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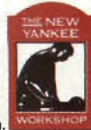
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Features



Built-in Bookcases

26

Learn how the professionals use a “fitting strip” and then you can build almost anything into that odd corner of your living room or den.



Kitchen Island

30

Need more counter space in your kitchen? This design stores many common kitchen utensils, and the drop-leaf top gives your cook more work space.

Chippendale Secretary

48

Build one of the quintessential pieces of 18th century American furniture. This beauty has all the trimmings, including a dovetailed case and secret drawers.

Woods That Blotch

55

The latest installment in our “Ten Commandments of Finishing” gives you the straight dope about which woods blotch and which don’t — and how to avoid this common and frustrating problem.

Pop Wood’s Shop

59

Take a “behind the scenes” tour of our workshop at *Popular Woodworking*, get some tips for organizing your own shop and find out some of the tools we choose to use.



Panel Shutters

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If you own a table saw, you can build these raised panel shutters from pine to enhance the value and appearance of your home.



Medicine Cabinet

64

The price tags on commercial medicine cabinets are enough to make your wallet beg for painkillers. Ours is a quick remedy.



55

48



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26



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Project File

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

Arts & Crafts Cradle 34

Inspired by the work of the Greene brothers, this swinging cradle is destined to be a family heirloom.

Dart Board Case 36

Perfect for your basement or playroom, our dart board case will make you feel like you're in a corner pub in England.

Pipes of Pan 45

This ancient Greek instrument is also a puzzle for youngsters to assemble. Even better, it's cheap and quick to build.

Alien Swing 46

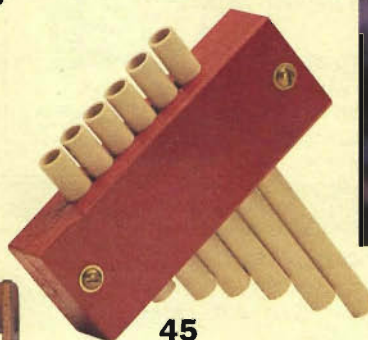
Be the first on your block to build this otherworldly project that is sure to become a classic at craft fairs this summer.

Squirrel in a Tree 47

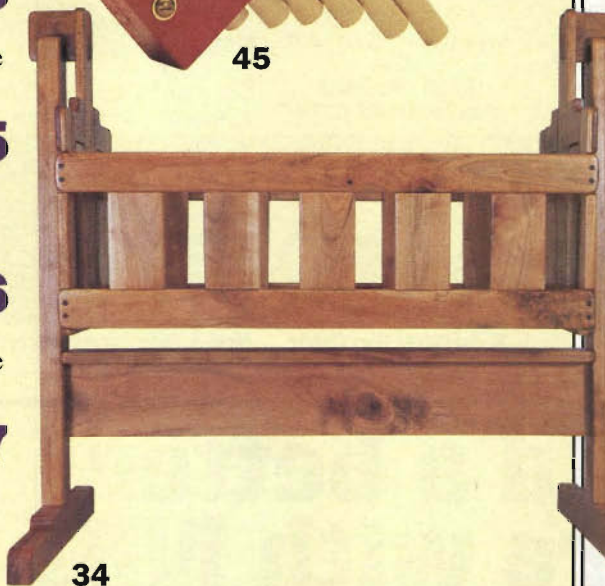
This three-dimensional scroll saw puzzle reveals a black critter sitting in the tree's branches.



36



45



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Are we on target?

We want to know what type of projects you want to see in future issues. So throughout this issue, you'll see this symbol next to every project. If you like that project, simply circle that project's identification number on the postage-paid card located at the back of this magazine. We'll use this information to help plan future issues.

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Cover photo: Pam Monfort/Bronze Photography

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!**

Cabin Fever Sets In With The Popular Woodworking Crew

Steve Shaney
Editor & Publisher

Specialties:
Projects, techniques, article and project selection
(513) 531-2690 ext. 238



David Thiel
Senior Editor

Specialties:
Projects, new products and tools, tricks of the trade
(513) 531-2690 ext. 255



Christopher Schwarz
Managing Editor

Specialties:
Article submissions, letters, reader contests
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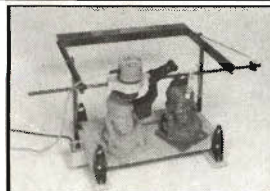
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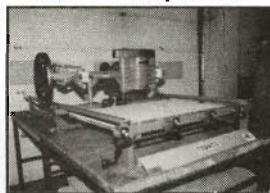
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ADVERTISING

National Sales Representative

Bill Warren, Five Mile River Assoc. LLC
RR1 Box 1400

Stockton Springs, ME 04981

Tel. (207) 469-1981; Fax (207) 469-3050

Advertising Sales

Joe Wood — Tel. (513) 336-9760

Fax (513) 336-9761

Classified Advertising Sales

Joan Bambeck-Wright — Tel. (800) 234-0963

Advertising Production Coordinator

Debbie Thomas — Tel. (513) 531-2690, ext. 219

SUBSCRIPTION SERVICES

Send all subscription inquiries, orders and address changes to: **Popular Woodworking**, P.O. Box 5369, Harlan, IA 51593 or call (515) 280-1721. Please allow 6 to 8 weeks for delivery.

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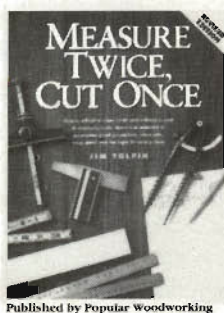
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Fine Woodworking Magazine test Oct. 96 page 43

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Ryobi-Makita & all 10"x80TX5/8"	\$207	\$129
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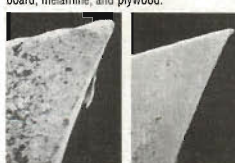
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220mm x 80T x 1/8" & 30mm	---	\$167	14" x 80T x 1"	\$232	\$197
9" x 80T x 1/8" & 3/32" K	\$207	\$179	14" x 80T x 1"	\$266	\$226
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OUT ON A LIMB

Pass the BISCUITS



THE TRUE VALUE of the sometimes-maligned biscuit joiner was brought home to me years ago when I decided to buy one. At the time I owned a stationary horizontal boring machine (a doweling machine) that was in great shape. My plan was simple: Sell it, then take the \$500 and buy a top-of-the-line Lamello biscuit joiner. Heck, I'd even have cash left over.

Much to my chagrin, the biscuit joint had so far supplanted the dowel joint that I ended up selling the boring machine for a couple hundred bucks. I guess that's the price for being on the back side of a wave.

Let's face it, the biscuit joiner is second only to the router in importance in terms of woodworking machine innovations of this century. It only makes sense. Any time you can bring a tool to the work rather than the work to the tool you're bound to have an improvement — so long as you get a satisfactory result with less effort at less cost.

But as with most innovations, there are the "Ned Head" Luddites out there who refuse to leave the darkness and bask in the light. I remember a few years back when I read in another woodworking magazine how they had tested the biscuit joint against other joints and found it withstood more pounds of pressure than both mortise-and-tenon and dowel joints. Yet the article's author still maintained that mortise-and-tenon joinery was the best. I guess he was afraid to rewrite the Old Testament!

When you consider the nature of the biscuit joint, the strength it develops shouldn't be a surprise at all. Just think for a moment about the strength of plywood, or for that matter the incredible strength of laminated wooden beams that are used in build-

ing construction. Making biscuit joints is a lot like making plywood. In essence, you are layering wood "plys" at the place you make the joint. What's great about the biscuit is that the football shape has the wood grain running about 45 degrees to its long axis. This gives you good gluing strength and material (shear) strength in and across the joint, even when joining end grain to long grain, as in a table apron to a leg, or a stile to a rail.

In addition to engineered strength, biscuit joints are wonderful for their alignment accuracy. You can master the machine in short order and the portability of the machine makes it as handy as a router, jigsaw or drill. It is excellent for joining solid wood, plywood and particleboard panels. You can use them for casework joinery, frame joinery, and in most cases where a dowel or mortise and tenon, or spline joint would otherwise be used.

In joining table aprons to legs, or other situations where the joint will be under stress, two or more biscuits, placed side by side, can be used. If space allows, jumbo-sized biscuits work great; and for delicate work, tiny mini-biscuits are now available.

For most real-world woodworkers, biscuit joints are an integral part of their joint-making repertoire. If you haven't jumped on the bandwagon, let me give you a hand climbing aboard. You need not abandon other traditional joints, they are great in many circumstances; but for everyday joinery in numerous situations, the biscuit joint is the answer.

"Pass the biscuits!" **PW**

Steve Shaney

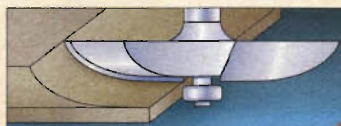
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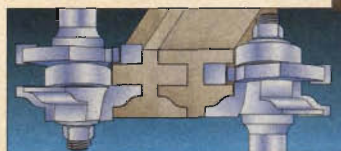
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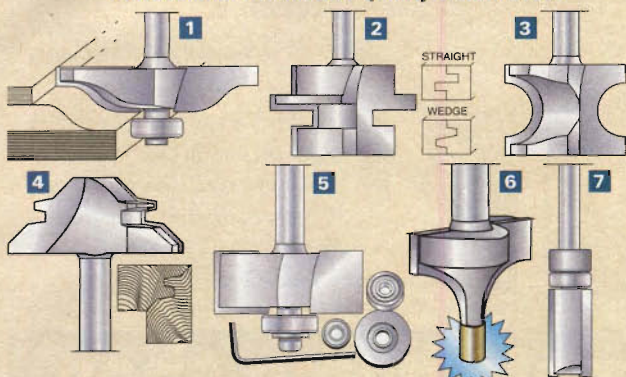
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Set includes: 4 Round Over Bits with 1/2" OD bearing: (1/8", 1/4", 3/8", 1/2"), plus 3/8" OD bearing & allen wrench.



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Circle #109 on Resource Directory Coupon

INFEED/OUTFEED

From the PW Mailbag . . .

Thanks For The 'Little Shop' Series

I have been a reader of *Popular Woodworking* for years now and each and every time I read the "Little Shop That Could" stories I always feel a special closeness to the projects and ideas. I always learn and grow smarter and think more about projects that I too could make.

I want to say "Thank You" for me and all the others who don't write in. Keep the "Shop" open and inspire all of us who fit in the "Shop" for whatever reason.

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: pop-wood@earthlink.net. Letters may be edited for publication.

— Steve Shanesy,
editor, PW

Albert Younger
Boiling Springs, Pennsylvania



An Impressive Patio

Having visited the Gamble House in Pasadena, Calif., and being much impressed, I couldn't resist building the "Greene and Greene Bench" by Jim Stuard in the May 1997 issue (#96). Once finished, I had to expand it to a patio ensemble. I used heart redwood and a varnish finish.

Everett L. Vinzant
Claremont, California

Editor's note: All we can say Mr. Vinzant, is that we're really impressed with your work. We especially liked the design of your coffee table with its keyed tenons and reverse-cloudlift aprons.

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Optional powerfeed: Yes

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—Edward Zych (TN)



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Optional powerfeed: No

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—Joe Galgoczi (PA)

*Current prices at time of publication.

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Finishing Advice Needed

I need some advice on a special job. I just lost a 100-year-old pine that Grandpa used to play in and hide when his Ma sent him to the spring to get water. Well Grandpa is gone and the pine succumbed to just plain tiredness, I guess. When it came down, I had it sawed into boards that I plan to use to make a "Grandpa's tree" table.

Here's the problem: I've made some small stuff with the wood already, and it has so much resin in it that it clogs up a sanding sheet in about two minutes. I don't mind that because I can get more sandpaper. But some of this resin-impacted wood is just like bone, especially in the knotty areas. So what do you figure would be the best finish I should use for this table?

Dan M. Russell
Wildlife Biologist, retired
Mathews, Virginia

Editor's note: In most cases, a sealer coat or two of shellac applied over the particularly resinous areas will prevent the pitch from leaching out.

—Steve Shanesy, editor

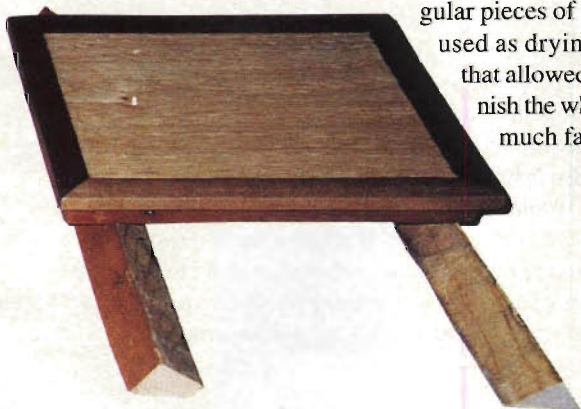
Playing Card Tricks

I recently made the "Playing Card Box" from the November 1997 issue (#99) as a gift for newlywed friends. During construction, two ideas came to me that might be of interest to your readers:

First, using my computer and a copying machine I personalized the box by adding the words "Pat and Alice — A Golden Fit" (a bridge term) into the base of the box. I printed out the text on my computer and copied it onto a clear adhesive paper you can buy at office supply stores.

Second, in order for me to varnish both sides without waiting for one side to dry before coating the other, I cut triangular pieces of scrap that I used as drying supports that allowed me to varnish the whole project much faster.

Norman Ward
Dix Hills,
New York



Continued on page 10

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5/16"	1"	1/2"	P1219	5.94
3/8"	1"	1/4"	P1222	5.94
3/8"	1"	1/2"	P1223	5.94
1/2"	1"	1/4"	P1237	6.88
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1/2"	1-1/2"	1/2"	P1242	8.49
5/8"	3/4"	1/4"	P1253	7.95
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3/4"	3/4"	1/4"	P1270	9.67
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1/8"	1/2"	P3103	9.94
3/16"	1/4"	P3104	9.97
3/16"	1/2"	P3105	9.97
1/4"	1/4"	P3106	10.88
1/4"	1/2"	P3107	10.88
5/16"	1/4"	P3108	11.96
3/8"	1/4"	P3110	13.88
3/8"	1/2"	P3111	13.88
1/2"	1/4"	P3114	14.94
1/2"	1/2"	P3115	14.94
5/8"	1/2"	P3116	17.95
3/4"	1/2"	P3117	18.88
1"	1/2"	P3119	29.95
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3/8"	15/16"	5/8"	1/4"	P3199	17.95

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1/4"	3/4"	1/4"	P1508	13.78
1/4"	1"	1/4"	P1509	14.67
3/8"	1-1/4"	1/2"	P1514	27.88
1/2"	1-1/2"	1/2"	P1521	34.78

ROMAN OGEE

R	SHANK	ITEM#	SALE
5/32"	1/4"	P3506	\$15.44
1/4"	1/4"	P3508	17.88
1/4"	1/2"	P3509	17.94

COVE

R	SHANK	ITEM#	SALE
1/4"	1/4"	P2904	\$11.95
1/4"	1/2"	P2905	11.95
3/8"	1/4"	P2908	13.95
3/8"	1/2"	P2909	13.95
1/2"	1/4"	P2910	14.95
1/2"	1/2"	P2911	14.95
5/8"	1/2"	P2912	25.97
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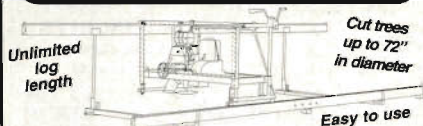
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INFEED/OUTFEED

Continued from page 9

I Cut The Tree; Why Is It Still Growing?

In April 1997 I had some Beech and White Oak cut into lumber that I stacked in my garage. I put 1/4" strips between the rows. Recently I unstacked the wood and found green mold, black mold and some kind of spider-web type of stuff that looked like fungus.

I unstacked the wood in my driveway to dry it out and kill the mold. It doesn't appear to have damaged the wood (except in a couple places). I then re-stacked it and increased the spacing to 3/8".

Will the mold continue to grow? What should I do to prevent it?

Charles Sexton
Richlands, North Carolina

Editor's note: Sounds like your garage is the problem. I'd put an exhaust fan in there to keep the air circulating and increase your sticker thickness to 5/8"

More Readers Debate the Mission of Popular Woodworking

Editor's note: During the past few issues, readers have been discussing the direction of this magazine. We have been paying close attention to this debate and appreciate all the honest comments. Some readers, such as Doug Green and Richey A. Wallis, have suggested the magazine is best for the "weekend warrior" and not the serious craftsman and that we need to publish more high-end projects. Other readers disagree. Here, we hope, are the final words on this debate.

Someday I Will Be a 'Master Craftsman'

I would like to respond to the recent letters saying that *Popular Woodworking* is for weekend woodworkers. I am a beginning woodworker and find your projects just right for my level of ability. One day I hope to be a "master craftsman" but for now I can only dream of completing the projects in all of the other publications. I hope that you continue to have projects for guys like me, but in all fairness, perhaps you could include more difficult projects in each issue for the more advanced woodworkers. Keep up the fine job.

Mike Elliott
Shreveport, Louisiana

'Wood Snobs' Cross The Atlantic

I have just read the letters in the January edition with great sadness on a subject that I thought was confined to here in England, namely, wood snobbery. The arrogance of "hand craftsman" is fortunately one of the few downsides in woodworking; the majority of woodworkers see in the works of others the creativity and enthusiasm of their work, whether this is by a beginner or a master craftsman.

All woodworkers should encourage each other to aspire to greater work, whether this is with hand tools or power tools or, as is usual, a mixture of both. Projects in magazines such as yours should and do cater to us all and to disparage some woodworkers by calling them "weekend butchers" for using dowel/biscuit joinery etc. is to also disparage the likes of Sam Maloof and other master craftsmen who I am sure would be the first to admit that there is always something new to learn and always a different way to achieve the end result.

I have taken out a subscription to your magazine after managing to get hold of a copy here in England because it gives another perspective to my woodworking; whilst many things are the same, a lot are not, and this and other American woodworking magazines bring a freshness to my work.

Alan M. Gagg
London, England

Continued on page 12

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Continued from page 10

Popular Woodworking is Fine As Is

I don't usually take the time to comment on most magazines I read, but after reading the January 1998 issue, in particular the comment by Doug Green, I must. I subscribe to *Popular Woodworking* because it contains projects and articles that interest me. Some are within my skill level; many are not. But a long time ago I learned that to get better at something you must practice, and you must have access to examples of things that are beyond your current capabilities. Otherwise there's no challenge; nothing to set as a goal.

I believe woodworking is just like any other craft — there are many right ways to do it — each dependent upon the individual. Doug Green certainly knows what is right for him, but who died and appointed him the almighty guru of woodworking? I am, by his description, a “wood-butchering weekend wanna-be,” and I'm proud of it. If he is an example of a “true craftsman,” then please drop the “wanna-be” from my title, because I don't “wanna-be” a craftsman like Doug.

By the way, if *Popular Woodworking* does such a poor job of representing the enduring quality of you masters, why do you spend your hard earned money on it?

To the editors of *Popular Woodworking*, please keep up the good work. I enjoy it and every issue contains something valuable — something that helps me do better next month than I did last month. I may never become a master, but I am happy and enjoying myself with wood (butchering!)

Dick Henson
Woodbridge, Virginia

It's Not For Elitists

I use dovetails when I have to, biscuits when I can, and the simplest joinery whenever possible. Historically, dovetails were used because there wasn't any other legitimate choice.

I don't have to please anyone but my own “wood-butchering” self. Doug Green's elitism can best be served by *Home Furniture*, a magazine that didn't have the subscriber base to survive. My advice to Mr. Green regarding *Popular Woodworking* would be to take what you need, leave the rest and keep your opinions to yourself.

Dr. James H. Carmack Jr.
Hendersonville, Tennessee



Magazine is a Tool, Nothing Else

I agree with Mr. Richey Wallis. He is just asking for what he feels you have promised readers: A fair number of projects for the advanced reader.

I do not consider myself a “master craftsman,” but I have been woodworking for most of my 50-plus years and consider myself an advanced woodworker. Over the years I've learned to purchase tools wisely, and your magazine is a tool. I just recently renewed my subscription to *Popular Woodworking*. That decision was based mainly on your new series on wood finishing and not the projects featured. When I want ideas for projects to build I consult other magazines. When I want to know about “Tricks of the Trade,” new products or wood types, I turn to you.

In my mind it isn't hand-cut dovetails that determine the quality of the project. It's the knowledge of the craftsman. In that department I feel your magazine has done what was intended. If a project does not challenge my skills, it's not fun and I feel no satisfaction in doing it.

You asked for photos of what readers were building to determine your readers' skill levels. Here is one of my projects. **PW**

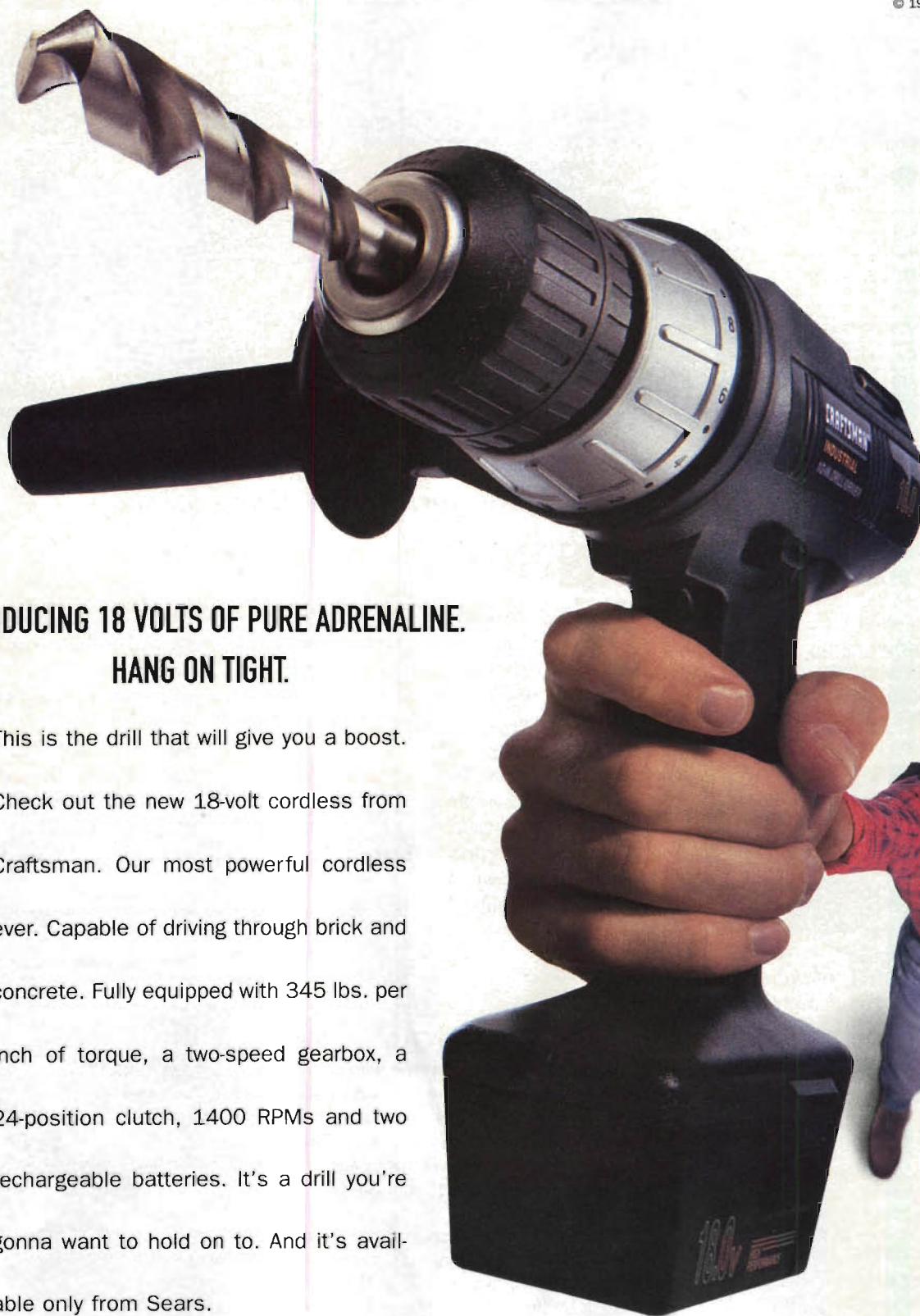
Gary McRoberts
Browns, Illinois

Editor's Notes: The Exploding Bank

In the January 1998 issue (#100) we published plans for the “Exploding Bank,” which is powered by a mousetrap. One concerned reader pointed out that children could get their fingers stuck in the mechanism and urged caution. We agree. While we think it would be difficult for someone's fingers to get caught (the trap is activated before the sides explode), for the sake of safety, be careful and don't allow small children to play with the bank.

Rare Earth Magnets

In recent issues we've touted the amazing strength of rare earth magnets. However, be advised there is a trade dispute brewing over these magnetic wonders, and the inexpensive imported ones are going to be scarce or impossible to find until the issue is resolved.



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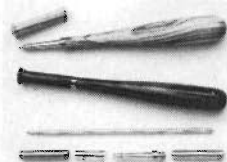
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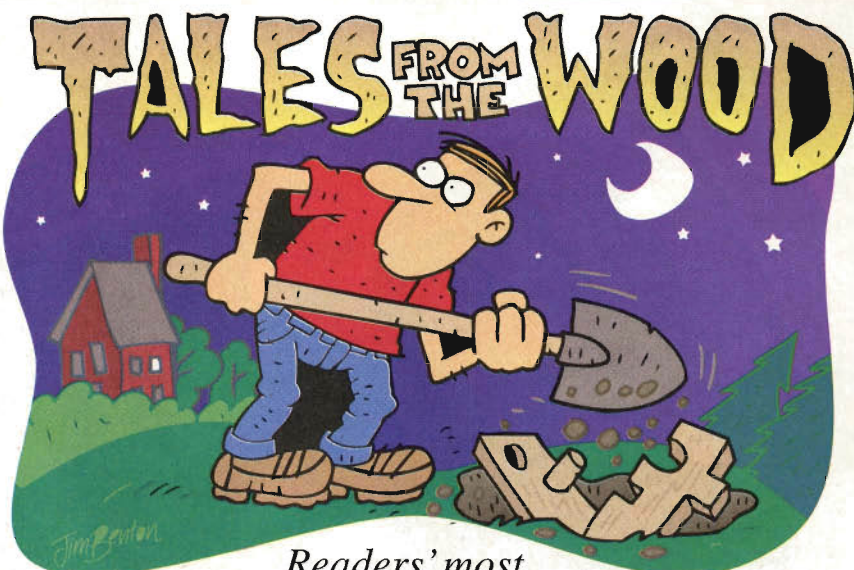
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WOOD TALES



*Readers' most
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WINNER!

Call the Scientists! He Painted a Table!

One June evening about dusk, my next-door neighbor asked me to spray paint a poker table he had just acquired. He wanted it yellow. I took my sprayer over and he had the table outside with a light over it so I could see what I was doing. When I finished my spraying, the table looked great.

The next morning I went over to see if the table looked as good in daylight as it had the night before. To my amazement, there was a group of people around it. I thought they were admiring my great job. It turned out they were entomologists and the table was a dream come true for them. Nearly every type of bug in the state of Iowa was stuck to that table top. If one more June bug had landed there, that table would have flown away.

It seems my neighbor had forgotten to turn the light off the night before.

John Reinhold

Desert Hot Springs, California

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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



What Happens When You Don't Make a Construction Drawing Beforehand

My young cousin was all excited about building his first woodworking project after completing two months of wood shop classes in grammar school. He decided to build a little sitting bench as a surprise for his mother and went down to his father's workshop to begin.

He found some nice-looking lumber and marked it off for cutting. The only saw he could find was a hacksaw, so the cuts weren't very straight or square. He nailed the pieces together and then discovered he had a problem, so he called me over. By mistake he had used one of the legs as the top rail of the bench and the top rail for one of the legs. As a result the bench was significantly higher on one end. I laughed hysterically.

Just then his father came down to see what was going on. I will never forget the look on his face when he discovered his son had used expensive lumber for this "project." After things quieted down, my aunt tried to cheer my cousin up by telling him she loved the bench and she tried to sit on it gently. It immediately collapsed. Now, almost 40 years later, we still laugh about this incident.

*John Rembris
Clifton, New Jersey*

It's Not a Saw, It's a Catapult

About 40 years ago my wife surprised me on Christmas day with a brand new Beaver 8" table saw. Though this was my first woodworking machine, I thought I was reasonably intelligent and could set it up myself. At that time I was just into my second year as an apprentice printer. Apprentices do not make much money, so when I went looking for a motor for the saw I ended up with a small, fractional-horsepower motor that probably came from a washing machine or other household appliance.

This motor, as I recall, was about 1/3 horsepower. I thought that would probably do the job so I fastened it to my new saw. I followed the safety procedures and put the guard on. I was ready to cut my first-ever piece of wood.

With the rip fence in place I proceeded with my first board. The board leaped out of my hands and flew across the room. I tried not to get discouraged and figured all I had to do was hold the board tighter. So I did that. Again, same result. Then I figured there must be something wrong so I went to the manual and read the instructions. I had done everything according to Hoyle. Finally I figured it out. My little motor was wired to run backwards. Needless to say I didn't tell anyone about my embarrassment. But now I can look back and laugh. **PW**

*Donald J. Howson
Sault Marie, Ontario*



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- Motor: 3/4 HP, 115V, 5.18 amps

ITEM 36158-1SGA

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- 24 grit, 7/8" arbor

ITEM 06674-0SGA

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- Made in Tallahassee, Florida

ITEM 07697-2SGA

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4 SPEED 14" WOODWORKING BANDSAW

Great where the cutting of curves and compound curves is required. Precision cast iron table tilts 45° for bevel cuts, grooved for a miter gauge.

- Blade to frame distance: 13-1/2"
- Cutting capacity: 6"
- 600, 1140, 1670 and 2670 FPM cutting speeds
- 14" x 14" table size
- 24-1/2" x 19-1/2" x 65-1/2"
- 191 lbs. shipping weight

ITEM 05687-2SGA

REPLACEMENT METAL CUTTING BANDSAW BLADES

- 1/2" x .025" x 64-1/2"
- 10 TPI

ITEM 00522-9SGA

CHICAGO Electric Power Tools

VARIABLE SPEED RECIPROCATING SAW

- 3.6 Amps • All ball bearing • 600 Watts
- 300 SPM to 2400 SPM • 1-1/4" stroke
- 110V, 60 Hz, single phase
- Tool Wt: 7-1/4 lbs.
- Overall length: 17"

ITEM 36595-4SGA

MILWAUKEE BI-METAL SAWZALL® BLADES

Milwaukee Model No. 48-01-1184

- 18 teeth per inch, 6" length
- 1/2" universal shank

ITEM 03323-3SGA

RECIPROCATING SAW BLADES

- 5 metal cutting 18 TPI, 5 wood cutting 8 TPI
- 1/2" universal shank

ITEM 06467-5SGA

DELTA

Delta 22-540 12" PORTABLE PLANNER

- Four precision ground columns to effortlessly raise & lower cutter head
- Long lasting high speed steel, reversible, double edged knives
- Precise thickness scale
- Conveniently located for easy reference
- Includes removable table extensions, and fold away depth adjustment
- Factory reconditioned, factory perfect
- Motor: 15 amp, 120V; Capacities: 12" width, 6" thick, 3/16" depth of cut; 26.2 FPM feed rate; 8000 RPM, 16,000 CPM; 27-1/4" x 20-1/2" x 15" overall dimensions;
- Table size with extensions: 12-1/8" x 26"; 68 lbs. tool wt.

ITEM 06177-2SGA

PLANNER BLADES

ITEM 33075-3SGA

HOLE SAW SETS

Cut smooth, clean, accurate holes through wood, drywall, or even plaster up to 1" thick! Ideal for plumbers and electricians.

11 PC. HOLE SAW SET

Includes 8 tool steel cups sized 3/4", 7/8", 1", 1-1/4", 1-1/2", 1-3/4", 2", and 2-1/2", plus 1/4" and 3/8" mandrels, a 1/4" bit, a hex wrench, and a blow mold case.

ITEM 01263-1SGA

10 PC. LARGE HOLE SAW KIT

Includes cutting cup sizes 2-1/2", 3", 3-1/2", 4", and 5", plus 3/8" mandrell, drive plate, hex wrench, and blow mold case.

ITEM 36222-2SGA

DRILL MASTER

115 PC. TITANIUM NITRIDE COATED DRILL BIT SET

These titanium nitride coated high speed steel bits last up to six times longer than standard bits. Cool turning titanium bits are a must for metal workers. All bits can be resharpened. Straight shanks. Includes: 29 fractional sizes 1/16" thru 1/2"; 26 letter sizes A thru Z; 60 numbered sizes 1 thru 60; Heavy duty metal drill index.

ITEM 01611-1SGA

115 PC. M2 HIGH SPEED STEEL DRILL BIT SET W/INDEX

- Same sizes as above
- M2 high speed steel

ITEM 00528-1SGA

CENTRAL MACHINERY

HEAVY DUTY CAST IRON BASE

COMBINATION 4" x 36" BELT & 6" DISC SANDER

Save space and money when you buy this two-in-one sanding tool with table. 1/2 HP, 115V, 3 amp, 3535 RPM belt drive motor; Belt table tilts from 0°-45°. Disc table comes with miter gauge; Equipped with 1-1/4" dust chute attachment; Table dimensions: 7-1/2" x 5"

ITEM 30837-9SGA

SANDING BELT CLEANER

- Increase the life of sanding belts & discs up to 500%
- 8-1/2" x 1-1/2" x 1-1/2"

ITEM 30766-0SGA

TUNGSTEN CARBIDE TIPPED ROUTER BIT SETS

Both include individually organized storage cases. 15 most popular sizes. • 1/4" shanks

15 PC. ASSORTED BITS

Includes: 1-1/4" rabbelling, 1-3/8" cove, 1-1/16" roman ogee, 1-1/4" rounding over, 1/2" flush trimming, 1-3/16" 45° chamfer, 1/2" dovetail, 3/4" straight, 1/2" straight, 3/8" V-groove, 1/4" combination panel, 1/4" straight, 1/2" mortising, 1/4" cove, 1/8" straight

ITEM 31164-3SGA

4 PC. ROUNDING OVER BITS

- Sizes: 1/8", 1/4", 3/8", & 1/2"
- Set includes 4 rounding over bits w/pilot bearing tips
- 2 flutes each
- 1-5/32" long shanks

ITEM 33078-5SGA

DEWALT

DeWalt DW991K

3/8", 14.4V HEAVY DUTY CORDLESS DRILL/DRIVER KIT

- 0-450/0-1400 RPM, variable speed, reversible, adjustable clutch
- Maximum capacities: 1-1/4" oak, 1/2" steel
- Includes: 1 hour charger, XR PACK extended run time battery, case, & a double ended screwdriver bit
- Shipping weight: 12-3/4 lbs.
- Factory reconditioned, factory perfect

ITEM 50496-4SGA

CORDLESS DRILL/DRIVER KIT WITH EXTRA BATTERY

DeWalt DW991K-2R

ITEM 51651-4SGA

DELTA

Delta 36-220

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 06125-0SGA

CENTRAL MACHINERY

16" SCROLL SAW

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

ITEM 36392-1SGA

5 PC. 5-1/2" SAW BLADES

- Pin end type

ITEM 35024-0SGA

CHICAGO Electric Power Tools

3-1/4" PLANNER

- Front base has a V-groove to help guide in chamfering
- 2 blade cutter
- Depth adjustment knob
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ITEM 32222-3SGA

2 PC. REPLACEMENT BLADES

ITEM 33262-0SGA

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4"	12	04184-1SGA	\$11.99



10" SAW BLADE SHOP CLOCK

Here's a sharp looking clock for your shop, den or office. The face is made from a 40-tooth saw blade emblazoned with the Harbor Freight logo. A precision quartz mechanism powers the high visibility hands. Runs on one AA battery (sold separately).

~~\$6.99~~ **\$5.99**
ITEM 37013-1SGA



1/2 OFF!

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: 2-18"
- 1-1/2" throat depth
- Weight: 2-7/16 lbs.

~~\$3.99~~ **\$3.49**
ITEM 31255-8SGA

1/2" PIPE CLAMP

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

~~\$2.99~~ **\$2.99**
ITEM 37056-2SGA

CENTRAL MACHINERY

NO MORE LOST
CHUCK KEYS!

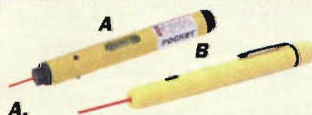
5 SPEED BENCH DRILL PRESS WITH KEYLESS CHUCK

- 8-1/4" maximum distance spindle to table
- 1/3 HP motor • 2" stroke, 8-1/4" swing
- 620 to 3100 RPM • 1/2" chuck
- 22-1/2" high, 47 lbs.

~~\$49.99~~ **\$49.99**
ITEM 34231-6SGA

DRILL PRESS WITH KEYED CHUCK

~~\$48.99~~ **\$48.99**
ITEM 05901-0SGA



A. LASER LEVELER

Compact high output leveler projects a round dot visible up to 600 feet away. Solid brass construction. Also includes a professional quality built-in spirit (bubble) level. Locking on/off switch.

- 4-1/4" long x 3/4" diameter

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ITEM 36535-2SGA

B. HI-OUTPUT LASER POINTER

Make sure people get your point. Perfect for supervisors, teachers, product demonstrators.

- Includes two AAA batteries
 - 5-1/2" long
- ~~\$19.99~~ **\$14.99**
ITEM 37431-2SGA



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Multiple clutch plates permit instant adjustment. Simply depress plates to slide handle against workpiece. Includes heat-treated steel bars with cast iron jaws, plated steel screws, and hardwood handles.

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24"	05976-2SGA	\$5.99
30"	34389-4SGA	\$6.99
36"	34388-3SGA	\$7.99



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- 16-1/4 lbs. shipping weight

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- 2 HP, 110V, 1 phase, 11 amp, 8000 RPM
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- 10-1/8" x 9-1/8" feed table
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- 10-1/8" blade size
- 2-blade cutter head
- 61 lbs. shipping weight
- Stand sold separately

~~\$239.99~~ **\$239.99**
ITEM 06935-1SGA

PLANER STAND (NOT SHOWN)

- 20" x 10" x 27"
- Shipping weight: 20 lbs.

~~\$32.99~~ **\$32.99**
ITEM 32969-2SGA

CENTRAL MACHINERY

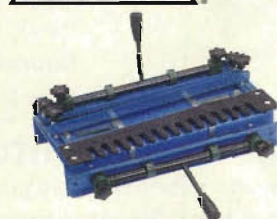
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DOVETAIL MACHINE

Just place stock and pull cam handles to positively lock material in place. Allows cutting tails, pins, half blind, and standard dovetails. Accepts stock up to 12" wide and 1-1/4" thick. Includes 1/2" template.

~~\$59.99~~ **\$39.99**
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5 PC. 8 TO 32 OZ. BALL PEIN HAMMER SET

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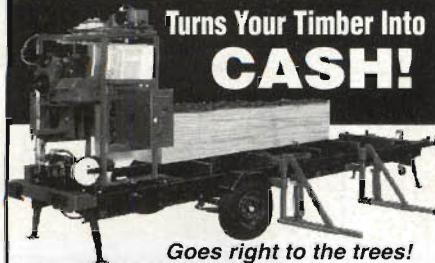
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What is 'Trees to Furniture'

Trees to Furniture is an effort started by two professors/woodworkers in Cincinnati who wanted to turn fallen urban trees into lumber for projects in their home shops. In the last two years, they've figured out the best ways to find the trees and have them cut into usable lumber by other people who own portable sawmills. And they do this for less than 50 cents a board foot.

If you'd like more information about the program, send a self-addressed, stamped envelope (with two first-class stamps) to Trees to Furniture • 1507 Dana Ave. • Cincinnati, OH 45207. Or e-mail us at popwood@earthlink.net.

Or you can contact the founders directly:

• Sam Sherrill (513) 248-0509 • samuel.sherrill@uc.edu

• Michael Romanos (513) 961-3680 • michael.romanos@uc.edu

On the web: www.woodmizer.com • oz.uc.edu/trees



Connecticut reader Harold Morton read about the "Trees to Furniture" program and sent in these photos of his sawmill and the shed he built with the lumber. Harold's been doing this for years — his saw is homemade!

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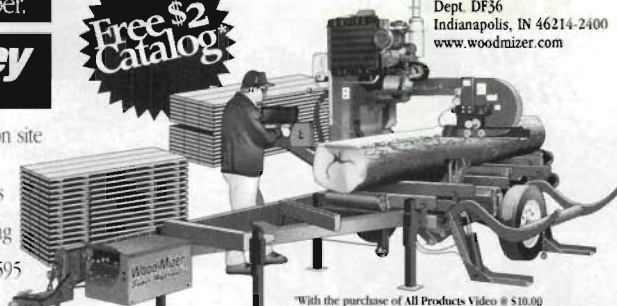
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Thanks to Arrow's considerate engineering, Arrow glue guns feature exclusive non-drip nozzles, high volume melt chambers and unique heat flow systems to keep handles comfortably cool. The compact MT300 series features a high-impact, high-temp housing and a safety stand.



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Circle #117 on Resource Directory Coupon

PROJECTS

from the Past

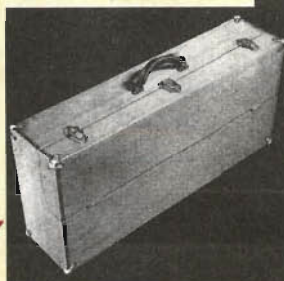
This issue's project

HANDY TOOL BOX

You can make this handy tool box in your own workshop and use it to transport your tools to your outside jobs. The box can be constructed from pine or a hardwood such as oak.

This box holds a large selection of tools. A handy drawer holds the small tools and hardware. The lid holds three hand saws. The corners are protected by brass box corners and the tool box may be locked with a simple latch. The corner joints of the box are $\frac{1}{8}$ " tongue-and-groove and are all cut with a table saw and glued and clamped together.

You can leave the box unfinished, cover it in polyurethane or give it two coats of enamel paint. **PW**



The Delta

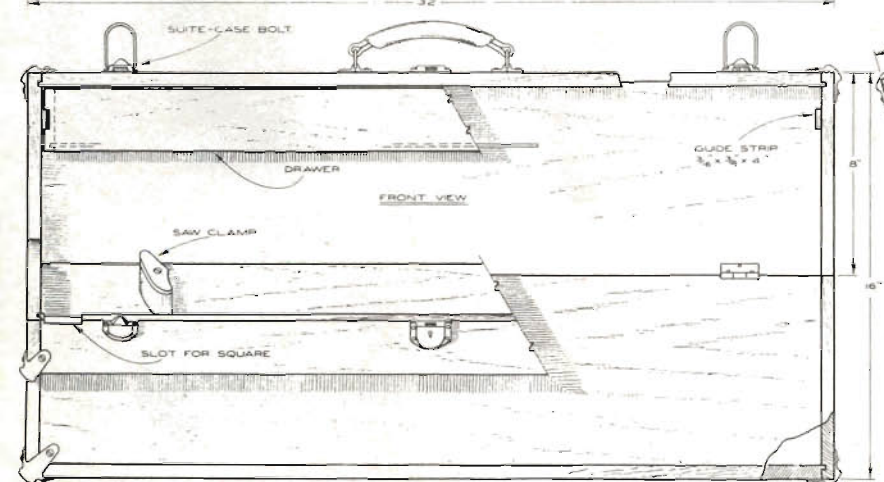
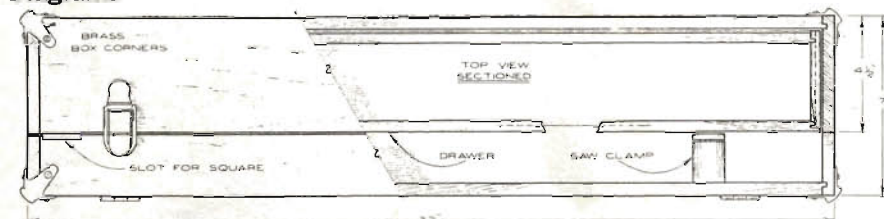
Vol. 16,
Issue 1
1946-47

Earlier this century, Delta Machinery published a magazine filled with wood-working 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**

Materials: Handy Tool Box

No.	Item	Dimensions T W L	Material
1	Side	$\frac{1}{2}$ " x $15\frac{1}{4}$ " x $31\frac{1}{4}$ "	Pine
2	Hinged sides	$\frac{1}{2}$ " x $7\frac{5}{8}$ " x $31\frac{1}{4}$ "	Pine
2	Ends	$\frac{1}{2}$ " x 7" x 16"	Pine
1	Bottom	$\frac{1}{2}$ " x 7" x $31\frac{1}{4}$ "	Pine
1	Top	$\frac{1}{2}$ " x $4\frac{1}{2}$ " x $31\frac{1}{4}$ "	Pine
1	Top	$\frac{1}{2}$ " x $2\frac{1}{2}$ " x $31\frac{1}{4}$ "	Pine
2	Drawer sides	$\frac{3}{8}$ " x $2\frac{1}{2}$ " x $3\frac{7}{8}$ "	Pine
1	Drawer back	$\frac{3}{8}$ " x $2\frac{1}{2}$ " x $29\frac{3}{8}$ "	Pine
1	Drawer front	$\frac{3}{8}$ " x $2\frac{1}{2}$ " x $29\frac{7}{8}$ "	Pine
1	Drawer bottom	$\frac{1}{8}$ " x $3\frac{3}{4}$ " x $30\frac{1}{8}$ "	Plywood
2	Guide strips	$\frac{3}{16}$ " x $\frac{3}{4}$ " x 4"	Pine
2	Saw clamps	To fit	Pine

Diagrams



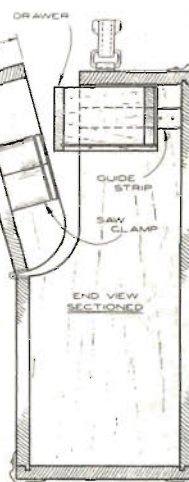
BOX MADE OF $\frac{1}{2}$ " PINE OR WHITE OAK STOCK JOINTS: $\frac{1}{8}$ " TONGUE & GROOVE - GLUED & NAILED

DRAWER MADE OF $\frac{3}{8}$ " PINE OR WHITE OAK STOCK

GUIDE STRIPS: $2\frac{1}{2}$ " HIGH & WIDE

29 $\frac{1}{2}$ " LONG

DRAWER BOTTOM: $\frac{1}{8}$ " PLYWOOD $3\frac{3}{4}$ " x $30\frac{1}{8}$ "



Are we on target?

To see more projects like this in future issues, circle "P1" on the postage-paid card in the Resource Directory.

Tools that can get you out of the doghouse, keep you out of the doghouse, or build the doghouse.



There's an age old secret to successfully doing it yourself. The secret is having the right tool for the job. All of a sudden you find yourself tackling projects you used to pay someone else to do. And

looking for your next project.

Once you've cut a perfectly straight edge or a gentle curve, you'll be wanting to drill a perfect hole or sand a perfect circle or grind a perfect edge. And right then and there, you'll understand why so many professionals own Delta. For the name of your

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Circle #119 on Resource Directory Coupon

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

The Masked Marvel

Make room for a roll of masking tape in your tool box. It holds parts together in light clamping (**figure 1**). Small numbered pieces of tape can be stuck to joint parts, avoiding making pencil marks on the wood that must be removed afterwards (**figure 2**). Masking tape peels off cleanly.

If you are unsure how you wish to mark wood, as with freehand curves on a bookcase side, you can put on masking tape and mark on that (**figure 3**), avoiding a mass of pencil lines directly on the wood. Also, by not having to

draw directly on the wood, you avoid breaking the surface grain, which can cause problems, particularly if you are using a scroll saw, which cuts on the up-stroke.

If you want to mount a bathroom shelf and have to mark the positions of the screw holes on glazed tiles, attach masking tape to the tile and locate the positions on it (**figure 4**). Besides allowing accurate marking, if you drill through the tape you should reduce the risk of marring or cracking the surface of the tile.

Percy W. Blandford
Warwickshire, England

Figure 1

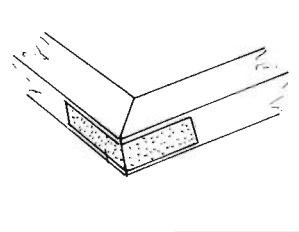


Figure 2

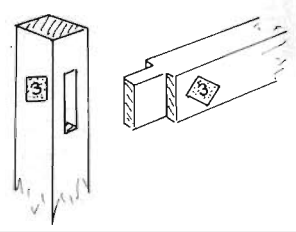


Figure 3

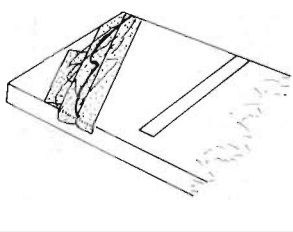
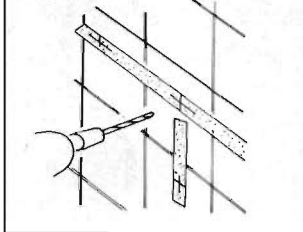


Figure 4



Largest selection of Router Bits & Shaper Cutters in the U.S.A.
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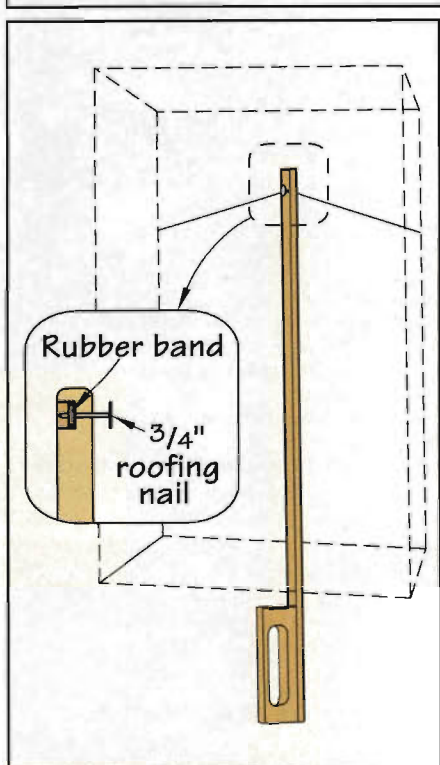
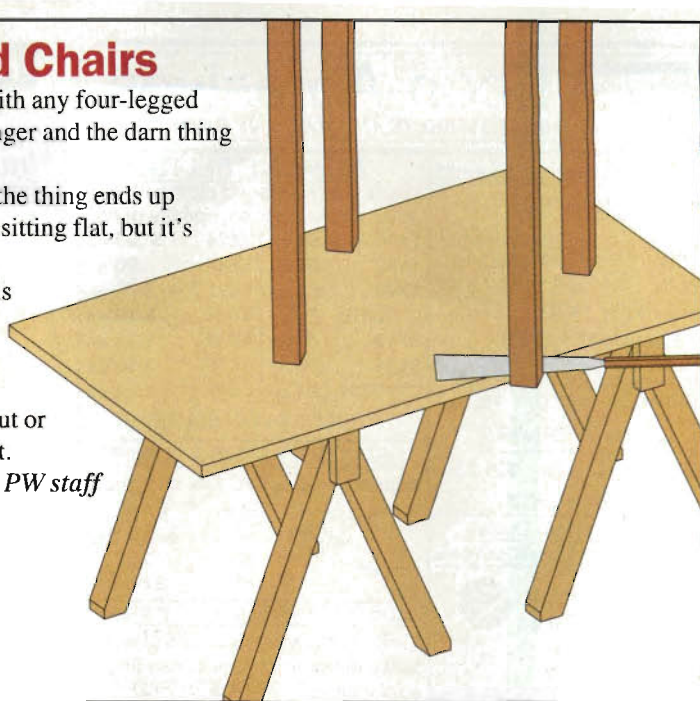
Help For Wobbly Tables and Chairs

No matter how hard we try, by the time we get done with any four-legged piece of furniture, one of the legs has gotten a little longer and the darn thing wobbles!

When you go and try to shorten the offending leg, the thing ends up wobbling the other way! A little while later it's finally sitting flat, but it's an inch shorter.

A simple and foolproof way to solve this problem is to place the piece of furniture on a flat, elevated surface with one of the longer legs hanging over the edge. The other three legs will sit even and the fourth leg can be marked flush with the elevated edge, then cut or sand to that mark. Viola! A flat table or chair in one cut.

— PW staff



Hang Pictures the Easy Way

After having moved several times, I thought I had mastered the art of hanging pictures and mirrors using masking tape, rules, pencils and guesswork. Recently I happened upon an idea that eliminates all of these. It's a simple device made from scrap $\frac{3}{4}$ " pine, a $\frac{3}{4}$ " roofing nail and a small piece of rubber band.

Place the frame's hardware (wire, hanger, frame edge) over the nail head. Holding the handle, position the picture where you want it, remove the picture without moving the tool and press the nail head into the wall with your thumb. The nail leaves a small dimple — the exact spot to place your nail or picture hook.

Art Misicka
Roanoke, Virginia

More Thumb-Saving Ideas From Readers

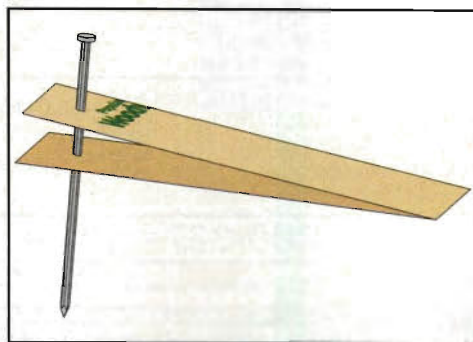
Here's my contribution to your list of devices to hold small nails (PW issue #100).

1. Fold a small strip of paper, ($\frac{3}{4}$ " x 6"), and push the nail through the folded end of the paper near the end (see diagram). After the nail is started,

tear the paper off and drive the nail the rest of the way.

2. My favorite way is still an alligator clip, (found on the end of an electrical jumper wire). The spring-loaded clip is kept in the same small box with my brads and nails.

James D. Stokes
Bosque, New Mexico



Router Surgery Helps its Adjustability

Much comment has been made about the difficulty of adjusting a plunge router when it's mounted in a router table. Here's how to make that task easy: Remove the return springs. The springs are located in the base columns and it's a five-minute job to remove them. This simple solution is unbelievable. I can raise and lower the router with ease and still make the fine adjustments not possible with many non-plunge routers. PW

Charles D. Honl
Burnsville, Minnesota



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NO LOAD PAPER(white)

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*C = 100 SHEETS

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1X30	.81 ea	3X24	.93 ea
1X42	.81 ea	3X27	.96 ea
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3X18	.86 ea	4X36	1.35 ea
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3X23 3/4	.93 ea	6x89	6.24 ea

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Clamps come w/PVC tips and grips.



Size	Price
4"	\$1.75 ea
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8"	3.50

JUMBO ROUTER PAD(24" x 36")

It will not allow small blocks of wood to slip out under router or sanding applications. ROUTER PAD ONLY \$8.95ea.

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NEW PRODUCTS

Popular Woodworking endeavors to provide readers with accurate, useful information on the newest woodworking tools and products by testing most of them in the *Popular Woodworking* shop. We consider cost, design and benefit, and add our comments about tested items to help you make future purchasing decisions.

"After years of rumors, the Italians finally figured out how to produce the cordless router."—PW

LIRPA-1, The First Battery-Powered Router!

Contact: The Four/One Group, 888-555-3665

Retail Price: \$599, available at specialty stores fall of 1998.

Features:

- The 24-volt, 4-amp-hour Nickel Metal Kryptonium (NIMKr) battery provides up to 30 minutes of continuous use
- The battery charges in one hour using AC current, or in three hours with the optional solar charger
- Router is available with only 1/4" collet at this time, plunge model available in 1999
- Complete kit includes router, two batteries, AC charger, flashlight and metal case
- Operates at either 12,000 or 22,000 rpms, with soft start



For more information, circle #150 on the Resource Directory Coupon.

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ALL WOODLINE ARIZONA BITS & CUTTERS FEATURE:
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For the Shaper WL-1580 only \$49. New only \$89.

GLUE JOINTS in 2 sizes, for up to 5/8" (also is drawer joint cutter)
1/4" shank WL-1430-1 only \$24.
1/2" shank WL-1430-2 only \$24.
for up to 1-1/4" material
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NEW "V" FACE T & G router bit for up to 1-1/8" material. WL-1488 only \$30.
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Router bit **CORNER LOCK MITRES** in 3 sizes
WL-1420-2 (1/4" shank-up to 5/8" material) only \$25.
WL-1420-1 (1/2" shank-1/2" to 3/4" material) only \$30.
WL-1420 (for material to 3/4" to 1-1/4") only \$38.

NEW Carbide tip ROSETTE CUTTERS
cutting width—2-1/4" \$99. 3-1/4" \$49.

SUPER BUY!!

These great sets are packaged in an attractive wooden box! Available in both 1/4" and 1/2" shank

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- 6 pc. Roundover Set 1 1/8" 3/16" 1/4" 5/16" 3/8" 1/2" radius \$55
- 5 pc. Cove Set 3/16" 1/4" 5/16" 3/8" 1/2" radius \$49

NEW 24 pc. SUPER Set \$129

SUPER SALE!!

CUTTERS and BEARING SETS (to change depth of cut) Two-Flute Cutters in 1/4" or 1/2" shank. Allen wrench incl.

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Circle #114 on Resource Directory Coupon

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Retail Price: \$319, available through JET retail distributors.

Features:

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- Headstock's spindle uses 1" x 8TPI thread to accommodate most lathe chuck accessories
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- Also includes a 5" tool rest and safety goggles

For more information, circle #151 on the Resource Directory Coupon.



Make Custom Clocks That Are Accurate to the Exact Second

Contact: Klockit 800-556-2548

Retail Price: \$28.95, through the Klockit catalog.

Features:

- Quartz clock movement works via a low frequency radio receiver to monitor a signal that broadcasts national standard time
- Movement self-corrects four-times daily, as well as automatically correcting for daylight savings
- Movement uses one AA battery
- Oustide measurements are 3 $\frac{5}{8}$ "H x 2 $\frac{1}{4}$ "W x $\frac{11}{16}$ "D
- Available in three shaft lengths ($\frac{5}{32}$ ", $\frac{3}{8}$ " and $\frac{5}{8}$ ") for use with almost any project, though due to the radio signal it can not be used with metal dials

For more information, circle #152 on the Resource Directory Coupon.

"A good drill bit set, with duplicates of the most commonly used (lost) sizes. The clear, vertical case makes access easy and also lets you know what's missing." — PW

Black & Decker's Bullet® Pilot Point® Set

Contact: Black & Decker, 800-54-HOW-TO

Retail Price: \$20, now available at home center stores.

Features:

- This 10th anniversary 20-bit set includes the 14 most popular drill bit sizes in a transparent plastic case
- The Pilot-Point tips drill a smaller starter hole to eliminate walking, providing improved accuracy and mar-free work surfaces
- The set includes two of each of the following: $\frac{1}{16}$ ", $\frac{9}{64}$ ", $\frac{3}{32}$ ", $\frac{7}{64}$ ", $\frac{1}{8}$ ", $\frac{5}{32}$ ", and one of each $\frac{9}{64}$ ", $\frac{11}{64}$ ", $\frac{3}{16}$ ", $\frac{7}{32}$ ", $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ "

For more information, circle #153 on the Resource Directory Coupon.

"Handy, clever, compact and affordable tool for the workbench, toolbelt or shop apron." — PW

Veritas® Carpenter's Gauge

Contact: Lee Valley 800-871-8158

Retail Price: \$14.95, through Lee Valley catalog.

Features:

- Can be carried in an apron or pocket, functions as a compass or marking gauge
- Direct-read gauge for radius and diameter is marked in inches and centimeters
- Made of brass, stainless steel and high-impact ABS
- 7 $\frac{1}{2}$ " long tool will scribe circles up to 12" in diameter

For more information, circle #154 on the Resource Directory Coupon.

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SAND along edges and into corners without vibration



SAW wood, fiberglass, metal & grout



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Why buy just a "detail" sander when the FEIN "Triangle" Sander offers so much more versatility? Sure there are alot of other sanders that cost less, but none of them have the patented oscillating motion. Our Newest Sander features variable speed control, 20% more power, yet weighs 1/2 lb less than the original FEIN Sander.

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Circle #121 on Resource Directory Coupon





BUILT-IN BOOKCASES

Learn the secret of the 'fitting strip' and you can make anything built-in.

IN ALMOST EVERY HOME in America there's the odd corner that not a single piece of furniture looks right in. You know what I'm talking about: The weird space beside the fireplace, the interior corner in the solarium, the space next to the sliding glass door. You've probably thought to yourself that a custom built-in cabinet would do the trick. In my home, that space was next to the fireplace. Here's how I turned that liability into an attractive asset that adds value to my home.



Schedule of Materials: Built-in Bookshelves

Lower Cabinet

No.	Item	Dimensions T W L	Material
2	Sides	$\frac{3}{4}$ " x $21\frac{1}{2}$ " x $30\frac{1}{4}$ "	Cherry Plywood
1	Bottom	$\frac{3}{4}$ " x $20\frac{1}{2}$ " x $29\frac{1}{2}$ "	Cherry Plywood
2	Support rails	$\frac{3}{4}$ " x 3" x $29\frac{3}{4}$ "	Cherry Plywood
1	Back	$\frac{1}{2}$ " x 30" x $27\frac{1}{4}$ "	Cherry Plywood
2	Fitting strips	$\frac{1}{2}$ " x $1\frac{1}{2}$ " x $30\frac{1}{4}$ "	Cherry
2	Facing stiles	$\frac{3}{4}$ " x $1\frac{1}{2}$ " x $30\frac{1}{4}$ "	Cherry
2	Facing rails	$\frac{3}{4}$ " x 3" x $27\frac{1}{4}$ "	Cherry
4	Door stiles	$\frac{3}{4}$ " x $1\frac{1}{2}$ " x $24\frac{1}{4}$ "	Cherry
4	Door rails	$\frac{3}{4}$ " x $1\frac{1}{2}$ " x $13\frac{5}{8}$ "	Cherry
2	Door panels	$\frac{1}{4}$ " x $11\frac{5}{8}$ " x $22\frac{1}{4}$ "	Cherry Plywood
1	Top	$\frac{3}{4}$ " x $22\frac{1}{4}$ " x $31\frac{3}{4}$ "	Cherry Plywood
1	Top edging	$\frac{3}{4}$ " x $1\frac{1}{2}$ " x $32\frac{1}{2}$ "	Cherry
1	Top edging	$\frac{3}{4}$ " x $1\frac{1}{2}$ " x 23"	Cherry

BUILT-IN BOOKCASES

Upper Bookcase

No.	Item	Dimensions T W L	Material
2	Sides	$\frac{3}{4}$ " x 9" x 54"	Cherry Plywood
1	Top	$\frac{1}{2}$ " x 9" x $29\frac{1}{2}$ "	Cherry Plywood
3	Shelves	$\frac{3}{4}$ " x $7\frac{3}{4}$ " x $28\frac{3}{4}$ "	Cherry Plywood
3	Shelf facings	$\frac{3}{4}$ " x $1\frac{1}{2}$ " x $28\frac{3}{4}$ "	Cherry
2	Facing stiles	$\frac{3}{4}$ " x $1\frac{1}{2}$ " x 54"	Cherry
1	Facing rail	$\frac{3}{4}$ " x 3" x $27\frac{1}{4}$ "	Cherry
1	Back	$\frac{1}{2}$ " x 30" x $53\frac{1}{4}$ "	Cherry Plywood
2	Fitting strips	$\frac{1}{2}$ " x $1\frac{1}{2}$ " x 54"	Cherry

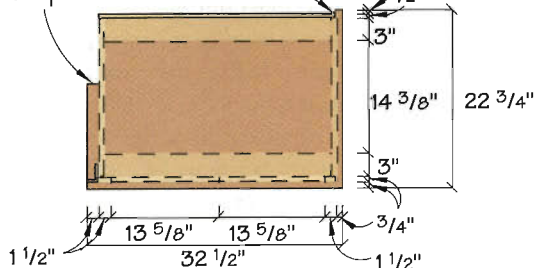


Are we on target?

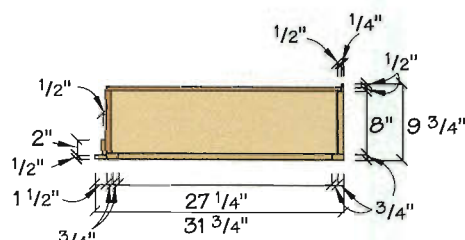
To see more projects like this in future issues, circle "P12" on the postage-paid card in the Resource Directory.

Diagrams

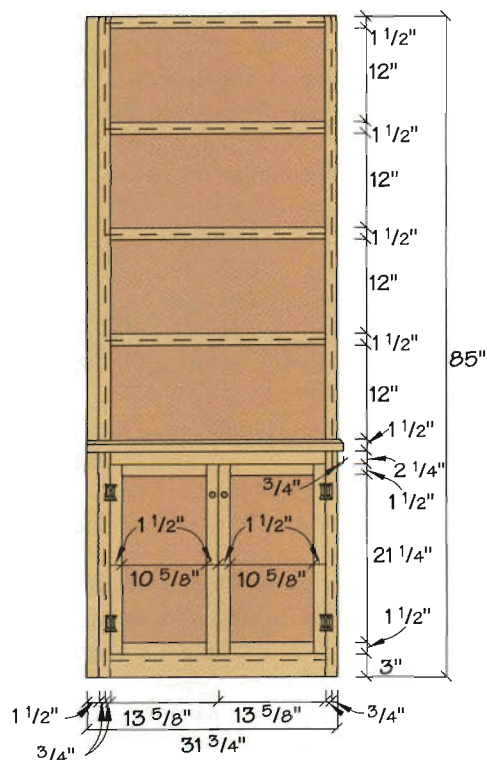
Notch the top up to the back of the fitting strip.



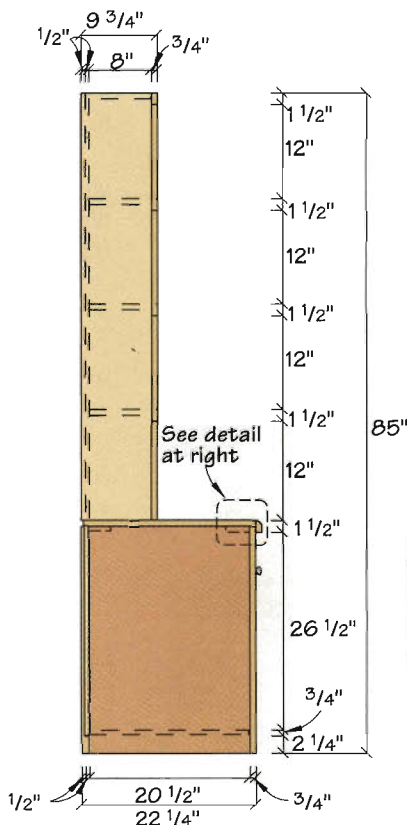
Plan of lower cabinet



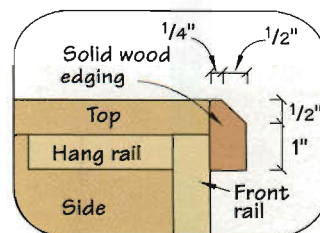
Plan of upper cabinet



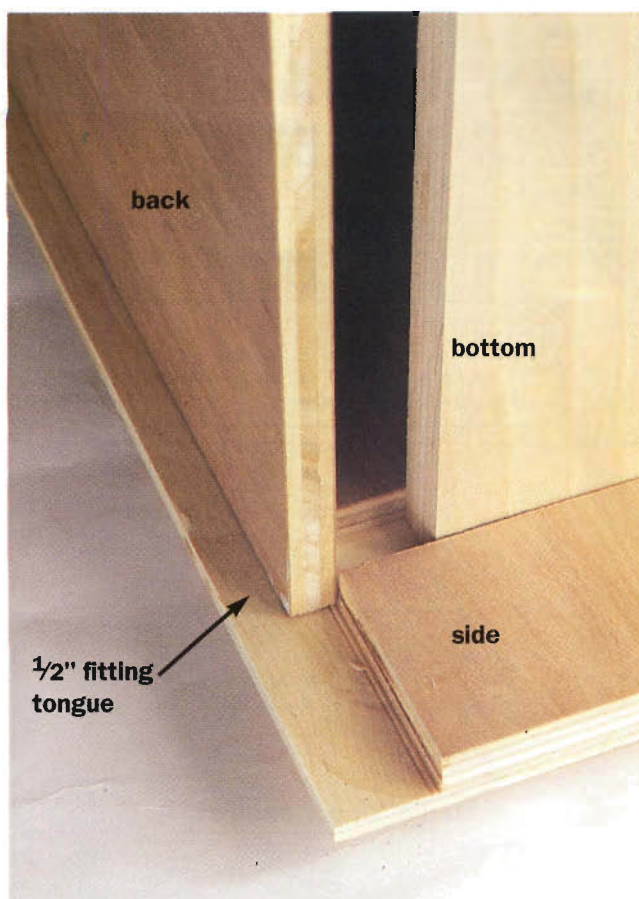
Elevation



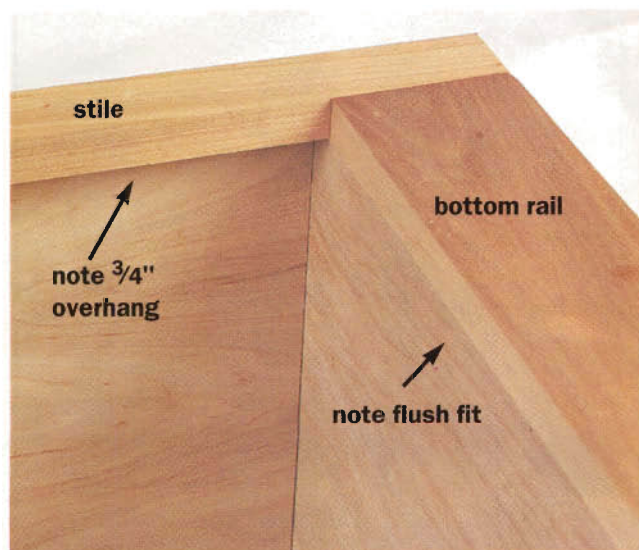
Profile



Detail of top profile



1 BACK RABBIT • For our corner cabinet, the visible side has a $\frac{1}{2}$ " thick x 1" rabbet cut the length of the back edge. This allows room for the $\frac{1}{2}$ " back to fit in the rabbet and another $\frac{1}{2}$ " tongue, which is fit to the wall with a jigsaw or hand plane.



2 FRAME SHOP • Mill the facing rails and stiles to size and then glue the frames together with biscuits, remembering to check for square. When the glue has dried, sand the inside frame surface flush, and then glue and clamp the frames to the front of the cabinet carcasses.

STEP 1 Rabbets & Dados • Face frame cabinets are one of the easiest types of cabinets to build. Start by cutting the carcass sides and bottom. To support the bottom, run a $\frac{3}{8}$ " deep x $\frac{3}{4}$ " wide dado on the inside of each side so the top of the dado is 3" up from the bottom. Next, run a $\frac{1}{2}$ " deep x $\frac{3}{4}$ " rabbet on the inside top edge of each side to accept the support rails.

The first step in making this cabinet built-in rather than free standing is routing a rabbet on one of the sides, (see photo 1). If your wall is perfect and square, you're in great shape and won't have to do any fitting.

In my corner cabinet, the interior side was ripped a second time to $20\frac{1}{2}$ ". This allows the back to simply overlay the entire back edge of the interior side without the worry of a rabbet. If the cabinet were being mounted to a wall where both sides would be visible, both sides would be made with a rabbeted back edge.

Assemble the lower cabinet using glue and clamps, strategically placed nails, or for extra strength and less nails, cleats can be used to attach the sides to the bottom from underneath. Square up the cabinet and temporarily attach the back to support the cabinet.

The upper shelving section is built in the same manner, but with the dado this time cut at the top of the sides, $1\frac{1}{2}$ " down from the top. Since there are no support rails at the bottom of the unit, run the same rabbet on the back edges of each side and temporarily attach the back for extra support.

STEP 2 Face Frames • Next, make the two face frames. The stiles of the lower cabinet overhang the inside of the cabinet by $\frac{3}{4}$ ", but the bottom rail overhangs the bottom only a fraction of an inch on the inside, (photo 2). The outside overhang should be sanded flush to the cabinet after gluing.

The top for the lower cabinet is simply cut to size from plywood, and then a solid cherry edge is glued and biscuited to the two visible edges with a miter joint at the corner. I ran a $\frac{1}{2}$ " chamfer on the top edge to soften the edge of the top.

STEP 3 Fitting Strips • The most important piece of the built-in part of the cabinetry is next. Referred to as fitting strips, these are simply L-shaped strips that are screwed to the wall side of the cabinet during installation, (photo 3).

The shelves are the next step in construction. The shelves are simply cut to size and a $\frac{3}{4}$ " x $1\frac{1}{2}$ " solid cherry rail is glued and biscuited to the front edge. This not only gives the shelves a more substantial appearance, it keeps the shelves from bowing under the weight of the books. The shelves are held in place with shelf pins which can be located to suit your needs.

STEP 4 Half-Lap Doors • The simple door construction is shown in photo 4. The butterfly hinges I used don't require any mortising, but you do need to be careful to align the doors correctly when attaching the hinges.

The interior of the lower cabinet can be whatever you need. On the piece shown I installed three interior drawers compartmentalized for video tape storage.

I finished the piece using a cherry oil-based stain and a coat of satin finish lacquer, giving the piece a rich appearance.

3 FITTING STRIPS •

Both pieces of the fitting strip were made of solid $\frac{1}{2}$ " cherry. For the inset doors, the fitting strip is flush. For overlay doors, attach the strip forward to match the overlay (see inset).

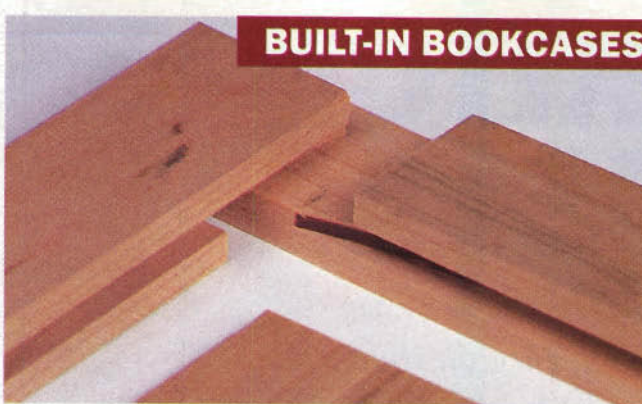
fitting strip

STEP 5 Installation • Now it needs to be installed. At this point you might want to take a couple of minutes to consider how the cabinets are being used. If you're using any lighting or stereo components in the cabinets, consider your wiring options. Also consider ventilation for the stereo.

Start the installation by preparing the space where the cabinet will go. If the room is carpeted, the cabinet can sit right on top of the carpeting. This cabinet has been designed to work without a base moulding. If you've got hardwood floors with any grooving detail on the floor, the cabinet base against the floor will show off these grooves. If this offends you, a small quarter-round moulding can be added after installation. Any existing baseboard in the cabinet's location can be marked and cut in place with a backed saw so the cabinet will slip into place (from above if it's a corner cabinet). Or the baseboard can be removed and cut and reattached after the cabinet is installed. A third option is to cope the back of the cabinet and the fitting strip to match the base moulding and allow the cabinet to cover the baseboard.

With the space prepared, put the cabinet in place allowing space for the fitting strip (or with the fitting strip attached), square it up and level it up front-to-back and side-to-side. Then check the fit against the walls. If you're lucky you won't have to touch a thing, but more likely than not you'll need to use the scribing method in the photo. This cabinet is of a size that the face frame could have been designed to extend beyond the cabinet and serve as a fitting strip, but the removable fitting strip is a lot easier to move around than the whole cabinet.

Put the cabinet back in place and again check the fit. If everything looks good, the cabinet can be screwed in place against the wall. Locate the studs behind the cabinet. Hopefully you can catch two. If not, a molly in the wall would provide a second attachment location. Then mark the stud locations



4 THE DOORS • The doors are simple but classic flat panel construction using half-lap joinery at the corners. The $\frac{1}{4}$ " cherry plywood panels are captured in a $\frac{1}{2}$ " groove run in the stiles and rails prior to assembly. Since they are inset doors, check the sizes in the Schedule of Materials against your actual opening and allow the doors to be a hair oversized to allow for fitting.

5 SCRIBING • Take a compass, and with the legs separated to the width of the widest gap between wall and cabinet, scribe a line down the back edge and against the front of the fitting strip. Remove the cabinet and cut almost to the scribe line, then clean the cut with a plane.



on the cabinet back and drill a clearance hole, then screw the cabinet in place. Make sure you use a long enough screw, 3" is preferable. Don't over-tighten the screw, it needs only to pull the cabinet to the wall, not correct any bow in the dry-wall (that's what the scribing was for).

Before putting the top in place, drill clearance holes (two each) in the support rails to attach the top after fitting. Next put the top in place and check its fit against the wall and plane or cut to provide the best joint. Then place the upper bookcase unit on the top, and again fit, scribe and plane or cut the back edge and fitting strip to match. With the bookcase fit to the walls, lightly mark the side location on the top and then remove the bookcase. Drill holes through the top (two per side), then remove the top from the lower cabinet and attach the upper case to the top with screws.

The upper assembly should fit into place with a few inches clearance on top. Screw the top to the lower cabinet through the support strips. A couple screws through the upper case's back at the very top will secure it to the wall. Hang the doors, put the shelves in place and you're ready to fill the cabinets. **PW**

—David Thiel, PW staff

KITCHEN ISLAND



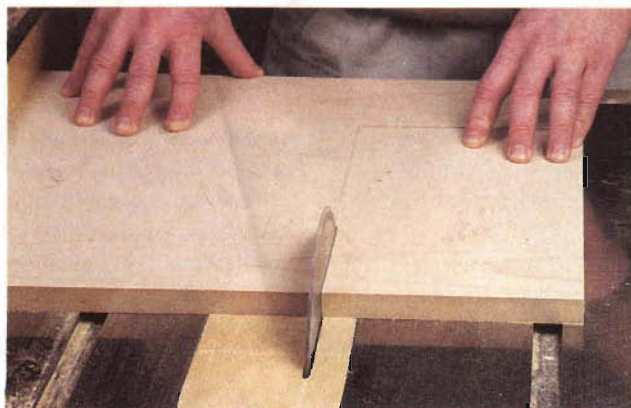
There's never ever been enough space in the kitchen — until now!

I DON'T KNOW if you've ever spent a lot of time in the kitchen (besides that time you used the dishwasher for that steam-bending experiment), but the No. 1 complaint of cooks is the profound lack of space there. Especially in homes built before the 1970s.

Short of tearing out a wall, this kitchen island is the best way to stretch your existing counter space by 7½ square feet and increase another commodity that's in short supply in many kitchens: storage space. And on those nights you're eating grilled cheese for dinner instead of lobsters thermidor, and you don't need the extra space, the kitchen island rolls into a corner out of the way.

This kitchen island is made of hard maple and maple veneered MDF (medium density fiberboard). To make things easier, I didn't build the maple butcher-block top. You can make your own, buy it from a local vendor or order it cut to size from the distributor listed at the end of the article.

STEP 1 **Legs, Sides & Shelves**
• Cut the 2" stock for the legs to the size listed in the Schedule of Materials. Then cut all the case parts from ¾" MDF maple plywood. Now cut the 7" x 13¼" notches in the sides for the shelves and onion bin. You'll notice that I made the grain on the sides run left-

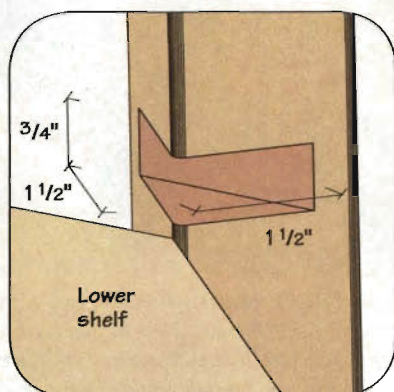


1 NOTCHES IN THE SIDES •
The notches require four saw set-ups. The trick here is to keep the outside surface facing up when you're making these cuts. This will keep the blade under-cut on the inside of your case piece, where it won't be seen. First, lay out the locations of the notches. Cut the second notch to allow the waste piece to fall to the waste side of the blade, so plan your cuts accordingly. Make the cuts with your saw blade up all the way.

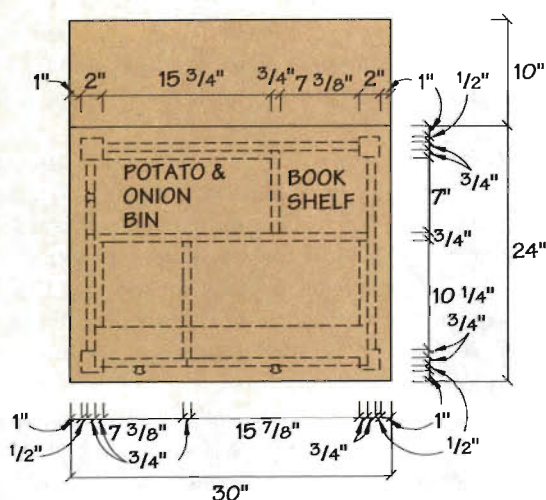


Are we on target?

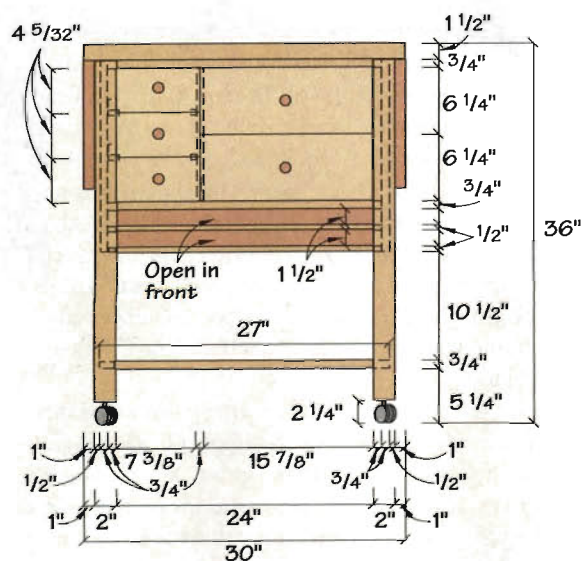
To see more projects like this in future issues, circle "P3" on the postage-paid card in the Resource Directory.



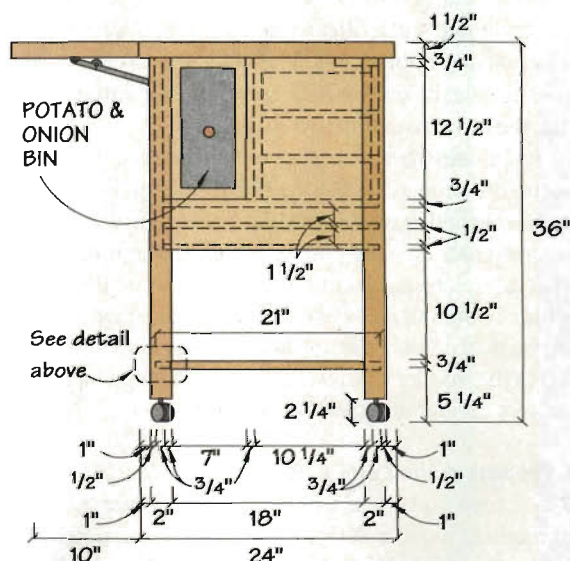
Detail of lower shelf notch



PLAN



ELEVATION



PROFILE

Schedule of Materials: Kitchen Island

No.	Item	Dimensions T W L	Material
1	Top	1 1/2" x 24" x 30"	Maple
1	Drop Leaf	1 1/2" x 10" x 30"	Maple
4	Legs	2" x 2" x 32 1/4"	Maple
2	Case sides	3/4" x 18" x 18"	Plywood
1	Case back	3/4" x 18" x 24"	Plywood
1	Inner bottom	3/4" x 20 1/4" x 25 1/2"	Plywood
2	Tray dividers	1/2" x 20 1/2" x 26"	Plywood
1	Lower shelf	3/4" x 21" x 27"	Plywood
1	Center divider	3/4" x 13 1/4" x 25 1/2"	Plywood
1	Bin divider	3/4" x 13 1/4" x 7 3/4"	Plywood
2	Drawer divider	3/4" x 13 1/4" x 11"	Plywood
1	Front rail	3/4" x 3" x 25 1/2"	Plywood
2	Drawer faces	3/4" x 6 1/4" x 16 1/4"	Plywood
4	Drawer fronts	1/2" x 5 3/4" x 14 1/4"	Plywood
4	Drawer sides	1/2" x 5 3/4" x 10 3/4"	Plywood
2	Drawer backs	1/2" x 5" x 14 1/4"	Plywood
2	Drawer bottoms	1/4" x 6 3/4" x 10 1/2"	Plywood
3	Drawer faces	3/4" x 4 1/8" x 7 3/4"	Plywood
3	Drawer fronts	1/2" x 3 1/2" x 6 3/4"	Plywood
2	Drawer sides	1/2" x 3 1/2" x 10 3/4"	Plywood
2	Drawer backs	1/2" x 3" x 6 3/4"	Plywood
2	Drawer bottoms	1/4" x 6 3/4" x 10 1/2"	Plywood
4	Drawer cleats	3/4" x 1 1/2" x 10 1/4"	Plywood
1	Drawer cleats	1/2" x 1/2" x 10 1/4"	Plywood
1	Drawer cleat	3/4" x 1 1/2" x 13 1/4"	Plywood
2	Bin sides	1/2" x 13 1/4" x 16 1/2"	Plywood
1	Bin back	1/2" x 12 1/2" x 6 1/2"	Plywood
1	Bin bottom	1/4" x 16 1/4" x 6 1/2"	Plywood
2	Bin face stiles	3/4" x 1" x 13 1/4"	Maple
2	Bin face rails	3/4" x 1" x 7"	Maple
5	Drawer fillers	3/4" x 2" x 10"	Plywood
2	Bin Fillers	3/4" x 2" x 15 1/2"	Plywood

KITCHEN ISLAND



2 BISCUIT TRICK • Joining material of different thicknesses with biscuits is easy when you use spacer blocks. Using a $\frac{3}{4}$ " piece of MDF on top of my work put the biscuit slot in the middle of the panel without having to change the fence setting. After cutting the slot in the panel, I used the same setup to cut a slot in the legs.

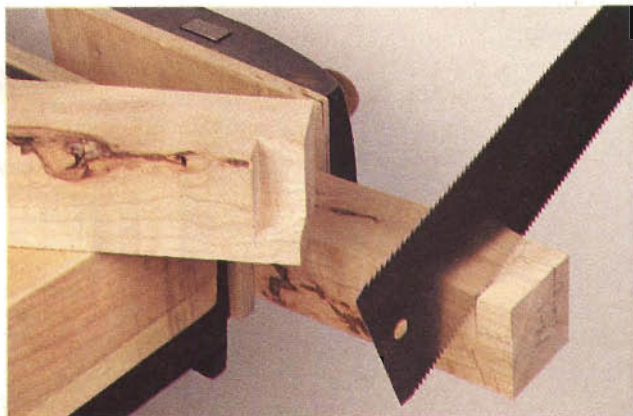
to-right. Because wood movement isn't a problem with MDF, you can make the grain run whatever direction you want.

The inner bottom below the drawers is biscuited into the sides and back so it fits flush to the bottom of the notches in the sides. I then cut $\frac{1}{4}$ " deep x $\frac{1}{2}$ " wide grooves and rabbets into the sides and back to capture the two tray dividers. The lower divider is captured flush to the bottom of case sides in the rabbet, then the groove is cut $1\frac{1}{2}$ " up from the top of the rabbet. The corners of the tray dividers will need to be notched to fit into the corners, but it's best to do that after your first dry assembly. For now, make all your cuts, but don't assemble anything yet, there's more to do.

STEP 2 Biscuit Joint Boogie • Lay out the biscuit locations to attach the legs to the back and side panels, holding the panels $\frac{1}{2}$ " in from the outside of the legs. With the notch in the side panels, there isn't a very long glue joint left at the rear legs. Fear not. After applying veneer edge tape to the edges of the notch, cut a filler to the size of each opening and tape it in place temporarily. This allows you to clamp evenly across the case, keeping the whole thing square when you glue the case assembly together later.

The inner construction of the case consists of three vertical panels: the center divider, the bin divider and the drawer divider. The bin and drawer divider are screwed in place through the center divider (see the plan view in the diagrams). Then the bin divider is biscuited into the case back, while the center divider is biscuited between the two case sides, flush with the vertical edge of the notches. The inner bottom is then screwed to the dividers. Now iron on veneer edge tape to the front drawer divider and the case bottom.

STEP 3 Preparing the Legs • Next cut the notches in the legs to accommodate the front rail and the lower shelf. The top rail requires a $\frac{3}{4}$ " x $\frac{3}{4}$ " x $1\frac{1}{2}$ " squared-out notch. The one for the lower shelf is a little different. Start by laying out a $\frac{3}{4}$ " wide x $1\frac{1}{2}$ " notch on the two inside faces of all four legs, $2\frac{3}{4}$ " up from the bottom. Starting your saw cut at the inside corner, define the top and bottom edges of the notch,



3 NOTCHES IN THE LEGS • The photo shows the cut for the top notch. Mark the location of the notch with a marking gauge, then cut across the diagonal to the center of the leg with a pullsaw. Finally square out and clean the waste with a chisel.

cutting diagonally across the inside corner. Then remove the waste leaving a triangular notch. The corners of the lower shelf are then cut at a 45-degree angle to fit into the notches.

STEP 4 Case Assembly • With the inner case assembled, it's time to dry assemble the whole case. First, lay out and cut the $\frac{3}{4}$ " x $\frac{3}{4}$ " notches on the back corners and the $\frac{3}{4}$ " x $1\frac{1}{2}$ " notches on the front corners of the inner bottom. Also, cut the 1" x 1" notches on the back corners and 1" x $1\frac{1}{2}$ " notches on the front corners of the tray dividers. Finally, lay out and cut $1\frac{1}{2}$ " x $1\frac{1}{2}$ " mitered corners on the lower shelf. You're now ready to dry assemble.

Begin by fitting the biscuits and dry-clamping the case back between the back legs flat on a bench. Then fit the inner case assembly to the back leg assembly with biscuits. Now set the sides into place on the back legs' respective joints.

With the front legs not in place yet, you should be able to slide the tray dividers and shelf into place. Then place the front legs in place and check for a good fit.

Disassemble the legs and case panels and rout a $\frac{1}{8}$ " radius on all four long edges of the legs. Lastly, before gluing the unit together, screw and glue the cleats for attaching the top assembly to the sides. Wait until the case is assembled before attaching the fillers for the drawer slides (see photo 4).

Proceed to glue up the case and legs check the case for square after assembly. As you begin to clamp the case together, remove the masking tape from the sides that will interfere with the glue joints. Now you can iron on veneer edging tape to the four edges of the bottom shelf and the fronts of the two tray dividers.

Build the drawers by first cutting out and assembling the sides, fronts and backs using simple glued-and-nailed rabbets for the joinery. The rabbet is $\frac{1}{4}$ " x $\frac{1}{2}$ ". Make sure to check the sizes given with the openings on the case as they may vary slightly. Also remember that the large drawers use drawer slides that require the drawer boxes be 1" smaller in width than the opening. Cut out the drawer faces and edge tape them, then finish sand and set aside.



4 FILLER STRIPS • When the case is dry, install the filler blocking for the drawer slides. Use a block cut to the height you want your drawer slides to sit. Hold the spacer against the side, lay the filler strip on top of it and nail away! Always remember to attach the top blocking first then work your way down.

5 PUNCH THE TIN • After some testing, the tool I liked best for punching the tin was a nail set with a fine tip. Make a copy of the pattern in the PullOut™ Plans and tape it to a piece of tin cut to size. Center the pattern on the material and punch away.

STEP 5 Build the Bin • Though similar in construction to the drawers, the bin front is a stile and rail frame built with half-lap joints. A punched tin panel is then nailed to the inside. Also, the front is the drawer face, and the entire bin fits inset in the opening, rather than overlaying.

The bin sides fit into $\frac{1}{2}$ " x $\frac{1}{2}$ " rabbets cut on the sides of the assembled bin front. Cut a $\frac{1}{2}$ " x $\frac{1}{4}$ " rabbet on the inside back edge of the sides to capture the bin back. Finally, make a $\frac{1}{4}$ " x $\frac{1}{4}$ " groove $\frac{1}{4}$ " up from the bottom edge of all four drawer pieces to capture the bottom. Now punch the pattern in the tin using the method shown in the photo, and nail the punched tin into the bin front after it's finished.

Attach the wooden knob to the bin by running a screw through a $\frac{3}{4}$ " x $\frac{3}{4}$ " x 6" wooden strip that is attached to the front frame of the bin, behind the tin.

STEP 6 Down to the Nitty Gritty • Cut the top and leaf in the Schedule of Materials to size. Ours was already finished with a catalyzed varnish. Begin attaching the top by laying the top and the leaf next to each other and attaching the continuous hinge to the top and leaf at the joint. Place the case upside-down on the case and locate it roughly in the center. At this point there should be about $1\frac{1}{2}$ " between the back of the case and the hinge barrel. This is important for attaching the drop leaf supports. Screw the case to the top with cleats, then attach the stays.

Flip the piece back over and place it on a level surface to attach the drawer faces. Start by placing the drawer boxes into their openings, then, using shims to locate the lower-left drawer face, clamp it to the box. Pull it out and hammer a couple short nails into the front from the inside of the box. This gives you a fairly adjustable drawer face. Repeat the process with the remaining fronts and then adjust the faces so there are equal gaps around each drawer. When done, drill a clearance hole in the front of the box and attach the faces with screws.

Now you're ready to finish the piece. Remove the drawer faces from the drawer boxes and the top from the case. Finish sand all parts and finish the case with three coats of



6 ATTACH THE STAYS • The instructions offer different mounting locations for different set-backs on the sides. I chose $1\frac{1}{2}$ " between the barrel of the hinge and the leaf. First attach the long end of the stay to the leaf. Then attach the short end to the case, $2\frac{1}{16}$ " down from the top of the case, allowing the leaf to drop down all the way.

Source of Supply

Butcher Block: Tamarack Distributors • 800-582-4555
• Two 25" x 30" slabs • \$123.50 + shipping

Casters & Slides: Woodcraft • 800-225-1153 • casters item# 27I46 • \$9.50 for a set of four + shipping • drawer slides item# 27E30 • \$33 for two pairs + shipping

Stays: Woodworker's Supply • 800-645-9292 • item# R11965 • \$12.50 for the pair + shipping

clear finish. Rubbing out the finish with a gray Scotch Brite™ pad and some wool wax soap will yield a stellar finish on this tight-grained maple.

When the finishing is done, reassemble the top and case upside-down, then drill the holes for the locking casters and install. Now you're ready to carve that pot roast. **PW**

— Jim Stuard, PW staff

Arts & Crafts CRADLE

Believe it or not, the wood in this cradle was cut from a fruit-bearing cherry tree from my parent's backyard in Bloomsburg, Penn. I don't remember the tree, but there are photos of my father and me (still in diapers) in front of it. Dad had to cut the tree down a short time after the photos were taken, but he hauled it to a saw mill, and stored the rough-cut lumber in our garage.

Twenty-five years later my wife and I were expecting our first baby, so Dad and I figured out a cradle design and pulled out some of that wood that was still in the garage. The old photos, the old wood, a new baby and a new design have created an heirloom.

STEP ONE: The lumber I had on hand forced me to laminate the legs and feet to yield the necessary $1\frac{1}{2}$ " x 3" pieces, but you may have thicker stock available. I planed the other pieces to $\frac{3}{4}$ " or $\frac{5}{8}$ " thick, then cut them to width and length according to the Schedule of Materials. When laminating the legs and feet, allow extra material for additional milling in steps eight and nine.

STEP TWO: To form the end frames,

cut a 6-degree angle on the ends of the stiles and rails so that the end frames are slightly trapezoidal. The center slats each have one long edge tapered on a 6-degree angle so that its edges are all parallel to the frame pieces.

STEP THREE: Join the end frames with half-lap joints where the stiles and rails meet. The two center slats and the center stile overlap and are recessed into the rails from the inside (**see diagram**). I used a $\frac{1}{8}$ " straight bit in a router to recess the slats into the rails.

STEP FOUR: I was inspired by Greene and Greene furniture, and by rounding the corners with a disc sander, I attained a similar look. All the edges are then rounded with a quarter-round router bit.

To hang the basket, cut a $\frac{5}{8}$ " x $3\frac{1}{2}$ " notch centered in the top end of the center stiles to hold the pivot pieces. I used a doweling jig to drill holes through the width of the center stiles to accept a $\frac{1}{4}$ " maple dowel. Dowel the pieces together and trim the ends flush.

STEP FIVE: Dry assemble the end frames and mark and notch the frames to accept the side rails as shown in the diagram. Cut half laps on the ends of each side slat, then notch the rails to match.

STEP SIX: Sand all pieces to 220 grit and glue up the end and side frames.

Attach the side frames to the end frames using countersunk $1\frac{1}{4}$ " #6 wood screws, filling the holes with walnut dowel plugs for contrast.

STEP SEVEN: Cut the two support cleats and screw them to the inside, about $\frac{1}{2}$ " up from the bottom of the basket.

Next, countersink holes in the bottom slats, and glue and screw the bottom slats to the cleats.

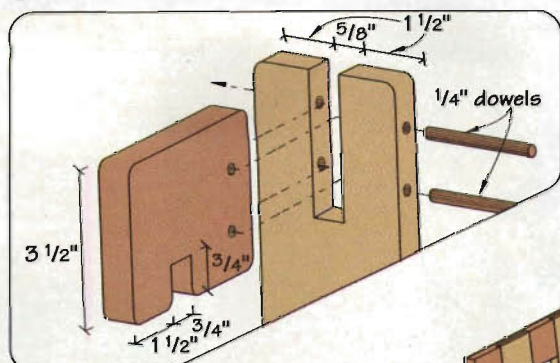
STEP EIGHT: Attach the legs to the feet with a mortise and tenon joint. Cut a 1" deep x 1" x $2\frac{1}{2}$ " mortise in the center of each foot. Then cut the tenons on the legs to fit.

STEP NINE: To form the notch in the legs that the pivot piece rests in, drill a $1\frac{1}{4}$ " diameter hole centered 1" down from the top. Then cut 1" off that end, giving you a $\frac{5}{8}$ " notch in the end to support the basket.

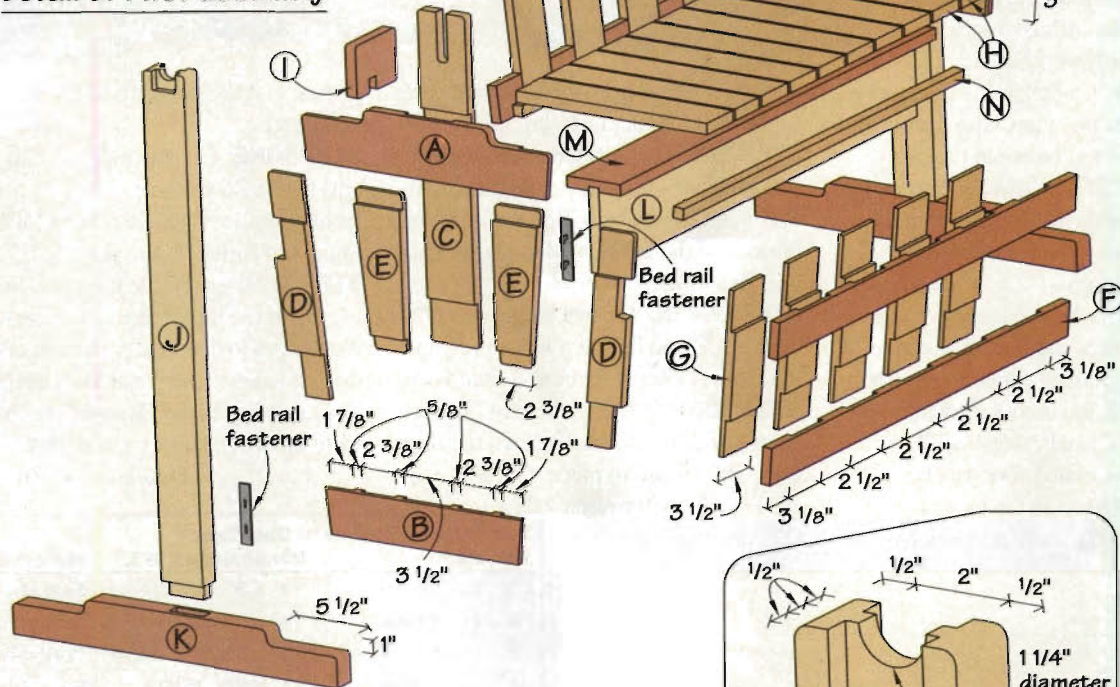
The pivot piece and leg fit together in a loose bridle joint. You will need to cut a $\frac{3}{4}$ " x $\frac{3}{4}$ " notch in the pivot piece, then cut a $\frac{1}{2}$ " deep recess around the notch on the inside and outside faces of the legs (**see diagram detail**).

STEP TEN: To allow for easier transport, attach the legs and stretcher with

Diagrams



Detail of Pivot assembly



Detail of cutout on leg for pivot assembly



Are we on target?
To see more projects like this in future issues, circle "P7" on the postage-paid card in the Resource Directory.

knock-down bed hardware. Mark and mortise the legs and stretcher ends for the hardware. I used a router with a 1/8" spiral bit to make these mortises.

STEP ELEVEN: To attach the stretcher cap, cut a 3/4" wide x 1/4" deep groove down the center of the stretcher cap. I used a dado head on the table saw to make the groove, then glued and clamped the cap in place.

STEP TWELVE: To finish the piece in a baby-friendly manner, sand all the pieces to 220 grit, then apply three coats of General Finishes' Toy Maker's Finish, a wipe-on oil finish, (available from Woodworkers' Store, 800-279-4441), buffing lightly with 400 grit sandpaper between coats. **PW**

—Bruce Stoker,
Popular Woodworking Books

Schedule of Materials: Arts & Crafts Cradle

No.	Letter	Item	Dimensions T W L	Material
2	A	End rails (top)	5/8" x 4" x 18 1/2"	Cherry
2	B	End rails (bottom)	5/8" x 3" x 16"	Cherry
2	C	Center stiles	5/8" x 3 1/2" x 22"	Cherry
4	D	End stiles	5/8" x 2 1/2" x 14 5/8"	Cherry
4	E	Center slats	5/8" x 3 1/2" x 10 1/2"	Cherry
4	F	Side rails	5/8" x 2 1/2" x 34"	Cherry
10	G	Side slats	5/8" x 3 1/2" x 11"	Cherry
10	H	Bottom slats	5/8" x 3" x 14 3/8"	Cherry
2	I	Pivot pieces	5/8" x 3 1/2" x 4 1/2"	Cherry
2	J	Legs	1 1/2" x 3" x 33 3/4"	Cherry
2	K	Feet	1 1/2" x 3" x 24"	Cherry
1	L	Stretcher rail	3/4" x 5 3/8" x 36"	Cherry
1	M	Stretcher cap	3/4" x 4" x 36"	Cherry
2	N	Cleats	3/4" x 3/4" x 32"	Cherry

4" heavy-duty bed rail fasteners (#125-061 from Woodworkers' Supply, 800-645-9292; \$8.75 for a package of 4 sets.)

DART CASE

A nice wooden dart case can cost hundreds of dollars. Making your own saves money and allows you to add personal touches (like the cup holders).

STEP ONE: Cut all the pieces to size. Then cut a $\frac{3}{8}$ " wide x $\frac{3}{4}$ " deep rabbet on the case pieces to hold the $\frac{1}{2}$ " cork (from an office supply store) and the $\frac{1}{4}$ " plywood back.

STEP TWO: Assemble the case pieces using biscuits and glue, with the top and bottom captured between the sides.

STEP THREE: Machine a rabbet on the back edge of the door panels leaving a $\frac{1}{4}$ " x $\frac{5}{16}$ " long tongue on all edges.

STEP FOUR: Run a $\frac{1}{4}$ " x $\frac{3}{8}$ " deep groove ($\frac{1}{4}$ " in from the front edge) on the inside of the door stiles and rails. The panels fit into the door pieces allowing enough space for $\frac{1}{8}$ " expansion across the width. Pre-stain the door panels, then biscuit and assemble the doors and door panels.

STEP FIVE: Mortise the hinges into the case and door sides so the doors are set

about $\frac{1}{8}$ " down from the top of the case to allow the doors to swing freely.

STEP SIX: The dart ledges have three $\frac{3}{8}$ " holes drilled to a $\frac{1}{2}$ " depth, with a $\frac{1}{8}$ " diameter hole drilled through the bottom of the ledge. Cut the front corners at a 45-degree angle.

STEP SEVEN: The pen ledge has a $\frac{1}{2}$ " deep x 1" groove down the center, and the front corners are then rounded off.

STEP EIGHT: Make the cup holders from 1" thick material, resawn to leave a $\frac{1}{4}$ " thick bottom piece. Cut 3" diameter holes in the top piece. Glue the pieces back to-

gether. Cut the two cup holders to finished size.

STEP NINE: Cut the top piece to size and rout a 45-degree chamfer on the front and side edges, leaving a $\frac{1}{4}$ " flat. Stain and finish all the pieces.

STEP TEN: Assemble the case. Screw the top to the top of the case. Screw the dart ledges to the door panel and biscuit the pen ledge to the panel from the back. The dry-wipe board also was purchased from an office supply store. **PW**

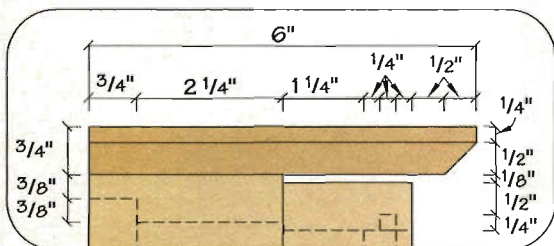
—David Thiel, PW staff



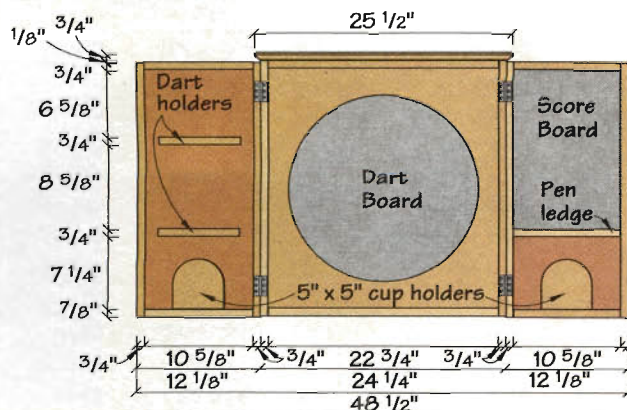
Schedule of Materials: Dart Case

No.	Item	Dimensions T W L	Material
2	Sides	$\frac{3}{4}$ " x 3" x 25 $\frac{1}{2}$ "	Sassafras
2	Top & bott	$\frac{3}{4}$ " x 3" x 22 $\frac{3}{4}$ "	Sassafras
1	Back	$\frac{3}{4}$ " x 23 $\frac{1}{2}$ " x 24 $\frac{3}{4}$ "	Cork/ply
4	Door stiles	$\frac{3}{4}$ " x 2" x 25 $\frac{1}{2}$ "	Sassafras
2	Door top rails	$\frac{3}{4}$ " x 2" x 10 $\frac{5}{8}$ "	Sassafras
2	Door bottom rails	$\frac{3}{4}$ " x 2" x 10 $\frac{5}{8}$ "	Sassafras
2	Door panels	$\frac{1}{2}$ " x 11 $\frac{1}{8}$ " x 24 $\frac{3}{8}$ "	Sassafras
1	Top	$\frac{3}{4}$ " x 6" x 25 $\frac{1}{2}$ "	Sassafras
1	Pen ledge	$\frac{3}{4}$ " x 1 $\frac{1}{2}$ " x 10 $\frac{1}{8}$ "	Sassafras
2	Dart holders	$\frac{3}{4}$ " x 1 $\frac{1}{2}$ " x 8"	Sassafras
2	Cup holders	1" x 5" x 5"	Sassafras

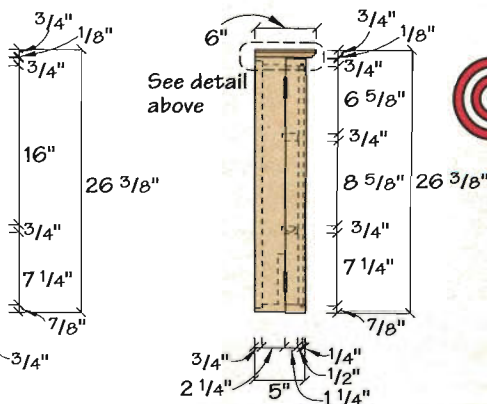
Diagrams



Detail of crown



Elevation (doors open)



Profile (closed)

Are we on target?
To see more projects like this in future issues, circle "P8" on the postage-paid card in the Resource Directory.

Popular Woodworking

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

INSIDE

project

Kitchen Island

Alien Swinger

Squirrel in a Tree

Chippendale Secretary

From page

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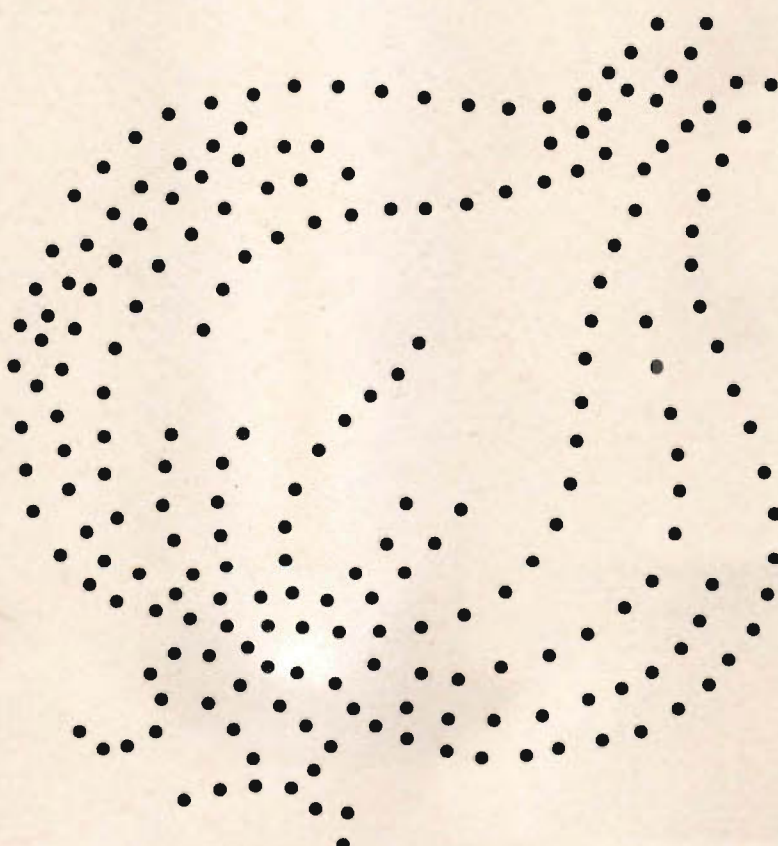
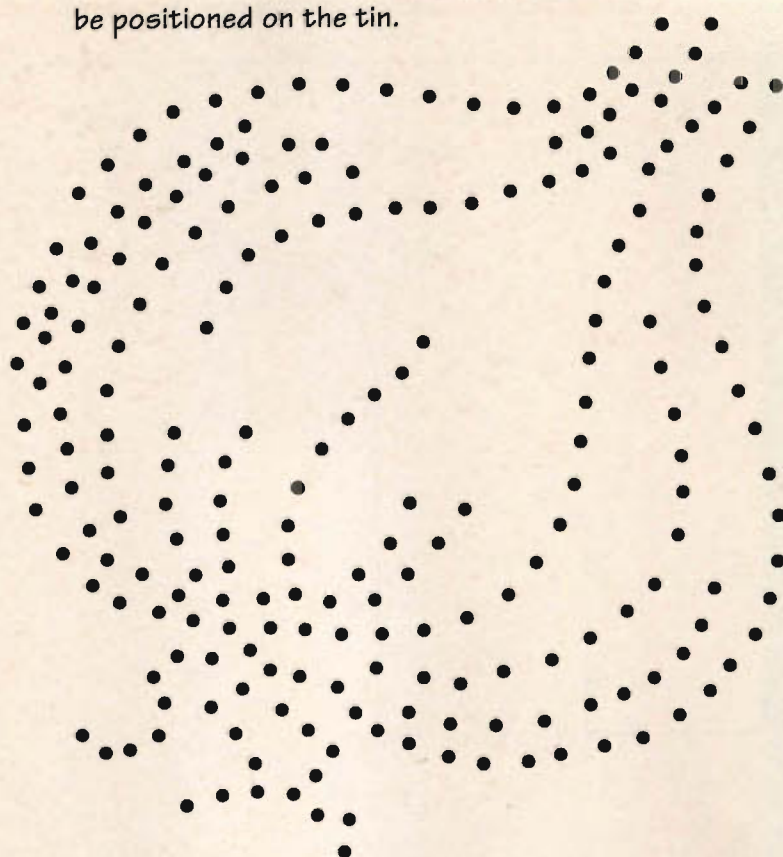
47

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These plans comprise pages 37 through 44 of the magazine

Kitchen Island

Full-size layout of the punched tin pattern. Note that the locations of each onion are where they should be positioned on the tin.



a Tree

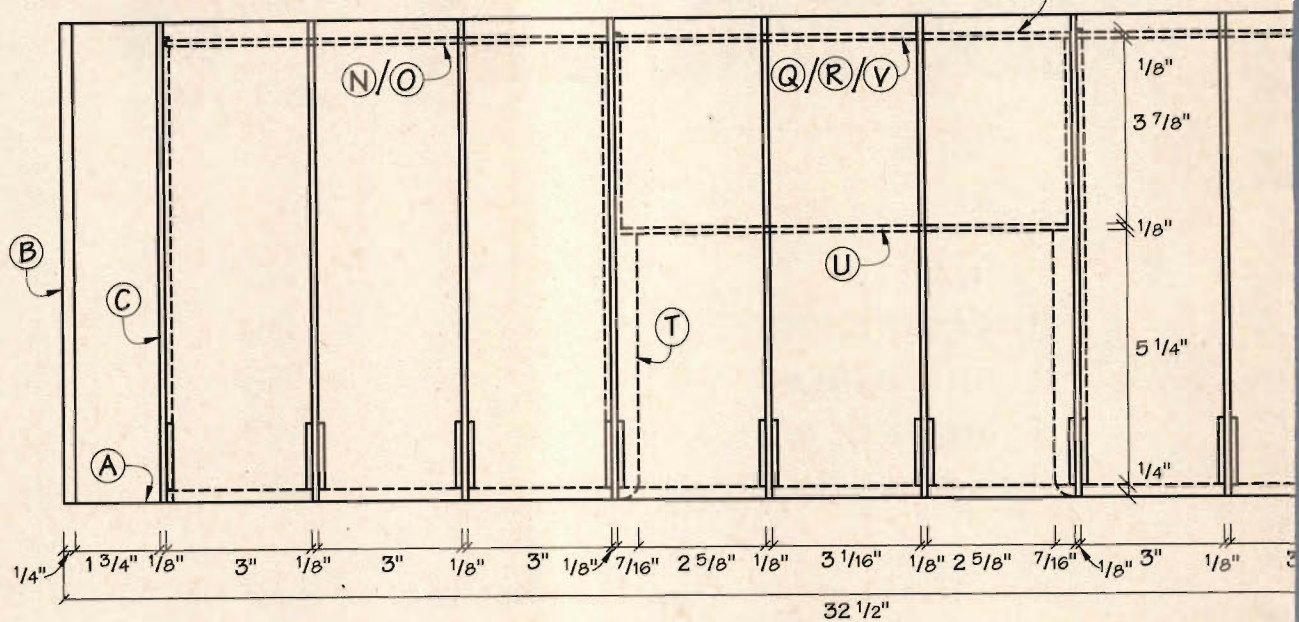
of the squirrel
hes.



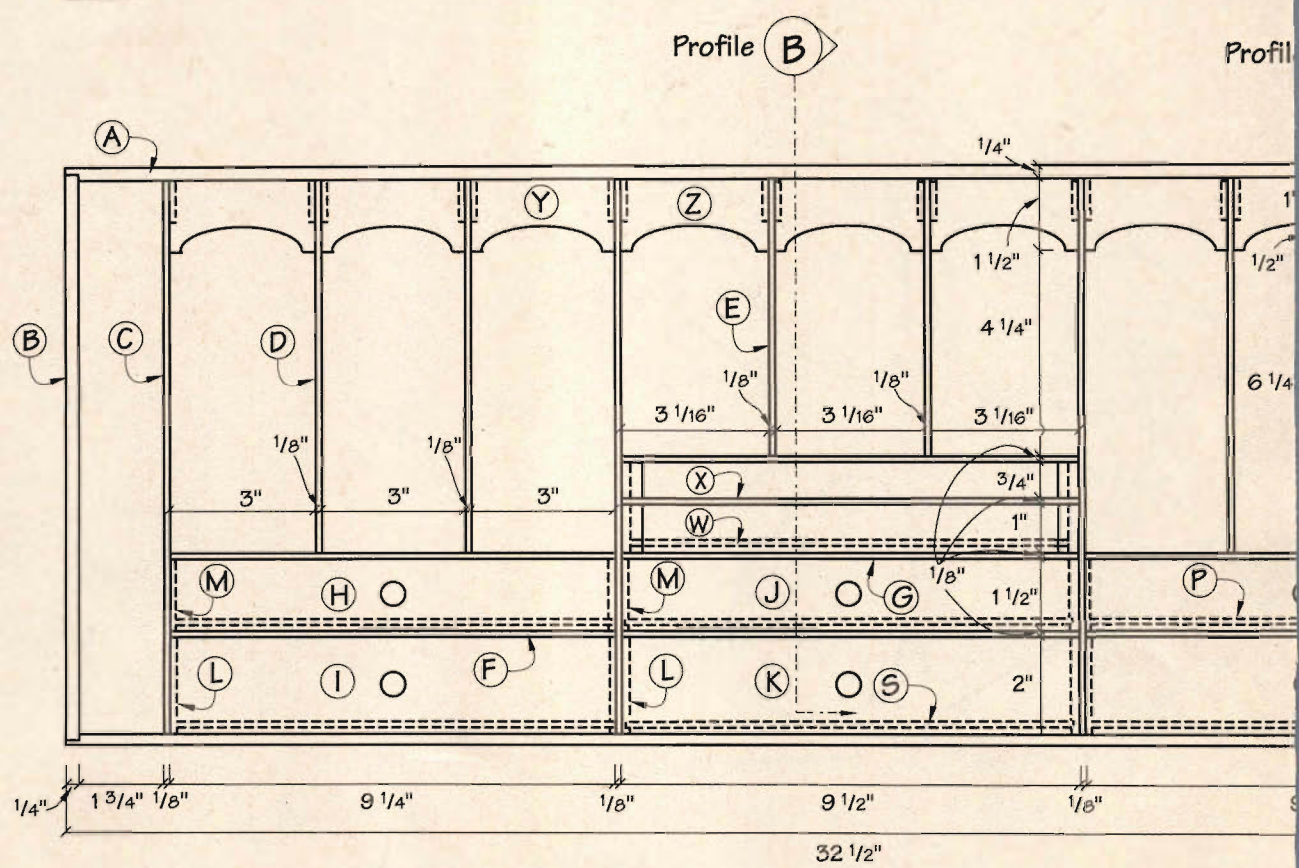
Chippendale Secretary

Scale 3" = 1'-0"

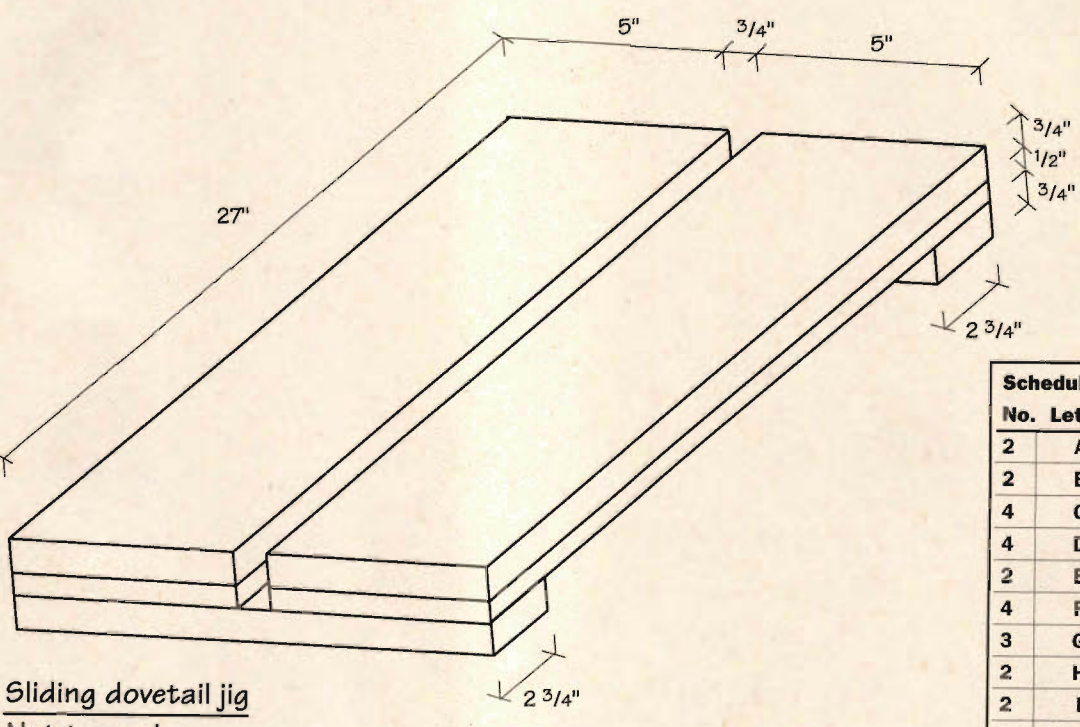
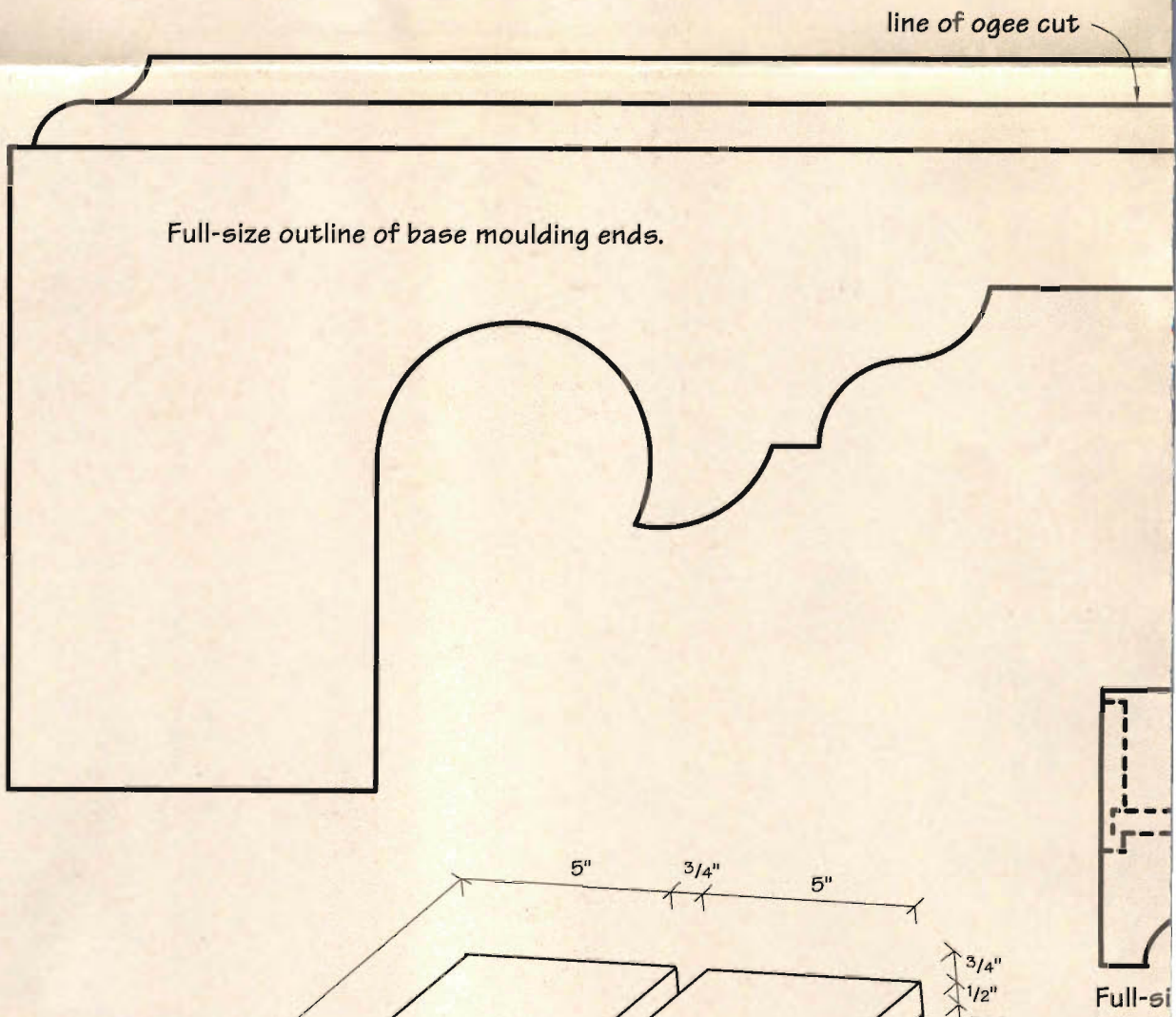
Dashed lines indicate drawer outlines



Plan



Elevation

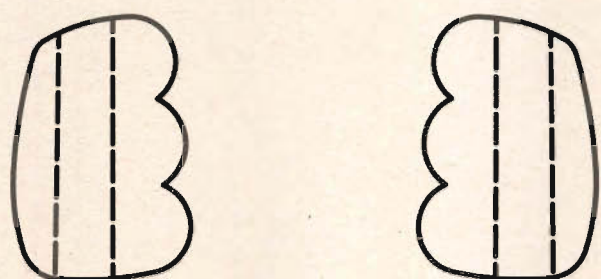


Sliding dovetail jig
Not to scale

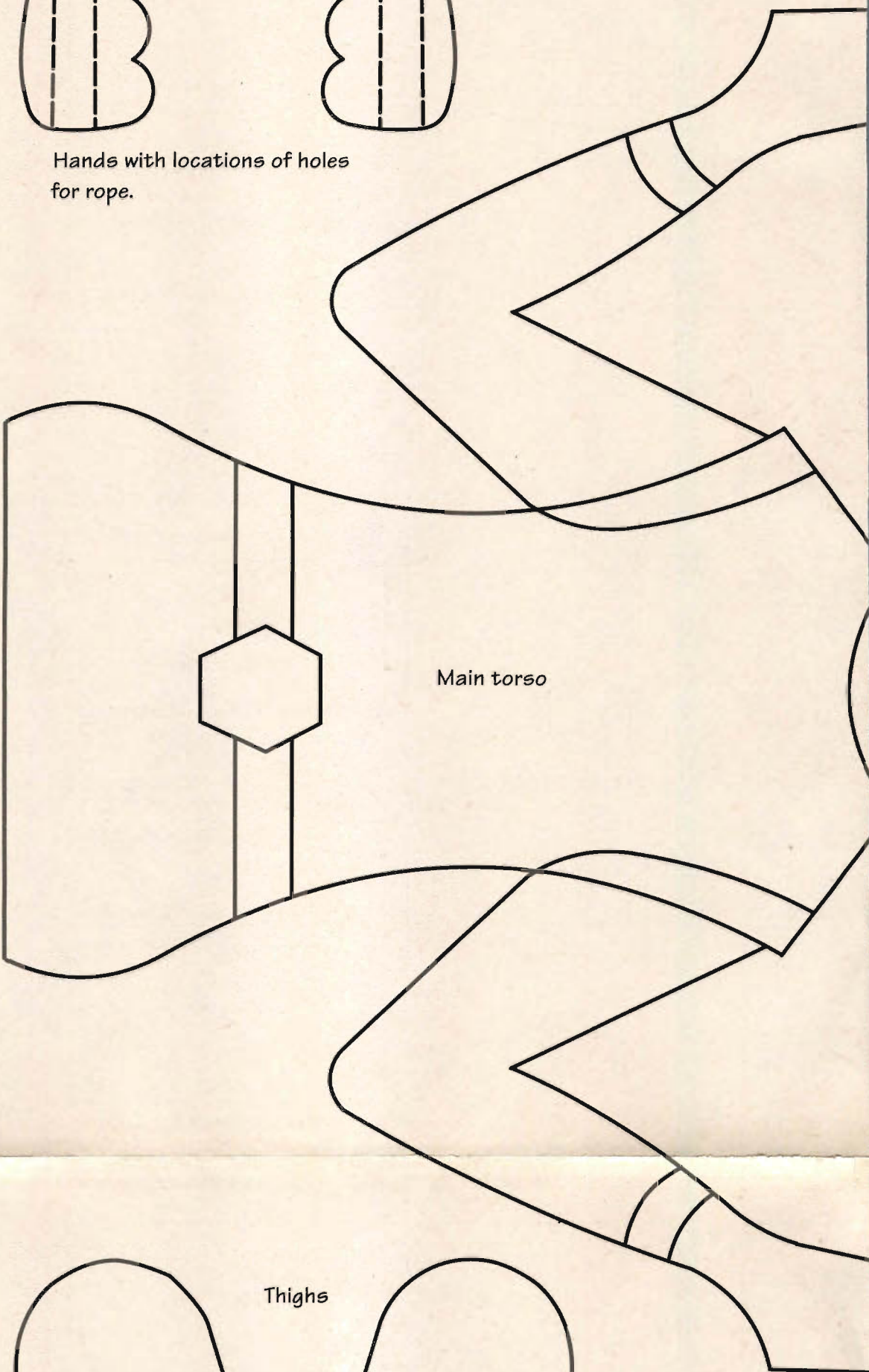
Schedule of Materials:		
No.	Letter	Item
2	A	Top and bottom
2	B	Ends
4	C	Full height
4	D	Outer divider
2	E	Center divider
4	F	Outer rails
3	G	Center rails
2	H	Drawer front
2	I	Drawer front
1	J	Drawer front
1	K	Drawer front
6	L	Drawer side
6	M	Drawer side
4	N	Drawer back

Alien Swinger

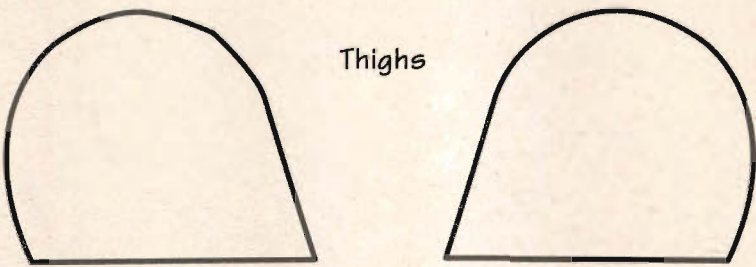
Full-size diagrams of body parts



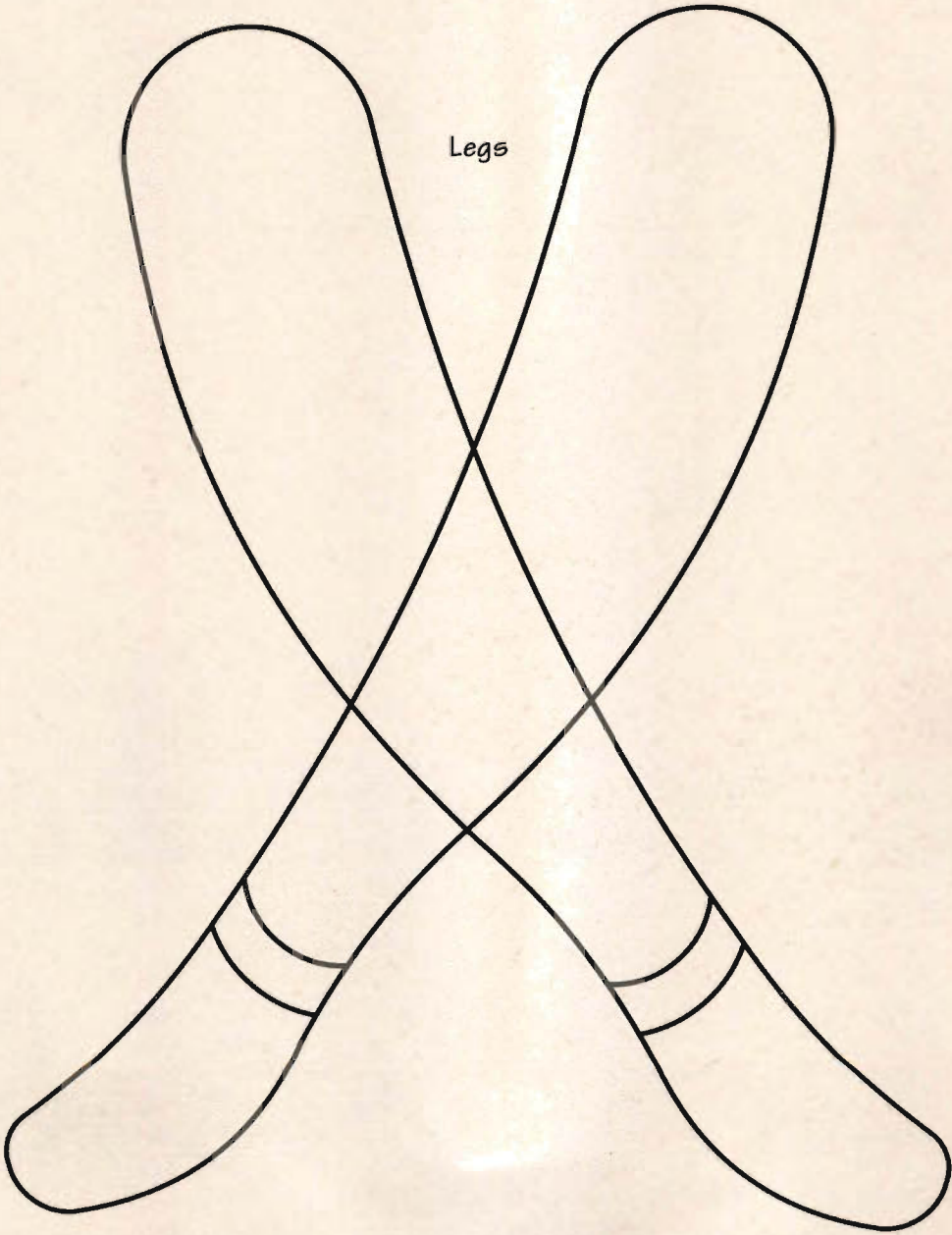
Hands with locations of holes for rope.



Main torso



Thighs

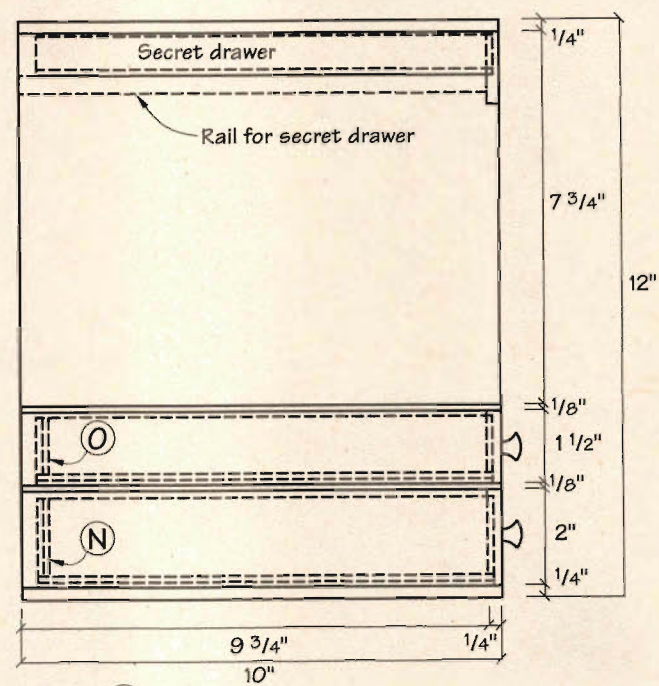
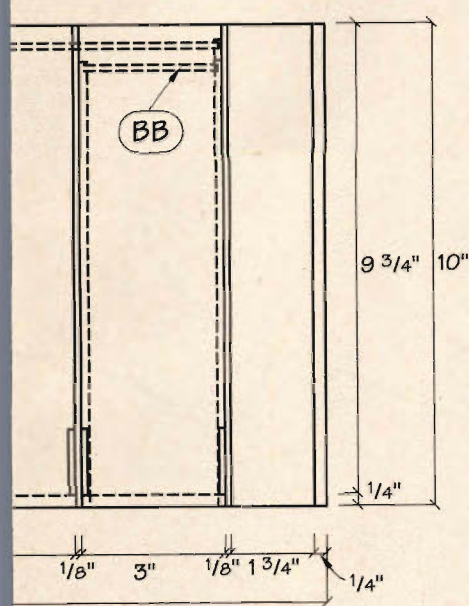


Legs

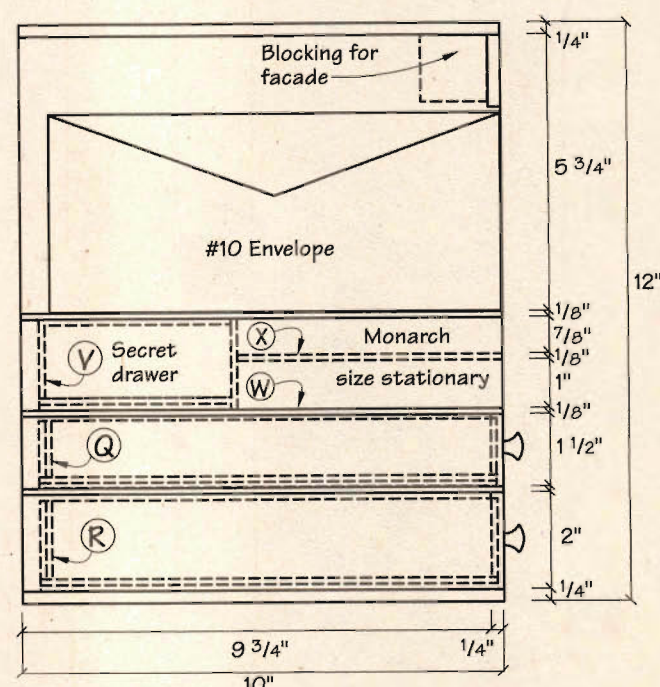
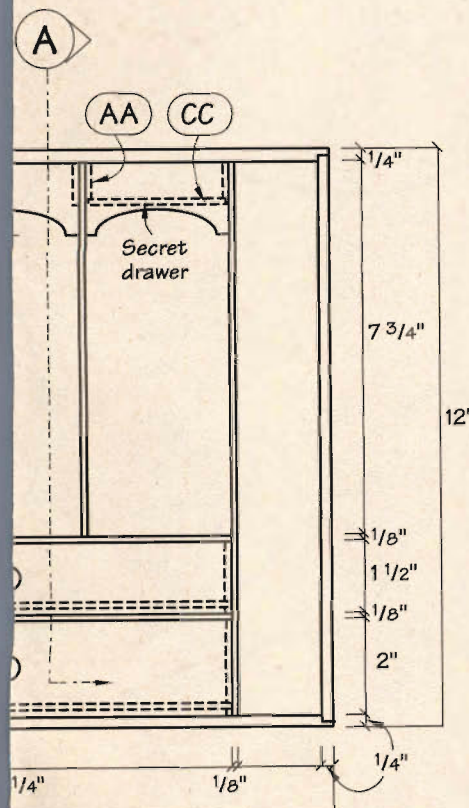
Squirrel in

Full-size diagram and his tree bran

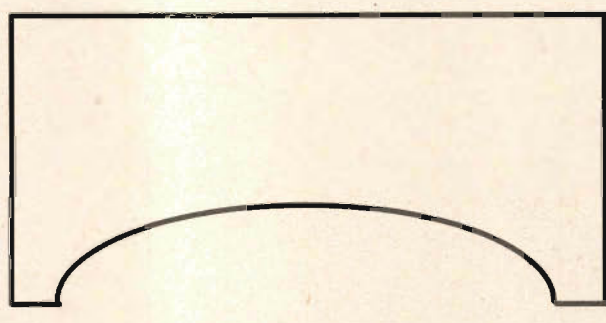
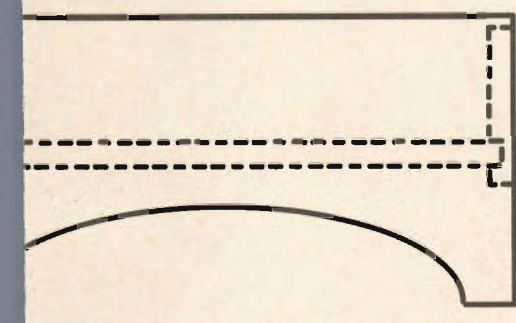
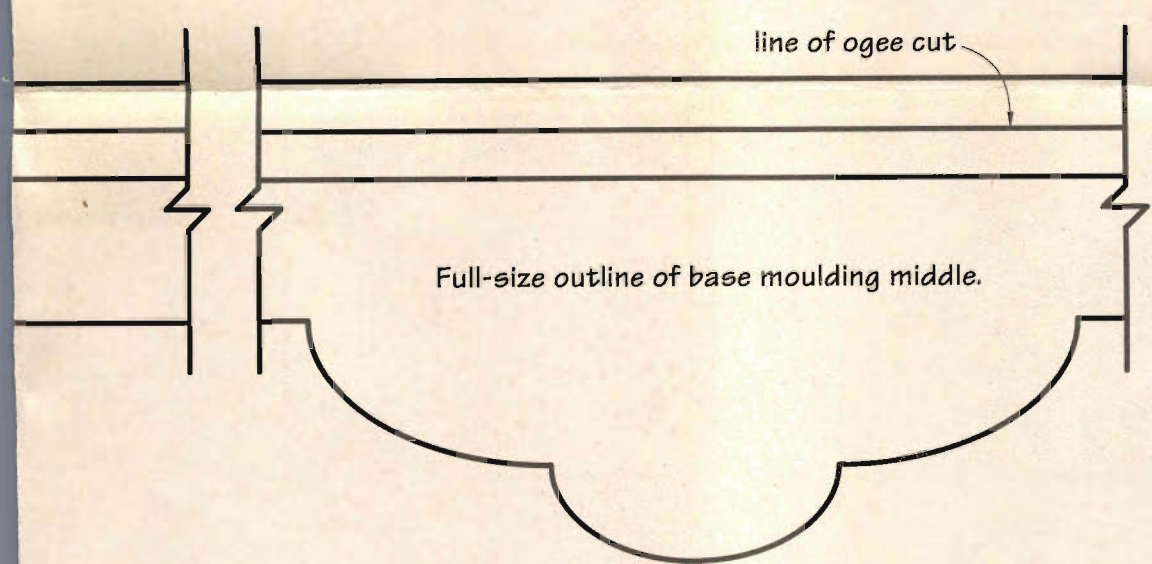




Profile A



Profile B



Appendix Secretary Insert							
	Dimensions T W L	Material	No.	Letter	Item	Dimensions T W L	Material
om	1/4" x 10" x 32 1/2"	Maple	4	O	Drawer backs	1/8" x 1 1/4" x 9 1/16"	Maple
	1/4" x 10" x 11 3/4"	Maple	4	P	Drawer bottoms	1/8" x 9 1/4" x 9 1/16"	Plywood
viders	1/8" x 10" x 11 5/8"	Maple	2	Q	Drawer back	1/8" x 1 1/4" x 9 1/4"	Maple
s	1/8" x 10" x 7 7/8"	Maple	2	R	Drawer back	1/8" x 1 3/4" x 9 1/4"	Maple
rs	1/8" x 10" x 5 7/8"	Maple	2	S	Drawer bottom	1/8" x 9 1/4" x 9 1/4"	Plywood
	1/8" x 10" x 9 5/16 "	Maple	2	T	Paper slot sides	7/16" x 2 1/8" x 9 1/2"	Maple
	1/8" x 10" x 9 9/16 "	Maple	1	U	Paper slot false front	1/8" x 2 1/8" x 9 1/4"	Maple
s	1/4" x 1 1/2" x 9 1/4"	Maple	1	V	Paper slot back	7/16" x 2 1/8" x 9 1/2"	Maple
s	1/4" x 2" x 9 1/4"	Maple	1	W	Paper slot frnt bttm	1/8" x 5 5/8" x 9 1/2"	Plywood
	1/4" x 1 1/2" x 9 1/2"	Maple	1	X	Paper slot rear bttm	1/8" x 4" x 9 1/4"	Plywood
	1/4" x 2" x 9 1/2"	Maple	6	Y	Outer facades	1/4" x 1 1/2" x 3"	Maple
	1/8" x 2" x 9 3/8"	Maple	3	Z	Inner facades	1/8" x 1 1/2" x 3 1/16"	Maple
	1/8" x 1 1/4" x 9 3/8"	Maple	2	AA	Facade drawer sides	1/8" x 1" x 9"	Maple
s	1/8" x 1 3/4" x 9 1/16"	Maple	1	BB	Facade drawer back	1/8" x 3/4" x 2 9/16"	Maple
			1	CC	Facade drawer bottom	1/8" x 2 9/16" x 8 7/8"	Plywood

Pipes of Pan

This project is both an instrument and a simple puzzle for school children. The child has to arrange the pipes in order in the frame and tighten the wing nuts without all the pipes tumbling out of the frame. (Beware that wing nuts are a choking hazard for small children.) It generally takes a bit of trial and error on the child's part before he gets it right.

The pipes are PVC with an inner diameter of $\frac{1}{2}$ " and an outer diameter of $\frac{5}{8}$ ". These pipes produce a pentatonic scale, the musical scale used by the ancient Greeks and Pan himself. By blowing across the ends of the pipes, children usually get a pretty, soft sound.

STEP ONE: Make the wood holder by first drilling the screw holes. Use screws to hold the wood together as you drill the $\frac{5}{8}$ " holes in the top. Round and smooth all edges. Finish or paint as desired.

STEP TWO: Cut the pipes to length. Sand any rough edges. Assemble. **PW**

—Erwin V. Cohen



A Jig to Make the Holes

Set up a piece of scrap pine ($\frac{3}{4}$ " x $1\frac{1}{2}$ " x 4") and draw a center line running the 4" length. On the center line, drill a $\frac{5}{8}$ " hole 2" from one end. Then carefully locate the midpoint of an adjacent $\frac{5}{8}$ " hole. Drill through that point with a $\frac{1}{16}$ " bit. Put a small length of PVC in the $\frac{5}{8}$ " hole that protrudes about $\frac{1}{2}$ " from the bottom. After you drill the first pipe hole in your pipe, insert the jig's PVC protrusion into it. Use a nail in the $\frac{1}{16}$ " hole to locate the center for the next pipe hole.

Schedule of Materials: Pipes of Pan

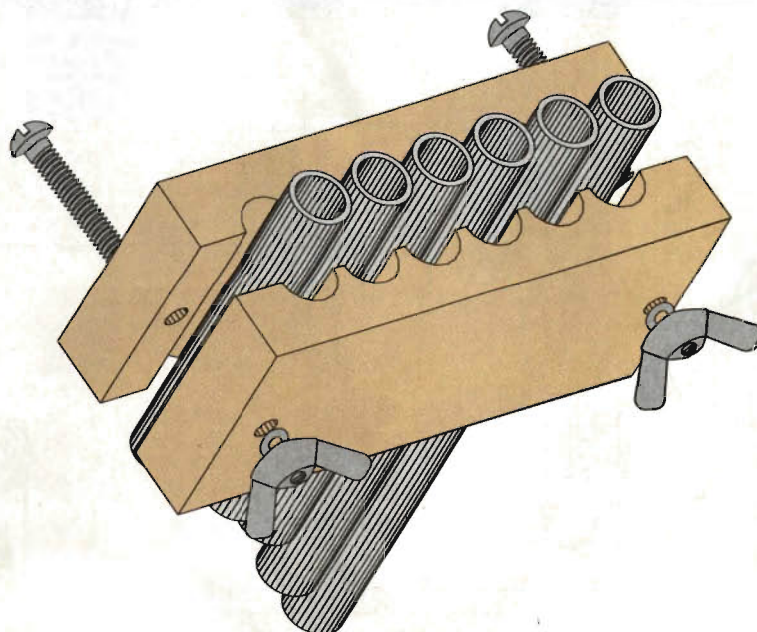
No.	Item	Dimensions T W L	Material
2	Sides	$\frac{3}{4}$ " x $2\frac{1}{2}$ " x $5\frac{1}{2}$ "	Scrap
1	Pipe	$\frac{5}{8}$ " x 9"	PVC
1	Pipe	$\frac{5}{8}$ " x $7\frac{3}{32}$ "	PVC
1	Pipe	$\frac{5}{8}$ " x 6"	PVC
1	Pipe	$\frac{5}{8}$ " x $5\frac{10}{32}$ "	PVC
1	Pipe	$\frac{5}{8}$ " x $4\frac{3}{4}$ "	PVC
1	Pipe	$\frac{5}{8}$ " x 4"	PVC
2	Machine screws	$\frac{1}{4}$ " x 20 x $1\frac{3}{4}$ "	
2	Washers		
2	Wing nuts		



Are we on target?

To see more projects like this in future issues, circle "P11" on the postage-paid card in the Resource Directory.

Diagram



ALIEN SWINGER

A few years back my sister got me started going to craft shows to sell my work. I've had real good luck selling "lawn swingers," so with all the talk of UFOs and abductions lately I decided it was time for an "alien" swinger.

This little feller is my own design. I drew the face while watching TV. I charge \$17.50 each for them at the craft shows (each one takes a couple hours to build with about 75 cents worth of material).

STEP ONE: Make posterboard templates of the parts in the PullOut™ Plans (or from diagram below). Trace the shapes and cut out the parts from $\frac{3}{4}$ " plywood. Shape the legs to your liking. The thighs are cut from pine 2 x 4s.

STEP TWO: Drill $\frac{1}{4}$ " holes for dowels in the legs, thighs and body. Drill $\frac{1}{4}$ " holes in the hands for the rope.

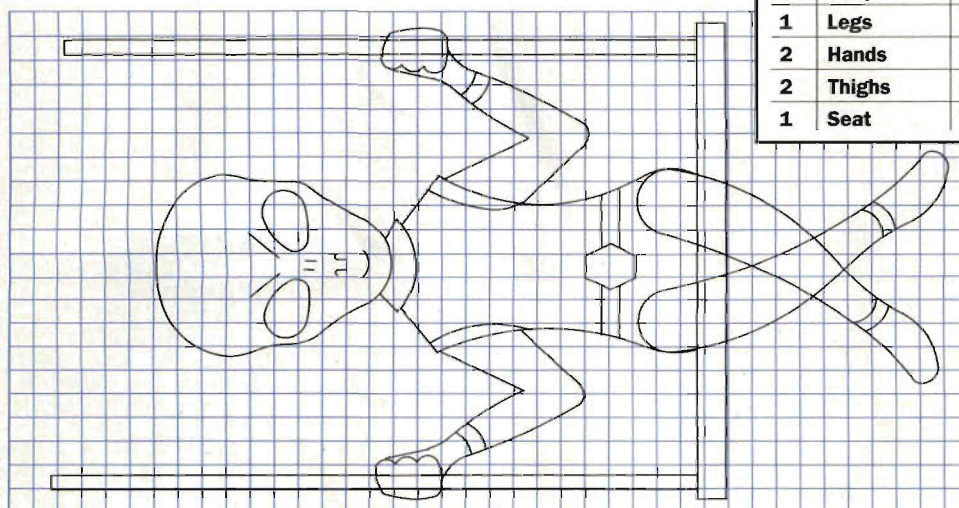
STEP THREE: Cut the dowels and assemble the parts. Cover the body with waterproof sealer. Paint the alien's features. When dry, cover the alien with two coats of outdoor urethane.

STEP FOUR: Cut the seat and drill $\frac{1}{4}$ " holes for the rope. Attach the alien to the seat with screws. String $\frac{3}{16}$ " clothesline through the hands and seat. **PW**

—Leonard Wardle



Diagram



Enlarge to 380 percent of original. Each square equals $\frac{1}{2}$ ".

Schedule of Materials: Alien Swinger

No.	Item	Dimensions T W L	Material
1	Body	$\frac{3}{4}$ " x 10" x $11\frac{1}{2}$ "	Plywood
1	Legs	$\frac{3}{4}$ " x 6" x $6\frac{1}{2}$ "	Plywood
2	Hands	$\frac{3}{4}$ " x 1" x $1\frac{1}{2}$ "	Plywood
2	Thighs	$1\frac{3}{4}$ " x $1\frac{3}{4}$ " x $1\frac{1}{2}$ "	Pine
1	Seat	$\frac{3}{4}$ " x $1\frac{1}{4}$ " x 10"	Pine



Are we on target?

To see more projects like this in future issues, circle "P9" on the postage-paid card in the Resource Directory.

SQUIRREL

in a Tree

While I was in college a friend would regale me with tales of the squirrels in her hometown that were jet black. I didn't believe her until she showed me a photo of one of the rodents feasting on a nut. Darned

if those critters aren't black as coal.

This three-dimensional scrollsaw puzzle features a black squirrel in a tree. The bottom level of the puzzle has the squirrel and the branches of the tree. Once you complete that level (which is real easy), you have to piece together the leaves and trunk (which is harder).

The real trick to making this puzzle is to have the right blade for your scrollsaw. I tried

every blade in our shop, but they all had kerfs that were too wide for puzzle making. Finally, I found the trick: skip-tooth 2/0-sized blades (I bought Olson Saw Co. brand). Then I turned the speed on my scrollsaw all the way down and began.

STEP ONE: Sand your material. Attach the patterns to your wood (I used rubber cement). Cut small holes in the waste areas to start your cut. Cut out all the pieces for both puzzle layers.

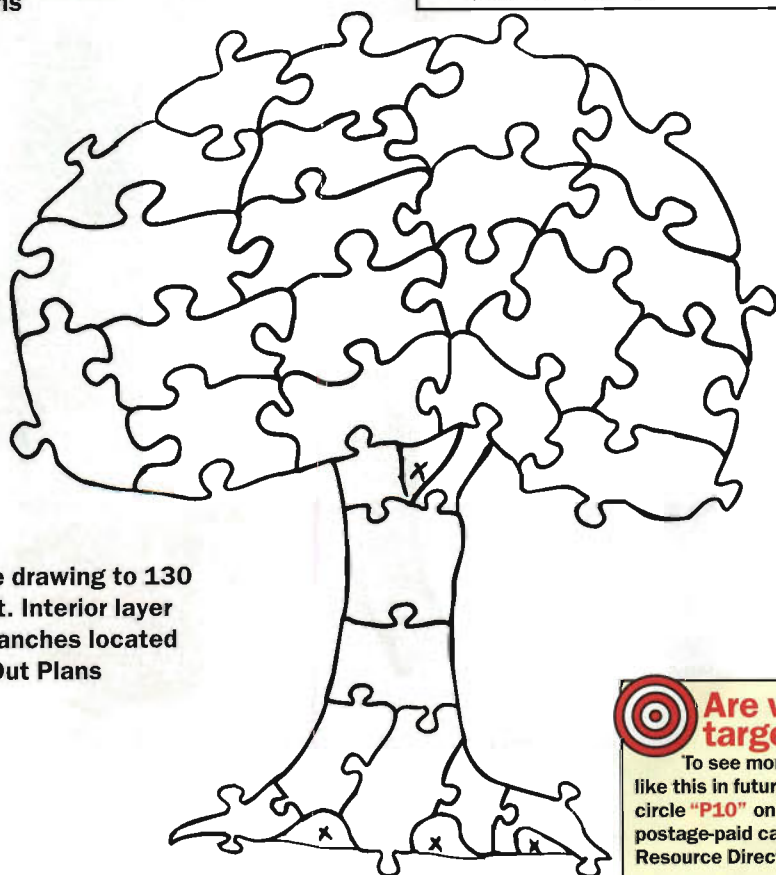
STEP TWO: Glue the three layers together. Finish sand the puzzle pieces. Color them with dye or stain. Coat the entire project (including the back) with two thin layers of a clear finish. **PW**

—Chris Schwarz,
PW staff

Schedule of Materials: Squirrel in a Tree

No.	Item	Dimensions T W L	Material
3	Layers	1/4" x 6 1/2" x 7 1/2"	Oak

Diagrams



Enlarge drawing to 130 percent. Interior layer with branches located in PullOut Plans



Are we on target?

To see more projects like this in future issues, circle "P10" on the postage-paid card in the Resource Directory.

Chippendale SECRETARY

The centerpiece of the 18th century home is pure joy to build and behold.

THESE DAYS people communicate with e-mail, cellular phones and faxes. However, in the not too distant past (read 20 years ago), our forefathers and foremothers actually wrote letters by hand, on paper, with a pen!

The modern work station is decked out with a place for all of our technological writing tools, software, hardware and storage devices. It's always been interesting that our computer desks bear a striking resemblance to antique secretaries (the furniture not the office assistant). Secretaries have a place for writing tools, paper and served as storage devices for all of the correspondence of the day. People ran their households and their businesses from these beautiful pieces of furniture. Here is our understated interpretation of this wonderful, albeit dated, communication tool.

The first thing to do, after getting up the cash to build a piece this large, is to select the wood for the case, drawer fronts and trim. We came across some nice curly maple at a mill in Indiana that was wide enough for the drawer fronts. Because curly maple is in short supply, we used plain maple on the case sides and poplar for the interior drawer parts. Wood selection is very important. It can make a simple design look great or a great design look plain.

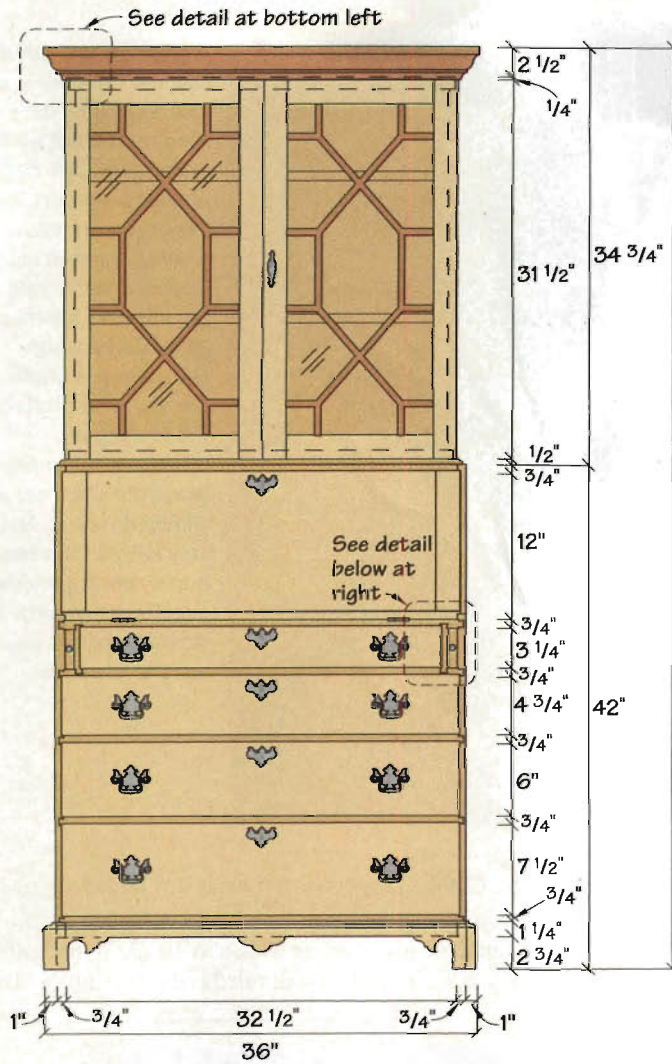
Begin construction by cutting to length the boards that make up the lower and upper case sides and tops and bottoms and gluing them together. Then turn your attention to the top case.

STEP 1 Build the Top Case • Begin the top case by cutting the pieces to size, then make the rabbets on the ends that will hold the top and bottom pieces. The rabbet for the top is $\frac{1}{2}$ " x 1". The rabbet for the bottom is $\frac{1}{2}$ " x $1\frac{1}{2}$ ". Cut these on the table saw in two passes. While you're at the table saw, cut the $\frac{1}{2}$ " x $\frac{1}{4}$ " deep rabbet on all four pieces for the back of the case. Begin assembly by clamping a handscrew to one of the sides to support it on your bench with the rabbet facing up. With glue on the end of the top, put the top into its rabbet. Then clamp the top to the side as shown in the photo. Pilot drill and screw that corner together with #8 x $1\frac{1}{2}$ " screws. Repeat this procedure for the other corners. Check the cabinet to make sure it's square. Clamp it as needed to pull the cabinet square. Next cut the

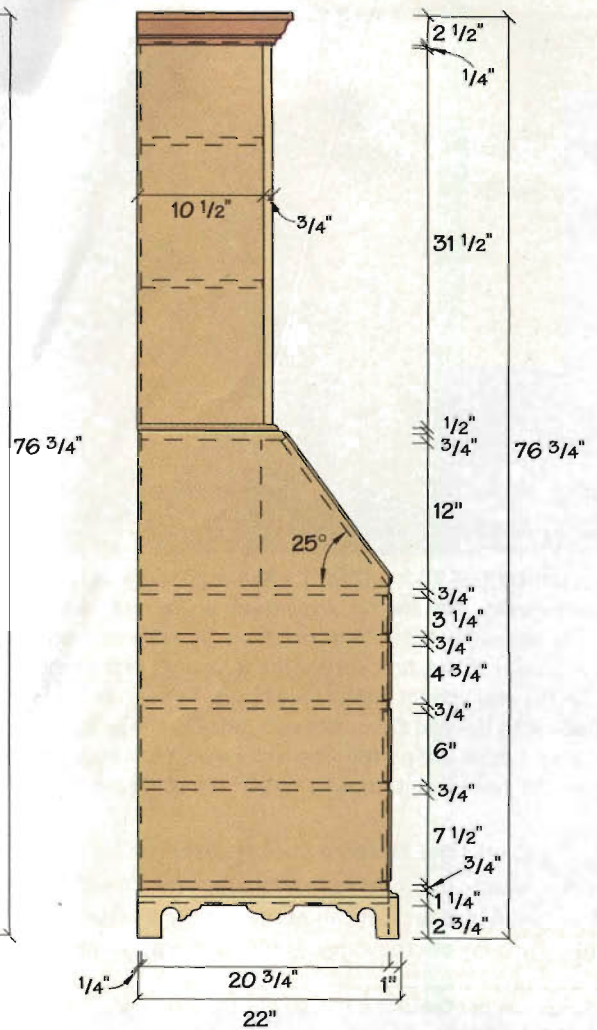
back from $\frac{1}{4}$ " maple plywood and set it aside. The shelves are made from $\frac{3}{4}$ " plywood with iron-on veneer tape applied to the front edge, but you can use solid wood if you're feeling traditional.



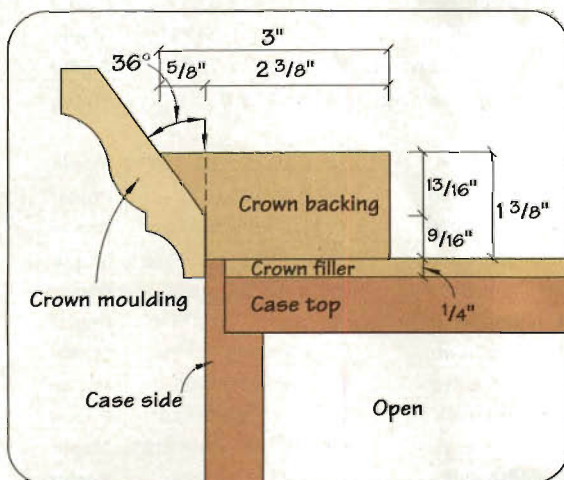
Diagrams



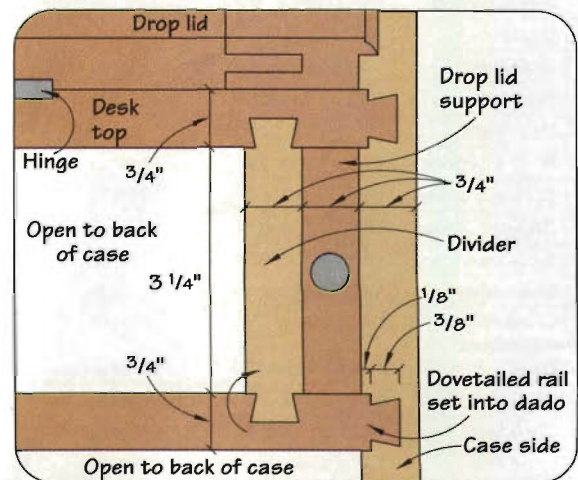
Elevation



Profile



Profile detail of crown moulding backer



Enlargement of drop lid support



Are we on target?

To see more projects like this in future issues, circle "P5" on the postage-paid card in the Resource Directory.



1 BUILD THE TOP CABINET • The upper cabinet is screwed together with the top and bottom fitting into rabbets cut in the sides. The rabbets were cut on the table saw using a two-pass method, first cutting the thickness of the rabbet with the end upright against the fence. The second pass was made with the end flat on the saw defining the height of the rabbet. Watch out for the waste piece as it can shoot out from the saw when trapped between the blade and fence.



2 FIRST THE DADO • The dovetail is set into a shallow dado running the full width of the side. The dado provides support for the drawer runners, and it is formed using a jig and a $\frac{1}{2}$ " straight bit with the top-mounted guide bearing shown in the photo. The four front rails and the top are all attached to the sides using the shouldered sliding dovetail. Not only is this joint traditional, but it provides excellent strength and stability for the case and the drawers.

2 Begin the Bottom Case • Begin by laying out the locations for the rails that divide the drawers and the desk top. Mark these locations across the total width of the side. Then lay out the clipped corners that accommodate the

drop front. Cut the corners on the band saw and clean up the edges with a block plane.

Now build the plywood jig shown in the photo for cutting the sliding dovetails. The jig is detailed in the PullOut™ Plans.

Schedule of Materials: Chippendale Secretary

Upper Cabinet

No.	Item	Dimensions T W L	Material
2	Sides	$\frac{3}{4}$ " x $10\frac{1}{2}$ " x $32\frac{1}{4}$ "	Maple
2	Top & bottom	$\frac{3}{4}$ " x $10\frac{1}{2}$ " x 32"	Maple
1	Back	$\frac{1}{4}$ " x $31\frac{7}{8}$ " x $30\frac{7}{8}$ "	Ply
2	Shelves	$\frac{3}{4}$ " x $10\frac{1}{8}$ " x $30\frac{7}{8}$ "	Maple
4	Door stiles	$\frac{3}{4}$ " x 2" x $31\frac{3}{8}$ "	Maple
4	Door rails	$\frac{3}{4}$ " x 2" x $14\frac{1}{2}$ "	Maple
1	Door fretwork	$\frac{1}{4}$ " x $\frac{1}{2}$ " x 24"	Maple
1	Crown moulding	$\frac{3}{4}$ " x $3\frac{1}{8}$ " x 6'	Maple
1	Crown backing	$1\frac{3}{8}$ " x 3" x 6'	Pine
1	Shoe moulding	$\frac{1}{2}$ " x $\frac{1}{2}$ " x 6'	Maple
1	Shoe filler	$\frac{1}{2}$ " x $\frac{3}{4}$ " x $32\frac{1}{2}$ "	Maple
1	Crown filler	$\frac{1}{4}$ " x $\frac{3}{4}$ " x $32\frac{1}{2}$ "	Maple

Lower Cabinet

No.	Item	Dimensions T W L	Material
2	Sides	$\frac{3}{4}$ " x 21" x 39"	Maple
1	Desk top	$\frac{3}{4}$ " x 21" x $33\frac{1}{2}$ "	Maple
1	Case top	$\frac{3}{4}$ " x 1" x 4"	Maple
1	Back	$\frac{1}{4}$ " x $33\frac{1}{2}$ " x $37\frac{5}{8}$ "	Ply
4	Front rails	$\frac{3}{4}$ " x $3\frac{1}{2}$ " x $33\frac{1}{2}$ "	Maple
2	Dividers	$\frac{3}{4}$ " x 4" x $3\frac{1}{4}$ "	Maple
1	Base moulding	1" x 4" x 80"	Maple
2	Drop front	$\frac{3}{4}$ " x $15\frac{1}{4}$ " x 33"	Maple
2	Drawer runners	$\frac{3}{4}$ " x $2\frac{7}{8}$ " x $15\frac{3}{4}$ "	Poplar

No.	Item	Dimensions T W L	Material
6	Drawer runners	$\frac{3}{4}$ " x $1\frac{1}{2}$ " x $15\frac{3}{4}$ "	Poplar
4	Stretchers	$\frac{3}{4}$ " x $5\frac{1}{4}$ " x 8"	Poplar
2	Lid supports	$\frac{3}{4}$ " x $3\frac{1}{4}$ " x $20\frac{1}{2}$ "	Maple
2	Support dividers	$\frac{3}{4}$ " x $1\frac{1}{2}$ " x $15\frac{3}{4}$ "	Poplar
1	Stop moulding	$\frac{1}{4}$ " x $\frac{3}{8}$ " x 8'	Maple

Drawers*

No.	Item	Dimensions T W L	Material
1	Top front	$\frac{3}{4}$ " x $3\frac{7}{16}$ " x $29\frac{15}{16}$ "	Maple
2	Top sides	$\frac{1}{2}$ " x $3\frac{3}{16}$ " x 20"	Poplar
1	Top back	$\frac{1}{2}$ " x $2\frac{1}{2}$ " x $28\frac{15}{16}$ "	Poplar
1	2nd front	$\frac{3}{4}$ " x $4\frac{15}{16}$ " x $32\frac{15}{16}$ "	Maple
2	2nd sides	$\frac{1}{2}$ " x $4\frac{11}{16}$ " x 20"	Poplar
1	2nd back	$\frac{1}{2}$ " x $3\frac{13}{16}$ " x $31\frac{15}{16}$ "	Poplar
1	3rd front	$\frac{3}{4}$ " x $6\frac{3}{16}$ " x $32\frac{15}{16}$ "	Maple
2	3rd sides	$\frac{1}{2}$ " x $5\frac{5}{16}$ " x 20"	Poplar
1	3rd back	$\frac{1}{2}$ " x $5\frac{1}{4}$ " x $31\frac{15}{16}$ "	Poplar
1	4th front	$\frac{3}{4}$ " x $7\frac{11}{16}$ " x $32\frac{15}{16}$ "	Maple
2	4th sides	$\frac{1}{2}$ " x $7\frac{7}{16}$ " x 20"	Poplar
1	4th back	$\frac{1}{2}$ " x $6\frac{3}{4}$ " x $31\frac{15}{16}$ "	Poplar
1	Top bottom	$\frac{1}{4}$ " x 20" x $28\frac{7}{8}$ "	Ply
3	Bottoms	$\frac{1}{4}$ " x 20" x $31\frac{7}{8}$ "	Ply

*-The drawer sizes are nominal in order to fit into the openings with $\frac{1}{16}$ " clearance all around. The drawer back sizes reflect the location of the height of the $\frac{1}{4}$ " groove in the side and the front.



3 NOW CUT THE DOVETAIL • Using the same jig for the dados, cut the dovetails $3\frac{1}{2}$ " in from the front of the cabinet sides. Remember to work with the rotation of the bit to avoid tearout. Start your cut from right to left across the front edge of the side to define the dovetail, then cut into the side starting on the left side of the jig opening, and push the router out along the right side of the opening.

The top layer is $\frac{3}{4}$ " thick. The middle layer is $\frac{1}{2}$ ", and the supports are $\frac{3}{4}$ " thick. The jig had to be this thick because the shanks on my dovetail bits are really long (yours might be different).

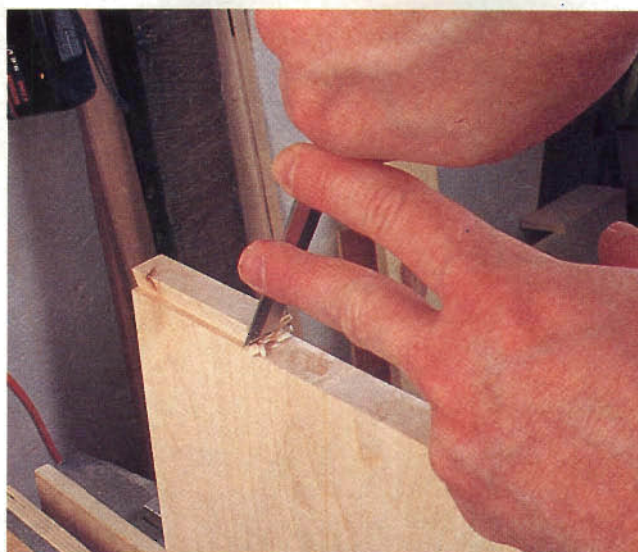
Begin cutting the joints in the sides. The first thing to do is use a bearing bit with a bearing on top to cut the shallow shoulder for the joint. This shoulder permanently aligns the drawer runners. Align the jig on the panel with the location of one of the rails (or desktop). Set the bit to cut $\frac{1}{8}$ " deep into the side. Make the cut the entire width of the side.

STEP 3 Dovetails • Then cut the dovetail-shaped groove. I used a $\frac{1}{2}$ " carbide-tipped dovetail bit and a template guide for these joints. Set the bit to cut $\frac{3}{8}$ " deeper than the dado you just cut and use the same jig setup. This cut goes $3\frac{1}{2}$ " into the width of the sides.

By the way, cutting these joints is a lot easier with two routers. With one router set to cut the shoulder and one to cut the dovetail, you can quickly cut the joints without having to change bits or having to change the set-up of the jig.

While the dovetail bit is in your router, lay out the joints for the dividers. The dividers go in the rails for the top drawer and capture the two supports that slide out to hold the drop front (see diagram). These dovetails don't require a shoulder, so you don't need to use a bearing bit first. Simply set your dovetail bit to cut $\frac{3}{8}$ " into the material and make the cut.

STEP 4 Finish the Dovetail Cuts • Now complete your dovetails by making the cuts on the ends of the rails and desk top. The desk top cut is easy. Using a router table, set the



4 TRIM THE DESK TOP • The front rails have a dovetail cut on both ends to mate with the dovetails in the case sides. The desk top has a $3\frac{1}{2}$ " dovetail formed on the front side, and the remaining depth of the top is cut flush to fit into the dado in the case. Some trimming with a chisel will likely be necessary to provide the best fit.

dovetail bit to a depth of $\frac{3}{8}$ ". Set the fence to the appropriate width. Make the cut on all four edges and set the top aside.

Now scare up a square piece of 12" x 12" plywood and use that as a backing board to push the rails through the router table. If, after your cuts, the rail won't seat flush to the front, chisel down the back of the rail's dovetail until the fit is good.

Now take your desk top to your table saw and cut off the back part of the dovetail, leaving $3\frac{1}{2}$ " in the front. Chisel the dovetail to fit as shown in the photo.

Now it's time to cut the dovetails that hold the case together. First cut the 42-degree angle on the front of the top that will match the angle on the sides. Even though these dovetails won't be exposed, it was the traditional method and the joint is superb. I used a dovetail jig to cut the half-blind dovetails on the top and sides.

My jig has templates that give me 2" centers between the tails. Set the jig up to center the tail locations on the top so there's an equal amount of tail at each edge. Each manufacturer's dovetail jig is a little different, so cut your pins and tails according to your jig's manual.

Glue the top, desk top, dividers and rails to the sides. I used polyurethane glue, which is stronger than yellow glue. However, be careful not to use too much glue because the squeeze out is hard to remove. Additionally, dried polyurethane glue is harder to see than yellow glue when you're trying to remove the squeeze out. And if you're not vigilant, you'll get big white spots on your project when you're staining. The glue prevents the stain from penetrating the wood; this is also known as "glue size." That being said, we still think polyurethane



5 THE GUTS • With the case assembled, the drawer runners are slipped into the dados and attached using screws in elongated slots to allow for wood movement. The drawer stretchers are then screwed to the rear of the drawer runners. Also shown in the photo is one of the lid supports in the closed position. Note the dowel that serves as stop for both open and closed positions.

glue is a useful adhesive, warts and all.

If your machine-cut dovetails are snug, very little clamping is required when you assemble the case.

STEP 5 Screwing in the Guts • Cut the poplar runners, stretchers and dividers to size. Start by attaching the runners. First mark the location of the clearance holes on the runners. Chain-drill a slot with a $\frac{3}{8}$ " drill bit about $\frac{3}{4}$ " long and $\frac{3}{8}$ " deep at each location. This accommodates the screw heads. Next use a $\frac{3}{16}$ " drill bit and chain drill a $\frac{1}{2}$ " slot through the runner centered on the large slot. These slots allow for wood movement and prevent the case from cracking — a common problem on pieces from the 18th century.

Attach the three lower drawer runners with a #8 x $1\frac{1}{2}$ " panhead screws, making sure they butt into the drawer rails at the front of the case. Now screw the stretchers into the back ends of the runners.

Next you need to fashion the poplar support dividers that keep the desk's lid supports from coming all the way out of the case. These dividers also guide the top drawer. Cut a $\frac{1}{2}$ " x $14\frac{1}{4}$ " notch in each divider. Screw and glue the support dividers to the top drawer's runners. Now attach a $1\frac{1}{2}$ " long $\frac{1}{2}$ " dowel to each lid support. The dowel is located $2\frac{3}{4}$ " from the back end and $1\frac{7}{8}$ " from the top of the lid support. The final result should look like the photo above.

Attach a 1" x $\frac{3}{4}$ " filler strip into the gap between the bottom rail and the bottom of the ends at the front of the case. Glue and clamp this piece into place. This piece is critical because you will later attach the base moulding to it. Cut the back for the case from $\frac{1}{4}$ " plywood and set it aside.



6 THE DROP FRONT • Because all the material in the drop front lid is solid maple, wood movement must be allowed for. In our case, I cut a tongue on the ends of the center panel. Next, I made elongated holes in the tongue on the two outside holes with a coping saw. The center hole is not elongated so that wood movement will be equally distributed front to back. I then drove wooden pegs through holes in the grooved section of the breadboard ends.

STEP 6 Build the Drop Front • I glued up three pieces of curly maple for the front and attached breadboard ends. If you're using curly maple, you might want to alternate the curl's wave direction for each board. If it bows to the right on the top board, make it bow to the left on the middle board. This gives the drop front a pleasing appearance. Use the same philosophy when picking your drawer fronts.

Cut the glued-up front panel to $15\frac{1}{4}$ " x 30", then cut $\frac{1}{4}$ " x 1" tongues on each end. Cut $\frac{1}{4}$ " x 1" grooves into the $2\frac{1}{2}$ " x $15\frac{1}{4}$ " breadboards. Follow the directions in the photo and then glue the center peg in. Then, without getting any glue on the tongue, glue the other pegs to the breadboard ends.

STEP 7 Finish the Drop Front • First cut a $\frac{1}{4}$ " x $\frac{1}{2}$ " rabbet on the sides and top edge using your router table with a rabbeting bit. This will leave a $\frac{1}{4}$ " overlap on three edges of the front. Use a backer block to make sure you don't get any tearout. While your router is set up this way, go ahead and cut the same rabbet on the sides and top edge of the drawer fronts.

Finally, cut the 25-degree angle on the bottom of the drop front using your table saw. This angle keeps the drop front from wacking the top drawer.

STEP 8 Make the Doors & Drawers • First cut the $\frac{1}{4}$ " x $1\frac{1}{2}$ " x 1" mortises on the stiles. The tenons on the rails are haunched to accommodate the rabbet on the door's inside edge that holds the glass. So the shoulders of the $\frac{1}{4}$ " thick tenon measure 1" long on the inside edge and $\frac{3}{4}$ " on the outside. After cutting the cheeks of the tenon, cut the haunch by hand. Then make the $\frac{1}{2}$ " x $\frac{3}{8}$ " rabbet on the inside edge



7 DROP FRONT DETAIL • For the drop lid to open flat while still allowing the top drawer and the lid supports to align at the top, a 25-degree bevel must be cut on the bottom edge of the drop lid. The bevel should be cut prior to fitting the drop front hinges. The hinge locations can prove critical to the fit of the drop front. Don't insert all the screws until you're happy with the fit of the front.



8 DOOR JOINERY • The joinery on the doors is traditional. A haunched tenon is formed on the ends of the door rails. This allows the rabbet cut for the glass to run the entire length of the stiles without interfering with the joint. The cheeks of the tenon are first cut on the table saw, then the shoulders are defined using the miter gauge to guide the cut. Lastly I cut the haunch by hand with a chisel. The rabbet is then cut on the inside of the piece.

of the rails and stiles. Glue the doors together, clamp, check for square and set aside.

Now make the drawers. We used the same dovetail jig and template for the case to make the half-blind dovetails on the drawer fronts. Center the work in the jig to make sure you have an equal amount of tail on each end. Cut the pins on the front and the tails on the drawer sides.

Next determine where the groove for the bottom will go on each drawer. Bury the groove in one of the tails so you won't see the groove in the drawer front. Then lay out the locations of the drawer bottoms and cut the $\frac{1}{4}$ " x $\frac{1}{4}$ " grooves in the front and sides of all the drawers.

Now cut the backs to fit into $\frac{1}{4}$ " x $\frac{1}{4}$ " dadoes in the drawer sides. The height of each drawer back is determined by measuring from the top of the groove you cut for the drawer bottoms to the top of each side.

Assemble the drawers. Clamp the dovetails as needed; glue and nail the backs into the sides. Check for square, as al-

ways. When dry, cut a $\frac{1}{8}$ " roundover with a $\frac{1}{32}$ " bead on the front edges of the drawer fronts and drop front.

Now make the base moulding. The moulding is cut from 1" x 4" maple stock. Cut the ogee profile on the top while the moulding is one continuous piece. Miter the piece for the front. Cut the miters for the sides but leave them long until you get a good fit on the joints. Then cut the back ends square and flush to the back of the case.

Use the pattern in the PullOut Plans to lay out the pattern on the base. Cut the pattern on the band saw; rasp and sand to finish the pieces. The front piece is screwed and glued to the filler strip on the front of the case. Biscuit and glue the miters and then attach the sides to the case with screws through slotted holes made in the sides. (Use the same procedure you used for the drawer runners without the counter-bore.) Don't glue the sides to the case.

Now attach the $\frac{1}{2}$ " x $\frac{1}{2}$ " quarter-round shoe moulding on the top of the case with glue and nails for the front piece.

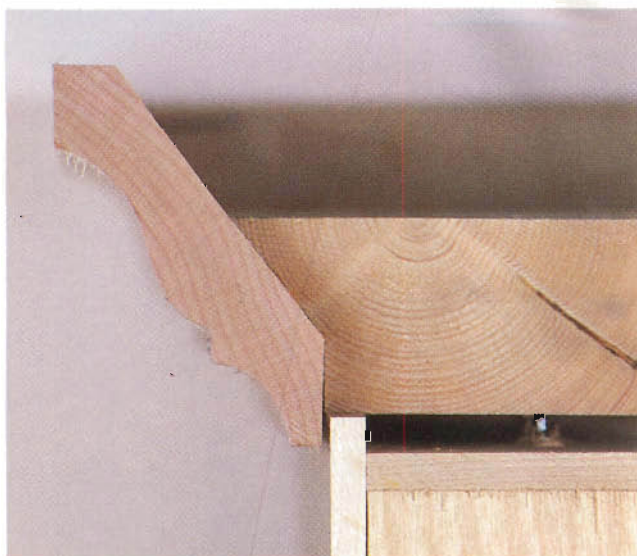
Appointments For Your Secretary: The Insert

First mill out the top, bottom and sides. Rabbet the sides into the top and bottom in a $\frac{1}{8}$ " x $\frac{1}{4}$ " rabbet. Tape the assembly together to make sure it fits. Then lay out the $\frac{1}{16}$ " x $\frac{1}{8}$ " dadoes for the interior according to the diagram in the PullOut Plans. Cut the $\frac{1}{8}$ " material to size because you'll have to cut dadoes in these as

well. The dadoes in the $\frac{1}{8}$ " material are about $\frac{1}{32}$ " deep. Once you get all the material cut to size, dry-assemble the insert. Fit the pieces with a block plane. Glue up the entire assembly, clamp the outside and allow to dry. Cut the drawer bottoms out of $\frac{1}{8}$ " plywood and set them into $\frac{1}{16}$ " x $\frac{1}{8}$ " dadoes cut into the sides and front.

The size of the backs are determined in the same way you did for the large drawers. Glue the drawers (I used masking tape for clamps; it really works) and nail.

We made one of the facades into a shallow secret drawer. The center stationery storage slots also pull out to reveal a secret drawer.



9 CROWN MOULDING • The crown is a stock $3\frac{1}{8}$ " moulding glued to 2 x 4 backing pieces. The angled cut on the backing pieces is made to fit the crown angle and allow the crown to hang $\frac{1}{4}$ " over the front of the upper cabinet. I cut and assembled the backing frame using glue and biscuits, then fit the crown moulding to the frame while in place on the upper cabinet. The crown assembly is left loose for easier finishing and transportation.

Glue the miters and then nail the side pieces in. Then attach a $\frac{1}{2}$ " x $\frac{3}{4}$ " filler strip (part K) behind the long piece of moulding on the front with glue and nails.

Next hang the doors and attach the drop front. Mortise all the hinges. If you use the kit from Paxton Hardware, you might want to polish the hinges for the drop front. We did this by first sanding them with 400 grit paper and then polishing them using a buffing wheel with jewelers' rouge. Then apply a thin coat of lacquer to the hinges to prevent them from tarnishing.

Mortise the locks in the case, drop front and right door. We used a laminate trimmer with a $\frac{1}{4}$ " carbide straight bit. You have to cut two mortises for the locks. One for the steel innards and one for the brass case surrounding them. Cut the mortise for the brass case first.

STEP 9 Crown Moulding • You're almost done with the assembly. There's no easy way to do this next part. You either need a hand saw miter box or a power miter saw. You could try to figure out the compound angles on your table saw, but be ready for some math.

We used a sliding compound miter saw, which made the task a bit easier. Cut the front piece so the inside miters match the width of the top case. Cut the miters on the sides, allowing an extra 1" for the crown to overlap the doors, and a little extra length for fitting. Cut the crown backing from 2 x 4 pine stock according to the diagram. The front edge of the backing extends $\frac{3}{4}$ " beyond the front of the case. Cut the sides

10 GLUE THE MULLIONS • Stain and finish the fretwork mullions in strips, then cut them to length and fit them after the glass is installed. First fit and glue the corner and side patterns. Then fit and glue the "X"-shaped pattern (see inset). I used cyanoacrylate to glue the pieces to the glass. The glass was cut from an old window we found in a neighborhood filled with historic houses.



Hardware Kit

You can get all the hardware for this project by ordering a kit from Paxton Hardware 800-241-9741. The kit includes the pulls, hinges, locks and escutcheons. Ask for item #8708-K.

to fit and biscuit and glue the backing assembly together. Temporarily attach the assembly with screws to the top case. Now attach the crown to the backing. Glue and nail the $\frac{1}{4}$ " x $\frac{3}{4}$ " filler piece to the exposed crown backing above the doors.

The Rest of the Secretary

The insert is constructed from an outer shell of $\frac{1}{4}$ " solid maple and $\frac{1}{8}$ " panels for the inside. If you don't feel like planing out these

thin pieces, you can use plywood. The diagram and Schedule of Materials for our insert is located in the PullOut Plans. See the story "Appointments For Your Secretary" for details on how we built ours. Once that's built, it's time to move to finishing.

Sanding is critical with maple, especially the case sides, drawers and doors. Sand the entire project to 180 grit. Then with a damp rag raise the grain on the entire secretary. Finally, sand all surfaces to 180 grit again. This will reduce blotching when you apply color.

We used a water-based aniline dye (J. E. Moser's Golden Amber Maple) and then two coats of clear finish, sanding between coats. Insert the glass using $\frac{1}{4}$ " square tack strips. Then cut the mullions from 20 feet of $\frac{1}{4}$ " x $\frac{1}{2}$ " maple that's been stained to the same color as the secretary. Cut the mullions to the pattern in the PullOut Plans and glue to the glass (see photo). Drill shelf pin holes into the cabinet to divide the case into thirds. Insert the shelves and attach all the hardware. **PW**

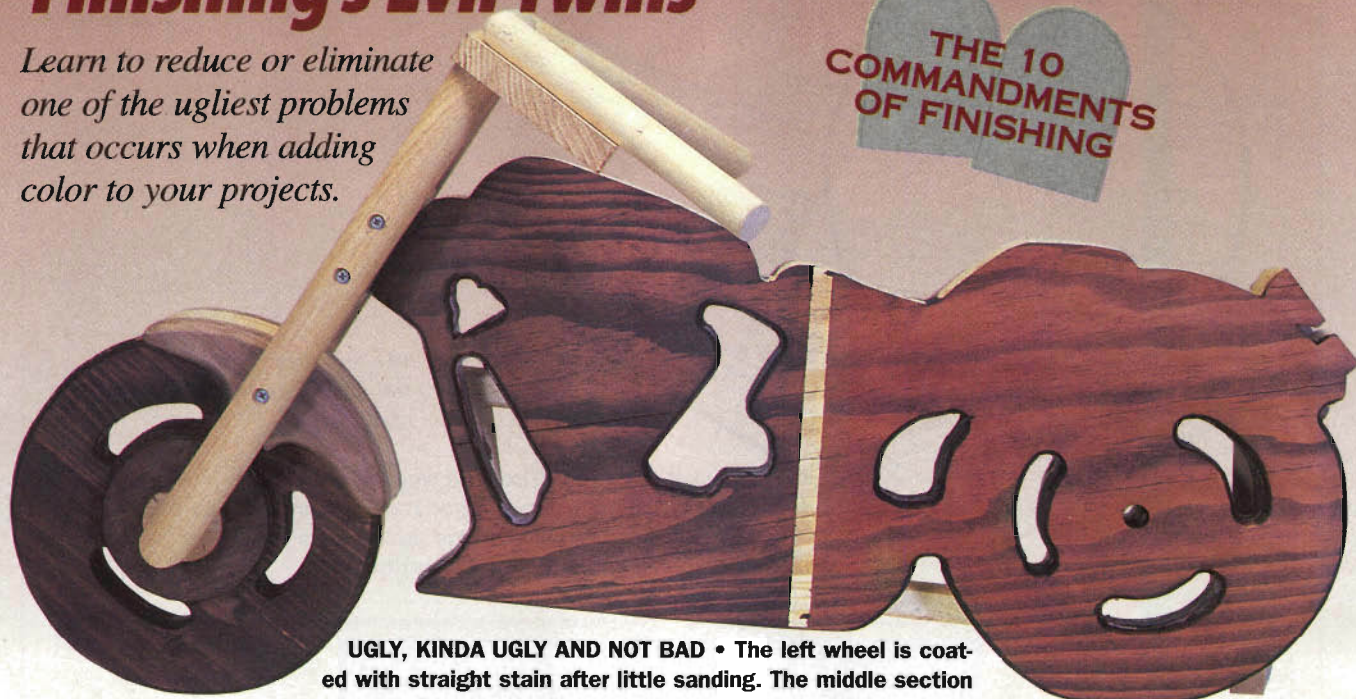
—Jim Stuard & David Thiel, PW staff

BLOTCHING & SPLOTCHING

Finishing's Evil Twins

Learn to reduce or eliminate one of the ugliest problems that occurs when adding color to your projects.

THE 10
COMMANDMENTS
OF FINISHING



UGLY, KINDA UGLY AND NOT BAD • The left wheel is coated with straight stain after little sanding. The middle section was properly sanded and then stained and the back end was sanded, wash-coated using diluted shellac and then stained.

WHEN WOODWORKERS talk about their apprehension with finishing, chances are they're reacting to frustrating experiences when applying color to their projects. You know the scenario: after accurately cutting materials, careful assembly and thorough sanding, you swipe on that first rag full of stain and ugh! Staring back at you is not that evenly colored future heirloom, but a heartbreaking blotchy range of color that looks more like a calico cat.

Can you avoid it? Can you fix the problem once the damage is done? To say that you can overcome the problem altogether, all the time, is an overstatement. Fixing the problem is a whole lot harder than avoiding the worst effects in the first place. (For repair jobs, see the brief article on fixing blotches and splotches.) So the answer to both questions is a qualified "yes."

So how do you avoid the problem in the first place? Start by understanding which woods will blotch and avoid them if your plan is to stain or dye the project. If you find you must use a wood that tends to blotch, learn how to minimize the effects by sanding properly then applying stain controller, also known as wood conditioner. Consider using film finishes that have the color mixed with them.

Why do woods blotch? If you looked at the end grain of any wood species through a powerful magnifying glass,

Common Woods That Blotch

Most all softwoods blotch, especially:

- Pine
- Spruce
- Firs
- Cedar

Hardwoods

- Poplar
- Cherry
- Birch
- Maple
- Alder

you'd see what looked like the end of a boxful of soda straws (see diagram). These holes once served as the miniature channels through which the tree sucked up moisture from the ground. That ability to draw up moisture is precisely why end grain is always darker after staining. It absorbs more stain.

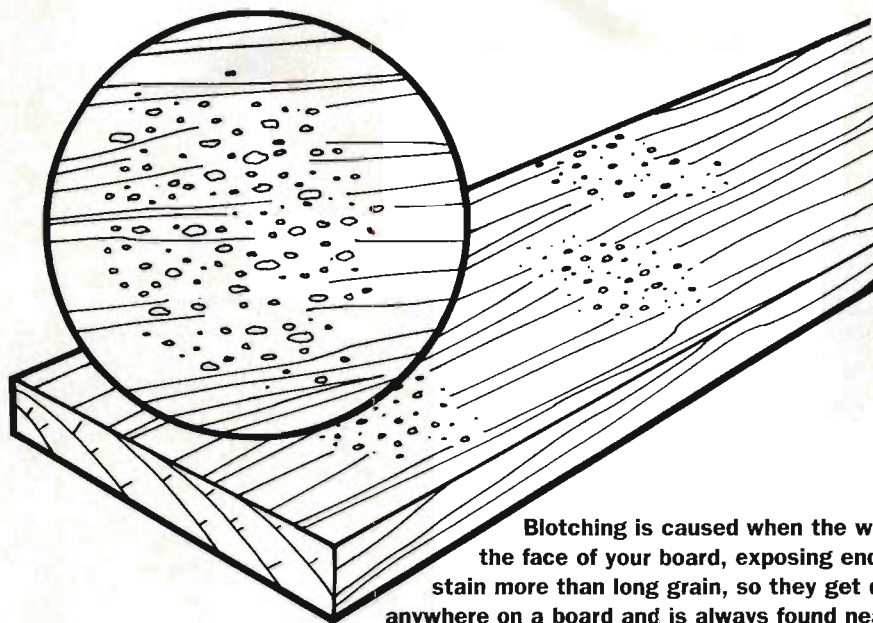
Now, what we see on the wide surfaces of a board and the edges is long grain, or the walls of those tiny soda straw-like channels. These fibrous walls absorb stain much less than the end grain, and they absorb at a consistent rate that should produce uniform color on the wood.

And they would do exactly that — except that among certain species of wood, pine being a prime example, those long channels head off in all sorts of directions instead of just straight up. So, in addition to those long fibrous walls of grain, you get some grain that might actually be end grain, or other grains sheared off at all sorts of angles, each providing a different rate of absorption for the stain or dye.

So which woods are the predictable blotchers? Unfortunately, they are many of the common woods you use on a regular basis. (See "Common Woods That Blotch.")

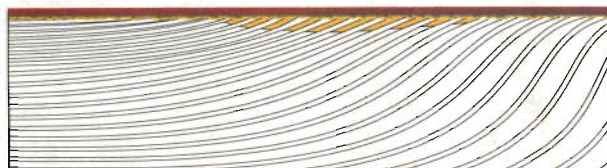
But before you curse those wood grains that have lost their sense of direction, know that it's this very phenomena that puts the curl in curly maple, the wave in wavy birch,

Diagram

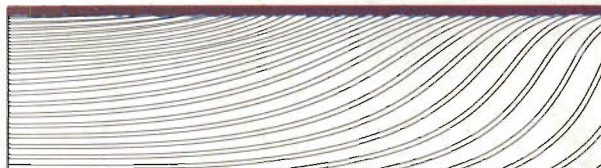


The end grain of a piece of red oak. Note the open soda-straw ends.

Blotching is caused when the wood fibers turn up into the face of your board, exposing end grain. They soak up stain more than long grain, so they get darker. This can occur anywhere on a board and is always found near knots.



Stain controller, shown as yellow, fills the open pores, preventing the stain from penetrating and blotching.



A gel stain, shown here, lies on top of the wood's surface and won't soak into the upturned end grain.

and in most cases, the beauty into many figured woods. Adding color to these woods actually enhances their beauty by building contrast in the figure of the material.

Wash Coat

Now if you will be using a wood type that is going to blotch, there are some steps to help prevent most, but probably not all, the unwanted discoloration. First, let's talk about wash coats. This is a relatively quick and easy way to avoid blotching on many, but not all, types of woods. A wash coat is simply a very thinned down clear top coat of finish. For example, you could use varnish or lacquer, but I find good ol' clear shellac to be a great choice. Here's how I use shellac as a wash coat, but the same principle applies to any film-forming top coat.

Assuming you are using commercial shellac from a can, thin the material using three parts denatured alcohol to one part shellac. This produces a sealer that closes up much of the porous

grain and produces a porosity that's relatively consistent for absorbing the stain. The coat is thin enough that it still allows the stain to "bite" the wood.

The wash coat is easy to apply since not much care need be taken in brushing or spraying it on. You can really just slap it on without worrying about lapping strokes, runs,



Cherry with Minwax cherry stain applied directly to wood.



Cherry with shellac wash coat stained with Minwax cherry. Knotty area most likely to blotch.

sags, etc. You just have to make sure all the surface to be stained gets covered. A nice feature of shellac is that within 15 minutes of application, it's dry and you can continue with staining.

Stain Controllers

Another method for gaining a measure of control over the way wood absorbs stain is using wood conditioners, also called stain controllers. They also condition the wood so the stain is absorbed more consistently in all grain conditions. It accomplishes this by filling or clogging those open soda straw ends, thus preventing the stain from being sucked up the shoots.

The problem with these products is not the products themselves, but how they are used. In many cases, the instructions advise you to wipe on the conditioner, wait a few minutes, then apply the stain. This is usually not sufficient to overcome blotching because it might take *several* applications to plug the open grain ends. You'll know you've applied enough when a minute or so after wiping on the stuff you see the wet material lying evenly on the surface everywhere. View the wood you are conditioning with a light at a low, raking angle. This will make the wet and dry spots show up more easily. If some areas appear dry, the conditioner is still soaking in at a greater rate. More is needed.

Once you achieve a uniform appearance with the conditioner, wipe the work thoroughly to remove all that remains on the surface. Then apply your stain immediately because the conditioner loses its effectiveness after 20 to 30 minutes.

Because of the linseed oil in the conditioner, make sure you allow sufficient drying time after staining. Two or three days should be adequate for most conditions. If less conditioner was applied, an overnight dry may be sufficient.

Gel Stains

If the whole idea behind blotch prevention is to achieve a uniform stain penetration rate, then changing the stain's viscosity to a thicker consistency is another approach and is available in the form of gel stains. These heavy-bodied stains lie on the surface of the wood, rather than seeping into it. It is too thick to be sucked into the open-ended grain areas. (It also has the added benefit of staying on the work and not getting splashed on you and everything else because it's the consistency of peanut butter!)

These stains come in either oil- or water-based formulas. Personally, I prefer the oil base because it doesn't raise the grain. With the water-based gel stain, even a careful light sanding to knock down the raised grain is risky because you could sand through the color. It's particularly

TRICKS TO FIX BLOTCHING

GENERAL BLOTCHING • If you have applied a stain and it has blotched the wood's surface, the easiest remedy is to let it dry then resand it back to natural wood color. Of course, some color will remain in the deep pores of the blotchy area. If your stain color is relatively dark, this shouldn't matter. Before reapplying stain, use the appropriate stain-controlling product. In the worst case of blotching, it might be necessary to use paint stripper, following the label directions. When done, use an appropriate stain controller before applying color.

RAISED GRAIN • If, after applying color, you find unevenness as a result of the grain being raised, simply resand the blotched area to the same grit as you last sanded before applying the color.

GLUE SPOTS • Should you find splotching from glue sizing, remove the glue, usually by sanding, again to the same grit you finished prior to coloring.

STAIN DRIED TOO QUICKLY • If you have stain that's dried before you've had a chance to wipe off and only a brief amount of time has passed, simply re-wipe with more stain to activate the color so that it can be wiped off.

MIX YOUR OWN CONDITIONER

You can make an effective stain conditioner with easy-to-acquire ingredients from your hardware or paint store. Simply combine these materials in the following proportions: 3 parts paint thinner, 2 parts boiled linseed oil, 1 part VMP naphtha.



Cherry with wood conditioner then stained with Minwax cherry. Again, knotty area blotches a bit.



Cherry with cherry gel stain by Wood Kote called Jel'd Stain applied directly to wood.

risky because the gel creates only a thin layer of color on your wood.

Sand Thoroughly

Hardwoods that splotch, like maple and cherry, will accept aniline dye (but not necessarily stain) more consistently when sanded very thoroughly and consistently to a finer grit (say 180 or even 220). The hard woods especially, like maple, require more work to sand out the abrasion of previous lower grits. If you don't do a consistent and thorough sanding, you leave behind scratches from the rougher previous grit. The coarser abrasion absorbs dye differently. If you look carefully at the Chippendale secretary in this issue, you'll see that the stiles and rails in the upper doors would have benefited from a better sanding, as would the case sides.

Knowing the condition of the wood's surface will help you anticipate uneven stain or dye coloration. Just as in the case of sanding, grain raised accidentally by water, for example, will cause the color to absorb more deeply. You might literally find a polka dot effect on a board that was splattered with water and colored without resanding.

Ferret Out Glue Spots

Of course, it's also critical to make sure no dried glue has been left behind. Although discussed in detail in the last installment of this series, a reminder is in order to be on a constant vigil for finding and removing dried glue. Where the glue has cured on the wood, the pores have been sealed, or sized (as in sizing a wall before applying wallpaper paste to seal the wall's porous surface). The sealing obviously prevents any stain or dye from penetrating where the glue has sealed it.

Make it a practice to systematically clean glue from the surface as it occurs. Remove it with a clean, wet rag when it squeezes from joints, from areas near assemblies that may have the adhesive left behind and from your hands while assembling parts. This practice saves time and aggravation when you're applying finish to your project.

As with all aspects of finishing, it's very important to make a sample board of the finish process you intend to use. Use scrap wood from your project and go through each step. This will give you the chance to change your method, if necessary, before you make a mistake on your project.

You'll overcome much of your fear of finishing when

you get control over the application of stains and dyes to your work. Understanding when blotching and splotching is likely to occur empowers you to take the necessary steps to prevent it. Armed with this knowledge, you're on your way to the successful completion of every project from start to *finish*. **PW**

—Steve Shanesy, *PW* staff



Pine with Minwax cherry applied directly to wood.



Pine with Wood Kote's cherry Jel'd Stain applied directly to wood.



Pine with wood conditioner then stained with Minwax cherry.



Pine wash coated with shellac then stained with Minwax cherry.

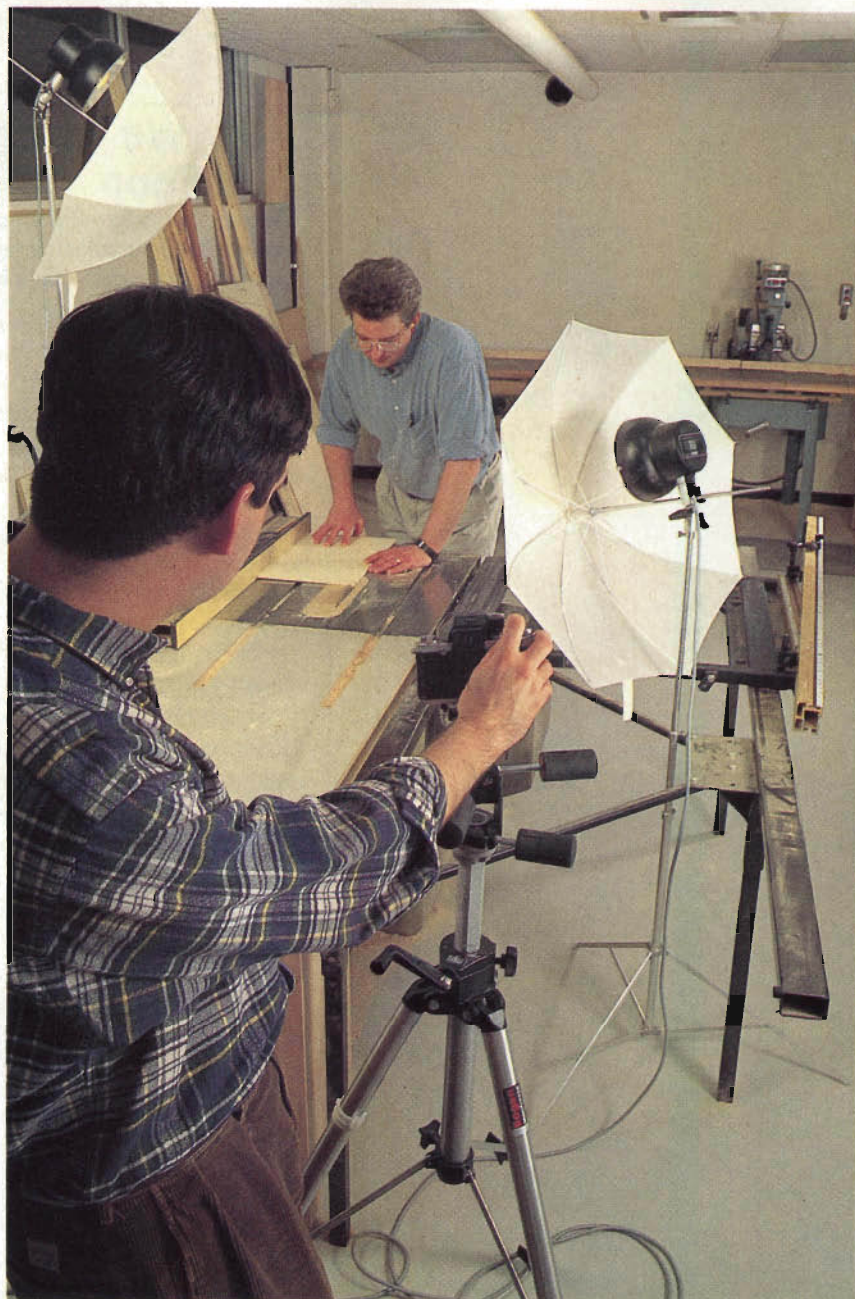
Pop Wood's Project Shop

Visit sawdust central where the proof is in the completed project.

LIKE MONEY, PROJECTS DON'T LGROW ON TREES. And with 15 or more projects in each issue of *Popular Woodworking*, our on-site wood shop is busy most every day as the staff designs, builds, photographs and writes most of the projects in "America's Best Project Magazine."

You might think of our shop as Betty Crocker's "test kitchen," where recipes (or projects, in our case), are tested before they get into the "cook-book," your magazine. Yes, before we publish a project, it's been built to verify its "buildability." In so doing, cutting lists are verified and corrected, and the step-by-step construction photos are taken.

There's usually discussion among the staff as construction details are worked out. The goal is to show the methods that give you the quality result you want in the most practical, no-nonsense way possible. We reckon if you're looking for difficult, time-consuming methods that are fraught with opportunities to fail, you'd be reading some other magazine. Our approach to woodworking also is mindful of one of the biggest problems we all face today — there's not enough time to do the things we must, not to mention those we enjoy. It's an approach we learned in the real world of custom cabinet and furniture shops. Jobs were bid competitively and had to be delivered when promised. Otherwise, you were out of business.



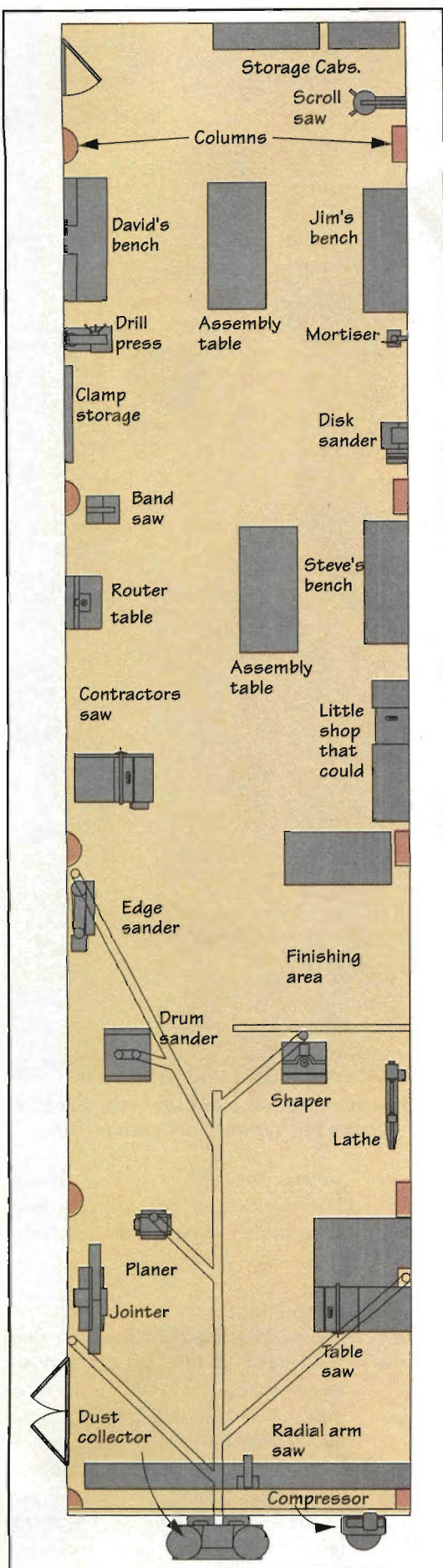
Not only do we build most of the projects in our shop in Cincinnati, Ohio, we also do all of the step-by-step photography and drawings for each article.

Our project shop at *Popular Woodworking* is set up to reflect this thinking. From the beginning we asked ourselves if we should work in a limited shop environment as some of you do or give ourselves the space and equipment more likely found in a small commercial shop. We chose the latter, reasoning we could serve a broader audience *so long as* the methods and techniques we used more closely represented the real life conditions you readers work in at home. To underscore this commitment, I started my "Little Shop That Could" series of

projects that appear in most issues. This series presents projects built using tools and equipment purchased on a meager \$500 budget.

Shop Planning

Popular Woodworking's project shop was carved out of about 1,800 square feet of warehouse space on the basement level of our building. In a sense, we were lucky to start from scratch. We organized the shop to our needs, rather than having to recast a pre-existing shop. When we began the process (and it really is a process) of



How We Equipped Our Shop

We acquired much of our equipment from manufacturers by exchanging merchandise for advertising. We thought you'd be interested to know what's in our shop.

- Powermatic 10" Table Saw Model 66
- Delta 8" Jointer DJ20
- Delta Radial Arm Saw 33-893
- Delta 12" Planer DC33
- Powermatic Shaper Model 27
- Jet Lathe JWL 1236
- Grizzly Dust Collector G1030
- Ryobi Drill Press
- Campbell Housefield Air Compressor (5hp)
- Binks Spray Booth and Equipment
- Lobo Drum and Edge Sander
- Jet Contractor Table Saw JWTS-10
- Jet 14" Band Saw
- Delta Scroll Saw Q3 18"
- Wilton Disc/Belt Sander
- Tormek Grinder

planning the shop, the piece of paper was clean.

When beginning any shop plan, it's important to understand the kind of work that will get done, accounting for the various stages of building then applying them to work areas. Even kitchens are organized around these principles. For the woodshop, you plan for receiving and storing materials, converting the materials into usable parts, assembling the parts and finishing the work.

This boils down to moving material from storage to a machining area, then to assembly, followed by a finishing space. This not only organizes the stages of building, but it organizes electrical and dust collection needs. For example, your stationary machines that might use 220v power get grouped together, making wiring and dust collecting easier.

Machining Area

This area includes our radial arm saw, jointer, planer and table saw within just a few steps of one another. It puts all the equipment needed to convert rough stock to project parts conveniently together with dust collection. We also positioned our shaper and lathe here as well.

The radial arm saw is equipped with long stock support benches to the right and left of the blade with the machine set off center to provide more options when crosscutting long boards. The table saw is outfitted with a "T" square type fence and an after-market sliding table arrangement. We constructed a large table on the outfeed side of the saw to support long stock and plywood sheets. There are two cabinets under the tables. One is for saw blades, our dado set, saw inserts, wrenches and push sticks. The other neatly stores tooling and accessories for the shaper and lathe.

Dust Collection

Because dust collectors tend to run continuously when you're machining stock, the noise level becomes a real annoyance. That's why we parked our dust collector *outside* the shop wall behind the radial arm saw and put the switch *inside* the shop. (We put the air compressor outside for the same reason.) The ductwork is sheet metal like that found in residential HVAC systems. The 4" ducting to each machine branches off a 6" main duct that runs down the center of the machining area. Aluminum blast gates regulate the suction so that only

machines in use are collected.

Further dust collection for the assembly area is accomplished by three filtered air cleaning units suspended from the ceiling. Because most of the dust produced in the assembly area is made up of smaller particles (from sanding and routing), these units work well.

Assembly

After basic machining, project parts are taken to the assembly area at the opposite end of the shop. There are three assembly stations (not counting the "Little Shop" work station, which rolls out of the way when not in use).

Each assembly station has a work bench with a vise mounted to the top, a belt of three drawers and shelf storage below and behind doors. Each station also has an assembly bench where most of the actual assembly takes place. Frequently used hand tools are kept at each bench, while those used less frequently are kept in separate cabinets. Some small clamps are kept at each bench, but longer clamps are conveniently hanging on the wall for all to use.

We keep most of our power hand tools, such as routers, biscuit joiners, jig saws, orbit and belt sanders, pneumatic fasteners and circular saws in a separate cabinet as well. Another cabinet holds sandpaper, nails, screws, glues, rags and other miscellaneous supplies.

There are several machines in the assembly area, including a drill press, belt/disc sander, band saw and sliding compound miter saw. We keep a bench top hollow chisel mortiser; a slow-speed, wet-sharpening wheel and a regular bench grinder in this neighborhood, too. A smaller contractor-style table saw is nearby for small cutting projects, as is our router table and scroll saw.

Finishing

While sanding is done at assembly stations, finishing takes place in an area that divides the machining and assembly areas. Here, finish materials are kept in a flammable materials cabinet. Fumes from finish materials are removed by a powerful exhaust fan after being drawn across special filters that screen out any airborne particulates.

We use many types of finishes, ranging from rubbed oil to sprayed lacquer. You'll also find us finishing with both water- and solvent-based polyurethanes, varnishes and shellac, most of which we brush on. As you might expect, we use a variety of oil stains and glazes, plus aniline dyes on occasion.

Air pressure

Compressed air is piped throughout the shop with pressure regulators and air filter/drying units incorporated in key areas. Pressurized air is used to power pneumatic staplers, pinners and nailers; in conjunction with spray finishing and, of course, to blow dust from wherever you don't want it to be.

Our piping is installed so that it runs slightly downhill



The machining area of the *Popular Woodworking* shop (top), and the assembly area (below).

to the end of the line where any excess water accumulated in the system can be easily drained into a bucket.

Lighting

Florescent lighting is used throughout the shop, and for us, lighting is not just important for ease of seeing. You see, the shop is not only a woodworking shop, but a busy photo studio as well. Nearly every week we take at least a hundred photos of projects in one stage or another of completion. For this reason, we use florescent lighting that outputs light in the same range of the color spectrum as daylight. Of course, we supplement this with a variety of special photographic lights.

All of us at *Popular Woodworking* feel quite fortunate to be working in such a well-equipped shop. We can each remember a time or two when the shop we were working in fell far short of the ideal. A good example being the small, low-ceiling shop I work in at home, which is in my basement. I have few modern conveniences, like an old Delta contractor table saw, a 6" jointer made by the Beaver woodworking tool company (can anybody remember that one?), a Jet band saw and the very first model of plunge router ever made by Makita.

I hope you've enjoyed your "tour" of our shop. We wanted to share it with you because we thought you might be curious about where your projects come from. **PW**

—Steve Shanesy, *PW* staff

Folding Panel Shutters



If you own a table saw, you can make these refined but inexpensive panel shutters.

FROM A PURELY practical standpoint, making pine panel shutters is no more expensive than buying drapery fabric. In addition, shutters bring a richness to a room and the wood adds warmth to any interior. What I also like about shutters is they don't hide the windows' trim work, which can be extensive and beautiful in older homes.

These shutters are a snap to make because construction consists of simply making a raised panel door. You don't need fancy tools (such as a shaper with expensive bits) either. You can make the stile and rail joints as well as raise the panel on your table saw.

I made my rails wider than my stiles because the overall shape of the completed shutter is tall and narrow. These wider parts provided more

purchase at the joint. Given that the weight of a pair of shutters will hang from that narrow stile, the extra glue surface at the joint gives an extra measure of security.

I chose pine for my shutters because it's light and inexpensive. If your wallet is fatter, cherry

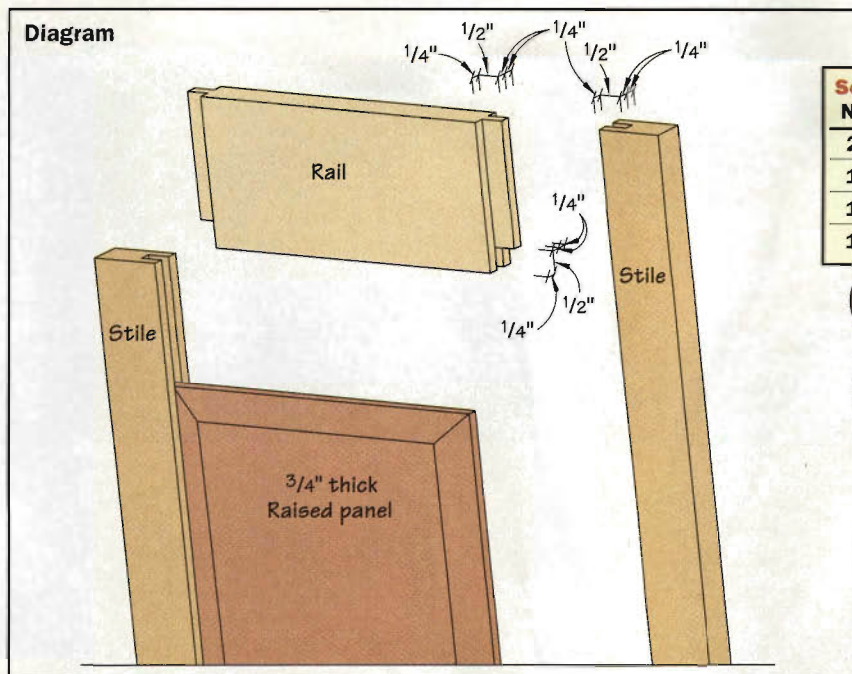


1 GET INTO THE GROOVE • The groove on the long edges is $\frac{1}{4}$ " wide by $\frac{1}{2}$ " deep. Make the groove on your table saw. To ensure your groove is centered, run one side against your rip fence; then, without changing any settings, turn the piece around and run it through the saw again. Reset the fence only to remove any material left in the middle.



2 HOW TO CUT THE TENONS • Cut your tenons on the table saw using two set-ups. The first cut defines the shoulder and length of the tenon. The second cut defines the thickness and the cheeks. When you run the parts on edge, make sure you keep your material pressed against the fence. You might find it easier to push the part through using a back-up block.

Diagram



would be great, though it might need a stouter hinge. You'll no doubt make several shutters, so think of this project as a short production run while planning. Needless to say, your dimensions are going to vary depending on your windows.

Mill Your Parts

It's very important in door construction to keep all your edges square. For the shutters, this means the long edges of the stiles and the short edges of the rails must be absolutely square to both the faces and the perpendicular edges. If not, everything will get wacky when it comes time to install your shutters.

First cut all the pieces you need for the stiles and rails. If you're using pine, buy 1 x 12s and study your material before cutting it up. Save the best-looking material for the panels; it's easy to cut around the knots for the short rails. Lastly, you must use knot-free wood for the stiles so your shutters are structurally sound.



3 TRICKY CUT • If your saw's rip fence is too low for making this cut conveniently, consider attaching a wider piece of material to give you five or six inches of height. The extra height will be handy when you raise the panel on the second side because some of the flat material has been removed from the first side.

PANEL SHUTTERS

Schedule of Materials: Shutters

No.	Item	Dimensions T W L	Material
2	Stiles	3/4" x 2" x 36"	Pine
1	Top rail	3/4" x 3 1/2" x 6"	Pine
1	Bott. rail	3/4" x 4" x 6"	Pine
1	Panel	3/4" x 5 3/4" x 29 1/4"	Pine



Are we on target?

To see more projects like this in future issues, circle "P2" on the postage-paid card in the Resource Directory.

STEP 1 Cut the Grooves • With the stiles and rails cut to width and length, mill a groove on one long edge of all the frame parts. The groove serves two purposes. It houses the raised panel and also serves as the groove for the mortise in the stiles.

STEP 2 Cut the Tenons • Like the grooves, the tenons must be perfectly centered on the ends of the rails. If not, two bad things will happen. The faces of the rails and stiles won't be flush, and the panel won't fit correctly because the grooves will then be out of wack.

Fit the tenons to the groove so they fit snugly without forcing. Also, make the tenon a shade shorter than the groove. You don't want the tenon to bottom out in the groove without the tenon's shoulders seating against the edge of the stile.

STEP 3 Raise the Panels • Panel raising on the table saw requires a precise set-up so that the "V" shape you create on the panel's edge fits in the groove in the stiles and rails. Be sure to make some trial cuts on scraps first. The critical measurement here is the angle of the cut relative to the fence. I set my saw to 11 degrees for my panels.

Assembly

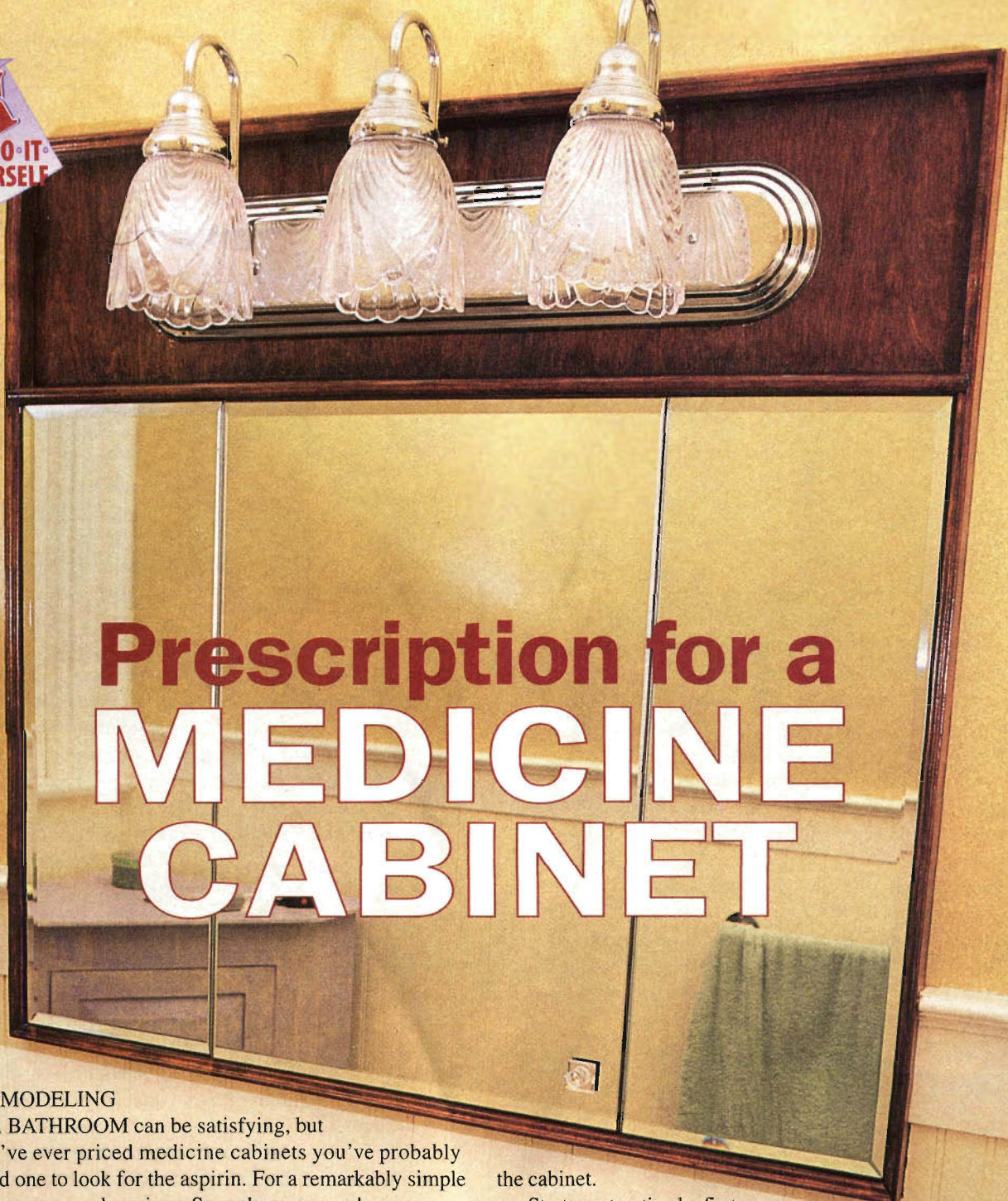
Sand your parts before gluing up the stiles and rails with the panels in place. Apply glue to the mortises and tenons but avoid getting any glue in the groove for the panel. You want the panel to float to allow for seasonal expansion and contraction. Clamp the shutters across the ends and make sure your assembly is flat on the clamps (you don't want to twist the shutter). Make sure the outside edge of the rails are flush to the ends of the stiles.

After the glue dries, sand and finish. I clear-coated my shutters. And because I had a lot of shutters to finish, I used a high volume, low pressure (HVLP) sprayer and lacquer.

Installation is easy. To avoid mortising all the hinges, I used butt hinges that didn't need a mortise. When attaching the hinges, be sure to remember that the barrel goes on the outside face of the shutter when that hinge attaches to the window frame. And when you attach one shutter to another, the barrel on that hinge should face inward.

I should add that one of the terrific advantages a home-made panel shutter has over the store-bought louvered kind (besides the price) is that panel shutters are easier to finish and keep clean. **PW**

—Steve Shanesy, PW staff



Prescription for a MEDICINE CABINET

REMODELING

A BATHROOM can be satisfying, but if you've ever priced medicine cabinets you've probably opened one to look for the aspirin. For a remarkably simple box they sure can be pricey. So make your own!

Most medicine cabinets are a standard size, with the depth being determined by the thickness of the wall into which they are being recessed. Working with a standard interior stud wall with a 1/2" drywall skin, the maximum depth will be about 4", including one piece of drywall. This limits the depth of the cabinet — unless you have an older house. The dimensions we've provided will work for the standard medicine cabinet size, but double check your opening before you begin.

STEP 1 **What's In a Frame?** • The cabinet shown here is a simple box with a frame surrounding it. The box part is built with a 1/4"-deep frame glued to the front and simply slipped into the opening left by removing the old cabinet. The decorative frame surround is then attached to the wall around

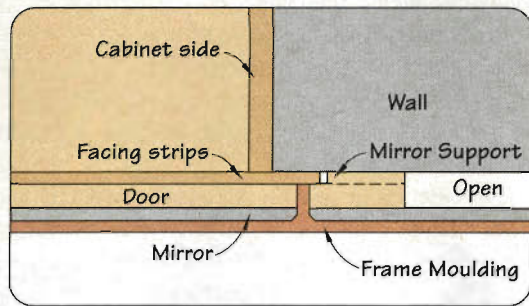
the cabinet.

Start construction by first removing the existing cabinet, and (if you're lucky) the light fixture above it. If you don't already have a light fixture wired above the medicine cabinet you'll want to talk to an electrician to either to do the wiring for you, or to make sure you're doing it to code.

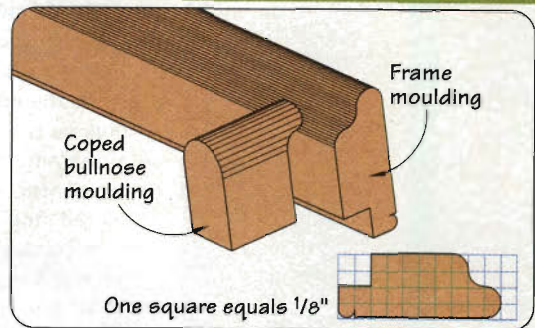
The box of the medicine cabinet is made of birch plywood. First, cut the pieces to size, then cut a 1/4" x 1/4" rabbet on the inside back edge of each piece for the back. Next, mark and drill the sides for the shelf supports you've chosen for your cabinet. The cabinet is then assembled by simply nailing the top and bottom between the two sides, and the back is then nailed in place to hold it square.

With the cabinet assembled, miter the 1/4" x 1 1/4" facing strips at the corners and glue and nail them to the front of

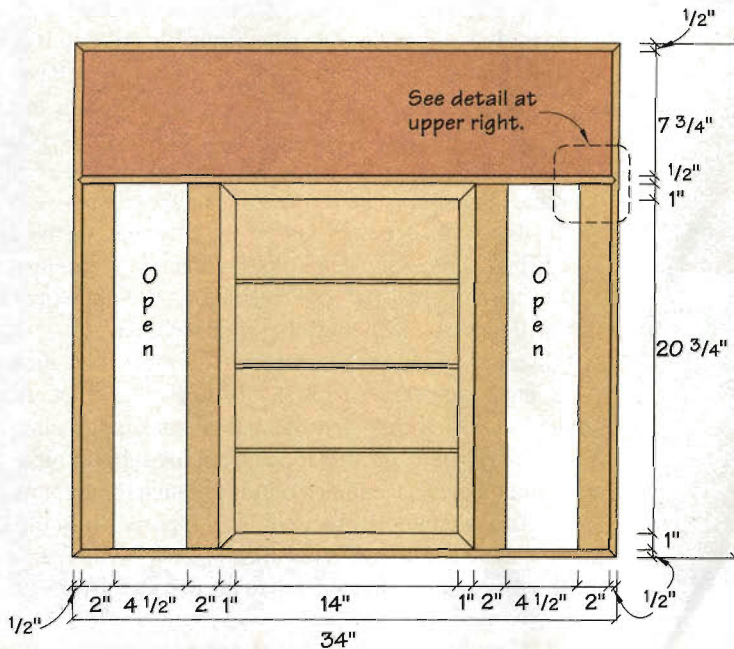
Diagrams



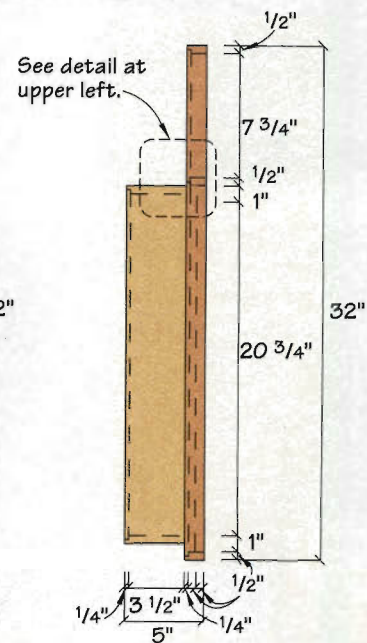
Plan detail of mirror backing



Detail of moulding joint



Elevation



Profile

Schedule of Materials: Medicine Cabinet

No.	Item	Dimensions T W L	Material
2	Sides	1/2" x 3 3/4" x 21 3/4"	Birch Ply
2	Top & Bottom	1/2" x 3 3/4" x 15"	Birch Ply
1	Back	1/4" x 14 1/2" x 21 1/4"	Birch Ply
3	Shelves	1/4" x 3 1/2" x 14"	Birch Ply
2	Facing strips	1/4" x 1 1/4" x 17"	Birch
2	Facing strips	1/4" x 1 1/4" x 23 3/4"	Birch
2	Frame stiles	1/2" x 1 1/4" x 32"	Birch
2	Frame rails	1/2" x 1 1/4" x 34"	Birch
1	Frame rail	1/2" x 7/8" x 34"	Birch
1	Light panel	1/4" x 8 1/4" x 33 1/2"	Birch Ply
4	Mirror supports	3/4" x 2" x 23 1/4"	Birch Ply
1	Door	1/2" x 15 3/4" x 22 1/2"	Birch Ply

* Depth of cabinet may be able to increase in your house.



Are we on target?

To see more projects like this in future issues, circle "P4" on the postage-paid card in the Resource Directory.



1 BOX DETAILS • Viewed from the rear, you can see the back and the rabbet into which it fits in the assembled cabinet. The flange visible to the front is the facing strip in place against the front of the cabinet.

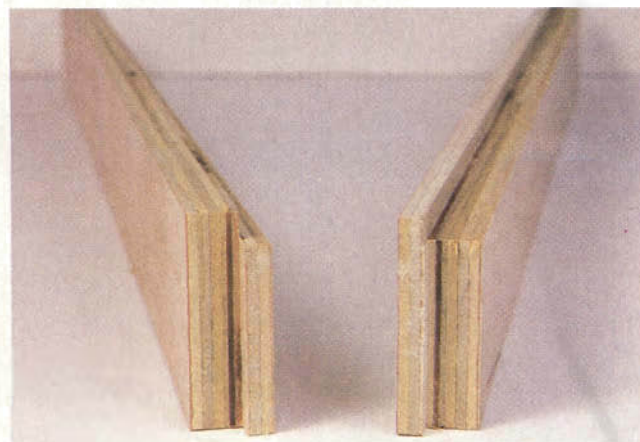
the box, flushing up the interior edges. Now mount the box in the wall. It is a little undersized to allow for shimming and squaring prior to screwing it in place between the studs.

STEP 2 Begin the Face • The exterior frame also is simple, but it does require planning and milling prior to assembly. First, the two outside rails and the two frame stiles

MEDICINE CABINET



2 CORNER DETAILS • Shown assembled and finished, the edge profiles on the outside frame and on the center frame rail meet at a coped joint. It's a nice way to finish off this joint that's not really as difficult as it might appear.



3 HOW THE SUPPORTS SHOULD LOOK • Note the smaller rabbet cut on the inner support to provide a lip to overlay the facing rail. If making these rabbet cuts on the table saw, use a rip blade. The flat teeth provide the best finish at the end of the rabbet.



4 EUROPEAN TOUCH • The European hinge offers three-way adjustment for the door, while providing hidden hardware and the loss of very little storage space. Many woodworking catalogs are now offering European hardware and drill bits for attaching them at affordable prices.

need a $\frac{1}{4}$ " x $\frac{1}{4}$ " rabbet on the inside back edge. This rabbet captures the $\frac{1}{4}$ " light panel, the mirror supports and overlaps the facing strip at the cabinet's bottom.

Next rout a profile on the front edge of the four frame pieces with the rabbets. I used an ogee bit and also rounded over the outside edge (see detail in diagrams). In addition, I cut a bead along the outside of the frame for a decorative touch.

The center frame rail also has a bullnose detail on its front edge that matches the ogee detail on the outside frame pieces. This center rail is then coped to fit into the frame stiles, continuing the ogee pattern with only a minimal break.

STEP 3 Mirror Supports • Next cut the four mirror supports to size. The Schedule of Materials calls out these pieces as birch plywood, but as one edge is visible on each interior side you can substitute solid birch, or apply veneer tape.

On the two pieces that will be to the outside of the mirror, cut a $\frac{1}{4}$ " x $\frac{1}{2}$ " rabbet on two short and one long edge of each piece (with the rabbets cut on the same face), leaving a tongue the same thickness as the facing strips on the cabinet.

On the two inner pieces, cut $\frac{1}{4}$ " x $\frac{1}{2}$ " rabbets on the short ends. Then on the long edges that will meet the facing strip of the cabinet, cut a $\frac{1}{4}$ " x $\frac{1}{4}$ " rabbet on the opposite face so it will overlap the facing strip of the cabinet.

Miter the corners of the frame and assemble. Tack the light panel into the upper rabbets; it should overlap the center frame rail halfway. Next tack the two outer mirror supports into the frame rabbets, with the upper tongue of the support piece fitting under the center rail and butting against the light panel. Remember, the whole object of the supports is not only to provide a surface to mount the mirrors, but also to make sure the mirrors on the side are flush to the door's mirror.

STEP 4 Mount Up! • Next, position the frame in place over the cabinet mounted to the wall. The facing strip should fit into the rabbet in the lower frame, and it should fit behind the center rail, again butting against the light panel. Temporarily slip the inner mirror supports into the rabbets and slide them in place overlapping the facing rail of the cabinet. Mark their location, remove the frame and attach the inner mirror supports permanently.

Prior to mounting the frame to the wall, apply a brown mahogany stain and a couple of coats of shellac to the exterior. Then mark and drill a hole in the light panel for the light fixture. After locating the studs in the wall, screw the frame to the wall. The light fixture I used has a large mounting plate that covered the screw holes through the light panel. Two screws through the bottom of the inner mirror supports finished the mounting.

Next cut the $\frac{1}{2}$ " door for the cabinet. I used European hinges to mount the door because they are infinitely adjustable. When the three bevel-edged mirrors are in place, it's great to be able to adjust the door on three axes. With the door mounted, the only thing left is to attach the mirrors and the light fixture. The mirrors are attached to the door and the mirror supports with pure silicone caulk. Now all that's left is building the vanity under the cabinet — maybe next issue. **PW**

—David Thiel & Steve Shanesy, PW staff

WOOD TYPES

Soft Maple

(*Acer rubrum*)

Other Common Names: Carolina red maple, Drummond red maple, Red maple, Scarlet maple, Swamp maple, Water maple. This wood is often found in the same bin as Silver maple.

Growing Regions: Maple is found throughout the Northeast in the United States and in Eastern Canada. It is thought to have the greatest north-south distribution of all species along the East Coast, according to "Woods of the World." The tree grows well in mixed hardwood forests and thrives in moist soils.

Characteristics of Tree: The tree grows quickly during its first 20 years. Mature trees measure between 60 and 90 feet high with a trunk diameter of 30 inches.

Characteristics of Wood: The sapwood of this

unfinished

finished

fine-textured wood is whitish; the heartwood is light brown and may show a grayish or greenish tinge or purplish hue. The grain is generally straight, though curly or tiger patterns are more common in soft maple than in the hard maple species. The wood isn't suitable for use outdoors.

Finishing Characteristics: Takes stain well, though blotching is common if the surface is not adequately sanded.

Workability: Soft maple planes more easily than hard maple. While it screws and nails well, maple's density and close grain structure make it sometimes difficult to glue. Soft maple is good for turning and steams OK.

Common Uses: Furniture, paneling, dowels and veneer.

Special Features: The Red maple is the state tree of Rhode Island. Curly, birds-eye and spalted varieties of this wood are highly desirable and can command a price up to \$19 a board foot.

Midwest Price: About \$3.75 a board foot, $\frac{3}{4}$ good, surfaced. Soft maple is a bargain compared to the hard species, which average about \$5.25 a board foot. **PW**

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IN CONVERSATION I often change the word "woodworking" to "fun-working." (It's a play on words, really, because woodworking should always be enjoyable.) The point is to get away from chore projects and delve into a

sphere where we're not committed to a specific plan but try for non-traditional items, sometimes produced in non-traditional ways.

Being in such a mood one day, I saw I had accumulated a good amount of

"scrap" architectural and picture frame moulding. This led to a weekend that proved that leftovers, as with food, can have another life.

First off, picture frame moulding doesn't have to be mitered conven-



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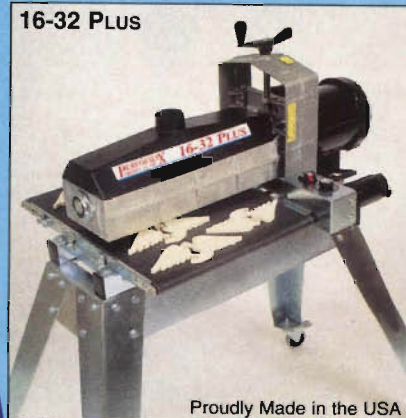
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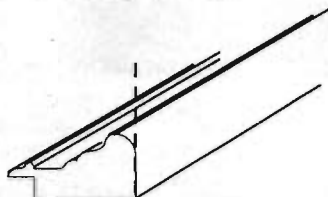
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Figure 1

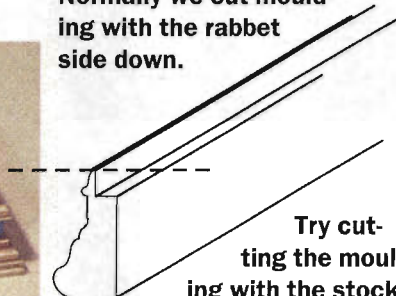
Picture frame moulding mitered while on edge made this attractive frame for this hot plate. The insert, which is Corian™, sits in the rabbet that is part of the moulding's form. I found that heavy rubber bands are excellent "clamps" for projects like this.



Moulding on Edge

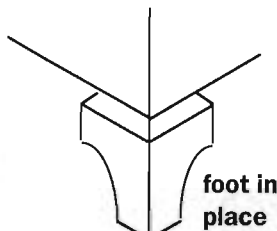
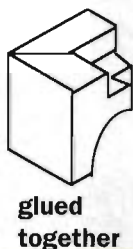
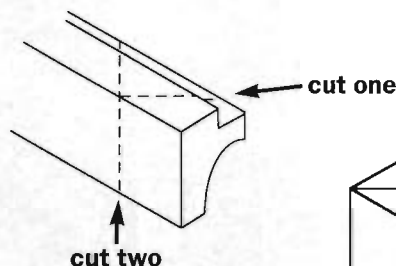


Normally we cut moulding with the rabbet side down.



Try cutting the moulding with the stock on edge.

Make Bracket Feet



foot in place



Bracket feet for small boxes are easy to produce from picture frame mouldings.

tionally; that is, flat, with the rabbet down. Miter it while holding on edge (figure 1) and it becomes ready-made framing for projects like the hot plate shown in the photo. Likewise, the idea can be used to produce parts for bracket feet for small projects.

Moulding, when its size permits, can be adapted for other purposes by forming a groove down its length (figure 2). Modified that way, the moulding is usable as ready-made corners for boxes, lamp bases and similar projects.

Continued on page 70

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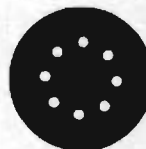


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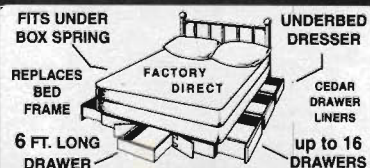
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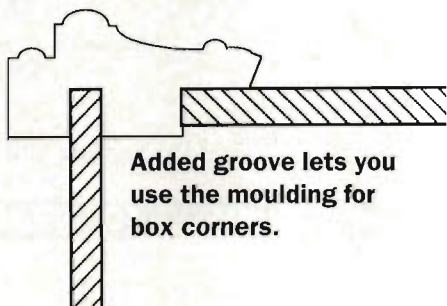
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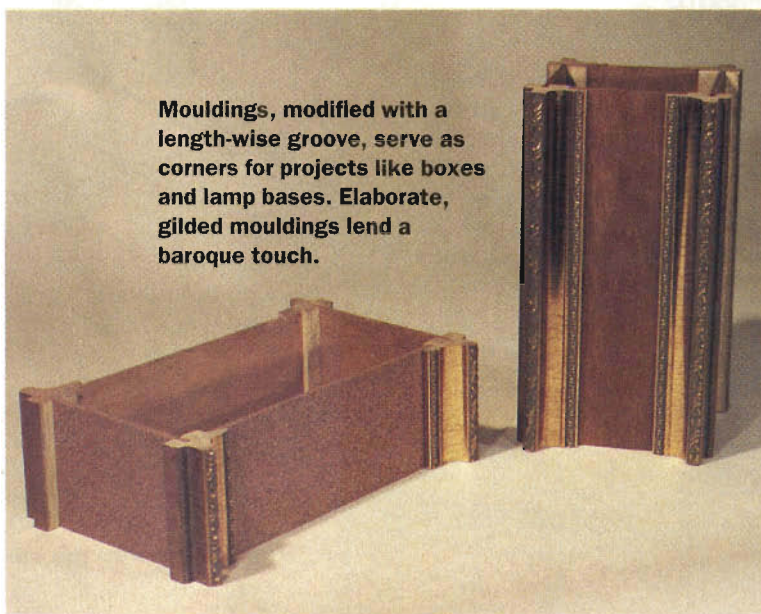
Figure 2



How we normally use moulding



Added groove lets you use the moulding for box corners.



Mouldings, modified with a length-wise groove, serve as corners for projects like boxes and lamp bases. Elaborate, gilded mouldings lend a baroque touch.

You also can miter-cut moulding as triangles, which are then assembled as squares (**figure 3**). Mary (my friend and wife) instantly latched on to these, and they are now grouped as part of a

wall decor. But there also are functional applications — for example, drawer pulls.

These projects require precise miter cuts. The best technique is to work with

a triangle miter-guide like the accessory for the Master Table Saw Jig (see September 1997 #98). This allows making opposing cuts without having to disturb the initial setting.

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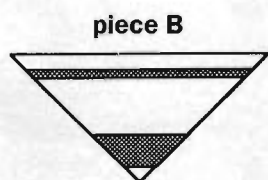
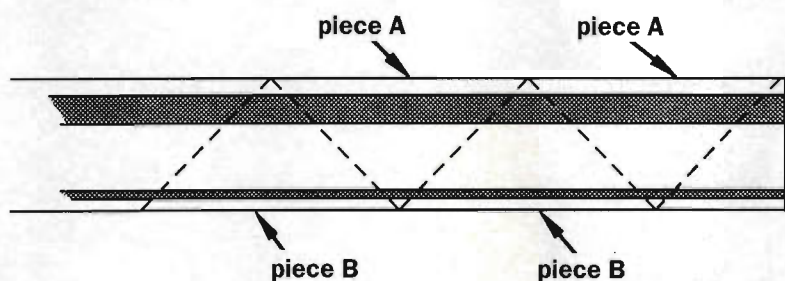
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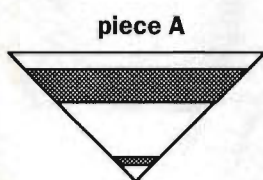
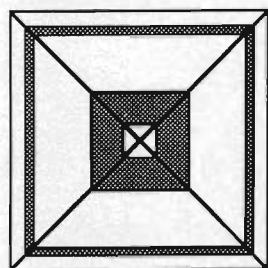
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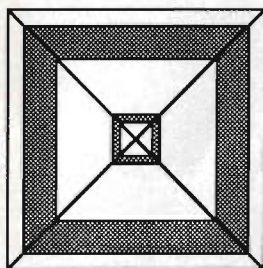
Figure 3



Four B pieces assembled



Four A pieces assembled



Triangular pieces, assembled as squares, make attractive decor details, or they can have a functional use as drawer pulls.



Interesting results occur because of the configuration of the moulding. The second piece that is cut will not mate with the first one because the shape is inverted. However, when you are through sawing the parts for one square, you will have four other parts for another project.

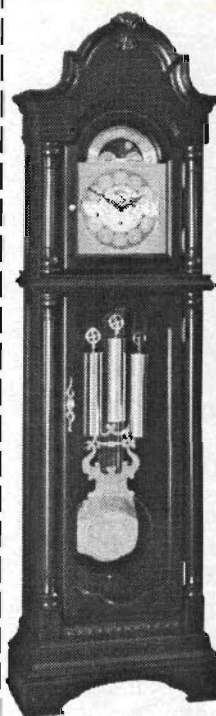
Slim pieces crosscut from crown, cove or bed mouldings can be assembled in various ways to serve as decorative overlays or, when properly finished, as Christmas tree ornaments (figure 4).

Continued on page 72

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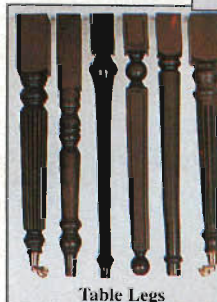


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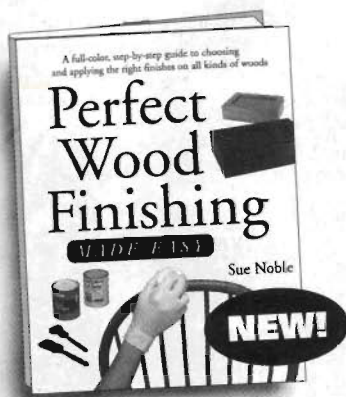


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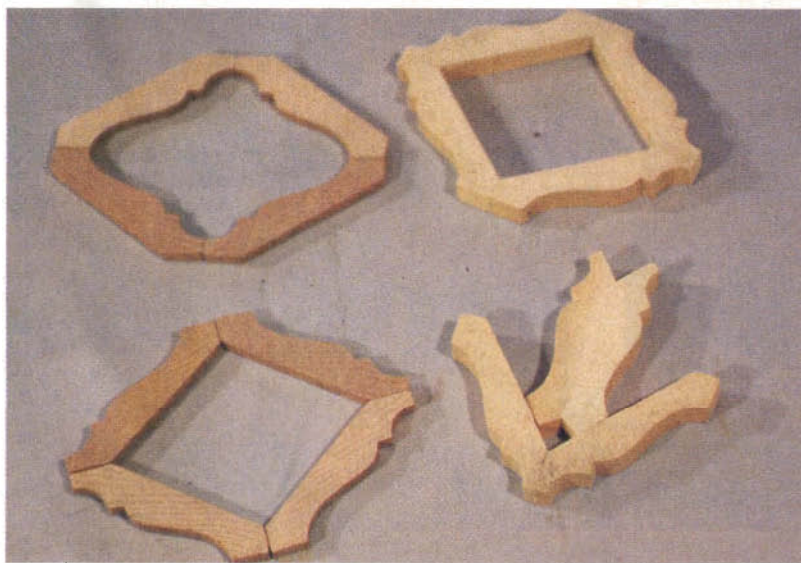
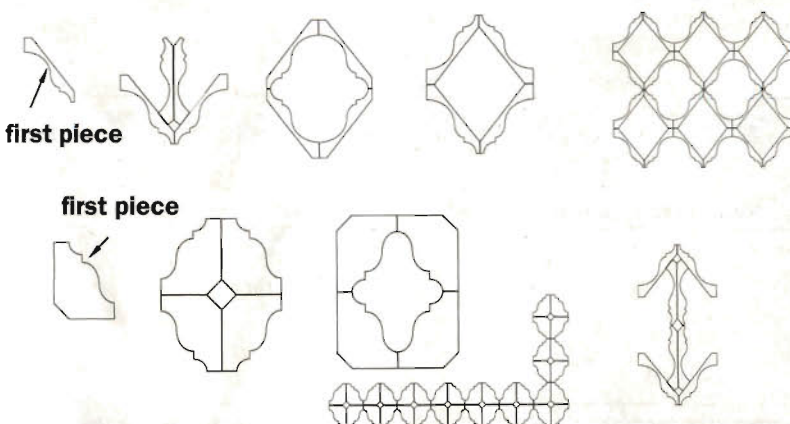
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CRIS CUTS

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Figure 4

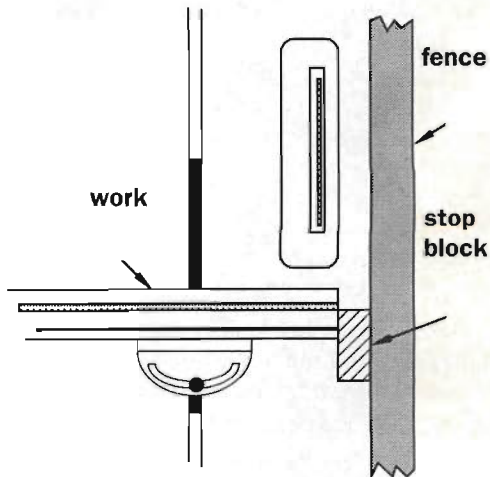


Examples of "scroll type" items that result by assembling slim pieces cut from crown, bed or cove moulding.

The accurate and safe way to produce the pieces is to use the setup shown in **figure 5**. Use a thick stop block so there will be ample room for the cut-offs between the blade and fence. Clamp the stop block well ahead of the saw blade. Even so, don't allow too many of the pieces to accumulate; they can move around and be caught by the blade. **PW**

R.J. DeCristoforo has written more than 30 how-to books, including "Jigs, Fixtures and Shop Accessories" (McGraw-Hill).

Figure 5



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Our resident turner, Jim Stuard, came up with some pretty clever designs for the classic bud vase, including one that looks like a rocket ship.

POLYURETHANE GLUE

Learn the facts and fictions of polyurethane glue as we shop test the major brands of glue. Learn how to use the newest glue in the U.S. market, how it works, why it's different than traditional wood glue and which projects benefit from its use.

BLANKET CHEST

Build this traditional-style maple blanket chest using frame-and-panel construction and bun feet. **PW**



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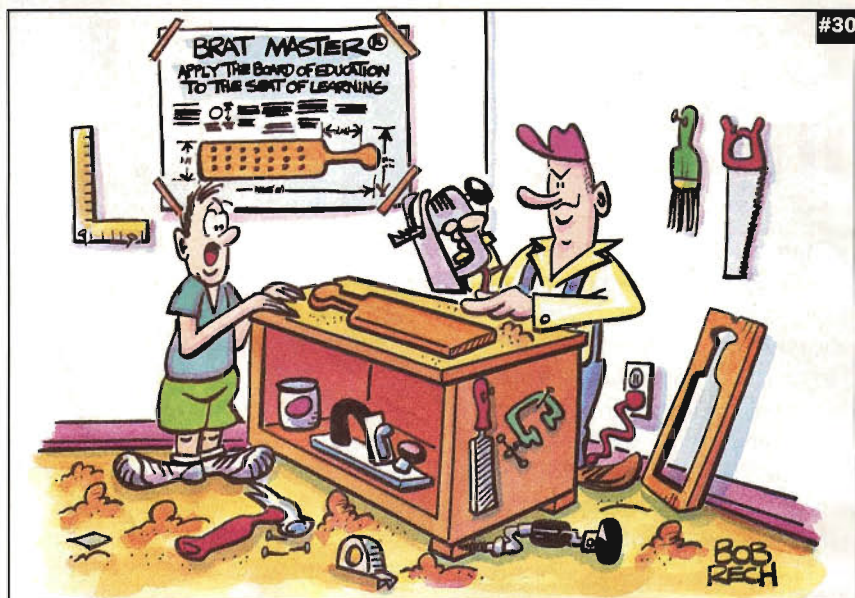
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CAPTION the CARTOON

RYOBI



#30

William Smith
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the Cartoon Contest #28"
from the January issue
and recipient of the
Ryobi 14.4v cordless drill.

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"Maybe I should cancel my order for that dovetail jig."

— Stephen Fritz, from Wexford, Pennsylvania

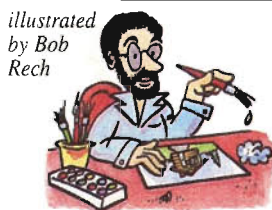
**"Now that you've got the plane, you have to buy the 'pilot' bit! Ha
ha!"** — Jim Perri, from Pittsford, New York

**"Says here if you grasp it by the tail and spin the propeller
it converts to a precision router!"**

— A person without a name, from Lima, Ohio

"Good thing you didn't order the 'scratch owl.'"

— Clark Gravedoni, from Ishpeming, Michigan



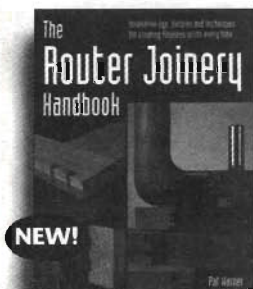
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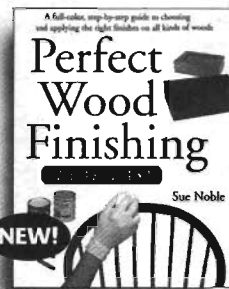
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PBA2

The Warmth of Wood

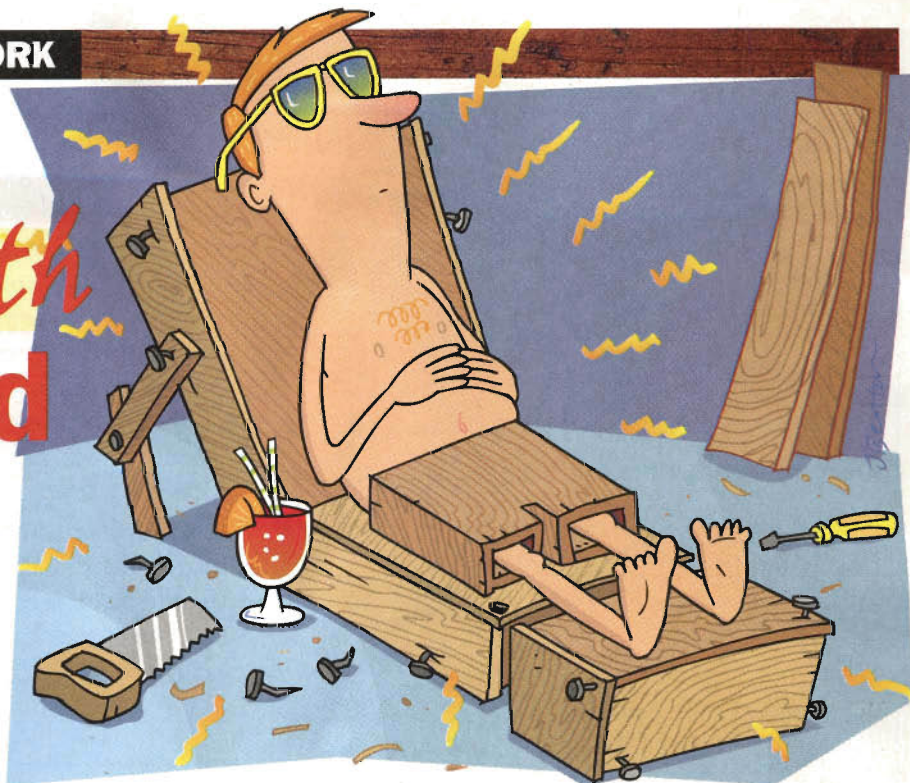
Believe it or not, science is what makes wood so wonderful to the touch.

I'M SURE you've noticed it. Being a woodworker, your friends and family probably can't wait to get their hands on the things you make. Not only because they want the results of your craftsmanship for their own, but because they love to touch the material that makes woodworking what it is: the wood.

I notice it at my own home and again and again at the craft shows I go to. People find wood hard to resist touching. If they can pick it up, they will fondle and caress the wood. If it's too large to pick up, they will simply run their hands over the wooden surface, enjoying the warm, comfortable feel of wood.

More than any other material, wood simply begs to be touched. Working with it all the time, and achieving satisfaction mainly from the process of creating wooden objects, you might have forgotten what it is about wood that draws you to it. Other people know what it is. They know that wood simply feels good to the touch, and it has a warmth to it that can't be matched by other materials.

In the age of plastics and metals, we have come to expect something different from the wooden objects in our life. More than simple beauty, it's one of those things where the feel lives up to the look: warm and inviting. This expectation stays with us even though common sense tells us that the wood should be the same temperature as everything around us.



What makes wood feel so good is pure physics. It is based on the thermal (heat-related) properties of wood and how it contrasts with other materials. In everyday terms, whenever you touch something, there is a difference between the temperature of the object (usually at room temperature) and your fingers (closer to body temperature). Since body temperature is normally above room temperature, this difference is what makes wood feel warm, even though it isn't.

This contradiction is explained by the natural laws of physics, which make the object and your fingers want to become the temperature of the other —

to reach equilibrium. A good, practical example is when you drop a couple of ice cubes into your favorite drink. The result is that the drink will become cooler and the ice cube will become warmer until they both reach the same temperature (I know, the ice cube actually melts. It's the point — and a cool drink — that's important). Which brings us back to the physics. There is such a thing as thermal conductivity that affects how quickly the heat is transferred from the warmer object to the cooler object. It's this transfer of heat that makes

objects feel cool to the touch, since our fingers are almost always warmer than our surroundings, and heat will transfer from our fingers to the object we are touching.

So why does wood feel warmer than many other materials when physics tells us that objects will usually feel cool to the touch? It's because wood's thermal conductivity is lower than many of the common materials around us, like metal, plastic or glass. This means that heat is drawn from your fingers at a slower rate when touching wood than when touching most other materials. It's not that wood is naturally warmer than other materials, simply that it's not so quick to rob us of our own heat.

This relative difference is what we notice when we handle wooden objects, and gives most of us an instinctive feeling that wooden objects are naturally warmer than most other materials. The experiences we have with most modern materials we are used to touching contrasts enough with that of wood to confirm our expectations: wood has a natural warmth. **PW**

Thermal Conductivity of Common Materials:

Material	Thermal Conductivity
Wood	0.0015
Glass	0.011
Iron	0.791

Michel Theriault lives in Ottawa, Ontario, and is the author of Woodworking Projects With A Few Basic Tools (Sterling). His articles about woodworking woodcarving, woodturning and general woodworking projects and techniques have appeared in four countries.

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