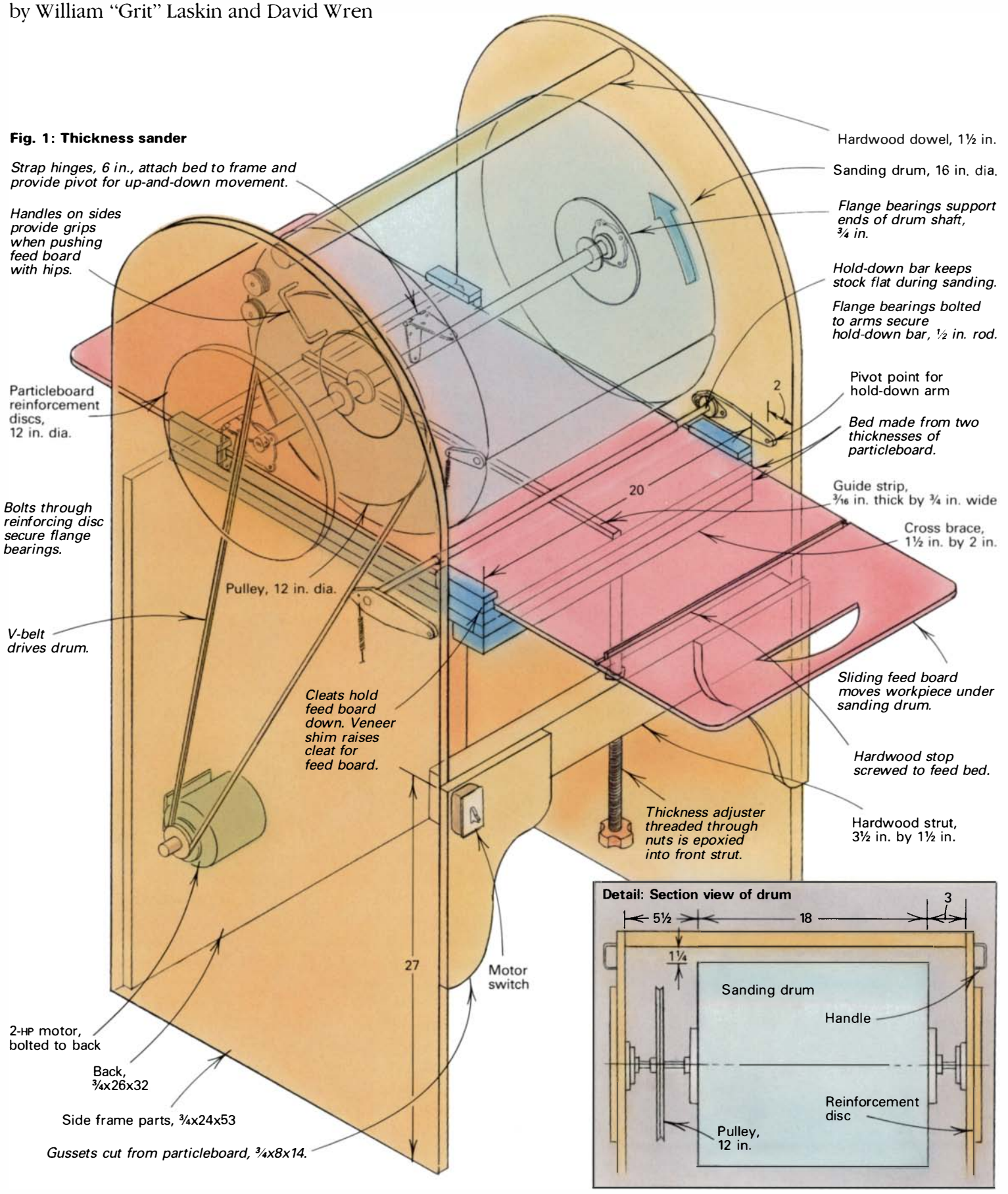
Building a Thickness Sander

A large drum turns an abrasive machine into a smooth operator

by William "Grit" Laskin and David Wren

Fig. 1: Thickness sander



Drawings: Aaron Azevedo

Like most other woodworkers, guitarmakers routinely need to plane and smooth wide, flat pieces of wood for instrument parts. Unfortunately, the job is usually too delicate for most stationary thickness planers. As guitarmakers, we often have to plane the sides, back and top of a guitar to 1/10 in. or less, and most planers don't surface stock much thinner than 1/8 in. Further, many of the wood varieties typically used by guitarmakers, such as rosewood, curly maple or koa, are susceptible to splintering and tearout from the cutting action of a thickness planer. The alternatives are scraping, handplaning and hand-sanding the wood or running the stock through a thickness sander, if you have one at your disposal.

Thickness sanders come in several different styles. The Cadillacs of the breed are the wide-belt sanders: expensive machines that sport power feeds, accurate thickness adjustments and oscillating sanding drums. The lower-cost alternatives are drum sanders that have a small-diameter drum, wind-on sandpaper and manual feed. The problem with these is that resinous woods, like rosewood, easily clog the small surface area of the sandpaper. We considered building one from mail-order plans, but those we saw were so poorly conceived, we decided that we could design and build a better machine ourselves. The machine we came up with, shown at right, fulfilled our basic tenets: it was quick and inexpensive to build and it operates to close tolerances. Building the machine requires mostly woodworking tools and skills and very little metalworking. It will be a welcome addition to any woodworker's shop.

A large-drum thickness sander can provide even a small shop with the capacity to abrasive-plane and smooth wide stock. This sander, designed and built by Grit Laskin and David Wren, is economical to make: the drum and most parts were cut from 3/4-in.-thick particleboard.

Anatomy—Our sander incorporates elements of both wide-belt and small-diameter drum-style machines. The large-diameter sanding drum provides a lot of surface area, similar to a wide-belt sander, which extends sandpaper life. But because the single sheet of paper is wrapped around the drum, there's no need for an elaborate belt-tracking mechanism, as found on the wide-belt machines.

The large-diameter drum is made from separate discs that are cut and routed to shape and then glued together. A special grip mechanism, which will be described later, secures and tightens the sandpaper around the drum. To change sanding thickness, the sander's bed moves relative to the drum, not the other way around. The bed is hinged at the back end and rests on a threaded rod at the front, allowing adjustment. The workpiece is supported and guided by a feed board that slides along the bed. The feed board is moved manually, eliminating the need for a separate power-feed drive mechanism—keeping complex construction to a minimum.

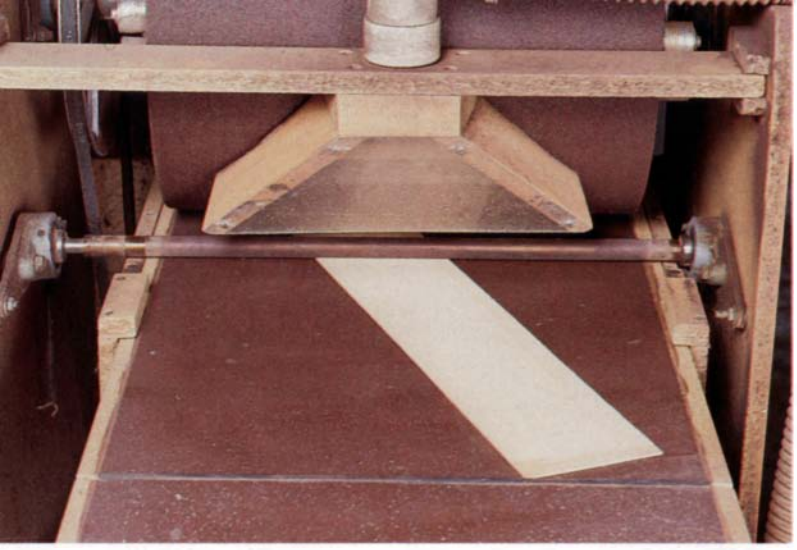
To keep costs down, most sander parts are 3/4-in.-thick particleboard. Other supplies needed for building the machine include flange bearings, a few pulleys and a 2-HP motor, all available from W.W. Grainger Inc., 5959 W. Howard St., Niles, Ill. 60648; (312) 647-8900. You'll also need strap hinges, springs and a few other supplies, which should be available from your local hardware or building-supply store.

Building the frame—The body or frame of our thickness sander is made up of nine pieces: two side panels; one back panel; a front strut and two reinforcing gussets; a dowel strut at the top edge; and two circular side reinforcements. All the pieces were cut to the dimensions given in figure 1; straight edges were cut on the tablesaw and curves on the bandsaw. The pieces were then assembled with glue and screws run into predrilled holes. The most sensible order for assembly is to first attach the reinforcing circles to the side panels, and then attach the back panel to the sides. Next take the front cross strut and mark the location for the threaded rod that will raise and lower the table. Drill a hole larger than the rod through the strut, and use a 1/2-in. chisel to mortise a space to inset nuts for the rod on both the top and bottom of the strut. Glue the nuts in place with five-minute epoxy while threading the rod through them, to make sure the threads align. When the epoxy has set, remove the rod, and glue and screw the strut to the frame, as well as the gussets to the sides and the strut. Also, glue and screw in the large dowel that reinforces the sides above the drum. Finally, attach a handle to the threaded rod. A simple block of wood is fine; you just want something that will enable you to turn the rod in small, incremental movements.

Bed and feed board—To ensure that the bed would be sturdy enough to resist the pressure of the drum without deflection, we made it from two pieces of particleboard glued and screwed together. Further reinforcement is provided by a thick hardwood cross brace that spans the infeed side of the bed and provides a bearing point for the adjustment rod. The photo above shows an additional curved piece of mahogany beneath the bed. Ignore this; it was an experiment on the first sander we built. You should locate the strut as shown in figure 1.

A feed board that directly supports and guides the workpiece during sanding rides atop the bed. The feed board is a piece of 3/4-in.-thick particleboard that's a little less than 1 1/2 in. narrower than the bed and long enough to support the workpiece, as well as engage the hold-down cleats after the workpiece is through the drum. For our sanding needs, a 53-in.-long feed board is long enough to support guitar side strips, which are normally 32 in. to 34 in. long.

To guide its travel along the bed, a 1/4-in.-deep by 3/4-in.-wide groove is dadoed along the center of the feed board's bottom. The groove accepts a 3/16-in.-thick guide strip that's screwed to the bed. Two cleats at both ends of the feed board capture it and keep it flat on an extended bed. To ensure smooth feed-board movement, a



To ensure that the sandpaper wears evenly, narrow workpieces are run through the sander on an angle. The spring-tensioned hold-down bar, just in front of the drum, puts downward pressure on the stock, to help keep it flat during sanding.

thin veneer shim between the cleats and the bed provides a bit of clearance. To keep the workpiece from slipping backward during sanding, a 3/16-in. hardwood stop (we used ebony) is inset into a 1/8-in.-deep groove in the feed board (see figure 1 on p. 80). The sandpaper sheet that you'll glue to the bed later, for drum truing, also helps keep the work in place during sanding. Finally, a semicircular slot cut into the feed board provides a hand grip for hauling it back after each pass.

Install the bed to the frame with two 6-in. strap hinges, bolted through the back of the sander. While marking the hinge holes, keep the bed square to the frame and as level as possible. The cross brace at the bed's infeed end should rest on the adjustment rod. Thread the rod in place, and where it contacts the brace, screw on a small square of Plexiglas or metal to reduce wear.

Making the drum—For convenience and economy, the sanding drum is also made from particleboard. To keep the drum from being physically unwieldy, yet still big enough to yield a large sanding surface, we chose a diameter of 16 in. This translates to a more than 4-ft. circumference, which provides an ample sanding surface. Because we needed to be able to sand a large guitar back or top, which can be more than 16 in. wide, we made the drum 18 in. wide.

The cylindrical drum is made by stacking 24, 3/4-in. particleboard discs, which are individually rough cut, template routed, and glued and screwed together (see figure 2 on the facing page). Later, the sandpaper clamp is added, and the drum is balanced and trued to the bed. But the first task in making the drum is to bandsaw each disc (a sabersaw is also good for this job), making each one slightly larger than its final diameter. Each disc is then trimmed to shape, including the sandpaper slot, using a piloted straight bit in a router and a 1/4-in.-thick Masonite template temporarily screwed to the disc to guide the cut.

To reduce the weight of the drum, we hollowed out most of the discs by sabersawing away all but a 2-in.-wide border around the perimeter of the disc and around the sandpaper-grip slot. Don't worry about making perfect cuts; the drum will be balanced later. The two outer discs and one in the center are left solid and are concentrically drilled to fit the drum's 3/4-in.-dia. steel shaft. The drum attaches to the shaft via a pair of 6-in. pulleys screwed to the outside discs. (Pulleys are available from a hardware store or from Grainger.) Drill three mounting holes through each pulley (easily done with a twist bit), slide the pulleys on the shaft, and use the holes as a template for drilling pilot holes. Then screw the pulleys on.

Now you're ready to glue and screw the discs together one at a time. Align the sandpaper slot and the outer edges of each successive disc so that the stack is as cylindrical as possible. The two outer discs, with pulleys attached, are glued on last. As a final touch, slightly recess the leading edge of the drum around the sandpaper slot (see the detail in figure 2). Using a rasp or file, gently round the first 1/2 in. on the leading edge of the slot, to prevent premature wear in that area.

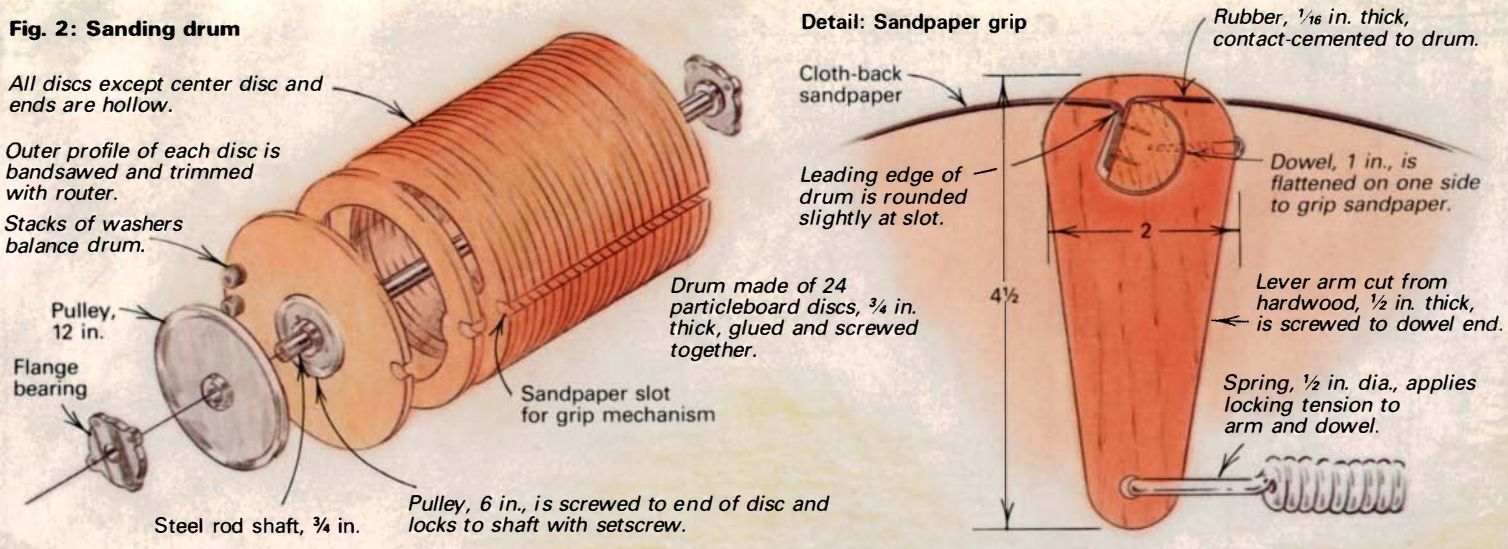
The sandpaper grip—To easily attach or remove the cloth-back sandpaper that wraps around the drum, we devised a simple sandpaper grip. Start with a 1-in. hardwood dowel that's at least as long as the drum. Plane one side of the dowel flat, until you're almost halfway through, and then drill a row of small pilot holes on the leading edge of the dowel flat for 3/4-in.-long brads, which keep the sandpaper from slipping. Nip the brad heads with wire cutters, leaving 1/8-in.-high, sharply pointed studs. Trim the dowel to length, leaving 1/2 in. protruding from each side of the drum. The ends of the dowel are attached to lever arms cut from hardwood scraps, as shown in the detail in figure 2. With the dowel in place in the slot, screw the arms on as shown and attach one end of a spring to the bottom of each arm with an eye hook that's been pried open slightly. Stretch the springs out about one-third more than their relaxed length, mark the spot and insert a small, sturdy cup hook. Bend or slip the end of the spring around the hook and the grip is complete. To change sandpaper, you simply lift the lever arm, which releases the ends of the cloth.

Mounting the drum—The thickness-sander drum rotates on a 3/4-in.-dia. steel shaft (a 5/8-in. shaft will also work) supported at both ends by four-hole flange bearings (Grainger #5X698) bolted to the sides of the sander. The holes drilled in the sides for the bolts that hold each flange should be slightly larger than the attaching bolts themselves, to give you a bit of flexibility in aligning the drum, should you need it.

To mount the drum, first draw a vertical centerline on the inside faces of the side panel. This helps you position the drum. Now, slip the drum onto its shaft and lock it by tightening the setscrews on the two pulleys screwed to the drum. The 12-in. pulley and the V-belt that will drive the drum can now be attached, but you won't tighten the setscrew until the pulleys have been aligned with the motor later. Next attach the flange bearings to the shaft ends by tightening the setscrews in each. With the bed level and the feed board in place, lay a piece of wood, approximately 1/8 in. thick, on top of the feed board. Lift the drum into position, resting it on the wood, center the flanges to your pencil lines and mark the position of the flange's bolt holes. Finally, remove the drum, drill the holes, and then realign the drum and bolt it in place.

Prior to any further work with the drum, the motor must be mounted to the thickness-sander frame and wired to a switch. We chose a 2-HP, 1,750-RPM, single-phase motor, which has more than enough power for our needs. The motor base is bolted directly to the back of the sander, and the switch (we used a standard motor switch, rated to handle the amperage of the motor) is screwed onto one of the particleboard gussets on the front of the sander. A small 3-in. pulley is mounted on the motor shaft and aligned with the 12-in. pulley, and then both pulleys are tightened on their shafts. The smaller pulley driving the larger one produces a slow drum speed, which makes the sander suitable for hand-feeding.

Balancing and truing the drum—The extra bulk of the drum around the sandpaper-grip mechanism throws the drum out of rotational balance. To correct that, we screwed two stacks of large fender washers on each end disc directly opposite the grip, a process similar to adding balancing weights to car tires (see figure 2).



A hole drilled through the side of the frame allowed screwdriver access and made it easy for us to add weight during balancing. We just kept spinning the drum and adding washers until it came to rest at different spots after each spin—indicating that it was balanced. When you do this, make sure the V-belt is disconnected and add the same number of washers to each side of the drum; our sander took two stacks of 11 on each side, 44 washers in all.

Now comes the fun part: truing the drum. Start by contact-cementing a sheet of 40-grit cloth-back sandpaper to the feed board. With the drum under power, crank the bed up until the paper bites into the particleboard drum and sands down the high spots. Take a few subsequent passes, raising the bed and moving the feed board so that you use a fresh area on the sandpaper each time. Repeat the process until every bit of the drum has been sanded. The drum should now be perfectly even across its width and parallel to the bed. Recheck the balance, especially if you removed a great deal of material during truing.

To complete the drum, glue on a 1/16-in.-thick dense rubber sheet with contact cement. (For rubber sheets, check with your local building-supply store or in the yellow pages under "rubber products.") The rubber serves as a backing for the sandpaper, gives the paper a better bite and extends its life. The trick to applying the rubber is working slowly and smoothing it down as you go, to avoid air bubbles. Start with a rubber sheet that's wider than the drum and longer than its circumference; any excess can be trimmed with a sharp knife after gluing.

Hold-down bar—The hold-down mechanism is not an absolute requirement, but it's helpful, especially if you plan to sand very thin boards. The hold-down bar flattens uneven or slightly warped boards before they're sanded by the drum. The mechanism consists of a steel bar that's held loosely at either end by spring-tensioned arms that secure the workpiece tightly against the feed board as it's fed into the sanding drum. Start by covering a ½-in.-dia. steel rod with vinyl tubing, available from a conveyor-supply company. (You can substitute rubber tubing or wrap the rod with duct tape.) Leave the ends of the rod bare, as these are set into a pair of two-hole flange bearings (Grainger #4X727). These bearings are self-aligning, which means that one side can move up or down independently and not inhibit the rolling motion of the rod as uneven stock is fed through. The flange bearings are bolted to two small arms made from ¼-in.-thick Masonite that are bolted loosely to the frame, to allow up-and-down movement (see figure 1 on p. 80). Springs at each end, which pull the arms and bar down, are attached in similar fashion to the sandpaper-grip springs.

The last element you'll need to deal with before you've completed your thickness sander is dust collection. The small shroud on the original machine we built, shown in the photo on p. 81, was woefully inadequate and captured no more than 20% of the dust the sander produced. So we recommend that you equip your sander with a shroud that fully encloses the top of the machine. A piece of thin, flexible sheet metal, such as sheet aluminum (available at most hardware stores), is ideal for this job. The connection port for a shop-vacuum hose should be located on the outfeed side of the machine.

Using the sander—We've had good success using 60-grit cloth-back sanding belts. We buy this material in rolls from a local abrasives supplier; you could also buy a 36-in.-wide by 60-in.-long thickness-sander belt from The Sanding Catalog, Box 5069, Hickory, N.C. 28603; (800) 228-0000. By tearing the belt's width and length in half, you have enough for two 18-in.-wide by 52¼-in.-long sheets. This length covers the 16-in.-dia. drum (actually 16⅛ in. with rubber covering) and includes about ¾ in. extra on each end for the sandpaper grip. Secure the paper tightly in the grip, and check it occasionally during sanding to ensure it hasn't loosened. Also make sure to clean the sandpaper periodically with a regular rubber belt-cleaning stick.

To use the sander, slide the feed board out on the infeed side, and set one end of the workpiece against the stop and the other under the hold-down bar. To take advantage of the full width of the paper when sanding narrow stock, you can set the stock on the feed board at an angle (see the photo on the facing page). Now set the bed height by turning the adjustment handle. Eyeball the gap between the feed board and drum, and adjust the bed height to set the degree of sanding desired. Now switch on the motor and take a trial pass, pushing the stock through in one smooth, continuous motion. To cut down on vibration and to keep the sander from moving, we bolted the machine to a wall. Also, if your floor is slippery, you may find it easier to push the feed board with your hips while grabbing handles—regular kitchen-type drawer pulls—screwed to the frame. Beyond that, you now only have to deal with the particular idiosyncrasies of your own sander. All homemade tools have their own personalities, and once you learn their quirks, a good working relationship will quickly follow. □

Grit Laskin is a guitarmaker, author and musician. David Wren is a guitar restorer and builder. Both live and work in Toronto, Ont., Canada. A kit for the drum sander is available from W.G. Laskin, 192 Dupont St., Rear, Toronto, Ont., Canada M5R 2E6.