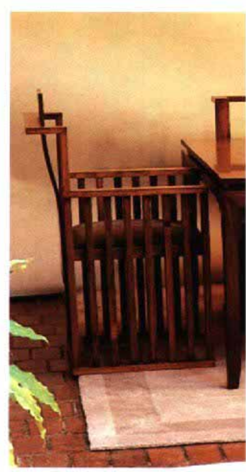
# Extension Tables

## *Their design and construction*

by Jeremiah de Rham


*Extension tables allow many design options. Three-beam slides, as shown in the drawing above, can be fitted with a fifth leg to prevent sag. The author's long two-beam slides, visible in the photo below, have been tenoned into the table's aprons, thereby transferring load from the screws in the tabletop to the aprons and legs. Leaves can be aligned with dowels (see photo) or stub tenons (see drawing). Author de Rham's table and chairs are shown below, right.*



Large tables are wonderful for crowds of ravenous, feasting relatives. But as soon as they go home, you're stuck with a conference table for twenty—and who wants to live with that every day? Besides, where do you put such a big table? Expanding tables are the answer to filling the room and feeding the folks three times a year; adding and subtracting table leaves can transform the table into any required size. The backbone of such a useful table is a pair of table-extension slides.

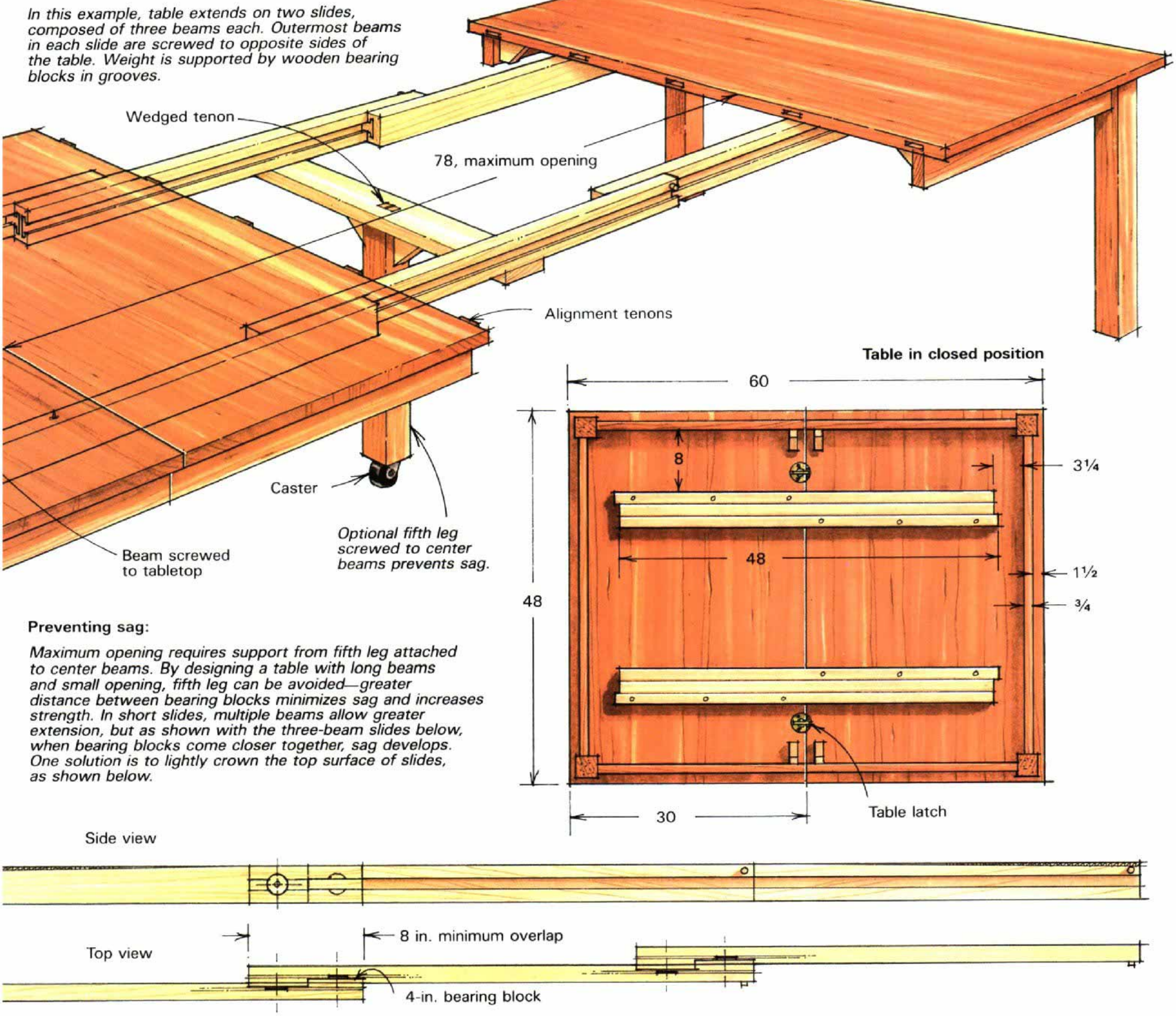
Figure 1 shows the basic way any slide system operates. A single slide consists of two or more beams, sandwiched together so they can slide past each other, and held face-to-face by a coupling system. My coupling system—wooden bearing blocks screwed to the beams—works as a load-bearing mechanism that supports the weight of the table. A slide needs a small amount of play in the coupling system to work smoothly, but this play also creates some sag when the table is extended. The more beams per slide, the more pronounced the sag—especially when the table is in its fully open position. On a smaller table with just two beams per slide, sag is negligible, but a larger table with many beams can sag noticeably. There are three main ways to counteract sag and keep a big table flat: increase beam overlap, crown the slides or add a fifth leg. The table's design determines which approach to take.

Many four-legged tables are large by design—6 ft. to 8 ft. long when closed—and may not require many additional leaves. This was the case with one table I built. Closed, it measured 7 ft. 6 in. in length. The client required only two leaves, each 10 in. wide. With the table long to begin with and requiring a minimal number of leaves, the slide design was of the simplest variety: two beams per slide stretching the length of the table.

The length of the beams determines how far the table opens. Slides with two 7-ft. beams open a table 6 ft. 4 in.—allowing for an 8-in; beam overlap at the center, which I consider to be the least you can get away with. Shorter beams of 3 ft., centered under the table's midpoint, will open a table 2 ft. 4 in. (again, with an 8-in. beam overlap). Thus, either approach—7-ft. slides or 3-ft. slides-would have opened my client's 7-ft. 6-in. table wide enough to accept the two 10-in. leaves. But longer slides are superior in three -ways: they effectively eliminate sag; they can be tenoned into the aprons for added strength; and they allow more leaves to be added in the future, if desired.

The farther apart the bearing blocks, the less possibility for sag. So a long table with beams from apron to apron that opens less than the full possible amount will not sag noticeably—the bearing blocks will remain 2 ft. to 3 ft. apart. When the two 10-in. leaves are in place on the table I built, the bearing blocks remain

Fig. 1: Extension table principles




4 ft. apart. This amount of overlap makes the slides considerably straighter and stronger than if the blocks were close together. The other distinct advantage of full-length slides is that the whole table is strengthened by tenoning the secured end of each beam into the apron with a small stub tenon (figure 6). This transfers to the aprons and legs much of the weight stress otherwise carried entirely by the screws going into the tabletop.

Now suppose you want to build a four-legged table that is small to start with, say 3 ft. to 4 ft. in length, but must open up to at least 12 ft. long. With this design, you need multiple beams per slide-even with the slide beams going from apron to apron. And sag may still become a problem. Opening a 4-ft. table to 12 ft. requires four beams per slide, each 45 in. in length (this is the maximum length you can fit, assuming a ¾-in.-thick apron and ¾-in. top overhang). Allowing for beam overlap, the fully extended table will be 13 ft. 3 in. long. Adding another beam to each slide will push a little four-

Drawings: Joel Katzowitz; photos (except where noted): Lance Patterson

**Fig. 2: Pedestal table**

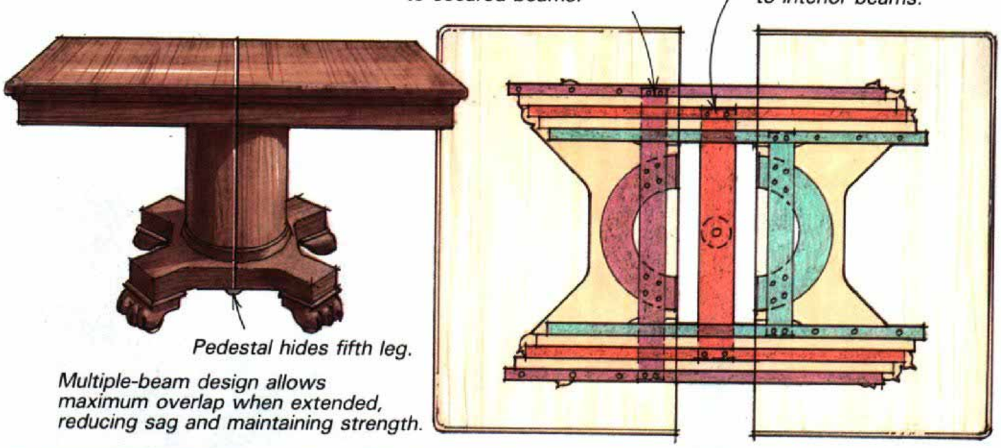
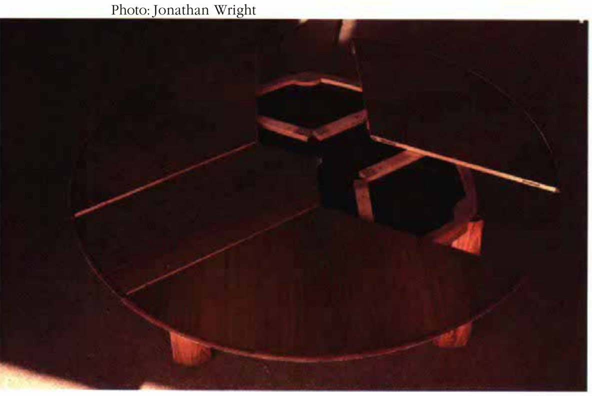



Photo: Jonathan Wright



***Jonathan Wright of Cambridge, Mass., built the ingenious three-way slider with radiating leaves shown at left. The table closes to form a three-lobed circle. John Michael Pierson of La Mesa, Calif., made an extension table (photos right) that slides on heavy-duty drawer glides (Grant #3320) concealed by the table's hollow, bent-laminated apron. Each slide assembly consists of two drawer glides screwed together, face-to-face, to allow extra extension length. When the table is extended, the glides are covered by U-shaped apron sections fastened to the underside of the wood-framed glass leaves.***

footer into the big leagues at 16 ft. 4 in. Typical of any table with many beams per slide that opens a great distance, this table is ripe for sag. It's simply difficult with this design to keep the bearing blocks spread apart from each other without adding a ridiculous number of beams to each slide. If you want to avoid a fifth leg, consider crowning the slides (figure 1). This isn't difficult, just time-consuming. To tell how much the slides dip in the middle, extend the slides and stretch a string from one end of the table to the other. Theoretically, you need to plane the top of the slides so, when fully extended, the sag becomes a straight line. This often means planing up to $\frac{3}{16}$ in. from the ends of the beams screwed to the tabletop (planing nothing from the midpoint of the opened slides). But planing this much crown tends to crown the table itself when closed, so the idea is to strike a happy medium—planing enough crown into the slides to visually reduce the sag, but not so much that the table appears obviously hunched when closed.

Design considerations for pedestal extension tables aren't all that different. The minimal-leaf-addition/long-beam solution often works here as well. But many pedestal tables don't have aprons, and this complicates matters. Without a table apron, the slides have to be placed a little closer to the center and kept on the short side so they're not easily seen. Pedestal tables that open a great deal will almost certainly need a fifth leg, usually a turned leg hidden within the pedestal when the table is closed (see figure 2). A couple of other approaches are shown in the photos above. In one case, the three-legged "pedestal" is large enough to support the table, regardless of whether the top is in the open or the closed position. The other design uses heavy-duty drawer extensions concealed in the table's aprons as slides.

If you use a fifth leg (often two tapered legs about 18 inches apart, joined by a stretcher and riding on casters), attach it to a board screwed to the bottom of the two center beams at their midpoint (see figure 1). As the table opens, the fifth leg tends to remain centered, holding the middle beams still while the inside and outside beams travel freely. This is the surest way to prevent sag. With all the chairs in place, a fifth leg isn't that noticeable, so don't be too reluctant to use one.

Keeping all this in mind, it's easy enough to figure out the general design on paper. To find the maximum opening for leaves, draw the beams as if they were fully extended. Add the length of each beam to that of the previous one, subtracting the 8-in. minimum overlap. Then, subtract the amount of beam attached underneath the tabletop. The remainder is the available space for leaves. Those readers who are squeamish about trusting their measurements as drawn could use thin strips of scrapwood—cut to the length of the proposed beams—as models of how the various amounts of extension will add up. This provides hands-on proof that what you draw will actually work as intended.

In my search for the ultimate table slide to incorporate in a recent commission, I came across a number of designs. I settled on the one that promised versatility, strength, ease of operation and—just as important—ease of manufacture.

Factory-made table slides are available in both wood and metal, but I quickly decided against these after shopping around. The wooden slides I found were skimpy and wobbly, didn't track smoothly and were available only available in certain lengths. The metal slides worked well but, again, their prescribed length limited their use. And while metal is immune to moisture movement, I felt reluctant to incorporate metal slides into a beautiful walnut table. A custom-built dining table deserves custom-built slides.

All of the older tables I've seen utilize one of several wooden

# Dovetail extension slides

by Monroe Robinson

I like the idea of all-wood, dovetail slides. The round table shown below has three sets of them. The center slide set is longer than the others, and provides that much more stability. Starting with a 3-in.-thick plank of hard maple, it takes me two or three days to complete a set.

First, rip the stock oversize. How much oversize depends on how much the stock moves and warps as it comes off the plank—3/16 in. is usually enough. I cut the parts about 3 in. over-long, then stack the pieces (with spacers) and allow them to stabilize for several days.

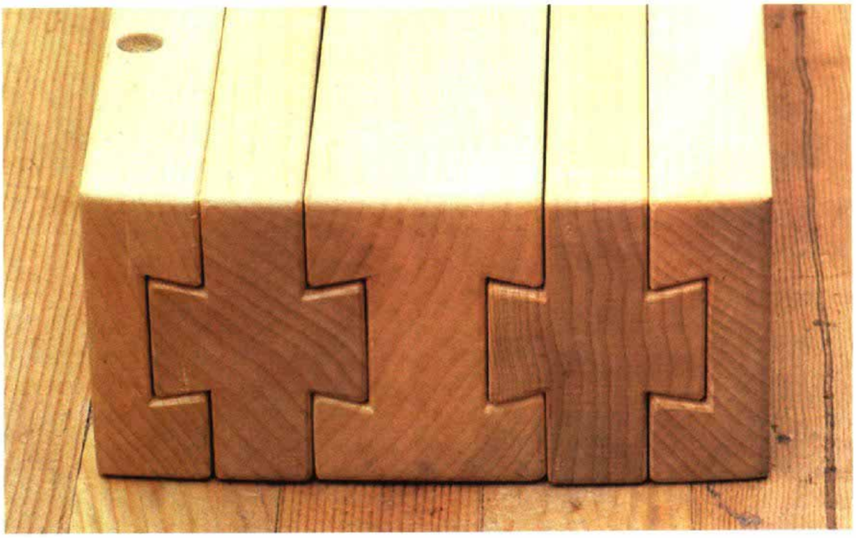
Next, I carefully joint and thickness the pieces. I always cut several spares—to allow for those that warp in spite of everything. I also cut several short pieces for test cuts.

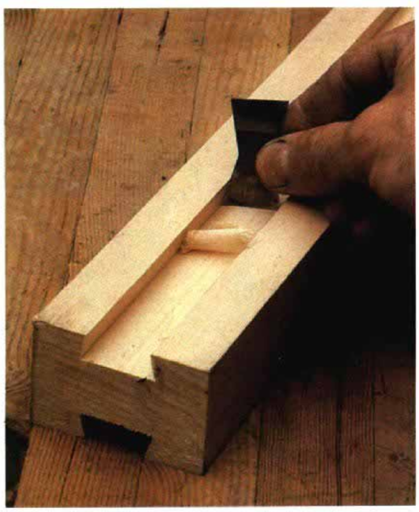
I remove most of the waste on the tablesaw, flipping the stock so that both the top and bottom edges of the beams are reference surfaces against the fence. This ensures that the dovetails and their grooves are centered. The cuts are then brought to size on a router table in the same way, again centering the cuts. I aim for a tight fit, then work to the final fit using a pair of shopmade dovetail planes. I finish with a scraper, as shown in the photo at right. When final-fitting, number the slides so they will pair up again when fitted to the table.

The slide stop shown in the photo at the far right is made from 3/8-in.-dia. brass tubing plugged with a short length of dowel. Epoxy holds the dowel in place, and also anchors the end of the 3/4-in.-long spring. The stops engage the ends of tapered slots, which are made with a router, a 1/2-in. straight bit and an angled template.

Before attaching the slides, plane down all the top surfaces that won't be screwed to the tabletop; this reduces friction. Wax is the final finish on all surfaces. □

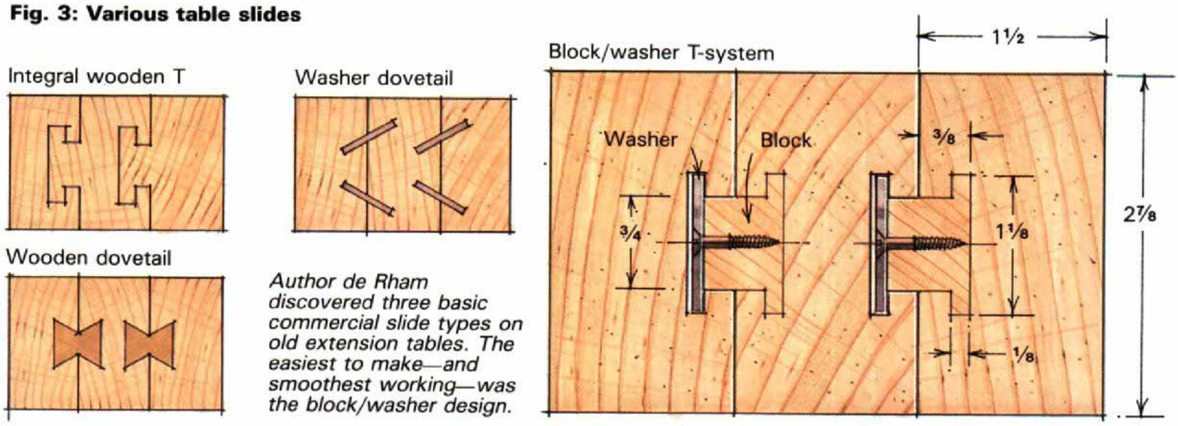
*Monroe Robinson is a professional woodworker in Ft. Bragg, Calif., and an Anderson Ranch Art Center instructor.*





*Robinson's 58-in.-diameter table extends to a full 13 ft. 3 in., as shown below. Full-length dovetail slides require a stable wood, such as maple, and careful hand-fitting with the shopmade scraper shown in the photo, above left. The slide stops (right photo, above) engage a tapered slot about 1/4 in. deep and 5 in. long.*

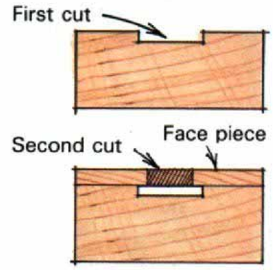
**Fig. 3: Various table slides**




*Author de Rham discovered three basic commercial slide types on old extension tables. The easiest to make—and smoothest working—was the block/washer design.*

**Fig. 4: Alternative method**

*Instead of routing, you can dado wide groove, then glue face piece and dado again.*




slide designs (figure 3)—any of which is far more substantial than anything available commercially today. Of these, the quickest to build is what I call the block/washer system. Others include the integral wooden T, the washer dovetail and the wooden-dovetail coupling system, although I've never seen the latter on an old table. These designs all had disadvantages that I wanted to avoid. I considered using the integral wooden-T system—it appeared to be the Rolls Royce of wood slides—but it requires more stock, takes longer to build and is harder to adjust if it binds. And since wooden Ts are more easily affected by expansion and shrinkage problems, they're often greased heavily to ensure smooth operation. So on to the infinitely simple block/washer table slide.

**Making slides**—For the commissioned walnut table, I built two 7-ft.-long beam slides to open the table 6 ft. 4 in. But to better understand how three-beam slides open a smaller table, I'll explain how to build a pair of slides that would extend a 5-ft. table an additional 6 ft.

Selecting a straight-grained hardwood that's dry and stable is important. Maple, ash or oak all perform well. For this particular pair of slides, we'll need six beams (three per slide), measuring 4½ ft. long, 2⅞ in. wide and 1½ in. thick. Rough-mill the stock first to relieve any stress in the wood, and let it sit in your shop a couple of days. That way, it's more likely to remain straight and true when you mill it to the final dimension.

Cutting grooves for the bearing blocks is next. Each slide consists of an outside beam, a middle beam and an inside beam. The middle beam needs a groove on both faces, while the inside and outside beams are grooved only on the face that tracks against the middle beam. With dado blades on the tablesaw, cut a groove centered along the length of the beam, ¾ in. wide and ⅜ in. deep. Reference the cut from the same surface of the beams—either top or bottom—so when the slides are together, the tops of the beams will be flush with each other.

Once the grooves are cut, you must rout slots at their bases, perpendicular to the edges. The washers that hold the beams together ride along in these slots. To accommodate the washers, the slots need to be ⅛ in. wide and ⅛ in. deep. Routing out this T-shape is a simple operation, but don't waste your time looking for an off-the-shelf bit to do it. I couldn't find one. A keyhole bit is a possible solution, but it won't cut the slots quite wide enough without widening the groove, and it'll cut too deep a slot without some alteration. Instead, I chose to alter a ⅞-in. steel rabbeting bit (shown in the top left photo, facing page) to cut the exact shape I wanted. This entailed carefully scribing the unwanted areas on the faces of the bit and then grinding them away—also grinding away the bit's integral pilot in the process. (A detailed explanation of how to modify router bits can be found in *FWW* #50.)

Use a router table or a router with a fence attachment. The bit will cut a full-depth washer slot on one side of the groove while, at the same time, cutting slightly into the other side of the groove. You need two fence setups to complete one T-slot. Clamp a beam to your bench and start routing. When the clamp's in the way, stop the router, leave it in place and move the clamp to the other end of the beam. Hold the router firmly, turn it on and finish the cut. Repeat this process on all beams, then change the fence setting for the opposite side of the slot. After routing is completed, the beams are ready for the wood blocks and tracking washers.

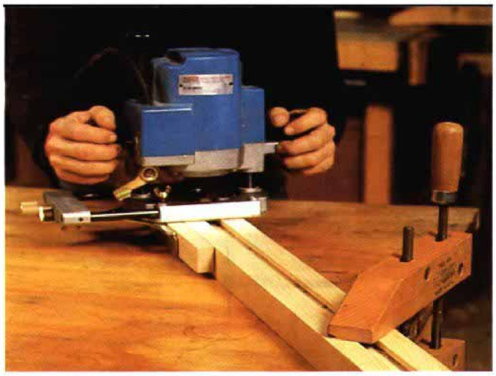
The 4-in.-long blocks serve two purposes. Primarily, they bear the weight of the table while guiding each beam along the groove of the adjoining beam. But they also serve as stop blocks to keep the beams from coming apart when fully extended (see drawing below). Place the blocks at opposite ends of adjoining beams, one block to a groove. These blocks can be T-shaped to fit the groove and slots, or they can be rectangular in cross section—the easier of the two designs to make. A tight fit holds the T-shaped blocks in place, but you'll need screws to hold the rectangular blocks.

Now, screw a 1-in.-dia. fender washer in the exact center of the bearing blocks with a flathead wood screw. (These washers don't bear any weight—they merely slide along in the T-slots, holding the beam together.) The screw's shank should be a little smaller than the washer's hole so there's a bit of slop, allowing the washer to glide along easily in the beam slots. The three beams can now be slid together. As you slide them back and forth, you may

**Fig. 5: Block/washer T-system**

*Block rides in groove, bearing weight of tabletop. Blocks also act as stops to prevent opening the slides too far.*

*Chamfer ends that might bump tabletop when slid.*

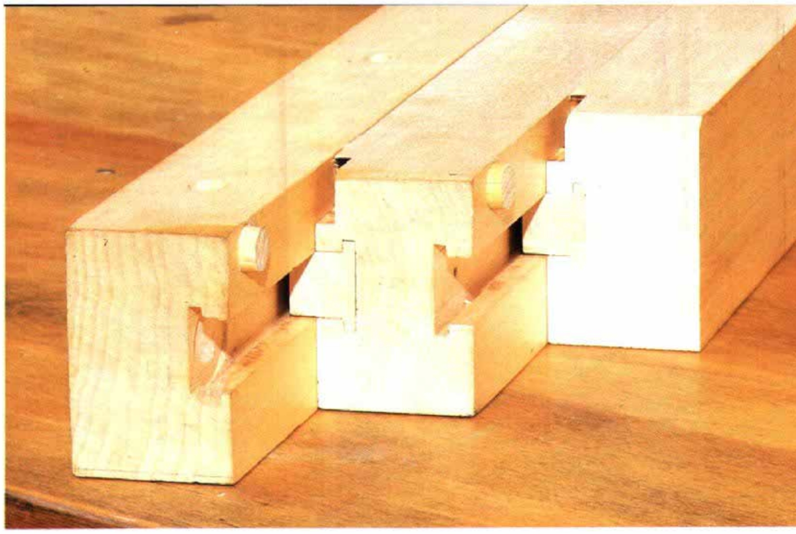


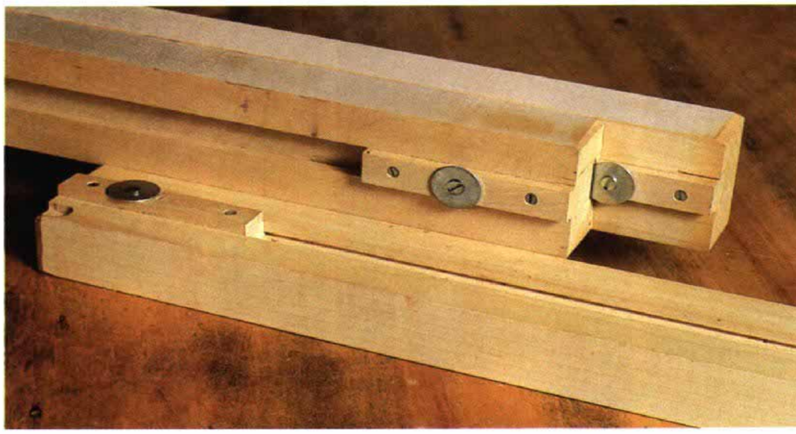
*Author de Rham demonstrates how to rout T-slots for slides. He modified a standard rabbeting bit (above, left) to enlarge the dado into a T-slot, one side at a time. The router's fence rides the side of the beam. When it reaches the clamp, de Rham turns the router off, relocates the clamp at the other side of the router and proceeds. An alternative method for machining the T-slot with glued-up stock is shown in figure 4, facing page.*

notice some binding. One or two adjustments will cure these sticks. First, check to see if the washers are screwed down too tightly, clamping the beams so close that the surfaces don't want to run past each other. Loosen the screws just enough to allow the washers to run like wheels. This adjustment will also help beams that are slightly bowed. Again, slide the beams back and forth. If they still stick, one of the wood blocks probably fits too snugly in the track. To remedy this stickiness, pull the beams apart, remove the washers and take a couple of shavings from the blocks with a rabbet plane. I find that a 1/64-in. to 1/32-in. clearance is optimum. More than this creates too much play and sag. Smooth-planing the beams' faces and liberally applying paraffin wax will really let the slides fly.

Once the sliding action is properly tuned, put the beams together and install closure stops like those shown above right and below. Without closure stops, the beams are likely to fall apart when the table is being closed, the blocked end of one beam slipping out of the open end of another. A simple stop is a ½-in. dowel fitted into a hole drilled ½ in. in from the open end of the outside and middle beams (see photo, top right). Drill a hole ½ n. deep and tap in a ⅝-in.-long dowel. Don't apply glue—the dowels must remain removable (with pliers) to get the beams apart. In order to stop the beams in line with each other, rout a shallow, short groove into the adjoining beam for the stop to slide into.

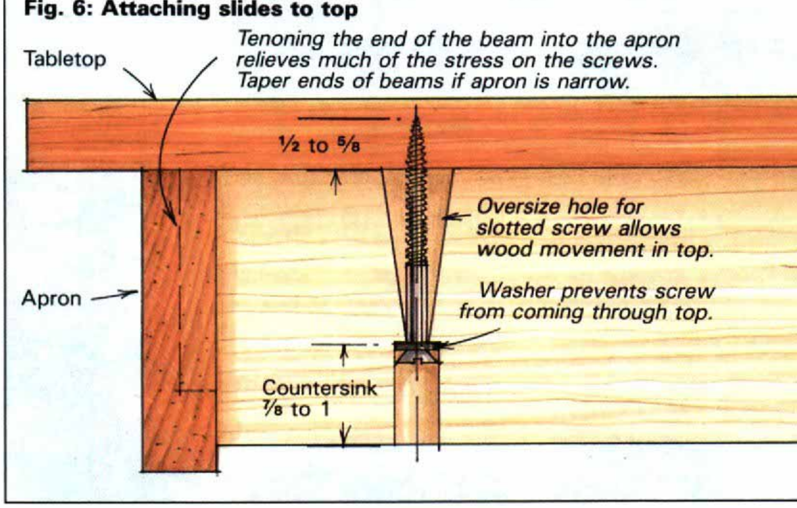
Now, attach the pair of slides to the table's underside. At each open, unblocked end of the inside and outside beams, drill three holes 6 in. apart, centered on the top edges, starting about two inches in from the end. Plan to use either #10 or #12 screws. Drill oversized holes, as shown in figure 6, right, and ream them further with a round rasp—to allow the screws to pivot back and forth along the length of the beam, ensuring free cross-grain movement for the tabletop. These screws are, in effect, holding the table up, so set the screws ½ to ⅝ in. into a ¾-in.-thick tabletop. For a 2½-in. screw, countersink ⅞ in. to 1 in. on the underside of the slides. To avoid dimpling the tabletop—or even cracking it—by bottoming out the screws too close to the surface, place a washer into the countersunk hole. That way, you can't tighten

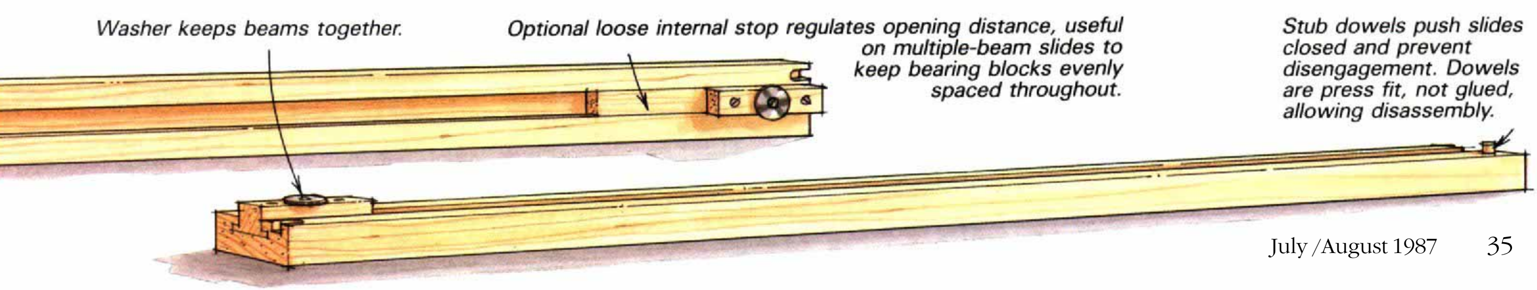


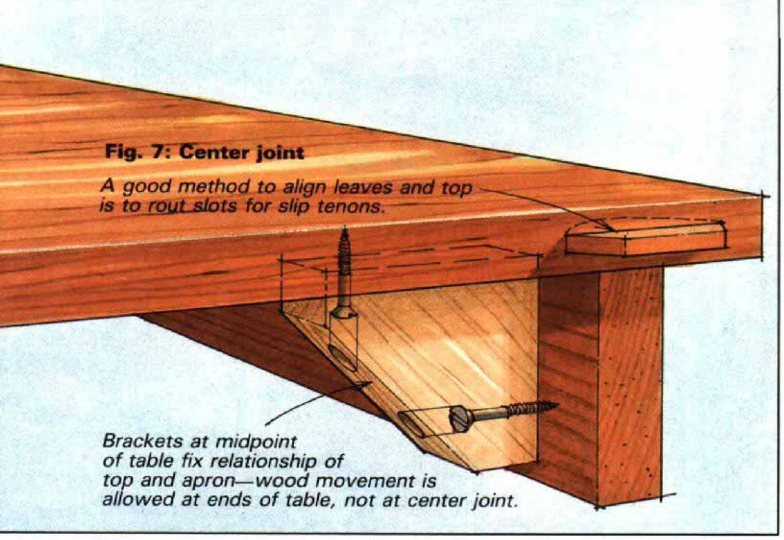


*The two photos above and the drawing at the bottom of the page show the geometry of a three-beam slide—the end blocks bear the weight, while the washers merely keep the beams together. As the slides extend, the center beam remains more or less in place, while the outer beams—attached to the tabletop—slide to the left and right. At the ends of the slides, press-fit dowels act as stops to prevent the beams from disengaging (top photo).*

**Fig. 6: Attaching slides to top**



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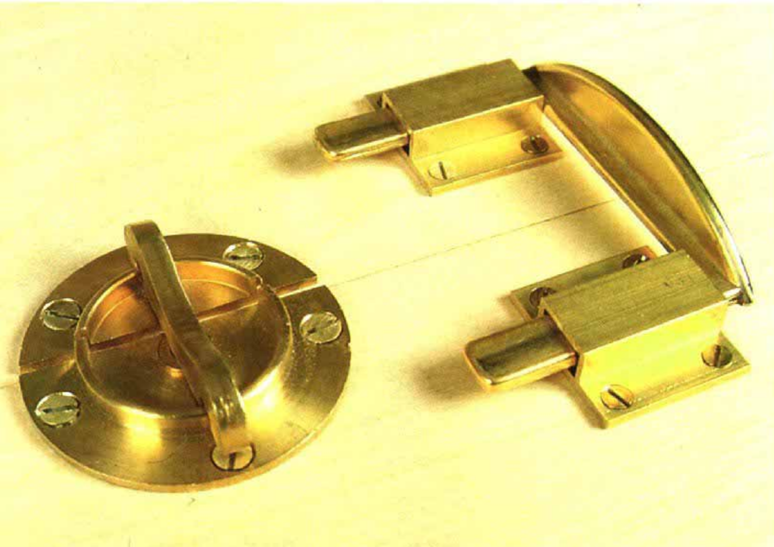

*To hold an expansive table closed, round clasps, left, may be fastened to the apron or under the top. U-shaped clasps, right, are used in pairs on tables without aprons. Both clasps, Garrett Wade.*

the screw heads farther into the top than planned. Use a drill press to countersink so depths are constant. And, by all means, measure carefully.

To attach the slides, place the table upside down in the closed position. Lay the closed slides down, with the midpoint of the slides at the tabletop break, pulling them open about an inch so the closure stops don't prevent the table from closing tight. Depending on the width of the table, place the slides so the outside beams are 8 in. to 12 in. in from the aprons. If there are no aprons, you may want to place the beams farther in—to ensure they'll be out of view. Mark the screw holes, remove the slides and drill for the screws. Use a wood stop block on the drill bit so you won't drill through the top. Replace the slides and screw them down, then turn the table over and push and pull until you tire of enjoying your mechanical wizardry,

Figure 7 shows how to handle the center joint of a table with an apron. At the center joint, secure the tops to the aprons with a fixed bracket; secure the rest of the top with some method that will allow the ends of the top to move (see "Fastening Tabletops," *FWW* #62). Closed, the aprons will always touch and not be held apart by a swollen top. Use table clasps (see photo, left) under the top to hold the center joint tight when the leaves are stored.

Leaf boards are usually left apronless—they're easier to store that way—but adding aprons to leaves is a nice design option. A mortised slot (made with a router and three-wing cutter) with slip tenons (figure 7) is an excellent way to join leaves. This method is very accurate to mark and easy to fit. Build a nice box to store your leaves in so they're not damaged. I've seen large hall chests that store leaves, with slots carefully lined with felt to protect the leaves as they're slid in and out. Now, invite everyone over, open up the table and enjoy. *Bon appétit!* □

*Jerry de Rham is a member of Fort Point Cabinetmakers in Boston, Mass. The commissioned table and chairs shown were designed by David Handlin, an architect in Cambridge, Mass.*

## *Another variation*

by Curtis Erpelding

I built the slides for this table according to plans in Ernest Joyce's *Encyclopedia of Furniture Making* (Sterling, 1979). There are three rectangular nesting frames made of maple, each sized both horizontally and vertically to fit within the next. The slides are grooved their full length. The "bearing blocks" are full-length strips of wood glued into one of each pair of matching grooves. The frames don't need a washer system to keep them interlocked—that function is served by the short sides of each frame.

A hard-won hint to the wise: the table's diameter-when closed—48 in.—turned out to be just a little too tight for comfortable dining. □

*Curtis Erpelding lives in Seattle.*

*This Honduras mahogany table was chemically stained with hydrated lime.*