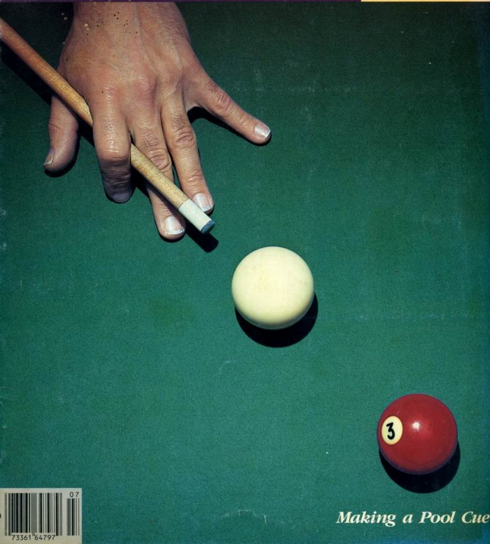
Fine WoodWorking

July/August 1986, No. 59, $3.75

Federal Card Table
Shop-Made Crosscut Saw
Designing a Bed
Letter Carving
Polyurethane Basics
Shop-Noise Dangers



Making a Pool Cue

Fine WoodWorking
July/August 1986

A steady hand and sharp eye are required to make a pool cue, as well as to use one. Improve your lathe skills, if not your game, by following the advice beginning on p. 66.

Fine Woodworking (ISSN 0361-3453) is published bimonthly, January, March, May, July, September and November, by The Taunton Press, Inc., Newtown, CT 06470. Telephone (203) 426-8171. Second-class postage paid at Newtown, CT 06470, and additional mailing offices. **Subscription rates:** United States and possessions, $18 for one year, $34 for two years; Canada and other countries, $21 for one year, $40 for two years (in U.S. dollars, please). Single copy, $3.75. Single copies outside U.S. and possessions, $4.25. Send to Subscription Dept., The Taunton Press, PO Box 355, Newtown, CT 06470. Address all correspondence to the appropriate department (Subscription, Editorial, or Advertising), The Taunton Press, 63 South Main Street, PO Box 355, Newtown, CT 06470. U.S. newsstand distribution by Eastern News Distributors, Inc., 1130 Cleveland Road, Sandusky, OH 44870.

DEPARTMENTS

ARTICLES

Postmaster: Send address changes to The Taunton Press, Inc., PO Box 355, Newtown, CT 06470.

Re router joinery by Bernie Mass (*FWW* #57). I have a few suggestions: make the router subbases and many of the jigs from ¼-in. clear acrylic sheet. It cuts and drills just like wood, may be tapped or glued, is extremely strong and provides a clear view of the work without the need to cut viewing ports. A scored line from an awl on the underside of any acrylic jig or template shows white from above and can be used to accurately position the router or the work. Using ¼- or ½-in.-thick acrylic as a template for the router guide ring or for bearings on bits is preferable to plywood or Masonite, as the plastic virtually never wears out or rounds over and the added savings in accuracy and safety will always pay off. —*Paul Armstrong, Toronto, Ont.*

Right on! Thank you for the fine article by Rich Preiss on choosing a tablesaw (*FWW* #56). I have lusted for a Unisaw for as long as I have called myself a woodworker, yet I've never had the cash to buy one. I use a Sears Craftsman 10-in. saw of early 1950s vintage that I purchased secondhand. It is every bit as accurate as I am. Sure, it takes a bit more time to adjust, the fence needs to be checked before and after locking down and I cannot slam it around as I might a commercial model. It has, however, served me well for many years.

I also use a 1970 Craftsman radial-arm saw and a lathe that goes back to when Sears tools were labeled "Companion" rather than Craftsman. These, plus an old Delta drill press and a small jointer, have enabled me to make a modest living from woodwork and that is the bottom line. No one need shy away from getting a shop going just because they can't afford the best. —*Michael H. Kirch, Lucerne, Calif.*

In issue #55, "Turning a Lidded Box" by Richard Raffan, I was surprised to find that Mr. Raffan, a professional turner of many years, could not offer your readers something a little more substantial pertaining to lid fit problems.

Achieving that perfect fit Mr. Raffan talks of is one thing, but having the box retain it for any reasonable amount of time is another matter. A little attention given to seasoning the box in the roughcut form could go a long way.

I have only seen a few perfect lid fits of lasting stability in my many years of box making. Those crafted by Del Stubbs of Chico, Calif., come as close as any I have seen. I am sure they were only achieved through additional drying at the roughout stage, reducing the moisture level to equilibrium moisture content. Wood movement can successfully be held to a minimum, even on boxes 10 in. in diameter or more, when a few drying practices are applied. —*Bob Krauss, Dinosaur, Colo.*

Why is my "free" jigsaw costing $95? After seeing Ryobi's offer in *FWW* #58 for a free jigsaw with the purchase of an AP-10 planer before May 31, I called to learn the participating distributors. They gave me some names and I began to call around. I talked first with Woodworker's Supply of New Mexico. They told me the price of the planer alone was $399. The "free" jigsaw would add an extra $95 to the cost. That didn't sound as free as I would have liked. Next, I called Leichtung—the price with the "free" saw was indeed $495. I phoned The Source in Springfield, Va., who told me the planer alone sold for $369 and that they had a special on the planer/saw combo for $459. One more call. Seven Corners Ace Hardware says, "What's all the confusion about? The planer/saw package is $375, delivered." A consumer shouldn't have to work so hard to spend money! —*Craig B. Wynett, Charlottesville, Va.*

James Ippolito of Ryobi replies: Dealer participation in our free jigsaw offer was voluntary. We couldn't force Ryobi dealers to participate if they chose not to, but if you bought an AP-10 planer between February 1 and May 31, 1986, and your Ryobi dealer didn't honor the free jigsaw offer, send proof of purchase to the following address and Ryobi will send you your free jigsaw: Ms. Lil James, c/o Ryobi America Corp., 1158 Tower Lane, Bensenville, Ill. 60106.

I enjoy reading *FWW* and, as a mathematician, was particularly interested in the note on drawing large shallow curves (Methods, *FWW* #57). After some calculations, it was determined that the shallow curves being drawn by the "spile board" were arcs of circles of long radius, $r = (a^2 + b^2)/2b$ for an arc with rise b and run a as shown.

The following device, which I might call a long compass, should work equally well for drawing a circular arc through any three non-linear points.

Insert guide pins at the extreme points, place a pencil at the interior point and tighten pivot bolt with wing nut to hold the compass at this angle opening. Then simply slide the compass on the pins as the pencil traces the curve.

This device and technique avoids having to make any measurements and having to cut a new spile board each time. Also, it's handy to know when finished that the circular arc does have radius $r = (a^2 + b^2)/2b$ and could be drawn with an ordinary compass centered at this (possibly quite large) distance from each of the three given points. The distances a and b can be measured from the finished arc (or from the compass setting with points A and C). —*Cliff Long, Bowling Green, Ohio*

Being an antique tool collector and user, I shuddered at Graham Blackburn's suggested use of paint stripper as a method of cleaning old wooden planes (*FWW* #57). To a tool collector, paint stripper comes in the same category as covering a fine tool with polyurethane or drilling holes in it so you can mount it on the wall. They can't be replaced.

Almost any old wooden surface can be vastly improved using 0000 steel wool and a 75-year-old household cleaner called Murphy's Oil Soap, which should be in most hardware or paint stores. It has the consistency of Vaseline, is amber in color and has a pleasant smell. Ask your mother, I'll bet she used it. Once you have a small amount of soap on your steel wool pad, rub it into the surface until it disappears. Now search the linen closet for one of those fluffy bath towels and buff the surface to a high luster. —*Jim Schumacher, Green Bay, Wis.*

I feel that I must respond to M. Breed's letter printed in issue #55. In it he claims that efficiency in craft is the motivation behind *FWW*. I believe that most who read *FWW* are those who love wood and the aura of the shop. Efficiency certainly has its place, especially to one who attempts to pay his bills by pursuing his dreams. If Aldren Watson and Theodora Poulos choose to spend their entire lives on only one "turning" (*FWW* #54), let them. I urge *FWW* to continue to seek out those who pursue their craft on their own terms and who are happy, content people. It enriches all of us, both in our life and in our craft. —*Dennis R. Mitton, Vidalia, Ga.*

I must comment on the article by W.W. Sauer, "Cousin Fred's Wonderful Woodworking Shop" in *FWW* #55. It is a pity that there are so many insensitive, non-understanding wives and cousins in this world. It seems to me that building, having and caring for a beautiful, well-organized shop can also be a pleasurable hobby. Talking about it and showing it to people is also fun. What does it matter if he makes anything or not? Cousin

RYOBI TOOLS

Model		List	Sale
S500A	3x5½ Finish Sander	70	41
SU6200	Finishing Sand. ½ Sheet	142	88
B7075	3x21" dustless Belt Sand.	179	116
B7100	3x24" dustless belt Sand.	208	140
B7200A	4x24" dustless Belt Sand.	269	165
D100VR	3/8" VSR 0-1200 rpm drill	91	49
W640	7¼" 13 amp circular saw	158	99
W740	8¼" 13 amp circular saw	171	109
JS60	Jig Saw-Single Speed	172	99
JSE60	Jig Saw-electronic v/speed	198	123
R150	1 H.P. Plunge Router	138	86
R330	2 H.P. Router	220	138
R500	3 H.P. Router	265	163
E3800	Drywall screwdriver 0-4000	126	79
L120U	3⅛" Planer	142	89
BD1020R	⅜" 2-spd Cordless Drill w/free holster-Xtra special buy	148	95
TS251U	10" Mitre Box	300	169
SG1150C	4½" H.D. Mini-Grinder	99	59

YOUR ATTENTION PLEASE!

All Above RYOBI TOOL Prices
Take Additional **10% OFF** Sale Prices

MILWAUKEE TOOLS

Model		List	Sale
0224-1	⅜ drill 4.5A magnum	159	109
0234-1	½ drill 4.5A magnum	159	112
0244-1	½ drill 4.5A magnum	159	115
0222-1	⅜ drill 3.3A 0-100 rpm	146	99
0228-1	⅜ drill 3.3A 0-1000 rpm	129	92
0375-1	⅜ close quarter drill — NEW — 3.5 amp	175	118
0210-1	⅜ cordless drill — NEW — 2 speed	154	95
6539-1	cordless screwdriver — NEW — 190 RPM	84	59
1007-1	½" drill 4.5A D-Hdle	199	145
1107-1	½" drill 4.5A D-Hdle	204	145
3300-1	magnum rt angle drive kit	249	170
3102-1	Plmbrs rt angle drill kit	263	180
1676-1	HD Hole Hawg w/cse 2 sp	333	235
5395	⅜ sgle sp hammer drill kt	203	150
5397	⅜ var sp hammer drill kit	208	155
5371-1	HD mag. hammer drill ½"	287	207
5373	HD mag. ham. drill ⅜"	240	175
6511	2 speed Sawzall w/case	181	122
6226	port band saw 2 sp w/case	382	280
6234	TSC band saw port w/case	382	280
6405	8¼" circ. saw 13 amp	179	127
6460	10¼" 15 amp w/case	349	245
6165	12" Chop saw 15 amp 4200 R.P.M.	285	189
6255	v/sp Jig Saw 3.8 amp	199	140
6245	sgle sp Jig Saw 3.8 amp	175	125
6012	⅓ sheet HD Orb. sander	159	110
6014	½ sheet HD orb. sander	169	112
5660	1½ HP router 10 amp	265	175
5680	2 HP router 12 amp	314	220

DRYWALL SHOOTERS

Model		List	Sale
6753-1	3.5 amp 0-4000 rpm new	115	79
6747-1	4.5 amp 2500 rpm	144	100
6750-1	4.5 amp 0-4000 rpm	129	90

NEW FROM RYOBI

MODEL AP-10 — 10" Surface Planer
WEIGHS ONLY 58 LBS.
LIST 659.00 — SALE 375.00

MILWAUKEE Super Specials!

• • BRAND NEW • •
Model 0212-1 Cordless Variable Speed 3/8" Drill
LIST. . .179.00 SALE. . .125.00

Model 6145 — 4 1/2" Sander-Grinder
LIST. . .139.00 SPECIAL SALE. . .85.00

Go Cordless with MILWAUKEE

#6305 — 6¼" Cordless Circular Saw
12 volt — 1 Hour Charge
Cuts (80) 2x4's (Pine)
List Price 195.00 ★ SALE PRICE 119.00

FREUD SAW BLADES

Univ. Bore — Professional Series
CARBIDE TIPPED SAWBLADES

Item No.	Description	Diam.	Teeth	List	Sale
PS203	Gen'l Purp.	7¼"	24	27.24	17.50
PS303	Fine cutting	7¼"	40	32.97	20.50

⅝" Bore — Industrial Grade
CARBIDE TIPPED SAWBLADES

Item No.	Description	Diam.	Teeth	List	Sale
LU72M010	Gen-l Purp.	10"	40	68.58	34
LU81M010	Gen-l Purp.	10"	40	69.30	35
LU73M010	Cut-Off	10"	60	79.65	36
LU82M010	Cut-Off	10"	60	86.40	44
LU84M010	Combination	10"	40	70.99	36
LU84M011	Combination	10"	50	74.51	37
LU85M010	Super Cut-Off	10"	80	110.88	62
LM72M010	Ripping	10"	24	64.85	34
DS 306	6" Dado			139.00	92
DS 308	8" Dado			170.00	105
TR 100	3 blades & Dado set			399.00	255

MAKITA CORDLESS FESTIVAL OF VALUES

Model		List	Sale
4300DW	Jig Saw	158	99
5081DW	3⅜" Saw Kit	174	95
5600DW	6¼" Circular Saw	224	125
9035DW	Finishing Sander	128	73
6010DWK	⅜" Cordless Drill Kit	152	88
6010SDW	⅜" Cordless Drill	84	45
8400DW	⅜" Hammer Drill	188	105
DA3000DW	⅜" Angle Drill	176	98
6010DL	⅜" Drill w/Flashlight	162	89
6012HDW	⅜" 2 spd Driver Drill w/Bat & Metal Case	178	98
DK1002	⅜" Drill w/Flursnt Lt	164	90
6710DW	Cordless Screwdrvr Kit	148	84

DELTA BENCH TOP TOOLS

Model		List	Sale
11-950	8" Bench Drill Press	124	100
28-160	10" Bench Band Saw	158	125
40-500	15" Scroll Saw	105	85
23-680	6" Grinder Bench	62	50
23-880	8" Grinder Bench	99	85

MAKITA TOOLS

Model		List	Sale
BO4510	Sander	79	43
9900B	3"x 21" belt sander	198	119
9924B	3"x 24" belt sander	189	130
9924DB	3"x 24" b/sand. w/bag	214	130
9035	⅓ sheet finish sander	79	48
9045B	½ sheet finish sander	156	90
9045N	¼ sht fin. sand. w/bag	158	105
4200N	4⅜ circ. saw 7.5 amp	152	93
5008NB	8¼ circ. saw 13 amp	178	105
5201NA	10¼ circ. saw 12 amp	348	215
4300BV	v/sp jig saw 3.5 amp	192	120
4301BV	orb v/sp jig saw 3.5 amp	208	125
JR3000WL	2 sp recip saw w/cse	168	120
JR3000V	vs recip saw w/case	178	120

• • • MAKITA TOOLS • • • SPECIAL PROMOTION

Model		List	Sale
LS1000	New 10" Mitre Box	348	198
792210-7A	Carbide Bld for above	45	31
9820-2	Blade Sharpener	244	159
741074-9	60 (coarse) Grdg Whl	33	23
741070-7	1000 (med) Grdg Whl	30	22
741071-5	6000 (fine) Grdg Whl	43	30

Model		List	Sale
1900BW	3¼" planer w/case	154	92
1100HD	3¼" planer w/case	278	160
3608BK	¼ hp router w/case	132	85
3601B	1⅜ hp router	168	115
3700B	½ hp trimmer 28,000 rpm	124	82
BO4530	6" Round Sander	84	48
DA3000	⅜" angle drill	158	105
DP4700	½ v/sp w/rev' 4.8 amp	154	92
HP1030W	⅜ v.s.r. hammer drill w/case	145	98
6300LR	½" angle drill w/rev	229	152
841988-2W	½" s sp. hammer drill w/case	238	150
GV5000	Disc Sander	79	53
6800DB	2500 rpm 3.5 amp	123	79
6800DBV	0-2500 rpm 3.5 amp	133	89
6801DB	4000 rpm 3.5 amp	123	79
6801DBV	0-4000 rpm 3.5	133	89
2030n	12" planer/jointer	2160	1475
2040	15⅝" planer	1780	1195
1805B	6⅛" planer kit w/case	416	265
JV1600	var. speed jig saw	145	89
JV2000	var. speed orb. jig saw	165	100
5005BA	5½" circular saw 8 amp. with brake	154	98
9207SPC	7" var/speed electronic sander/polisher	209	130
9303BH	4½" sander-grinder kit	146	95
4014NV	var/speed blower	128	79

DOWL JIGS

MODEL	DOWL-IT	List	Sale
1000		32.95	23.95
2000		42.95	32.95
RECORD VICES			
520	7" jaw - 8" Opening	69.00	51.00
52½D	9" Jaw - 13" Opening	92.00	76.00
3M Co. Respirators			
#8500	Box of 50 - 10.00-Case of 600		89.00
#8560	Box of 15 - 13.50-Case of 180		135.00

buying from Seven Corners Hdw. . . . is a good Rule to follow.

Model	STANLEY	List	Sale
33-116	PL-316 ¾" x16' Rule	15.95	7.50
33-320	PL-320 ¾" x 20C Rule	16.95	7.95
33-425	PL-425 1" x 25' Rule	18.95	8.95
33-430	PL-430 1" x 30' Rule	20.95	9.95

1986 TOOL CATALOG AVAILABLE
Call Toll-Free 1-800-328-0457 — In Minnesota Call (612) 224-4859
4 WAYS TO BUY: CHECK — MONEY ORDER — VISA — MASTERCARD
SEVEN CORNERS ACE HDW. Inc.
216 West 7th St. • St. Paul, MN 55102 • Est. 1933

SAW-ATHON by PORTER CABLE

Model		List	Sale
#314	4½" Trim Saw	180	109
#346-1	6½" Top Hdle	161	100
#617	7¼" Push Hdle	166	96
#587	7¼" Speedtronic	199	125
#315-1	7¼" Top Hdle	166	96
#368-1	8¼" Top Hdle	176	110

• BELT SANDERS by PORTER CABLE

Model		List	Sale
#363	4" x 24" w/o Bag	280	185
#362	4" x 24" w/Bag	295	198
#503	3" x 24" w/Bag	510	350

DELTA #34-410 — 10"

CONTRACTORS SAW w/Stand & 1½ H.P. Motor
SPECIAL PRICE 679.00
FACTORY REBATE 100.00
579.00
FREE DELIVERY TO 48 STATES

TOOLS ON SALE™
AMERICA'S LOWEST PRICED TOOLS
★ **PLUS — FREE FREIGHT** ★
ON EVERY ITEM

SUPER CORDLESS SPECIALS from BLACK & DECKER

Model	DRILL KITS	List	Sale
1930	⅜" rev/hi speed	165	110
1950	⅜" High Torque	165	110
5930	Reversible Hammer	179	120
1970	⅜ rev/hi torque screwdriver	179	120
1980	Rev/adj. clutch Scrudrill	179	120

BRAND NEW! SUPER SPECIALS from MILWAUKEE

Model		List	Sale
0214-1	⅜" c/less drive/drill	159	109
8975	H.D. heat Gun, 11.6A Low 570°F - High 1000°F	74	49
5920	belt sander 3x24 w/o bag	289	199
5925	belt sander 3x24 w/bag	309	215
5930	belt sander 4x24 w/o bag	299	209
5935	belt sander 4x24 w/bag	319	214

PORTER-CABLE = NEW ITEMS +

Model		List	Sale
655	Drywall Driver 0-4000 Rev	115	85
367	3¼" Plane 6.5A	170	115
5009	Mortise & Tenon Jig	50	34
351	3" x21" Belt Sander	189	125
352	3" x21" Belt Sndr w/bag	199	135
9810	Cordless Screwdrvr kit	175	115
320	Abrasibe Plane 3A	129	91

★ ★ ROUTER RIOT ★ ★ by PORTER-CABLE

Model		List	Sale
100	7/7 H.P. 6.5 amp	141	98
630	1 H.P. 6.8 amp	150	100
690	1½ H.P. 8 amp	194	130
691	1½ H.P. D-Hdle 8 amp	218	145
536	1½ H.P. Speedmatic Double Handle	300	190
537	1½ H.P. Speedmatic Double Handle	315	215
520	3 H.P. Production	460	270
518	3 H.P. Micropressor 5-sp	490	345
TRIMMERS BY PORTER-CABLE			
309	3.8 amp laminate trimmer	130	90
310	3.8 amp laminate trimmer	190	135
312	offset base laminate trim	205	140
319	tilt-base laminate trim	215	150

★ X-TRA SPECIALS ★

MAKITA TOOLS		List	Sale
6010DL	C/less Drill w/flashlight-charger & case	162	90
DP3720	⅜ drill Rev. 0-1800 rpm	90	47
6510LVR	⅜ drill Rev. 0-1500 rpm	116	67
6013BR	½" Drill rev. 6 amp	174	100
5402A	16" Circular Saw-12 amp	468	315
2414	14" Cut Off Saw-13 amp	282	169
3612BR	3 HP Plunge Router	286	175
9401	4x24 belt Sander w/bag	248	160

PORTER-CABLE		List	Sale
696	H.D. Shaper Table	150	105
695	H.D. 1½ hp Router/Shaper	278	190
399	Drywall Cut-Out Unit	100	70
736	V/Speed Speedtronic Band Saw	450	330
7564	½" X.H.D. Drill 8 amp	205	145

BOSCH TOOLS		List	Sale
1581VS	Top Handle Jig Saw	225	126
1582VS	Barrel Grip Jig Saw	126	118
1604	1¾ H.P. Router	199	118
1942	Heat Gun 650°-900°	99	85
1272	3x24" Belt Sander	259	159
1272D	3x24" Belt Sander w/bag	274	169
1273	4x24" Belt Sander	274	169
1273D	4x24 Belt Sander w/bag	289	179

DELTA		List	Sale
34-010	Motorized Mitre-Box	231	149

★ NEW LOW PRICES ★ PONY CLAMP FIXTURES

Model		List	Sale	Lots of 12
#50	for ¾" Black Pipe	11.23	7.15	79.00
#52	for ½" Black Pipe	9.36	6.10	67.50

JORGENSEN HAND SCREWS

Model	Jaw Length	Open Cap.	List	Sale	Box of 6
#5/0	4"	2"	11.59	7.25	39.15
#4/0	5"	2½"	12.45	8.10	43.75
#3/0	6"	3"	13.36	8.50	45.95
#2/0	7"	3½"	14.36	8.95	48.35
#0	8"	4½"	15.97	9.95	53.75
#1	10"	6"	18.25	11.35	61.25
#2	12"	8½"	20.94	13.60	72.95
#3	14"	10"	26.56	16.75	91.35
#4	16"	12"	34.55	23.75	128.25

JORGENSEN BAR CLAMPS

STYLE 37 — 2½" Throat ¼" x ¾"

Model	Jaw Length	List	Sale	Lots of 6
#3706	6"	7.88	5.50	29.70
#3712	12"	8.73	5.95	32.13
#3718	18"	9.64	6.95	37.53
#3724	24"	10.54	7.35	39.69
#3730	30"	11.76	8.25	44.55
#3736	36"	12.85	8.95	48.33

Who Has The Saws That Cut It Across The Board?

BLACK & DECKER of course!!!

Model	WORM DRIVE SAWS	List	Sale
3050	6½" 12 amp - 4600 rpm	247	169
3051	7¼" 13 amp - 4300 rpm	232	149
3052	8¼" 13 amp - 4300 rpm	247	169
SUPER SAWCATS			
3047-09	7¼" w/brake - 12.5 amp	226	149
3048-09	8¼" w/brake - 13 amp	240	155
BUILDERS SAW CAT			
3030	7¼" 13 amp - 5800 rpm	155	100
3035	8¼" 13 amp - 5800 rpm	175	125
3034	7¼" 13 amp - 5800 rpm	162	115
3033	6½" 13 amp - 5800 rpm	162	115
JIG SAWS			
3157-10	var/sp orb action d/hdl	174	115
3153-10	var/speed 4.5A 0-3100	158	105
3159-10	2/sp orb action barrel grip	178	120
CUT SAW KITS			
3103	2 sp 6 amp-2400 strokes	163	100
3105	v/sp 6 amp-2300 strokes	170	110
3107	v/sp orb 6A 0-2300 strokes	183	119
4300	Drill Bit Sharpener	289	205
1321	½" drill 450 rpm 6 amp	175	115
4010	Palm Sander	80	48
4015	½ Sheet Finish Sander	160	105
DRYWALL GUNS			
2034	v.s.r. 0-4000 rpm	121	79
2037	v.s.r. 0-4000 rpm	139	89

"Door Openers" from MAKITA

Model		List	Sale
9501B	4" Grinder Kit	119	55
2708	8¼" Table Saw	348	199
5007NB	7¼" Circ. Saw	158	94

MILWAUKEE BUY OF THE YEAR

Model 6365 — 7¼" Circular Saw
List $159.00 Sale $99.00
Lots of 3 — $289.00

Brand New • PORTER CABLE

Model 7548 Top Hdle Jig Saw
LIST 199 — SALE 129.95
Model 7648 Barrel Jig Saw
LIST 199 — SALE 129.95

PORTER-CABLE

Model		List	Sale
9548	HD v/s bayonet saw w/case	255	169
9627	2 sp. tiger saw kit 8 amp	193	130
9629	V/sp. tiger saw kit 8 amp	204	135
505	H.D. ½ sheet finish sander	175	100
330	spd bloc sander ¼ sheet sz	87	54
304	Professional 7" disc sander	169	120
305	Professional 7" polisher	169	120
7511	⅜" xtrahvy v/s drill 5.2 amp	164	115
7554	½" xtra hvy drill 8 amp	210	150
9652	Versa-Plane Kit	419	285
9118	Porta Plane Kit	289	190
DRYWALL SHOOTERS			
7544	5.2 amp — 2500 rpm	158	105
7545	5.2 amp — 0-2500 rpm	158	105

AEG POWER TOOLS

Model		List	Sale
EZ 501	C/less Scrwdrvr **Brand New**	59	35
EZ 502	C/less Scrwdrvr-190 rpm	98	52
EZ 505	C/less Drill/Driver	139	79
EZ 506	C/less Electronic Drl/Drvr	159	94
EZ 581	C/less Caulk Gun var/sp	179	106
SCR1E	Drywall Screwgun 0-2000	125	74
SCR11E	Drywall Screwgun 0-4000	125	74
BE8RL	⅜" var/sp drill 3.8 amp rev	86	51
BE10RL	⅜" var/sp drill 5 amp rev	125	74
SBE401RL	⅜" Ham Drill v/sp h.d.	88	52
SE2E13RL	½" Ham Drill 2 sp h.d.	169	101
TC25E	Tech Driver v/sp 5 amp	150	89
PC70	7¼" Circular Saw 12 amp	157	93
VS130	Orb Sndr 20,000 OPM ⅓ sh	75	48
VS260	Orb Sndr 25,000 OPM ½ sh	156	88
VSS260	Orb Sndr 25,000 OPM w/bag	189	118
Hbse75S	Belt Sander v/sp 3" x 21"	199	118
BSPE60	Jig Saw Orb v/sp 4.6A w/case	214	127
RSK600	Recip Orb Saw 10 amp	229	136
ROTARY HAMMERS			
PHE 16RL	3.8 amp ⅝" capacity in concrete	269	175
PH 210	5.2 amp ¾" capacity in concrete	398	260
PHE 20	Same as above — except var/sp 0-750	418	270
PHD 26	6.3 amp 1" capacity in concrete	495	320
PH 38	7.5 amp 1½" capacity in concrete	549	355

All above complete with cases

SKIL TOOLS		List	Sale
551	5½" Circ. saw 6.5A	99	73
77	7¼" Worm Saw	240	135
367	6½" Worm Saw	239	135
825	8¼" Worm Saw	270	165
807	7¼" Skilsaw 13A-Super	153	100
808	8¼" Skilsaw 13A-Super	172	110
2016-02	⅜" Cordless Drill complete W/Charger, Case & 2 batteries	199	95

Fred's hobby shop is giving cousin Fred as much pleasure as Mr. Sauer's hobby shop is giving Mr. Sauer.

—Jack Saltzman, Balboa Ancon, Republic of Panama

Good article by Jim Cummins on hide glue (*FWW* #57). Some points from my 15 years as a harpsichord maker. First, a gel depressant, like urea, might weaken joints locked by hide glue. I recall the sadness of a fellow maker who had to remove and re-secure a wrestplank (the block holding the tuning pins) which had broken loose inside the case of one of his first harpsichords. He'd used liquid hide glue to hold it in place.

On strength: there is a thin piece of wood running around the inside of a harpsichord case into which the hitchpins, opposite the tuning pins, are driven. In modern instruments one often sees screws holding this rail tightly to the case. Not in antiques. There are perhaps 122 strings, each pulling with a force up to 20 lb. and, on certain antiques, the rail hasn't budged. The first instrument I made suffered from creeping hitchpin rail after a year because I'd used yellow glue.

The best glue I've found is one I don't use regularly, because of its cost. Rabbit skin glue is a beautifully clear and quick-mixing powder of incredible strength sold at large art-supply houses (or from Conservation Materials Ltd., Box 2884, 240 Freeport Blvd., Sparks, Nev. 89431). I've never lost a hitchpin rail since I started using it for critical joints. The only problem I've had with it occurred some years ago. My small daughter asked "What kind of glue are you using?" Without thinking, I replied, "Rabbit skin glue." A deadly silence. She recovered before I did; "Daddy, you always like to make the worst jokes." *—Bob Greenberg, San Francisco, Calif.*

Jim Cummins' article on hot hide glue (*FWW* #57) prompted me to try the stuff on a dovetailed carcase. After the clamps came off, I pared off the protruding ends of the pins with a chisel, then grabbed my year-old Stanley block plane to finish the job. After one slice, the plane wouldn't cut. I opened the mouth a little and lowered the iron. Still wouldn't cut, and I'd just sharpened the thing. I took out the iron and found that the dried hide glue had completely turned the edge. The edge of my super-hard (RC 63?) Japanese chisel was still intact, but the hard glue had left tiny scratches on the back of even that hard steel. Next time I'll scrape off the hide glue before it hardens. *—Lazlo Spectrum, Tucson, Ariz.*

JIM CUMMINS REPLIES: The culprit in the harpischord case was not the urea. It's most likely that the liquid hide glue had exceeded its one-year shelf life—always test that a drop of liquid glue dries rock-hard overnight before trusting it. Fresh glue dries hard enough to scratch steel, as reader Spectrum discovered.

I thoroughly enjoyed your recent article about hide glue (*FWW* 57). However, the last sentence of the article is in error. Paper is definitely not held together by glue. Paper is mostly cellulose plant fibers which have been macerated (beaten), suspended in water and deposited in a layer on some sort of porous surface, like a screen. The fibers are held together by hydrogen bonding. Glue sizing is added to give paper various desirable properties including stabilizing the dimensions (unsized paper swells and shrinks with the seasons, as wood does). *—Timothy Moore, Madison, Wis.*

I am sure many small shops and weekend woodworkers are not able to afford routers and cutters to make raised panels (*FWW* #57). Many people do have radial saws and they can get a small rotary planer (available from Sears) for the end of the shaft. I have used one and it does a fine job as you can set it for any width or bevel you need. *—Evans Downing, Pottstown, Pa.*

Re M.F. Marti's letter on tablesaw safety in *FWW* #57. I felt Mr. Marti has forgotten about all the subscribers who are less experienced than he is. I teach woodworking on the high school level and am fortunate enough to see people with different levels of experience work. I've seen a tablesaw kick back on some of my less experienced students. No one has been hurt and I intend to keep the guard on the machine. I share Mr. Marti's attitude towards some guards. Their design merits removing them from the machine and placing them in some long-forgotten back room. There are, however, some very good guards on the market that I wouldn't hesitate to put on my machine. The Bret Guard (available from HTC Products, 120 E. Hudson, Royal Oak, Mich. 48067) being one of them.

—Rolf Warncke, Oak Ridge, N.J.

The only bone I have to pick is your use of "the serious woodworker." My woodshop, like many, is in the basement of my home. It's small, cramped and, yes, it is filled with mostly Craftsman tooling from Sears. I am building a grandfather clock that I won't be able to stand up till I get it upstairs. Now that's a small shop. But, I am serious. Whether I'm building a bird feeder or a grandfather clock, I am serious.

So, in your reviews of machinery, please don't use "serious woodworker" when you should use "professional woodworker." Just because I use a $400 saw instead of a $2,000 saw does not make me less serious. Slower yes; less serious no. If it were not for companies like Sears, there are many of us who could not enjoy woodworking. We wouldn't be able to see, feel and smell a board turning into a thing of beauty. Even if you use a penknife to create a carving, it is serious business.

Keep up the excellent work on the magazine but don't forget us "unserious" people out there.

—Steve Schwab, Toledo, Ohio

With respect to formaldehyde, there seems to be some question these days about how serious a threat it is to health. However, reader Carnell is dead wrong about his conclusions on combustion (Letters, *FWW* #57). Wood products, coal and added trash are *not* burned completely in a closed space heater or fireplace; if they were, we would not need chimney sweeps. Heat accompanied by steam causes a low-grade destructive distillation in all our solid-fuel home-heating systems. I found my neighbor sniffing the air one day when I had thrown old resin-coated sanding belts into our stove. A burning candle is one thing; an oxygen-starved stove is something else. McCann is right. *—Vernon Raaen, Oak Ridge, Tenn.*

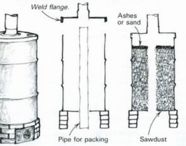
Re "One Sawmill to Go" (*FWW* #57). Mention was made of straining to put the first log on the mill with one man pushing and another using a peavy. A very important safety factor was overlooked. Never roll a log up an incline that you can't hold with your body or bodies easily. If the log is big enough to require a peavy or cant hook it would be best to use another method. The hook on the tool can disengage. I do not plan on being on the downhill side of a log when a hook lets loose.

—Lee W. Dodd, Niles, Mich.

The wood stores are full of brilliant woods, some of which are going to disappoint some woodworkers badly. If you have ever seen an old piece of amaranth (purpleheart) you would never guess that the ordinary brown you see started out purple. Pink ivory will turn red, it won't stay pink. Brilliant yellow osage orange will be a nice teak brown if you leave it in the light for a month. Some woods improve with age, others go lousy. Maybe someone at the Forest Products Laboratory has a paper on this. It sure needs to be published.

—John W. Wood, Tyler, Tex.

Homebuilt sawdust-burning shop heater



If you've ever looked at the huge pile of sawdust and planer shavings that even a small shop produces and wished you could burn it for heat, here is an inexpensive but efficient solution based on an ordinary 55-gal. steel drum.

Construction of the stove is relatively simple. Because you have to open up the stove every day for loading, what you're after is a removable lid that can be easily assembled or disassembled from the stovepipe. First cut the top off the drum right below the lip. Fashion a retainer ring of strap iron and weld it around the top to produce a removable lid, as shown in the sketch. Cut a hole in the center of the lid and attach a 6-in. stovepipe adapter flange to the middle of the top. You will also need to cut a 4-in. hole in the center of the bottom of the drum for the fuel packing pipe, explained below. Set the stove up on an airtight ring of firebricks (use fireclay for mortar) laid right on your cement floor. If possible, add a scrounged door from an old woodstove to regulate air and to provide an access for cleaning out ashes—this was an improvement we added the second year; the first year we blocked off the air with the lid of a 5-gal. paint can.

How this stove works is truly amazing. The secret is leaving a chimney hole right through the fuel after it is packed. To do this you just remove the stove's lid and insert the "fuel packing form" (a length of 3½-in. plastic sewer pipe) down through the hole in the bottom so that it sticks up out of the top of the drum. Now load the drum with planer chips, sawdust, floor sweepings—anything that will burn. Pack it down tightly around the plastic pipe until the drum is full to about 5 in. or 10 in. from the top. Sprinkle the top of the packed sawdust with sand or ashes so it won't burn anywhere but in the middle. Pull the plastic pipe out of the packed fuel, replace the lid and light a small fire underneath the barrel.

A full drum will heat our 3,500-sq.-ft. North Carolina shop for eight hours with no attention. Since we are burning kiln-dried wood chips, the flue gasses are clean and combustion is complete. When the stove is going strong no smoke comes from our chimney—only clear, hot gasses.

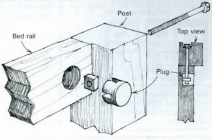
—Paul G. Caron, Cashiers, N.C.

Quick tip: To work glue into a crack, try using an auto feeler gauge as a spatula. *—Charles Moyer, Peninsula, Ohio*

Plug locates nut

Embedded nuts are a convenient joinery technique for beds, trestle tables and other projects that may have to be knocked down for moving or storage. The method shown here, in which a square nut is held in place by a slotted dowel plug, has some nice features and can be adapted to a variety of sizes. My usual combination is a standard bedbolt and nut (available from most period hardware suppliers) with a 1-in.-dia. dowel. For clarity, the drawing omits the stub-tenon on the rail and the mortise in the post, which, if you use just one bolt, are necessary to keep the joint from twisting.

I slot the end of the dowel by running it over a ⅜-in. dado blade in the tablesaw. I've devised holding and indexing jigs that attach to my miter gauge for this job because I make about a year's worth of plugs at one time. For just one or two projects, you could use a regular blade and make two or three side-by-side passes until the slots are wide enough to accommodate the bolt and nut. It would be a good idea to use the end of a 2x4 scrap as a push block to keep the dowel vertical and prevent it from kicking back. The depth of the slot should allow the end of the inserted nut to be just flush with the end of the dowel. Then cut the plug off a little longer than necessary—as it will be smoothed flush after it is glued in place in the rail—and continue cutting plugs until the dowel gets too short to handle safely.



The plug gives a nice inside finish to the rail, stops the nut from turning, and prevents the nut's corners from cutting into the rail, which would eventually loosen the joint.

Alignment of the holes is critical. One trick is to drill the bolt-holes in the bed's posts on the drill press, to ensure that they are centered and straight, then, with the joint assembled, use an electric drill (with the holes in the bedposts as pilots) to continue the bolt-hole into the rail. Size the depth of the dowel-hole in the rail so that the bolt engages the nut smoothly. Test the alignment before gluing the dowel and nut in place; if you are a little off, you can enlarge the bolt-hole somewhat without weakening the joint much.

—Christian Becksvoort, New Gloucester, Me.

Consistent dadoes on the tablesaw

The secret of this simple wooden tablesaw insert is the hump in the middle. Because the work will touch only at the high point of the hump, dadoes and grooves will be consistently the same depth regardless of slight waves and warps in the wood.

—David Ward, Loveland, Colo.

Sheet-metal sanding shield

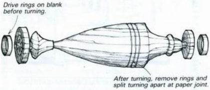
Whenever I sand panel frames or other woodwork where it is difficult to avoid getting cross-grain scratches on adjacent surfaces, I use a very thin piece of sheet metal in much the same way as a draftsman uses an erasure shield. I hold or clamp the shield over the section I want to protect and then just sand right up to and over it. In a similar way I can drill or cut out

shapes from the center of a sheet that allow a tenon or plug, for example, to stick through and be sanded without affecting adjacent areas. The sheet metal I use is some 28-gauge stainless steel that I found at a surplus and salvage store. It's thin, less than $\frac{1}{64}$-in., yet can withstand occasional belt sanding.

—Sandor Nagyszalanczy, Santa Cruz, Calif.

Quick tip: Paraffin wax makes a good finish for wooden toys. Warm the wood, then rub on paraffin that's been melted in a double-boiler (melt it carefully—paraffin is extremely flammable). The finish is safe, non-staining and can be polished to a dull luster. *—Keith Hacker, Scandia, Minn.*

Compression rings for split turnings



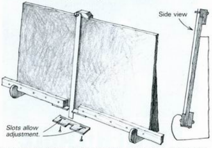
Half-round turned columns and finials make attractive decorative elements on clocks and chests. These are usually made by gluing up a laminated turning blank with paper between the pieces. After turning, the halves are separated by inserting a thin knife into the paper joint.

One drawback with this technique is that the lathe centers can wedge apart the weak paper joint when the blank is tightened on the lathe. To avoid the problem I use compression rings, driven in each end of the workpiece, to hold it together during turning. I make the rings from thin-wall tubing (conduit) by sharpening one end with a file, then I drive the rings about $\frac{1}{4}$ in. into each end of the turning.

—Norman Brooks, Greenville, Penn.

Quick tip: When sharpening on the grinder, I chill my tools in ice-water. Heat builds up more slowly in the cold metal, making the whole operation much more relaxed, and therefore more accurate. *—Milton B. Ketter, El Sobrante, Calif.*

Wall-hung right-angle marker



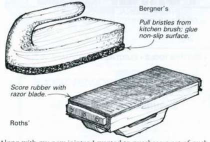
In my modelmaking/prototype shop much of our layout work requires quick, accurate right-angle scribe marks on thin materials ($\frac{1}{16}$ in. to $\frac{1}{2}$ in.). Frustrated with inaccurate and easy-to-knock-out-of-square framing squares, we built this wall-hung right-angle scribing unit that can accommodate materials as wide as 34 in. The main part of the unit is a 3-ft.-tall, 4-ft.-wide panel of cabinet-grade particleboard fitted with a two-piece 1x2 hardwood ledge screwed to the bottom edge. Other components include a stainless steel ruler that hangs from a pin at the top and is indexed by a notched plate at the bottom.

We turned a threaded rod to make the ruler-pin; it must fit the hole in the ruler exactly. At the bottom of the notch-plate assembly is the key to the unit's accuracy, a $\frac{1}{8}$-in.-thick steel plate about 3 in. wide and 6 in. long. File a notch in the plate carefully, so that it is just as wide as the ruler and no more. Screw the notch-plate to the bottom of the assembly through slotted holes so that the ruler-notch can be adjusted left and right. You can trial-and-error the ruler into perfect square by scribing a line on a test piece then flipping the test piece 180°. If the scribed line on the flipped test piece matches the ruler, it is square. If not, adjust the notch-plate and try again.

The unit works best when it is tilted back from vertical. The drawing shows a quick, if crude, way to support it with two wall brackets. This allows it to be lifted out if there is a need to use it elsewhere. *—Ed Stringham, East Bethany, N.Y.*

Quick tip: If you need an unusual-size hole, you can make a regular twist drill bit cut a hole slightly larger than its nominal size by grinding one cutting edge a little longer than the other, so that the point is off-center. *—Michael Turi, Arcata, Calif.*

Two non-slip push blocks



Along with my new jointer I wanted to purchase a set of push blocks—the kind with a molded plastic handle and $\frac{1}{4}$-in.-thick black foam material on the bottom. But when I found the set was priced at $16, I promptly left the store without them.

The next day I happened to bump into a kitchen brush sale and realized that, except for the bristles on the bottom, the $.55 brushes were virtually identical to the expensive push blocks. So I bought a pair, pulled out the bristles with pliers and glued a Scotch-Brite pad to the bottom for a non-slip surface. Felt and sandpaper or dense foam could have been used equally well. The total project took 30 minutes and cost $2.50 to complete. *—Mitch Bergner, St. Louis Park, Minn.*

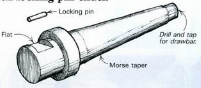
When I needed a non-slip, non-mar push block for pushing panels through the shaper I borrowed an idea from boat shoes. I attached an innertube scrap to the bottom of a shopmade block and scored the tube with a razor blade about $\frac{1}{32}$-in. deep every $\frac{1}{4}$ in. or so. The slices open up slightly under pressure and really grab the wood. *—Mike Roths, Vinton, Iowa*

Melting shellac sticks with a hot-glue gun

The experts say that melting a shellac stick with a hot knife is the best way to fill imperfections (see *FWW* #34). But when I tried, my lack of expertise with a hot knife produced an awful,

uncontrollable mess. So I retrieved my hot-glue gun from the box labeled *things I wish I had never bought* and discovered, to my delight, that the glue gun is an excellent shellac stick applicator. It heats the material to just the right temperature and puts it just where I want it. To conserve material, I cut off only the amount of shellac I need and use a short length of dowel as a piston to push the shellac stick through the barrel of the gun. —*Stephen Kelly, Birmingham, Ala.*

Self-locking pin chuck

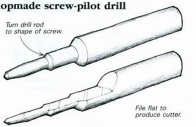


This lathe chuck features an ingenious self-locking mechanism that allows quick and easy mounting and dismounting. It works equally well in both forward and reverse rotation. The chuck is ideal for projects with predrilled, centered holes, such as candlesticks, bud vases, wooden flutes and the like. You simply mount the hole over the end of the chuck to turn the profile.

To make the chuck, start with a length of mild steel bar. Turn a Morse taper on the tail of the chuck to fit your headstock. Then turn the head of the chuck to fit a predrilled hole in your turning blank—¾ in. for example. Now file a flat spot on the head, as shown in the sketch. The depth of the flat should be just a bit greater than the diameter of the locking pin. The locking pin is nothing more than a piece of nail almost as long as the flat.

To use the chuck, first drill a hole the same size and depth as the head of the chuck in your workpiece. With the locking pin centered in the flat, slip the workpiece on the chuck and rotate the work until the pin wedges and locks the workpiece in place. The chuck will lock in either direction—be sure you lock the work opposite the way your lathe will be turning. If you don't, tool pressure will unlock the chuck while you work. —*John G. Martin, Cumberland, Me.*

Shopmade screw-pilot drill



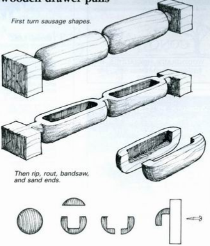
Most woodworkers are familiar with the special bits that drill a combined pilot hole, counterbore and countersink for screws. They are quite useful when you have a large number of screws to install. Unfortunately, these tools are not available for screws smaller than No. 6 or for other odd sizes and shapes. Here's how to customize your own to fit any screw.

Start with a length of oil-hardening drill rod, available at any industrial distributor or machine shop. Chuck the rod into a metalturning lathe and machine the end to the desired shape of the screw hole. If you don't have access to a metal lathe, chuck the rod in a drill press, a wood lathe, or even your electric drill and file the rod to shape while it is rotating. Taper the transition points to avoid sharp internal corners that would lead to stress points and possible breakage later.

To produce a cutting edge on the tool, file away exactly half of the cutter using care not to round over the edges. Now harden and temper the cutter with a propane torch (see *FWW* #50 for more on hardening and tempering). Whet the flat side with an oilstone and the cutter is ready to use. —*John G. Martin, Cumberland, Me.*

Quick tip: When gluing up tabletops or other projects made from several boards, it is difficult to keep the surfaces aligned. One or another board in the assembly gets contrary, despite the various tricks for keeping things flat. I have found that I have much less trouble if I glue and clamp just two boards, then, when the joint is dry, add the others one at a time until the job is done. It takes longer, but saves a lot of surfacing time in the long run. —*R.B. Rennaker, Kokomo, Ind.*

Wooden drawer-pulls



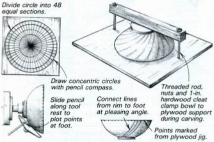
When I couldn't find any solid oak drawer-pulls that I liked, I devised this method to make my own. To make four pulls, mount a 12-in.-long, 2-in.-square blank on your lathe. Turn two 4¼-in.-long, 1¾-in.-dia. sausages. Then rip or plane ½ in. off one side of the sausages to produce a flat face. Rout hollows in the flat with a core-box bit as shown in the sketch. To complete, split the blank lengthwise with a bandsaw, cut the rough pulls apart and finish the rounded ends with a disc sander. Install the pulls with two screws—one each into the solid wood on both ends. —*Gary P. Korneman, St. Joseph, Mo.*

Methods of Work buys readers' tips, jigs and tricks. Send details, sketches (we'll redraw them) and photos to Methods, Fine Woodworking, *Box 355, Newtown, Conn. 06470. We can acknowledge contributions only when the final decision has been made. We'll return those that include an SASE.*

Carving fluted bowls

I am intrigued by pictures of Alan Stirt's fluted bowls (FWW #56). Is the fluting that spirals down the side of his bowls done with a special jig? I would like to carve the same curls on some of my own work. *—Howard V. Nelson, Albany, Ore.*

Alan Stirt replies: I used to carve the flutes by hand, but now I use a Rakuda flexible shaft power carver, which has a gouge attached to a flexible shaft with a reciprocating head (available from Woodline, The Japan Woodworker, 1731 Clement Ave., Alameda, Calif. 94501). The power carver takes most of the muscle out of the carving, and efficiently cuts a smooth curve. I lay out the flutes using the simple plywood indexing jig shown in the drawing, then follow the lines by eye, carving from the foot to the rim as much as possible.



To lay out the flutes, place the turned bowl on the plywood jig, and center it by eye within the concentric circles. Don't remove the faceplate from the bowl, nor sand the area to be carved—grit from the sanding will dull the carving tool quickly. Mark the rim of the bowl where it intersects with the 48 lines on the plywood. Next, remount the bowl on the lathe and use the tool rest as a pencil guide to transfer the 48 points on the rim to the bottom of the bowl. If you have a lathe with an indexing mechanism, you could skip the plywood layout guide and mark the rim and bottom directly from the tool rest. The swirl or spiral effect is created by connecting the points on the rim and the bottom at a pleasing angle with a piece of cardboard or other flexible straightedge. I choose the angle by eye (different angles can be drawn, so decide which best fits the piece you're working on). Because you're bending the cardboard along a curved surface, you'll be drawing a curve rather than the expected straight line. If the bowl is thin, I use the holding device shown on the plywood jig to support the bowl while I'm carving.

You have to carve carefully, since you'll be cutting against the grain in some areas. If you get considerable tearout, reverse your direction of cut. I intentionally don't use a mechanical jig to guide the cut because I don't want machine-like precision. The flutes can be cut quickly in three or four passes of the gouge. After carving, coat the flutes with your favorite oil finish, let the oil dry, and rub the flutes with a fine Scotch-Brite pad (an abrasive similar to 000 steel wool which can be found in auto supply and hardware stores). To smooth the flutes more, use 400-grit wet-or-dry sandpaper and oil.
[Alan Stirt is a professional woodturner in Enosburg, Vt.]

The acoustics of clocks

After reading recent articles on clockbuilding (FWW #56, #57), I began studying some of the clocks in my area before trying to build my own. I've been impressed by the variety of sounds they produce. Some seem very clear and bright; others are very muffled. Is that due to different types of chimes, or does the clockcase design affect the sound?
—W.B. Lord, Baltimore, Md.

Howard Lawrence replies: A clockcase can be much more than just an ornamental housing for a clock movement. A well-designed case can increase the loudness of the sound, and it can improve the tone quality by emphasizing certain sound ranges, reducing others, and increasing the duration of each note. A poor acoustic design can smother the most pleasing parts of the best chime tones and significantly muffle the sound.

Strike and chime tones are often generated by striking bells, rods or tubes. The rods may be straight or coiled. Special metal alloys help bells and chimes produce clear, sustained tones. A hard-faced hammer produces a tone with high harmonic or overtone content, sometimes called a bright tone. A softer-faced hammer produces a more mellow tone with fewer harmonics.

How and where a bell, rod or tube is struck affects both the tone and volume. Rods and tubes vibrate in several modes simultaneously. In general, the closer the strike point is to the rod's mounting, the greater its harmonic content. Try changing the striking point until you hear the most pleasing tone. The vigor of the hammer blow also affects the tone. This vigor is determined by the strength of the spring driving the hammer and the distance traveled before the hammer strikes.

Reverberation within the clock case, and the resonance of the surfaces of the case can modify the chime and strike tones, increase their loudness and help sustain the tones, much as a guitar body affects the sounds made when the strings are plucked. For the best sound, the walls of the case should be thin enough for the sound waves to make them vibrate, and they should be made of a hard, acoustically resilient wood. Sitka spruce, hard maple and black cherry are excellent choices for clock cases. Each piece should be a panel of solid wood, not plywood. If you have to glue up several boards to make the panel, use a thin layer of urea-resin glue or another glue that dries hard. If you tap the wood before and after assembly, you should be able to get some idea of how the wood's acoustical quality will affect the sound of the clock. The wood should have a musical quality when tapped, not a dead sound. The smaller the clock, the thinner you should make the case walls. The hood sides of a tall case clock should be less than ½-in. thick. The waist and back board should also be thin. A small mantel clock should be built from ¼-in.to ⅜-in stock to produce the most pleasant and loudest tone.

The mounting used for the chime rods and bells is an important sound path. The iron castings on which rods are often assembled should be solidly mounted to the back of the case, preferably with steel bolts drawn up tight and steel washers under the heads. If a spacer is needed, it should be a single piece of cherry, maple, or other hard acoustically resilient wood fastened to the back with a thin layer of urea-resin glue. The iron casting should then be tightly bolted all the way through with steel screws and nuts. The chime assembly shouldn't be mounted to any auxiliary structure in the case.

The chime and strike tones must escape through some opening in the case, through the walls by vibrating them or by conduction through the clock's mounting feet or base. The thin, solid panels of resilient wood used to achieve good tone help the sound escape by their being vibrated, then radiating the sound like loudspeakers. You can sometimes feel the panels vibrating by lightly pressing your fingernail or knuckle to the surface.

Much of the sound from a small table or mantel clock is transmitted through its feet or base into the table or shelf on which it rests. For this reason, feet should be solidly made from a suitable wood mounted with hard-drying glue. Don't put felt or other sound-insulating material between the legs or

base and the surface on which the clock sits. In an ideal location (a wood mantel mounted to a wood-paneled wall that produces a good tone when tapped, for example) the mantel and wall resonances can significantly improve both the tone and volume. I had a mantel clock that could be heard only in the room in which it was located when a pad was placed under it, but which could be heard clearly on the second floor of the house when the pad was removed, and the quality of the sound was noticeably better.

While not part of the case design, you should realize that where the clock is installed affects its performance. Hard walls, tables and floors help to provide bright, sustained tones, whereas heavy drapes, carpeted floors and cloth table covers absorb much of the sound, especially the higher frequency sounds that add much to the brightness of the chimes.

[Howard Lawrence is a retired electronics engineer who has studied acoustics and designed loudspeakers and microphones.]

Where does bloodwood come from?

What can you tell me about bloodwood or cardinal wood? Where does it come from? Are there other names for it?

—Bob Freese, Ceresco, Neb.

Bruce Hoadley replies: Bloodwood is the commercial name for *Eucalyptus corymbosa* from Australia. The wood is usually a uniformly deep red or dark reddish-brown, fairly hard and heavy (specific gravity averages 0.75. In contrast, the specific gravity of black walnut is about 0.55). The wood is considered difficult to work since it's usually roey with interlocked grain, but it takes a smooth polish.

The name bloodwood is also sometimes applied to species of *Pterocarpus*, such as padauk from Africa and sangre from South America, which can vary considerably in color. Bloodwood and cardinal wood have been used as the common or trade names for satine (*Brosimum paraense*) from northern South America. This wood varies from a bright lustrous red to variegated shades of red and yellow. It is very heavy (specific gravity 0.95) but is fairly straight grained, and reasonably easy to work and carve.

[Bruce Hoadley is professor of wood technology at the University of Massachusetts at Amherst.]

Keeping purpleheart purple

I have a desk made of amaranth (purpleheart). The wood has a wax finish, and in four years has changed from a bright purple color to deep reddish-brown. Can I restore the desk to its original purple and preserve the color?

—Malcolm Fleming, Taos, New Mex.

David Shaw replies: Restoring the purpleheart color is easier than maintaining it, and you'll have a better chance of preserving it if you use something other than a wax finish. First of all, scrub the piece with turpentine, then rinse it with water to clean all the wax and other impurities off. You'll probably notice some of the purple color returning right away.

After letting the piece dry, sand it very lightly with 220-grit paper to remove the grain whiskers raised by the water. Sand gently in a circular or figure-eight motion, making sure every bit of the surface is covered. This type of sanding will remove all the raised grain (if you sanded only with the grain, you would push some of the grain back down, rather than cutting it off) and removes tiny amounts of surface material. Finish sanding with 320-grit or 400-grit sandpaper with the grain and you should be back to the original color.

There are numerous theories about how to maintain the color. The one thing that everyone agrees on is that light is at least partly responsible for the fading. This leads to a dilemma. You can hinder the passage of harmful ultraviolet rays in light with inhibitors (spar varnish is an example of a finish containing ultraviolet inhibitors), but you will be sacrificing the clarity and color of the wood by doing so. And why bother preserving the purple color if the finish makes it difficult to see it?

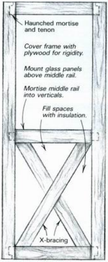
I would suggest several possible alternatives: you can refinish the piece every five years or so. I'd recommend you use tung oil for resiliency and ease of application and removal. It will hold the color longer than plain wax. If you want to try a light-inhibiting finish, try spar varnish thinned 50/50 with paint thinner and tung oil. Finally, you can cheat. Get a water based aniline dye that matches the original color of the desk and apply it before finishing.

[David Shaw is a writer and finisher in Kelly Corners, N.Y.]

Insulated torsion boxes for doors?

I would like to make a pair of insulated doors, about 32 in. by 80 in., with large triple-glazed windows. I was planning to build the doors like torsion boxes (FWW #32) and fill the interior grids with Styrofoam for insulation. The lightness and strength of a torsion box appeal to me, but I'm worried that the cutouts for the large windows will weaken the assembly too much.

—Steve Anthony, Minneapolis, Minn.



Simon Watts replies: Although hollow-core doors for interior use are actually torsion boxes, I don't think torsion-box construction is the best method for a heavy exterior door. Torsion boxes are designed to resist twisting and bending stresses. These forces don't operate on doors in normal use. The force you most often are concerned with is the tendency of any door to sag. This can be a real problem with a large door like this one. To effectively oppose this force, you can use stiff corners, diagonal bracing or a rigid skin, or sometimes all three methods together. You didn't say what the exterior skin of the door would be, but plywood would be the best bet to prevent sagging.

If you want to use torsion boxes, though, I suggest you use twin mortise-and-tenon joints, preferably haunched at the corners, and a middle rail mortised into the verticals. Above this member you can install your glass, below it you can use diagonal bracing, as shown in the sketch. Fit the braces tightly into the corners, then cut the insulation to fit in the triangular spaces.

[Simon Watts is a cabinetmaker, teacher and boatbuilder in San Francisco and Nova Scotia.]

Reader exchange

Blades for cutting jigsaw puzzles. The blades are 5 in. long, 20 teeth per inch, .008 in. thick and .035 in. wide. The only blades I can find are .10 in. thick.

—Anne D. Williams, Lewiston, Me.

Send queries, comments and sources of supply to Q&A, Fine Woodworking, *Box 355, Newtown, Conn. 06470.*

Great Products - Great Prices!

Don't Buy Powermatic

until you've talked to us!

Model 66 10" Table Saw	Call
Model 26 Heavy Duty Shaper	Call
Model 60 8" Long Bed Jointer	Call

We carry the entire line of Powermatic working machinery. Please call for the best prices available on these fine tools. FOB Factory.

MACHINERY

2030N	**MAKITA** jointer/planer	CALL
2040	**MAKITA** 15-5/8 planer	CALL
F1000-A	**HITACHI** jointer/planer	CALL
P100F	**HITACHI** 12" planer	CALL
CB75F	**HITACHI** bandsaw	CALL
HC260	**ELEKTRA BECKUM** jtr/plnr	CALL
TF100	**ELECTRA BECKUM** shaper	CALL
SP1000	**ELEKTRA BECKUM** dust clr.	CALL
M/MX-2	**HEGNER** precision saw	CALL

Introducing Mini-Max!

The Xylophile's Co. is proud to offer the **Mini-Max** line of woodworking machinery. Made to exacting specifications, we feel these tools represent the best value available to the advanced craftsman today. Please call or write for information on the complete line of **Mini-Max** machinery.

Listed below are specs on two **Mini-Max** machines. Examine these and see if you don't agree with us.

FS-35 Jointer-Planer
Table Width 13½"
Table Length 63"
Weight 719 lbs.
3 HP, 1 PH or 3 PH Motor
Magnetic Controls
Cast Iron
$2095.00 Freight Collect

S45 Bandsaw
18" Throat Depth
10.8" Resaw Capacity
330 lbs.
1.5 HP Motor
Table Tilts to 45°
Cast Iron
$1049.00 Freight Collect

Prices Valid thru August 31,1986

MAKITA

B04510	4" finishing sander	$ 47.00
DP3720	3/8" var/rev. drill	49.00
1100	3-1/4" planer kit	164.00
1900BW	3-1/4" planer kit	94.00
1805	6-1/8" planer kit	264.00
2708	8-1/4" table saw	209.00
LS1000	10" miter saw	229.00
3612BR	3HP plunge router	177.00
GUIDES	for 3612BR	20.00
3601B	1/2" router	119.00
3608BK	1/4" router	86.00
3700B	1/4" trimmer	83.00
4301BV	orbital jig saw	127.00
5007NB	7-1/4" circular saw	98.00
5008NB	8" circular saw	109.00
5201NA	10-1/4" circular saw	220.00
5204	16" circular saw	369.00
6000R	3/8" clutch-drill	105.00
6000LR	low speed uni-drill	119.00
6010DWK	3/8" cordless drill	89.00
6012HDW	3/8" cordless clutch drill	109.00
6510LVR	3/8" low speed drill	69.00
9900B	3 x 21 belt sander	119.00
9924DB	3 x 24 belt sander	129.00
9401	4 x 24 belt sander	159.00
9045N	1/2 sheet finish sander	104.00
9820-2	blade sharpener	159.00
DP4700	1/2" var/rev. drill	92.00
6010SDW	3/8" cordless drill	49.00

MAKITA 8" JOINTER!! HALF-PRICE!!

Model 2020

$925.00

SPECIFICATIONS:
8" wide; 60" long; 2 HP, 110V motor; rack and pinion fence adjustment; both infeed and outfeed tables adjustable.

We have obtained a limited supply of Makita's new 8" jointer at an incredible price. This machine lists at $1700, but we are offering them for $925 (includes freight), nearly a 50% savings.

Don't miss this opportunity to own an 8" long-bed jointer at a fantastic savings. Remember, quantities are limited.

This offer expires August 31, 1986

FREUD

WC-104	4 pc. chisel set	$ 20.00
WC-106	6 pc. chisel set	28.00
WC-110	10 pc. chisel set	48.00
CS-106	6 pc. carving set	57.00
CS-112	12 pc. carving set	107.00
CM-100	carver's mallet	8.95
TT-108	8 pc. turning set	52.00

SAWBLADES

LM72M	10", 24t. flat top rip	34.00
LU73M	10", 60t. ATB cutoff	34.00
LU84M	10", 50t. smooth comb	36.00
SET	ALL THREE ABOVE	103.00
LU82M	10", 60t. triple chip	42.00
LU85M	10", 80t. super blade	59.00
DS306	6", dado 1/4"-13/16"	92.00
DS308	8", dado 1/4"-13/16"	102.00

ROUTER BIT SET 15 Piece Carbide Set with Wooden Box 134.00

SHAPER CUTTER SALE

Economy Raised Panel Cutters	79.00
EC-260 3/4" Cabinet Door Set	184.50
EC-270, EC-274 Door Sets	210.00

We carry the entire line of Freud Shaper cutters and route bits at discounts up to 30%. Please call for prices on these items.

LEIGH

TD514	12" dovetail jig with 1/4" bits for 1/2" dovetails	$145.00
TD514	12" dovetail jig with 1/2" bits for 3/4" dovetails	173.00
TD514L	24" dovetail jig with 1/2" bits for 3/4" dovetails	248.00
D1258-12	New 12" jig for through & half blind dovetails	259.00
D1258-24	New 24" jig for through & half blind dovetails	329.00

Optional bits in stock

MISC.

Biesemeyer fences	Call
" bladefinders	115.00
Watco Gal.	17.00
Shophelper	75.00
Jorgensen 3/4" pipe clamps	$40/6

RECORD

BENCH PLANES

04	Smooth Plane	$34.00
05	Jack Plane	40.00
07	Jointer Plane	60.00
Set of Three Above		129.00

VISES

52 E/D	52.00
52½ E/D	78.00
53E	84.00

ORDER TOLL FREE
1-800-354-9083
IN KENTUCKY CALL
(606) 254-9823

138
THE Xylophile's COMPANY
138 E. Loudon Avenue • Lexington, KY 40505

MasterCard

MAIL ORDERS: Simply enclose your check or money order with a note describing the item(s) desired. Ky. residents please add 5% sales tax. We will ship right away.

VISA

on orders of $35 or more **PRICES INCLUDE SHIPPING** TO THE CONTINENTAL U.S. *EXCEPT AS NOTED ABOVE* otherwise please add $1.95 shipping

Sold through leading distributors. Write for complete catalog: Wetzler Clamp Co., Inc., Rte. 611, P.O. Box 175, Mt. Bethel, PA 18343.

WETZLER

THE PROFESSIONALS' CHOICE

Factory-Direct Savings

Quality Furniture Hardware

For Dealers & Professionals only

Solid brass, porcelain, wood and cast iron.

Over 300 items

Write for our **FREE** 22-page catalog. Available only to dealers & professionals. *Use letterhead or business card.*

Ritter & Son Hardware
38401 Hwy. 1 So. Box 578-FW Gualala, CA 95445

NATIVE AMERICAN HARDWOODS

WALNUT, BUTTERNUT, CHERRY
CURLY & BIRD'S-EYE MAPLE
Most Other Domestic Woods

- EXTRA WIDE/EXTRA THICK STOCK
- TURNING SQUARES/BLOCKS
- QUARTERSAWN/BOOKMATCHED LUMBER
- SPALTED LUMBER/BLOCKS
- THIN STOCK
- FLOORING/PANELING

NO MINIMUM
WHOLESALE & RETAIL

Comprehensive Listing—One Dollar (Refundable)

NATIVE AMERICAN HARDWOODS LTD.
R1, W. VALLEY, N.Y. 14171 • (716) 942-6631

BAND SAW BLADES

WELDED TO YOUR EXACT LENGTH

WIDTHS	TEETH	PRICE/INCH
1/8" thru 5/8"	3 thru 32	$.05

COMPLETE BAND SAW BLADE LINE INCLUDING SAW MILL BLADES

TO FIGURE PRICE:
Inch Length x Price/Inch + $1.85 Weld Charge

MINIMUM ORDER $10.00. Add $2.50 per order for packing and shipping. MasterCard and VISA accepted.

TO ORDER Phone or write to:

BUCKEYE SAW COMPANY
P.O. Box 14794, Cinti., OH 45214
1-800-543-8664 (Except Ohio)
1-513-621-2159 (In Ohio)

Easy Wood Finishing with WATCO®

The Original and Still the Best

DANISH OIL FINISH

You'll be amazed at how easy it is to finish wood beautifully with Watco Danish Oil. Watco gives wood that natural hand-rubbed look with long-lasting durability. And because Watco is **IN** the wood . . . not on it like temporary surface coatings... there is no finish that will wear off. Watco Danish Oil is ideal for furniture, antiques, paneling, cabinets, doors, and trimwork. It's also safe for butcher blocks, cutting boards, and children's toys. Choose from 8 beautiful finishes . . . Natural, and Medium, Dark, and Black Walnut shades, and Cherry, Golden Oak, Fruitwood, and English Oak colors.

Send today for your "FREE" color booklet "How to Finish Wood Beautifully and Easily" . . . and the name of your nearest Watco Distributor.

WATCO-DENNIS CORP.
1756 22nd Street
Santa Monica, CA 90404, Dept. FW-JA6

Name __________
Street __________
City __________
State ______ Zip ______

213/870-4781

Better By Design®

POWERMATIC

MODEL 66, 10" TA SAW
3 HP, 1 PH, 230 Volt
Mag. Control
YOU PAY..................$1695
FREE 8" Adjust. Dado Blade
For Biesemeyer Fence
Add $99

MODEL 60, 8" JOINTER
with stand
1 1/2 HP, 1 PH, 115 Volt
Switch
YOU PAY..................$1319

MODEL 26 - SHAPER
1/2" & 3/4" Spindles,
3 HP, 1 PH, 230 Volt
Mag. Control
YOU PAY..................$1750

supplies limited — FOB McMinnville, TN

BRADY CORP.
649 MADISON AVENUE
P.O. BOX 326
ELMIRA N.Y. 14902-0326
607-733-6591

OUR HEAVYWEIGHT LATHE IS BUILT TO LAST. THAT'S WHY IT'S WARRANTED FOR 10 YEARS.

That's right, 10 years. And the warranty protects you against breakdown or failure under normal use, as well as against defective parts and workmanship.

Go ahead—compare ours with any foreign or domestic 12" power lathe. Then you'll agree with other serious woodworkers—the Williams & Hussey Heavyweight delivers top value.

Get complete specs and price (it's low!). **Call toll-free 1-800-258-1380** (In NH; 673-3446) or return the coupon.

Here's why the warranty is so strong:
Massive cast iron headstock and tailstock mounted on machined steel bed. No rattle. No sag.

Machined steel and cast iron throughout. No flimsy plastics or stampings to shake and break.

Here's what you can do with The Heavyweight:
Turn 12" diameter stock that's 46" long.

Sand, buff, grind and drill both outboard and inboard, thanks to threadless, precision-ground, .750" headstock spindle.

BUILT TO GO THE DISTANCE
Williams & Hussey Machine Co.
Elm St., Dept. 136GL, Milford, NH 03055

Name __________
Address __________
City/State/Zip __________

30 Day
No Risk Trial

BOSCH Power Tools

Jig saws only $126.00
Model 1581VS

NO.	TOOL	SALE
1582VS	Orbit. Action Nob Hdle Jig Saw	$118.00
3238VS	Unv. Shank Mult. Orbit. Jig Saw	83.00
1601	1 hp Router	104.00
1602	1½ hp Router	129.00
1604	1¾ hp Router	110.00
1606	D-Handle, 1¾ hp Router	163.00
90300	Fixed Base Router, 3¼ hp	350.00
90303	Plunge Base Router, 3½ hp	472.50
90085	¾ hp Router	91.00
3270D	3x21 Dustless Belt Sander	122.00
1272	3"x24" Belt Sander	159.00
1272D	3"x24" Belt Sander w/Dust Collector	169.00
1273	4"x24" Belt Sander	169.00
1273D	4"x24" Belt Sander w/Dust Collector	179.00
1921VSRK	3/8" Var. Spd. Screwdriver	$129.00
1920VSRK	3/8" Cordless Reversing Drill	99.00
1920RK	3/8" Cordless Reversing Drill	85.00
3268	Heat Gun	48.00
1158VSR	3/8" Var. Spd. Rev. Drill	54.00
1651	New Bosch 7¼" Cir. Saw, 13 amp	99.00
	HITACHI	
F1000A	Planer Jointer	1275.00

CALL TOLL FREE 1-800-525-0750
In Colorado 1-800-523-6285
Denver 355-2391

AVIATION/INDUSTRIAL SUPPLY
P.O. Box 39159 • Denver, CO 80238
TOOLS FREIGHT PAID

Enjoy more than four years worth of Fine Woodworking information.

There's a wealth of ideas and information in the Fine Woodworking *back issues that are still in stock. Twenty-six are currently available, but supplies are limited. So order the issues you want now. They're just $3.75 each, postpaid.*

(Our Fine Woodworking On... *and* Techniques *books organize back issue articles by subject and year respectively. For more information about them, see the order form after page 22.)*

Issue 21. Hans Wegner. Inflatable drum-sander. Sanding-disc jointer. Low-tech thickness sander. Ogee bracket feet. Hewing. Dovetailing carcases. Japanese saws.

Issue 22. Kerf-bent boxes. Chair and sofa. Cowhide for chairs. Wood-drying. Sharpening saws. Shop math. Drawing the ellipse. Flexible-veneer marquetry. Oblique miters.

Issue 23. Building blockfronts. Turning thin bowls. Hardwood plywood. French fitting. Abrasive planer. Carbide-tipped circular saws. Disc sander.

Issue 31. Gluing up. Turning for figure. Designing chairs. Six projects. Mechanism for cribs. Pillar-and-claw table. Bowl lathe. Lacquer finishing.

Issue 33. Split and shaved chair. Designing for machine craft. Scribed joints. Air-drying lumber. Shop-built panel saw. Twist turning. Vietnamese planes.

Issue 34. *Shoji.* The tablesaw. Ellis desk plans. Blockfront treasure. Bamboo fly rods. Stereo cabinets. Routing wide moldings. Period hardware. Repairing finishes.

Issue 37. Art Carpenter. Make a molding plane. Dovetail jigs. Lapstrake boatbuilding. Turning tips. Lathe duplicator. Horizontal boring machine. Color finishes.

Issue 38. Building an 18th-century secretaire-bookcase. Turning goblets. Marquetry on furniture. Matched bowls. Walnut-oil finish. Stanley #55. Fixed-knife planers.

Issue 39. Wood bending. Souping up planes. Sharpening. Southern huntboard. Un-turned bowls. Radial-arm raised panels. Humidity and wood. Backsaw.

Issue 40. Making buckets. Miniatures. Restoring a secretary. A spider-leg carriage table. Bandsaw blades. Japanese resaws. Turning tools. Bent bowl gouges.

Issue 41. Turning giant bowls. A wooden tablesaw. The laminated wood ribbon. Respiratory hazards. Kitchen on a stick. Norris plane. Pencil-post bed. Color and wood.

Issue 43. Little boxes. Reading the grain. Which glue? Bandsawn and tablesawn dovetails. European-style cabinets. Improving the fretsaw. Spoon bits. Jointer-planers.

Issue 45. How to make drawers. Rubbed-on varnish finish. Pipe clamps. Knockdown furniture. Laying plastic laminates. Doweling jigs. Boston bombé chest. Carving tips.

Issue 46. Plywood basics. Veneering. Files. Taiwanese machines. Oscillating spindle sander. Pines. Jimmy Carter. Porch swing. Blind finger joint. Chair design.

Issue 47. Laying veneer. Hepplewhite card table. *Netsuke.* Water-based varnishes. Ventilation. Furniture from paintings. Scroll saws. Patternsawing.

Issue 48. Pennsy painted chests. Hepplewhite chest of drawers. Edge-joining. Tambours. Japanese measuring tools. English oak table. Shop-built sharpener.

Issue 49. Bridle joints. Wooden puzzles. Building doors. Vintage machines. Mounting hardware. Chippendale sofa design. Fixing a cracked finish. Chatterwork.

Issue 50. Kerf-bent seats. Lumber grading. Decorative turning. Corner cupboard. Fancy raised panels. Simple bookcase joints. Driftwood finishes. Small tools.

Issue 51. Ruhlmann. Flip-top table. Hollow-chisel mortising. Testing chisels. Ash. Shopmade bowsaw. Japanese lacquer. Drawermaking. Bandsaw your own veneer.

Issue 52. Tage Frid. Making marionettes. Queen Anne handkerchief table. Low-cost dust collection. Adirondack chair. Using a spokeshave. An oil and varnish finish.

Issue 53. Period bedposts. Shop-built moisture meter. Measuring antiques. Movable louvered shutters. Workbench. Perspective in marquetry. Drill-chuck repair.

Issue 54. Segmented turning. Bentwood desk. Turning without a lathe. Block planes. Joinery machines. Inlaid tambours. Quilted mahogany. Catalyzed lacquers.

Issue 55. James Krenov. Turning a lidded box. Making a panel plane. Jointer talk. Newport-style tall clock. Wood stains. A cabinetmaker's baskets.

Issue 56. Designing wooden clockworks. Console table. Choosing a tablesaw. Carving benches. A 17th-century chest. Vacuum veneering. Coopering. Turning school.

Issue 57. Wooden planes. Carving finials. Plywood chairs. Shopmade lathes. Quilt cabinet. Dovetails. Making wooden clockworks. Router joinery.

Issue 58. Shaker casework. Hanging a cabinet door. Walnut. Bandsawn veneer. Shopbuilt thickness sander. The scraper. Guitar maker's inlay. French polishing.

Fine Woodworking Index. A complete listing of articles, letters, columns and photos from issues 1 through 50. *Softcover, $3.95 postpaid, Publication #71*

To order: Use the insert after page 22, or call 1-800-243-7252 and use your credit card.

NEW FROM freud® FOR...

ROUTING

Freud's new 5 piece router bit door system allows you to produce raised panel cabinet doors with your 1/2" chuck router. Each bit is made with the finest carbide available and sharpened with a 600 grit diamond wheel.

The bit profiles are: rail and stile, raised panel, door lip, glue joint. The bits come in a wooden, box jointed case for ease of storage.

As a set, the 94-100 list for $\$248^{00}$ .... Sale Price $\$199^{00}$

SHAPING

Freud's new 5 piece cabinet set for the 3/4" - 1/2" shaper comes with rail and stile, raised panel, door lip and glue joint cutters. A box jointed, wooden case is included for ease of storage and prevention of damage.

The cutter profiles are: rail and stile, raised panel, door lip, glue joint.

The cutters are made with the highest of manufacturing standards and materials. If purchased individually, they would cost \$510.00.

As a set, the EC-900 list for $\$499^{00}$ .... Sale Price $\$349^{00}$

BORING

Freud's new 16 piece Forstner bit set comes in a box jointed, wooden storage case. These bits, guided by their rim, will create a clean flat bottom hole in wood. A special heat treated steel is used in their production to assure long lasting edges.

The 16 bits range in size from 1/4" to 2 1/8" in 1/8" increments. These bits will fit any stationary or portable drill using a 3/8" or larger chuck.

The FB-100 Forstner bit set list for $\$249^{00}$ .... Sale Price $\$199^{00}$

DRILLING

Freud's new 50 piece drill bit set comes with a heavy duty carrying case for ease of storage and protection. This set consists of: A) 25 high speed steel bits (1/16 - 1/2 in 1/16 increments) B) 4 high speed steel bits for use in sheet metal (1/4, 3/16, 1/8, 3/32) C) 6 chrome vanadium steel brad point bits for use in wood (1/8, 5/32, 3/16, 1/4, 5/16, 3/8) D) 6 carbide tipped masonry bits with hex shanks (5/32, 3/16, 7/32, 1/4, 5/16, 3/8 E) 1 center punch, 2 Allen keys and 6 depth stops to set bits at pre-determined depths.

These bits will fit any stationary or portable drill using a 3/8" or larger chuck. The DB-050 drill bit set list for $\$89^{00}$ .... Sale Price $\$69^{00}$

For The Name Of Your Local Distributor:
Call Toll Free (outside N.C.) 1-800-334-4107
In North Carolina Call 1-919-434-3171

Furniture from the Lathe

New forms from traditional techniques

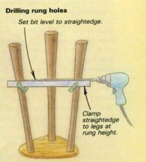
by Dick Burrows

Years ago, when I was traveling from craft fair to craft fair selling turned and carved bowls, I was continually surprised by the contempt some people had for lathe work. Perhaps it was because they remembered how easy it was in junior high school to produce an ash tray or candlestand—the machine did all of the work and most of the designing. And, lathes have been around forever, filling our lives with bats, bowls and brush handles.

Bowl turners have grabbed most of the publicity in recent years for changing the image of turning, proclaiming themselves artists in search of the perfect shape, the perfect finish, the ultimate art object. But, what about all those other woodworkers to whom the lathe is still just another tool, no more glamorous than any saw or chisel hanging from their tool racks. After visiting furnituremakers across the country who rely heavily on lathe-turned furniture parts, I found they are more attuned to the new wave bowl turners than to the old-time production turners or those who think lathe work is a synonym for junior-high-school clunky. The last thing they want is for their furniture to look as if it popped off a lathe.

Actually, none of the furnituremakers I talked with considered himself primarily a turner—some were almost deferential toward the skill of the bowlmakers—and none wanted to be limited to the round or cylindrical forms traditionally associated with turners. Pennsylvania woodworker Mark Sfirri, for example, uses a lathe to carve and raise panels for cabinet doors; Californian Lewis Buchner combines stacking techniques with turning to produce top-of-the-line cabinets too large to fit on any lathe. Another Californian, Robert Leung, does massive faceplate turnings up to 56 in. in diameter, then bandsaws them apart and reassembles them into sculptural tables and desks.

Speed is what makes the lathe special for this group of furnituremakers. The lathe can produce cylindrical and curved shapes almost as fast as a planer can flatten stock. It can transform an idea into a scrapwood mockup so quickly that it virtually makes wood a three-dimensional sketchbook. If your idea doesn't work out, you can redraw the shape with gouge or skew, or just start over with a new blank of wood, again and again if you want, until you get it right, then you can quickly turn your refined idea into a finished product. With a lathe, a clever worker can almost mass-produce parts for cabinets, tables, chairs, benches, as well as for a variety of mirrors, boxes and other decorative items. And the tool itself is fairly simple, easy



To align rung holes, Kopf runs a bit extension between legs so the first hole is the drill-guide for the second hole.

Photos above, below: Smith/Weiler Photography

Bob Kopf

The curly maple and mahogany game table (29 in. by 36 in. by 36 in.), left, is a good example of Kopf's efforts to make functional furniture with a minimum number of joints and wood elements. The legs are assembled by boring through the maple block that will become the ball, turning a tenon on a mating mahogany piece, then gluing the two pieces together and turning them as a single piece. Kopf, far left, mortises table legs with a plunge router and a box-like jig mounted over the lathe bed. Runners on top of the jig guide the cut. Bolts and wingnuts in the side slots set the jig height. The mahogany and ash buffet (36 in. by 16 in. by 60 in.), above left, has tapered breadboard ends and chamfered edges that blend with the angled legs to create a sense of motion. Kopf shapes the tops with a block plane, which he says cuts a very shallow curve. This curve is a very personal trademark because it depends largely on the distinct way his arm and hand move and twist during each plane stroke. Kopf sometimes relies on wood grain to convey a sense of visual unity, as shown on the three stools, above center, cut from a single plank of bird's-eye maple.

to maintain, relatively inexpensive, and doesn't require a cabinet full of cutters and gouges to be versatile.

One of the first woodworkers I visited was Bob Kopf, who works in an airy shop decorated with camouflage paint, a real standout amid the chestnut brown sheds of the neighboring tobacco farms in the tiny community of Walnut Cove, N.C. I first became interested in Kopf's work about 10 years ago when I was living in Charlotte, N.C. At a time when many of us were making tables and stools that resembled those our grandfathers made, Kopf was incorporating elongated knobs, swollen feet and other unconventional forms in his turnings as he tried to make elegant furniture with the minimum number of joints and wood elements. His later experiments with balance points, carving stools and tabletops, and combining parallelograms, rhombuses, and architectural forms would lead to tables with tapered breadboard ends, chamfered handplaned edges and legs turned and angled to draw the eye toward the motion of the table. Some of his more recent works include tables with legs that look like segmented cones, almost insect like, and dining room sets where the spindles and balls seem to be growing out of each other to form legs.

Kopf is passionate about his explorations in design and about the lathe being an incredibly fast way to make furniture, but he's laid back about the mystique of the machine and its tools. When asked what lathe tools he favored, he replied one big one and one little one. The big one turns out to be a 1⅛-in. roughing-out gouge, the smaller one a ¾-in. gouge. He sums up his turning technique simply as a "whole sense of working, producing a smooth feeling and a smooth shaving."

Self-taught, Kopf relishes methods of work that are practical and logical. Rather than make a big production of boring rung holes, he uses a drill extension and lets the first hole be the drill guide for the second, as shown in the drawing on the preceding page. Mounting the rungs in the legs is equally low-tech, Kopf glues the legs into the top then springs the legs apart enough to jockey the rungs into place. The maneuver is simple—he puts his hand on one leg, then wedges his elbow against the next leg to push the two apart. For joinery, he relies heavily on his plunge router, which he uses with a simple box-like jig that fits over the lathe bed, as shown on p. 34. With this set up, he can cut up to eight mortises in ten minutes. A favorite joint is the wedged mortise and tenon, which he considers almost fool-proof.

His old Crescent lathe doesn't even have a faceplate, but he doesn't miss it, concentrating exclusively on spindle turning. "You really have only two shapes to work with—the cove and the bead, everything springs from those two shapes. We've all studied the old ways, now we're trying to do newer interpretations of the cove and bead, explore shapes, trying to come up with something new and current."

Kopf does about 20 major pieces of furniture a year, most of them commissions for tables and chairs, benches and sets of stools. He says his work has been strongly influenced by the work of Wharton Esherick, Brancusi and the Shaker prohibitions against excessive ornamentation and decoration. In the thirteen years that he has been a full-time furnituremaker, he says he's been constantly experimenting to refine his designs. One of the most significant changes in his work is that his components have been getting lighter. "I've learned how to make things just strong enough. The pieces are also structures—stronger than the sum of their parts. I used to really overbuild things."

I contacted furnituremaker and designer Lewis Buchner in San Francisco after seeing an intriguing picture of his lacquered armoire and table shown below. The piece was so symmetrical it had to be turned, but since it was more than 6 ft. tall and hollow, it was difficult to imagine how. Buchner told me both the 78-in. armoire and the 18-in. table were simply stacks of 32-in.-diameter rings glued together with yellow glue. Buchner assembled each ring from six bandsawn segments of western red cedar, then glued four of the rings together, staggering the joints between segments for maximum strength. Each four-ring unit was then mounted on a faceplate on a large patternmakers' lathe and turned inside and out until the walls were about ½ in. thick. A set of oversize, homemade calipers was used to ensure that the inside and outside diameters of the rings were identical. The top and bottom of the armoire were also turned on a faceplate.

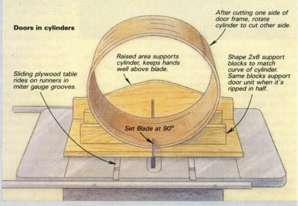
Sets of the ring units were then glued and butt jointed together to form three sections: the upper cabinet, the waist and the lower cabinet. He cut the doors by mounting the cylinders in a cradle and running the pieces over the tablesaw, as shown below. After the three major segments were glued together, the doors were remounted using custom-made wooden hinges of goncalo alves, the same wood used for the turned door handles.

Buchner uses a lathe for many of his designs. It's also an efficient tool for making joints—turn a tenon on one piece, fit it into a bored hole and wedge the tenon—and it works well in combination with other tools in the shop. "I use a lathe like a bandsaw, shaper or any other tool in the shop. I often like to

Photo: Phil Toy

Lewis Buchner

This lacquered armoire and matching table were constructed from stack-laminated rings of western red cedar. Buchner assembled each ring with six bandsawn segments, then glued the rings together in groups of four. The four-ring segments were turned down to ½-in. thick, 32-in. diameter cylinders which were, in turn, glued together to make the 78-in.-high armoire and 18-in. table. Lights shining on the white textured gesso and copper leaf interior create a soft-glow in the stained-glass-like windows.

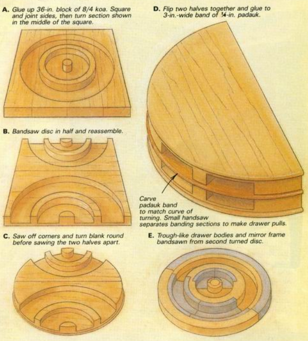


Robert Leung

This koa and African padauk hall table is contructed almost entirely with lathe-turned parts. The cleverly-designed top and drawer assembly is made from one large faceplate turning. First, a series of troughs is turned in the middle of a square blank. By cutting that turning apart, reassembling and returning it, as shown at right, Leung simultaneously makes the top and pigeonholes for the drawers.

Photo: Robert Leung

Semi-circular table and drawers



incorporate round forms in my designs, and the lathe is just the right tool for certain processes."

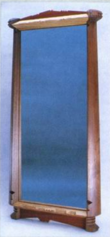
Another Californian, Robert Leung, also relies heavily on faceplate turnings in his work. Leung works in a large shop in what used to be a paint factory in one of Oakland's industrial areas. The factory is now being divided and renovated into studios for woodworkers, potters and other artists. Leung, a woodworker for seven years, was running a movie theater when he started making his own furniture with a coping saw and a file. He was soon hooked on wood and enrolled in the woodworking program at Cal. State (San Bernardino). There, he worked with Leo Doyle, an RIT graduate who got him started in turning. Leung says he stuck with it because he liked the curved forms that were possible on the lathe, he was excited by the possibilities of combining stacking techniques with lathe work.

Smooth, rounded forms are a favorite motif for Leung in all his work, from small boxes to large tables. He says he prefers imported hardwoods, like pau ferro and koa, because they have more color than domestic species. Many of his large forms could be carved with a router, but he says the lathe permits more detailing. Much of his work is done on faceplates made from large plywood discs, ranging from 12 in. to 56 in. in diameter. Some of the larger ones are propelled by the coving action of a body grinder, rather than the lathe motor. The rotation of the grinder bit cutting the wood keeps the faceplate spinning.

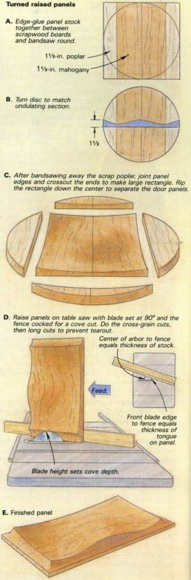
One of his best known designs is a coffee table made from a 30-in. to 34-in. disc of 8/4 koa that's turned, then bandsawn into three wedge-shaped pieces. The bottom of each piece is grooved to fit over a Y-shaped frame welded from ½-in. square steel. The grain of each wedge seems to be cascading down each curved edge, creating an impression of both restfulness and tension. "When you deal with curves, there is always implied tension," says Leung.

The koa and African padauk hall table shown above is almost entirely lathe-made. The drawers for this table are shaped on the lathe using the procedure outlined in the drawing, but for many of his smaller works Leung waxes the three edges of the carved or assembled drawers before sandwiching them into the large disc. The tension from clamping when the rest of the disc is glued up holds the drawers securely while the disc is being turned. Once the piece is taken from the lathe, the waxed drawers can be pulled out.

When I visited Mark Sfirri at his home in New Hope, Pa., a popular tourist town with a rich resource of woodworkers, including George Nakashima and Robert Whitley, he laid out a series of



Turned raised panels



Mark Sfirri

Sfirri combined a tablesaw and lathe to come up with a machine-made panel with a handcarved look, above. The cove cut used to raise the panels on the tablesaw continues the shaping begun on the lathe because the blade cuts more deeply into the thickest area of the turnings, but takes less wood from the thinner areas. Split turnings are a good way to make mirrors, especially if you don't mind making two at a time. The sides of the 52-in.-high walnut mirror are two quadrants of a cylinder formed from four pieces of walnut joined together with glue-and-paper joints. After the pieces are separated, they can be tapered on a tablesaw, since the two straight, unturned sides of each quadrant form a right angle that can be run against the saw's rip fence. The pieces are joined at the corners with a beveled miter and spline.

Photos: Mark Sfirri

slides on his dining room table to show how his furniture had changed since 1970 when he began working with Tage Frid at the Rhode Island School of Design. "Frid often pointed out that there were numerous, untapped possibilites for the lathe in furnituremaking, but we didn't do much with it." In addition to Frid, Sfirri said he was inspired by the work of Canadian Stephen Hogbin, one of the first contemporary turners to cut turnings apart and reassemble them into sculptural forms.

"I originally used the lathe for speed," Sfirri told me. "I don't think I was in any way compromising on my designs, but it was faster than making everything by hand. I didn't want to make something that looked as if it had come off a lathe." After turning the pieces, he then shapes, carves and assembles them into more complex forms that can't be readily related to the original cylindrical or round form that spawned them. Sfirri always enjoyed carving with traditional handtools—chisels, gouges, files and rasps—but knew nobody would be able to afford his work unless he could do carving on a production level. The lathe gave him a way to do just that.

One of his early lathe experiments involved producing a set of dining room chairs with only turned parts. Even the contoured arms and curved slats were turned on large faceplate jigs. He's still using the chairs in his home, and although they are quite attractive and comfortable, he's reluctant to go into too much detail about how they were made because he remembered how easily the parts flew out of the jig when he was turning them. His other experiments included a series of sculptured raised panels, and a large, turned disc which, when bandsawn apart, became little, tapered wooden race cars. Adding scrap to widen an assembly for turning, as was done with the raised panels shown at left, is a technique Sfirri also likes for making bowls and other objects where an oval or oblong, rather than circular form is needed.

Sfirri, who teaches woodworking and design at Bucks County Community College in Newtown, Pa., was trained as an artist before becoming a furniture designer, so he feels comfortable with sketching out ideas. But he still likes the spontaneity offered by the lathe and the flexibility it gives him to see and work out possibilities. Even with this freedom to explore, though, he was Frid's student long enough to understand the need to work out every step of the construction process before work begins. On complex assemblies, he always provides some means for holding the work, bearing surfaces for sawing, or a way to clamp the piece while joints are being cut. When he turns mirror frames, for example, he uses paper and glue to make a 4-piece spindle, turns the shape he wants, then splits the turned quadrants apart. Each quadrant has a 90° angle and two straight sides that can act as reference surfaces for further machining, such as tapering the piece or cutting the rebate to house the mirror glass.

Composition and interrelation of parts, not turning, is the main focus by Christopher Weiland, a designer and furnituremaker in Penn Run, Pa. Turning was just the natural way to develop a beautiful shape that would bring together the planes, shapes and lines of his design, as in the mirror and jewelry box shown above. After seeing the mirror in a turning show, I called Weiland to ask how it was made. He told me the base of the mirror is a faceplate turning rabbeted to hold a mirror which is secured with ebony pins. Both the bottom and the top, a resawn and bookmatched pear plank turned on the faceplate, are grooved to accept the horizontal supports, which are finger jointed together with brass pins and ebony spacers. The jewelry box bottom and lid are faceplate turned discs that were cut down the middle then jointed to strips of maple and a thin, flat piece of padauk.

Christopher Weiland

The pear mirror, above, is two faceplate turnings joined by maple supports that hinge together with brass pins and ebony spacers. The bottom and lid of the jewelry box, right, are cut in half, then joined to strips of maple and a thin padauk slide.

Photos: Christopher Weiland

A few hundred miles south of Pennsylvania, deep in the Blue Ridge Mountains, I visited David Scott, a woodworker who likes turning so much that a lathe was his first major power tool purchase when he went into business for himself five years ago. Scott came to North Carolina to attend the production crafts woodworking program at Haywood Technical College in Waynesville. He liked the area so much he stayed, and now works in a small one-man shop behind behind Waynesville's Museum of North Carolina Handicrafts, where he and his wife, Kathy, are caretakers.

Almost everything Scott makes includes lathe parts—from clocks and yo-yos to stools, tables, beds and benches. All of his work is functional, has a light, airy feel, clean lines and a highly polished, clear finish. The variety of products is essential to his business, since he sells most of his work directly through craft shows. Living in a rural area with few galleries, he relies on the craft shows to generate both commissions and a good portion of his income.

I asked him why he was drawn to the lathe. "It would be a cliché to say quickness of results, but it must be a factor for everybody who turns. Just the ability to form something quickly. But it's something more difficult to explain, too. From the start I felt that so many turners did round forms, especially bowls, that it was important to do something different, to alter the form, to find a fresh approach in an area that had been heavily mined for years."

When you make furniture from the lathe, Scott says you're starting the design process by setting limits—you're restricting the number of flat parts you can use, you can only produce a limited number of shapes, and there are often no natural relationships between the parts. It isn't long before you begin carving the lathe-turned parts, or splitting them apart and reassembling them.

Although he doesn't do mechanical drawings, Scott invests a lot of time generating ideas with a sketch pad and pencil. Then, rather than developing the idea fully with more drawings, he goes right to the lathe and turns a quick study piece from scrap

David Scott

For production work, Scott, above, relies on a Hegner duplicating attachment. The duplicator follows the prototype shape and a V-shape cutter brings the blank to a nearly finished shape. Scott likes to combine the colors and textures of wood. He emphasized the lines of his rocker, above right, with mahogany and maple laminations and curly maple arm rests. On the table, right, he blended the laminated ash and Maccassar ebony braces into the turned bands on the legs to soften the lines of the piece. This walnut and curly maple bench, far right, is one of Scott's first pieces where function is secondary to appearance. The bench itself is fairly plain—the energy is in the turning—the random pattern of spindles and the playful back rail.

wood. "I'm a real seat-of-the-pants person. I rely on the educated guess, trial and error. I prefer straightforward, simple solutions, clean lines, nice proportions, with one piece relating to another and to the whole in an understandable way, rather than having just an array of pieces." Often he ties his designs together by laminating woods of contrasting color. When he was in school, he worked hard to make sure the laminations didn't show, but soon realized he was missing a good way to emphasize the lines of a piece. On small, glass-topped tables like the one shown above, he marries the diverse elements together by repeating the turned shapes and bands thoughout the piece, then connecting the turnings with laminated braces. For the table, he laminated the braces from ⅛-in. strips of ash and ⅓₂-in. thick Macassar ebony, then blended the braces into the turned leg bands and coves to soften the lines of the piece. Recently, he has been extending this type of interplay by machining tusk tenons to match the shape of the turning supporting the tenon.

From top-of-the-line designer furniture to a bare-bones stool, from the eminently functional to the purely whimsical, a lathe can be an efficient, useful tool for all sorts of work. The main danger in relying on the lathe harkens back to those people who contemptuously relegate it to the junior-high-school kids. Things made on the lathe all too often look as if they were made on the lathe. The tool can overpower the craftsman, quickly obliterating a thoughtful design into a stack of Tinker Toy parts. But, if the designer's eye controls the process, the lathe is a versatile workhorse that can improve the products of any shop. □

Dick Burrows is an associate editor of Fine Woodworking.

9-in. steel square from Garrett Wade

Getting Squared Away

Finding the perfect perpendicular

by Paul Bertorelli

Whether you actually have need for it or not, a well-made tool has an attraction that's hard to resist. Polished brass milled into some interesting-looking geegaw practically begs to be picked up and examined, if not bought. Owning a trunk full of perfectly serviceable tools doesn't make you immune from this peculiar urge either, as I found out at a woodworking show last year when I bumped into John Economaki. He's an Oregon furnituremaker who has met rousing success selling precious, pricey measuring and marking tools. Barely a minute after I approached his booth, I'd coughed up $34 for a 5-in. trysquare to add to the three I already own. A year later, even with a few scratches and dents, the square shimmers with a satisfying gleam.

Of course, a good trysquare is more than just a trinket. Much woodworking begins and ends with this humble tool. For stock preparation, a trysquare tells when a board's edge is square to its face. A trysquare is indispensable for marking out joints, setting the tablesaw's miter gauge or the jointer's fence and then checking how precisely they've done their work. It's worth having a good one and taking care of it. Practically every mail-order catalog offers trysquares in several sizes and styles. The better-known tool houses are giving splashy play to Economaki's Bridge City Tool Works line alongside the popular brands made in Europe. Not knowing much about how squares are made, I decided last fall to investigate by visiting three square manufacturers. During the course of my travels, I learned that despite big variations in price ($8 to $100 and beyond) there's really not much practical difference between one square and the next. Given reasonable standards of accuracy, they will do the same job. But, some are clearly better buys than others.

Bridge City Tool Works' 5-in. Jointmaker square

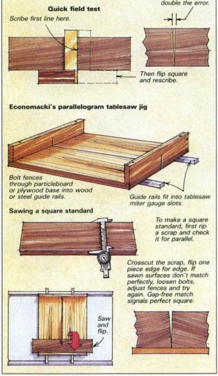
Bridge City Tool Works is housed in a cavernous defunct furniture factory near the center of downtown Portland, Ore. As is the fashion in old industrial buildings, the open bays have been walled off into spacious, high-ceilinged rooms. When I arrived on a chilly November morning, sunlight streamed through the south-facing windows, illuminating a pall of dust suspended in the air, an unappetizing mix of brass and rosewood: squaremaking here, and elsewhere, is mostly an abrasive process. "It's pretty awful in here right now," Economaki explained. "We've designed a dust-collection system. I want to get it in by next month." With Christmas just six weeks away, Bridge City was filling last-minute orders at near-frantic pace while Economaki hurriedly prepared for a weekend sales trip to North Carolina.

What with the dust and hubbub, the scene was almost surrealistic. It must seem especially so to Economaki. Three years ago he was working alone in the same shop, building furniture commissions and small production items. "I was doing well with my furniture. I had plenty of work but I couldn't see myself working those kinds of hours when I'm 40 or 50," Economaki recalls. Wanting the regular hours of production work, Economaki turned to toolmaking. For some ten years he had made short runs of fine little brass and rosewood trysquares that had sold well in galleries. It was logical to pitch them to a broader market. To say the tools have caught on is an understatement. The day I visited, Bridge City's three toolmakers were cranking out one hundred fifty 5-in. trysquares, and had orders for that many more standing by. By the end of last year, Economaki's sales were well into six figures.

Bridge City makes two sizes of trysquare, the 5-in. Jointmakers' square I had bought, and an 8-in. model that sells for $47, plus a scratch awl, a T-square, a miter square and some specialty items. The square designs are based on Stanley's 8-in. trysquare and evolved from Economaki's days as an industrial arts teacher when he had his students make them as a ninth-grade shop project. Where Stanley has a beech handle and steel blade, Economaki has substituted a sweet combination of rosewood and brass. Brass wear strips protect both edges of the handle and the blade rivets are set into brass strips inlaid into the handle. Brass, rivets and wood are all sanded perfectly flush.

Apart from an automatic screw-setting machine and a dial-indicator jig for checking accuracy, Economaki makes squares with essentially the same tools he used for furniture work. Brass is sawn on the tablesaw, just like wood. "We use the Forrest Manufacturing blade. I could do a great testimonial . . . it cuts brass like it was walnut." Like virtually all wooden-handled squares,

Fig. 1: Two ways to check a square



To ensure the accuracy of each of his squares to 0.002 in. over the length of the blade, Economaki devised the dial-indicator jig shown here. Referenced against the steel pins, the square's angular error is converted to a directly readable linear run out.

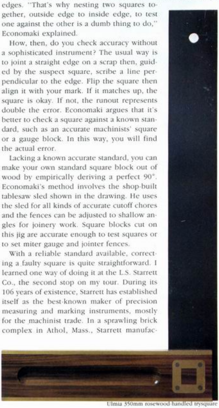
Economaki's are made by inserting the metal blade into a slot milled in the handle. Before the blade is mounted, it's carefully sanded parallel in width and to reasonably uniform thickness.

Economaki is methodical about accuracy. He achieves it in one of two ways. Each blade is set into its handle with a dab of fast-setting cyanoacrylate cement. Moving smartly before the cement hardens, the square is either clamped against a National Bureau of Standards certified angle block or, more usually, checked on a dial-indicator jig, which measures how close the blade is to perpendicular. It's adjusted, if necessary, then riveted once the cement sets. Although no Federal inspectors come poking around square factories, the government does publish accuracy standards for woodworking squares. A General Services Administration regulation says that squares bought for government use must not run out more than 0.001 in. per inch of blade length, a standard also observed by European manufacturers. Economaki promises a finicky plus or minus 0.002 in. over the entire length of blade, inside and out. That last distinction is an important bit of square lore. The vast majority of woodworking trysquares are meant to be square only on the *inside* edges. "That's why nesting two squares together, outside edge to inside edge, to test one against the other is a dumb thing to do," Economaki explained.

How, then, do you check accuracy without a sophisticated instrument? The usual way is to joint a straight edge on a scrap then, guided by the suspect square, scribe a line perpendicular to the edge. Flip the square then align it with your mark. If it matches up, the square is okay. If not, the runout represents double the error. Economaki argues that it's better to check a square against a known standard, such as an accurate machinists' square or a gauge block. In this way, you will find the actual error.

Lacking a known accurate standard, you can make your own standard square block out of wood by empirically deriving a perfect 90°. Economaki's method involves the shop-built tablesaw sled shown in the drawing. He uses the sled for all kinds of accurate cutoff chores and the fences can be adjusted to shallow angles for joinery work. Square blocks cut on this jig are accurate enough to test squares or to set miter gauge and jointer fences.

With a reliable standard available, correcting a faulty square is quite straightforward. I learned one way of doing it at the L.S. Starrett Co., the second stop on my tour. During its 106 years of existence, Starrett has established itself as the best-known maker of precision measuring and marking instruments, mostly for the machinist trade. In a sprawling brick complex in Athol, Mass., Starrett manufac-



Ulmia 350mm rosewood-handled trysquare

At Starrett, blades are soldered not riveted to the beams. Scott Songer, above, heats both sides of the beam with a dual-tip burner then feeds solder in as the joint warms. Once soldered and quenched, he tests the soundness of the joint by gently tapping the flat of the blade on his vise. A bright, tuning-fork ring indicates a good joint and the square is ready for testing.

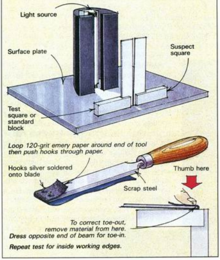
tures a staggering assortment of 3,000 tools, including a line of precision machinists' trysquares popular with woodworkers. Scott Robinson, a Starrett toolmaker, was assigned to show me around the place.

Following Robinson onto the factory floor reminded me of Industry on Parade, a Commerce Department gee-whizzer I watched on television as a kid during the 1950s. Amid the pervasive odor of warm machine oil, there's a constant clatter of machine tools, some attended by operators, others spitting out parts at the command of tape- or computer-driven controllers. At every turn, we encountered dollies stacked high with minutely machined parts, each of which Robinson seemed able to identify.

Intriguing as the machines were, the real fascination for me was the amount of handwork that goes into making a precision measuring tool. Scattered throughout the factory are rows of workbenches where toolmakers deburr and clean parts prior to assembly. Each finished part is calibrated and tested before it's carted off to another department for final inspection. Nowhere is this fussy work more demanding than in Department 9, a warren-like room off the main factory floor where Starrett machinists' squares are assembled. The squaremaker's benchroom is kept dark, about like a movie theater. Better to see the bare sliver of light that squeaks between a pair of square blades being checked against a light source. It's hot, too. Open gas burners furnish the heat for silver soldering each square blade to its handle.

Starrett makes eight standard sizes of hardened-steel machinists' squares, from a tiny 1½-in. model to one with a 36-in. blade. You can special order a giant square with a six-foot blade but

Fig. 2: Adjusting a square

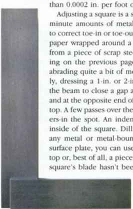


better plan on having a muscular friend help you move it. He can also help shovel money out of your wallet. Starrett squares are expensive. The 6-in. model 20-6, shown in the photo below, retails for $91.50, a 12-in. sells for $187.25. Even at these prices, a Starrett square is no more than an ordinary right angle, but one that is manufactured to a high standard and designed to hold the tight tolerances necessary in machine work. For thermal stability, the square's beam (handle) consists of three precision-ground steel blanks riveted together and then ground again to final size. Soldering instead of riveting the blade keeps the beam from being distorted during assembly.

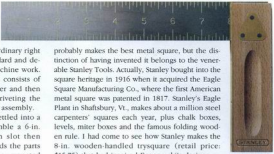
Once my eyes had adjusted to the darkness, I settled into a corner to watch squaremaker Scott Songer assemble a 6-in. square. First, he slid the blade into the beam slot then clamped both into an angle-block fixture that holds the parts square. With everything aligned, a dual-tip gas burner mounted on a single pivoting arm is swung into position to heat both sides of the beam evenly. Fifteen seconds later, an even bead of silver solder melts into the joint, followed by a water quench to finish the job. The acid test of a good joint is a bright, tuning-fork ring when the flat of the blade is tapped lightly against a metal surface. A dull thunk signals trouble. Songer says any metal machinists' square with a soldered blade should be ring-tested occasionally.

Songer's work brings a square close to the final tolerances. Richard Dill, another Starrett squaremaker, does the fine tuning. Dill works in front of a precision-ground cast iron surface plate on which is positioned a fluorescent tube shaded to form a bright vertical slit as long as the blade of the square being tested. To check a square, he positions it upright on the plate in front of the light slit, blade-to-blade against a square of known accuracy. As the blades converge, there's the sensation of a door being closed against a brightly lit room. An accurate square shuts out the light completely the instant it touches the test square, then breaks or shows an even hairline of light when the two are moved gently apart. This method is extraordinarily accurate. A gap as small as 50 millionths of an inch is detectable by the human eye, a tolerance far finer than woodworkers or even machinists need. Starrett aims for light-blocking perfection but will allow a run out of no more than 0.0002 in. per foot of blade length.

Adjusting a square is a simple matter of removing minute amounts of metal, usually from the beam, to correct toe-in or toe-out. Dill uses 120-grit emery paper wrapped around a burnishing tool he made from a piece of scrap steel, as shown in the drawing on the previous page. The tool is capable of abrading quite a bit of metal so Dill sands sparingly, dressing a 1-in. or 2-in. spot at the butt end of the beam to close a gap at the bottom of the blade and at the opposite end of the beam for a gap at the top. A few passes over the length of the beam feathers-in the spot. An indentical procedure trues the inside of the square. Dill's method will work with any metal or metal-bound wooden square. For a surface plate, you can use a flat jointer or tablesaw top or, best of all, a piece of ½-in. plate glass. If the square's blade hasn't been badly bent or the joint loosened by a careless drop on the floor, it can be trued as often as necessary. Starrett probably makes the best metal square, but the distinction of having invented it belongs to the venerable Stanley Tools. Actually, Stanley bought into the square heritage in 1916 when it acquired the Eagle Square Manufacturing Co., where the first American metal square was patented in 1817. Stanley's Eagle Plant in Shaftsbury, Vt., makes about a million steel carpenters' squares each year, plus chalk boxes, levels, miter boxes and the famous folding wooden rule. I had come to see how Stanley makes the 8-in. wooden-handled trysquare (retail price: $15.75) that had inspired Economaki's designs.



Starrett 6-in. hardened steel machinists' square



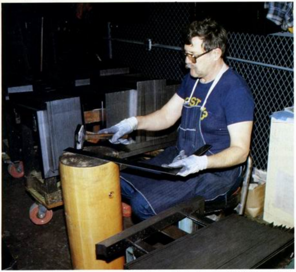
Stanley's 8-in. steel and beechwood square

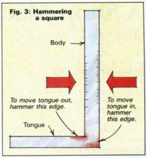
In principle, Stanley squares are made just like Economaki's are, but in a more automated way. Twenty years ago they used rosewood handles, but rising costs and declining sales forced a switch to beech, which is harvested from a 4,000-acre woodlot Stanley owns in northern Vermont. The steel blade (inscribed with rules graduated to ⅛ in.) is attached to the handle via three steel rivets set in a triangular brass seat, and the handle's inside edge is protected by a brass wear strip. As at Starrett, an angle-block jig holds the parts square during assembly, but instead of soldering, an operator inserts the parts into a pneumatic hammer that flattens the rivets in about a second. Stanley isn't nearly as fussy about accuracy as are Starrett and Bridge City. Paul Harris, the plant's chief engineer, showed me a simple go, no-go tester that employs a microswitch to flash a warning light if a trysquare is more than 0.001-in. out of square per inch of blade length, the U.S. and European standard. When I asked how an errant square is brought into line, Harris picked one up from a nearby bin and unceremoniously whacked the corner of the blade against the worktable. I couldn't hide a flinch. "We don't try to move them much," Harris later told me, "If they're too much out, we scrap them."

In another part of the plant, we watched carpenters' steel squares being die-stamped out of giant sheets of cold-rolled steel, like so many cookies. I was surprised to learn that Stanley makes two grades of steel squares in two sizes, plus a top-of-the-line aluminum square. The high-grade square is accurate to 0.005 in. in 15 in. of tongue length (in a large square, the blade is called a tongue) and 0.015 in. in the lower grade. Each square is hand-flattened and hand-hammered to tolerance.

Lew Levine, an Eagle toolmaker, demonstrated. First he flattened the square's tongue and body by hammering the faces atop an anvil made of end-grain maple. Using a dial-indicator jig like Economaki's, Levine tested the square. To open the angle, he gently hammered the tongue close to its edge at the inside angle. Hammer blows near the edge of the outside tongue closed the angle. Levine is fast and seems to hardly need the dial indicator to check his work. Although he is allowed 0.005 runout, the indicators hardly budged off zero during the entire time I watched him. Stanley's aluminum squares, by the way are considered the most durable. Besides resisting rust, aluminum has a better "memory" than steel, so, if a square is dropped, it returns more closely to the orginal shape than does steel.

At the end of my Eagle Square tour, I had formed some definite opinions about what makes a good square. First and foremost, a square ought to be accurate. How accurate is as much a





Stanley's best carpenter's squares are hand-hammered to tolerences of 0.005 in. in 15 in. of tongue length. Lew Levine first flattens the tongue on an anvil of end-grain maple, above. Then he trues the square by hammering it as shown in the drawing. A dial-indicator setup similar to Economaki's measures run out. Abrasives (right) play an important role in squaremaking. After the blades are riveted at Stanley, they're sanded flush and sharp metal edges are eased on a large beltsander.

function of pocketbook as it is of skill. I liked Economaki's squares best of all. They are very accurate, beautiful and priced just far enough shy of outrageous to be affordable. A far-from-exhaustive survey I did while researching my article turned up two other wooden-handled trysquares that tested accurately against the Starrett, but are cheaper than Bridge City's tools. Garrett Wade sells an Ulmia 350mm trysquare (catalog 90N01.03) of brass-bound rosewood for $30.25. The finish is not quite as nice as Economaki's, but it's precisely square inside and out. Woodcraft sells a bargain 6-in. trysquare (catalog 14C11-CL) for $8.95. The one that I bought showed barely a peep of light next to the Starrett. Given the finish quality and prices of these squares, the Stanley seemed like less of a good buy at nearly $16.

If you decide to lay out a lot of money for a square, you are buying two things: good materials and guaranteed precision. In that regard, Starrett leads the pack. You won't find a better quality tool. But if Starrett's prices are too rich for your budget, there are better buys for woodworking purposes. The very best value I found is a 9-in. steel engineers' square sold for $32.40 by Garrett Wade, catalog 39N04.02. The one I purchased is well-made and has a pleasing heft that suggests it will retain its accuracy. The manufacturer, an English firm called O. Fisher and Co., promises accuracy of 0.004 in. over the entire length of the riveted blade.

One tool merchant I talked with told me it doesn't make sense for a woodworker to buy expensive precision squares given the sloppy tolerances of woodworking machines and the cantankerous, changeable nature of wood itself. He's right; you don't absolutely need Class-A toolroom precision in a woodworking square. But how much inaccuracy can you tolerate before everything comes out just a little off? To do the very best work on a tablesaw whose blade wobbles like a top or a jointer with 0.015 in. runout in the cutterhead, you need *something* to rely on. A good, well-maintained square can help. □

Paul Bertorelli is editor of Fine Woodworking. *Starrett, whose address is given below, operates a small musuem with exhibits illustrating its toolmaking history. Write the company for more information.*

Sources of supply

Woodworkers' trysquares, engineers' squares
Garrett Wade, 161 Avenue of the Americas, New York, N.Y. 10013

Woodworkers' trysquares, combination squares
Woodcraft Supply, 41 Atlantic Avenue, P.O. Box 4000, Woburn, Mass. 01888

Machinists' squares, combinaton squares
L.S. Starrett Co., Athol, Mass. 01331

Inexpensive machinists' squares
Penn Tool Co., 1776 Springfield Avenue, Maplewood, N.J. 07040

Wood and brass measuring and marking tools
Bridge City Tool Works, 2834 N.E. 39th Ave., Portland, Ore. 97212

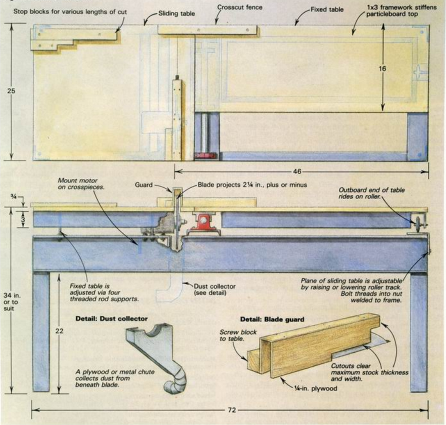
Inexpensive measuring and marking tools
U.S. General, 100 Commercial Street, Plainview, N.Y. 11803

A Shop-Made Crosscut Saw

Table slides smoothly on linear-motion bearings

by T.H. Ralph

Fig. 1: Crosscut tablesaw



During the five years I've been manufacturing a wooden needlework frame holder in my shop, I've learned that the key to successful production work is accurate tooling. My frame holder has 14 wooden parts, each of which must be precisely crosscut to length to fit boring, shaping and sanding jigs, and so they'll go together correctly at assembly. Industrial tablesaws will do the job, but it seems a shame to invest in a machine best at ripping when what you really want is a crosscut tool. The sliding-table crosscut saw shown here is my solution to this dilemma. I built two—one is permanently set up to crosscut parts of five different lengths, the other to cut four lengths.

My saw design is based on two pieces of specialized hardware: linear-motion bearings and a compact direct-drive electric motor. Linear-motion bearings have been used in industry for years in applications where a cutter or tool of some kind must slide back and forth. The bearings themselves are sleeves or pillow blocks with rows of tiny ball bearings set into grooves inside the bearing's bore. The pillow blocks are fastened to the sliding member and they, in turn, ride on a precision-ground shaft. The bearings I used for my sliding table are made by Thomson Industries Inc., Channel Dr., Port Washington, N.Y. 11050, (516) 883-8000. Thomson doesn't sell direct, so you'll need to write or phone and ask for your local distributor. For my saw, which has a 9-in. travel, I used SPB 20 pillow blocks, 1¼-in. shaft and SB 20 shaft supports. The total cost was about $200. For greater travel, just buy a longer shaft.

The motor is a 2-HP, 3-phase induction motor made by a German firm, Himmel. It's ideal for this application because it is only 4¾ in. high so it fits snugly under the saw's fixed table, allowing 2¾ in. of a 12-in. blade to protrude above the table. The motor output shaft is a 1-in. threaded arbor. I bought mine from American Contex Corp., 964 Third Ave., New York, N.Y. 10155, for $290. A less expensive solution would be to mount an arbor on pillow blocks beneath the fixed table and then belt it to a standard single-phase motor mounted on a frame under the saw.

I welded my saw frame out of heavy channel and angle iron because I happened to have it. Straight framing lumber, glued-up plywood, or lighter steel members bolted instead of welded will work just as well, as long as the frame is rigid. The fixed and sliding tables are made of ¾-in. particleboard, stiffened by 1-in. by 3-in. frames glued and screwed to their undersides. In assembling the saw, there are two critical relationships: the motor arbor must be precisely perpendicular to the linear-motion shaft and parallel to the horizontal plane of the sliding and fixed tables. To square the motor to the bearing shaft, I mounted a blade, assembled the sliding table, then used a dial indicator to position the motor relative to the table travel. Once it was perfectly square, I bolted it down. Use an accurate trysquare to adjust the tables in the horizontal plane, then, with a long straightedge, make sure they're aligned.

Once the saw is set up and aligned, it should produce reliably accurate crosscuts with only occasional adjustments. □

T.H. Ralph operates Roadrunner Woodworks in Albuquerque, New Mexico.

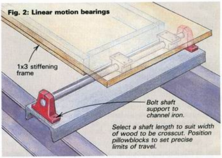


Fig. 2: Linear motion bearings

T.H. Ralph's sliding-table crosscut saw has 9-in. travel and will saw stock up to 2¾ in. thick. The Thomson linear-motion bearings, visible in the photo at near right, ride on a 1¼-in. precision-ground shaft mounted in a pair of steel supports. The sliding table's outboard end rolls on a wheel cannibalized from garage-door hardware. Its bearing surface (photo at far right) is a piece of heavy angle iron that can be raised or lowered to square the table to the blade in the horizontal plane.

Carving Incised Letters

Just a few tools do the job

by Roger Holmes

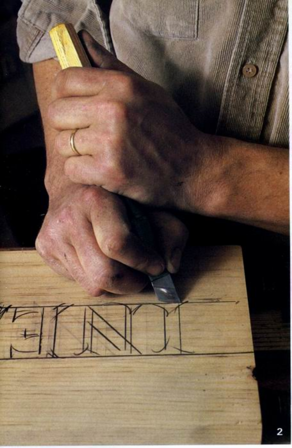
I first saw Frank Cushwa carve a sign at the Bridgewater Fair, a cattle-and-cotton candy fest up the road from us in rural Connecticut. With a single skew chisel and a couple of gouges, Cushwa incised eight or so 2-in.-high letters in a piece of pine, a nameplate for someone's vacation home. Layout and carving took all of about 20 minutes. It was a handsome sign. Though sketched freehand, the letters were nicely formed and spaced, and the carving was crisp. Until then, I had thought letter carving required complicated layout and a trunkful of carving tools. Cushwa made it look easy—well, accessible at least—so I decided to look him up and find out more.

Cushwa and his wife, Rhonda, run their business, Kent Carved Signs, out of a building just behind an old railroad station in the center of Kent, Conn. While Frank carves at a waist-high, lectern-like bench, Rhonda tends the phone, the order book and the computer. It's clear from a glance at the 15 or 20 signs displayed around the showroom that carving is only part of the job. Most are painted pine or poplar, though some are polyurethaned butternut or walnut. After carving, letters are either painted to contrast with background colors, or gilded with 23K gold leaf. Gold leaf is popular for commercial signs—doctors' and lawyers' offices, bakeries, shops. Gold, according to Cushwa, reflects light as well as status and makes a letter stand out like nothing else. It is also expensive: 2-in.-high letters, for example, cost $5 apiece painted, $8 each gilded.

Cushwa is a self-taught carver. After receiving his master's degree in music performance on the clarinet, he decided against music as a career—he liked the playing, but hated the hustling required to make it pay. In 1979, a chance encounter with a sign carver demonstrating his work in a shopping mall planted the seed of his new career. A carver in Amherst, Mass., told him a bit about tools and techniques; type books provided a short course in lettering. Experiment and practice did the rest.

Cushwa's technique is straightforward and involves using carving tools rather like knives, pushing or pulling them to make slicing instead of chopping cuts. The technique is similar to chip carving, in that several angled cuts pop a chip of triangular cross section out of the wood to create an element of a letter. Straight cuts are made with a skew chisel that is as large as practical for the letter size. Curves are roughed out with a skew, then the outside, concave curves are finished with one or two gouges, the inside, convex curves with the skew. Almost all the cutting is done from just four hand postions, shown in photos **2**, **3**, **4** and **7**. Cushwa has built up the shafts of some of his tools with duct tape to

Frank Cushwa carves a sign (top) with only a skew chisel and a few gouges. His waist-high bench, its surface about 2½ ft. on a side, allows him to move around large signs. Cushwa lays out letters freehand (bottom), using a plastic rule for straight lines. Spaces between letters should be roughly equal in area.



2

3

4

5

Three basic hand positions are shown here as Cushwa sets in and makes two vertical straight cuts for an I. Some trimming with the skew completes the letter.

make the pencil-grip he frequently employs more comfortable.

The beauty of the method is most evident in the curved gouge cuts. With the waste cleared by the skew, the gouge needs only to establish its own bearing surface as it slices down at the beginning of the cut. Then, pushed or pulled according to grain direction, it cuts a fair curve across the wood, guided by the rubbing of its bevel on the surface just cut and, minimally, by hand and eye. This flowing movement is essential to the technique, whether the cut is straight or curved. In some cuts, the hands, wrists and tool may be rigid, the upper arms and body moving them as a unit across the wood. In others, the fingers and wrists combine to pivot the cutting edge in an arc.

As economical as Cushwa's method is, it's hard work, and hard on the body. A run of some 300 signs carved over a twelve day period at the New England States Exposition last year induced a painful case of tendonitis in his right elbow. To lessen the strain, Cushwa has been experimenting with other carving styles, as well as the use of a router to clear waste prior to hand cutting.

Though a simple sign may require only a skew and two gouges to carve, Cushwa's tool collection is much larger than that. To accommodate letters of varying size, his skews range in width from ⅜ in. to 1¼ in. Gouges are similar widths, the sweeps mostly #5, #6 or #7, and include a few in a fishtail pattern. Punctuation—periods, commas and so on—require narrower, tighter-radius gouges.

Cushwa prefers thin tools, which slice through the wood with less effort. To reduce drag on the skews further, he extends the sharpening bevels back about ½ in. from the cutting edge. He doesn't grind the bevels, but works them over a series of oilstones—medium and fine India, then hard Arkansas. Three increasingly fine grits of buffing compound on a wheel, followed by stropping with leather, bring the tool to a mirror polish, which also lessens friction. He works a small, second bevel at a slightly higher angle on the hard Arkansas stone, then rounds the tip minutely and the skew is ready to carve. Gouge bevels are also lengthened, though not quite as much—most of the

6

To avoid cutting against the grain on a diagonal cut (above), reverse the skew and push it away from you. Cushwa uses the hand position at right to make the top cut of a horizontal letter stroke.

wood is removed first by a skew, so drag isn't as important. Corners are slightly rounded to keep them from catching during a cut. Once he prepares a tool with stones and buffing, Cushwa can carve pine with it for days with only frequent touch-ups on the hard Arkansas stone.

Cushwa's skews are extremely sharp but fragile because of the long bevel. A surprising amount of flexing occurs on curved cuts (Cushwa likens the varying flexibility among skews to that found in clarinet reeds), and you must be constantly aware of the stress on the tool. Rounding the tip, Cushwa discovered a couple years back, helps keep it from snapping off on curves, and saves much tedious sharpening time.

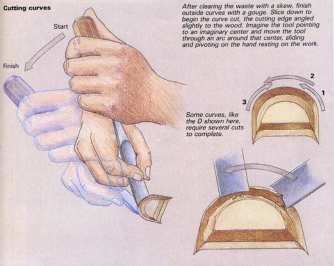
Regardless of how well it's carved, a sign is only as good as the form and layout of its letters. Cushwa has a good eye and what penmanship teachers used to call a good "hand." He keeps a copy of the Lettraset catalog of transfer type close at hand for reference, and studies other type books from time to time. (These books are available at most art supply stores or libraries.) Most of Cushwa's signs employ letters based on the Caslon face, an austere, distinguished face consisting of straight lines and simple arcs. Serifs, small tails ending the strokes that form the letter, add a simple touch of grace.

Cushwa rules layout lines on the board, then draws the letters with a 6B pencil (**1**). A short plastic ruler aids him with the straight lines, but curves are all freehanded. The letter shapes are roughly, but fluidly indicated; Cushwa defines the final shape while carving. Spacing is important and more difficult to alter once carving has begun. After establishing the center of a line by measurement, he spaces the letters and words by eye, trying to make the spaces between the letters in a word roughly equal in area. Cushwa will erase three, four or more times until a layout looks right—he says he spends more money on erasers than he does on tools.

Lettering freehand mirrors the carving style—the movements are much the same for both, so the two tasks are complementary. If you're uncomfortable with freehand lettering, you can trace letters, shrinking or enlarging them if needed with an overhead projector. Blue, black or white carbon paper works for transferring the tracings, depending on the color of the groundwork.

After layout, Cushwa fixes the board securely to the carving bench with as little obstruction as possible. Small signs are held by two commercially made aluminum bar clamps called Back-to-Back Bench Clamps, which clamp to the benchtop and the work (available from Woodcraft Supply Corp., 41 Atlantic Ave., P.O. Box 4000, Woburn, Mass. 01888). C-clamps hold large signs. Carving begins by making cuts with a skew along the base and height lines; Cushwa calls these stop cuts (**2**). Make them deep in the center and shallow at both ends, which form the points of the serifs. Two vertical cuts complete an I, the simplest letter (**3**, **4**). Each cut begins and ends at the points of the serifs, curving with a twist of the wrist into or out of the straight cut. The hands and tool are rigid for the straight cuts, pulled by the upper arms and shoulders. In these and virtually all other cuts, the heel of the right hand rests on the work (as for holding a pencil) and steadies the cut. Likewise, all cuts are made holding the tool at an angle between 30° and 40° to the wood. Cushwa says precise angles and the depth of the cuts are less critical than the width of the letter's strokes. Nevertheless, his cuts are of a fairly uniform angle, resulting in the narrow strokes being shallower than the wider strokes.

After clearing the chip, clean the juncture of the two cuts and the serifs. Trim as needed to even the surfaces and straighten lines (**5**). Remember, this is freehand carving; each letter need



Rough out the inside and outside arcs of curved strokes with a skew before slicing around the outside curves with a gouge.

Tight curves are cut with a narrower gouge and a pivoting motion (left). A 360° pivot around a tight radius makes a period (right).

Gold leaf against a painted background brings out the full character of incised letters.

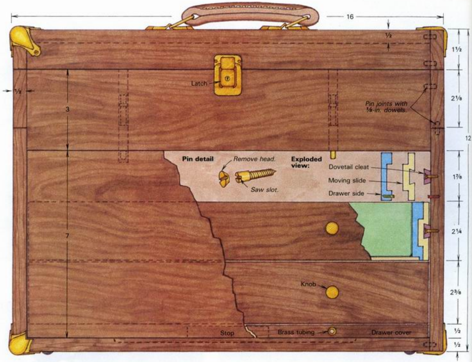
not be uniform or perfect to create a pleasing sign.

Diagonal cuts are made much like vertical cuts—hands and tool moved as a unit by the upper arms and shoulders. In photo **6**, Cushwa has reversed the skew and is pushing it away from his body in order to cut with the grain. Horizontal cuts are complicated only by the tendency of the tool to follow the grain. Top and bottom stop cuts for an E are just like those for an I, only stretched out between the points of the serifs at each end. After cutting the letter's vertical stroke, make vertical stop cuts at the ends of the letter's three horizontal strokes, then make the remaining horizontal cuts (**7**). The horizontal strokes are narrower than the vertical one and are, therefore, shallower, widening and deepening into the serifs.

Cushwa roughs out curved letter strokes with a skew, shifting hand positions and reversing tool direction as the grain dictates to cut both the inside and outside curves of the stroke (**8**). A gouge of as large a sweep as is comfortable finishes the outside curve, as shown in the drawing. Think of the tool as pointing to the center of an imaginary cone forming the outside curve. Slice into the wood and rotate the tool through an arc around that center to make the cut. While the upper arms and shoulders move the hands and tool laterally, the tool is also pivoted, the right hand serving as fulcrum. Large curves may require several cuts to complete. Finish inside curves with a skew.

Small-radius curves are cut much like large ones. Rough them out with a skew. Pay particular attention to grain direction on an S. The gouge cut may be almost entirely pivoted (**9**). A period is the tightest radius curve—twirling the tool almost on a point pops out a tiny plug (**10**). Photo **11** shows how nicely gilded letters stand out on a painted background. □

Roger Holmes is an associate editor of Fine Woodworking.



Carvers' Chest

Drawers on moving slides

by Aaron C. Zeamer

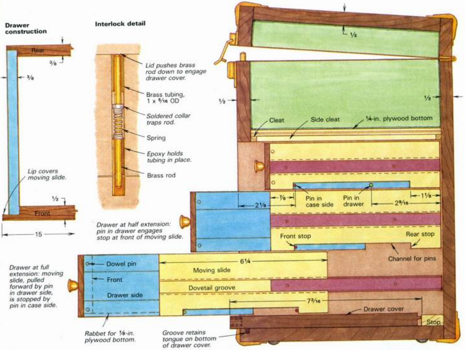
I got the idea for this carvers' chest from a photo in the *Woodcraft* catalog. Their small tool chest seemed a good size to make as a gift for my woodcarving son. I modified the design somewhat by including a moving-slide drawer support, which allows the drawers to extend fully without falling out.

The chest is made to look as if the top compartment is a separate box that can be lifted off, but it is not—the horizontal-grain part of the sides is firmly doweled and glued to the lower part before the sides are cut to size. This is the sort of cross-grain construction that should be avoided on large woodworking projects, because seasonal wood movement can break such joints apart (wood shrinks and expands in width, but not in length). But this chest's sides are only 8 in. wide and it has held together fine for several years now. There is always some cross-grain joinery in any solid-wood box, and this design actually minimizes the more troublesome cross-grain joint between the back, which has horizontal grain, and the sides, which would otherwise be entirely vertical grain.

Two or three parts in the drawing may need some explanation. The drawers run on a moving slide which, in turn, runs on a dovetail cleat, as shown. The critical part of the system is the location of the pins, one in the drawer and one in the case side. When the drawer is pulled out, the pin in the drawer runs out to the end of the channel in the moving slide and hits the front stop. Then the pin pulls the slide out with the drawer to provide support. When the moving slide reaches full extension, it is stopped by the pin in the case side. When the drawer is returned, its lip pushes the moving slide back into the case.

Proper placement of the pins—in conjunction with the dimensioning of the moving slide's channel and stops—is necessary for the extension system to work properly. The drawing gives positions and dimensions that can act as a guide, but the pin locations are best marked after all the wooden parts are made. The pins should project far enough to engage the slide, but must not project so far as to foul each other as the drawer moves.

When the chest is fully closed, a wooden panel covers the draw-



ers; when the chest is in use, this drawer cover stows away beneath the bottom drawer, as shown in the drawing. The drawer cover is secured at the top by an interlock—a spring-tensioned brass rod—that is activated by the chest's lid. I obtained the parts at a local crafts shop, but the rod, springs, tubing and silver solder can be purchased by mail for about $15 from Small Parts, Box 381736, Miami, Fla. 33238. The bottom edge of the drawer cover is secured by a tongue and groove. Because the tongue is off-center toward the rear edge of the panel, the panel tips forward by gravity when the lid is opened and does not require a finger-grip.

Traditionally, chests like this are equipped with brass corner protectors. These, hinges and other hardware to suit are probably best bought locally. I lined the drawers of my son's chest with adhesive-backed felt, from Constantine, who also supplied the ⅛-in. basswood plywood for the drawer bottoms.

It might be of interest that even though I had a fairly complete shop in our home in Warrenton, Va., ninety percent of this chest was built in Clearwater, Fla., while my wife, Lois, and I were spending the winter in St. Petersburg. I had taken a three-month membership in a small woodworking shop, allowing me practically unlimited hours using their machinery and tools, which happened to be mostly Craftsman, as mine were at home. A migratory woodworker *can* have the best of both worlds. □

Aaron Zeamer now lives in Bradenton, Fla., year round. His son and the completed chest are in Germany.

The drawers, which will be lined with adhesive-backed felt, ride on moving slides that allow full extension. The drawer-cover panel stows away beneath the bottom drawer when the chest is in use.

Drawing: Lee Hov

Federal Card Table

String inlay frames the game

by Michael Dunbar

At no other time in our history were Americans more fascinated with card playing than during the Federal period. So much time was devoted to cards that a special piece of furniture—the round card table with one hinged leaf that closed book-fashion—was created for just this purpose.

Often called demi-lunes, these tables were made from the early-18th century until the mid-19th century, but the form was never as popular as it was during the Federal period. A household that did not own at least one card table was as unusual as a modern household without a television. Card tables were often the most elaborate pieces of furniture a family owned. When not in use, these tables were prominently displayed in the front hallway or the formal parlor.

This particular table has a visual intensity created by the string inlay, or stringing, on every visible surface except the top and the insides of the legs. Stringing was commonly used in formal Federal furniture, perhaps because cabinetmakers appreciated its ability to draw the viewer's eye—particularly when illuminated by candlelight. On this table, which is primarily mahogany, the light-colored inlay acts as a visual fence, bounding each area and preventing the eye from moving easily from one to the other. For a brief moment, the viewer's attention is trapped inside each area, scans the perimeter several times, then moves on to the next surface where it is again briefly seized and spun around the outline of the stringing.

A card table was often the most elaborate piece of furniture in the Federal-period home. The left rear leg swings out to support the hinged top, which opens up book fashion.

Each time I view this table, my eye is drawn first to the skirt. There it moves quickly around the long rectangle, like a marble spinning inside a tin can. The concave corners enable my eye to jump from a horizontal line to a vertical to the other horizontal. On less well-thought-out tables, where the corners of the stringing are square, the eye will follow the horizontal lines into the corners and the quick scanning motion is subverted. The effect is like trying to spin a marble in a box instead of a can.

From the skirt, my eye usually falls to a leg, where the stringing pulls it quickly down the long taper to the ankle, across the ankle banding and back up the other side.

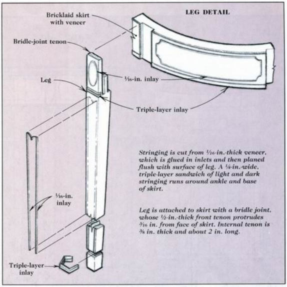
Near the bottom of the tapered legs, two horizontal lines of light stringing flank a dark, thicker core of ebony veneer to define the ankles. If the stringing simply ran vertically to the foot, the eye would travel down to the floor and not easily jump from one edge of the leg to the other. The same triple banding is used as a border to delineate the lower edge of the skirt. The effect is strongest under candlelight. The banding creates a sharply defined line that prevents the edge of the mahogany skirt from fading into the shadows under the table.

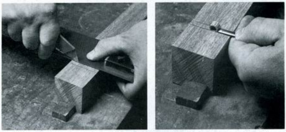
From whatever direction you view the folded table, you see an arc of skirt framed by two legs. The veneer on the skirt is made from three adjacent cuts taken from the same flitch so that each surface is nearly identical to the other two. From the front, you glimpse two blank surfaces on the rear legs. It may seem odd that they have no stringing, but this would have scuttled the maker's noteworthy design. With inlay only on the extreme left face of the left leg and right face of the right leg, the table breaks into a symmetrical triptych—three identical sections made up of two legs and a panel, each one sharing a leg with its neighbor.

When the table is open this careful arrangement no longer exists. The maker knew that participants in a card game commonly draped a green, floor-length wool cloth over the table. Even if this were not the custom, one is more likely to interact visually with the piece when it is folded and against the wall than while playing cards on it.

This card table is not a particularly complex woodworking project. Beneath its mahogany veneer, the curved skirt is bricklaid from two layers of pine. There are three curved segments in the top layer glued to two longer segments in the bottom layer. Once the glue hardened, the inner and outer surfaces of the segmented skirt were planed smooth.

There are about a dozen nail holes in the lower edge of the skirt, indicating that the cabinetmaker laid the glue on the mating surfaces then nailed the pieces together. The nails may have prevented the sections from slipping when being clamped or may have eliminated the need for clamps altogether. Either way, the nail heads were never set, and the nails were extracted after they had served their purpose.





To lay out the groove for the ankle banding on the leg, score the edges of the inlet on one face with a mat knife and square, then remove the wood with a chisel. After tapering the leg, cut inlets on the remaining three sides of the leg.

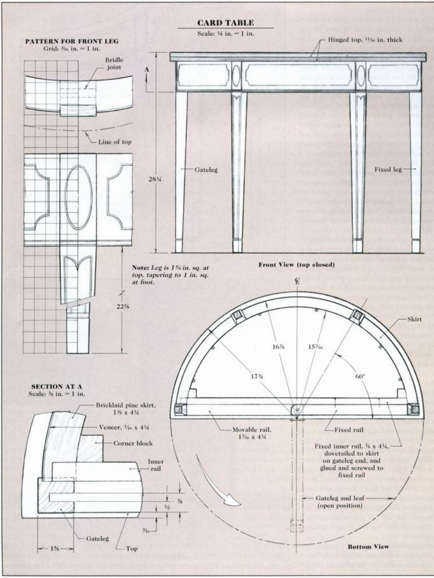
Bricklaid construction makes a stronger skirt than would three single pieces cut from a plank. The short lengths of edge grain that occur in a curve are strengthened by the other layer. A bricklaid skirt allows for some joinery techniques that differ from the standard mortise-and-tenon normally used to join a table's legs to the skirt. The two center legs are joined to the skirt with a modified bridle joint. The rear tenon of the bridle is short, and housed in a blind mortise in the skirt.

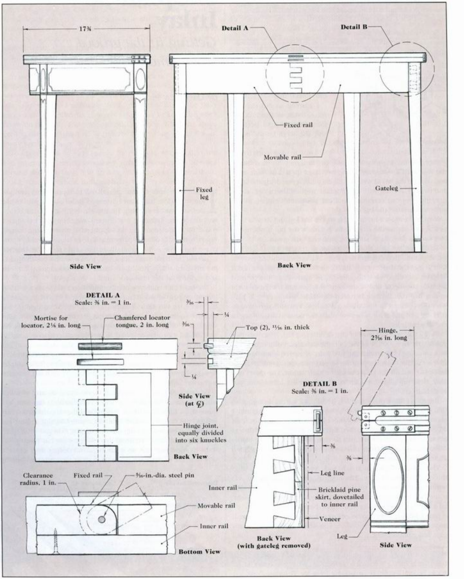
The rear legs are treated differently. The right rear leg is fixed, and joined to the skirt and the back rail with a standard mortise and tenon. The left leg is a swinging leg, or gateleg, hinged to the middle of the back rail, from which it swings out to support the open top.

Some interesting joinery is required to enable this leg to swing. The back rail itself is two layers thick. The outer layer is made of two separate pieces, the movable rail and the fixed rail. These are connected in the middle by a series of interlocking knuckles that form a wooden hinge (making this type of hinge is explained in detail in *FWW* #47, p. 45). The gateleg is attached to the end of this movable rail with a mortise and tenon. The inner layer of the back rail is glued and screwed to the fixed outer rail and joined to one end of the curved skirt with half-blind dovetails. The other end of the inner rail is butted against the skirt.

The two edges of the card-table leaves merely butt together when the table is open. A short tongue is set into the center of the rear edge of the hinged leaf, and a mortise is made in the rear edge of the fixed leaf. When the top is open, the locator tongue fits into this mortise and keeps the movable leaf from shifting. Otherwise, all that strengthens this butt joint between the leaves when the top is open are the two card-table hinges.

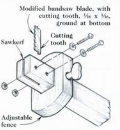
Card-table hinges (available from Garrett Wade) have two long


CARD TABLE
Scale: ⅛ in. = 1 in.
PATTERN FOR FRONT LEG
Grid: 3/16 in. = 1 in.
Bridle joint
Line of top
Hinged top, 11/16 in. thick
A
28¾
Gateleg
Fixed leg
22⅝
Note: Leg is 1⅝ in. sq. at top, tapering to 1 in. sq. at foot.
Front View (top closed)
SECTION AT A
Scale: ⅜ in. = 1 in.
Bricklaid pine skirt, 1⅜ x 4¼
Veneer, 1/16 x 4¼
Corner block
Inner rail
⅜
½
3/16
Gateleg
Top
1⅝
℄
Skirt
16⅞
15 7/16
17¾
60°
Movable rail, 1 5/16 x 4¼
Fixed rail
Fixed inner rail, ⅞ x 4¼, dovetailed to skirt on gateleg end, and glued and screwed to fixed rail
Gateleg and leaf (open position)
Bottom View



17¾
Detail A
Detail B
Fixed rail
Movable rail
Fixed leg
Gateleg
Side View
Back View
DETAIL A
Scale: ⅜ in. = 1 in.
Mortise for locator, 2¼ in. long
Chamfered locator tongue, 2 in. long
³⁄₁₆
¼
Top (2), ¹¹⁄₁₆ in. thick
Side View (at ℄)
Hinge joint, equally divided into six knuckles
Back View
Hinge, 2³⁄₁₆ in. long
DETAIL B
Scale: ⅜ in. = 1 in.
Leg line
Bricklaid pine skirt, dovetailed to inner rail
Veneer
Leg
Inner rail
Back View (with gateleg removed)
Side View
Clearance radius, 1 in.
Fixed rail
³⁄₁₆-in.-dia. steel pin
Movable rail
Inner rail
Bottom View

legs that open like a pair of scissors rather than opening and closing like table-leaf and butt hinges do. Both the table-leaf and butt hinges would have to be set into the playing surfaces of the leaves, which Federal-period cabinetmakers seemed inclined to avoid. Instead, card-table hinges are set into the outside edges of the leaves.



String inlay—To make the inlets for string inlay, I prefer to use a couple of tools that I can quickly make myself.

I adapted an old marking gauge to use as a scratch tool for making straight inlets. It will also work on the edges of the leaves.

While the leg stock is still square, cut the inlet for the ankle banding only on the front of the leg. With a mat knife scribe two lines for a ¼-in.-wide inlet and remove the wood with a ¼-in. chisel. After tapering the sides and back of the leg with a handplane to the dimensions in the drawing, you can continue the front ankle inlet around to the sides and around the back.

Next, measure 4¾ in. from the top of the leg and draw a light pencil line across the front surface. This is the point where the two vertical lengths of stringing stop and turn inward.

To cut the two radii that turn inward at the top of the leg, I use a pair of modified dividers to lay out and cut this curved groove. One leg of the dividers is pointed, and the other leg has a notch filed into its end that scribes line 1/16 in. apart. Place the pointed leg near the top of one of the vertical inlets and set the dividers to one-half the distance between the inlets. You'll have to play with the opening to find the exact radius. You will also have to find, by trial and error, where to place the pointed divider leg in the straight inlet.

Swing the notched end of the dividers so that it scribes two concentric arcs. Do the same with the dividers positioned in the other straight inlet so that the two pairs of curved lines intersect in the middle. Now deepen the scored sides of the inlets with a mat knife and lift the chip out with a 1/16-in. chisel. The chisel will also clean up the intersection of the curved inlets with the straight inlets.

Because I think that white birch was used for the stringing on the original table, I chose this wood for my stringing too. I make a sheet of white-birch veneer by resawing thin slabs from a board on the bandsaw. I then thickness-plane them as thin as possible and finish them down to 1/16 in. with a smoothing plane. I cut the stringing from this veneer with a mat knife guided against a straightedge.

The ankle stringing is a ¼-in.-wide sandwich of birch with a thicker, dark ebony core. The original, three-tiered veneer was undoubtedly cut in a single slice from three slabs of wood planed to the desired thickness and glued together. Make a similar sandwich of veneer for your ankle banding.

String inlay is meant to be enjoyed from a distance, and small imperfections are not noticeable. The finish will usually fill any gaps left after sanding. □

Michael Dunbar, of Portsmouth, N.H., has made Federal furniture since 1972. This article is adapted from a chapter in his book, Federal Furniture, *available from the Taunton Press.*

Shop-Made Inlay

Getting in the groove with a motorized grinder

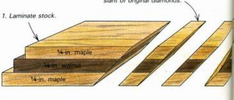
by David Ray Pine

In the ten years I have specialized in reproducing antique furniture, I've had many customers order pieces with inlaid decorations—everything from plain holly stripes to elaborate sunbursts. Initially, my designs were limited by what I could buy from commercial suppliers. I often talked myself (and my clients) out of a particular style because I couldn't purchase it anywhere. We generally had to settle for a *similar* style in *almost* the right size. Gradually, it dawned on me that making my own inlays would be easier than redesigning a piece and waiting for the mail-order items.

The most common type of inlay found on antiques is a narrow, long-grain strip of wood laid into a groove cut in a table, chair or casepiece. In the 18th century this was called "stringing," but today it's usually known as pinstripe or striping. Typically, pinstripe is a close-grained, subtly figured wood—holly, maple, boxwood, or ebony—selected to provide a decorative contrast with the primary wood, called the ground, that surrounds it. For the early cabinetmakers it was an effective way to emphasize the lines of their furniture. Many Federal pieces, for example, depend largely on inlay to delineate the base, waist, cornice and other sections.

Commercial pinstripe measures 1/16 in. by 1/20 in. and is inlaid with its broadest face showing. While manufacturers can easily cut these strips from 1/20-in.-thick veneer, and the strips conveniently fit grooves cut with standard 1/16-in.-dia. router bits, this striping has an irritating tendency to flip onto its narrow side and twist when bent in a tight curve. To avoid this twist, we cut our pinstripe to show its narrowest face, so it can be inlaid deeper than its show side is broad, or we make it square in cross-section. Our 1/32-in. by

Diamond banding



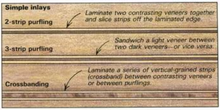
1/16-in. pinstripe is a favorite because its dainty effect is reminiscent of many antique pieces. It's narrow enough to be bent around tight curves without being soaked or steamed, and its 3/16 in. depth gives it strength and ample glue surface. For more striking effects on larger pieces or coarser country pieces, we use 1/16-in. by 3/16-in. or 1/8-in. by 1/8-in. inlay. If you want something more dramatic than a simple stripe, you can expand the striping techniques to make wider bands, which can include different colored woods for even more visual interest.

You can readily make any size striping on a tablesaw outfitted with an auxiliary fence that fits snugly against the table and a wooden insert that hugs the sawblade. You don't want the thin inlay slices to bind under the fence or in the insert. Use push sticks and featherboards as much as you can to keep the stock down on the table and snug against the fence. When the slices get too narrow to push safely past the blade—*stop*. Don't risk an injury just for a piece of inlay.

To make 1/32-in. by 1/16-in. strips, for example, start by dressing and edging an easy-to-handle, straight-grained piece of stock about 3 ft. to 4 ft. long, 4 in. to 8 in. wide and 3/4 in. to 1 in. thick. Using your smoothest cutting blade—we like a sharp plywood blade—set the rip fence about 1/32 in. from the blade and rip off a long slice. Check the thickness with calipers or, better yet, by trial-fitting the piece into a groove cut into a hardwood scrap. Don't use softwood, which will compress enough to accept a slightly thicker slice than hardwood, or you will end up with a batch of too-thick inlay. Adjust the fence until the inlay slip-fits the groove.

When the fence is adjusted properly, rip slices off both edges of the stock, rejointing the edges after every third or fourth pass to keep them straight and true. Then, reset the fence to 1/16 in., adjusting the cut as you did before. Rip striping off both edges of the slice, again using a featherboard or hold-down to prevent the thin strip from riding up over the blade. It's generally safer to have someone tail the saw and pull the end of the stock through the blade. Expect to lose a few inches off the last couple of strips, since the slices will be flexible enough to wander from the fence and often whip or shatter as they are pulled through.

Multicolored bandings are common border treatments, either set into the perimeter of table and chest tops or let into the edges of the top. The simplest banding to make is purfling, two contrasting stripes laminated side-by-side. Basically, you laminate two veneers together and slice strips off the laminated edge. Use any two contrasting woods that also contrast with the finished ground—ebony (or ebonized wood) and holly, walnut and holly, or walnut and maple work well. You can also sandwich a lighter veneer between two darker veneers—or vice versa—to make a wider purfling with a more symmetrical appearance. If you saw your own veneers, you can make the final width match a groove cut with a standard 1/16-in. or 1/8-in. router bit. If you laminate commercial veneers, you'll have less control over width, but probably have a wider selection of colors, and you can grind a router bit to fit your purfling.

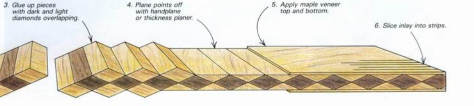


Another common device is crossbanding—a vertical-grained strip (crossband) sandwiched between contrasting veneers or between purflings. The wood used for the crossband should have a strong stripe to show the grain direction clearly. Zebrawood and vermilion (padauk) are commonly used, but quartersawn walnut, ash or rosewood work well if they have a strong straight-line grain pattern.

To make the crossband, cut slices from the end of squared-up and surfaced stock. The thickness of the stock largely determines the width of the veneer sandwich you'll rip into banding. Eight-quarter stock is ideal, but any board that's at least 3/4 in. thick can be used. The more nearly quartersawn the stock, the more uniform the appearance of the crossbanding will be throughout its length, since these off-cut slices will be glued edge-to-edge. If a dark crossband has sap on one edge, try mating the sap edge of one slice with the heart edge of the next to produce a dark-to-light gradation that repeats along the banding's length. This technique was frequently used by makers of the "Roxbury" type cases designed for Aaron and Simon Willard's tall clocks in early-19th-century Massachusetts.

We join pairs of crossbands by making a rub joint with hot hide glue or white or yellow glue. Put glue on both pieces and rub the glue surfaces together, sliding them back and forth until you feel them stick, then carefully place them on a flat surface to dry. When the pairs are dry, join them to another pair in the same way. Continue until you have a piece the required length, then sandwich it between two slices of veneer or purfling. When laminating veneers or inlays, place the glued-up stock between flat cauls so that clamping pressure is distributed evenly, thus preventing the thickness of the band from varying along its length.

Once the stock has been glued up and taken from the clamps, clean up one or both edges with a handplane or jointer, then rip the slices off. You may want to use a bandsaw to minimize kerf waste. Aim for a band about 1/16-in. thick; thinner banding may



Drawings: Caren Mastranardi

come apart when sawn. Also, this thickness reduces the danger of sanding through the inlay during cleanup.

Recently our shop had to match an inlaid banding on an antique Hepplewhite drop-leaf table. The client brought the table to us after another shop had recommended replacing the remaining inlay on the apron and legs with all new stock banding. The original banding was a typical pattern—a string of dark walnut diamonds joined point-to-point, surrounded by light maple half-diamonds above and below. The diamonds were sandwiched between maple veneers, then the whole was inlaid across the bottom edge of the apron and around each tapered leg. When we examined the inlay closely, we discovered that the wood grain was not aligned with the axis of each diamond but ran diagonally parallel with the flats. Each diamond had been cut off at an angle from a 1¼-in.-thick strip, and we figured the 18th-century cabinetmaker had made the inlay as shown in the drawing on pp. 58-59.

The ease with which you can decipher and duplicate the diamond banding indicates the range of effects possible with simple bands and stripes. I've presented my techniques in a general way to give you leeway to experiment and develop your own designs. You don't even have to worry about wood movement. Even when run across the width of a tabletop or other surface, pinstripe is very forgiving. Perhaps its small cross-section can't offer much resistance to seasonal movement. At any rate, I've not had any problems in ten years. □

David Ray Pine builds reproductions of antique furniture in Mt. Crawford, Va.

Fitting and finishing inlay

The handiest tool I've found for cutting inlay slots and grooves is a tool-and-die makers' rotary grinder mounted on a stand, below, that my father made to go with the clamp Sears sells to mount the grinder on a metal lathe (catalog number 9 HT 25846). The stand lets me use the machine like a router, but the grinder's long "nose" provides more visibility and it's lighter and easier to handle. Holes bored in the stand allow me to use the grinder with several jigs, including an adjustable fence that can locate a router bit any distance from an edge, and a center pin for indexing into various sheetmetal templates to cut arcs and circles. To cut $\frac{1}{32}$-in. kerfs for striping on drawerfronts or legs, we mount a small Dremel circular saw in the grinder, as shown at right. A collet is needed to adapt the ⅛-in. saw shaft to the ¼-in. grinder chuck. A wooden fence controls the depth of cut.

To cut slots and grooves on a drawerfront, for example, I first mark out the horizontal and vertical grooves with a marking gauge, then cut the long horizontal grooves before doing the vertical sections. I stop just short of the intersection of the two grooves to make sure I don't

A tool-and-die makers' rotary grinder, left, mounted on shop-built stand cuts the inlay grooves. Shaped blocks can be attached to the 6-in. by 3-in. stand to guide the tool against a fence or curved template. To cut $\frac{1}{32}$-in. slots for inlay, Pine mounts a small Dremel circular saw in the grinder. The wooden block around the blade sets the depth of cut, and the base of the stand bears against the edge of the piece being cut.

Pine stops the grinder cut just short of the intersection of the two grooves to avoid marring the wood outside the inlay border, then connects the grooves with a $\frac{3}{32}$-in. chisel ground from a file, above. Inlay corners look best mitered. Pine eyeballs the miter angle, using the corners of the inlay grooves for reference, then scores the stripe with a skew chisel, top right. He cuts the strip on a small hardwood block, making a heavy cut to size the piece, then paring down to the line.

damage the wood outside the inlay area, and remove the last tiny bits of wood with a $\frac{3}{32}$-in. chisel ground from a file, above, left. If you'd rather not use a motorized grinder, you can cut grooves for the inlay using a scratch stock (*FWW* #48, p. 43).

Once the grooves are cut, dry-fit all striping before applying glue. Corners look best mitered—it's easiest to just eyeball the angle of the miters. Cut a miter on one end of a stripe, as shown above, top right, and lay it in its recess. Cut the ends to length by lightly marking the stripe with a chisel (a skew point carving chisel is handy here) while it is in place, then cutting it on a small hardwood block, above, right. Press it into place and fit the next piece. Continue fitting until you reach the starting point or the end of the run. Then remove the inlay and place each piece so it won't be confused with any others.

The inlay should snap into place, especially at the ends. If it's sloppy in the groove, select another piece and recut it. Sometimes the inlay thickness will vary slightly from piece to piece. Don't worry about a slightly undersized stripe, it can be smashed down somewhat to fill the recess during glueup. If the stripe is too thick in places, thin it by hammering lightly. Moisture from the glue will swell the fibers enough to produce a snug fit.

You need only a tiny bead of glue to secure the striping. We apply glue with a small syringe or a cut-down brush with just a few long bristles. Once the glue is in the recess, the striping is pressed in. If the dry fit was snug, you may have to tap the inlay in place because the glue will swell things a bit—work quickly. Glue the inlay down in the same sequence in which it was fitted. When it's all in, hammer it down well. Sometimes the inlay will tend to buckle up out of the groove. To remove the buckle, scrape the surface level when the glue has dried.

Inlaying wider strips of purfling or banding is much like inlaying striping. When applying banding as a border on the corner of a case or top, where the banding is not surrounded by the ground, apply strips of masking tape every few inches to pull the inlay tightly into the routed recess. Masking tape is also good for fitting banding around the corner of an apron. Let the banding on the most visible side extend $\frac{1}{16}$ in. or $\frac{1}{8}$ in. beyond the stock. Fit the end of the next piece against the inside of this protruding piece, thus hiding its endgrain, and tape the corner together until the glue is dry and you can pare the ends flush.

The effect of any nicely executed inlay can be ruined by a poor finish. The inlay should be scraped level and true, then carefully sanded with a pad sander or fine sandpaper on a block. A good rule of thumb is to sand at least one, preferably two grits finer than usual. No scratches should be visible on the inlay, even on miters and other places where it must be sanded cross-grain. I've found 280 or 320 is a good final grit, but some elaborate assemblies might require 400-grit paper.

The easiest finish for an inlaid piece is a clear finish—oil, shellac or varnish—that will highlight the color of each wood in the inlay, heighten the contrast between the various woods used and protect the surface. It's difficult to stain an inlaid piece and retain the contrast between woods. The only coloring agent I know of with sufficient natural selectivity is potassium dichromate. This chemically colors mahogany, cherry and oak to beautiful shades of reds, oranges and browns, depending on the strength of the solution used, but does not darken holly, maple, poplar or satinwood at all. It turns them yellow, a nice contrast to the ground.

Pigment stains (earth colors suspended in an oil base) are somewhat successful because a close-grained maple or holly inlay usually accepts less pigment than open-pored grounds like walnut and mahogany. A poorly sanded inlay like a fine pinstripe or a maple/cherry combination may disappear, however. Pigment stains also tend to look slightly muddy. Aniline dyes produce good, clear colors, but tend to make the inlays the same color as the ground, unless the two contrast highly, such as maple in walnut. In that case, a subtle effect is achieved. Most often, though, dye on an unprotected inlaid piece will simply cause the inlay to fade into the background.

The most common way to preserve the contrast of an inlay on a stained ground is to stop out the stain or dye by giving the inlay a coat of shellac or lacquer. These clear finishes can be tinted slightly to keep the inlay from looking too raw against the stained ground. The technique requires a small brush, patience and a steady hand, for if the brush wanders off the inlay, the adjacent ground will be stopped out as well. The result will be a ragged stripe and blotchy ground, which would be an unhappy end for all this careful preparation. —*D.R.P.*

Workshop Noise

Are machines damaging your hearing?

by Joy O'Neal

Hearing protectors

Hearing protectors come in many shapes and colors but they're all muffs or plugs under the skin. Plugs on a cord (1 and 2) or headband (6) can be worn around the neck so they're handy when needed. Disposable plugs (3) are cheap enough to wear and toss after use. Foam plugs (4) expand inside the ear canal to block out noise. One type of plug (5) requires a plastic tube to stiffen the shaft during insertion. Foam-filled muffs (7) cover the entire ear while canal caps (8) seal off only the ear canal.

Do you wonder whether the noise from your woodworking machines is damaging your hearing? As an audiologist, I often evaluate the hearing of people—woodworkers included—whose work or hobby exposes them to high noise levels. I have found that noise-induced hearing loss is widespread, despite the fact that it's so simple to prevent. Unfortunately, once hearing has been damaged by noise, the loss is permanent and irreversible.

In this article, I will explain what steps you can take to protect your hearing from noise damage. I am particularly concerned about loud woodworking machines because my husband, Michael, is a woodworker who suffers from noise-induced hearing loss. Curious about the noise levels in his shop, I used a sound level meter to measure the intensity of noise at ear level from Michael's machines, as well as some in other shops. Every machine produced sound levels high enough to cause hearing damage after long-term exposure.

Sound is the result of vibrations set up in the air by a mechanical force, which could be anything from rustling leaves to a pounding hammer. The intensity of a sound, which we perceive as loudness, is a measure of the pressure of the sound waves, and the unit of measure is the decibel (dB). The higher the decibel reading, the louder the sound. It's important to remember that the decibel is logarithmic and, therefore, nonlinear. In other words, if the intensity of a sound wave is doubled, the decibel level doesn't double, rather it increases by 3 dB. The reason this is important to you is that if you're in a shop where a router is producing 105 dB, and someone starts another router as loud as the first one, the intensity isn't doubled to 210 dB, but increases only 3 dB to 108 dB.

Frequency, which we perceive as pitch, is a measure of sound vibration in cycles per second (cps or, more commonly, Hz). The more cycles of vibration that occur per second, the higher the frequency of the sound. Most woodworking machinery noise is in the mid- to high-frequency range, but a saw or router cutter turning at a very high rate of speed will produce a higher-pitched sound than a drill press or lathe which turns more slowly. These high-frequency sounds are more likely to cause hearing damage than low-frequency sounds of the same intensity.

Noise levels from the woodworking machines I measured varied from 90 to 108 dB, as shown in the chart on p. 64. Because of its huge high-speed blade, the noisiest machine was a

14-in., 5-HP De Walt radial-arm saw at 110 dB. The quietest piece of equipment was a Delta/Rockwell drill press at 87 dB. An air-powered nail gun probably produced a higher intensity level, but my meter could not measure the burst of impact noise.

To provide a meaningful reference point for the intensity levels of the machines, a just-audible sound would be 0 dB, a whisper at four feet would be 20 dB, normal conversation at three feet would be 60 to 70 dB, a pneumatic drill at ten feet would be 90 dB, and hammering on a steel plate at two feet would be 115 dB.

The U.S. Occupational Safety and Health Administration (OSHA) recommends that hearing protection should be worn in industry when a person's exposure to noise equals or exceeds an eight hour average of 85 dB. It is important to keep in mind that the louder (more intense) the sound, the shorter the safe exposure time. OSHA's limits for noise exposure without hearing protection, illustrated in the chart, show that even slight increases in sound intensity dramatically reduce the safe exposure time. Notice that for every 5 dB increase in intensity, the amount of safe exposure time without hearing protection is decreased by half. Most woodworkers don't run machines eight hours a day, but many woodworkers work in shops where others are using machines all day, everyday, and the noise levels are quite high.

OSHA's guidelines should be considered a minimum standard. The best way to protect your hearing from damage is to wear hearing protection whenever noise levels exceed 85 dB—even for a short period of time. There are many varieties of hearing protection devices in the form of ear muffs or plugs. Most devices provide adequate protection in the frequency range produced by woodworking machines, but muffs or foam ear plugs provide the best protection.

Hearing protection devices are rated by the amount of noise they block out, referred to as the noise reduction rating (NRR). If you're wearing earmuffs rated at NRR 25 dB, the sound that reaches your ears is reduced by approximately 25 dB. The NRR is derived by a calculation based on the measured effectiveness of the protection device at nine specific frequencies between 125 and 8,000 cps. Catalogs usually list only the NRR of a device, but manufacturers are required to print more complete test information on the package. In reality, the calculated NRR has a lot in common with the miles-per-gallon figures touted in new car ads. Measurements are taken under controlled lab conditions that might be very different from those encountered by real ears subjected to real noise. While it's true that a higher NRR generally means more effective protection, small differences in the NRR aren't substantial. Comfort and convenience are more significant factors in choosing a device than a 5 or 6 dB difference in the NRR. If the difference is greater than that, choose the higher rated device, providing it is comfortable.

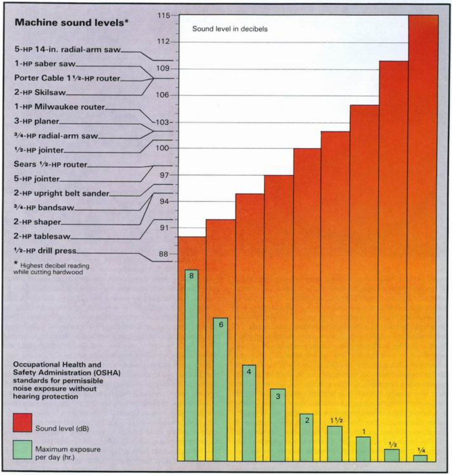
Ear plugs are relatively comfortable in hot weather and easy to carry around. There are many different types—custom earmolds, foam plugs, wax plugs, rubber plugs, air-cushioned plugs, plugs with or without cords or headbands. Plugs are much less expensive than muffs and they neither restrict head movement nor interfere with eyeglasses, headgear, or hair. The disadvantages are that some types of plugs require more effort to fit properly than do muffs, and dirt, stain and sawdust from the hands can be transferred to the ear canal if the plugs are inserted with dirty hands. If you have any type of chronic ear problems, such as drainage, plugs are inadvisable. The plugs you choose should be appropriate for the type of noise in which you work. For example, there is a type of plug, often used by shooters, that has a valve that closes when an impact noise, such as a gunshot, occurs. Because most shop noises are not impact noises, these plugs could fail to protect you from most machinery noise.

Foam ear plugs have the highest NRR (29 to 35 dB) of any type of hearing protection. You insert them by rolling the plug between your fingers to compress it into a narrow cylinder. When inserted in the ear canal, the plug slowly expands to conform to the shape of the canal. Foam plugs are inexpensive—less than 50¢ a pair if bought in quantity—and they can be washed and reused several times or discarded after use.

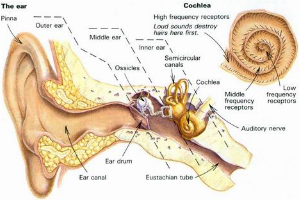
The device called a canal cap consists of soft pads (usually foam) fitted on a headband. It reduces the intensity of sound by sealing off the outside of the ear canal. While these are comfortable and easy to use, it is possible that an effective seal might not be maintained and loud sounds could enter the ears. Canal caps cost more than earplugs but less than muffs.

The final category of hearing protectors is the ear muff, which tends to reduce noise more than any device except foam plugs. There are special muffs with deep cups for low-frequency protection, muffs with foam or glycerin-filled cushions (foam is lighter and cheaper) and muffs made to be worn with hard hats. Expensive muffs usually have metal headbands and fancier cups, but foam-filled muffs with a plastic headband are fine for the workshop. If possible, try on the muffs before you buy them to make sure they are comfortable. Another thing to check is the durability of the attachment between the cup and the headband—some designs are flimsy and liable to break. Unfortunately, muffs may restrict head movement in close quarters, they are uncomfortable in hot weather, eyeglasses may prevent the cups from sealing completely, and they are not as easy to carry around as the plugs. Ear muffs are also the most expensive hearing protection device, starting at about $12.

All of these protective devices are easy to use and once you have become accustomed to thinking in terms of protecting your ears, it becomes an automatic reflex to reach for the muffs or plugs prior to starting noisy equipment. The key to selecting the most appropriate hearing protection device for yourself is to choose the one that you'll use. If you dislike the confining feeling of ear muffs and that's all you have in your shop, chances are you won't wear them. Assess your likes and dislikes and purchase the device that suits your needs. Muffs or plugs can be obtained from sporting goods stores, mail-order woodworking suppliers and safety-equipment supply companies, such as Direct Safety Co., 7815 South 46th Street, Phoenix, Ariz. 85044, or Belmar Safety



How noise destroys hearing



The hearing mechanism can be divided into three parts: the outer, middle and inner ear. The outer ear includes the part attached to the head (the pinna) and the ear canal as far as the eardrum. The middle ear includes an air-filled cavity behind the eardrum and three tiny bones, called ossicles, as well as the eustachian tube. The inner ear includes the cochlea, a snail-shaped, fluid-filled structure that converts the energy of sound waves into the electrical impulses that our brains perceive as sound, as well as the semicircular canals that are our balance mechanisms.

When a sound wave reaches the ear, it is gathered in by the external part of the ear and sent down the ear canal to the eardrum, where it vibrates across the ossicles and on into the cochlea.

The cochlea is lined with tiny hair cells imbedded in a very thin membrane. Sound waves set up motion in the fluid inside the cochlea which moves the tiny hairs back and forth. The moving hair cells generate nerve impulses which are sent along the auditory nerve to the brain. Different frequencies of sound (perceived by us as pitches) are received in specific locations along the membrane of the cochlea. The cells that respond to higher frequencies are located at the beginning of the structure, while those that respond to lower frequencies are found toward the end of the membrane. It is this specific location of frequency-sensitive receptor cells that is of interest to those who work in high noise areas. When loud noises of any frequency enter the cochlea, they hit with the most force in the first bend of the structure, where the high-frequency receptor cells are found. This area becomes eroded, much like the mud in the bend in a river is eroded when high water rushes along it. The hairs are bent, broken or blown away by the force of the loud sounds, and high-frequency hearing is eventually damaged. This type of hearing loss is called a sensorineural loss.

A person with this type of sensorineural loss can have normal hearing in the low frequencies and a severe loss in the higher frequencies. This type of loss causes persons to miss parts of words because they can't hear some of the high-frequency consonants, such as s, sh or f. Because they miss these consonants, words may sound garbled to them, especially in the presence of noise, while the loudness of the words may not seem affected at all.

Another clue, other than hearing loss, that noise may be damaging your hearing is tinnitus, which is a noise in the ear, generally described as a ringing, buzzing or hissing. Tinnitus often occurs after exposure to very loud noise. It is also an indicator of an already damaged hearing mechanism, although tinnitus which occurs intermittently and lasts for only a few seconds is not uncommon. One explanation for tinnitus among people whose hearing has been damaged by high noise levels, is that when the hair cells in the cochlea are damaged, they no longer wait to be stimulated to send signals, rather, the damaged structure continuously sends signals. —*J.O.*

Equipment, Inc., 212 Clements Bridge Rd., Barrington, N.J. 08007.

When you're standing next to a noisy machine, most of the sound travels directly from the cutterhead to your ears. But in a multi-person shop where others are running machinery, reflected sound levels can be high. Anyone who has spent time in various shops knows that all are not equally noisy. The harder the floor, wall and ceiling surfaces, the more sound will reverberate. The softer, more irregular the surfaces, the more sound will be absorbed. If you were going to build a new shop, the quietest one you could build would have acoustical tile on the ceiling, acoustical board or another soft wallboard for walls, and thick carpeting or thick rubber mats on the floors. In reality this doesn't often occur—people don't want plush carpet on the floors of their shops.

It's not always possible to dictate the specifications of the space in which you work. You can, however, improve things in a multi-person shop by putting acoustical tile on the ceiling, and arranging your equipment so that the noisiest machines are away from hard, sound-reflective walls and corners.

When you have purchased hearing protection and taken steps to reduce noise levels in your shop, your next step is to find out whether your hearing has already been damaged. To do this, contact an audiologist in your area and arrange to have your hearing sensitivity evaluated. Audiologists can be found in speech and hearing centers, hospitals, rehabilitation centers, ear, nose and throat physicians' offices or in private practice.

I recommend that all woodworkers have their hearing evaluated immediately to establish a baseline audiogram (a graph of hearing sensitivity) and that they keep copies of the test results and monitor their hearing annually. Although noise-induced hearing loss is irreversible, it's not too late to protect your remaining hearing. Remember to reach for that hearing protection before you reach for the "on" switch of your machine, regardless of how short a time you will be working. □

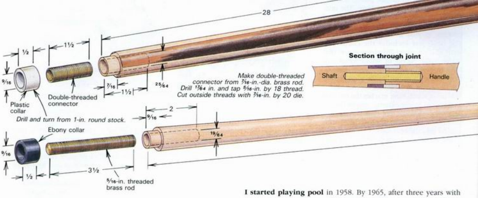
Joy O'Neal is audiology supervisor at the University of Texas Speech and Hearing Center in Austin, Texas.

Drawing: Mark Kara

Turning a Pool Cue

A hustler shares his secrets

by Colorado Slim



It was a hot, dry August day, and we were shooting nine-ball for dollars at The Wheel, a little cowboy bar in Estes Park, Colorado. The three of us were definitely in our stride by mid-afternoon when a new guy walked in, saddled up to the bar and ordered a beer and a shot. After a while, he just seemed to fade into the crowd.

Jimmy caught the guy's side glance at the pool table. "Hey, Slim," he said under his breath, "I think maybe we got ourselves some action here. How do you want to play it?" If I turned around I'd play my hand, so I waited for my turn on the table to get a better look. Cody was on a roll, and I began to wonder if he was going to scare this fellow off before we'd had a chance to see his dance. Cody wowed the crowd with a three-rail slice into the corner and calmly asked if we'd like to up the stakes. "Nice shot, cowboy," I said as I got up to rack the balls.

The new guy was a real sleeper. He looked good from a distance; almost indifferent, but confident. He was laying back just checking things out. One thing for sure, he was learning more about us than we were about him and that didn't sit good with me at all. Got to get him off that stool before the stakes get too high and he runs. Got to see him bridge that cue—just once—then I'd know for sure. It was time to put on the squeeze.

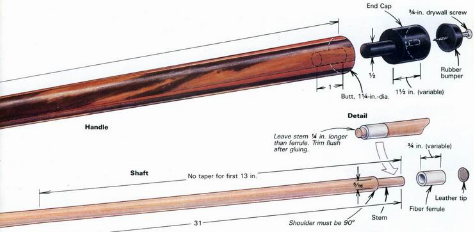
I slipped Jimmy a twenty that I'd folded around a dime and whispered, "You're out." (The twenty was for beer. . .the dime let him know he'd get ten percent of the take.) "OK, Cody, $5 and $5, with re-spots only on the nine." I said. If I lost, it was on my shoulders. Cody was ready to flip for the break when the new guy finally opened up. . ."You fellows want a third?"

I started playing pool in 1958. By 1965, after three years with Uncle Sam, I was hot stuff. I made my first cue stick in 1970. It was a beauty—rosewood, maple, ebony, purpleheart, mother-of-pearl inlays in the handle—everything I'd seen in other cues, and more. The shaft was the best part; bright red padauk. When I walked into a hall with that stick it was "eyes RIGHT!" It didn't matter if I was good or not; this was a lesson in intimidation. Unfortunately, the first time I opened up a full rack there was a sickening sound of splintering timbers, and there I stood with toothpicks all over the table and a large red spike lodged in my left forearm. Red wood, red blood and a red face. Like most other lessons in the game of pool, this was a hard one to learn.

My second cue had two straight-grained sugar maple shafts—one with a tip diameter of 15mm for 3-cushion billiards, and a thinner shaft with a 13mm tip for snooker and the standard money games of 9-ball and one-pocket. By this time I'd worked out this slick design for a self-aligning and self-tightening connecting joint. What I hadn't worked out was how to make that "star joint" in the handle of commercial sticks. I had soaked open an old cue in my parents' bathtub to check out how that joint was made and concluded that some frustrated engineer had mis-spent his youth hunched over a drawing board. The star joint was out.

Unlike my first cue, this one was a real "lady," perfectly balanced and, best of all, it practically shot by itself. The acid test came with a rack of 15 little red snooker balls and a billiard ball used as a shooter. I spent an hour one afternoon splattering those little devils all over the poolroom and never once did that stick buckle or split.

Over the years, I've made a number of sticks for different shooters. The easiest part is the turning, which can be done by any decent spindle turner. The hard part is trying to figure out



what the client wants, or thinks he wants, in a stick.

The sticks I make have a "European taper," meaning that the diameter of the shaft remains equal for a distance of 13 inches back from the point of the tip. Then the diameter expands in a straight line directly to the butt of the handle. This way the shooter experiences no increase in shaft diameter as he is stroking through his shot. With an "American taper" the cue tapers in a straight line from the tip to the butt. The shaft gets larger in diameter as it passes through the bridge hand, and this draws the shooter's attention to the stick instead of his game.

Threaded brass connectors—a double-threaded connector in the handle and a threaded rod in the shaft—fasten the shaft and handle together. I make these from brass rod using standard taps and dies. With the aid of the "dummy bar" and "dummy rod" driving jigs shown on the following page, I can chuck up the connectors without damaging the threads. I don't glue the connectors into the cue so, as the joint "settles" with use, it tightens by virtue of the direction of the threads in each element.

A good cue joint should act like a shock absorber to dampen the impact of the cue and the ball. I use a collar of ebony at the end of the shaft which butts up against a plastic collar at the receiving end of the handle, as shown on p. 69. The plastic simply rebounds with the impact of each shot. Using a skew, I turn the plastic collar from a length of 1-in.-dia. Delrin Acetal rod (available from AIN Plastics, 249 E. Sandford Blvd., P.O. Box 151, Mt. Vernon, NY 10550).

The key to a well-balanced cue is equal distribution of weight (mass) throughout the stick. The total weight of the cue (between 15 oz. and 21 oz.) is a matter of preference, but a lighter stick is usually used for snooker, a heavier one for 3-cushion billiards. I've seen big guys use light sticks and little fellows use heavy ones. If the balance is correct, it really doesn't matter. I use a ⅝-in.-square maple core for the handle of sticks in the 15 oz. to 18 oz. range, but will switch to a rosewood core for those in the 18 oz. to 21 oz. range. If weights must be added, they should be placed in both ends of the handle, not just in the butt end. Weight holes can be drilled into the handle just below the double-threaded brass connector, and into the butt end just ahead of the end cap. Each hole receives half the amount of lead to be used, resulting in equal distribution of the added mass throughout the handle. The weights must be glued in place, but don't get any glue on the threads of the brass connector.

The handle design shown here reflects the influence of the star joint. Starting at the butt, the padauk laminates taper to a point near the middle of the handle, where they finally disappear. At this same point, the edge of the square maple core piece begins to emerge from beneath the ebony, creating a mirror image of the padauk as the maple extends toward the joint. Laminated handles can easily become more elaborate. I don't mind a few inlays for glitz, but I've seen some cues that look like rejects from a tattoo parlor and I was not impressed.

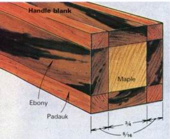
The drawing on the next page shows how to glue up the handle blank. After jointing the pieces, I smooth up the mating surfaces with a cabinet scraper before gluing. I use Hot Stuff cyanoacrylate glue (available from Craft Supplies USA, 1644 S. State St., Provo, Utah 84601) as it bonds well with exotic woods, but epoxy may be just as good. Make sure that clamping pressure is distributed evenly along the length of the blank.

By means of a jackshaft setup, I can reduce the speed of my lathe down to 36 RPM or 50 RPM so that I can drill and thread the brass parts on the lathe with the aid of a 3-jaw engineers' chuck and a drill-press chuck in the tailstock. I cut outside threads with the die chucked in the 3-jaw and the brass rod in the tailstock chuck. The inside threads on the handle insert are cut with the tap in the tailstock chuck. If you don't want to gear down your lathe, drill the brass at your lathe's slowest speed then rotate the 3-jaw chuck by hand to cut the threads.

To keep the turning from whipping around as it gets thinner, I've rigged up a steady rest made from a pillow-block bearing, shown in the photo on p. 69. I turned maple sleeves to fit the inside of the bearing. Each sleeve has a different sized hole in the center to fit over different diameters along the tapered shaft and handle.

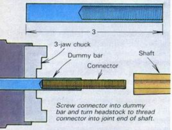
As with any spindle turning, I work from specific lengths and

Drawings: David Dann



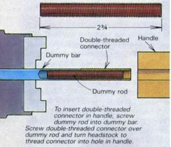
Dummy-bar driving jig

Make dummy bar from 7/16-in.-dia. brass rod. Drill with 17/64-in. twist drill. Thread with 5/16-in. by 18 tap.



Dummy rod

Make dummy rod from 5/16-in.-dia. brass rod. Thread with 5/16-in. by 18 die.



Turning the handle

Glue up the blank as shown in the drawing at left. Glue and clamp the ebony strips to the maple core two at a time, then glue the padauk strips in the corners. Next, drill the connector hole in the joint end. Chuck a 25/64-in. drill in the 3-jaw chuck, hold the joint end of the blank with one hand and bring the tailstock center up against the butt end. Turn the tailstock handwheel to advance the handle blank into the drill. Chuck up the dummy bar, dummy rod and the double-threaded connector as shown in the drawing (bottom, left), and thread the connector into the handle at a very slow speed (top, right). Chuck the handle by the connector and turn the handle to size. For final cuts, draw the skew toward you for a more accurate taper (below). Turn down the joint end (right) and glue on the plastic collar. Replace the tailstock center with a Jacobs chuck and drill the butt for the end-cap tenon. Glue on the end cap and trim with a skew. Sand with the grain using 320-grit paper and apply finish.

The shaft and handle join with a self-aligning, self-tightening joint which consists of a threaded brass connector in the shaft that screws into a female brass connector in the handle. The 1/16-in. maple shoulder on the end of the shaft (right) fits into a corresponding recess on the end of the handle.

Turning the shaft
Support the rough-turned shaft blank with the steady rest (shown at left) and bore a 19/64-in.-dia. hole for the connector. Next, chuck up the dummy bar and connector, as shown in the drawing on the preceding page (left, center), and thread the connector into shaft. Turn the shaft, then fit the ebony collar. Sand with the grain and apply the finish, then turn the tip for the ferrule (right).

diameters in the critical areas of the cue's parts. I then use a straightedge as a guide in the roughing stages, but the final turning is done by eye. I rough out the shaft and handle with a 1½-in. spindle gouge at about 600 RPM, then finish turn with a ½-in. skew at 2,000 RPM. In the final stages, I draw the skew toward me instead of pushing it away. With the palm of my left hand I can feel all the imperfections on the surface before they reach the edge of the skew. Also, I'm less likely to make mistakes with my hands moving toward my body than if they were extending away to the outer limits of my reach.

I turn the shaft in progressive stages between centers, allowing the wood to dry and settle out between each stage. Several weeks may go by before the wood is ready to be re-turned, depending on how soon it reaches moisture equilibrium. To compensate for warp between stages, I sometimes have to relocate the center points slightly when I remount the spindle. When the shaft is straight, about ¾ in. dia., and doesn't deflect or buckle when struck solidly on the tip end with a rubber mallet, I drill the hole for, and install, the brass connector. With the connector (protected by the dummy bar) in the chuck, I finish turning the shaft.

Care must be taken that the holes in the shaft and handle for the threaded brass connectors are exactly centered. This can be done by using the steady rest to begin the initial boring operations. The ebony and plastic collars, as well as the end cap, can also be turned and drilled from longer stock in the same manner. All these parts must fit so exactly that they "slip" into position. If they must be press-fit they are too tight and the collars will eventually split. Glue should be used, but not to fill gaps from a sloppy fit.

The end cap of the handle may be made from a variety of exotic woods, depending on personal taste and whether you wish to add or subtract a little weight in balancing the cue. The actual amount of weight involved will probably be no more than ½ oz. The end cap is turned with a post about 1 in. long, which is later glued into a hole drilled in the butt end of the handle. Again, proper centering is essential.

Turning the end of the shaft to receive the ferrule is something I always save for last, and it must be done with absolute perfection. I use a fiber ferrule that comes pre-drilled to 5/16 in. (Ferrules, tips and rubber bumpers are available from Penn-Ray Sutra Corp., P.O. Box 1088, Bensalem, Pa. 19020.) Turn the maple stem with the skew to the exact diameter of the hole in the ferrule and ¼ in. longer than the ferrule itself. Slip on the ferrule and turn the exposed end off flat with the point of the skew. Then reverse the ferrule and check that it fits perfectly square to the shaft. If it doesn't, the ferrule will split with use. Glue it in place and turn down with the skew to match the shaft diameter. True up the end to receive the leather tip and trim off the ¼-in. of maple protruding from the center. The tip can now be glued on with contact cement. Score the surfaces of tip and ferrule with a sharp knife for additional traction, coat each surface, let dry, then attach. Beat the tip down with several strikes of a hammer to ensure a perfect bond. I always use an oversized tip and then turn off the excess with the skew by remounting the shaft on the lathe using the brass dummy-bar in the 3-jaw chuck and a cup center against the tip in the ball-bearing center. This avoids sanding the leather tip and can be repeated whenever a new tip is needed.

The finish on any pool cue probably relates more to the desires of the shooter than to any prescribed formula. Most people want the pores of the wood to be sealed so that the wood won't discolor from use. Any hard urethane sealer will work, but be sure to remove the high gloss with 0000 steel wool so that a sweaty hand won't stick to the shaft. Waterlox is another good product which I cut with 50% naptha, applying many coats. My original stick (the 2nd one) has no finish at all on the shaft—just sweat, grime and a slight greenish hue from years of chalking the tip. It has a beautiful patina and still feels like satin. I don't know if that makes it a better finish than others, but for all the nerves I've rattled with it over the years, who cares? □

Colorado Slim is the pool-hall alias of a retired hustler who now turns wood for a living.

Polyurethane Finishes

Price tells as much as the label on the can

by Otto Heuer

Companies manufacturing polyurethane describe it as a stunning finish that is unbelievably tough. Even though some craftsmen complain that the glossy finish has an artificial, plastic look, it does wear well, resists scratches and other abrasions, and is virtually impervious to household chemicals and detergents, alcohol, even boiling water.

Picking the right polyurethane for your job can be a bewildering journey through a maze of cans: Urethane Finish; Polyurethane Varnish; Clear Gloss Urethane; Spar Urethane; Polyurethane Liquid Plastic; Polyurethane Reinforced Varnish; Spar Urethane Varnish. The composition labels on the cans are difficult to understand, and at times, remind me of the old saying about well-organized confusion. I know one man who was so confused he wasn't sure if he bought polyurethane or something being compared to polyurethane (he bought oil-based varnish).

Part of the confusion comes from the chemical complexity of polyurethanes. They are not merely blends of solvents and resins, but highly reacted chemical compounds. In contrast, lacquers are relatively simple mixtures of nitrocellulose (as a film-former), hard resins (to increase gloss), and plasticizers (to make the film more flexible). Traditional varnishes, mixtures of vegetable oils and natural or synthetic resins, are slightly more complex than lacquers. The varnish is heated during the manufacturing process, promoting chemical reactions among the components.

Because of the elaborate equipment needed to produce the complex polyurethane, many small- to medium-size finishing companies don't even manufacture it. They buy "concentrated" resins from some of the country's major chemical companies, blend it with their own ingredients, and market it under their own names. This may explain why I found so many similarities among various brands. I tested 15 clear gloss and 12 satin luster polyurethanes on wood and glass panels as I researched this article. The finishes were so consistently clear and strong I concluded that most of the differences in quality of finish had to do with application methods. Price is also an important factor. If you buy a brand-name product, you improve your chances of getting a good finish. If you buy a bargain-basement brand that's considerably cheaper than the brand-name ones, you're tilting the odds in favor of an inferior result.

The terms polyurethane and urethane have nothing to do with quality—both terms, along with names like urethane polymer and isocyanate polymer, refer to the same type of finish. The name game seems to be mostly a sales gimmick—a label advertising isocyanate polymer might scare people away. "Plastic" is another sales pitch. Although polyurethanes are chemically similar to plastics, the term "synthetic" would be more correct in describing polyurethane, epoxy, and other modern finishes.

Oil-modified polyurethanes are based on vegetable oils (linseed, soya, safflower and others) that have been reacted with polyhydric alcohol (glycerine or pentaerythritol) and diisocyanate. An alkyd-modified polyurethane is composed of the same oils and polyhydric alcohols, but the phthalic anhydride, which is the usual acidic ingredient reacted with the oils and alcohols, is partly replaced by a portion of diisocyanate. In both oil-modified and alkyd-modified mixtures the amount of diisocyanate, the most expensive ingredient in the mixtures, affects the hardness, chemical and abrasion resistance, and drying speed of the film.

The chemical reaction that produces polyurethane must take place in a large (1,000 gallons or larger), closed, stainless steel reactor. The air in the vessel usually is replaced with carbon dioxide before the tank is heated, to prevent discoloration of the raw materials during the reaction. After the reaction is completed, the resinous mixture is cooled, then pumped from the reactor vessel into a thinning tank, where it is reduced with mineral spirits (or other petroleum distillates) until it is about 60% to 70% non-volatile solids by weight.

I have formulated oil-modified polyurethanes for several small companies by blending these "concentrated" polyurethane resins with alkyds to improve adhesion and reduce cost, and for semi-gloss and satin mixtures, silicates as flatting agents to reduce gloss, and anti-settling agents to keep the silicates and the solvents from separating. At this point, small amounts of metallic dryers (cobalt, calcium and zirconium) are added. To prevent the polyurethane from skinning over in the can, anti-oxidant agents are also added. Then the mixture is thinned with mineral spirits until it is 45% to 50% solids by weight.

The type of oil used in the manufacturing process is a good guide to several aspects of finish quality. Polyurethanes are never water-white clear, but they have a tendency to darken to an amber color as they age. This is especially true if linseed oil is the base. With soybean oil mixtures, the dried film will be slightly lighter and have less tendency to darken with age. Polyurethanes based on safflower oil darken the least, and, therefore, are most suitable for finishing furniture and interior woodwork made of light-colored (not stained) woods like white pine, birch and maple.

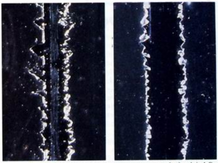
Gloss polyurethanes tend to be tougher than the satin finishes, which contain transparent, inert silica powder that serves as a flatting agent. The light, fluffy silica has a tendency to float to the surface while the polyurethane is drying. Light rays striking these transparent particles tend to scatter, thus reducing the gloss. This loss of strength is insignificant on interior finishes, and you may decide you prefer the satin look because scratches and defects in the finish are less noticeable. Gloss finishes tend to magnify any imperfections; satin finishes are more forgiving.

Manufacturers rate the durability of polyurethanes as an exterior finish at fair to good, depending on the climate. Linseed-based polyurethanes are slightly better than the other types and I'd recommend you use only these as an exterior finish. Patio furniture left outdoors during the spring and summer, but stored inside for the winter, should look good for several seasons with this finish. This toughness also makes the linseed-based formulas better for floors and other heavy-wear areas.

Other types of polyurethanes are available, but are not recommended for small production and home shop use. These two-component industrial coatings are used on laboratory equipment, skis and tennis rackets, and as anti-graffiti shields in schools and on subways. Some stores specializing in automotive refinishing paints and enamels handle these finishes, but they're expensive, tricky to mix and apply, and usually available only in large quantities. Once the clear resin and catalyst are mixed, the finish thickens within 2 to 8 hours and even the strongest solvents can't stop it.

You might also find moisture-cured polyurethanes at your local hardware store, but avoid them unless you plan to work fast and use the whole can in one application. These polyurethanes harden quickly after being exposed to the air, and will continue to harden after the can is resealed. They're also very sensitive to impurities and tend to flake off if contaminated during application.

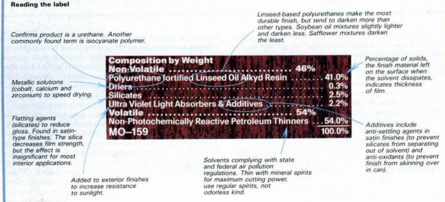
In trying to gauge the strength and quality of various polyurethanes, I applied the finishes to small panes of glass and a series of 6-in. by 12-in. panels of mahogany, walnut, cherry, and other woods. Since the glass won't absorb finish the way wood does, it is a good surface for checking the drying time of the film and determining if it is seedy (contains impurities), cloudy, or too viscous to flow out evenly. To check flow out, I poured a little bit of each sample on clean pieces of 6-in. by 10-in. window glass held in an upright position so the excess would flow off. Flow out can be a problem with polyurethanes. Their fast drying time prevents the film from flowing out and "bridging over" very small pores in the wood. If you hold the panels on an angle, you can sometimes see little pockmarks beneath the surface. I found these imperfections occurred when the finish was too thick—either it wasn't thinned properly or was applied in a too-cold room. For best results, the finishing area should be from 70°F to 80°F. If you find your finish hasn't flowed properly, you may be able to wash off the partially dry film with mineral spirits. Otherwise, let it harden, then sand it with 600-grit wet/dry paper before applying another, thinner coat.



To compare flexibility and chip-resistance, scratch the dried finish off a pane of glass with a coin. A brittle finish fragments (left). A more flexible one (right) peels off as a smoother strip.

A good way to gauge the hardness or adhesion of a sample is to hold a nickel on end between your thumb and index finger and scratch the finish. It may take two or three passes to scratch through a very hard finish. If the dried finish scratches into little flakes or fragments, I'd call the film brittle. If the edge of the coin cuts through the film and takes off a soap-like cheesy strip, I'd call the film flexible. A flexible film will most likely be a better finish on wood, since it will not chip easily. All of the brands I tested produced a film that was strong and flexible enough to be re-

Reading the label



Spraying polyurethanes and other varnishes

by Nancy Lindquist

In our furniture shop people ask for "that plastic finish" on their fine furniture, so they can enjoy the beauty of the wood without "doing anything" to take care of it. "Miracle" finishes don't exist, but apparently miracles happen everyday in the marketing of furniture finishes. Urethanes are known for their toughness, but like any other finish, they're only as tough as the wood they protect and I don't think they are the best choice for every piece of furniture. I choose polyurethane for interior floors, trim work, bar tops and table surfaces subjected to heavy wear, marring, heat and water exposure. The best way I've found to apply polyurethanes and varnishes is spraying, which eliminates brush marks and many of the contamination problems that can mess up a finish.

Because of their high solids content, polyurethanes and varnishes have tremendous "build." Unlike lacquers, in which each coat dissolves the previous coat to form a single or monolithic film, varnishes and polyurethanes form distinct layers that are stacked on top of each other. This makes adhesion to the wood and between coats a primary concern.

For good adhesion, use the same polyurethane or varnish finish for the entire job, from the first sealer coat to the final top coat. Commercial sanding sealers are less expensive, faster drying, and easier to sand, but they may reduce the bond between the wood and the top coats. In contrast, a thinned coat of polyurethane will penetrate deeply into the pores of the wood to provide a better grip for subsequent layers. A heavy coat of the finish, however, may bridge the wood pores and reduce adhesion. The wood should be clean and free of wax, grease or oil. I wash the raw wood with naptha and clean rags before I begin. Scuff-sanding between coats gives the polyurethane layers a mechanical bond that helps adhesion. Heavy oil glazes floated between the finish coats, thick staining, or fillers will cause adhesion problems.

I spray polyurethane and other varnishes with a conventional cup gun with a general purpose or standard lacquer fluid nozzle and either a standard lacquer air cap or a lacquer primer air cap, if the finish is a little cool to spray. The gun must be clean. Before using it, I clean the gun by spraying and backflushing with lacquer thinner, and then blow air through the gun until the solvent has evaporated. After spraying, I clean the gun with mineral spirits first, then lacquer thinner.

Not all brands of finish spray easily. I've had good results with Pratt & Lambert products. I thin the material as little as possible and deliver it at the lowest air pressure that will make it flow without obvious spray texture. (For technical fanatics this is a viscosity of between 14 to 16 seconds at room temperature with a #2 Zahn cup. My air pressure at the regulator is between 30 and 35 PSI with a 25-ft. hose.) It's no problem on tabletops to adjust the flow by trial and error—thinning the finish to reduce viscosity and manipulating the fluid valve to change the spray pattern. On vertical surfaces, though, you risk applying finish that's too thin and runs, or of spraying such a heavy coat that it sags. If you're accustomed to spraying lacquers, polyurethane will feel heavy and clumsy because of its higher solid content and lower viscosity. I always test the finish first on a vertical sample board so I can adjust my spray pattern and see how much I can apply before it sags. If you run out of patience before you get

moved from the glass after 24-hours drying time by lifting one edge of the film with a razor blade. After 72-hours drying time, none of the films could be easily peeled off the glass.

In applying the finish on wood, I followed the instructions on the labels, let each coat dry as directed, then sanded lightly between coats with 600-grit paper. Make sure you follow the manufacturer's instructions on recoating times. If you let polyurethane cure more than about four hours, the film becomes so hard and inert that the solvents in the following coats won't soften the previous coats enough to allow the new material to adhere. If you wait too long between coats and have to scuff-sand before applying another coat, do so carefully—you don't want any scratches in the film. Avoid using steel wool for the scuff-sanding—the fuzzy fibers will stick in the finish. In most cases, the best looking and most durable finish comes from three to four thin coats rather than two heavy ones.

Most of the manufacturers recommend that polyurethanes be reduced 10% to 20% by volume with mineral spirits for a first coat on unfinished wood. This thinned mixture penetrates the wood much more effectively than unreduced polyurethane, which is viscous enough to stay on the surface. Subsequent coats may be applied without thinning, but I recommend you thin the top coat about 5% if the label states that the finish is 45% to 50% nonvolatile solids. Always use regular mineral spirits, which has more cutting power than the odorless kind. This will enable you to thin the polyurethane without drastically altering the percentage of film-forming solids, thereby interfering with proper drying.

For applying the top coats, I used a foam-type applicator instead of a bristle brush. Even the best brushes leave some marks on the surface, whereas the foam brush (urethane foam) produces a very smooth film. For best results, dip the applicator in the finish, just as you would a brush, and apply it cross-grain, feathering out the strokes in opposite directions. The finish should flow together smoothly. If you soak the foam applicators in mineral spirits you might be able to clean and reuse them, but they're so inexpensive I just discard them.

Labels on many brands warn the user: "Do not shake the can, but stir the contents of the can before using." Shaking may pro-the gun adjusted, you can always brush the verticals and try a different brand next time.

Apply the finish in a clean, controlled environment and keep the area dust-free while the finish is drying. Before spraying, I sweep sanding dust and overspray in my spray booth, then sprinkle water on the floor around the project to reduce static that might attract dust. A plastic drop cloth suspended over my drying area prevents direct fallout from my tar roof. I also like to change into clean clothes and wear a cap to keep personal touches out of the finish. Eliminate traffic in the area until the surface is "tack free." Your nose is a good guide on when the finish is dry. If you can't smell solvent, it's safe to touch the surface. (The rest of the time I wear an organic solvent respirator.)

Besides the bugs and junk in the air, watch for contaminants in the can. You may have problems if you leave the lid off while you're sweeping up, or if you use an improperly cleaned brush containing traces of old stain or dried varnish. Varnish won't redissolve after it dries. You must strain out the dried specks of cured varnish, called seeds, by filtering the finish through a paper-cone strainer. Some finishes just come seedy; it's a measure of quality for the finish to be clear in the can. If the finish looks cloudy or foamy, something is probably wrong. When you thin the finish, always use the solvent recommended by the manufacturer, who's the only one that really knows what's in that can.

One brand's "satin" sheen looks like what another brand calls "semi-gloss," so you may have to experiment to find the look you want. The manufacturer's idea of what's "satin" may not match yours. Mix the finish just enough to lift any flatting agents that have settled to the bottom of the can and blend them evenly with the solvents. Overmixing may create bubbles that will pop and make craters in the finish film. Undermixing may produce an uneven sheen. Make a sample chip for each product you use to serve as a reference for future jobs.

When you apply the finish, it helps to use the automotive technique of first spraying a light "tacky" coat with very little overlapping on verticals. When you come over this with a wet coat, it will hold easier without sagging. On tops I want an even film thickness and texture, not only for a smooth finish but for an even sheen. I'll first spray across the grain and then, with a second pass, go with the grain for an even, full wet coat. It is very tempting to put on more in one coat because it looks so great when you spray the tops, but thin coats dry most evenly.

Temperature and humidity also affect finish quality. With polyurethanes and other varnishes, temperatures below 65°F and high humidity slow drying time and invite runs and sags. I think the labels should read, "dries in four hours unless you live in Missouri where it may take three days!" Temperatures above 85°F may cause the finish to dry too quickly, leaving a skin over the surface that traps solvents and uncured finish underneath. Direct sunlight or strong drafts on the wet finish also trap solvents and prevent even drying. The older the finish, the longer it takes to dry. If the finish is too thick and cold to apply, warm it by placing the can in a sink full of warm water.

Polyurethanes also differ from varnishes in that they don't rub out or flow under friction. A gloss finish will polish well if you apply liquid polishes and buff. For lesser sheens, practice until you can spray cleanly enough to avoid rubbing the surface. If you do try to rub the surface, you risk uneven glossy or hazy patches and scratches. If you want a rubbed finish, apply varnish.

It's ironic that one disadvantage of varnishes and polyurethanes is that they do build so fast. The biggest complaints about polyurethane involve putting too much on. If you spray the surface, you'll be using thinner coats and be able to control the thickness of the film more easily than if you were brushing it on. If you spray or wipe a couple of really thin coats of urethane on a nice piece of wood, most people would never question your saying it was an "oiled" finish. This is something most purists would hate to admit, but others know it's true and use this fact to their advantage. □

Nancy Lindquist operates Kansas City Woodworking with her husband, John, and Integrated Finish Systems, an architectural millwork finishing shop in Kansas City, Mo.

duce air bubbles in the applied films. When these air bubbles burst, they create small pinholes, or, if the finish dries before the bubbles break, you're left with air pockets in the film. The labels also warn against applying polyurethane over lacquer sealer, shellac, traces of varnish removers containing paraffin, wood fillers or pigmented wiping stains containing stearates or other waxy substances that will prevent the polyurethane from adhering.

Adhesion problems arise whenever polyurethane is applied over another finish. For the polyurethane to adhere, you must scuff the old finish enough to provide a mechanical bond between the roughened surface of the old finish and the fresh coat of polyurethane. Sand the old finish carefully, using 400-grit paper for gloss and 320- or 280-grit for satin. Follow the direction of the grain, but don't go down to the bare wood. Remove dust and debris with mineral spirits on a clean, lint-free rag. This will clean the surface as well as a tack rag, and you don't risk leaving any oily residue to contaminate the surface. Touch up any surface defects, such as scratches and bare spots. Apply a thin coat of polyurethane, and let it dry several hours before sanding with 600-grit paper and applying another coat.

Proper ventilation is needed whenever you apply polyurethane. Dry, cured polyurethane films are non-toxic, according to federal guidelines, but be careful with the liquid. With spray applications, use a respirator—every label I saw indicated that breathing the spray was harmful and dangerous. Don't get any in your eyes and avoid prolonged skin contact. If the label states flammable, do not use the material near open flames, pilot lights electric sparks or similar hazards. Throw used rags into a pail of water to prevent possible spontaneous combustion.

Polyurethane can look as good as most varnishes, and offers a number of advantages over varnish. It dries faster, thereby reducing the chance of dust contamination, cures at a lower temperature, has a higher gloss, and has better wear and water resistance. Polyurethane is also easy to maintain. You don't even have to worry about waxing the finish—just buff it with a soft cloth periodically. □

Otto Heuer is a finishes consultant in Waukegan, Ill.

Cove and Pin Joint

Making a bull's-eye dovetail

by David Gray

The cove and pin joint is a real eye-catcher. It has a beautiful symmetry, is captivatingly intricate, and adds a special quality to any project. It is also a nice way of combining careful machine work with some pleasurable handfitting. I first became fascinated with the joint after seeing it on a box by Timothy McClellan of Minneapolis, Minn., in the first *Biennial Design Book* (Taunton Press, 1977). I later saw the joint on drawers in several older casepieces, but those joints were cut by machines that are no longer available. Eventually, I worked out a hand/machine method for cutting the joint with a modified plug cutter chucked in my drill press. For the maximum visual effect on things like drawers or jewelry boxes, I cut the pins in a dark wood and the coves in a light wood. My method for cutting the joint is to mill the pins by running the plug cutter into the endgrain of one board, and then use the same cutter to score the face of the mating piece to mark out the coves. Then, I bore out the pin holes and trim the outside of the cove with a saw, chisel, and knife.

Before you can cut the joint, you'll have to modify a four-fluted plug cutter to form pins and coves, as shown in figure 1 detail, regrind a bevel-edge gouge that matches the outside diameter of the coves, and build an indexing jig for your drill press. My cutter is a stock Fuller model (available from W.L. Fuller, Inc., P.O. Box 8767, 13 Cypress St., Warwick, R.I. 02888) designed to cut 5/16-in.-dia. plugs. The outside diameter of the cutter, which is used to mark out the coves, is about 9/16 in. The odd-looking 1/2-in. gouge with its edges ground back, shown in figure 2, is used to trim the roughsawn coves. A standard 21/64-in.-dia. twist drill clears the pin holes.

My indexing jig is based on a 10-in.-square piece of 1/4-in. aluminum plate that has 1/4-in. holes drilled on 17/32-in. centers along one side, as shown in the drawing. The joint components are clamped to an L-shaped wood tray that slides along the indexing plate. To ensure that mating pieces will interlock, I use the same jig for both the endgrain pins and the face coves, so any inaccuracies are mirrored on each piece and cancel each other out. No matter how good your setup, though, you'll still have to invest a healthy amount of time and patience to handfit the pieces together. I average about five minutes per pin for handfitting.

To make the jig, I lay out the hole locations with a 6-in. steel rule and a sharp knife, then make a punch mark to guide the drill into the aluminum. The spacing isn't terribly critical here; small variations won't show and will be duplicated on both pieces. Next, bore two holes so that you can fasten the plate to the slots on your drill-press table with flat-head machine screws, washers and wing nuts. You should have enough free play in the slots to adjust the jig back and forth. Make sure the side with the stepping holes hangs just over the table edge to give clearance for the sliding tray. I made the pin by spinning 1/4-in.-dia. brass rod in the drill-press chuck and sanding until it fits.

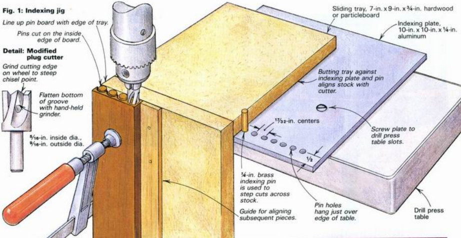
The sliding tray is two 9 in. by 7 in. pieces of hardwood or particleboard glued together at right angles along the 7 in. side. The tray slides along the edge of the index plate, hanging over the side with the holes. It's butted against the metal edge and the index pin each time the pin is moved to locate a new cut. To cut the pins, clamp the dark wood endgrain up on the vertical portion of the tray. The coves are cut with the pieces aligned in the same position at the corner of the tray, but this time along its horizontal surface.

In laying out the joint, you can experiment with different sizes and numbers of pins, but there's a practical limit on the width of the pieces to be joined—the more pins you use, the more handwork necessary to fit the pieces together. I lay out four to six pins on small drawers and have done up to 10 pins, but it's very difficult to accurately space so many cuts. Generally, 2 3/16-in.-wide stock is perfect for four pins and 3 1/4-in.-wide stock for six pins. The stock for the pin side should be at least 5/8-in. thick. The pins are cut at the inside edge of the board, thus leaving space for the 1/8-in.-wide plug-cutter groove and for the scalloped border of the coves. The cove stock is considerably thinner, usually about 1/4 in. to 5/16 in., because the plug cutter can't mill pins longer than that before bottoming out.

Once you've decided on the number of pins, you'll have to go through a juggling act to line everything up properly. With the tray and indexing plate in place, align the drill-press table so the plug cutter will cut at the inside corner of the pin board. Position the piece of stock with a clamp and/or change the location of the jig on the table to locate the first and last cuts equidistantly from the edges. Move the pin back and forth between the two outside step positions, adjusting until everything is symmetrical. Make sure the stock is clamped perpendicular to the press table and that the endgrain edge is perfectly flush with the tray. Once the magic position is located, mark it and tack an auxiliary fence next to the pin board to make it easy to line up the next piece to be cut. Set the drill-press depth gauge to cut the pins as deep as the stock you plan to join. Cut all the pins, stepping across each end to be joined.

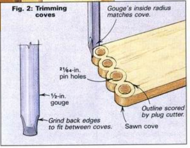
Next, mill the cove stock to match the depth you have cut the pins. Again, go through the juggling act, but this time clamp the light wood to the tray's horizontal surface, with its endgrain just flush with the corner of the tray. The cove must be stepped across the jig twice, once to score the stock with the plug cutter to out-

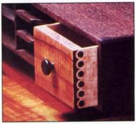
Fig. 1: Indexing jig



After the coves are laid out with a plug cutter, the pin holes are bored with a twist drill.

Fig. 2: Trimming coves





The bandcut pin and cove joint shown on this small desk drawer is a captivatingly intricate alternative to dovetails.

line the coves, and once to bore the holes for the pins, above, left. Chuck the plug cutter in the press to do the alignment, but position the table low enough so you can install the 21/64-in. drill, and drill the pin holes without moving the table. Position the jig so the plug cutter will score the edge of the stock and leave a slight ridge on the outside edge. Then position the stock and/or the jig to create a symmetrical cut at each end position. Once this is established, again tack on a guide bar to help you line up subsequent pieces, and screw a hold-down clamp onto the sliding tray to lock the pieces on the jig as you make the plug cutter and drill pass over each edge to be joined. Finally, trim the scored cove pieces on a bandsaw or jigsaw. I cut as close to the score mark as possible, but leave the line as a guide for the chisel work.

Now—the handfitting. Choose a pair to be joined and mark them clearly. Chisel away the little triangles and the leftover ends of the pin sides flush with the bottom of the plug cutter's cut. To ease the fit, I also trim the sharp point where the adjacent curves meet. Fitting the joint is very repetitive, fussy work. I first pare straight down the ridge lines with the modified ½-in. gouge. Sharp tools are essential. Next, with a knife trim the corners where the coves meet. Hold the joint together as it will ultimately fit, mark areas that don't fit, then trim the bottom edge of the non-fitting coves with a knife or chisel. Work from one edge of the piece to the other. This is a process of cutting, looking at the fit, cutting, looking, and so on, until the bottom fits. If you find the pins don't line up well enough to go into the holes, trim the pins with a small chisel until they do fit. When the joint goes together, flip the cove piece over and clean up the faces of the coves straight, but be careful not to overcut the joint. Leave the joint tight; you can drive it that last 1/16 in.

After fitting the joint, do any dadoing or rabbeting required for box bottoms or shelves. Apply glue to both the pin and cove sections, and tap the joint home with a mallet. If you have trimmed any areas too much, drive some glue-covered slivers into the gap. After the joints are dry, sand or handplane the score marks and apply the finish of your choice. □

Dave Gray designs and makes furniture at the Second Floor Woodworks, a cooperative he formed with six other woodworkers in Seattle, Wash.

Photos: David Gray, left; Geoff Manasse, right

Designing a Bed

From paper to prototype

by Ian Kirby

We are all capable of handling woodworking design decisions up to a point, but beyond a certain level most people become frustrated and switch off. An analogy would be the way we treat ourselves when we are sick. For a minor illness, we may prescribe the same treatment a doctor would have prescribed, but beyond a certain point of illness or injury we know we need a doctor—a professional who will use a combination of training, experience and analysis to arrive at a course of treatment.

Like a doctor, a trained designer has methods, techniques and pathways—a well ordered, well organized route that establishes the problem then solves it. Creativity plays a part, but it's a common saying among designers that the work is 99% perspiration and 1% inspiration. Everyone is creative to a considerable degree; design methods are the tools that bring creativity out.

In purely graphic terms, the design process might look something like the drawing below. We start at a point that represents the need for a design, whatever that need might be. From this point, we research and gather data in an increasing amount—trying not to exclude possibilities—until we reach the center circle in the drawing. This center circle is where the data are considered and developed. The path leads off to the right in a narrowing triangle wherein the broad design is worked out, then its details, then the implementation of the design and finally, its evaluation. What's called for to the left of the center circle is divergent thinking, to the right of the circle, convergent thinking.

The diagram represents the signposts to the discipline of design. In this article about designing a particular bed, I will attempt to point to the places where we see some link between this ideal pathway and the job in hand—in other places the link is too obscure to unravel in this amount of space.

False leads—The most common misunderstanding is that to design you should have some knowledge of how to make the item. In reality it should be argued that, for a student, this knowledge is the greatest design barrier you could wish for since your design thinking is tethered within the knowledge. It causes convergent thinking early in the design process, at a time when diver-

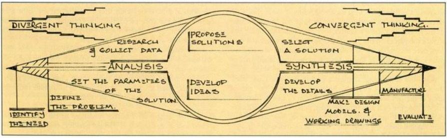
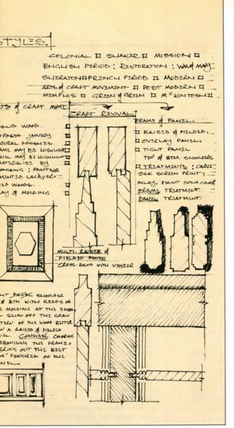
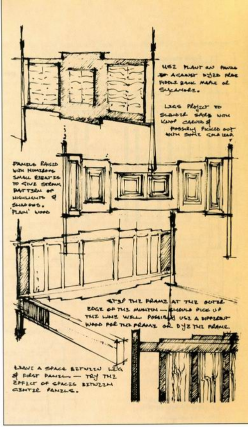


Photo: Randy McNeilly





gent thinking is called for. In practice, you will find that the mind resists the disciplined method. All sorts of shortcuts pop in at all sorts of times—we have creative leaps that seem to bypass groundwork. Yet if the groundwork is not completed, a designer is unable to be objective about the solutions. To assist in continuing on track, sudden inspirations can be recorded with drawings and notes in order to empty them from your mind.

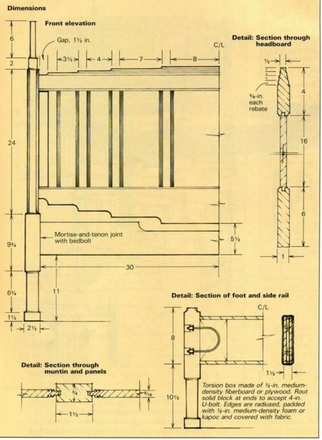
To know when not to re-invent the wheel yet keep to the pathway is part of the process of growing up as a designer. As one becomes more accomplished at problem solving, the design pathway seems to be somewhat lost—it isn't of course, but the double-edged sword of experience comes into play and makes observing the designer at work a complex operation.

The problem—Having explained the design method in general terms, I'm going to pick up the specifics that went into the bed design. The bed was to be designed for a client who was neither relative nor friend, but a business client. This is worth noting because the initial sorting out process is too easily passed over when you are dealing with someone you know—too much is assumed by both parties—not enough questions get asked.

In our first meeting some general parameters had to be set. The bed was to be the main piece in a small group of bedroom furniture to be sold in a store specializing in blankets and bed linens. The bedclothes are of wool, mohair, linens and silks. The weaves and colors are unusual, the finishing details superb, the whole accent on quiet, understated quality.

I explain this to illustrate the unspoken messages in the surroundings, which will be underscored by the conversation about the work in hand. In most cases the client has no idea that this is going on, it is something you have to work on alone. The client will be quick to tell you what he or she thinks you need to hear, including solutions to the problem, but a client's express wishes are often misleading and can be costly. You wind up building a million-dollar mansion on a quarter-acre sub-division. It's often expressed as the client having a champagne taste and a beer budget.

The store's ambiance suggested furniture of a similar image. After listing all the materials one might use for a bed, natural polished wood seemed to be the most in keeping with the tone



Stick to standards

The spaces allowed inside a bed's frame must leave enough room so that standard springs and mattresses will fit. Spring units are sized to fit within the bed's rails, whereas matching mattresses are sometimes wider so bedclothes can overhang the side rails. The following dimensions are in current use, but it's best to check the actual springs and mattresses you plan to use.

Twin	39 in. by 75 in.
Double	54 in. by 75 in.
Queen	60 in. by 80 in.
King	76 in. by 80 in.
California King	72 in. by 84 in.

California King is a sensible proportion for a large bed, but springs and mattresses are generally not available except on the West Coast. Twin and Double are usually available in the 80-in., extra-length size. Adjust the length of the bed's rails to suit.

If you design a bed with a high footboard, allow about 2 in. of clearance in the length so that heavy winter bedclothes can be tucked in at the foot. This clearance can be smaller if the bed will be used in warm climes—it should not be larger than necessary, because too much space is an invitation for the mattress to slide down, which then allows pillows to drop between the mattress and the headboard. Similar clearance is necessary for a bed with side rails that extend above the box spring. This is seldom the case these days, as the box springs are usually higher than the side rails.

The bed in this article can be built in any of the four larger standard sizes by changing the width of the center panel in the headboard (and of course the length of the headboard's top and bottom rails). The dimensions of the other panels remain the same. —*I.K.*

the owner wished to project. Making such an important decision early in the process may not be possible on every occasion—it may not be wise either, because it does close some doors. The next step is to research and record all the options within the one form of bed—natural wood, that is a beginning point once again.

I earlier described the client as the store owner. In reality there are two clients and the second one now becomes paramount—the buyer. Most design work sets the selling price parameters very early in the process, yet if too much consideration is given to the cost at an early stage then ideas get bypassed. The aim is to go for the best ideas, then cut costs later.

The style—Another important decision that is frequently sifted out early is the style of the furniture: Shaker, Mission, Colonial, the European styles, Art Deco, Post Modern, Memphis—they each define the form of the piece within a wide set of boundaries. Don't typecast things too tightly into styles, but use the words as shorthand so that you and the client have a path to follow without going in every conceivable direction at once.

A style that was suited to the situation was arrived at by considering all sorts of factors. Does the style lend itself to machine work? If so, what machines are available? Does it show off the material? These questions, this data, are collected and considered at this stage not as *solutions*—it is too early for that—but as possibilities that will be winnowed out later in the design process.

The outcome was a decision to work within the English Arts and Crafts Movement and, in particular, to take advantage of the visual possibilities inherent in frame-and-panel construction. The sketches on p. 77 show some of the wealth of variations.

Drawings—Do you have to be able to draw to design? The answer has to be no, but drawing is the fastest way you can express and analyze visual ideas of form and space, both to yourself and your client. It's like a language. When you use sketches to converse with yourself, you don't yet know where the conversation will lead and at times, you watch the ideas develop as though you were an onlooker.

Anyone who has the wish can learn to draw. The muscular skill required to write your name is far more complex than that needed to draw a straight line. A great deal of our reluctance to work on the drawing board is that it is such a merciless medium. It's like expecting to pick out a tune on a piano when we have no knowledge of the instrument. We become quickly frustrated and embarrassed, yet we all have to begin somewhere and my own experience reminds me of what the feeling is like. Classes in perspective, life or plant drawings are all useful. But even without classes, we are all capable of drawing squares, triangles and circles, which are the basic elements of all furniture forms.

The bed required dozens of sketches. These were done quickly, often in succession as I developed various ideas. Don't be afraid to experiment. Draw an orthographic view, photocopy it, vary the sizes, trace the various parts then move the elements around. Do everything you can to get your collection of shapes fitting together in a harmony that appeals to you. Check your progress against your initial list of data to make sure you aren't straying from your design brief. Sleep on it and have a look the next day.

Deliberations—Solutions begin to evolve from the work on the drawing board. For the bed's headboard, I decided to treat the frame and panel in a manner that would lift it out of the traditional mold. It occurred to me that if the headboard was held in place by the top and bottom frame member, then by using a dry mortise-and-tenon joint between the headboard and post, the whole board could be turned upside down and back to front, presenting four different faces of the headboard.

I wanted two looks from the headboard. Both had to come from the same form—one when it was made of exotic material, and the other when it was made of a hardwood. The material I had in mind was English brown oak, and to create the focus, I decided to use ebonized ash for the frames. For a more prosaic look, I wanted the same form to look good when made totally of cherry. To accommodate orders for different bed widths, the center panels would be made wider or narrower. In this way, the sizes and proportions of all else remained the same.

I decided not to have a footboard. This way, attention would be focused on the headboard, and the blankets would be more visible. The legs needed to be sufficiently large to hold the bed up and define the corners, but no more. Some sketches developed initial ideas about the form of the legs. I wanted the connecting frame or rails to be low-key. Certainly, I didn't want large rails going round the base of the bed. I have always imagined knocking into these and being the recipient of some colorful bruises as a result.

Before sketches can be refined into working drawings, real sizes must be decided upon. I planned for a standard-size mattress with 1 in. to 1½ in. between mattress and frame to allow for sheets and blankets. A list of the standard bed sizes is given on the facing page. The height of the mattress within the bed frame should be worked out so that the headboard is positioned correctly. It's very easy to design the whole thing then put the box spring and mattress in place only to discover that when the pillows are placed on the bed they practically obliterate the headboard. Also, the headboard must retain the pillows and not let them slip under its the bottom edge.

Other considerations came into play. We had in mind multiples: the bed had to be producible by machine woodworking methods using what I had available—tablesaw, bandsaw, jointer and planer. Moldings and other treatments could come from the router, so only a small number of jigs had to be made. One virtue of this minimal manufacturing technique is that if you select your materials well, you can offer what appears to be quite a range of product. In fact, it's all made the same way, just detailed and finished differently.

The dry mortise and tenon connecting the end rail to the bedposts allows the headboard to be flipped, and also allows the bed to be knocked down for packing and transport. Obviously, the rails have to be firmly connected to the legs when the bed is set up. I used a bed bolt and captive nut in the rail end. But for the side rails on the production model of this bed, I decided to use a U-bolt system instead, which is stronger and easier to install. Details of this construction are shown on the facing page. Since I didn't want a show-wood rail around the bed, and since I wanted it to be softened in some way, a torsion box was the solution. Made with ½-in. medium density fiberboard, they are light in weight but very robust looking. The outside core strips are large enough to receive a large radius. The U-bolts are captive in a groove routed into a solid block at each end of the torsion-box/rail. The rail itself is wrapped with ½-in. foam or Kapoc batting and covered with cloth. My preference was black silk for the ebonized frame and neutral brown cloth for the cherry.

The holes made in the legs have to accept a socket wrench, thus they need a plug or some form of cover once the bed has been assembled. This illustrates how the design process occasionally folds back upon itself—because now a round of research into plugs and covers is called for. If you find yourself having to research major stuff at this stage, however, you have probably skimped on the necessary work at the beginning.

Solid stuff—No matter how accomplished any of us are as a draftsman, the point comes when we reach the end of what we can usefully do at the drawing board. We need to see how our ideas translate into the real thing by making a scale model or a full-scale mock-up. I prefer a mock-up that, although full size in its parts, needs only to be fastened together quickly—hot-melt glue works well—in such a way that half of it is completed. This half is then placed against a mirror so that the whole image can be looked at and evaluated. At this stage you need to concentrate on form and how shapes interrelate, not on wood grain, so a wood such as poplar will do. It is a good idea to spray paint your mock-up white and review it purely in terms of shapes and negative space.

Beyond this point, further design research is really a function of quantities. If large numbers of the item are to be made, one or more mock-ups need to be constructed, and jigging and production methods tested. Such was not the case here, so we went right to a prototype, which is shown at the beginning of this article. No matter how much you try to get it right the first time, there are improvements that can be made. It requires that you never close the doors on your thinking and never become so obsessed with your efforts that you can't consider changes. □

Ian Kirby is a designer, author and educator. He operates Kirby Studios in Cumming, Ga.

Wendell Castle's Clocks

Time is money

by Roger Holmes

***Four Years Before Lunch** mixes ebony and Swiss pear in four partial clock faces.*

About two years ago, Wendell Castle and art dealer Sandy Millikan sat down to talk. Castle's collection of 15 high-style pieces of furniture inspired by the French designer Jacques-Emile Ruhlmann was at the end of a successful run in Millikan's New York City gallery. Well received critically, the show was also selling. The question now was, what next?

"I said, 'Wendell'," Millikan recalled recently, "'if you do another show of furniture, you're going to get labeled a furnituremaker. If you want to be an artist and be in the fine arts world, I think you have to deal with the issue of art. Now how do we do that?' And that's when Wendell came up with the idea of the clock."

The culmination of that idea, an exhibition of 13 clocks (eight of which are shown on the following pages), completed a three-gallery tour this past winter. Opening at Cincinnati's Taft Museum in September, the show moved to Millikan's in November and December and drew to a prestigious close at the Smithsonian's Renwick Gallery in Washington, D.C., in May.

The clocks are extraordinary. Their size alone, ranging between 6 ft. and 8 ft. high, commands attention. When seen together, they bend our scale to theirs, as though the viewer had stepped into a world slightly larger than life. Each clock has a theme, through which various ideas about time and the representation of it are given shape and structure. The materials are sumptuous, the workmanship impeccable, the prices, at least as contemporary furniture goes, are stratospheric: from $75,000 to $250,000.

That's a lot of money for a clock. But there's a lot of money being spent in the

Photos: Bruce Miller

art market these days. Important paintings of the 1950s are already fetching millions, out of the league of many buyers who are looking for affordable, perhaps adventurous alternatives. Millikan and Castle are not alone in hoping to catch the imagination of these buyers, many of whom are also dissatisfied with certain trends in contemporary painting and sculpture. Glass and ceramics have moved into this market. Some studio glass, for example, reportedly goes for as much as $45,000.

For people tired of searching for meaning in works of art that could often, they're certain, be produced by any child, craftwork is an obvious antidote. Its meaning, or at least its forms, are readily accessible. Chairs, pots, rugs are most often instantly recognizable. Its techniques, on the other hand, are inaccessible, taking years of training and practice to master. Easy to understand and difficult to do, craftwork neatly fills the brief for popular art. One of the primary reasons that we go to the ball park or concert hall, that we stop to examine a Rolls Royce or a Degas, is to see something done extremely well. The fascination with skill is nearly universal.

Millikan is no exception. He had been showing new wave painters, street painters and graffiti artists (styles known in part for their conscious rejection of technical finesse) when Castle's Ruhlmann-inspired show, he says, changed the direction of his gallery. "I decided," he explained, "that the thrill for me was to see the depth of finesse and technique and skill, and the real beauty that can come from them."

Millikan is enthusiastic about Castle's work, and believes it has an importance beyond the craft and decorative arts communities in which it has developed. He sees the clock show as "a turning point in contemporary art," and a challenge to the fine arts community. He's miffed that the challenge has so far been ignored. "I think the fine arts critics have avoided the show," he says. "They just don't want to deal with the issues raised by it."

For the issues to have relevance, and the challenge to have teeth, the work should be successful when judged as fine art. Unfortunately, looked at as sculpture, I don't think the clocks are particularly successful.

Sculpture, like other fine arts, is concerned with meaning. The meaning may be visual and tactile—the pleasing or moving arrangement of form, surface, texture, color and so on. Meaning may be literal, arising from the symbolic, metaphoric or actual content of a form. Meanings may be layered and combined in a single piece, but the resulting mix should have some sort of coherence. Looked at this way, Castle's clocks are, for the most part, a jumble. "Desk" and "Sun God," for example, combine a clock with a desk; "Arch" combines a clock with shelves. Do these combinations provide insight into either element of each pair? If the juxtapositions are comments on the nature of time, or clocks, or writing, or storage, they escape me.

The pieces are extraordinarily well-made of unusual and precious materials, so we might expect them to tell us something about the nature of craftsmanship or of materials. But, with the exception of "Ghost Clock," the pieces don't draw the viewer's attention to craftsmanship or materials in ways that encourage reflection on them. The clocks *are* superb craftsmanship, they're not *about* it.

There are clever and ingenious ideas here. Some of the representations of time are novel—split faces, free-floating hands, a sundial variant—but the pieces seem to be more about clocks, specifically tall-case clocks, than about time. And clocks are a much more limited subject than time. Several pieces play with the parallels between clocks and the human form: faces, arms, hands and so on. Geometric solids, ancient Egyptian and Greek architecture, allusions to the mysticism and mystery of time, all appear. Castle has a fertile imagination, but there is little depth or subtlety in the exploration and employment of the ideas, and in most of the pieces, the ideas compete with each other, with the craftsmanship or the materials. The result, as sculpture, is too often banal, clichéd or incoherent.

But while for me the clocks fail as sculpture, they succeed brilliantly as objets d'art or curios, joining a rich tradition that includes court furniture, Faberge eggs and, to stretch the point, Rolls Royces. Like the eggs, they are delightful in their cleverness; like a Rolls, by aspiring to be the ultimate form of a functional object, they surpass function. Relieved of the need to provide meaning, the dazzle and virtuosity of the materials and craftsmanship, the entertainment of the ideas, the audacity of the whole undertaking become ends in themselves. And as such, they are entirely successful.

There are others working the same vein, makers as skillful, designers as imaginative and daring. What sets this show apart is its scope. No furniture designer-maker has put together a show as focused and as ambitious as this. To do so required vision, confidence, a lot of hard work and a considerable sum of money—materials, workshop overhead and 18 months' wages for eight cabinetmakers and Castle cost a bundle. Without Millikan, there would have been no clocks; even with him, it has been touch and go. After their initial agreement to do a clock show, Castle began work and Millikan set out to find the money. He first put together a partnership with two outside investors. Then, with five months' of work on the clocks completed, one investor vanished and the other was unable to come up with the missing share. "We were stuck," Millikan said. "So at that point I had to go to the bank and basically take on the whole deal myself."

Discussing the financing with Millikan, I began to see the sense of the clock prices. Millikan wouldn't go into specifics, but my own quick calculations indicate Castle's costs may have run between $300,000 and $500,000. (When I later spoke with Castle, he didn't dispute those figures.) Promotion, according to Millikan, might be $50,000 to $100,000 for such a show (photography alone for the clock show cost $10,000). In addition to out-of-pocket costs, Millikan says he spent as much as three-quarters of his time on the project during the year prior to the exhibition. Clearly, both men were taking a huge risk. The return would be entirely dependent on the sale of the clocks, of which Castle owns two and Millikan the rest.

Five clocks sold during the New York showing, two to corporate collections, two to heads of corporations and one to a private collector. Millikan is cautiously optimistic about selling the rest. So, what's next? Castle's long range plan is to make some furniture that transforms, something like transformer toys, those ingenious gizmos that, by pivoting the parts, can be changed from fire engines or sports cars, for example, to robots and back again. These promise to be even more expensive to produce than the clocks, so while Millikan puzzles out the financing for them, Castle is working on a collection of twenty "not very usable" pieces, mostly hall tables, which he says developed from imagery and ideas spawned by the Caligari and Jester clocks. Some will be on show at Millikan's in June. □

Roger Holmes is an associate editor of Fine Woodworking. *Six of Castle's clocks will be shown during July and August at the Memorial Art Gallery in Rochester, N.Y.*

The eight clocks shown here are titled (counterclockwise, from top left): Jester, Arch, Desk, Sun God, Magician's Birthday, Four Years Before Lunch (subtitled Grandson in a Hawaiian Shirt), Bird and Ghost. With the exception of Ghost, which is carved from stack-laminated mahogany, all are veneered onto Uniboard Premier, a Canadian-made medium density particleboard. Most panels were edgebanded with ⅛ in. or more of solid wood, then veneered before jointing and assembly.

Castle's clocks were made in his Scotsville, N.Y., workshops by an extraordinarily talented group of woodworkers: Don Sotille, director of design and production, Gregg Bloomfield (who adapted the clock movements), David Fowler, Chris Lodermeier, Michael Scott, William Sloane, John Zanetti, Sam Dickenson and Peter Pierobon. Sotille carved the birds, made the Lucite clock covers, and devised much of the hardware. Castle carved Ghost Clock himself.

PRO TOOLS INC.

Largest Power Tool and Accessory House on the West Coast! Orders Shipped Within 24 Hrs!

FREUD

ALL FREUD PRODUCTS **20-55% OFF!**

WC104	4 Pc Chisel Set	18.00
WC106	6 Pc Chisel Set	27.00
WC110	10 Pc Chisel Set	47.00
TT-108	8 Pc Turning Set	47.00
CS-106	6 Pc Carving Set	56.00
CS-112	12 Pc Carving Set	99.00
CM100	Carvers Mallet	8.00
LM72M010	10x24 Rip	34.00
LU73M010	10x60 Cut off	34.00
LU84M011	10x50 Combo	35.00
	Set of Three above	99.00
LU85M010	10x80 Super Cut-off	62.00
LU82M010	10x80 Plywood	43.00
LU78M010	10x80 Plastic	82.00
LU72M010	10x40 Gen Purpose	34.00
LU84M008	8x40 Combo	39.00
LU85M008	8x64 Super Cut-off	54.00
LU73M012	12x72 Cut-off	74.00
LU73M014	14x84 Cut-off	89.00
LU84M012	12x60 Combo	69.00
LU84M014	14x70 Combo	85.00
LU85M012	12x96 Super Cut-off	79.00
LU85M014	14x108 Super Cut-off	99.00
PS203	7¼x24	17.00
PS303	7¼x40	21.00
AD800	8" Adjustable Dado	44.00
DS306	6" Production Dado	91.00
DS308	8" Production Dado	101.00
DS310	10" Production Dado	179.00
DS008	8" Dovetail Saw	18.00
GS006	6" Gents Saw	8.00
PS002	22" Panel Saw	16.00
RS024	24" Rip Saw	17.00
TS012	12" Tenon Saw	21.00
90-100	15 Pc Router Bit Set	139.00
92-100	26 Pc Router Bit Set	269.00
EC900	4 Pc Door Making Shaper Cutters	299.00

94-100	Carbide Cabinet Set ½" Shank	189.00
DB050	50 Pc Drill Set Comb. Drill/Brad w/case	69.00
FB100	16 Pc Forstner Set ¼-2⅛ w/case	189.00
EC 202,209, 210, 211, 212 213	Raised Panel Shaper Cutters ¾" Bore w/ Bushings ½ or ⅝ Arbor	77.00
EC260	Complete Style & Rail Set ¾ Bore w/Bshings ½ or ⅝ Arbor	158.00

Complete line of FREUD EC & UP cutters in stock!

"Jorgensen" / "Bow" / "Adjustable"

CLAMPS

	Jaw Length	Open Cap	
2/0	7"	3½"	7.25
0	8"	4½"	8.10
1	10"	6"	11.35
2	12"	8½"	13.60
3	14"	10"	16.75
50	Fits ¾ Pipe	7.00 ea	6.50/12 pk
52	Fits ½ Pipe	6.10 ea	5.75/12 pk
3706	Bar - 6"	5.50 ea	4.95/6 pk
3712	Bar - 12"	5.95 ea	5.35/6 pk
3718	Bar - 18	6.95 ea	6.25/6 pk
3724	Bar - 24"	7.35 ea	6.60/6 pk
3736	Bar - 36"	8.95 ea	8.00/6 pk

SENCO

SKS	¼ Crown ⅝-1½ Cap	249.00
LSII	18 Ga Pinner ⅝-1" Cap	249.00
LSIV	18 Ga Pinner ⅝-1¼ Cp	259.00
MW	⅝-1½ Wide Crwn Stplr	349.00
PW	½-1½ Wide Crwn Stplr	249.00
PWRoofer	½-1¼ Wide Crwn Stplr	299.00
SCI	5/16-9/16 Senclamp Face Frame	339.00
SFNII	1½-2½ Finish	389.00
SFNI	1-1¾ Finish	254.00
SNIV	2-3" Framing	499.00
NR83A	Hitachi Framing Nailer	449.00

LEIGH

TD504	12" Dovetail Jig Thru	137.00
TD514L	24" Dovetail Jig Thru	210.00
T1258-12	12" Dovetail Jig ½" Blind & Through	262.00
D1258-24	24" Dovetail Jig ½" Blind & Through	339.00

POW'R/MITERMATE

Fits All Mitre Saws Extends to 10' 139.00

SHOPHELPER™ Anti-Kickback System 75.00

DOWEL IT

Model 1000 .... 25.00

Model 2000 .... 35.00

Makita Power Tools

9820-2	Blade Sharpener	159.00
6012HDW	⅜" C'less Clutch Drill	96.00
6010DWK	⅜" C'less Drill w/case	88.00
DP3720	⅜" VSR Drill	47.00
DP4700	½" VSR Drill	92.00
6510LVR	⅜" VSR Drill	56.00
DA3000R	⅜" Angle Drill VSR	102.00
DA3000DW	⅜" Angle Drill VSR Cordless	98.00
6800DBV	0-2500 RPM Drywall Screwdriver	85.00
6801DBV	0-4000 RPM Drywall Screwdriver	85.00
6802BV	0-2500 RPM TEK Scrw	109.00
HP1030W	⅜" VS Hammer Drill	97.00
8419B2W	½" 2 Spd Hmmr Drill	149.00
6905	½" Drive Imp. Wrench	139.00
JR3000V	VS Recip Saw	119.00
LS1000	10" Miter Saw	196.00
GE0600	¼" Die Grinder	59.00
GV5000	5" Disc Sander	59.00
9207SPB	7" Sander/Polisher	125.00
9207SPC	7" Electronic Sdr/Plshr	129.00
9501BKW	4" Sndr/Grndr w/case	109.00
2708	8" Table Saw	192.00
4200N	4⅜" Circular Saw	92.00
5005BA	5½" Circular Saw	97.00
5081DN	3⅜" C'ls Circ Saw Kit	96.00
5600DW	6⅜" C'less Circ Saw	86.00
5402A	16-5/16 Circular Saw	299.00
1100	3¼" Planer HD	164.00
1900BW	3¼" Planer	92.00
3601B	1¼ hp Router	115.00
3612BR	3 hp Router	174.00
3700B	¼ hp Trimmer	79.00
3700DW	Cordless Trimmer	85.00
3705	Offset Laminate Trmr	119.00
4300DW	Cordless Jig Saw	99.00
4301BV	Var Speed Jig Saw	124.00
9030	1⅛x21" Belt Sander	225.00
9035DW	⅓ sheet C'less Sndr	78.00
9045B	½ Sheet Sander	90.00
9045N	½ Sheet Sndr w/bag	105.00
9900B	3x21 Belt Sndr w/bag	119.00
9924B	3x24 Belt Sander	130.00
9924DB	3x24 Belt Sndr w/bag	129.00
9401	4x24 Belt Sndr w/bag	149.00
B04510	4" sq Finish Sander	44.00
B04530	6" Round Finish Sndr	49.00

HITACHI

TR6	Laminate Trimmer	79.00
TR12	3 hp Router	167.00
C10FA	10" Mitre Saw	299.00
C15FB	15" Mitre Saw	425.00

Milwaukee

0228-1	⅜ Var Speed Drill	91.00
0224-1	⅜ Magnum Drill	108.00
0234-1	½ Magnum Drill	111.00
6511	2 Speed Sawzall	120.00
6507	Var Speed Sawzall	124.00
0375-1	⅜ Var Close Qtr Drill	117.00
1107-1	½" D Handle Drill	142.00
3102-1	Plumbers Rt Angle Drill Kit	179.00
3202-1	Plumbers Rt Angle Drill Kit	179.00
3002-1	Electricians Rt Angle Drill Kit	175.00
3107-1	VS Rt Angle Drill Kit	189.00
3300-1	Magnum Right Angle Drill Kit	169.00
1676-1	Hole-Hawg w/case	224.00
1610-1	½" HD Hole Shooter	132.00
0214-1	⅜ Handle C'less Drill	117.00
8975	Heat Gun 570°-1000°	49.00
5397	½ Hammer Drill with Case & Bits	149.00
6234	VS Band Saw w/case	278.00
6365	7¼" Circular Saw	105.00
6305	6½ C'less Circular Saw	134.00
6255	Var Speed Jig Saw	139.00
6014	½ Sheet Finish Sander	111.00
5920	3x24 Belt Sander	198.00
5925	3x24 Belt Sndr w/bag	213.00
5930	4x24 Belt Sander	207.00
5935	4x24 Belt Sndr w/bag	212.00
5620	1 hp Router	169.00
5660	1½ hp Router	173.00
5680	2 hp Router	218.00
6145	4" Sander Grinder	95.00
6753-1	0-4000 RPM Drywall Screw-shooter	78.00
6850	18 Gauge Shear	130.00

BOSCH Power Tools

90300	3¼ hp Router	349.00
90303	3¼ hp Plunge Router	469.00
1600	2¼ hp D Handle Rtr	249.00
1601	1 hp Router	89.00
1604	1½ hp Router	109.00
1606	1½ hp D Handle Rtr	134.00
91263	⅝ hp Tlt Bse Lam Trmr	149.00
91263-5	⅝ hp Tlt Bse Install Kit	199.00
90085	⅝ hp Trim Router	85.00
90086	⅝ hp Laminate Trmr	105.00
1920VSRK	⅜ Variable C'less Drill	94.00
1921VSRK	⅜ Var C'less S'driver	114.00
1158VSR	⅜ VSR Drill	54.00
1198VSR	½" Hammer Drill	119.00
11202	1½" Rotary Hammer	375.00
11213K	¾" C'ls (24v) Rot Hmr	249.00
11212VSR	⅞ Rot Hmr (Bulldog)	189.00
11305	Demolition Hammer	575.00
11304	The Brute Brkr Hmr	1249.00
1581VS	Top Handle Jig Saw	125.00
1582VS	Barrel Handle Jig Saw	117.00
1322	7" or 9" Sander Grndr 6000 rpm	109.00
1323	7" or 9" Sander Grndr 5000 rpm	109.00
1520	18 Ga Piston Grip Shr	133.00
1529	18 Gauge Nibbler	229.00
1942	Heat Gun	78.00
3270D	3x21 Belt Sndr w/bag	108.00
1272	3x24 Belt Sander	158.00
1272D	3x24 Belt Sndr w/bag	168.00
1273	4x24 Belt Sander	168.00
1273D	4x24 Belt Sndr w/bag	178.00
1288	½ Sheet Finish Sander	104.00
1288D	½ Sheet Finish Sander w/bag	118.00

FACE MAKER

Face Maker Machine
Clamps, Drills & Screws
Face Frames

279.00

PORTER+CABLE

PROFESSIONAL POWER TOOLS

315-1	7¼" Top Handle	103.00
314	4½ Trim Saw	114.00
587	7¼ Speedtronic Circ Saw	129.00
7548	Orb Action Jig Saw	129.00
9629	Var Action Jig Saw	134.00
661	7" Disc Polisher	136.00
662	7" Disc Sndr Grinder	136.00
304	7" Disc Sander	119.00
305	7" Disc Polisher	119.00
666	⅜ T Handle Drill	115.00
621	⅜ Var Speed Drill	85.00
7511	⅜ HD Var Speed Drill	114.00
7514	½ HD Var Speed Drill	119.00
399	Drywall Cut-out Unit	69.00
695	Shaper Table with 1½ hp Router	189.00
696	Shaper Table w/o Rtr	104.00
309	Laminate Trimmer	84.00
310	Laminate Trimmer	134.00
312	Offset Lam Trimmer	139.00
319	Tilt Base Lam Trmr	143.00
520	3 hp HD Router	275.00
518	3 hp Speedtronic Rtr	339.00
537	1½hp HD D Hndle Rtr	210.00
536	1½ hp HD Router	189.00
691	1½hp HD D Hndl Rtr	139.00
100	⅞ hp Router	94.00
690	1½ hp Router	129.00
330	Bloc Sander	55.00

ASK ABOUT OUR PORTER CABLE STICK-IT™ SYSTEM!

505	1/2 Sh Finish Sander	109.00
336	3x21 Belt Sander	109.00
337	3x21 Belt Sndr w/bag	114.00
503	3x24 Worm Drive Blt Sander w/bag	339.00
504	3x24 Worm Drive Belt Sander	329.00
360	3x24 Belt Sndr w/bag	175.00
361	3x24 Belt Sander	167.00
362	4x24 Belt Sndr w/bag	187.00
363	4x24 Belt Sander	182.00
5008	Dovetail Template	69.00
5009	Mortise & Tenon Jig	39.00
513	Lock Mortiser	669.00
42234	Corner Chisel	19.00
59831	Hinge Butt Tmplt Kit	159.00
320	Abrasive Plane	95.00
9118	Door Plane w/kit	190.00
9652	Versa Plane w/kit	284.00

AIR COMPRESSORS

* 1½ hp K15A-8P Emglo 579.00
* 5 hp Honda Emglo 649.00
3/4 hp Shuttle Mini Compressor ... 229.00
* 1 hp Pioneer 249.00
* 1½ hp Pioneer 279.00

ARCO

11 pc Forstner Bit Set ¼-1½" 75.00

16 pc Forstner Bit Set ¼-2⅛" 148.00

4 pc Forstner Bit Set ½-⅝-¾-1" 24.00

MAKITA DIAMOND BLADES

4" Super Dry Diamond Blades 49.00

7" Super Dry Diamond Blades 79.00

RYOBI

AP10	10" Surface Planer	365.00
AH115*	12½ Planer/Jointer	1150.00
BS-360NR*	3" Band Saw	1089.00
RA2500*	10" Radial Arm Saw	329.00
X2450*	Stand	29.00
SU6200	½ Sheet Finish Sndr	78.00
B07075	3x21 Belt Sander	102.00
B7100	3x24 Belt Sander	124.00
B7200A	4x24 Belt Sander	147.00
S500A	1/6 Sheet Fin Sander	34.00
BD1025R	¼ C'less Screwdriver	85.00
C355C	14" Mtl Cut-off Saw	169.00
JSE60	Electronic Variable Speed Jig Saw	89.00
L120U	3¼ Planer	84.00
R151	1 hp Plunge Router	89.00
R500	3 hp Plunge Router	146.00
TR30U	Laminate Trimmer	79.00
SG1000K	4" Sander Grinder w/case	54.00
TS251U	10" Miter Saw	160.00
TS380	14" Miter Saw	379.00
W200S	16" Circular Saw	299.00
W740G	7¼ Circular Saw	89.00

Virutex

Virutex Spline Machine w/case 289.00

BIESEMEYER.

52" Homeshop 238.00

50" Commercial 288.00

Angle Finder 115.00

Blade Finder 115.00

DELTA

11950	8" Drill Press	99.00
14040*	14" Drill Press	179.00
17900*	16½" Drill Press	225.00
22651*	13" Planer w/motor	850.00
50-315*	Stand For Above	59.00
23-680	6" Grinder	59.00
23-880	8" Grinder	89.00
28-140*	10" Band Saw	295.00
28-160	10" Mini Band Saw	109.00
28-243*	14" Band Saw	479.00
28-560*	16" Band Saw	325.00
31-352	1x42 Belt Sander	209.00
33-150*	Sawbuck	465.00
33-890*	12" Radial	999.00

34-410*	10" Contrctrs w/motor after rebate	525.00
34-710*	Super 10" Saw	409.00
37-255*	6" Jointer	445.00
40-500	15" Bench Scroll Saw	79.00
40-601*	18" Var Spd Scrl Saw	779.00
43-122*	Shaper	466.00
34-763*	3 hp Unisaw	1535.00
34-781*	1½ hp Unisaw with Unifence	1475.00
34-782*	3 hp Unisaw w/unifn	1695.00
43-375*	3 hp Shaper	1719.00
31-730/52-611*	6" Belt 12" Disc	1145.00

SANDING ACCESS.

GRIT/QTY		
40 Grit/100	6" Pressure Sensitive Disc	30.00
60 Grit/100	6" Pressure Sensitive Disc	24.00
80 Grit/100	6" Pressure Sensitive Disc	22.00
100 Grit/100	6" Pressure Sensitive Disc	19.00
120 Grit/200	6" Pressure Sensitive Disc	38.00
Any Grit	3x21 Sanding Belts Box of 10	9.00
Any Grit	3x24 Sanding Belts Box of 10	10.00
Any Grit	4x24 Sanding Belts Box of 10	11.00
	Belt Cleaning Stick	5.00

SKIL POWER TOOLS

551	5½ Circular Saw	72.00
367	6½ Worm Drive Saw	134.00
77	7¼ Worm Drive Saw	134.00
825	8¼ Worm Drive Saw	164.00
983	Sand Cat Sander	67.00
2016-02	⅜ C'less Drill w/case & 2 Batteries	94.00

PRO TOOLS INC.

1218 E. KATELLA AVE., ANAHEIM, CA 92805

* FREIGHT PREPAID ON AD ORDERS OF $50 OR MORE IN CONT. U.S. (Some Restrictions may apply)
* CHECK, MONEY ORDER, VISA OR MASTERCARD ACCEPTED
* CALIFORNIA RESIDENTS ADD 6% SALES TAX

CALL OUR TOLL FREE ORDER LINES:

(800) 445-TOOL (Outside California)

(800) 842-TOOL (Inside California)

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE
NOT RESPONSIBLE FOR MISPRINTED PRICES
* CALL FOR SPECIAL DISCOUNTED FREIGHT RATES

ALSO AVAILABLE AT THESE LOCATIONS...

PRO TOOLS AND FASTENERS
7640 CLAIREMONT MESA BLVD., SAN DIEGO, CA

T.O. TOOLS
1507 E. THOUSAND OAKS BLVD., THOUSAND OAKS, CA

CLASSIFIED

The CLASSIFIED rate is $5.00 per word, minimum ad 15 words. All payments must accompany orders; all are non-commissionable. The WOOD & TOOL EXCHANGE and SITUATIONS WANTED are for private use by individuals only; the rate is $7 per line. Minimum 3 lines, maximum 6 lines, limit 2 insertions per year. Allow 30 letters or spaces per line, including name and address. DISPLAY CLASSIFIED rates on request. Send to: *Fine Woodworking*, Advertising Dept., Box 355, Newtown, CT 06470. Deadline for the September/October issue is June 25th; for the November/December issue, August 25th.

Busn. Opportunities

NEW HAMPSHIRE. Restored 7,000 sq. ft. shop on picturesque mill pond. 30 kw hydro, 7 room home, 35 miles from Portsmouth. $263,000. Owner (603) 473-2518.

NORTHERN MICHIGAN custom woodworking shop with gift shop and living quarters, machinery, stock. $39,500. (906) 337-0289.

CABINET-WOODWORKING SHOP in the Vail Valley. Shop, equipment and home in Eagle, CO. $165,000. Call Slifer & Co., Tom Backhus, (303) 476-2421.

QUALITY WOODWORKING BUSINESS in Taos, New Mexico, grossing $100,000 annually; including fully-equipped shop, retail showroom, wholesale dealers and custom work. Asking $120,000. PO Box 858, 87571.

DEALER INQUIRIES INVITED
We are a direct importer stocking all quality hand tools needed for a woodworking tool store or specialty department. Resale only—no enduser sales.
Robert Larson Company, Inc.
82 Dorman Avenue
San Francisco, CA 94124 (415) 821-1021

Help Wanted

EXPERIENCED WOODWORKER. Bozeman & Co., Organbuilders, RFD 1, Deerfield, NH 03037. (603) 463-7407.

CABINETMAKER. Excellent opportunity for experienced person in modern, fully-equipped custom cabinet shop catering to select trade including architectural. Position requires experience and/or comparable training; apprentice/journeyman background. Good benefits and compensation. Josesph Ambrozaitis, PO Box 4, Middlebury, CT 06762. (203) 758-2545.

EXPERIENCED FURNITUREMAKER: Excellent opportunity for knowledgeable and aggressive type person(s) to build one-of-a-kind furniture. Good salary and benefits. Send resume to P.O. Box 555, Sulphur Springs, TX 75482.

ASSOCIATE HOME AND SHOP EDITOR. We are a major men's newsstand magazine located in New York City that currently has a staff position open that requires specialized knowledge plus top editorial skills. As part of our home and shop staff, you'll be originating article ideas, supervising photo sessions, writing articles, editing and proofreading manuscripts and galleys, and working with artists and art directors to develop technical illustrations. To handle this position you'll have to be very detail-minded and a skillful editor. Approximately 5 years of hands-on building experience including new constructions, remodeling, and shop work are required. You should also understand technical drawings and have at least 2 years editorial experience in this or a related field. Send your resume in confidence to B. Rosenberg, 224 West 57th St., 10th Fl., New York, NY 10019. E.O.E. M/F.

WOOD CRAFTSMAN INSTRUCTOR for cabinetmaking/wood crafts program. Olney Central College. Full-time, tenure track position. Salary commensurate with education and work experience. Starting date 8/25/86. Closing date 6/30/85 or until filled. Contact Personnel Office, Illinois Eastern Community Colleges, 233 E. Chestnut St., Olney, IL 62450. (618) 393-2982 for application. An equal opportunity employer.

PUBLISHING. Technical Editor, Production Editor and Copy Editor needed for *Practical Homeowner*, formerly *New Shelter*, the magazine for people dedicated to creating a safe, efficient and healthy home environment. Please send work samples and resume to: Personnel Department (PH-FWM) Rodale Press, Inc., 33 East Minor St., Emmaus, PA 18049. E.O.E. M/F.

Instruction

APPRENTICESHIP in prominent studio/workshop/showroom. Individual supervision designing and building a full range of furniture from solid walnut/rosewoods using intricate wood joints and pegs—the very finest hand work. Tuition. Jeffrey Greene Design Studio, New Hope, PA. (215) 862-5530. Call, don't write, Monday-Friday, 9:30 to 4:00.

PRIVATE TURNING LESSONS. $200 per day. Gablecraft, #308, 7125 SW 57th St., Miami, FL 33155. (305) 662-6091.

SWAIN SCHOOL OF DESIGN now has Boston University's Program in Artisanry (PIA). Swain offers the BFA degree in Architectural Artisanry, Ceramics, Fiber, Graphic Design, Metals, Painting, Printmaking, Sculpture and Wood. MFA degrees in Ceramics, Fiber, Metals and Wood. Swain's newly renovated facilities provide individual studio space for junior, senior and graduate students. Write: Admissions, Swain School of Design, 388 County St., New Bedford, MA 02740.

NEW ENGLAND TECHNICAL INSTITUTE, a nationally accredited post-secondary institution offers a diploma program in woodworking/furniture design and finish carpentry/architectural woodworking. Classes commence in September and February. Financial aid/dormitory facilities and part-time job assistance available. Write to N.E.T.I., 750 Massabesic St., Manchester, NH 03103.

LEARN WOODEN BOAT BUILDING AND DESIGN. Two full-time residential programs that offer intensive training in a creative but disciplined environment. Equal opportunity enrollment. V.A. approved. The Landing School, Box 1490F, Kennebunkport, ME 04046. (207) 985-7976.

E. LYNN FOREHAND on wood-fowl carving, Oct. 17-19. The Craft Center, Box 7305, North Carolina State University, Raleigh, NC 27695. (919) 737-2457.

LEARN TO TURN. Two-day concentrated course in all aspects of lathe. Workshop located in converted 18th-century spring house. Individualized instruction. Reading and Lancaster nearby. Send for free brochure. James L. Cox Woodworking School, R.D. 1, Box 126, Honey Brook, PA 19344. (215) 273-3840. We use and sell the Myford English lathe.

RUSS ZIMMERMAN
TURNERS' WORKSHOPS
Turn Better With Personal Instruction.
ZIMMERMAN TURNING LETTER: 9 Comprehensive issues, 220 pages. $22 ppd. 1986 Subscription: $9 ppd. SORBY TOOLS, ETC. 44¢ in stamps for brochure, or free with Turning Letter

RFD 3, BOX 242, PUTNEY, VT 05346

WENDELL CASTLE SCHOOL. College of Furniture Design and Woodworking. For Catalog: 18 Maple St., Scottsville, NY 14546. (716) 889-1521.

CONCENTRATION IN WOOD
PENLAND
FALL '86
10/6 - 11/28 (8 weeks)
JON BROOKS
SPRING '87
4/20 - 5/15 (4 weeks)
RICHARD TANNEN
PENLAND SCHOOL
Dept. W, Penland, NC 28765
704/765-2359

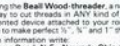
Accessories

DUST COLLECTION SYSTEM filter bags ($40.00), fabric (80-in. $10/yd.) postpaid. Barter Enterprises, Box 102B, Prospect Harbor, ME 04669.

PEPPER & COFFEE MILL WORKS
European quality for America's awakening taste
For illustrated price list write:
Don Snyder Imports
P.O. Box 207, Comptche, CA 95427
(707) 937-0300

WEST SYSTEM* Epoxy Products, well-known for their quality and durability, have been developed to meet the requirements of today's high strength structures. Our experienced technical staff is available to assist you with your questions.
Gougeon Brothers, Inc.
706F Martin Street
Bay City, MI 48706
517/684-7286
* Trademark of Gougeon Brothers, Inc., U.S.A.

The Beall Tool Co.



Introducing the **Beall Wood-threader**, a new and better way to cut threads in ANY kind of wood. This patented device attached to your router allows you to make perfect ½", ¾" and 1" threads.
For more information write:
541 Swans Road, N.E., Newark, Ohio 43055
614-345-5045

HINGES
50 sizes and shapes/cast bronze only
send stamped self-addressed envelope for flyer and prices
Custom Work Available
ROSTAND-R.I. Inc.
Box 737-FW, Chepachet, R.I. 02814

DUST COLLECTION INNOVATIONS
...The source for dust collection plumbing...

- Y PIPE
- DAMPNER VALVES
- REDUCERS
- MACHINE HOOKUP

JD WOOD WORKING PRODUCTS
2634 Mineral Point Rd.
Friday Harbor, WA 98250
(206) 378-5618
★ SEND FOR FREE BROCHURE ★

THE FINE GOLD LEAF PEOPLE™
Genuine, Imitation and Variegrated Sheets & Rolls
Brushes, Supplies & Technical Books
IN USA: Three Cross Street, Suffern, NY 10901-4601, 1-800-772-1212 (NY-AK 914-368-1100)
IN CANADA: 454 Lawrence West, Toronto, Ontario, M5M 1C4, 416-787-7331

Finishes

SPRAY—without mess or overspray. Incredible APOLLOSPRAY gives finest finish. Lacquers, enamels, urethanes, etc. Portable. No compressor. Easy to use/clean/maintain. Save on materials. Used worldwide since 1966. Excellent for woodworking/cabinet shop. Information brochure. East (914) 764-8448. West (714) 546-6217.

Swedish Wood Dyes. *Beautiful, brilliant colors. Inexpensive, non-toxic. $5 for 3 samples. Professionally used.* ***T.H.&.A., P.O. Box 6004, Dept. FW, Rockford, IL 61125***

Miscellaneous

BRANDING IRONS for craftsmen. Logo design. Send your ideas for quote. Heat Mark Co., Rt. 6, Box 828, Mooresville, NC 28115.

BRANDING IRONS. Names, signatures, logos, any size, design. Norcraft Custom Brands, Box 277F, So. Easton, MA 02375. Telephone (617) 238-2163 anytime.

BRANDING IRONS. Fast delivery, solid brass, logos, free literature. Call/write, BrandMark, Dept. F, 462 Carthage, Beavercreek, OH 45385. (513) 426-6843.

COMPUTER OWNERS! Program makes bidding custom work easy. C-64, Apple, IBM. $29.95: BID, Box 218, Brookston, IN 47923. (317) 563-3504.

CUSTOM BRANDING IRONS
DRILL PRESS or HANDHELD
250 to 800 watts
SEND $1.00 FOR BROCHURE
ENGRAVING ARTS (707) 984-8203
P.O. Box 787
Laytonville, CA 95454

Musical Supplies

REPAIR GUITARS? Free 80-page catalog packed with tools and hard-to-find parts for guitars, banjos and mandolins. Stewart-MacDonald, Box 900F, Athens, OH 45701. (614) 592-3021.

LUTHIERS' SUPPLIES: Imported tonewood, tools, varnishes, books, plans, parts, accessories, strings, cases, for violins, violas, cellos, basses and guitars. Assemble-yourself violin and guitar kits. Catalog, $.50, includes 10% discount certificate. International Violin Company, Ltd., Dept. WG, 4026 W. Belvedere Ave., Baltimore, MD 21215.

VIOLIN, GUITAR, banjo, mandolin-making materials, accessories, books. Catalog, $1. International Luthiers Supply, Box 580397, Tulsa, OK 74158.

EARLY INSTRUMENT KITS! Build hammered dulcimers, mandolins, banjos; even harps, lutes, harpsichords. FH Hughes, 4419 W. Colfax, Denver, CO 80204.

HAMMERED DULCIMER PLANS! By noted builder Charlie Alm. Photos of each step! Best book on subject. $19.95. Woodworks, Box 218, Brookston, IN 47923.

Plans & Kits

WATERBEDS AND BEDROOM FURNITURE CATALOG of plans, $2.75. Over 50 beautiful selections! Kraemer Furniture Designs, PO Box 33, 1350 Main St., Plain, WI 53577.

PLANS FOR 150+ TOOLS. Sample plan and catalog, $3. Wood-Met, 3314 Shoff FW, Peoria, IL 61604.

BANDSAW OWNERS. Learn the rewarding technique of making small, unique specialty boxes from solid blocks of wood. Fully illustrated instructions of 15 profitable designs (see display ads in former issues). Send $10 to Box-Art, Dept. FW, Box 8069, Woodridge, IL 60517.

WOODEN DEMONSTRATION MECHANISMS. Plans; precut parts, kits for cams, eccentrics, etc. Illustrated data sheet. SASE to Craftworks, Box 804, Soquel, CA 95073.

Services

INLAYS—antique repairs, new work, ivory, metal, wood, guaranteed best. Reinholds, 4446 Westridge, Williamsburg, MI 49690. (616) 938-9211.

Tools

INCA IN MINNEAPOLIS. Complete line now available at The Woodworkers' Store, 3025 Lyndale Ave., So. (612) 822-3338.

RESTORED MACHINERY - Finest woodworking machines ever made. Oliver, Yates, Northfield. Bandsaws, table saws, wood lathes, etc. Puget Sound Machinery. (206) 627-0802.

NEW ENGLAND AREA—Call us about your machinery needs. New, used, rebuilt. Woodshop Machines, RFD #3, Box 180-D2, Laconia, NH 03246. (603) 524-8545.

FINE EUROPEAN HANDTOOLS—modest prices, great values. Send $1 for catalog (receive $2 merchandise credit). B&B (FW), 6262 Ascot Dr., Oakland, CA 94611.

WOODBUTCHER TOOL SHOP—fine hand and power tools. Send $2 for catalog. 38 Center St., Bath, ME 04530.

DUST COLLECTOR FOR SALE. York Shipley Exijet 24—one year old, handles 15,000 ACFM, 36 filter, self cleaned with compressed air. Unit cost was $19,000. We outgrew. $10,000 or make offer. Call Bob Baum, (717) 637-8977.

Make your own **12-in. DRUM SANDER** with our kit or order a complete unit that fits your Shopsmith or stands free to take a separate motor for under $200. Universal Clamp Corp. 6905 Cedros Ave., Van Nuys, CA 91405.

TOOLS—ANTIQUE AND USED—STANLEY. Quality, older hand tools for collectors and woodworkers. Prompt, postpaid shipping. Satisfaction guaranteed. Current illustrated list, $1.25. Subscription, $5/yr., 5 lists. Bob Kaune, 511 W. 11th, Port Angeles, WA 98362. (206) 452-2292.

SUMMER SPECIALS: SAMCO wood lathes 1HP, 1PH, with stand for $549. This is a heavy-duty imported lathe F.O.B. Philadelphia, PA. Dewalt 6-in and 8-in. hollow ground dado sets with a ⅝-in. bore and a $^{5}/_{64}$-in. width of cut. The 6-in. sets are $19.99 and the 8-in. sets are $29.99 delivered to your home. Also on special this month is the Delta 46-140 $^{11}/_{16}$-in. wood lathe with open stand and ½HP motor for $399 F.O.B. Philadelphia, PA. Carpenters Machinery is your General Machinery outlet. So do it now while they last! Write to Carpenters Machinery Co., 212 N. 11th St., Philadelphia, PA 19107. Attn: Wm. Murphy.

VIRUTEX #081, $250. Pneumatic finishing "T"-nailers, $120. 14-in. bandsaws, $275. 6-in. jointers, $215. Semi-automatic edgebanders, $2,475. "Super-Sale" on Bosch and Makita router bits. (717) 289-4686. Frank.

JAPANESE TOOLS SINCE 1888. Free catalog. New location, Tashiro's, 1435 S. Jackson, Seattle, WA 98144. (206) 322-2671.

BEST FOR LESS. Woodworking machinery combinations. Henry Wiegand Corp. Since 1924. Box 831, Claremont, NH 03743.

PORTER CABLE #315-1 7¼-in. builder's saw complete with carrying case and 24T carbide blade (all proudly made in USA) on sale, only $166 prepaid. (List $221.60). Ohio residents add 5½% tax. Check, VISA, MC. For COD add $1.90. Offer good through Sept. '86. Keim Lumber Company, Charm, OH 44617. (216) 893-2251. (Ohio) 800-362-6682. Mon-Thur., 7:30-5:00; Friday, 7:30-8:00; Saturday, 7:30-11:30.

OHIO WOODWORKERS—Lathes, lathe tools, Beall threading tool (July and August special, $99.95 delivered), Foredom ⅛HP, variable speed, foot control and assorted accessories (July and August $169.95 delivered). Carving tools, measuring devices, Behlen finishes, mill-route. Woodcrafters Supply Company, 20 Arcadia, Columbus, OH 43202. (614) 262-8095.

VIRUTEX 0-81, $295 ppd. Biscuits, $28. Authorized dealer for INCA, Freud, Sand-Rite, Leigh, Easy-Mortise, Lyon. Precision Woodworking Machines, Route 7A, Box 603, Manchester Village, VT 05254. (802) 362-1985.

LASER WOOD ENGRAVING SYSTEM: 250 watt CO2 laser, scanner, controls and smoke removal apparatus. (415) 948-3670.

HOCK HANDMADE KNIVES
FOR YOUR COMMITMENT TO QUALITY
MITCHELL CREEK DRIVE FORT BRAGG CA 95437

SEATTLE
You'll find a large selection of the best woodworking tools at:
The Wooden Boat Shop
1007 NE Boat St., Seattle, WA 98105
(206) 634-3600
9 AM–5:30 PM weekdays
9 AM–5:00 PM Saturday

We're just minutes from Expo 86...

Lee Valley

We invite you to visit our store while you're in town for Expo. Just drive down Granville St. on to S.W Marine Dr. We're at the foot of the Arthur Laing Bridge. Call (604) 261-2262 for information.

Precision Combination Chuck

Designed for woodturners by a woodturner. Simply the best available.
We have the largest selection of woodturning accessories in the world.
Send $2 for colour catalogue

CRAFT SUPPLIES
The specialists in wood turning tools and ideas.
The Mill, Millers Dale, Buxton, Derbys. SK17 8SN. England.

Free
Catalog
Decoy and Wood Carvers Tools
P.C. English Enterprises, Inc.
P.O. Box 7937 Dept FW7
Fredericksburg, Va. 22404 (703)371-1306

JULY SPECIAL
All Freud router bits and shaper cutters . . . *25% OFF*
WOODWORKER'S EQUIPMENT & SUPPLY
566 Danbury Rd.
New Milford, CT 06776
(203)354-2219

Small bevel-edge shaper collars fit Sears and Rockwell ½" Shapers **$49.95**
Patterns custom ground to your specifications **$19.95 & up.**
Custom kitchen cabinets style, rail and vertical panel cutters available.
WDR SALES
9604 Belmont, Kansas City, MO 64134
1-800-346-3026 Ext. 958

EDGE JOINING CLAMP

NO DOWLING - JUST GLUE & "DUO-CLAMP"
FAST • EASY
A perfect mate every time!
Send For FREE Info
MARK PRODUCTS • Box 46143, Dept. FW7 • Bedford, Ohio 44146

Toy Plans/Kits

MAKE WOODEN TOYS—PROJECTS. 100's plans, kits, hardwood parts, (toy, craft, furniture), tools, wood, supplies. Color catalog, $1. (614) 484-4363. Cherry Tree Toys, Belmont, OH 43718-0369.

MUSEUM-QUALITY KITS. Praised for beauty and authenticity, these Low-Boy and High-Boy kits recall the finest in eighteenth century joinery, style, and proportion. Deep hand-carved shell motifs, scalloped skirts, and graceful cabriole legs combine to make each kit a period masterpiece. Complimentary brochure. Call toll free: 1-800-233-6520, Ext. 26, or write: Hunter Woodworks Ltd., 6015 W. 11th Ave., Lakewood, CO 80214.

CREATE AN HEIRLOOM with TOY DESIGNS
CATALOG of PATTERNS & TOYMAKERS SUPPLIES
$1.50 (U.S. dollars)
TOY DESIGNS,
P.O. BOX 441F, Newton, Iowa 50208

Peanut Butter Toys

Bee Plan $5 ppd.
More Unique Plans
Catalog $1
Granite Road, Ossipee NH 03864

Wood

CHESTNUT SPECIALISTS. Old hemlock, sassafras. Woods of Heavenly Valley, Plymouth, CT 06786. (203) 283-4209 after 8 p.m.

HARDWOOD PLYWOODS. Ash, Baltic birch, red, white or natural birch, cherry, mahogany, maple, knotty pine, red oak, white oak, walnut, teak. All items ¼ in. and ¾ in. thickness. Sheet sizes 4x8, 2x8, 4x4, 2x4 or precision cut ($^{1}/_{16}$ in. tolerance) to any size, paying for what you order. Edging for all species in hardwood veneer strips or hardwood molding ¾ in. by ¾ in. Sheets of hardwood veneer with polyester backing. Wholesale quantity discounts. Call (617) 666-1340 for quotations. Shipping in USA via UPS or a common carrier. Boulter Plywood, 24 Broadway, Somerville, MA 02145.

EAST MOUNTAIN HARTWOODS, Rt. 7, Box 31H, Sheffield, MA 01257. Select oak, cherry, maple, ash, butternut, walnut, mahogany, tulip, pine, plank flooring, butcher block, hardwood plywood, custom milling. Toll free: Mass. 1-800-551-5028. Northeast: 1-800-521-2019.

EXOTICS. Lumber, logs, squares. Direct importer. Blackwood, tulipwood, cocobolo, Brazilian rosewood, bocote, pink ivory, kingwood, ebonies. Desert ironwood, quilted and burled maple, lilac burls, lignum (plane sole blanks available), other species. SASE for list. SJW, 650 St. John, Pasadena, CA 91105. (818) 441-1067.

BURL TURNING BLOCKS. Exhibition-grade turning blocks cut to size from western maple burl, box elder burl and myrtlewood burl. Send $2 for our 42-page color catalog of turning supplies, refunded with order. Craft Supplies USA, 1644 S. State St., Provo, UT 84601.

EXOTIC AND DOMESTIC HARDWOODS, veneer, marine plywood, Baltic birch, basswood to 4 in. thick. 90 woods in stock. Northwest Lumber Co., 5035 Lafayette Rd., Indianapolis, IN 46254. Phone (317) 293-1100.

OSAGE ORANGE—the American exotic—beautiful saffron color with red streaks. Available in logs, boards, turning squares. Special offer! 50 lb. box shorts and turning sections, $49.95 plus shipping. Reliance Industries, Inc., PO Box 129, Richland, IA 52585. (319) 456-6030.

QUALITY WALNUT AND CHERRY. Air dried, any thickness, many widths. Near Exit 23, Pennsylvania Turnpike. Call Frank (215) 942-4332.

HARDWOOD LUMBER: Oak, maple, cherry, ash, walnut, poplar, mahogany, plus millwork services. Design Craftsmen, Inc., 312 Marlboro St., Keene, NH 03431. (603) 352-5072.

In stock **HUNDREDS OF VARIETIES** of domestic and imported veneers. Tools and cements. Send $1 for instructions and price list. Homecraft Veneer, 901 West Way, Latrobe, PA 15650.

RARE MACASSAR EBONY in hard-to-find dimensions. 16/4 to 48/4 up to 14 in. wide. Random lengths. World's finest turning/carving stock. Incredible grain/color. Wholesale/retail. Art Eisenbrand, 4100 Spencer St., Torrance, CA 90503. (213) 542-3576.

ATTENTION:
FLORIDA WOODWORKERS
We have Florida's largest selection of exotic and native hard and soft woods, table slabs, veneers, etc. for the professional and novice. Send SSAE for list.

HENEGAN'S WOOD SHED
7750 Southern Blvd/FW, West Palm Beach, FL 33411
Call (305) 793-1557

Sawmill Kiln

Hardwoods Exotics
Willard Brothers Woodcutters
300 Basin Rd., Trenton, N.J. 08619
Call (609) 890-1990

Wood Parts

WOOD & TOOL EXCHANGE

Limited to use by individuals only

For Sale

Williams & Hussey PF7 Surface Planer with 1HP motor. $755 value, used only 30 hours, $495. New Jersey (201) 245-6883.

Red oak FAS, AD 3 yrs. in barn, 3 to 8-in. wide. $1.60/ft., rough; $1.75/ft. S2S; min. 100 ft. J. Houck, Temple, NH. (603) 878-2385.

INCA wood/metal lathe. 9 in. by 39 in., little use, many accessories. $1,200 (new $2,600). (414) 824-5646.

DUPLI-CARVER F-200 like new, $550. INCA table saw, 341.017, standard motor, $350. (203) 264-0262 evenings.

Redwood lace burl, planks, squares, slabs, whole: bird's-eye and curly lumber. Other burls, too. SASE to 3346 D St., Eureka, CA 95501. (707) 445-3371.

Lot clear white oak, red oak, cherry, $1.95 BF: walnut, $2.90 BF. 6 ft. to 10 ft. and wide. AD 6 years. Architectural quality. Dr. J. Shrewsbury, 505 S. Jefferson, Princeton, KY 42445. (502) 365-6119.

Powermatic chain saw mortiser, $1,250. Wallace 8-in. joiner, $450. Will consider trading machines. Chillicothe, IL. (309) 274-4234.

Dust collector Type D roto-clone by American Air Filter. Size 12, 5HP, 3PH, with precleaner and hopper. Contact Ron Nikkel, Rt. 2 Box 180N, Bartlesville, OK 74006. (918) 333-7033.

Complete shop. Floor tools, hand & power tools, clamps. Everything goes. *FWW* 1-53. So. Central Idaho. (208) 726-4634.

Williams & Hussey W-7S planer used less than 15 minutes. 3 rollers, table guides, 1½HP BB motor. Cost $950: sell $690. Delta scroll saw model 40-419 like new, $950. Sacrifices due to relocation. Call (305) 833-2456 evenings.

Wanted to Buy

Wanted: used Shopsmith router arm, any condition, no router. W.A. Nagel, Box 1173, Honokaa, HI 96727.

Listings are free, but restricted to happenings of direct interest to woodworkers. Our Sept./Oct. issue will list events between Aug. 15 and Nov. 15; deadline July 1. Our Nov./Dec. issue will list events between Oct. 15 and Jan. 15; deadline Sept. 1.

CALIFORNIA: **Workshops**—Woodworking for women, beginners and advanced, traditional furnituremaking, focus on handtools. Contact Debey Zito, 103 Wool St., San Francisco, 94110. (415) 648-6861.
Juried show—California State Fair–California Works: Realist and Functional Aesthetics, Aug. 15–Sept. 1. California State Fair, California Works, PO Box 15649, Sacramento 95852. (916) 924-2015.
Workshop—Lumber drying, Aug. 11–15. Limited enrollment. University of California Forest Products Laboratory, 1301 S. 46th St., Richmond 94804. Tom Breiner, (415) 231-9456.
Exhibition—1986 Western Regional "Images in Marquetry," Oct. 1–31. Entry deadline Sept. 1. Center Hall Gallery, 931 N. Harbor Blvd., Anaheim. Contact Gordon C. Olson, 16707 Garfield St., No. 1217, Paramount 90248. (213) 630-2922.
Show—Woodcarving, Sept. 6–7. The Barn, Pacific Ave., Livermore. Contact Liz Finigan, (415) 447-3186.
Show—11th Annual Pacific States Craft, ACC Craftfair, Aug. 8–10. Fort Mason Center, Pier 2, 3, San Francisco. Contact American Craft Enterprises, Inc., PO Box 10, New Paltz, NY 12561. (914) 255-0039.
Workshops—Furniture design/construction, John Cedarquist, June 23–July 26; introduction to woodworking, Randy Bader, July 28–Aug. 23; wood sculpture I, July 28–Aug. 23; wood sculpture II, July 28–Aug. 23. Laguna College of Arts, 2222 Laguna Canyon Rd., Laguna Beach 92651. (714) 497-3309.
Workshops—Tools, techniques, June 23–July 18; woodcarving, July 21–Aug. 1. Contact Program coordinator, College of the Redwoods, Fine Woodworking Program, 440 Alger St., Ft. Bragg 95437. (707) 964-7056.
Show—Orange County Woodworkers Association Fifth Annual, Aug. 8–10. Brookhurst Community Center, 2271 W. Cresent, Anaheim. (714) 526-7100 or 998-6733.
Class—Building a recreational single rowing shell, Simon Watts, Oct. 11–18. National Maritime Museum Association, 680 Beach St., San Francisco 94109. (415) 673-0700.

COLORADO: **Workshops**—Furniture design, Peter Korn, June 16–27; furniture construction, Art Carpenter, June 30–July 11; style, James Krenov, July 14–25; chairs, John Nyquist, furniture, Sam Maloof, July 26–27; July 28–Aug. 8; veneering, Silas Kopf, Aug. 4–8; furniture techniques, Tage Frid, Aug. 11–22. Anderson Ranch Arts Center, Box 5598, Snowmass Village 81615. (303) 923-3181.
Juried exhibition—2nd annual Colorado Woodworkers, Oct.–Dec. 16. Pioneers' Museum of Colorado Springs, 215 S. Tejon, Colorado Springs. Contact Woodworkers Guild of Colorado Springs, Box 9594, Colorado Springs 80932. (303) 632-8548 or (303) 630-1422.

CONNECTICUT: **Classes/workshops/exhibition**—Numerous classes June 22–Aug. 31. Brookfield Craft Center and Brookfield/SoNo Craft Complex. Contact Brookfield Craft Center, Inc., PO Box 122, Brookfield 06804. (203) 775-4526. 10th annual SONO arts celebration, Aug. 2-3. Contact Paula Mae Green, SONO Arts Celebration, Box 2222, Norwalk 06852. (203) 853-6155.
Juried exhibition—18th Annual Celebration of American Crafts, Nov. 10–Dec. 23. Entry deadline July 15. Write Roz Schwartz, Creative Arts Workshop, 80 Audubon St., New Haven 06511.
Juried exhibition—51st annual, Society of Connecticut Craftsmen, Inc., Sept. 7–28. Entry deadline for members, Aug. 1. The Arts and Crafts Association of Meriden, 53 Colony St., Meriden 06450. Contact Society of Conn. Craftsmen, Inc., PO Box 615, Hartford 06142.
Show—Woodworking World, New York, Sept. 26–28. Sheraton Hotel and Towers, Stamford. Sponsor, Woodworking Association of North America, Plymouth, NH. Contact Convention Designs, Inc., PO Box 485, Plymouth, NH 03264. (603) 536-3768

GEORGIA: **Show**—1986 International Woodworking Machinery & Furniture Supply Fair—USA, Sept. 6–9, Georgia World Congress Center, including 11th biennial student furniture design competition, Sept. 5–8, Atlanta Civic Center. Early registration advised. Contact International Woodworking Fair, Cahners Exposition Group, 999 Summer St., Stamford, Conn. 06905. (203) 964-0000.

IDAHO: **Juried show**—18th annual "Art on the Green," Aug. 1–3. Campus of North Idaho College. Contact Citizens Council for the Arts, PO Box 901, Coeur d'Alene 83814.

ILLINOIS: **Workshops**—Furniture conservation, July 7–25. Campbell Center, PO Box 66, Mount Carroll 61053. (815) 244-1173.

Juried exhibition—7th annual Fountain Square Arts Festival, June 28-29. Contact Evanston Chamber of Commerce, 807 Davis St., Evanston 60201. (312) 328-1500.
Show—1986 Woodworking World—The Chicago Show, Oct. 17–19. O'Hare Expo Center, Rosemont. Contact Convention Designs, Inc., PO Box 485, Plymouth, NH 03264. (603) 536-3768.

INDIANA: **Juried show**—Wood furniture, modern, classic, traditional, Sept. 1–Oct. 12. Chesterton Art Gallery, 115 South 4th St., Chesterton. Contact Marsha Demkovich, Chesterton Art Gallery, PO Box 783, Chesterton 46304. (219) 926-3041.
Juried exhibition—Madison Chautauqua of the Arts, Sept. 27–28. Deadline July 1. Vine St. near Lanier Mansion, Madison. Madison Chautauqua of the Arts, c/o Dixie McDonough, 1119 West Main St., Madison 47250.
Workshops/show—Woodworking, basketmaking, dulcimermaking, 5-day, Aug. Brown County Colony Art Fair, Aug. 9–10. Entry deadline June 15. Contact Brown County Craft Guild, PO Box 179, Nashville 47448.

IOWA: **Workshop**—Furniture construction, July 21–Aug. 1. Contact Northeast Iowa Technical Institute, Box 400, Calmar 52132. (319) 562-3263.
Show—Holzfest (woodfest), Aug. 16–17. Amana Colonies (Exit 225 on I-80). Contact Holzfest, Box 193, Amana 52203. (319) 622-3100.
Show—11th annual old-time country music and crafts, Aug. 29–Sept. 1. Pottawattamie Fairgrounds, Avoca. Contact Traditional Country Music Association, Inc., 106 Navajo, Council Bluffs 51501. (712) 366-1136.

KENTUCKY: **Juried exhibition**—Kentucky Guild of Artists and Craftsman's 25th anniversary, July 25–27, Water Tower, Louisville. Contact KGAC 25th Anniversary, Water Tower Art Assoc., 3005 Upper River Rd., Louisville 40207. (502) 896-2146.

MAINE: **Exhibitions**—David and Susan Kirk, painted wood boxes, furniture; David Keator, wood tables, July–Aug. Maple Hill Gallery, 367 Fore St., Portland 04101. (207) 775-3822.
Fair—Deering Oaks Family Festival, July 22–27. Deering Oaks Park, Portland (Exit 6 on I-295). Contact Donald McNamara, Chamber of Commerce Greater Portland Region, 142 Free St., Portland 04101. (207) 772-2811.
Workshops—Numerous boatbuilding, June through Sept. The Woodenboat School, PO Box 78, Naskeag Rd., Brooklin 04616.
Show—11th Annual Directions Bar Harbor Craft, Aug. 15–17. Mount Desert Island High School, Bar Harbor. Contact Cheryl Wagner, Box *2, Bar Harbor 04609.

MARYLAND: **Juried exhibition**—Artscape '86, outdoor, July 18-20. Mid-Atlantic states. Crafts, Artscape '86, c/o MACAC, 21 S. Eutaw St., Baltimore 21201. (301) 396-4575.
Juried show—23rd Annual Havre de Grace Arts & Crafts, Aug. 16-17. Tydings Park. Entry deadline July 15. Contact Havre de Grace Arts & Crafts Show, PO Box 174, Havre de Grace 21078. (301) 879-4404.

MASSACHUSETTS: **Workshops/seminars**—Numerous events. Contact The Woodworkers' Store, 2154 Massachusetts Ave., Cambridge. (617) 497-1136.
Workshops—Woodworking for high school students, summer sessions. Craft retreat, Aug. 18–25. Horizons: The New England Craft Program, 374 Old Montague Rd., North Amherst 01002. Contact Jane Sinauer (413) 549-4841.
Exhibition—Scent bottle invitational, July 1–Sept. 3. Signature Stores, Inc., Village Market Place, Stevens St., Hyannis 02601; Dock Square, North St., Boston 02109.
Juried show—7th Annual Fair of Traditional Crafts, Nov. 1 & 2. Contact Frank G. White, Old Sturbridge Village, Old Sturbridge Village, Sturbridge 01566. (617) 347-3362, ext. 236.
Show—Wooden furniture invitational, Aug. 16–Sept. 18. Salmon Falls Artisans Showroom, P.O. Box 176, Ashfield St., Shelburne Falls, MA 01370. Wheelchair accessible. Contact Nancy Dean.
Show—Dollhouse and miniature, Aug. 17. Dunfey's Hyannis Resort, West End Circle, Hyannis. Sponsored by The Cape Cod Miniature Society. Contact Angela J. Goodwin, PO Box 98, Kent Rd., So. Harwich 02661. (617) 432-2840.
Show—ACC Craftfair, June 20–22. Contact American Craft Enterprises, Inc., PO Box 10, New Paltz, NY 12561. (914) 255-0039.

MICHIGAN: **Fair**—Ann Arbor Street, July 23–26. South University and East University Sts. Contact Susan Froelich, 415 N. 4th Ave., Ann Arbor 48104. (313) 994-5260.

MINNESOTA: **Workshops/seminars**—Numerous events. The Woodworkers' Store, 3025 Lyndale Ave. S., Minneapolis. (612) 822-3338.
Workshop—Woodcarving, Aug. 3–9. Villa Maria Retreat Center, Villa Maria Workshop, PO Box 37051, Minneapolis 55431.

Workshops—Woodcarving wildfowl, beginning Aug. 11–15. Contact Grant Goltz, Wildfowl Sculpture, HCR 1, Box 520, Hackensack 56452. (218) 682-2110.

MONTANA: **Workshops**—Hand tool joinery, June 23–29, July 21–27. Primrose Center, 401 West Railroad, Missoula 59802. Contact Steven Voorheis, (406) 728-5911.

NEW HAMPSHIRE: **Workshops**—13th annual violin and bow maker's summer institute, June 9–Aug. 1. University of New Hampshire, Durham. Early registration advised. Contact Summer Violin Institute, Univ. of N.H. Continuing Education, 24 Rosemary Ln., Durham 03824. (603) 862-1088.
Tour—Switzerland, two weeks, guide Wayne Barton. Sponsored by Woodworking Association of North America for woodworkers and woodcarvers. Sept. 30–Oct. 14. Contact W.A.N.A., PO Box 706, Plymouth 03264. (603) 536-3876.
Exhibition—Handcrafted hardwood tables, Michael Ciardelli and C. B. Oliver, July–Aug. The Woodworkers Gallery, 161 Nashua St., Milford. (603) 673-7977.
Exhibition—Woodworker's Day, Aug. 31. New Hampshire Farm Museum, Rte. 16, Plummer's Ridge, PO Box 644, Milton 03851. Contact Melissa Walker, (603) 652-7840.

NEW JERSEY: **Workshops/fair**—numerous events, July 4–Aug. 29. Peters Valley Crafts Center, Layton 07851. (201) 948-5200. Annual Peters Valley Craft Fair, July 26–27. Delaware Water Gap National Recreation Area, Layton.

NEW MEXICO: **Shows**—Carved, painted wooden animals, William Jauquet, July 13–26; furniture, Larry and Nancy Buechley, Marc Coan, Jim Davis, Bill Hedden, Gerald Otis, Bruce Peterson, Alejandro Puig, Alan Radebaugh, John Sheriff, Lynn Sweet, David Trapp, Aug. 10–30. Contemporary Craftsmen Gallery, 100 West San Francisco St., Santa Fe 87501. (505) 988-1001.

NEW YORK: **Juried exhibition**—10th Anniversary American Crafts, June 28–29, July 5–6. Lincoln Center for the Performing Arts, NYC. Contact Brenda Brigham, American Concern for Artistry and Craftsmanship, PO Box 650, Montclair, NJ 07030. (201) 798-0220.
Workshops—Hand tools, ongoing. Robert Meadow. The Luthierie, 2449 West Saugerties Rd., Saugerties 12477. (914) 246-5207.
Juried shows—Furniture, architectural crafts Aug. 30–Sept. 1. Ulster County Fairgrounds, New Paltz. Contact Scott and Neil Rubinstein, Quail Hollow Events, PO Box 825, Woodstock 12498. (914) 679-8087 or (914) 246-3414.
Juried show—Chautauqua Crafts Festival, '86, July 4–6 and Aug. 8–10. Bestor Plaza, Chautauqua Institution, Chautauqua. Contact Gale Svenson, Chautauqua Crafts Festivals '86, PO Box 89, Mayville 14757.
Juried exhibition—Mixed media, Dec. 6–7. Entry deadline July 7. Schenectady Museum & Planetarium, Nott Terrace Hgts., Schenectady. Contact Karen Engelke, 1791 Central Pkwy., Schenectady 12309. (518) 372-9155.
Exhibition—Hand-crafted summer furniture, through July 20. The Gallery at Workbench, 470 Park Ave. South, NY 10016. Contact Vanessa Lynn, (212) 481-5454.
Demonstration—Dovetail joints, Maurice Fraser, Sept. 15. YWCA, Craft Student League, 610 Lexington Ave. (corner 53rd), Manhattan. (212) 755-4500.
Juried exhibition—33rd annual national, sponsored by Mamaroneck Artists Guild, Oct. 24–Nov. 9. Community Unitarian Church, Rosedale Ave., White Plains. Contact Open Juried Exhibition, Mamaroneck Artists Guild Gallery, 150 Larchmont Ave., Larchmont 10538.
Juried exhibition—International Art and Craft Competition, June 24. 112th Street Gallery, 112th St., New York. Contact Metro Art, PO Box 286-H, Scarsdale 10583. (914) 699-0969.

NORTH CAROLINA: **Exhibition/fair**—39th annual guild, July 17–20. Asheville Civic Center, Asheville. Contact Blair White, Southern Handicraft Guild, PO Box 9545, Asheville 28815. (704) 298-7928.
Workshops—Tools, furniture, techniques, design, turning, through Sept. 19. Penland School, Penland 28765. (704) 765-2359
Workshops—Japanese woodworking, July 14–18; Scandinavian woodenware, July 28–Aug. 1; greenwood chairmaking, Aug. 18–22; white oak basketry with Darry Wood, Sept. 1–5. Contact Drew Langsner, Country Workshops, 90 Mill Creek Rd., Marshall 28753 (704) 656-2280.
Show—1986 Woodworking World—The Charlotte Show, Nov. 21–23. Charlotte Civic Center, Charlotte. Contact Convention Designs, Inc., PO Box 485, Plymouth, NH 03264. (603) 536-3768.

OHIO: **Juried exhibition**—Contemporary woodworking, Sept. 13–Oct. 12. Sponsored by Dairy Barn Southeastern Ohio Cultural Arts Center, Athens. Contact American Contemporary Works in Wood, PO Box 747, Athens 45701. (614) 592-4981.
Workshops—Numerous craft, through July 18. Rowan Hall, Miami University, Oxford 45056.

Workshops—Woodturning, chairmaking, shaker boxmaking, through June 27. Conover Workshops, 18125 Madison Rd., Parkman 44080. (216) 548-3481.
Juried exhibition—Cincinnati: Fine Woodworking, Nov. 29–Dec. 21. Entry deadline Aug. 8. Emery Galleries, Edgecliff Campus of Xavier University, 2220 Victory Parkway, Cincinnati 45206.
Juried show—3rd annual national furniture invitational, Sept. 26–Oct. 26. Entry deadline July 31. Sylvia Ullman American Crafts, 13010 Larchmere-Woodland, Cleveland 44120. (216) 231-2008.
Juried show—27th Indian Summer arts and crafts festival, Sept. 12–14. Contact Indian Summer Festival, Box 266, Marietta 45750. (614) 373-8027.

OKLAHOMA: **Show**—10th annual national woodcarving, July 11–13. Kensington Galleria, 7130 South Lewis, Tulsa. Contact Robert Hughes, 2204 S. 132 E. Ave., Tulsa 74134. (918) 664-9991.

OREGON: **Workshop**—Bentwood woodworking, Seth Stem, July 7–11. Register early. Oregon School of Arts and Crafts, 8245 SW Barnes Rd., Portland 97225. (503) 297-5544.
Classes/show—Various programs offered year-round. 1986 Wooden Boat, July 25–27. World Forestry Center, 4033 SW Canyon Rd., Portland 97221. (503) 228-1367.

PENNSYLVANIA: **Exhibition**—Wharton Esherick, sculpture, furniture, utensils, daily. The Wharton Esherick Museum, PO Box 595, Paoli 19301. (215) 644-5822.
Juried show—8th annual Longs Park Art and Craft Festival, Aug. 30–Sept. 1. Contact Dick Faulkner, Longs Park Art and Craft Festival, PO Box 5153, Lancaster 17601.
Juried exhibition—20th annual sidewalk sale, Central Pennsylvania Festival of the Arts., July 10–13; Campus of Penn. State, State College. Contact Central Pennsylvania Festival of the Arts, PO Box 1023, State College 16804. (814) 237-3682.
Seminars—Wood identification, June 18; cabinetmaking, June 21; joinery, July 19; Inca demonstration, Aug. 16; turning, Oct. 18. Olde Mill Cabinet Shoppe, Box 547A, RD #3, York 17402. (717) 755-8884.
Classes/show—Woodcarving in the round, July 14–18; beginning bird carving, Aug. 4–8; 2nd annual woodcarving, July 19–20. Sawmill Center for the Arts, Cook Forest State Park, Cooksburg. Contact Sawmill Center for the Arts, PO Box 6, Cooksburg 16301.
Juried exhibitions—Crafts 20, June '86. Museum of Art, Pennsylvania State Univeristy. Sculpture and sculptured objects, July 7–Aug. 1. Zollar Gallery, Pennsylvania State University. Send SASE to Sculpture or Crafts 20, Central Pennsylvania Festival of the Arts, Box 1023, State College 16804. (814) 237-3682.
Workshops—Japanese joinery, Robert Meadow, July 19-20; woodworking, Nick Cook, June 16-21; wood sculpture, Thad Mosley, July 28–Aug. 2; furniture design and construction, Tom Merryman, July 28–Aug. 6. Contact Touchstone Center for Crafts, PCC, PO Box 2141-W, Uniontown 15401. (412) 438-2811.
Exhibition—Bill Accorsi, Wendell Castle, John Cedarquist, Hap Sakwa, Steve Robin, through July 13. The Society for Art in Crafts, 719 Allegheny River Blvd., Vernona 15147. (412) 828-6121.

RHODE ISLAND: **Show**—6th annual wooden boat, Aug. 21–24. Newport Yachting Center, Newport. Contact Abby Murphy, (401) 846-1600.

SOUTH DAKOTA: **Juried show**—15th annual show, July 12–13. Contact Brookings Summer Arts Festival, Box 555, Brookings 57006.

TENNESSEE: **Workshops/Exhibition**—Woodcarving, Lockhart; woodturning, Nish, Osolnik, Doyle, Ellsworth, Sakwa; furniture construction, Osgood, June 9–Aug. 15. Faculty and staff exhibition, mixed media. Bob Lockhart, Dale Nish, Rude Osolnik, Jere Osgood, Leo Doyle, David Ellsworth, Hap Sakwa, through Aug. 15. Contact Debbie Johnson, Arrowmont School of Arts and Crafts, PO Box 567, Gatlinburg 37738 (615) 436-5860.

TEXAS: **Show**—1st annual last chance woodworker's, sponsored by Austin Woodworkers Guild and Last Chance Art Productions, Nov. 8–9. Palmer Auditorium, Austin. Entry deadline Aug. 15. Contact French Smith, 701 W. 22nd, Austin 78705. (512) 472-4864.

VIRGINIA: **Juried show**—Annual hand crafts, Oct. 24–26. Radisson Hotel, Lynchburg. Contact Lynchburg Fine Arts Center, 1815 Thomson Dr., Lynchburg 24501. (804) 846-8451.

WASHINGTON: **Seminar**—Kasha design, Richard Schneider, July 27–Aug. 17. Contact Pat Gentry, Lost Mountain Center for the Guitar, PO Box 44, Carlsborg 98324.
Exhibition—10th national, Guild of American Luthiers, July 31–Aug. 3. Pacific Lutheran University, Tacoma. Contact Guild of American Luthiers, 8222 South Park Ave., Tacoma 98408. (206) 472-7853.

WEST VIRGINIA: **Juried exhibition**—Mid-Atlantic woodworking, functional, sculptural, through Aug. 24. Oglebay Institute, Stifel Fine Arts Center, 1330 National Rd., Wheeling 26003. (302) 242-7700.
Workshops—Folk arts and crafts, July 13–Aug. 17. Augusta Heritage Center, Davis & Elkins College, Elkins 26241. (304) 636-1903.

BRITISH COLUMBIA: **Exhibition**—Freeform woodturning, functional, sculptural, Jason Marlow, July 2–Aug. 29. Seymour Art Gallery, 1204 Caledonia Ave., North Vancouver V7G 2A6. (604) 929-7981.

ONTARIO: **Competition**—Craft Focus II. Slide entry deadline June 20 (Ontario residents only). Winning entries published in winter 1986 Ontario Craft magazine. Contact Ontario Crafts Council, 346 Dundas Street West, Toronto, Ontario M5T 1G5. (416) 977-3551.
Juried show—Variety of demonstrations, seminars, Aug. 8–9. Contact the Wood Show, Box 920, Durham N0G 1R0. (519) 369-6902.

SASKATCHEWAN: **Conference**—Make a chair from a tree, John D. Alexander; Totem carving, Keith Matheson; sculpture, Prairie Sculptures Association, Aug. 8, 9, 10. Contact Saskatchewan Craft Council, Box 7408, Saskatoon, Saskatchewan S7K 4J3. (306) 653-3616.

NOVA SCOTIA: **Show**—Maritime Do-It-Yourself, July 18–20. Atlantic Winter Fairgrounds, Halifax. Contact Convention Designs, Inc., PO Box 485, Plymouth, NH 03264. (603) 536-3768.

ENGLAND: **Exhibitions**—Contemporary new work, July 19–Aug. 30; carved birds, Guy Taplin, Sept. 5–Oct. 4. British Crafts Centre, 43 Earlham Street, Covent Garden, London WC2H 9LD. 01-836-6993
Show—3rd Annual International Creative Marquetry, Oct. 13–18. Exhibition Hall, The Corn Exchange, Ipswich, Suffolk. Entry deadlines July 1 or Sept. 1. Contact International Creative Marquetry Show, 63 Church Lane, Sproughton, Ipswich, Suffolk IP8 3AY, England.

Korean Furniture by Man Sill Pai and Edward Reynolds Wright. ***Kodansha International, 10 E. 53rd. Street, New York, N.Y. 10022; $60.00, hardbound; 192 pp.***

My first experience with traditional Korean furniture was on a visit to Japan in 1975, when I initially mistook it for Japanese. Visually it excited me and when I returned to Britain I searched the country for examples, but found only one; a fine Korean chest in an Oxford museum. At that time, in Europe, we were ignorant of the centuries-old tradition of Korean woodwork as seen in the fine timber buildings and furniture of the Yi Dynasty, 1392-1910. No books, either in Korean or English, were available on the subject, and Eastern furniture was simply attributed to either China or Japan.

In 1980 I had a second opportunity to visit the Far East. I spent five weeks of a three-month tour in South Korea. There I befriended a furniture historian, Park Young-Kyu, who was working at the National Museum of Korea in Seoul. He was preparing the first book in Korean of the Yi Dynasty furniture, and as a result of his generosity, I visited every important collection of furniture in Korea. Later, I discovered many excellent pieces in the remote rural areas.

I was delighted to thumb through the pages of *Korean Furniture*, renewing my acquaintance with many of the pieces I'd seen six years earlier. The authors unfold the mysteries and excitement of a furnituremaking tradition that owes something to both China and Japan, yet is so essentially Korean, and that has remained virtually unknown outside the "Hermit Kingdom."

To understand why such a small country produced such distinctive work, it's necessary to understand a little of the Koreans themselves—this beautifully-presented book goes a long way in fleshing out such a background to the furniture it illustrates.

Koreans are the descendants of several migratory Mongolian tribes. Their centuries-old spoken language is closer to Finnish or Hungarian than to other Asian languages, and as a European, I felt more at home in Korea than in Japan or China. The dominating influence on Korean culture, its buildings and its furniture has been religion. The puritanic nature of this mostly Confucian society gave rise to a very simple, quiet aesthetic not dissimilar in tone to that of the Shakers. Korean houses were structured on Confucian lines; men and women had separate living quarters, and furniture evolved for these separate areas, while other fine pieces were developed for the kitchen area. As with the Japanese, but unlike the Chinese, Koreans did not use chairs. Their range of furniture, as illustrated in this book, is much larger than that of Japan or China. Koreans made wide use of drawers in various forms, and their medicine chests, with numerous small drawers, are a positive delight. Chests, ranging from low coin chests to large clothes chests reminiscent of European tallboys, were the most popular items, but low desks and beautifully simple stationery chests for the mens' quarters were also made. The graceful open-book and display stands are stunning in their simplicity and beautiful proportions, and show the Korean aesthetic at its best.

Whereas the Japanese have shivered for centuries in their drafty houses in winter, Korean homes, even down to quite primitive peasant dwellings, have had underfloor heating for centuries, using the *ondol* system by which clay flues distribute hot air from the kitchen range to the rest of the house.

Throughout their history, Koreans have absorbed the cultures and religions of the races that have occupied their country, without losing their own identity. Even Buddhist temples in Korea are simpler and less ornate than their counterparts in China or Japan. The result is a nation that appears, by Asian standards, to be very neat, tidy and tasteful, without the extremes of beauty and ugliness found side-by-side in Japan. Korea's furniture up to the late-19th century was very simple, in line with a quiet, understated aesthetic that reflected their buildings and culture.

There is an honesty of construction that was later echoed in the work of the British Arts and Crafts Movement, and here I quote from the book: "The Korean craftsman does not force his materials to perform tricks or to be obscured by obvious technique, but rather lets his work flow with the character and idiosyncrasies of the material."

Korean furniture was built by generations of poorly rewarded craftsmen who obviously loved and understood their materials. They built mostly for the local communities rather than a wealthy elite. Its appeal to me, and others, is largely an aesthetic one, for often these pieces are comparatively crudely-made and lack the sophistication and perfection of early Ming Chinese work. But one cannot help but warm to it, and in terms of pure furniture design, much of it was centuries ahead of its time. Fortunately, the tradition remained pure much longer than it did in China simply because of the isolation from Western culture. However, some deterioration did occur in the mid- to late-19th century when many Korean chests were given new bases and legs, echoing the Western styles.

This excellent book is an education in the largely unknown, and the text is accompanied by good illustrations. My only criticism is of the choice of pieces given the most prominence. The simple, unadorned pieces, largely portrayed here in black and white reflect, for me, the true Korean tradition far more than the many 18th-century pedestal tables shown, or some of the cleverly ornate pieces featured in color. —***Alan Peters***

The Antiques Directory: Furniture edited by Judith and Martin Miller. ***1985, G.K. Hall & Co., 70 Lincoln Street, Boston, Mass. 02111; $55.00, hardbound; 640 pp.***

This huge book will delight antique collectors, restorers and period-furniture enthusiasts. There are roughly 7,000 photos here, of which about 600 are in color. Furniture is arranged first by country, then by type within a given country. You'll find page after page of every imaginable period furniture form shown side-by-side with similar pieces so you can compare legs, chair backs, arm rests, ormulu, marquetry styles—you name it. Each little photo has a descriptive caption including a price code. The section on American chairs alone is divided into 26 smaller sections including Windsor chairs, dining chairs, wing chairs, sedan chairs, etc.

The book focuses mainly on British, American and French furniture, but most European countries are represented, as are China, Korea and Japan. Included in the glossary is a handy chart showing the dates of furniture periods in each country. Did you know that English Regency was in vogue from 1800 to 1830? —***David Sloan***

Measured Shop Drawings for American Furniture by Thomas Moser. ***Sterling Publishing Co., Inc., Two Park Ave., New York, N.Y. 10016; 1985. $24.95, hardback; 320 pp.***

For a dozen years, Thomas Moser and his cabinetmakers have produced a variety of comfortable, pleasant and unobtrusive pieces of furniture in their New Gloucester, Maine, workshops. This book amounts to a catalog of some 70 of those pieces, each with orthographic and assorted detail drawings of the construction. There is no how-to text, but those with some machine and handtool experience should be able to make the most of what's here. The furniture, which derives largely from Shaker and 18th-century country pieces, will complement most modern and many period styles. —***Roger Holmes***

Alan Peters is a furnituremaker in Devon, England. David Sloan and Roger Holmes are associate editors of FWW.

Photo: David Berson

Glenn Braun attends to the yards on a tiny ship prior to mooring her inside a bottle. Hinged masts fold flat to fit through the bottle's neck.

Bottleships

Every so often Glenn Braun will admit that "only crazy people do this kind of work." Braun makes tiny ships and puts them in bottles. He's very good at it, and if he's crazy, it's a pleasant enough sort of madness.

I went to Braun's New York City workshop, housed appropriately enough in an old ship's container at the South Street Seaport, with a request for a model. For ten years I have been sailing aboard Petrel, a lovely 70-ft. yawl, and I thought it would be nice to put her in a bottle. Braun agreed, and told me to bring him a clean bottle and some photos of Petrel under sail.

To earn his living, Braun splits his time between opera singing and model building. Although he has built many larger models, he finds special pleasure in small scale—3 in. is considered large. He thinks nothing of constructing lifeboats, complete with thwarts, that are no larger than a well-clipped fingernail. He has made 50 minuscule models so far, each new one more complex, and more magical, than the last.

My favorite point of sail on Petrel is a broad reach, all sails set—the big Genny, staysail, main, mizzen staysail and mizzen. Braun is used to doing square-rigged ships with three or four masts and lots more sail than a yawl carries. Petrel, he said, would not be a problem.

Like any resourceful craftsman, Braun uses the best of what's available to build his ships. He makes the hull from "printers' furniture," pieces of wood, probably beech, used by printers to hold type in place. Masts are made from bamboo shish kebab skewers, sails are parchment paper. Modelmakers once used human hair for rigging; Braun rigs with cotton and linen thread that he runs through a block of beeswax before gluing into place. Much of the work is done with a razor saw, X-acto knife and rasp, but Braun's toolbox is filled with jewelers' pliers, coat hangers and an assortment of homemade hooks and probes.

The completed model was uncanny. No more than 3 in. long, the ship was perfect, right down to the ⅟₁₆-in.-diameter windlass on the bow. Its sails set for a broad reach, the only thing Petrel lacked was a crew. I brought Braun a wine bottle, its contents recently consumed. Despite repeated rinsings, the smell still lingered; Petrel would be sailing for some time through the faint aroma of Valpolicella.

Braun laid the bottle on its side and inserted a bed of modelers' clay, painted blue, complete with whitecaps. The usual procedure for bottling a ship is to hinge the masts in place, collapse them, push the model through the neck then, once the ship is in place, raise the sail by means of threads attached to the rigging. Because of Petrel's relatively open deck space, Braun didn't want the thin wire hinges to show. He chose instead to erect the collapsed masts in pre-drilled holes in the deck. Though Petrel's beam was no more than ½ in., it took some delicate probing to slip the model

Blast destroys San Francisco shops

An explosion and fire last April 4 killed several members of San Francisco's close-knit family of craftspeople and destroyed the shops and homes of many others. The blast leveled a three-story building in the city's Hunter's Point district. The converted factory housed more than 100 small businesses and apartments, many of them occupied by craftworkers and artists. At least eight people were killed and several others were seriously injured.

Among the dead were woodworkers Frank Wallis and Bob Shoemaker, whose shop was located directly above the illegal fireworks factory believed to be the cause of the explosion. Hugh Patterson, an art student helping in the shop, was seriously injured. Patty Livingston, a woodworker in a nearby shop, was also killed. Representatives of the Bay Area Woodworkers' Association estimated that the fire burned out the shops of nearly 10% of its members.

Shortly after the fire, the Woodworkers' Association held an emergency meeting to arrange blood donations for those who were seriously burned, and located money and temporary shop space to keep workers going until they can set up new shops and get back in business. A couple of businesses whose partially completed orders were lost began recruiting out-of-work woodworkers to help meet their contract deadlines. Despite the help, several of the victims might never be able to rebuild their businesses. One photographer, for example, lost 20 years of photos and negatives along with all his household belongings.

Money and materials are being collected for the victims. You can send money to Craft Emergency Relief/Bayview Fund, c/o American Craft Enterprises, P.O. Box 10, New Paltz, N.Y. 12561. Those wishing to send equipment and other materials, or to find out more about the disaster, should contact Bayview Aid at (415) 822-8688.

—Simon Watts, San Francisco, Calif.

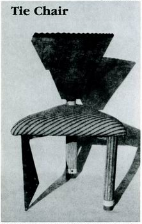
through the bottleneck, a technique Braun refers to with some humor as "ram and cram."

To position the boat, Braun used a homemade tool resembling a primitive dental pick, a ¼-in. square piece of wood about a foot long, tipped by a bent piece of heavy gauge wire. Once the boat was satisfactorily anchored in the clay, Braun guided the masts into position with long tweezers. After a series of minute adjustments, Braun sealed the bottle with wax and placed a Turk's head knot around the neck. I was very pleased, especially when Braun told me a little folklore. It seems that once a ship is sealed in a bottle, the fate of her real-life counterpart is secure. She will be safe forever. A comforting thought.

—*David Berson, New York, N.Y.*

Photo: David Caras

Tie Chair

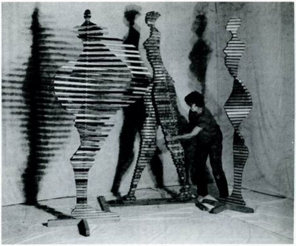


Ellen Mason and Dudley Hartung's whimsical chair from 'Unique,' a furniture invitational at Clark Gallery, Lincoln, Mass.

The $ky's the limit

At Christie's, a swanky New York auction house that deals in paintings and *objets d'art*, a New Hampshire businessman recently plunked down $1,045,000 for an 18th-century Chippendale-style tea table; the highest price ever paid for a piece of American furniture. Made in Philadelphia between 1765 and 1775, the piecrust tilt-top table, with ball-and-claw feet and a fluted pedestal, is considered by many experts to be one of the best of its type in existence. The same table sold for $7,000 back in the early 1950s.

Photo: Allison Paschke



Once daunted by woodworking techniques, sculptor Nancy Helfant, shown above with 'Wood Woman Trees,' learned the skills so she could use wood in her sculpture.

Sculptor's tale

During years of making sculpture in bronze, polyester resins and fabric, my contacts with wood were restricted to life's practical realities: I salvaged Salvation Army oak furniture. I stripped paint, reglued loose joints, added backs and seats to chairs. I began to appreciate the nature of wood, particularly red oak, uncovering beneath many layers of paint its pretty and colorful imperfections.

But I was put off using wood in my sculpture by the daunting prospect of mastering the techniques needed to work it. A few low-tech projects (several pieces made by bolting together plywood leg splints designed by Charles Eames during World War II; simple jigsawn plywood dolls for my daughter) fed my confidence. Finally, I was confronted with a sculptural problem that pointed to a wooden solution. I decided I was ready to tackle the material in earnest.

I applied for a grant from Wheaton College, in Massachussetts, where I teach, and took a summer course from John Dunnigan and his graduate assistant, Janice Smith, at the Rhode Island School of Design. My fears surfaced immediately. The noise of all those finger-eating machines intimidated me. I became known as the lady who majored in laminating strips of wood in order to avoid ripping on the tablesaw. My progress was slow, and I chewed up a lot of expensive wood. Janice Smith continually encouraged me to face the tablesaw, the planer and the table-mounted router.

The precision needed to plan a wood project was new to me. Other materials I had worked allowed me to add a little more when needed and to subtract it when it was too much. The "happy accident" of the creative process was overshadowed by the nature of the material. My first project, a tapered, striped sarcophagus, became smaller and smaller as I miscalculated the cuts. But a friend submitted the piece to a show and it was accepted. With increased enthusiasm, I made several more small coffins with figures on top, employing newly learned expertise in finger jointing. I dreamed that someday I might build my own sarcophagus.

After completing the course, I bought a Sears tablesaw and spent the summer in frustration trying to understand the 25 pages of directions that came with it. A 30-year-old Sears bandsaw, a hand drill and a disc grinder rounded out my powered equipment. An accidental nod at a bankruptcy auction of a butcher-block furniture company made me the owner of a lot of surplus hardwood. I work from the stimulation of the materials at hand, so as time has passed, the wood has proven a most important investment.

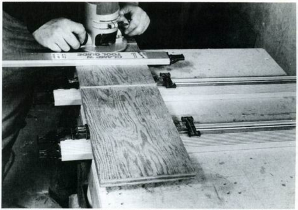
Encouraged by Janice Smith and driven by financial necessity, I increased my skills working on my studio loft. "If you can make a box," Janice assured me, "you

can make a drawer." She was right, though making a bunch of boxes all the same size to fit the openings was a challenge. Gaining confidence, I began to contemplate large scale wooden sculptures. "Wood Woman Trees," several of which are shown in the photo on p. 98, were the result, and reflect my interest in the lonely forms of abandoned dolls, artist's mannequins and empty armor.

Made of wooden slats stacked on aluminum conduit, the Woman Tree I was an adventure in hole drilling, and an elbow-wrenching nightmare. I drilled over 100 holes, 15⁄16 in. in diameter, using an egg-beater drill and my two feet as a vise. I bought a small drill press to drill 120 angled holes for Woman Tree II, but bent the machine's spindle. The precise holes I finally produced are the proud result of the purchase of a 12-speed, heavy duty drill press and clamp vise. My elbows came to appreciate the choice of the proper equipment for the job. Most of the holes were perfect; those that blew out I treated with the much sneered at, but important, "crap in the gap" technique I learned at Rhode Island School of Design. Subsequent pieces have been made with slabs of wood assembled with a variety of lap joints, laminations and slots.

My woodworking has remained simple and direct. The aim of my designs in sculpture is flexibility and rearrangement of configuration. I have learned to respect the machinery and approach new projects without the overwhelming fear that permeated my first efforts. During the time-consuming laminating, cutting and sanding of the various elements, I think about possibilities for future work, visualizing new techniques ahead of my abilities. A recent grant allowed me to make a steam box—the day of bentwood women looms ahead. —*Nancy Helfant, Providence, R.I.*

Photo: Ann Michael



Griset's Back to Back Bench Clamps hold the plywood while their Clamp 'N Tool guide provides a straightedge to guide the router.

Product review

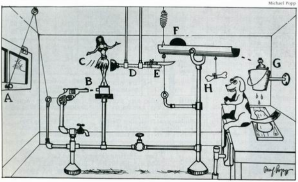
Tru-Grip Clamps, *Griset Industries, P.O. Box 10114, Santa Ana, Calif. 92711.*

Every month, half-a-dozen new woodworking gadgets hit the market. Some are pretty ingenious, some downright silly, and rare indeed is the gadget that fills a genuine need. I don't know about you, but I don't have the extra time, money or storage space to clutter my workshop with tools I can just as well do without.

That said, there are those rare exceptions. For the last few weeks I have been trying out a product that I like a lot—the Tru-Grip Clamp. The clamp is made in two styles: the Clamp 'N Tool Guide and the Back to Back Bench Clamp.

The Clamp 'N Tool guide is a flat, ½-in.-thick extruded aluminum channel about 2 in. wide, containing a steel rod that runs the length of the clamp. It comes in two lengths, 24 in. ($26.95) and 48 in. ($37.95). There's a fixed nylon jaw at one end and a second jaw that slides along the rod. You bring the slider up against the stock and flip the cam lever to clamp. I find the Clamp 'N Tool guide most useful as an obstruction-free straightedge guide for a router or skillsaw or as an auxilliary bandsaw or drill press fence. Those functions alone make it worth having. So far, I use it less often as a clamp. You don't get bone-

Michael Popp



No-mess glue spreader

The Professor recommends the method shown at left for spreading glue without a mess. (With a tip of the hat to Rube Goldberg.)

Window closes (A), tightening string attached to trigger of gun (B). Bullet turns on switch of "Shimmy" doll (C), hip motion of doll pushes against plumber's helper (D). Knife (E) tied to end of helper cuts string, which releases rain gutter. Spring pulls gutter up and cannon ball (F) rolls down gutter and smashes bottle of glue (G) in pail that has holes drilled in the bottom. Bone (H) dangles in front of dog who wags his tail, spreading glue evenly over the wood.

—*Michael Popp, Elizabeth, N.J.*

INDEX TO ADVERTISERS

Fine WoodWorking

Subscriber List Service

We occasionally make our subscriber list available to companies whose products we think may be of interest to you. If you prefer not to receive this mail, just fill out the form below and return it to our subscriber service department (see address below). We'll take care of the rest.

☐ Please do not share my name and address with other companies.

Name ____________

Address ____________

City ________ State ____ Zip ______

Send this form to:
Subscriber Service Dept.
The Taunton Press
Box 355, 63 South Main St.
Newtown, CT 06470

crushing power, although it's adequate for light-duty clamping where you want to apply pressure right near the edge.

Imagine two of these things back to back with the jaws on opposite faces and you've got the Back to Back Bench Clamp. The bottom jaws clamp to a bench and the top jaws grip the workpiece. I think of this more as a holding device than a clamp. A pair of Back to Back clamps is a reasonable substitute for bench dogs and a tail vise for most tasks. The low-profile jaws don't stick up over a ¾-in.-thick board. I tried clamping both ends of a board in one clamp and planing the face with a hand plane, using the clamp jaw for an end stop. I found that a spring compresses if you put too much muscle behind the plane and the stock shifts. For beltsanding, carving, routing and other holding tasks, however, these things are hard to beat. I find a pair of Back to Back clamps more useful than one, and found more use for the 36 in. length ($49.95) than the 18-in. model ($39.95).

Tru-Grip clamps are available from Griset, as well as most mail-order woodworking companies. *—David Sloan*

Daphne Awards

Each year, the Hardwood Institute sponsors the Daphne Awards for outstanding residential furniture design. The Designer/Limited Production Division is open to all furniture makers and designers who market their work themselves or sell through galleries and designer showrooms. Entries must be received by August 1, and winners will be announced in October. To enter the competition write: Hardwood Institute, 230 Park Avenue, New York, N.Y. 10169.

OK, you can all stop!

About a hundred readers sent in the correct solution to the brain-teasing problem that stumped us in issue #57—how to get the wide arrowhead through the small hole in the apple—but before getting to it, here are some of the wrong guesses.

The most popular wrong answer, about half the mail, was that the sycamore apple is made and drilled, then slipped over a live basswood branch. Years later, with the branch grown large enough to produce wood for the arrowhead and feathers, the patient craftsman harvests the crop and carves the arrow. So many people suggested this that there may be some truth in it—if anybody out there is actually producing novelties this way, we'd like to see the results. I suspect, however, that the choked branch would die rather than grow, and that the apple would severely check and weather over the years.

A lot of readers assumed that we had overlooked a hidden glue joint somewhere, which was my own best guess (I was on the verge of soaking the apple in hot water to see if something came apart). Nope, the trick needs no glue.

Ten or more readers suggested yet another answer, an industrial process that uses refrigerated liquid ammonia to plasticize the wood until it's like overcooked pasta—when the ammonia evaporates, the wood stiffens back to normal. Some thought the arrow was plasticized, some the apple. This guess is close to the truth, but there's an easier way.

The right answer appeared in *Popular Science* in 1952, and more than a few readers sent in a photocopy (presumably from a collection of old magazines that would overflow a four-car garage). The article showed a brandy snifter pierced by a wooden arrow, and a series of photos outlined the process, which depends on wood's "memory," its ability to return to shape after being deformed: First, drill a ½-in hole through the glass (or the carved apple). Next, bandsaw or whittle the rough shape of the arrow from quartersawn stock ¾-in.-thick by 1-in.-wide, rounding the shaft of the arrow but leaving squarish blocks where the arrowhead and tailfeathers will be. Very slowly squash one of these blocks in the vise until it is the same dimension as the shaft, and quickly pass it through the hole. Soaking the squashed wood in water will cause it to come back nearly to full size, giving you plenty of wood to carve to shape. You can expect some failures, but there's not much loss involved.

A variation is to first soak or steam the blank. I tried both ways, using soft, springy pine, and found that pre-soaking wasn't necessary. My only failure was with riftsawn wood, where the annual rings were diagonal rather than square across.

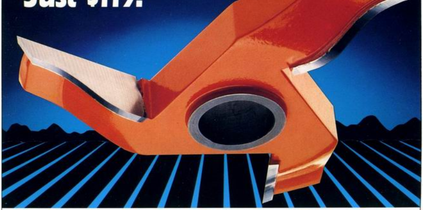
Many thanks to all who wrote. The first correct answer, by the way, came from Ralph O. Haskins of Rhinebeck, N.Y., who, if there had been a prize, would have won it. My favorite, though, came from Herman B. Haynes, of Darien, Conn., who first mastered the trick some 60 years ago, long before *Popular Science* taught it to the masses. He admits: "I don't know anything about apples, but I gave a number of arrows through hearts to girl friends and the results were very satisfactory." Trading crafts for kisses! I have to say, Haynes, you're a rogue and a scoundrel, and I only wish I had your energy. *—Jim Cummins*

Not content with telling us how it's done, many FWW *readers showed us up by sending in their own variations of the arrow through the apple.*

Notes and Comment

What's new in woodworking in your area? Notes and Comment buys brief articles about interesting events, shows and people and welcomes all manner of commentary. Send manuscript, if possible with color slides or black-and-white photos (preferably with negatives), to Notes and Comment, Fine Woodworking, ***Box 355, Newtown, Conn. 06470.***

An Amazing Cutter.
An Amazing Price.
Just $119!



The Freeborn Mini-Pro Raised Panel Shaper Cutter.

Our Mini-Pro Raised Panel Shaper Cutter is no ordinary cutting tool . . . it's quite simply the finest cutter available. And now it's on sale for just $119 (reg. list $138).

Designed with a ¾" bore, this geometrically precise cutter is manufactured in the USA with a **15° up shear** and features the distinctive Freeborn OSHA Safety Orange color.

Hurry! Offer ends August 29th, 1986.

To find out more about the complete line of Freeborn Cutters, as well as custom cutter capabilities, contact the Freeborn dealer nearest you.

Freeborn Mini-Pro Raised Panel Cutters For 3/4" Material

Same Cutters Also Available For 5/8" Material

Master Dealers

Charles G.G. Schmidt
301 West Grand Ave
Montvale, NJ 07645
1-201-391-5300 (NJ)
1-800-544-2447

Daily Saw
4481 Firestone Blvd.
South Gate, CA 90280
1-213-564-1791

Merchants & Manufacturers Supply
P.O. Box 6365
Greensboro, NC 27415
1-800-334-0818 (NAT)
1-800-632-4985 (NC)

Willow Creek Tool Sales
P.O. Box 85 / Main St.
Willow Creek, MT 59760
1-800-592-8500 (MT)
1-800-592-8501 (NAT)

R.A. Ness
8888 N. Milwaukee
Niles, IL 60648
1-312-824-0565

Ballew Saw & Tool
420 Booneville
Springfield, MO 65806
1-800-641-3322 Ext. 2
1-417-865-7511

Dealers

Southeast

Addkison Hardware Co., Inc.
126 E. Amite St., P.O. Box 102
Jackson, MS 39205
1-800-281-2750 (NAT)
1-800-321-8107 (MS)

Hiller Hardware
P.O. Box 1762
Columbia, SC 29202
1-803-779-3131

Manny's Woodworkers
602 S. Broadway
Lexington, KY 40508
1-800-243-0713 (NAT)

Paramount Saw
1071 Harbor Rd.
W. Columbia, SC 29169
1-803-791-8501

Midwest

Neus Supply
N. 95 W. 16915 Richfield Way
Menomonee Falls, WI 53051
1-414-251-6550

Woodworkers Tool Works
2420 E. Oaktan Unit A
Arlington Heights, IL 60004
1-312-640-6420

WDR Sales
10407 Blue Ridge Suite 400
Kansas City, MO 64134
1-816-966-0511
1-800-346-3026 Ext. 958

Hank's Tool Crib
3625 Christy Way
Saginaw, MI 48603
1-517-791-3098

Markay Cutting Tools
2210 Elmhurst Rd.
Elk Grove Village, IL 60007
1-312-364-5505

Capitol Carbide Co.
1000 University Ave.
St. Paul, MN 55104
1-800-328-8152 (NAT)

Carbide Specialties
3941 Eastern SE
Grand Rapids, MI 49508
1-616-241-1424

Northeast

Alpha Carbide
Portland Rd.
Saco, ME 04072
1-207-282-7174

Stevens - Walden
475 Shrewsbury St.
Worchester, MA 01604
1-617-799-4111

Wrona Finishing
Box 26 Alexander Rd.
Holland, MA 01550
1-413-245-9036

Beaver Woodworking
1 Brockton Ave.
Brockton, MA 02402
1-617-583-4631

Brady Supply Corp.
P.O. Box 326
Elmira, NY 14902
1-607-733-6591

Brian's Tool Sales
9 Moody Rd.
Enfield, CT 06082
1-203-623-6282
1-203-763-2084

Burns Power Tools
350 M.S. Bishop Blvd.
Falls River, MA 02721
1-617-675-0381
1-800-341-2200 (NAT)

Ross Cutter
265 Bear Hill Rd.
Waltham, MA 02154
1-617-890-1250

Blue Ball Machine
P.O. Box 218 Rt. 322E
Blue Ball, PA 17506
1-717-354-4478

West

Blaisdell, Inc.
4040 S.E. Division
Portland, OR 97202
1-503-235-2260

Missoula Saw
2301 Grant St.
Missoula, MT 59801
1-800-548-4284

Craftmasters Wood Products
34-D
Watsonville, CA 95076
1-408-728-2098

Spokane Power Tools
E. 801 Trent Ave.
Spokane, WA 99202
509-489-4202 (Local)
1-800-521-1770 (NAT)
1-800-426-0013 (WA)

PME Wholesale
848 Nottingham Dr.
Manteca, CA 95336
1-209-823-1343

R&B Sharpening
P.O. Box 784
Cottonwood, CA 96022
1-916-365-1479

Schlosser Tool
301 Bryant St.
Denver, CO 80219
1-303-922-8244
1-800-272-SAWS (7297)
CO ONLY

Bay Area Carbide
1843 East St.
Concord, CA 94520
1-415-687-7543

D & D Saw & Supply
6162 Mission Gorge Rd.
San Diego, CA 92120
(619) 280-9320

South

Woodworkers Service & Supply
1410 N. Trinity St.
San Antonio, TX 78207
1-512-735-3506

Angelo Tool Co.
914 Arroyo Dr.
San Angelo, TX 76904
1-915-944-8258

Circle Saw Builders
1711 W. 27th St.
Houston, TX 77008
1-713-864-8444
Austin, TX
1-512-477-2863

Century Saw
6704 Woodway Dr.
Waco, TX 76710
1-817-776-5838

Call toll free
1-800-523-8988
In Washington, call (509) 535-3075

Freeborn Tool Company, Inc.
3355 E. Trent Avenue • Spokane, WA 99202-4459

Photo: White Light

Boxes in Basic Black

Black box: a modern euphemism for a container whose insides are too complex—or perhaps too mysterious—to fathom. But for these black boxes by Phil and Chris Weber of Freeport, Maine, it's the outsides that matter. They're made of ebony scraped to a flawless finish and detailed with hobby-store brass rod, bar and channel. Both boxes are shown here nearly full-size. They were sold to collectors (the box above for $1,350, the one below for $450) at the American Craft Enterprises' 10th anniversary show in Baltimore last February.