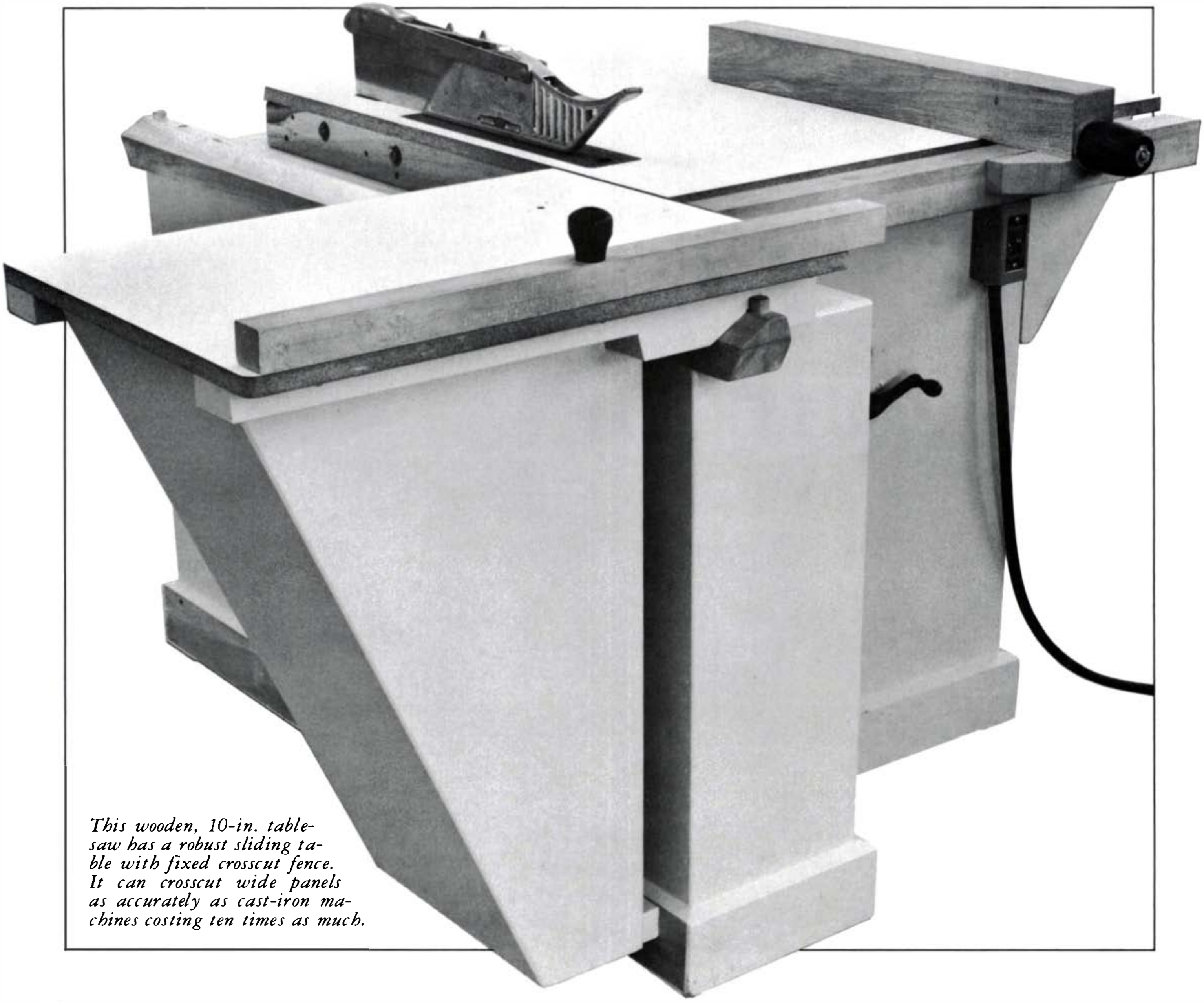


This wooden, 10-in. tablesaw has a robust sliding table with fixed crosscut fence. It can crosscut wide panels as accurately as cast-iron machines costing ten times as much.

A Wooden Tablesaw

An attractive, shopmade alternative to cast iron

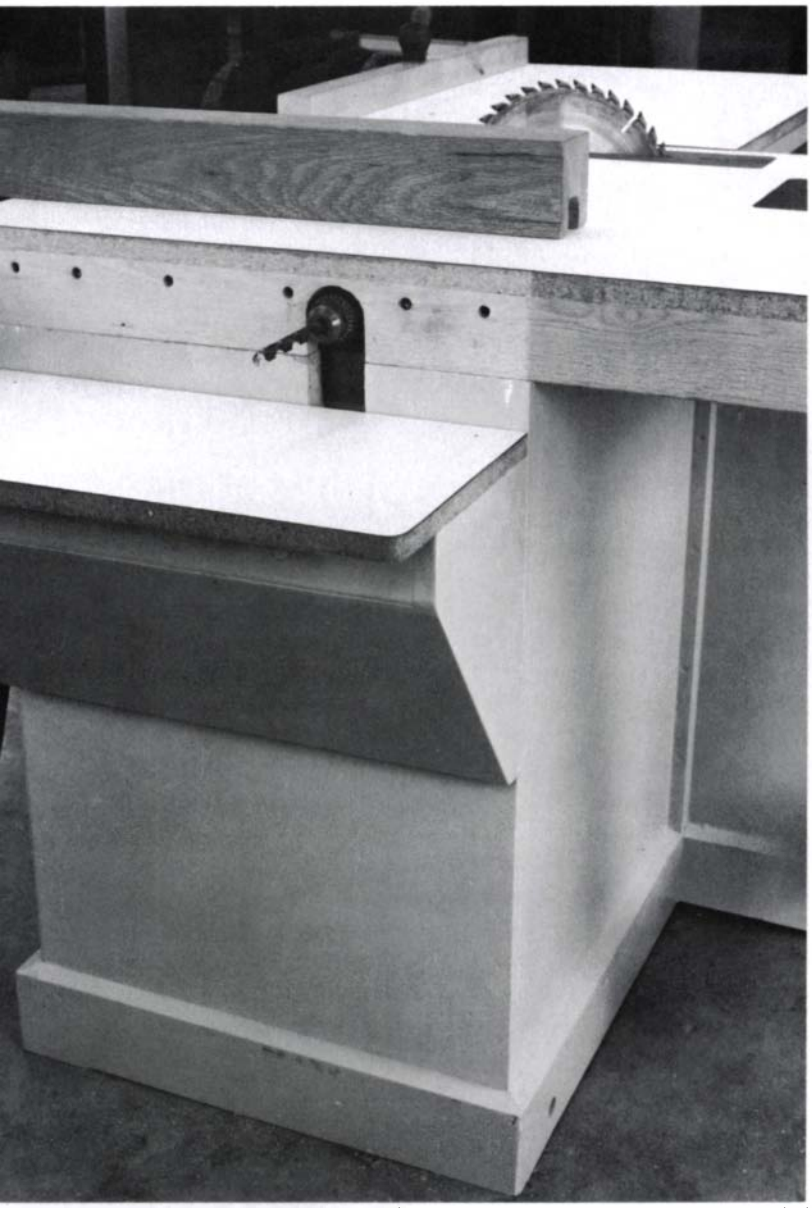
by Galen Winchip

Early in my woodworking career, I remember arranging to use a friend's big radial-arm saw to make critical crosscuts on wide panels for cabinets I was building. We spent hours fussing with the saw's adjustments, only to have it cut each panel frustratingly out of square. I longed for a sliding crosscut table—standard equipment on the heavy, industrial tablesaws that were way beyond my price range.

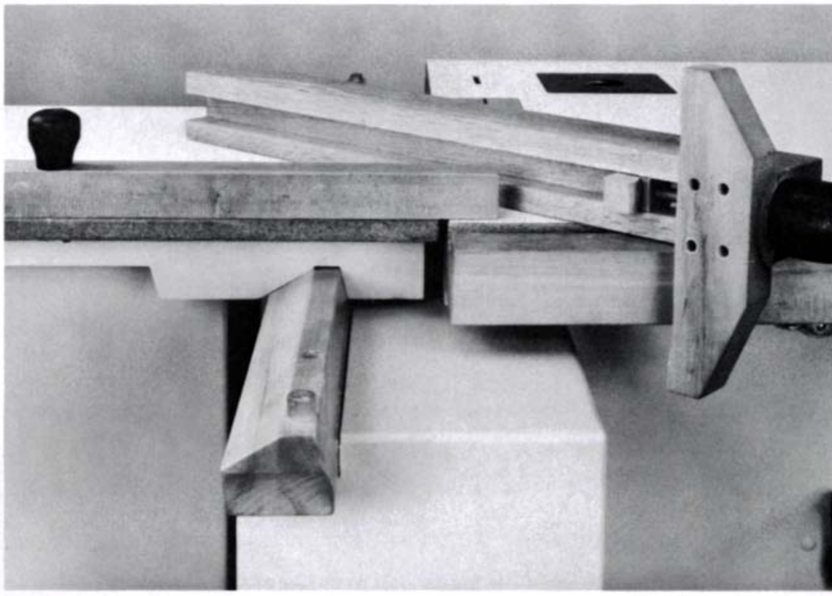
I had looked at the sliding tables then appearing as options on medium-duty saws, but they seemed flimsy and certain to sag when crosscutting heavy boards. Worst of all, these devices were fitted with as many adjustment knobs, screws and levers as a radial-arm saw has, making them far from the set-it-and-forget-it crosscut machine I wanted.

I decided that the only way I'd own a sliding table was if I designed and built one myself out of wood. I had already constructed a half-dozen wooden woodworking machines, including panel saws, jointers (*FWW #28*, pp. 44-50) and lathes. I've found them to be well up to the rigors of daily use and, like a vintage wooden hand plane, they have the friendly feel that's absent from their cast-iron counterparts.

Photos: Pete Krumhardt



For horizontal boring and slot-mortising, a chuck can be threaded onto the saw's extended arbor. The auxiliary table can be set in two positions: flush with the main table, or 5 in. below it.



The saw's sliding table mechanism is self-centering and self-adjusting, and it won't bind or loosen as the wooden rail swells and shrinks. The guide rail and rip fence are laminated from thinner stock for stability.

I built two tablesaws with complicated tilting-arbor mechanisms, but because I wanted my third saw, described in this article, to be easier to build, I opted for a fixed arbor. I didn't include an adjustable miter gauge either, relying instead on jigs fastened to the sliding table. Most of the adjustments on this machine are achieved by planing or jointing a small amount of wood from a critical surface, or by inserting paper shims. Because I didn't have mortising machinery at the time, I extended the saw's arbor and added a table for horizontal boring and mortising. Of course, you can modify the design to suit your own needs. After I'd built my saw, alternatives and modifications kept coming to mind, and because I've included these changes in the drawings, the photos and drawings don't correspond exactly. If you do modify, keep in mind some basic wooden-machine-building principles, which I've outlined below.

Wood vs. cast-iron—If you set out to build a wooden chair, you wouldn't look to one made of plastic as your structural model, so it follows that cast-iron woodworking machine mechanisms shouldn't serve as models for wooden ones. Cast-iron is an unyielding, predictable material which can be machined into parts that will maintain close tolerances. Wood expands and contracts with the seasons, so you must design mechanisms that won't swell and seize up in summer, then shrink out of precision in winter.

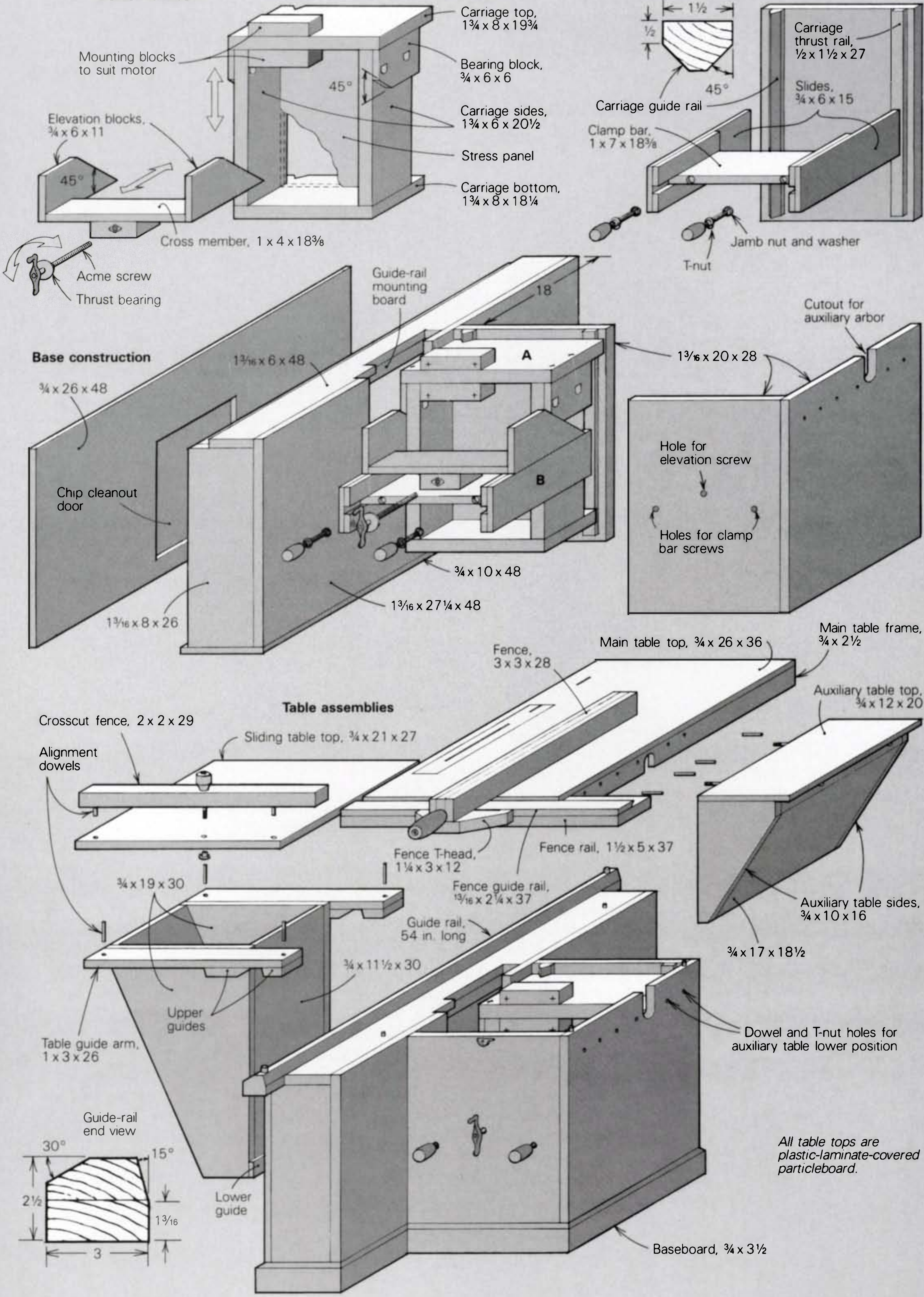
The rail I devised for my sliding table is an example of one such mechanism. As the photo above shows, it's an angled-section member which supports guides shaped so that the table's weight keeps them accurately centered, regardless of dimensional changes caused by moisture or wear. There's no play in this mechanism, but the compromise is friction. The table doesn't move as freely as do commercial models that roll on steel bearings.

For a given cross-section, cast iron is about ten times as rigid as wood, thus wooden members must have larger cross-sections for equivalent stiffness. Obviously, cast iron is harder and denser too, so it can bear concentrated loads that would crush wood. The best way to achieve rigidity in wooden machines while avoiding crushing is to distribute loads widely. In a cast-iron saw, the arbor bearings might be mounted 2 in. or 3 in. apart, but in my wooden saw, they are about 19 in. apart. Spreading out these mounting points also masks minor construction inaccuracies and distortions caused by uneven movement of wooden components.

My favorite wood for machines is well-seasoned, straight-grained hard maple, though I've had good luck with cherry, beech and oak. Whichever wood you pick, it's a good idea to let it live in the shop for a few months so it can reach equilibrium moisture content before you work it. I always cull out the highly figured pieces because they are more likely to twist, bow or cup. You can further counterbalance some of the wood's inherent instability by laminating several thin pieces into one larger one, as I did for the saw's sliding-table guide rail and rip fence.

For sheet stock, I prefer particleboard with a density of at least 45 lb./cu. ft. It's cheap and strong, and can be finished nicely with paint or covered with plastic laminate. Fiber-

Fig. 1: Wooden tablesaw construction



All table tops are plastic-laminate-covered particleboard.

boards such as MD44 could also be used. Particleboard has one quality that cast iron can't match: it muffles the piercing, high-frequency whines that are rough on the ears. I don't recommend the lower-density particleboards sold for a song as shelving at the local discount lumberyard, because their larger particles are bound together with less adhesive, making them weaker and more difficult to join reliably.

Building the saw—As figure 1 shows, the saw consists of a particleboard cabinet that houses the motor, arbor and arbor-raising mechanism. A second particleboard cabinet—built in the form of a box-beam for strength and rigidity—supports the sliding table. The two are screwed and glued together to form a T-shaped pedestal that enhances the saw's stability by spreading its 400 lb. over a wider area than a cast-iron saw would occupy. I built my cabinets out of 1³⁄₁₆-in. and ¾-in. particleboard joined with glue and screws. Where possible, I reinforced the corner joints with glue blocks. If you want a lighter, more portable saw, build the cabinets out of plywood. Five-eighths to ¾-in. plywood should be rigid enough.

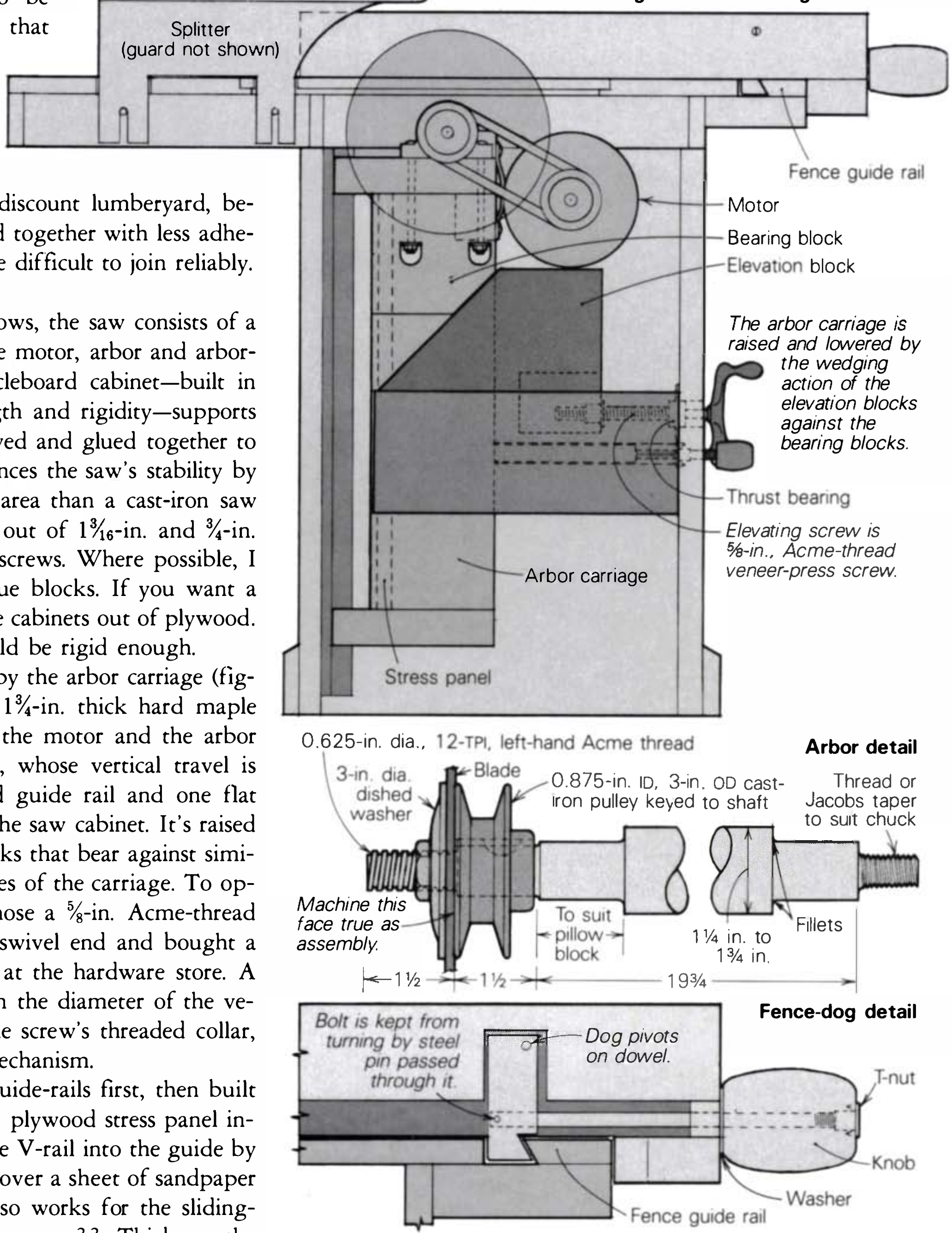
The blade is lowered and raised by the arbor carriage (figure 2), a box-like frame made of 1¾-in. thick hard maple glued and doweled together. Both the motor and the arbor bearings are bolted to the carriage, whose vertical travel is guided by two rails—one V-shaped guide rail and one flat thrust rail—screwed to the back of the saw cabinet. It's raised by two wedge-shaped elevation blocks that bear against similarly shaped blocks glued to the sides of the carriage. To operate the elevation mechanism, I chose a ⅝-in. Acme-thread veneer-press screw. I discarded the swivel end and bought a flange-mounted ball thrust bearing at the hardware store. A small shoulder made by filing down the diameter of the veneer screw transfers the thrust to the screw's threaded collar, which is mounted on the raising mechanism.

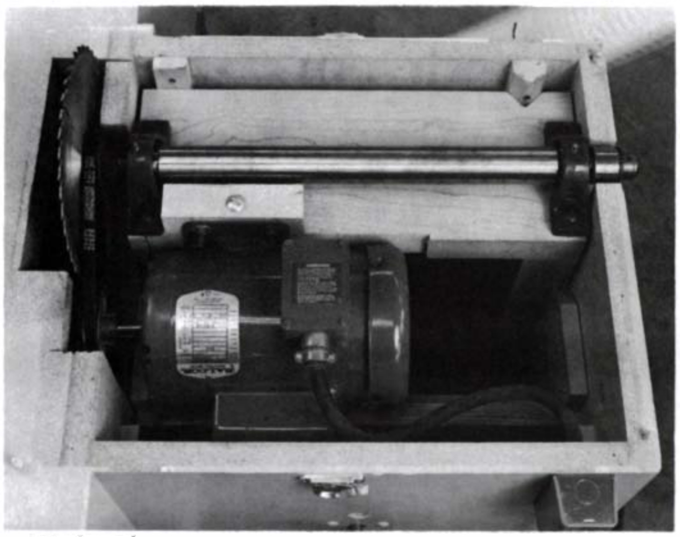
I mounted the vertical carriage guide-rails first, then built the carriage frame, installing a ¾-in. plywood stress panel inside it to keep it square. I lapped the V-rail into the guide by moving the carriage back and forth over a sheet of sandpaper taped to the rail, a method that also works for the sliding-table guides, as shown in the photo on p. 33. Thickness the flat carriage rail so that the edges of the top and bottom members of the carriage are about parallel to the back of the saw cabinet. If the carriage rocks on the guides, plane a bit of wood off the flat rail to correct the problem.

I originally designed the arbor carriage to include the clamp bar shown in the drawings but not in the saw photographed for this article. The bar will lock the carriage firmly in place, but I never installed it. The machine works fine for sawing and drilling, but the carriage assembly vibrates when slot-mortising. The clamp would probably cure this. One other variation between the drawings and photos: I've drawn the V-shaped carriage rail on the sliding-table side of the saw rather than the other way around, as shown in the photos. Due to the motor location, the carriage's center of gravity is on the sliding-table side, and positioning the rails this way should give the carriage better balance and smoother action.

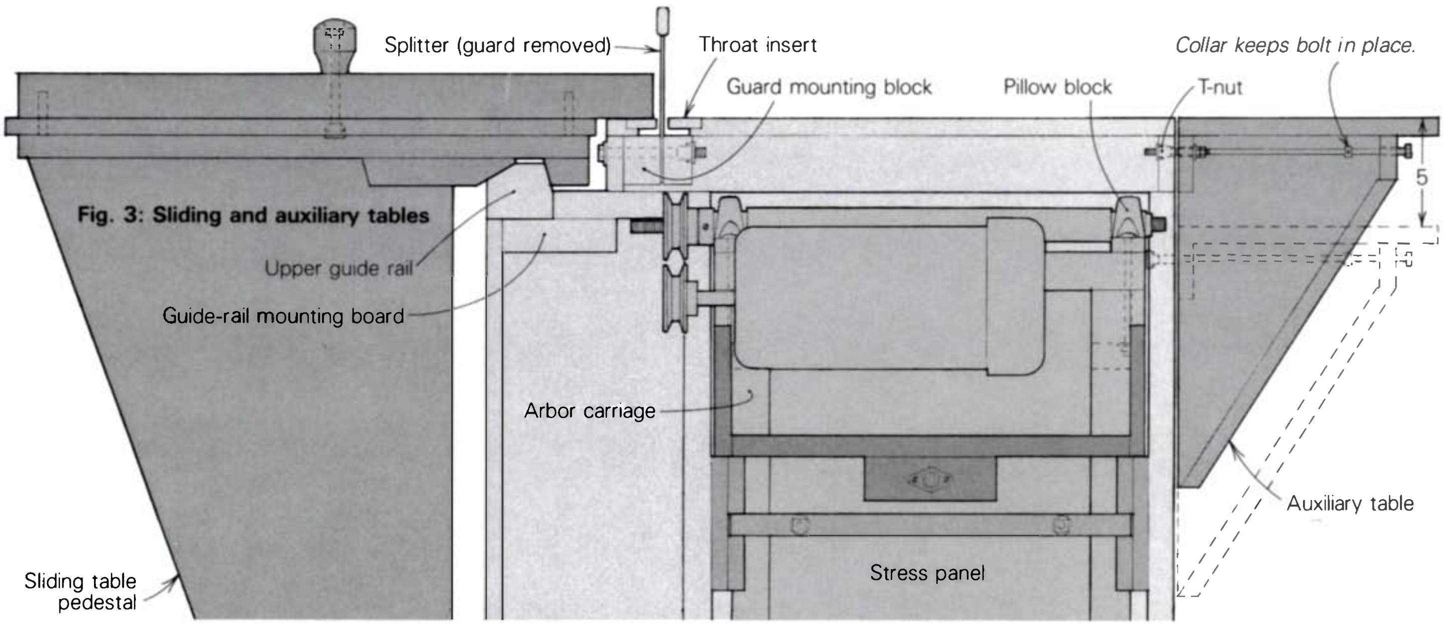
The arbor spins in two 1-in. ID, self-aligning, cast-iron pillow blocks bolted to the top of the arbor carriage, as shown in the photo at right. I turned my arbor shaft according to

Fig. 2: Arbor carriage and fence





A V-shaped guide rail and a flat thrust rail steady vertical travel of the arbor carriage. For better balance, the V- and thrust rails should be reversed, as in figure 1.



the detail in figure 2. Machine the arbor out of stress-proof steel rather than mild steel. To keep stress risers from developing at the inside corners where the shaft diameter is turned down, have the machinist leave small fillets at these points. The auxiliary end of my arbor is machined to take a screw-on chuck, but if you do much slot-mortising, I suggest that you install a collet instead.

Once the arbor shaft has been machined so that the bearings and pulley are a light press fit, these parts can be installed, and the face of the pulley remachined to serve as the blade flange. The pulley must be either cast iron or solid machined steel, not stamped steel or die-cast white metal.

When it's time to calibrate the saw, you can shift the pillow blocks in their slotted holes to align the blade parallel to the sliding table's travel. Insert sheet-metal shims under one of the pillow blocks to square the blade to the table surface.

The motor is bolted to two blocks glued and doweled to the arbor carriage. I used a 1½-HP, fully-enclosed, fan-cooled motor. Since my saw is connected to a large dust-collection system, there's plenty of air swirling around to cool the motor. If dust collection isn't used, cut some cooling slots in the side of the saw cabinet.

The sliding table—The most critical assembly is the sliding table and its guide rails. The table consists of a triangular particleboard pedestal to which the two guide arms are attached. As the photo on p. 29 shows, the sliding table simply hangs on the upper guide rail, and it can be lifted off when it's not needed. The upper rail should be laminated, sawn to the cross-sectional shape shown in figure 1, and jointed true. The upper-rail mounting board, a 1½-in. thick maple plank glued beneath the top of the sliding-table cabinet, should also be machined true so that it won't bow the rail when it's attached. I glued the upper rail to the saw with a "paper joint" like that used in bowlturning, so it can be removed for remachining or for replacement. It's also bolted, since that was the most convenient way to clamp the glueline.

The sliding table's upper guides are glued and doweled to the arms, and positioned so that the guides rest on the inclined surfaces of the rail, leaving a small clearance gap between the underside of the arm and the top surface of the rail, as shown in the drawing above. This space is important—it ensures that the guides will ride on the angled surfaces of the rail and it allows for wear. To make two identical arms and guides, I fabricated them as one assembly 6 in. wide, then ripped them in half to make two pieces 3 in. wide.

With the arms glued and screwed to the sliding-table pedestal, the assembly can be hung on the machine. The table's lower guide rides against the saw's baseboard (thrust rail), a member whose thickness must be adjusted so that the top of the sliding table will remain in the same plane as the main table throughout its travel. True up the table travel by trial and error, planing a taper on the baseboard if necessary. Lap the table guides to the rail, one at a time, using the sandpaper method described earlier and pictured on the facing page. Fit properly, the guides will push sawdust in front of them rather than packing it up into clods that will hinder smooth travel of the table.

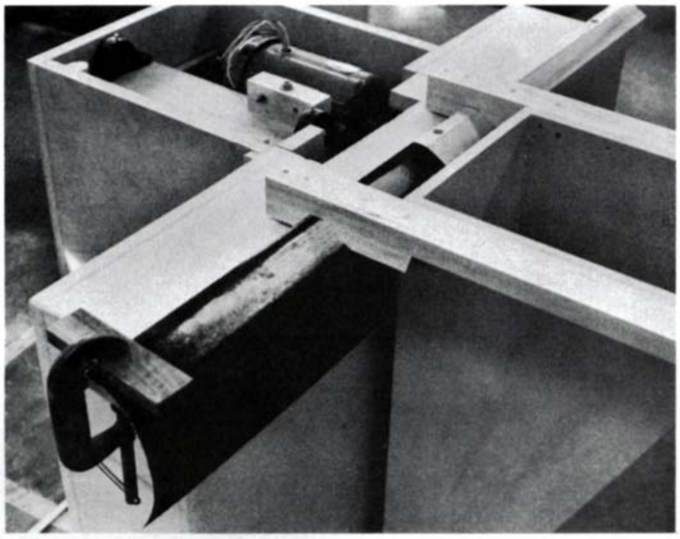
Final assembly—The saw's main table is made of ¾-in. particleboard screwed to a frame that sits atop the saw cabinet, aligned by dowels and held fast by two draw latches. With the latches popped open, the saw table can be lifted off and the arbor carriage removed for maintenance and cleaning, an operation that requires no tools. To keep the sliding and main tables in vertical alignment, I equalized the effects of seasonal movement by orienting the annual rings in the guide rail horizontally and those in the main table frame vertically.

The auxiliary table, attached to the saw with dowels and bolts threaded into T-nuts (figure 3), has only two positions: flush with the main table (where it supports extra-long or wide stock), and 5 in. below the main table (for drilling or mortising). To create a smooth, durable surface, I covered all three tables with white plastic laminate. Make sure that the tables are in proper alignment before you cover them.

I strongly recommend that this and any tablesaw be equipped with a blade guard, a splitter or riving knife, and anti-kickback pawls. My guard assembly is from an old Rockwell Unisaw. It's bolted to a block glued to the inside of the main table frame. To adjust the knife in line with the blade, I inserted thin metal shims between the guard and the mounting block.

I prefer a fence whose length ends just before the splitter. This type of fence is less likely to cause a kickback, because

G. Winchip



With sandpaper taped to the guide rail, the table guides can be lapped to a perfect fit.

once the wood has been pushed past the blade's cutting edge, it won't bind against the back of the blade. For stability and ease of fabrication, I made the fence out of three pieces of oak laminated to the 3-in. finished thickness. The fence is glued and doweled to a T-head, and it's locked in place with the wooden dog mechanism shown in the detail in figure 2. I relieved the T-head so that it bears against the fence guide rail on just two points. By planing a small amount of material from one of these contact points, I can make coarse adjustments in the fence so that it's parallel to the blade. Finer adjustments can be made by planing a slight taper on the fence guide rail.

The crosscut fence is fastened to the sliding table by dowels and a bolt threaded into a T-nut. Make some test cuts with the fence clamped in place, and once you've got a perfect 90° cut, drill for the dowels and bolt the fence down. Adjust it later by planing a taper on its front side.

With the saw built and calibrated, you can paint the particleboard with an oil-based primer, followed by a coat or two of enamel paint. I finished the solid wood parts with Watco oil and then paste-waxed the sliding parts.

Aside from the lower cost (about $300 for this saw), I've found that the greatest advantage to building my own machines has been scaling their features to meet my needs. On this saw, for example, the tables could be made larger, or the crosscut capacity made greater, by lengthening the guide rails and supporting pedestal. My machine accommodates a 10-in. blade, but the design could be modified to accept a 12-in. blade and perhaps a 3-HP motor.

The machine described here has been in use now for 2½ years at the Iowa State University woodworking shop, a high-abuse place if there ever was one. So far, it has required only routine cleaning and lubrication, plus an occasional tightening of the arbor mounting bolts. In our shop we have two other saws, a 10-in. Rockwell Unisaw and a 14-in., 5-HP Oliver. Often these two machines sit idle while students wait in line to use the wooden saw. They tell me that its smoothness of operation, its adaptability to jig-work and its amiable disposition make it a more pleasant tool to use. □

Galen Winchip teaches woodworking and computer-aided manufacturing at Iowa State University at Ames.

Testing the wooden saw

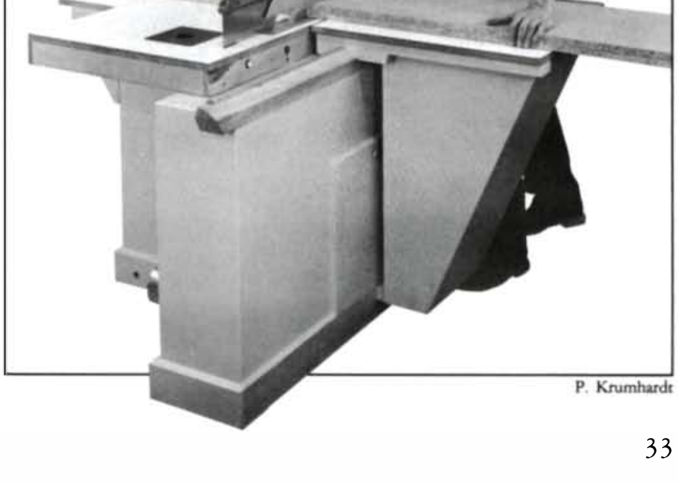
When I flew out to Iowa this spring to try Winchip's wooden tablesaw, I had in mind comparing it to the sliding-table-equipped Rockwell Unisaw I've owned for three years. Having heard student raves about the wooden saw, I wasn't surprised to find it nicer on a couple of counts.

I did some ripping first, immediately discovering that the fence on Winchip's saw works better than the Unisaw's does. It's easier to position and clamp without the opposite end hopping out of alignment, as a lot of factory metal fences always seem to do, even on relatively expensive saws.

Apart from their size and construction material, I discovered the major difference between these two saws when I tried some crosscuts. With a couple of 8-ft. long, 15-in. wide panels on the sliding table, it took some muscle to make the cut—about the same effort you'd exert opening a heavy door. By contrast, the Unisaw table will slide one-handed. Although it's stiffer, the wooden table has no play and seemed more predictable than its steel counterpart, passing over the guide rail with an even swish instead of the clatter of steel on steel. A half-dozen crosscuts I checked were about 0.003 in. out of square across a 15-in. wide board. That's okay by my standards; slicing it finer calls for hunting down the renegade mils with a hand plane, a task that I suspect is no less frustrating than tickling the many adjusters on a steel table. I think Winchip is right about the guides' self-adjusting aspect, so the wooden saw should need less attention than a steel one.

The arbor carriage works as effortlessly as any I've used. Not having it tilt is a shortcoming I can live with, if only because it costs a thousand bucks less. The guard on this saw is a gem. It pivots handily out of the way for fence-setting, and it can be removed and, most importantly, reinstalled in seconds. I didn't much like the horizontal boring/mortising feature, though. For boring, 4500 RPM is too fast, and without a fence to guide it, impaling a chunk of wood on the bit is scary. Adding the clamp bar and a larger auxiliary table to accommodate fences and clamp jigs would help, especially for slot-mortising. I'd make two other changes: the sliding-table guide rail needs to be 2 in. longer, so that a full 24-in. wide panel can be crosscut, and a 3-HP motor would provide the extra power the saw needs to rip thick stock quickly, something it can't do with the smaller motor. *—Paul Bertorelli*

Winchip crosscuts two 15-in. wide panels on his wooden tablesaw.



P. Krumhardt