on either end of the divider, leaving a 3/4" overhang to the front of the case. Then use a 3/8" radius router bit on the top and bottom edges of the overhang, and on the inside edge of the cap and base.

Dry fit the box assembly and make sure everything fits, then glue and nail the parts together. The nails can be recessed with a square set to simulate an actual cut nail as shown in Steve Shanesy's "Little Shop" article in this issue. Check for square on the case and nail the divider into the side dadoes, then glue in the face mounts flush to the front of the upper case opening and sand.

**STEP 2 Make the Doors** • The doors are the only difficult part of this project, so take your time and measure accurately. For best appearance, lay out your stiles so the upper and lower door stiles on each side come from one length of wood to match the grain. Next, mark and crosscut the lower door stiles from the pieces, then rip the fall off to 1 1/4" and mark and crosscut the lengths for the upper door stiles.

Mortise the stiles first then cut the tenons to fit. Then groove the lower door rails and stiles for a panel, and rabbet the upper door parts for the glass as shown in the diagram. The inside corners of all of the door parts are mitered (see diagram), to allow for a decorative chamfer on the inside edge. Finally, glue up the lower door panel and cut it to the size given in the Schedule of Materials, and bevel cut the inside face of the



**1 FRAME DETAILS • To cut out the holes for the side lights, pilot-drill the four corners, then scroll-saw the waste. Then cut a 1/4" x 1/4" rabbet using a 1/4" offset bearing bit. After routing the rabbet, remove the waste with a chisel (top). Then, to match the chamfer planned for the front doors, I chamfered the edges of the side lights with a mill file (bottom).**

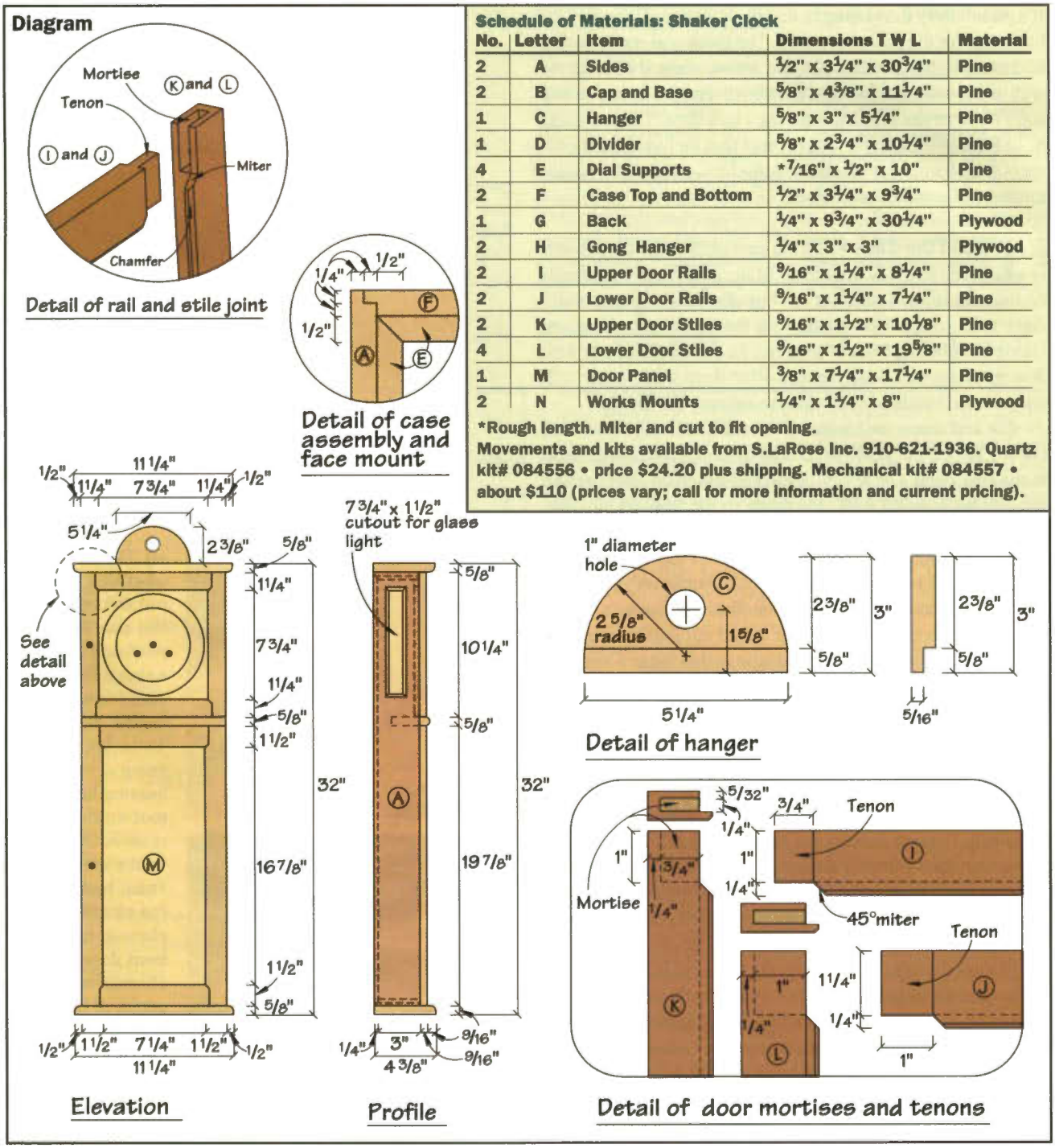
panel and dry assemble the door.

When everything fits, glue the doors together. Be sure to check for square and try not to get any glue on the door panel so it can expand and contract with humidity changes. After the glue sets, fill any loose joints and sand the doors and case where needed. Then, lay out and inlay the hinges so you get a nice tight joint when they close.

**STEP 3 Strong Magnets** • The kit for sale by S.LaRose has two magnetic catches. I decided not to use these catches in favor of rare earth magnets supplied by Lee Valley Tools (800-871-8158). These are very strong and very small magnets, perfect for a project such as this.

**STEP 4 The Works** • Cut and fit the 1/4" back in the rabbet at the rear of the case, then cut and install the mounting blocks for the works and the chime. Before you install the works, I suggest first mounting them and the chime to a piece of plywood with all of the appropriate mounting spacers as shown in the photo.

Next, cut the face to fit in the upper opening. You should have equal spacing on all four sides of the glass opening on




**Schedule of Materials: Shaker Clock**

| No. | Letter | Item | Dimensions T W L | Material |
|---|---|---|---|---|
| 2 | A | Sides | 1/2" x 3 1/4" x 30 3/4" | Pine |
| 2 | B | Cap and Base | 5/8" x 4 3/8" x 11 1/4" | Pine |
| 1 | C | Hanger | 5/8" x 3" x 5 1/4" | Pine |
| 1 | D | Divider | 5/8" x 2 3/4" x 10 1/4" | Pine |
| 4 | E | Dial Supports | *7/16" x 1/2" x 10" | Pine |
| 2 | F | Case Top and Bottom | 1/2" x 3 1/4" x 9 3/4" | Pine |
| 1 | G | Back | 1/4" x 9 3/4" x 30 1/4" | Plywood |
| 2 | H | Gong Hanger | 1/4" x 3" x 3" | Plywood |
| 2 | I | Upper Door Rails | 9/16" x 1 1/4" x 8 1/4" | Pine |
| 2 | J | Lower Door Rails | 9/16" x 1 1/4" x 7 1/4" | Pine |
| 2 | K | Upper Door Stiles | 9/16" x 1 1/2" x 10 1/8" | Pine |
| 4 | L | Lower Door Stiles | 9/16" x 1 1/2" x 19 5/8" | Pine |
| 1 | M | Door Panel | 3/8" x 7 1/4" x 17 1/4" | Pine |
| 2 | N | Works Mounts | 1/4" x 1 1/4" x 8" | Plywood |

*Rough length. Miter and cut to fit opening.

Movements and kits available from S.LaRose Inc. 910-621-1936. Quartz kit# 084556 • price $24.20 plus shipping. Mechanical kit# 084557 • about $110 (prices vary; call for more information and current pricing).

**2 DOOR ASSEMBLY • I cut the mortises on the stiles with a mortising attachment for my drill press (left). Traditional methods work well here, too. The mortises on the upper doors measure ¼" x 1" x ¾". The mortises on the lower doors ¼" x 1¼" x 1". After you cut the tenons, mortises and grooves for the door parts, you need to cut back the corner lips on the face frame pieces. See the diagram for the precise locations of the lip. Cutting this back allows the chamfered edges to meet at the corners.**

**3 QUICK CATCHES • To install the rare earth magnets, drill a small hole in the frame and the door. Put a few drops of cyanoacrylate in the holes and press the magnet in with the cap of the glue (it won't stick to the magnet). Allow the glue to ooze up the sides and onto the top of the magnet. When it dries, sand it for a finished appearance.**

**4 HANG THE MECHANICS • Before you put the mechanics in your clock, it's best to first hang them on a piece of plywood to find out exactly where the mounting blocks need to be located on the back of the clock (left). Make sure that when you're laying out the location of the face that the center spindle is in the center of the door. Then cut your face to size. Once you figure out where the mounting blocks should be located, attach them to the back of the clock (right).**

**5 CAMOUFLAGED PUTTY • To make the water putty look the same color as the wood, first mix up the stain to the appropriate color. Then add the watter putty. Finally, apply the mixture with a piece of scrap wood.**

the door. Lay out and drill the winder holes in the face and install the brass grommets and temporarily tape the face into the opening. Lay the clock on its back with the works loose inside. Position them to line up with the holes in the face and mark their location on the back. The works should be spaced so that the spindle protrudes enough to let the hands work properly(mount them so you can make sure they rotate freely). Once you are sure the movement is working, remove them, the doors and hinges and proceed to finishing.

STEP 5 **Finishing** • I used a water-based, powdered aniline dye with a lacquer finish. However, my test pieces were too blotchy. To fix this condition the pine with clear Watco oil finish. After wiping on two quick coats of oil, wipe it dry and wipe on the aniline dye. The dye will appear to be separating from the oil finish but keep wiping. After a couple of swipes the dye soaks in and gives nice, predictable results. Apply two coats of lacquer and rub the finish out to suit.

## Clockin' on the Cheap

**If you can't spend about $100 for a swell German movement, install an electric movement with a pendulum instead. During construction of the clock, eliminate the mounting blocks and mount the face to a piece of ¼" masonite. Drill the center hole out and mount the movement in the hole and make sure that the pendulum can swing freely when the clock is running. The part number for this kit is available in the Schedule of Materials.**

Reinstall the doors and components. Nail the face in from behind with small brads and screw the back, with the works attached into the case. Now you are ready to hang your clock on the nearest Shaker peg rack. **PW**

*—Original article by John A. Nelson. Construction by Jim Stuard. This article originally appeared in the May 1991 issue of* Popular Woodworking.

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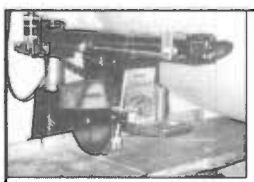

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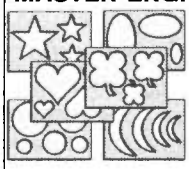

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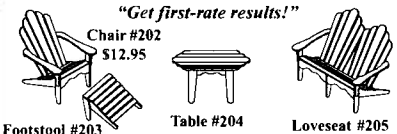

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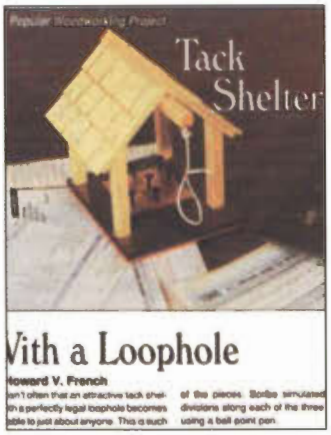


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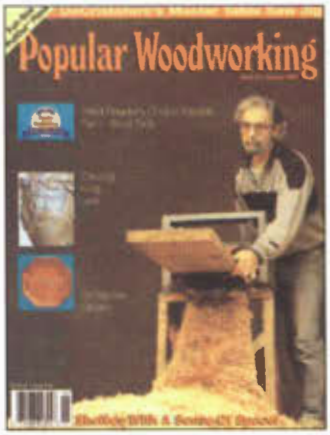


**Our best-selling cover. Why? It's still a mystery to us.**


**The Pocket People get our vote for one of the most unusual projects we've published.**

IN THIS ISSUE we presented some of the best projects and best "Tricks of the Trade" that have appeared in *Popular Woodworking* in the last 16 years. However it would be folly to suggest that everything we've published has been great. In fact, as we pored over the old magazines to prepare for this issue, we saw some stuff that just boggled our minds. So after looking at nearly every one of the 664 projects we've published, here's a sample of some of stranger stuff that has appeared between our covers:

• ***Popular Pornography* magazine:** We don't know how this one got through the editors, but in issue #9 (November 1982) the then-editors published a picture of a nude centerfold. She was the model that a carver had used to make an ebony torso that won first place at the 1980 California State Fair. Surprisingly, readers didn't protest. Perhaps it was because two issues later (#11) the magazine ran a photo of, and we swear this really happened, a carved scene that depicted three bears filming two other bears in a rather compromising position. Readers got upset, and we think that was the last display of nudity in *Popular Woodworking*.

• **Redemption Perhaps; or the Wooden X-Files:** After its risque period, the editors tried to atone perhaps by running an article about a miraculous and mysterious 100-year-old staircase built for a church in Santa Fe (September 1984). The circular staircase went from the main floor to the choir loft, had no center support, and was built without nails. And legend has it the builder showed up unannounced, built the inexplicable stairs and then disappeared before he could be paid.

• **Don't Try This at Home:** The cover of the January 1989 issue is dominated by a photo of Ed Moulthrop turning a 5-foot-high stemmed chalice from tulipwood (see photo above). For the sake of saving paper and ink, we were glad there wasn't a full-size diagram of the chalice in the PullOut™ Plans.

• **He Built a Pun:** In March 1991 we published an article called "Tack Shelter With a Loophole." It was plans for building a miniature shelter house made for thumbtacks (a tack shelter, or "tax" shelter, get it?); and hanging outside the house was a little noose (the "loophole"). We all groaned when we saw the article, but some of us wished we had thought of it.

• **A Best-Selling Mystery:** The cover of the January 1994 issue will never win a design award (see photo). It's a fuzzy photo of a guy planing a board with an impossible amount of sawdust coming out the bottom. The background is an unstylish color of brown. It also was our best-selling issue for years. Go figure.

• **For the Tropical Reader:** Judging from readers' letters (and our subscription list) a lot of readers live in the warmer climates, especially the retirees. So it came as some surprise to us to see the long article in February 1989 that explained how to build snowshoes.

• **Oh No, Not Another Bear:** In May 1991 we showed you the 16 steps to carve a 4-foot bear from a log with a chain saw (At least the bear wasn't in front of a video camera this time).

• **People in Your Pocket:** We know we've built some silly projects (for example, "Stumpy the Reindeer Mailbox," a Christmas card holder made from firewood, November 1997) but the silliest project we saw was "Pocket People" in September 1991. These little wooden contraptions fit in your shirt pocket. When you press on your pocket, a little wooden head peeks out over the hem of your pocket. We weren't sure if the effect would either delight or terrify young children.

• **Shoot Some Wood:** Maybe this seemed weird because some of us had a rural upbringing, but September 1993's article about building a special BB target with some intermediate joinery made us scratch our heads. We always used old Neil Diamond records.

Certainly when this magazine celebrates its 200th issue in another 16 years or so, the editors of the magazine will look back at these issues and sometimes wonder what was going on in *our* heads. Especially when they see "Stumpy the Reindeer Mailbox." We're still laughing about that one. **PW**

*—PW staff*

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