

Fine Woodworking

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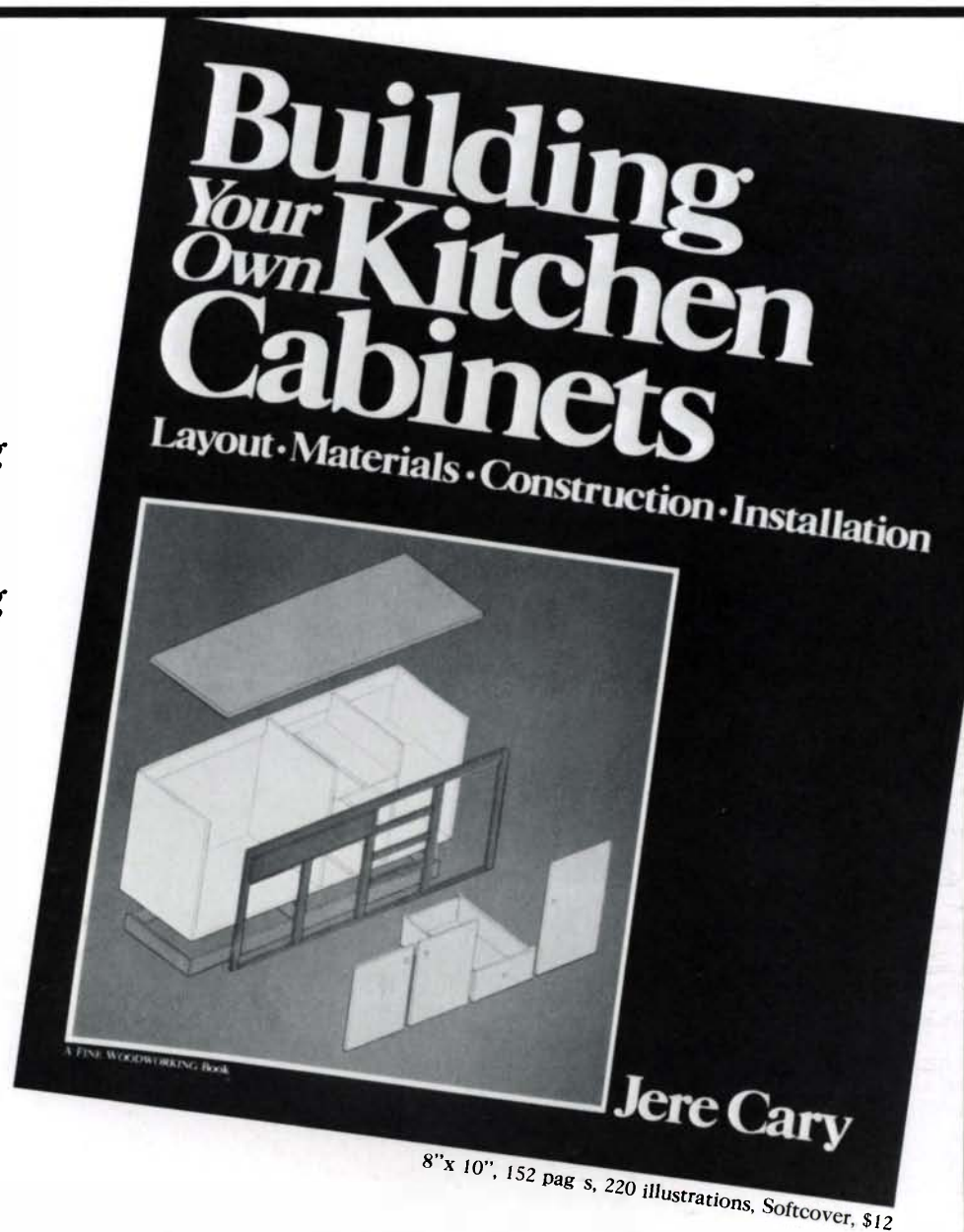
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Cover: Rudolph Kohler planes pine staves for a milk bucket. Drew Langsner, who studied with Kohler in Switzerland, explains the coopers' craft on pp. 73-78. Cover photo: Drew Langsner.

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Letters

Re Art Carpenter's "Artiture" (*FWW* #38): I'm one who makes things that "dare to not take the traditional form of their semi-functional function," although the quotation makes my head swim. I'm not sure that it is necessary to make the "artiture" distinction. There are, after all, art and furniture already. Carpenter's path from suspicion to acceptance of what he calls artiture is something he is working out for himself, but I don't think many of the examples he uses to illustrate his thesis support it. I am very familiar with the work of McKie, Zucca, Madsen, Loeser, Smith, Crozier and Maruyama. To my mind, they are all trying to do work that is useful, fun, individual and visually interesting—decorative art. Each piece may not be completely successful, but this work does not fit under Carpenter's artiture umbrella.

"Most artiture pieces had little to do with wood and less to do with craftsmanship." This statement is not supported at all by Carpenter's examples. The makers that I have mentioned are all very careful workers and most use wood for the wonder of the material.

But maybe artiture is a valid concept, useful to help people over the art/craft, functional/non-functional hurdles. I am happy to see *FWW* give space to the exploration of this corner of the craft scene. A good percentage of your readers are, I think, holed up in this corner.

—Jim Fawcett, Esopus, N.Y.

In response to Art Carpenter's article in *FWW* #38, I would like to quote Edward Lucy-Smith in *World of the Makers*:

"When skill is preserved after the need for it is gone, then it turns into an exercise in pure virtuosity. It is the knowing how to do it and not the end product which gives delight. Yet it must be recognized that crafts exercised in this way, for their own sake, or in simple rejection of the modern world and its assumed evils, seldom produce objects which are particularly interesting to look at."

While technical proficiency is a means to freedom of creative thought and work, it is not necessarily a prerequisite for creativity nor does it guarantee success. Woodworking will not come of age until woodworkers stop thinking of technique and wood as ends in themselves, and start producing pieces of aesthetic value and conceptual substance.

It seems unlikely that Art Carpenter has ever spoken with Judy McKie, Tom Loeser, Wendy Maruyama or others about their work. Had he done so, I doubt he would be so inaccurately guessing their motives to be "play, farce, ego fix, money, or ease of construction." The truth is, these people take their work quite seriously, most are not making ten times the money, and many possess unquestionable technical expertise. They have moved away from traditional furniture because they have found more interesting and challenging avenues to pursue.

—Gail Fredell Smith, Oakland, Calif.

As delighted as I am about the technical side of your publication, I have to add a word about the artistic content.

Almost all pieces of furniture you show or report on (except the classics) are, in my opinion, misconceptions with the purpose of showing off the craftsman's skill rather than serving a purpose in the most beautiful way. Beautiful may have many interpretations, but when the furniture's purpose is fulfilled in an awkward way just to be different, the piece is bad.

—H. Jaeckel, Nevada City, Calif.

Bob Johnson included some good safety advice in his article on pouring babbitt bearings (*FWW* #38), but he neglected an important health hazard: toxic metal fumes can be inhaled when pouring and heating babbitt metal. Babbitt alloy com-

positions vary. All contain lead, which is reason enough to take precautions. However, other highly toxic metals such as cadmium, nickel, arsenic and antimony may also be present.

Heating and pouring the metal should be done outdoors or in an area provided with local exhaust ventilation. If back-up respiratory protection is needed, a NIOSH-approved fume or high-efficiency particulate respirator should be worn. Filings, shavings and dust should be cleaned up scrupulously with a wet mop to avoid raising dust.

—Monona Rossol, Center for Occupational Hazards, New York, N.Y.



I wanted to carve a crow, took a saw, took a walk, found an up-rooted cedar heaved over and dying on its side. The first cut crowned his head, the second laid flat his feet. Among the roots the cedar is deeply furrowed, just so deeply figured was the crow around feet and tail. The white sapwood seemed to describe his folded wings. First incredulously then enthusiastically I discovered that the crow was within the wood, not to be imagined as my own creation.

—Richard Harrington, Austin, Tex.

Regarding *FWW* #39, a few corrections...

In the book review of *Apprenticeship in Craft*, Berea College was founded in 1855, not the 1920s. *Crafts* (in its modern usage) neglects *trade*. To speak historically of craft, one must include trade. Berea has always (since 1855) taught crafts and trades. One of the most beautiful buildings on campus, built about 1912, was built by students. They made the bricks, and did the woodwork and the building. The Berea Woodcraft Industries are not "cottage industry," they are serious factory.

Now, on to Wallace Nutting (pp. 70-73). I do not see Berea mentioned. Berea was, in fact, quite involved with Nutting. He bequeathed a fine personal collection of antique furniture to Berea College, and there was commercial/industrial interchange between Berea's and Nutting's furniture factories. For details, write Berea College Woodcraft Industries, Berea, Ky. 40404...

—William Post Ross, Georgetown, Maine

I read with interest a back issue of *FWW* (#34) concerning the ravages of the powderpost beetle. In my area of northwestern California, the U.S. Department of Agriculture operates a gas chamber for fumigating seed. They will, however, accept other objects which need treatment.

I recently had a long-case clock fumigated over a weekend for the very modest fee of \$5. Probably the best way to find out where other such chambers are operated would be to check with the local county Agricultural Extension Service.

—D.V. Gayton, Loleta, Calif.

The article by Antoine Capet on walnut oil in *FWW* #38 is misleading in two ways. First, it gives the impression of covering the full range of natural oils and their drying capabilities, when in fact it doesn't mention oils (like Oiticica) which have been much more significant commercially than sunflower oil or poppy oil in wood finishing. Second, by saying that "tung oil is not edible" Capet leaves the impression that it is

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toxic. Capet has confused palatability with edibility. Tung oil is not only non-toxic, it is edible. However, it is not palatable. This is of little import, since tung oil imparts no taste or smell to food once dry.

When Capet refers to products which smell of petroleum distillates, any product can be rendered toxic by adding toxic materials. I speak of pure tung oil as, I assume, he speaks of pure walnut oil. . . . Woodworkers should certainly experiment with walnut oil, but they don't have to throw out their tung oil yet.

—Leonard G. Lee,

Lee Valley Tools Ltd., Ottawa, Ont.

In my father's saw shop in San Francisco, we used a method of filing backsaws (and other handsaws) that is much more accurate than the count-the-file-strokes method outlined by Ian Kirby in his article (FWW #39).

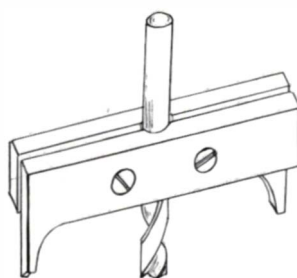
Backsaws need very little set, but if your saw needs more, joint it with a file and then carefully set it. After setting, joint it lightly again to restore the flat top profile to the teeth.

Position yourself for filing so that you can see the light reflected off the joint marks on the teeth (you'll need good light over your saw vise for this). Hold the file level and at the slight bevel angle suggested by Kirby. (This slight bevel works best for me whether crosscutting or ripping.) File the front and back of adjacent teeth simultaneously only until you have removed half of the joint mark on both teeth. Continue filing every other pair of teeth this way, concentrating on keeping the file level and at the same slight bevel angle as on the previous pair. When you run out of saw, flip it end for end and begin the return trip, this time filing until the marks just completely disappear. Keep the joint marks diminishing

equally by adjusting pressure toward the face or the back. After you finish filing, dress the teeth into perfect alignment by rubbing a benchstone *lightly* along the sides of the blade.

Resharpener the saw before it gets really dull is a good practice. You will still need to joint the saw, albeit very lightly, so that you'll have the small flats to see.

—Dan Foye, Arnold, Calif.



In FWW #37, the Q&A column shows a fly-cutter for making wooden wheels. It required a lot of cutting and brazing. Here's a sketch of a simpler design. We use ground stock, which is available in a great many sizes at hardware and mill supply houses. You can harden it if you choose, but we do not

usually bother unless we are making a great many wheels. Bolt two pieces together with a piece of thin cardboard between. Then drill the hole for the drill bit and shape the cutting edges. When screwed together without the cardboard, they make a tight grip on the drill.

—Henry Giffords, Jamaica, N.Y.

I have overall very high marks for the article by Norman Vandal, "How to Make a Molding Plane" (FWW #37). But yellow birch was not the only wood used by 18th-century plane makers. I do not profess to have seen all of the 18th-century Philadelphia planes, but I have as yet never seen any of yellow birch, only beech. Also, many Philadelphia plane

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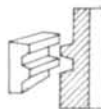
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makers and a few others used lignum vitae for wear strips, instead of boxwood. I believe that lignum vitae is superior. My personal theory as to why Philadelphia plane makers so widely used lignum vitae lies in the trade with the West Indies, which had native lignum vitae that found its way to Philadelphia at a cheaper price than distance-source boxwood.
—Dave Truesdale, Middleton, Del.

Re slender turnings and problems they create: Paraffin—a cake of it rubbed on the left hand of a right-handed turner relieves much of the friction heat. Doesn't take much, and while you're at it, slide it along the tool rest and top and bottom sides of the gouge, and marvel at your new-found turning ability.
—J.B. Small, Newville, Pa.

Re Paul McClure's "Whither Rosewood" (FWW #38): The company I work for, Palmer & Parker Co., Inc., specializes in importing mahogany lumber and veneer from Africa and South America. Our primary source of mahogany (*Swietenia*) is Brazil. The article says that because of the instability of supply of Honduras mahogany (*Swietenia macrophylla*) other woods are being sold as substitutes. Specifically mentioned was Brazilian mahogany (*Cariniana legalis*), not a *Swietenia*, as being more available. At first I was amused by this, but when customers started calling to say the Brazilian mahogany we were selling them was not really mahogany, I took offense.

First, the Brazilian mahogany imported to this country is *Swietenia macrophylla*, the true mahogany. It is both abundant in supply and stable in price. While Brazilian mahogany is lighter in color and very slightly different in properties than

Honduras, they are virtually indistinguishable.

Second, African mahogany is a relative of *Swietenia* and is available at competitive or lower prices.

Third, *Cariniana legalis* is more commonly called albarco or jequitiba in the industry and is only obscurely referred to as mahogany. It is not a very favorable wood because it contains large amounts of silica, which dulls cutting edges rapidly.

—Douglas Newhouse, Tewksbury, Mass.

PAUL MCCLURE REPLIES: Newhouse is correct. Brazilian mahogany (*S. macrophylla*) is quite abundant in Brazil and is exported all over the world. What I was driving at in my article is that quite a few importers and exporters do try to substitute mahogany look-alikes, such as jequitiba.

Newhouse is also correct in that African mahogany (*Khaya ivor-ensis*) is a relative of true mahogany—they both belong to the *Meliaceae* family. But so do dark-red Philippine mahogany (*Azadirachta integrifolia*), andiroba (*Carapa guianensis*), sapele (*Enpandrophragma cylindricum*), utile (*E. utile*), tigerwood (*Lovoa klainea*) and avodire (*Turraeanthus africana*). Even though these woods belong to the same botanical family and are even used as mahogany substitutes occasionally, they are definitely not *Swietenia macrophylla*.

Your two articles on exotic hardwoods (FWW #38) dismiss the issue of the depletion of tropical rainforests. The statement that "most land clearing has been done for agriculture, not timber" should not allow us to assume that the trade in tropical hardwoods is harmless. Most ecologists believe that too much tropical rainforest has already been cut and that further timbering, for whatever reason, may have global effects on weather.

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should remember that the cutting for agriculture and firewood is usually done by the poorest rural peoples, who have very little choice. Logging tropical hardwoods for the international market, however, is often engaged in by multi-national corporations and is unnecessary.

—Martin Holladay, Sheffield, Vt.



If sumac trees grow in Colorado, they must be plentiful in other parts of the country. This candle holder was made from the trunk of a tree cut in my yard. A master craftsman may laugh at my amateur workmanship, but look at the figure! Woodturners and hobbyists will be glad to know that they have a supply of such beautiful wood growing right in their own backyard.

—Bob Kellond,
Wheat Ridge, Colo.

Re Stanley #55: In trying to shape boards that have gnarled, twisted areas around knots, the Stanley will tend to dig in. One way to get through these troublesome areas with a minimum of profanity is to keep a bowl of turpentine handy and a brush or a rag. Wipe the area liberally, and you can skim through neatly.

—Ted Landon, Mineral Point, Wis.

I'd like to comment on "Putting an Old #55 to Work" by T.D. Culver (FWW #38). Culver's recommendation of planing through the work in one continuous stroke runs opposite to an article in the book *Planecraft*, wherein they suggest starting with shorter cuts at the end farthest away, then gradually working back until you have covered the full length of the board. I have tried this method in doing a group of beads and dadoes. The plane becomes self-guiding, and it is an extremely easy method of using both the Stanley #45 and #55 planes.

I am currently writing a dating history of the Stanley #55, if any of your readers would care to correspond.

—David Weinbaum,
44 Court St., Ste. 305, Brooklyn, N.Y. 11201

I was absolutely dumbfounded to read in FW #39 the Method of Work on pp. 14-16. The idea of using a bathroom exhaust fan for dust removal is fine, *but* paint and other finish fumes are highly volatile. An exhaust fan for these fumes should have non-sparking blades and an explosion-proof motor. In addition, you should wear a respirator that will protect against organic solvents. Exhaust fans and respirators are available from auto-body repair wholesalers (if the company won't sell directly to you, see your local body-shop owner).

I hope no one has tried this and blown up their shop or themselves.

—Craig Brown, Portland, Ct.

ERRATUM: In FW #39, p. 26, we reported that the founder of A.B. Bahco invented the world's first spanner (wrench). He actually invented the first adjustable spanner.

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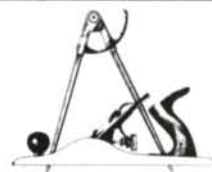
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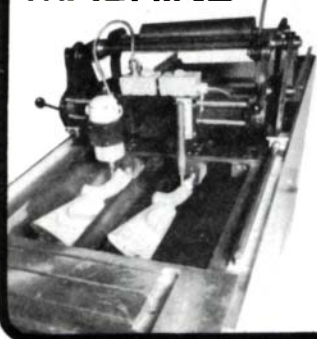
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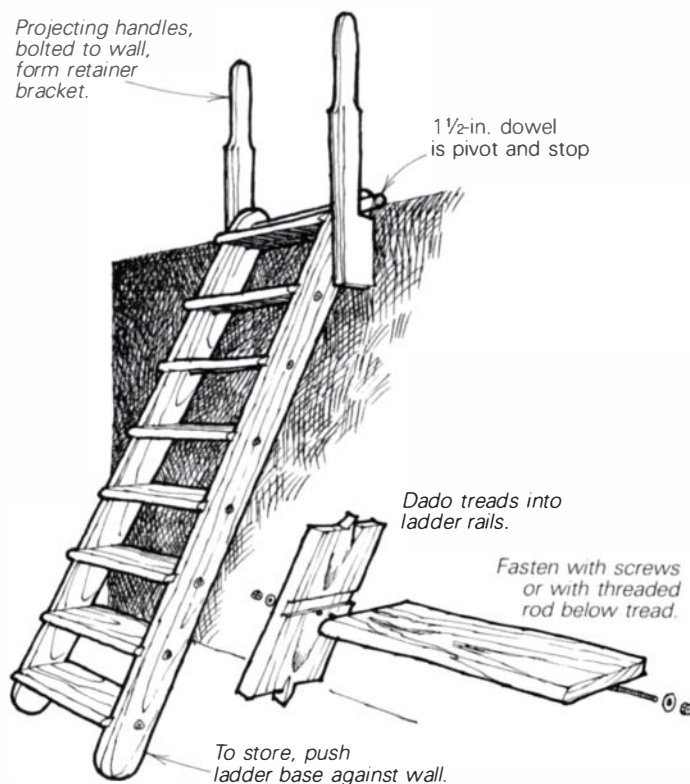
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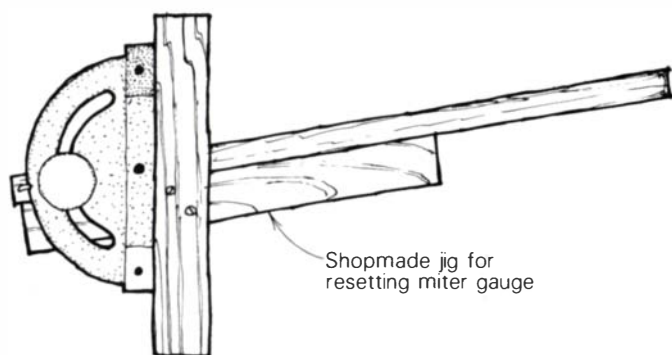
Fold-away ladder



Needing some form of access to an overhead storage area, I rejected a stepladder (shaky and dangerous) and permanent stairs (loss of valuable shop space). The solution was a sturdy, shop-built, fold-away ladder. It is always there when it's needed and a simple pull locks it into place. Because the steps are wide (more like stair treads) and the slant is not so steep (20° from vertical), the ladder is safe and reassuring to use. The projecting handles at the top make the most unstable phase of descent—mounting the ladder at the top—hardly more precarious than descending your front porch steps. With few changes you could adapt the design for over-the-side access or through-the-ceiling access.

—William Lego, Springfield, Va.

Miter-gauge setting jig



Some tablesaw miter-gauge settings are the result of tedious trial-and-error, cut-and-fit procedures. Here's how to preserve that hard-won setting for future use. Cut two 1x2 strips about 1 ft. long. Clamp one to the bar and one to the gauge face. Glue and clamp the strips where they overlap. Reinforce this joint with a couple of screws or dowel pins. When the glue has cured, you can reproduce the setting anytime you like simply by pushing the jig against the gauge.

—Tim Rodeghier, Highland, Ind.

Inlaying with dental silver

You can inlay silver into wood using the silver amalgam that dentists use to fill teeth. Draw the design on the wood, scribe the outline, then deepen the cut to $\frac{3}{82}$ in. or so with a small chisel or a rotary bur. Undercut the edge of the design to hold the amalgam (a dentists' inverted cone bur is ideal).

Now pack silver amalgam into the groove. After the alloy has set, smooth the surface with a flat tool. After 24 hours, level and polish the inlay with wet-or-dry sandpaper, finishing with 600-grit.

The inlay won't polish to a mirror finish, but will take on a softer sheen, something like pewter. It will need a coat of finish (tung oil works) to keep it from tarnishing.

For small designs (three initials about 2 in. tall, for example) the cost is minimal, probably about \$1.00.

—Lawrence Warner, Encino, Calif.

EDITOR'S NOTE: My own dentist's reaction was "Now why didn't I think of that." Intrigued, he showed me some premeasured plastic capsules (about the size of a cowboy's bullet), with powdered silver alloy in one end, mercury in the other, and a seal in between. A vibrating machine shakes the capsule end-to-end, and a little metal pellet inside the capsule breaks the seal and mixes the two ingredients, much like an agitator ball in a can of spray paint. He explained that different companies market different kinds of capsules with varying seal arrangements, amounts of silver, alloy mixtures and working consistencies, but none of the variables should affect the amalgam's use for inlay. The capsules he demonstrated contained silver the volume of a pea, and cost about 60¢ each.

He gave me a couple of capsules to try at home. There I found I could mix the amalgam by simply taping the capsule to the blade of a portable scroll saw and running it for 30 seconds at high speed. I also found that, in a pinch, you can mix the mercury and silver powder in a shot glass, using a rounded dowel as a pestle. Inlaying was no problem, but the silver will fill the pores of open-grained wood around the inlay, and it must be picked out later with a pin.

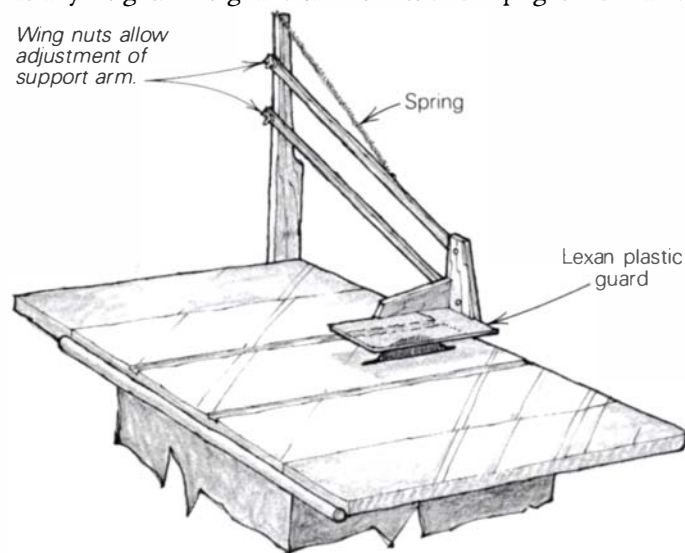
One cautionary note: free mercury is poisonous, as is mercury vapor. After mixing, the amalgam is non-toxic.

—J.R.

Shopmade tablesaw guard

During an evening's discussion with several other mechanics, I found that each of us came up with a good reason or two for not using the guards that came with our tablesaws. My long-tested shopmade guard, however, seemed just the sort of thing people would actually use. While it won't control kick-back, and won't protect against outright carelessness, it is a real help in my shop.

The guard is a piece of Lexan plastic suspended on a parallelogram arm fixture that keeps the guard parallel to the table at any height. The guard can be lifted for upright work and



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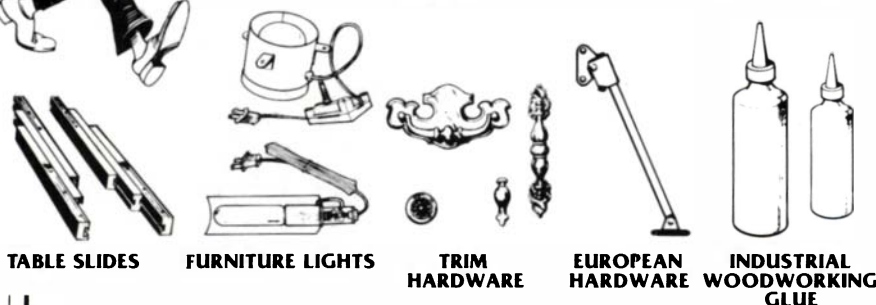


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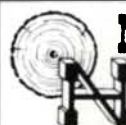
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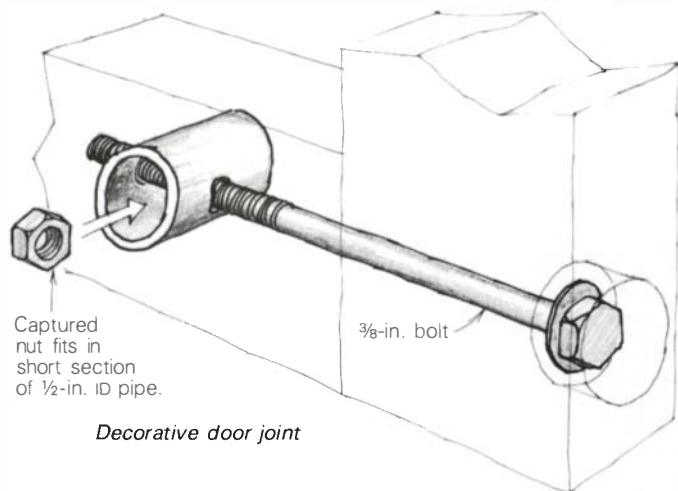
blade changes, then quickly lowered for ripping and cross-cutting. It keeps knots out of your face and sawdust from cascading behind your safety glasses. The plastic, if cleaned once a day, allows full view of the work without distortion, and its width keeps fingers well away from the blade.

The support post should be set back far enough to clear normal crosscut widths, and the entire post should be easily removable for cutting long work.

—Rod Goettelmann, Vincentown, N.J.

Decorative door joint

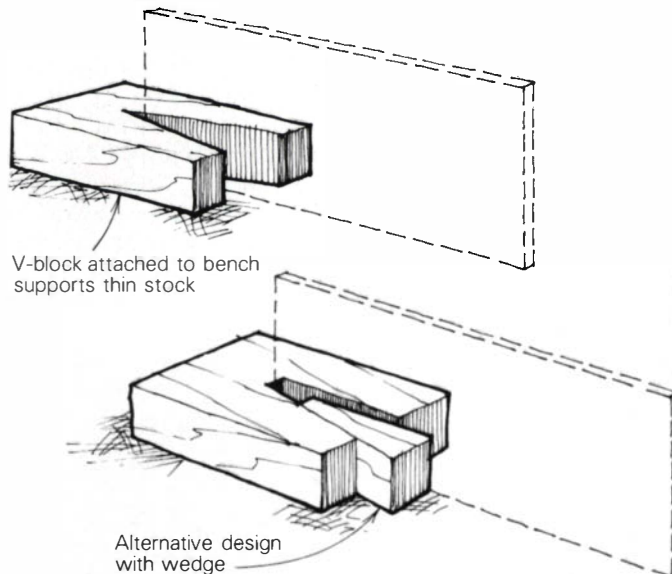
This homemade barrel-nut adaptation uses short sections of 1/2-in. ID iron pipe and captured 3/8-in. hex nuts. I installed several of these fasteners in an old weathered door to pull



together the loosened glue joints. The joint would work in other applications as well, such as machine stands and work-bench carriages. You can plug the holes in the pipe after the bolt is tight, allowing the metal to show like an inlaid ring.

—Jack Niday, Balboa Island, Calif.

Gripping thin wood



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6507	TSC SawzAll w/case	179	120
6511	2 Sp Sawzall w/case	167	117
6365	7-1/4" Circular Saw 13A	149	99
6405	8-1/4" Circular Saw 13A	167	117
6245	3.8 Amp Single Spd Jig Saw	129	91
5900	3" x 24" Belt Sander	311	218
5910	4" x 24" Belt Sander	330	229
5620	1 H.P. 8 AMP Router	215	145
5660	1.50 H.P. 10 AMP Router	239	165
5680	2.00 H.P. 12 AMP Router	299	209
5397	T.S.C. 3/8" Hammer Drill Kit	203	145
5399	1/2" 6.2A HD Hammer Drill Kit	239	169
6145	4 1/2" Angle Grinder 5.A	139	97
6750-1	HD Dry/W. Shooter 0-4000rpm	136	95

MAKITA ELECTRIC TOOLS

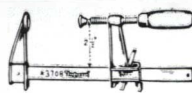
Model		List	Sale
1900BW	3 1/4" Planer w/case	\$143	\$ 89
1100	3 1/4" Planer Kit	261	178
1805B	6 1/8" Planer Kit	416	285
9900B	3"x21" Dustless Belt Sander	191	127
99240B	3"x24" Dustless Belt Sander	208	139
9401	4"x24" Dustless Belt Sander	273	179
804510	Finish Sander, Square Base	79	49
804520	Finish Sander, 5" Round Base	79	51
9045N	4 1/2"x9 1/4" Finish Sand.. Dustless	160	110
3608B	1 H.P. Router	118	82
3601B	1 1/4 H.P. Router	196	130
3600B	2 H.P. Plunge Router	299	190
6510LVR	3/8" Rev. Var. Speed Drill	109	68
DP4700	1/2" V.S.R. Drill 4.8 AMP	142	95
6013BR	1/2" Rev. 6 AMP Drill	159	118
6000R	3/8" R.V. S Uni-Drill	154	112
6010DWK	3/8" Cordless Drill w/case	142	84
6012HOW	3/8" Cordless 2-Sp. w/cl. Drill	164	107
4200N	4 3/8" Circular Saw	138	92
4300BV	Var. Speed Jig Saw	192	121

HITACHI POWER TOOLS

Model		List	Sale
OUT-10	3/8" 2 Speed 3.9 AMP Drill	\$133	\$ 88
SB-75	3"x21" Dustless Belt Sander 2 Sp.	195	140
SB-110	4"x24" Dustless Belt Sander 2 Sp.	273	189
SD-110	4 1/2" x 9" Finish Sander	144	99
SDD-110	4 1/2" x 9" Finish Sander Dustless	155	104
JHV-60	Var. Speed Jig Saw 3.5A	184	128
PSM-7	7 1/2" - 11 AMP Circular Saw	158	119
TSB-10	Mitre Saw - 10"	357	259
ORC-10	3/8" Cordless Drill 2-Sp/Rev with Adj. Torque Range	144	96
VTC-10	3/8" Cordless Hammer Drill 2 Speed, Reversible	171	125
DTC-10	3/8" Cordless Hitachi Drill 2 Speed with Reverse	133	74
DIOV	3/8" Hitachi Variable Speed Rev. 3.3 AMP Drill	114	69

★ SUPER SPECIALS ★

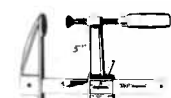
Model		List	Sale
6377	Milwaukee 7 1/4" Worm Drive Saw	\$220	\$139
6378	Milwaukee 8 1/4" Worm Drive Saw	235	149
9005B	Makita 5" Grinder, 10,000 rpm 9.4A	149	99
9607BL	Makita 7" Grinder, 6,000 rpm 15A	229	149
9609B	Makita 9" Grinder, 6,000 rpm 15A	236	154



2 1/2" Throat
Bar Size 1/4" x 3/4"

JORGENSEN STEEL BAR CLAMPS Style 37

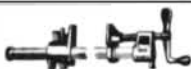
	List	Sale	Lots of 6
#3706 6"	\$ 7.88	\$ 5.50	\$ 29.70
#3712 12"	8.73	5.95	32.13
#3718 18"	9.64	6.95	37.53
#3724 24"	10.54	7.35	39.69
#3730 30"	11.76	8.25	44.55
#3736 36"	12.85	8.95	48.33



5" Throat

JORGENSEN STEEL BAR CLAMPS Style 45

Bar Size 1 3/8" x 5/16"	List	Sale	Lots of 6
#4506 6"	\$ 22.49	\$ 15.95	\$ 86.15
#4508 8"	23.04	16.50	89.10
#4512 12"	23.85	17.50	94.50
#4518 18"	25.16	18.95	102.35
#4524 24"	26.61	20.95	113.15
#4530 30"	28.06	21.95	118.50
#4536 36"	29.54	22.95	123.95



(pipe not included)

JORGENSEN PONY PIPE CLAMPS

	List	Sale	Lots of 12
#50 for 3/4" black pipe	\$11.23	\$ 7.95	\$ 85.86
#52 for 1/2" black pipe	9.36	6.50	70.20
#74 Bar Clamp Pads (Set of 4)	4.03	2.50	27.00



JORGENSEN BAND CLAMPS (CANVAS) Style 62

	List	Sale	Box of 6
#6210 10"	\$52.24	\$34.95	\$188.73
#6215 15"	57.29	37.95	204.93
#6220 20"	62.32	40.95	221.13
#6225 25"	67.34	42.95	231.93
#6230 30"	72.39	45.95	248.13

JORGENSEN BAND WEB CLAMP

	List	Sale	Lots of 12
#1215 15"	\$10.57	\$ 6.50	\$ 70.20

JORGENSEN HOLD DOWN CLAMPS

	List	Sale	Box of 6
#1623 3" Opening Gap	\$9.98	\$ 7.50	\$ 39.95



JORGENSEN ADJUSTABLE HAND SCREWS

	Jaw Length	Open Cap.	List	Sale	Box of 6
#5/0	4"	2"	\$11.59	\$ 7.50	\$ 40.50
#4/0	5"	2 1/2"	12.45	8.50	45.90
#3/0	6"	3"	13.35	8.95	48.33
#2/0	7"	3 1/2"	14.35	9.50	51.30
#0	8"	4 1/2"	15.97	10.50	56.70
#1	10"	6"	18.25	11.95	65.50
#2	12"	8 1/2"	20.94	14.25	76.95
#3	14"	10"	26.56	17.50	94.50
#4	16"	12"	34.55	24.95	134.73



Jaws - 2" High x 1 1/4" Wide
I Bar Size - 1 1/2" x 7/16" x 5/32"
5/8" Diameter Screw Size

JORGENSEN STEEL "I" BAR CLAMPS

Model		List	Sale
#7224	24"	\$23.45	\$16.50
#7230	30"	24.38	17.50
#7236	36"	25.16	18.50
#7248	48"	27.62	21.50
#7260	60"	30.77	24.50
#7272	72"	33.26	26.50

GENUINE FORSTNER BITS Type #60 - Made in U.S.A.

Size	List	Sale	Size	List	Sale
1/4"	\$18.20	\$13.65	1 1/2"	\$24.10	\$18.10
5/16"	17.90	13.40	1 3/4"	25.15	18.85
3/8"	17.65	13.25	1 7/8"	28.90	21.70
7/16"	17.65	13.25	2"	31.75	23.80
1/2"	18.20	13.65	2 1/8"	34.25	25.70
9/16"	18.75	14.10	2 1/4"	36.25	27.20
5/8"	19.05	14.30	2 1/2"	37.45	28.10
11/16"	19.15	14.40	2 3/4"	40.65	30.50
3/4"	19.25	14.45	2 7/8"	48.70	36.55
13/16"	19.50	14.65	3"	52.65	39.50
7/8"	19.70	14.80	3 1/8"	59.05	44.30
15/16"	19.90	15.00	3 1/4"	64.20	48.15
1"	20.10	15.20	3 1/2"	70.10	52.60
1 1/16"	20.85	15.65	3 3/4"	76.50	57.40
1 1/8"	22.25	16.70	3 7/8"	84.50	63.40
1 1/4"	22.80	17.10	4"	91.40	68.55
1 3/8"	23.45	17.60			

DREMEL MOTO TOOLS

Model	MOTO-TOOL KITS	List	Sale
2401	Constant Speed, 14 Access.	\$50.95	\$32.95
2501	Constant Speed, 14 Access.	62.95	39.95
2701	Constant Speed, 30 Access.	71.95	45.95
3701	Variable Speed, 35 Access.	82.95	52.95
3801	V/Sp., B/Bearing, 35 Access.	94.95	60.95

Model	MOTO-FLEX® TOOLS	List	Sale
232	Moto-Flex Tool	\$98.95	\$63.95
332	Variable Speed Moto-Flex Tool	109.95	70.95

Model	MOTO-TOOLS®	List	Sale
250	Moto-Tool (Constant Speed)	\$52.95	33.95
270	Moto-Tool (Constant Speed)	58.95	37.95
280	Constant Speed, Ball Bearing	70.95	45.95
370	Moto-Tool (Variable Speed)	71.95	45.95
380	Variable Speed, Ball Bearing	82.95	52.95

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mate with holes in the benchtop. You should arrange the dowels near the mouth of the V and angle them back slightly so the block won't shift as you plane.

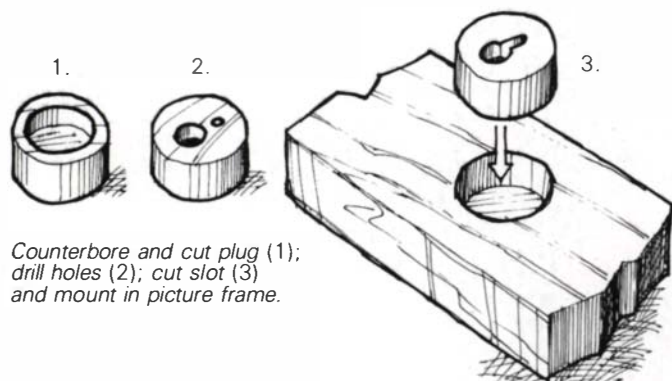
You might try a variation by cutting one side of the V parallel to the work and using a wedge for a positive grip. A pull on the workpiece releases the wedge.

—Percy W. Blandford, Stratford-Upon-Avon, England

Flush hanger plug

This wooden hanger plug, when fitted to a mirror or picture frame, allows the frame to be hung flush against the wall with the hanging screw concealed.

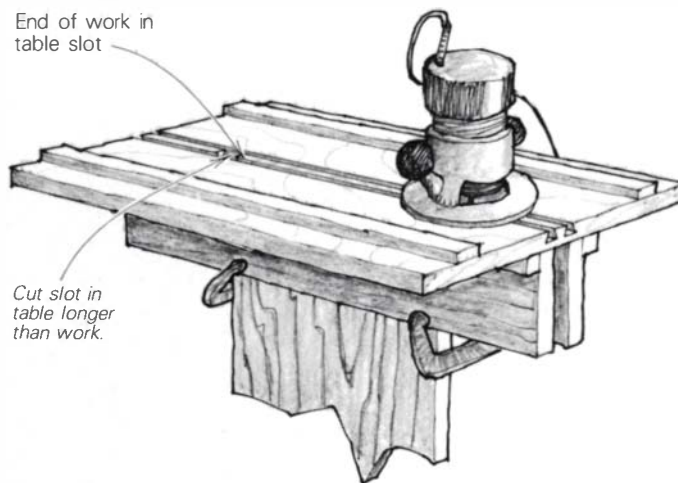
To make the hanger, cut a 1-in. diameter, ½-in. thick plug, counterbored with a ¾-in. bit to a depth of ¼ in. Cut a keyhole slot through the face of the plug (drill a ⅜-in. hole and a ⅛-in. hole and saw out the slot between the two). In the back of the frame, bore a blind hole 1 in. in diameter and



½ in. deep. Glue the plug in the hole with the narrow end of the keyhole slot up. The frame may then be hooked over a roundhead screw driven into the wall so that its head is just over ¼ in. out. On heavy frames, you'd best use two.

—Edward Grob, Naperville, Ill.,
and Charles Cohn, Clarendon Hills, Ill.

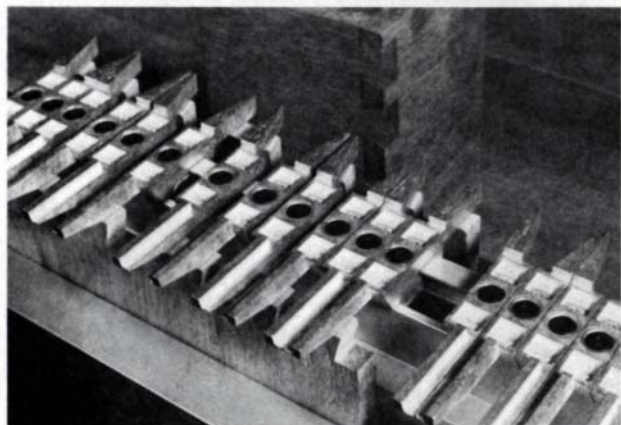
Sliding dovetail fixture



While attempting to rout long sliding dovetails on the end of shelving joints, I found it impossible to keep the over-wide and long shelves perpendicular to my router table. Here is a fixture I devised that, in effect, brings the table to the work. It's a platform with a slot in the middle and two perpendicular

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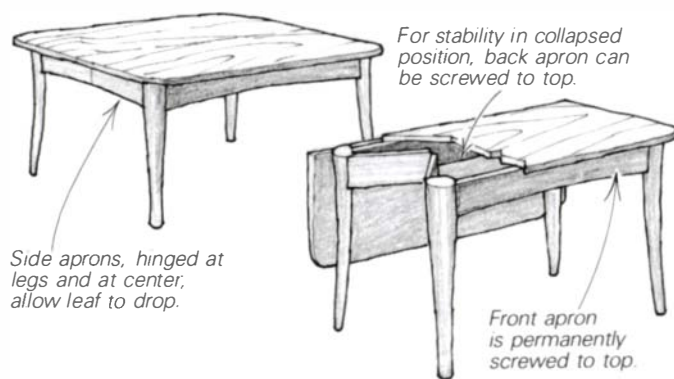
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lars for sandwiching the work. To rout the dovetail, I clamp the work in the jig flush with the top of the platform. Two fences, attached at the proper spacing, guide the router and ensure a consistent dovetail. —Victor Gaines, Glenside, Pa.

Table design converts to desk

This table design folds in to convert to a more compact side-table or a desk. It has been quite convenient during my frequent Navy transfers, where my furniture has had to adapt to various household settings.

The two table sections are fastened together at the center by a piano hinge. The front section of the top is permanently attached to the apron along the front edge. The two side aprons are hinged to fold in, allowing the rear legs to move forward. At its folded-in position, the rear apron can be screwed to the tabletop for stability. The entire conversion takes just a few minutes. —Andrew J. Pitts, Orlando, Fla.



Safe ripping on the radial-arm saw



While building an architectural model requiring extremely small pieces, I discovered this safe, accurate way to rip short or small stock on my radial-arm saw.

The key is a substitute rip fence with a built-in hold-down lip made from 1/8-in. thick pine. I made several of the hold-down fences to cover a range of stock thicknesses. With the workpiece in position, clamp the fence in its channel so that the lip applies downward pressure. To keep the workpiece against the fence, I staple a scrap of pine to the table along the outboard side of the workpiece. These staples should be methodically pulled and tossed in the garbage when you change hold-ins, to eliminate the possibility of stray metal on the saw deck.

The method holds the wood securely so that it doesn't become a workshop missile, and provides extremely accurate pieces of short, thin stock.

—Ross Asselstine, Minneapolis, Minn.

Molding head or shaper hold-in

I wouldn't use this gadget for ripping, because it would tend to close the kerf, but it's a solution to the problem of holding the feedstock against the fence on a shaper, or when using a molding head on the tablesaw. Start with a 1 1/2-in. square

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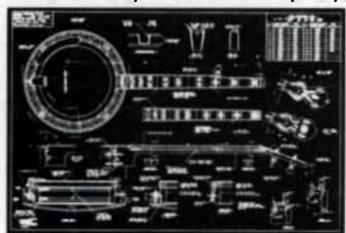
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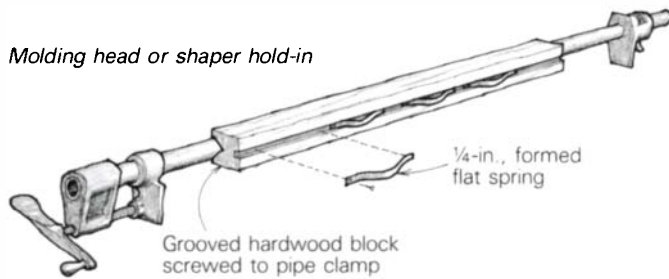
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length of hardwood. Cut a V-groove in one side (to fit the pipe of a pipe clamp) and rip a 1/4-in. slot in the other side. Screw the hardwood to a pipe clamp long enough to fit your saw table or shaper table.

Now install several 1/4-in. flat steel springs in the groove. These springs, available at hardware stores, are used to repair old double-hung windows with broken weight ropes. Clamp the hold-in across the machine table in a position so that the springs flatten as the work is pushed through. To prevent the work from moving upward, it's a good idea to use this pipe-clamp hold-in in conjunction with a fingerboard that will press the work to the table.—*Raymond Yohe, Altoona, Pa.*

Splint joint

To splice pieces of ash splints for chair seats, first soak the splints to make them pliable. Then, with a leather punch,

1. Punch holes with leather punch.



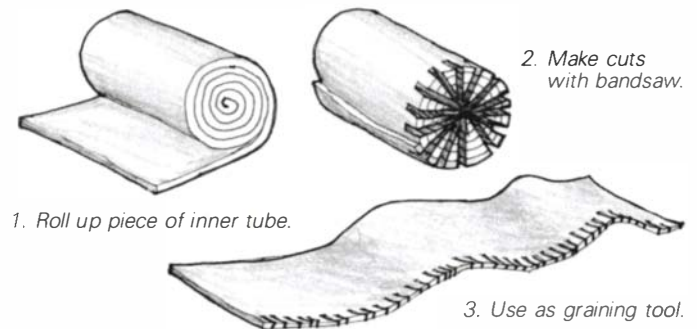
2. Trim.

3. Lock together.

punch holes in the splints and trim the ends to the shape shown in the sketch. This procedure achieves the same result as the traditional method (knife and chisel), but it's faster, easier, and handier in tight places. And the rounded edges resist splitting while the seat dries and tightens.

—*Bruce Herron, Ganges, Mich.*

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—*J.B. Small, Newville, Pa.*

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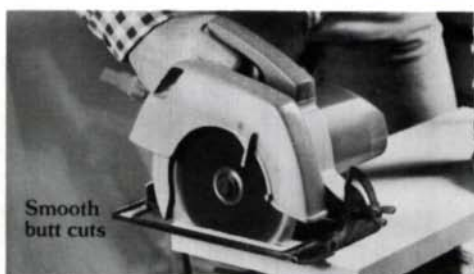
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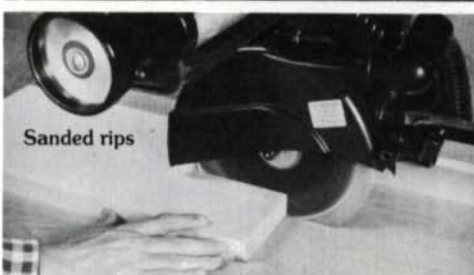
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NUTTING REVISITED

BY FRANKLIN H. GOTTSBALL

I was employed by Wallace Nutting in his Framingham shop from June 1926 to the end of March 1927, the time that the mahogany styles were first introduced. In addition to other duties, I made all of the new working drawings. Some things did not happen exactly the way your author, Bill Dulaney, said they did in his article on Nutting (*FWW* #39, pp. 70-73). Since I was directly involved in many of the projects mentioned, I think I can clarify what actually took place.

Contrary to Nutting's statement in his autobiography, that the block-front secretary by Goddard was his first mahogany piece, the block-and-shell chest-on-chest, shown on p. 50 of Nutting's 1930 catalog, preceded it. In his enthusiasm for new accomplishments, Nutting sometimes did not adhere strictly to the facts.

Also, the block-front secretary you showed on p. 72 is not the nine-shell Goddard secretary which Nutting referred to when he said he knew that if he could reproduce this "finest piece of furniture in America," he could "make anything." The secretary you showed has only six carved shells. The nine-shell is shown on p. 40 of Nutting's 1930 catalog, and has three additional shells on the upper drawer front. Nutting did take six of us workmen to Providence to study the piece, as well as other pieces in the collection, but then Nutting and I returned alone on another trip to make the drawings. Despite my protestations that it was unnecessary, Nutting insisted that I make these working drawings full-size, so that workmen building the piece could take measurements directly from them. These were the last drawings I made before I left

him to take a teaching position at Berry College in Georgia.

I may be able to shed some light on the chairs that were rejected by Williamsburg. Nutting's own drawings were often inadequate and poorly detailed, and his workmen may have had trouble following them. He once asked me to do a working drawing for a wing chair from measurements he himself had taken, and his data was of so little use that I had to sketch and measure the chair myself.

Dulaney's assertion that Nutting made two grades of furniture, one for collectors and an inferior grade for the general public, is one I cannot accept. I remember that Nutting set high standards, and everyone in the shop was told that nothing should go out if anyone saw anything that was not up to the highest standards. I have no reason to believe this was not the case after I left him. I'm sure that the poorer quality pieces are those that were made by the people to whom he sold his business for a time, and I think this was the period during which his pieces were marked by script lettering.

That all the negatives for Nutting's thousands of pictures were destroyed, and that Nutting's later years were beset by financial and other worries, leaves me with a feeling of sadness that I can hardly express in words, for until I was recently made aware of this, I had no knowledge of it. The legacies he left us surely deserved a more fitting reward. □

Franklin H. Gottsball's latest book, Provincial Furniture Design and Construction, has been published by Crown Publishers, Inc., One Park Ave., New York, N.Y. 10016.

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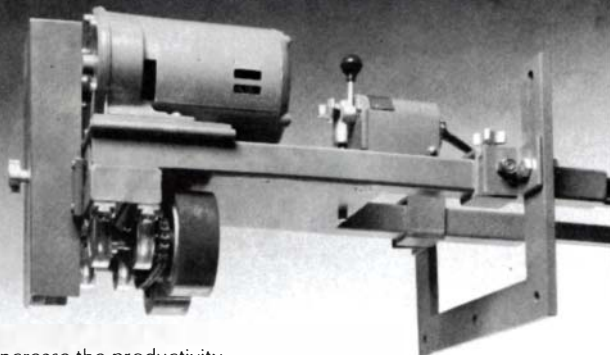
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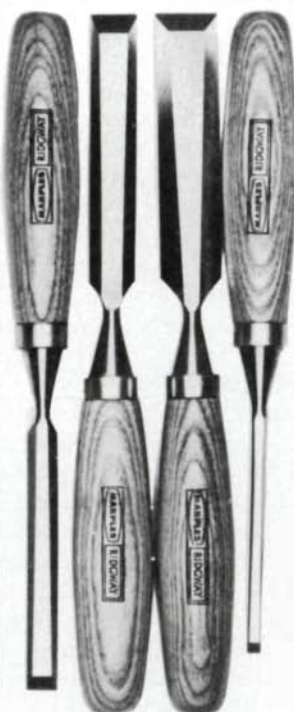
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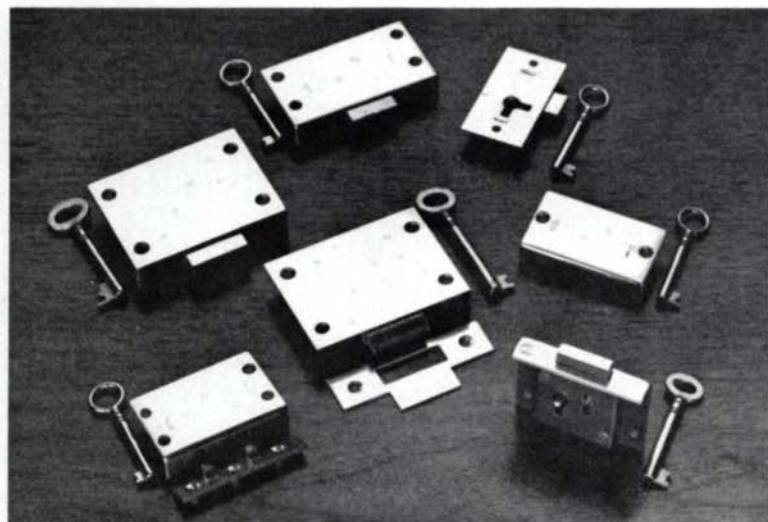
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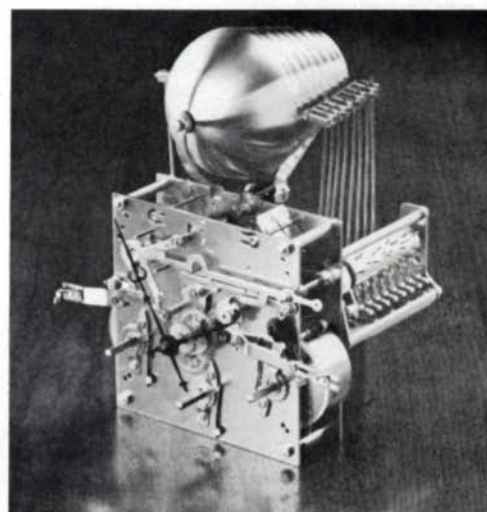
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Walnut-husk stain—*I would like to make my own stain from walnut husks and currently have about 20 gallons of black muck. If I can get my furniture to look like my hands, I'll be satisfied. Would straining the muck through burlap and mixing it with denatured alcohol be enough? And is there a way to extract the color from the shells?*

—Wesley Kobylak, Tuscarora, N.Y.

GEORGE FRANK REPLIES: What you are trying to concoct is the famous *brou de noix* (literally, brew of walnut), the pet dye of all old-time French *ébénistes*. Since our professor taught us how to make it, *brou de noix* has been replaced by far better and easier-to-use aniline dyes. Still, maybe *brou de noix* has a nostalgic value and charm that some of us can still detect. I envy you your 20 gallons of black muck. Here's how we made the stuff into a wonderful stain.

The boss lady soaked the walnuts' green husks (not the hard brown shells or the edible fruit) in rainwater for a few days and then she put this muck over a slow fire, being careful not to let it boil. All the while, her hands became as pleasantly brown as yours. She added some soda ash (dry sodium carbonate) while brewing, approximately a heaping teaspoon per gallon, and let the brew simmer for two or three days. And that was it. She let it cool, strained it through an old linen cloth (the burlap which you ask about would work just as well) and then filled green bottles with the filtered liquid. She kept the bottles firmly sealed and in a dark area

until we were ready to use our *brou de noix*.

If you insist on using alcohol, don't put it into the brew, but into the brewmaster. Rye would do, but go easy.

Gooseneck molding—*I'm building some reproductions of old Norwegian cabinets, and they have some pretty fancy crown molding at the top, which for the life of me I can't figure out how to make. I'm sending along a sketch and I'd appreciate any help you can give me.*

—Dean E. Madden, Decatur, Ill.

NORM VANDAL REPLIES: The type of cornice you describe is found on scrolled pediments, an important motif in period architecture and cabinetwork. The molding itself is sometimes called a gooseneck.

The traditional way to make this cornice is to hand-carve the curved section, a process that seems more difficult than it actually is. The first step is to make the straight returns that are nailed to the top of the cabinet sides. You can make these by hand with a molding plane (FWW #37, pp. 72-77), with a shaper or with a molding head mounted in your table-saw. Make sure to mill them long enough to allow for cutting the miters later.

Next, make a full-size cardboard template of your gooseneck section that's exactly as wide as the return molding, as shown in the drawing on p. 28. Transfer the shape to your stock and bandsaw the gooseneck. With the gooseneck blank

(continued on p. 28)

Follow-up: Router dovetail fixtures

By making your own templates out of tempered hardboard, you can make through dovetails of any size and with any spacing using the Sears-type dovetail jig (see FWW #37, pp. 69-71). As with the other two jigs mentioned in the article, you will have to mill the pins and tails separately, with a straight and a dovetail router bit.

I made my templates with slightly oversize fingers (drawing, below) and then trimmed them down by trial and error until I got tight-fitting joints. You'll have to take into account the outside diameter of the router's guide bushing. Cut both the pins and the

tails with the boards mounted in the jig vertically. To prevent the exiting router bit from tearing out the back of your stock, clamp a scrap in the jig horizontally.

—Michael Boyts, Crested Butte, Colo.

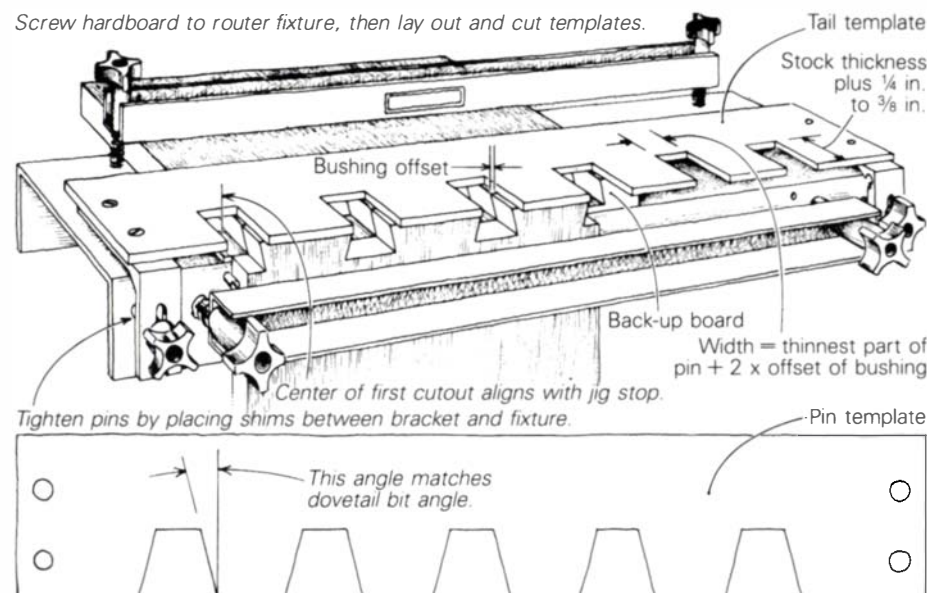
I vary the pin/tail spacing with my Rockwell dovetail jig (Sears-type) by inserting between the fingers of the template $\frac{1}{16}$ -in. dia. "coins" sliced from dowels. I insert a coin wherever I don't want a dovetail. The router follows the template in the usual way, but where the router's guide bushing encounters a coin, no tail will be cut. To center pins

and tails in the width of the stock, I cut dovetails in a 12-in. wide scrap and keep this on hand as a gauge. When I lay out my joints, I butt the gauge and the stock end to end, centering the stock (it's usually narrower than the gauge) in the gauge's width. I mark where pins and tails are to be, and then measure the distance between one edge of the stock and the edge of the gauge. A scrap piece ripped to this measurement, crosscut in half and placed on both sides of the stock when it's mounted in the dovetailer will automatically center the joint. If this centering leaves me with unattractive half-pins, I insert a coin and eliminate them.

—George R. Kahn, Potsdam, N.Y.

You reported that the Leigh dovetail jig will mill through dovetails in $\frac{3}{4}$ -in. thick stock only after you mill a rabbet in the pin board. But with a 14° carbide cutter (stock number DV09-C) sold by M.T.D. Products Ltd., 97 Kent Ave., PO Box 1386, Kitchener, Ont. N2G 4J1, this jig can be made to dovetail $\frac{3}{4}$ -in. stock without cutting the rabbet. This bit has a $\frac{3}{4}$ -in. cutting depth instead of the $\frac{1}{2}$ -in. depth of standard bits. It must be used with a $\frac{5}{8}$ -in. guide bushing mounted in the router. I limit tearout when cutting the tails by first wasting most of the wood with a $\frac{1}{16}$ -in. or a $\frac{3}{8}$ -in. straight bit, followed by a clean-up cut with the dovetail bit.

—Angelo Cifelli, East Hanover, N.J.



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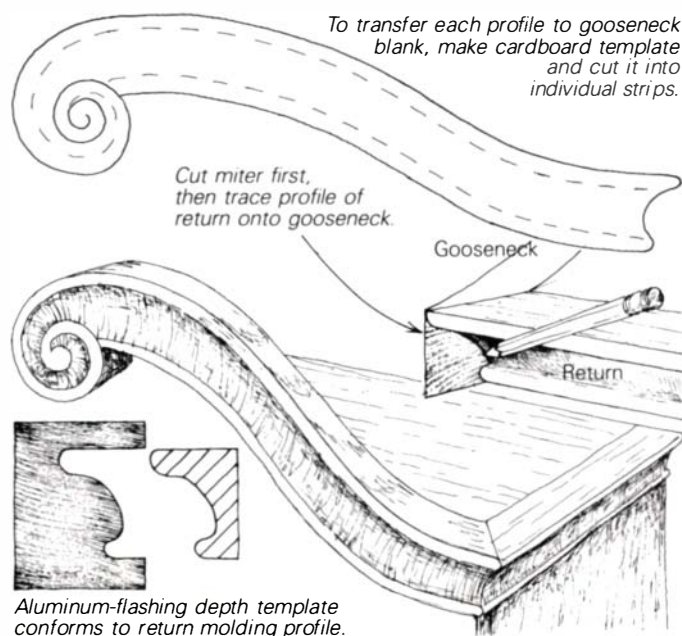
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27

held against the cabinet pediment, mark the point at which the miter will meet the cabinet corner.



Remove the blank and cut the miter. It may seem improbable to cut the miter before carving the molding, but it will prove to be helpful later.

Next, cut a matching miter on the return, leaving it long at the unmitered end to allow for fitting later. Fasten the return to the cabinet temporarily and then place the gooseneck sec-

tion on the pediment, butting the miters together. With a sharp pencil, trace the contour of the return onto the mitered face of the gooseneck. This represents the exact profile that the gooseneck must be where it joins the return. The layout lines for each separate profile of the molding should now be traced onto the gooseneck shape. Do this by first drawing lines representing the profiles on your template, then cut up the cardboard to make individual templates for each contour.

Before you begin carving, make another template out of aluminum flashing, using the contour of the return as a guide. As you carve the gooseneck, check the shape and depth of the profile with your aluminum template. Final shaping and truing should be done with a gooseneck scraper. Two important things to remember are that gooseneck moldings don't need to be as perfect or as consistent in profile as do straight sections, as long as they look correct, and that the only critical points are where the miter joins the two sections. See *FWW* #36, p. 80, for an article on cutting curved moldings with the radial-arm saw.

Selecting tool steel—*It's time to retire my old Sears chisels and, I hope, move up in quality. I'm puzzled, however, by the flowery rhetoric I read in some mail-order tool catalogs. I've seen chisels made of high-tensile alloy steel, tungsten vanadium steel, chrome vanadium steel, high-carbon steel and even competition steel. Is there any real difference? I realize that if you buy cheap, you get cheap, but I don't know how to judge quality.*

—Richard Fisher, Austin, Tex.

JERRY GLASER REPLIES: It's impossible to make a rational decision about which tools to buy based just on the materials

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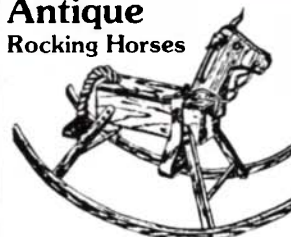
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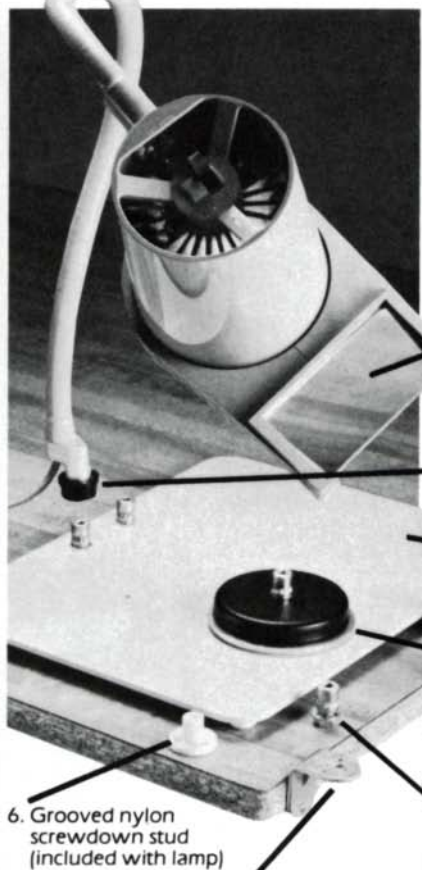
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descriptions provided in the catalogs. Most hand tools are made out of plain high-carbon steel with precious little tungsten, vanadium, chrome or other metals added to alter their properties. The steels you mention get their names from alloying elements added to improve heat-treating properties. Names such as Sheffield or Swedish refer to the place where the steel is made, or serve as manufacturers' trade names to identify a particular alloy. Which steel is best for which tool? That's a question likely to provoke arguments among even experienced metallurgists. Steels for hand woodworking tools are selected as much for their suitability to mass production as for their ideal edge-holding properties.

For practical purposes, harder steels hold a keener edge longer, though the tradeoff for this durability is added sharpening difficulty. The most reliable measure of steels is the Rockwell C index, which ranks them by hardness on a scale from about 20 to about 70. Sight unseen (and untried), the Rockwell index is as good a way as any to judge the steel in a tool. Western chisels, gouges and plane irons are likely to be in the high 50s on the Rockwell C scale, while Japanese edge tools, with laminated steel edges, will be in the 60s. Turning tools will usually rank in the 50s unless they are made of high-speed steel, in which case they may be 60 or harder.

Absent any other way of judging tool steels, I'd suggest asking the manufacturers of the tools you have in mind for the Rockwell numbers of their products. You can then buy a couple made of the hardest steel and try them out. If they do the job and work better than the ones you had before, you have a winner. Keep in mind, however, that steels from a particular manufacturer aren't always consistent from tool to tool; variations of a few points either way are common. And

steel hardness needn't be the sole criterion by which to evaluate a tool. Your sharpening skills, the woods you like to work, even the shapes and styles of handles will all bear on your success, and could easily offset a few points difference on the Rockwell scale.

Graying wood filler—*I am having trouble with wood filler turning gray under a lacquer top coat. I am using a brown mahogany filler thinned with naphtha, allowing drying time according to the directions on the can. I use a lacquer sealer over the filler before I spray on the top coat. Thanks for any help you can give me.*

—Ralph R. Fox, Grafton, Va.

OTTO HEUER REPLIES: The graying of your wood filler may be due to the slow evaporation rate of the naphtha. If the naphtha hasn't escaped through drying, it will cause the nitrocellulose in the sealer and the lacquer to come out of solution, forming a precipitate that clouds the finish. Usually naphtha is used as a wood filler solvent during the cooler winter months. During the summer, you can use a less volatile solvent such as mineral spirits.

Letting the filler dry longer may help; fillers can go stale, however, and lose their drying properties. To check, reduce a small amount of filler with the recommended solvent, then rub it on a clean piece of glass to a film about as thick as it would be on the wood. This film should dry hard in 24 to 48 hours at room temperature and should be hard enough to resist scratching with a fingernail.

You could also try a lacquer washcoat consisting of one part lacquer to three parts thinner. Spray on a mist coat before you rub in the filler. The washcoat keeps the naphtha

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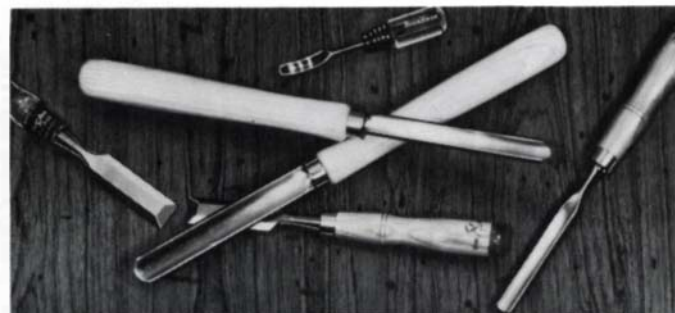
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Desert woodworking—*We live in the Nevada desert near Death Valley and our humidity is zero for most of the year. We buy kiln-dried hardwood and find that the wood splits and shrinks after it has been here a matter of days. Some of the furniture I've made has split apart at the joints. I'm thinking of putting a humidifier in the shop, but that won't do any good to someone who buys my furniture. I'd appreciate any advice you can give.*

—Evan W. Thompson, Beatty, Nev.

R. BRUCE HOADLEY REPLIES: I don't think I'd try to humidify the shop if your work will go outside it, as it obviously will. Instead, I'd concentrate on letting the wood slowly reach equilibrium moisture content (EMC) with the desert environment before working it. Because you are faced with moisture contents as low as 1% to 3%, resistance-type moisture meters won't help you measure EMC, since they function down to only about 6% or 7%. Instead, you can keep weight records on representative pieces of lumber. For example, out of a given shipment, pick out three or four boards that together weigh 80 lb. to 100 lb. Weigh them on a bathroom scale weekly, or perhaps daily, and plot the weights on a chart against time. When the boards reach EMC, they will hold a constant weight. Keep the data thus collected as a guide for judging how long you'll need to let each species adjust to EMC at various times of the year.

Rapid loss of moisture may cause end-checking or other defects, so you may have to slow down drying. End-coating valuable lumber with glue or latex paint usually pays for the effort in reduced checking. If your lumber is fairly moist when it arrives, slow the drying rate by stacking the lumber tightly without stickers, or if you do sticker it, cover it with a loose wrap of kraft paper or of plastic. Weights placed atop a stickered stack will help keep the more troublesome species from warping and cupping too badly, though you should expect some degradation in your harsh climate. But better to get it over with before you use the lumber.

Once you've built a piece, a final coat of a film finish such as shellac, lacquer or varnish will slow down moisture exchange and minimize sudden dimensional changes, although your pieces should be designed to allow for the eventual expansion if you expect that your customers will move them to a more normal environment. (For more on wood and moisture, see *FWW* #39, pp. 92-95.)

Errant router bit—*I recently bought a 3-HP router that will accept 1/2-in. shank bits. When I set the router to take a deep, hogging cut in oak, the bit slipped down out of the collet, ruining my day and the job. I've already made a mess of two projects. What causes this slippage and what can I do to prevent it?* —W.B. Lord, New York, N.Y.

JOHN RUSHMER REPLIES: To clear waste from the cut, some (not all) router bits have cutters brazed on at a slight angle to the bit axis, as in the drawing on p. 34. This angle creates an "upcut" that lifts chips out of the cut much as an auger would. Under the heavy load of hogging, this upcut exerts considerable downward thrust on the bit, actually pulling it



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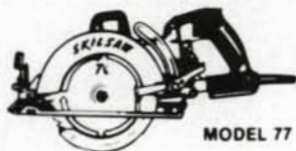
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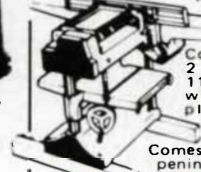


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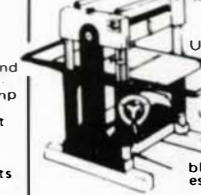
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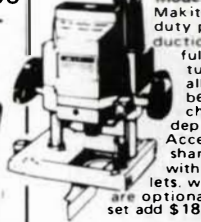
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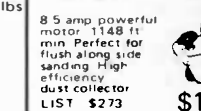
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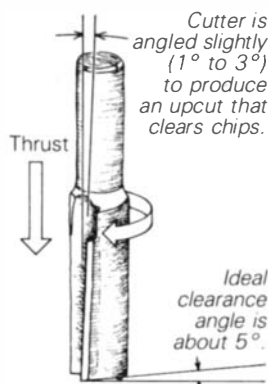
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out of the collet. The deeper the cut is, the greater the thrust will be. The clearance angle of the bottom of the bit, which is necessary for plunge-cutting, is critical in countering some of this downward thrust. Too great an angle, more than about 7° , results in a bit that plunges too easily and thus offers little resistance to downward thrust. Tests we've done at Milwaukee Electric Tool Corp. indicate that 5° seems to be the ideal clearance angle.

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—Mechanical and musical movements for toys are sold by Sankyo Seiki (America) Inc., 1275 Valley Brook Ave., Lyndhurst, N.J. 07071.

About our answer people:

GEORGE FRANK is a retired wood finisher and an author.

NORM VANDAL makes period furniture and architectural millwork in Roxbury, Vt.

JERRY GLASER is a toolmaker and engineer in Los Angeles, Calif.

OTTO HEUER is a chemist and a consultant to the wood finishing industry.

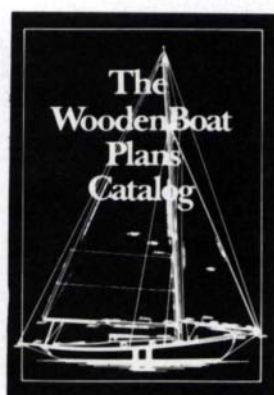
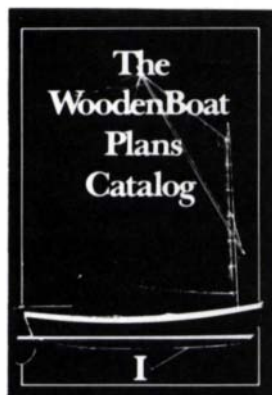
R. BRUCE HOADLEY is a wood technologist at the University of Massachusetts at Amherst.

JOHN RUSHMER is chief engineer at the Milwaukee Electric Power Tool Corp.

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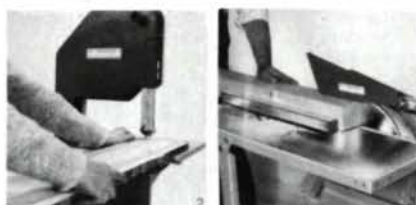


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RIGHT-BRAIN WOODWORKING

BY WILLIAM PAGE

It had been about six weeks since I'd spent an evening in my tiny basement workshop. I'd broken five ribs in a bicycling accident, and for several weeks I could hardly breathe comfortably, much less think about putting plane to wood. But finally I got up the courage to go downstairs and putter, spending most of the evening sharpening a hand-forged hatchet I'd bought the weekend before. When I came up from the basement, I noted with some surprise that I actually felt *less* tired than when I began. I'd forgotten in that six-week period the relaxed feeling one gets from woodworking.

That incident set me thinking about some things I'd read about how the human brain works. In her book *Drawing on the Right Side of the Brain* (published by J.P. Tarcher, Inc., Los Angeles, Calif., 1979), Betty Edwards characterizes the two sides of the brain in the following way: the left brain is verbal, logical and rational, while the right brain is non-verbal, intuitive and holistic. In our culture we have a kind of "left-brain bias," because we value more highly the verbal and analytical skills.

It seems to me that woodworking, especially the relaxing and enjoyable parts, is mostly a right-brain activity. Edwards relates that artists who are thinking with their right brain may be unaware of the passage of time, and may hear sounds but are uninterested in figuring out their meaning. This sounds a lot like my wife trying to get my attention when I'm working in the basement. Right-brain thinking, in addition, often gives an awareness of feeling alert but relaxed, clear in one's mind, and of feeling refreshed when fin-

ished. This too is a familiar experience.

Most important for me, however, is the release from the "chatter" of the left brain, which is always talking to itself about something, not necessarily making much sense, but pouring out a constant stream of words. The right brain, on the other hand, is blissfully quiet. When I am pleasantly absorbed in woodworking, the usually constant hum of thoughts seems to recede, and I am alert yet relaxed. Thus, getting away from it all in my basement workshop may actually be only getting away from my habitually verbal and analytic left-brain thinking, allowing me to experience the relaxed, non-verbal, holistic state of right-brain thinking. That's probably why, despite the often hard physical labor involved in woodworking (I use only hand tools in my work, even for stock preparation), I tend to feel relaxed and refreshed afterward.

Perhaps all this is just my excuse for those "wasted" solitary hours, but I don't think so. I belong to a local woodworking group, and have sensed that many other members, office workers like me for the most part, seem to get the same kind of satisfaction. My guess is that we all share the same deep, unspoken realization that, in woodworking, we get a necessary balance to our lives that we get nowhere else. The opportunity to "make some shavings" gives a quiet counterbalance to our usual noisy and hectic "left-brain" existence. And I for one am never going to spend another six weeks away from my woodworking if I can help it. □

William Page lives in Arlington, Va.

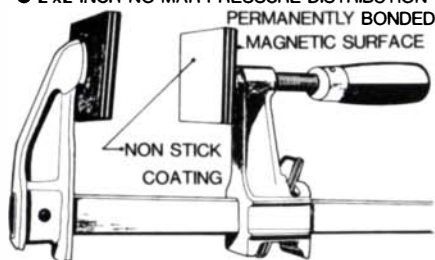
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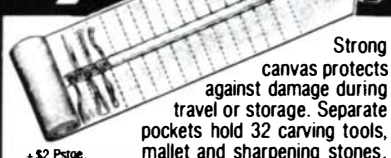
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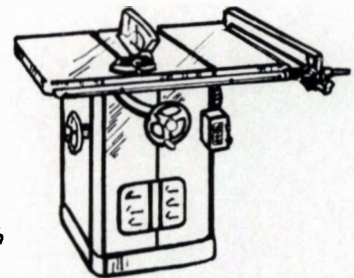
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Books

Making Folk Instruments in Wood by Dennis Waring. *Sterling Publishing Co., Inc., Two Park Ave., New York, N.Y. 10016, 1979. \$8.95, paperback; 160 pp.*

Musical instrument design has achieved such a level of sophistication that luthiers can sit around for hours propounding theories about the best design for grooves in a nut. It would be easy for such an instrument builder to react to this book with a flash of outrage, but that would be wrong-headed. Yes, the book is oversimplified; yes, the procedures and materials (plywood?) won't give you the best instruments; yes, some of the instruments absolutely won't play in tune. So what? The book is irresistible—Stradivarius himself might be tempted to build a drum or two.

Waring surveys, and builds in some form, just about everything that can make noise, from bull-roarers and kazoos to a Celtic harp. There's a bleach-bottle banjo, a garden-hose bugle, a willow whistle, spoons, jugs and the bones—46 instruments in all.

Mostly, they're not true folk instruments but look-alikes. Folk-instrument experts might feel shortchanged, but Waring's adaptations are designs that modern folks, especially kids, would build and play. Information about sound itself, why designs work, and how to change things around to suit what's at hand is interspersed nicely with the how-to-do-it stuff. Some of the instruments, the tissue-paper and comb for instance, require no tools at all. Others, like the teardrop fiddle in the later part of the book, call for a basic workshop.

I'd recommend the book to anyone as an enthusiastic leap into instrument-making. There's nothing here that will involve too much time or cost too much money, and if your

first instrument inspires you to make a better one, the book's purpose will have been achieved.

There are photographs throughout of children tooting, banging and plunking away. Although Waring gives enough directions for noisemaking on most of these instruments, he points out that a teacher is necessary if you actually want to make music. If your kids rattle your spine with the clamor of the glockenspiel, you can always institute a little formal practice. Among folk the world over, formal practice initiates the urge to do something else for a while. —Jim Cummins

The Nature and Aesthetics of Design by David Pye. *Van Nostrand Reinhold, 135 West 50th St., New York, N.Y. 10020, 1982. \$9.95, paperback; 160 pp.*

"The art of design, which chooses that the things we use shall look as they do, has a very much wider and more sustained impact than any other art. Everyone is exposed to it all day long. Indeed, in towns there is hardly anything in sight except what has been designed. The man-made world, our environment, is potentially a work of art, all of it, every bit of it."

One of the best books written on the subject. Reviewed in *FWW* #13, p. 24. Now available in paperback.

—Roger Holmes

Restoring and Renovating Antique Furniture by Tom Rowland. *Van Nostrand Reinhold, 135 West 50th St., New York, N.Y. 10020, 1980. \$5.95, paperback; 172 pp.*

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how to do it. This book is no exception. Rowland's excuse (referring to alterations of old commodes) is that the possibilities "are so many and varied that it is hardly practical to give detailed instructions." I would prefer to know exactly how to make one alteration than to know a little, but never enough, about how to make many.

This book is useful, then, in direct proportion to how much you already know about the procedures suggested. And you should take care with some of the suggestions. Rowland advises bleaching wood or finishes by scrubbing away with oxalic acid. If you do, wear gloves and goggles and don't breathe the stuff—it can cause severe skin damage and respiratory irritation. (It's a good idea to check the chemicals in any finishing portion recommended in a book. *Artist Beware*, by Michael McCann, published by Watson-Guipill in 1979, lists a great many and their attendant hazards.)

This is an American edition of a British book and it needs translation. Many terms will be unfamiliar to Americans, and the brand-name products may be difficult, if not impossible, to get here.

—Roger Holmes

SHORT TAKES

Woodworking Techniques and Projects by Rosario Capotosto. *Popular Science Books*, 380 Madison Ave., New York, N.Y. 10017, 1982. \$29.95, hardcover; 401 pp.

There's no shortage of simple project books, but this pricey addition to the genre has a greater variety of items than most—from your basic spoonrack to involved case pieces such as a rollout desk. There are lots of in-process photos and perspective construction drawings of the kind of furniture that's

so quick in the building that you're done with it before you realize how bland it is.

Chainsaw Savvy: A Complete Guide by Neil Soderstrom. *Morgan and Morgan*, 145 Palisade St., Dobbs Ferry, N.Y. 10522, 1982. \$9.95, paperback; 144 pp.

What with the boom in wood heating and home lumbermilling, nearly everyone owns or at least uses a chainsaw. Here's another book that tells you how to get the most out of these versatile tools. Quite properly, it's heavy on safety, and has sections on felling, bucking and saw maintenance, all illustrated with black-and-white photos and drawings.

Carving the Unusual by E.J. Tangerman. *Sterling Publishing Co., Inc.*, Two Park Ave., New York, N.Y. 10016, 1982. \$6.95, paperback; 128 pp.

One man's kitsch is another man's folk art, and this book, through small, fuzzy photos, offers plenty of examples of both. The volume deals mostly with wood, but as its title suggests, it has off-the-wall materials too, such as nutshells, pits and gourds. Minimal talk about tools and techniques.

Constructing Tables and Chairs with 55 Projects by Percy W. Blandford. *Tab Books Inc.*, Blue Ridge Summit, Pa. 17214, 1982. \$13.95, paperback, 298 pp.

More simple furniture projects, also some dope on the kind of joinery to use in assembling tables and chairs, told mostly through line drawings. In addition to woodworking, there's a section on upholstery, but I couldn't make much of it because our review copy was missing 33 pages. Best count the pages before you buy this one.

—Paul Bertorelli

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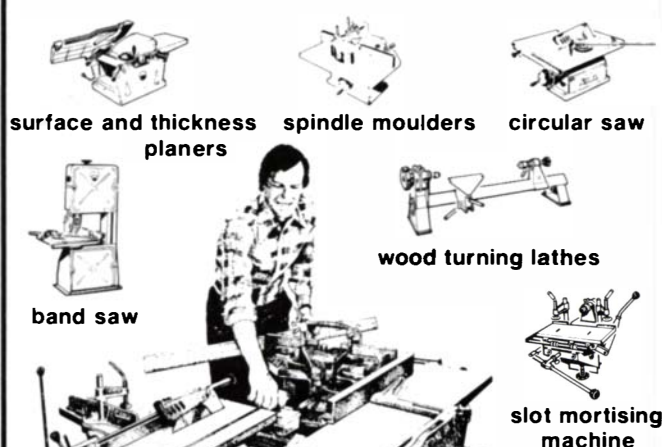
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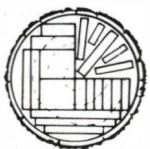
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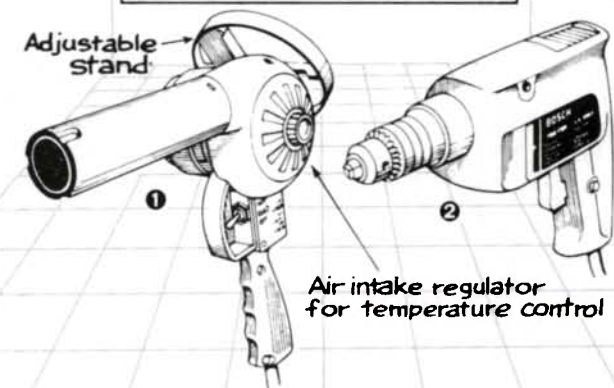
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ON INDEXES, PHOTOS AND ADS

BY JOHN KELSEY

In the center of this issue you'll find a comprehensive index to the last nine issues of *Fine Woodworking*. It was extracted from a new, cumulative index that goes back more than seven years, to our first issue. The complete index is 32 solid pages of small type, too huge to publish inside the magazine, which is why we're offering it as a separate booklet (\$2.50). The partial index in this issue picks up where our last cumulative index left off (#30, Sept. '81).

The new index was prepared by Harriet Hodges of Rural Retreat, Va., who was an editor and English teacher before becoming a woodworker and sheep farmer. It's unusual for a magazine to reindex all of its back issues. We did so because we agreed with readers who (like Harriet) judged our previous indexes inadequate.

Another colossal job has been sifting through the 20,000 photographs readers sent in for our *Design Book Three* competition. We've chosen the 500 best pictures, and we're now making them into a book which will be available in September. Readers awaiting word on the fate of their photographs will have heard from us by the time they read this.

Many readers have written to comment on the advertisements in our magazine. While some say they appreciate this vigorous marketplace in tools and materials, others call it a tasteless commercial clamor that's turning their favorite magazine into a shopper's news. Recently the ads have seemed overwhelming to us, too. I'd like to comment on the situation, and report on what we're doing about it.

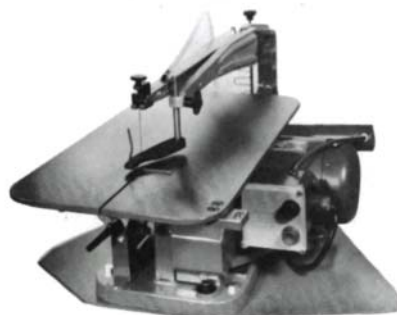
We think of advertising as a reader service, and have never accepted ads that weren't of direct interest to woodworkers.

Not too long ago, it was really hard to find woodworking tools and materials. While price isn't everything, competition was unheard of. Now, among the catalogs that crossed my desk last week, I found the very same English brass-backed tenon saw at prices ranging from \$40.25 down to \$29.95. And just for example, one firm, Lee Valley Tools of Ottawa, Canada, has even issued a 40-page catalog containing nothing but unused Victorian hardware, scoured up in odd lots from warehouses across the continent. Such an offering would have been impossible just a couple of years ago. What one thinks of this marketplace seems to depend on whether one is shopping for anything, or not. For myself, when I don't want to shop, I can always turn the page.

Most issues of *Fine Woodworking* contain about 66 pages of articles and editorial departments, with 40 to 45 pages of ads, that is, between 35% and 40% ads. Since most magazines contain from 50% to 70% advertising, I don't think our trouble is quantity. The problem is the way we display the ads, all loaded into the front of the magazine, among our regular departments.

Our solution, starting in the July issue (#41), will be to divide our usual mixture of advertising and editorial departments into the back of the magazine as well as the front. The main articles will be in the middle of the magazine, and they will remain uninterrupted by advertising. We're also adding a color editorial section to showcase the most interesting work we can find, whether traditional or contemporary, furniture or not. We like the way our prototype magazines look and feel, and we hope you enjoy our continuing evolution. □

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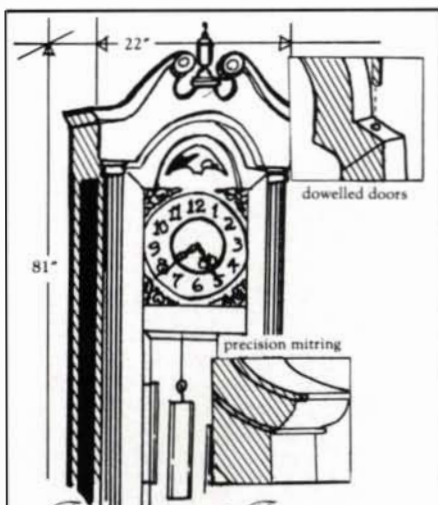
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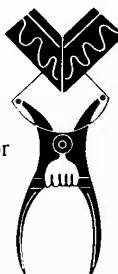
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Events

Listings are free but restricted to events of direct interest to woodworkers. The July issue will list June 15–Sept. 15, deadline May 1; the Sept. issue will list Aug. 15–Nov. 15, deadline July 1.

ARKANSAS: Art fair—Eureka Springs Convention Ctr., May 6–8.

CALIFORNIA: Workshops—Japanese tools, Toshio Odate, May 13–15 (Berkeley); simple musical instruments, May 28 (Berkeley); Sam Maloof workshop, May 28 (Los Angeles); turning, Jerry Glaser, May 28 (San Diego); joinery and veneering, Tage Frid, June 10–12 (Los Angeles), June 17–19 (San Diego), June 24–26 (Berkeley). The Cutting Edge, Los Angeles: (213) 390-9723; San Diego: (619) 695-3990; Berkeley: (415) 548-6011.

Show—Mendocino Woodworkers Association, May 24–June 12, Artisans Guild Store, 45050 Main St., Mendocino, 95460. (707) 937-5300. State fair—Sacramento, Aug. 19–Sept. 5. Calif. artists only. Slide deadline June 1. Write Calif. State Fair, Calif. Works, Box 15649, Sacramento, 95852. (916) 924-2015.

Exhibit—New furniture, Robert Erickson, May 27–June 27. The Retreat, 3865 E. Thousand Oaks Blvd., Westlake Hills Plaza, Westlake Village, 91362. (805) 496-7615.

Juried exhibit—Southern Calif. Expo, June 17–July 4. Open to San Diego and Imperial Counties. Entry deadline April 30. Contact S. Calif. Expo, Del Mar, 92014. (617) 297-0338.

Seminars—Michael Bock, Don Braden, Art Carpenter, Al Garvey, Dale Holub, Bruce McQuilkin, Grif Okie, Dean Santner, Jim Sweeney and Stuart Welch, May 1–June 5. Contact Baulines Craftsman's Guild, Box 305, Bolinas, 94924.

Seminars/workshops—James Krenov, June

24–25; projects course, June 27–July 30; tool-making, Aug. 1–13; joinery, Aug. 15–Sept. 3. College of the Redwoods, 440 Alger St., Ft. Bragg, 95437. (707) 964-7056.

COLORADO: Exhibition—Sculpture, June 5–July 10. Foothills Art Ctr., 809 15th St., Golden, 80401. (303) 279-3922.

CONNECTICUT: Workshops—Design for woodworkers, Michael Hurwitz, April 30–May 1; photographing crafts, Bob Hanson, April 30–May 1; lapstraking for boatbuilders, Simon Watts, May 7–8; natural basketry, Jean Farley, May 7–8; Windsor chairmaking, Michael Dunbar, May 14–15; survey of contemporary woodworking, John Kelsey, May 21; Colonial woodworking, Mack Headley, June 25–26; inlay and marquetry, Silas Kopf, July 16–17; chairbuilding, John Alexander, Aug. 8–12; wooden boatbuilding, Simon Watts, Aug. 15–21; Exhibit—Tools of the Woodworker, Aug. 7–Sept. 18. Crafts Ctr., Box 122, Brookfield, 06804. (203) 775-4526.

Crafts show—Conn. craftsmen, August, at The Guilford Hand Crafts Ctr. Contact Peter M. Petrochko, 370 Quaker Farms Rd., Oxford, 06483. (203) 888-9835.

Workshop—Lute building, July 24–30, Hartford. Sponsored by Lute Society of America. Contact Lawrence Lundy, 505 Elmside Blvd., Madison, Wisconsin 53704.

WASHINGTON, D.C.: Show/sale—Nationwide wood and crafts, May 6–8. Smithsonian Institution's Departmental Auditorium, 1300 Constitution Ave. N.W.

GEORGIA: Workshops—Advanced hand and machine joinery, May 14–15; frame and panel, June 11–12; carcase and drawer, July 9–10. Contact John McGee, 218 S. Boule-

vard, Carrollton, 30117. (404) 834-7373. Workshop—Shoji, Toshio Odate, May 20–22. Highland Hardware, 1034 N. Highland Ave. N.E., Atlanta, 30306. (404) 872-4466.

ILLINOIS: Juried festival—June 18–19. Contact Evanston Chamber of Commerce, 807 Davis St., Evanston, 60201. (312) 328-1500.

INDIANA: Juried fair—June 11–12, Talbot St. Art Fair. Contact Joan Kisner, 630 N. Washington St., Danville, 46122.

IOWA: Crafts exposition—Sept. 1–4, Potawattamie County fairgrounds, Avoca. Contact Bob Everhart, 106 Navajo, Council Bluffs, 51501. (712) 366-1136.

KANSAS: Exhibition—All media. Larry Peters, Topeka Public Library Gallery, 1515 W. 10th St., Topeka, 66604. (913) 233-2040.

KENTUCKY: Symposiums—Turning, June 16–18, Osolnik, Nish; turning and joinery, July 14–16 (Berea Craft Festival, July 15–17), Rude Osolnik, Warren May, Terry Fields. Contact James R. Hall, Berea College, CPO 758, Berea 40404. (606) 986-9341, ext. 440.

MAINE: Workshops—Hand-tool ingenuity, Sam Manning; plywood lapstrake boatbuilding, Geoffrey Schofield. For catalog, write WoodenBoat School, Box 78F, Brooklin, 04616. (207) 359-4651.

MARYLAND: Crafts festivals—A number of arts and crafts shows to be held in '83. Write Deann Verdier, Sugarloaf Mountain Works, Ijamsville, 21754. (301) 831-9191.

MASSACHUSETTS: Juried exhibition—Work of cabinetmaking and furnituremaking stu-

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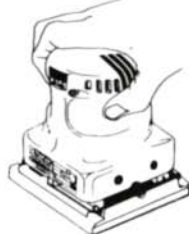
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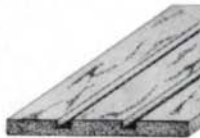
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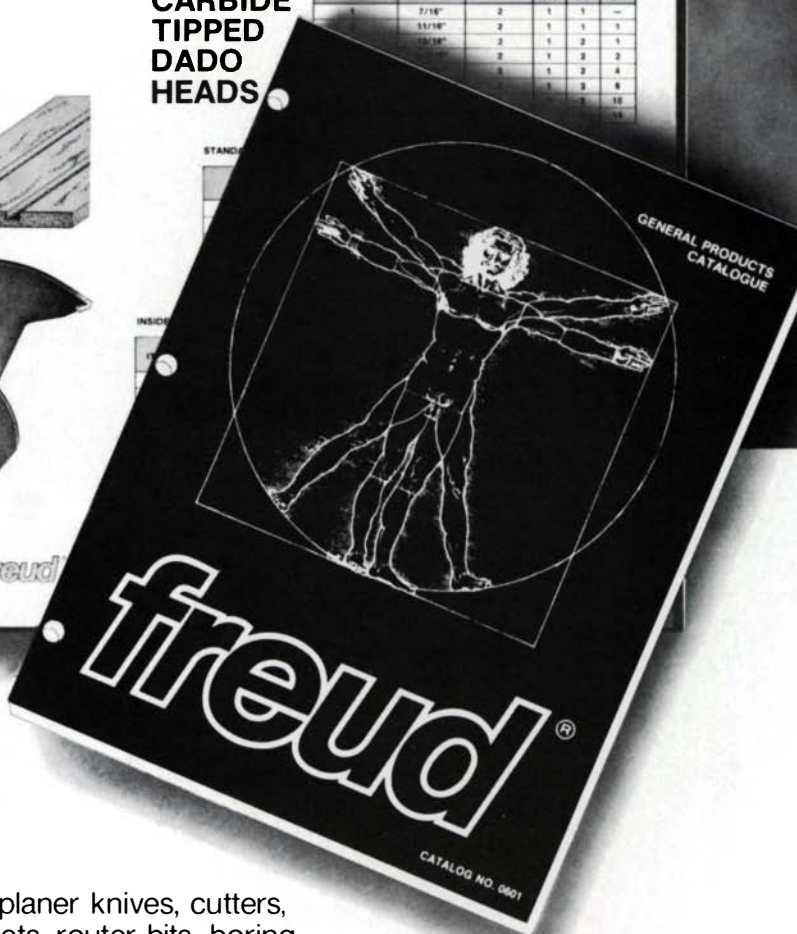
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2	1 1/16"	2	1 1 1
3	1 1/8"	2	1 2 1
4	1 1/4"	2	1 3 2
5	1 3/8"	2	1 3 4
6	1 7/8"	2	1 3 6
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dents, March 8–May 30. North Benet Street School, 39 N. Benet St., Boston, 02113.

Seminar—Toshio Odate, May 6–8. Preregister. Contact Pat Elsdon, Education Dept., George Walter Vincent Smith Art Museum, 222 State St., Springfield, 01103. (413) 733-4214.

Craft fair—May 13–15. Worcester Craft Fair, 25 Sagamore Rd., Worcester, 01605.

Workshop—Theorem Painting and The Work of the Country Cabinetmaker, Old Sturbridge Village, Sturbridge, 01566. (617) 347-3362.

MICHIGAN: Show—Carving, May 1. Lindell Arena, 1403 Lexington Blvd., Royal Oak.

MINNESOTA: Juried exhibition—Furniture, carving and accessories. Minneapolis, fall of '83. Write Minnesota Woodworkers' Guild, Box 8372, Minneapolis, 55408.

MONTANA: Seminar—Doug Ayers, Fredrico Armijo, Art Carpenter, Bob Stocksdale, Dean Santner, Gary Bennett, May 27–29, Montana S.U., Bozeman. Contact Doug Polette, Dept. of Ag. and Indust. Ed., Mont. S.U., 59717.

NEVADA: Juried craft fair—KNPR Craftworks Market, Oct. 28–30, slide deadline Aug. 1. Write Craftworks, 5151 Boulder Hwy., Las Vegas, 89122. (702) 456-6695.

NEW JERSEY: Auction—Catalog sale of antique and usable tools, April 30. Contact Harry J. O'Neill, Jr., RD #2, Box 176, Annandale, 08801. (201) 638-6981.

NEW YORK: International competition—New office furniture. Exhibition at the Musee des Arts Decoratifs in Paris through April 1984. Write Cultural Competition, 972 Fifth Ave., New York, N.Y. 10021, or Concours Mobilier, Commissariat General du Concours, Pavillon

de Marsan, 107 rue de Rivoli, 75001 Paris.

Exhibition—Wood and Wood Not, March 31–May 8. Workbench Gallery, 470 Park Ave., New York, 10016.

Juried fair—Bazaar Mall, May 28–30, Mt. Kisco; Croton Point Park, Sept. 24–25. Send slides to Monya Brown, 33 Lexington Dr., Croton-on-Hudson, 10520. (914) 271-5302.

Rhinebeck—Trade, June 21–22, public, June 24–26. Dutchess County Fairgrounds, Rhinebeck. American Craft Enterprises, Box 10, New Paltz, 12561. (914) 255-0039.

Exhibition/presentation—Art of Woodturning, through May 13; working with rare hardwoods, Bob Stocksdale, May 3–5. American Craft Museum II, International Paper Plaza, 77 W. 45th St., New York, 10036.

Workshops—Japanese woodworking, Toshio Odate, June 10–12; history of furniture 1750–present, Christopher Monkhouse, June 18–19; Windsor chairmaking, Michael Dunbar, June 20–24; furniture design and construction, Lee Schuette, June 22–July 8; turning, Stephen Hogbin, July 11–15; post-and-beam construction, Rick McAulay, July 18–29 and Aug. 1–12; furniture drawing and design, Wendell Castle and Wm. Sloane, July 25–29; inlay and surface embellishments, Richard Newman, Aug. 1–5; bentwood lamination, Michael Cooper, Aug. 8–12; working with green wood, John D. Alexander, Aug. 22–26. Contact Lanham Deal, 18 Maple St., Box 36, Scottsville, 14546. (716) 889-2378.

Exhibition and sale—Croton Point Park, Croton-on-Hudson, June 18–19. Write Great Hudson River Revival, Penny Cohen, RD 1, Box 304, Putnam Valley, 10579.

Juried festival—At Lincoln Center, New York City, July 2–3.

Juried fair—May 27–30, Sept. 2–5. Ulster County fairgrounds, New Paltz. Contact Quail Hollow Events, Box 437B, Woodstock,

12498. (914) 679-8087.

Summer workshops—Lake Placid. Write Special Programs, Parsons School of Design, 66 Fifth Ave., N.Y., 10011. (212) 741-8975.

Workshops—All crafts, weekend and longer. For brochure, write Woodstock Guild of Craftsmen, 34 Tinker St., Woodstock, 12498. (914) 679-2079.

Exhibit—Carvings and decoys, Sept. 17–18, American Civic Assoc., Binghamton. Robt. Fischer, 3520 Vestal Rd., Vestal, 13850.

Workshops—Make a classical guitar during July 11–22 or Aug. 8–19; Japanese hand tools, waterstone, bench, June 13–17, Aug. 1–5; subscription series, May 14–15; varnish making and application, Aug. 20–21. Robert Meadow, The Luthierie, 2449 W. Saugerties Rd., Saugerties, 12477. (914) 246-5207.

Seminar—Instrument making, Robert Meadow, Foundation for Baroque Music, RD 1, Wilton Rd., Greenfield Ctr., 12833.

Exhibit/sale—Sculpture, May 10–June 25, Jeffrey Briggs, Michael Coffey, Walter Horak. Verbena Gallery, Fourth Floor, 16 W. 56th St., New York, 10019. (212) 586-3606.

Exhibition—Second-year graduate students of Jamestown Community College Artisan Ctr., May 2–6, Jamestown Municipal Bldg., Jamestown, 14701.

Courses—Craft Students League begins June 6; free demonstration, old tools, June 1. Maurice Fraser, YWCA, 610 Lexington Ave. (at 53rd St.), New York, 10022. (212) 755-2700.

NORTH CAROLINA: Workshops—Two- and three-week workshops beginning May 30 through Aug. 26, with John McNaughton, Wendy Maruyama, Hunter Kariher, Simon Watts, Seth Strem, David Ellsworth, David Anhalt, Dan Rodriguez. Penland School of Crafts, Penland, 28765. (704) 765-2359.

Country Workshops—Chairmaking, Dave



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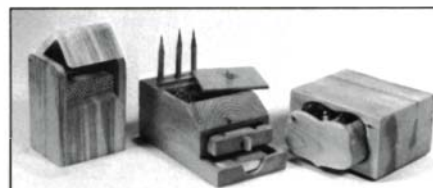
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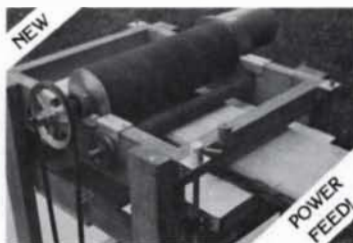
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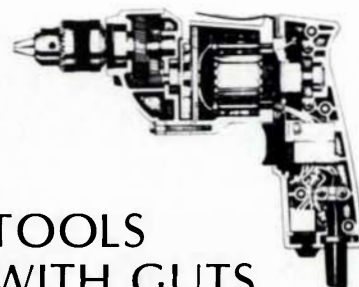
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Events (continued)

Sawyer, July 4-8, July 25-29; Japanese woodworking, Carl Swensson, Aug. 1-5; knife, ax and adze, Aug. 15-19, & cooperage, Aug. 29-Sept. 2, Drew Langsner, Country Workshops, Rt. 3, Box 262, Marshall, 28753. Exhibit/fair—Cherokee Crafts Today, through May. Main gallery, Folk Art Ctr., Blue Ridge Pky., Asheville. Fairs—Asheville Civic Ctr., Haywood St., July 20-23, Oct. 20-22. Contact James Gentry, S. Highland Handicraft Guild, Box 9545, Asheville. (704) 298-7928. Workshops—Basketry, blacksmithing, carving, dulcimer making, country woodcraft, May 1-June 5. The John C. Campbell Folk School, Brasstown, 28902. (704) 837-2775.

OHIO: Course—Timber frame housebuilding, Ed Levin, Anita and Roy Tiede, June 12-18. Contact American Restoration Trades, Box 255, Danville, 43014. (614) 599-7959 (eves.). Workshop—Equipment maintenance and repair, June 13-18. Contact Dr. R.A. Kruppa, School of Technology, Bowling Green S.U., Bowling Green, 43403. (419) 372-2436.

OKLAHOMA: Carving show—July 8-10, Woodland Hills Mall, 71st and S. Memorial, Tulsa. Contact Jim Inman, (918) 627-1602.

OREGON: Exhibits—Containers, through May 26; desk accessories, May 20-June 23. The Real Mother Goose Gallery, 901 S.W. Yamhill, Portland, 97205. (503) 223-9510. Juried show—Furniture, turning, instruments, Willamette Valley woodworkers, June 10-12, Eugene Hilton Hotel. Contact Steve Gellman, 957 W. 1st, Eugene, 97402. (503) 344-6099.

PENNSYLVANIA: Exhibition—Port of History Museum, Penns Landing. May 20-July 4. Write Society of Phila. Woodworkers, 4101

Lauriston St., Phila., 19128. Show/sale—Lancaster Co. Woodcarvers, April 30-May 1. Recreation Ctr., 21 N. Spruce St., Lititz, 17543. Contact Charles A. Smith, 311 Valley View Dr., New Holland, 17557. Crafts exhibition—July 5, Museum of Art, Pa. State Univ., Univ. Park.

Juried exposition—In Pittsburgh, Nov. '83. Deadline Aug. 1. Contact Quail Hollow Events, Box 437B, Woodstock, N.Y. 12498. (914) 679-8087.

Juried craft festival—Longs Park, Sept. 3-5. Slides. Write Longs Park Amphitheater Foundation, Box 5153, Lancaster, 17601.

Conference—Wood-processing health hazards, June 16. Contact Laurie Humphreys, Continuing Ed. Dept. 4006, The Pa. State Univ. of The Milton S. Hershey Medical Ctr., Hershey, 17033. (717) 534-6495.

Show—"The Woodworker," at Phila. Armory in Sept. Deadline May 20. Craft Market America, Box 30, Sugarloaf, N.Y. 10981.

RHODE ISLAND: Craft fair—July 22-24, Newport Yachting Ctr. Contact American Craft Enterprises, Box 10, New Paltz, N.Y. 12561. (914) 255-0039.

TENNESSEE: Workshops/juried exhibition—Impressions/Patterns, through May 30; woodturning, Dale Nish, June 6-10; furniture construction, Jere Osgood, July 4-15; turning, David Ellsworth, Aug. 8-12, Aug. 15-19; Sam Maloof, May 13-15. Arrowmont School of Arts and Crafts, Box 567, Gatlinburg, 37738. (615) 436-5860.

Courses—Lapstrake canoebuilding, Thomas Hill, June 13-24; woodturning, Rude Osolnik, June 27-July 1; marquetry and inlay, Silas Kopf, July 4-8; furnituremaking, John Dunnigan, July 18-29; production woodworking, Bradford Smith, Aug. 15-19, resto-

ration workshop, Adam Turtle, Aug. 1-5. Appalachian Ctr. for Crafts, Box 347A-1, Rt. 3, Smithville, 37166. (615) 597-6801. Exhibition/sale—E. Tenn. woodworkers, May. McMinn Co. Living Heritage Museum, Tenn. Wesleyan Campus, Athens, 37303.

TEXAS: Show—Open to Austin area woodworkers, Nov. 11-20. Deadline Aug. 1. Austin Woodworkers Guild, 225 N. Congress, Suite 156, Austin, 78701. (512) 282-0493.

UTAH: Workshops—Turning, May 2-6, Ray Key; Dale Nish, May 16-20, May 23-27, June 27-July 1, July 25-29, Aug. 1-5; Rude Osolnik, Sept. 19-23. Craft Supplies, 1644 S. State, Provo, 84601. (801) 373-0917. Workshop—Gamebird carving with Richard LeMaster, July 18-22. Write Nish, Brigham Young Univ., Provo, 84602. (801) 378-6491.

VERMONT: Workshops—Baskets: Tradition/Art, through June 4. Vermont State Craft Ctr., Frog Hollow, Middlebury, 05753. Classes—Furniture conservation and restoration, June 6-11; woodworking skills, June 13-18, Aug. 1-6; furniture, June 20-25; machine woodwork, June 27-July 2, July 18-23; frame and panel, July 25-30; carcass and drawer, Aug. 8-13. Write Kirby Studios, N. Bennington, 05257. (802) 442-3119.

VIRGINIA: Exhibit—Work of Peter Kramer, May 14-15, Rush River Gallery, Gay St., Washington, Va. 22747. (703) 675-3625. Craft fair—Richmond Arena, Nov. 10-13. Slide deadline June 1. Contact Jan Dettler, Hand Workshop, 1001 E. Clay St., Richmond 23219. (804) 649-0674.

WASHINGTON: Exhibition—Studies in knockdown furniture, Curtis Erpelding, May


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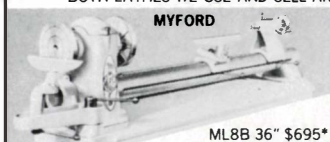
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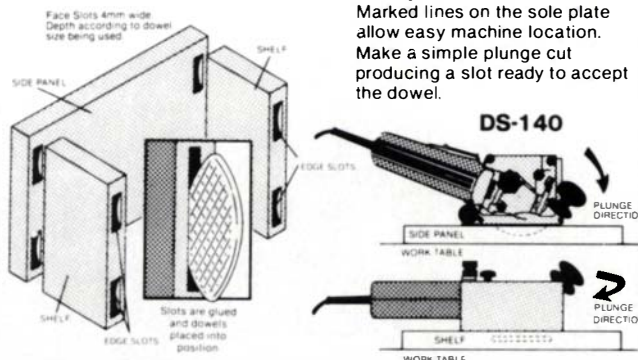
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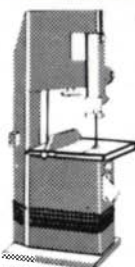
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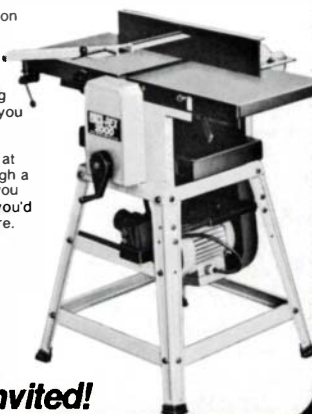
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19-June 19. Northwest Gallery, 202 1st Ave. S., Seattle, 98104. (206) 625-0542.
Saturday workshops—Lofing, May 7; carvel and lapstrake, May 21; one-day skiff, July 9. NW School of Wooden Boatbuilding, 330-10th St., Port Townsend, 98368. (206) 385-4948. As of June '83: 251 Otto St., Glenn Cove Indus. Pk., Port Townsend, 98368.

WISCONSIN: Lecture—Sculpture and Japanese woodworking, Toshio Odate, April 29-May 1. Write Punkin Hollow Wood and Tool, N34 W24041 Capitol Dr., Pewaukee, 53072. (414) 691-9411, (800) 558-8665.
Workshops/exhibition/sale—Carving, musical instr., wood I.D., furn. design, turning; trade show: tools, machines, equipment. July 15-17. Cont. Ed., Univ. of Wisconsin-Stout, Menomonie, 54751. (715) 232-1167.
Exhibition—Wisconsin Wood '83, functional furniture and utilitarian objects by Wisconsin artists, March 27-May 1. Charles A. Wustum Museum of Fine Arts, 2519 Northwestern Ave., Racine, 53404. (414) 636-9177.
Arts/crafts festival—Downtown Menasha, July 16. Deadline June 15. Mark F. Janness, Box 201, Menasha, 54952. (414) 725-3756.

QUEBEC: Show—Canada/Wood '83, Oct. 27-30. Write Cahners Expo Group, 12233 W. Olympic Blvd., Suite 236, Los Angeles, Calif. 90064. (213) 826-6070.

NOVA SCOTIA: Workshop—Lofing the Small Boat, Tom Klenck, Kim Aaboe, mid-May. Contact Richard Tyner, 32 Edmonds Grounds, Halifax, B3N 1M6. (902) 434-7170 or (902) 477-3008.

ENGLAND: Summer courses—One week each, start Aug. 7. Alan Peters, Aller Studios, Kentisbeare, Cullompton, Devon, EX15 2BU.

Connections

In Connections we'll publish membership calls for guild-style organizations, letters from authors compiling directories in which craftsmen might like to be listed, and appeals from readers with special interests looking for others who share them.

Computers in Craft seminar: Boston University's Program in Artisanry in fall of '83. If you have information about people using computers for business, technical or design applications, please contact Pat Doran at PIA, B. U., 620 Commonwealth Ave., Boston, Mass. 02215. (617) 353-2022.

East Texas Woodworkers welcome new members to their newly formed association. Meetings are held the second and last Thursdays of each month at 121 Railroad Ave. S., Humble, Texas 77338. Hank Beymer, (713) 540-1575.

Southwest Pa. woodworkers would like to form a guild and co-op. Michael L. Pierich, Box 76, Crabtree, Pa. 15624.

New association: Kentucky Woodworking Assoc., 505 E. High St., Lexington, 40508.

Oregon guild: New, but full of energy. Contact David Crafton, (503) 243-2824, or Peter Clark, (503) 244-3806.

The Reed Organ Society invites all reed organ enthusiasts, collectors, amateur and professional musicians and restorers to join this new non-profit organization. For details, write Mr./Mrs. D.A. Williams, 281 Green Terrace, Clarksboro, N.J. 08020.

Tool and Trades History Society is dedicated to hand tools, their use and the craftsmen who

use them. Write Philip Walker, Winston Grange, Debenham, Suffolk, England.

Willamette Valley Woodworking: Turners, furnituremakers, instrument makers and boatbuilders. Contact Steve Gellman, 957 W. 1st, Eugene, Ore. 97402. (503) 344-6099.

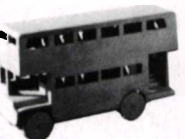
Toolboxes and tool chests seem worthy of a book. If you'd like to help, send me snapshots, drawings, descriptions, and I'll try to find a publisher. Phil Tomlinson, 157 Chestnut St., Apt. K22, Ithaca, N.Y. 14850.

More about schools

We've already received a few notes and calls from schools that slipped by us in our survey in the March issue. We will have our formal tally in the July issue, as promised, but in the meantime, prospective summer students might want catalogs from these:

Haystack Mountain School of Crafts
Deer Isle, Maine 04627.
Parsons School of Design
66 Fifth Ave., New York, N.Y. 10011.
Craft Students League, YWCA
610 Lex. Ave., New York, N.Y. 10022.
Univ. of Wisconsin-Stout
Menomonie, Wis. 54751.
Bucks County Community College
Newtown, Pa. 18940.
The WoodenBoat School
Box 78, Brooklin, Maine 04616.
Berea College Woodcraft
CPO Box 2320, Berea, Ky. 40404.
Vermont Instrument Workshop
Box 115, Post Mills, Vt. 05058.
Jamestown Community College
Jamestown, N.Y. 14701.

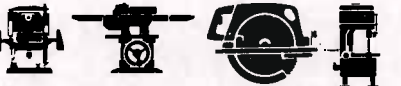
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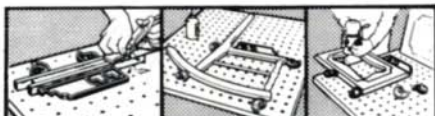


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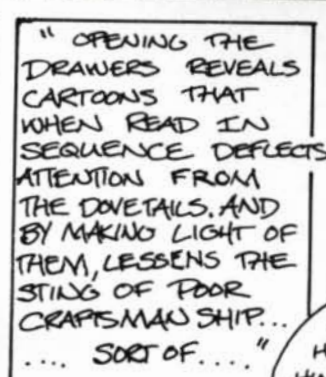
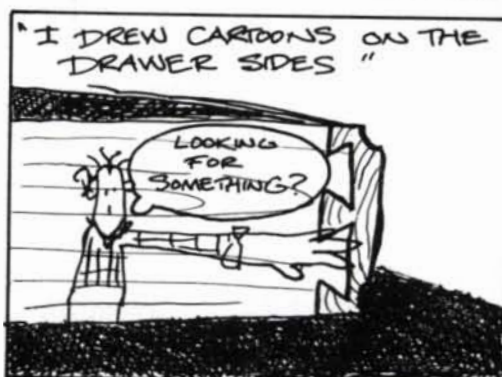
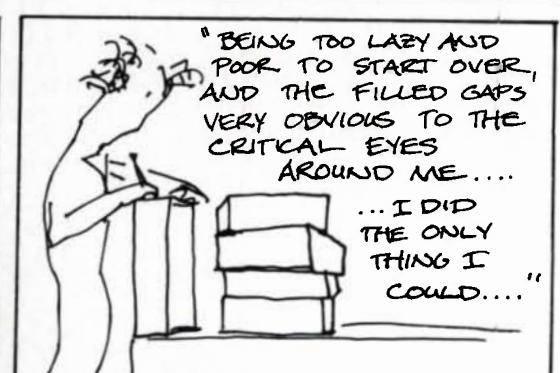
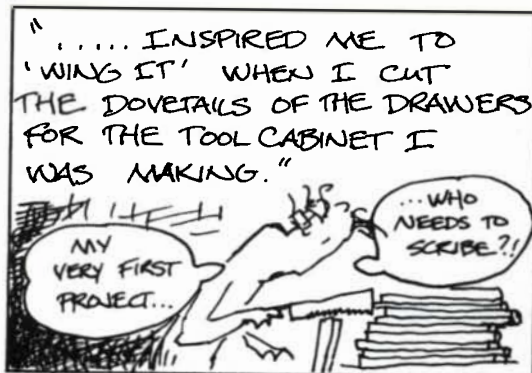
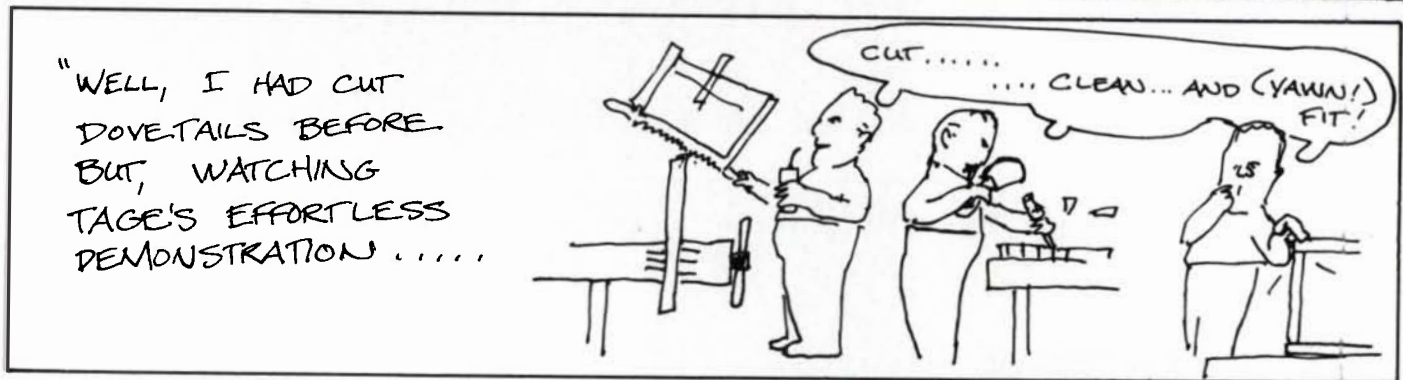
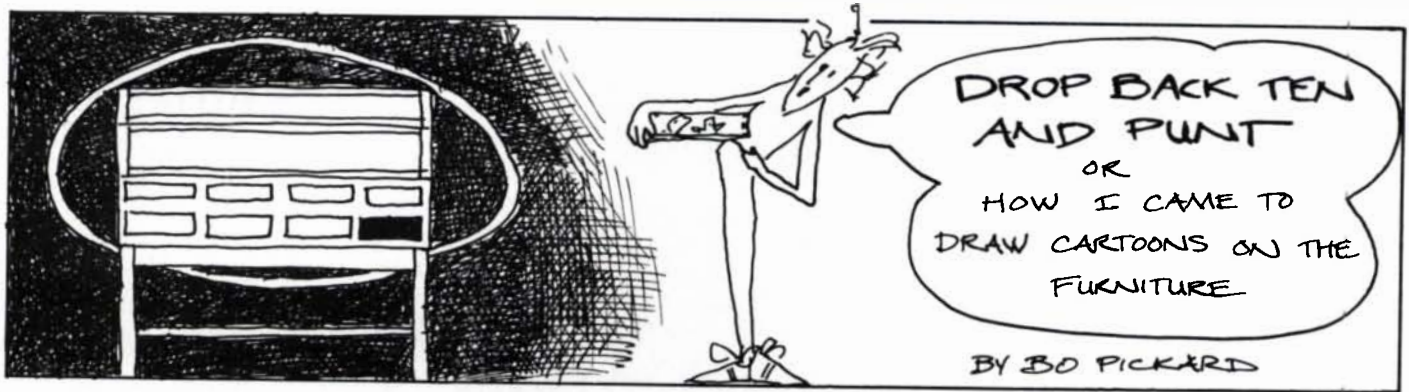
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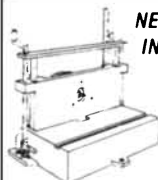
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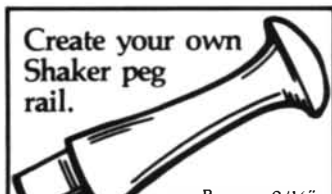
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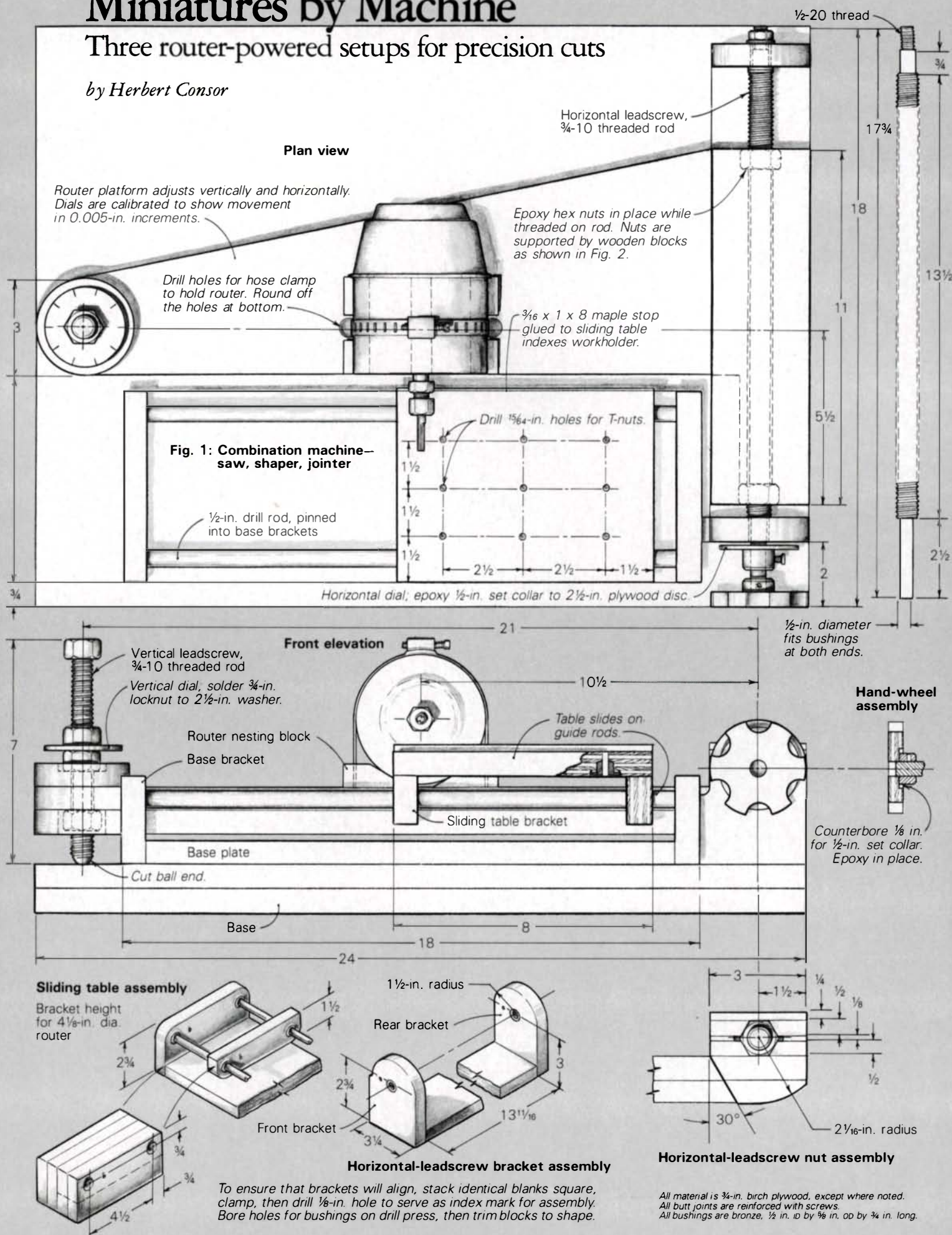
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Miniatures by Machine

Three router-powered setups for precision cuts

by Herbert Consor



All material is 3/4-in. birch plywood, except where noted. All butt joints are reinforced with screws. All bushings are bronze, 1/2 in. ID by 3/8 in. OD by 3/4 in. long.

Despite having made a lot of full-scale and half-scale furniture, I found I was totally unprepared when I was first bitten by the $\frac{1}{12}$ -size miniature bug. The techniques, equipment and measuring tools that had worked so well in the past just wouldn't cut the mustard. So I designed three router-powered machines for precision work: a combination machine (saw, shaper and jointer), a duplicating lathe, and a miniature pin router. Any one of them might prove just as useful for a woodworker making small, precise, full-scale parts.

Close cutting—A miniaturist has to work to precise dimensions or the piece just won't look right. So that I don't have to deal with unwieldy fractions, I convert measurements down to the nearest thousandth of an inch. In general, dimensions don't have to be machined *exactly*, but they should all be close. I usually work to the nearest 0.005 in., but sometimes closer. If each of the dimensions on the face of a typical cornice molding is enlarged by 0.005 in., for example, the equivalent full-scale error amounts to almost $\frac{1}{2}$ in. This is considerable, and just as such an error would ruin the looks of a full-scale piece, so will it ruin a miniature.

In designing the machines, I started out with some clear ideas about the problems they would have to cope with. Miniature parts, for instance, are too small to be safely held by hand. So as one of my first decisions, I borrowed the workholder idea from metalworking practices—the work would be rigidly clamped, and the cutter-to-workpiece relationship controlled by ways, leadscrews, cams, templates and stops.

I knew that normal cutting-tool forces could deflect, split or break the fragile parts. Supporting the work in the holder would partly prevent this, but I also wanted to minimize cutting forces. I accomplished this by allowing for very precise travel, and by using extremely high cutter speeds with controlled feed and depth-of-cut adjustments for taking light cuts. Despite my strong prejudice in favor of heavy cast-iron

machinery, the tool forces are so low that the wooden construction of my machines hasn't led to problems.

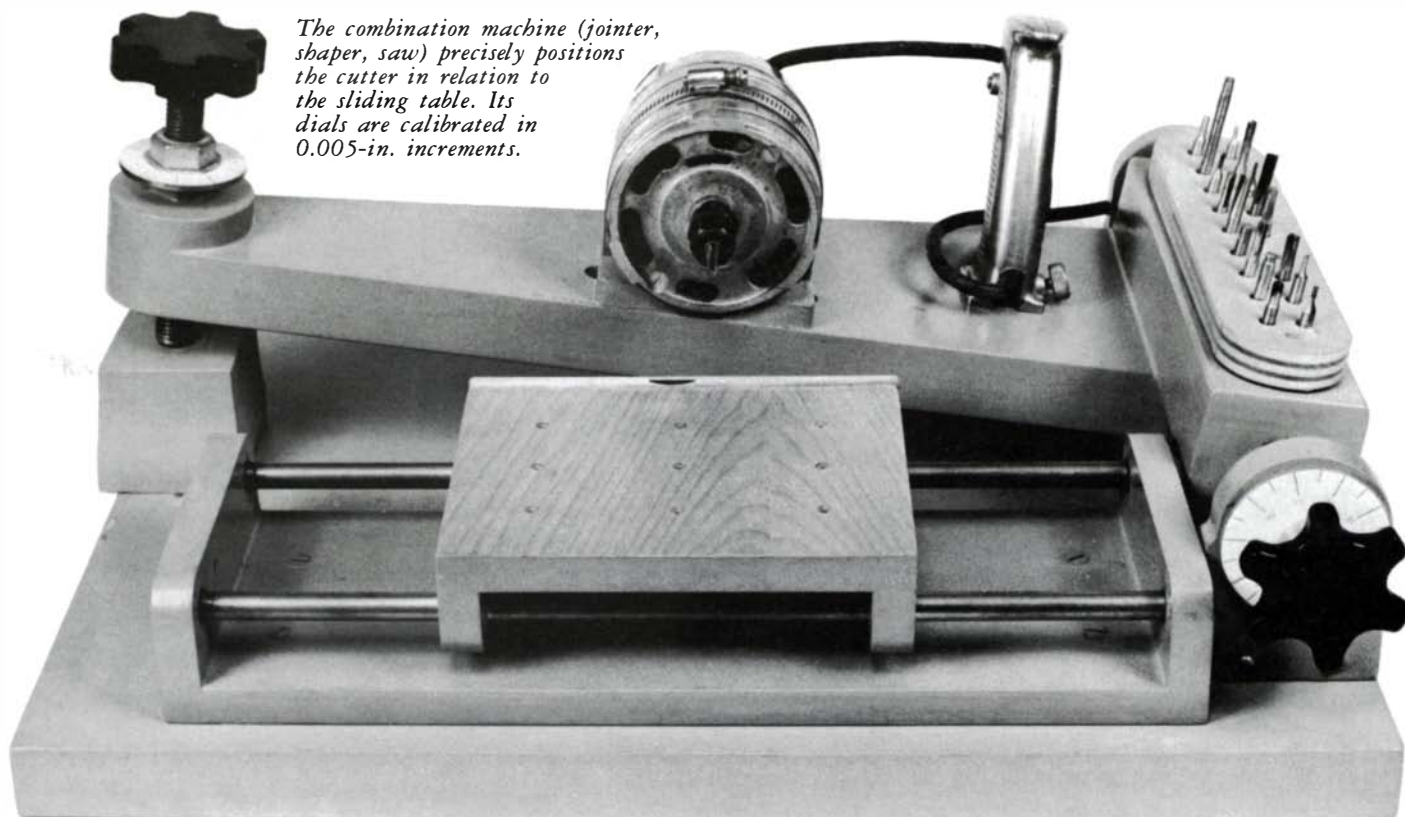
In addition, I tried to design machines that required little precision metalworking to build. I don't have the equipment these days to do metal turning and milling, so I wanted to job out that work without spending a fortune. In the end, the total cost of outside work—machining the leadscrews and spindles—came to \$40.

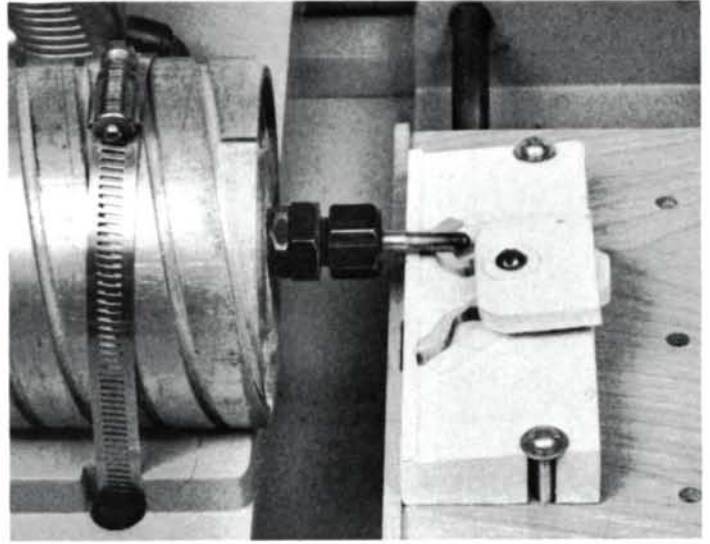
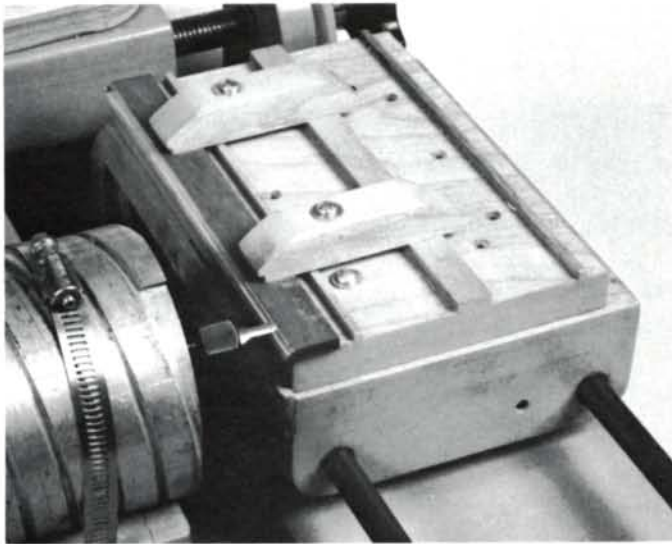
My three machines take care of all normal operations except drilling, rough-cutting and thicknessing. For the latter, a thickness sander is a must. Mine is an old belt sander rigged up with a sliding table. For the first two operations, I use conventional equipment.

Combination saw, shaper, jointer—The drawing on the facing page and the photo, below, will show you how this machine works. Its table, with various workholders attached, slides by hand on drill-rod support rods, and will carry a variety of workholders past the horizontally mounted router motor. Drill rod, instead of cold-rolled steel, offers greater stiffness, and its accurately ground surface makes a better fit and smoother movement in the bearings. The router's position can be accurately adjusted by means of the two leadscrews, one of which raises the platform the router is attached to, while the other moves the platform forward and back.

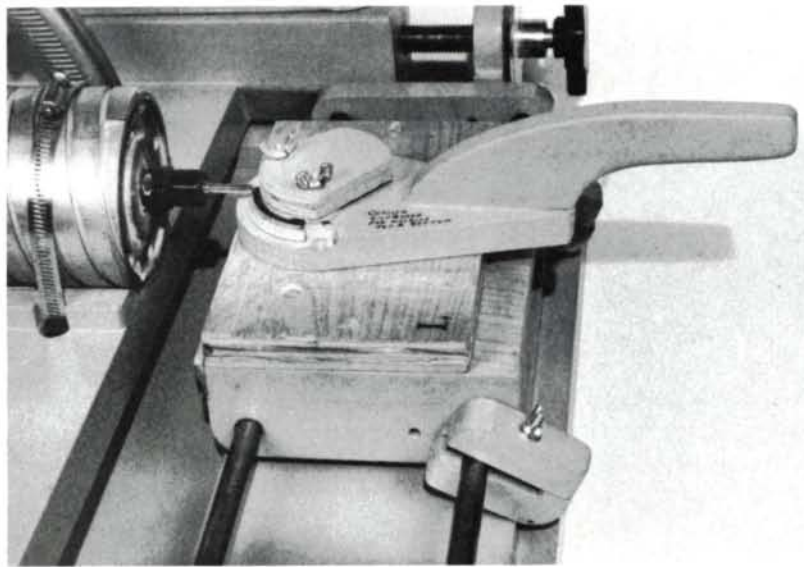
The two leadscrews are $\frac{3}{4}$ -10 threaded rod with rolled thread instead of cut thread. You'll probably have to get them at an industrial supply house, but it's worth the trouble—the action is much smoother. Brass nuts make the action smoother still. One turn of the screws will move the embedded nuts $\frac{1}{10}$ in. (0.100 in.). Thus, on the horizontal leadscrew, an indicator dial with 20 divisions shows back-and-forth cutter movement in increments of 0.005 in. To allow vertical movement, the router platform pivots up and down on the horizontal leadscrew as the vertical leadscrew is

The combination machine (jointer, shaper, saw) precisely positions the cutter in relation to the sliding table. Its dials are calibrated in 0.005-in. increments.

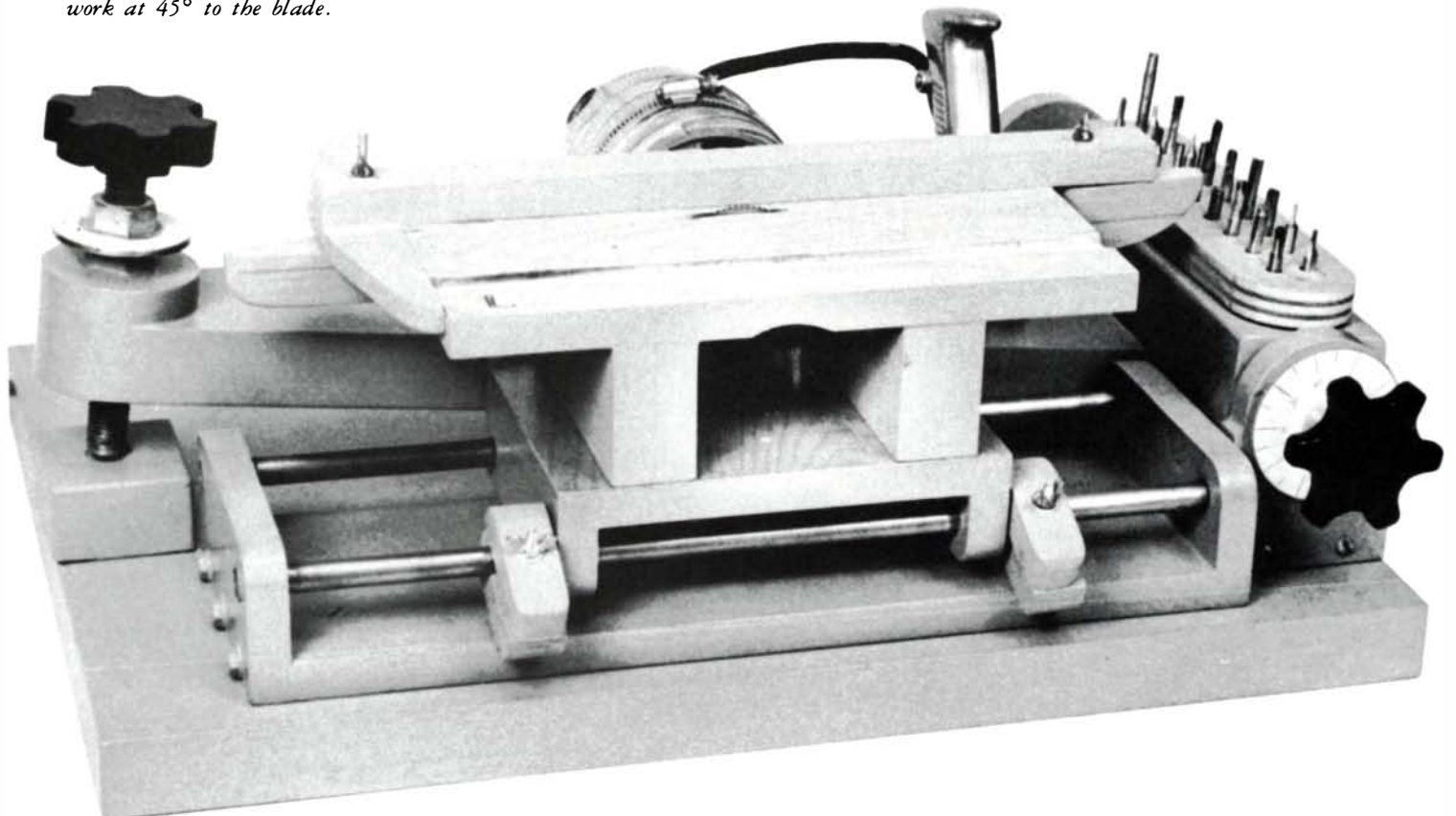




The combination machine's router wears many hats, depending on which appliance is attached to its sliding table. Clockwise from above left, it performs as a shaper, making miniature moldings element by element in a series of passes; as a surface planer, tapering the sides of a pair of pedestal-table legs held in a workholder that maintains the correct taper angle; as a curved-molding shaper, with a pivoting workholder; and, below, as a tablesaw, with rip fence in place.



The tablesaw attachment, like the workholders, bolts to the sliding table's embedded T-nuts. Clamps, visible on the front guide rod, can either lock the table in place or restrict its movement for safety. In order not to extend the vertical leadscrew beyond the point of stability, Consor made various support blocks that raise the router platform higher than its normal operating range. When ripping, he pushes the work along the fence with the sliding table stationary. When crosscutting, he slides the table while the work is held against a stop block. For mitering, he sets up a stop block that holds the work at 45° to the blade.



turned. Because the axis of the router is midway between the leadscrews, each full turn of the vertical leadscrew will move the router 0.050 in. up or down. Thus 10 divisions on the vertical leadscrew dial indicate increments of 0.005 in. Theoretically, the differing angles of the router platform introduce an error in the vertical dial reading, but the effect is inconsequential with the small angles involved.

As with most machine tools, different-size cutters preclude a fixed zero point. I bring the tool to a reference point on the workpiece, then shift to the exact cutting point by reading the dials. When I'm using the machine as a shaper (top left photo, facing page), this locating accuracy allows me to cut moldings one step at a time with straight and veining cutters. I round convex shapes by sanding them, or by grinding special cutters. You can freehand-grind one flute of a 1/4-in. bit to shape, then grind clearance on the other (*FWW* #20, pp. 69-73). As in full-scale work, moldings are best cut on wide stock that is stiff and can be clamped. They are sawn off when finished. A tapered workholder allows me to duplicate tapered legs for one piece or for a production run. Circular moldings can be cut on a rotating jig, with the sliding table fixed so that the pivot point is at the centerline of the router.

To use the machine as a jointer, clamp the work to an attachment on the sliding table, and use the end of a 1/4-in. bit to mill the edge of the work straight and smooth. It's similar to making a molding, but you make just one straight cut.

The tablesaw fixture, like most of the workholders, bolts to T-nuts in the sliding table, and it covers all but a few of the blade's teeth. After the ripping fence or cutoff gauges have been set for sawing, very exact final adjustments can be made within the width of the table slot by turning the dials.

Brackets ensure accuracy—Aside from the leadscrew adjustments, the accuracy of the machine depends on the table's traveling perpendicular to the router axis. In addition, the top face of the sliding table must be parallel to the router axis, and must not rise or fall as it moves from end to end. This alignment depends on the four brackets—two on the table itself and two on the base—that align the guide rods and the sliding table, as well as on the brackets that hold the horizontal leadscrew (figure 1). By carefully making and installing these brackets, you will achieve all the accuracy you can use.

To make the brackets, cut four identical plywood blocks, stack them flush and clamp them for drilling. Mark the stack (I drilled a small hole through it) so that you can align the blocks in the correct relationship when you set up the sliding-table assembly, then drill the holes on a drill press with a brad-point bit that will ensure a straight hole. I had planned to epoxy bronze bushings into the sliding brackets only where they are necessary to avoid wear, but I bought enough bushings from a local bearing-supply house for all the bracket holes. That way I could drill all the holes the same size and I didn't risk losing the centerline by changing bits. With this method, the spacing and relative heights of the holes will be the same in each set of blocks.

Trim the bottom of the two sliding-table brackets so they will clear the base, then mount them to the sliding table with the bushings, rods and base brackets assembled. Be sure that the table can slide freely. Epoxy the bushings to the brackets, then glue and screw the base brackets to the base, with the table and rods in place.

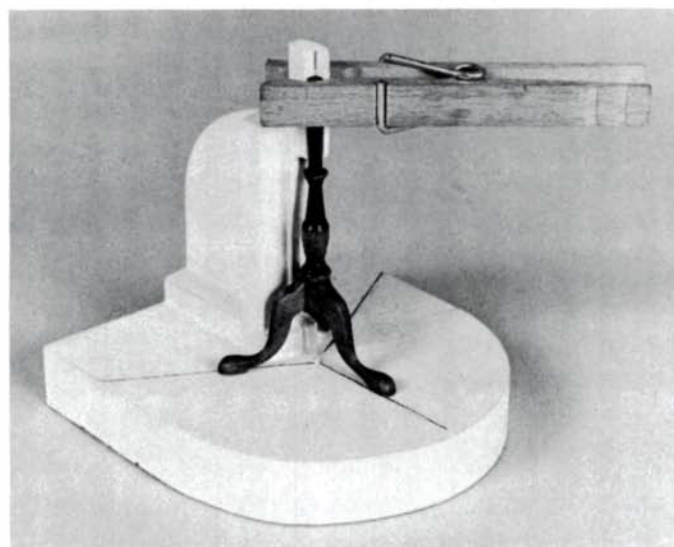
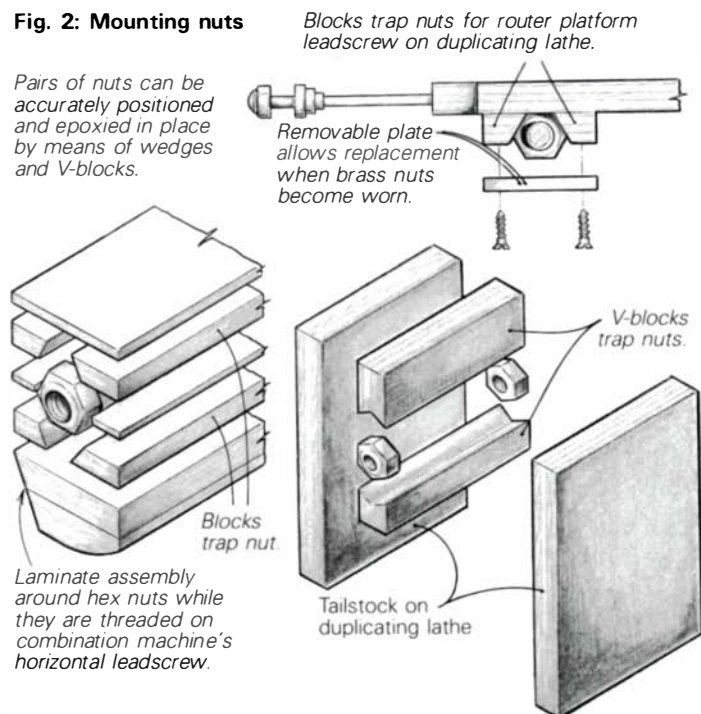
Use similar procedures for the horizontal leadscrew, but

mount it so that its centerline is perpendicular to the guide rods. This alignment doesn't have to be absolutely accurate; you can rely on a carpenter's square to check it. Figure 2 shows details of some ways I mounted nuts on these machines.

After you have installed the router platform, mount the router nesting blocks so that the router axis is perpendicular to the front face of the sliding table. When this is done, use the machine itself to make a light cut on the edge of the sliding table; this will true it exactly to the line of travel of the table. I glued a thin maple strip to the trued face so that its edge projects slightly above the surface of the table. When I mount the workholders and fixtures shown in the photos, I just push them up against the strip to locate them in relation to the cutting line. This saves a lot of measuring time.

Duplicating lathe—Despite very fine cuts and a variety of tool shapes, I encountered problems in turning slender table legs and bedposts with a small metalworking lathe. Deflec-

Fig. 2: Mounting nuts



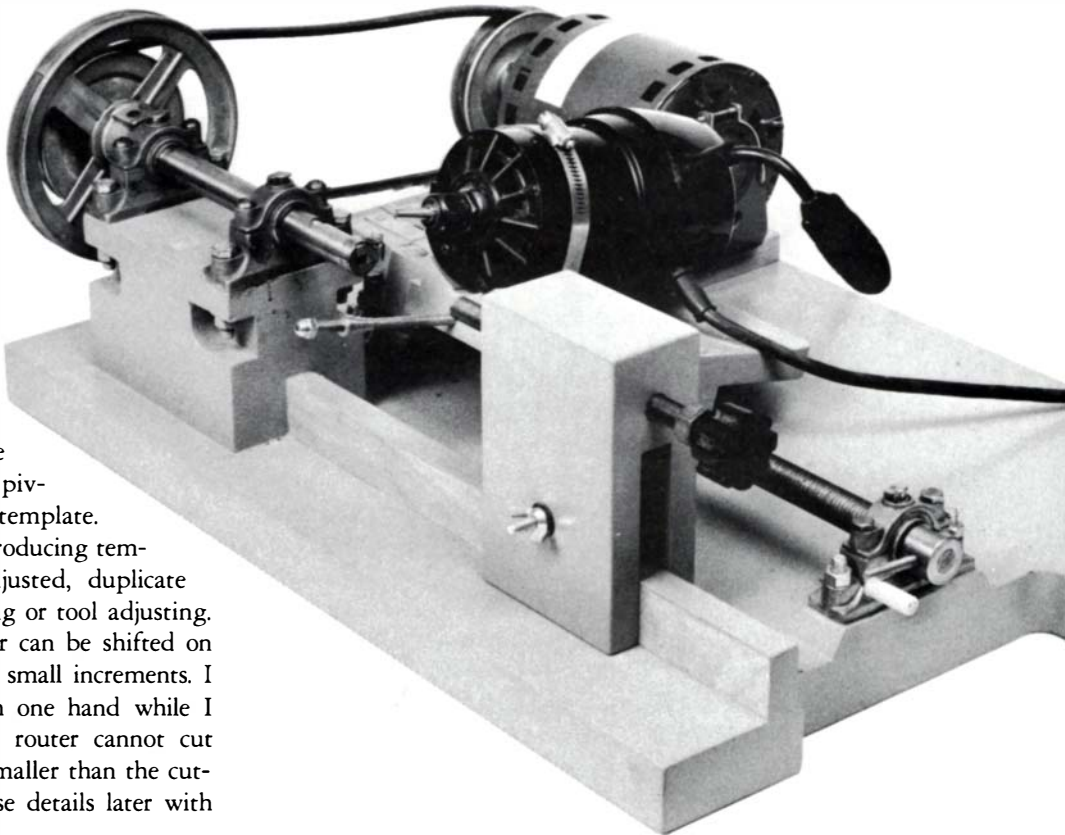
Miniatures not only need precision cutting, they call for special assembly fixtures for glue-up. The parts for this pedestal table are visible in mid-manufacture in some of the other photos.

tion of the workpiece caused out-of-round parts with non-uniform tapers and chewed-up surfaces. The template lathe, shown at right and below, cured these problems because it turns slowly, makes a light cut, and cuts mostly with the grain of the wood. In fact, the tool forces are so low that I don't usually need a steady rest or the tailstock support, and I routinely turn short parts down to as small as 1/32 in. in diameter.

With this machine, the router platform is carried from end to end on a hand-cranked leadscrew. You can vary the speed of travel to suit the cut. The router pivots until the template follower meets the template.

Figure 3 shows a method for quickly producing templates. Once the sliding wedges are adjusted, duplicate parts can be turned without any measuring or tool adjusting. A stepped spool on the template follower can be shifted on successive passes to cut the work down in small increments. I hold the spool against the template with one hand while I advance the router with the other. The router cannot cut sharp inside corners, or recesses that are smaller than the cutter diameter, but you can easily add these details later with needle files as the work rotates.

In construction of the lathe, no unusual precision is required. I mounted the pillow blocks for the headstock on a wood platform atop a block that I made from five vertical



Low cutting forces make this duplicating lathe ideal for turning fragile miniatures. The 1/4-in. template follower, below, is fitted with a stepped spool that allows depth-of-cut to be gradually increased as the blank is cut down to final form.

Fig. 3: Lathe-template construction

The template is a series of 1/8-in. wide blocks glued to the top wedge. The height of each block can be figured from the table, below right.

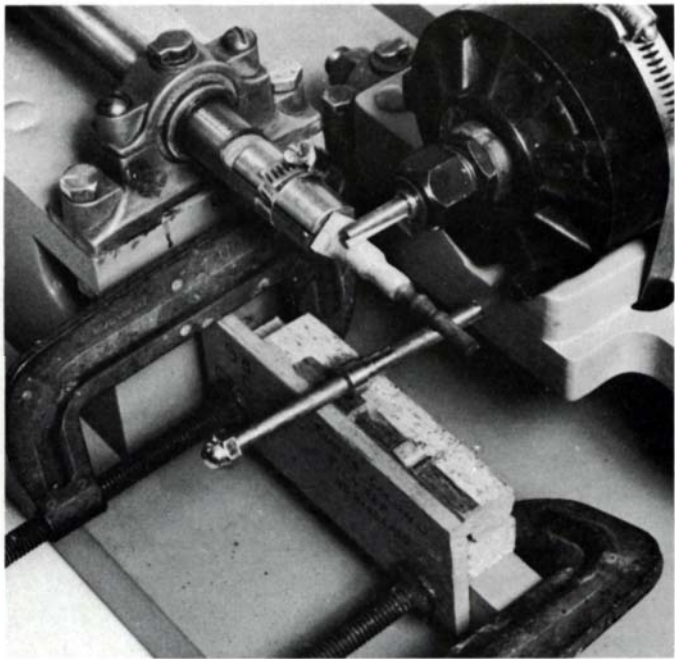
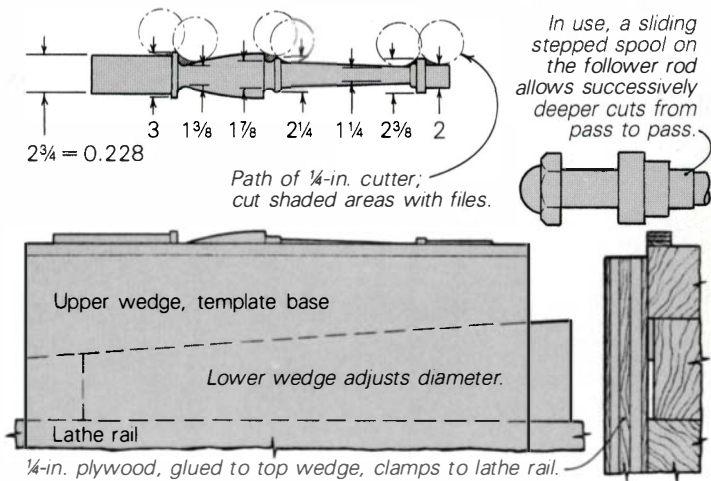
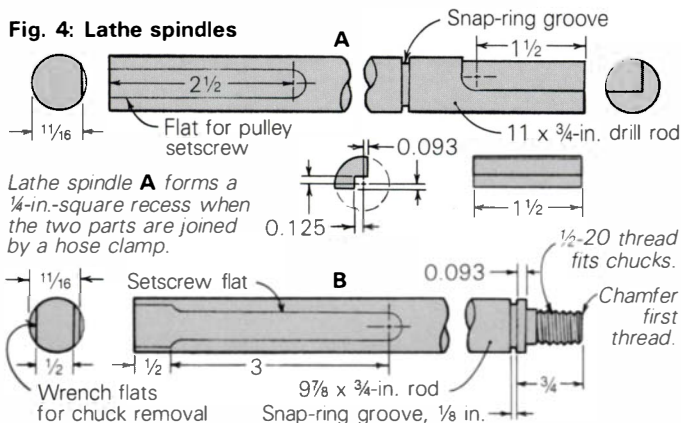


Fig. 4: Lathe spindles



Template Heights			
Diameter full-size	Radius full-size	Radius at 1/12 scale	Height above smallest radius
1 1/4	5/8	0.052	0
1 3/8	11/16	0.057	0.005
1 7/8	15/16	0.078	0.026
2	1	0.083	0.031
2 1/4	1 1/8	0.093	0.041
2 3/8	1 3/16	0.099	0.047
2 3/4	1 3/8	0.114	0.062
3	1 1/2	0.125	0.073

$\frac{3}{4}$ -in. thick pieces of wood laminated together. I left the center piece of the stack long to form the rail on which the tailstock rides, which is also the resting surface for the templates. To ensure that the template is parallel to the spindle, cut the top surface of the rail parallel to the top surface of the block.

First glue the headstock block and rail to the base. Then line up the pillow blocks: Take a 36-in. long, $\frac{3}{4}$ -in. diameter drill rod (from which you will later make the spindles), insert it through the pillow blocks and sandwich it between two boards clamped to the sides of the rail. This ensures that the spindle is parallel to the rail. When everything lines up, epoxy the pillow blocks to the headstock block. Wait until the epoxy has set before you drill and bolt the pillow blocks.

The tailstock spindle is $\frac{1}{2}$ -20 threaded rod (which fits a standard $\frac{1}{2}$ -in. Jacobs chuck) running through two nuts epoxied into the tailstock (figure 2). The $\frac{3}{4}$ -in. spindle in the headstock and the $\frac{1}{2}$ -in. threaded rod in the tailstock must line up exactly. Rather than attempting to line them up by measuring, I used the pillow blocks to register the height of the tailstock spindle. To do this, I supported a length of $\frac{1}{2}$ -in. threaded rod in the pillow blocks by means of two shopmade wood bushings. Centered by the pillow blocks, the threaded rod was thus in the correct position for the tailstock. I then threaded two nuts on the far end of the rod, and built up and epoxied the tailstock around the nuts.

The double-pulley drive provides speeds for low-speed turning as well as for high-speed sanding and filing. A simple, hinged motor mount provides quick belt-shifting.

The specific dimensions of the machine depend on the diameter of your router. In a horizontal position, the centerline of the router should be about $\frac{3}{16}$ in. above the spindle's centerline. The leadscrew should be at the router's center of gravity, so that the router's own weight will cause it to remain tilted up and out of the way when it isn't being controlled by hand.

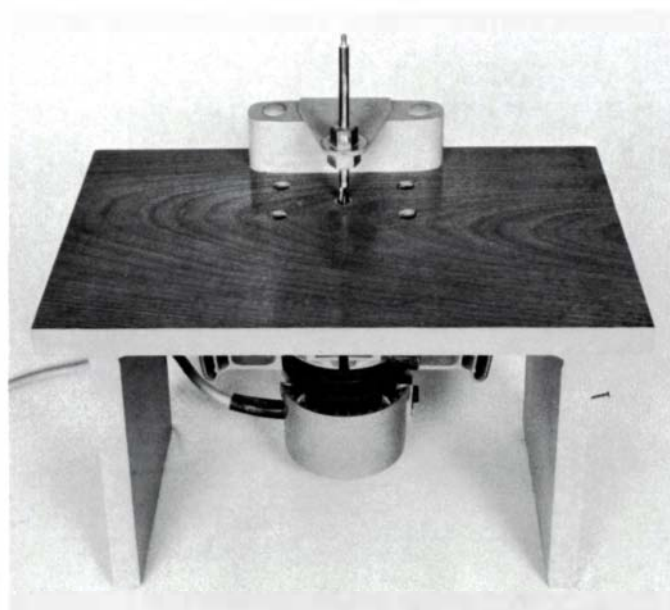
The first spindle shown in figure 4 holds $\frac{1}{4}$ -in. square stock. For smaller stock, use four shims for centering. For larger stock, cut down the surfaces to fit the chuck.

For offset turning, such as when making a cabriole leg, offset the end away from the chuck by inserting shims in the chuck. Brass shim stock or brass sheets obtained in auto supply stores will do nicely. Shim thickness may be determined by proportions or by trial.

A second headstock spindle is a $\frac{3}{4}$ -in. rod threaded to receive a standard $\frac{1}{2}$ -in. drill chuck. This will handle dowels up to $\frac{1}{2}$ in., which in full scale corresponds to 6-in. diameter work. This thread holds many small 3-jaw and 4-jaw chucks as well. For boring, use a chuck on the tailstock spindle.

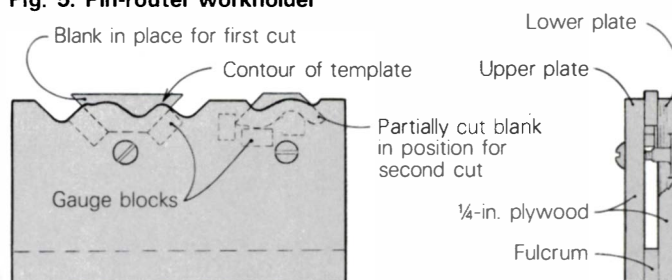
Pin router—The photo, above right, shows my pin router, which cuts small-scale, complex shapes of the sort that you would bandsaw in full-scale work. The machine is an inverted form of the normal pin router, which has the pin in the table and the router suspended overhead on an arm. Inverting the design simplifies construction and improves visibility.

On any pin router, a pin and a bit, usually the same size, are aligned on the same axis. In use, the pin contacts the edge of a template (to which the work is clamped), and the bit cuts the work to the template's exact size and contour as you move it around the pin. In small-scale work, the template acts as a workholder as well, helping to support fragile stock. A typical template is shown in figure 5.



This inverted pin router allows better visibility for small-scale work. Bit and pin can be varied according to the work.

Fig. 5: Pin-router workholder



The upper plate is the template that bears against the pin; the bottom plate serves only to clamp the work to the upper plate. Gauge blocks, mounted to the bottom of the upper plate, locate the work in the sand-wich. To concentrate clamping pressure at the cut and to minimize tear-out or splitting, put clamp screws and recessed T-nuts as close as practical to the cut, and make the fulcrum slightly thicker than the work.

Once you have carefully laid out and cut a template, you can make any number of duplicate shapes. This is a great timesaver for the preliminary cutting of Queen Anne legs, pedestal table legs (such as the ones in the photos on pp. 60 and 61) and other repeat patterns. Make the base and table, then install the router. The pin's height must be adjustable, to suit stock and template variations, and the pin must be removable, so that you can change router bits. I drilled a $\frac{1}{4}$ -in. hole through a cap nut so that the pin would be a snug sliding fit, then installed a setscrew that would lock the pin's height. To support the pin above the router, I cut a sheet-metal holder and locked the cap nut to it with a jam nut beneath. With the pin through the cap nut and its end chucked in the router—to align it—I epoxied and screwed the sheet-metal holder to its base.

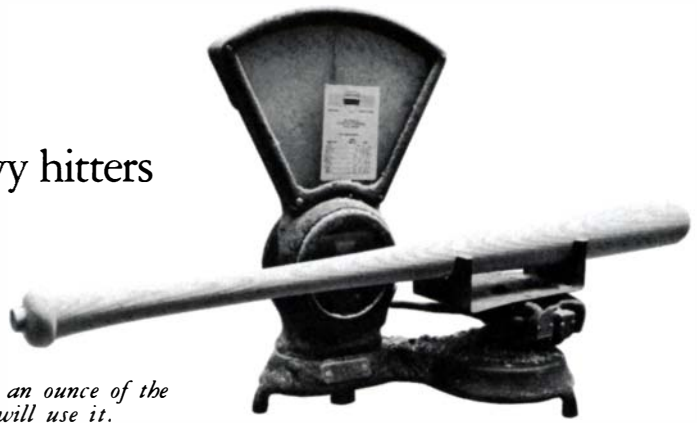
These three machines can help you overcome some of the wasted hours and frustrations I experienced in making the transition from full-scale to miniature work. Accept what you like, ignore what you will, find better ways, but do try your hand at miniatures. Even the most competent woodworker will find them a challenging and rewarding change of pace, and possibly a lifelong fascination. □

Herbert Consor, from Chagrin Falls, Ohio, is a retired engineer and manufacturing manager.

The Louisville Slugger

Custom-turned bats for baseball's heavy hitters

by Paul Bertorelli



A major league bat must be within an ounce of the weight specified by the player who will use it.

When I played sandlot baseball, I devised the cleverest batting strategy that my childhood grasp of physics would allow. I grabbed the biggest bat in the box, reasoning that no pitcher could possibly throw a ball past such a fat target held anywhere near the strike zone.

Until I visited the Louisville Slugger baseball bat factory, I hadn't connected my abysmal batting average with the trouble I had swinging those monsters off my shoulder before the ball whizzed by. At the famous Slugger plant, I learned that hitting is the end product of a refined equation in which four guys standing at lathes figure prominently. I'd read about how big-league bats are custom-turned for each player, so I went to see how it's done.

The Slugger factory—known properly as the Hillerich and Bradsby Co.—is actually not in Louisville at all but across the Ohio River in Jeffersonville, Ind. They've been making bats in the Louisville area since 1884, when the founder's son, Bud Hillerich, took to turning them for a local ball team in his father's job-shop turnery. Players found Hillerich's bats to be a great improvement over the crude, shapeless clubs they'd been accustomed to, and by the turn of the century, H&B was established as the premier maker of major league bats.

My tour of the plant began with a walk through the timber yard, where thousands of 3-in. by 40-in. white ash billets are left to air-dry. High tensile strength, resiliency and, most of all, lightness make ash the preferred bat wood, though hickory has also been used. Rex Bradley, H&B's timber and professional-bat expert, told me that the billets are shipped in from seven mills situated along the Pennsylvania-New York border, where soil and climate conditions encourage the moderately fast growth rates that result in ideal bat timber. Fast-growth timber is avoided because its greater ratio of dense

latewood makes the same size billet heavier, giving hand-turners less leeway in matching size and weight.

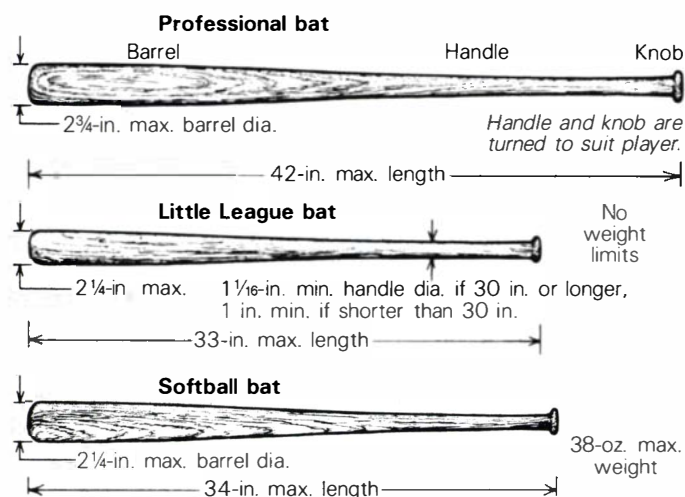
The billets are dried to about 10% moisture content, rough-turned, and sorted by weight and quality. The best will become major league bats; the rest softball and adult league models, the vast majority of the million or so wooden bats that H&B turns every year. As you would expect, the bat factory is a noisy place, with most of the floor given over to ranks of squat, semi-automatic lathes that spin out bats as fast as workers can load in blanks. Off in one corner, away from the din, was what I had come to see: the hand lathes and four turners who together make 20,000 major league bats a year.

Each bat is custom-turned to suit the swing, grip and whims of the player who will wield it. Bill Williams, an H&B vice president, told me that modern players prefer lighter, shorter bats over the heavy clubs I thought were the key to hot hitting. "Babe Ruth used a 42-ounce bat," Williams said. "You don't see any that heavy today. Most of the bats we make are around 32 to 35 ounces." That's because modern players face a more cunning variety of pitches than did their predecessors.

In Ruth's day, a batter might have faced the same pitcher three or four times in one game. By the end of the day, he would have seen enough of the pitcher's tricks to adjust his swing accordingly. Today's player has to contend with a starting pitcher and any number of relievers, each one with a different curve, fastball and slider. Because it can be snapped more quickly, a lighter bat allows the hitter to scope the approaching pitch an instant longer before he decides to swing, thus increasing his odds for a hit. The batmaker's challenge is to shave off as much wood as he can without weakening the bat's slender handle.

I watched Freeman Young turn a bat for Mike Jorgensen, a New York Mets utility fielder. Jorgensen likes a 32-oz. bat that's 35 in. long, requiring Young to skim the handle down to near its breaking point. Young picked a blank from racks sorted by weight, chucked it in his lathe and went to work. His toolkit is sparse: three gouges, a knob-sizing tool, and a yardstick with a knife in one end to mark the bat's length. With a 1¼-in. gouge, Young roughed the shape by eyeballing a bat he took from H&B's artifact room, where a sample of each of the hundreds of past and present models is kept. If no model exists, the turner looks up a card on each player that describes the diameter of his bat at 15 points along its length. He turns those diameters, checking with a caliper, then connects the points with a fair curve.

"I like to do the knob and the handle first," Young said, after he slid his gouge along the lathe's long, continuous tool



rest. "That way if it breaks, I won't have wasted my time on the barrel." Other H&B turners do just the opposite, figuring that turning the barrel first reduces the blank's weight, minimizing whip and reducing the risk of breakage. Young set his sizing tool a bit larger than the model's knob diameter. The extra material is needed because the sizing tool's high angle of attack scrapes rather than cuts, leaving a rough, cratered surface. Young smoothed the knob to size with a $\frac{1}{2}$ -in. gouge. He switched back to a larger gouge to slim the handle and lower barrel, lubricating the tool's travel along the rest with an occasional swipe of an oily rag. As he neared the finished size, Young checked his bat against the model by lining up his caliper with a position marker consisting of a steel rod that slides along another rod mounted behind the lathe and parallel to its centers.

I could see the bat flex as the tool cut the narrowest part of the handle, but before it began to whip, Young hooked his callused left hand behind the spinning work to support it. Oddly, the turners here had never heard of bracing slender work with a steady rest. I doubt they would use one anyway. They have to hustle to make their daily quota of 32 bats, and a steady would just slow them down.

Once Young had duplicated the model, he turned down both ends with a parting tool, gave the new bat a once-over with rough sandpaper and tossed it onto a scale above his lathe. It weighed $32\frac{1}{2}$ oz. "I like to get 'em right on... an ounce either way is okay for the major leagues," Young said. Final-sanding, finishing (lacquer) and the famous Slugger burned-in brand happen in another part of the plant. In the 10 minutes that had elapsed between centering the blank and weigh-in, Young hadn't stopped his lathe, neither to remove the completed bat nor to chuck a fresh blank.

Watching Young work, I realized that turning a bat is easy compared to the arcane task of selecting the right timber. "Ballplayers are notoriously superstitious about their bats," Bradley, a one-time minor leaguer himself, told me. "Ruth liked to have pin knots up around the barrel, Pete Rose won't use anything but wide-growth ash. To us, timber is timber, but we try to give a player what he wants so he won't have any doubt in his mind when he steps up to the plate." Some players even visit the plant to supervise the turning, having a little removed here and there until the balance is just so.

This infinite adjustability has, in part, kept wooden Sluggers from being driven to extinction by aluminum bats, the weapon of choice in Little League and college baseball. Aluminum bats can't be tailored to each player, but the metal is arguably a better bat material than wood. For its weight, it's stronger than ash, and it never has wind shakes or worm holes. Weak hitters do better with aluminum because the metal bats have a larger "sweet spot," that area of the barrel which imparts the most power when it strikes the ball squarely.

Tradition, however, is likely to have more to say about the survival of wooden bats in the majors than any volume of debate over how well they work or don't work. "It really comes down to pleasing the ballpark crowd," said Williams. "An aluminum bat just can't match the sound that a wooden bat makes when it hits the ball." □

Hillerich and Bradsby offers tours of its plant and baseball museum. For more information, write the company at PO Box 35700, Louisville, Ky. 40232. Paul Bertorelli is an assistant editor at Fine Woodworking.



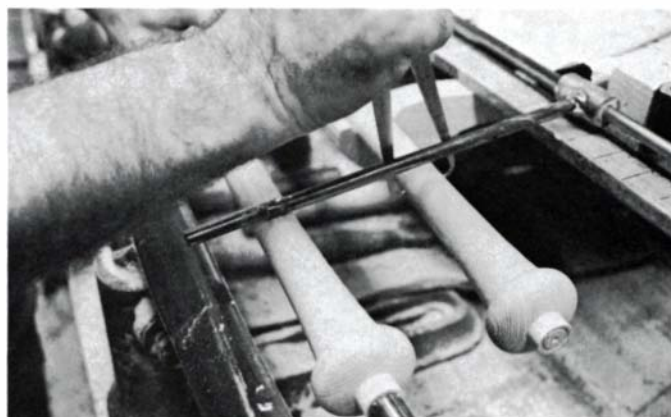
Four woodworkers at H&B hand-turn most of the bats swung by major league players. To make a bat for a particular player, the turner duplicates one of the hundreds of current models filed in the artifact room, above.



Above, turner Freeman Young sets his sizing tool to the model bat's knob diameter. He'll size the knob on the new bat and then shape it with a small gouge.



To keep the slender handle of a light bat from breaking, Young steadies the spinning work by hooking his left hand behind it. The thumb presses the gouge to the tool rest, ensuring a precise shearing cut that leaves a smooth surface.



As he turns a new bat to near its final size, Young checks his work against the model with calipers. He aligns the measuring instrument via a position marker that slides along a steel rod mounted behind the lathe and parallel to its centers.

Straightening Up an Old Secretary

What Winterthur conservators do about 200 years of sag

by Gregory J. Landrey

You need only glance at the asking prices in antiques shops to realize that many people believe that the furniture made in the mid to late 18th century is the epitome of quality. We don't lack for 200-year-old examples proving this point, and some furniture of the day has survived virtually intact. Yet the craftsmen of the "golden age" were far from infallible, and sometimes were guilty of significant oversights in the way they built the furniture we so highly revere.

A case in point is the Chippendale secretary pictured here, a 1951 acquisition of the Henry Francis du Pont Winterthur Museum, which I was recently assigned to prepare for a traveling exhibit. An impressive piece standing 103 in. tall, 45 in. wide and 23 in. deep, it's typical of the work done by Pennsylvania German cabinetmakers around the time of the American Revolution. Except for the usual dings, nicks and areas of deteriorated finish, it looked to be in good shape. A close inspection showed otherwise.

The arched rails of both doors were cracked, because the joints didn't allow for seasonal wood movement. The desk's rear feet were fastened by joints too weak to support its weight, a condition made worse by years of abuse and a couple of inept repair attempts. The most serious and difficult-to-repair deterioration was in the desk carcase itself. The sides bulged noticeably under the weight of the upper bookcase, because the joints which lent lateral support to the case were too weak and had failed.

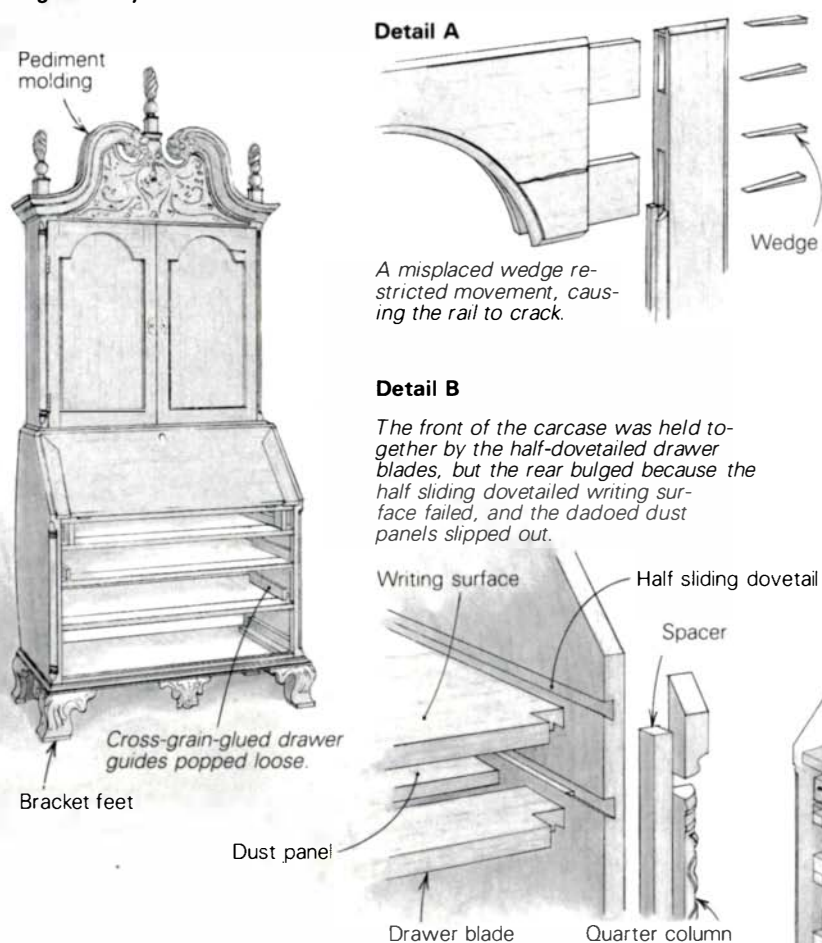
The secretary had been on view at Winterthur, but before it could travel to exhibitions outside the museum, these structural flaws and some finish problems had to be corrected. We had no intention of restoring the piece to like-new condition. The task of conservators at museums like Winterthur is to examine old furniture methodically, to record their findings objectively, and to make repairs to retard further deterioration. When possible, we try to make the piece visually appropriate to its period. In this way, we often discover unknown aspects of historic craft, while preserving valuable specimens for the enjoyment of future generations.

Saving the desk—Our survey of the secretary eventually included many pages of notes and more than 300 photographs. Research showed that the piece was built for Michael Withers in Lancaster, Pa., between 1785 and 1800, possibly by a cabinetmaker named Michael Lind, though the elaborate pediment molding and carving may have been the work of an itinerant carver. Both upper and lower carcasses are basically simple boxes, made of cherry boards joined by dovetails that still fit flawlessly. The bottom of the lower case is poplar. The wide dovetail pins, along with the use of pegs and wedges in construction, are in the tradition of northern European craftsmen. While far from crude, the carving, construction, and the choice of cherry rather than walnut or mahogany indicate that the secretary came from a shop out of the Boston-Philadel-



Though hardly a paradigm of the 18th-century furnituremakers' art, this Chippendale secretary is a good example of the work done by Pennsylvania German cabinetmakers of the late 1700s, reason enough for Winterthur conservators to repair damage done to it during two centuries of use.

Fig. 1: Why the case failed



phia mainstream. It's a sophisticated attempt to imitate English high-style design.

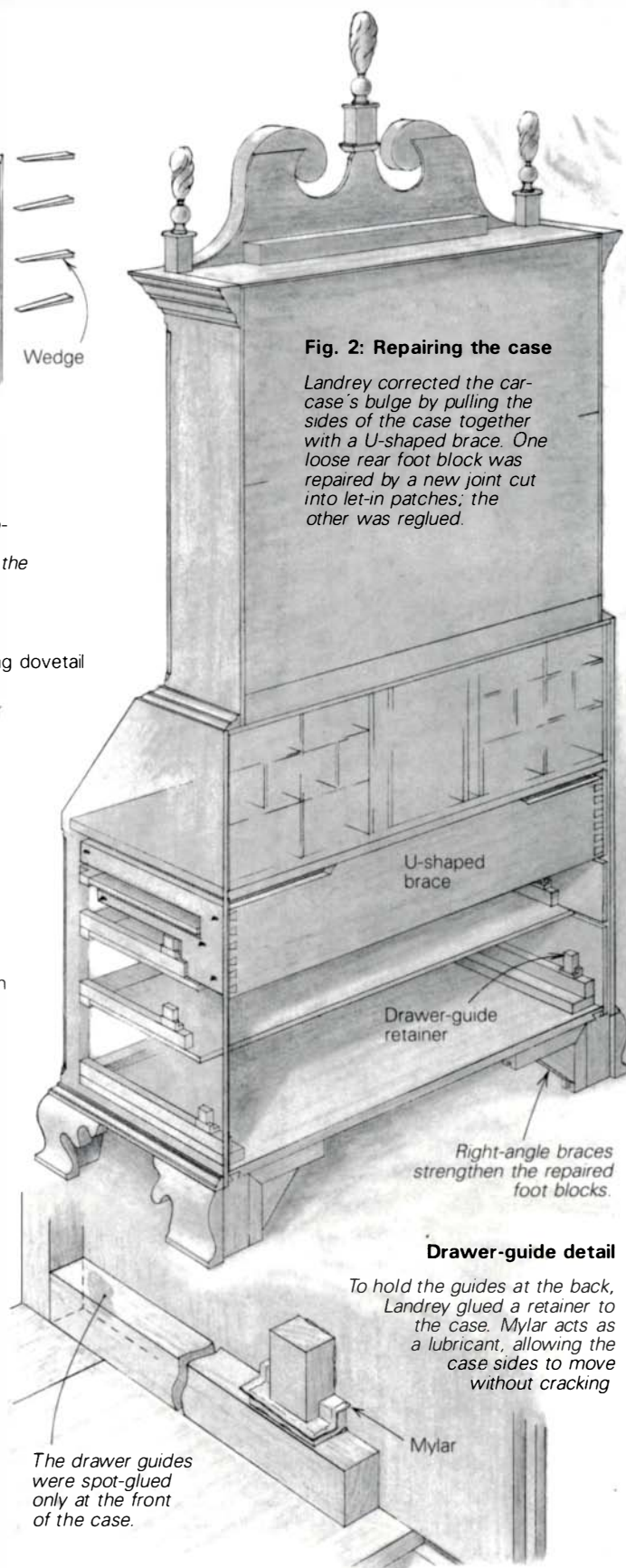
Once I had completed my survey, I discussed the project with Winterthur senior furniture conservator John Melody and museum curator Nancy Richards. We all agreed that the weakened desk carcass and loose rear feet should be repaired first, leaving lesser problems until later.

The desk carcass repair illustrates how conservation ethics can be at odds with sound woodworking practice—you can't always make the best repair. The case sides were joined by the dovetailed top and bottom and by the two-piece writing surface, which was let into sliding dovetails running the full width of the sides. The three dust panels that separate the drawers, however, were only dadoed into the sides and thus they offered no help in keeping the carcass sides from bulging out under the weight of the 90-lb. bookcase, which may have weighed 200 lb. when filled with books. The carcass was braced at the front by drawer blades half-dovetailed into the case, but because these blades are only 3 in. wide, they provided no support at the back. The case back—three tongue-and-grooved poplar boards nailed into a rabbet—added little because the nails had pulled out of the short-grain ends of the poplar or had split the rabbet. As a result, the carcass sides curved out $\frac{3}{8}$ in. at the back, and the entire piece swayed precariously if pushed from the side.

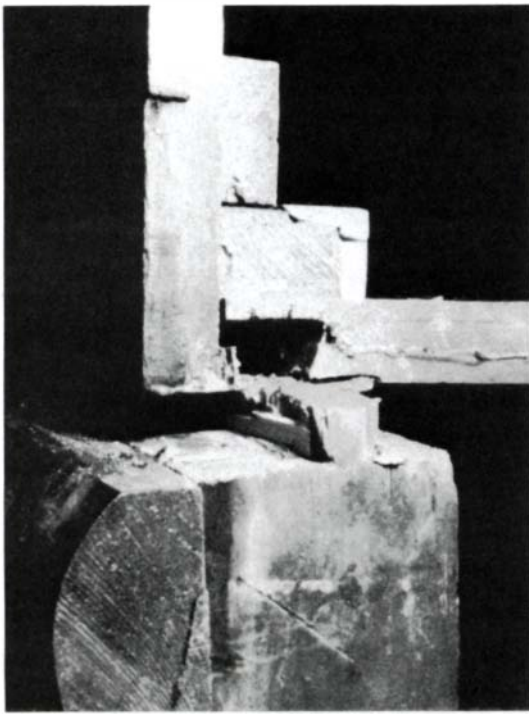
Rebuilding the dust panels and joining them with sliding dovetails the full width of the sides would have been the soundest repair, but such a drastic alteration would have changed the piece's character permanently, and was therefore ethically unacceptable. A cardinal rule of conservation is to

Fig. 2: Repairing the case

Landrey corrected the carcass's bulge by pulling the sides of the case together with a U-shaped brace. One loose rear foot block was repaired by a new joint cut into let-in patches; the other was reglued.

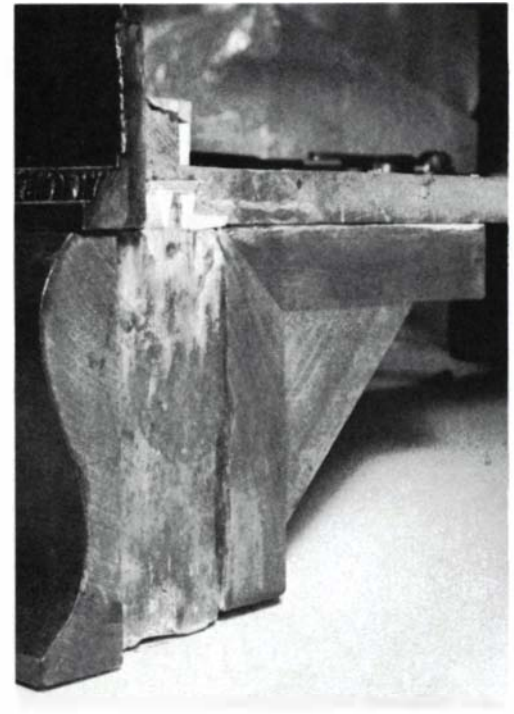


make repairs as reversible as possible and to supplement rather than alter existing constructions. Several of the ideas we considered, including dovetailing braces into the sides of the case, screwing on a plywood back or attaching an X-brace for diagonal support, entailed too much alteration. I finally decided to build a U-shaped brace (figure 2) that could be slipped into the top two drawer compartments from behind and screwed in place. The idea of sinking screws into 200-year-old wood might raise the eyebrows of some conservators, but I considered this solution acceptable because the sides



Sliding dovetails join the foot blocks to the bottom of the secretary, a seemingly sound alternative to the usual practice of blocks glued to the inside of the bracket feet. But this joint proved too weak, and the right rear block (photo, left) failed.

To repair the right rear foot block, Landrey recut the joint after replacing damaged wood with poplar patches, as shown at right. He reglued, then reinforced both blocks with poplar right-angle braces. The end grain of this particular bracket foot shows circular sawmarks, indicating a previous restoration.



were solid and because it involved the least removal of material. Moreover, the brace can easily be taken out.

I made the brace out of cherry because that's what the piece itself is made of and because this wood is strong, light and stable. Fortunately, there is $\frac{7}{8}$ in. between the drawer sides and the inside wall of the carcass—just enough room to fit the brace in. The sides of the brace are slotted to clear the drawer guides. To allow for wood movement (this is a cross-grain construction), I attached the brace to the carcass with ten round-head screws run through slotted holes. I put two steel washers under each screw head to minimize the chance of their binding in the slots. A piece of 1.5 mil Mylar placed between the brace and the carcass acts as a moisture barrier and a lubricant, further reducing binding. Mylar is a non-reactive plastic that finds many uses in the conservation lab.

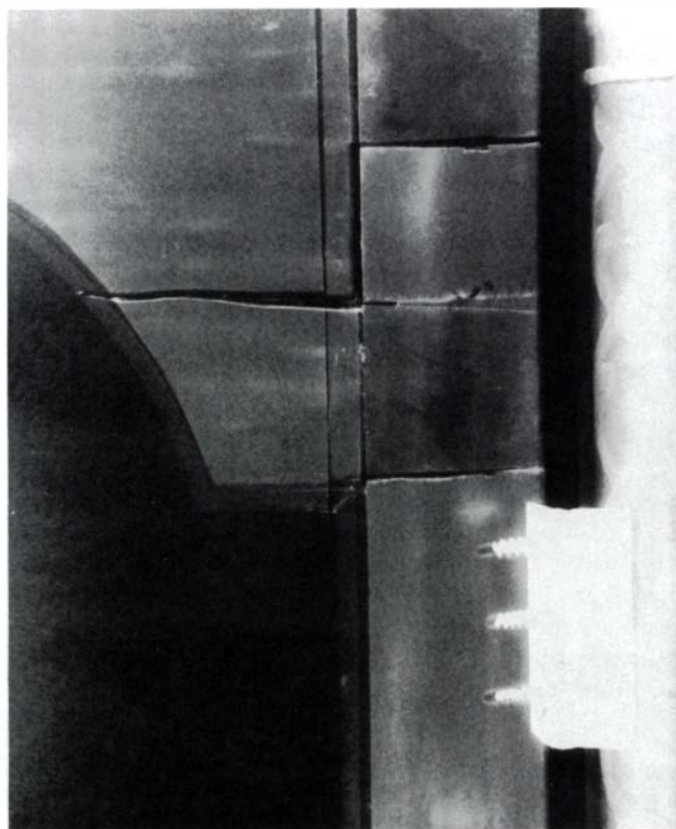
Fixing the loose rear feet was next. The desk actually rests not on its bracket feet but on four 3-in. by 3-in. by $6\frac{1}{2}$ -in. poplar blocks joined to the bottom with tapered sliding dovetails. While this is quite an ingenious alternative to the usual practice of simply gluing blocks to the inside of the bracket feet, it caused trouble. First, the sliding dovetail just about cut off the outermost pins of the carcass dovetails, weakening both joints. Also, this construction left weak short-grain that crumbled under years of stress. The secretary would have been better supported by glue blocks attached with the grain running in the same direction as that on the bracket feet. The front feet were sound, probably because they'd been supported by the bracket feet on two sides rather than just one. The right rear foot (photo, above) was the weakest. Insertion of wedges, shims, and excessive amounts of various adhesives, including epoxy, during previous repair attempts had aggravated the problem. We often see this sort of damage, which is difficult to treat for two reasons. First, it usually requires replacing the damaged original wood with new wood—a last resort in conservation. Second, it's hard to date old repairs. Recent ones may be unimportant, but those done a century ago may shed light on unknown techniques of the past and should therefore be preserved.

I chiseled out the weakened wood from the foot block and the case bottom, and glued in poplar patches with hide glue, which is reversible with warm water. So future conservators will know when the repair was made, I marked the date and my initials on both the glue line and the outside of the patch. I then recut the sliding dovetail and glued the leg back in. To keep the rear leg joints from failing again, I reinforced them with right-angle poplar braces, hide-glued in place.

Minor structural repairs—Once the carcass repairs were complete, I began work on the less serious flaws. The most troubling of these were the ugly cracks in the arched rails of the bookcase doors. At first, we couldn't determine why the rails had cracked. They were joined with double, through mortise and tenons, a good choice that should have accommodated the seasonal movement of the 6-in. wide rails.

An X-radiograph of the right door solved the mystery. One of the two wedges driven into each mortise had restricted the rail's movement, and when it shrank, a crack opened up in the weak short-grain near the base of the arch. The wedges blended into the end grain of the tenons so well that we couldn't see them without the X-radiograph. Extracting them to repair the rails would have altered the original construction and caused more damage. Since the joints were stable and tight, we left them alone. If the tenons had been wedged only on their outside edges, the rails might not have cracked.

We found many examples of cross-grain construction in the secretary, and while some had weathered seasonal movement well, others had not, particularly the battens glued to the ends of the desk's fall front. Since the battens hadn't shrunk with the top, their ends eventually stood about $\frac{1}{4}$ in. proud of the fall front's hinge edge. When the front was opened, the projecting end of the battens acted like a prybar on the hinges, splitting two chunks off the edge of the writing surface. Trimming the ends of the battens flush was more alteration than we could tolerate, so I simply reattached the hinges with new brass screws, left a little loose to allow some movement (figure 3, facing page). I glued the cracked pieces



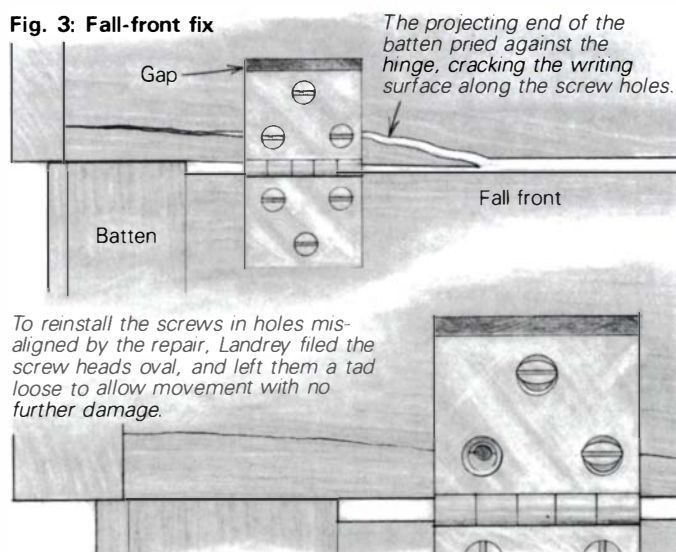
X-radiographs reveal much about how old furniture was made and why certain constructions fail. This one shows how a wedge next to the tenon cracked the arched rail of one of the bookcase doors. It also reveals evidence of previous repair work: The top hinge screw has coarse, hand-filed threads and is probably an original. But the finer, machine-cut threads of the bottom screw indicate that it was installed many years later.

back in place, filled with dowels the screw holes left by a previous repair attempt, then patched the surface with shellac stick. I saved the original hinge screws and they are kept in an envelope in the desk.

Restoring the desk's eight drawer guides was next. Originally, they had been hide-glued cross-grain to the inside wall of the carcass. They probably popped loose not too long after the piece was completed. If glued back in place with a modern, less forgiving adhesive, they could restrict wood movement enough to crack the carcass sides. To solve this problem, I hide-glued only the very front 1½ in. of the guides to the inside of the case, holding them in place at the back with the retainer shown in figure 2. Lubricated by a sheet of Mylar, this retainer allows the case sides to move independently of the drawer guides. Instead of replacing the bottom guides, which were badly worn, I made a positive mold of the missing wood out of modeling clay and used it as a guide to carve patches. When the drawer guides were back in place, I moved on to the final step: restoring the finish.

In conservation work, we try to preserve as much of the old finish as possible, making finish repair an arduous task that is further complicated by the arcane, often hard-to-identify finish recipes used by some cabinetmakers. Lab analysis of these finishes rarely helps, but we can sometimes identify a finish by the way it has cracked or crazed over time. The surface of spirit varnishes—solutions of shellac and other resins in alcohol—crazes into irregular-shaped islands. Oil varnishes form regular squares or rectangles. Lacquer, a relatively modern finish, crazes into elongated rectangles.

Fig. 3: Fall-front fix



To reinstall the screws in holes misaligned by the repair, Landrey filed the screw heads oval, and left them a tad loose to allow movement with no further damage.

The craze pattern on the secretary suggested shellac; I confirmed this by dissolving a small patch with an alcohol-soaked swab. I suspected that the piece had been refinished, but except for the carcass sides, the finish was in reasonably good shape on the lower case. I was able to restore it to the appropriate sheen by rubbing it with pumice and rottenstone applied with a soft cloth soaked in mineral spirits.

The finish on the upper case, however, was more severely crazed and flaking, possibly because it had been exposed for many years to the warmer upper air of heated rooms. Because it was unrestorable, I removed the old shellac with alcohol, using a stiff brush to loosen stubborn patches. Then I brushed on six coats of 2-lb.-cut shellac rubbed with 0000 steel wool between coats. After I touched up minor losses on the rest of the piece, a final rubbing with a carnauba-based wax on all finished surfaces completed the conservation work.

This secretary was one of the most difficult conservation challenges I've ever undertaken, and from it I learned some valuable lessons. True, there were flaws in the design and construction of this piece, but, interestingly enough, some of the most sophisticated of the Philadelphia Chippendale pieces had more serious defects. Although Lancaster was the largest inland city in the United States at the time, its rural setting meant fewer resources than were available to the cabinetmakers of the major port cities. The fact that this piece has survived two centuries is a notable tribute to the 18th-century craftsman who built it. He did not have our advantage of hindsight to see how two hundred years of wear, abuse, seasonal changes and eventually central heating would affect his furniture. Through scientific conservation, we can record the successes and failures of our predecessors, and apply these lessons to improve our own work. □

The secretary described in this article can be seen on tour at the Museum of Fine Arts, Houston, Tex., until May 15; at the M.H. de Young Memorial Museum, San Francisco, Calif., July 2–September 2; and at the Art Institute of Chicago, December 10, 1983–January 29, 1984. It is normally on view in the Port Royal Bedroom of the Henry Francis du Pont Winterthur Museum, Winterthur, Del. For more on secretaire-bookcases, see FWW #38, pp. 54–60. For more on furniture conservation, see FWW #22, pp. 65–67, and #35, pp. 58–60.

A Spider-Leg Carriage Table

Turned legs, tray top evoke diminutive elegance

by *D. Asher Carmichael*

Shortly after I moved to Mobile, Ala., five years ago, Dr. Samuel Eichold asked me to reproduce a table which an antique dealer refused to part with. I met with the dealer, Charles Crane, and coaxed him into letting me make the drawings, measurements and descriptions from which the table shown here eventually developed.

The original table was English, late Georgian (circa 1800), and seemed a tiny cousin to the butlers' tray-on-stand, which was then very popular, primarily for serving wines. The smaller examples—this one is only 21 in. high—were employed in outdoor excursions and were commonly called carriage tables. They are rare today because of their fragility and the rigors of country excursions. The one I copied had probably remained at home most of the time, serving as a chairside table for occasional use.

This table is mahogany with crotch veneer and satinwood veneer border. Like many butlers' tables, it could be made with fancier inlay or even painted and gilded. The top should be veneered rather than made of one piece of solid wood that would likely warp. A butlers' table, of course, has a removable tray, a possible alternative here. Perhaps hinging the top was meant to be insurance against leaving it behind, overlooked at the end of the day beneath some leafy English shrub.

To begin construction, refer to the bill of materials (p. 72) and prepare the rough stock. Dress the stock for the legs, stretchers, cap rails and hinge strip to finished square dimensions, and cut the pieces to length.

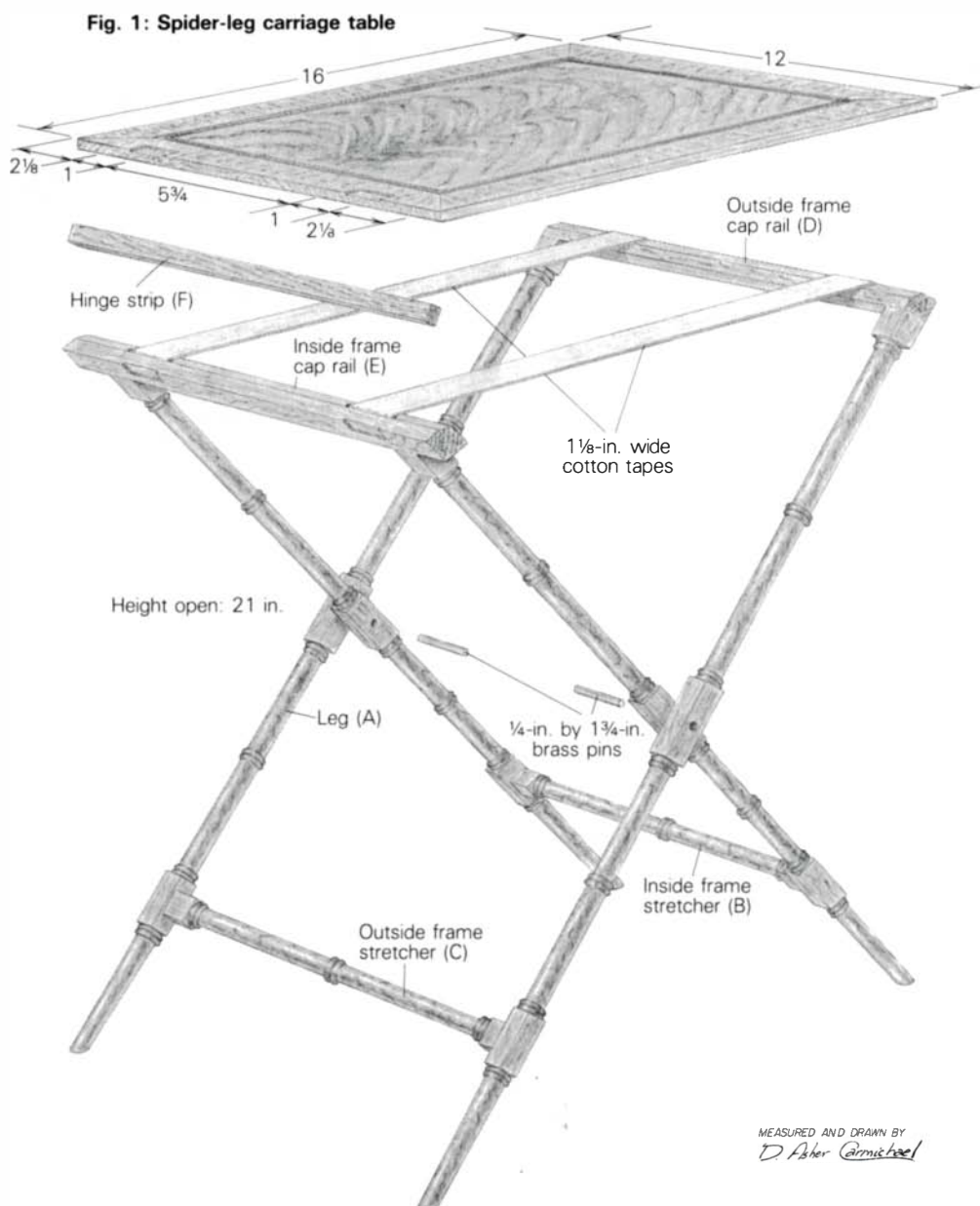
Turning the legs—Without a steady rest, legs as thin and long as these tend to whip a good bit on the lathe, but they can, like the original, be turned as one piece. Mount a leg blank in the lathe with just enough pressure to hold it securely—you don't want to introduce any more compression force than necessary, because it will increase the amount of whip. To further reduce whip, start at

the center, work toward the ends and don't remove any more wood than you have to for each step.

Cut the shoulders of the pummels with the long point of a skew chisel, then follow the sequence shown in figure 3, using a small gouge to rough out the legs. Mark the beads. If you are a confident turner, you can round them with the skew. Otherwise, leave them as V-cuts, then shape them with 150-grit sandpaper after you have turned the cyl-

inders to their finished diameters.

An alternative method for making the legs, which decreases whip, is to turn each one as two shorter pieces, then join the pieces with a $\frac{1}{2}$ -in. diameter tenon (leg detail, figure 2). Turn the tenon slightly oversize to allow for trimming and fitting. Also, sand the separate leg pieces while they're still on the lathe—it's not likely that the joint will be perfectly centered, and the leg will thus run off-center if you try to sand it on the



lathe after it's been glued up. Bore the $\frac{1}{2}$ -in. diameter mortises in the upper legs with a Forstner or a Power Bore bit chucked in a drill press or in your lathe.

Cap rails and frame assembly—Before you chamfer the cap rails, lay out and cut the leg and tape mortises. Also, lay out the stretcher mortises in the legs. You can cut the square mortises with a $\frac{3}{8}$ -in. hollow-chisel mortiser, or you can rough them out with a $\frac{5}{16}$ -in. brad-point bit and then chisel them square. Take care cutting the leg mortises in the cap rails. If they are too deep, they will show when you cut the chamfer. To cut the slot mortises for the tape, drill adjacent $\frac{1}{8}$ -in. holes through the stock, then clean up with a thin file.

Now cut the tenons on the legs and stretchers, using your choice of table-saw, radial-arm saw or hand tools. Also,

bore a $\frac{1}{4}$ -in. diameter hinge-pin hole through the center square of each leg.

I chamfered the cap rails with a hand plane—it's risky to use a tablesaw or a jointer on such small pieces.

When tooling is finished, sand the rails to 120-grit, then glue and clamp the frame assemblies.

Top and final assembly—You might decide to use $\frac{1}{4}$ -in. plywood for the ground, hiding its edges with a thin band of veneer, but the original table's ground is edge-glued from pieces of quartersawn stock. This choice of grain—along with the maker's care to veneer both sides and apply a good finish—has kept the thin top flat and true.

If you use solid stock, dress the lumber for the ground to $\frac{3}{8}$ -in. thickness. Watch for tearout as a clue to grain direction, then, to make planing easier,

Fig. 3: Turning the legs

To avoid whip, work from center toward ends, removing only enough wood to allow you to clean up details as you go. As an alternative to turning the beads with a skew, you can leave them V-shaped (as in step 2), then round them with sandpaper after you have turned the legs to finished diameter.

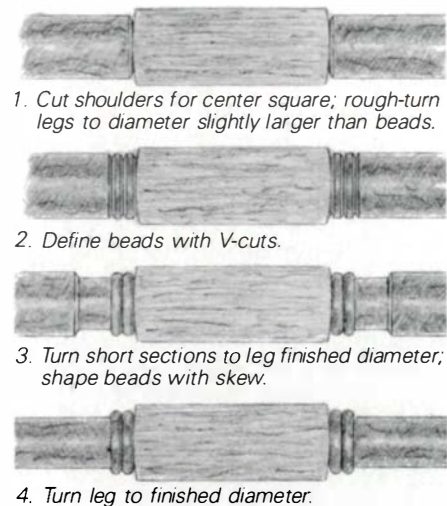
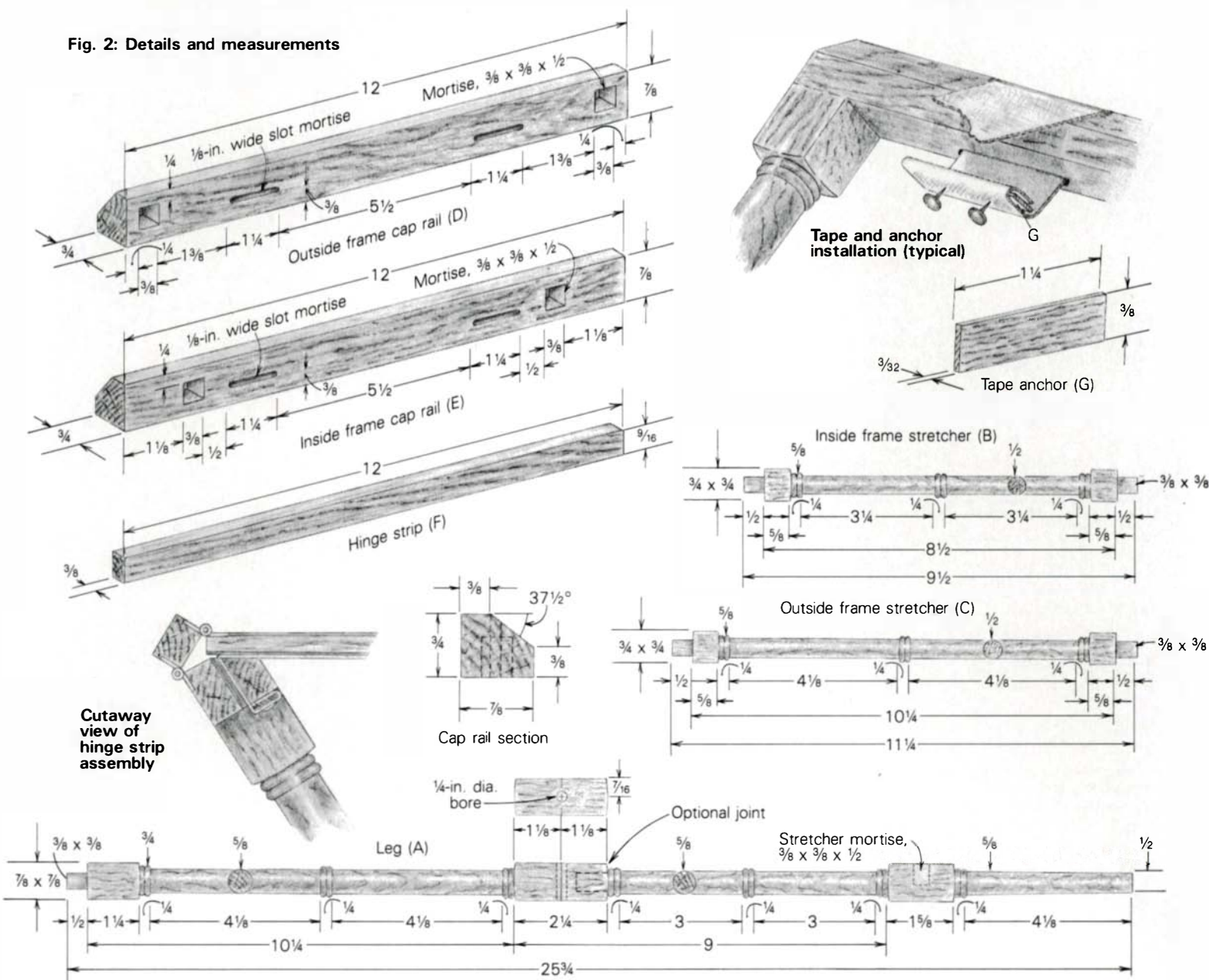


Fig. 2: Details and measurements



arrange the boards so that all the grain goes the same way. Edge-glue the pieces to make a panel $\frac{1}{2}$ in. oversize. Plane the panel to about $\frac{1}{4}$ in. thick, and cut it to final size.

Lay out and cut the veneers, allowing $\frac{1}{32}$ in. extra on the counter veneer and the border veneer to ensure complete coverage. Using a straightedge and a razor or a veneer knife, cut the miters from the long point toward the inside, to avoid breaking off the long point. Assemble the veneers as shown in figure 4 with some glue between the joints. The tape will be removed with scrapers and sandpaper once the veneers and ground have been laminated.

Fig. 4: Laying up the face veneer

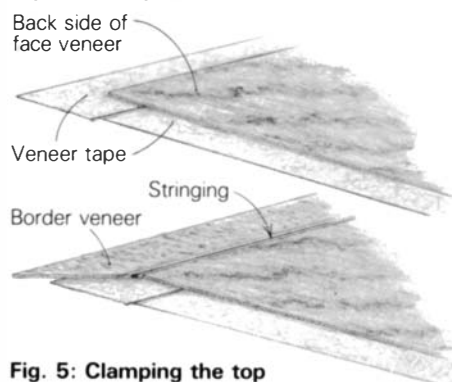
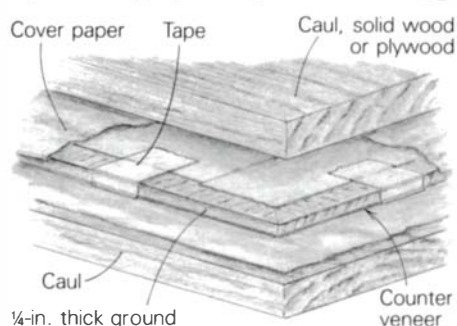


Fig. 5: Clamping the top



When the face veneer lay-up is dry, you can glue up the ground and veneers with yellow, plastic-resin, or hide glue (figure 5). Deep-throated handscrews and C-clamps will supply plenty of pressure if they are arranged evenly over the cauls (see *FWW* #38, p. 64, for another veneer glue-up method). Get everything ready, then apply glue to one side of the ground (not to the veneer) and center the counter veneer, best face showing. Turn the top over, apply glue to the other side, and center the top veneer, taped side out. Press down to remove any air bubbles, then, to keep it from sliding, secure the sandwich with several small strips of tape. Place either

waxed or plain paper over the veneers as a parting agent, and clamp up.

When the top is dry, remove the veneer tape with a freshly sharpened scraper. Then plane the veneer flush with the edge of the ground. Finish-sand, carefully easing the veneer edges.

Cut and sand the hinge strip and attach it to the top with two 1-in. by $\frac{3}{4}$ -in. brass butt hinges. Let in the hinges so that they are flush. You'll have to pre-drill the screw holes and file the screws shorter to keep them from going through the tabletop. Next, hinge the strip to the inside frame assembly.

Finishing up—Remove all the hinges, clean up any blemishes and give the table a final sanding to 150-grit. If you plan to stain the wood, seal the stringing and border veneer with shellac first. To avoid this step, I used a chemical stain, 2 cups of quicklime (calcium oxide) in 1 quart of warm water, which colored the mahogany black-red without darkening the lighter veneer too much.

Any finish will do, but be sure to apply thin coats rather than heavy ones, which would fill in the grooves at the beads and obscure the detail.

Next, reattach the top. To allow the table to fold, pin the legs with brass rod as shown in figure 1. If the pins do not fit snugly, peen one end oval. Resist any temptation to use epoxy, as this would prevent disassembly of the base frames should the need arise.

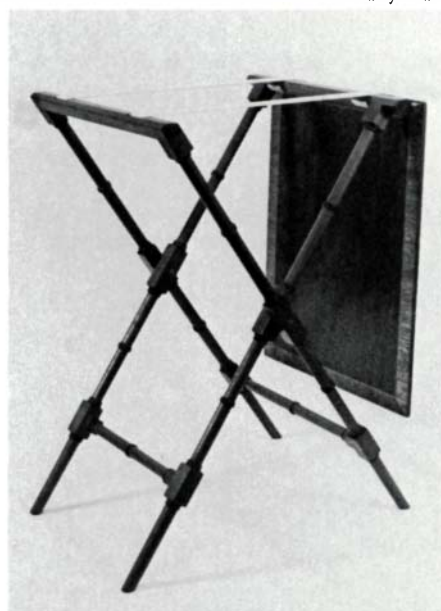
Now you can attach the cotton tapes (available from upholstery shops) to the cap rails as shown in figure 2. As with the hinges, pilot-drill the tape anchors to keep them from splitting. It will be easier to attach both tapes to the inside frame cap rail first and then use the top as a gauge to determine their final length.

Set the table up and check for level posture, then mark and trim the bottom of the legs to ensure a stable footing. Seal the trimmed leg ends, then apply a thin coat of wax until the table gleams.

Now that you're finished, the people in your life whom you've neglected so long would probably love to use the table for its original purpose—an outing in the country. If your heart isn't quite that strong, it's up to you to convince them that something a mite more substantial would be more appropriate. □

D. Asher Carmichael works for Emperor Clock Co. In his spare time he draws and makes furniture.

Marilyn Tario



The carriage table, even in semi-repose, tells tales of elegant Georgian picnics. It folds up for easy carrying, and the tray is attached with hinges so you won't accidentally leave it behind.

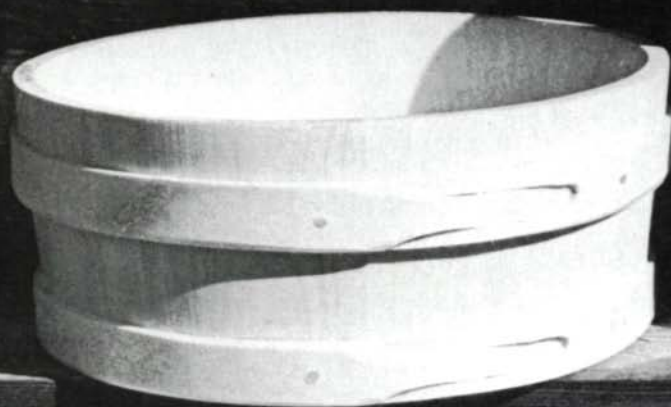
BILL OF MATERIALS

No. of pieces	Description	Dimensions (net) L x W x T
Mahogany: 4	Legs (A)	$25\frac{3}{4} \times \frac{7}{8} \times \frac{7}{8}$
1	Inside frame stretcher (B)	$9\frac{1}{2} \times \frac{3}{4} \times \frac{3}{4}$
1	Outside frame stretcher (C)	$11\frac{1}{4} \times \frac{3}{4} \times \frac{3}{4}$
1	Outside frame cap rail (D)	$12 \times \frac{7}{8} \times \frac{3}{4}$
1	Inside frame cap rail (E)	$12 \times \frac{7}{8} \times \frac{3}{4}$
1	Hinge strip (F)	$12 \times \frac{9}{16} \times \frac{3}{8}$
4	Tape anchors (G)	$1\frac{1}{4} \times \frac{3}{8} \times \frac{3}{8}$
1	Top (ground), can be plywood	$16 \times 12 \times \frac{1}{4}$
Veneer and stringing: 1	Counter veneer	$16 \times 12 \times \frac{1}{28}$
1	Figured face veneer	$14 \times 10 \times \frac{1}{28}$
50 in.	Holly-ebony-holly stringing	$\frac{1}{8}$ in. wide
60 in.	Satinwood border veneer	$\frac{7}{8}$ in. wide
Hardware: 2	Cotton tapes	$18 \times 1\frac{1}{8}$
4	Brass butt hinges	$1 \times \frac{3}{4}$ (open)
2	Brass pins	$1\frac{3}{4} \times \frac{1}{4}$ dia.
8	Brass tacks or light upholstery nails	

Making Wooden Buckets

White cooperage, the Swiss way

by Drew Langsner



Swiss-style buckets of close-grained pine, with maple hoops. Traditionally used in small dairies, these liquid-tight containers are known as 'white' cooperage. The sculpted bucket, right, is carved from extra-thick staves after the staves have been glued together.

Coopered containers range in volume from huge wine vats to pint-size beer steins. Whatever their size, they are all basically tapered cylinders made of vertically arranged wooden staves with mitered edges. The staves are held tight by two or more hoops made from wood or metal. Bottoms consist of one or more boards which fit into a groove cut into the staves. Because of their cylindrical shape and the compression/tension relationship among staves, bottom and hooping, coopered containers are remarkably strong and durable.

As a trade and technique, cooperage may be divided into four overlapping areas: Wet cooperage is for holding liquids. Dry (or "slack") cooperage is for such less demanding needs as transporting or storing grains, fruits or nails. Of greater importance to woodworkers is the distinction between single-bottom and double-bottom cooperage. Double-bottom containers have bowed staves whose mitered edges are curved. Whiskey barrels are typical. In single-bottom cooperage—called "white cooperage" because the buckets are traditionally used to hold milk in small dairies—the staves are straight, as are the mitered edges.

The methods for single-bottom cooperage described in this article were taught to me by Rudolf Kohler, an 83-year-old cooper who lives and works in the Swiss Alps. I met Kohler in 1972, while I was searching for a traditional Swiss milking bucket to purchase as a souvenir. I'd not done much woodworking, but I became so fascinated with his work (and his beautiful shop) that I asked if it would be possible to study with him. He agreed and we managed well, even though I speak little German and Kohler knows no English; we put a great deal of positive energy into the relationship. Ten weeks later I wasn't a cooper, but I had become a woodworm. In 1980 I returned to Switzerland and worked with

Ruedi Kohler again, this time for three fast-moving, hard-learning weeks.

Cooperage in the Swiss Alps was traditionally a winter trade practiced by farmers who were occupied with outdoor work from spring to fall. When Kohler was 22, having practiced alpine farming and cheesemaking with his father, he paid an old cooper fifty Swiss francs for four months of winter training. At the time (1923) the wage for a day's work was three francs. The next winter Kohler returned for another session. This time his usefulness earned back the fifty francs, and he was presented with a set of coopers' tools, which he still uses. Kohler says that when he got into cooperage the craft was in its decline. New factory-made metal containers were cheaper than coopers' woodenware, and modern health regulations gradually prohibited using old dairy vessels except high in the Alps. World War II was a good time for coopers, because metal was scarce. But after the war cheap plastics were introduced, and cooperage almost died out. During the last 15 years, interest in traditional crafts has renewed the demand for woodenware. In 1967 Kohler retired from farm-

Types of cooperage



Single-bottom (white) cooperage uses straight staves with straight edges.

VESSEL

VESSEL



Double-bottom cooperage requires bowed staves, curved stave edges, and a minimum of four hoops.

ing and cheesemaking to become a full-time cooper. He still makes a few coopered vessels for farm use, but the greater part of his output goes to the tourist trade: milk buckets, bowls and butter churns that will never be put to work.

Cooperage techniques are closely related to those of many other traditional woodcrafts. Most of the work is done at a shaving horse, although a workbench with a vise and bench dogs is also useful. Many cooperage tools are shared by other crafts—hewing hatchets, froes, carving knives, drawknives, spokeshaves, planes, saws, drills, etc. Coopers also use several specialized tools—curved (hollowing) drawknives, convex-soled planes, and a device called a *croze*, which cuts a groove for the bottom board inside the assembled staves. I'll discuss each as it comes to hand when making a typical, single-bottom, staved container, 220mm (8 $\frac{5}{8}$ in.) in diameter and 120mm (4 $\frac{3}{4}$ in.) high.

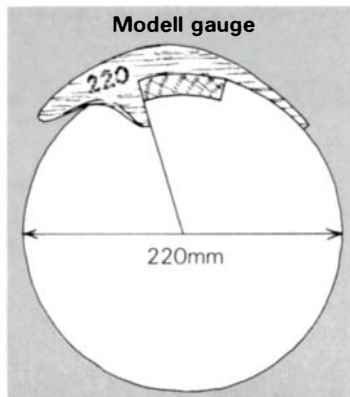
Wood selection—Many woods can be used for cooperage, but there are definite qualities that all coopers look for. The wood must be straight-grained and must work easily with hand tools. Cooperage requires well-seasoned wood, because shrinking staves leak and loosen the hoops. Double-bottom cooperage requires wood that bends easily; the best is white oak. For single-bottom cooperage, the favored wood in Switzerland is arve (*Pinus cembra*), known in English as Swiss stone pine. It is a slow-growing conifer found at altitudes generally above 3,300 ft. Arve growth rings average about 1mm ($\frac{1}{25}$ in.) per year. The fibers are extremely small, and the wood works easily, even across end grain and through knots. Arve does grow in the United States (it's planted as an ornamental), but any straight-grained softwood will do: pine, cedar, redwood, Douglas fir. Linden (basswood) can also be used. One of the appeals of cooperage is that the wood is readily available, and you need only a few board feet to make a bucket.

Traditionally, coopers buy wood as bucked logs, either round or split. A neighbor tells Kohler about some pine firewood of extra-fine quality, or a local sawmill puts aside an arve log. Kohler used to begin with a crosscut saw, but today he bucks out sections with a chainsaw, working around major knots, sawing suitable stave lengths. Staves for our 120mm high bowl are initially cut 150mm (6 in.) long. These rounds are then radially split into pie-shaped billers, which are air-seasoned in a drafty hayloft for at least a year.

Kohler sometimes buys wood that has been plain-sawn into thick, unedged planks. Sawmill edging often wastes much wood. The advantage of lumber is that it is easy to handle. The disadvantage is that some staves will not be quarter-grained, which is never the case with split-out stock. After air-seasoning, the wood is roughed into stave blanks—split along a radial plane using a small froe and a maul. Stave width varies. For our small container, widths can range from 35mm (1 $\frac{3}{8}$ in.) to 80mm (3 in.). Kohler uses a broad hatchet for trimming and roughly tapering the sides, perhaps 3mm to 6mm ($\frac{3}{16}$ in.) wider at the top than at the bottom. This produces a taper in the finished bucket such that the diameter of the bottom is about 10% less than that of the top.

Kohler next stacks the blanks against a south-facing outdoor wall for further air-drying. Then a few days before he needs them, he takes the staves indoors for a final drying on a

rack above the stove. He often groups stave blanks in bunches according to length, for single projects. At this stage the aggregate width of the staves should be about four times the bowl's diameter—in this case about 880mm (35 in.).



Shaping the staves—Swiss coopers find the correct edge angle of a stave with a simple gauge called a *modell*. The modell is a thin crescent-shaped piece of wood whose inner contour matches the exterior curve of the container. The perpendicular edge guide at one end of the modell represents the radius line of the curve.

Staves are shaped at a shaving horse, using a flat drawknife, a hollowing drawknife, a long jointer plane and an appropriate modell. Shaping begins with drawknife work on the exterior face. Hold the modell across the top end of the blank to gauge the curvature, then with the blank in the shaving horse, shave the top third of the stave to fit the modell. You could pencil in the shape on the end grain, but Kohler just judges by eye. The first cuts should be light, to verify grain direction and irregularities. Block out the curve from the sides toward the center, keeping the stave as thick as possible. Turn the blank end for end and drawknife the rest of the outside face. The curve for the bottom end is gauged by eye to match that of the top end. The modell is not used at the bottom end because stave taper results in a tighter curve there. Fair the whole outside face. If necessary, use the drawknife in reverse, as a push tool, to handle grain that runs into the wood. Or reposition the stave in the shaving horse, to get the most from your pull stroke. Then turn the stave over.

Rough out the inside face with a hollowing drawknife. This is a deeply curved coopers' drawknife with an exterior bevel. Shave from both ends, to approximately 18mm (1 $\frac{1}{8}$ -in.) thickness. Do not attempt to cut thinner walls at this stage. If you don't have a hollowing drawknife, you can use either a scorp or a narrow inshave ground with an outside bevel. Or you can reshape (and retemper) a flat drawknife to an appropriate curvature, about 35mm (1 $\frac{3}{8}$ -in.) depth across a circular arc that spans about 120mm (4 $\frac{3}{4}$ in.). Another method (which Kohler uses for the inside of his oval milking buckets) is to dog individual staves to the workbench and hollow them with a convex-soled plane.

Edge angles are roughed out with a flat drawknife and the modell, which is always gauged at the upper rim. To hold the stave and have tool access along the full length of the edge, Kohler sets one end against a rabbet cut across the near end of the work ledge on his shaving horse. He holds the other end tight against a breast bib, a small flat board that hangs by a string around his neck. Stave edges must be flat, not twisted or curved. Any container has to be tapered so that the hoops can be driven tight, but more than an 8mm ($\frac{5}{16}$ -in.) taper for a 150mm (6-in.) long stave results in a container with too much taper, which won't hold its hoops.

Stave edges are finished with a jointer plane set upside down on the edge of the shaving horse, or secured in a vise. Run the stave over the plane, checking the angle between passes. For safety, grip the staves well above the plane sole, and spit on your fingertips to increase your hold. Besides the

correct angle, check for flatness. Hold pairs of staves side by side and look for uniform contact. Try wiggling them back and forth, making sure they don't wobble or roll.

Once the staves are jointed, lay them out side by side in a flat shallow arc to check for correct circumference (3.14 times intended diameter). The proper length, measured with a tape or a folding rule, which can follow the arc, should be the circumference you are aiming for, plus or minus 2%. If the series is too long, drawknife and plane one or more staves down to size. If too short, substitute a slightly larger stave.

Test assembly—Two wooden hoops will hold the completed container together. To position the staves for setting the hoops, Kohler drills mating holes and inserts small hardwood pegs into the sides of each stave. The pegged staves won't shift while the hoops are hammered tight.

Two temporary metal hoops are used in an initial test assembly, and to hold the staves in place for further shaping before the wooden hoops are fitted. Kohler makes his own metal hoops (see drawing, below right), and keeps a large collection of them in various diameters. To test-assemble, peg the staves together and place the cylinder on a workbench, bottom rim facing up. Fit the larger metal hoop onto the assembled staves first, and drive it tightly in place with a square-headed hammer or a coopers' hoop driver. A hoop driver looks like a blacksmiths' hammer with a notch ground along the peening edge. I made one by taking a small rock-climbing hammer and filing a groove into the face of its pick end. Set the groove over the hoop edge and hit the head of the driver with a second hammer. Work round and round until the hoop stops moving downward. The correct test-fit should be about one-fourth from the top rim of the container. When the first hoop is in position, fit the second, smaller hoop.

Although the staves are pegged, they can pivot in and out on those pegs. If a stave protrudes, hammer it in—but place a second hammer inside to dampen the blows, and vice versa—until you have averaged out the differences.

Check the container for roundness by measuring across the upper rim from two perpendicular locations. You can live with a discrepancy up to 5mm ($\frac{3}{16}$ in.). Look for openings between staves. If you find any, knock off the temporary hoop and check all edge angles against the modell. Reassemble. If there are still spaces on the inside, disassemble and plane one stave narrower. If gaps show on the outside, remove a stave (save it for your next container) and substitute a new one that's wider. This is your last chance to be sure that the staves fit together perfectly.

Dressing the assembled staves—Once you have the stave edges flush, you can dress the rims and the interior surface. Slightly moisten the end grain of the upper rim with a wet sponge, to soften the wood. Then plane the rim flat. A block plane works nicely. Check by eye or by placing the container upside down on a flat surface.

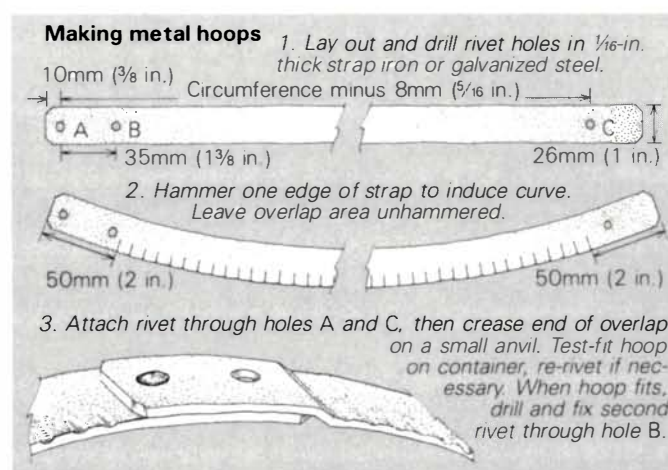
The lower rim of the assembled staves generally requires sawing before planing. Pencil a series of marks measuring from the (now flat) upper rim, in this case at 120mm ($4\frac{3}{4}$ in.). Set the container on its side and begin a shallow sawcut aimed from one pencil mark to the next. Kohler uses a small backsaw. Make a series of shallow passes around the container. For a flat cut, hold the saw parallel to the plane of the rim, not perpendicular to the side of the staves. With the



The outside curve and edge bevel of a bucket stave are checked with a gauge called a modell, drawn on facing page.

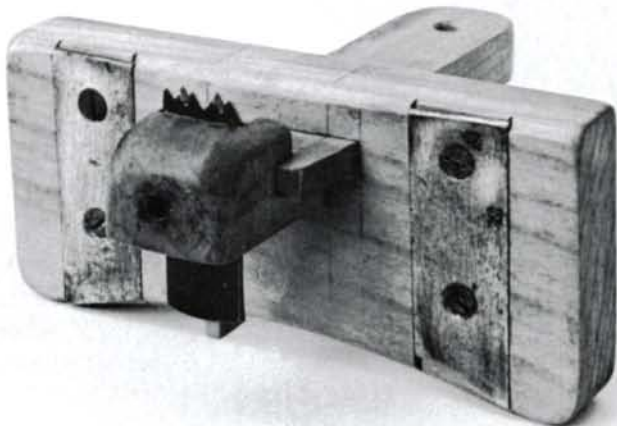


To shave short staves, cooper Ruedi Kohler supports one end of the blank in a rabbit on the front of his shaving-horse ledge, the other against a wooden bib.





The staves are test-assembled and temporarily held in place with two metal hoops, so that the inside of the cylinder can be smoothed either with a convex-sole plane, as on the front cover, or with a Surform, above.



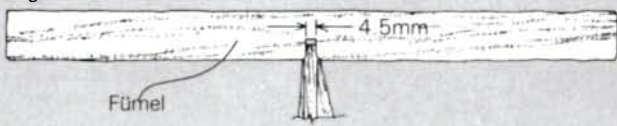
This croze is like a marking gauge with teeth. Instead of merely scribing the groove for the bottom, it cuts it directly into the assembled staves.

Shaping bottom board

1. Use a marking gauge to scribe the edge of the bottom board, and drawknife to this shape.



2. Use a slotted hardwood stick (called a fümél) to compress the edge to 4.5mm.



waste sawn away, plane the lower rim smooth.

At this point the staves are still of various thicknesses. To indicate their dressed thickness, bevel the rims inside and out, leaving the upper rim 15mm ($\frac{3}{8}$ in.) thick and the lower rim 17mm ($\frac{11}{16}$ in.) thick, to accommodate the groove for the bottom of the container. For the outside bevel, use a spokeshave held about 30° from the staves and produce a rim line as close to a circle as possible. Gauge the proper thickness and bevel the inside, using a sharp carving knife, held point down in your fist like a dagger.

Some white coopers dress the inside with a scorp, but Kohler uses small wooden planes with convex soles and irons. He planes along the length of the staves, first from the upper rim, then from the lower, until the inside surface is worked down to the rim guidelines. Difficult grain can be shaped with a convex Surform. Sand the inside with 80-grit, then 120-grit paper, working across the grain. The outside of the container will be dressed later.

The bottom—Kohler's croze, the tool that cuts the bottom groove in the assembled staves, resembles an enlarged marking gauge with a row of coarse teeth in place of the scribe (photo, below left). This cutter is held by a setscrew or a wedge in the sliding arm. The cutter's teeth are filed much like coarse crosscut-saw teeth, having 5 points to the inch. Kohler made his from an old plane iron. The groove can be cut in a number of other ways, including scribing the edges with a marking gauge and excavating it with a chisel.

On our container, the groove is 13mm ($\frac{1}{2}$ in.) above the lower rim, 5mm ($\frac{3}{16}$ in.) wide and 5mm deep. Set the assembled staves bottom up on the shaving-horse bench, secure between your thighs and against a block between the container and the upright supporting the shaving-horse work ledge. Be sure to hold the croze flat against the bottom rim. Press down hard to avoid chatter (and scratching the dressed staves) and take a series of shallow passes around the rim. The 5mm width of the groove requires resetting the distance between cutter and fence for a second round of passes.

Bottoms can be split from a wide straight-grained billet, taken from a clear sawn board, or glued up from narrower stock. The bottom wood is planed smooth on one side, scribed with a marking gauge to 18mm ($\frac{11}{16}$ in.) thick and planed to thickness.

You can find the radius for the bottom with straight-leg dividers. Open them to the approximate radius, judged by eye. Place one leg in the bottom of the groove and walk the dividers around the groove. By trial and error, readjust the dividers until you can walk off six equal divisions. The dividers are now set for the exact radius of the bottom.

Scribe the circumference on one face of the bottom and saw it out just outside the scribed line. Put the bottom in a vise, and spokeshave the rim to just inside the scribed line, rotating the wood in order to spokeshave with the grain. The bottom should be 0.5mm (0.02 in.) undersize.

With your marking gauge, scribe two lines 5.5mm ($\frac{1}{4}$ in.) apart on the edge of the bottom board, and then drawknife the board to the shape shown in the drawing at left. With the board still in the vise, use a hardwood stick with a 4.5mm ($\frac{3}{16}$ -in.) slot and compress the rim to 4.5mm thickness. Then sand the bottom board across the grain.

With the bottom shaped, you are ready to glue up. Knock off the metal hoops and disassemble the staves, laying them

on the workbench in order. Spread a thin coat of white glue on both edges of each stave. Glue is used so that the exterior can be dressed with the hoops removed. Do not use yellow glue. It sets too fast and complicates knocking the staves apart again if you run into trouble fitting the bottom. Re-assemble the staves with glue and pegs, and lower the bottom board (chamfered edge down) into the container from the top. Spread the lower rim until the bottom board snaps into its groove. Hold the staves in place with a loose-fitting, temporary upper hoop. Tap the staves around the bottom, replace the lower metal hoop, and tighten it with hammer and hoop driver. Hammer the staves in or out as necessary. Then tighten the upper hoop. Allow the glue to set at least one hour before you remove the metal hooping, so you can spokeshave the exterior of the staves to the beveled upper and lower edges. Sand the outside of the container.

Wooden hoops—The most distinctive feature of Swiss milk buckets is their beautiful wooden hoops. The design is a refined variation of the so-called arrow-lock pattern. Hoops can be made from maple, walnut, oak, even pine limbs. Traditionally, hooping stock comes from the trunk of a choice young maple, 120mm (4¾ in.) to 200mm (8 in.) in diameter at the butt. A tree that is growing in an open area is preferred because its limbs grow outward, perpendicular to the stem, yielding minimal grain deformity around knots. In thick woods, tree limbs reach up to the light, causing irregular stem grain.

Buck the bole to a length at least 200mm longer than the circumference you will need. The bottom hoop will fit flush with the container's bottom, and the top hoop will be about a hoop's width below the rim. Hoop length includes an overlap of some 160mm (6⅜ in.), plus about 50mm (2 in.) for waste and end-cuts. Each bole length will yield 20 to 40 hoop blanks, and it may be possible to take two clear lengths from a single tree. Seal the end grain, and split the bole in half and then into eighths as wood is needed. Green wood is easiest to work and to bend, but air-dried wood can be used. Maple splits easily, but its grain is rarely straight, so bandsaw two radial strips 8mm to 10mm (about ⅜ in.) thick, and 30mm to 35mm (about 1⅜ in.) wide; the growth rings will cross the thickness of the strips. Blanks from ring-porous hardwoods can be split to size. Drawknife the bark side to a smooth and straight, or slightly bowed, edge. You will have to support the hoop wood on an extension stick sandwiched between shaving-horse ledge and jaw.

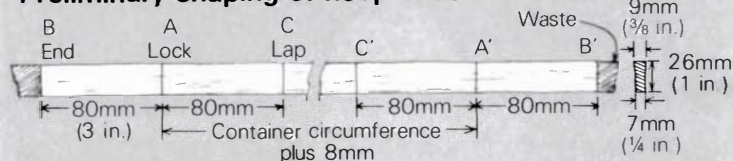
Next, decide which will be the outside face of the hoop. This can be either side of the blank, but the wood often takes a natural bow. Drawknife the outside face smooth, then scribe a line 26mm (1 in.) from the dressed edge and drawknife the blank to width.

To fit the tapering shape of the container, the hoop in section must be thicker at the bottom than at the top. Mark and then drawknife the hoop 7mm (¼ in.) thick at its top edge, 9mm (⅜ in.) thick at its bottom edge.

The next step is to measure the exact length of the hoop. Wrap a piece of stout string around the container where the center of the hoop will lie. Add 8mm (⅝ in.). Transfer this length to the hoop blank, leaving room for the 80mm (3-in.) overlap at each end. The drawings at right detail the steps for first shaping the same side profile at each end of the hoop, and then shaping the female and male pattern in plan view.

Assemble and fit the longer upper hoop first. Ladle boiling

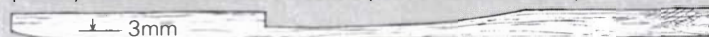
Preliminary shaping of hoop ends



1. Lay out both ends of hoop, penciling lines on inside face.



2. Saw off waste ends. Kerf inside face at A and A', leaving 4mm (⅜ in.) thickness at bottom, 3½mm (⅛ in.) thickness at top.

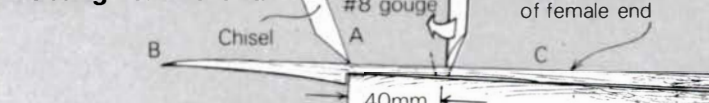


3. Drawknife a concave surface from C to A (and from C' to A'). Drawknife a slight taper, about 3mm (⅛ in.), on the outside face of each end.

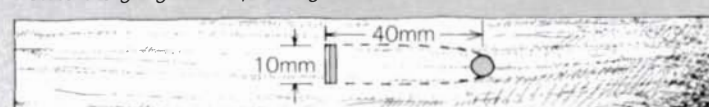
4. With a hollowing drawknife, relieve the inside face of hoop from A to A', so that only the corners of the hoop will contact the staves.

5. Drawknife a concave surface on the inside face of each end.

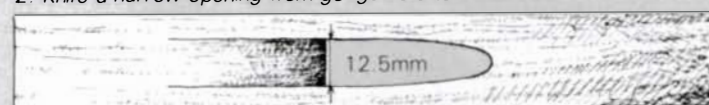
Cutting female end



1. Using a 10mm (⅜ in.) chisel, punch a slot at A. Using an 8mm (⅝ in.) #8 gouge, bore a hole centered 40mm (1½ in.) from the slot. Rotate the gouge while pressing down.



2. Knife a narrow opening from gouge hole to chisel slot.

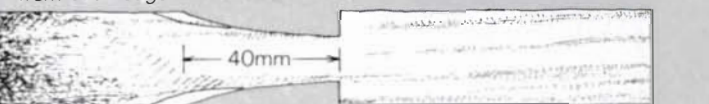


3. Widen the opening to 12.5mm (½ in.) at slot. Knife and chisel a flat, about 40mm long, that tapers into the slot.

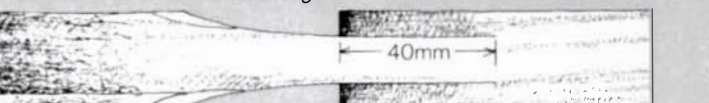
Cutting male end



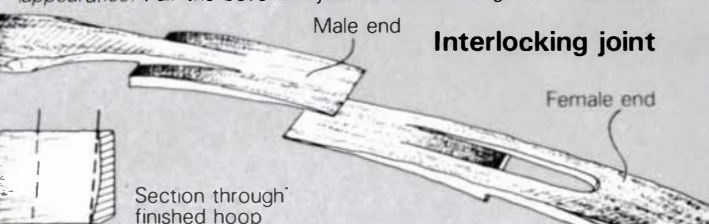
1. Whittle a piece of scrap, to scribe the width of the female slot on to the male end, centering it on the outside face at A'. Knife a V-cut from each edge to the scribe marks.

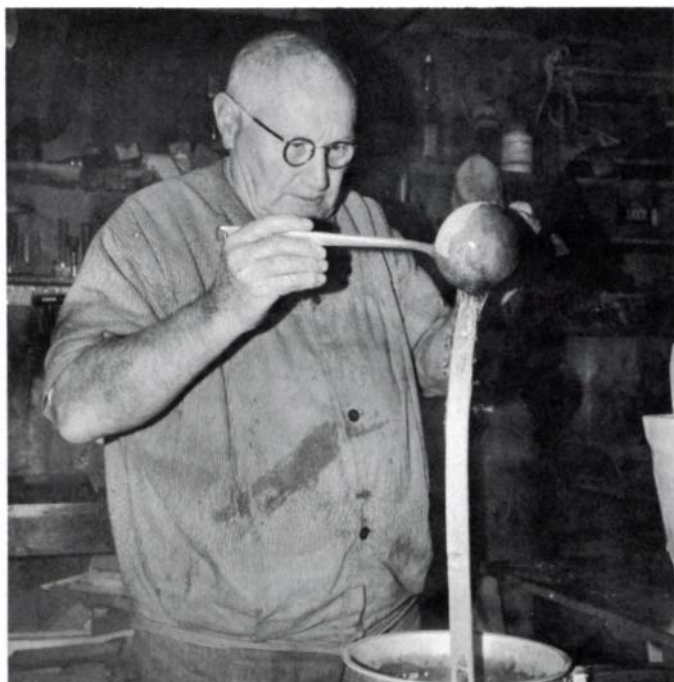


2. Knife a concave notch on each edge, about 40mm (1½ in.) long. Knife small chamfers to relieve the outside face where it can split when the ends are twisted together.

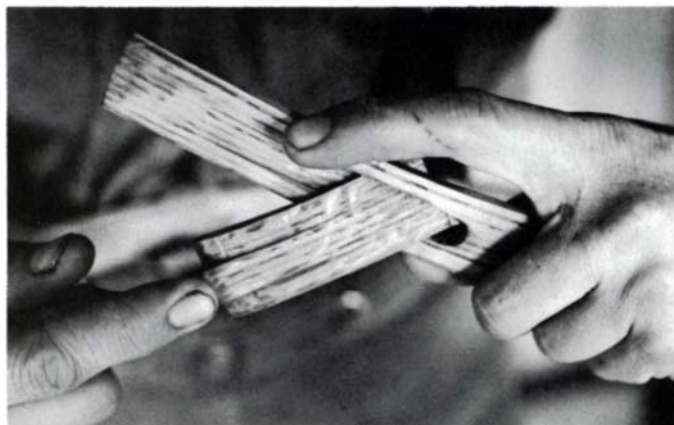


3. Knife and chisel two tapered flats, about 40mm long. Drawknife a narrow bevel along the lower edge of the hoop, for a lighter appearance. Fair the bevel out just before reaching the female end.





Ladling hot water over the hoop blank, above, limbers it for bending. The blank must be twisted, below, in order to fit one end through the other.



A knife sizes the rim line by beveling the waste away. Both the inside and the outside of the container will be thinned to meet these top and bottom rim lines.

water over the hoop for about one minute. Limber the hoop by flexing it. Limber the joint ends by inserting them in a vise opened about 10mm ($\frac{3}{8}$ in.); bend toward the interior face. Reheat the hoop by ladling more boiling water. Bend the hoop into a circle and twist the ends to insert the tab through the outside face of the slot. Any small splits should be immediately pared off with a knife so they don't run into the hoop.

With your container upside down on the bench, fit the hoop. Drive it into place by hammering on a small hardwood block. The hoop should become tight 25mm to 30mm (about an inch) from the upper rim. If the hoop is too tight (short), remove it from the container, and with the joint still assembled, saw 2mm to 3mm (up to $\frac{1}{8}$ in.) from one of the locking edges of the tab. An alternative is to thin the overlapping section by paring the inside faces with a knife. If the hoop is loose (too long), add a thin spacer between the male and female locking edges.

Now heat, limber and lock the lower hoop. Fit it so that the bottom of the hoop is flush with the bottom of the container. With a knife, trim the edges of the overlapping ends. Nail or peg both hoops in place. For pegs, drill 3mm ($\frac{1}{8}$ -in.) diameter holes through the hoops and into, but not through, the staves. Locate one peg on each side of the lock joint, plus two evenly spaced pegs on the opposite side of the hoop. Nails are generally brass with round heads.

After the wooden hoops have been fitted, the inside face of the rims can be dressed with a knife for a lighter, more finished look. Take long, smooth slices, beveling them about 65mm ($2\frac{1}{2}$ in.) from the top rim. The final thickness at the rim should be 8mm ($\frac{5}{16}$ in.). Make a similar bevel around the interior of the bottom rim.

A handle is optional. If you want one, make it from maple and secure it with wooden pegs. Note Kohler's clever arrangement in the photo on p. 73: the two extra-long staves are relieved, so the handle moves freely and doesn't bind against the rim. This photo also shows how the sides of a bucket are sometimes sculpted. While the effect is decorative, the purpose is really practical—it allows the bucket to be made more tapered, while still using a basically circular hoop of minimum inside taper. Kohler begins such a bucket with thicker, more tapered staves, gluing up the bucket as usual. Where the top of each of the two wooden hoops will be, he makes a sawcut about 3mm ($\frac{1}{8}$ in.) deep. With a skew chisel, he carves flat the area where each hoop will land. Above the area for the top hoop, he drawknives the outside of the bucket concave. Above the area for the bottom hoop, he drawknives the bucket convex. He then fits the wooden hoops as usual.

For farm use, staved containers are not given any surface treatment. The hoops of bowls and buckets sold as gifts or prizes are often chip-carved, and the whole is given a coat of quick-dry semigloss lacquer. Lacquered ware is easy to keep clean, but it is decorative, never used on the farm. Under continuous wetting and drying, it would soon deteriorate. □



Drew Langsner will be teaching a week-long course in coo- perage this summer. For details and information on this and other course offerings, write Country Workshops, Rt. 3, Box 262, Marshall, N.C. 28753. Photos by the author.

Taos Furniture

Southwestern style embodies Stickley's Craftsman spirit

by James Rannefeld

Nothing is ever created in a vacuum. Every masterpiece has its precursors and its pretenders, every tradition its exemplars and its exotics.

The history of furniture design makes a strong case for this argument. Although benchmarked by the Sheratons, Thonets, Wegners and Eshericks, furnituremaking has always been an evolutionary process of copying, modifying and synthesizing. It is, however, occasionally punctuated by masterful designs destined to become classics.

Taos-style furniture is one such design popular today in the desert Southwest. Despite the hundreds of thousands, if not millions, of dollars' worth of Taos furniture that has been made and sold in this area, it has remained basically a handcrafted cottage industry. Hundreds of woodworkers, including myself, make their own versions of this basic design. The style, classic in its simplicity and durability, is almost certainly derived from the Craftsman settees shown in the 1910 catalog entitled *The Work of L. and J.G. Stickley*, republished in 1979

by Dover as *Stickley Craftsman Furniture Catalogues*.

Gustav Stickley, repulsed by Victorian excesses, was an advocate of honest furniture with simple lines, preferably made from stalwart, native American hardwoods. His characteristic through mortise and tenon pinned by a dowel likewise became an important detail of the original Taos daybed and its derivatives.

Jim Hill, who started the Taos Furniture Company in Santa Fe, is generally credited with introducing the style in about 1970. But the Hispanic tradition has a way of working its magic on immigrants, and so it was with Craftsman furniture. The prevalent wood in the Southwest is Ponderosa pine, rather than the oak that Stickley championed. The use of pine made it necessary to beef up the dimensions of the old Craftsman style, giving it proportions more reminiscent of Spanish Colonial furniture. And, in fact, the new Taos style was almost immediately absorbed into that 300-year-old tradition as if it had been handed down for generations. Another obvi-



The Taos-style couch, which originated in Santa Fe about a decade ago, is a melding of Stickley precepts with the Spanish Colonial tradition. The convertible-bed variation (detail) has two mattresses and unfolds into a queen-size bed, as shown in figure 2 on p. 80.

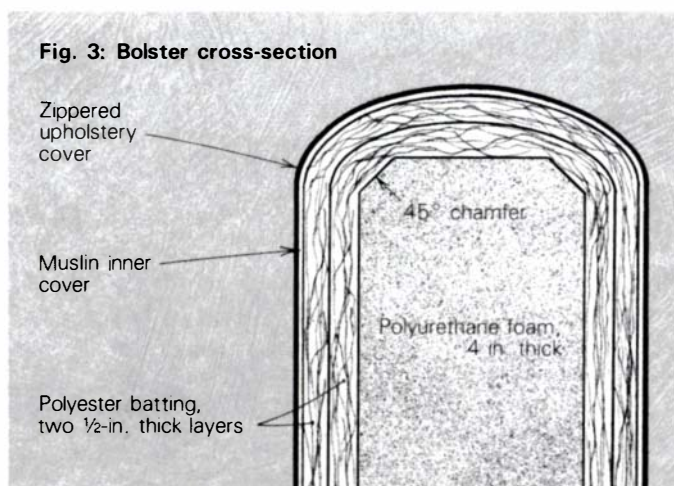
Fig. 2: Convertible-bed variation

The diagram illustrates a convertible bed variation with the following details:

- Side View (Left):** Shows the bed frame with a platform that is 29½ inches wide. The platform is supported by three 2½-in.-square removable legs. The platform is 4½ inches thick and 1¼ inches high. The legs are 9½ inches high.
- End View (Right):** Shows the bed frame with a platform that is 5¼ inches wide. The platform is supported by three 2½-in.-square removable legs. The platform is 4½ inches thick and 1¼ inches high. The legs are 9½ inches high.
- Assembly Details (Center):**
 - Dowels on legs protrude ¾ in. and fit into holes drilled in platform frame.**
 - 5½-in., high-density particleboard fits in dadoed groove.**
 - Three ½ x 6 dowels are added after platform is assembled.**
 - ¼-in. clearance** is indicated between the platform and the frame.
 - Hinges at each end and middle** are indicated on the side view.



80



ous change was in the slats that form the backs and sides of Stickley designs. Now they became bars, sometimes carved into traditional spirals, or replaced with *latillas*, small cedar or aspen branches either left natural or peeled.

It took only a few years for this style to be regarded as the indigenous furniture of northern New Mexico, with buyers coming in from all over the United States and abroad to get it. Today's offerings usually include the daybed (designed for a twin-bed mattress), the couch (for a 30-in. cot mattress), the love seat, the occasional chair, and, more recently, the convertible bed, which unfolds to make a queen-size bed. The basic design is so straightforward and universal that it invites variation. The prototype for the style is the couch. Simple dimensional variations produce the other pieces in the group, as well as bedroom furniture and other accessories.

I generally use oak for this design, laminated from 1 1/4-in. stock, but more often the pieces are constructed from 3-in. Ponderosa pine cut locally and milled to 2 1/2 in. Since material of this dimension is rarely available kiln-dried, most of us here use air-dried wood, which quickly gets down to 8% to 12% moisture content in our arid Southwestern climate.

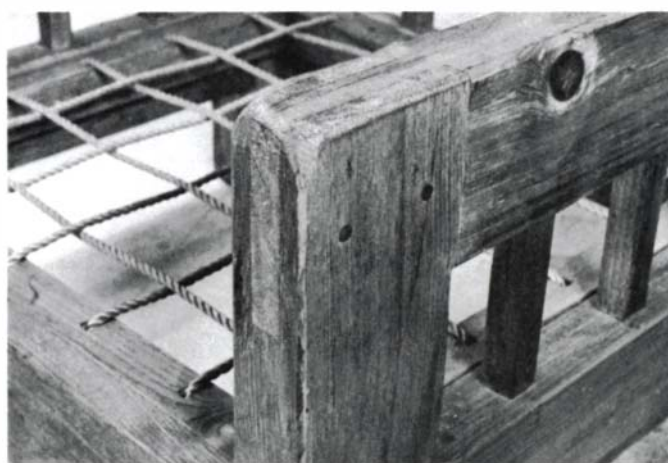
The original Taos furniture featured an open mortise-and-tenon joint (a bridle joint), pinned with dowels, at the front arm/leg joints. Although part of the beauty of this design is that wood movement isn't a serious structural problem, bridle joints do creep when the members shrink in width, causing an unsightly detail that's unfriendly to the touch. Consequently, in our shop we now use a stub tenon pinned with small dowels for insurance. The bars are likewise tenoned into the arms, although some makers dowel here. The end rails are let into the legs, and the ends are assembled as a unit.

The platform can be made from a variety of materials. I have chosen an industrial-grade hardboard to illustrate the process here, but the original pieces used 1-in. pine boards. You might use knotty-pine veneered plywood, or—for more comfort—a frame webbed with ropes or with latex strapping.

After the ends, front rail and rear rail have been dadoed to accept the platform, they are lap-joined, with a rabbeted shoulder that eases alignment when clamping up. After assembly, all the joints are pinned with dowels.

Pine is frustrating to finish with an orbital sander, so conventional wisdom here is either to leave the piece belt-sanded (100-grit) for a rustic look, or to give it a fine scraper finish.

Traditionally, Taos furniture has been stained with a tar-and-kerosene concoction, probably to mimic more expensive



This pinned bridle joint, a hallmark of early Taos furniture, has been all but abandoned because of problems with wood movement. A pinned stub tenon is more in favor now.



Jim Hill's Taos Furniture Company pioneered the basic couch design around 1970. Since 1976 the firm has been under the direction of owner Bob Powell, making a full line of variations as well as Spanish Colonial reproductions. Eight employees emphasize hand work and adaptability rather than assembly-line tooling, allowing increased diversity without cutting production.

walnut furniture brought in from elsewhere. Several local craftsmen have begun using aged or distressed finishes, and some just leave the wood its natural color, Scandinavian style. In any case, I recommend a mixture of Danish oil and polyurethane varnish (about 3:1), a heavy sealer coat brushed on, then two coats applied with fine steel wool and rubbed dry. This mixture has the best qualities of both products, without the drawbacks. It applies, repairs and looks like an oil finish, yet resists liquids and wear like polyurethane.

The upholstery for Taos furniture is as straightforward as the wood-frame construction. The lower cushion is usually a single (cot-size) mattress, with three 15-in. high back bolsters for comfort. These consist of a core of 4-in., medium-density polyurethane foam (chamfer the corners for a softer contour) wrapped twice with polyester batting. I would recommend an inner cover of muslin, and a zippered upholstery cover, so it can be easily removed for cleaning.

Whether contemporary or rustic, traditional or exotic, no matter how the craftsman adapts this basic design, the spirit of Craftsman furniture lives on. Direct construction, durable joinery, simple elegance and unpretentiousness remain the common denominators of the Taos style today. □

James Rannefeld designs and builds furniture at Media Seven Design Group, in Taos, N.M. Photos by the author.

Repairing Bandsaw Blades

And how to make up your own from bulk rolls

You don't need welding equipment to braze narrow bandsaw blades. A propane torch can generate enough heat, and silver solder is strong enough for a good joint. Any small shop can deal with the nuisance of a broken blade by repairing it on the spot. And if bandsawing is a daily operation in your shop, you can save money by buying blades in bulk rolls. This also lets you choose from a variety of widths and teeth, some of which aren't generally available in made-up blades. One commercial supplier, DoAll (254 N. Laurel, Des Plaines, Ill. 60016), sells a skip-tooth, $\frac{1}{4}$ -in. blade in 100-ft. rolls. Cut and soldered, each blade ends up costing about \$3, and the entire process takes little longer than sharpening and honing a dull tool.

Bandsaw blades break for a variety of reasons. Sometimes a sharp, new blade will snap when you trap it by trying to saw too tight a curve, or when you skew the work. You can repair

this type of break successfully, but fixing other kinds of breaks may be a waste of time. A dull blade, for instance, will break if it's pushed too hard, but repairing it won't be worthwhile unless you can sharpen it too (see facing page). Older blades, even ones that are still sharp, sometimes break because they've gotten brittle through work-hardening, having been flexed over the saw's wheels a few times too many. These blades aren't worth fixing either, because it's likely that they'll soon break in another spot.

You can probably buy silver solder and a compatible flux at the local hardware store, but be sure that it's about 45% silver with a melting point near 1100°F, or it will bead up on the blade without flowing. You'll need to make a holding jig (figure 2) from angle iron or scrap metal to position the ends of the blade while you solder it. The jig can be tucked away when you're not using it, then clamped in your bench vise when you need it.

Soldering metal is akin to gluing wood: success depends more on the fit of the parts than on the strength of the bonding material. Attempting to bridge an open joint with solder won't work. For this reason, the scarf joint (figure 1) should be a perfect fit and carefully aligned. First heat the blade ends red with the torch, then cool them slowly to soften the steel. The surfaces of the scarf should be at least three times as long as the blade is thick. The ends to be joined can be shaped on a bench grinder—either freehand or with a simple guide block—or they can be filed. One trick that ensures a matching joint is to lay one blade end over the other and bevel them both at the same time. The operation is easier than putting a bevel on a chisel, so use whatever method suits you.

Metal, like wood, must be clean for a good joint. Some low-temperature solders are hollow, and contain acid for cleaning the metal, making soldering a one-step operation. But high-temperature silver solders require a separate flux that is formulated to work with a particular solder's alloy and melting temperature. Flux performs several functions: when heated, it chemically cleans the metal, helps the solder flow and speeds heat conduction. Vapors from flux are very irritating, and some solders give off toxic fumes, so provide ventilation. Apply the flux to the scarf surfaces before you heat the joint. You can trap a flattened piece of cold solder in the scarf, or you can preheat the blade and drip solder onto it. If you drip the solder, it is not enough merely to melt it—you must get the blade itself hot enough to cause the solder to flow thinly over the metal and into the scarf.

As in gluing wood, the joint should be held tight while the solder sets. One jig, left, has a built-in adjustable screw support. Immediately after the initial soldering, you press down on the scarf with a screwdriver tip and reheat the joint until the solder flows. As an alternative that does without the screw, you can design the jig so you can grip the joint with a pair of pliers to clamp it and cool the molten solder. A traditional method requires brazing tongs (similar to blacksmiths' tongs). Set up the scarf with flux and cold solder, then grab

(continued on p. 84)

Fig. 1: Scarf joint

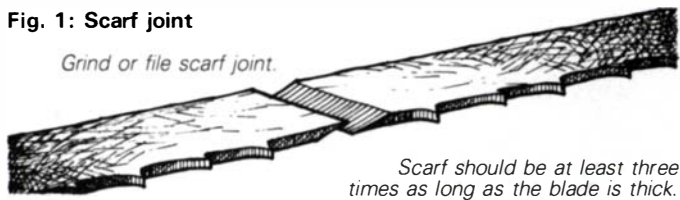
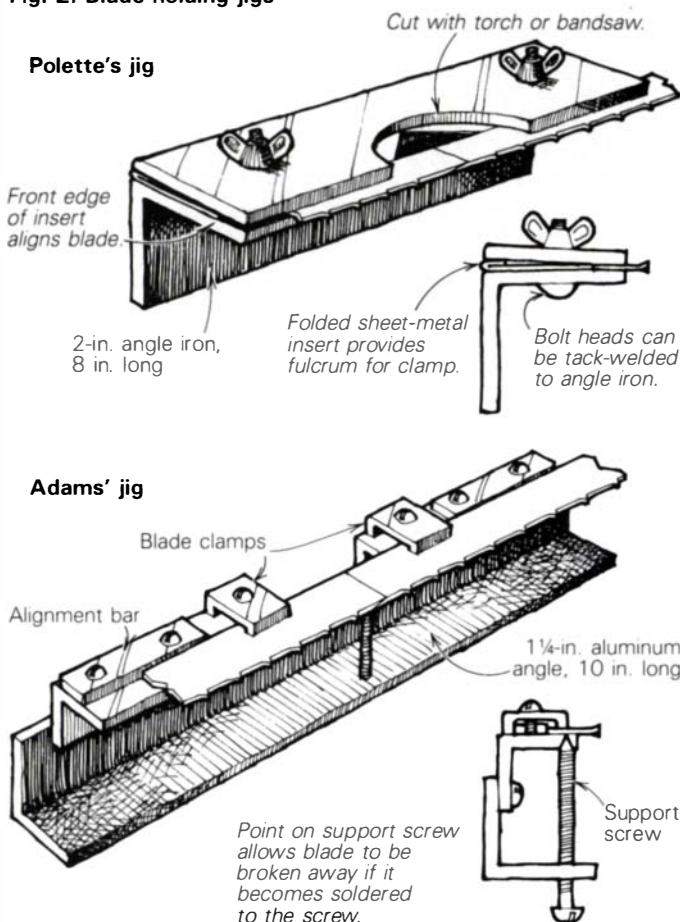
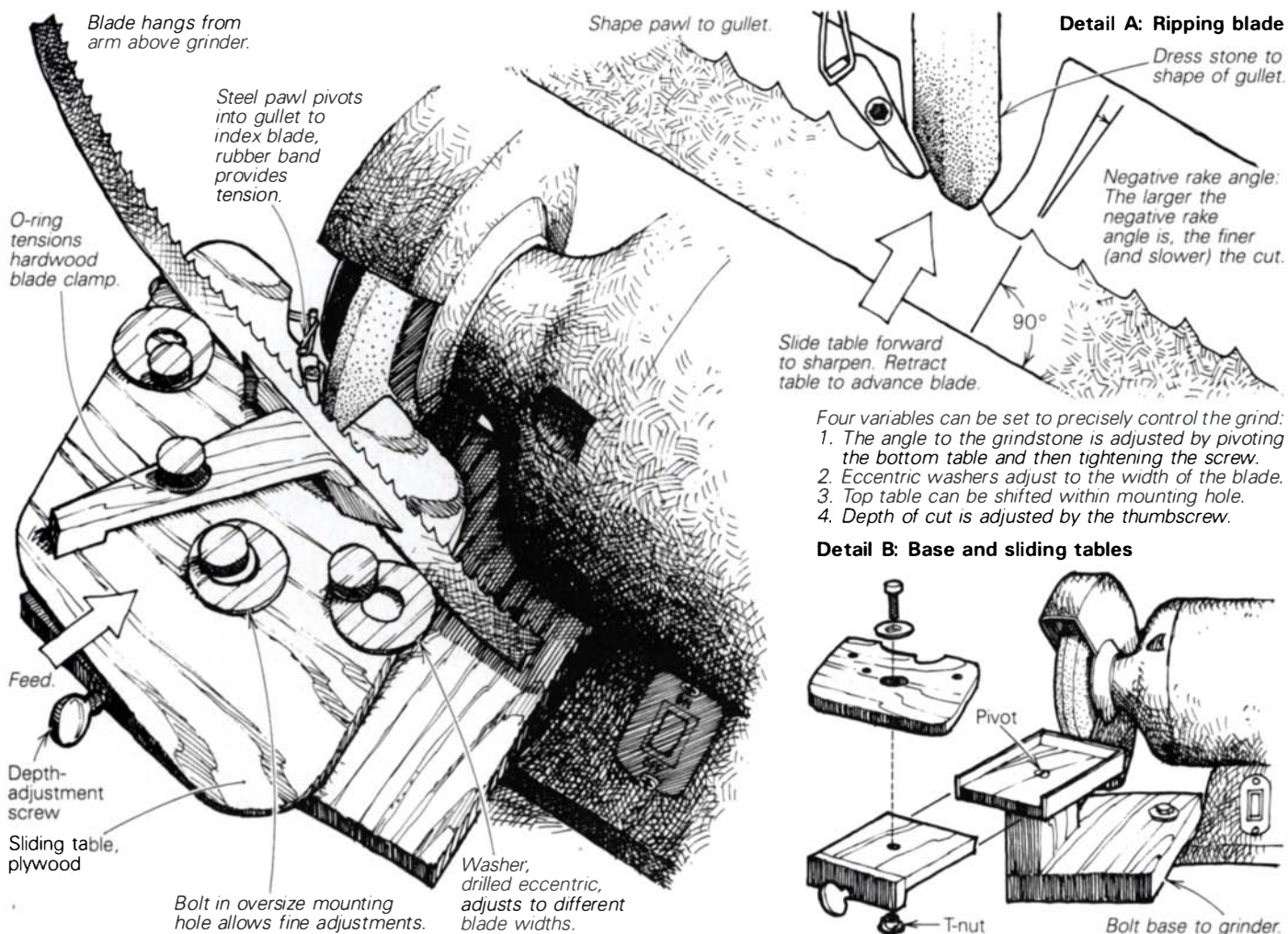


Fig. 2: Blade-holding jigs



Bandsaw-blade sharpening jig

by Robert Meadow



- Four variables can be set to precisely control the grind:
1. The angle to the grindstone is adjusted by pivoting the bottom table and then tightening the screw.
 2. Eccentric washers adjust to the width of the blade.
 3. Top table can be shifted within mounting hole.
 4. Depth of cut is adjusted by the thumbscrew.

Factory-fresh bandsaw blades leave a lot to be desired if you want to resaw slices thin enough for veneer or for instruments such as the lutes I build. The teeth are usually uneven, and they are sharpened to points like a crosscut or a combination blade, not square across like a ripping blade, which is the best shape for resawing. I built a sharpening rig that attaches to a standard bench grinder, adjusts to blades of various widths, and sharpens blades for ripping, with a slight negative rake and square-faced teeth. This not only improves a new blade, it greatly prolongs its life—the blade can be resharpened many times. I can adjust the mechanism and sharpen a 6-ft. blade in about 10 minutes. It will then cut slices that come off the flitch looking like they've already been sanded with 40-grit paper.

The setup is made from scrap and a few pieces of hardware. No doubt you can adapt a similar design for a dollar or two. The only real expense is the Nor-

bide dressing stick used to shape the stone to match the gullets of the blade. That cost me \$27.

The rig almost builds itself. First, attach the flat plywood base to your grinder. Next, choose your favorite blade, turn it inside out, and use the Norbide stick to true the grindstone to the shape of one of its gullets, or use the gullet shape shown in the drawing. Then, with the grinder turned off, line up the blade so that the stone fits the gullet—this will show you the height of the post, the angle at which the blade should be clamped and the angle at which the sliding table will have to move. The outside washers on the sliding table act as cams. They can be adjusted to different-width blades, and can also be used to change the sharpening angle slightly. Fine adjustments can be made by loosening the central bolt and shifting the upper layer of the sliding table. At the back of the sliding table, a thumbscrew controls the depth of cut.

The steel pawl, tensioned by a rubber band, indexes the blade. It pivots and clicks into each successive gullet as you slide the blade into position to sharpen the next tooth. When you reach the weld in the blade, you can just grind that tooth shorter freehand if the spacing is uneven. If you have a variety of blades with different-size teeth, you'll find it best to have interchangeable grindstones and pawls to fit.

I'm delighted with the results this gadget produces and I'm sorry I didn't make it years ago. It has had only one drawback so far: A friend of mine had been complaining that his 14-in. Rockwell bandsaw was too underpowered to resaw 12-in. stock. I made him an offer for the saw, then made the mistake of sharpening a blade for him. He promptly cancelled the sale. □

Robert Meadow runs The Luthierie, an instrument-making and woodworking school in Saugerties, N.Y.

the joint with the red-hot tongs. This activates the flux, melts the solder and clamps the joint all in one step. You can even get away with not clamping by taking advantage of the springiness of the blade. Align the scarf joint in the holder, then bend the ends of the blade until the joint is tight.

If you heat and cool the metal too quickly, it will be brittle. Manufacturers—who weld blades with an intense shot of electricity—reheat the joint at a lower voltage so it will cool slowly. But if the joint cools too slowly, the metal around the joint will be too soft. Conditions will vary depending on your torch, your solder, how you clamp and the speed at which you work. It's best to make a few practice repairs. Try to bend each joint. If the metal is too hard, it will snap. The remedy is to cool the joint more slowly. The blacksmiths'

tongs do this automatically, but cold pliers will probably leave the blade brittle. In this case, heating the joint with the torch until it turns the same blue color as the rest of the blade will temper it to the correct degree of spring. If the metal is too soft, it won't have any spring, and will bend easily. In this case, cool the joint more quickly.

After the solder has set, file away any excess from the sides and back of the blade—only the solder in the joint itself contributes to the strength of the bond. □

This article was compiled from information contributed by three woodworkers: Wash Adams, from Richardson, Tex.; Doug Polette, a professor at Montana State University in Bozeman; and John Leeke, of Sanford, Maine.

Japanese Resaws

Two small machines with big blades

by Rich Preiss

Resawing is a superb technique for getting the most out of your wood. You can slice thick planks to near their finished size and thereby lessen the amount of lumber that gets chewed up by the surface planer. After planing, resawn planks can be bookmatched to reveal attractive figure. Yet in many shops, resawing is difficult work. Large industrial bandsaws that do this task effortlessly are expensive and bulky; the smaller machines that shine at fine scrollwork bog down when you feed wide, thick stock into them. Two highly specialized bandsaws from Makita and Hitachi, two of Japan's best-known tool manufacturers, might resolve this dilemma.

These machines, which are scaled-down versions of the industrial bandmills that convert heavy logs to lumber, have been on the American market for three years now. Equipped with wide, coarse blades and geared motors, they are designed specifically for resawing. I borrowed one of each machine—a Makita 2116 and a Hitachi B600A—and tested them in my shop. I tried cutting all kinds of stock, from hard rosewood to softer oak and walnut. I used the machines for both resawing and ripping, and found that they did these tasks quickly and accurately.

The Makita costs about \$1,300; the Hitachi, about \$1,650 (figures vary, so shop around)—relatively high prices for bandsaws of this size, but a fraction of what you would pay for an industrial bandsaw that will resaw as well. I resawed boards up to 12 in. wide, dimensioned heavy timber and ripped boards to finished widths. I even resawed my own 1/16-in. thick veneer from wide boards, a job I wouldn't attempt with a standard bandsaw. This veneer was practically ready to use straight from the saw, requiring very little subsequent planing.

When I uncrated the saws, I was surprised at their small dimensions. Unlike other bandsaws that have base cabinets to elevate the table to a standard 40-in. working height, these resaws are designed for use at 29 in. to 30 in. This looked

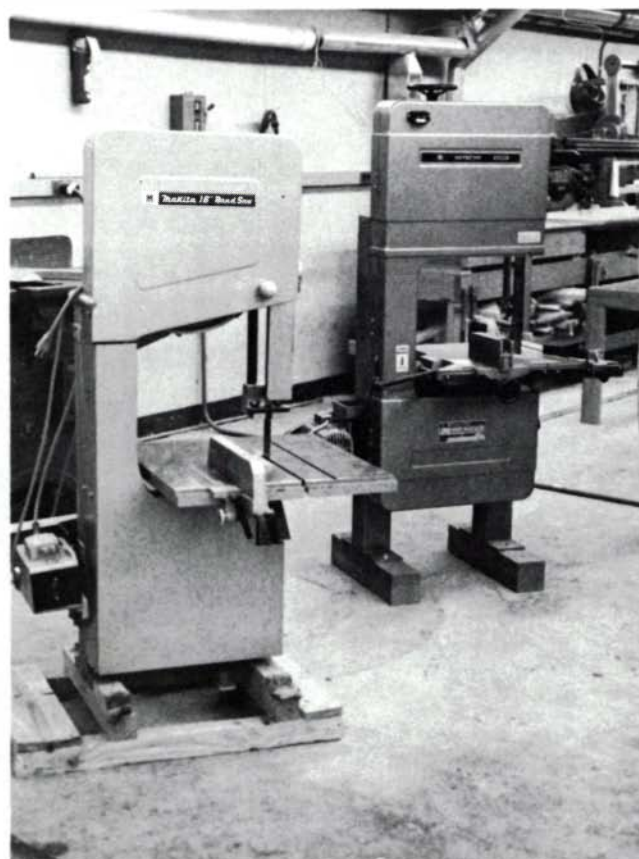
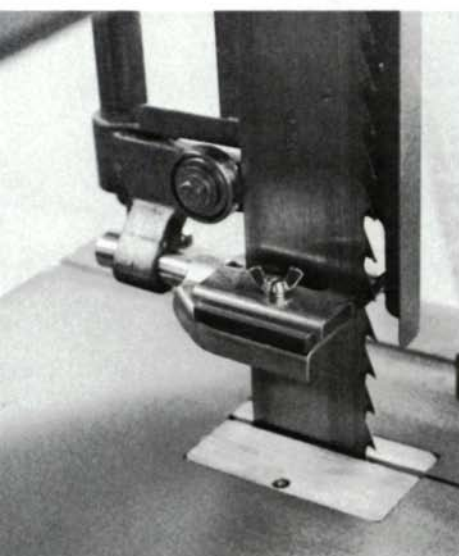
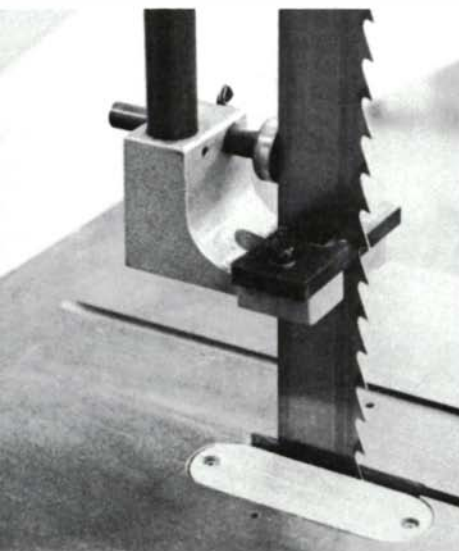
odd to me at first, until I realized that it means you don't have to hoist large timbers or heavy boards to chest height, balancing them precariously during the cut. Of course, you still have the option of blocking the resaw to any height, but I found that I soon got more comfortable working over the material instead of behind it.

A second unusual feature of these machines is the seemingly small size of the motors. But these high-speed motors run the saws' drive wheels through a geared transmission and pulley arrangement that gives enough torque for this kind of work. The 2-HP Makita motor, with its greater RPM, makes for a smoother cut, but will lag sooner than the slower, 3-HP Hitachi. If you rely on these saws continuously, or for extensive resawing of maximum-width boards, larger motors can readily be adapted to the universal mounting plates on these saws. Both seem built heavily enough to take more power, especially the Hitachi.

The real eye-opener on both machines is the width of the blade—2 3/8 in. on the Makita and 2 7/8 in. on the Hitachi. The blades have swage-cut teeth tipped with Stellite, an alloy harder than steel but softer than carbide. The tips are fused to a thin blade body, resulting in a highly tensionable blade that cuts a narrow kerf. At \$48 for the Makita and \$70 for the Hitachi, these blades are expensive. But they run cool and should last a while. You can resharpen them once or twice by hand with a file, but when they get really dull, you'll have to take them to a sharpening shop equipped to grind Stellite.

The guides on both saws are conventional friction-type blocks made of Bakelite. They are as wide as the blade, and about 3/8 in. thick, with the middle section relieved so that the blade will run cooler. Both have thrust bearings behind the blade, but the Hitachi's bearings run in line with rather than at right angles to the blade axis—an unusual arrangement I'd never seen before, but one that seemed to work fine.

I preferred the Makita's blade-adjustment mechanism, es-



Both resaws tested (Makita, left, and Hitachi, right, in the photo above) are surprisingly small. The saw tables are about 30 in. above the floor, a working height that makes it easier to balance the kind of heavy timber these machines are designed to cut. Blade guides are similar to those of conventional saws. The Makita 2116, top left, has two Bakelite guides adjusted with wing nuts. Those of the Hitachi B600A, bottom left, are similar, though slightly beefier. These saws will cut boards up to 12 in. wide; in the photo at right, Preiss uses the Hitachi to slice a 1/8-in. thick piece of veneer off a wide plank.



pecially the tracking control, which stays put without having to tighten an additional locknut, as on the Hitachi. The upper guides and thrust bearing on the Makita saw are fixed to a solid block, and are simpler to adjust than the Hitachi's, whose base tends to tilt when loosened.

I found quite a few other differences between these two machines. The wheel shafts and bearings on the Hitachi saw are about 50% larger than on the Makita. And like most industrial machines, the Hitachi has adjustable gibs on the upper blade-tensioning ways, enabling fine adjustment for future wear. The Makita lacks this feature, but I'm not sure it makes much difference to the average user anyway; nevertheless, it's a nice touch that's better to have than not. The Hitachi frame is made of fabricated steel, but is about 40 lb. heavier than the cast-iron Makita. The weight difference has little bearing on performance, though—either saw is stable enough to do what's expected of it.

Both saws are equipped with fences whose length ends at the front edge of the blade. The Makita's fence cleverly swings clear of the table, and it includes a vernier fine-adjustment control, two features that speed the work when you have to set up the saw several times a day. The stubbier Hitachi fence, however, locks more firmly and deflects less noticeably under feed pressure. In addition, it has a coarser rack-and-pinion adjustment that won't clog and bind when filled

with sawdust, a problem that made the Makita fence annoying to work with. The Hitachi also has a spring-steel hold-down that I found handy for holding boards against the fence. The Hitachi has another feature I liked: a manual brake that quickly stops the blade for safety and for speeding adjustments.

After working with these saws for more than a month, I can only conclude that, for me, they aren't an essential basic machine like a tablesaw or a jointer. I don't do enough resawing or timber-sizing to justify a machine devoted to just that one purpose. Since I tested these saws, Hitachi has redesigned its blade guides to accommodate narrower blades, and one Makita dealer has devised a kit to do the same thing, but I haven't tested either. For my money, these saws are best kept to resawing, leaving scrollwork for the lighter—and usually less expensive—saws designed for that job. If I did have the need for one of these saws, I'd pick the Hitachi, despite its higher price. This machine's heavier, more sophisticated construction and greater power make it more akin to the kind of industrial-quality machinery we would all buy if we could afford it. □

Rich Preiss supervises the architectural woodworking shop at the University of North Carolina at Charlotte. For more on bandsaws, see FWW #19, p. 96, and #27, p. 82.

Scroll Sawing

Filigree revitalized with a saber saw

by Ron Pessolano

About six years ago, I was involved in a form of aesthetic expression called string art, or in my case wire art. One day, when I realized that wire was not giving me the spiritual, emotional or financial rewards I'd hoped for, I trudged down to the lumberyard and invested in a couple of square feet of plywood, to see what I could tease from it with my saber saw.

I cut the 24-in. square into an abstract, amoeba-like shape, then made a similar inside cut to leave an unusual (strange, some called it) picture frame. Then I beveled and sanded all the edges, so that the laminations would show up well and add to the design.

I had made something, without a doubt. But I couldn't come up with a single painting, print or "thing" that looked good framed by it.

The next day a friend suggested I in-



Solid-core birch plywood can be saber-sawn into delicate filigree.

stall a mirror instead of a picture. So I bought a mirror, attached it to the frame, and suddenly got the feeling that my life would be taking a turn for the better. I spent the next few weeks drawing and sawing every amoeba-like design I could think of.

Later that year, 1976, while I was exhibiting some of my work in a shopping mall, someone asked if I could make a small square frame with the outline of the Liberty Bell inside. Sure. Why not?

I was soon designing *within* the frame, instead of making the frame itself the design. As I became more skilled with the saber saw, I began to devise patterns based on stained glass designs. For a while I fitted them with fabric or grasscloth backings instead of mirrors, mainly because the reflections in a mirror tend to overpower the delicate filigree. But lately I've gone back to mirrors because they sell better. Most of the fabric-backed panels were meant to be wall hangings, but many became glass-covered tabletops, door or window inserts, room dividers and free-standing screens.

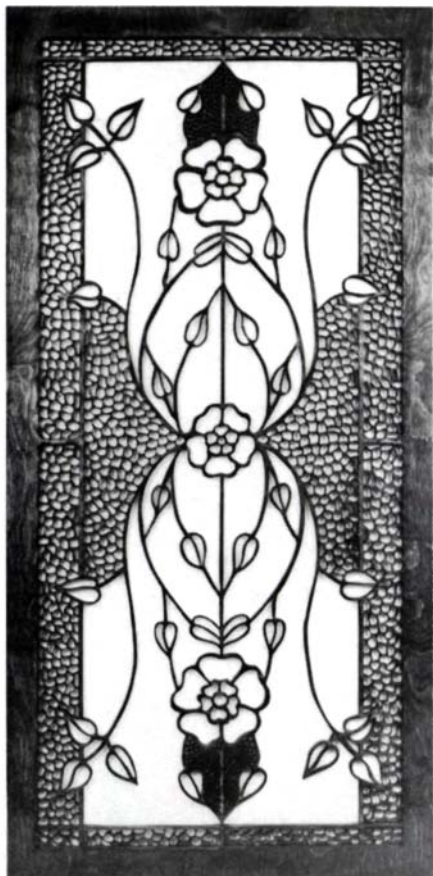
Each piece begins as a single panel of plywood: 1/2-in. for larger or less stable pieces, 3/8-in. for smaller ones; 3/4-in. plywood is thicker than necessary and slow to work. Baltic birch, Finnish birch and alder plywoods are the only ones I've found that will hold together.

After drawing or tracing the design, I drill a hole in each area to be cut out, insert the blade, and cut along using a hand-held saber saw.

The saw—When I began this work six years ago, I already had a Sears auto-scroller saber saw, model #17280. Sears was the only tool store I knew of at the time, and I bought the saw because it was on sale. I've scoured the market since, looking for a better design, but for my money that old saw has them all beat. Its wide, stable base is even better than the new Sears model.

I'd bought the saw for straight-cutting the backboards for my wire art, but when I took my first crack at the Liberty Bell design, I began to realize just what that knob above the blade is for. It rotates the blade—in a complete circle if necessary. You can push the saw with one hand while steering the blade with your other hand. Thus, the body of the saw doesn't have to point in the direction of the cut. Without this feature I'd have to either work on a round bench (to walk around the piece) or be a contortionist. You could attempt this work with a jigsaw, but you'd have to swivel the entire piece around the blade, and detach and reattach the blade to move from cut to cut.

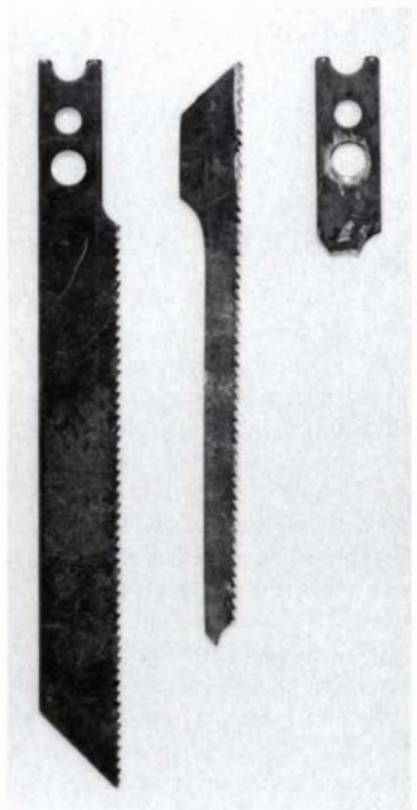
One problem I encountered with this saw is that the screw that's supposed to



Frame, 4 ft. high, awaits mirror.



For the tight curves pictured above, Pessolano makes narrow, set-tooth blades by grinding standard blades (right) and mounting them upside down in a blade holder modified to take a larger setscrew. The blades cut on the downstroke, limiting tearout to the back of the plywood. A shim made from a broken blade spreads the blade holder's clamping pressure.



hold the blade securely in the blade clamp doesn't—it's too small. The blade tilts backward under pressure. The best solution I could come up with was to drill and tap the clamp to accommodate a ¼-in. Allen screw. This holds if I insert a small flat piece of metal (the top part of an old blade) between the screw and the blade to spread the pressure.

Two months after solving the first problem, I realized I'd created another. As a result of my enlarging the hole, the blade clamp split. I noticed it was made of sintered metal (powdered and molded into shape) rather than of a stronger, solid piece. So I went to a local metal shop and asked what it would cost to have one made from solid metal. At least \$200, they told me. Ouch. Instead, I ordered two dozen blade clamps from Sears, and I just change them when they crack.

Blade modifications—I've tried out just about every blade you might find in a random search of hardware stores and lumberyards. I was lucky to come across some 18-tooth and 24-tooth set-tooth blades made by the Vermont American Co., of North Carolina. These blades outlast all others I've used by at least five to one, and they're also less expensive than most. Their set teeth make a wide kerf that allows tight turns.

You can get a smoother cut from

straight-tooth scrolling blades, but they are not stiff enough for my work, and they burn the wood around tight curves. They're best for straight cuts, and for wide turns in stock ½ in. and thinner.

Before I use a blade, which is about ⅝ in. wide, I make some modifications, as shown in the photo, above right. First, I grind the width down to ⅜ in. to ⅜ in. (sometimes less for really tight work) so that it doesn't bind in tight turns. Such a thin blade tends to weave and tilt, and despite six years of practice I still run into trouble once in a while. It's necessary to keep the saw directly over the blade as you turn the curves.

Second, because the blade cuts on the upstroke, sometimes the plywood splinters and obscures the line I'm trying to follow. To prevent this, I reverse the blade so that it cuts on the downstroke and leaves the burr on the underside. I use a 5-in. disc sander (a grinding wheel would work as well) to remove the set from the bottom teeth so that the blade can sit flat in the clamp. Otherwise the pressure of the clamp screw will crack the blade. There are commercially made, reverse-tooth blades, but those I've seen have straight teeth, so I recommend that you adapt your own.

Supporting the work—I used to work standing and leaning over a workbench, with the piece clamped and extended

over the edge, which I don't recommend unless you can tolerate back pain. I finally made an open-framed draftsman's-type table that clamps to the bench and enables me to work while seated. I clamp the stock with only a slight overhang so that my work area is solidly supported.

On most pieces, I start cutting in the center, reclamping and radiating outward. This maintains maximum strength in the board and leaves enough wood at the overhanging edge to support the weight of the saw.

Sanding and finishing—I round off the edges of the cuts with a shopmade drum sander in a high-speed electric drill. This is tricky work, particularly on springy parts, and more than once the drill and the work have ended up going in opposite directions. If the surface needs any smoothing, I use a belt sander. It shouldn't be necessary to sand the blade marks in a design with a lot of tight curves and small openings. Visually, the marks are regular enough to become part of the design.

After sanding, I stain the piece, then finish with Watco Danish oil. A few days later, I attach the mirror with screw clips, fit the frame with a hanging wire, and make drawings for the next one. □

Ron Pessolano lives in Dedham, Mass.

Knoll Makes a Wooden Chair

A look at the contract furniture business

by John Kelsey

To order the thousands of desks and chairs that a corporate skyscraper needs, one goes not to the local cabinetmaker but to the contract furniture industry. Huge quantities allow the industry to invest money and time in "product development," and to attract the leading architects and designers. Hardly any modern contract furniture is made out of solid wood, however, for wood is a difficult industrial material. Good production materials are tubular metal, molded plastic, particleboard and plywood: uniform and predictable. Solid wood is so variable that it needs a craftsman to figure out how to manage each ornery board, plus it never stops changing in size and shape in response to the weather.

Although we may look to the contract furniture industry for a kind of design leadership, it seems to be a vast closed shop operating on some other plane, with no use for the small woodworking operation and no place for the ordinary designer-craftsman. Of the contract furniture giants, Knoll International is the loftiest. Its pedigree descends directly from the Bauhaus, and its line includes such modern classics as Mies van der Rohe's X-frame Barcelona chair in stainless steel and black leather and Eero Saarinen's white plastic pedestal tables and chairs, as well as several new whole-office systems for people and computers. Knoll, which is privately owned, employs about 1,500 people, who produce and sell \$150 million worth of furniture a year.

Last autumn, Knoll introduced a severely modern all-wood chair with a solid slab seat, designed by the modernist architect Richard Meier. The chair's list price was \$2,520, what you might expect to pay for the finest one-of-a-kind art furniture. It was the progenitor of a collection that includes a rocking chaise lounge, a high and a low stool, a telephone stand, a coffee table, and three sizes of dining/conference table. The October debut was just in time for Designer Saturday, and Knoll generated considerable publicity about fine craftsmanship in joinery and finishing, which caught my interest. I decided to find out more.

It turned out that my suppositions about the contract colossus were mostly wrong, and Knoll International isn't an ultra-refined block of smoked glass, sufficient unto itself. I met craftspeople on its staff, and learned about opportunities for outside shops. The Meier collection represents a production experiment because it isn't being manufactured at Knoll's own factory in East Greenville, Pa., but a hundred miles down the road at John Martin's small, country-style chair shop. And I chanced to be watching when Knoll's staff designers discovered anew why their industry avoids solid wood. By the middle of the winter, after 84 Meier chairs had been made and shipped to Knoll's 15 U.S. showrooms, those solid wood seats were on the move (see box, p. 90).

Designer Saturday is an open house held every October by Manhattan's contract furniture showrooms. Normally these

Richard Meier (right) designed the furniture, which John Martin (far right) makes for Knoll. The rocking chaise lounge is the most work.



Richard Meier

places admit only "the trade"—licensed architects and interior designers who specify furnishings for their moneyed clients, corporate or individual. On the three days of Designer Saturday, however, the showrooms roll out their newest goods and entertain whoever finds the right address. Hundreds of decorators, students, furnituremakers, even some customers, trudge through the autumn wind from one showplace to the next. Camouflaged in my designer-purple shirt, I joined the throng. It was a day for having one's fill of desks wallpapered in rosewood veneer, and matte-white-Formica everything.

The clamor at Knoll swirled around Meier's rocking chaise lounge, some upholstered rocking chairs (\$2,800 to \$3,660) by Spanish designer Carlos Riart, and some little granite end tables (\$3,980 to \$4,790) by Lucia Mercer, a sculptor. The pull-up chair I had come to see consists of a slab seat supported by four vertical posts, connected by four horizontal, bent-laminated horseshoe shapes. The slightly saddled seat is 1½ in. thick. The sticks and horseshoes, in section, are 1½-in. squares. The stools look like the chair, and the tables repeat Meier's thicker of vertical sticks under fat, round-cornered rectangular tops. The odd man out is the chaise lounge, not only because it is upholstered and rocks, but also because it has neither the dead-flat horizontals nor the bent horseshoe shapes that characterize the rest of the seating. All the furniture is made of hard maple and comes lacquered clear, or else lacquered and hand-rubbed to a plasticky black or white.

Meier devised the original chair almost five years ago for the little members' library at the Guggenheim Museum, which Frank Lloyd Wright designed. Its oak latticework and slab seat recall Wright's oak chairs (as well as chairs by Wright's Viennese contemporary, Josef Hoffman), yet still it is in tune with Meier's own sparsely geometrical architecture. Jeffrey Osborne, Knoll's vice president for design, spotted the chair and worked with Meier to fill out the rest of the collection. Knoll people describe Osborne as "the company's eyes," and say that he is the channel through which portfolios are reviewed and new designs acquired. When Meier had done enough drawings, Osborne sent the project down to Knoll's factory in East Greenville for "development."

East Greenville lies in Pennsylvania Dutch country northwest of Philadelphia. The Knoll plant is a low-roofed, newish place covering almost ten acres, half of it set up for working metal and the other half for wood. They can work solid wood if it is straight and plain enough, but veneered panels, whether flat or curved, are what they're really good at. Veneers



Photos courtesy of Knoll International

come in one end, they meet up with skids of honeycomb core material and microlam edging, and acres of office desk go out the other end. When a chair needs a curved wooden part, Knoll laminates veneers between plywood molds in hydraulic presses 14 ft. high, with a radio-frequency zap to flash-cure the glue. The result is a wide, formed ribbon that can be sliced into heaps of armrests or of back legs.

My guide was Karen LaWall, a staff designer who had spent the previous 18 months working on the Meier collection. She pointed out the bending jig that had been used to laminate the chair's horseshoe shapes, a particleboard-and-toggle-clamp contraption no different from what you'd find in any small shop. With it, about 350 of the horseshoes had been glued up one at a time, each consisting of 12 to 17 layers of thick maple veneer. LaWall explained that the pattern shop had begun stacking up the forms for mass-producing the horseshoes, in anticipation of orders. "Contract" furniture means manufactured on contract; the 84 chairs made so far were only to supply Knoll's showrooms, plus a set (black) for Meier's own offices.

As big factories go, Knoll's seemed not half bad. There's ample air and room, the machinery is up-to-date, safety equipment is abundant. Furniture parts move on wheeled carts, not endless belts, with time enough for workers to pause for coffee and talk. Still, it is a factory and the workers do not make pieces of furniture. Instead, each person does some small job over and over again, those small jobs all adding up to a lot of furniture. But even in the most mechanized of industries using the tamest materials, there is always a haven for a few highly skilled craftspeople. It is the jig and pattern shop, where they make prototypes and then devise tooling for the quantities that follow. The principle is, if a few extremely clever craftspeople put in skill at the right points, then cheaper, unskilled labor can grind out the goods.

At Knoll this work goes on across town in a couple of unidentified buildings called D&D, for design and development. I was told it's deliberate that there is no sign, and the Knoll people I met seemed to enjoy the air of secrecy. The doors to part of one building were papered over with Keep Out posters. Under the wraps, designers were devising Knoll's next whole-office system, ever wary of spies for the competition. Nearby there's an eerie testing room full of furniture being rocked and hammered to destruction by automatic machines, with click counters keeping track of the blows.

At D&D I met the embodiment of theory about craft enclaves within industry, in the person of Angel Marrero.



Working at an unbelievably cluttered bench, with a small group of design and craft colleagues, surrounded by good machines and plenty of interesting materials, Marrero makes prototypes from designers' drawings. He had made the mahogany prototype of the Meier chair. Once the details and the bugs are all worked out, he figures out the manufacturing jigs, templates and forms, and makes them, too. The day I visited, he was working on router jigs for Knoll's next offering of architects' furniture, by the post-modernist Robert Venturi. Marrero, who said his is the most interesting job at Knoll, had come here from the main factory floor, as had many of the others. I also met a recent graduate of a university program in woodworking and furniture design who wanted prototype-shop experience before striking out on his own, and a staff designer who had taken refuge here after several years of struggling with his own small woodworking shop.

It would have been possible, LaWall said, to make the Meier collection in-house. But the factory has a ponderous inertia, quantities would be low, and the job required considerably more handwork than anything else in the company's line. The design would have been compromised. Instead, the job had been taken to John Martin's chair shop in the Farmersville district of Ephrata, Lancaster County. This is Amish country, where motorists share the roads with horsedrawn buggies. It's also thick with small woodworking operations, many of them fronting roadside stores to sell sturdy, Colonial-style tables and chairs, hutches, and benches. Martin's chair shop is entirely typical of the region, except that Martin himself is more willing than most to try something different and to learn something new. The Meier furniture was odd enough to raise local eyebrows, but Martin's been in business for 20 years here, he's well established and highly regarded. He's very happy to be working with Knoll, for the job has allowed his shop to grow in ability as well as in size.

Knoll discovered Martin when LaWall's colleague, Hy Zerkowitz, went looking for someone to steambend the

chair's horseshoe shapes. The shop that made the original chairs for the Guggenheim Museum had joined up each horseshoe from three pieces of solid oak, bandsawn and shaped. Zerkowicz thought that steambending would be more authentic, in the grand tradition of bentwood chairs. The local steambending specialist wasn't tempted, so he passed the job along to Martin, who was willing to experiment. He even bought a beech tree to saw into bending blanks. Eventually, though, steaming was rejected as imprecise and uneconomical, requiring too much hand-shaping.

In addition to the roadside store, where he sells about 40% of his regular furniture (the rest is wholesaled to dealers), Martin's operation consists of a main woodworking shop, a separate building for finishing, and a large, new barn where rough lumber gets planed and sawn into billets. A couple of the machines in the mill are old-time gems, but there's also a modern back-knife lathe for production-turning of legs, which Martin makes for other chair shops. Besides growing from 12 workers to 20, Martin's shop has absorbed one of Knoll's machines, a dream of an Italian combination mor-

Chair seats on the move

There are basically two ways to make a wooden chair. Either the legs join directly to a solid wood seat, or else four horizontal rails join into the legs, with the seat planted on. Frame-seated chairs are often more work, but slab seats are liable to crack. Although Knoll has been making furniture since 1938, the Meier chair is apparently the firm's first experience with a solid wood seat.

The seats of the 84 chairs made so far were glued up from three maple boards, with two ½-in. by 3-in. dowels crossing each glueline. Another dowel runs cross-grain, unglued, right through the seat near its front edge. The two ends of this dowel protrude into holes drilled into the chair's front posts, forming the joint.

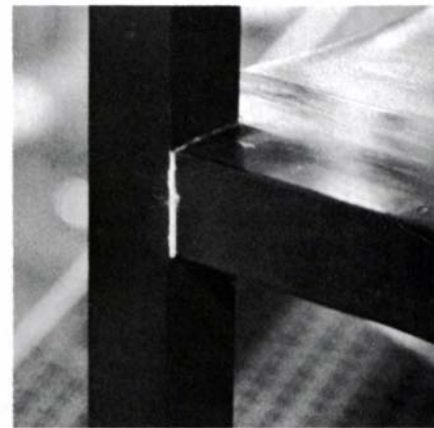
Karen LaWall, the staff designer in charge of the project, came to Knoll from Gunlocke, a contract firm well known for its wooden chairs. She had

the dowels added after a prototype chair with an edge-glued seat failed one of Knoll's standard tests. A machine drops a 125-lb. sandbag from a height of 2 in. onto the center of the seat, 100,000 times. The seat without dowels broke after 35,000 thumps.

While touring chairmaker John Martin's shop, I wondered what would happen if moisture exchange made the seat wood shrink. Mightn't the seat split at the notch for the back post, or pull away from the front post? No problem, said LaWall, because the long dowel wasn't glued in the seat, the maple was kiln-dried to 7% moisture content, and Martin keeps his shop at 50% relative humidity. She anticipated nothing worse than hairline cracking in the finish at the joint lines.

A couple of months after that conversation, the dry air inside Knoll's own SoHo showroom had separated the seat and the left front post of one black chair. No hairline, the crack was wide enough to insert a quarter in and the naked maple grinned through the shiny lacquer. The chair wobbled. Only two Meier chairs were still on display and the other was suffering less, but LaWall confirmed the trouble and said some seats were also cracking on the gluelines. Martin said that when the seat lumber came off the truck it might have been closer to 8% than 7% moisture content. That's potential for a full ¼ in. of movement if the relative humidity went from 50% to, say, 20%. Seven sanded coats of lacquer will slow down moisture exchange, but not prevent it.

The decision to manufacture the chair out of solid wood and to offer it in black, white or clear was made by Jeffrey Osborne, the vice president for design, in New York. Osborne started working for Knoll 16 years ago, while he was still studying business in college. His previous experience with solid wood chairs was as envoy to Hansen's in Den-



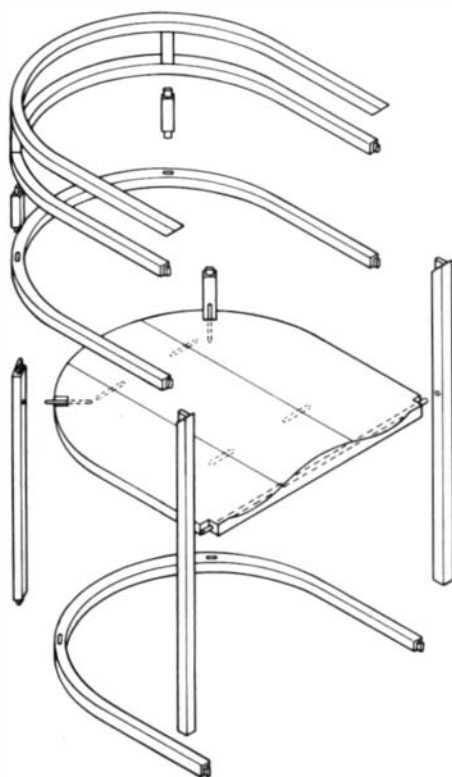
The chair in February.

mark, which makes Hans Wegner's Classic chair, which Knoll once marketed. The Classic (FWW #21) is a frame chair with a woven seat.

Richard Meier, the architect who designed the chair, said he had seen all of Knoll's development drawings and was consulted about the visual changes, but he had left the joinery to technicians. He'd noted the seat's construction, but hadn't anticipated any trouble.

Osborne said the fix would be to put a little space into that long dowel, and to dry the seat wood right down. Then if it were shaped a little oversize, it would pop in there under tension and the joint would stay tight no matter what. And next summer when high humidity sends the seat straining the other way? "Nothing, we hope," Osborne told me. "We're testing the chair in a humidity chamber at a university."

Since they were finishing the wood to look like plastic, and wishing it would behave as inertly as plastic, I asked the designers why they hadn't made the chair out of plastic in the first place. Meier said he wanted the chair to feel like wood and maintained that it does, even through the lacquer. Osborne said the tooling for plastic would have been prohibitively expensive. LaWall said a plastic chair couldn't have had the quality (and presumably the price) that comes only from real wood. —J.K.



tiser-tenoner. Each Meier chair has 24 mortises and the accompanying chaise lounge has almost 200. Martin gets to keep the Italian beauty as long as he's making the line. He is finding lots of ways to use it on his regular furniture.

Although he pumps out his best-selling arrow-back chair in batches of 100 or more, Martin has found it most efficient to produce the Meier chair 30 at a time. The men dowel up the chair's seat from three maple boards (drawing, facing page), saddle and spindle-shape it to templates, then saw notches for the posts. Half-inch dowels join the seat to the four posts. The front posts are continuous from floor to armrest, which they join in a miter that conceals a loose tenon. The rear posts terminate with a tenon into the lower of the three horseshoes that form the chair's back, while a pair of shorter pieces continues each post up to the backrest. For the clear-lacquered chairs, the post stock is crosscut and kept in order, so its figure will be continuous. The tenons at the bottom of the posts protrude $\frac{1}{16}$ in. through the floor-level horseshoe, so the chair won't hang up on uneven floors. The sharp edge atop the backrest gets rounded over. The chair is assembled with the aid of some stirrup-shaped, strap-iron clamps that Marrero devised. After assembly, the whole thing gets stroke-sanded flush and fair. Although Knoll has been supplying the bent-laminated horseshoes, Martin would like to bring that part of the job into his own shop as well.

The finish is the most difficult operation. For the black chair, Knoll specifies that Martin spray two coats of dye stain, two coats of primer (both sanded), two build-coats of nitrocellulose lacquer, and three top coats consisting of 25% lacquer and 75% urethane-modified lacquer (for durability), sanding between each. Then all the surfaces of the chair, underneath as well, get wet-sanded to 600-grit, hand-rubbed with coarse polishing compound and rubbed again with fine compound, topped off with a silicone treatment. Zerkowitz, who has since left Knoll, told me that the marketing department had trouble accepting that the only way to get a hand-rubbed finish is to rub it by hand; now they are making a virtue of the rubbing time. The finish on a black chair takes 5 hours to build up, 27 hours to rub down, or about half again as many hours as it took to make the chair. The chaise lounge requires an incredible 70 hours of rubbing.

Blemishes in the finish are a continuing problem. Such a finish requires perfectly featureless wood. If at the start the stock is sawn too close to a knot, it'll telegraph through as a dimple at the end. Martin's frugal craftsmen have spent their lives sawing just off the knots, for waste is a sin. Martin tries to persuade his men that even though sawing close might get an extra stick out of a plank, it might also ruin a chair.

Knoll's showrooms list the Meier chair at \$2,520 in black or white, \$1,920 when finished clear. The chaise lounge is \$13,500 or \$11,000, plus 5 yd. of fabric or 160 sq. ft. of leather. Typically, the retail list price of contract furniture is twice the wholesale price, which is twice the manufacturing cost. At a firm's own showroom, wholesale is the rock-bottom price for a large order. Architects and interior decorators generally order for 60% of list, then bill their clients a figure ranging from their cost up to full list. I could not confirm the numbers, but 25% of list would indicate \$630 to manufacture a chair, \$3,375 per lounge. Meier collects a royalty of between 1% and 2% of list. Knoll won't say how many chairs have sold, only that sales "are ahead of projections." Five months after the collection's debut, however, Martin hadn't



Martin's shop assembles the chairs in several stages.

been told to resume production.

That Martin is willing and able to resume whenever there are orders is one reason he's got the contract. LaWall emphasized that reliability is the main thing, which amounts to being already established in the woodworking business, and evidently able to get along without a Knoll contract. Knoll has staff members called "sourcers" who find and qualify "vendors" of materials, parts and services. They often divide a job among several shops, sometimes to take advantage of each shop's strengths, sometimes to establish competitive procedures and prices. Martin has recently taken on making Riart rockers, but so has an Upstate New York shop, and at least two other shops were involved at earlier stages of the project. As in all things, the way in seems to be to know somebody, however tenuously: Martin knew the steambender who didn't want the Meier job; the Upstate shop once employed a craftsman who now works at Knoll.

So is the Meier chair comfortable? I didn't think so. The seat is so level and slick that I slid out of it, the armrests are sharply unfriendly, the back is a bruiser of vertebrae. Meier, who designed the chair, believes that good looks are as important as a good sit and points out that no chair can suit everyone. The woman at the Guggenheim, when I examined the original chairs, volunteered that they sure do favor brief meetings. LaWall, who developed the design, likes the way it sits, and Martin, who makes the chair, said he doesn't mind it. Osborne, at Knoll's head office, termed it "too uncomfortable for a major market, you'd have to want it for an aesthetic reason." Zerkowitz put it this way: "They allow for people to sit in them, but that's all." □

Knoll International is more likely to approach an outside designer with a problem they want solved than to purchase your unsolicited solution. Still, they do review portfolios at Jeffrey Osborne's office, Knoll Design Center, 105 Wooster St., New York, N.Y. 10012. Dick Tyler is the sourcer in charge of purchasing outside services, PO Box 157, East Greenville, Pa. 18041. John Kelsey is editor of Fine Woodworking magazine.

Turning Tools That Cut

A book from Sweden favors some old tools

by James Rudstrom

My father's shop was equipped with all sorts of wood-working tools, and I was gradually introduced to their secrets. We had quite a number of machines, but no lathe. I guess one just didn't seem necessary for building houses and cabinets, and our economy permitted only necessities.

I was in ninth grade when I first tried turning. I don't recall being taught anything other than scraping, with the exception of attempting to make V-cuts with a rather dull skew. Several of my would-be masterpieces were ruined when the skew, instead of making its path toward the bottom of the V, skittered in the opposite direction, scarring everything in its path. That was my first experience with the cutting method of turning, although it took 20 years or so before I understood what I was up to.

I don't remember if it was because of my shop, his kids or his interest in English that I got to know my neighbor, crafts teacher Wille Sundqvist (*FWW* #38, pp. 84-88). In any case, we hit it off well from the beginning. In 1978, while he was teaching an evening course in my shop, Sundqvist mentioned a book that he was writing on turning. We had touched on the subject before, but not at length or in depth, probably for the same reason that I hadn't gotten to turning before—I still didn't have a lathe in my shop.

Sundqvist and another turner, Bengt Gustafsson, have published their book, *Träsvarvning enligt skärmetoden* (LTs förlag, Stockholm, 1981). *Turning, The Cutting Method*, as its title translates, is not a large volume, but it covers many aspects of lathe work that have been more or less forgotten. The book touches on lathe construction, tool design, tool care, safety, the turning of cylinders and profiles, bowlturning, green-wood turning and more. It is well illustrated with photos and drawings. Unfortunately, it is not avail-

able in English yet; the authors are exploring the possibility of U.S. publication. Until then, here are some of the book's most interesting points, for English-speaking woodworkers.

The cutting method presented by Sundqvist and Gustafsson would definitely be suited for efficient use on treadle lathes and other low-tech machines. High RPM are unnecessary; in fact, undesirable. In most cases, the tools advocated are almost opposites to those in the "long-and-strong" school. "Short, sharp and sensitive" is the name of this game. If you're interested in trying the approach, you'll find that some of these traditional tools are hard to come by. You may find some treasures at auctions and flea markets. But most of us will have to modify standard tools, make our own or find someone who can. Even with the right tools, this kind of turning requires industrious practice, but in return there's little dust, surfaces that require little or no sanding, and the good feeling when fine shavings reel off the workpiece.

Tool rests—Many of the standard and auxiliary tool rests on the market maintain too much distance between their point of contact and the tool's cutting edge. When you use a short, light tool, it is essential that the tool be supported as close to the cutting edge as possible. The usual type of rest, which has a flat for the bearing surface (figure 1), will shift this contact point away from the stock when the tool is positioned at the steep angles often used when cutting, especially in faceplate turning. The cleanest cut is usually obtained at a steep angle, very close to the threshold of kickback. Resting short finishing tools at point B in figure 1 will obviously increase the risks of chatter and kickback. Sundqvist and Gustafsson suggest the solution in figure 2. Notice the removable pins that prevent tools from slipping into the chuck.

Fig. 1: Standard tool rest

Tool rests topped with an inclined ledge are unsuitable for the cutting method. Supporting a tool at point B puts too much distance between the fulcrum and the cutting edge.

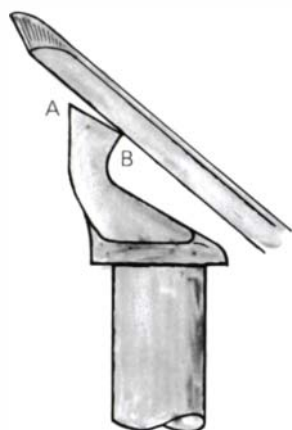
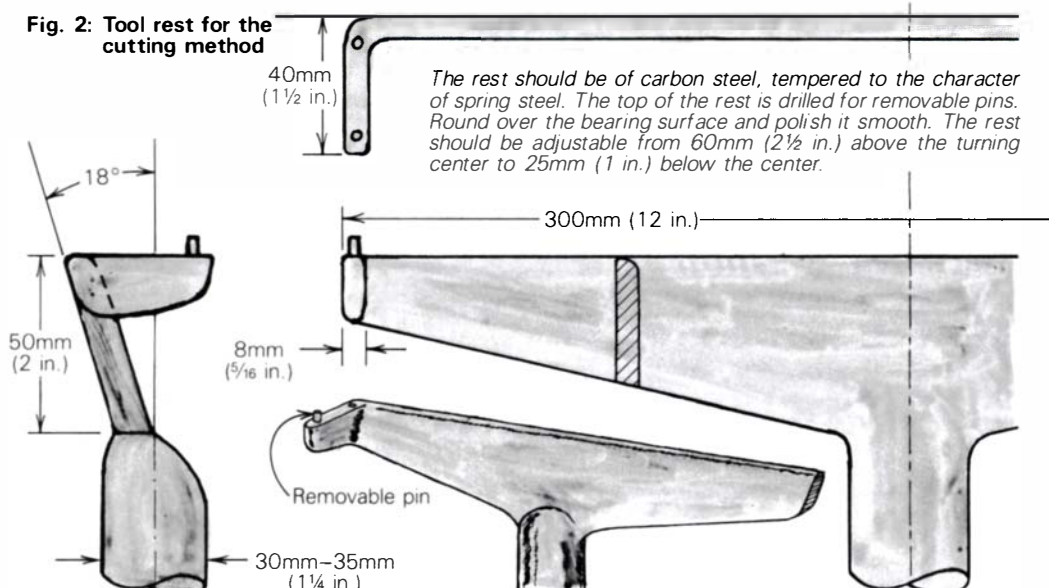
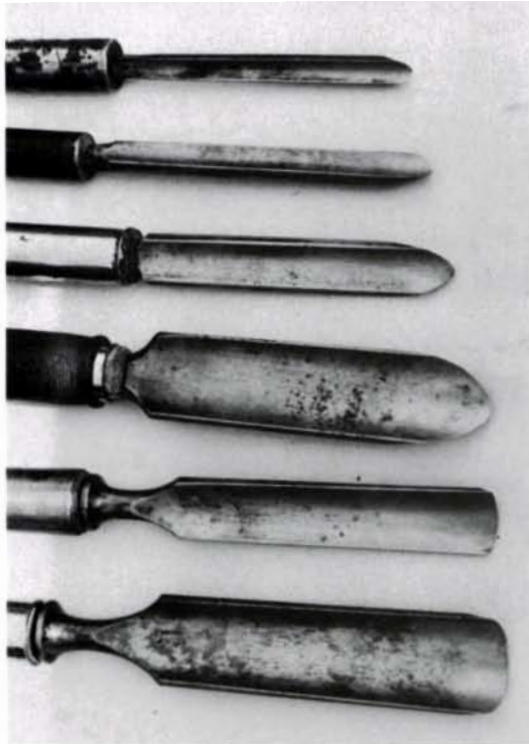


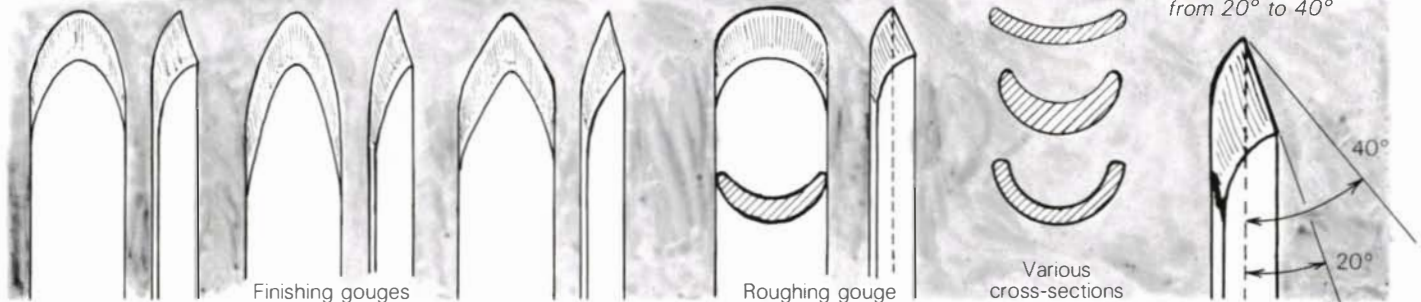
Fig. 2: Tool rest for the cutting method





The tools at left were made by regrinding standard carvers' and turning gouges. Smoothing gouges (upper four) have an edge more curved than the edge of roughing gouges (lower two). Above, a gouge smooths the inside of a bowl.

Fig. 3: Gouges

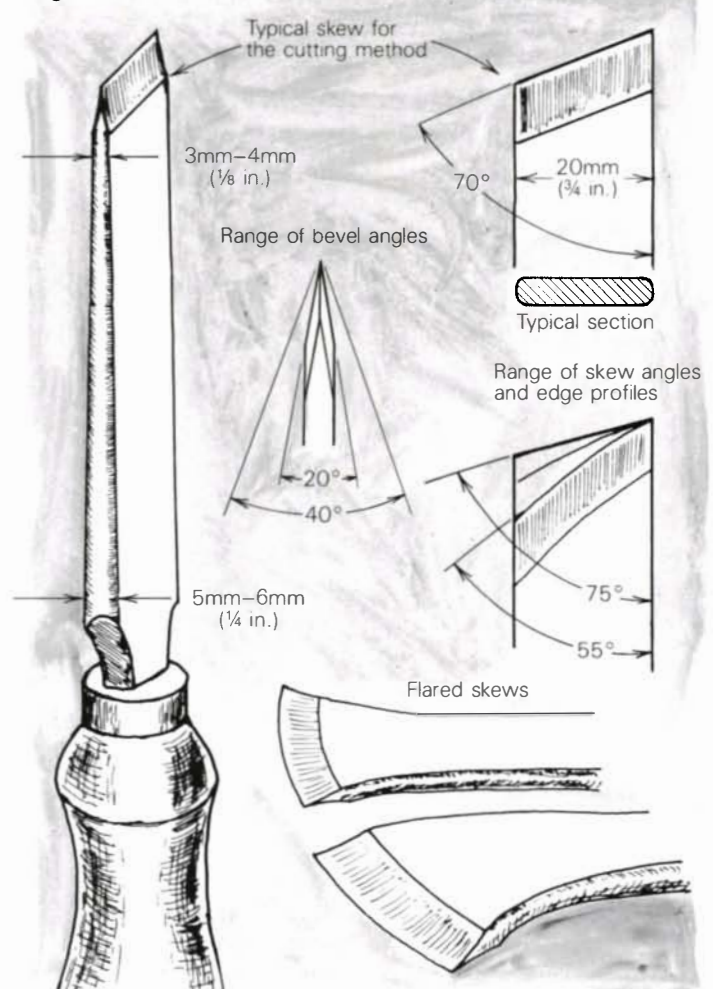


Gouges—Two main types of gouges are mentioned: those used for roughing out and those used for forming and finishing. Examples of different edge shapes are shown in figure 3. Note that the angle of the bevel can vary between 20° and 40° , following the general rule of a greater angle for harder or more figured wood. Many of the gouges on the market are too long for finishing work. The authors prescribe using imagination in regrinding standard turning gouges and in experimenting with the great variety of carvers' gouges available. In some cases, you might want to forge your own.

Skew chisels—The skew is perhaps the most versatile of all the turning tools used to cut. In the hands of a skilled turner, the skew can make profiles appear as if by magic. The short and rather thin skews recommended here should have a taper, being thicker toward the handle, as shown in figure 4, to lessen vibration. The corners along the length of the tool are rounded and polished for a better feel in the hand and to facilitate a light, gliding movement over the tool rest. The normal angle of the skew should be 70° , although different angles and variations from straight edges are common. Hand-forged skews were often flared at the edge and had long bevels, making them thin and liable to overheat on modern lathes with high RPM, especially when turning harder wood. Bevels otherwise are between 20° and 40° , as with gouges.

Turning hooks—Among the more valuable subjects in the book is that of turning hooks or hollowing hooks. These low-speed tools are near-forgotten things of the past. In essence, the turning hook is a gouge with its cutting edge oriented 90° to the length of the tool. It can have a double edge or a

Fig. 4: Skew chisels





Turning hooks are actually gouges with the cutting edge turned 90°. The tool at left in the photo above was forged from a pitchfork tine. In the photo at right, a hook hollows a bowl.

Fig. 5: Turning hooks

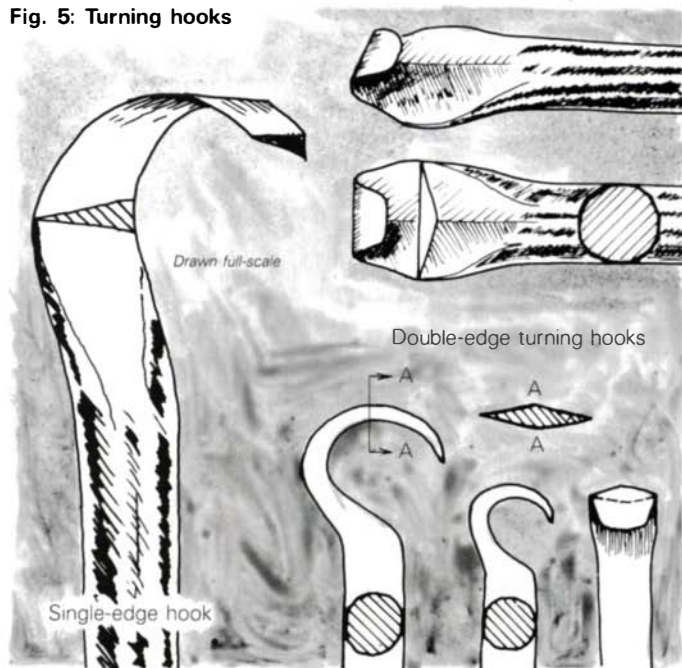


Fig. 6: Parting tools

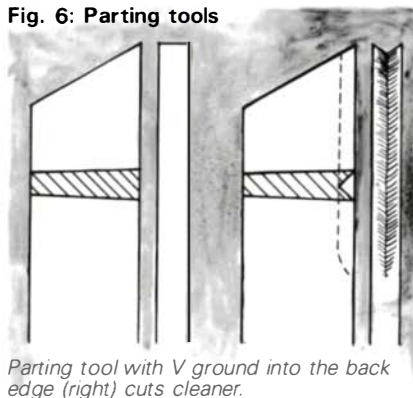
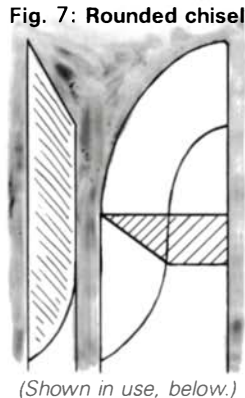
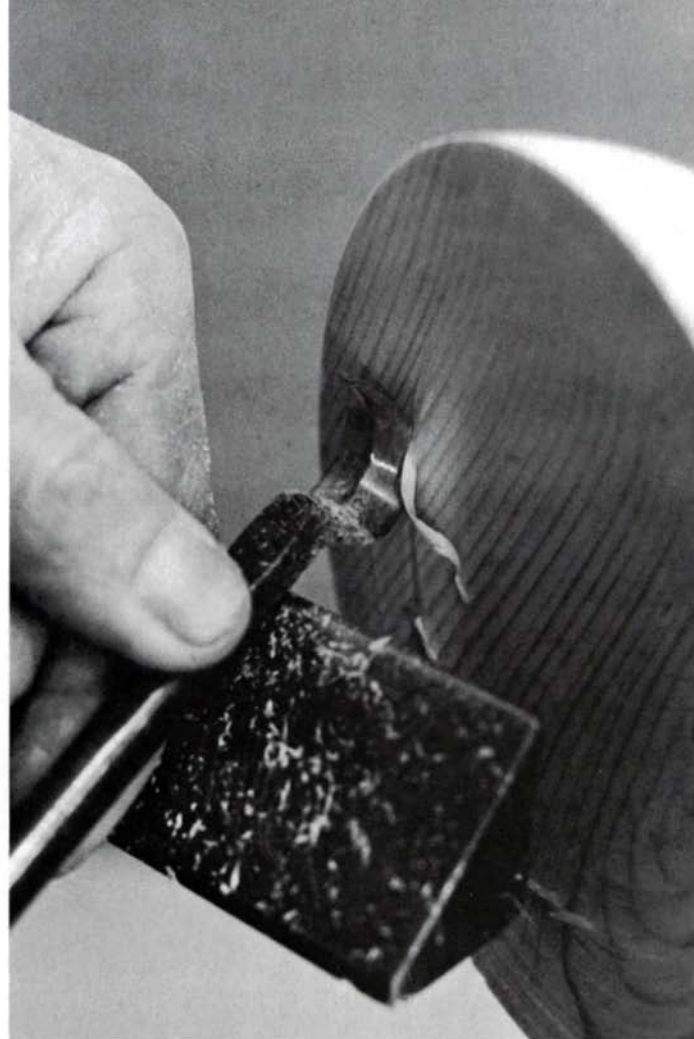


Fig. 7: Rounded chisel



A rounded chisel (figure 7) planes surfaces in faceplate turning. Its bevel rides the work.



single edge, as shown in figure 5 and the photos above.

The turning hook cuts with the grain when working cross-grain on a faceplate, starting from the outside and cutting toward the middle. Cuts in end grain are the opposite, starting from a bored hole in the middle and working outward. To work in tight places, some turning hooks have the bevel ground on the inside rather than the outside. Turning hooks more than $\frac{5}{8}$ in. across are best for softer woods. Long handles are also recommended for larger hooks, to help prevent chatter and kickback. Sometimes a bent or an angled handle facilitates holding the tool at an efficient, safe edge angle.

Other tools—A parting tool with a flat back will do; one with a V ground into the back (figure 6), however, will produce a cleaner cut. The blade is thinner toward the bottom edge to provide clearance. The tool needs plenty of metal beneath the cutting edge, and a long, sturdy handle to help avoid chatter and kickback.

For faceplate turning, the book recommends a rounded chisel (figure 7), which can be fashioned from a scraping tool.

Tool length—It is difficult to give definite rules for turning-tool length. Generally, large skews, roughing gouges and parting tools are about 450mm (18 in.) in overall length. Tools used for making profiles and doing other finishing work should be very short, 300mm (12 in.) or less. It should be possible to move these tools in front of you without having to hold your breath and pull in your stomach. Experienced turners work with smooth movements, switching hands when necessary. □

James Rudstrom is a school psychologist in Vilhelmina, Sweden.

Bent Bowl Gouges

Reforge your tools for finish-turning

by Douglas Owen

The idea of tools bent along their length came to me at a woodturning seminar I attended two years ago, where I had a go on a bow lathe with the turning hooks as used by turners of old (see facing page). Also, David Ellsworth was there demonstrating the amazing cranked tools he uses to make his bowls, which are hollowed out through a small hole in the top (*FWW* #16, pp. 62-66). Woodcarvers have always used tools shaped like mine, and for the same reason—to get into places where a straight tool can't.

I have never liked scrapers. They blunt quickly and produce a rough surface. I use the conventional deep-fluted, U-section bowl gouge as a roughing-out tool. I finish with a shallow, long-and-strong gouge. It is ground straight across and used on its side, with the bevel rubbing for a slicing action. This means it can reach only so deep into the bowl before the bevel loses contact.

I forged the gouges shown below from straight long-and-strong ones. The forge was the woodstove in my living room; the fuel, barbecue charcoal; the draught, from a windy day. By blocking most of the grate with firebricks, I didn't have to use too much charcoal. For an anvil I set a blacksmiths' fuller in a lump of wood—a fuller is a rounded iron wedge that fits into the square hole in an anvil, for shaping iron. I heated the gouge red, placed its end over the fuller, and struck it with a heavy hammer. I had to repeat the process several times to get the full curve. To reharden the gouge, I heated the newly bent end bright red and plunged it into a bucket of cold water. It's important here to hold only the cutting end of the tool in the hottest part of the fire; otherwise thin tools tend to warp and thick ones may crack. Then I ground the tool smooth with small grindstones in an electric drill. I tempered it by heating it in my kitchen oven for one hour at 350°F, which brought the polished steel to a medium straw color, and then letting it cool slowly.

I always test new tools with a sharp masonry nail. If I can scratch the tool just behind the edge, I reharden and retemper. I have never found a chisel or a gouge that cannot be made excellent this way.

The tangs I either cut off short or bury deep in the han-



Owen turned this elm-burl bowl green, finishing it with one of his bent gouges. He says, 'It is difficult to season burl woods without all the little knots cracking badly. I couldn't sand the wet wood on the lathe, and I didn't want to sand after the wood had dried. I wanted to keep the wrinkled surface that comes from the wood's drying and warping, the more the better in this case. So I had to get a fine finish directly from the tool. I got what I wanted from one of the first bent gouges I made.'

dle. If the handle is securely joined to the wide part of the tool shank, turning tools cut with less vibration. For handles I like a simple cylinder, though I'll rummage among the tools I'm not currently using for a handle before I'll make one. I frequently make a new handle when the first one does not seem quite comfortable. For ferrules I have used short pieces of plastic pipe, but I often don't bother. The handle can still split when driven on with a ferrule in position. Metal ferrules are cold on the hands. A handle should not be too long, too short, too fat, too thin, too light or too heavy. These are all matters of personal taste.

I grind the bevels hollow, stopping just short of the edge. I hone, using a fine oilstone, several times before having to regrind. I round over the heel of the bevel, to prevent its rubbing and marring the wood, and to make it slide smoothly.

Recently I tried one of my bent gouges inside a large elm goblet. I was delighted with how quickly I could get it smooth, even though cutting from rim to bottom was going against the grain. These gouges also work happily a long way over the tool rest. No doubt dig-ins are possible, but using the gouges only as finishing tools, I've had nothing nasty with them. □

*Douglas Owen makes his living as a turner near Bainbridge, England. Photos by the author. For more on forging, see *FWW* #4, pp. 50-52, and #9, pp. 58-61.*



Owen forged his bent gouges, excellent for finishing bowl insides, from straight long-and-strong gouges. The bent part is kept short to make the gouges easier to use.

Woodshop Computers

They're best at figuring cutting lists

by Paul Bertorelli

The electronic technology that's creeping into every other facet of daily life has now pried open the door of the village woodshop. And though a microcomputer can't direct the spokeshaving of a chair spindle, these fascinating and versatile machines can do such useful jobs as calculating cutting lists and controlling small machines and tools.

In big furniture factories, main-frame computers can help designers visualize three-dimensional objects, and computer-controlled tools have been commonplace for at least the past decade. They've speeded production and freed workers from mind-numbing, repetitive jobs. This technology has bypassed the small shop, however, mostly because custom shops don't have enough "dumb" work to justify a sophisticated, expensive machine. But, as some cabinetmakers are finding out, there is still work for a small computer in the small shop.

Two companies are selling computer hardware and software (hardware is the computer itself, software the lists of instructions, or programs, that make it work) designed specifically for calculating materials lists and cutting lists, a job that consumes hours in custom shops. One, Cabinets Built by Computer Systems (CBCS) of Harrison, N.J., has a setup that can be bought outright or subscribed to on a per-job basis, thus making it cheap enough for even a hole-in-the-wall shop. A California firm, Cybix Intelligent Systems, sells a more elaborate system that uses rudimentary computer graphics to help the cabinetmaker design and draw his kitchens. Other companies (see Sources of Supply) sell hardware/software packages aimed more at retail businesses that sell and install ready-made modular cabinets.

John Castronova, a lifelong professional cabinetmaker, started CBCS about seven years ago. He wondered if the microcomputers then new on the market could be programmed to do the simple but ponderous addition and subtraction required to compile the bill of materials and the cutting list for a kitchenful of cabinets. Once he had taught himself how to program it, Castronova found that a microcomputer could calculate an error-free cutting list in about 30 minutes, a job that took a full day with pencil and scratch pad.

Castronova has sold this system—which costs \$16,000 complete with Canon CX-1 computer, instruction manuals and a custom program disc—to only one cabinet shop, but 18 others subscribe to CBCS's sizing service. Each shop pays a \$395 one-time license fee and is then charged \$35 to \$75 for each job processed. When he signs up a new shop, Castronova sends out a questionnaire to find out exactly how the shop builds its cabinets, including details on carcase and face-frame joinery, door and drawer construction, hardware and fasteners. This data, plus the shop's hourly overhead and its desired profit margin, goes into the shop's custom program.

When a job is to be sized, the cabinetmaker phones Castronova with the size of each cabinet and a code number describing its basic shape, the number of doors, drawers and

shelves, the hardware needed, and other details. The code number is taken from a loose-leaf binder describing 71 cabinet types, which Castronova provides to his customers. The data is punched in and the computer prints out three lists: one that shows the sizes of all the parts for each cabinet; a master that groups like-sized parts together so they can be cut at the same saw settings; and a bill of materials listing everything that's needed, complete with the phone numbers of local suppliers. Castronova usually mails the printouts to the customer the same day the order is phoned in.

Proven Design Inc., a four-man cabinet shop in Roselle Park, N.J., has subscribed to the CBCS system for four years. Designer Paul Horvath says that the computer, combined with a big investment in specialized machinery, has about doubled his shop's output. "Before we had the computer," he explains, "I could outsell the shop. We had customers waiting six months for cabinets. At one point we had 12 men, and they weren't putting out enough work to pay their own expenses." Now, says Horvath, the computer cutting lists let his men concentrate on cutting parts accurately, not puzzling over drawings for sizes. They cut all the parts for a kitchen at once, instead of having to complete the carcasses before moving on to doors and drawers. With strict adherence to the lists, all the parts come together at assembly, eliminating time-consuming cut-and-fit.

As handy as the cutting lists are, Horvath says that the real forte of the CBCS system is cost control. The computer ruthlessly accounts for the price of every scrap of plywood, every hinge and every screw needed for an entire kitchen. Instead of



Cybix Inc.

With its light-pen data entry and isometric drawing talents, the Cybix Intelligent Systems computer, an Apple II, helps you design cabinets by quizzing you on various design features. It then calculates cutting and materials lists, and prints out a complete drawing of the job.

guessing, Horvath updates the computer's program each time the price of an item goes up. This control has sharpened his estimates and changed the way he responds to competition. "Now we know what it costs us to make a cabinet. We go into the market with the correct price at the profit we want. It's not affected by what the guy down the street charges."

While Castronova's computer sizes the cabinet parts from a regular drawing, the Cybix Intelligent System actually helps design the cabinets and then draws them. Cybix sells the software for \$5,750, leaving the customer to buy his own Apple II computer from a local dealer for \$3,500 to \$4,200. Like CBCS, Cybix writes a custom program to suit a shop's standards, and includes with it a graphics package that projects isometric cabinet drawings onto the computer screen.

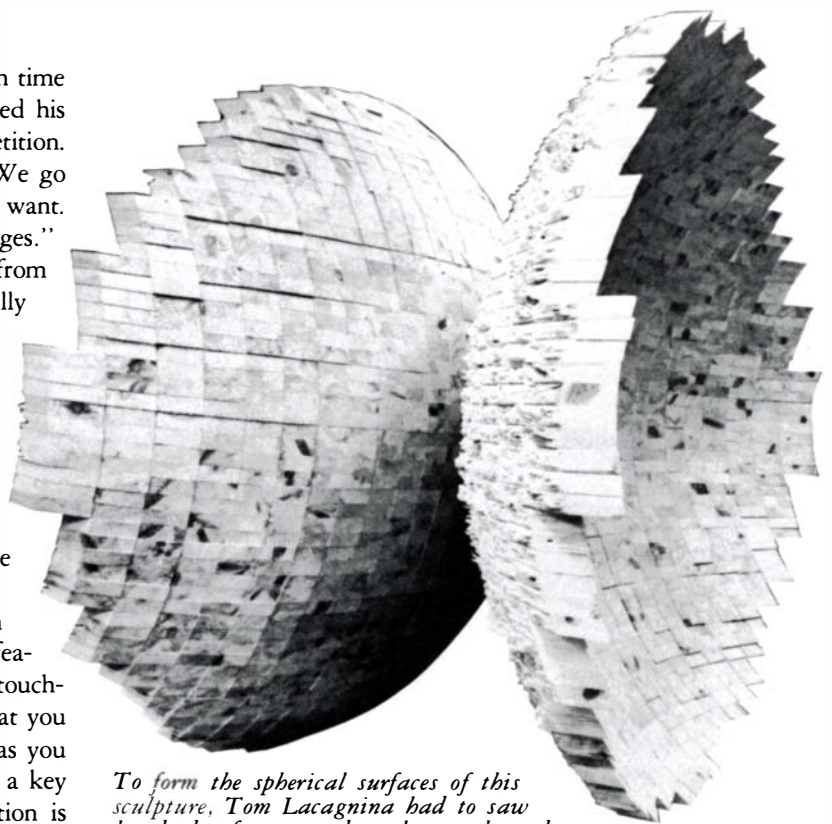
To use the system, you type in basic dimensions. The video screen responds with a drawing of a plain box depicting the cabinet to be built. The computer then asks a series of multiple-choice questions about such features as the number of drawers, shelves and doors. By touching an electronic light-pen to the screen, you signal what you want. The machine fills in the details of the drawing as you go. When you're satisfied with the design, you punch a key that starts the sizing and costing work. That information is printed out along with an isometric drawing.

Ron Shattuck, Cybix's president, says it takes about 40 minutes to design a kitchen on his system and another hour or so for the computer to complete its calculations. Cybix's checklist design routine reduces errors, says Shattuck, because the operator talks to the computer with the light pen instead of through a keyboard. But the light pen won't replace the draftsman's pen, at least not yet. "When you ask the computer for a particular door style, one doesn't look any different from another on the screen or on the printout," says Shattuck. "Microcomputers aren't capable of that kind of resolution." Even if screens and printers could reproduce the detail, the operator might spend hours keying in the right commands, defeating the time-saving appeal of this technology.

The Cybix computer is a bargain version of the CAD-CAM (computer-assisted design and manufacturing) systems used in state-of-the-art industrial design. On a CAD-CAM screen, whose futuristic graphics make eye-popping car commercials, a designer can draw a three-dimensional object and then alter it in any way he wishes. It's possible, for instance, to project an image and then take a "real time" excursion that mimics walking through or around it. It's a trick you can't duplicate with a sketch pad, and it takes getting used to.

Woodworkers who've used CAD-CAM systems report that learning to design with a computer is a slow, frustrating experience—for all their sophistication, computers can do only exactly what they're told. Tom Lacagnina, a sculpture teacher at the New York State College of Ceramics, conceived the sculpture pictured above as a drawing, then used a Xerox 560 computer to calculate the hundreds of compound angles that form the piece's spherical surfaces. "I'm basically lazy," Lacagnina says. "I probably wouldn't have made the piece if I didn't have the computer to figure the angles."

Yet he was disappointed when he later had a technician punch the sculpture's outline into a CAD-CAM so he could fiddle with the shape. "I couldn't understand the way the computer would see the form... the whole process is very abstract. I found that I could think something, but it was really



To form the spherical surfaces of this sculpture, Tom Lacagnina had to saw hundreds of compound angles on the ends of 2x4s. A Xerox 560 computer speeded the calculations. He later manipulated the shape on a CAD-CAM, which drew the sculpture in movable perspective. The surfaces were textured by breaking off the ends of the 2x4s on an arbor press.

hard to get the computer to do it." He compared drawing on the CAD-CAM to trying to cut curves on a tablesaw. "You can do it, but it's forcing the issue."

While CAD-CAM machines won't replace drawing tools and modeling clay just yet, the technology behind them is turning up in some mundane woodworking applications. Black & Decker has put a microprocessor—the electronic chip that forms the working guts of small computers—into a plunge router. It's programmed to measure and to display on a digital readout the cutting depth in 0.020-in. increments. A similar microprocessor in a B&D drill press is supposed to protect you against injury if you forget to clamp the work being drilled. By monitoring current and torque, the microprocessor shuts off the motor if the bit jams, keeping the work from being spun out of your hands.

Just how much further toolmakers can go with this technology depends mostly on how well it's accepted by craftsmen. Microcomputers are already so able that designers sit up nights thinking up new things for them to do. If manufacturers can resist tacking on flashing readouts as sales gimmickry, power tools might acquire useful little brains that will make them faster, safer and even more fun to use. □

Sources of Supply

Cabinets Built by Computer Systems, 211 Central Ave., Harrison, N.J. 07029. Cutting lists, materials lists, and costing hardware and software. Offers subscription service.

Computerized Cabinetry Inc., 1107 Lake Ave., Lakewood, Fla. 33460. Design, cutting lists, and graphic hardware and software packages.

Computer Mart, 170 Main St., Nashua, N.H. 03060. Hardware and software for fitting pre-built cabinets.

Cybix Intelligent Systems Inc., 21601 Marilla Ave., Chatsworth, Calif. 91311. Design, cutting lists, materials lists, costing software.

Radial Saw Meets Computer

A cross-cutting robot for the small shop

by Lewis Buchner

About seven years ago, as my woodworking business went through the transition from a one-man shop in a garage to a six-person operation with more machinery and space, I was asked to manufacture cabinets for a computerized medical instrument. The job promised to be a bread-and-butter item that could augment my custom cabinet and furniture business, so I decided to take a crack at it.

It proved to be quite a challenge. Because each cabinet had to be accurate within 0.015 in. to accommodate the instrument's panels, we had to cut the parts precisely. We made jigs that slid down a fence past a tilted radial-arm saw; we tried fancy ball-bearing attachments for the shaper table and a host of hold-down, slide-along, slip-back, bevel-cut gadgets. Warped or cupped boards and material that varied in thickness (as much as 0.025 in. in a single plywood sheet) gave us the biggest problems.

After much hair-tearing and a failed search for machinery remotely within our budget, we concluded that we should

either bail out of the box business or create our own robot to do the job for us. I called a brainstorming meeting at the shop one night with our foreman and a couple of friends, one an electronics engineer and computer nut, the other a machinist and inventor. The challenge of building such a smart machine was appealing, and we agreed that each person would develop an aspect of it that was within his area of expertise.

We decided we would make our boxes by cutting five accurately spaced V-shaped grooves in a plywood panel as wide as the cabinet's depth. The grooves would be cut through the plywood core and about halfway through the face veneer on the opposite side of the panel. Once cut, the plywood could be folded on the grooves, transforming them into miters and creating an instant box.

If our machine was to work, we had to accurately control two things: the depth of cut and, to compensate for variation in the plywood thickness so that the case's inside dimensions would be consistent, the distance between grooves. We started with an old 16-in. DeWalt radial-arm saw, refurbished by the local DeWalt service center so that it would cut more accurately. We had the blade custom-made—a 10-in. diameter, 2-in. thick steel disc with eight large triangular carbide teeth. Because of the mass of the cutter and the healthy size of the cut, it would be impossible to operate the saw by hand, so we built a hydraulic-pneumatic system to move the saw.

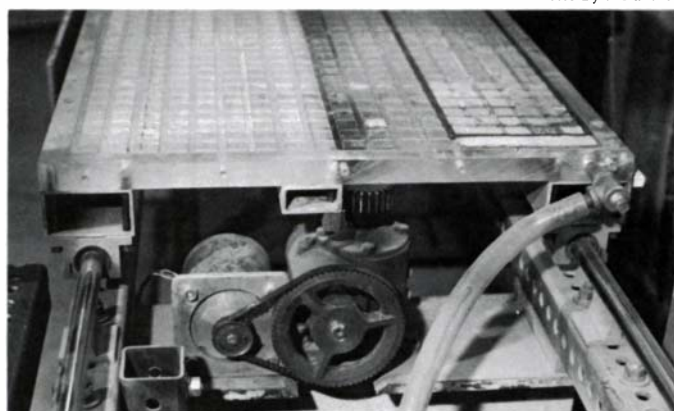
To get the critical accuracy between V-grooves, we needed to position the stock in front of the blade precisely, time after time. Stop blocks set on the saw fence would have been too slow and inaccurate, since each box had to be cut slightly differently. So we built an 8-ft. bed that slides back and forth in front of the saw. This bed, which rides on linear-motion bearings and steel rods, is motivated by a rack-and-pinion gear attached to a computer-controlled stepping motor. The stepping motor has 200 poles and rotates its shaft one pole for every pulse that it receives from the control circuitry.

We made the bed itself of 1-in. thick Plexiglas with a 1-in. square grid routed into it. At the leading edge of the bed, we drilled a small hole where vacuum pressure from a pump enters the grid. Once the plywood blank is positioned on the grid and the vacuum is actuated, several hundred pounds of force eliminates any warp or cup and allows the cutter to operate unhindered by clamps.

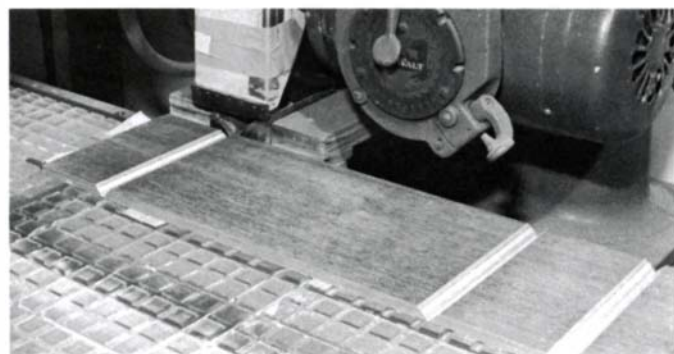
With the saw calibrated and working, it's amazing how quickly the boxes can be made. First, the operator measures the thickness of the plywood at each of the five points where a groove is to be cut. Using a chart we made up, he sets thumbwheels on the saw's control panel that tell the computer the distance between the V-grooves.

Next, he applies tape to the back side of the panel to support the thin veneer left after the cut is made. He places the panel on the saw table, turns on the vacuum and pushes the start button. The computerized control circuit is pro-

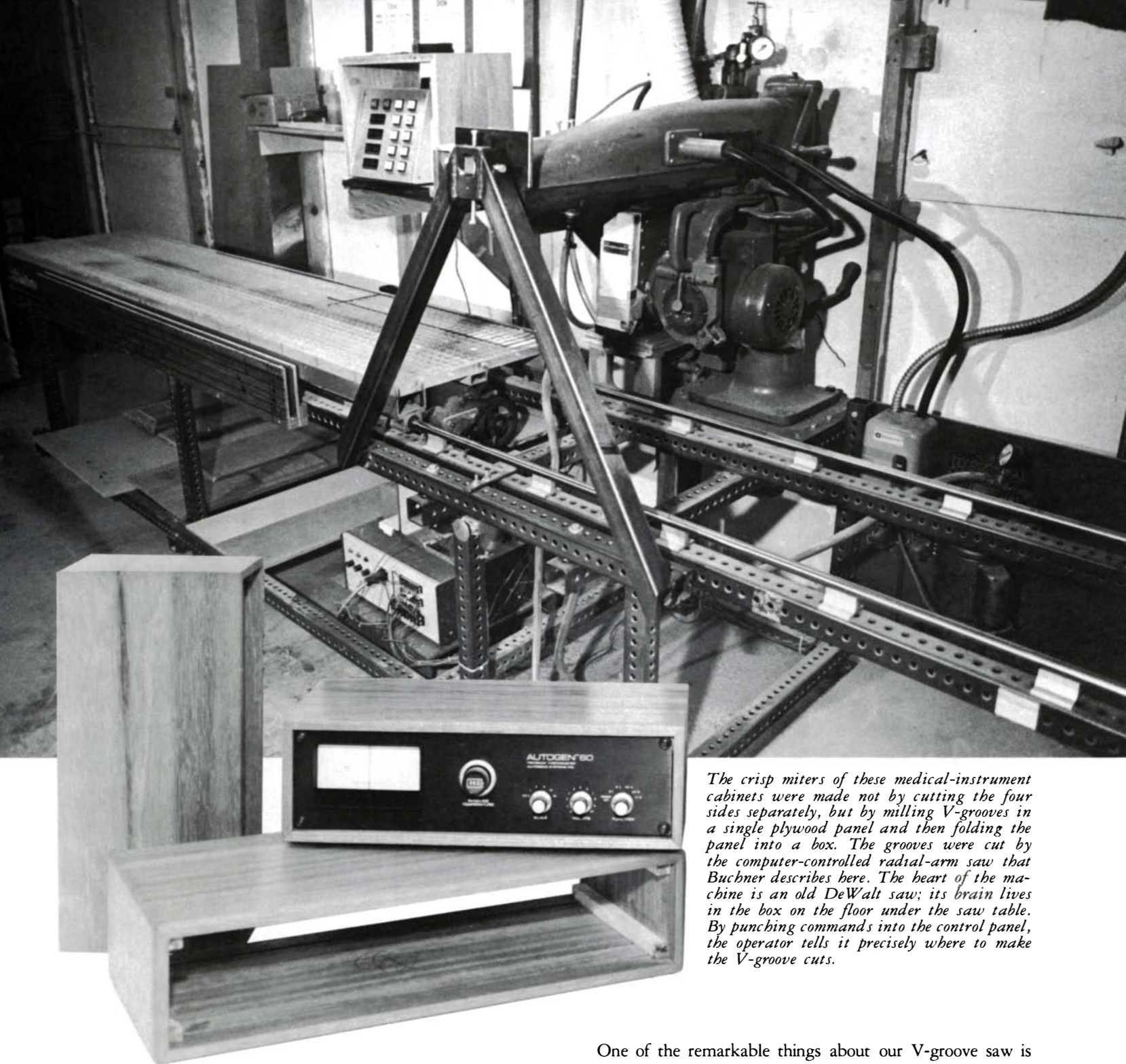
Photos by the author



To position the wood for sawing, Buchner built this Plexiglas sliding table, which glides on linear-motion bearings riding on steel rods. The wood is clamped to the table via vacuum pressure, and the computer positions the stock by moving the table through a rack-and-pinion gear connected to a stepping motor.



An accurate cut is vital to Buchner's folded-box technique. The V-grooves are made in one pass, cutting through all but half the $\frac{1}{8}$ -in. thick face veneer on the outside face of the plywood. Tape reinforces the joint, acting as a hinge when the cabinet is folded and glued up.



The crisp miters of these medical-instrument cabinets were made not by cutting the four sides separately, but by milling V-grooves in a single plywood panel and then folding the panel into a box. The grooves were cut by the computer-controlled radial-arm saw that Buchner describes here. The heart of the machine is an old DeWalt saw; its brain lives in the box on the floor under the saw table. By punching commands into the control panel, the operator tells it precisely where to make the V-groove cuts.

grammed to make an initial groove about an inch in from the end of the blank. This groove is the zero point, from which all the other distances are measured. The computer sends out pulses to the stepping motor, telling it where to position the sliding bed. When the bed comes to rest, a solenoid activates the cylinder that drives the cutting head. When one cut has been completed, the stepping motor moves the bed the appropriate distance to the next cut. We found that bed movement is accurate to within 0.005 in.

It takes about 30 seconds to mike the blank and enter the numbers on the control panel, and about a minute for the machine to do its work. During this time, the operator can mike and tape the next blank. Once a blank is positioned on the table, the machine does everything automatically, except turning the vacuum on and off, which is done by hand. The V-grooved panels are taken to another room where they are glued up, sanded and finished.

One of the remarkable things about our V-groove saw is how well it has held up. By now, it has cut more than 5,000 boxes, running for a few days each week. Last year, when I returned to one-of-a-kind furniture work, I sold the saw to a woodworker friend, who tells me that it's still running strong. During the time I owned the saw, I experienced no major breakdowns, and did little more than replace hydraulic seals, sharpen the blade and blow the dust off it. We spent \$7,500 to build the machine in 1977, including buying and programming our own electronic chips to run the thing. You could probably do it much more cheaply now. Anyone with basic computer knowledge could program an Apple or other personal computer to direct a machine—the hardest part would be connecting the computer to the various switches, solenoids and motors that actually run the machine. Except for the stepping motor, we bought most of the hardware for our saw from electronic and industrial supply houses. □

Lewis Buchner makes furniture in San Francisco.

An Adaptable Instrument Form

Bob Mattingly's straightforward route to a musical box

by Jim Cummins

I'd had in mind building a *vielle*, a sort of modern medieval fiddle, ever since I traced and sketched one about six years ago, but the project kept stalling. I'd done enough repair work to know that the intimidating complexity of most musical instruments is an illusion—that instrument building is basically simple, depending more on common sense and sharp tools than on magic and secrets. I already knew something about the separate procedures involved—bending the sides, thickening the back and top, what woods instru-

ment makers use. What I lacked was a straightforward way to fit all the procedures together.

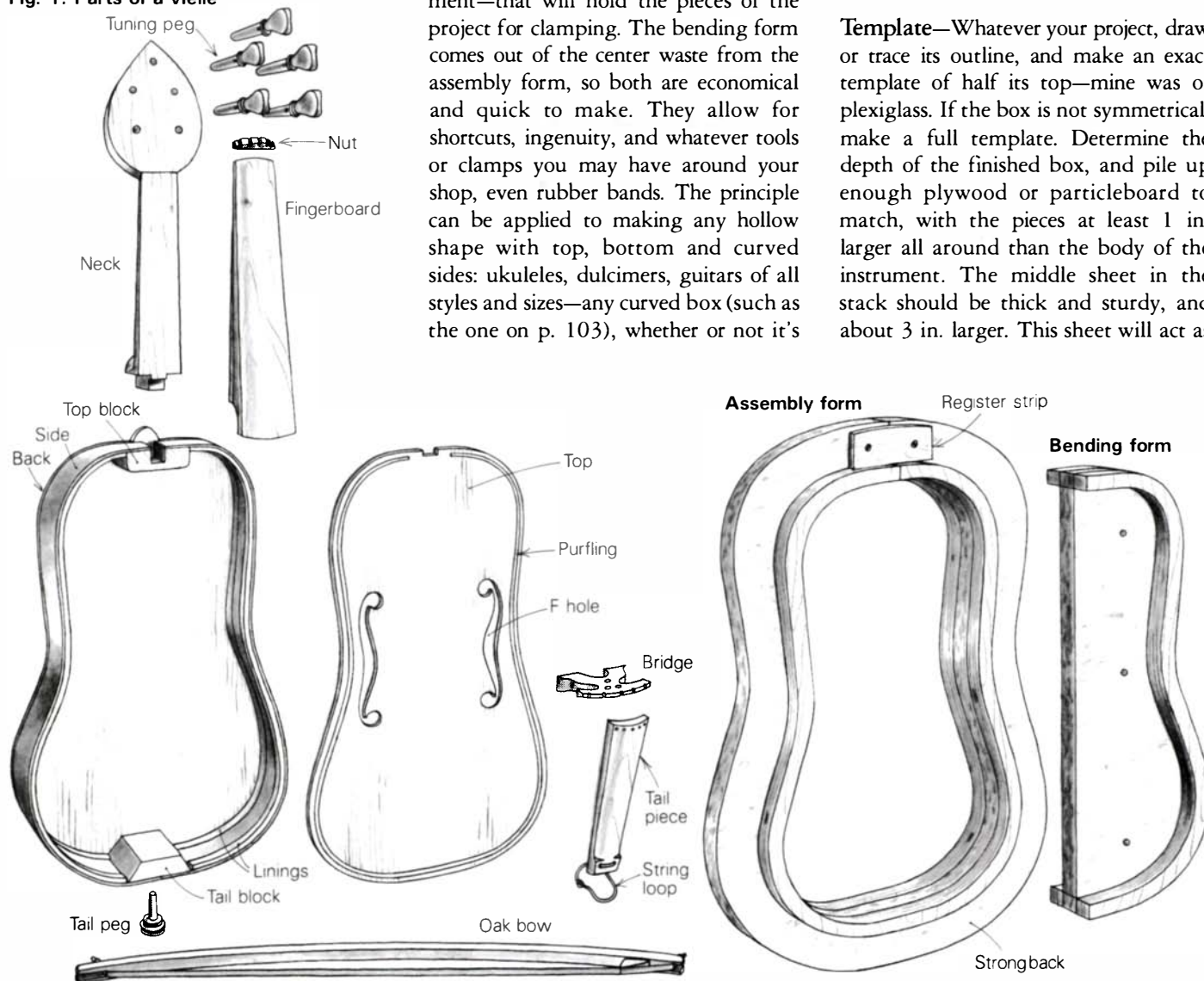
Then, at the 1982 Guild of American Luthiers Convention in Colorado (*FWW* #37, pp. 80-81), I met Bob Mattingly, a guitar maker from Long Beach, Calif., who has developed a course aimed at non-woodworkers who want to make guitars. His best trick is two clever forms built up from layers of plywood and/or particleboard. When the stack is bandsawn, it yields both a bending form for the instrument's sides and an assembly form—an outside mold the exact size and shape of the instrument—that will hold the pieces of the project for clamping. The bending form comes out of the center waste from the assembly form, so both are economical and quick to make. They allow for shortcuts, ingenuity, and whatever tools or clamps you may have around your shop, even rubber bands. The principle can be applied to making any hollow shape with top, bottom and curved sides: ukuleles, dulcimers, guitars of all styles and sizes—any curved box (such as the one on p. 103), whether or not it's

intended to make music. The whole process seemed so accessible that I dug out my old drawings and cleared my workbench. With help from my wife, Karen, I got the fiddle ready for pegs and strings over a three-day weekend.

Figure 1 shows how simple the basic construction is. The instrument has a flat top and back, bent sides reinforced by strips called linings, and blocks inside the body at the neck and tail for strength. Guitars and other modern instruments have a series of internal cross-braces to stiffen the back and the top. The *vielle*, with its relatively heavy, 1/8-in. thick pieces, needs none.

Template—Whatever your project, draw or trace its outline, and make an exact template of half its top—mine was of plexiglass. If the box is not symmetrical, make a full template. Determine the depth of the finished box, and pile up enough plywood or particleboard to match, with the pieces at least 1 in. larger all around than the body of the instrument. The middle sheet in the stack should be thick and sturdy, and about 3 in. larger. This sheet will act as

Fig. 1: Parts of a *vielle*



a strongback, an oversize, wider lamination that will make the thin walls more rigid. I used particleboard for the strongback, but something as large as a guitar needs $\frac{3}{4}$ -in. plywood instead. The stack should be at least the height of the deepest part of the instrument; later the box's walls can be trimmed down to exactly the right height or even tapered. Figure 2 shows the steps that get you both forms from the stack.

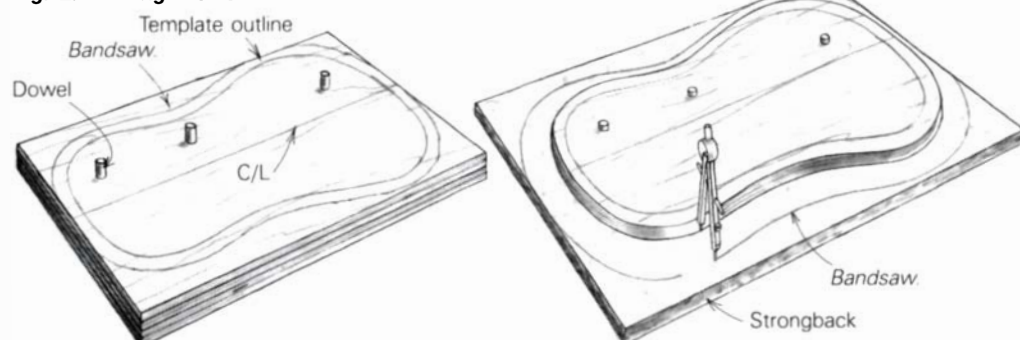
Register strip—As seen in steps 4 and 5, a register strip placed over the entrance kerf solidifies the assembly form and compensates for the sawkerf, keeping the form the exact size of the template. The shape of a *vielle* is a straightforward curve that can be made with one continuous bandsaw cut. For more difficult shapes, including those with right-angle corners or other tight spots that require you to back up the blade and reapproach from another direction, you can design various inserts, held in place by additional register strips, that will restore the assembly form to one piece, as shown in figure 3. Thus you can adapt the form to other methods of attaching the neck, as well as to cutaway guitar styles.

Sanding—The assembly form is so accurate that it exactly reproduces any error. Take care to sand the bandsaw marks away without distorting the shape or flaring the walls. If you want the instrument to be tapered in depth (many guitars are deeper at the tail than at the neck), be sure to taper the bottom side of the assembly form rather than the top, otherwise the neck's top surface won't lie in the right plane. Mattingly's students make an extra-long sanding block to help them keep the mold's top and bottom surfaces flat and even. Shellac and wax the form so it will resist glue.

Using the forms—I'll move quickly through the following steps to show how the forms are used. Rather than attempting to give a crash course in luthiery, I've put a list of references on p. 103. The basics of instrument making are simple enough to cover here, although the fine points can be argued forever.

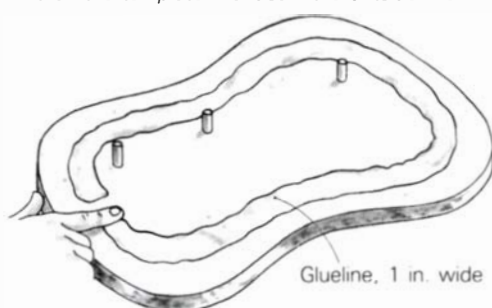
Bending wood—You have to prebend the instrument's sides and the linings in order to be sure of a tight glue joint when you clamp them in the assembly form. I made a steamer from a

Fig. 2: Making the forms

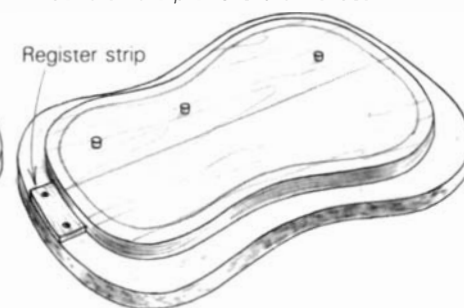


1. Remove the strongback sheet, and index the stack with dowels. Trace the template on the stack, then trace a contour $\frac{1}{2}$ in. larger than the template. Bandsaw the outside line.

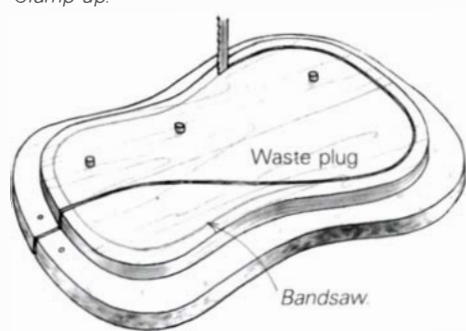
2. Replace the strongback, and drill index holes, using the previous holes as pilots. Draw the outline of the strongback, about $1\frac{1}{2}$ in. wider than the previous cut. Bandsaw.



3. Use the dowels to glue the layers to the strongback one at a time. Spread a 1-in. wide band of glue around the edge of each layer. Clamp up.



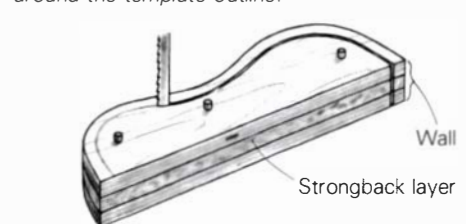
4. Screw a register strip across the top of the strongback, then remove it. Later on the strip will hold the mold at its original dimensions and strengthen it.



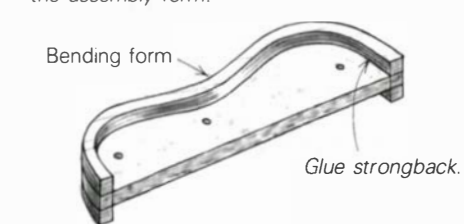
5. Beginning the cut at the top, bandsaw around the template outline.



6. Reattach the register strip. This completes the assembly form.



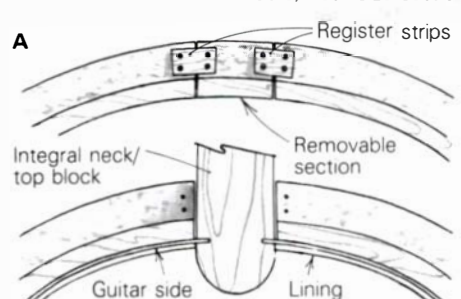
7. Saw the waste plug down the centerline, and scribe a line $\frac{1}{2}$ in. from its edge. Bandsaw to make the wall of the bending form.



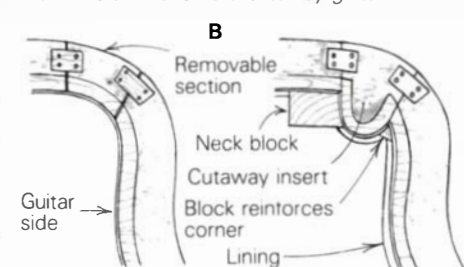
8. Split the waste layers away from the strongback, then glue it back to the wall to complete the bending form.

Fig. 3: Variations

A shows the Spanish method of attaching neck to body, with a removable, neck-size section in the mold. **B** shows a cutaway guitar.

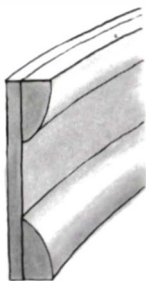


After the linings have been glued to the bent sides, remove the section and install the neck.



Build up the complete guitar sides as usual. Then remove the section where the cutaway will fit, miter the sides, install the cutaway insert and complete the shape.

hot pot and a rolled-up-cardboard tube (photo, below), and steamed a single 1½-in. strip of dogwood (it was handy, though maple would have done fine) to make the linings. They will eventually be glued around the inside of the sides, as shown at right, to provide more gluing surface for attaching the top and bottom. Don't slice and taper the linings before you bend them, or they'll twist. In the bending-form photo below, the wood is being heated with an industrial hot-air gun to set the bend. After the bend had set, I bandsawed the piece into four narrow strips (about ¼ in. wide), and then tapered them so they would blend smoothly into the instrument's sides.



Mattingly bends guitar sides on the bending form, too, using a natural-gas flame to steam up the damp wood as he clamps along. But a vielle's sides are thicker than a guitar's. It turned out that my clamps were not strong enough to hold the sides on the form. So I prebent mine around a bending iron I rigged up—the hot-air gun held in my vise, shown in the photo, below left.

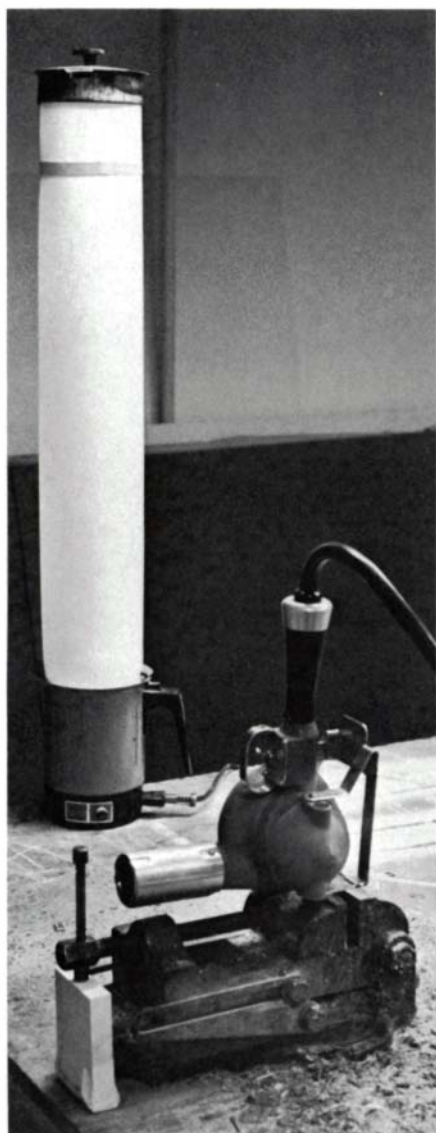
Clamping the sides in the mold—

The sides are butt-joined and glued at the bottom of the instrument, but at the top, at this stage, they just float free. Figure 1 shows the maple tail block, which strengthens the joint and will later be drilled to hold the peg to which the tail piece is tied. The linings butt against it, and I clamped and glued them one at a time to the sides as shown

below. The tail block could be smaller in an instrument with less string tension, or it could be replaced by another lamination if you were building a box. In fact, for a box, you could dispense with linings entirely by double-laminating the sides, perhaps with one lamination narrower than the other to form a rabbet for the box's top.

After the glue had dried, I removed the sides from the assembly form to check that I hadn't glued them in, and I found that there was little springback.

Fitting the neck, top and back—I shaped the maple neck with bandsaw, jointer and belt sander, then cut its tenon on the tablesaw. Next I made a top block with a matching mortise and glued it in place in the assembly form. The tenon is stepped down so the top



An improvised bending setup: An industrial hot-air gun can plasticize the wood as it is levered around the vise's tommy bar. The steamer in the background is a cardboard tube in an electric hot pot.



The bending form: Linings are first steamed, then clamped and heated with a hot-air gun or a gas flame to set the bends. Guitar sides can be bent the same way.

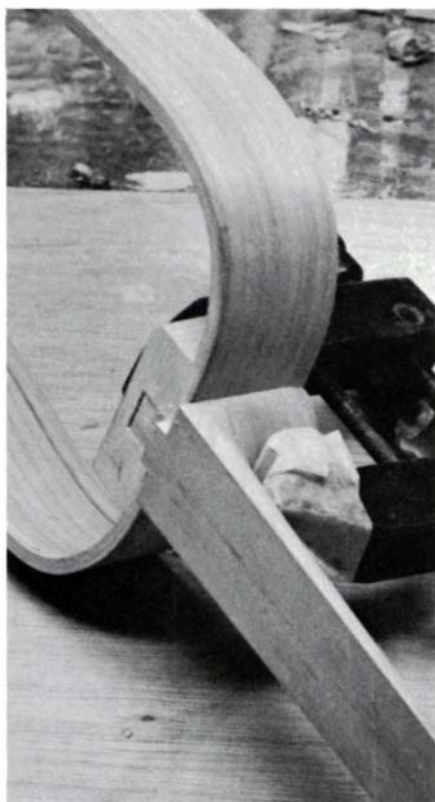


The assembly form: Pre-bent sides and linings are laminated with spring clamps, while the handscrew secures the tail block. The top block will be glued in last.

can overlap it, but I left a little of the tenon showing as a clue to anybody who might ever try to remove the neck. I made the back from bookmatched maple and the top from bookmatched spruce. I know people who've made instrument tops by quartersawing red cedar construction lumber, but it makes a quieter instrument.

The next step was to plane the linings, sides and blocks to make a good glue joint with the top and back. Most of the truing-up can be done with the sides in the assembly form, which provides stability and reference points.

I clamped the neck to the top block with the instrument outside the mold, as shown below. While the glue dried, I cut the F holes in the top with a knife. Since spruce grain is alternately hard and soft, which makes for a jumpy cut,



The neck can be clamped to the top block outside the assembly form. For an alternative neck joint, see figure 3.

Further reading:

"Appalachian Dulcimer," *FWW* #33.
 "Binding and Purfling," *FWW* #28.
 "Guitar Joinery," *FWW* #5.
 "Hot Pipe Bending," *FWW* #10.
 "The Shape of a Violin," *FWW* #15.
 Data sheets from the Guild of
 American Luthiers, 822 South
 Park Ave., Tacoma, Wash. 98408.

I made a light cut around the outline, and gradually deepened the cut by making wider and wider Vs until it went through. I'm tempted to try some filigree the same way.

I clamped the back and top to the instrument using rubber bands for tension around the sides and Jorgensen hand-screws over the blocks.

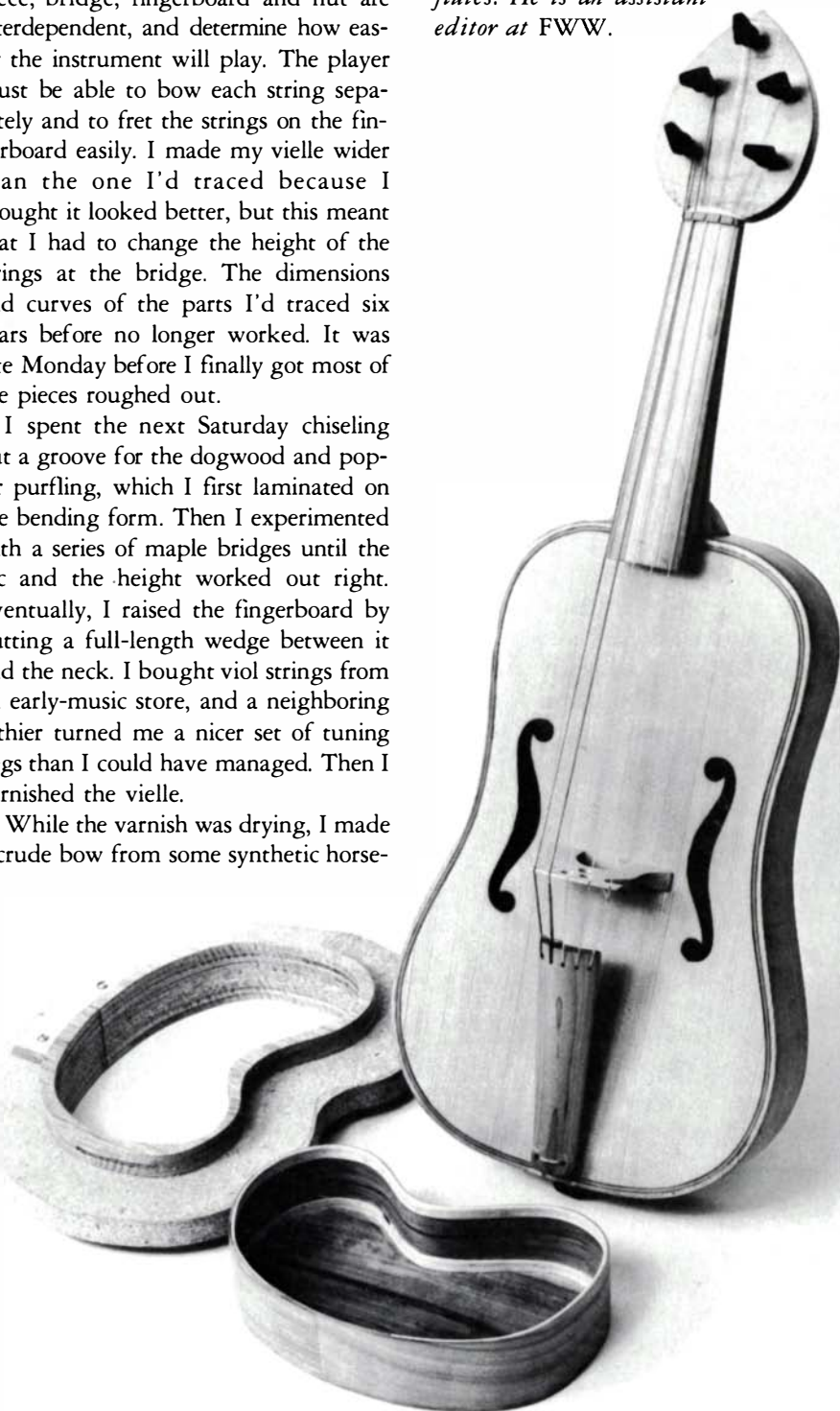
Odds and ends—Figure 1 shows the other parts needed to complete the vielle. The relationships between the tail piece, bridge, fingerboard and nut are interdependent, and determine how easily the instrument will play. The player must be able to bow each string separately and to fret the strings on the fingerboard easily. I made my vielle wider than the one I'd traced because I thought it looked better, but this meant that I had to change the height of the strings at the bridge. The dimensions and curves of the parts I'd traced six years before no longer worked. It was late Monday before I finally got most of the pieces roughed out.

I spent the next Saturday chiseling out a groove for the dogwood and poplar purfling, which I first laminated on the bending form. Then I experimented with a series of maple bridges until the arc and the height worked out right. Eventually, I raised the fingerboard by putting a full-length wedge between it and the neck. I bought viol strings from an early-music store, and a neighboring luthier turned me a nicer set of tuning pegs than I could have managed. Then I varnished the vielle.

While the varnish was drying, I made a crude bow from some synthetic horse-

hair I'd stashed away. I rosined the bow, touched it expectantly to the strings, and was rewarded with an intermittent squeaking wail that sounded like a dried-out bearing sounding its death rattle. I didn't find out until weeks later that the sound was all my fault and not the instrument's. In the hands of a string player, it sounded fine. Making the box was the easy part. Now I have to learn how to play it. □

Jim Cummins usually makes and plays flutes. He is an assistant editor at FWW.



The finished vielle next to another shape that can be made by adapting Mattingly's assembly form, a little dogwood-and-ash box.

Current Work

Seven pioneer their own show in Chicago

by Rick Mastelli

Last winter's "Chicago Furniture, 1982" marked a first for the influential Hyde Park Art Center in Chicago, and a breakthrough for the seven woodworkers who promoted this, their own show. Hyde Park's usual fare is painting and sculpture, the iconoclastic, rowdy stuff of the Chicago School art movement. But Howard Kavinsky, armed with slide portfolios of his furniture and the furniture of six of his woodworker neighbors, gave the art center something new to think about: sophisticated woodwork, maybe not art as the show-review committee was used to, but not crafts-fair woodenware either.

It was out of desperation, this audacious proposal to appropriate a month of showspace, for there is no furniture gallery in Chicago, no outlet for classy woodworking. The art center went for it. The seven craftsmen brought forty pieces to their November 21 opening, half of which they had produced especially for the show—a truly intrepid investment of time, energy and capital.

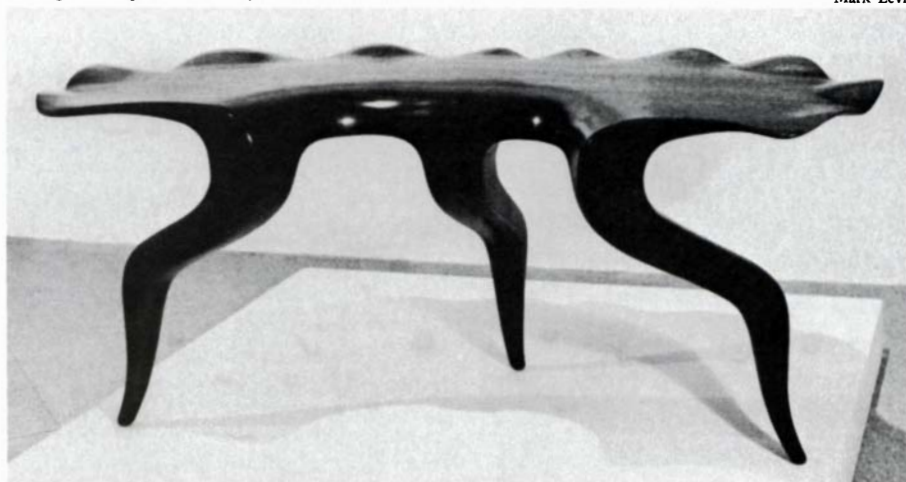
It may not be news to those who've been paying attention to contemporary woodworking, but the Hyde Park Art Center sure was surprised: the public turnout for this show was larger and more enthusiastic than it had been for any show of regular art in recent memory—400 people at the opening, about a thousand in all attending the show. The pieces ran the gamut of contemporary styles: post-modernist and art-deco designs, traditional Shaker and African-inspired furnishings, constructivist and trompe l'oeil sculptural stuff. Techniques ranged from hand-planing to opaque-lacquering, from inlay to stacked lamination. In effect, it was a broad survey of the current state of the art of furniture in Chicago. Not bad for seven individual woodworkers.

Rick Mastelli is associate editor of Fine Woodworking.



'Ginger-Leaf Table,' by Mark Levin.

Mark Levin



Mark Levin's stack-laminated mahogany writing table, above, is part of a series of three-legged tables he has modeled on leaf forms. "Ginger-Leaf Table" he calls this one, and priced at \$3000 the same design won 1981's Marietta Crafts National purchase award. The wavy edge of the top is carved from a face-glued thickness, which results in visible glue lines that Levin says he will avoid in future versions by using a thicker, one-piece top. Levin, 30, takes his principal inspiration from the early work of Wendell Castle, but favors a firmer and more regular symmetry than Castle has aimed for.

Joe Agati, 30, began this set of table and chairs (bottom of facing page) intrigued with the effect of thin, teardrop-sectioned members that from most views seem to have no mass, only line and plane. The table, made first, looked two-dimensional. To make chairs to match, he wrestled with rectilinear forms. Then it occurred to him that instead of reiterating the table, half-round chairs would alter the table's shape and at the same time connect to it. He used ebonized oak, strategically plate-joined together. The thin edges are colored citron yellow and fire red. The table was priced at \$2,200, and the chairs at \$1,795 apiece.

Glenn Gordon relies on the quiet techniques of hand-planing and hand-joining to display lusciously figured slabs of domestic hardwoods. Having come to woodworking via creative writing, Gordon, 40, invests his pieces with a poetic simplicity, then lets them be. He appreciates when age and wear leave their natural marks on his furniture. This corner bench, made from two successive flitches of air-dried cherry and priced at \$1,500, was inspired by the Prairie School of architecture, and was one of the more geometrically dynamic of the eight uncomplicated pieces he showed at Hyde Park. His other work included a 48-in. wide, myrtle-flitch trestle table called "Feast," and a matching curved bench called "Longing."



'Corner,' by Glenn Gordon.

When Tom Tedrowe was studying furnituremaking at Rhode Island School of Design, his teacher, Tage Frid, often remarked that his pieces looked like they ought to have been made out of metal. Tedrowe, 33, admits liking the way metal bends and looks, but working it, he says, is dirty. So he works wood, but in this table, shown with one of its four chairs, he decided to make explicit his latent attraction. The diamond-plate pattern is of cherry and holly veneer over poplar plies, the I-beam legs are of elm and ash, and the girder skirts are of pearwood. He calls the table "Trestle," to reinforce the pun. Painstakingly crafted, the set carried the largest price tag in the show: \$16,500. □



'Trestle,' with chair, by Tom Tedrowe.



Ebonized oak table and chairs, by Joe Agati.



The Woodcraft Scene

by Allen Koenig

JOHN WINKLER'S SIERRA BOXES

John Winkler came to America as a teenager in the early part of this century. He studied art in California, and eventually made his living producing etchings of scenes from San Francisco's Chinatown and waterfront. But from 1932 until the outbreak of the Second World War, he found his own recreational escape in the uncrowded High Sierra, where he sought and collected mountain-gnarled deadwood, from which he made intricate boxes.

The woods he brought back—white-bark pine, juniper, hemlock, tamarack and laurel—whether cut from trunk, branch or root, had been shaped and weathered by the elements until they resembled the mountains themselves. Once in a while Winkler would make a box from rosewood, but most of his boxes are from white-bark pine (*Pinus albicaulis*), which requires strenuous effort to harvest. Elizabeth Winkler showed me some photos of her husband at work. In one he is handsawing a fallen trunk more than 20 in. in diameter; in another he is belayed by rope, cutting out a section of pine root from a steep slope.

In the Sierra, each species of tree is a signpost of altitude. Hemlock and juniper thin out as you hike toward the timberline, but white-bark pine prevails. It grows only above 8,500 ft., often the sentinel of a craggy, scree-covered slope where it alone can keep a foothold. At the highest elevations, where no other vegetation rises more than a few inches, it hugs the ground against arctic winters and desert summers. Its wood is contorted and resinous, and seems to have been squeezed by time—it can have more than 100 growth rings per inch.

Winkler didn't cut living trees. Consequently the wood he worked frequently looked more like an experiment in destructive distillation than anybody's

efforts at kiln-drying. Back from a trip, he would work late at night, roughing out each box as soon as he could, then applying the finishing touches—sometimes carved scenes or decorations, sometimes painted designs—at intervals that could stretch out for years. He accomplished his work with the simplest of hand tools, and used no jigs to achieve symmetry, just a pair of calipers. He hated interruptions. When working, his concentration was intense as he thoroughly explored variations on the compact shapes he favored. If he uncovered embedded rock or large pitch pockets, the box might go to the scrap heap; on the other hand, he would often painstakingly splice small pieces into ingenious mosaics. I counted 281 pieces of white-bark pine in one small box. His tour de force, perhaps, is the hexagonal burl box shown on the facing page. He pieced it together from six matched segments, carved the drawers from solid wood, then incised landscape designs into their sides.

Winkler finished his boxes with a few coats of thin shellac, polished to look the way the fiber and the resin in the wood would look without a finish coat. He never allowed a heavy coat of varnish to touch any of his boxes.

Winkler signed and dated his last box in 1953. "He felt he had exhausted the possibilities," Elizabeth says. He never sold a box, and gave them away but rarely. Elizabeth has been custodian of more than 200 of them since Winkler's death in 1979. She would like to find a home for them in a museum, but so far none has found the funds to house the collection. □

Allen Koenig, who has been a guitar-maker and a cabinetmaker, owns an importing business in Conway, Mass. Photos by author, except where noted.

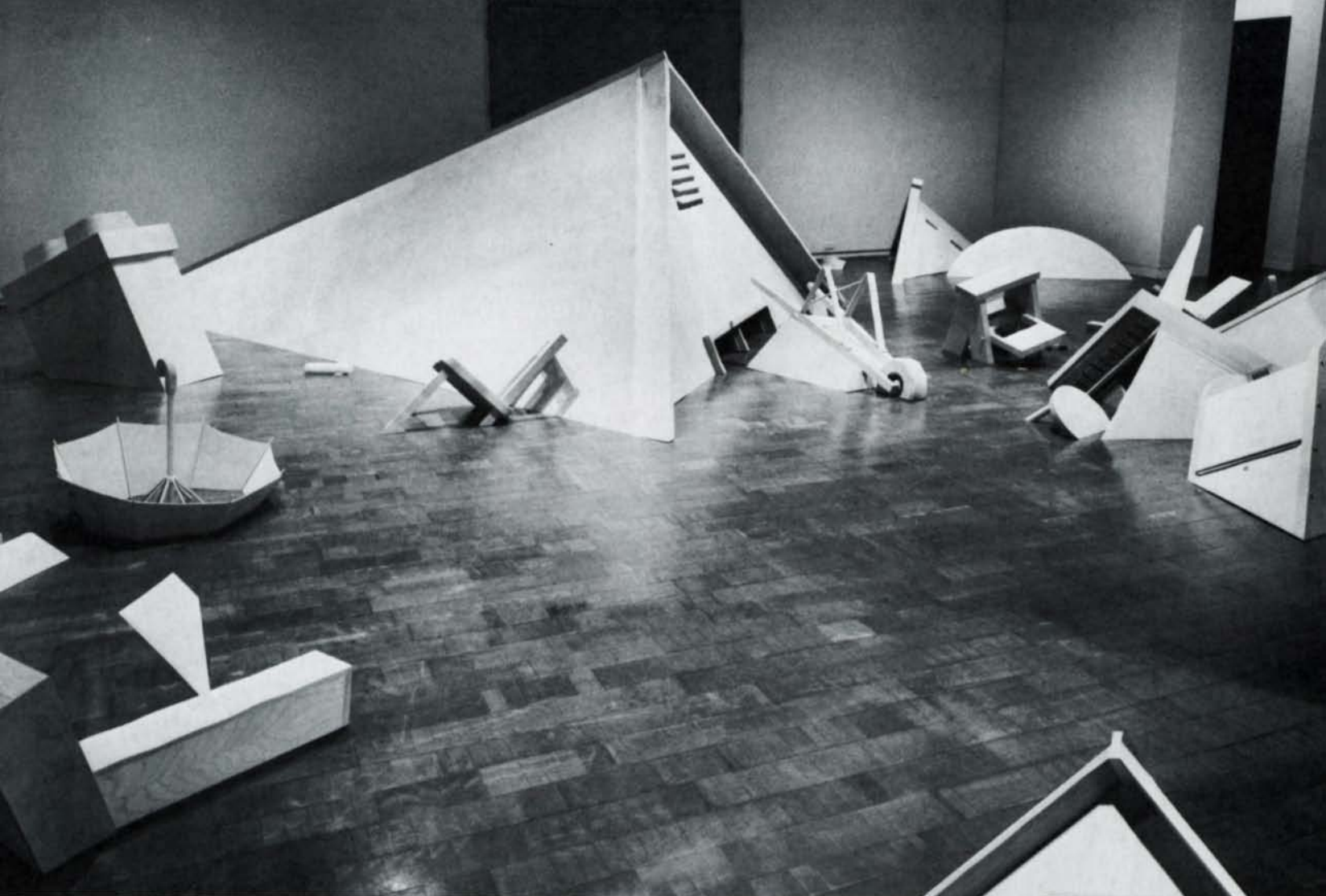




Winkler roughed out his boxes with hand tools in his basement workshop, working wood that he'd brought down from the Sierra timberline. He shared his workspace with one or two pet skunks and a poisonous pet Gila monster, Montezuma, who bit him twice.



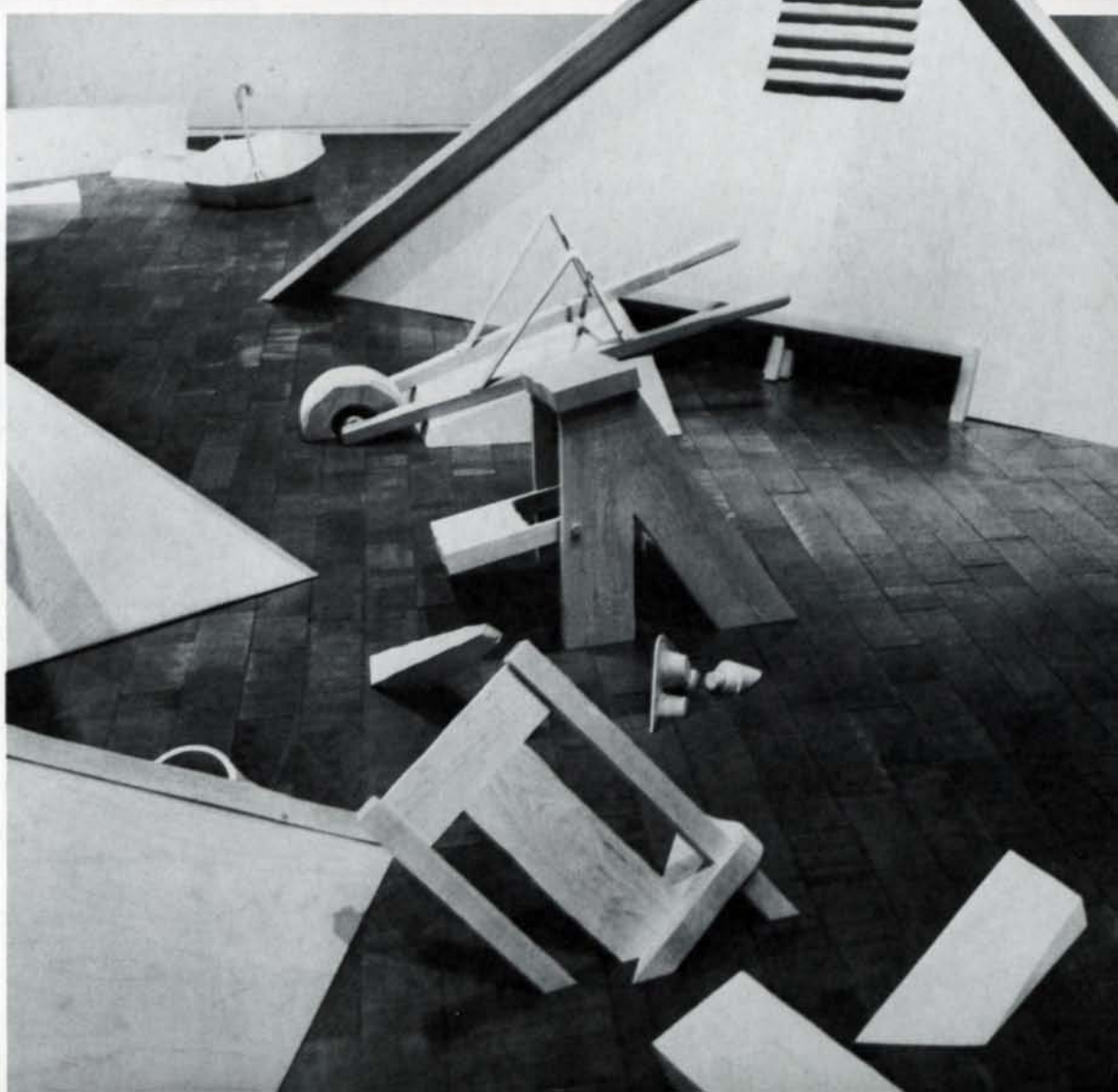
This hexagonal box has carved drawers (left). Above left is a box painted with pinwheeling designs. At far left, white-bark pine, drawn by Winkler.



FLOODED

"My intention is to change the audience's view of the floor," said Gary Martin, of Balboa, Calif. His sculpture, entitled "Flooded," consisted of 32 common objects, all sliced off at various angles and arranged last winter across the floor of the Newport Harbor Art Museum in Newport Beach, Calif. "It's as if the floor were the surface of some undefined depth," said Martin. "As people step out across the floor, they feel like they're walking on water."

Martin's flotsam is made of solid maple and birch plywood. The wood, unfinished, looks blached. And many of the edges are band-sawn wavy, suggesting watery reflections.



Fine Woodworking

Index to Issues 31-39

This index to *Fine Woodworking* magazine spans issues #31 through #39, that is, November 1981 to March 1983. It supplements, but does not replace, our concise cumulative index to issues #1 through #30, which appeared in issue #30 (September 1981).

The sheer mass of information published in *Fine Woodworking* since 1975 has made it impossible to continue our custom of periodically printing a cumulative index inside the magazine. Instead, we have prepared a new, comprehensive and minutely detailed cumulative index to all our back issues, from #1 through #39. It is being published as a separate 32-page booklet costing \$2.50 a copy, which readers may order using the regular form and envelope bound into the magazine.

This is a technical index which pays particular attention to Letters, Methods of Work, and Questions & Answers, as well as to the articles themselves. The format for each entry is issue number followed by a colon and page numbers. A hyphen separating page numbers within an issue indicates a continuous discussion of the topic, whereas commas between page numbers indicate a mention or intermittent discussion.

This index to issues #31 to #39, and the new cumulative index from which it's taken, was prepared by Harriet Hodges of Rural Retreat, Va.

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