

Woodsmith
CUSTOM WOODWORKING

Workshop Essentials



TIME
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BOOKS

WOODSMITH CUSTOM WOODWORKING

Workshop Essentials



SHOP SAFETY IS YOUR RESPONSIBILITY

Using hand or power tools improperly can result in serious injury or death. Do not operate any tool until you read the manual and understand how to operate the tool safely. Always use all appropriate safety equipment as well as the guards that come with your tools and equipment and read the manuals that accompany them. In some of the illustrations in this book, the guards and safety equipment have been removed only to provide a better view of the operation. Do not attempt any procedure without using all appropriate safety equipment or without ensuring that all guards are in place. Neither August Home Publishing Company nor Time-Life Books assume any responsibility for any injury, damage or loss suffered as a result of your use of the material, plans or illustrations contained in this book.

WOODSMITH CUSTOM WOODWORKING

Workshop Essentials

By the editors of *Woodsmith* magazine

Time-Life Books

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GLUING & CLAMPING

One of the most common tasks in woodworking is gluing together two or more pieces of wood. The projects in this section help you “get it together.”

Assembly Table

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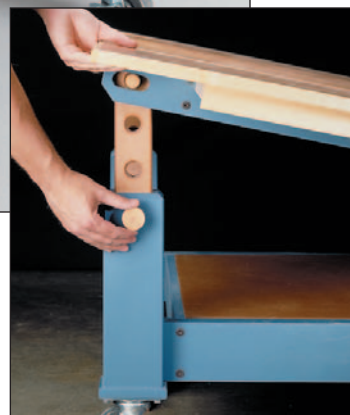
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Assembly Table

This Assembly Table has it all — a top that adjusts in height, an expandable work surface, and plenty of room for storage. Plus it's mounted on casters so you can roll it out of the way when it's not needed.



When it comes to assembling a project, it's hard to find just the right place. The top of my bench can be too high up off the floor (or too small) to handle some projects. And assembling a project on the floor is hard on my knees and back.

That's why I built this Assembly Table. To hold a project at a comfortable working height, I just raise or lower the table. And for big projects, I can make the work surface larger.

ADJUSTABLE HEIGHT. To adjust the height of the Assembly Table, each leg has a post that slides inside a sleeve. A series of holes in each post lets you raise the table up to 30", or lower it down to 21" off the floor.

The nice thing about adjusting the height of the table is you don't need a

helper to do it. That's because each end can be raised (or lowered) separately (see top inset photo).

WINGS. Making the work surface bigger when assembling large projects is just as easy. That's because there's an extension wing that flips up on each side of the table. To hold the wings and the weight of the project, a sturdy support pulls out from underneath the table (see bottom inset photo).

STORAGE. Another thing I like about this project is its storage shelf. It's a perfect place for glue, clamps, and parts that are going to be assembled. And the table itself is easy to store. Just roll it out of the way when the job is done.

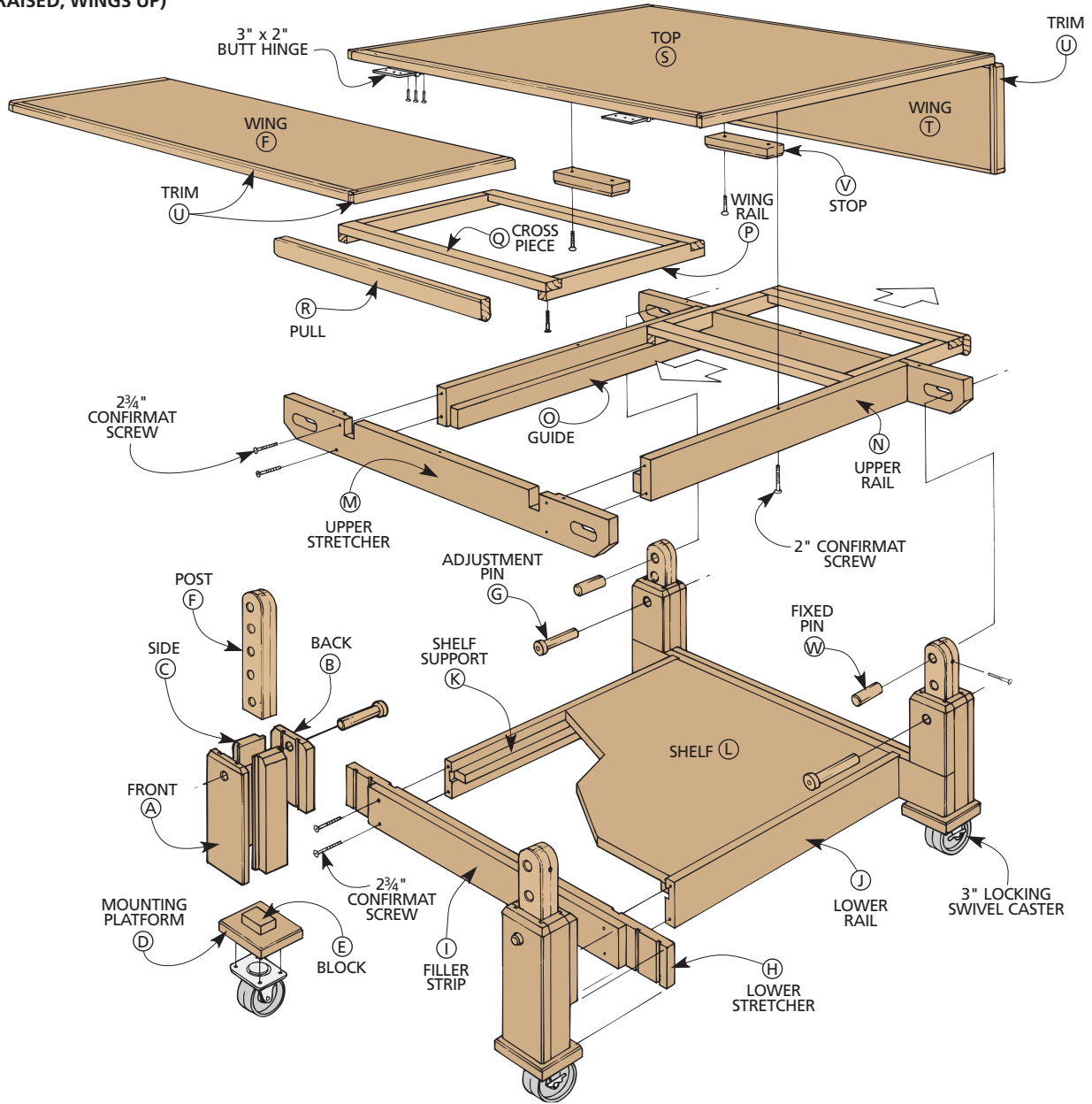
PAINT. Finally, you can finish the table with spray paint as shown here. Or just apply several coats of oil.

EXPLODED VIEW

OVERALL DIMENSIONS:

60W x 36D x 30H

(FULLY RAISED, WINGS UP)



MATERIALS LIST

BASE

A Fronts (4)	3/4" MDF - 4 x 12 3/4"
B Backs (4)	3/4" MDF - 4 x 8 3/4"
C Sides (8)	3/4" MDF - 1 3/4" x 12 3/4"
D Mnt. Platforms (4)	3/4" MDF - 3 1/2" x 4 1/2"
E Blocks (4)	3/4" MDF - 1 1/2" x 2 1/2"
F Posts (8)	3/4" MDF - 2 1/2" x 14 3/4"
G Adjustment Pins (4)	1 dowel x 3 3/8"
H Lower Stretchers (2)	3/4" MDF - 4 x 33 1/2"
I Filler Strips (2)	3/4" MDF - 4 x 25 1/4"
J Lower Rails (2)	3/4" MDF - 4 x 26 1/2"
K Shelf Supports (2)	3/4" MDF - 1 x 26"
L Shelf (1)	3/4" MDF - 22 1/4" x 26"

TOP

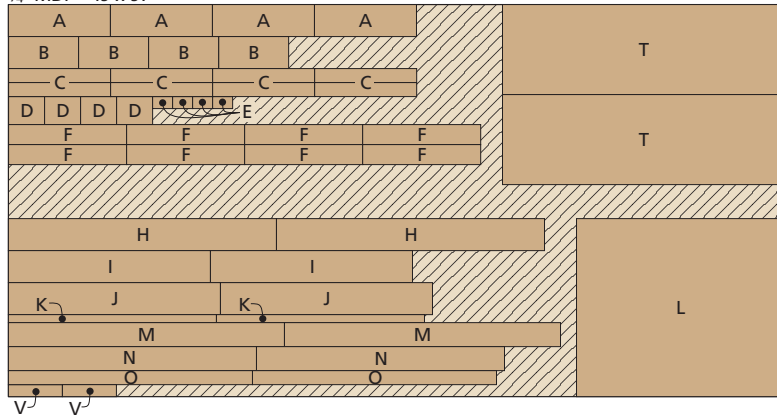
M Upper Stretchers (2)	3/4" MDF - 3 x 34 1/2"
N Upper Rails (2)	3/4" MDF - 3 x 31 3/4"
O Guides (2)	3/4" MDF - 1 3/4" x 30 1/2"
P Wing Rails (4)	3/4" x 1 1/4" - 17"
Q Cross Pieces (4)	3/4" x 1 7/16" - 22 1/4"
R Pulls (2)	3/4" x 1 3/4" - 22 1/4"
S Top (1)	3/4" MDF - 35 1/4" x 35 1/4"
T Wings (2)	3/4" MDF - 11 1/4" x 35 1/4"
U Trim	3/4" x 3/8" - 360 rough
V Stops (2)	3/4" MDF - 1 1/2" x 6"
W Fixed Pins (4)	1 dowel x 2 3/4"

HARDWARE SUPPLIES

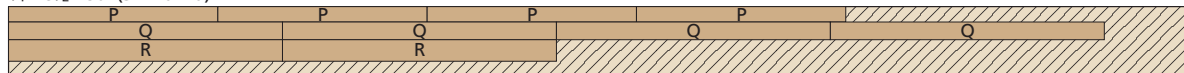
(8) No. 8 x 1" Fh woodscrews
(4) No. 8 x 1 1/4" Fh woodscrews
(4) No. 8 x 2" Rh woodscrews
(8) 2" Confirmat screws
(16) 2 3/4" Confirmat screws
(16) 1 1/4" x 1" lag screws
(4) 3" x 2" butt hinges w/ screws
(4) 3" locking swivel casters
(4) 1 1/2"-dia. x 1/2"-thick wheels w/ 1/4"-dia. hole
(1) 1/4"-dia. dowel x 12"

CUTTING DIAGRAM

¾" MDF - 49 x 97



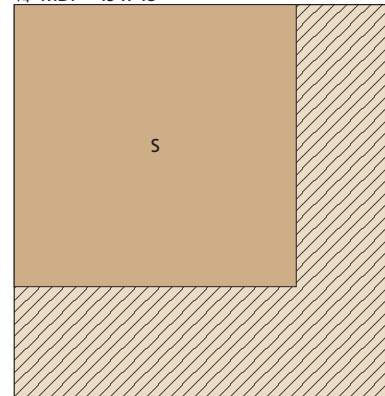
¾ x 5½ - 96 (3.7 Bd. Ft.)



¾ x 3½ - 96 (2.7 Bd. Ft.)



¾" MDF - 49 x 48



NOTE:
PARTS G
AND W ARE
CUT FROM
A 36"
LENGTH OF
1" DOWEL.
ALSO NEED
¼" DOWEL,
12" LONG.

BASE

I started on the Assembly Table by making the base. It consists of four adjustable legs that let you raise and lower the table, and a frame that supports a storage shelf.

LEGS. To adjust the height of the table, each leg is made of two parts: a hollow sleeve and a post that slides up and down. The post has a series of holes. Aligning one of these holes with a hole in the sleeve and inserting a pin sets the table to the desired height.

MDF. To raise and lower the table easily, it's important that the post slides in the sleeve without binding. So both parts are made from medium-density fiberboard (MDF) which won't expand and contract with changes in humidity.

SLEEVES. I began work by making the four sleeves. Each one is just a box with a wide front (A) and back (B) piece and two narrow sides (C) (Fig. 1).

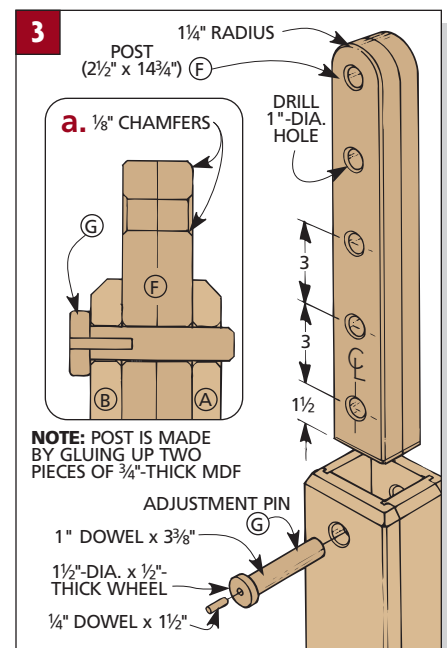
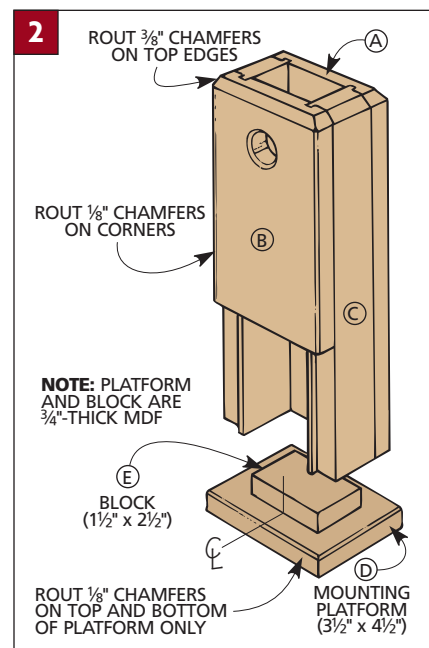
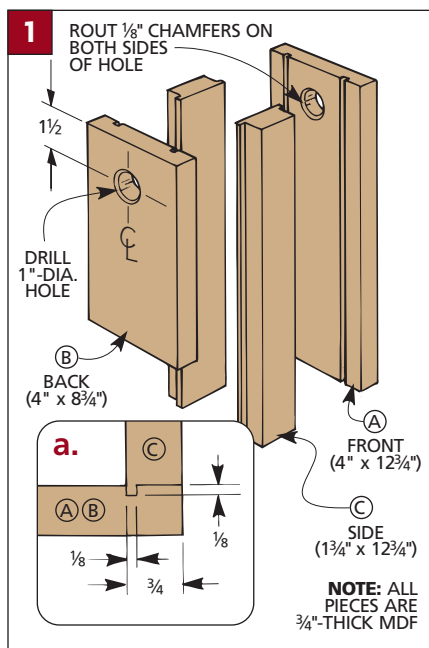
Note: To create a recess for the stretcher that will be used to join the legs together, the back is shorter than the front and sides.

The sleeve is held together with simple tongue and groove joints (Figs. 1 and 1a). This makes it easy to align the pieces so the opening is consistent from top to bottom.

Before assembling the sleeve, you'll need to drill and chamfer the holes in the front and back for the adjustment pin (added later) (Fig. 1).

After gluing up the sleeve, I routed chamfers on the top outside edges and on all four corners (Fig. 2).

All that's left to complete each sleeve is to add a platform to the bottom for a



caster. It's nothing more than two glued-up blocks. The caster will attach to the mounting platform (D) (Fig. 2). A small block (E) centers the platform in the sleeve when it's glued in place.

POST. With the sleeves complete, the next step is to add the four sliding posts (F) (Fig. 3). Each post starts out as just two pieces of MDF glued together.

Once the glue dries, there's a series of five holes drilled in each post (Fig. 3). The upper hole will be used later to attach the top assembly to the base. And the bottom four holes provide for the different height adjustments.

Since the table angles as you adjust the height (refer to the top inset photo on page 8), you'll need to cut a curve on the top of each post to provide clearance (Fig. 3). Then rout small ($\frac{1}{8}$ ") chamfers on all the edges to keep the post from catching inside the sleeve.

PINS. Now all that's left is to add four adjustment pins (G) to lock in the height adjustment. These pins are just 1"-dia. hardwood dowels. (I used maple.) A toy wood wheel that's held in place with a $\frac{1}{4}$ "-dia. dowel makes it easy to remove the pin (Figs. 3 and 3a).

LOWER FRAME

With the legs complete, you can add the lower frame that joins them together. What I found worked well was to connect the sleeves in pairs, and then join the two assemblies together.

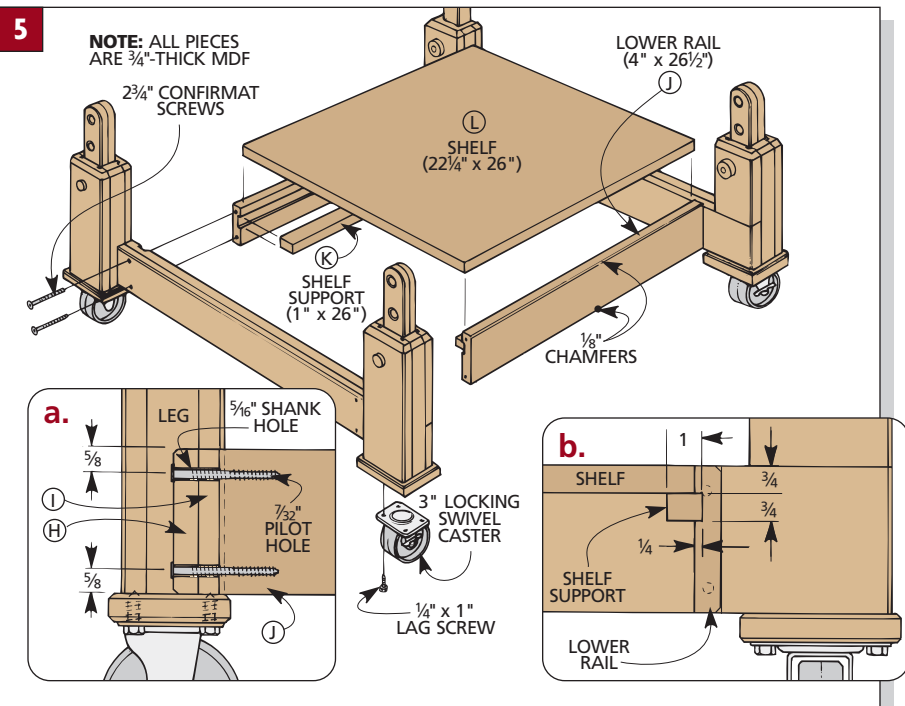
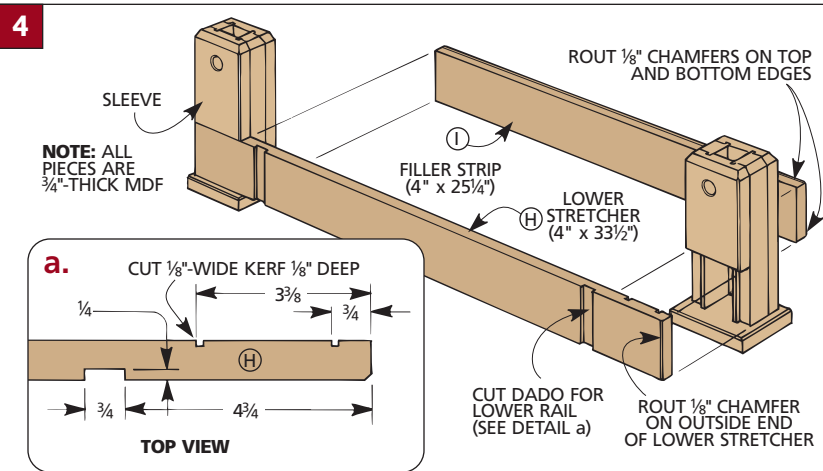
STRETCHERS. The first step is to connect each pair of legs with a lower stretcher (H) (Fig. 4). Two narrow kerfs cut in each end of the stretcher fit the exposed tongues on the sleeves (Figs. 4 and 4a). And a dado accepts the rails (added later) (Fig. 4a).

To provide additional support, I cut a filler strip (I) to fit between the legs and glued it in place.

RAILS. At this point, it's just a matter of adding a pair of lower rails (J) to tie the two assemblies together (Fig. 5). After cutting a groove for a shelf support (K) that's glued in place, I used a special fastener to attach the rails. (See the Hardware box at right.)

SHELF. With the rails in place, you can add the shelf (L) (Fig. 5). It's a piece of MDF that's cut to fit the opening and set in place.

CASTERS. To complete the base, just attach a locking swivel caster to each platform with lag screws (Fig. 5).



HARDWARE Confirmat Screws



One of the best fasteners I've found for use in medium-density fiberboard (MDF) is a Confirmat screw (see photo above).

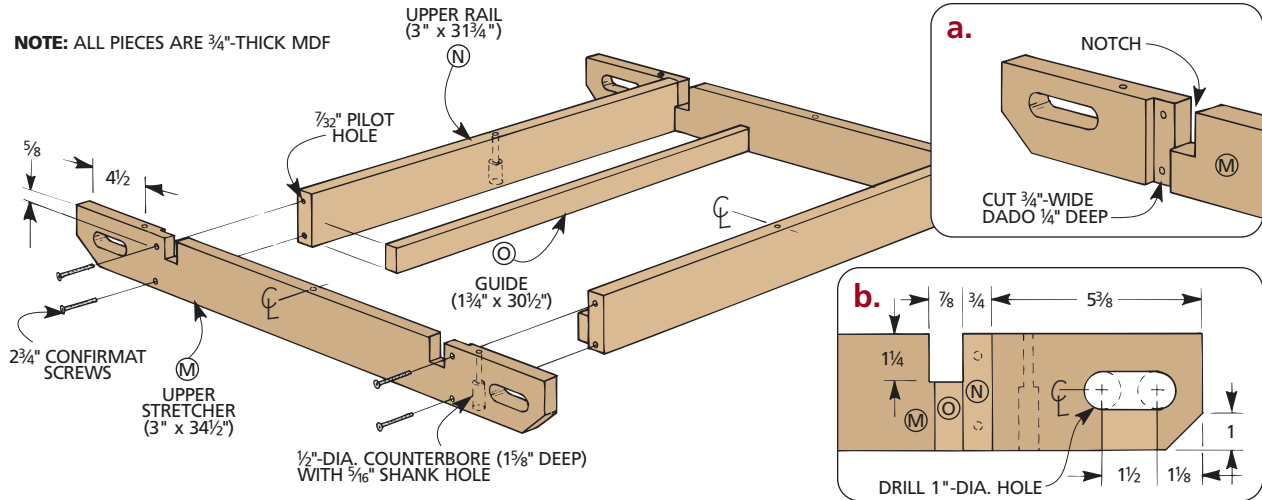
THREADS. First, the threads are deeper and farther apart than on a standard woodscrew. So they won't pull out of the workpiece as easily.

SHANK. Also, the shank is straight, not tapered like a woodscrew, so it's less likely to split the MDF.

HEAD. And lastly, the head is flat on the bottom so it won't pull into the workpiece. (There's a recess in the head for an Allen wrench.)

To find these screws, see page 126.

NOTE: ALL PIECES ARE $\frac{3}{4}$ "-THICK MDF



UPPER FRAME

With the base complete, you can turn your attention to the top assembly. It consists of three main parts: an upper frame, a pair of wing supports, and a top with two wings (refer to *Fig. 9*).

Besides supporting the top, the upper frame houses the wing supports that slide out to hold up each wing.

STRETCHERS. The frame is attached to the base of the table by two upper stretchers (M) (*Fig. 6*). It's attached to the legs by a pin (added later) that

passes through a slot at each end of each stretcher (*Figs. 6a and 6b*). These slots let you raise the frame without binding on the pin.

Also, to keep the stretchers from catching the sleeve of the leg, the bottom corners are angled (*Fig. 6b*).

To complete the stretchers, there's a dado cut near the end that will accept the upper rail (*Fig. 6a*). And a wide ($\frac{7}{8}$ ") notch right next to each dado provides an opening for the wing support.

RAILS. The stretchers are connected by a pair of upper rails (N) (*Fig. 6*). To create a track for the wing supports to slide in and out, there's a guide (O) glued to the inside of each rail flush with the bottom of the notch (*Fig. 6b*).

Before assembling the upper frame, there's one more thing to do. You'll need to drill counterbored shank holes in each stretcher and rail so you can attach the top later (*Figs. 6 and 6b*).

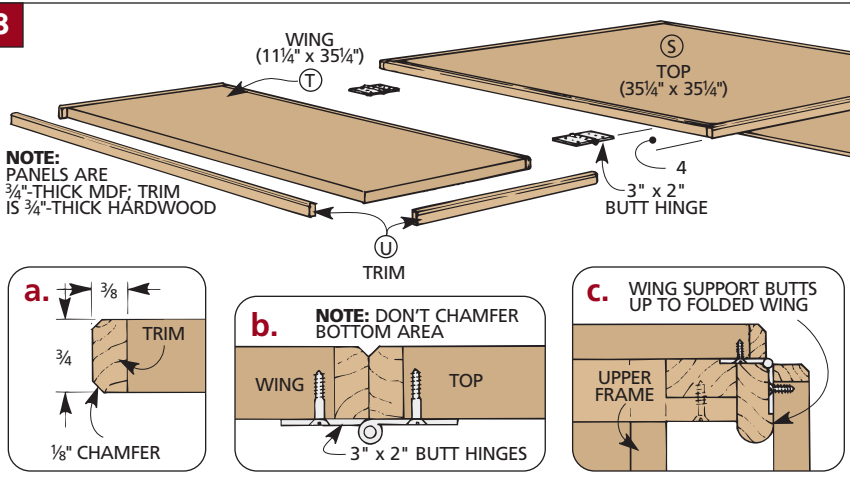
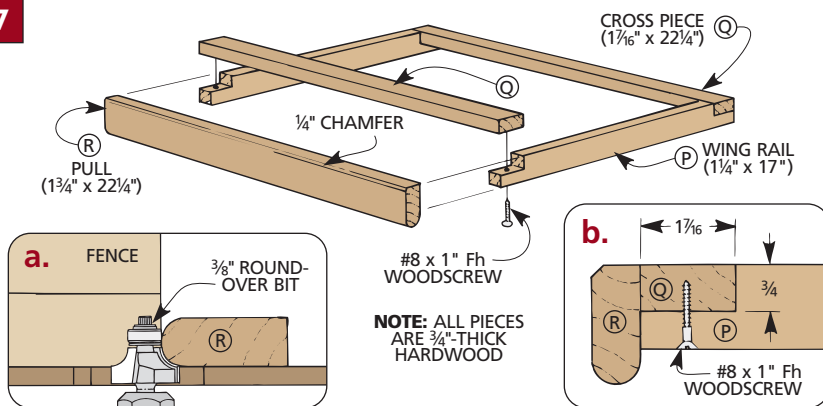
ASSEMBLY. With the holes drilled, the upper frame is ready for assembly. Here again, I used Confirmat screws to attach the stretchers to the rails.

WING SUPPORTS

With the frame complete, you can add the two wing supports. They're just small hardwood frames that slide in and out to support the wings.

Each frame is nothing more than a pair of wing rails (P) that are rabbeted at the ends to accept two $\frac{3}{4}$ "-thick cross pieces (Q) (*Figs. 7 and 7b*).

After gluing and screwing the frames together, I added a hardwood pull (R). To provide a comfortable grip,



the bottom edges of the pull are rounded over (*Fig. 7a*).

Finally, to prevent the wing from catching the edge of the pull as it's raised or lowered, I chamfered the top outside edge (*Figs. 7 and 7b*).

TOP & WINGS

The table has two rectangular wings to increase the size of the work surface when working with large projects.

PANELS. The top (S) and wings (T) are $\frac{3}{4}$ "-thick MDF panels "wrapped" with hardwood trim pieces (U) (*Fig. 8*).

After gluing on the trim, I chamfered all the edges except the bottom (where the wings and top come together) (*Figs. 8a and 8b*). This way, there's a continuous surface when you install the hinges that hold the pieces together.

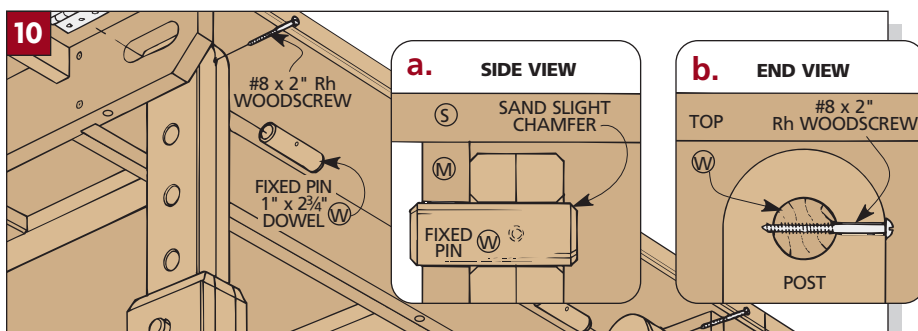
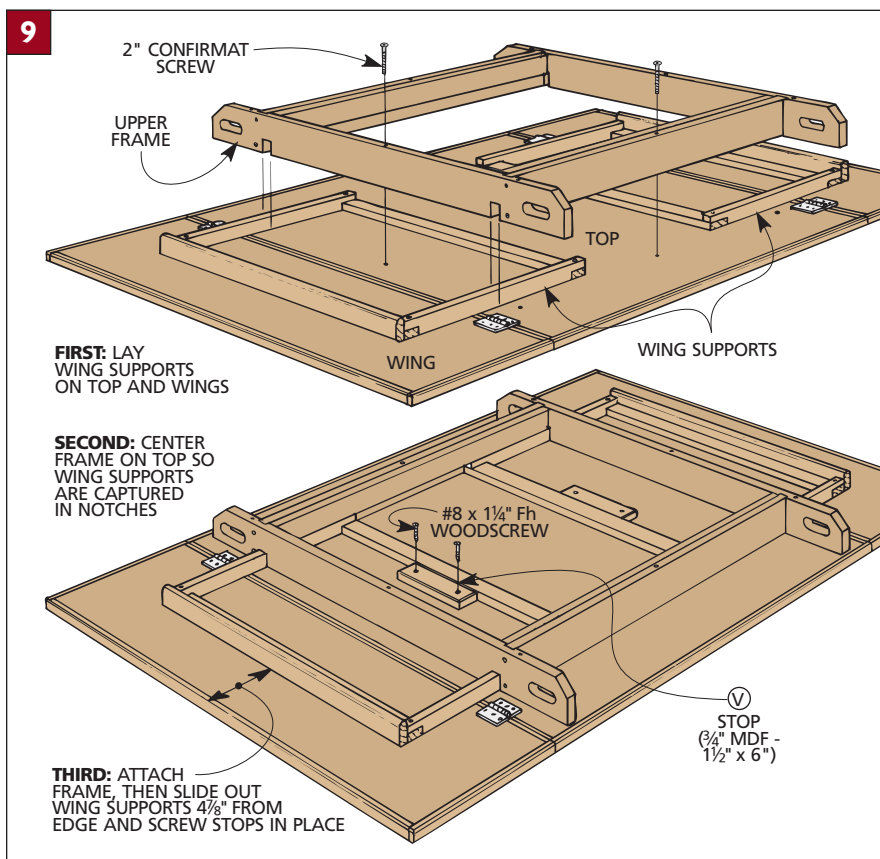
ATTACH FRAME. Once the top and wings are hinged together, you can attach the frame. It's easiest to start by flipping the top and wings upside down.

First, center the frame on the top. Then "capture" the wing supports in the notches of the stretchers (*Fig. 9*).

Now all you need to do is drill pilot holes in the top, and attach the frame with Confirmat screws (*Fig. 9*).

Next, to avoid pulling the wing supports out too far, I screwed two simple stops (V) to the top (*Fig. 9*).

All that's left is to flip the top assembly back over and attach it to the base. It's held in place with a fixed pin (W) that passes through the top hole of the post and into the slot in the stretcher (*Figs. 10 and 10a*). Installing a screw "locks" the pin in place (*Fig. 10b*). ■



FINISHING TIP

The Assembly Table needs a durable finish, so I used enamel spray paint.

Since the edges of MDF are quite porous, they'll wick up paint like a sponge. So I fill them with a hard-

ening putty first (left photo). It's available at most hardware stores.

Then I apply a coat of primer (middle photo) before applying the color coats (right photo).

Spray Painting

The thing to be aware of is that subsequent coats either need to be sprayed on within the hour (when the paint is still tacky) or after 48 hours (when it's completely dry.)



Clamp Storage Rack

Most clamp racks are designed by other woodworkers for their own clamps. This organizer can be customized for the clamps you have, and then expanded as your collection of clamps grows.



One of the problems I've had with clamp racks is they're always designed for someone else's clamps. But not this clamp organizer. It's a modular system with a variety of hangers for all kinds of clamps. Just build the hangers you need to store the clamps you have.

The heart of this system is a pegboard frame. Depending on the floor space and your storage needs, it can be mounted to the wall a couple of ways. And the rack accepts custom hangers designed to fit your clamps.

CUSTOM HANGERS. The hangers hold bar clamps, C-clamps, and spring clamps. There's even a storage box for the odds and ends you need at assembly time, like clamp pads, glue bottles, and brushes. As your collection of clamps grows, it's easy to build additional hangers to hold them.

L-HOOKS. Each hanger has L-hooks screwed into the back. (I found them at my local hardware store.) The advantage of using L-hooks is they can't fall off or pull out of the pegboard like traditional pegboard hooks (see the inset photos). But you can still remove and rearrange the hangers if you need to.

DOUBLE THE STORAGE SPACE.

When you're deciding where to put the rack in your shop, consider a spot that allows room in front. If you have such a place, you can double your clamp storage. All you need to do is hinge the rack on one side so you can access the back of the pegboard. There's more about this option in the Designer's Notebook on page 17.

CLAMPS. As you can see in the photo, I have a wide variety of clamps. There's an article on page 20 that describes the benefits (and drawbacks) for each

type of clamp, as well as the types of jobs they're best suited for.



EXPLODED VIEW

OVERALL DIMENSIONS:

32W x 6 $\frac{3}{4}$ D x 84H

MATERIALS LIST

PIPE CLAMP RACK

A	Top/Bottom (2)	1 $\frac{1}{2}$ x 1 $\frac{1}{2}$ - 31
B	Sides (2)	1 $\frac{1}{2}$ x 1 $\frac{1}{2}$ - 84
C	Pegboard (1)	$\frac{1}{4}$ pgbd. - 31 x 83
D	Support Base (1)	1 $\frac{1}{2}$ x 5 $\frac{1}{4}$ - 31 $\frac{3}{4}$
E	Cradles (2)	1 $\frac{1}{2}$ x 3 $\frac{1}{2}$ - 31 $\frac{3}{4}$

C-CLAMP HANGER

F	C-Clamp Base (1)	$\frac{3}{4}$ x 5 - 11
G	C-Clamp Head (1)	1 $\frac{1}{2}$ x 2 $\frac{1}{4}$ - 5
H	C-Clamp Pegs (4)	$\frac{3}{4}$ dowel - 4 $\frac{5}{8}$

SPRING CLAMP HANGER

I	Sprg. Clmp. Base (1)	$\frac{3}{4}$ x 4 - 16
J	Sprg. Clmp. Head (1)	1 $\frac{1}{2}$ x 2 $\frac{1}{4}$ - 4
K	Sprg. Clmp. Pegs (3)	$\frac{1}{2}$ dowel - 5 $\frac{5}{8}$

BAR CLAMP HANGER

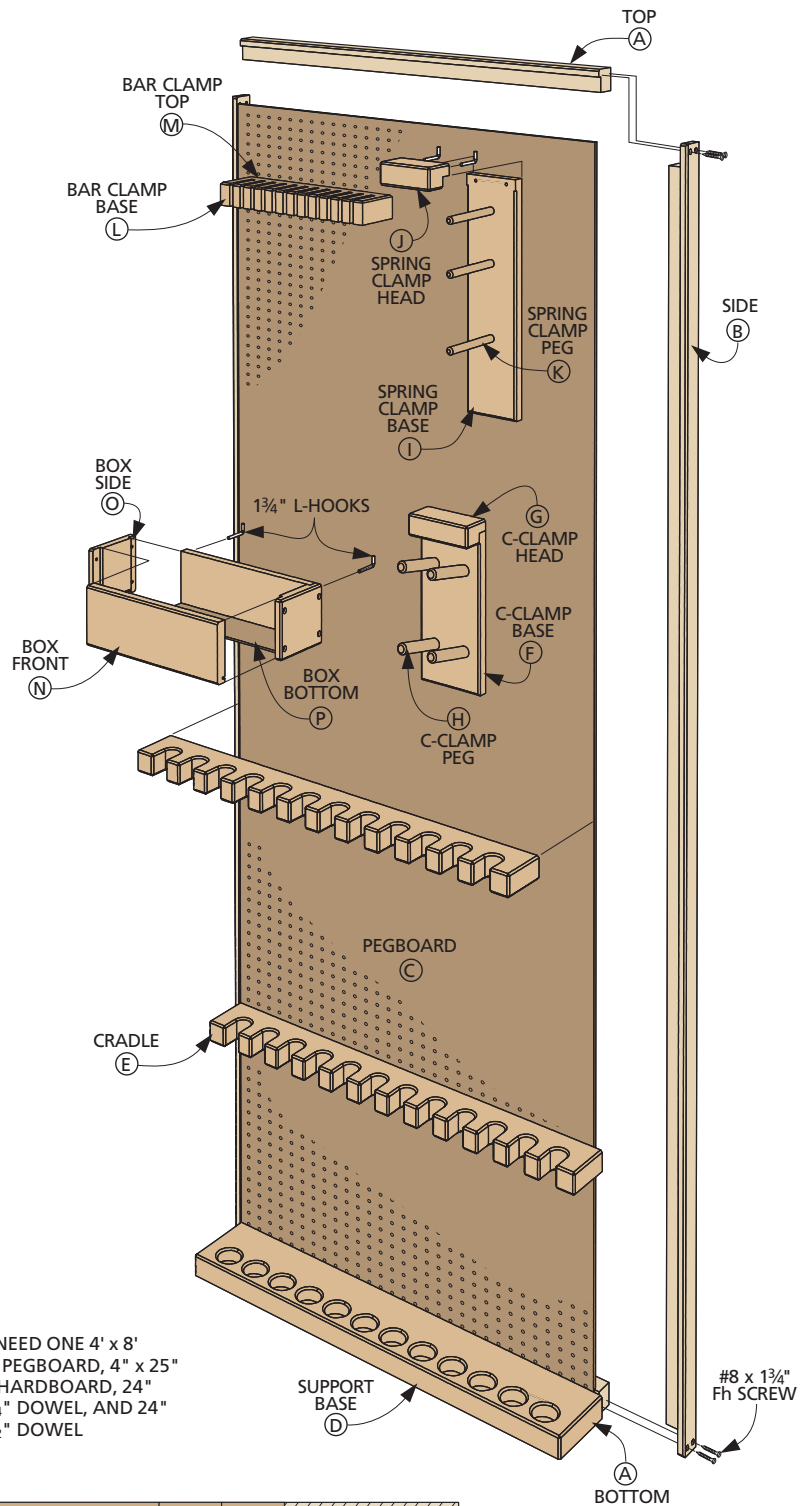
L	Bar Clamp Base (1)	1 $\frac{1}{2}$ x 3 $\frac{1}{2}$ - 13
M	Bar Clamp Top (1)	$\frac{1}{8}$ hdbd. - 3 $\frac{1}{2}$ x 13

STORAGE BOX

N	Box Front/Back (2)	$\frac{3}{4}$ x 4 - 11 $\frac{3}{4}$
O	Box Sides (2)	$\frac{3}{4}$ x 4 - 4 $\frac{1}{2}$
P	Box Bottom (1)	$\frac{1}{8}$ hdbd. - 3 $\frac{1}{2}$ x 11 $\frac{3}{4}$

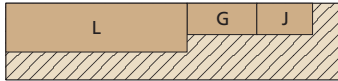
HARDWARE SUPPLIES

(28) No. 12 x 1" Fh woodscrews
 (8) No. 8 x 3 $\frac{1}{2}$ " Fh woodscrews
 (8) No. 8 x 1 $\frac{3}{4}$ " Fh woodscrews
 (13) No. 8 x 1 $\frac{1}{2}$ " Fh woodscrews
 (8) 1 $\frac{3}{4}$ " L-hooks



CUTTING DIAGRAM

2x6 (1 $\frac{1}{2}$ x 5 $\frac{1}{2}$) - 24 (1.4 Bd. Ft.)



$\frac{3}{4}$ x 5 $\frac{1}{2}$ - 72 (2.75 Bd. Ft.)



2x2 (1 $\frac{1}{2}$ x 1 $\frac{1}{2}$) - 96 (1.5 Bd. Ft.)



2x2 (1 $\frac{1}{2}$ x 1 $\frac{1}{2}$) - 96 (1.5 Bd. Ft.)



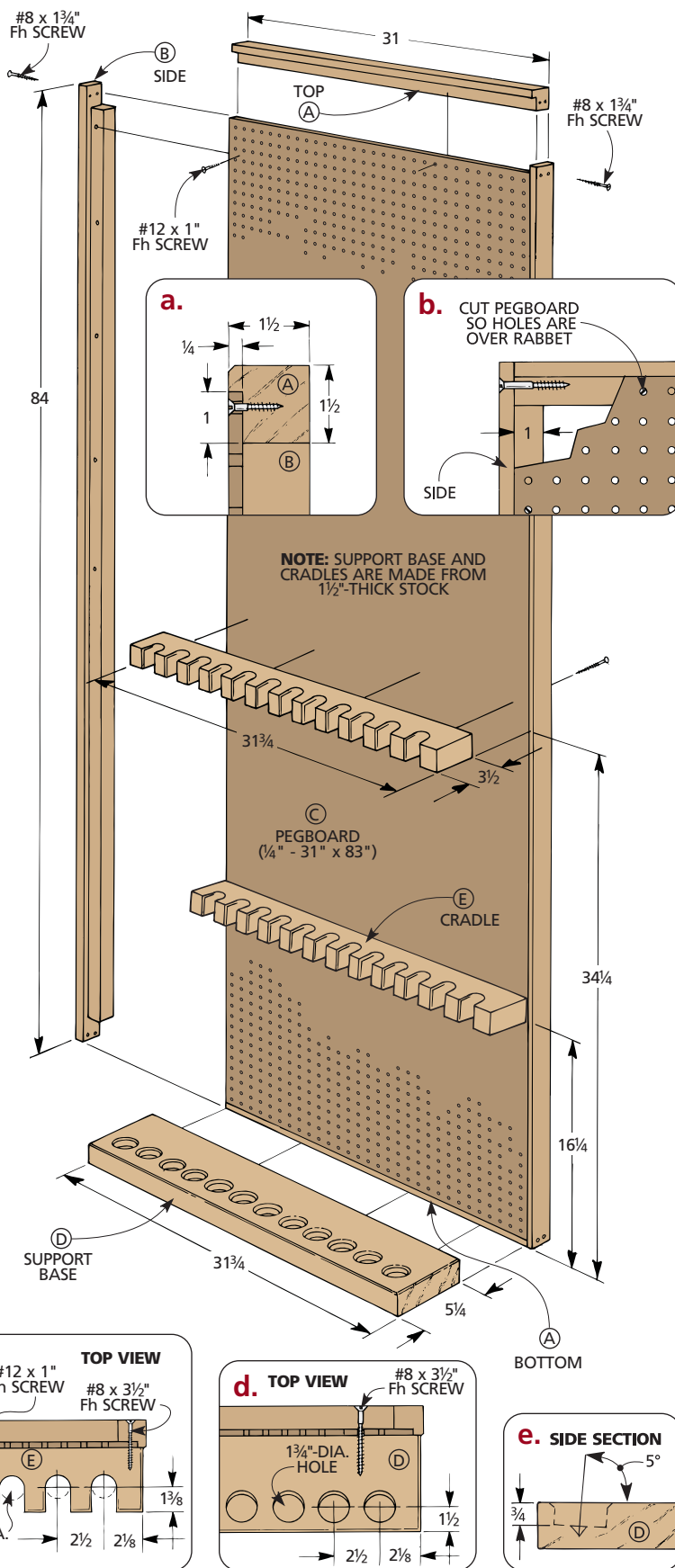
2x2 (1 $\frac{1}{2}$ x 1 $\frac{1}{2}$) - 96 (1.5 Bd. Ft.)



2x6 (1 $\frac{1}{2}$ x 5 $\frac{1}{2}$) - 96 (5.5 Bd. Ft.)



NOTE: ALSO NEED ONE 4' x 8' SHEET OF $\frac{1}{4}$ " PEGBOARD, 4" x 25" PIECE OF $\frac{1}{8}$ " HARDBOARD, 24" LENGTH OF $\frac{3}{4}$ " DOWEL, AND 24" LENGTH OF $\frac{1}{2}$ " DOWEL



PEGBOARD FRAME

I started on the Clamp Storage Rack by building a frame to hold a pegboard panel. The top and bottom (A) and the two sides (B) are cut from “two-by” dimension lumber (*Fig. 1*).

RABBET. To hold the pegboard, a 1/4"-deep rabbet is cut along the inside edge of each frame piece (*Figs. 1a and 1b*). I used a dado blade in the table saw.

JOINERY. The frame pieces are held together with a simple rabbet joint. The rabbets are cut in the ends of the sides to accept the top and bottom (*Fig. 1b*). Then the sides are screwed to the ends of the top and bottom.

PEGBOARD. After the frame is assembled, it's ready for the pegboard (C). But before cutting the pegboard to fit, there's one thing to keep in mind.

Since it's easiest to screw through the holes that are already drilled in the pegboard, make sure the holes along the outside edges align with the center of the rabbet in the frame (*Fig. 1b*).

To complete the rack, soften the edges by routing chamfers along the outside edges (*Fig. 1a*).

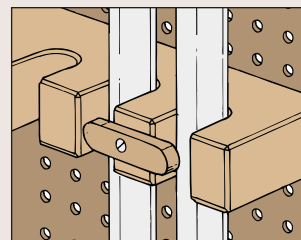
At this point, you have a few options. You can go ahead and mount the rack to the wall by screwing through the sides and into wall studs. If you're building the pipe and bar clamp rack described on the next page, you'll need to add them before securing the frame to the wall. Or you might consider the option shown in the Designer's Notebook on the next page.

SHOP TIP

Turnbutton

To “lock” your pipe clamps in place, add a simple turnbutton to the rack.

All that's needed is a scrap of hardwood and a screw.



PIPE CLAMP RACK

The first holder I built to attach to the pegboard is designed to hold pipe clamps and large bar clamps. These clamps will take the most space, and the other clamp holders will fill in around them. The holder consists of three parts: a support base that keeps the clamps up off the floor, and two cradles that separate the clamps (Fig. 1).

SUPPORT BASE. I started building the pipe clamp rack by cutting the support base (D) from a 2x6 (Fig. 1).

To provide a “pocket” for the end of each clamp to rest in, lay out and drill a series of holes in the base (Fig. 1d).

Note: In order for the clamps to lean into the cradles, I drilled these holes at a 5° angle (Fig. 1e). I did this by putting a 5° wedge under the workpiece while I drilled the holes with the drill press.

Now you can complete the base by routing chamfers on all the exposed edges and the rim of each hole (Fig. 1).

CRADLES. To build the cradles (E), start by cutting two pieces of “two-by” lumber to size. Then you can lay out the slots for the clamps. The easiest way to make sure the slots align between both cradles and the base is to carpet tape the cradles together and transfer the locations of the holes in the base to the cradles. Then drill the holes for the

back of each slot while the pieces are still taped together.

To complete the slots, remove the waste with a jig saw or band saw. And chamfer all the exposed edges.

MOUNT RACK. Unlike the other hangers, the pipe clamp rack is screwed to the pegboard and frame. This helps distribute the weight of the clamps.

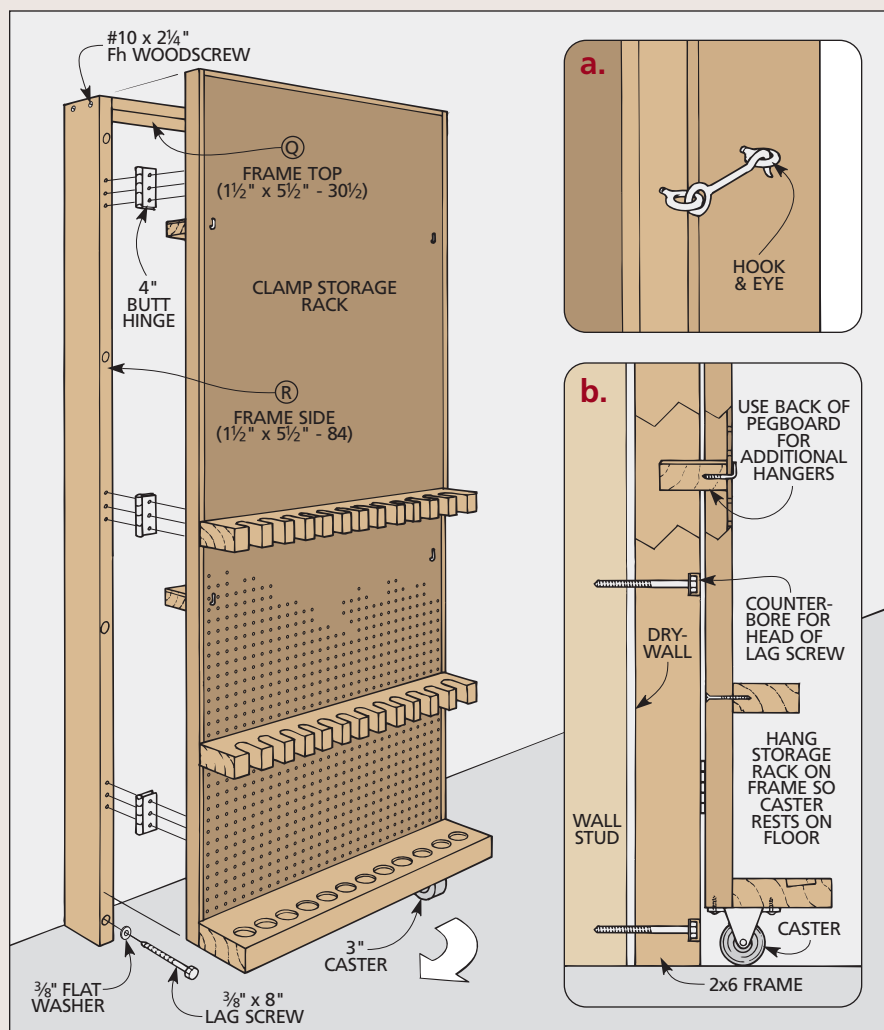
And by mounting the support base flush with the bottom of the frame, the weight from the pipe clamps will be transferred directly to the floor.

Now the pegboard frame can be mounted to the wall with the pipe clamp support base resting on the floor. Just make sure you screw into studs.

DESIGNER'S NOTEBOOK

By adding a frame and some hinges, you can double your clamp storage in the same amount of space.

HINGED CLAMP STORAGE RACK



■ First, a three-sided frame is made from 2x6s. This positions the rack away from the wall so you can use the back face of the pegboard to store more clamps.

■ The frame top (Q) is cut to length so that the distance between the frame sides (R) matches the spacing of the wall studs (32" on-center, in my case).

■ The frame is anchored to the wall studs with lag screws. Counterbores for the screw heads allow the rack to fit close to the frame (see detail 'b').

■ To help support the extra weight the tools add, and to make it easier to swing the rack, a 3" caster is installed on the bottom of the rack (see detail 'b').

■ After the caster is in place, the rack can be attached to the frame with 4" butt hinges (see drawing).

■ Finally, to keep the rack closed, attach a hook and eye to the frame and to the side of the clamp rack (see detail 'a').

MATERIALS LIST

NEW PARTS

- | | | |
|----------|-----------------|------------------------|
| Q | Frame Top (1) | 1 1/2 x 5 1/2 - 30 1/2 |
| R | Frame Sides (2) | 1 1/2 x 5 1/2 - 84 |

HARDWARE SUPPLIES

- (4) No. 10 x 2 1/4" Fh woodscrews
- (8) 3/8" x 8" lag screws
- (8) 3/8" flat washers
- (3) 4" butt hinges
- (1) 3" caster
- (1) Screw hook and eye

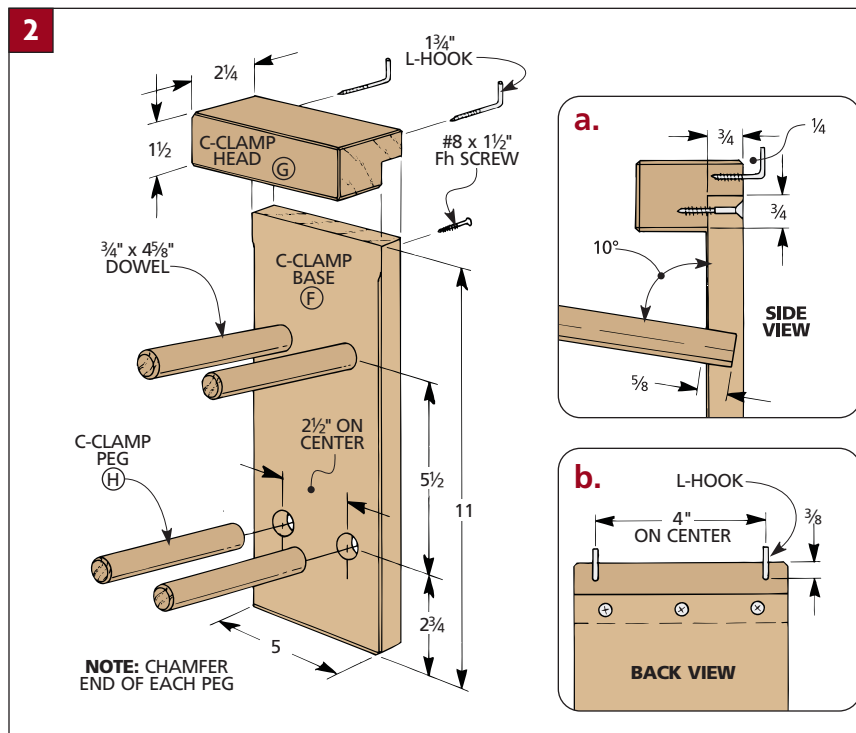


C-CLAMP HANGER

Storing C-clamps has always been a challenge. This hanger lets you slip them on or off without having to open or close the clamps. It consists of a hardwood C-clamp base (F) and head (G), and four C-clamp pegs (H) (Fig. 2).

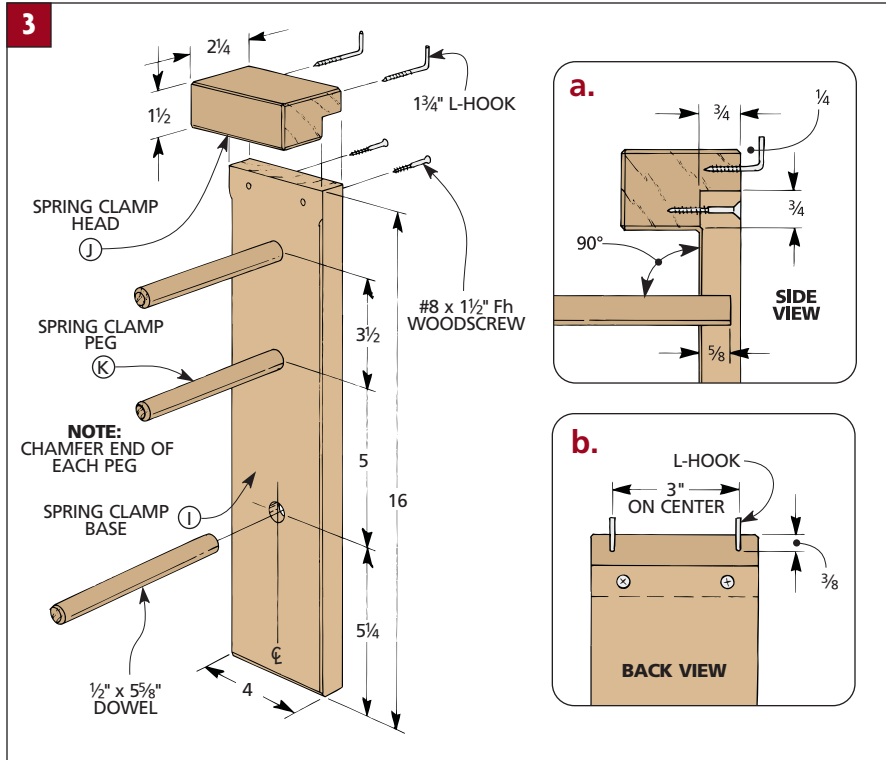
The base is a piece of $\frac{3}{4}$ "-thick stock with four $\frac{3}{4}$ " holes to accept the pegs. To prevent the clamps from sliding off the hanger, I drilled the holes at a 10° angle (Fig. 2a). To do this, I cut a wedge from a piece of scrap, then placed the scrap under the base while I drilled the holes on the drill press.

The base attaches to the pegboard by way of the head. It's $2\frac{1}{4}$ " wide to pro-



vide plenty of room for the L-hooks to screw into. And it's rabbeted in the back to fit over the base.

To assemble the hanger, just glue and screw the head to the base. Then glue in four $\frac{3}{4}$ "-dia. dowels for the pegs and attach the L-hooks (Fig. 2). Finally, ease the sharp edges with sandpaper.



SPRING CLAMP HANGER

The construction of the spring clamp hanger is similar to that of the C-clamp hanger. But on this hanger there are only three spring clamp pegs (K). And they're positioned so the clamps "nest" together (see photo above). Also, the spring clamp base (I) is longer to accommodate three different sizes of spring clamps (Fig. 3).

Because spring clamps are lighter than C-clamps, I used a smaller diameter peg. I drilled the holes for the pegs straight into the base (Fig. 3a).

To complete the hanger, just screw the L-hooks in place (Figs. 3a and 3b).



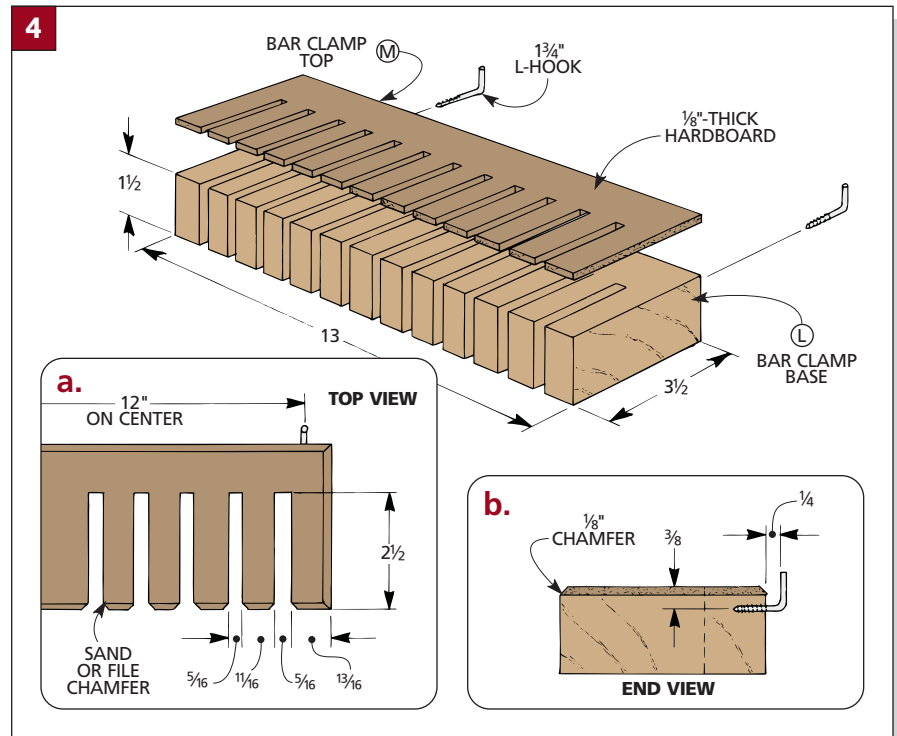
BAR CLAMP HANGER

Most bar clamp hangers I've seen require the jaws of the clamp to be closed before the clamp can be hung on the rack. This hanger eliminates that.

The bar clamp base (L) of the hanger is a short piece of "two-by" stock with a series of slots in the front (Fig. 4). I made the slots wide enough to hold most of the bar clamps I use in my shop.

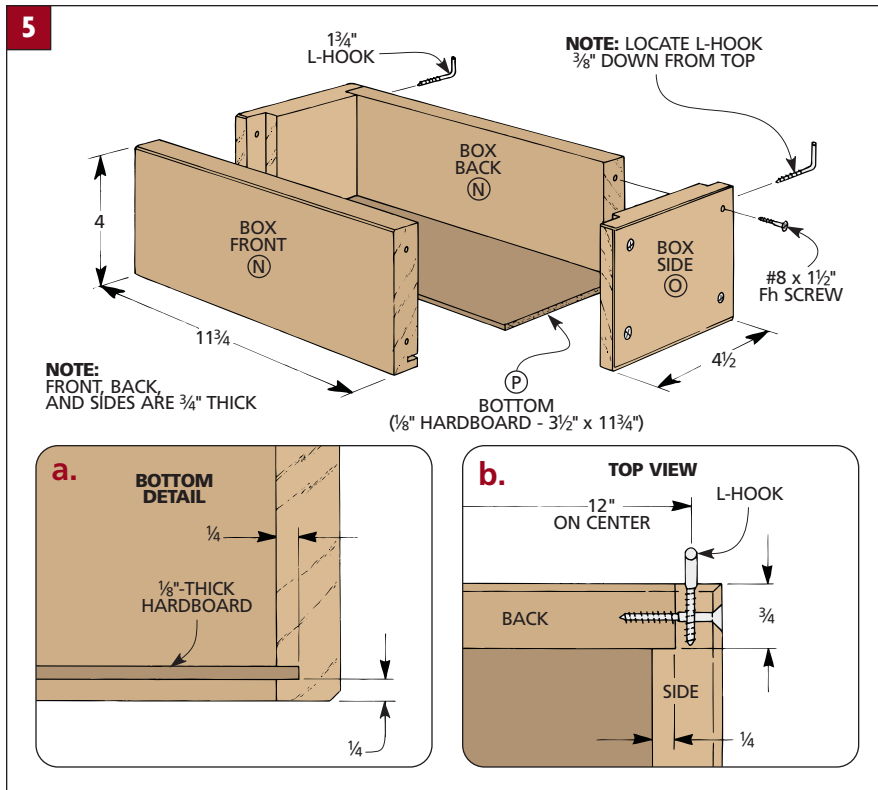
To reinforce the narrow tongues created by the slots, I glued a bar clamp top (M) cut from 1/8"-thick hardboard to the base before cutting the slots.

After the slots are cut, sand or file chamfers on the front corners of each tongue to help guide the clamp into the slot. This also prevents the tongue from getting chewed up.



Then to complete the hanger, just rout or sand 1/8" chamfers along the top outside edges and install a couple of L-hooks (Fig. 4b).

To hang a bar clamp on this hanger, just slide down the bottom jaw and slip the clamp in place (see photo above).



STORAGE BOX

To provide a convenient place for all the odd-shaped clamps and gluing supplies that can't be hung on a conventional clamp hanger, I built a simple storage box. The box is constructed from 3/4"-thick pine and 1/8"-thick hardboard. It's held together with rabbets and countersunk screws (Figs. 5 and 5b).

The rabbets on the box sides (O) are cut to fit the box front and back (N). And a groove is cut near the bottom of each piece to hold a box bottom (P) made of 1/8"-thick hardboard (Fig. 5a).

Once the box is glued and screwed together, rout or sand chamfers around the inside and outside top edges.

And finally, install the L-hooks in the sides of the box (Fig. 4b) and hang the box on the pegboard.

In my shop, I build a wide variety of both small and large projects. So I thought it might be helpful to take a look at some of the clamps that I use for various jobs.

Of course, like any other tool, there are bound to be individual preferences. So I'll also try to point out some of the things I like (and dislike) so that you can make your own decisions on what clamps are best for you.

LONG CLAMPS

Whether I'm gluing up a panel or assembling a carcass for a cabinet, I couldn't get by without an assortment of long clamps.

PIPE CLAMPS. For edge-gluing, you want a clamp that's strong enough to pull slightly sprung boards straight and create tight glue joints. The clamps I use most often for this job are pipe clamps (upper clamp in *Fig. 1*). These are the kind that attach to a length of $\frac{1}{2}$ " or $\frac{3}{4}$ "-dia. black iron pipe.

Pipe clamps are fairly inexpensive. And because you buy the iron pipe sepa-

ately from the clamp fixture, it's easy to make up any length of clamp you want.

As much as I like pipe clamps, they do have a couple of drawbacks. First, because of the round profile of the pipe, the adjustable jaw has a habit of flopping out of line with the jaw at the end of the clamp. This is especially annoying when you're trying to clamp across the front of a wide cabinet or carcass.



But in my opinion, the biggest drawback to pipe clamps is their weight. So for large assembly jobs I like to use aluminum bar clamps.

ALUMINUM BAR CLAMPS. This type of clamp has a hollow bar of aluminum for the body (lower clamp in *Fig. 1*). They are sold in fixed lengths from 24" to 60".

Since the bar is rectangular in cross section, the jaws always stay in alignment with each other.

But there are a couple of reasons not to rely solely on aluminum bar clamps. The first is cost — nearly twice as much as pipe clamps (even when you add in the cost of the pipe).

Secondly, the aluminum bar tends to flex under heavy clamping pressure, more so than iron pipe.

LOCKING MECHANISMS. One other thing I find a little frustrating on the aluminum clamps is the locking mechanism used on the adjustable jaw. With pipe clamps, the adjustable jaw uses a spring and a stack of clutch "discs" to grip the pipe and lock the jaw in place (*Fig. 1a*). All you have to do is depress the spring and slide the jaw along the pipe to exactly where you want it.

But the aluminum bar clamps use a spring-loaded pawl that locks into a row of notches. The problem is that I usually have to adjust the screw on the clamp head so the pawl doesn't end up in between two of the notches.

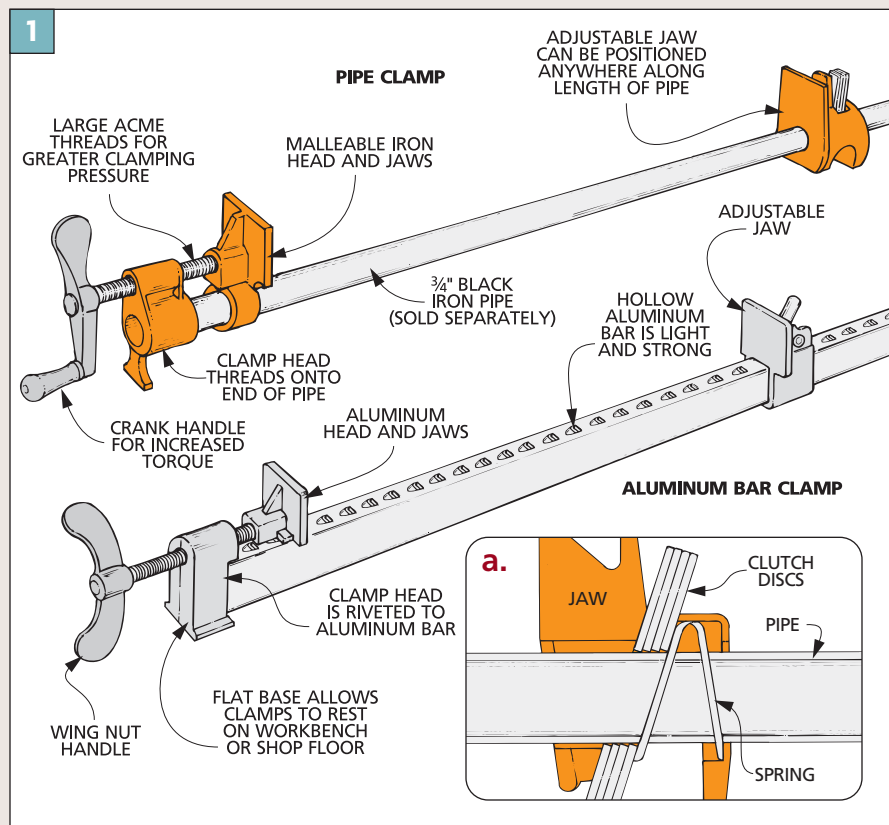
SHORT CLAMPS

If I could only have one type of clamp in my shop, I'd choose clamps like the ones shown in *Fig. 2*. This style of bar clamp is sometimes referred to as an "F-clamp" because of its shape. I use them on just about every project I build.

They come in a range of lengths (6" to 36"). But the ones I use the most are the 6" and 12" sizes.

F-clamps are used pretty much the same way as C-clamps. But instead of a fixed, one-piece frame, an F-clamp has an adjustable jaw that slides along a steel bar (*Fig. 2*). This makes them a lot quicker and easier to adjust.

HEAVY-DUTY CLAMPS. As soon as you pick up one of the heavy-duty clamps (upper clamp in *Fig. 2*), you can



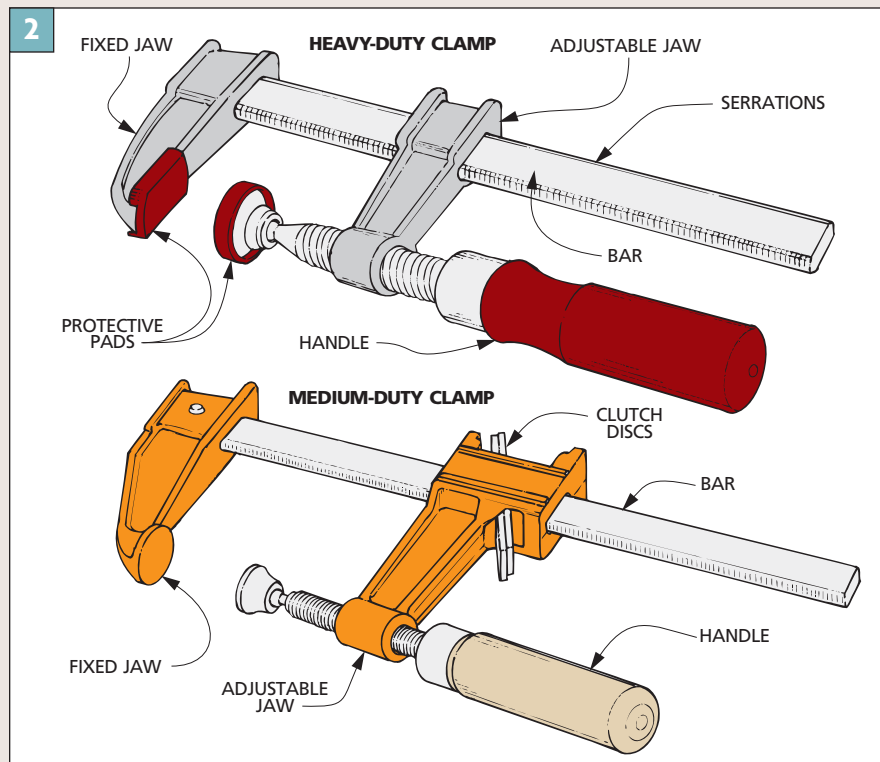
see why they're a favorite in my shop. The iron jaws are stout and heavy. The screw has large, square Acme threads, which are stronger than conventional V-threads. And the jaws are even fitted with plastic protector pads to prevent marring your workpiece.

In addition to these features, I like the quick-adjust mechanism of the jaws. It allows you to adjust the clamp by just slightly cocking the jaw forward and then sliding it along the bar. When you let go, the jaw (usually) locks in place.

MEDIUM-DUTY CLAMPS. You won't have to worry about the jaw of a medium-duty clamp sliding down the bar (lower clamp in *Fig. 2*). That's because this clamp uses the same type of multiple-disc clutch system that's used on pipe clamps.

Even so, the medium-duty clamps just don't have the muscle of the heavy-duty clamps. The jaw castings and the steel bar are smaller and lighter. I also find it difficult to get a good grip on the small handle of these clamps.

CLAMP-BUYING STRATEGY. So how many (and what type) of clamps do you really need? If I were starting over from scratch, first I'd buy 12 heavy-duty F-clamps — in the 6" and 12"



sizes. (I'd probably throw in a pair of 18-inchers just for good measure.)

Then I'd buy at least a couple of pipe clamps and a pair of 36" or 48" alu-

minum bar clamps. This is a good, all-around assortment to start with. Later, you can always add more clamps as your budget allows.

SIX MORE CLAMPS FOR YOUR SHOP



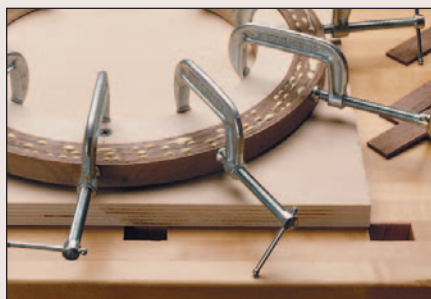
Spring Clamp. These are handy for holding small, delicate pieces that might be crushed by heavier clamps.



Pistol-grip Clamp. One-handed operation gives you a "third hand." But it lacks the strength of a regular bar clamp.



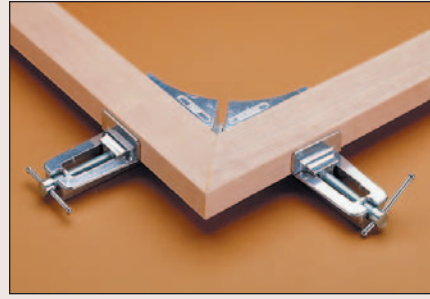
Band Clamp. For clamping up odd-shaped or cylindrical assemblies, band clamps work where other clamps can't.



C-Clamp. Use C-clamps for maximum torque on a concentrated spot. They're also useful for reaching into tight spots.



Hand Screw. I like to have a couple of hand screws around for holding small pieces while drilling on a drill press.



Corner Clamp. If you're making picture frames, you might want to consider a specialty clamp such as this one.

Band Clamp

There are some clamping jobs where regular bar clamps just won't work. In those cases, a band clamp is what you need. A simple design makes this shop-built Band Clamp as easy to build as it is to use.



One thing is for sure. I couldn't get along without this shop-made Band Clamp. It may not look like a typical clamp, but it can do jobs that any other clamp can't.

For example, it's great for clamping mitered frames (see photo). With just one clamp, I can pull all four corners closed at once without having them slip out of alignment.

By using several Band Clamps, it's easy to clamp taller mitered boxes and cabinets (refer to the photo in the Technique box on page 25).

And still another job where a band clamp excels is when clamping odd-shaped projects like the one shown in the photo at the bottom of page 21.

WEBBED BAND. The heart of the clamp is a webbed nylon band that passes through an eye bolt in the body of the clamp. Once the band is wrapped around the project, a couple of metal rings secure the loose ends and allow you to take up most of the slack.

Then, by tightening a wing nut against the body of the clamp, the eye bolt pulls the band tight. (I used a large plastic wing nut so I could get plenty of leverage.) The angled "jaw" at the front of the clamp captures the corner of the project and closes the joint tightly.

The size of the project you can clamp is limited only by the length of the band. (The bands can be found at hardware stores and home centers.) In fact, I keep

several lengths on hand so I can clamp projects of different sizes without having to deal with miles of excess band.

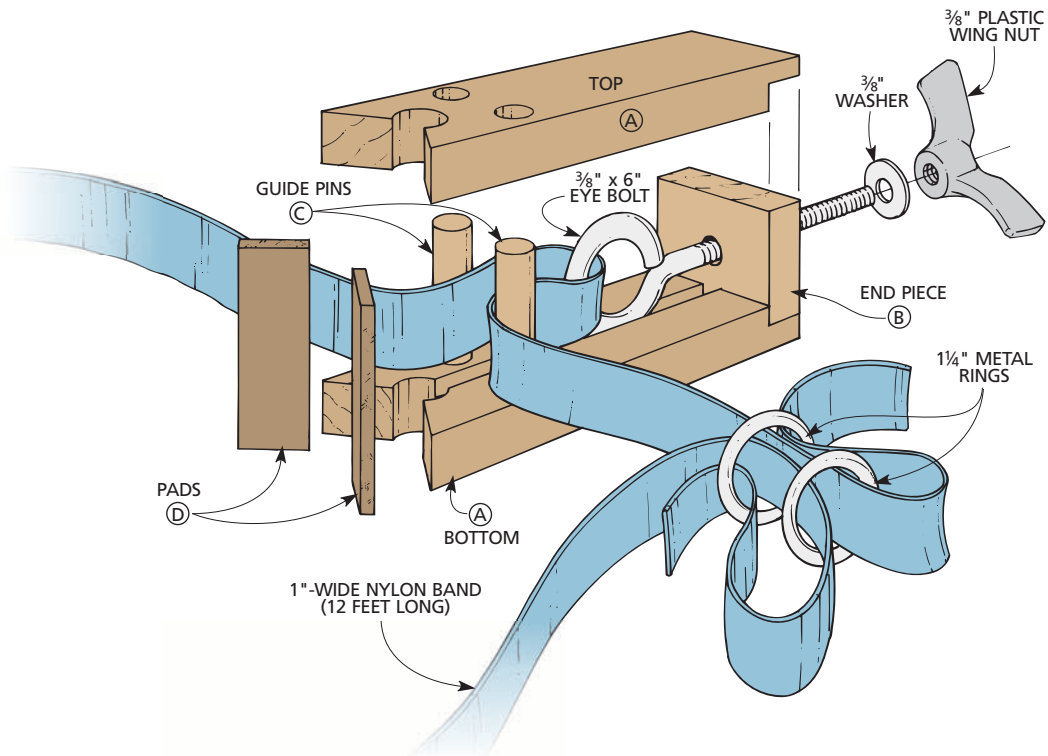
QUICK TO MAKE. Best of all, you can make several of these clamps in just an hour or two. But don't let that fool you. It's a heavy-duty clamp that can apply plenty of even pressure on large projects. And its unique design allows you to apply only the pressure you need when it's time to clamp small projects.

CORNER BLOCKS. With just a simple modification to the clamp, you can make a set of Corner Blocks that make it easier to close miter joints and protect corners from being crushed. The details about this are in the Designer's Notebook on page 24.

EXPLODED VIEW

OVERALL DIMENSIONS:

2 1/4" W x 8 5/8" D x 3 1/4" H



MATERIALS LIST

WOOD

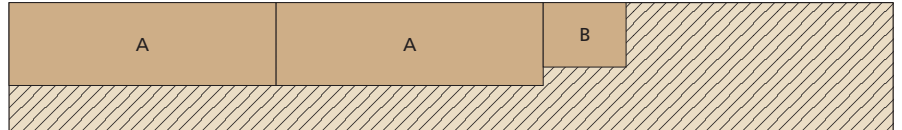
- A** Top/Bottom (2) 3/4 x 2 1/4 - 7 1/4
- B** End Piece (1) 3/4 x 1 3/4 - 2 1/4
- C** Guide Pins (2) 1/2 dowel - 2 5/8
- D** Pads (2) 1/4 hdbd. - 1 1/8 x 2 5/8

HARDWARE SUPPLIES

- (1) 3/8" x 6" eye bolt
- (1) 3/8" washer
- (1) 3/8" plastic wing nut
- (1) 1"-wide nylon band (12' long)
- (2) 1 1/4"-dia. metal rings

CUTTING DIAGRAM

3/4 x 3 1/2 - 24 (.6 Bd. Ft.)



NOTE: ALSO NEED 6" LENGTH OF 1/2"-DIA. DOWEL FOR PART C, AND SCRAP PIECE OF 1/4" HARDBOARD FOR PART D.

1

NOTE:
TOP AND BOTTOM
ARE $\frac{3}{4}$ "-THICK
HARDWOOD

a.

NOTE: USE AUXILIARY FENCE
ATTACHED TO MITER GAUGE
TO SUPPORT WORKPIECE

NOTE:
CUT JAWS
IN TWO
PASSES

WASTE

TILT SAW
BLADE
TO 45°

NOTE:
FASTEN PIECES
TOGETHER WITH
CARPET TAPE

DRILL $\frac{1}{2}$ "-DIA.
HOLE

DRILL $\frac{3}{4}$ "-
DIA. HOLE

TOP/BOTTOM

A

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BODY

The wood body of the clamp houses the clamp mechanism. And its V-shaped jaws help position the clamp on the corner of a workpiece.

SIDES. The body starts out as a hardwood top and bottom (A) (Fig. 1). Each piece has three holes in it. To ensure that all these holes aligned, I fastened the top and bottom pieces together with carpet tape before drilling the holes.

Two of the holes are sized to fit a pair of $\frac{1}{2}$ "-dia. dowels (added later). And a larger hole towards the end creates a curved opening at the corner of the jaws. This keeps all the stress from concentrating at one point when the clamp is tightened. It also serves as a "relief" for glue squeeze-out.

JAWS. After drilling the holes, you can cut the jaws. (I left the pieces taped together.) What I found worked best was to tilt the blade on the table saw to 45° and make two passes (Fig. 1a). I fastened a stop block to an auxiliary fence on the miter gauge so that the jaws would end up symmetrical.

GROOVES. To provide a "track" for an eye bolt that's part of the clamp mechanism, the next step is to cut grooves in the top and bottom (Figs. 2 and 4). These grooves keep the eye bolt from turning as the wing nut is tightened. You can cut the grooves with a dado blade in the table saw or with a straight bit in the router table.

You'll also need to cut a rabbet on one end of each piece to accept an end piece that's added next (Figs. 3 and 4).

END PIECE. The end piece (B) is just a block of $\frac{3}{4}$ "-thick hardwood with a centered hole drilled in it to accept the eye bolt (added later) (Fig. 4). But before gluing the end piece in place, there's one more thing to do.

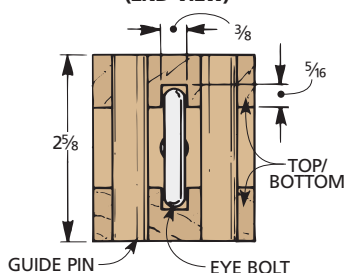
GUIDE PINS. To allow the band to cinch up tight, I added two guide pins (C) (Fig. 4). These pins are short hardwood dowels that fit in the holes drilled earlier in the top and bottom pieces. I cut these dowels a little long and sanded them flush after assembling the clamp.

When installing the guide pins, it's easiest to glue them into the bottom first (Fig. 4). Then just glue the end piece and the top in place.

PADS. One of the reasons I built this clamp is to help when I'm gluing up frames. To keep smaller frames from slipping through the opening between

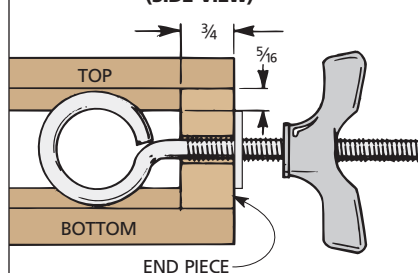
2

CROSS SECTION
(END VIEW)



3

CROSS SECTION
(SIDE VIEW)



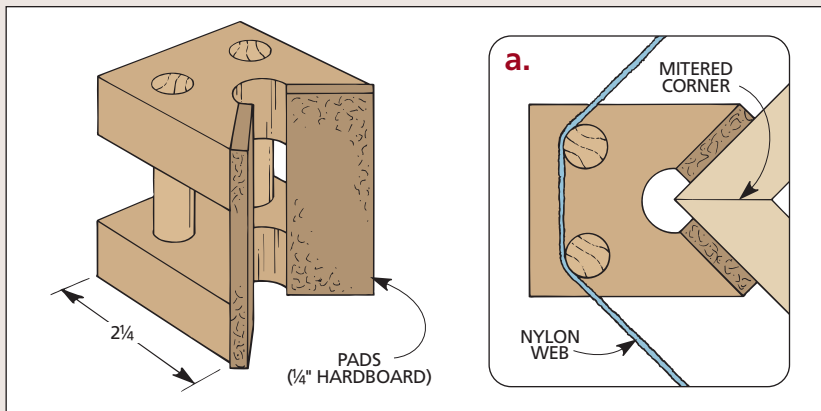
DESIGNER'S NOTEBOOK

CORNER BLOCKS

■ These Corner Blocks are useful accessories when you use the Band Clamp. They work especially well to keep miter joints tight and will also help square up assemblies as you tighten the clamps (see detail 'a').

■ The blocks are just shorter versions of the Band Clamp without the eye bolt, wing nut, or end piece.

■ When wrapping the assembly to be glued, position a block at each corner, then snug up the clamp.



The Band Clamps are really rather easy to use. The trickiest part may be feeding the strap through the metal rings. But even that's pretty easy. After you've done it a couple of times, it almost becomes second nature.

POSITION CLAMP. The first thing to do is position the clamp by one corner of the project. Back the wing nut to the tip of the eye bolt so you can get the eye as close as possible to the guide pins.

Then feed the band in front of one of the guide pins, through the eye bolt, and then around the other guide pin (refer to the Exploded View on page 23).

RINGS. The loose ends of the band are held by a couple of metal rings. (These rings can be found at hardware stores.) It works sort of like a buckle. After wrapping the band around the project, both ends of the band are fed through both rings. Then the band

comes back around the outside of the top ring before being fed back through the bottom ring (refer to the Exploded View on page 23). Give the ends of the band a good tug to take up most of the slack (see left photo below).

TIGHTEN BAND. If you've taken up most of the slack with the rings, all you have to do is turn the wing nut against the end piece to tighten the band around the project (right photo).



the jaws, I added a pair of pads (D) (Figs. 5 and 5a). These are just strips of 1/4"-thick hardboard that are glued onto the jaws and sanded flush.

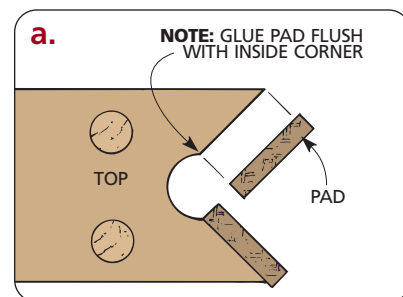
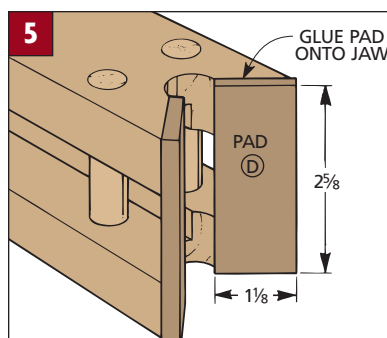
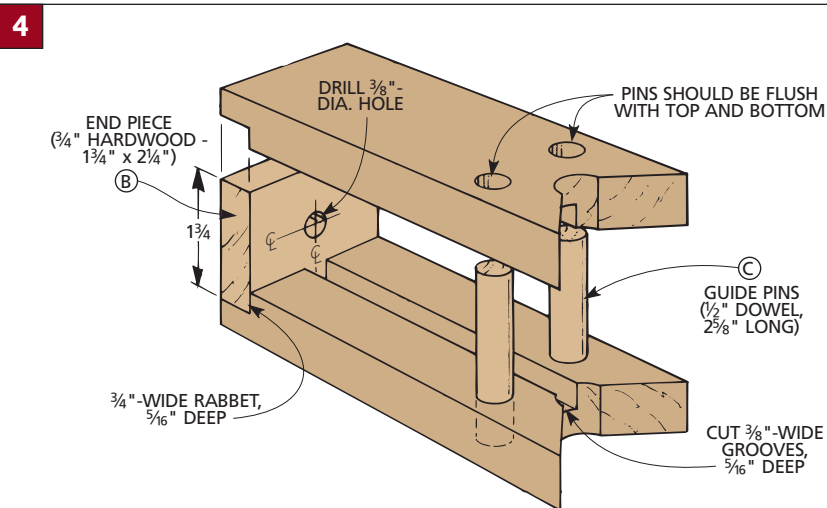
CLAMP MECHANISM

Now all that's left to complete the Band Clamp is to install the clamp mechanism. The key to this mechanism is an eye bolt that's inserted through the jaws of the clamp.

Here's how it works: the shank of the bolt passes through the hole in the end piece (Fig. 3). And the "eye" of the bolt rides in the grooves. When you slip on a washer and tighten a plastic wing nut against the end piece, it draws the bolt back and applies tension to the band.

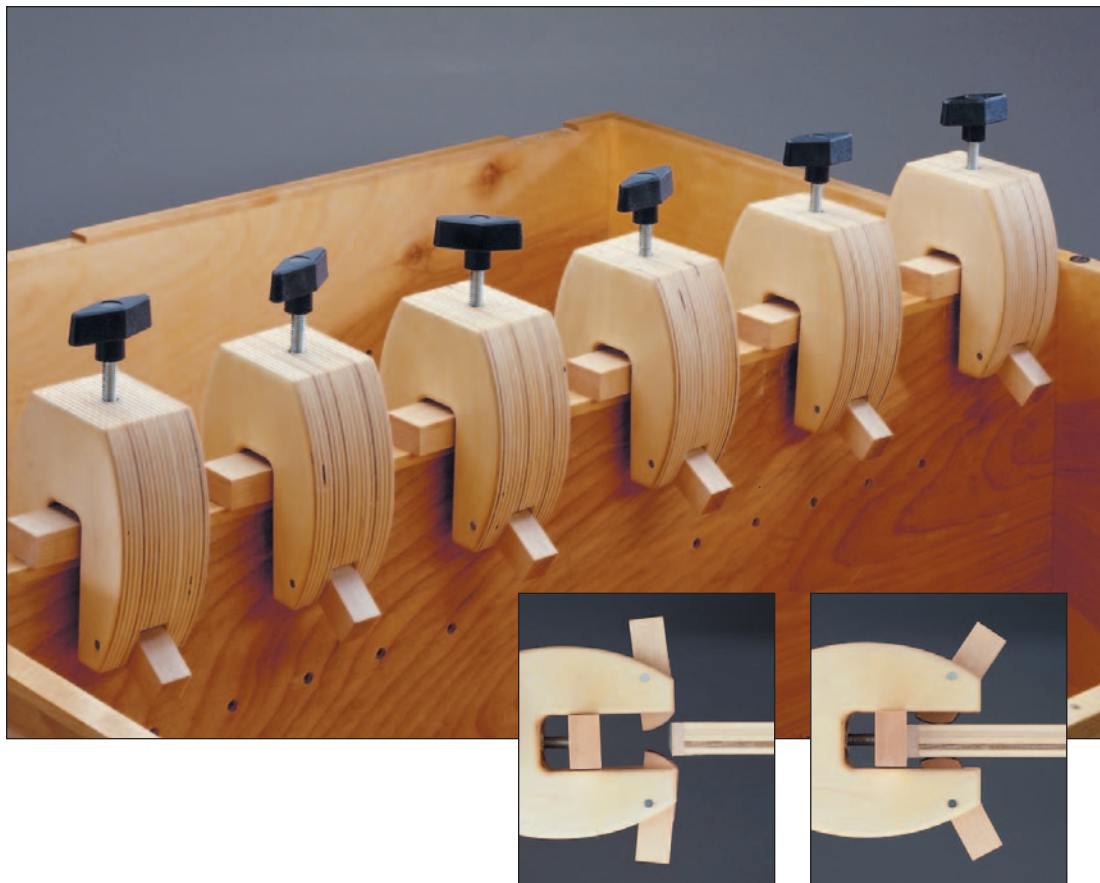
BAND. To make this work, a nylon band slips through the eye of the bolt and around the guide pins. The ends of the band are woven through a pair of metal rings (refer to the photo above and the Exploded View on page 23).

These rings let you snug up the band around the project, and then they hold tight when you apply pressure. When the pressure is released, the rings loosen. (For more on using the clamp, see the Technique box above.) ■



Edge Clamps

The unique design of these shop-made clamps makes it easy to apply hardwood edging. You decide how tightly the clamps grip the workpiece by adjusting the knobs.



Like most woodworkers, I've built quite a few projects that use $\frac{3}{4}$ " plywood. So covering the exposed edges of the plywood with strips of solid wood edging has become fairly routine.

In spite of that, gluing on these narrow strips of wood always seems to require more fiddling around and frustration than I'd like.

If it's a long piece of edging, for instance, I have to drag out an armload of heavy clamps to apply pressure along the entire length of the strip. And even then, trying to align the edging with one hand while positioning and tightening the clamps with the other is a bit tricky.

It's a race to see whether I run out of clamps or patience first.

To simplify this process, I built a set of six Edge Clamps. They're small, lightweight, and don't require a lot of materials. These clamps make it easy to align the edging and apply pressure at the same time.

FINGERS. The secret is a pair of pivoting "fingers" in a C-shaped body (see the inset photos above). When you slip the clamp in place, the fingers lightly grip the top and bottom surface of the plywood. Because of this, the clamp stays put. This lets you use both hands to position the edging.

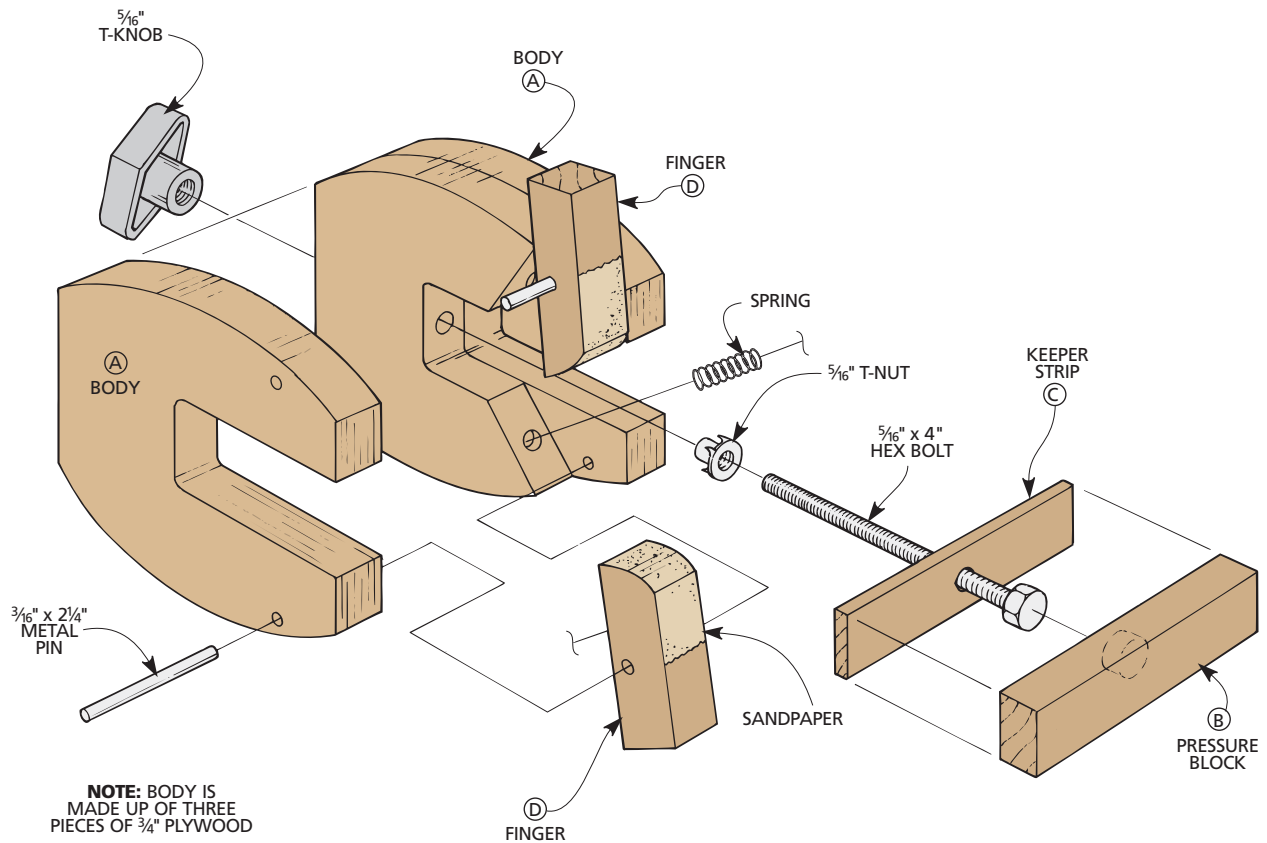
But that's not all the fingers do. The more you tighten the clamp, the harder they grip. (The end of each finger is covered with sandpaper for a sure grip.) This anchors the clamp on the plywood so it doesn't slip back once the pressure is applied to the edging.

ASSEMBLED CABINETS. There's one more nice thing about these clamps — they can be used in places a pipe clamp (or bar clamp) won't work. The cabinet shown in the main photo above is a good example. It's already assembled, and only one edge is accessible. But you can still fit the clamps over the "open" edge to apply the hardwood edging.

EXPLODED VIEW

OVERALL DIMENSIONS:

2¼W x 5D x 5½H



CUTTING DIAGRAM

MATERIALS LIST

WOOD

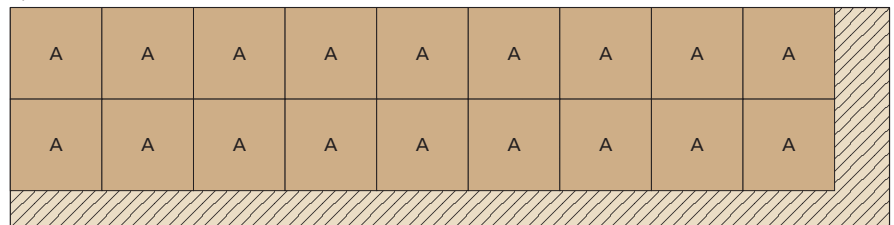
- A** Body Pieces (3) ¾ ply - 5 x 5
B Pressure Block (1) ½ x 1¾ - 4
C Keeper Strip (1) ¾ x 1¾ - 4
D Fingers (2) ¾ x 1½ - 2½

HARDWARE SUPPLIES

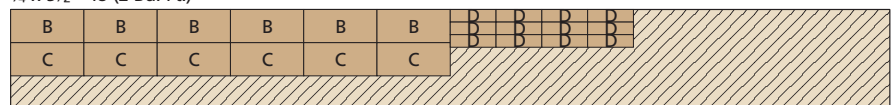
- (1) 5/16\" T-nut
 (1) 5/16\" x 4\" hex bolt (full thread)
 (1) 5/16\" T-knob
 (2) 3/8\" -O.D. x 1¾\" springs (.025\" wire dia.)
 (2) 3/16\" x 2¼\" metal pins

Note: Materials listed are for one clamp.

¾\" BALTIC BIRCH PLYWOOD - 12 x 48



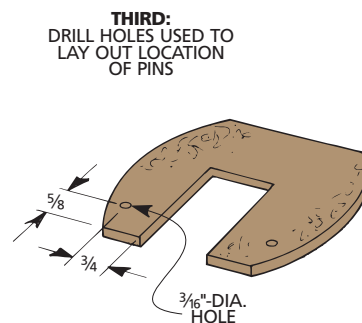
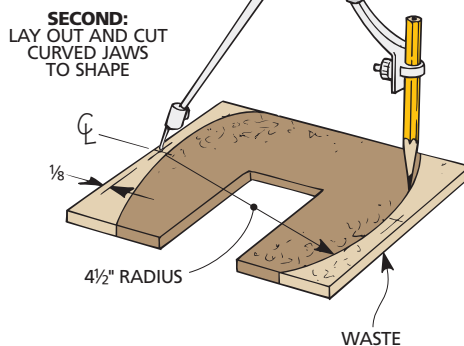
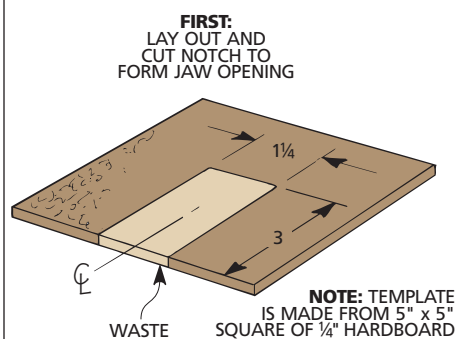
¾ x 5½ - 48 (2 Bd. Ft.)



NOTE: CUTTING DIAGRAM SHOWS PIECES FOR SIX CLAMPS.

1

CLAMP BODY TEMPLATE



BODY

The body of each clamp is a thick block made up of three layers of 3/4" plywood. Depending on the number of clamps you make, it may require cutting quite a few pieces to shape. (I needed eighteen pieces to build my six clamps.)

TEMPLATE. To do this quickly (and to ensure that all the pieces are identical), I started by making a hardboard template (*Step 1 in Fig. 1*). A wide notch in the template forms the "jaws." And there's a gentle curve on the outside edge of each jaw (*Step 2 in Fig. 1*).

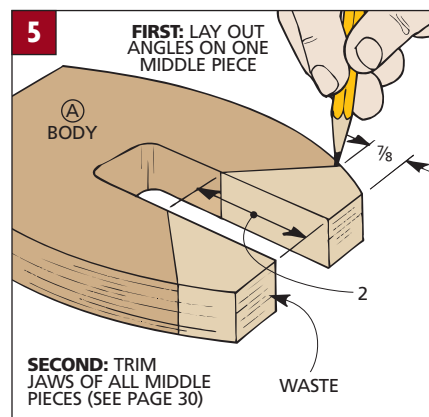
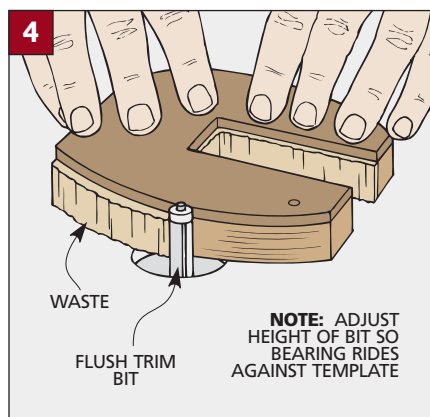
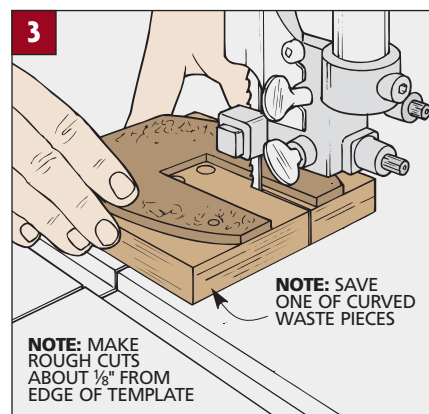
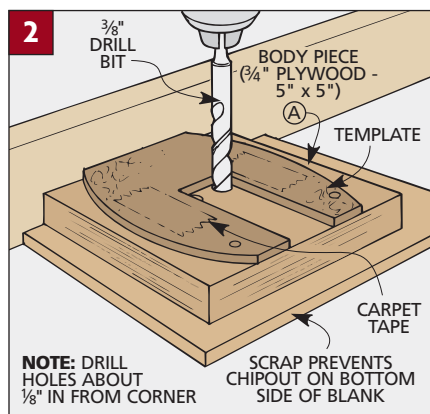
The thing to be aware of here is the template will be used when routing the pieces to shape. So any "bumps" in the edge of the template will transfer to the workpiece. To avoid this, I cut the template to rough shape on the band saw, then sanded up to the line.

Once the edges are smooth, you can drill a hole in each jaw (*Step 3 in Fig. 1*). These holes are used to locate two pivot pins (added later) for the fingers.

BLANKS. With the template complete, the next step is to cut as many blanks as you need for the pieces of the body (A). I used Baltic birch plywood and cut it into 5" x 5" squares.

There's no need to lay out the shape of the body on each blank. It's easier to fasten the template to the blank with carpet tape. But before cutting each blank to shape, it's a good idea to drill holes near the inside corners of the notch (*Fig. 2*). As you cut the piece to rough shape with a band saw (or jig saw), the holes provide clearance so you can "turn the corner" (*Fig. 3*).

Note: Save one of the curved waste pieces. It'll come in handy later when working on the middle body piece.



ROUT TO SHAPE. Now you're ready to rout the piece to final shape. This is where the time spent making the template pays off. With a flush trim bit in the router table, you can remove the excess waste in a matter of minutes (*Fig. 4*). Then you can remove the template and tape it to the next blank.

TRIM JAWS. After repeating this process to bring the rest of the blanks to shape, there's one more thing to do. To create an opening for the fingers, the jaws of the middle pieces *only* are trimmed at an angle.

But if you use the miter gauge on the table saw to do this, the curved edges of the pieces will rock when you set them against the miter gauge. The solution is a simple jig that uses the curved waste piece that was cut earlier (refer to the Shop Jig box on page 30). To set up this jig, you'll need to lay out the angled lines on one of the pieces first (*Fig. 5*).

GLUE-UP. Now it's just a matter of gluing up the body of each clamp. Here, an assembly jig made of scrap pieces keeps the edges aligned, as shown on the next page.

SHOP JIG Assembly Jig

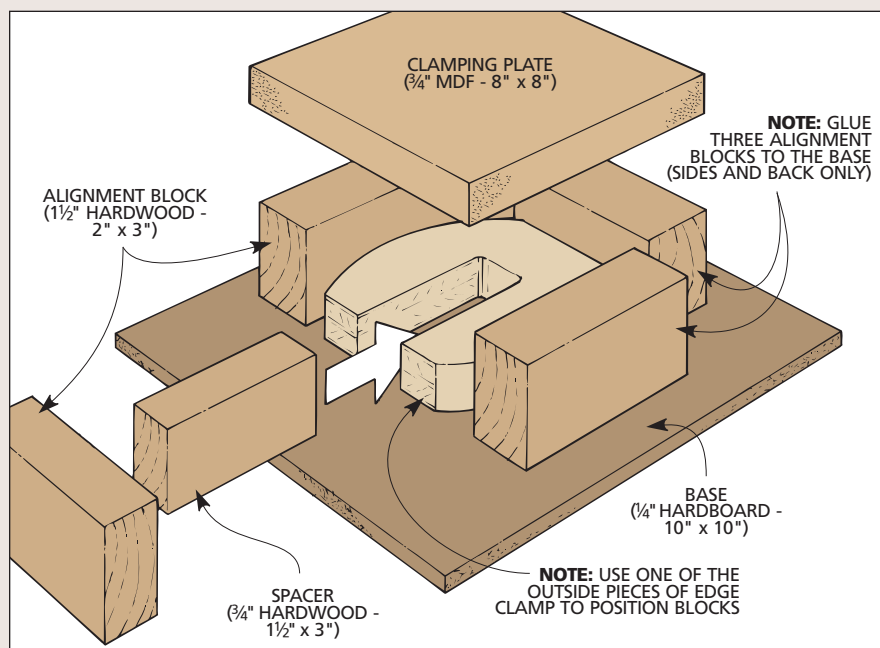
When it comes to gluing up workpieces face to face, I usually start with oversized pieces and then trim them to final size once the glue dries. But with the three pieces that make up the Edge Clamp, I started with workpieces already cut to final shape. So the problem is keeping the edges aligned as you clamp the pieces together.

ASSEMBLY JIG. To help keep everything aligned, I made a small assembly jig. The jig consists of a few simple parts: a hardboard base, a set of four alignment blocks, a wood spacer, and an MDF clamping plate (see drawing).

The purpose of the alignment blocks is to “corral” the workpieces. To make it easy to set the workpieces in place, only three of the alignment blocks are glued to the base of the assembly jig.

Note: I used one of the workpieces to help position the alignment blocks.

The fourth block serves two purposes. First, it keeps the outside edges aligned. And second, it pushes the spacer against the middle clamp piece to keep the notches in all three pieces properly aligned.



CLAMP ASSEMBLY. After the three fixed alignment blocks are glued in place, give everything a few coats of finish (polyurethane is a good choice) and a good coat of paste wax to keep

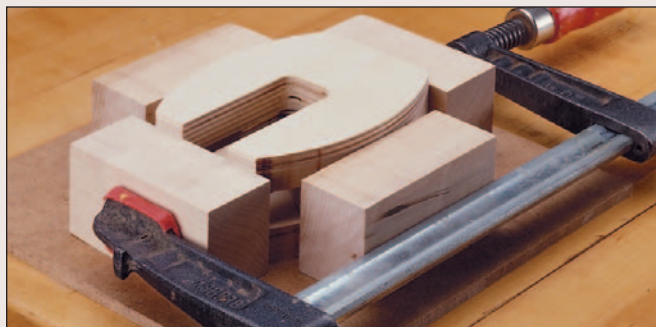
glue from sticking to the assembly jig. Once that's complete, gluing up the body of each Edge Clamp is a simple four-step process, as demonstrated in the photos below.



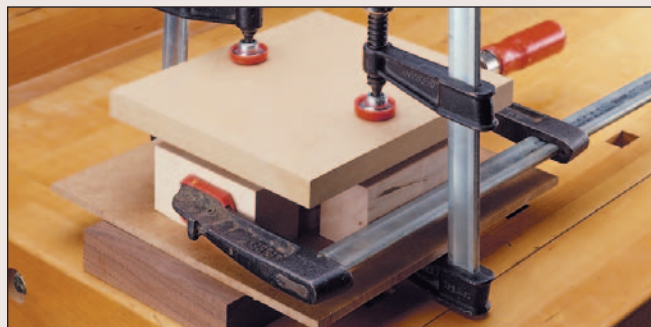
1 To assemble an Edge Clamp, start by applying glue on the mating faces of each workpiece. Then stack them in the assembly jig like a layer cake.



2 Next, slip a spacer between the jaws to prevent the middle piece from shifting. Then place the last alignment block against the ends of the clamps.



3 With the last block in place, clamp across the ends of the jig to prevent the workpieces from slipping out of alignment. Check that the inside edges of all three workpieces align.



4 Next, use a couple of small scraps to raise the jig off the bench. Then apply pressure to the entire assembly by clamping a scrap of MDF to the top of the jig.

To provide clearance for the fingers of the Edge Clamp, the jaws of the middle layer need to be angled.

MITERING JIG. To hold the rounded edge of the workpiece securely, I made a mitering jig for the table saw (see drawing). The jig consists of three parts: a fence that attaches to the miter gauge, a curved cradle to match the shape of the middle piece, and a stop.

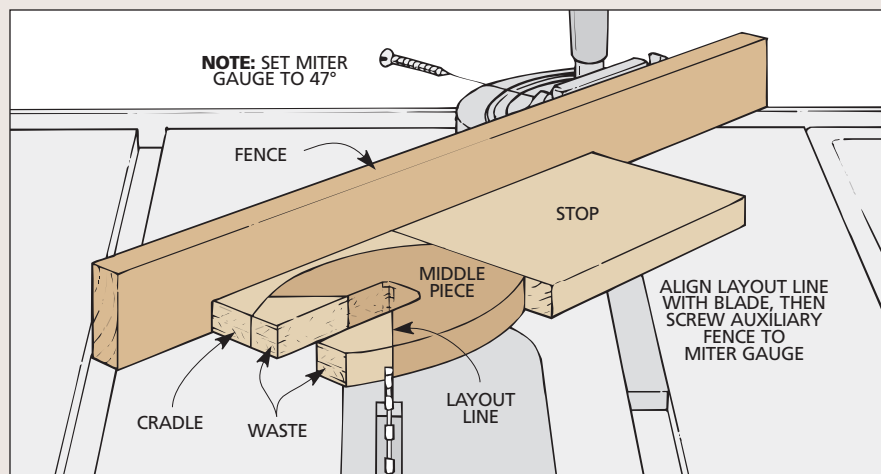
The cradle is one of the curved scraps from cutting the pieces to shape. The fence and stop are made from hardwood scraps. The stop and cradle are glued to the fence (see drawing).

SETUP. Before positioning the jig on the miter gauge, first you'll need to set the miter gauge to 47° to match the desired angle on the jaw. Then place the middle piece in the cradle with its back against the stop.

Once the piece is secure, slide the jig along the fence until the edge of the blade aligns with the waste side of the layout line (see drawing). Then secure

the fence to the miter gauge with a couple of screws.

When cutting the angle, be careful you don't cut into the opposite jaw.

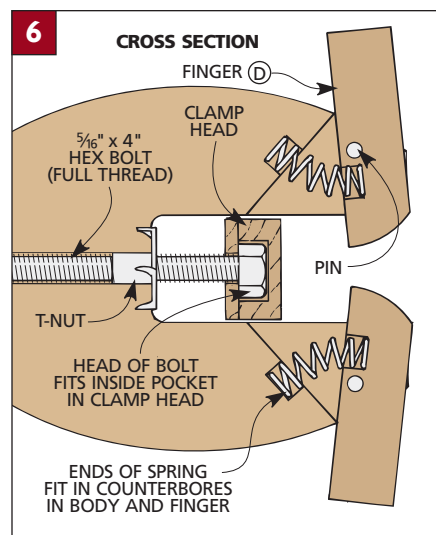


CLAMP HEAD

The clamp head is a hardwood block that distributes the clamping pressure. This pressure is applied by a hex-head bolt that threads into a T-nut in the body of the clamp (Fig. 6).

POCKET. But if the head of the bolt were left uncovered, it could mar the edging when the clamp is tightened. So it's enclosed in a "pocket" inside the clamp head (Fig. 6).

To create this pocket, the clamp head is made up of two pieces: a thick pressure block (B) and a thin keeper strip (C) (Fig. 7).



The bolt head sits in a counterbore that's centered in the pressure block. And a centered hole in the keeper strip fits over the threads of the bolt. Gluing the two pieces together captures the head of the bolt in the clamp head.

T-NUT. The next thing to do is to add the T-nut that accepts the bolt. It fits in a centered hole in the jaw opening. It's easiest to drill this hole from the back of the clamp (Fig. 7a). A piece of scrap in the opening will help reduce chipout.

After tapping the T-nut into place, just thread the bolt through it and out the opposite end. Then apply epoxy to the end of the bolt and thread on a plastic knob (Fig. 7).

FINGERS

Once the clamp head is installed, you're ready to add the fingers. They hold the clamp securely in place on the workpiece as pressure is applied.

PIVOTING FINGERS. To make this work, the fingers pivot back and forth like flippers on a pinball machine. When you slip the clamp over the edge of the workpiece, the curved ends of the fingers pivot in. This compresses a spring which exerts pressure in the opposite direction (Fig. 6). This pressure holds the clamp snug as you align the edging.

But the springs aren't strong enough to keep the clamp from slipping once

pressure is applied. That's why the ends of the fingers are curved. As you tighten the clamp, the fingers rock slightly on their curved ends and squeeze the plywood between them.

CONSTRUCTION. Each finger (D) starts out as a short block of hardwood (Fig. 8). To ensure that the curved ends are identical in shape, I butted the blocks together and marked a radius across each one (Fig. 8a).

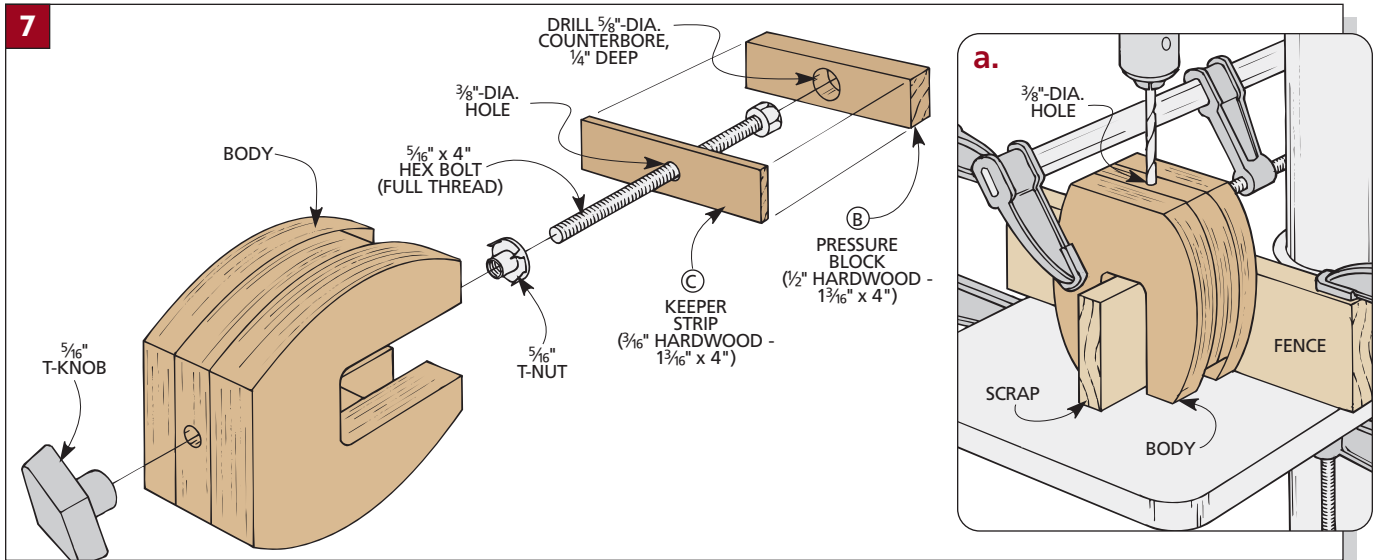
But why doesn't the finger just rotate around on the curved end as you tighten the clamp? Because of the location of a pin that's used as a pivot point for each finger (Fig. 6).

CAM. The key is to drill the holes for these pins so they're offset toward the inside edges of the fingers (Fig. 8). This way, the curved ends of the fingers act like cams — the more pressure you apply, the harder they grip.

In addition to the holes for the pivot pins, you'll also need a counterbore in each finger. It traps one end of the spring when the clamp is assembled.

The other end of the spring fits in another counterbore in the body of the clamp. It's located in the angled end of the middle piece. So to keep the tip of the bit from slipping, I "leveled" the drilling surface by clamping the body at an angle (Figs. 9 and 9a).

PIVOT PINS. Before assembling the clamp, you'll also need to drill a hole



through each jaw to accept the pivot pins. The best way to locate these holes is to use the template once again.

Start by aligning the template with the edges of the body. Then, to mark the centerpoints, tap a $\frac{3}{16}$ " brad point bit through the holes in the template.

Next, to reduce chipout, cut a scrap to fit between the jaws (Fig. 10). Two more scraps support the body so it sits level while you drill the holes.

PINS. Now you're ready to add the pins. These are pieces of metal rod that

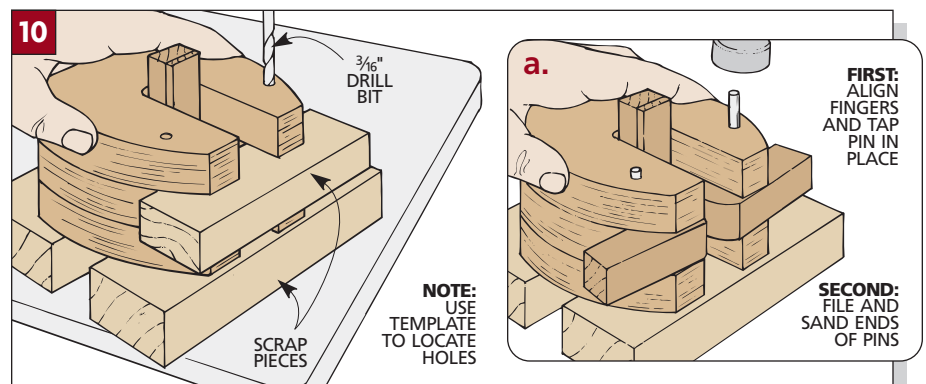
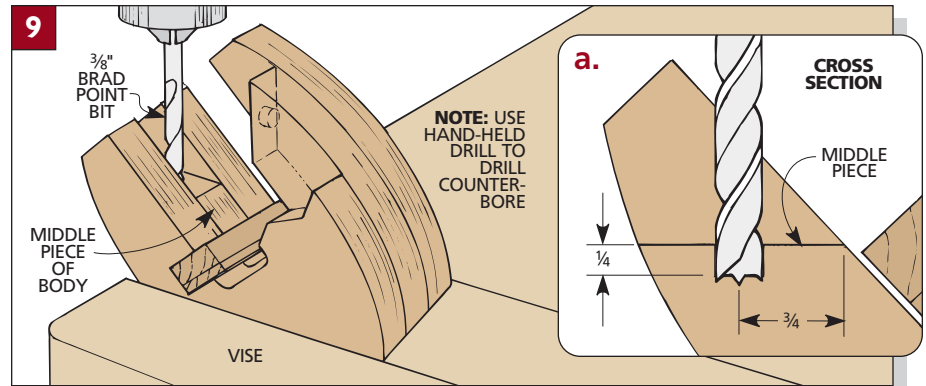
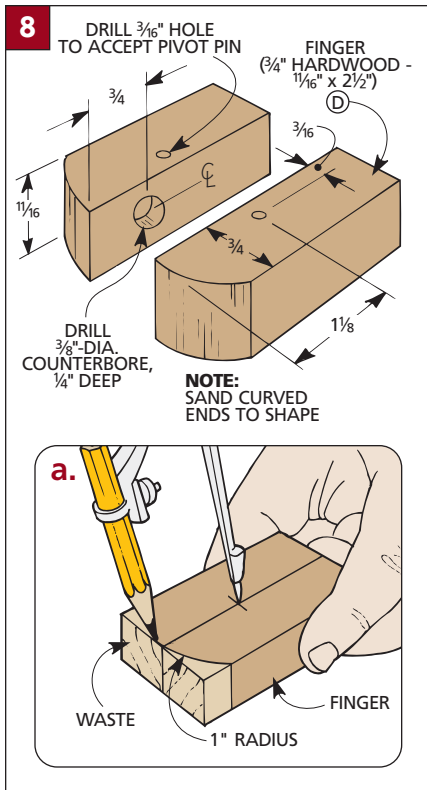
are cut $\frac{1}{8}$ " longer than the height (thickness) of the body.

Before installing the pins, make sure the springs are in place and that the holes in the fingers align with the holes in the body. Then just set the clamp on a couple of scraps to provide clearance, and tap the pins into place (Fig. 10a).

SANDPAPER. After filing and sanding the pins flush, all that's left is to glue a piece of sandpaper to each finger to improve its "grip." (I cut strips from an old belt sander belt.)



To produce a no-slip surface, glue strips of cloth-backed sandpaper (100-grit) to the ends of the curved fingers.



WOODWORKER'S NOTEBOOK

The fingers of the Edge Clamps on the previous pages are a type of cam. Since cams apply pressure quickly and firmly, this makes them perfect for shop-built clamps like this one.

CAM PANEL CLAMP

■ This clamp provides clamping pressure by using cams to press the workpieces against a stop block (see photo).

■ The clamp consists of only three parts (plus hardware): an arm, an adjustable stop block, and the cam (Fig. 1). I made all of the pieces from hard maple for strength and durability.

■ The first thing to do is to cut the arms to size. (I made three clamps.) You can make the arms as long as you need for the type of glue-ups you do.

■ Then, to speed up the process of drilling the holes that accept the bolt for the stop block, I fastened the blanks together with carpet tape and drilled through all three pieces at once.

■ Next, the stop blocks can be cut to size from hardwood. Note that these pieces are *not* square (Fig. 2).



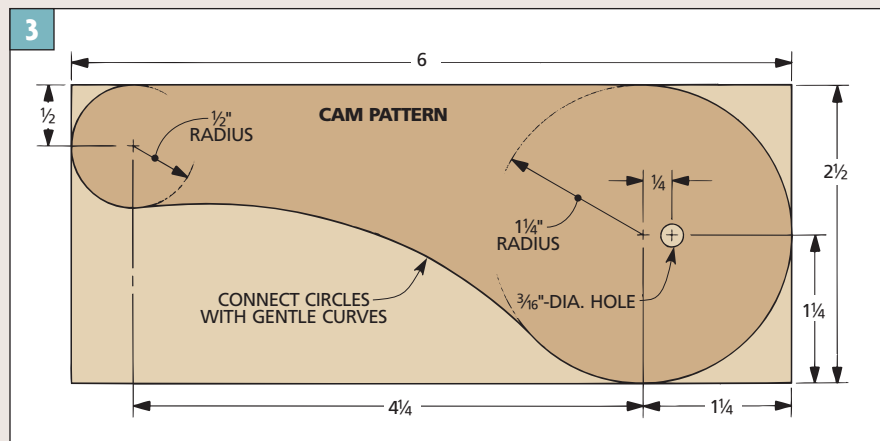
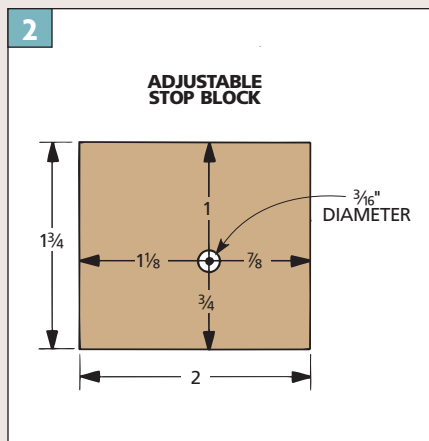
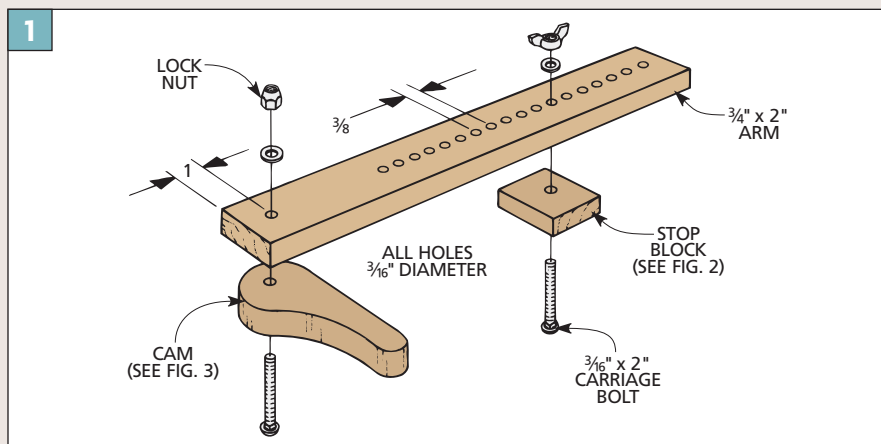
■ Carefully lay out and drill the hole in the stop block (Fig. 2).

■ With the stop block completed, you can move on to the cams. Cut the cams to shape using the pattern in Fig. 3.

■ Finally, you can assemble the pieces with the hardware (Fig. 1). A lock nut is used to secure the carriage bolt through the cam. On the stop block, a wing nut is used to secure the carriage bolt. This makes it easy to adjust the block if necessary.

■ The stop block is adjustable two ways. First, it can be positioned in any one of a number of holes in the arm. And, for fine adjustment, the block itself is adjustable — the hole for the bolt is carefully located off-center (Fig. 2). This way, by rotating the block you can slightly increase or decrease the distance between the block and cam.

■ If the cam doesn't exert quite enough pressure against the stock, you can make a slight adjustment by rotating the block to the next tighter position.



Clamping Station

Much more than just a place to glue up perfectly flat panels, this project converts into an assembly table. Plus it provides space to store your clamps when they're not in use.



Until recently, whenever I had to glue up a large panel or frame, the first thing I had to do was clear out a large area on the shop floor. It was the only flat surface I had in the shop that wasn't already crowded with tools or half-finished projects.

But bending over to get the boards aligned and clamps tightened got to be a pain in the back. It was time to design a working-height Clamping Station.

TABLE DESIGN. The Clamping Station is just a wood frame with four legs. But there are a couple of special features.

CLAMP CRADLES. First, the ends of each pipe clamp are attached to cradles

that hold the clamp heads upright, so there's no fumbling around when you're ready to start gluing. The cradles also slide from side to side in rabbets built into the table frame. That way you can put the clamps exactly where they're needed for a glue-up.

SUPPORT RAILS. Another feature of this Clamping Station is the support rails. These rails raise the workpiece off the pipe clamps just enough so the edges of the boards are centered on the clamp screws. This gives a direct line of pressure from the clamps so the panel is glued up flat. It also prevents any chance of the pipes staining the panel.

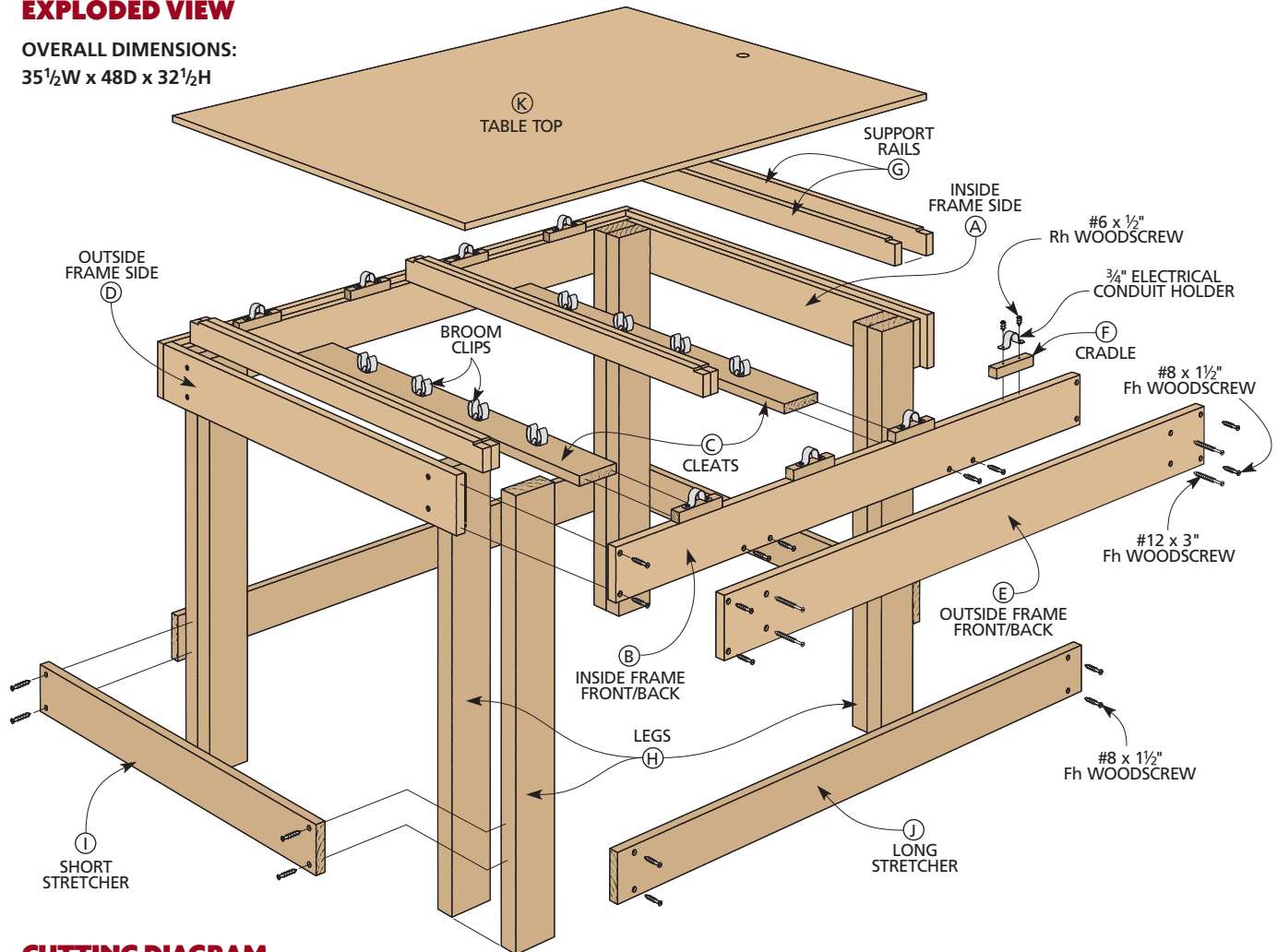
FLOOR-STANDING OR HINGED. If floor space in your shop is too limited for the floor-standing version, the table can be hinged to the wall so it swings up out of the way. See the Designer's Notebook on page 36 for details about this option.

ASSEMBLY AREA. You can also use this table for more than just glue-ups. By adding a plywood top, the table converts to a good-sized work surface (see inset photo). And when you're not gluing boards together, the pipe clamps can be stored inside the table.

EXPLODED VIEW

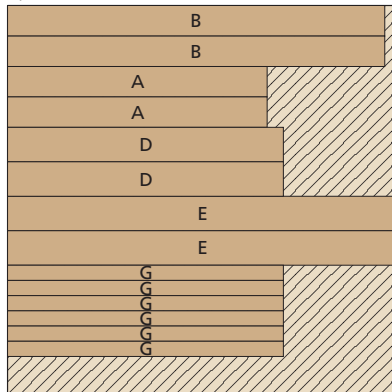
OVERALL DIMENSIONS:

35½" W x 48" D x 32½" H



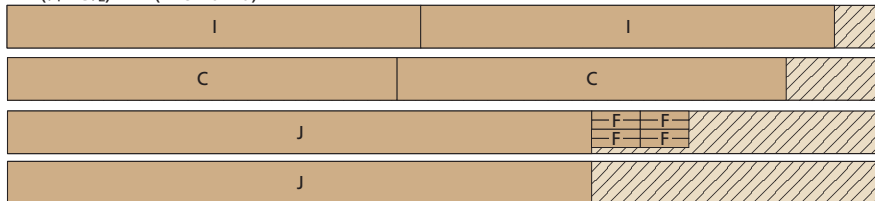
CUTTING DIAGRAM

¾" PLYWOOD - 48 x 48



NOTE: ALSO NEED 36" x 48" PIECE OF ½" PLYWOOD FOR PART K

1x4 (¾ x 3½) - 72 (1.75 Bd. Ft.)



2x4 (1½ x 3½) - 72 (Four Boards @ 2.7 Bd. Ft. Each)



MATERIALS LIST

WOOD

A In. Frame Sides (2)	¾ ply - 3¾ x 32½
B In. Frame Fr./Bk. (2)	¾ ply - 3¾ x 46½
C Cleats (2)	¾ x 3½ - 32½
D Out. Frame Sides (2)	¾ ply - 4¼ x 34
E Out. Frame Fr./Bk. (2)	¾ ply - 4¼ x 48
F Cradles (8)	¾ x ¾ - 4
G Support Rails (3)	1½ ply - 1⅞ x 34
H Legs (4)	3 x 3½ - 32
I Short Stretchers (2)	¾ x 3½ - 32½
J Long Stretchers (2)	¾ x 3½ - 45½
K Table Top (1)	½ ply - 34 x 46½

HARDWARE SUPPLIES

(16) No. 6 x ½" Rh woodscrews
 (40) No. 8 x 1½" Fh woodscrews
 (8) No. 12 x 3" Fh woodscrews
 (8) ¾" electrical conduit holders
 (8) Broom clips w/ screws

TOP FRAME

The heart of the Clamping Station is the top frame. It acts like a third hand to hold the pipe clamps in place during a glue-up. And between jobs, the station provides a space to store clamps.

I made the top frame wide enough to hold 36"-long pipe clamps, and long enough to glue up a 48"-long panel. (You can easily adjust the dimensions if you need a larger or smaller table.)

The top frame actually consists of two frames, one inside the other. Since the outside frame is taller, this creates a rabbet around the inside edge (refer to *Fig. 2a*). This rabbet holds the clamp cradles and support rails (added later).

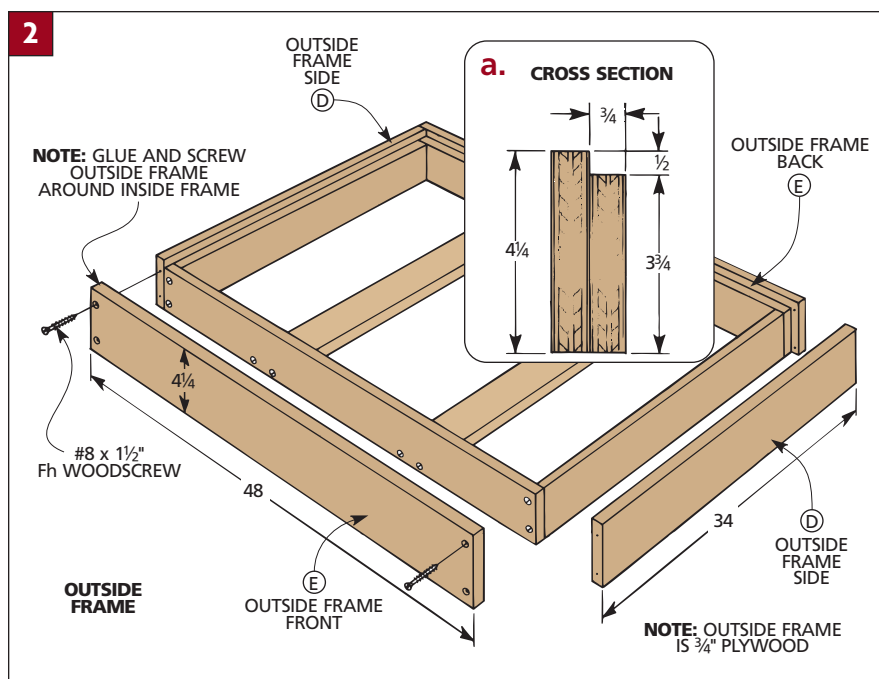
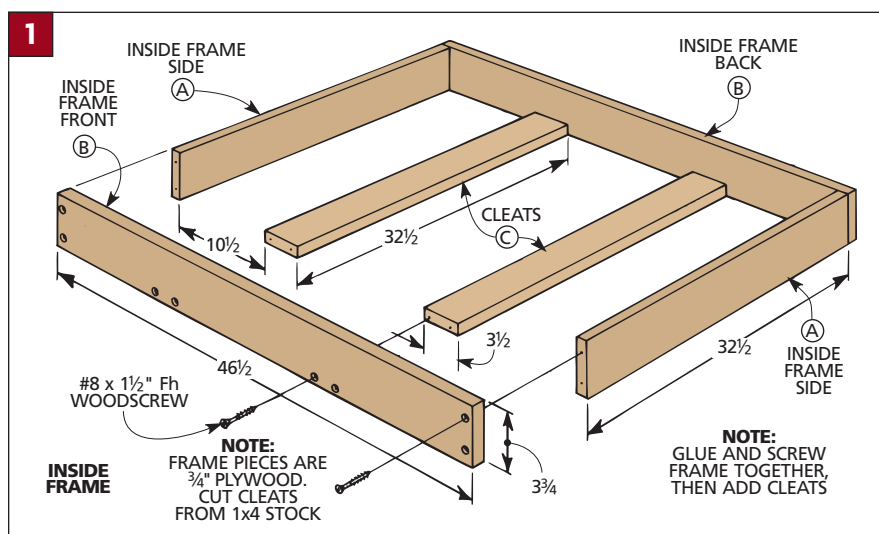
Note: I used $\frac{3}{4}$ " plywood to build both frames. If these frames were made out of solid wood, they could warp and transfer a twist to the workpiece.

INSIDE FRAME. To build the inside frame, start by cutting the sides (A) and the front and back pieces (B) to size (*Fig. 1*). The four pieces are glued and screwed together with simple butt joints. (Make sure the assembly is flat.)

Then to keep the table from racking, I added two cleats (C) across the center (*Fig. 1*). I cut these pieces from a 1x4.

OUTSIDE FRAME. Now you can start work on the outside frame. To create the rabbet, the four outside frame pieces (D, E) are cut $\frac{1}{2}$ " wider than the inside frame (*Fig. 2a*). Then glue and screw these pieces around the inside frame so their bottom edges are flush (*Fig. 2*).

That's all there is to building the frame, so now you can start work on the cradles that hold the pipe clamps.

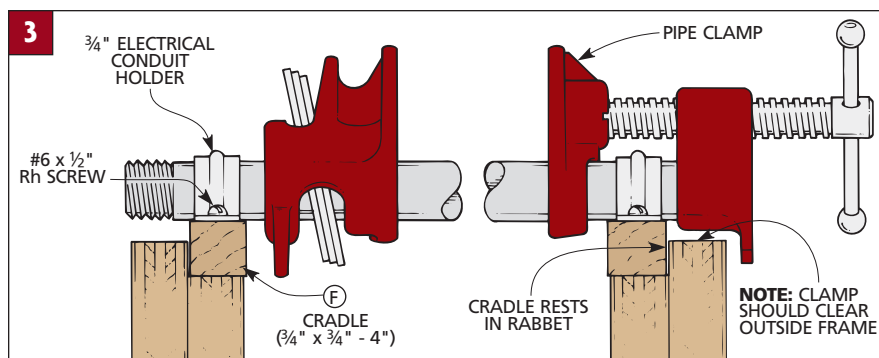


CRADLES

One of the most frustrating things about using pipe clamps is that the clamp heads always seem to fall over just when you're ready to tighten the screws. That's one of the problems I solved with the Clamping Station.

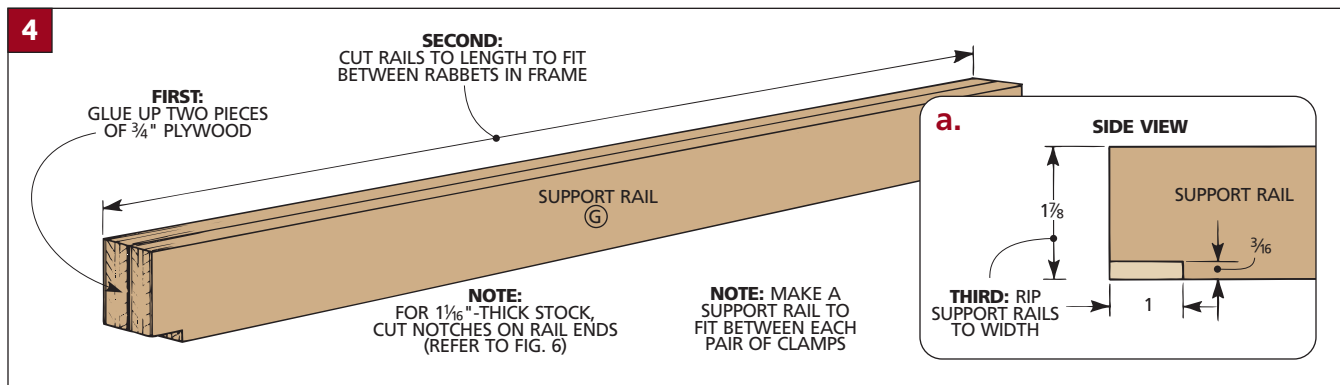
To hold the clamp heads upright, I made two cradles (F) for each clamp. The cradles are just wood blocks with electrical conduit holders screwed to them (*Fig. 3*). The blocks just need to be tall enough so the clamp heads clear the top edge of the frame.

Note: On the clamp head, you'll need to slip the conduit holder between the pipe and the screw before fastening the holder to the cradle (*Fig. 3*).



The cradles rest in the rabbet on the inside edge of the top frame. They're not fastened to the frame. This allows you to slide the clamps from side to side for panels of various lengths.

Note: You don't have to use the whole Clamping Station to take advantage of the cradles. They work great on any flat surface to hold the clamp heads upright as you're gluing up a panel.



SUPPORT RAILS

One unique feature of this Clamping Station is the support rails. The purpose of these rails is to raise the boards so they're centered on the clamp screw (refer to *Figs. 5 and 6*).

Why not just lay the boards directly on the pipes? Because as a pipe clamp is

tightened, the pipe starts to bow up in the middle. If the boards are sitting on the pipe, they will "copy" this same bow.

SOLUTION. So how do you prevent this from happening? There's really nothing you can do to prevent the pipe from bowing. The problem is "built into" the clamps. But you can raise the workpiece off the pipes.

SUPPORT RAILS. That's where the support rails come in. They elevate the boards above the pipes so the bow in the pipe can't transfer to the workpiece.

Making the support rails (G) is easy. Just glue up two pieces of $\frac{3}{4}$ " plywood face to face, and then cut this blank to length to fit between the rabbets in the top frame (*Fig. 5*).

DESIGNER'S NOTEBOOK

Since this version of the station folds against the wall, it won't take up valuable floor space.

FOLD-UP CLAMPING STATION

■ Before starting on the fold-up version, you'll need to choose the spot where it will go in your shop. To allow the station to fold up, you'll need clearance on the wall above the cleat. For this version (with 32"-high legs), you'll need a ceiling clearance of 81".

■ The top frame is the same as the regular Clamping Station.

■ Since one end of this design is fastened to the wall, only two legs are needed (see drawing). Each leg is a 32"-length of 2x4 that's bolted to the *outside* of the top frame (details 'b' and 'c').

■ When securing the legs to the table, don't tighten the bolts too much. The legs need to pivot and swing toward the wall when the table is stored.

■ Since there are only two legs, you'll only need one stretcher (see drawing).

■ To mount the table to the wall, first screw the wall cleat (L) in place. Position the cleat so that the table top will be level when it's in the down position. (Make sure you screw into studs.)

■ Now fasten the hinges to the table and screw the table to the cleat (detail 'a').

■ Finally, add a hook and eye to store the Clamping Station in the up position.

MATERIALS LIST

CHANGED PARTS

H Legs (2)	$1\frac{1}{2} \times 3\frac{1}{2}$ - 32
I Stretcher (1)	$\frac{3}{4} \times 3\frac{1}{2}$ - 32 $\frac{1}{2}$

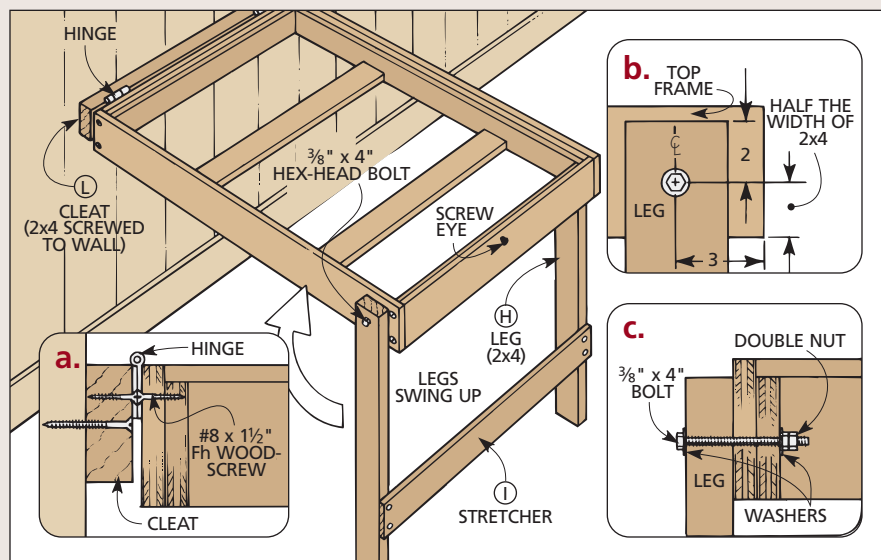
NEW PART

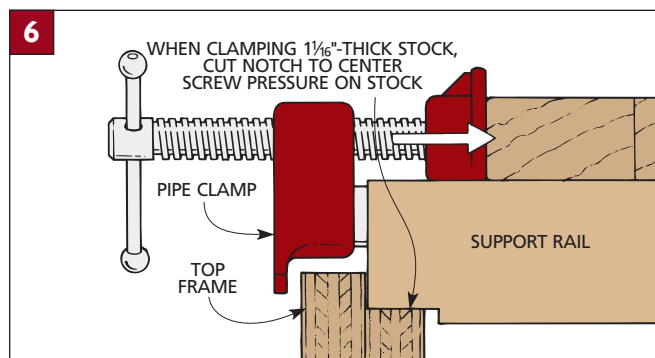
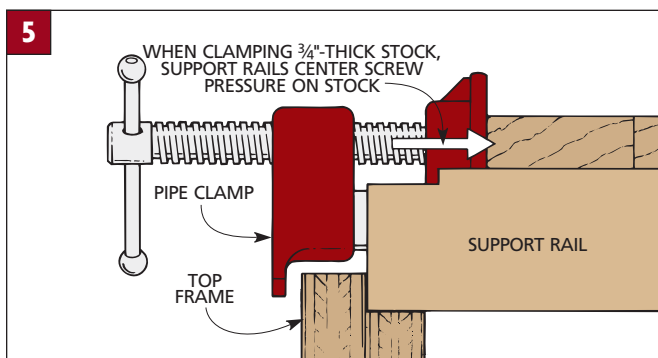
L Wall Cleat (1)	$1\frac{1}{2} \times 3\frac{1}{2}$ - 34
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Note: Don't need part J.

HARDWARE SUPPLIES

(4) No. 8 x 3" Fh woodscrews
(2) $1\frac{5}{8}$ " x 2" butt hinges
(2) $\frac{3}{8}$ " x 4" hex-head bolts
(4) $\frac{3}{8}$ " hex nuts
(4) $\frac{3}{8}$ " washers
(1) Screw hook and screw eye





The only tricky part is figuring out how tall (wide) to make the rails so they raise the stock to the center of the clamp screw.

DETERMINE WIDTH. This requires a little arithmetic. Start by measuring the distance from the bottom of the rabbet to the center of the clamp screw ($2\frac{1}{4}$ " in my case). Then subtract half the thickness of the stock you'll be clamping up. (For example, for $\frac{3}{4}$ "-thick stock, subtract $\frac{3}{8}$ ".) Then rip the rails to this width ($1\frac{7}{8}$ ") (Fig. 4a).

NOTCH. The same support rails can also be used for thicker stock. But because of the extra thickness, the rails need to be lowered.

To do this, cut a $\frac{3}{16}$ " notch on each end of the rails (Fig. 4a). Then rest the notches in the rabbet (Fig. 6).

There's a side benefit of using the support rails. If the boards rest directly on the pipe, a chemical reaction occurs between the glue and the pipe which causes black marks. But the rails raise the boards off the pipe to prevent this.

LEGS & TABLE

To complete the Clamping Station, I added four legs. Each leg (H) is made by gluing two 2x4s together (Fig. 7).

I cut the legs 32" long. But you can adjust the length so the station's height matches another work surface in your shop. Or just find a comfortable table height for you and cut the legs to suit.

Note: The Designer's Notebook on the opposite page shows how to build a fold-up version of the station. The legs on that version are different than these.

ATTACH LEGS. After the glue dries, clamp the legs to the frame so the top is flush with the bottom of the rabbet (Fig. 7a). Then drill countersunk shank holes, and glue and screw the legs to

the inside corners of the frame. For added strength, glue and screw 1x4 stretchers (I, J) to the legs.

TABLE TOP. If needed, you can convert the Clamping Station into an assembly table. To do this, cut a table top (K) from a piece of $\frac{1}{2}$ " plywood so it fits in the rabbet on the top edge of the frame. If you drill a 1" finger hole near one edge, it's easier to lift out the top (Fig. 7).

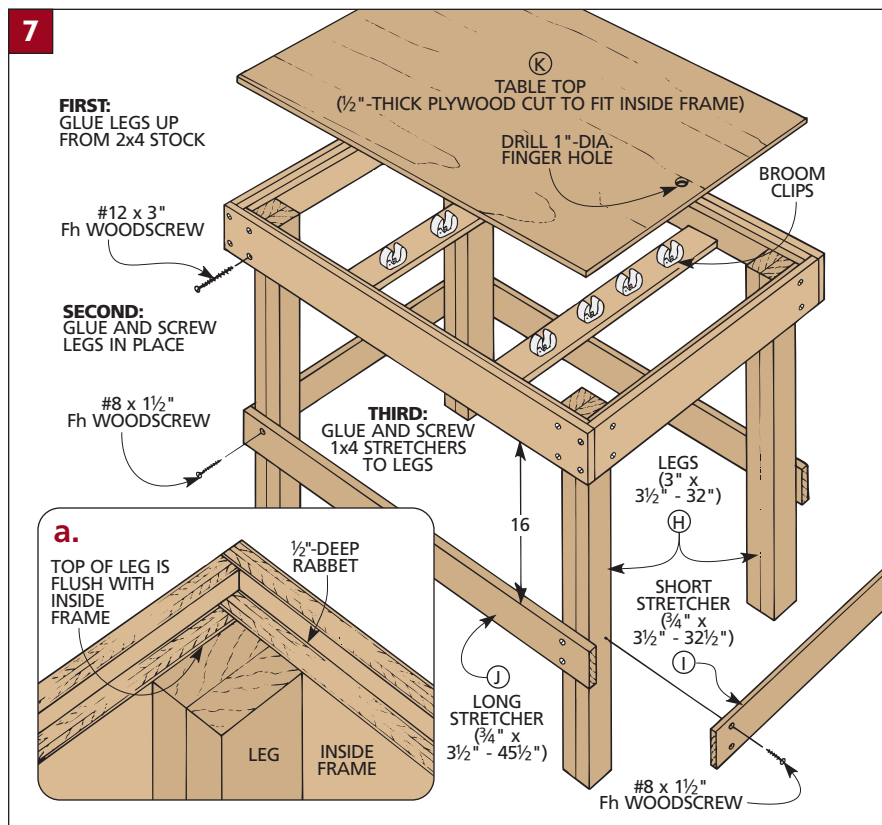
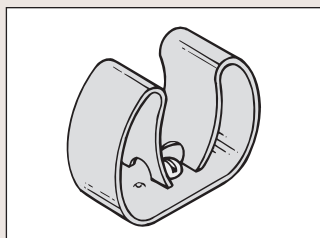
FINISH. To keep glue from sticking to the support rails, you can place strips of wax paper along the top edge of the rails. Or, brush on several coats of polyurethane, and apply a couple of coats of paste wax.

BROOM CLIPS. Finally, I screwed broom clips to the cleats (Fig. 7). The Shop Tip below left shows why. ■

SHOP TIP

Clamp Clips

Broom clips in the frame of the Clamping Station provide a great way to store your clamps when they're not being used.



Vacuum Clamping System

It's almost magical. You can't see anything that keeps a workpiece attached to these jigs. The secret is a device that may look a little "high-tech," but that works where traditional clamps can't.



Stepping into the shop, I heard the gentle “hiss” of air. Then I saw one of our designers start routing around a workpiece that was sitting on what looked like a cutting board. I almost panicked since it appeared nothing was holding the workpiece in place. But as he routed the roundover, the workpiece didn’t budge.

When he was done, he looked up and smiled. Then he reached over to a gizmo on the bench, turned off the hissing air, and lifted the workpiece. By now I was very intrigued.

He explained that he was testing a Vacuum Clamping System powered by

an air compressor. I must have just stared at him because then he began explaining how the whole thing works. It was really pretty fascinating. (And not as complicated as it sounds — it’s all explained in an article on page 42.)

VACUUM TABLE. The centerpiece of the system is the “cutting board” I saw being used in the shop. It’s actually a vacuum table (see photo above). It holds a workpiece securely in place *and* anchors itself to a workbench without any clamps to get in the way.

The basic idea of the vacuum table is simple. A vacuum is formed under the workpiece. This way, the air above it

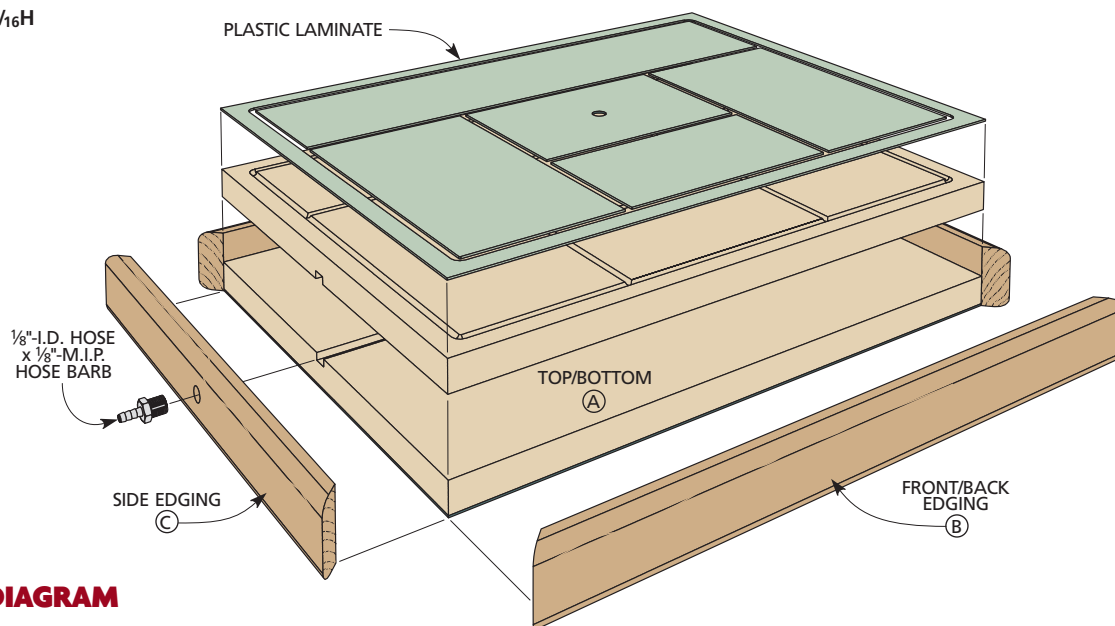
exerts pressure downward that holds the workpiece tightly to the table.

JIGS AND ACCESSORIES. But the table is just one of several simple jigs and accessories that work with the vacuum system (see the photos on the opposite page). Creating a vacuum in each one allows a workpiece to be held securely in place without using a single clamp.

VENEER PRESS. Still another use for this versatile Vacuum Clamping System is as a veneer press. It requires another piece of specialized equipment (a vacuum bag), but if you do a lot of veneering, it can make life easier. For more about this, see page 48.

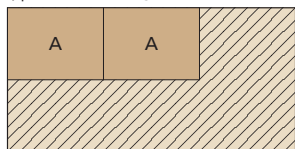
EXPLODED VIEW

OVERALL DIMENSIONS:
17W x 13D x 1⁹/₁₆H



CUTTING DIAGRAM

3/4" MDF - 24 x 48



1/2 x 3 1/2 - 36 (.9 Sq. Ft)



This sanding jig gives you better control of the workpiece while keeping your hands away from the sanding belt.

MATERIALS LIST

VACUUM TABLE

- | | |
|-----------------------------|---|
| A Top/Bottom (2) | 3/4" MDF - 12 x 16 |
| B Fr./Bk. Edging (2) | 1/2 x 1 ⁹ / ₁₆ - 17 |
| C Side Edging (2) | 1/2 x 1 ⁹ / ₁₆ - 13 |

HARDWARE SUPPLIES*

- (2) Plastic laminate 12" x 16"
- (Used for vacuum table)
- (1) Venturi valve
- (1) 1/4" acrylic plastic mounting plate
- (3) Coupling mounts (threaded)
- (1) Air pressure gauge
- (1) Regulator

- (1) Quick-release fitting
- (1) Shutoff valve
- (1) Venturi coupling
- (1) T-shaped adapter
- (1) Vacuum gauge
- (1) Air filter
- (1) 1/8" -I.D. hose x 1/8" -M.I.P. hose barb
- (1) 1/4" -O.D. poly tube (approx. 36" long)
- 1/4" -dia. foam backer rod (length varies with clamping requirements)

*For vacuum kit shown. See page 42 for more details.



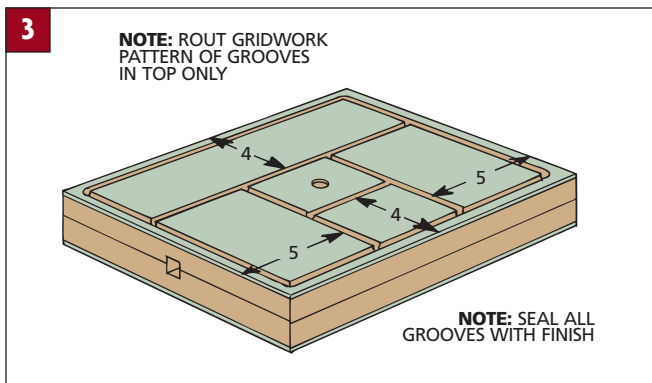
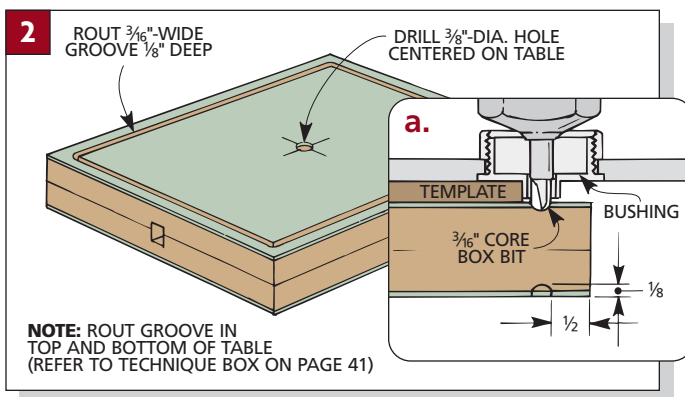
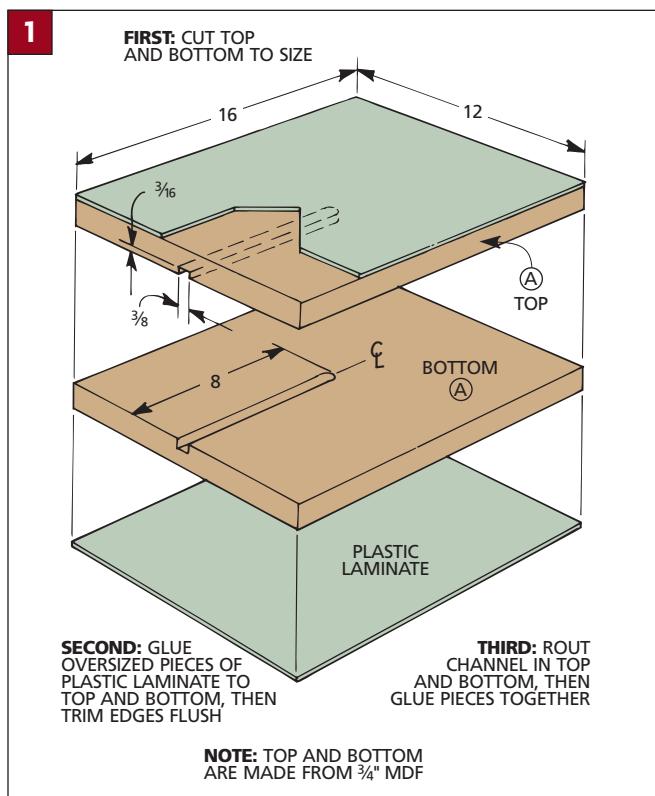
Vacuum pressure provides a solid grip for this featherboard. And it releases quickly when the vacuum is turned off.



Like a magnet sticking to a piece of iron, this push block grabs a workpiece and won't let go until you tell it to.



Two handles give you plenty of control and the vacuum provides lots of grip in this versatile routing jig.



VACUUM TABLE

The centerpiece of the Vacuum Clamping System is the vacuum table.

VACUUM AREA. To accommodate workpieces of different sizes, you can make the vacuum area on the table larger or smaller. The key is a gridwork pattern of grooves that accept a foam backer rod (refer to *Fig. 4*).

When working with small pieces, place the foam around the area in the center of the table. Or surround a larger area for big workpieces.

Okay, so the table keeps the workpiece from moving around. But what holds the table in place? There's also a vacuum established on the bottom of the table. It acts like a suction cup to anchor the table on the bench.

TOP AND BOTTOM. The table starts out as identical top and bottom (A) pieces (*Fig. 1*). To provide a durable work surface (and to seal the MDF from air leaks), both pieces are covered with plastic laminate on one side.

AIR CHANNEL. The opposite (interior) sides of the top and bottom each have a groove that's routed from one end to the center (*Fig. 1*). Along with a hole (drilled later), these grooves form a channel for the air that's drawn from the top and bottom surfaces of the table.

GLUE UP. At this point, you're ready to glue the top and bottom together. To prevent air from leaking between the two layers, brush a thin layer of glue on both surfaces. Just be careful to avoid getting glue in the grooves — you don't want to clog the air channel.

DRILL HOLE. Now you can complete the air channel by drilling a centered hole through the table (*Fig. 2*). It connects the air channel to the top and bottom surfaces so a vacuum can be produced on each side.

To maintain this vacuum, you need an airtight seal. That's where the foam comes in. It fits in a series of grooves in the top and bottom of the table.

GROOVES. Each side of the table has a groove running around the perimeter (*Figs. 2 and 3*). A grid pattern of grooves is routed in the top only (*Fig. 3*).

Regardless of the location, one thing to be aware of is the depth of the grooves. The idea is to rout the grooves so the foam is a bit proud when it's pressed in place. (I routed $\frac{1}{8}$ "-deep grooves.) When the vacuum is applied, this prevents the foam from getting crushed all the way down which could allow air to leak in.

The shape of the grooves is also important. To seal out air, the grooves are curved on the bottom to match the

shape of the foam. I found that a $\frac{3}{16}$ " core box bit cut just the right profile. (See the Technique box on page 41 for details about creating the grooves.)

EDGING. After routing the grooves, I "wrapped" the exposed edges of the table with hardwood edging (B, C) (*Fig. 4*). These are just $\frac{1}{2}$ "-thick strips that are mitered to length.

SHOP TIP

Sealing Fittings

For an airtight seal, wrap the threads of the brass fitting with pipe thread sealant tape (available at hardware stores) before screwing it in place.



To rout the grooves in the vacuum table I used a hand-held router and a core box bit. To guide the bit, all you need is a template and a guide bushing attached to the base of the router.

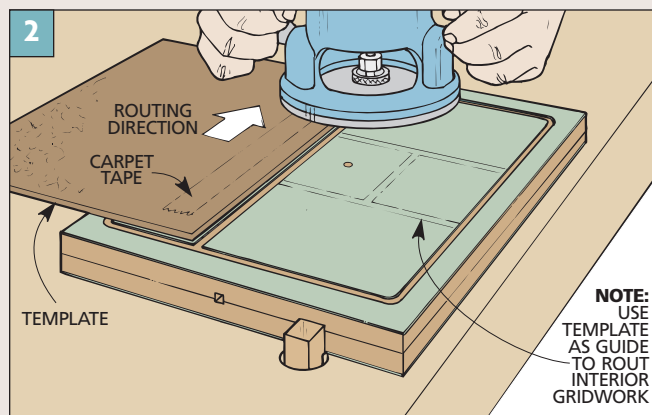
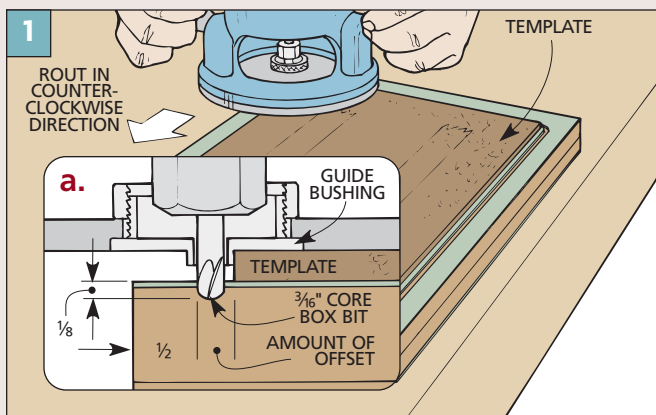
TEMPLATE. The template is a piece of $\frac{1}{4}$ " hardboard attached to the top of the vacuum table (Fig. 1). When sizing the template, keep in mind that the groove around the perimeter is set in $\frac{1}{2}$ " from

the edges of the table. Since you'll be routing all the way around the template, the first step in sizing the template is to subtract twice that amount (1") from the length and width of the table.

You also have to consider that it's the guide bushing (not the router bit) that rides against the template. So you'll need to figure out the offset and subtract double that amount too (Fig. 1a).

ROUT GROOVES. After cutting the template to final size, you're ready to rout the grooves. Start by attaching the template with carpet tape so it's centered on the table (Fig. 1). Then rout in a counter-clockwise direction.

To rout the gridwork pattern, just reposition the template (Fig. 2). Then rout the grooves, working from the longest one to the shortest.

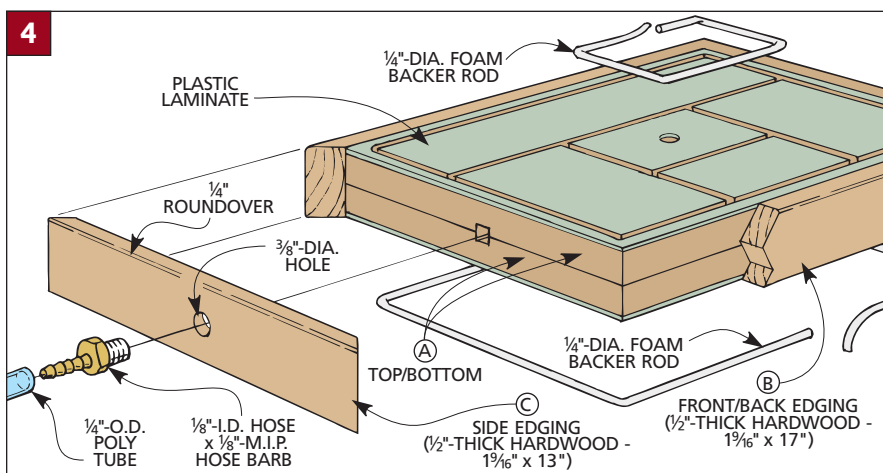


Before gluing the edging in place, you'll need to drill a $\frac{3}{8}$ "-dia. centered hole in the piece of edging that covers the air channel.

HOSE BARB. This hole accepts a brass fitting called a hose barb. (I picked it up at the hardware store.) The "barbed" end of this fitting makes it easy to slip the air tube from the vacuum system on and off. After wrapping the threads of the hose barb with tape (see the Shop Tip on the opposite page), thread the fitting into the hole (Fig. 4).

INSTALL FOAM. Before you use the table, you'll need to install the foam. What works well here is to cut the foam a bit longer (about $\frac{1}{4}$ ") than necessary. This lets you "bunch" the foam at the corners and ends for a better seal (see the Shop Tip at right for a way to improve the seal even more).

FINISH. But even with the foam, outside air can be drawn right through some materials. So it's important to seal the exposed surfaces of the jig with a film finish (polyurethane or varnish).



SHOP TIP

Installing Foam

Using rubber cement in the grooves (top photo) helps the foam form a tight seal, yet allows you to remove the foam easily.

Bunching the foam in the corners also ensures a tight seal (bottom photo).



The heart of the Vacuum Clamping System is a “kit” built around a venturi valve. (The venturi valve is the little red box on top of the kit in the photo.)

The venturi valve is what creates the vacuum. (More about that in a moment.) The “kit” shown in the photo at right and the drawing below also includes a couple of gauges, a shutoff valve, an air filter, and a series of fittings. These accessories make the Vacuum Clamping System easier to use.

Note: You may be able to buy these pieces individually from local sources. Otherwise see page 126 for mail-order sources of ready-made kits.

VENTURI VALVE. So how does this “magic box” work? Inside the valve, air from the compressor is funneled past an opening (see detail ‘a’ in drawing). As the air rushes past, it pulls the air out of the jig — like the suction created in the wake of a big truck. The air that’s drawn out is what creates the vacuum.

The venturi valve I bought has a porous metal cone on top. This cone serves as a muffler. Without it, you’d have to live with the loud rush of air blasting out the top of the valve. The muffler diffuses the airstream and greatly reduces the noise level.

REGULATOR. In the kit shown at right, the regulator is the black knob below the venturi valve. Its purpose is to adjust the amount of air from the compressor heading into the venturi valve. If your compressor has a regulator, this piece isn’t necessary. But I added it anyway — it lets me adjust the pressure easily for the jig.

SHUTOFF VALVE. This device attaches between the regulator and the venturi valve. Just think of it as a switch. It makes it easy to turn on and off the air flow to the venturi valve, so you can turn the vacuum clamping on or off.

Gauges. The kit shown here uses two gauges — one is attached to the regulator and the second is in-line between the venturi valve and the jig.

The air pressure gauge (the lower one) measures the air pressure from the compressor. (Here again, if your compressor already has a pressure gauge, this one isn’t necessary.)

The vacuum gauge (upper one) mea-

sured at the jig. You can get by without this gauge too, but it’s useful to keep track of how much pressure the valve is creating. If the gauge shows the pressure beginning to drop, you’ll know you have a leak and that the clamp may be losing its grip.

FILTER. The last major piece of the kit is the filter. This piece is attached to the hose leading to the jig. Its job is to trap any dirt or debris that might get pulled from the jig through the hose before the dirt can reach the venturi valve.

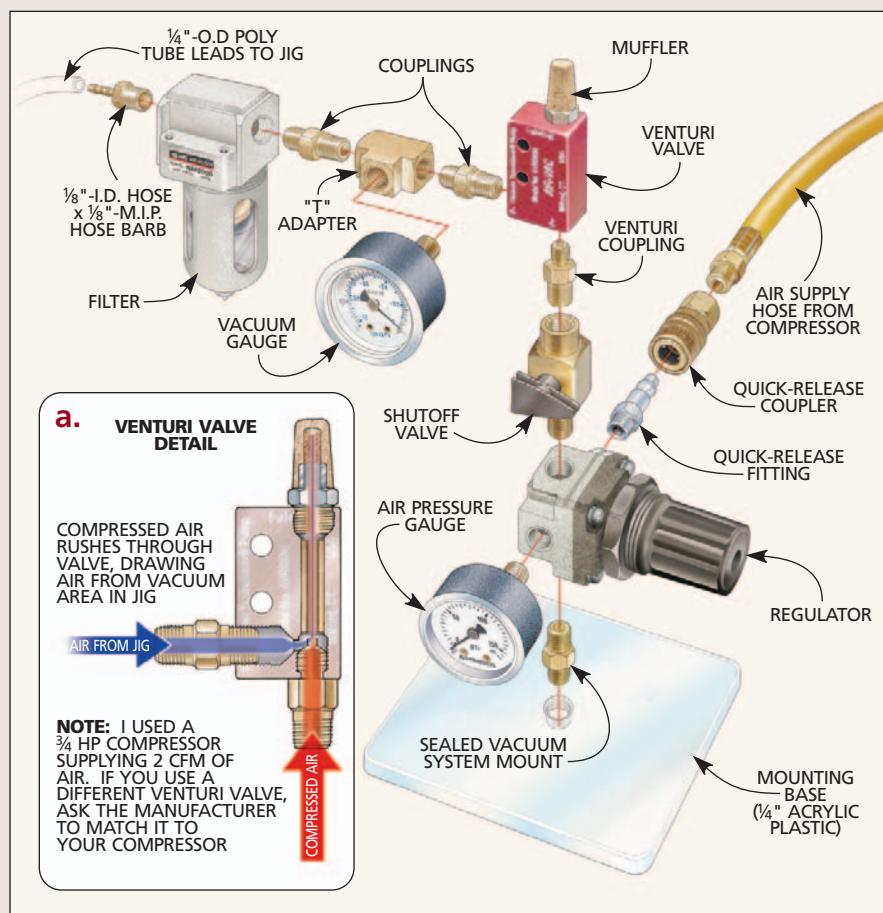
FITTINGS AND BASE. All these parts are joined together by a series of fittings and adapters. And the whole assembly is attached to a base of acrylic plastic to keep the filter upright.

BUILDING A KIT. For the most basic kit, you’ll need the venturi valve, a filter, and a base. In this arrangement, you’ll have to turn the vacuum on and off by turning your compressor on and off, or by connecting and disconnecting the hose leading to the venturi valve.



For a better system, add the shutoff valve, and the regulator even if your compressor already has one.

Even the parts for the “full-blown” kit shown here won’t cost much more than several bar clamps. And as the jigs on the next few pages show, this will work where regular clamps can’t.





SANDING JIG

The next several pages show you how to make some of the accessories and jigs I've come up with to use with my vacuum system. They're all made with small pieces of plywood and hardwood you can probably find in your scrap bin.

SANDING JIG. The sanding jig is an L-shaped assembly that holds a work-

piece tightly against a vertical plate (see photo at left). This gives you more control and lets you sand a small workpiece on a disk (or belt) sander without accidentally sanding the tips of your fingers.

BASE. To provide a stable platform for the jig, I began by making a plywood base (D) (Fig. 5). (I used $\frac{1}{2}$ "-thick Baltic birch plywood.)

VACUUM PLATE. After cutting the base to size, the next step is to add a vacuum plate (E). It's a piece of $\frac{1}{2}$ " plywood with a waffle pattern of grooves running across it.

Since the grooves extend all the way across the vacuum plate, I found it was faster to cut them by mounting the core box bit in the router table.

Here again, these grooves accept the foam backer rod. You simply arrange the foam around the area where you want to create the vacuum.

Note: The gridwork pattern lets you create a very small vacuum area. But as a rule, the larger the area, the greater the holding power.

As with the vacuum table, the sanding jig has a barbed fitting that's used to connect it to the air tube from the vacuum system. The fitting threads into a hole centered on one of the squares in the vacuum plate (Fig. 5b).

ASSEMBLY. Now it's just a matter of gluing the vacuum plate to the base. To ensure that it stays perpendicular to the base, I glued a triangular support (F) to both pieces (Fig. 5).

HANDLE. While I was at it, I also added a thick, sturdy handle (G). It pro-

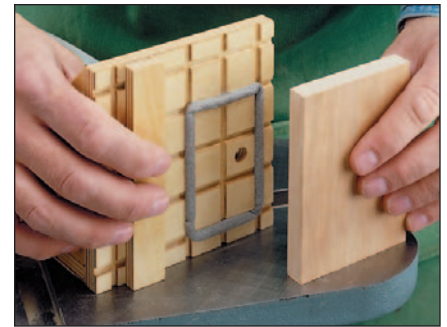
vides better control (and a comfortable grip) when sanding. (I used the same type of handle on several of the vacuum jigs. You can find the details about making the handles in the Technique box on page 45.)

ALIGNMENT STRIP. One final note about the sanding jig. When sanding a number of pieces to shape, you may want to use an alignment strip (H) to position each one in exactly the same place on the vacuum plate.

This piece will likely be custom-made for each particular job, but the basic construction is always the same. Start by cutting a wide, shallow rabbet in an oversized blank so you leave a $\frac{3}{16}$ "-wide lip along one edge (Fig. 5a).

Then round the lip by sanding it lightly. This allows the key to fit easily into the grooves in the vacuum plate.

And finally, cut the key to width so that the workpiece will be properly positioned on the jig (see photo below).



An alignment key (on left in photo), makes it easy to repeat the placement of a workpiece on the sanding jig.

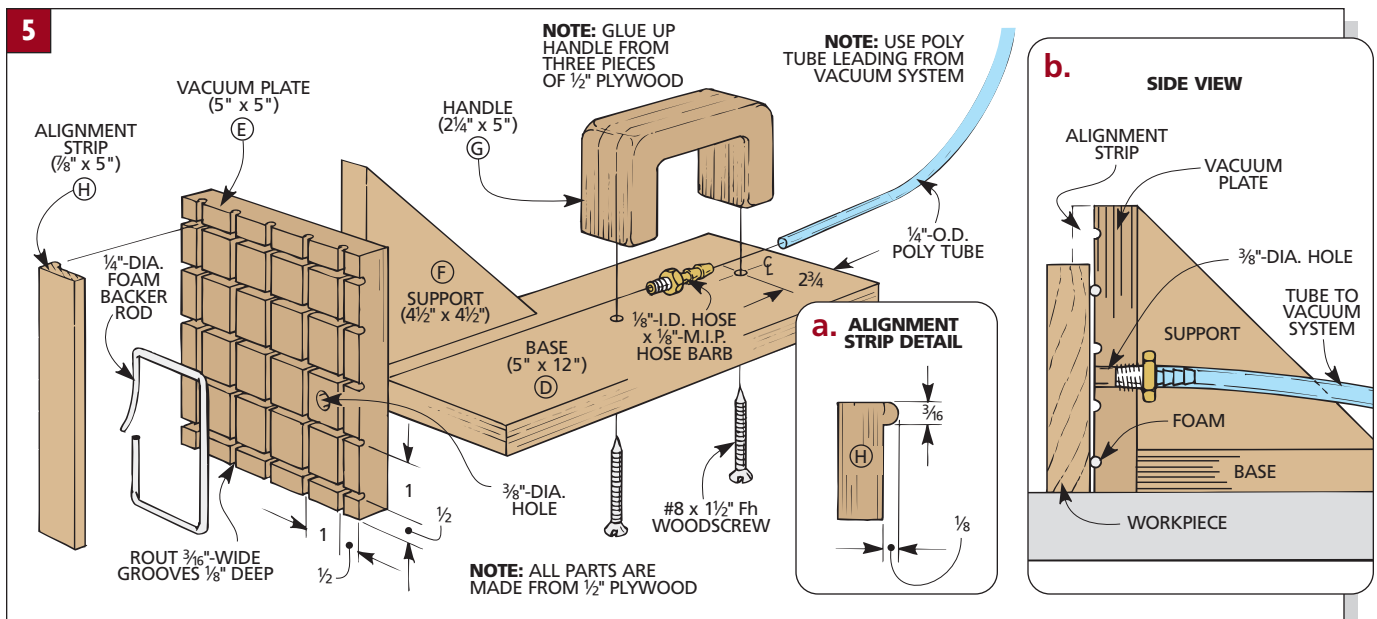
MATERIALS LIST

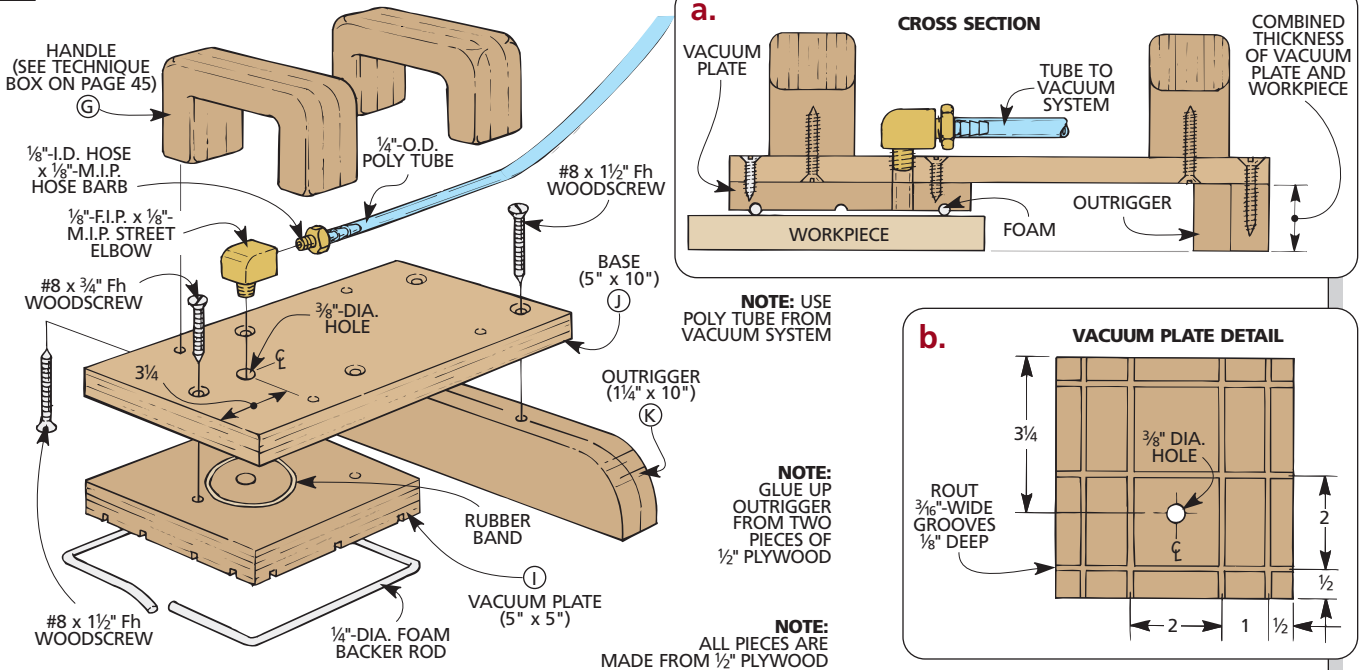
SANDING JIG

D Base (1)	$\frac{1}{2}$ ply - 5 x 12
E Vacuum Plate (1)	$\frac{1}{2}$ ply - 5 x 5
F Support (1)	$\frac{1}{2}$ ply - 4 1/2 x 4 1/2
G Handle (1)	1 1/2 ply - 2 1/4 x 5
H Alignment Strip (1)	$\frac{1}{2}$ x 7/8 - 5

HARDWARE SUPPLIES

- (2) No. 8 x $1\frac{1}{2}$ " Fh woodscrews
- (1) $\frac{1}{8}$ "-I.D. hose x $\frac{1}{8}$ "-M.I.P. hose barb
- $\frac{1}{4}$ "-dia. foam backer rod (length will vary)





ROUTING JIG

Although the routing jig looks different than the sanding jig, it uses the same basic principle. A vacuum plate holds the workpiece so you can safely rout small pieces on the router table as shown in the photo above. Or you can

adapt the jig for pattern routing (as shown on the opposite page).

VACUUM PLATE. Here again, a plywood vacuum plate (I) has a series of grooves that let you change the size of the vacuum area (Fig. 6b). And as before, the vacuum plate is attached to a plywood base (J).

This time, the air that's drawn out of the vacuum area passes through both the vacuum plate and the base. This requires drilling a hole in each piece for the air to pass through.

RUBBER BAND. One thing to be aware of is that air can leak between the base and the vacuum plate. So to create an airtight seal, I used an ordinary rubber band that's sandwiched between the two pieces (see the Shop Tip at right).

Note: Only use screws (no glue) to secure the plate to the base. This way, the plate can be removed to attach a different size or shape plate.

OUTRIGGER. After screwing the vacuum plate to one end of the base, I attached an outrigger (K) to the other end. It keeps the jig and the workpiece level while routing.

To provide stability, the outrigger is 1" thick. (I glued up two pieces of 1/2" plywood.) Its height (width) depends on the thickness of the workpiece.

The idea is to size the outrigger so the workpiece lies flat on the router table. To accomplish this, I cut the out-

rigger to width to match the combined thickness of the vacuum plate and the workpiece (Fig. 6a).

Note: Here again, use only screws to secure the outrigger so you can remove it to attach a new one for thicker or thinner workpieces.

SHOP TIP

Rubber Band Seal

To get the tightest grip on a workpiece, you need to prevent air from leaking between the base of the routing jig and the vacuum plate. An ordinary rubber band is all you need to create an airtight seal.



MATERIALS LIST

ROUTING JIG

- | | |
|---------------------------|-----------------------|
| G Handles (2) | 1 1/2 ply - 2 1/4 x 5 |
| I Vacuum Plate (1) | 1/2 ply - 5 x 5 |
| J Base (1) | 1/2 ply - 5 x 10 |
| K Outrigger (1) | 1 ply - 1 1/4 x 10 |

HARDWARE SUPPLIES

- (3) No. 8 x 3/4" Fh wood screws
- (6) No. 8 x 1 1/2" Fh wood screws
- (1) 1/8" -F.I.P. x 1/8" -M.I.P. street elbow
- (1) 1/8" -I.D. hose x 1/8" -M.I.P. hose barb
- (1) Rubber band
- 1/4" -dia. foam backer rod (length will vary)

BRASS FITTINGS. After the outrigger is screwed to the base, you'll need to provide a way to connect the jig to the air tube from the vacuum system.

As with the sanding jig (and vacuum table), I used a straight hose barb. But this time, it doesn't thread into the base. To keep the hose from sticking straight up out of the jig (which would be a nuisance), I threaded a street elbow into the base (*Fig. 6*). Then I tightened the hose barb in the street elbow.

HANDLES. All that's left is to add two handles (G). They're identical to the handle on the sanding jig. (See the Technique box below.)



PATTERN ROUTING JIG

As I was designing the routing jig on the previous page, I knew I wanted to make the vacuum plate removable. That way I could make plates of several sizes to accommodate different sizes of workpieces. But it didn't occur to me until later that the jig is also ideal when you need to rout a number of pieces to the exact same shape.

The idea here is simple. The vacuum plate on the jig is replaced by a plywood template that has a vacuum area on the bottom (see photo at right).

Once the vacuum is applied, the workpiece is held tight against the template. By running the template against the bearing on a pattern bit, the workpiece is trimmed to the identical shape as the template (see photo at left).

To create the vacuum area, you'll need to rout a groove for the foam in the bottom of the template. You may be able to do this freehand. For the template shown in the photos, I made a round hardboard template to guide a bushing



When making a pattern routing template for use on the routing jig, drill the hole into the vacuum area slightly over-size. That makes it easier to align the holes in the template and the base.

in the router base plate (similar to what I did with the vacuum table).

As with the vacuum plate, there's a hole in the template to draw air out of the vacuum area. But this time, I drilled a large ($\frac{3}{4}$ "-dia.) hole. This makes it easy to align the holes in the template and the jig.

TECHNIQUE

Shop-Made Handles

The C-shaped plywood handles on the sanding jig and routing jig give you more control over the jigs and the workpieces attached to them. They also help keep your fingers a safe distance from the bits and sanding belts.

Making the handles is a simple process, even though they're fairly small. To work with them safely, I glued up a large blank that's sized to produce two handles (*Fig. 1*). Although my handles are made from plywood, you could just as easily use scraps of hardwood to make the blanks.

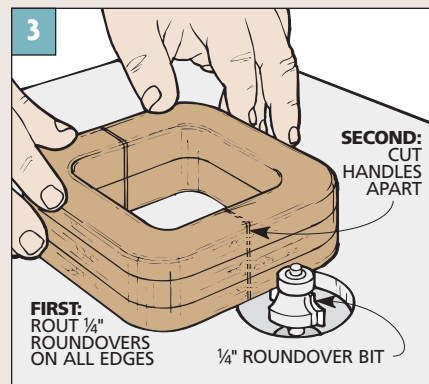
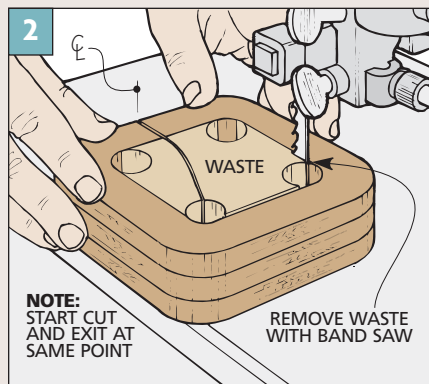
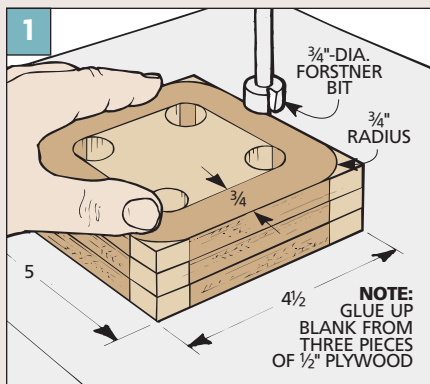
The curved shape on the inside of the handles is formed by drilling a hole near each corner. The outside corners are cut and sanded to match (*Fig. 1*).

The next step is to remove the waste between the holes. This can be done with a band saw (or jig saw) (*Fig. 2*).

Note: To end up with two handles of equal size, make an entry cut that's centered on one edge of the blank (*Fig. 2*). Then after removing the waste, exit the cut at the same place.

Next, you'll need to do some sanding to remove the saw marks. To complete

the handles, you can rout roundovers on all the edges (*Fig. 3*). And finally, cut the two handles apart.





PUSH BLOCK

This push block works in situations where an ordinary push block can't.

Take a plunge cut on the router table, for instance. You have to lower the workpiece carefully onto the spinning bit at the start of the cut, then lift it off at the end. And all the time, the fence prevents you from getting a good grip.

But this push block holds the workpiece like a magnet (see photo above). So you have total control over the cut.

VACUUM PLATE. The key is a narrow vacuum plate (L) with a vacuum area on the bottom (*Fig. 7*). This vacuum area is formed the same way as the others — just rout a groove around the perimeter of the plate and press in the foam.

Here again, I wanted the tube that connects the push block to the vacuum stem to run straight out the back, instead of straight up. So I combined two fittings to form a 90° corner.

HANDLE. All that's left to complete the push block is to add a handle (M). After experimenting with several different handles, I decided on the shape shown below (*Fig. 7b*). It provides a comfortable grip. And it has a small "rest" in back for my hand.

Like the other handles, it's made by gluing up three pieces of 1/2" plywood. After cutting the handle to shape on the band saw, I routed 1/8" roundovers on all the edges except where the handle contacts the vacuum plate.

MATERIALS LIST

PUSH BLOCK

- L** Vacuum Plate (1) 1/2 ply - 2 x 12
M Handle (1) 1 1/2 ply - 3 1/4 x 10 1/2

HARDWARE SUPPLIES

- (2) No. 8 x 1 1/2" Fh woodscrews
 (1) 1/8" -F.I.P. x 1/8" -M.I.P. street elbow
 (1) 1/8" -I.D. hose x 1/8" M.I.P. hose barb
 1/4" -dia. foam backer rod (length will vary)



FEATHERBOARD

It's hard to imagine a more practical use of the vacuum system than to hook it up to this featherboard (see photo above).

The featherboard attaches quickly and easily to a router table (or table saw) without fiddling with clamps. Yet even though it's held firmly in place, you can adjust it in seconds.

The reason is simple. There's a vacuum area formed in the base of the featherboard (*Fig. 8*). So the base sucks down tight against the table like a giant leech. But the featherboard slides back and forth in an angled notch in the base. This lets you adjust the amount of pressure against the workpiece.

FEATHERBOARD. The featherboard (N) starts out as a 1/2"-thick hardwood blank (*Fig. 8*). To make the featherboard adjustable, there's a slot centered on the blank. I drilled a series of holes to form the slot, then filed away the remaining waste.

Since the featherboard will rest on the base in use, the "fingers" would be raised above the table. That's okay for thick stock. But thin stock would slide right under the fingers. The solution is to increase the thickness of the end of the featherboard.

FILLER BLOCK. To do this, I added a filler block (O) (*Fig. 9*). It's a piece of 1/2"-thick hardwood attached to the bottom of the featherboard. Before

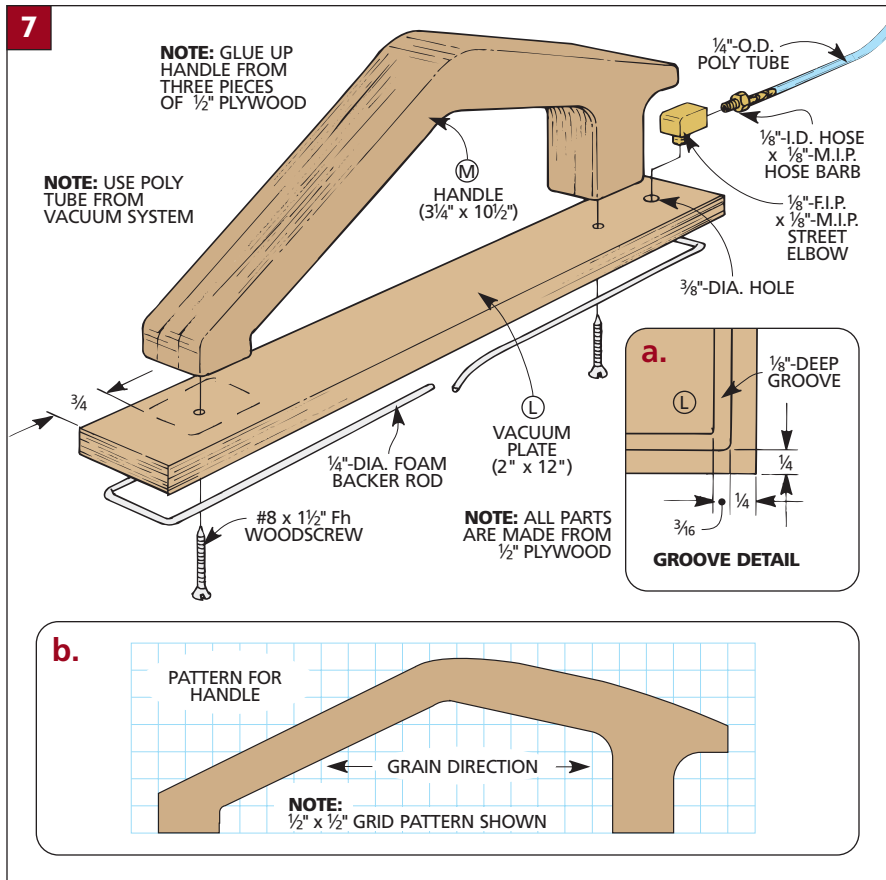
MATERIALS LIST

FEATHERBOARD

- N** Featherboard (1) 1/2 x 5 1/8 - 15
O Filler Block (1) 1/2 x 5 1/8 - 5 3/8
P Base (1) 1/2 x 4 - 12

HARDWARE SUPPLIES

- (1) 3/8" x 1 1/4" carriage bolt
 (1) 3/8" wing nut
 (1) 3/8" washer
 (1) 1/8" -F.I.P. x 1/8" -M.I.P. street elbow
 (1) 1/8" -I.D. hose x 1/8" M.I.P. hose barb
 1/4" -dia. foam backer rod (length will vary)



gluing on the filler block, I cut one end at an angle to match the mitered ends of the featherboard that are cut next.

MITER ENDS. There's nothing critical about the angle on the ends of the featherboard. I mitered the thick end at a 30° angle and cut the other end to match.

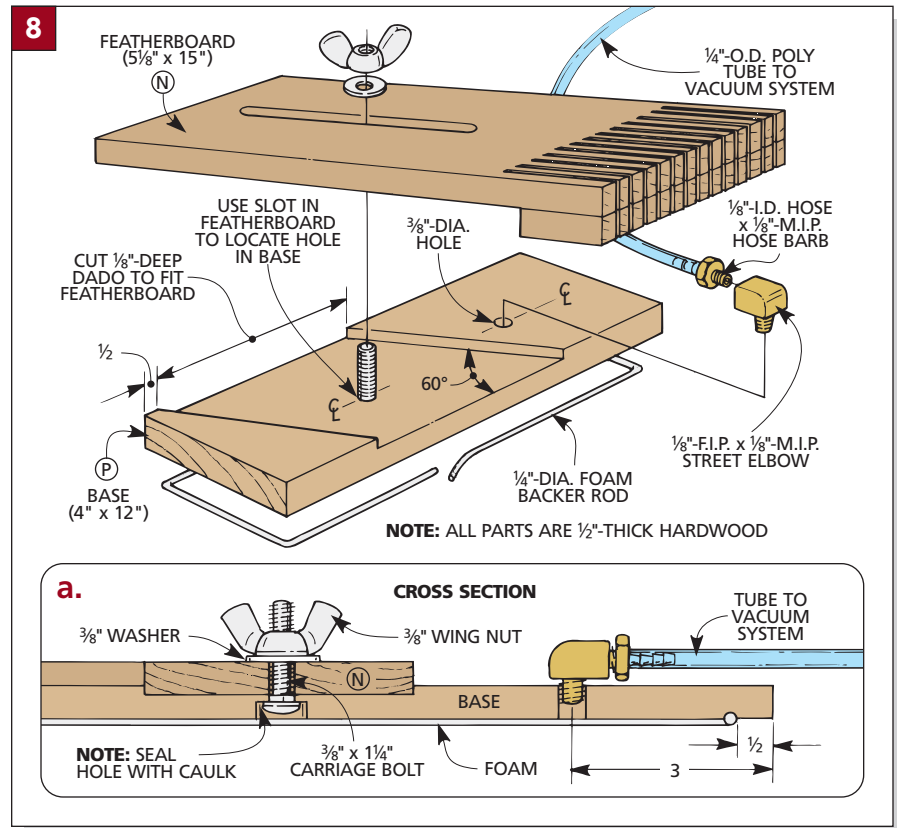
FINGERS. Now all that's left is to cut a series of saw kerfs to form the fingers of the featherboard. The goal here is to end up with evenly spaced fingers. To do this, I used a simple jig (refer to the Shop Jig on page 73).

RIP TO WIDTH. While the jig ensures uniform spacing between the fingers, you may find that the finger formed by the last kerf is wider (or narrower) than the rest. If that's the case, rip a narrow strip off the edge so the last finger matches the size of the others.

BASE. Once the featherboard is trimmed to width, you can turn your attention to the base (P) (*Fig. 8*). The base is a 1/2"-thick piece of hardwood with an angled dado that's cut to match the width of the featherboard.

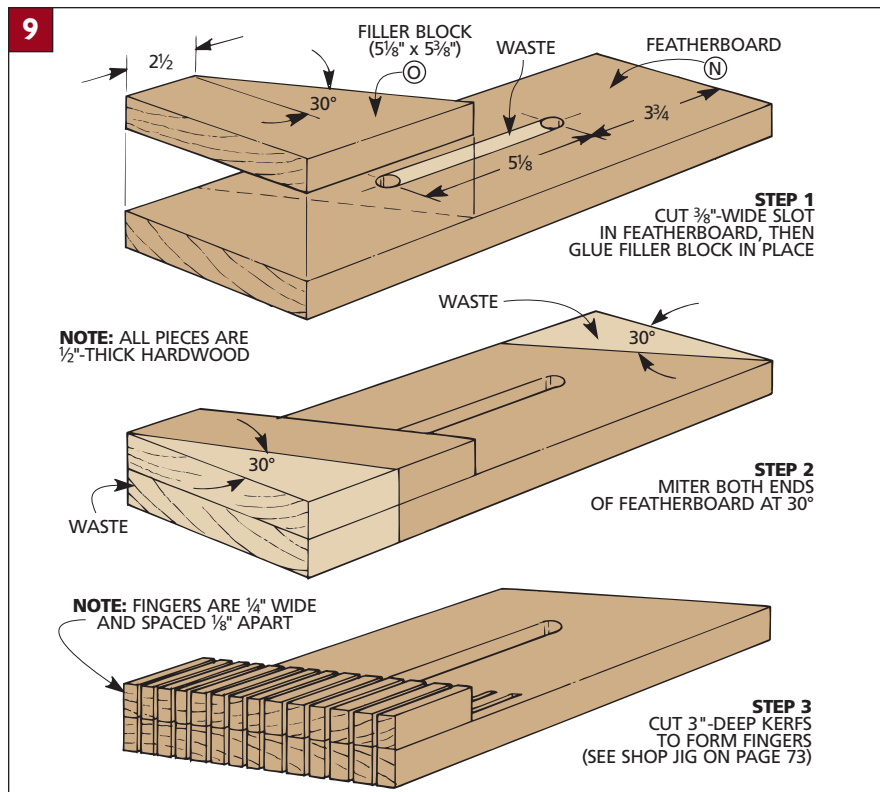
To establish the vacuum area, a groove is routed in the bottom of the base for the foam. Then you can install the fittings that connect the featherboard to the air tube.

To lock the featherboard in place, a bolt passes through a counterbored



hole in the base and the slot in the featherboard. Tightening a wing nut over a washer on the end of the bolt locks the featherboard in place.

CAULK BOLT. But locating the hole for the bolt in the vacuum area presents a bit of a problem. When you turn on the vacuum system, it will pull outside air through the hole and into the vacuum area. An easy way to prevent this is to seal the hole before installing the bolt (see the Shop Tip below).



SHOP TIP

Caulk Sealer

To seal the hole in the base of the featherboard, squeeze caulk in the counterbore before installing the bolt.



ACCESSORIES... Vacuum Veneer Press

Whenever I think of a veneer press, one of the first things that comes to mind is clamps — lots of clamps. But a vacuum veneer press is different.

PLASTIC BAG. Basically, a vacuum veneer press is just a heavy-duty plastic bag. To produce the clamping pressure, the bag is hooked up to a vacuum system. (For information on the system I use, refer to page 42.)

There's nothing mysterious about how a vacuum press works. You just slide the project into the bag and turn on the vacuum system. As the air inside gets sucked out, the air outside presses down and firmly molds the bag around the project like a shrink-wrapped slab of corned beef (see photo at right).

EVEN PRESSURE. But it's not the amount of pressure that makes a vacuum press so useful. It's the fact that it distributes this pressure so evenly.

For example, when gluing veneer to a large, flat panel, you get perfectly uniform pressure across the entire surface. So you're not as likely to end up with an air bubble under the veneer.

NO-SLIP. Another advantage of this even pressure is it prevents the veneer from slipping. Because of this, a vacuum press is also ideal for working



with curved shapes that might be impossible to clamp otherwise (see the photo at the top of the opposite page).

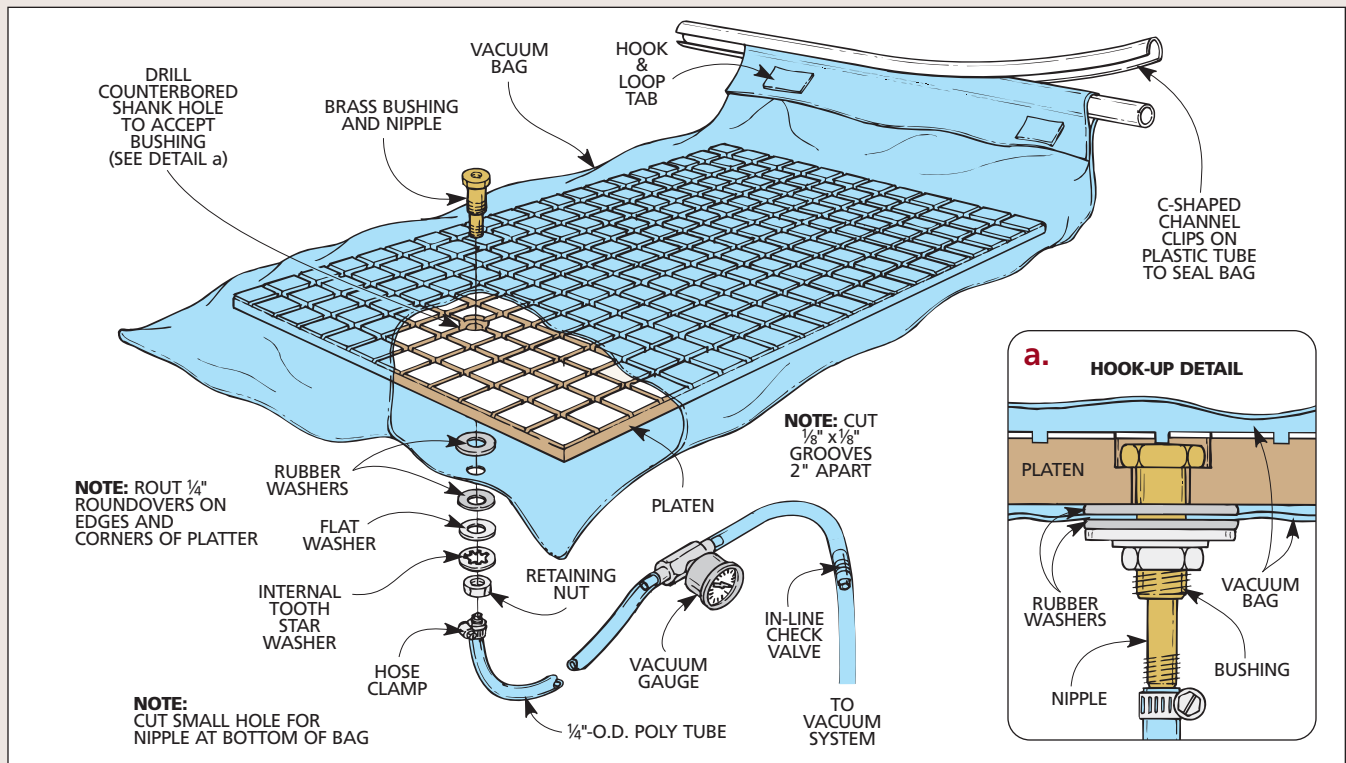
BAG

There are a couple of things to keep in mind if you're thinking about getting a vacuum bag.

SIZE. First of all, vacuum bags come in a wide range of sizes.

The smallest bags can be used for pieces up to 24" wide and 48" long. But you can also get larger bags that can handle work that's twice as wide and as long as eight feet. (For sources of vacuum bags, see page 126.)

THICKNESS. In addition to size, you also need to decide on the thickness of the bag. Most bags are available in 20 or 30 mil thicknesses (.020" or .030"). So what's the difference between them?



As you'd expect, the 20 mil bags are more pliable. But with repeated use, they're more likely to get small pinholes. The thicker (30 mil) bags are more puncture resistant. And they still have plenty of flexibility.

SETTING UP THE PRESS

Once you have the vacuum bag, it's just a matter of setting up the veneer press.

PLATEN. To provide a flat, solid surface for the workpiece inside the bag, it rests on a shop-made platen made from $\frac{3}{4}$ "-thick material (see the drawing on the opposite page).

Note: I used melamine because it has a slick surface that prevents glue from sticking to it.

When determining the size of the platen, it's tempting to make it fit tightly inside the bag. But this would stretch the bag as the vacuum is applied. So I cut the platen about 4" narrower and 6" shorter than the bag.

GRIDWORK. One thing to note about the platen is there's a gridwork pattern of grooves running across it. These grooves serve as channels for the air as it's drawn out of the bag.

After cutting the grooves, it's a good idea to soften the edges and corners of the platen. (I routed $\frac{1}{4}$ " roundovers on all the edges.) This way, the bag won't have to stretch around any sharp corners as the air is removed.

BUSHING AND NIPPLE. The air exits the bag through a brass bushing and nipple installed in the platen. The bushing fits in a counterbored shank hole drilled at the intersection of two grooves (see drawing).

To install the nipple, you'll have to cut a small hole in the bag where it pokes through. This hole is sealed by two rubber washers that sandwich the bag between them (see detail 'a' in drawing). After slipping on a couple of

metal washers, tightening a nut secures the bushing to the platen.

At this point, the press is complete. But you still need to connect it to your vacuum system. That's where an installation kit comes in.

KIT. The kit consists of a vacuum gauge and a short length of plastic tubing. A check valve inside the tubing keeps air from leaking back into the bag. (Sources of kits are listed on page 126.)

APPLYING VENEER

Now you're ready to put the squeeze on the veneer. To start, you build up a "layer cake" made of four parts.

GLUE. To form the bottom two layers, the veneer is simply glued to the core material (*Step 1* below). For most work, I use yellow glue. But if I need more working time, white glue works fine.

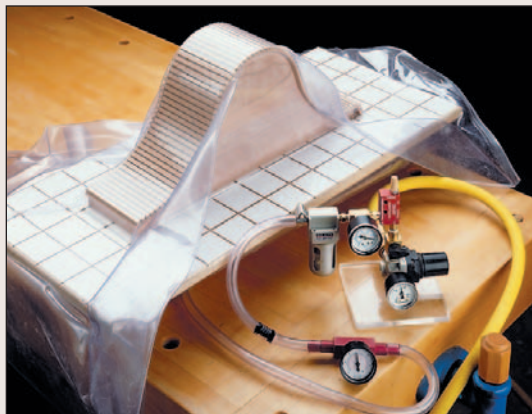
Note: A strip of masking tape will keep the veneer from slipping as you slide it into the bag.

CAUL AND WAXED PAPER. The top layer is a caul made from $\frac{1}{4}$ " hardboard (*Step 2*). The caul works with the bag to distribute pressure evenly across the surface of the veneer. Here again, it's best to soften the edges of the caul.

Between the caul and the veneer is a layer of waxed paper. This prevents any glue that's drawn through the veneer from sticking to the caul.

LOAD PRESS. With the caul in place, you just slide the whole thing into the bag like a cake into an oven (*Step 3*). It's a good idea to place the project over the bushing. This will keep the vacuum bag from getting sucked down into the opening in the bushing.

APPLY VACUUM. All that's left now is to turn on the vacuum system and wait.



Odd-shaped projects. There's no struggling with clamps to glue the tambour to this curved project. The vacuum press applies even pressure quickly.

To provide a good bond, I usually let it "cook" in the bag for about three hours.

When you take it out, the top surface of the veneer may be damp. But don't worry. It's just the moisture from the glue that has been pulled through the veneer. When the moisture evaporates, the veneer will be glued down tight.

CURVED PROJECTS

Applying veneer to a curved surface can be a tricky process, to say the least. This is one job where a vacuum bag can simplify things considerably.

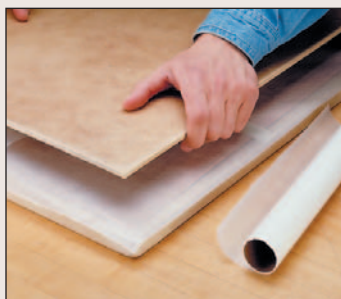
The photo above shows a perfect example. The bag hugs the contours of the project, applying uniform pressure across the curved top.

PLATEN SIZE. One thing to be aware of with curved projects is the size of the platen. It should be small enough so the bag drapes loosely around the project during a "dry run." This way, the bag won't stretch (and possibly rip) as the vacuum is applied.

COVER OPENINGS. Also, it's a good idea to cover any openings in the project with a scrap. This keeps the bag from getting sucked inside.



1 Start by gluing the veneer to the core material. Tape keeps veneer from shifting.



2 Next, put waxed paper over veneer. Then place a hardboard caul on top of the panel.



3 After sliding this "layer cake" into the open end of the vacuum bag, seal the bag by clipping the C-shaped channel over the plastic tube.





SHOP ASSISTANTS

There are times in the shop when you might wish you had a few extra hands. This section features several shop fixtures that will assist you where it's needed most.

Whether you need extra support for your workpiece, want to free up your hands during an operation, or just want to build in a little extra safety and accuracy, you're covered. These projects are all easy to build, but you'll find yourself using them over and over in your workshop.

Roller Stand

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- Shop Tip: Fitting Wheels 56
- Designer's Notebook: Wide Stand 57

Table Saw Knee Switch

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- Shop Info: Push-Button Switch 60
- Shop Tip: Rip Fence Alignment 61
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Roller Stand

Ripping long boards is made easier with a roller stand, and this one is inexpensive and simple to make. The stand is portable, its height is adjustable, and you can even turn it into a wide stand for plywood.



The biggest problem with making a roller stand is the rollers themselves. Manufactured rollers can get costly — especially if you want a stand with more than one roller. And shop-made rollers can be tricky and tedious to make. I figured there had to be a simple, efficient way to make them, and I found it with the help of some common supplies.

PIPE AND WHEELS. Combine PVC pipe with some steel rod and wooden toy wheels and you've got an easy, strong, and inexpensive way to make rollers. I used 2"-dia. PVC pipe (used for plumbing drain lines) for the rollers and

plugged the ends with wooden toy wheels. And I used a piece of steel rod as an axle to support the rollers.

When the roller problem was solved, I concentrated on building some extras into the stand.

HEIGHT ADJUSTMENT. The roller unit is mounted to a large sliding sleeve that fits inside a pedestal. By loosening a single wing nut, the sleeve can be adjusted to different heights.

In addition, the stand can be lowered enough to fit under the extension wings of most table saws for storage (refer to the Overall Dimensions on the opposite page).

LEVELERS. I've found the handiest feature on the Roller Stand to be the shop-made levelers. They allow you to move the stand all around the shop and to adjust the levelers quickly to cancel out any irregularities in the floor. And when they're down, the levelers keep the stand from shifting.

WIDE ROLLER STAND. The stand shown above is perfect for ripping most boards. But what do you do if you're ripping a plywood sheet? There are times when you might want a wider stand for added surface area and stability. This option is explained in the Designer's Notebook on page 57.

EXPLODED VIEW

OVERALL DIMENSIONS:

12 1/2" W x 30" D x 30" H (36 1/2" H AT HIGHEST SETTING)

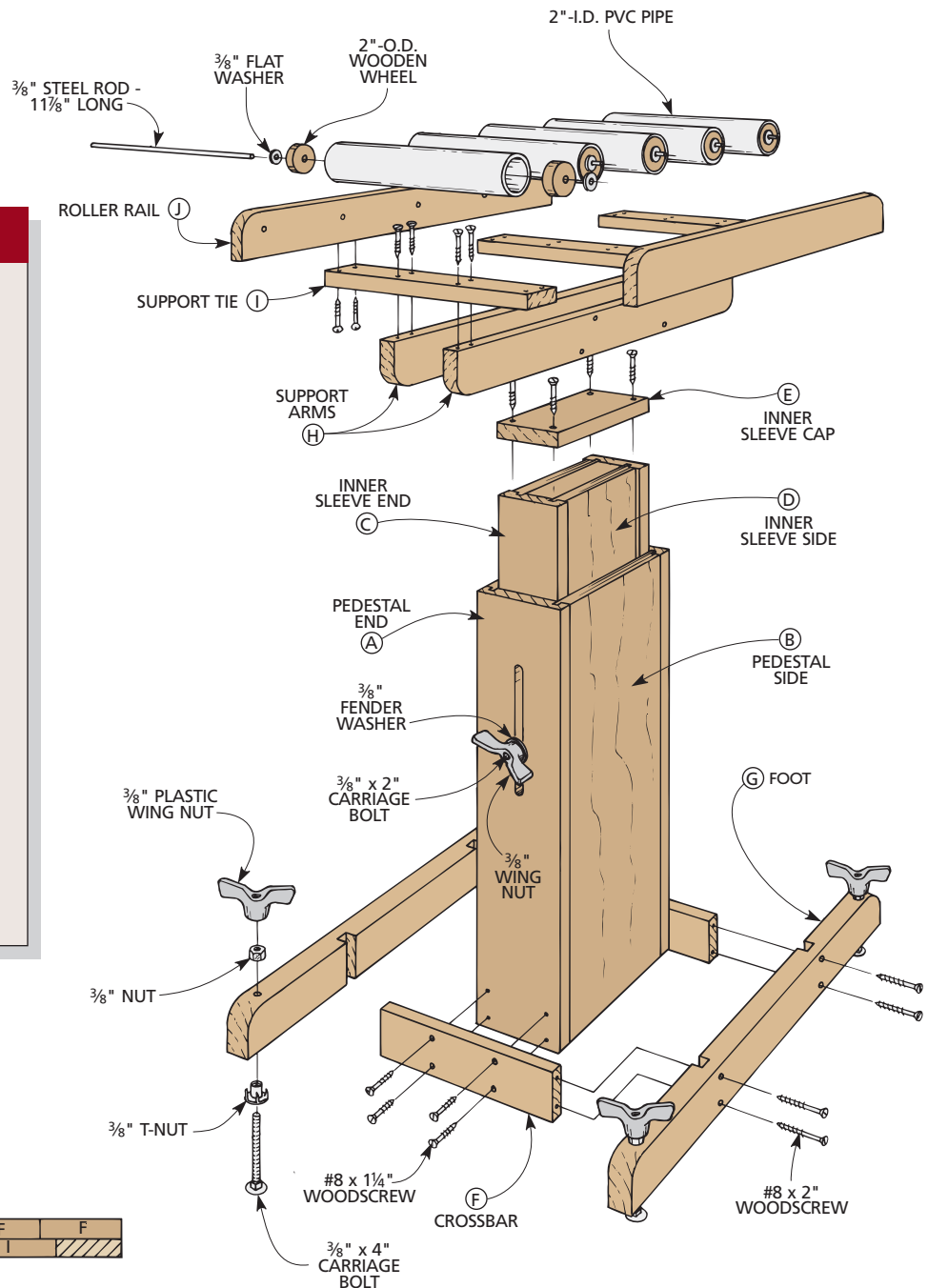
MATERIALS LIST

WOOD

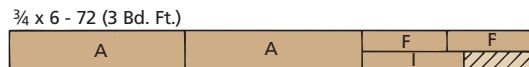
A	Pedestal Ends (2)	3/4 x 5 1/2 - 24
B	Pedestal Sides (2)	3/4 ply - 11 x 24
C	In. Sleeve Ends (2)	3/4 x 3 15/16 - 23
D	In. Sleeve Sides (2)	3/4 ply - 9 7/16 x 23
E	In. Sleeve Cap (1)	3/4 x 3 15/16 - 10 7/16
F	Crossbars (2)	3/4 x 2 1/2 - 11
G	Feet (2)	1 1/2 x 2 1/2 - 30
H	Support Arms (2)	3/4 x 2 1/2 - 30
I	Support Ties (3)	3/4 x 2 1/2 - 12 3/4
J	Roller Rails (2)	3/4 x 2 1/2 - 30

HARDWARE SUPPLIES

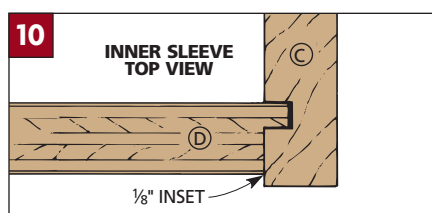
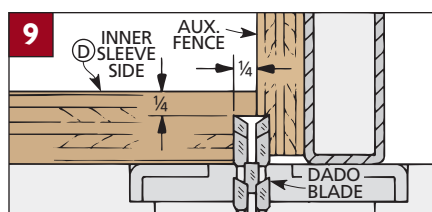
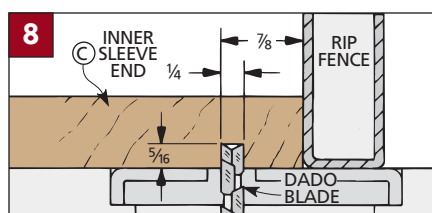
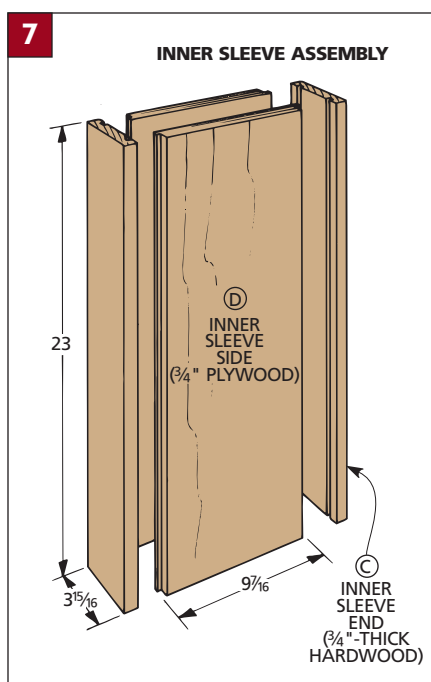
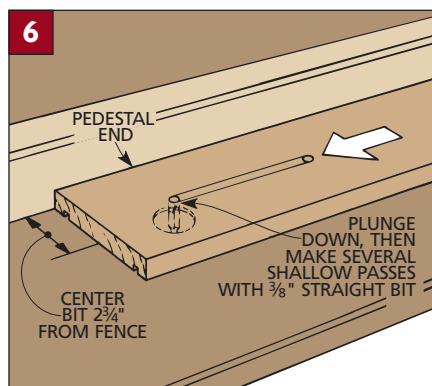
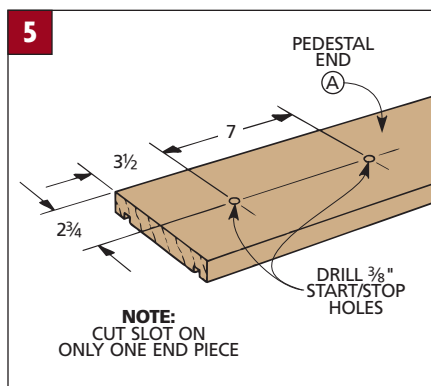
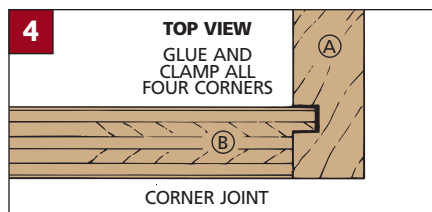
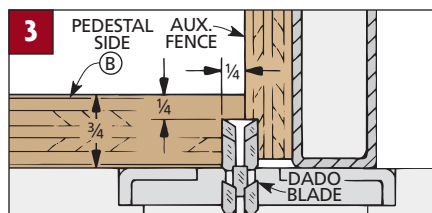
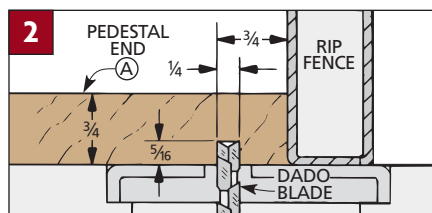
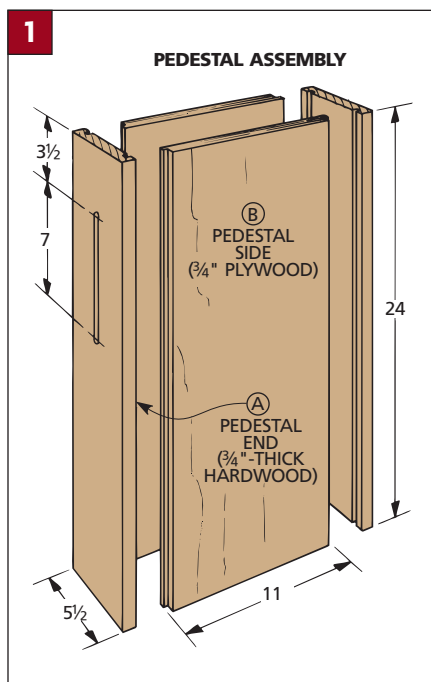
- (36) No. 8 x 1 1/4" Fh woodscrews
- (8) No. 8 x 2" Fh woodscrews
- (20) Wire brads
- (4) 3/8" x 4"-long carriage bolts
- (1) 3/8" x 2"-long carriage bolt
- (1) 3/8" fender washer
- (10) 3/8" washers
- (4) 3/8" nuts
- (4) 3/8" T-nuts
- (5) 3/8" plastic wing nuts
- (5 ft.) 2"-I.D. PVC pipe
- (10) 2" wooden wheels
- (5) 3/8" x 1 1/8"-long steel rods
- (20) 3/4" wire brads



CUTTING DIAGRAM



NOTE: ALSO REQUIRED: 3/4" PLYWOOD - 48 x 48



CENTER SUPPORT

The first step in building the Roller Stand is to make the center support. This support consists of two parts: a pedestal and an inner sleeve. To adjust the height of the rollers, the inner sleeve slides inside the pedestal and is held in place with a wing nut.

PEDESTAL. I started by making the pedestal. Cut the two pedestal ends (A) from $\frac{3}{4}$ "-thick solid stock (*Fig. 1*).

Note: I used solid stock because it won't crush as easily as plywood when the wing nut is tightened.

Once the ends are cut, the next step is to cut the two pedestal sides (B). Since there won't be any pressure on these pieces, I used $\frac{3}{4}$ " plywood (*Fig. 1*).

TONGUE AND GROOVE. With the ends and sides cut, the next step is to join them together. The tricky part is keeping the pedestal the same size from top to bottom. I used a tongue and groove corner joint (refer to *Fig. 4*).

Using a dado blade on the table saw, cut two $\frac{1}{4}$ "-wide grooves on the inside faces of the end pieces (*Fig. 2*). These grooves are cut slightly deeper than the tongue ($\frac{5}{16}$ ") and are located so the distance from the fence to the far side of the blade is equal to the thickness of the plywood sides ($\frac{3}{4}$ ").

Once the grooves are cut, I used a $\frac{3}{8}$ " dado blade to cut tongues on the edges of the plywood sides to fit into the grooves. To cut the tongues, start by attaching an auxiliary fence to the table saw fence (*Fig. 3*). Adjust the fence to make a $\frac{1}{4}$ "-long tongue. Then raise the blade gradually until the tongue fits the $\frac{1}{4}$ " grooves in the end pieces.

ADJUSTMENT SLOT. Before gluing the pieces together, I routed a slot for the adjustment bolt in one of the end pieces. To locate the starting and stopping points of this slot, drill two holes centered on the width of the end (*Fig. 5*). The center points of these holes are 7" apart with the center point of the top hole being $3\frac{1}{2}$ " from the end. Then rout the slot on the router table by making several shallow cuts (*Fig. 6*).

Finally, after the slot is cut, the pedestal pieces can be glued up.

INNER SLEEVE. Once the pedestal is complete, the next step is to make the inner sleeve. It's made the same way as the pedestal, except the plywood sides are inset from the edges of the end pieces (refer to *Fig. 10*). I did this for a

couple of reasons. The edges of the end pieces will act like runners and keep the sides from binding, and if need be, these runners can be planed to fit.

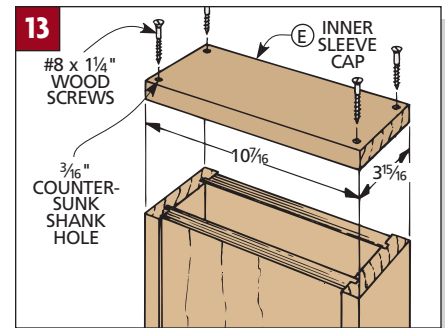
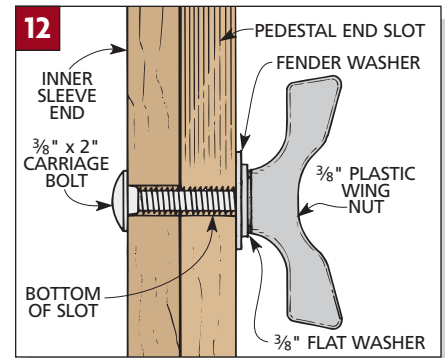
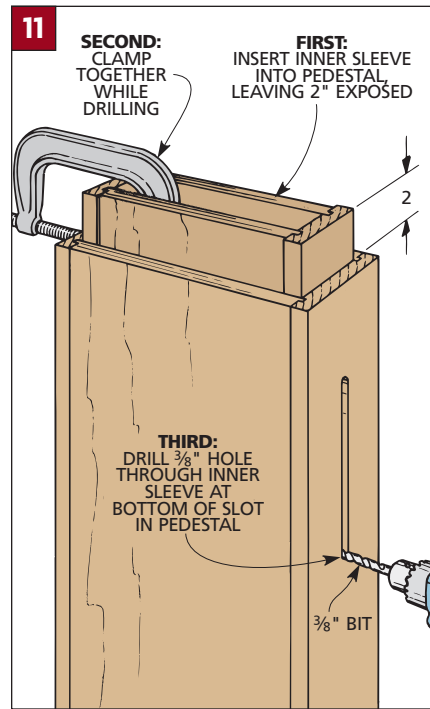
END PIECES. Start by ripping the two inner sleeve ends (C) to fit inside the pedestal with $\frac{1}{16}$ " of clearance. Then cut them to length (23") (Fig. 7).

SIDE PIECES. After the ends are complete, the next step is to cut the inner sleeve sides (D). Subtract $\frac{1}{16}$ " from the inside width of the pedestal. This will give you $\frac{1}{16}$ " clearance between the pedestal and the sleeve. Now, cut the sides to their finished size. In my case this was $\frac{9}{16}$ " wide by 23" long (Fig. 7).

GROOVES. Once all of the inner sleeve pieces are cut to size, the inside face of the end pieces are grooved to accept the sides. This time set the saw fence $\frac{7}{8}$ " to the far side of the $\frac{1}{4}$ " dado blade and cut the $\frac{5}{16}$ "-deep grooves in both end pieces (Fig. 8).

TONGUES. To make the tongues on the ends of the plywood sides, attach an auxiliary fence to the saw fence (Fig. 9). Using a $\frac{3}{8}$ " dado blade, I cut the $\frac{1}{4}$ "-long tongues to fit into the grooves.

GLUE AND FIT SLEEVE. Finally, glue the end and side pieces together to form the inner sleeve. Once the glue is dry, test fit the inner sleeve into the pedestal. It should slide without



binding. If it does bind, you will have to plane or sand the edges or the outside faces of the inner sleeve end pieces.

ADJUSTMENT BOLT. The inner sleeve is held in place with a carriage bolt and wing nut. To determine the location of this bolt, position the inner sleeve 2" above the pedestal and clamp it with a C-clamp (Fig. 11). Now, place a $\frac{3}{8}$ " drill bit in the bottom of the slot in the pedestal and drill through the sleeve.

Now reach down into the inner sleeve and push a $\frac{3}{8}$ " x 2" carriage bolt through the hole (Fig. 12). Tap the bolt with a hammer to make sure it's seated.

Then, to keep from marring the wood, I put a fender washer and a standard washer over the bolt and threaded on a $\frac{3}{8}$ " wing nut. I used a large plastic-handled wing nut, but you can make your own (see the Shop Tip at left).

CAP. To complete the inner sleeve, I added a cap. To make the cap (E),

simply cut a piece of $\frac{3}{4}$ " stock to fit flush with the outside edges of the sleeve (Fig. 13). Then drill countersunk screw holes and screw the cap into the ends.

BASE

Once the center support is complete, the next step is to make the base to support it. The base is made up of two parts: the crossbars and the feet.

CROSSBARS. Starting with $\frac{3}{4}$ "-thick stock, cut two crossbars (F) to their finished size (Fig. 14). Then, position the crossbars so they're centered and flush with the bottom of the outer sleeve. Now, drill four countersunk holes in each crossbar and screw them in place.

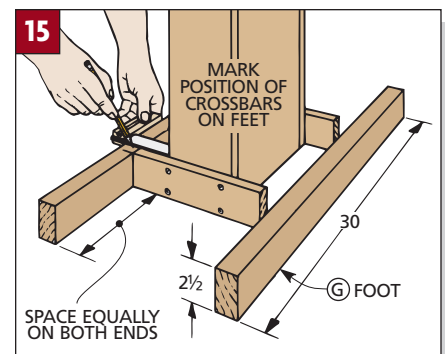
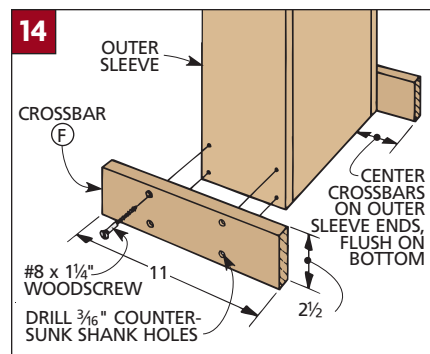
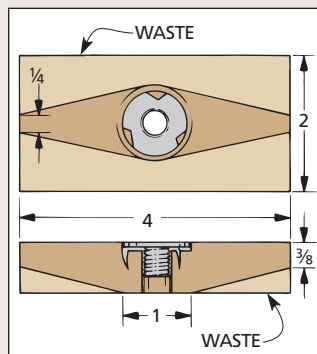
FEET. Now you can make the feet (G) from $1\frac{1}{2}$ " stock (Fig. 15).

Next, center the feet against the crossbars and mark where the crossbars intersect the feet (Fig. 15).

SHOP TIP

Wing Nut

Wooden wing nuts can be more comfortable when exerting hand pressure. This one is made from $\frac{3}{4}$ "-thick stock with a counterbored hole for a T-nut and tapers on the sides and bottom.



Once both feet have been marked with the crossbar positions, cut the $\frac{3}{4}$ "-deep dadoes to match the thickness of the crossbars ($\frac{3}{4}$ ") (Figs. 16 and 16a).

Next, I sanded the top edges on the ends of the feet to a 1" radius (Fig. 17).

LEVELERS. To keep the Roller Stand from rocking on an uneven floor, I drilled a $\frac{1}{2}$ " hole through each end of each foot and added a leveler. These levelers are just $\frac{3}{8}$ " x 4" carriage bolts threaded through T-nuts (Fig. 17).

To make it easier to adjust the levelers, I threaded on a plastic wing nut (or you could make the shop-made wing nut shown on page 55).

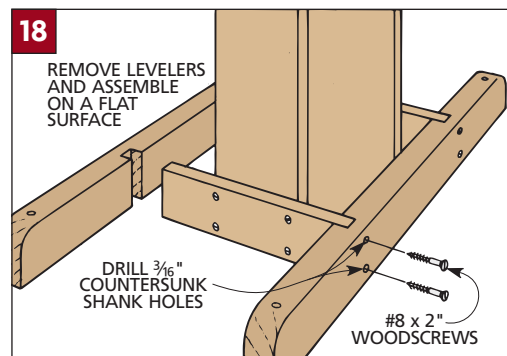
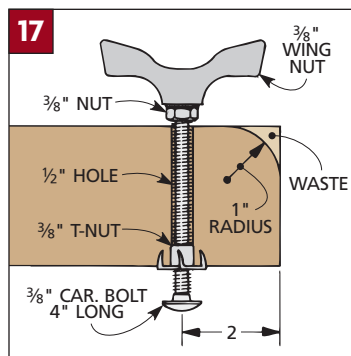
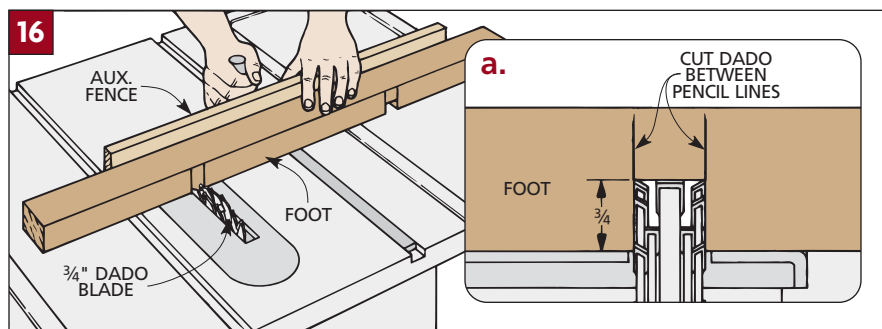
ATTACH FEET. Finally, screw the feet to the crossbars (Fig. 18).

ROLLER SUPPORTS

Having completed the base, I started building the supports for the rollers. Begin by cutting the $\frac{3}{4}$ "-thick support arms (H) and support ties (I) to their finished dimensions (Fig. 19). Then sand a 1" radius on the bottom corners of the support arms.

ATTACH ARMS. Next, center the arms on the inner sleeve, keeping the arms flush with the top edge of the cap. Now mark the location of the screw holes so the top screws go into the edge of the cap and the lower ones go into the edges of the end pieces (Fig. 19). Then drill countersunk shank holes and screw the arms to the sleeve.

ATTACH TIES. To complete the roller support, screw the support ties across the top edge of the arms (Fig. 19a).



ROLLERS. With the roller support completed, I started working on the heart of this project — the rollers.

Each of the five rollers is made from a section of 2" PVC pipe. This pipe is normally used for drain lines and is sold by the foot at hardware stores.

To make the rollers, begin by cutting the pipe into five 11"-long tubes. First cut them to length with a hand saw (or hack saw). Then sand their ends to remove any rough edges.

WOODEN WHEELS. After filing off the burrs, the tubes are plugged to support a steel axle rod. I plugged the ends with

2" hardwood toy wheels (Fig. 20). These wheels come pre-drilled to the correct size for the $\frac{3}{8}$ " steel rod that supports the roller.

Note: For mail-order sources of wooden wheels, see Sources on page 126. Or if you prefer, you can make your own wheels in the shop using an adjustable circle cutter.

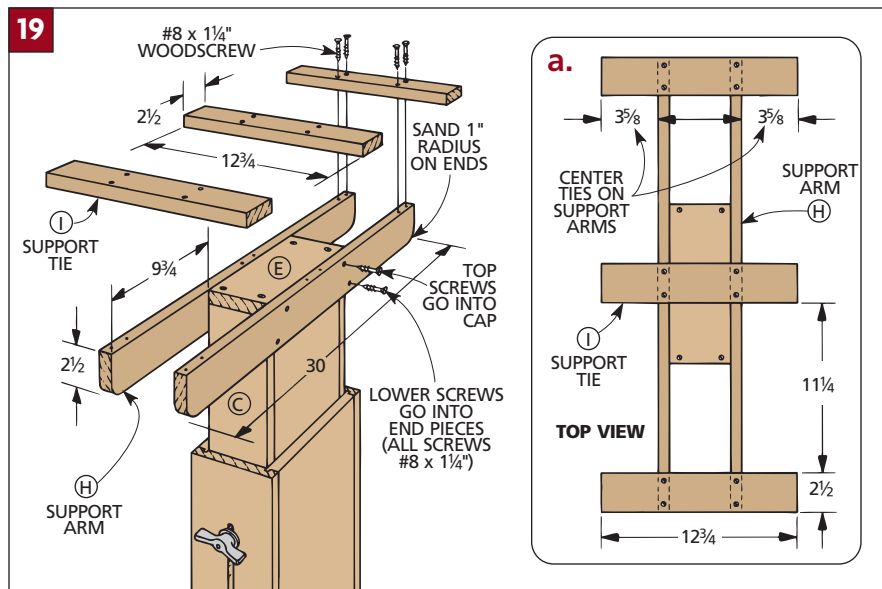
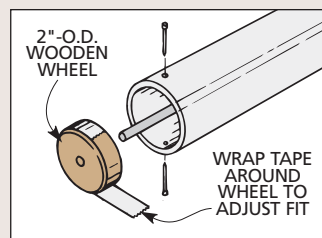
I used electrician's tape to help make up for any irregularities on the inside of the tubes or the outside of the wheels (see the Shop Tip at the lower left).

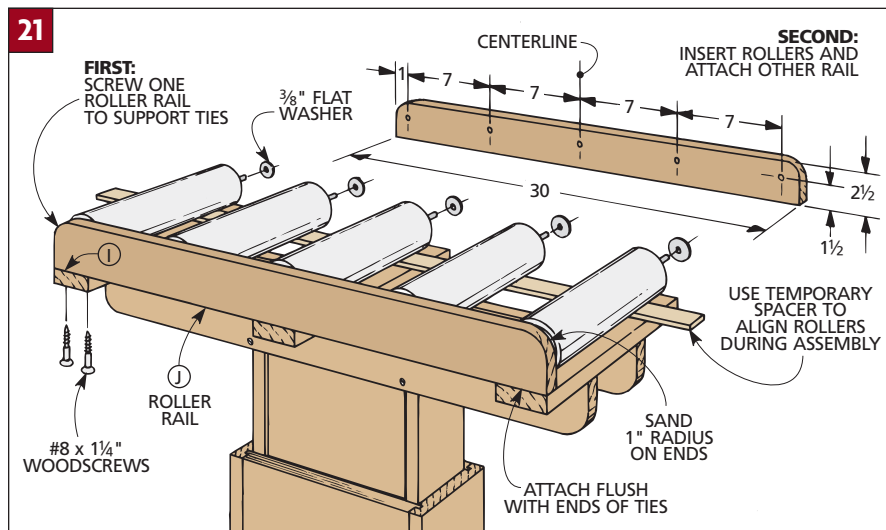
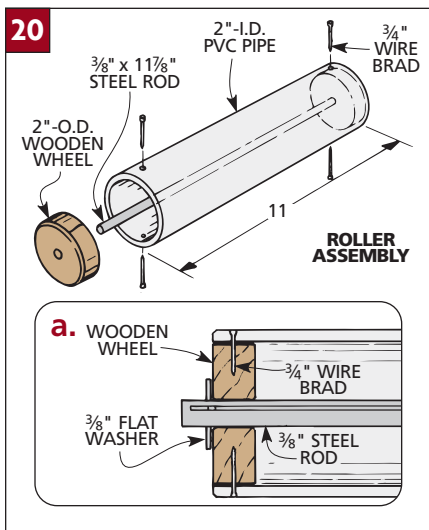
STEEL AXLE RODS. Next, to support the rollers, I cut five pieces of $\frac{3}{8}$ " steel

SHOP TIP

Fitting Wheels

To help the wheels fit properly in the rollers, wrap electrician's tape around them and pin them in place with two 17-gauge wire brads.





rod. Each piece is cut $11\frac{7}{8}$ " long and inserted through the holes in the wheels. Then, to keep the rollers spaced properly, I put a $\frac{3}{8}$ " flat washer on each end of the rod (Fig. 20a).

RAILS. All that's left to make are the roller rails (J). These rails are screwed to the support ties and are used to

hold the rollers in place. Using $\frac{3}{4}$ "-thick stock, cut the rails to their finished size. Then sand a 1" radius on each top corner of the rails (Fig. 21).

Next, drill five $\frac{7}{16}$ " holes along the inside face of each roller rail (Fig. 21). These holes are $\frac{3}{8}$ " deep and centered 7" apart, $1\frac{1}{2}$ " up from the bottom edge.

Finally, screw one of the rails to the top of the support ties. Then insert the roller assemblies into this rail.

Note: I wanted to make sure the rollers stayed at the correct height while I installed the opposite rail. So I placed a $\frac{1}{4}$ "-thick temporary spacer under one end (Fig. 21).

DESIGNER'S NOTEBOOK

A wider version of the Roller Stand comes in handy when cutting large sheets of plywood.

CONSTRUCTION NOTES:

■ To make the Roller Stand wider (making it handy when working with plywood panels), the building procedure doesn't change. The only differ-

ence is that four of the parts will have to be made longer. This means you'll need more $\frac{3}{4}$ " stock, 10 feet of PVC pipe and more $\frac{3}{8}$ " steel rod.

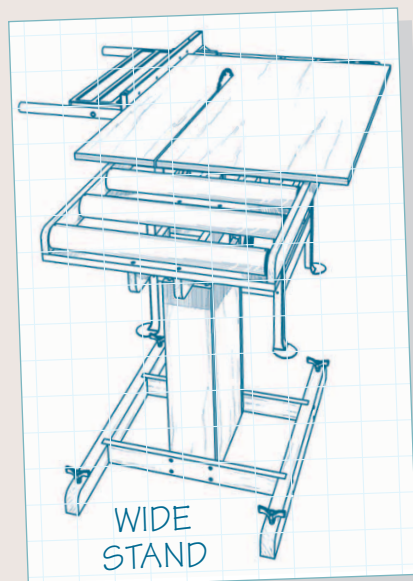
■ The first pieces that need to be lengthened are the two crossbars (F). Instead of 11" long, cut these pieces 22" long. This extra length is needed to keep the roller stand from tipping side to side.

■ Next, adjust the length of the three support ties (I) for the longer rollers. Cut the ties $22\frac{3}{4}$ " long.

■ With the support ties cut to length, the next step is to cut the longer rollers.

Each of these five 2" PVC rollers has to be made 22" long.

■ Finally, the five $\frac{3}{8}$ " steel rods need to be cut $22\frac{7}{8}$ " long to support the rollers.



MATERIALS LIST	
CHANGED PARTS	
F Crossbars (2)	$\frac{3}{4}$ x $2\frac{1}{2}$ - 22
I Support Ties (3)	$\frac{3}{4}$ x $2\frac{1}{2}$ - $22\frac{3}{4}$
HARDWARE SUPPLIES	
(10 ft.) 2" -I.D. PVC pipe	
(5) $\frac{3}{8}$ " x $22\frac{7}{8}$ " -long steel rods	

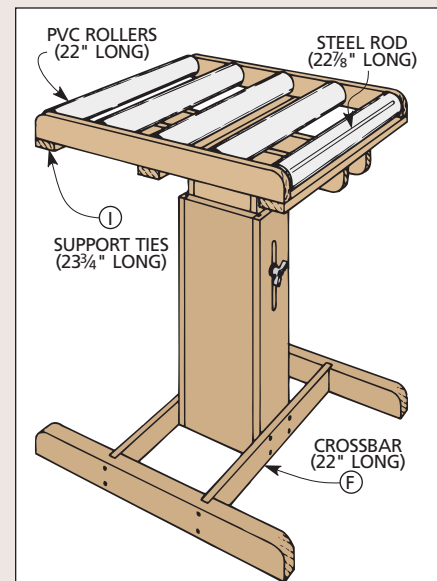


Table Saw Knee Switch

You don't want to get caught fumbling for the OFF switch when your table saw's blade starts to bind. Installing this simple knee-operated shut-off switch is easy, and it makes your saw that much safer.



You're in the middle of a rip cut on the table saw when the motor starts to bog down. The wood begins to smoke. Then the blade binds up. Sound familiar?

Your first instinct is to reach for the power switch. But then you realize it could be difficult (and dangerous) to control the workpiece with one hand while groping for the switch with the other.

Recently I faced this very situation. Fortunately, someone else was in the shop to turn off the motor for me. But I knew I wouldn't be so lucky every time.

Once the dust settled, I decided right then and there that I didn't want to get

stuck in a dangerous situation like that ever again. I needed a simple, effective safety device for just such an occasion.

KNEE SWITCH. The result is this convenient knee-operated shut-off switch. The shut-off switch is basically a large bar that rests against the OFF button of the saw's ON/OFF switch.

Note: If your table saw doesn't already have a push-button switch like the one shown in the photo above, refer to the box on page 60.

BAR. The bar hangs from a pair of arms and support brackets on the sides of the saw cabinet like a swing. To use the shut-off switch, just kick or lean a

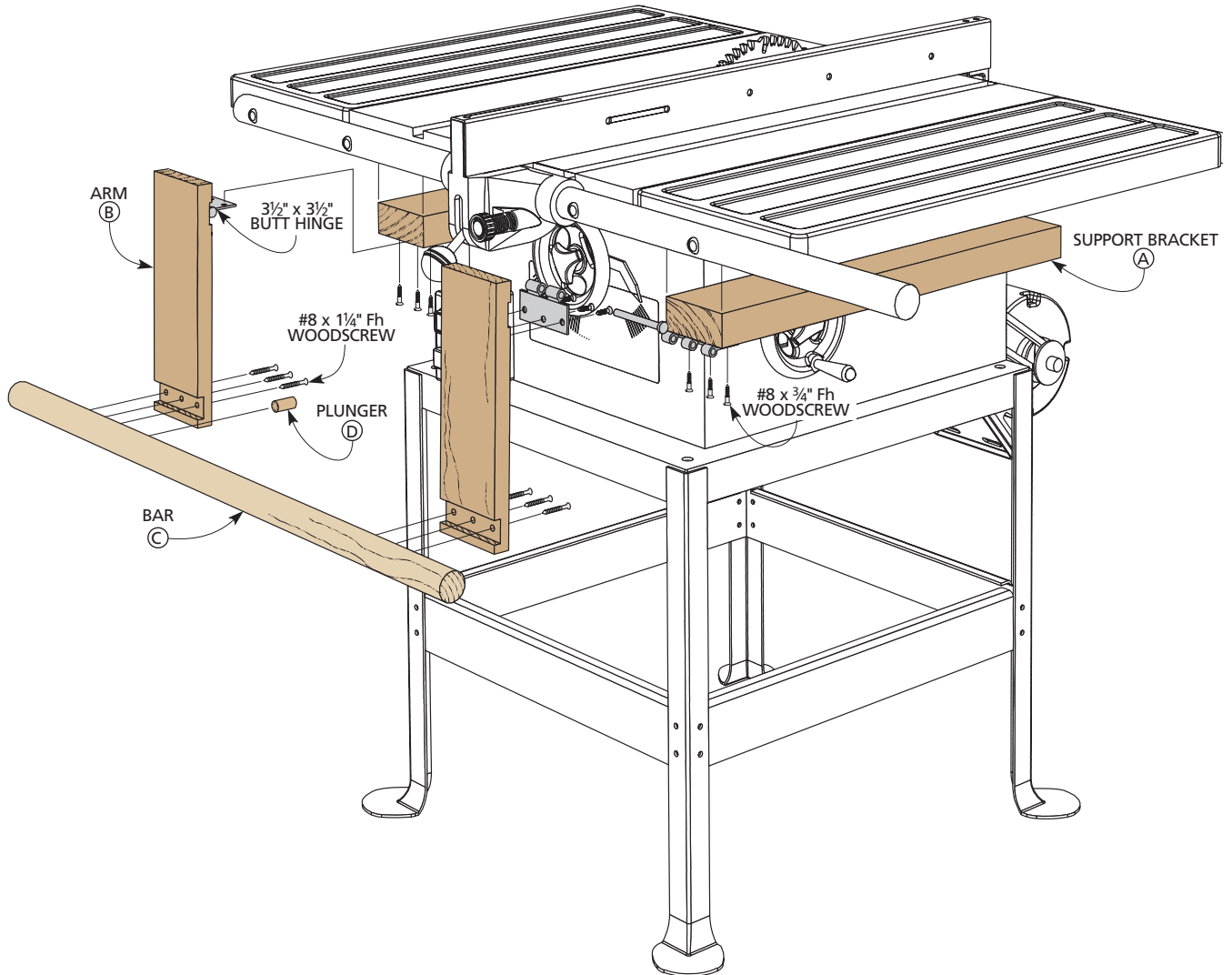
knee into the bar. A plunger on the bar automatically presses the OFF button to kill power to the motor. Or if you prefer, you can even use your hands (see the photo on page 61).

SHOP NOISE. Since this article is about shop safety (and happens to deal with one of the loudest tools in the shop), I thought it was a good excuse to talk about how to reduce the noise levels in your home workshop.

Saving your ears is every bit as important as any other safety precaution, so it might be worth your while to check out the Shop Info article beginning on page 62.

EXPLODED VIEW

OVERALL DIMENSIONS:
DEPENDENT ON YOUR SAW'S DIMENSIONS



CUTTING DIAGRAM

2x4 (1 1/2 x 3 1/2) - 72 (2.6 Bd. Ft.)



3/4 x 3 1/2 - 72 (1.75 Bd. Ft.)



NOTE: PART C IS CUT FROM A 36" LENGTH OF 1 3/4"-DIA. DOWEL. PART D IS CUT FROM A LENGTH OF 1/2"-DIA. DOWEL

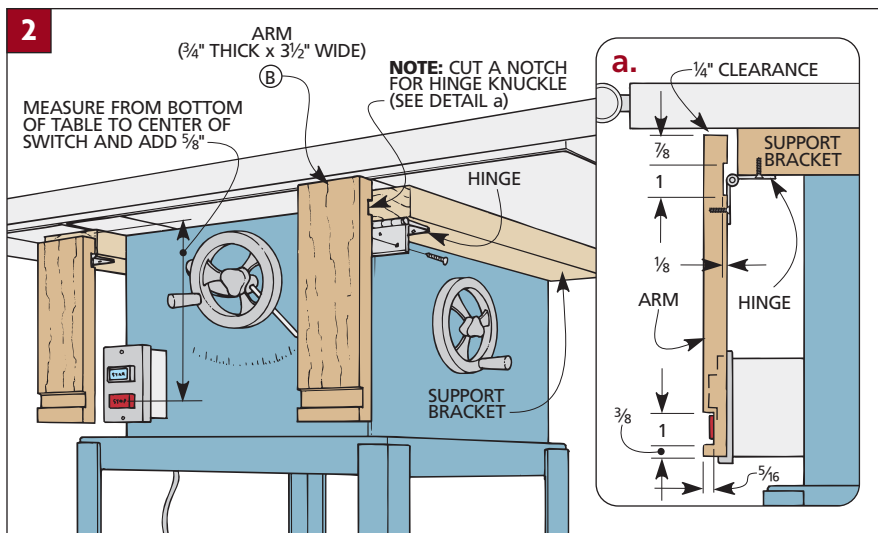
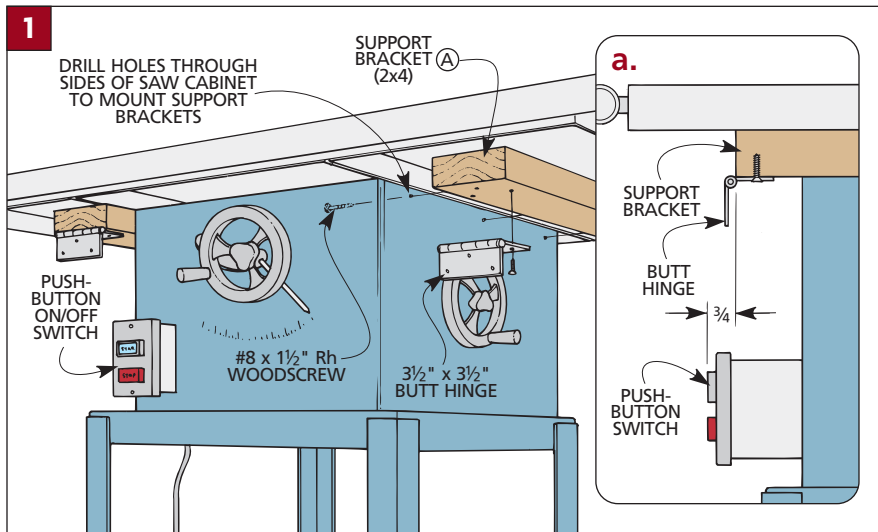
MATERIALS LIST

WOOD

- A** Support Bracket (2) 1 1/2 x 3 1/2 - 24 rgh.
- B** Arm (2) 3/4 x 3 1/2 - 18 rough
- C** Bar (1) 1 1/4 dowel - 36 rgh.
- D** Plunger (1) 1/2 dowel - 3 rough

HARDWARE SUPPLIES

- (12) No. 8 x 3/4" Fh woodscrews
- (6) No. 8 x 1 1/4" Fh woodscrews
- (6) No. 8 x 1 1/2" Rh woodscrews
- (2) 3 1/2" x 3 1/2" butt hinges



SUPPORT BRACKETS

Because the knee switch is designed to fit your saw, the first thing you'll need to do is determine the size of the two support brackets (A) the bar hangs from. (They're just lengths of 2x4.)

To do this, measure from the back of your saw cabinet to the front edge of the box the ON/OFF switch is housed in (Figs. 1 and 1a). Then subtract $\frac{3}{4}$ " to allow for the arms added later.

Once the support brackets have been cut to length, they can be mounted to the cabinet. To mount them, drill three holes through the cabinet to fit No. 8 x $1\frac{1}{2}$ " woodscrews and screw them in place (Fig. 1).

With the brackets in place, the next step is to screw a butt hinge to the end of each support (Fig. 1). These hinges allow the knee switch to swing.

ARMS

Now you're ready to move on to the U-shaped knee bar that's made up of two arms and a bar.

To determine the length of the arms (B), just measure from the bottom of the table top to the center of the OFF button (Fig. 2). Then add $\frac{5}{8}$ " for a dado that's added next.

Once the arms are cut to size (I used $\frac{3}{4}$ "-thick hard maple), a dado is cut on each side of the arm — one allows clearance for the hinge knuckle, the other accepts the bar (Fig. 2a).

When screwing the hinges to the arms, leave $\frac{1}{4}$ " clearance on top so the arms can swing freely (Fig. 2a). After you've screwed them in place, all that's left is to add the bar.

BAR

The bar hangs from the arms and runs across the full width of the table saw. The bar is just a length of $1\frac{1}{4}$ "-dia. dowel with a plunger (a $\frac{1}{2}$ "-dia. dowel) glued in it to make contact with the OFF button (refer to Fig. 4).

Note: If your saw doesn't have a push-button switch, you'll need to acquire one (see the Shop Info box at left).

To determine the length of your bar (C), measure from the outside edges of the arms and add 8" for a 4" overhang at each end (Fig. 3a).

Then to locate the hole for the plunger (D), temporarily clamp the bar

SHOP INFO .. Push-Button Switch

Many table saws come with toggle-type power switches. If your saw has one, you'll have to replace it with a push-button switch (like the one shown in the photo at right) before you can build and use the Table Saw Knee Switch.

SOURCES. Push-button switches are available through most electrical supply dealers. Some tool manufacturers even carry them. Refer to Sources on page 126 for more information.

But be sure to check around. Prices can vary widely, and taking some extra time to find the best deal could save you quite a bit.



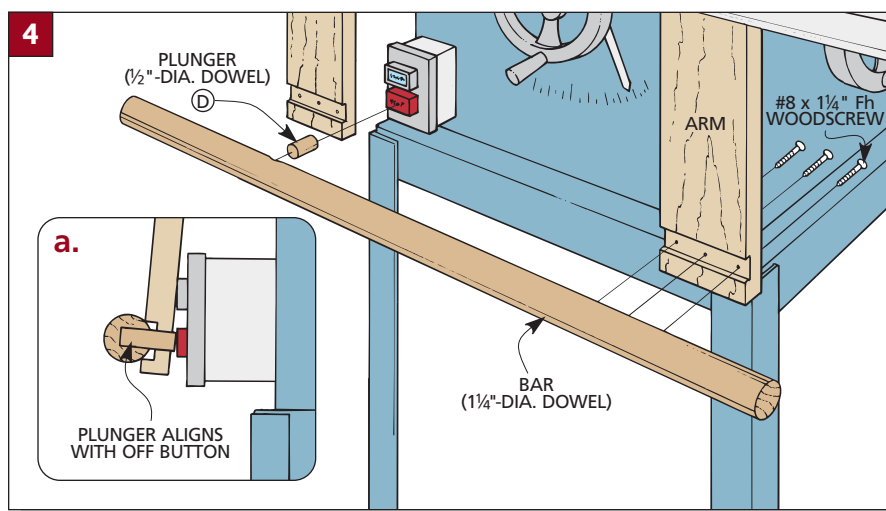
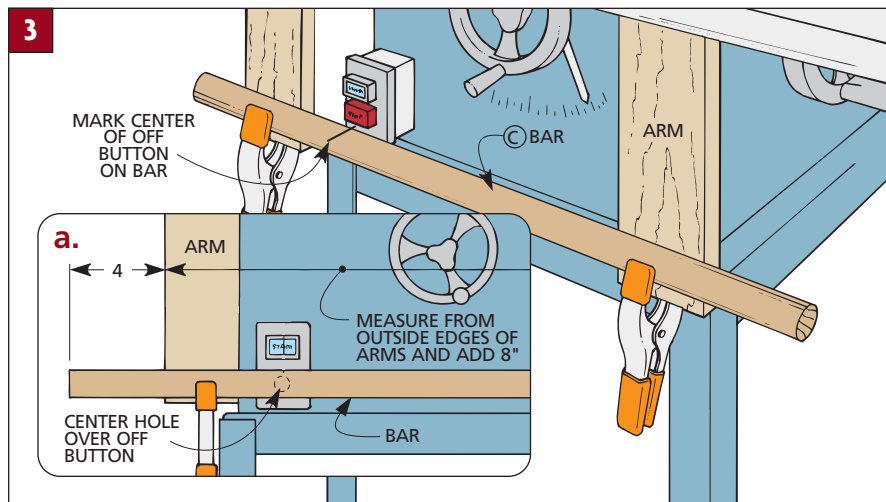


The shut-off bar is designed to be knee operated, but you can also use your hand if it's more convenient.

to the arms (Fig. 3). Next, make a mark on the bar where it's directly over the OFF button (Figs. 3 and 3a). Now drill a hole and add the plunger.

Finally, to mount the bar, first clamp it in place again with the plunger positioned directly over the OFF button. Then just screw the arms to the bar, making sure it doesn't shift in the process (Figs. 4 and 4a).

Now the knee switch is ready to use, just in case a board binds as you're cutting. However, if you find that workpieces bind regularly on your saw, you might need to adjust the rip fence (see the Shop Tip below). ■



SHOP TIP

I mounted the knee switch on a contractor's-style table saw. Binding on this style of saw can usually be traced to a misaligned rip fence.

To prevent this type of binding, I like to adjust the fence so it's slightly canted from the miter gauge slot (about $\frac{1}{32}$ "). To make this easier, I use a simple alignment jig that rides in the miter gauge slot.

The jig is made from two pieces of scrap screwed together in a T-shape,

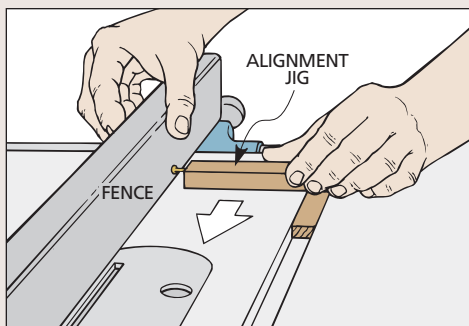
with a small brass screw in one end.

To align the fence, simply slide the jig to the front of the saw, move

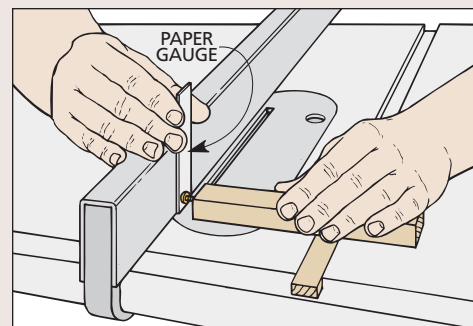
the fence in and lock it down (Step 1).

Now slide the jig to the far end of the fence and use a paper spacer to allow for a $\frac{1}{32}$ "

gap (Step 2). This still allows for straight cuts, reducing the chance of binding between the blade and the fence.



1 To align the fence, first lock it down with its face just touching the brass screw on the alignment jig.



2 Now slide the jig to the far end of the fence and adjust the fence to produce about a $\frac{1}{32}$ " gap.

SHOP INFO *Reducing Tool Noise*

Let's face it. Noise is a fact of life in most shops. And even though you can insulate yourself with a pair of hearing protectors, the high-pitched whine of a router or table saw still carries throughout the house (and sometimes even to the neighbor's).

To avoid disturbing the people around me (and being forced to close down shop early in the evening), I've been experimenting with different ways to put a damper on the tools that generate the most noise.

METER. As a starting point, I wanted to get an idea of just how noisy my tools were to begin with. So I bought a "noise meter" from a local electronics store (see photo at right).

This meter measures the intensity of the sound in decibels (dB). And since this intensity usually increases as you make a cut, all of the readings were taken with the tool in operation (see the chart below).

BENCHMARK. Although this gave me an initial noise level that served as a "benchmark," I was surprised by one thing. There wasn't as much of a range as I'd expected between the decibel readings of a relatively quiet tool (a drill press for example) and those of an "ear-buster" (like a table saw).

SCALE. To find out why, I called a local hearing specialist. He said that the scale used to measure decibels was logarithmic. What this means is that a slight increase (or decrease) in the decibel reading has a much more significant effect than you'd think.



For example, for every 3-dB increase in the reading, the intensity of the sound actually doubles. So, for example, if one shop vacuum spikes 90 dB, two shop vacuums would top out at 93 dB on the meter.

Understanding how the scale works is one thing. But when it comes to dampening tool noise, the real test is to

use the scale as a measuring stick to see (or hear) what works and what doesn't.

MULTIPLE SOLUTIONS. What I've found is that there's no single solution that's going to dramatically reduce the noise level of the tools in your shop. But there are combinations of little things you can do that soon add up to produce a quieter shop.

Conversation (at 3ft)	60-70dB
Drill Press	77dB
Scroll Saw	88dB
Shop Vacuum	90dB
Table Saw	92dB
Router	96dB
Jet Engine (at 100ft)	140dB

How Loud Is Loud?

NOTE: AN INCREASE OF 3 DB DOUBLES THE INTENSITY OF THE SOUND.

TOOL SELECTION

If you're planning to buy a new tool, one of the simplest things you can do to reduce your shop's noise level is to select a quiet tool. This may sound like a simple task, but it might require a bit of detective work.

While some manufacturers include decibel readings along with other information about the tool, that seems to be the exception — not the rule.

Be sure to ask the salesperson about noise while you're examining the tool, in case the information isn't posted where it's easily accessible.

NOISE TEST. So what I do is fire up the tool in the store. After all, if it's too loud in a wide open space (like a tool or home improvement warehouse), you know it's going to be too loud at home.

Don't give a tool the benefit of the doubt when it comes to noise. That sound will actually feel a lot louder when you bring the tool into your home workshop, so be realistic.

Note: Unfortunately, this "test it in the store" method isn't exactly fool-proof. Until you can actually run a scrap piece of wood through the blade of the

tool, you won't know exactly how loud it will get in use.

FEATURES. Another thing that's worth considering before buying a tool is the features it has that can contribute to quieter operation. Some of them are designed specifically with noise reduction in mind, while others have unrelated uses (a lower level of noise is just a pleasant bonus).

There are several features to consider, but some important ones to be aware of are the motor, drive system, and the speed of operation (see below).

MOTOR

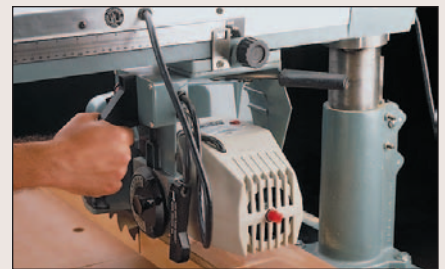
One thing that affects the noise produced by a tool is the type of motor. Because it runs at a higher speed, a universal (brush-type) motor is louder than an induction (brushless) motor.

Note: To tell them apart, simply check for the "caps" that hold the brushes in place.

Although most hand-held power tools use a universal motor, you'll often have a choice when buying a stationary power tool (see photos at right).



Universal Motor. Because it operates at high speed, a tool with a universal motor runs louder.



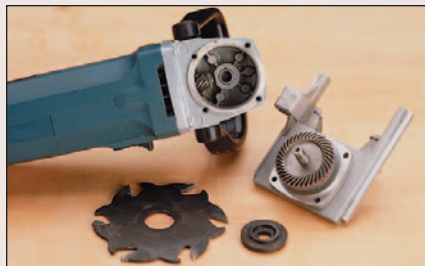
Induction Motor. A heavy motor housing and slower speed contribute to a quieter running tool.

DRIVE SYSTEM

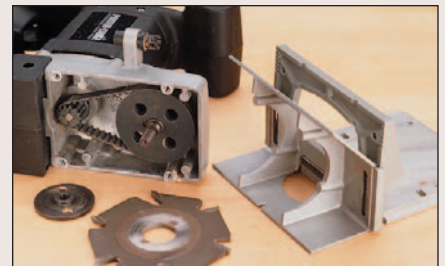
The drive system of a tool also makes a difference in the noise it generates. As a rule of thumb, a gear-driven tool runs louder than one that's belt-driven (see photos at right).

The reason is simple. In a gear-driven tool, there's a certain amount of "transmission" noise caused by the gears meshing together.

But if you transfer power from the motor to the blade through a belt, it eliminates this noise.



Gear-Driven. A tool that transfers power through a system of gears tends to run louder.



Belt-Driven. A belt-driven tool offers a quieter method of getting power from the motor to the blade.

VARIABLE SPEED

Although it's not designed specifically to reduce noise, a tool with a variable speed control can be set to run slower (and therefore significantly quieter) than a single speed tool.

For example, the decibel reading of the variable speed router in the left photo drops from 100 dB at high speed to 78 dB at the slowest speed.

If you already have a fixed speed router, you can use a control like the one in the far right photo.



Variable Speed. A router with a built-in variable speed control can be set to run slower and quieter.



Speed Control. To reduce the RPM (and noise) of a fixed speed router, use a speed control unit.

MOTOR VIBRATION

One of the main sources of tool noise is the vibration that's set up by the tool's own motor. Reducing this vibration will go a long way toward a quieter tool and a quieter workshop.

The best way to damp this vibration (and noise) is to absorb the vibration *before* it's transferred to other parts of the tool or stand.

ANTI-VIBRATION PADS. One way to do this is to insulate the base of the tool from the stand. To do this, you

can use a rubber-like pad that's specially designed to absorb vibration (see left photo). They generally come oversized so they are large enough to fit most tools.

This pad can be cut to match the "footprint" of your tool. Or you can cut strips to fit between the frame of a motor and the mounting plate.

Note: See page 126 for mail-order sources of anti-vibration pads.

ISOLATION MOUNTS. But after a lot of searching and testing, the best thing I've found for soaking up motor vibration is a special product called an "isola-

tion mount." Basically, an isolation mount is a hard rubber cylinder with a threaded hole at each end for a mounting bolt (see right photo).

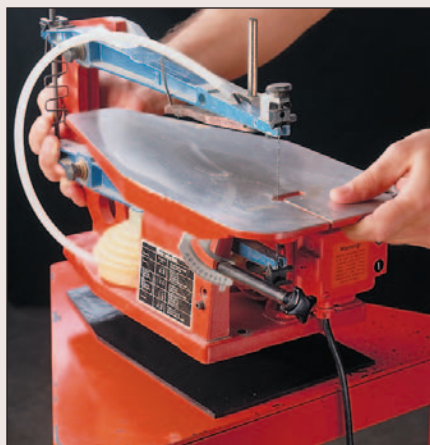
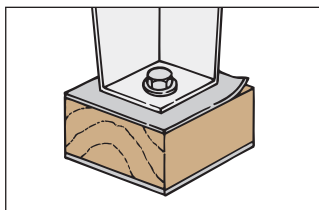
What makes these mounts work is that the holes (and the mounting bolts that thread into them) don't go all the way through. Instead, they're separated by a rubber "cushion" that helps dissipate the vibration.

Note: Be sure to select a bolt that's short enough so it won't "bottom out" before it tightens up. See page 126 for sources of isolation mounts, hardware, and other supplies.

SHOP TIP

Isolation Pad

Controlling vibration at floor level helps reduce noise. Here, a block sandwiched between rubber strips keeps vibration (and noise) from transferring to the floor.



Anti-Vibration Pad. This rubber-like pad absorbs vibration instead of transferring it to the tool stand.



Isolation Mounts. Hard rubber cylinders "isolate" the vibration set up by the motor on a tool.

TOOL STANDS

Sometimes even the stand that a tool is mounted on can add to the noise level in your workshop.

TIGHTEN BOLTS. Because a stand can loosen up with use and start to rattle, it's a good idea to tighten down the bolts that hold it together. And to keep them from vibrating loose again, replace any flat washers with lock washers.

But noise can still be a problem if the stand flexes when the tool is running. To keep the metal parts from rubbing against each other, you'll need to "insulate" the tool stand.

INSULATE. One way to do this is to disassemble the stand and apply construction adhesive between parts that touch. Or, just add weight or ballast to the stand. (Concrete blocks or sand work well.) To insulate the stand from the floor of the shop, see the Shop Tip above.

SHOP-BUILT STANDS. But perhaps the best way I've found to damp the noise of

a metal stand is to replace it with a shop-built one. To absorb as much vibration as possible, incorporate heavy, dense materials like particleboard or MDF.



Router Cabinet. An enclosed cabinet decreases the noise level of this router from 100dB to 90 dB.

To further reduce noise, enclose the tool inside the stand (see photos). Just be sure to provide plenty of ventilation to prevent heat build-up.



Shop Vacuum. Here, an enclosed cabinet is used to muffle the shrill pitch of a shop vacuum.

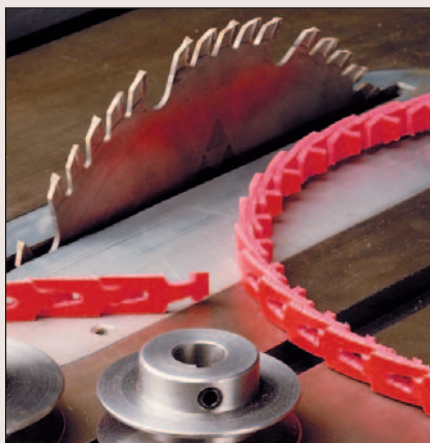
BELTS & PULLEYS

Although it's easy to overlook them, the drive belt and the pulleys on a motor also contribute to how much noise a tool makes.

BELT. With use, a lump can form on the belt where it's fused together. As this lump passes across the pulleys, it can sound like a washing machine that's out of balance.

You can replace the old belt with a standard V-belt. But a belt like the one in the left photo is specially designed to reduce noise (see Sources on page 126).

TENSION. No matter which one you use, a belt that's too tight runs louder.

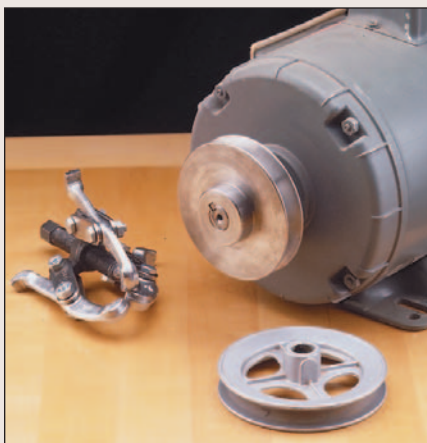


Link Belt. The interlocking links create a flexible belt which makes a tool run smooth and quiet.

So on tools with a fixed (not hinged) motor, I back off the tension just enough so the belt doesn't slip (see the Shop Tip at right).

PULLEYS. Noise can also be traced back to the pulleys on a tool. Typically, many tools have pulleys that are *cast* from a soft metal. Since these pulleys aren't always perfectly balanced, they have a tendency to wobble and make noise.

My solution to this problem is to replace the old pulleys with ones that are *turned* from solid pieces of steel (see right photo).



Turned Pulley. Balanced to run true, this turned steel pulley reduces noise caused by vibration.

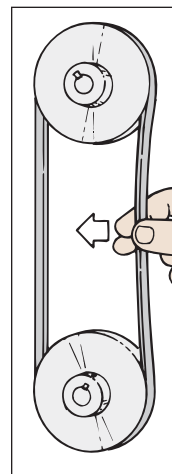
ALIGNMENT. Regardless of the pulleys, they won't run quiet unless they line up. To check this, I use a straight-edge. When held against the pulleys, it should touch the outside edges of both pulleys.

SHOP TIP

Belt Tension

Adding a bit of slack to a tool's belt can reduce the noise the tool makes. Just make sure you don't loosen it too much.

A good rule of thumb is to loosen the belt tension just enough so that you can push the belt in about an inch (see drawing at right).



SAW BLADES

When it comes to noise, one of the worst culprits in my shop is the blade on my table saw. Luckily, there are some easy remedies to reduce its shrill sound.

SHARP AND CLEAN. First, it makes sense that cutting with a sharp, clean blade produces less noise than a worn blade (about 3 dB difference).

I also make it a habit to raise the saw blade so it's only slightly higher than the thickness of the workpiece I'm cutting. This can make a difference of 2 dB compared to when the blade is set to maximum height.

STABILIZER. Another thing you can use to reduce the noise of a blade is a stabilizer (see left photo). A stabilizer is designed primarily to help stiffen a blade when cutting thick stock. But I've found that it also helps damp the blade's noise by as much as 2 dB.

QUIET BLADES. Finally, you can look into "quiet" blades. These are designed

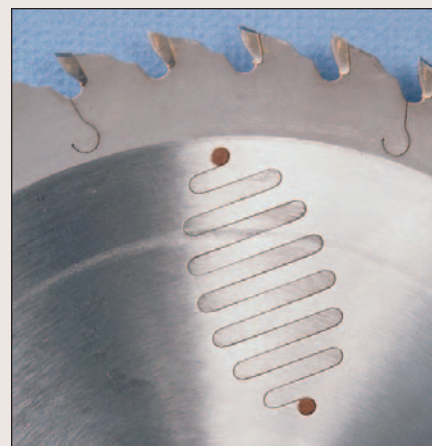
to reduce the high-pitched ringing you typically get when you make a cut.

The secret is a series of slots in the body of the blade (see right photo).



Stabilizer. By adding side support, a stabilizer damps noise produced by a wobbly blade.

While they don't eliminate vibration, they do direct it to a "plug" at each end. These act as shock absorbers to damp the sound. (For sources, see page 126.)



Quiet Blade. Slots and sound-absorbing plugs reduce the noise level of this blade from 92 dB to 88 dB.

Drill Press Foot Pedal

If you find yourself wishing for a third hand when working on the drill press, consider using your foot. A few scraps of wood and an assortment of hardware are all you need to add safety and convenience.

Like most woodworkers, I often need a “third hand” around the shop when drilling holes in a large workpiece: two hands to hold the piece in the correct position, and a third hand to operate the quill feed.

To free up both hands for safety, I added a foot pedal to my drill press.

Basically, it works like the accelerator pedal on a car. To lower the bit, just step on the pedal. Easing off the pedal returns the bit to its starting point.

What makes this work is a wire cable that slides inside a flexible cable “sleeve.” The cable transfers the movement of the pedal directly to the quill feed on the drill press.

WOOD AND SUPPLIES. All the wood parts of the foot pedal are made from $\frac{3}{4}$ ”-thick stock. Just about any solid hardwood will do, and since it’s a relatively small project, you might just find enough scrap pieces in your shop to build the whole thing.

Beyond the standard screws and bolts, there are a few special pieces of hardware needed to build the foot pedal. Among these are spring hinges, a pulley, a cable clamp, a crimp-on stop, a length of cable, and a flexible cable sleeve (refer to the Materials List on the opposite page for a complete list of the hardware needed).

You should be able to find most of these items at a hardware store or home center, but wherever you get them, be sure you have them in hand before beginning. (See page 126 for additional hardware sources.)

MODIFICATION. A simple design alteration can add two additional features to your drill press: a quill lock and a depth stop. Depending on which of these features you need at a given time, you simply change the position of a single carriage bolt.

See the Designer’s Notebook on page 68 for more on how these features work, and how they’re built in.



EXPLODED VIEW

OVERALL DIMENSIONS:

6³/₄W x 15¹/₂D x 11¹/₂H

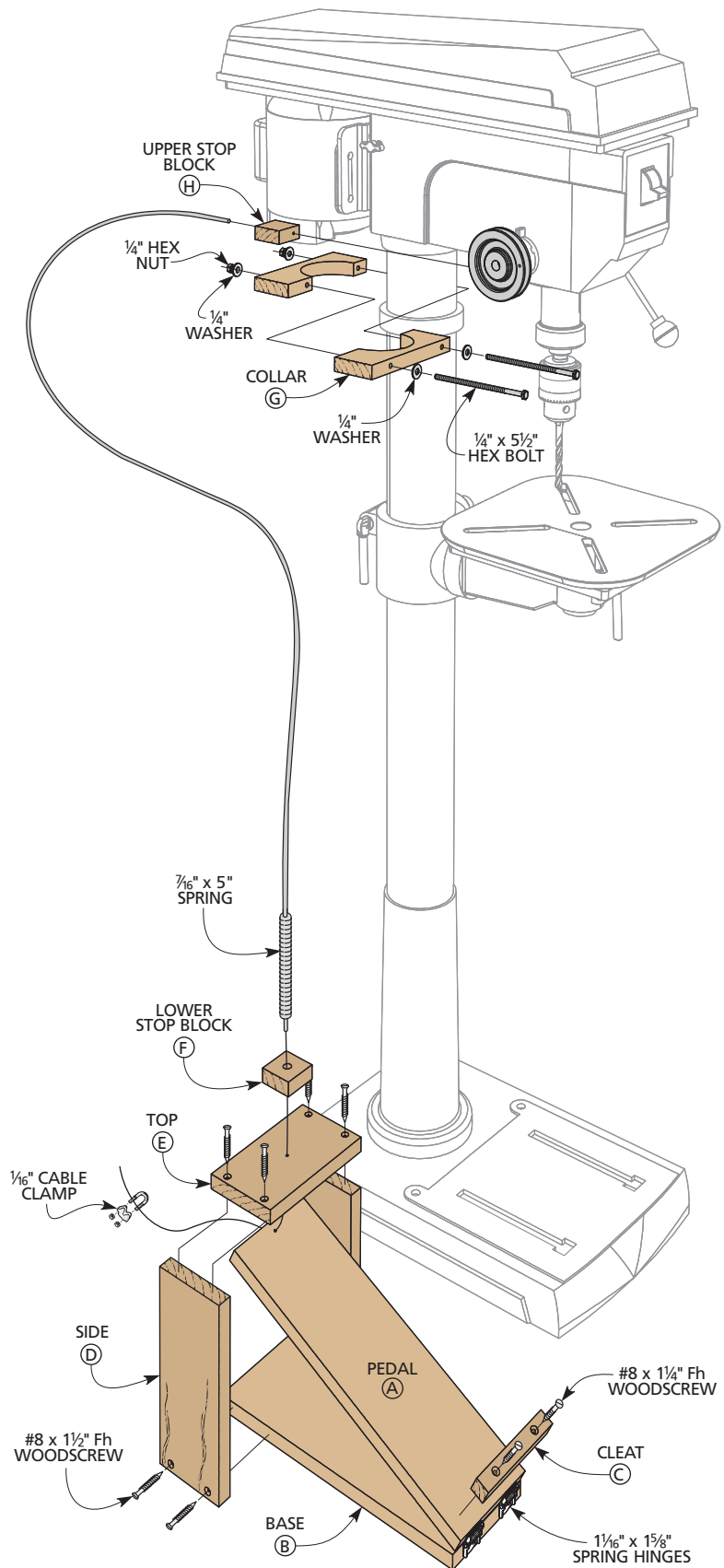
MATERIALS LIST

WOOD

A Pedal (1)	3/4 x 5 - 16
B Base (1)	3/4 x 5 1/4 - 14 3/4
C Cleat (1)	3/4 x 3/4 - 5
D Sides (2)	3/4 x 4 - 10
E Top (1)	3/4 x 4 - 6 3/4
F Lwr. Stop Block (1)	3/4 x 1 3/4 - 1 3/4
G Collar (1)	3/4 x 5 - 7
H Upr. Stop Block (1)	3/4 x 1 3/4 - 1 3/4

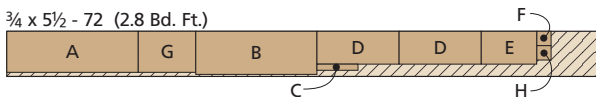
HARDWARE SUPPLIES

- (2) No. 8 x 1 1/4" Fh woodscrews
- (8) No. 8 x 1 1/2" Fh woodscrews
- (2) 1 1/16" x 1 5/8" spring hinges
- (1) 7/16" x 5" spring
- (2) 1/4" x 5 1/2" hex bolts
- (4) 1/4" flat washers
- (2) 1/4" hex nuts
- (1) 3 1/2" -dia. pulley w/ 1/2" bore
- (1) 1/16" crimp-on stop
- (1) 1/16" cable clamp
- (14') 1/16" -dia. wire cable
- (10') Flexible cable sleeve

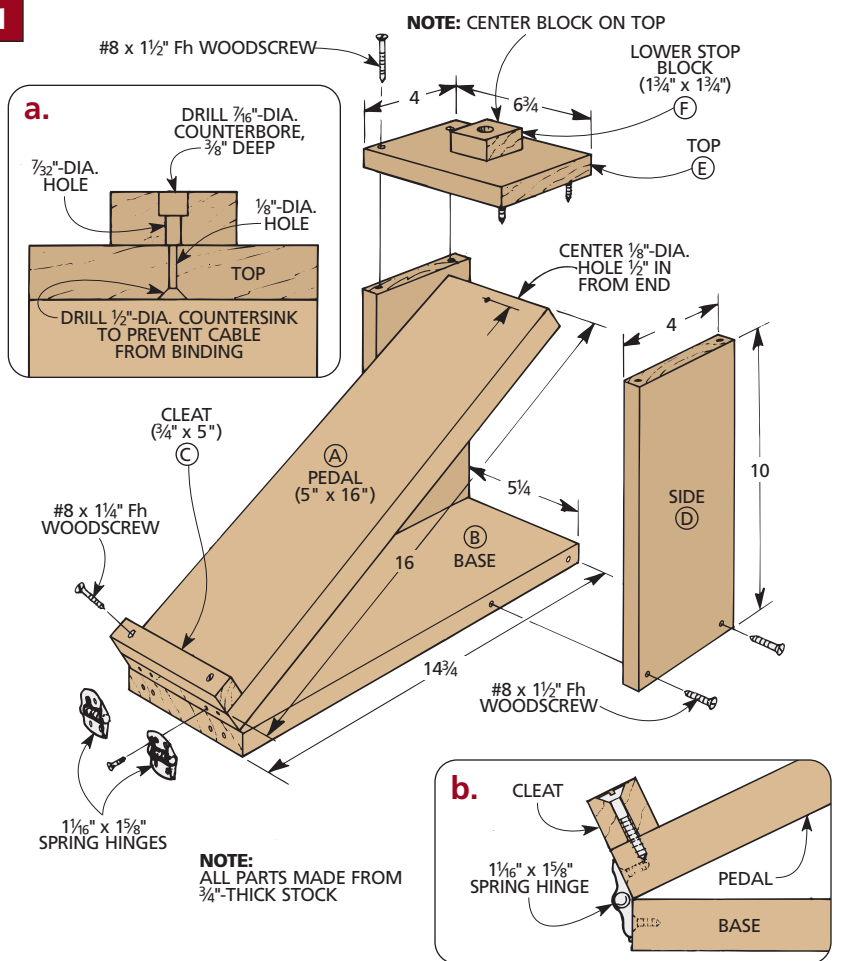


CUTTING DIAGRAM

3/4 x 5 1/2 - 72 (2.8 Bd. Ft.)



1



CONSTRUCTION

I started work by making the pedal (A) and base (B) (Fig. 1). To maintain tension on the cable, I used a pair of spring hinges to connect the pieces. There's a cleat (C) screwed to one end of the pedal to keep your foot from slipping off, and a hole drilled through the other end for the cable to pass through.

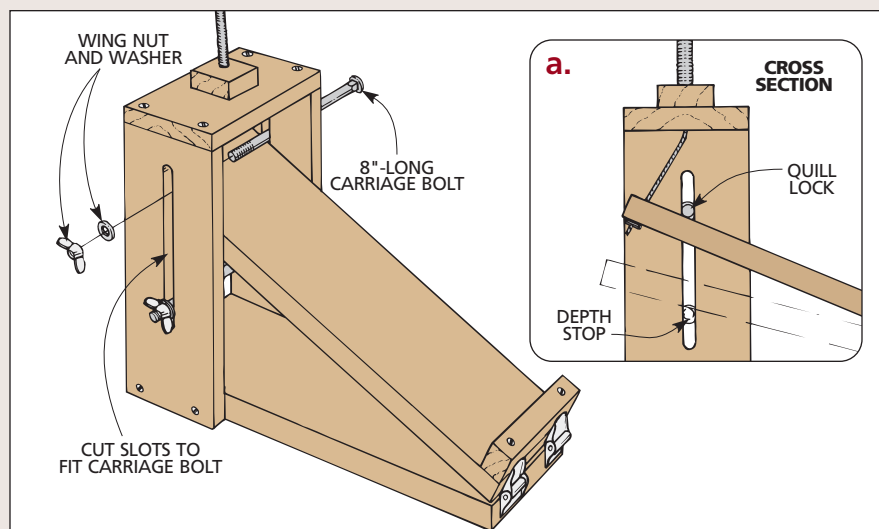
FRAME. To support the pedal, I built a simple frame. It consists of two sides (D) screwed to the base and a top (E) that holds the sides together.

Before attaching the top, I glued on a lower stop block (F). A series of holes is drilled in the block and through the top — a large diameter hole for a spring

DESIGNER'S NOTEBOOK

Add a carriage bolt and two slots to the pedal, and you add two convenient features to your drill press.

DEPTH STOP & QUILL LOCK



■ The Drill Press Foot Pedal is great for freeing your hands up for safety and convenience. But a simple modification can add two additional features to your drill press if it doesn't already have them: a depth stop and a locking quill.

■ To add both of these features, simply cut a slot down each side (D) (see drawing at left).

■ Then insert an ordinary carriage bolt, either above or below the pedal (A) (see drawing). Tightening a wing nut on the bolt locks it in position.

■ Inserting the carriage bolt *above* the pedal allows it to serve as a quill lock. Placing it *below* the pedal makes it a convenient depth stop (see detail 'a' in the drawing at left).

added later, and smaller holes for the cable and the sleeve (Fig. 1a).

Note: I bought a sleeve for a brake cable from a local bike shop. (For hardware sources, see page 126.)

COLLAR. To secure the other end of the sleeve, I fit a collar around the drill press column that supports another stop block. The collar (G) starts out as a single hardwood blank (Fig. 2a).

After laying out a circle the same diameter as your column, the blank is ripped down the center. Then the curved openings are cut, and holes are drilled in each piece for a pair of bolts that hold the collar in place.

The next step is to add the upper stop block (H) (Fig. 2). Here again, I drilled a counterbored hole for the cable and sleeve, then glued the block to the collar (Figs. 2 and 2b).

PULLEY. After attaching the collar, I added a pulley to the shaft that runs through the quill feed (Fig. 3). When the cable is attached, the pulley turns the shaft that raises and lowers the bit.

Note: Since my drill press has a $\frac{1}{2}$ "-diameter shaft, I used a pulley with a corresponding size bore (see the Materials List on page 67).

Regardless of the size, you'll need to provide a way to attach the cable to the pulley. I drilled a small hole near the bottom of the V-groove (Fig. 3).

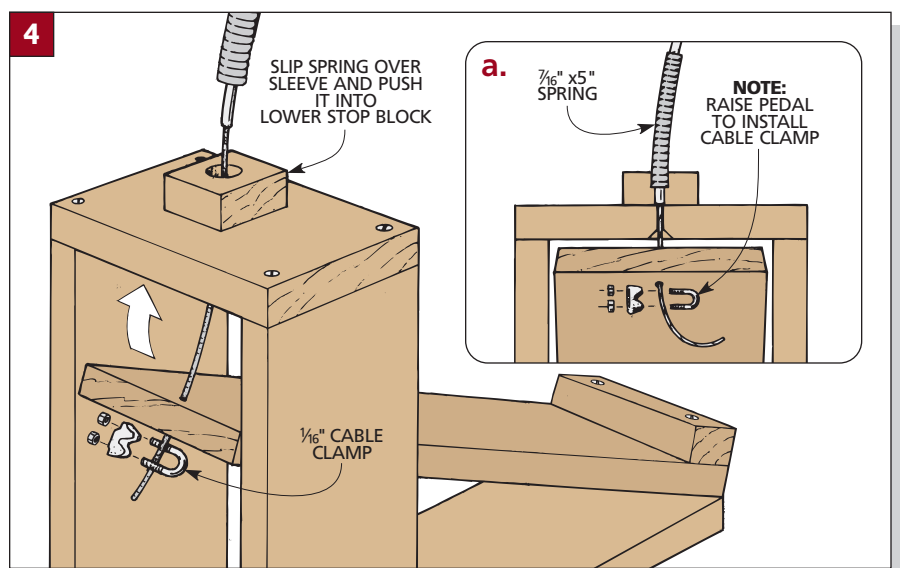
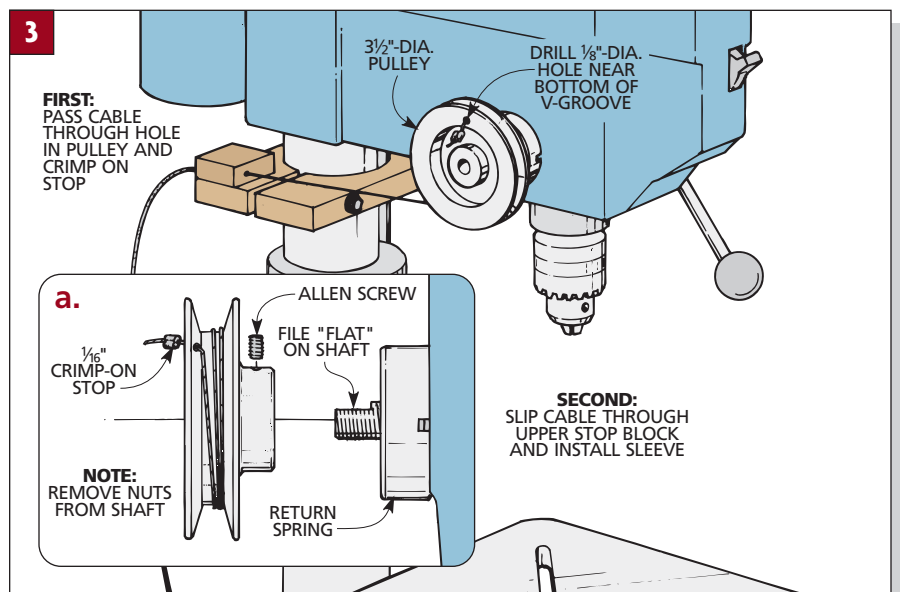
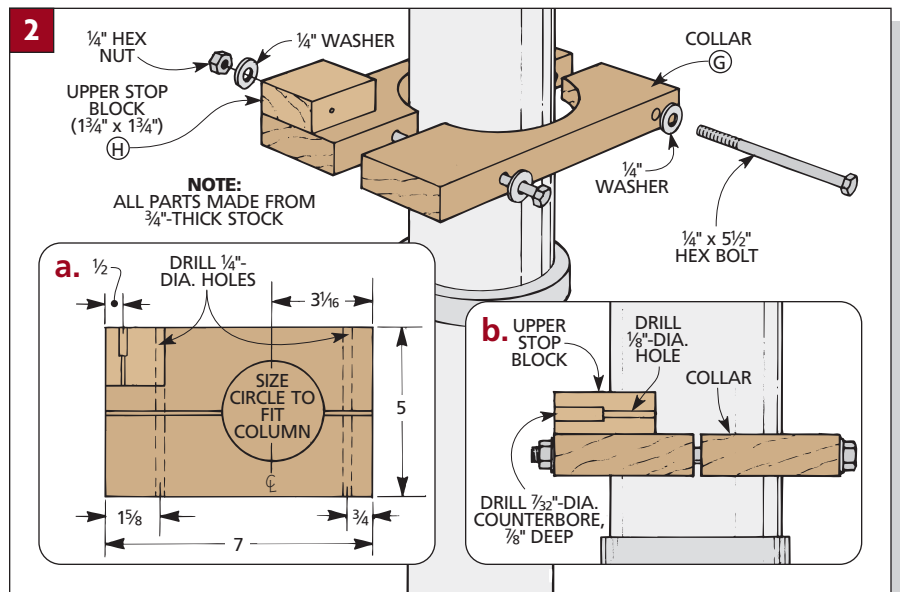
To make room for the pulley, I removed the two nuts that were holding the return spring in place. Then I filed a "flat" on the shaft, slipped on the pulley, and tightened down the Allen screw (Fig. 3a).

INSTALL CABLE. Now you're ready to run the cable from the pulley to the pedal. The thing to be aware of is to make both the cable and the sleeve long enough so the pedal can be positioned in a convenient location. (I used a fourteen foot length for the cable and a ten foot sleeve.)

Once the cable is cut to length, start by inserting one end through the hole in the pulley, and attach a crimp-on stop (Fig. 3a). Then, after taking a couple of wraps around the pulley, pass the other end through the upper stop block, and slip the flexible sleeve over the cable.

Next, to keep the cable from kinking, I slid a spring over the sleeve and pushed it down into the lower stop block (Figs. 4 and 4a).

Then it's just a matter of threading the cable through the pedal and securing it with a cable clamp.



Featherboard

Adding safety to your table saw or router table can be as simple as using a shop-made featherboard. A pair of sturdy hold-downs and a versatile design make this one a perfect addition to any workshop.



One of the simplest things you can do to make a table saw or router table safer for yourself is to use a featherboard like this one. It prevents a workpiece from kicking back at you if the blade or bit happens to grab hold of it.

And even though safety is one of the best reasons for using a featherboard, it's not the only one. A featherboard helps to hold a workpiece firmly against the table top or fence, providing constant pressure that just isn't possible with hand pressure alone. This is especially important when cutting or routing multiple pieces that have to be identical.

HOLD-DOWNS. Unlike most featherboards, this one has two identical hold-

downs. And they're adjustable because each hold-down is attached to the base, thanks to a pair of carriage bolts that ride in a T-slot formed in the base.

By loosening two knobs, the hold-downs can be positioned anywhere along the length of the T-slot or the height of the base.

Safety Note: When cutting a deep kerf or all the way through, *don't* use the second hold-down behind the blade as it can pinch the kerf closed.

MATERIALS. The base of the Featherboard shown here is made from $\frac{3}{4}$ " plywood with a $\frac{1}{4}$ "-thick hardboard "skin" glued to one side. You could make the hold-downs from the same material or even softwood,

but I like to use hardwood instead, and the reason is quite simple: strength.

Featherboard fingers need to be strong and flexible. Softwood is too weak, and hardboard and plywood have a tendency to break because they don't have the grain to support the kerfs.

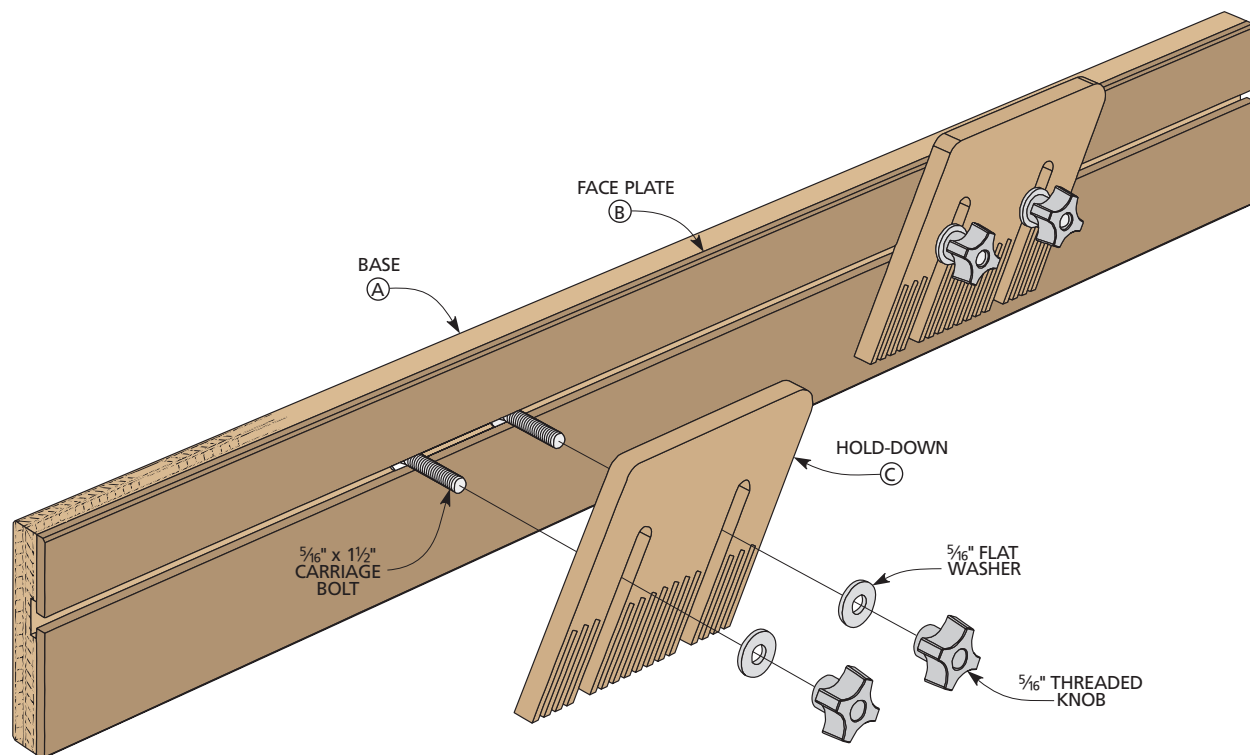
But hardwood's tight grain, density, and springiness make it an ideal material for the hold-downs in this project. (I chose $\frac{1}{2}$ "-thick hard maple.)

Note: Be sure to choose wood that's free of knots, cracks, and splits that could cause the hold-down to break apart.

HARDWARE. The only hardware you'll need are a pair of carriage bolts, washers, threaded knobs, and some clamps to hold everything in place.

EXPLODED VIEW

OVERALL DIMENSIONS:
34L x 2½D x 4½H



CUTTING DIAGRAM

¾" PLYWOOD - 6 x 48



¼" HARDBOARD - 6 x 48



¾ x 5½ - 18 HARD MAPLE (.7 Bd. Ft.)



MATERIALS LIST

WOOD

- A** Base (1) ¾ ply - 4½ x 34
- B** Face Plate (1) ¼ hdbd. - 4½ x 34
- C** Hold-Downs (2) ½ x 4¾ - 7½

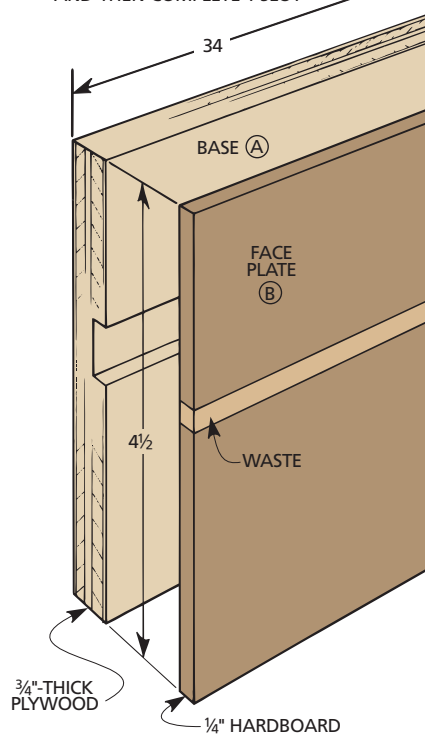
HARDWARE SUPPLIES

- (4) ⅝" x 1½" carriage bolts
- (4) ⅝" flat washers
- (4) ⅝" threaded knobs

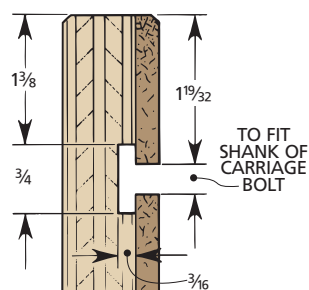
1

FIRST:
CUT GROOVE IN PLYWOOD

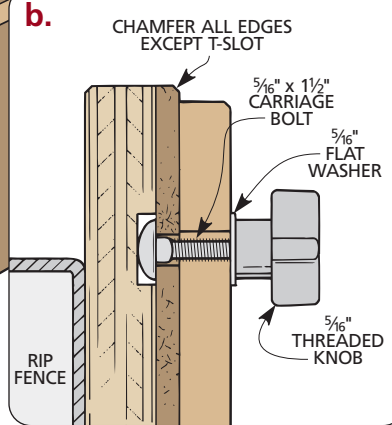
SECOND:
GLUE HARDBOARD TO PLYWOOD
AND THEN COMPLETE T-SLOT



a.



b.



CONSTRUCTION

Construction of the Featherboard is fairly straightforward. I started by working on the base.

BASE. The base (A) of the Featherboard is made from $\frac{3}{4}$ " plywood and has a $\frac{1}{4}$ "-thick hardboard face plate (B) glued to one side (Fig. 1). But before gluing the face plate in place, a groove is cut in the base to form the bottom half of the T-slot (Fig. 1a). I cut this groove to fit the head of a $\frac{5}{16}$ " carriage bolt. (Refer to the Materials List on page 71 for information on hardware.)

After the face plate is glued in place (I used contact cement), the T-slot can be completed. To do this, cut a second groove centered directly over the first groove. You want the width of the second groove to just fit the square shank of the carriage bolt.

HOLD-DOWNS. Now the base is ready for the two hold-downs (C). Since these are going to take a lot of abuse, I made them from $\frac{1}{2}$ "-thick hard maple.

To make the hold-downs, first cut two blanks to finished width and rough length (Fig. 2). Then, so the hold-downs will grip a workpiece and pre-

TECHNIQUE

Using The Featherboard

Once you're finished building the Featherboard, you'll probably be itching to try it out. As you can see from the photos below, the Featherboard is very versatile. It can be used on either the table saw or router table, and set up in either of two positions depending on where you feel you need the most added support. So it comes in handy in a variety of situations.

But before you begin using the Featherboard, there are a couple of things to remember. These will help you not only when it comes to safety, but also accuracy and efficiency.

First, when positioning the Featherboard (in this case, the adjustable hold-downs) against your workpiece, take the time to check whether the fingers are exerting the

proper amount of pressure. They should keep the workpiece snug against the fence or table top (depending on how you're positioned for the cut), but not be so tight that they slow down the cut.

Safety Note: Although a featherboard will help prevent kickback, it's still a good idea to avoid standing directly behind the workpiece (especially when ripping on the table saw).



Rip Fence. Clamping the featherboard to the rip fence of your table saw will press the workpiece firmly against the table top.



Table Top. Alternately, you can clamp the featherboard directly to the table top to hold your workpiece firmly against the rip fence.



Router Table. This featherboard isn't just for the table saw. You can also clamp it to a router table top or a router table fence.

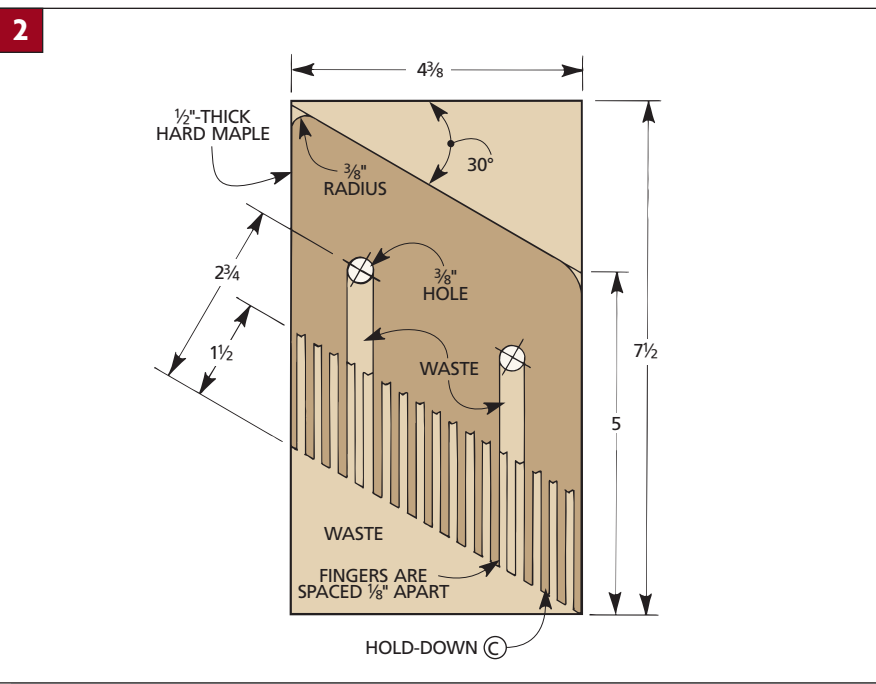
vent it from kicking back, cut the ends of each blank at a 30° angle.

INDEXING JIG. To create the fingers that press against and grip the workpiece, the next step is to cut a series of kerfs. So they'll all be spaced evenly, I made an indexing jig that attaches to the table saw miter gauge (see the Shop Jig box below for details).

Once the fingers have been cut, it's just a matter of laying out and drilling holes for the slots.

Then remove the waste with a band saw or a jig saw. Finally, you can attach the hold-downs to the base with the mounting hardware.

USING THE FEATHERBOARD. Now that construction is completed, you're ready to start using your new Featherboard. You'll find it's perfect for a variety of operations. For more information, see the Technique box on the opposite page. ■



SHOP JIG

Indexing Jig

Cutting evenly-spaced kerfs on a featherboard hold-down doesn't have to be a difficult or time-consuming process. In fact, it's quick and easy with this indexing jig.

If you're at all familiar with how an ordinary box joint jig works, then you're already familiar with how this particular jig works.

The indexing jig has two saw kerfs that are spaced 1/8" apart (Fig. 1). One kerf has a hardwood pin glued in it,

while the other kerf lines up with the table saw blade.

Note: When screwing the jig to the miter gauge, it's best to have the blade in this kerf so the jig is perfectly aligned with the blade.

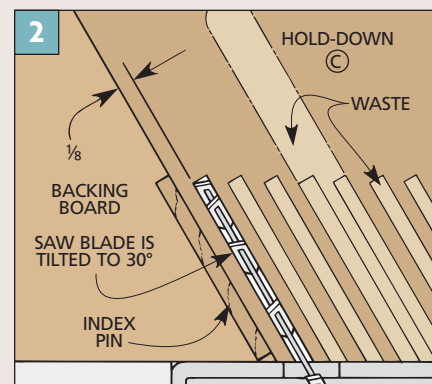
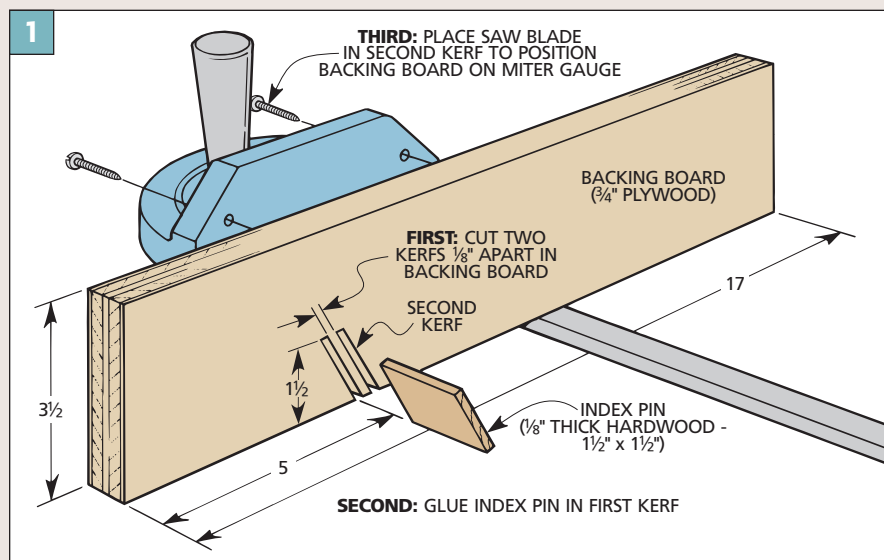
To cut the first kerf, clamp the workpiece to the backing board so it's tight against the pin (Fig. 2). Then make the first pass.

After the first kerf has been cut, unclamp the workpiece and shift it over

onto the index pin. Then re-clamp the workpiece and take another pass. Repeat this process to complete all the fingers (see photo below).



Perfect Kerfs. The index pin on this jig makes it easy to cut evenly-spaced kerfs. Just index the workpiece on the pin between each pass.



Lathe Steady Rest

Turning a spindle on a lathe can be difficult if the workpiece bends or flexes as its diameter decreases. This simple steady rest automatically applies gentle but constant pressure to the spindle as you work.



Usually, wood is a stiff, rigid material. But when turning a long, thin spindle on the lathe, it gets a bit “rubbery.” As the spindle gets thinner, it flexes and bends away from the turning tool. This makes it hard to avoid digging into the spindle.

To prevent the spindle from flexing, I made a steady rest that attaches to the lathe bed (see photo). It supports the workpiece from behind, so it's easy to get a smooth, controlled cut.

SELF-ADJUSTING. One nice thing about this steady rest is that it doesn't have to be readjusted constantly as you turn the spindle to a smaller and smaller diameter. Instead, it automatically

adjusts to the size of the spindle so you are free to work.

WEDGE. The secret is a simple wedge that applies pressure against a tilting arm (refer to the Exploded View on the opposite page). There's not a lot of pressure — just enough to hold a pair of ball bearings gently against the spindle.

With the spindle cradled between the bearings, it won't bow out. And as the spindle gets progressively smaller, the wedge gradually works its way down and tilts the arm forward. This keeps the bearings in continuous contact with the spindle.

MATERIALS. Most of the pieces of the steady rest are made from either $\frac{3}{4}$ "-

thick hardwood or $\frac{1}{4}$ "-thick hardboard. The only exception is the wedge, which is made from 1"-thick hardwood (the extra thickness will allow it to move the support arm forward by the force of its own weight).

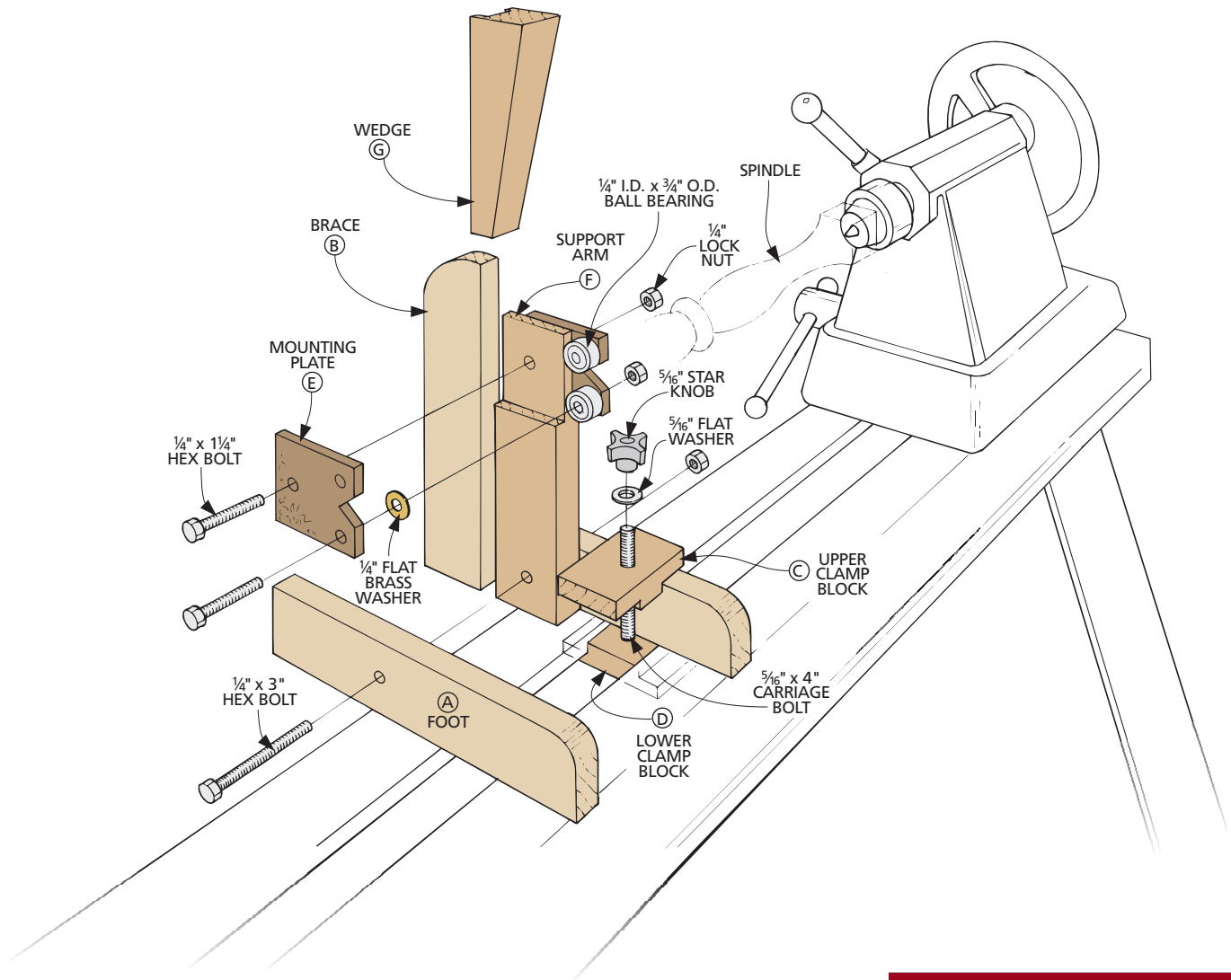
Aside from the pair of ball bearings, there are no special supplies needed to build this project. You should be able to find everything you need at a hardware store or home center.

USING THE STEADY REST. The design of the steady rest is fairly simple and safe, but there are things to keep in mind when using it. See the Technique article on page 78 for procedures and tips on using the jig.

EXPLODED VIEW

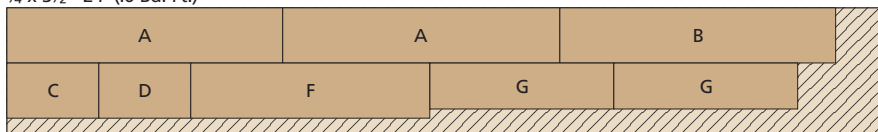
OVERALL DIMENSIONS:

2¹/₄W x 7¹/₂D x 11¹/₂H



CUTTING DIAGRAM

3/4 x 3 1/2 - 24 (.6 Bd. Ft.)



NOTE: ALSO NEED 6" x 6" PIECE OF HARDBOARD FOR MOUNTING PLATES (E)

MATERIALS LIST

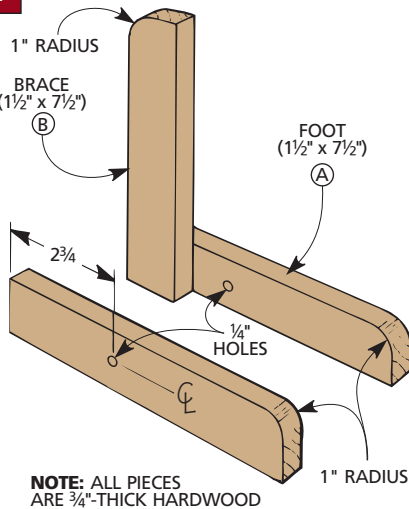
WOOD

A Feet (2)	3/4 x 1 1/2 - 7 1/2
B Brace (1)	3/4 x 1 1/2 - 7 1/2
C Upr. Clamp Block (1)	3/4 x 1 1/2 - 2 1/2
D Lvr. Clamp Block (1)	3/4 x 1 1/2 - 2 1/2
E Mounting Plates (2)	1/4 hdbd. - 1 1/2 x 2
F Support Arm (1)	3/4 x 1 1/2 - 6 1/2
G Wedge (1)	1 x 1 1/4 - 5

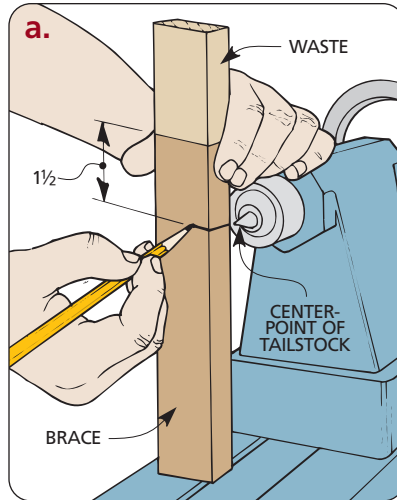
HARDWARE SUPPLIES

- (1) 1/4" x 3" hex bolt
- (3) 1/4" x 1 1/4" hex bolts
- (4) 1/4" lock nuts w/ nylon inserts
- (1) 5/16" flat washer
- (1) 5/16" x 4" carriage bolt
- (1) 5/16" star knob
- (4) 1/4" flat brass washers
- (2) 1/4"-I.D. x 3/4"-O.D. ball bearings

1



NOTE: ALL PIECES ARE $\frac{3}{4}$ "-THICK HARDWOOD



L-SHAPED SUPPORT

I began work on the Lathe Steady Rest by making an L-shaped support. This support consists of three pieces: two feet with an upright brace sandwiched between them (*Fig. 1*).

FEET. The feet (A) are pieces of $\frac{3}{4}$ "-thick hardwood that rest on the lathe bed. (I used maple, but any strong hardwood will work.)

After cutting the feet, you'll need to drill a hole in each foot to accept a bolt that secures the arm later (*Fig. 1*).

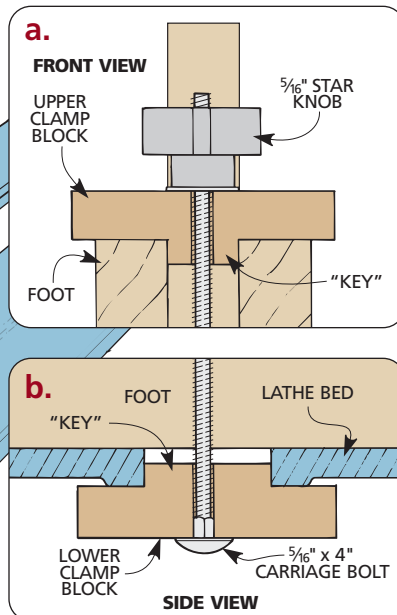
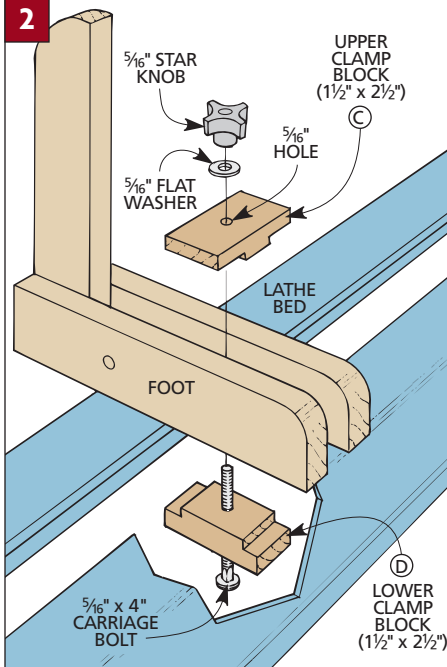
Note: It's also a good idea to cut a gentle curve on each foot (*Fig. 1*). This way, you won't have to worry about bumping into a sharp corner when working at the lathe.

BRACE. After you've finished making the feet, you're ready to add the brace (B) (*Fig. 1*). The brace is actually the same size as one of the feet, and is also made of $\frac{3}{4}$ "-thick hardwood.

The brace serves two functions. It will guide the wedge as it slips down between the brace and the arm (refer to the Technique on page 78), and it also prevents the arm from tilting back.

One thing to be aware of is the height (length) of the brace. It has to be tall enough to catch the tip of the wedge. To accomplish this, the brace is $1\frac{1}{2}$ " longer than the distance from the lathe bed to the center of the tailstock (*Fig. 1a*). Here again, I cut a curve on the upper back corner of the brace before gluing it in place.

2



CLAMP HEAD

Once the L-shaped support is complete, the next step is to add a clamp head to secure it to the lathe.

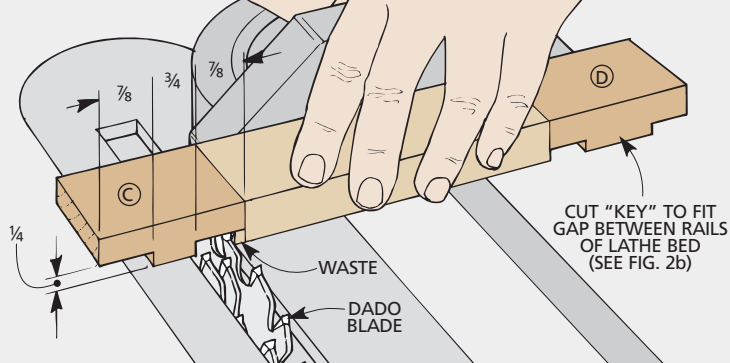
CLAMP BLOCKS. The clamp head consists of two T-shaped blocks that work together to pinch the support against the lathe bed (*Fig. 2*). This pressure is applied by tightening a knob on the end of a bolt that passes through each block.

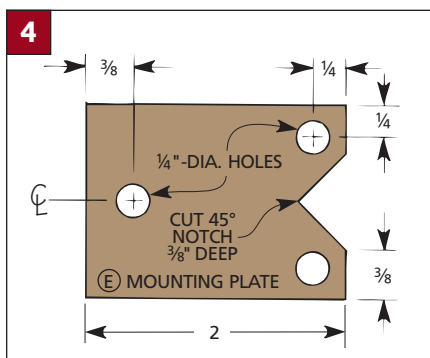
KEY. To prevent the blocks from spinning as you tighten the knob, one part of each block forms a "key." The key on the upper clamp block (C) fits between the feet (*Fig. 2a*). And the key on the lower clamp block (D) fits between the rails of the lathe (*Fig. 2b*).

Since the clamp blocks are quite small, it's best to start with an extra-long piece. The keys are formed by cut-

3

SAFETY NOTE: START WITH EXTRA-LONG BLANK





ting a rabbet and a dado at each end (*Fig. 3*). Then just cut the clamp blocks to length and drill a centered hole in each one to accept the bolt.

HEAD ASSEMBLY

The steady rest uses a simple system to support the spindle. The heart of this support system is a pair of ordinary ball bearings that ride against the spindle as it's being turned.

Note: I bought bearings from a bearing supply company, but they're available in many woodworking catalogs as well. See page 126 for additional information about sources.

The bearings are housed in a head assembly that's attached to a vertical arm (*Figs. 5 and 6*). This assembly is made up of a pair of mounting plates that sandwich the bearings and some washers between them.

MOUNTING PLATES. The mounting plates (E) are pieces of 1/4" hardboard that are about the size of matchbooks (*Fig. 4*). To accept bolts that will be used to secure the bearings, you'll need to drill two holes near the front of each

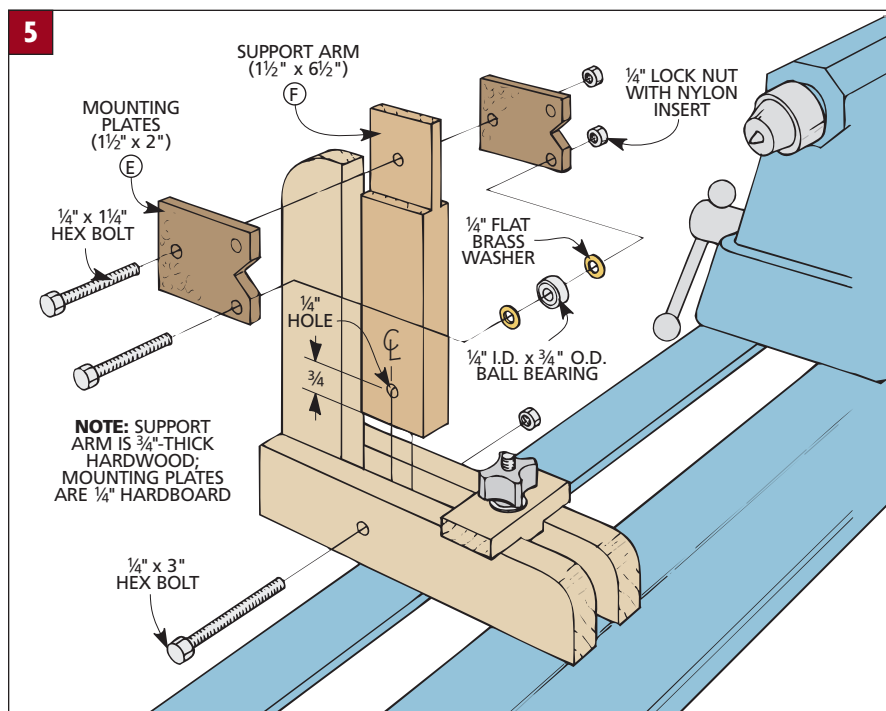


plate. And another hole near the back provides a way to attach the head assembly to the arm.

In addition to the holes, there's a small, V-shaped notch centered on each mounting plate. This notch provides clearance between the mounting plates and the spindle.

INSTALL BEARINGS. After cutting the notches, it's just a matter of installing the bearings between the mounting plates. Each bearing is held in place with a bolt and lock nut.

To allow the ball bearings to spin freely, I added a small washer on either side of each bearing. These washers act as spacers that will prevent the

mounting plates from pinching against the bearings.

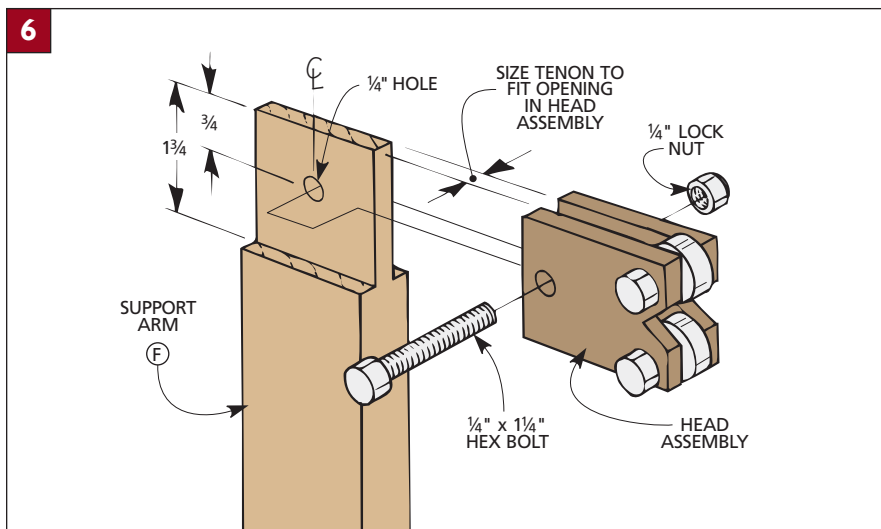
SUPPORT ARM

When the head assembly is complete, the next step is to add a support arm (*Fig. 5*). Besides providing a way to mount the head assembly, the arm raises it to a height that allows the bearings to ride against the spindle.

That may sound fairly straightforward — but there is a catch. As you turn the spindle to a smaller diameter, the bearings will need to remain in continuous contact with the spindle.

The solution to this is simple. As the spindle gets thinner, the support arm tilts forward and the head assembly pivots to keep the bearings right where you want them — against the spinning workpiece. This all happens automatically, so you won't endanger yourself or ruin your project while trying to make adjustments (refer to the photos in the Technique article on page 78).

The support arm (F) starts out as a piece of 3/4"-thick hardwood that's cut 1" shorter than the brace (B) (*Fig. 5*). To secure the arm to the feet (and to provide a pivot point), a bolt passes through a hole drilled near the bottom end of the arm. And another hole in the top accepts a bolt used to secure the head assembly (*Fig. 6*).



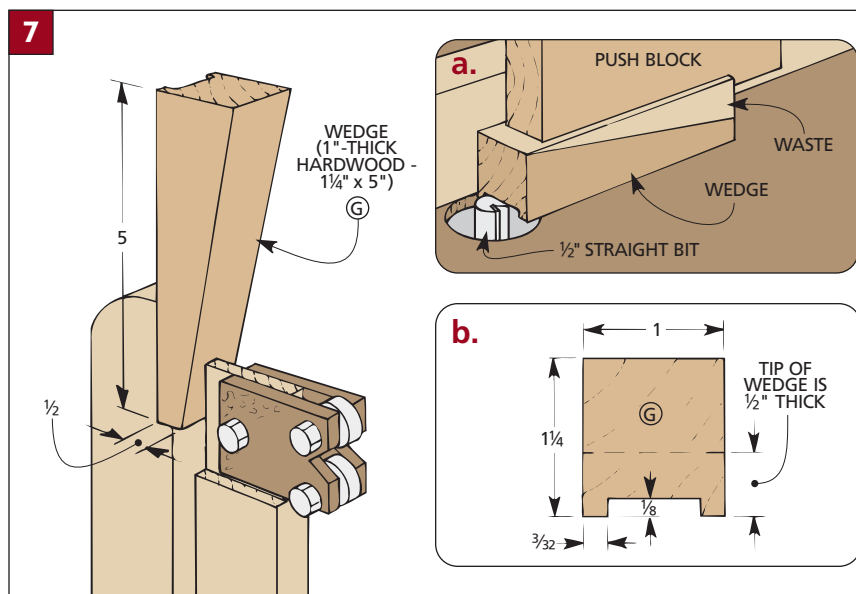
TENON. You're almost ready to attach the head assembly. But before you can, there's one more modification to make. You'll need to cut a tenon on the top end of the support arm. The tenon fits between the mounting plates on the head assembly (refer back to *Fig. 6* on page 77).

The idea here is to cut the tenon $\frac{1}{4}$ " longer than the width (height) of one of the mounting plates. This will provide clearance above the shoulder of the tenon that prevents the head assembly from binding.

Another thing to be aware of is the thickness of the tenon. What you're looking for here is a *loose* fit that allows the tenon to slip easily into place. This will allow the head assembly to pivot smoothly up and down.

If you cut the tenon to the proper length and width, the steady rest will be much safer and more efficient.

ASSEMBLY. Once the tenon is completed, you can secure the head assembly and support arm. After installing the bolts that hold them in place, be careful not to over-tighten the lock nuts. Again, you want both parts to move without binding.



WEDGE

All that's left to complete the steady rest is to add a hardwood wedge (*Fig. 7*). This is the part that makes the whole assembly work properly.

As the spindle gets smaller in diameter, the wedge slips down between the brace and support arm. This tilts

the arm forward, which in turn holds the bearings in the head assembly against the spindle.

To guide the wedge (G), there's a groove in one edge that fits over the edge of the brace (*Fig. 7b*). I used a table-mounted router to cut this groove and then cut out the wedge shape on a band saw (*Fig. 7a*). ■

TECHNIQUE

Using The Steady Rest

Using the Lathe Steady Rest is a simple three-step process (see the series of photos below). But there are a couple of things to keep in mind as you turn projects.

ROUGHING OUT. First, you'll need to rough out a cylinder so you have a round surface. This way the bearings

can make full contact with the workpiece (a turning square or a blank with sharp corners won't work). Then, you can lock the steady rest down and add the wedge.

GENTLE PRESSURE. The whole idea of the wedge is to provide gentle pressure to hold the bearings against the

spindle. But if you catch the edge of your tool on the workpiece, the workpiece may flex, causing the wedge to drop too low.

If this happens to you when you're turning a project, simply lift the wedge back up. Then gently set it back in place before resuming your work.



1 To set up the steady rest, slide it forward until the bearings contact the spindle. Then tighten the lock knob.



2 Now gently slip the wedge in place. The weight of the wedge applies all the pressure that's needed.



3 To reposition the steady rest closer to where you're turning, simply slide it along the lathe bed.

Sliding Cutoff Table

Acting as a giant miter gauge for support, this jig adds safety and accuracy when crosscutting panels. A removable hold-down and an adjustable stop block add even more convenience and versatility.



Crosscutting wide boards or plywood panels with a miter gauge on a table saw can be unsafe as well as awkward. It's usually a balancing act — trying to hold the workpiece steady against the short face of the miter gauge while pushing it through the cut. And the result of all this maneuvering is a less-than-perfect cut.

A solution to this problem is a Sliding Cutoff Table. The table acts as a giant miter gauge to give extra support. This version adds three features not usually found on cutoff tables. These features improve accuracy and safety.

HOLD-DOWN. The first thing I added is a removable hold-down bar that fits

between the sliding table fence and support rail. When positioned over a workpiece, two machine bolts in the hold-down bar keep the workpiece flat and secure. With this addition, you get accurate crosscuts on wide boards and panels — particularly on workpieces that are slightly warped or cupped.

STOP BLOCK. Since I often use a sliding table to cut off several pieces to exactly the same length, I added an adjustable stop block. (Even if you don't want to build this table, this stop block is worth looking at.)

SAFETY. For additional safety, I added an acrylic plastic blade guard that covers the blade after it passes

through the fence. And to prevent the blade from cutting through the guard, I screwed a safety stop onto the bottom of the cutoff table.

MATERIALS. This Sliding Cutoff Table is easy to build out of common materials. I made the base with $\frac{3}{4}$ "-thick plywood and all the other parts with $\frac{3}{4}$ "-thick maple.

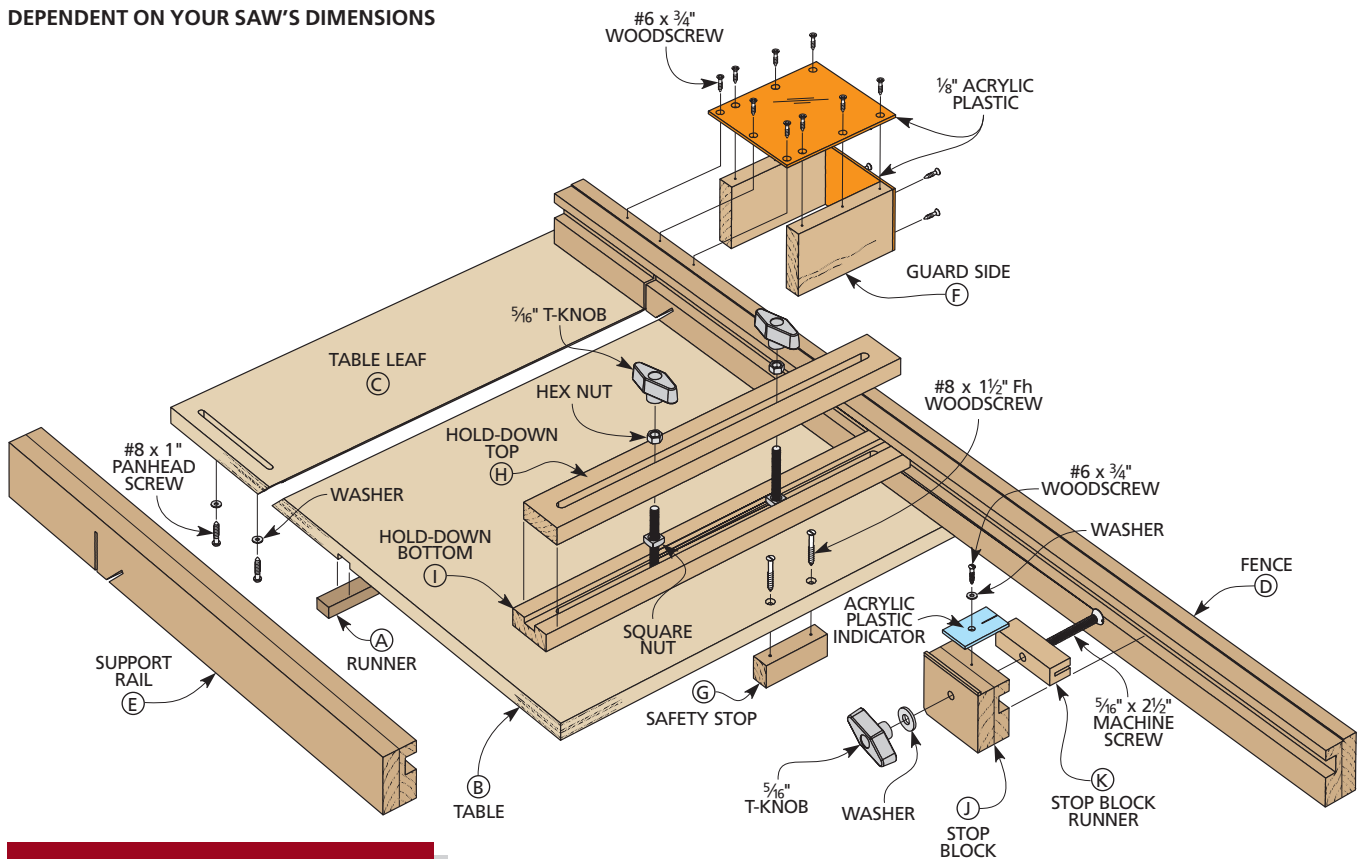
All the hardware can be purchased from most hardware stores and home centers (for mail-order suppliers, see Sources on page 126).

Note: For the best cut when using this Sliding Cutoff Table, the saw blade should be adjusted so it's parallel with the miter gauge slot.

EXPLODED VIEW

OVERALL DIMENSIONS:

DEPENDENT ON YOUR SAW'S DIMENSIONS



MATERIALS LIST

WOOD

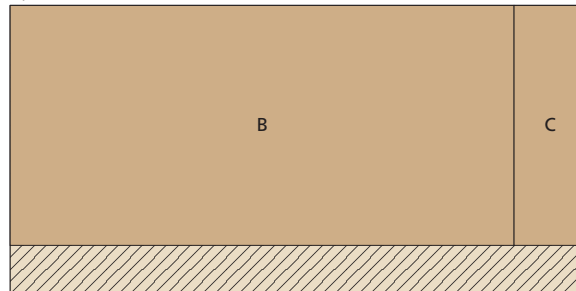
- A** Runner (1) $\frac{1}{2} \times \frac{3}{4}$ - 21
- B** Table (1) $\frac{3}{4}$ ply - 20 x 36 rgh.
- C** Table Leaf (1) $\frac{3}{4}$ ply - 20 x 6 rgh.
- D** Fence (1) $1\frac{1}{2} \times 2\frac{1}{2}$ - 45
- E** Support Rail (1) $1\frac{1}{2} \times 2\frac{1}{2}$ - 36 rgh.
- F** Guard Sides (2) $\frac{3}{4} \times 3$ - 5
- G** Safety Stop (1) $\frac{3}{4} \times 1$ - 3
- H** Hold-down Top (1) $\frac{3}{4} \times 2$ - 16 $\frac{3}{4}$
- I** Hold-down Btm. (1) $\frac{3}{4} \times 2$ - 17 $\frac{3}{4}$
- J** Stop Block (1) $1\frac{1}{2} \times 2\frac{1}{2}$ - 3
- K** Stop Blk. Runner (1) $\frac{3}{4} \times 1$ - 3

HARDWARE SUPPLIES

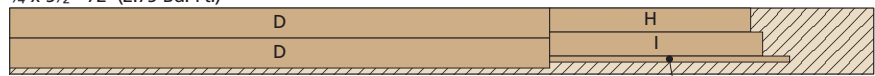
- (13) No. 6 x $\frac{3}{4}$ " Fh woodscrews
- (1) No. 6 x $\frac{3}{4}$ " Rh woodscrew
- (3) No. 8 x $\frac{3}{4}$ " Fh woodscrews
- (6) No. 8 x $1\frac{1}{2}$ " Fh woodscrews
- (4) No. 8 x 1" Ph screws
- (4) $\frac{3}{8}$ " washers
- (1) $\frac{1}{8}$ " acrylic plastic, 12" x 12"
- (1) $\frac{1}{8}$ " acrylic plastic, $1\frac{1}{4}$ " x $2\frac{1}{8}$ "
- (1) $\frac{1}{4}$ " x 1" machine bolt
- (1) $\frac{1}{4}$ " hex nut
- (2) $\frac{5}{16}$ " x 4" machine bolts
- (2) $\frac{5}{16}$ " hex nuts
- (2) $\frac{5}{16}$ " square nuts
- (3) $\frac{5}{16}$ " T-knobs
- (1) $\frac{5}{16}$ " x $2\frac{1}{2}$ " machine screw
- (1) $\frac{5}{16}$ " washer
- (1) Wire brad

CUTTING DIAGRAM

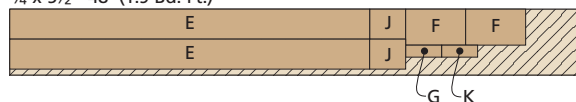
$\frac{3}{4}$ " PLYWOOD - 24 x 48



$\frac{3}{4} \times 5\frac{1}{2}$ - 72 (2.75 Bd. Ft.)



$\frac{3}{4} \times 5\frac{1}{2}$ - 48 (1.9 Bd. Ft.)



RUNNER & BASE

Since table saws vary in size, this cutoff table is designed so you can customize it to fit your saw's dimensions.

RUNNER. Start building the cutoff table by cutting a 1/2"-thick hardwood runner (A) to width so it slides smoothly in your table saw's miter gauge slot. Then cut the runner to a finished length of 21". You can also use a piece of phenolic plastic to make the runner (see Sources on page 126).

BASE. The base for the cutoff table consists of two pieces: a table (B) that supports the workpiece, and a table leaf (C) that supports the waste. I cut both from a single piece of plywood.

To determine the length of this piece, I positioned the rip fence 6" to the right of the blade and then lowered the blade (*Fig. 1*). (The 6" area to the right of the saw blade is for the table leaf.)

Next, butt a piece of 3/4" plywood (I started with a 24" x 48" sheet) against the fence. Make a mark on the plywood 1" past the left edge of the table saw (*Fig. 1*). (This 1" overhang allows for a safety stop added later.) Also mark reference lines on the front edge of the plywood for a dado that will align with the left miter gauge slot. This dado is for the runner.

Now, cut the base to length (1" past the saw's edge), and to a width of 20".

RUNNER DADO. To cut the dado for the runner, position the rip fence so the reference lines on the front edge of the plywood base are over the blade. Then, cut a 1/4"-deep dado in the base by making a series of passes until the runner fits tightly in the dado.

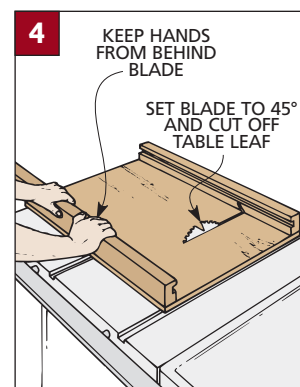
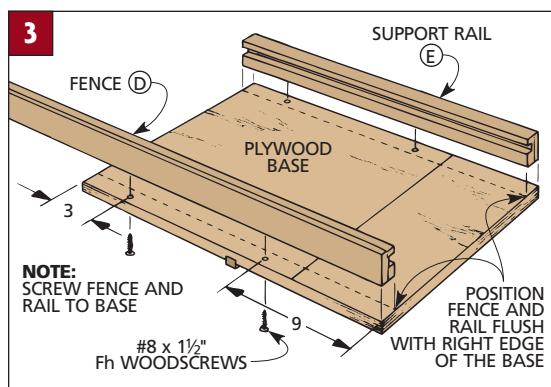
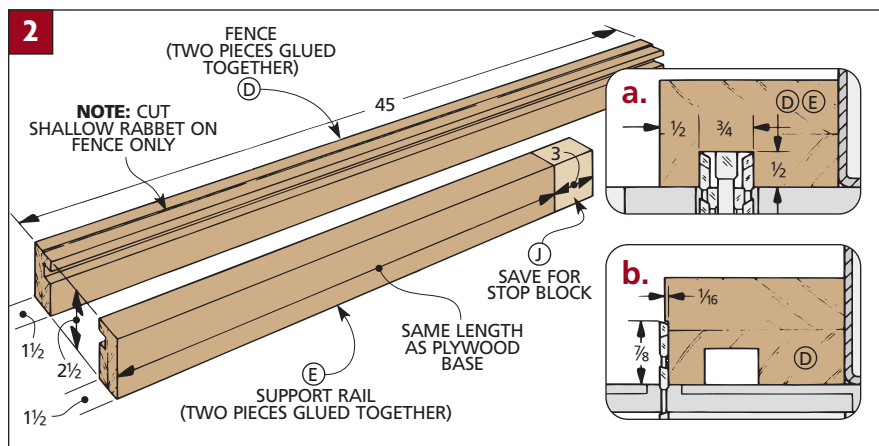
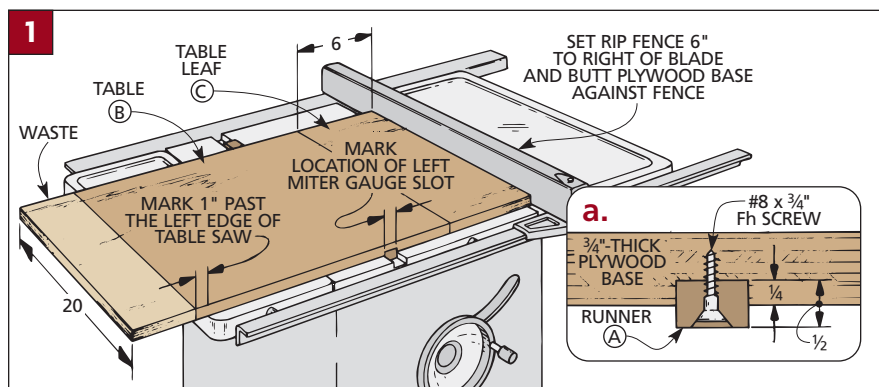
Next, glue and screw the runner in the dado (*Fig. 1a*). (The runner is 1" longer than the table, so it's easy to align the runner and slot when setting the table on the saw.)

FENCE, RAIL, & LEAF

With the runner screwed to the base, you can start on the fence and support rail.

FENCE. To make the fence (D), cut two pieces of 3/4" stock 3" wide and 46" long. Then glue up the pieces to make a 1 1/2"-thick blank. When the glue dries, cut the blank to a finished width (height) of 2 1/2" and length of 45" (*Fig. 2*).

SUPPORT RAIL. The blank for the support rail (E) is made the same way. To determine its rough length, add the



length of the plywood base plus 4" extra for a stop block that's cut off later (*Fig. 2*).

GROOVE AND RABBET. Now cut a 3/4"-wide groove in each blank to mount the hold-down (*Fig. 2a*) and a shallow rabbet on the top of the fence to accept a self-adhesive measuring tape (*Fig. 2b*).

STOP BLOCK. Next, trim a 3" piece off the support rail for the stop block (J) and set it aside (*Fig. 2*). (The stop block is completed later.) Then trim the rail to the same length as the base (*Fig. 3*).

MOUNT FENCE AND RAIL. To mount the fence and rail to the base, position the fence flush with the front of the base and the right edge (*Fig. 3*). Then, screw the fence to the base, posi-

tioning the screws 9" from the right edge of the base and 3" from the left edge. (This allows the leaf to be cut free in the next step.)

Note: Don't glue the fence in place. You may want to adjust it later if the table isn't cutting exactly 90°.

Next, screw the support rail to the plywood base so it's flush with the back and sides (*Fig. 3*).

LEAF. Since I wanted to use the cutoff table for bevels, next I cut the table leaf off the table at a 45° angle (*Fig. 4*). Don't make a 90° cut yet.

Note: If your saw blade tilts to the right, see the Woodworker's Notebook on the next page.

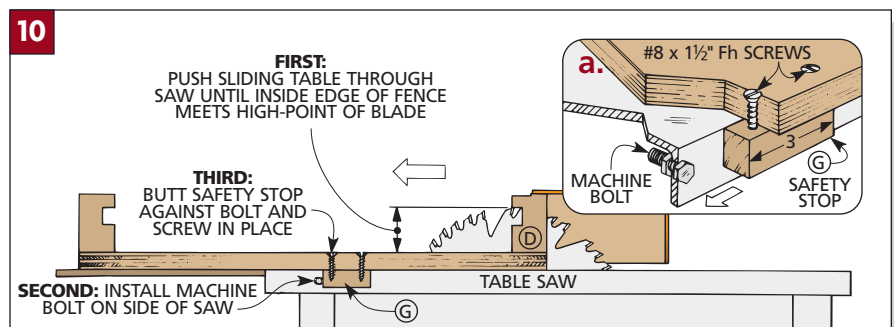
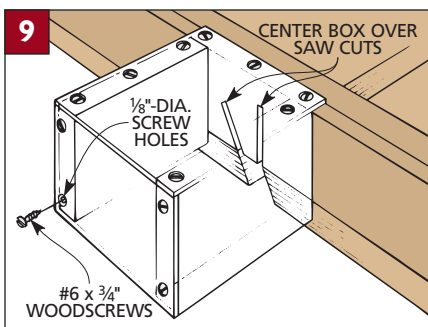
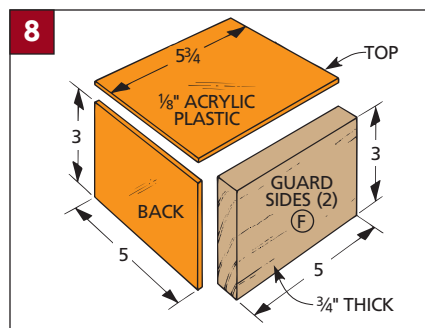
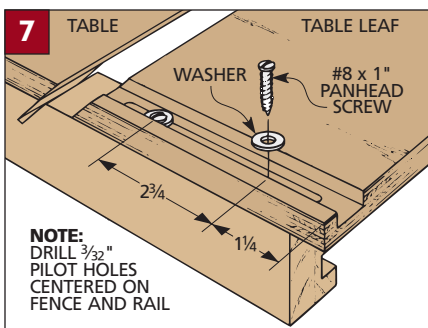
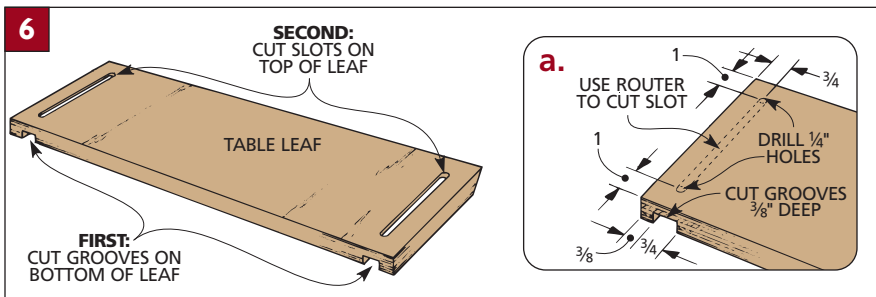
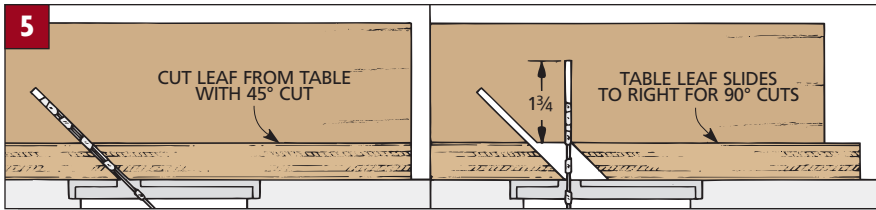
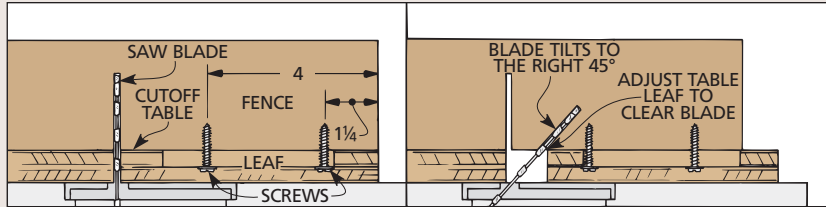
WOODWORKER'S NOTEBOOK

RIGHT-TILTING BLADE

The Sliding Cutoff Table is designed for use on a table saw where the blade tilts to the *left*. If your saw's blade tilts to the *right*, first make a

single 90° cut (see below).

Then, to cut miters, adjust the leaf so it's open and close it to make 90° cuts (see below).



The leaf opens to make 90° cuts and closes up for bevel cuts (*Fig. 5*). To make it adjustable, cut a $\frac{3}{8}$ "-deep groove at each end of the leaf (*Fig. 6a*). Then drill $\frac{1}{4}$ " holes centered on the groove, and cut a slot between the holes (*Fig. 6*).

ATTACH LEAF. Now screw the leaf to the fence and rail with panhead screws and washers (*Fig. 7*). Next, slide the table leaf to create a $\frac{3}{4}$ "-wide opening, and turn the table over so it sits in position on the saw. Then make a 90° cut with the blade set $1\frac{3}{4}$ " above the leaf (*Fig. 5*).

SAFETY FEATURES

Now two safety features are added: a guard to cover the blade as it passes through the fence, and a stop to keep the blade from cutting into the guard.

GUARD. To make the safety guard, start off by cutting two guard sides (F) from $\frac{3}{4}$ "-thick stock (*Fig. 8*). To cover the top and back of the guard, I used transparent acrylic plastic. Center the guard over the cuts in the fence and screw it in place (*Fig. 9*).

SAFETY STOP. Now you can work on the safety stop (G). This is just a 3"-long piece of $\frac{3}{4}$ "-thick stock. To position the stop, raise the blade to $2\frac{1}{2}$ ", turn the power on, and push the table into the blade, stopping when the inside edge of the fence meets the blade's high point (*Fig. 10*). Turn off the saw, and install a machine bolt on its left wing (*Fig. 10a*).

Note: If your saw doesn't have holes in its wing, just drill a hole for the bolt.

Now, butt the stop against the bolt and screw it in place.

HOLD-DOWN

The hold-down is a clamp system that fits in the grooves in the fence and rail.

To use the hold-down, a workpiece is placed on the table with the hold-down positioned over it. A pair of machine

bolts holds the workpiece flat (refer to Fig. 17 on page 84).

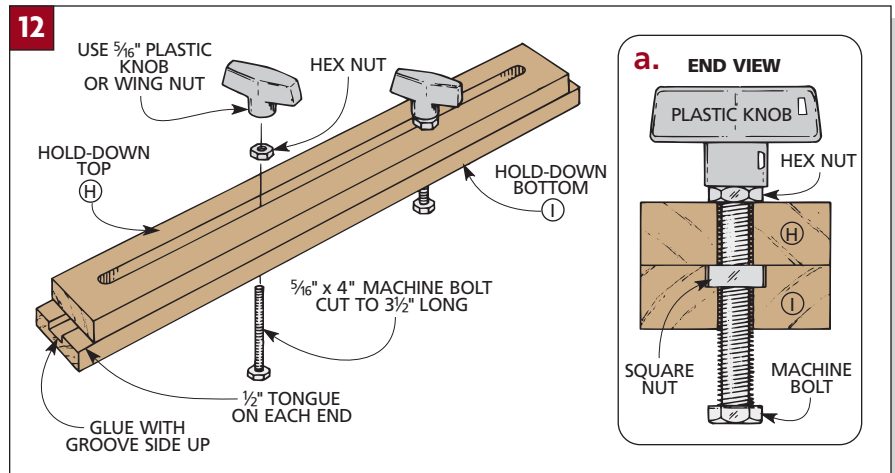
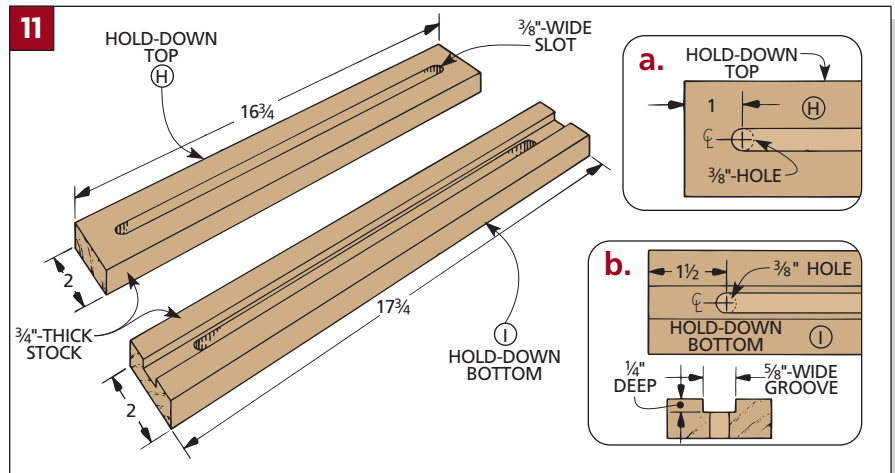
The bolts thread into square nuts that are “captured” in a groove in the hold-down (Fig. 12a). This allows the head of the bolt to be screwed down tightly against the workpiece. To accommodate different size panels, the bolts can slide back and forth in a slot in the hold-down.

TOP AND BOTTOM. To make the hold-down, start by ripping $\frac{3}{4}$ " stock to a width of 2". Then, cut a top hold-down (H) to a finished length of $16\frac{3}{4}$ " and a bottom hold-down (I) to $17\frac{3}{4}$ " (Fig. 11).

GROOVE. Next, to capture the square nuts in the bottom piece, cut a $\frac{5}{8}$ "-wide groove, $\frac{1}{4}$ "-deep down the center of the bottom piece (Fig. 11b).

SLOTS. To make the slots for the bolts, drill $\frac{3}{8}$ " holes in the top and bottom pieces (Figs. 11a and 11b). Now, rout a slot between the holes (see the Technique article below).

ASSEMBLE HOLD-DOWN. Finally, glue the top (H) centered on the bottom (I) so there's a $\frac{1}{2}$ "-long tongue on each end (Fig. 12). Then, slide two $\frac{5}{16}$ " square nuts into the groove in the bottom piece and thread machine bolts into the nuts. Now, to tighten down the bolts, add $\frac{5}{16}$ " hex nuts and knobs (or wing nuts) (Fig. 12a).



TECHNIQUE Routing And Cutting Slots

To make the hold-down, I needed a piece of wood with a $\frac{3}{8}$ "-wide centered slot. Here are three ways to create that slot.

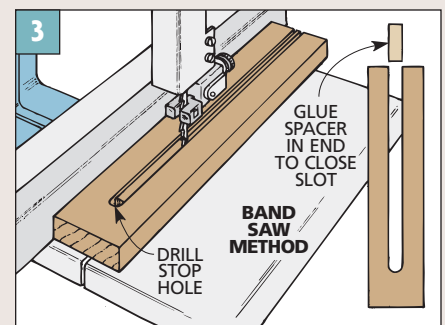
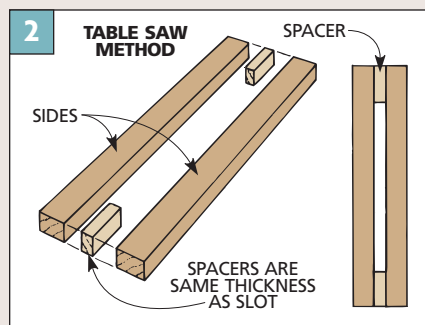
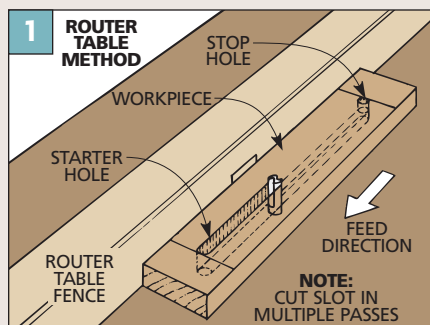
ROUTER TABLE. To use a router table, lay out the slot. Then bore a $\frac{3}{8}$ " starter hole at the left end and a $\frac{3}{8}$ " stop hole at the other (Fig. 1).

Mount a $\frac{3}{8}$ " straight bit in the router table and drop the starter hole over it to align the fence. Now remove the piece and rout the slot in several shallow passes. To do this, turn on the router and plunge the starter hole over the bit, sliding *left* to the stop hole.

TABLE SAW. On the table saw, start by ripping two side pieces (their total width should equal the finished width of the piece minus the width of the slot). Now make two spacers the same thickness as the slot, and glue them between the sides, one at each end (Fig. 2).

BAND SAW. On a band saw, first lay out the slot on the workpiece. Then bore a hole the same diameter as the slot's width at one end.

Now extend the outside lines all the way to the opposite end and cut them. To close the slot, glue a spacer into the open end (Fig. 3).



STOP BLOCK & TAPE

The last part to add to the table is a stop block (J). (This was cut off of the support rail earlier.) It runs in the same groove that holds the hold-down (Fig. 17).

The secret to the stop block is a hardwood runner in the groove. A machine screw is inserted in a hole in the runner (Fig. 15), and as a knob on the screw is tightened, it causes the runner to expand. This creates pressure to lock the stop in place (Fig. 15a).

STOP BLOCK RUNNER. Begin by cutting a stop block runner (K) from $\frac{3}{4}$ " stock (Fig. 13). Next, to mount the machine screw, drill a countersunk hole centered on the runner. Now cut an expansion slot in the runner and glue the runner into the groove (Fig. 14).

INDICATOR. If you add a measuring tape to the fence, you can use an indicator on the stop for cutting pieces to length.

First cut the indicator from $\frac{1}{8}$ " acrylic plastic (Fig. 14). Then scribe a centered "hairline" and darken it with a felt-tip pen.

To keep the indicator from twisting, cut a $\frac{1}{8}$ "-thick strip and glue it to the top edge of the block (Fig. 14).

Now drill a hole in the indicator and screw it in place (Fig. 15).

ASSEMBLY. To mount the machine screw in the stop block, use the hole in the runner as a guide to drill a $\frac{5}{16}$ " hole through the block (Fig. 15). Then, insert the machine screw through the hole.

Next, I epoxied a brad into the screw slot to keep the screw from turning as it's tightened (Fig. 15). Then mount a washer and plastic knob (or wing nut).

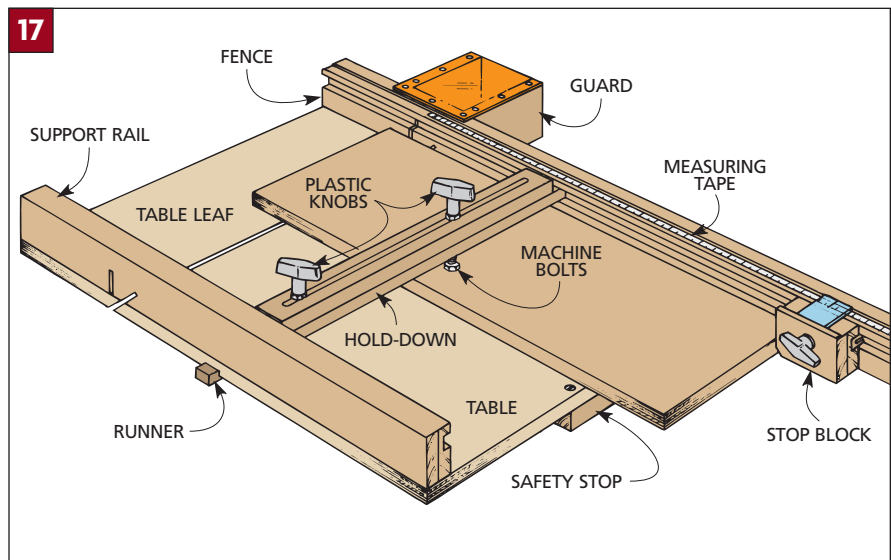
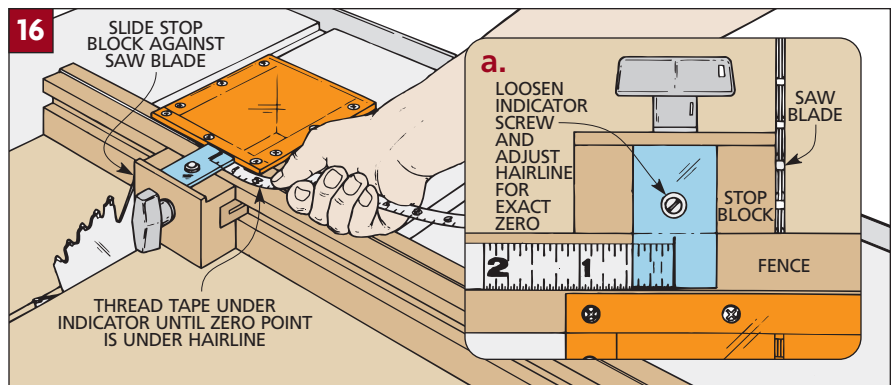
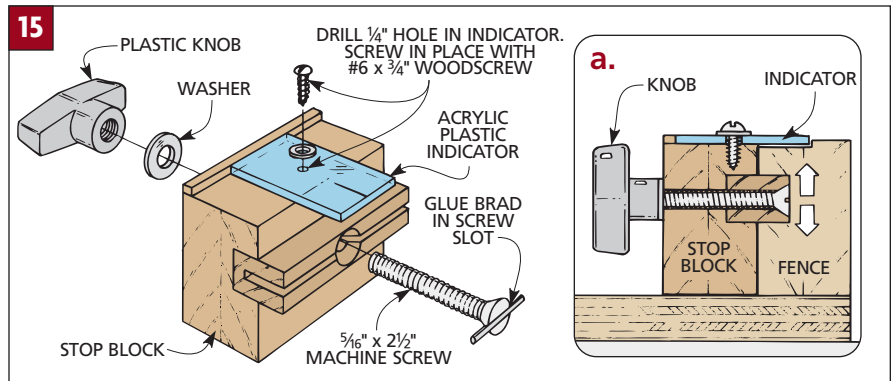
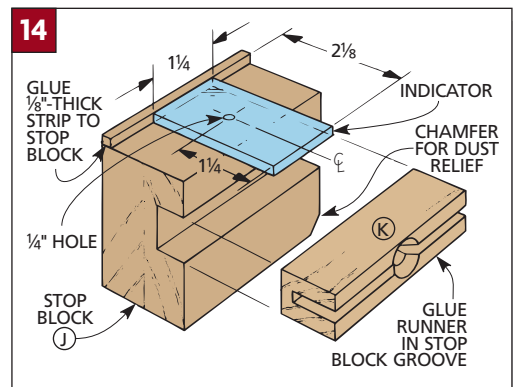
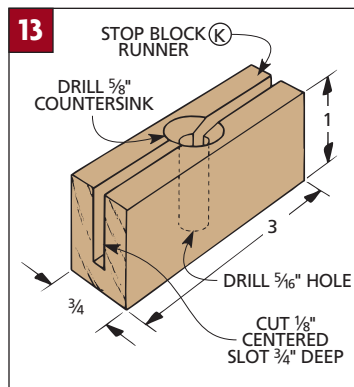
It's a good idea to sand a chamfer on the block as a sawdust relief (Fig. 14).

MEASURING TAPE. Now, to attach a right-to-left reading tape, butt the stop block against the saw blade (Fig. 16). With the stop locked in position, peel back a couple inches of paper backing from the zero end of the measuring tape.

Then slide the tape under the indicator and position the "zero" mark under the hairline (Fig. 16a). Remove the rest of the backing, press the tape onto the fence, and cut it to length.

FINE TUNE. If the hairline doesn't read zero, loosen the screw and slide the indicator until the hairline is zeroed (this is the reason for the $\frac{1}{4}$ " hole).

If you use a different blade (such as a thin kerf blade), simply re-adjust the indicator so the hairline gives an accurate "zero" reading.



DESIGNER'S NOTEBOOK

If you'd prefer a simpler, lighter, less expensive version of the Sliding Cutoff Table, you're in luck. This streamlined jig has all of that, without sacrificing the accuracy of the original version.

CONSTRUCTION NOTES:

■ The Sliding Cutoff Table shown on page 79 is great for improving the accuracy and safety of your table saw crosscuts. But if you'd like a lighter, cheaper, and simpler version, this one still offers the benefits you want.

■ To make this table, there are a few adjustments. The most obvious change you'll notice is all the parts you *won't* need: the table leaf, support rail, guard, safety stop, and hold-downs (refer to the Materials List below right).

■ The table (B) is still sized to fit your table from the blade to the edge of the table, but now it's shorter from front to back (*Fig. 1*).

■ In addition, the outside corner is cut off at a 45° angle (*Fig. 1*). This helps even more with the weight and handling of the table.

■ To get a perfect fit, first cut the table slightly longer than needed. Then after gluing the runner in place, trim the right edge of the table by running the table past the saw blade.

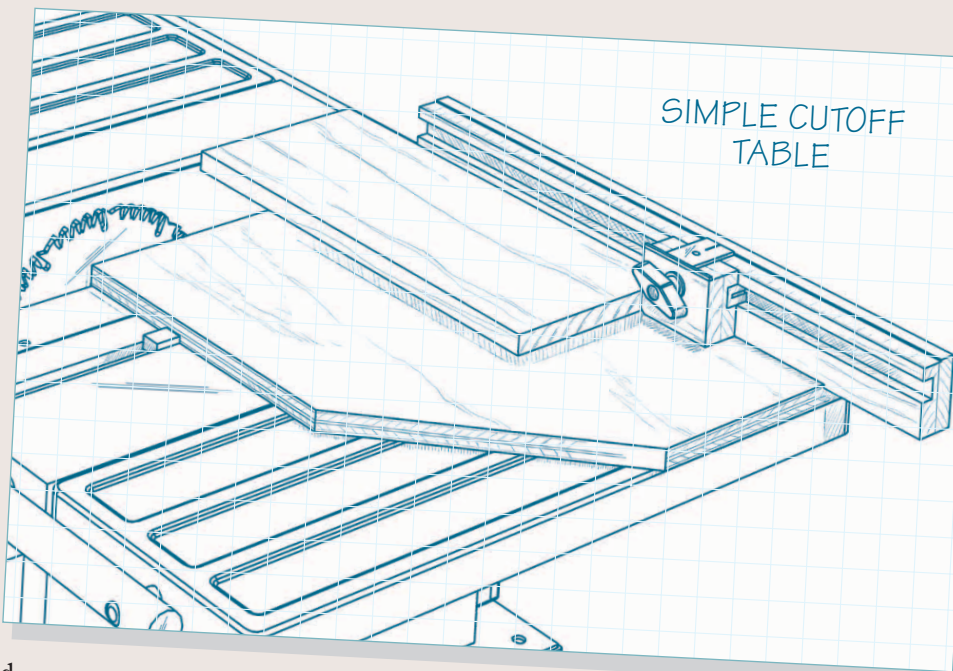
■ The fence (D) for this simple table is designed with versatility in mind. Instead of being screwed right to the table, it's attached with threaded inserts and machine screws (*Fig. 1*). This means you can now use fences of

different lengths, depending on the workpiece you're cutting. I made several, one 45" long and another 24" long.

■ To position the fence and help hold it, the table also has a shallow groove in the top, $\frac{3}{4}$ " from the back of the table (*Fig. 2*). I cut this groove with a dado blade in the table saw.

■ Finally, in order for the stop block to slide smoothly, you need to trim about $\frac{1}{8}$ " off the bottom (*Fig. 2*).

SIMPLE CUTOFF TABLE



MATERIALS LIST

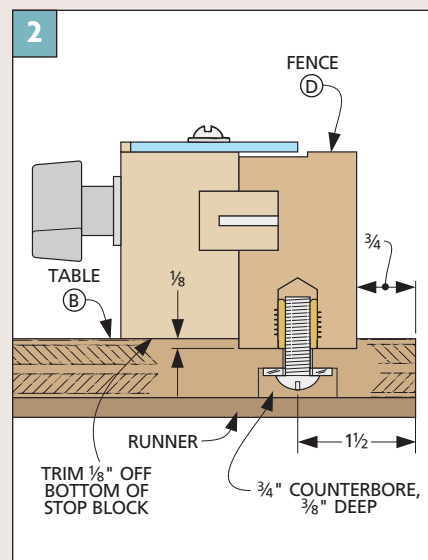
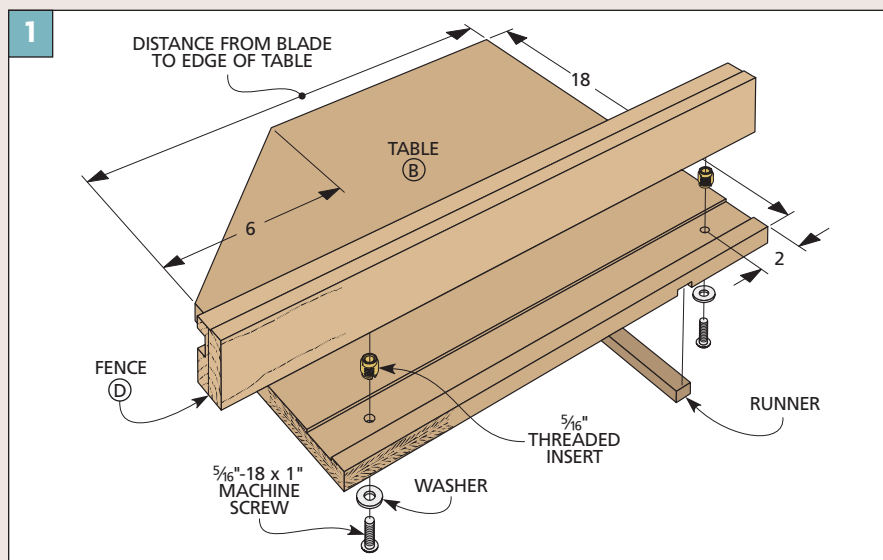
CHANGED PART

B Table (1)	$\frac{3}{4}$ ply - 18 x 36 rgh.
J Stop Block (1)	$\frac{3}{4}$ x $2\frac{3}{8}$ - 3

Note: Do not need parts C, E, F, G, H, I.

HARDWARE SUPPLIES

- (2) $\frac{5}{16}$ "-18 x 1" Rh machine screws
- (2) $\frac{5}{16}$ "-I.D. threaded inserts w/ washers





SANDING & DUST CONTROL

Time in the shop is best spent woodworking. These projects make it a lot easier; that is if you enjoy making sawdust — not cleaning it up.

The sanding table provides a convenient work space that cleans the air as it disposes of shop dust. A dedicated air filter recycles shop air, depositing dust in a series of furnace filters. And the sandpaper dispenser helps keep adhesive-backed sandpaper organized and handy.

The table saw dust collector turns a contractor's table saw into a clean machine. Interior baffles direct the sawdust out of the cabinet and into your collection system. And speaking of dust collection, our dust collector is easy to build and will make a dirty, dust-filled shop a thing of the past.

Sanding Table

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Sanding Table

This shop-built table pulls in the clouds of dust that are produced when sanding a project. Plus, it can double as an air filter system for your whole shop when you're not sanding.



On the outside, this Sanding Table looks like an ordinary shop cabinet. It's not until you open the door and look inside that you start to appreciate how it really works.

At the center of the system is a blower that pulls air down through a pegboard top with slightly enlarged holes. This way, the fine dust that's produced when sanding is drawn *inside* the cabinet instead of filling the air in the shop.

But there's more to this project than just a Sanding Table. Even when you're not using it for sanding, you can run the blower and the table doubles as an air filtration system for the entire shop.

FILTERS. What makes this work is the air passing through a series of three furnace filters — two above the blower and one below. These filters screen dust particles out of the air before the air is returned to the shop. Standard fiberglass furnace filters do a good job of filtering sawdust (high-efficiency pleated filters are another option). For more information on the types of filters available, see the Shop Info box on page 92.

BLOWER. I used a squirrel-cage style blower that moves 465 cubic feet of air per minute (cfm). I purchased mine new (see page 126 for sources). But you may be able to find a used one from a heating

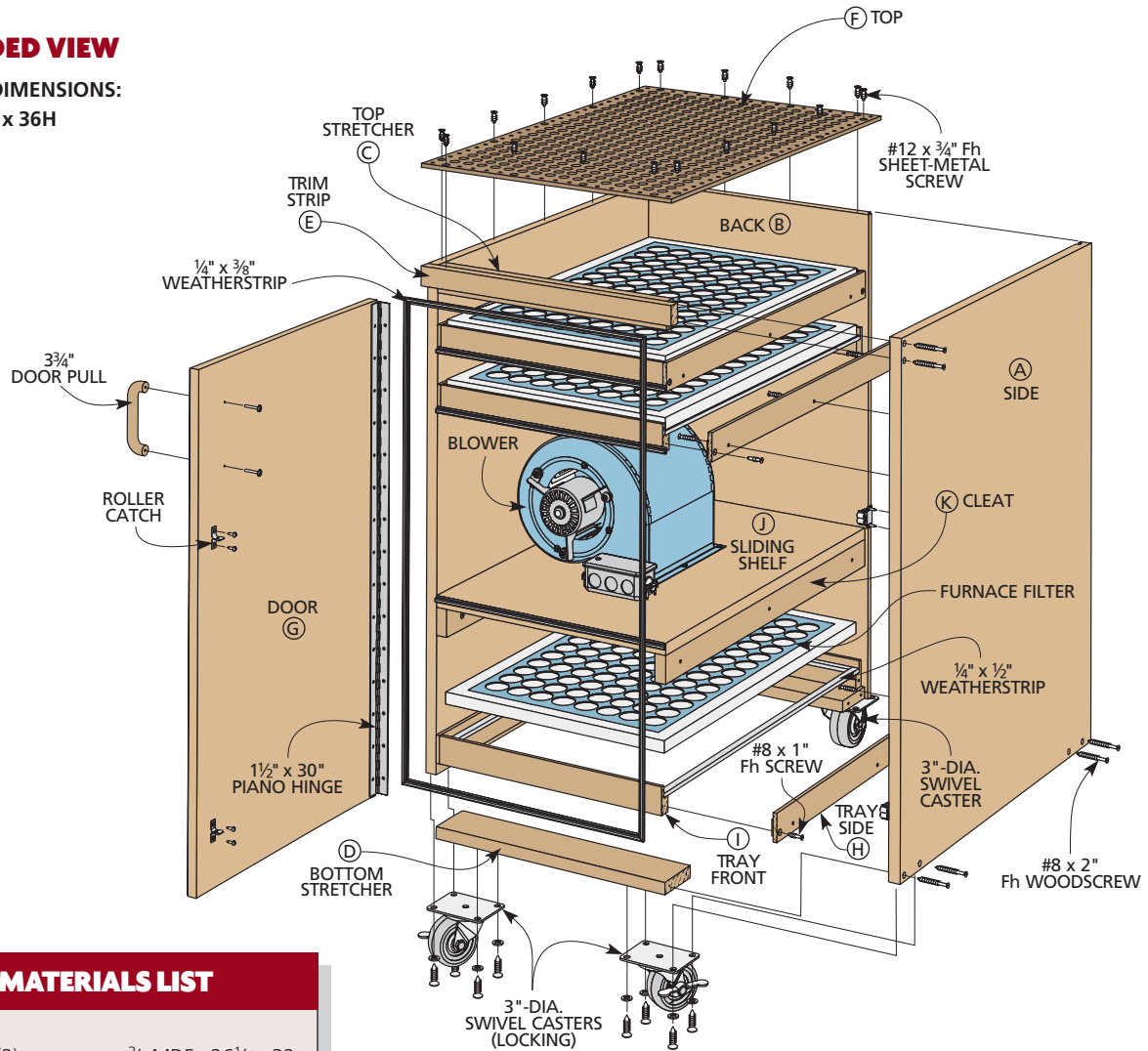
and air conditioning contractor. Either way, have it on hand before starting to make sure it fits your cabinet.

I ran an electric cord to a receptacle with a switch mounted to the side of the case, but you could just plug it directly into a wall outlet. If you have any questions concerning the wiring of this unit, call in a licensed electrician for help.

DUST HOOD. The large top on the Sanding Table has plenty of room for most projects. But when you're working on small pieces, you can increase the suction power of the table with an optional dust hood. To learn more about it, see the Designer's Notebook on page 93.

EXPLODED VIEW

OVERALL DIMENSIONS:
18W x 27D x 36H



MATERIALS LIST

WOOD

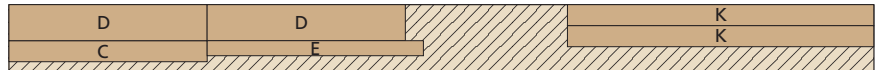
A Sides (2)	$\frac{3}{4}$ " MDF - 26 $\frac{1}{4}$ x 32
B Back (1)	$\frac{3}{4}$ " MDF - 17 x 32
C Top Stretcher (1)	$\frac{3}{4}$ x 1 $\frac{3}{4}$ - 16 $\frac{1}{2}$
D Bottom Stretcher (2)	$\frac{3}{4}$ x 3 - 16 $\frac{1}{2}$
E Trim Strip (1)	$\frac{3}{4}$ x 1 $\frac{1}{4}$ - 18
F Top (1)	$\frac{1}{4}$ pgbd. - 18 x 27
G Door (1)	$\frac{3}{4}$ " MDF - 18 x 30 $\frac{11}{16}$
H Tray Sides (6)	$\frac{3}{4}$ x 1 $\frac{3}{4}$ - 25 $\frac{1}{2}$
I Tray Fronts/Backs (6)	$\frac{3}{4}$ x 1 $\frac{3}{4}$ - 16
J Sliding Shelf (1)	$\frac{3}{4}$ " MDF - 16 $\frac{1}{2}$ x 25 $\frac{1}{2}$
K Cleats (2)	$\frac{3}{4}$ x 1 $\frac{3}{4}$ - 25 $\frac{1}{2}$

HARDWARE SUPPLIES

- (1) 465 cfm squirrel cage blower
- (2) 3"-dia. fixed casters
- (2) 3"-dia. locking swivel casters
- (16) No. 14 x $\frac{5}{8}$ " Ph screws
- (16) $\frac{1}{4}$ " flat washers
- (12) No. 8 x 1" Fh woodscrews
- (18) No. 12 x $\frac{3}{4}$ " Fh sheet-metal screws
- (1) 1 $\frac{1}{2}$ " x 30" piano hinge w/ screws
- (12) No. 8 x 2" Fh woodscrews
- (30) No. 8 x 1 $\frac{1}{4}$ " sheet-metal screws
- (6) No. 10 x $\frac{5}{8}$ " Ph screws
- (1) 3 $\frac{3}{4}$ " door pull (maple)
- (2) Roller catches w/ screws
- (3) 16" x 25" x 1" furnace filters
- (25') $\frac{1}{4}$ " x $\frac{1}{2}$ " weatherstrip
- (17') $\frac{1}{4}$ " x $\frac{3}{8}$ " weatherstrip

CUTTING DIAGRAM

$\frac{3}{4}$ x 5 $\frac{1}{2}$ - 72 (2.8 Bd. Ft.)



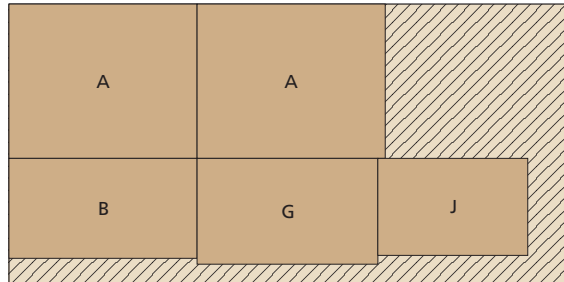
$\frac{3}{4}$ x 5 $\frac{1}{2}$ - 72 (2.8 Bd. Ft.)



$\frac{3}{4}$ x 5 $\frac{1}{2}$ - 72 (2.8 Bd. Ft.)

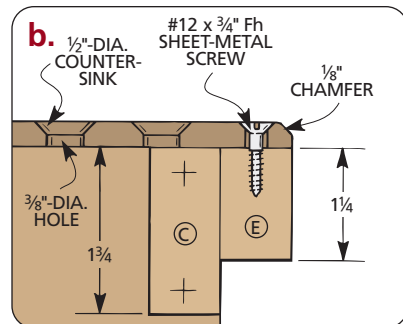
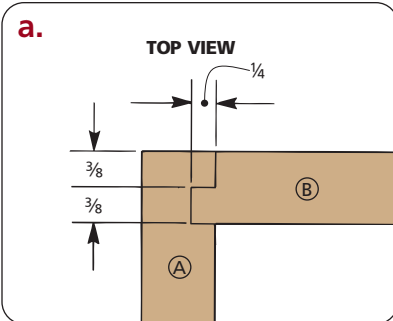
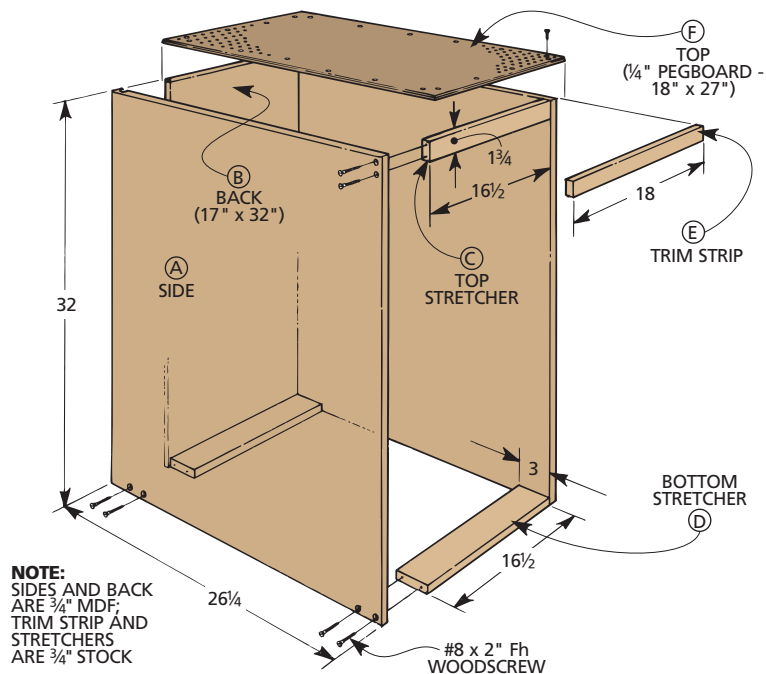


$\frac{3}{4}$ " MDF - 48 x 96



$\frac{1}{4}$ " PEGBOARD - 24 x 48





CASE

I started on the Sanding Table by making the case (*Fig. 1*). In addition to supporting the top, it houses the air filter system. To provide an exhaust for the air from the blower, the bottom of the case is open. And the front is left open for a door that's added later.

The sides (A) and back (B) of the case are made from $\frac{3}{4}$ "-thick MDF (plywood would also work) (*Fig. 1*). These pieces are held together with a rabbet and groove joint (*Fig. 1a*). To ensure a tight fit, it's best to cut the grooves in the sides first. Then cut rabbets in the back to form tongues to fit the grooves.

STRETCHERS. To add rigidity, three hardwood stretchers span the case. A narrow top stretcher (C) runs across the front of the case and helps support the top. And two wider bottom stretchers (D) double as mounting platforms for casters (added later).

ASSEMBLY. After dry-assembling the case and cutting the stretchers to fit, you can glue the sides and back together. Then just screw the stretchers in place (*Figs. 1 and 1b*).

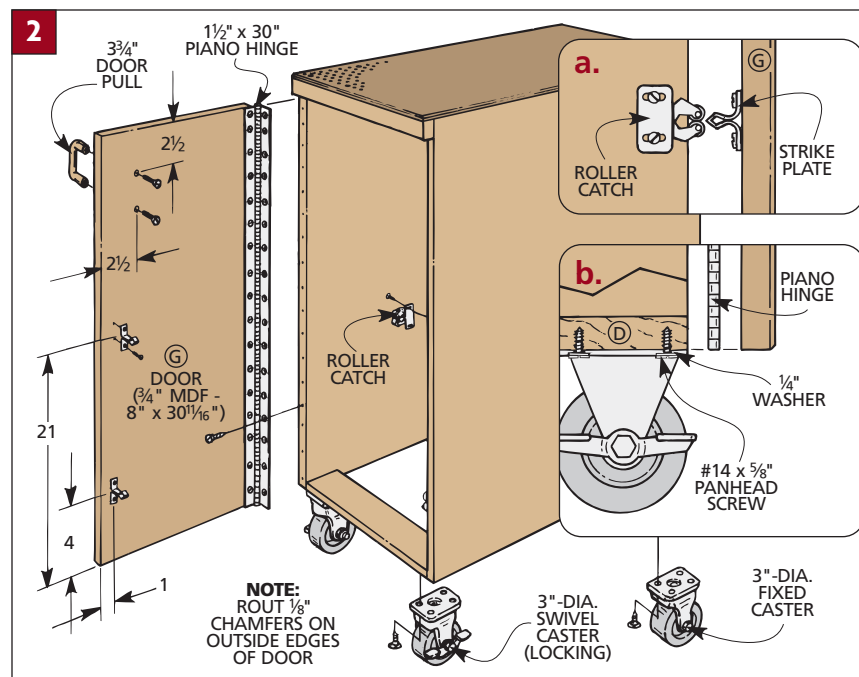
TOP. The next step is to add the top of the Sanding Table. It's supported by the case and a hardwood trim strip (E) that's glued to the top stretcher (C).

To draw dust down into the case, the top (F) is made from a piece of $\frac{1}{4}$ "-thick

pegboard that's cut to fit flush with edges of the case. But before attaching the top, there are a couple of things to do.

To improve the airflow through the top, enlarge each opening in the pegboard by drilling a $\frac{3}{8}$ "-diameter hole (see the Shop Tip on the opposite page and *Fig. 1b*). Then, after counter-sinking the holes, simply screw the top in place and rout small chamfers around the edges.

DOOR. To provide easy access to the air filter system, the next step is to add a door (G) (*Fig. 2*). It's a piece of $\frac{3}{4}$ " MDF that's cut to the same width as the case (18"). But to provide clearance when opening and closing the door, it's $\frac{1}{16}$ " less than the distance between the trim strip and the bottom of the case ($30\frac{11}{16}$ "). After attaching the door with a piano hinge, I added a wood pull and a pair of roller catches (*Figs. 2 and 2a*).



CASTERS. Now all that's left is to screw casters to the bottom stretchers. To make the table easy to roll (yet still provide a stable work surface), I used two locking swivel casters in front and fixed casters in back (*Figs. 2 and 2b*).

AIR FILTER SYSTEM

The thing that's unique about this Sanding Table is it also works as an air filter system. So even if you're not sanding, you can cycle the air in the shop through the table and remove the fine particles of dust.

There's nothing complicated about the air filter. It consists of three fixed trays that hold furnace filters and one sliding shelf that serves as a mounting platform for the blower (*Fig. 3*).

FIXED TRAYS. Each of the fixed trays is identical — just an open frame to hold a filter (*Fig. 4*). Two trays are located *above* the blower and the third one is *below*.

This way, the filter at the top removes the dust from the incoming air. And the other two filters collect any dust that gets through the first one. As a result, the air is practically dust free when it circulates back to the shop.

Each tray has two side pieces (H) and a front and back (I) made from $\frac{3}{4}$ "-thick hardwood (*Fig. 4*). Each of these pieces has a rabbet cut in the top edge to accept the filter (*Fig. 4a*). Then, after cutting a notch in the end of each side piece to accept the front and back, the trays are simply glued and screwed together (*Figs. 4 and 4b*).

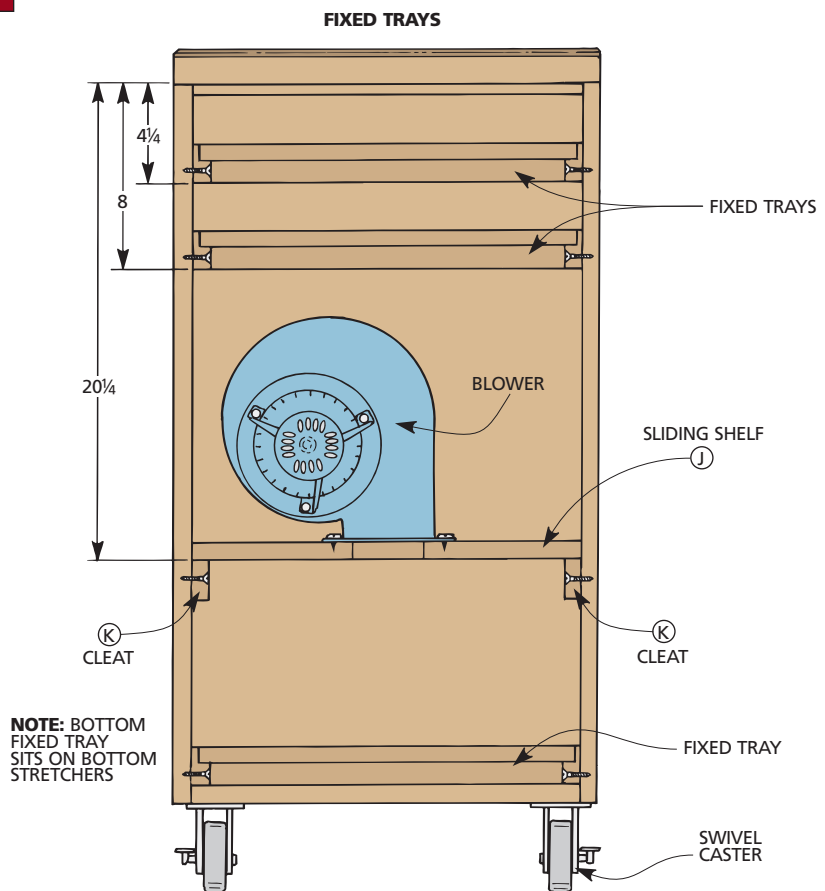
SHOP TIP

Enlarge Holes

To increase airflow, first enlarge the holes in the top with a drill bit. Then chamfer the edges of the holes with a countersink (see photo).

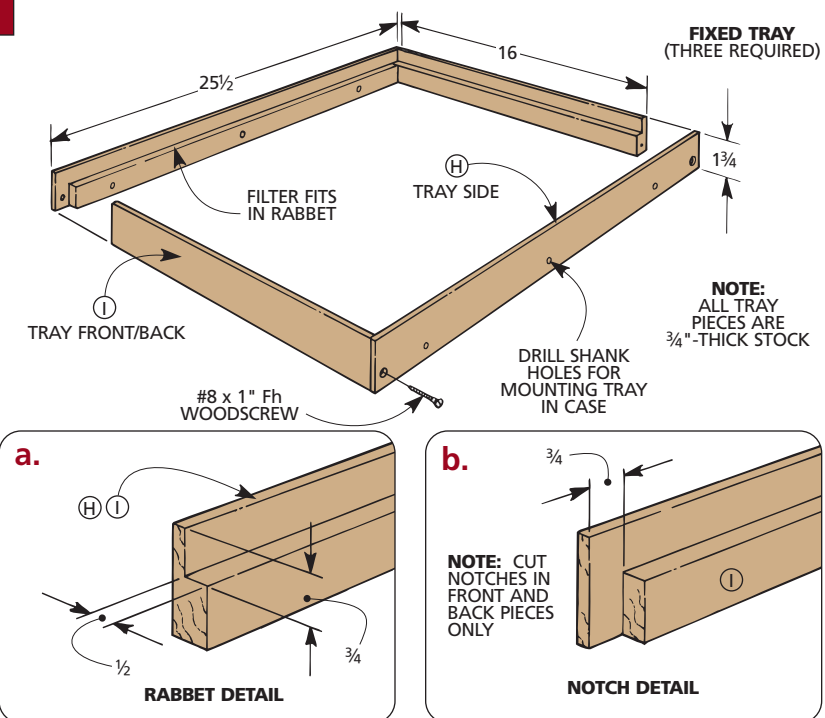


3



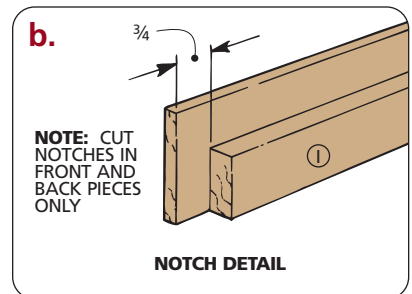
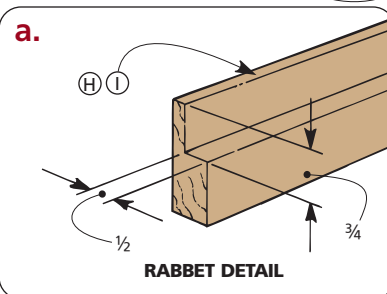
NOTE: BOTTOM FIXED TRAY SITS ON BOTTOM STRETCHERS

4



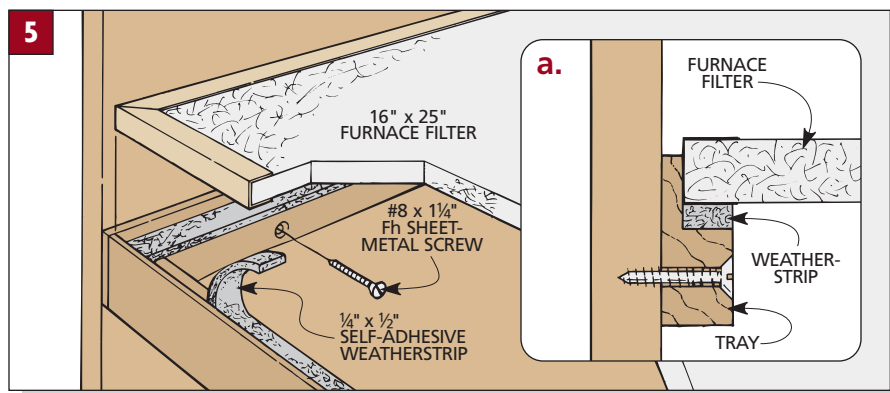
FIXED TRAY (THREE REQUIRED)

NOTE: ALL TRAY PIECES ARE $\frac{3}{4}$ "-THICK STOCK



INSTALL TRAYS. Once you've completed all three of the trays, it's just a matter of screwing them to the case (refer to *Figs. 3 and 5*). You want the dust to be contained on each level, so to keep dust from traveling from one layer to the next, I added strips of self-adhesive weatherstrip to the bottom of the rabbets before installing the filters (*Fig. 5a*).

SLIDING SHELF. With the fixed trays in place, you're ready to add the sliding shelf (J) for the blower (*Fig. 6*). It's a piece of $\frac{3}{4}$ " MDF that acts as a mounting platform for the blower. And since it slides in and out of the case on a pair of cleats (added later), it's easy to lubricate the blower periodically or blow out any dust that accumulates around the vents.

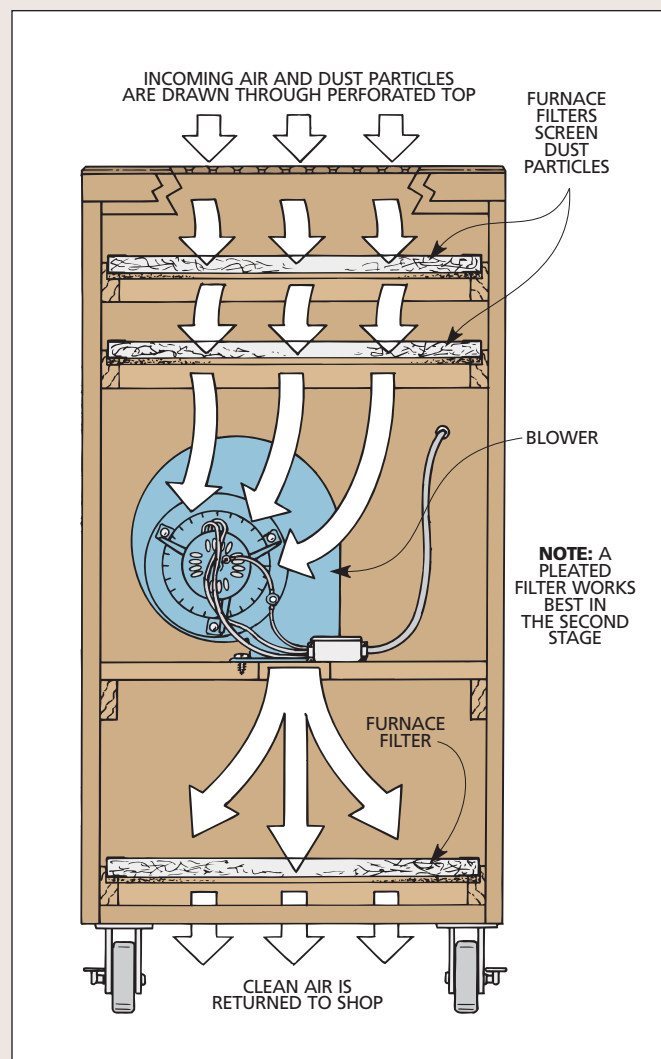


After cutting the shelf to fit inside the case, you'll need to cut an opening for the blower's exhaust to pass through (*Fig. 6*). Just make sure the hole is sized to fit the blower housing on your

blower. And to distribute this air equally in all directions, it's best to cut the opening for the blower so that it's centered on the shelf. Then you can mount it with screws (*Fig. 6*).

SHOP INFO

Furnace Filters



Building this dedicated Sanding Table (which doubles as an air filter) is a good first step toward controlling shop dust. Almost as important is deciding which type of filter to use.

Standard fiberglass furnace filters (see 'A' in photo below) are inexpensive, disposable, and they trap large dust particles effectively.

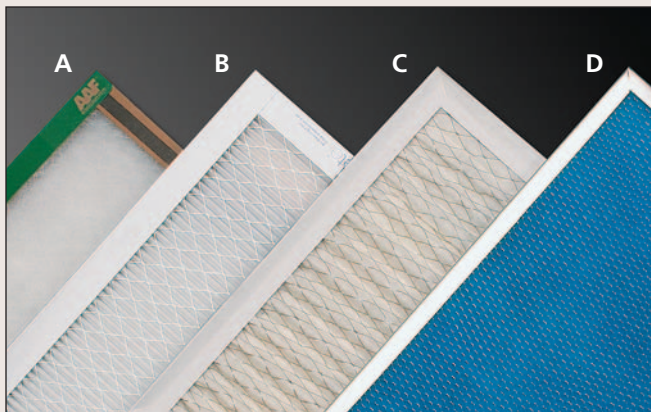
Better yet are high-efficiency pleated furnace filters that have an electrostatic charge ('B' in photo). This type of filter is designed to capture the small particles that other filters miss.

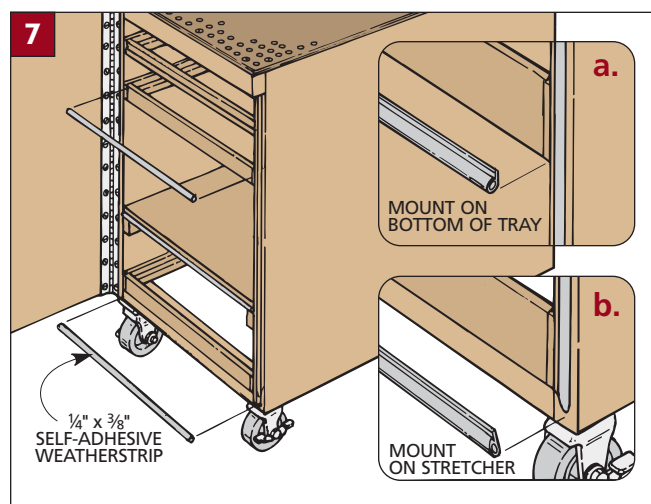
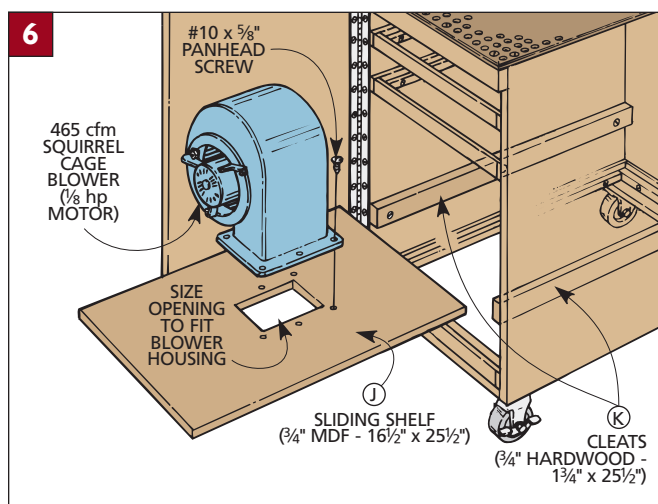
Note: These filters are a little more expensive. I like to

save cost by using fiberglass filters during the first and third stages, and a high-efficiency pleated filter in the second stage *only*.

A less expensive option is a regular pleated furnace filter ('C'). They have lots of surface area so they catch plenty of dust. However, they're not as effective as the high-efficiency filters.

Finally, you have washable/reusable furnace filters ('D'). They're more expensive and require more maintenance than disposable filters. And they're not as effective at trapping small particles. But they last longer, which can balance out the cost.





To support the weight of the blower (and allow it to slide in and out easily), it rests on two cleats (K). These are pieces of 3/4"-thick hardwood that are cut to size and then glued and screwed to the inside of the case (refer to *Fig. 3* on page 91 and *Fig. 6*).

WEATHERSTRIP. Before hooking up the blower, I applied weatherstrip to the front edges of the case, shelf, and trays (*Fig. 7*). But this time, to stand up to the wear and tear of repeatedly opening and closing the door, I installed a more durable weatherstrip like the kind used

on exterior doors (*Fig. 7*). You should be able to find this style of weatherstrip at most hardware stores.

HOOKUP. All that's left to complete the Sanding Table is to hook up the blower. There are a couple of different ways to do this. You could run the electric cord to a receptacle with a switch mounted to the side of the case, or you could simply connect the motor wiring to a length of electric cord. But, as always with wiring, contact an electrician if you're not comfortable doing any part of this job yourself. ■



DESIGNER'S NOTEBOOK

With this simple modification, the Sanding Table is perfect for working on small parts.

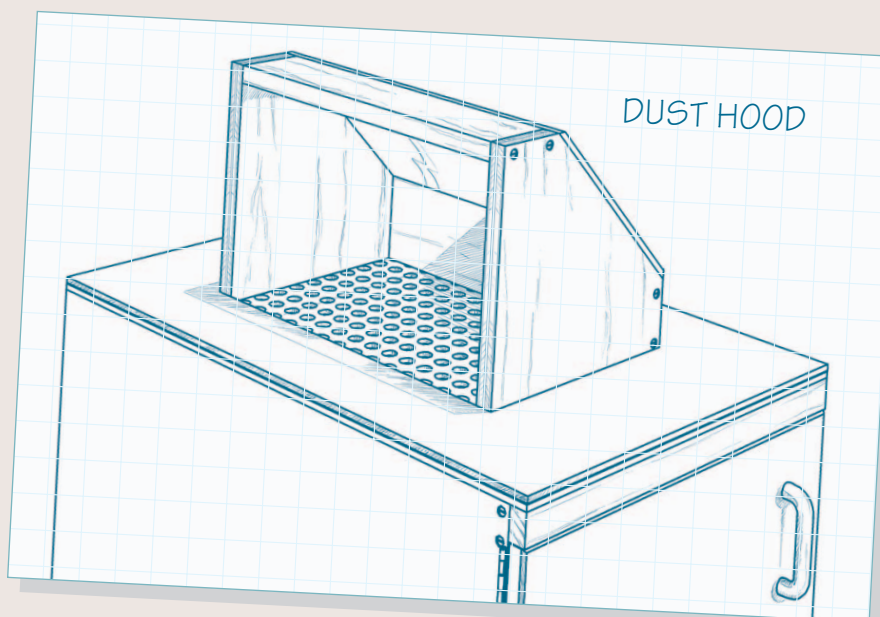
CONSTRUCTION NOTES:

■ To make the Sanding Table work more efficiently when carving or sanding small parts, I added a small "dust hood" that sits on top of the table. The hood helps to concentrate the airflow to one small area, making the Sanding Table even more effective at removing dust particles.

■ The hood is nothing more than a few pieces of plywood glued together with simple butt joints (see drawing). A few brads work well to hold the pieces together until the glue sets up.

■ I glued on a piece of clear acrylic over the opening at the back to let in light.

■ The secret to increasing airflow is covering the rest of the table top with a piece of hardboard. This blocks off the other air holes so the dust and chips are drawn in through the sanding hood.



Shop Air Filter

Whether ripping at the table saw or finish sanding, airborne dust is a nuisance every woodworker has to deal with. Here is an inexpensive solution that will clear the air in your shop.



It doesn't take too much sawing or sanding to kick up a lot of dust. And a shop full of airborne dust is not a good place to work.

AIR FILTER. There is a way to get rid of airborne dust. Professional shops often have a separate filter unit that will remove potentially harmful shop dust from the air. Unfortunately, these units aren't cheap. So I designed a heavy-duty Shop Air Filter that uses three furnace filters to clean the air. There are two pre-filters at the intake end of the unit and one at the exhaust end.

By the time the air passes through the last filter, there's not much dust left to trap. The results are dusty furnace filters and cleaner air.

To make the unit even more efficient, I used pleated furnace filters instead of the standard fiberglass mesh furnace filters. These filters are com-

monly available and only cost a couple dollars more. (For more information on the variety of filters available, see the Shop Info article on page 92.)

Changing the filters is easy too. To get at them, the bottom of the case isn't permanently attached. I used tongue and groove joinery, so it slides open in either direction, and the filters simply drop down (see inset photo).

BLOWER. To circulate the air through the shop, I used a squirrel cage blower with an enclosed motor. This blower is easily the most expensive part of this project. But it's a workhorse that's worth every penny. It'll circulate the air in a 250 sq. ft. shop in about 5 minutes. (A used blower from your local heating and air conditioning contractor could be used as an inexpensive alternative.)

CASE. The filters and the blower are housed in a simple, open-ended case.

For the wood, I used just three board feet of hardwood and a little over half a sheet of $\frac{3}{4}$ "-thick plywood.

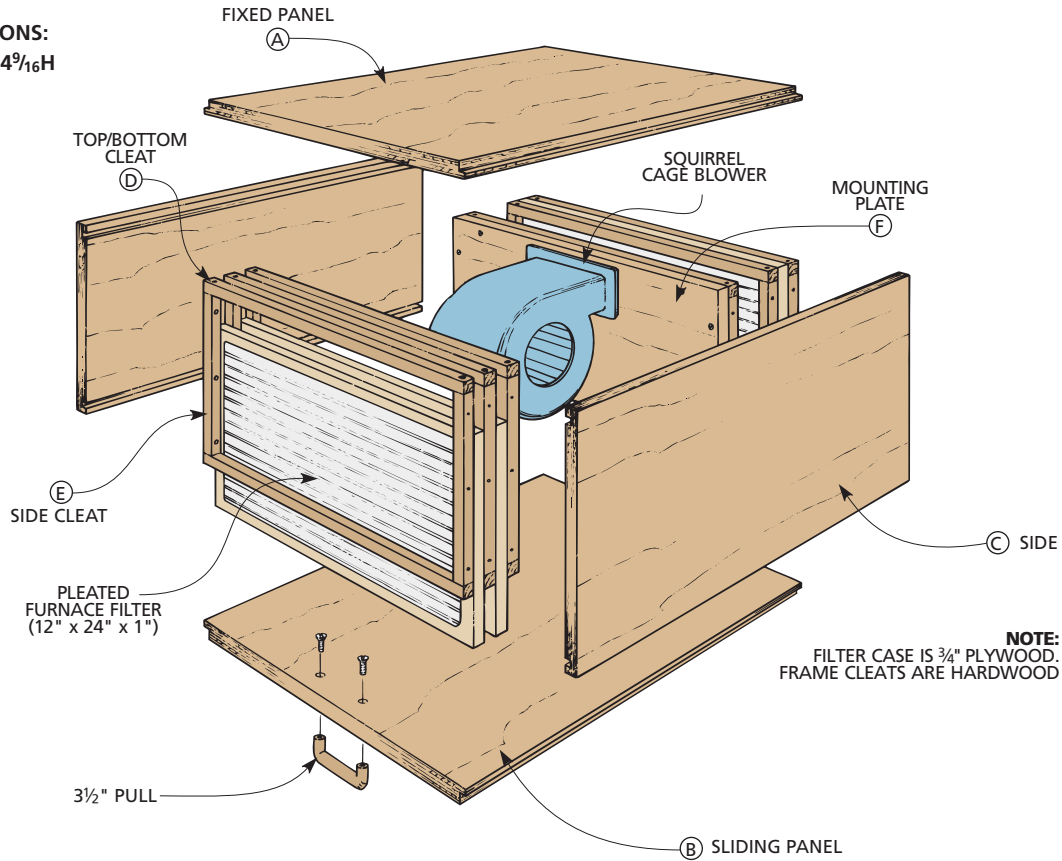
SMALL AREA SHOP FILTER. Since many woodworkers don't have large workshops, I'm also including plans for a small air filtering system.

Instead of a heavy-duty squirrel cage blower to move the air, this air filter uses two bathroom exhaust fans. For more on this unit, see the Woodworker's Notebook on page 98.

EXPLODED VIEW

OVERALL DIMENSIONS:

25 1/2" W x 31 3/4" D x 14 9/16" H



NOTE:
FILTER CASE IS 3/4\"/>

MATERIALS LIST

WOOD

A Fixed Panel (1)	3/4 ply - 24 3/4 x 31 3/4
B Sliding Panel (1)	3/4 ply - 21 1/16 x 31 3/4
C Sides (2)	3/4 ply - 13 1/2 x 31 3/4
D Top/Btm. Cleats (12)	3/4 x 3/4 - 24
E Side Cleats (12)	3/4 x 3/4 - 10 1/2
F Mounting Plate (1)	3/4 ply - 12 x 24

HARDWARE SUPPLIES

- (1) Squirrel cage blower
- (3) 12" x 24" x 1" pleated furnace filters
- (62) No. 8 x 1 1/4" Fh woodscrews
- (12) No. 8 x 1 3/4" Fh woodscrews
- (10) No. 8 x 2 1/2" Fh woodscrews
- (5) No. 10 x 5/8" Ph screws
- (5) No. 10 flat washers
- (2) 3 1/2" pulls w/ screws

CUTTING DIAGRAM

3/4 x 3 1/2 - 36 (.9 Bd. Ft.)



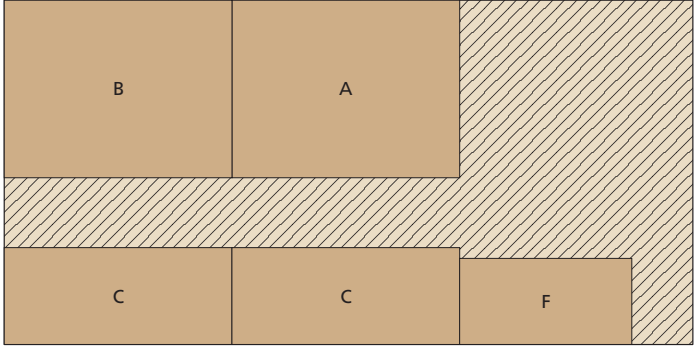
3/4 x 3 1/2 - 36 (.9 Bd. Ft.)

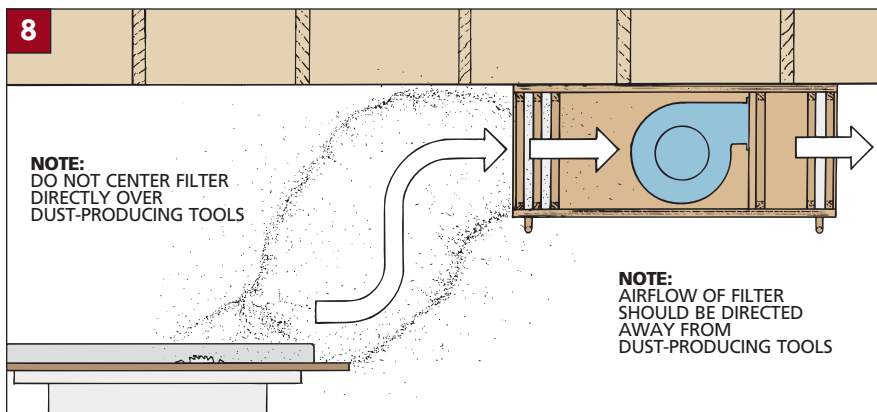
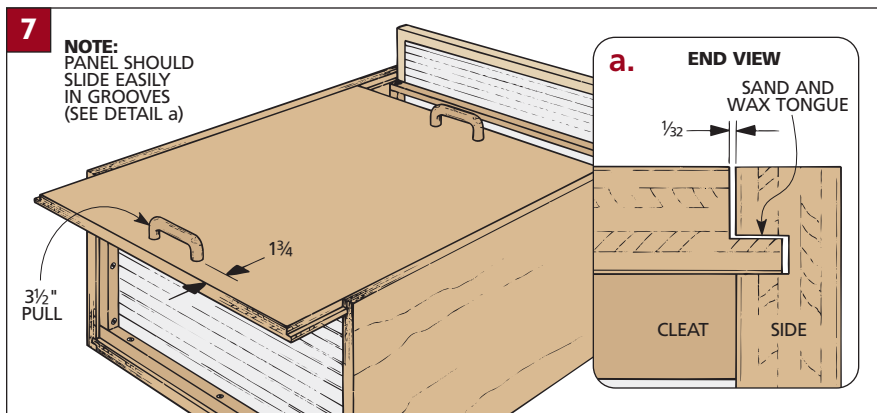
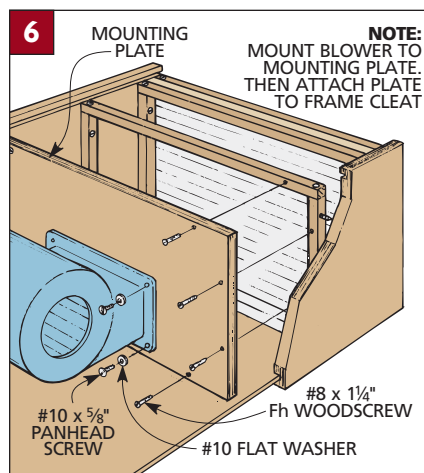
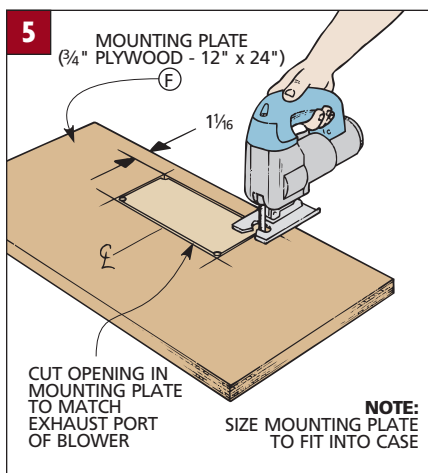
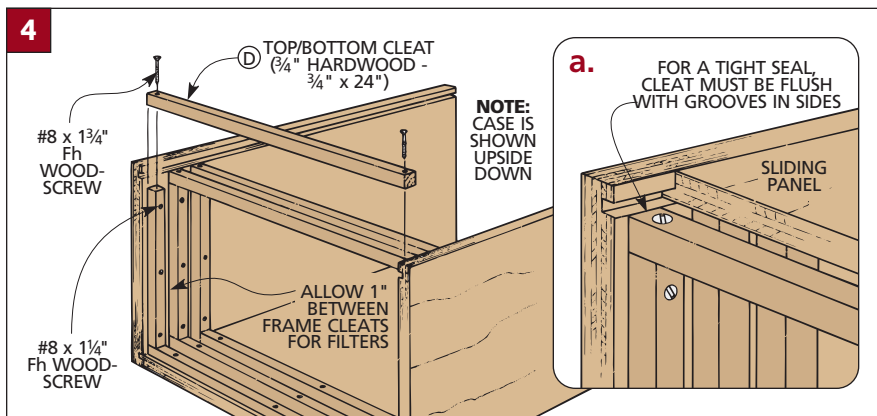


3/4 x 3 1/2 - 36 (.9 Bd. Ft.)



3/4" PLYWOOD - 48 x 96





MOUNTING THE BLOWER. There's one last set of cleats that form a frame near the center of the case (*Fig. 3*). This frame supports the blower. But I couldn't screw the blower directly to the frame. Instead, I made a mounting plate (F) out of plywood (*Fig. 5*).

To make the mounting plate, first cut a piece of plywood to fit inside the case. Then cut an opening in the plate to match the exhaust port on the blower (*Fig. 5*).

Screw the blower to the mounting plate first (*Fig. 6*). Then screw the plate to the center cleats.

FITTING THE PANEL. The last step is to install the sliding panel (*Fig. 7*). This panel already has tongues that fit the grooves in the case sides. If the fit is tight, sand the tongues until they slide smoothly (*Fig. 7a*). A little wax will help.

Finally, I attached pulls near the ends of the sliding panel (*Fig. 7*). They give you something to grab onto when sliding the panel open to change the filters.

LOCATING THE UNIT

This filter unit should be located so all the dust is drawn into the intake filters (*Fig. 8*). You don't want it centered directly over a dust-producing machine like a table saw or sanding table. The reason is simple. You don't want to blow dusty air around, just clean air.

CEILING-MOUNTED. To suspend it from the ceiling, all you will need to do is screw it to the ceiling joists.

But be careful. This filter unit isn't light. So before you attempt to mount it, locate and drill the mounting holes first. Then be sure to get plenty of help when lifting the filter into position.

And if your ceiling is low (as in a basement), consider mounting it on a wall, as shown in the photo below.



For the most versatility, the air filter can be mounted to the ceiling or to a wall (as shown in the photo above). Either way it's highly efficient.

WOODWORKER'S NOTEBOOK

This inexpensive filter is the perfect size for a small shop. It also works great in larger shops for filtering the air around a table saw or a stationary sander.

SMALL AREA SHOP FILTER

■ While this filter isn't really big enough for a large shop, it's perfect for filtering the air around one or two dust-producing tools like a table saw or a stationary sander.

■ Instead of using three furnace filters like the Shop Air Filter, this Small Area Shop Filter uses only one. And to circulate the air around the shop, it uses two bathroom exhaust fans instead of a heavy-duty blower. These inexpensive fans are readily available at home centers.

Note: Before starting, it's best to have the exhaust fans on hand. Sizes can vary and it would be a shame to build the unit only to find that the parts that you've purchased aren't the right size.

■ Another consideration is the size of the furnace filter used. I decided on a 16" x 20" filter. Then I sized the case to hold a single filter that slides into grooves in the sides and becomes the bottom of the case.

Note: Here again, I used a pleated furnace filter — not your typical fiberglass mesh filter (refer to the Shop Info article on page 92). Also, the filters won't be exactly 16" x 20". They'll be slightly smaller. So measure your filter and build the case to fit around it.

■ To build the small air filter, start by cutting the case sides (A) to finished size from $\frac{3}{4}$ "-thick plywood (Fig. 1). (The length of the sides should match the length of the filter.)

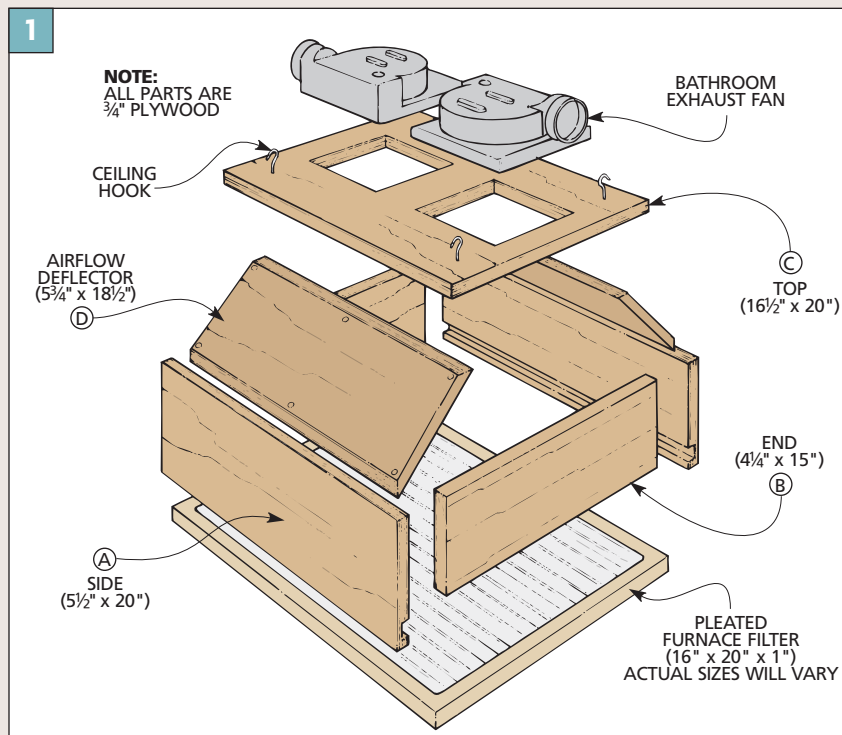
■ Next, cut a $\frac{1}{2}$ "-deep groove in each side to hold the furnace filter (Fig. 2).

■ After the grooves have been cut, the next step is to add the ends (B). But the ends aren't the same width as the sides. They're cut so they end up flush with the top of the groove in each side (Fig. 2). This way, the filter will slide in easily but will still keep a tight seal.

Note: The length of the ends depends on the actual size of the filter. They should equal the actual width of the filter minus $\frac{7}{8}$ ".

■ Now, the sides and the ends can be glued and screwed together (Fig. 2).

■ The next step is to add the top (C) (Fig. 3). It's cut to cover the case



MATERIALS LIST

WOOD

- A** Sides (2) $\frac{3}{4}$ ply - 5 1/2 x 20
- B** Ends (2) $\frac{3}{4}$ ply - 4 1/4 x 15
- C** Top (1) $\frac{3}{4}$ ply - 16 1/2 x 20
- D** Airflow Deflectors (2) $\frac{3}{4}$ ply - 5 3/4 x 18 1/2

HARDWARE SUPPLIES

- (2) Bathroom exhaust fans
- (1) 16" x 20" x 1" furnace filter

- (8) No. 8 x 2" Fh woodscrews
- (12) No. 8 x 1 1/4" Fh woodscrews
- (12) No. 8 x 1 1/2" Fh woodscrews
- (1 tube) Siliconized latex caulk
- (2) No. 8 hex head sheet-metal screws
- (2) 3"-dia. metal duct, 24" long
- (4) Ceiling hooks
- (1) 48"-long chain (cut into four pieces)

assembly and then is glued and screwed in place. (Mine was 16½" x 20".)

■ Now cut two square openings in the top piece for the intake ports on the fans (*Fig. 3*). Make them ½" smaller in both directions. But don't attach the exhaust fans quite yet. There are a couple of things to do first.

■ To make the airflow more efficient, add two deflectors (D) to help direct the air into the fans (*Figs. 4 and 5*).

■ Wire the exhaust fans now, because it's much harder to do this *after* they've been attached to the case. If you're not comfortable doing this yourself, hire a qualified electrician.

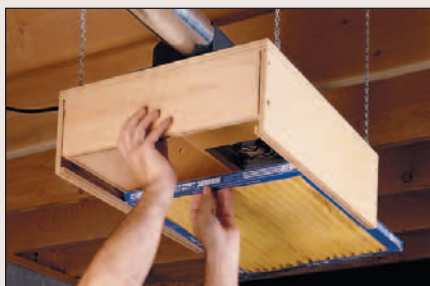
■ Now all that's left is to attach the fans. To do this, I didn't glue or screw them in place. Instead, I used siliconized latex caulking to create an air-tight seal (*Fig. 6*). (I found out the hard way that regular silicone caulking won't adhere to the plastic bodies on the exhaust fans.)

■ After the caulk is dry, you need to do something about the exhaust ports on the fans. These fans are powerful — they push the filtered air away with such force that they disturb the air below the filter. This means a lot of dusty air floating around that never gets pulled through the filter.

The solution is to add a 24" length of 3"-dia. duct to extend the exhaust ports away from the unit (*Fig. 7*). (This way the dusty air hangs beneath the unit until it can be drawn up through the filter.)

■ The last step is to hang the filter unit. But you can't just screw the unit in place to the ceiling joists — the exhaust fans are in the way. So the unit has to be suspended from the ceiling. To do this, I used four ceiling hooks and some short lengths of chain (*Fig. 7*).

■ Since the fans draw the air straight up through the filter, it's best to suspend it directly above an area, like a table saw or sanding station, where a lot of your shop dust is created.



Grooves. The grooves allow you to easily slide the filter in and out, but they're positioned to provide an airtight seal.

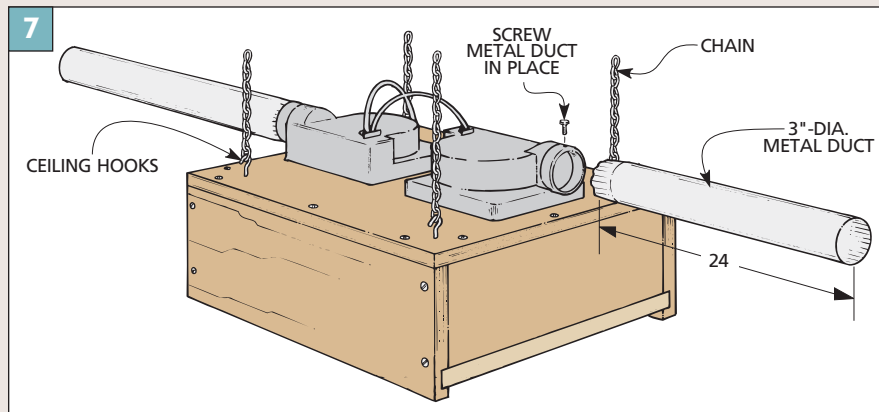
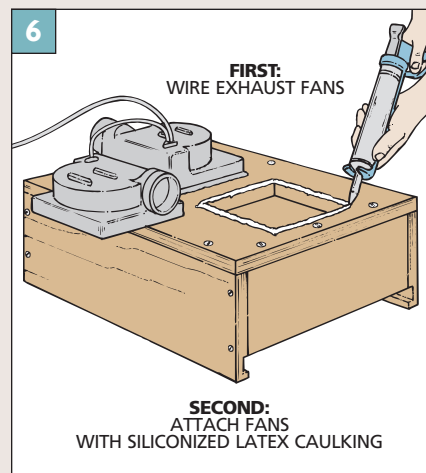
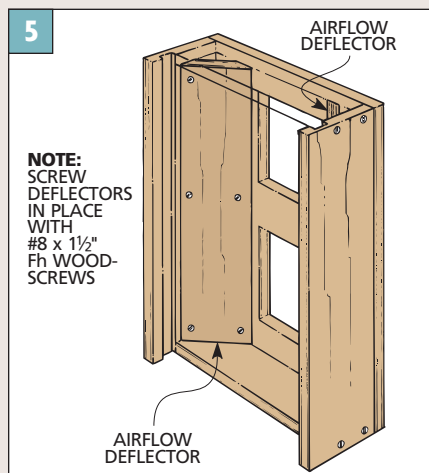
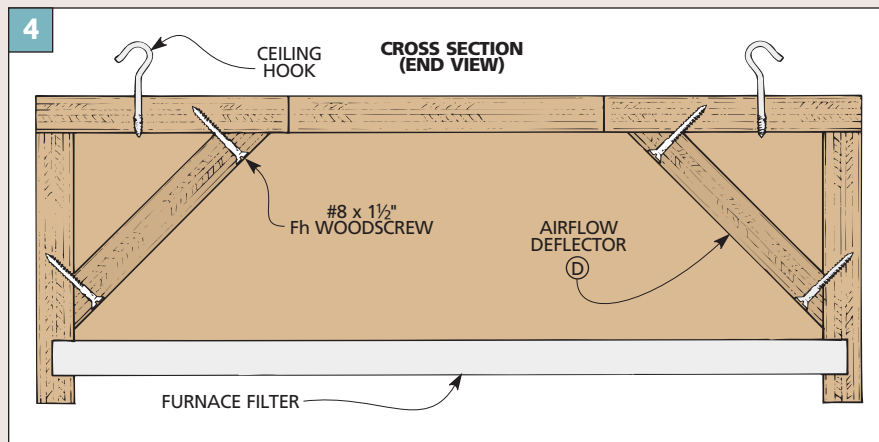
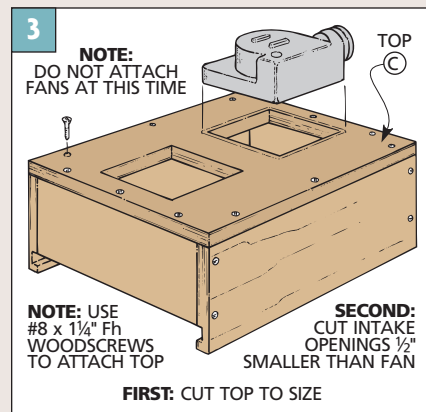
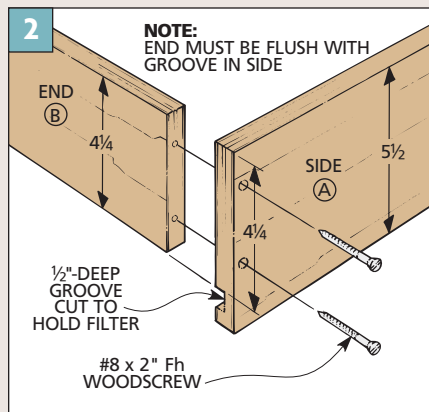


Table Saw Dust Collector

It's hard to imagine a simpler way of collecting the dust and chips produced by a table saw — or a jointer or router table, for that matter. This versatile design can be adapted for a variety of stationary tools.



Sometimes it seems like collecting all the dust produced by a stationary shop tool (like the table saw) is a losing battle. Even if you're only cutting a few small pieces, it can still fill the air with a cloud of dust that settles into every nook and cranny in the shop.

To solve this problem, I added a simple dust collection baffle system inside my contractor's saw cabinet (see the Exploded View and the detail on the opposite page). It's designed to be used with a dust collector or shop vacuum to catch the chips and sawdust that settle inside and all around a table saw cabinet.

The secret to making everything work is how the baffles are positioned. They're angled to control the flow of air inside the saw cabinet.

When you turn on the dust collector, air rushes in through the back of the cabinet and "sweeps" across the baffles, drawing dust and chips down into the hose leading to the dust collector (see the air flow detail shown on the next page).

I didn't bother to block off the back of my contractor's saw. I've found that the funneling action created by the baffles works best when I leave the back side open. That's because the dust collector draws outside air in to prevent the dust from escaping the cabinet. To make sure that the air came in only from the back, I installed some short strips of foam to seal the upper parts of the saw cabinet (see the Shop Tip on page 103).

BAFFLES. The slick surface of the hardboard baffles is perfect for this application. And the hardboard is only

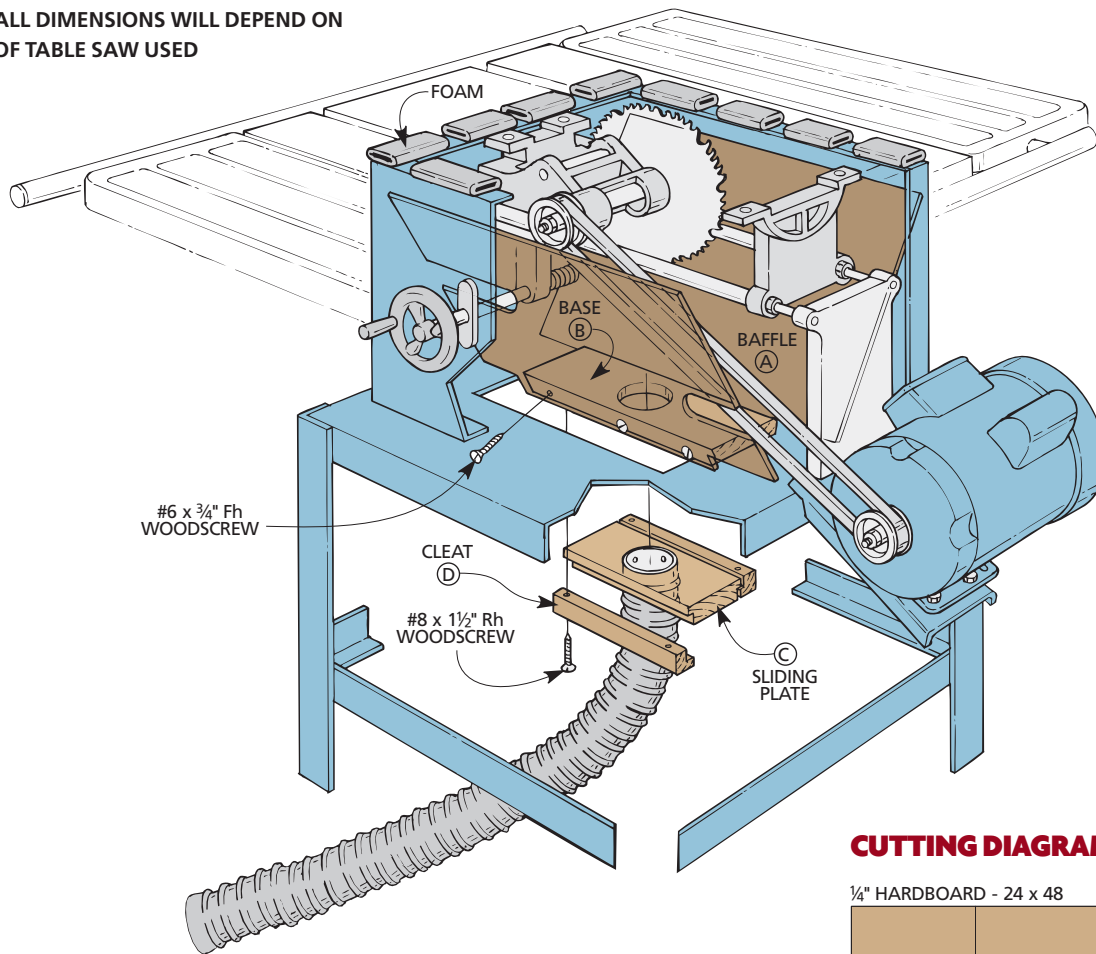
1/4" thick, making it a lot easier to install in tight spaces. Speaking of tight spaces, you'll need to remove the motor to install the baffles. This is a big job, but it's easier to do than it sounds. Just consult your owner's manual.

HOOKUPS. To hook up the dust collector hose, it's attached to a wood plate that slides in place under the baffles (see the inset photo above). The nice thing about this plate is it makes it easy to adapt this type of hookup to other tools as well.

ROUTER OR JOINTER. Two of the most notorious dust-producing tools in any shop are the router and the jointer. By adapting the hose mount to each of these tools, it's easy to move the dust collector hose from one tool to another. See the Designer's Notebook on page 103 for details on how to best do this.

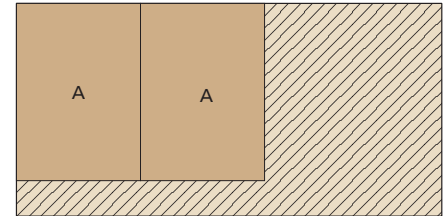
EXPLODED VIEW

OVERALL DIMENSIONS WILL DEPEND ON
TYPE OF TABLE SAW USED

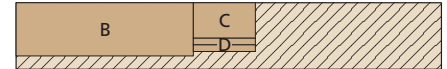


CUTTING DIAGRAM

1/4" HARDBOARD - 24 x 48



3/4 x 7 1/2 - 24 (1.2 Bd. Ft.)



MATERIALS LIST

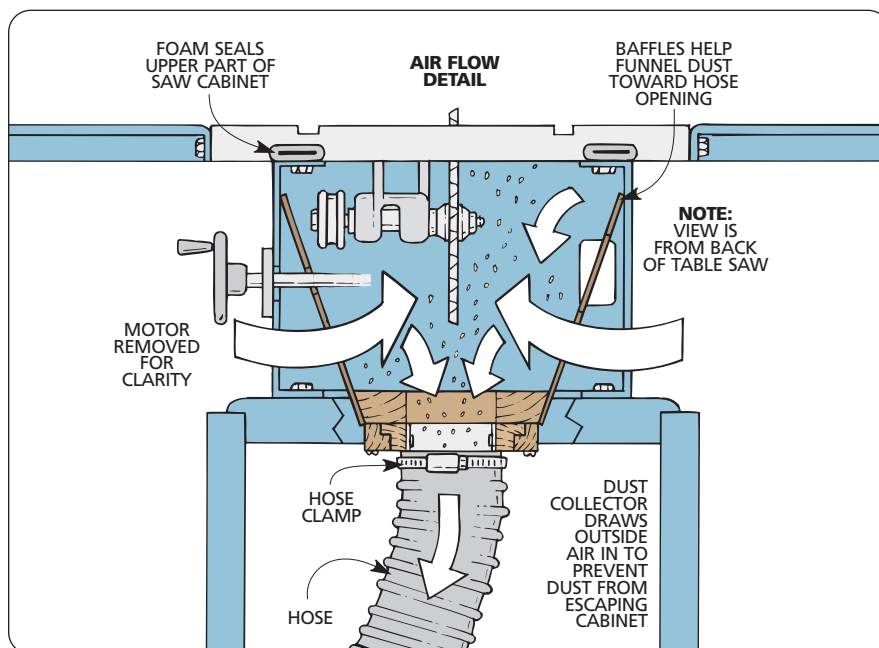
WOOD

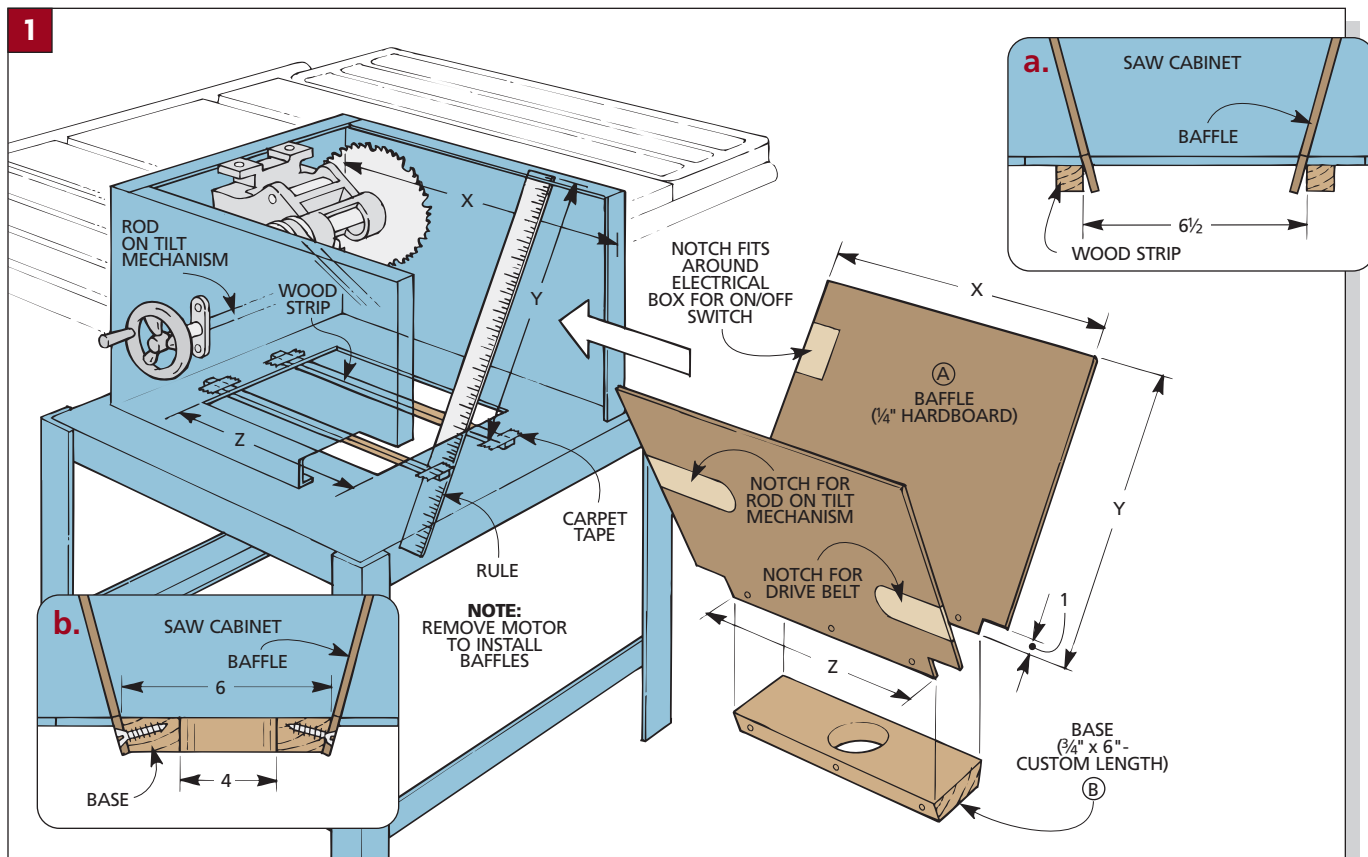
- A** Baffles (2) 1/4 hdbd. - 'x' x 'y'
- B** Base (1) 3/4 x 6 - varies
- C** Sliding Plate (1) 3/4 x 4 - 7
- D** Cleats (2) 3/4 x 3/4 - 7

Note: The dimensions for the baffles (as well as the length of the base) will vary depending on the model of table saw they will be mounted to.

HARDWARE SUPPLIES

- (6) No. 6 x 3/4" Fh woodscrews
- (4) No. 8 x 1 1/2" Rh woodscrews
- (4) No. 6 x 1/2" tacks
- (1) 2 1/2" x 13 1/2" metal flashing
- (1) 4" hose clamp





CONSTRUCTION

Depending on your table saw, the size you end up with for the baffles will vary. Determining the baffle's *length* is the easy part; it's finding the *width* that will take a little extra work. Some wood strips and a rule will help.

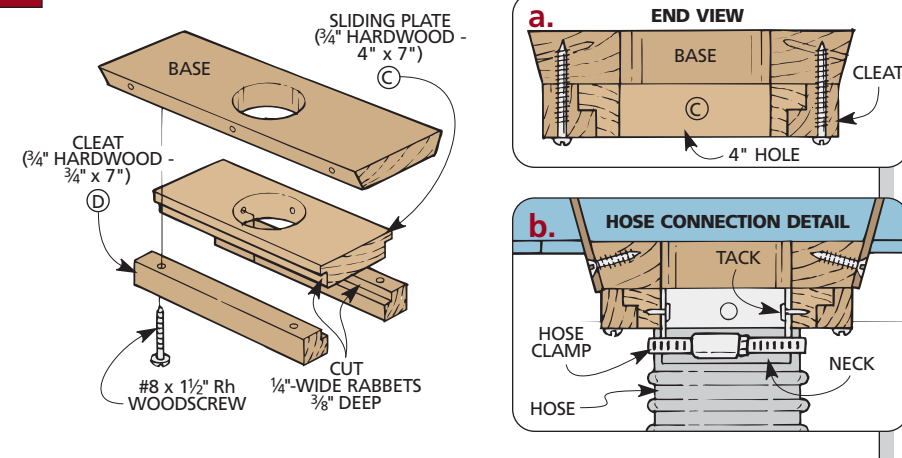
BAFFLES. Each baffle (A) is a piece of $\frac{1}{4}$ " hardboard that needs to be notched to fit around all of the obstructions you'll find inside the saw cabinet (*Fig. 1*).

To get the dimension for 'x,' simply measure the inside of the table saw cabinet from front to back (*Fig. 1*).

Figuring out the width of the baffles is a bit trickier. It depends on the angle of the baffles. The exact angle isn't critical. I "eyeballed" mine. First, I used a metal rule and two strips of wood. Then I used double-sided carpet-tape to temporarily attach the strips to the bottom of the cabinet (*Figs. 1 and 1a*).

With the strips in place, I simply measured the distance from the upper corner of the cabinet to the top inside edge of the strip. (This distance will be dimension 'y' in *Fig. 1*.)

NOTCHES. The next step is to notch the lower corners of each baffle. This creates a tongue that fits down through



the opening in the bottom of the cabinet. (Dimension 'z' in *Fig. 1* shows the length of the tongue.) The tongues serve two purposes — they make it easier to fit the base and to remove the sliding plate (*Figs. 1 and 2b*).

Now notch to fit around the rod on the tilt mechanism, the electrical box for the on/off switch, and the drive belt.

Note: To get a good fit, make poster-board templates of the baffles first. Then it's just a matter of cutting the baffles to match the templates.

INSTALL BAFFLES. At this point, you're ready to fit the baffles into the cabinet. But first, you'll need to remove the motor from the table saw to do this. But don't take off the wood strips just yet. They'll hold the baffles in place while you work on the base.

BASE. The base (B) is nothing more than a piece of $\frac{3}{4}$ "-thick stock that's been beveled to fit between the baffles (*Figs. 1 and 2*). (I used pine for my base.) To allow dust to pass through the base, you'll also need to cut a large hole

that's sized to match the diameter of the dust collector hose.

HOOKUP. Before the base is installed, it's easiest to add the hookup for the dust collector hose. The hookup consists of three parts: a sliding plate (C) that's connected to the hose and a pair of L-shaped cleats (D) attached to the base (*Fig. 2*).

The plate simply slides in and out on the cleats. To accomplish this, there's a lip on each cleat that's formed by rabbeting one edge. A matching rabbet in each edge of the sliding plate allows it to fit on the cleats.

To hook up the hose, I made a short connector from a piece of metal flashing and attached it to the sliding plate. It's simply wrapped around a large hole that's cut in the sliding plate. Then I used a few short tacks to nail the flashing in place (*Figs. 2b and 3*).

ASSEMBLY. Now you can assemble all the pieces for the Table Saw Dust Collector. The goal here is to position the cleats on the base so the sliding plate moves freely back and forth without binding. After you've glued and screwed the cleats in place, just screw the baffles to the base. (Don't forget, you'll have to remove the wood strips first.) Then attach the hose with a hose clamp (*Figs. 2b and 3*). ■

SHOP TIP Foam Sealer

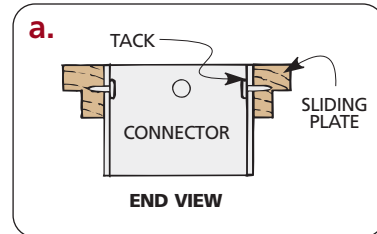
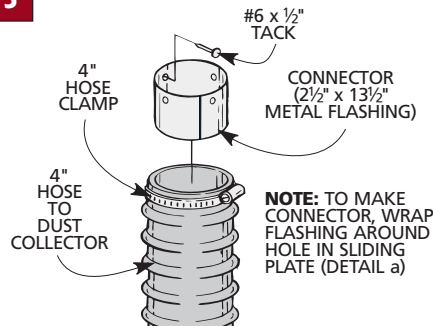
The angled baffles on the table saw dust collector help direct the flow of air inside the saw cabinet. And the source of outside air needs to come through the back of the saw when you turn on the dust collector.

So to help direct the air flow, I seal the upper parts of the cabinet with short pieces



of foam insulation. To do this, simply stuff the "ribs" of the cast iron table (as shown in the photo above).

3



DESIGNER'S NOTEBOOK

Whether you're using a portable dust collector or a shop vac, you'll need a way to hook it up to more tools.

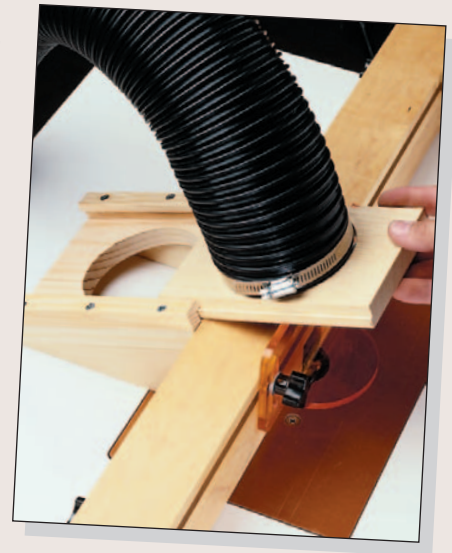
ALTERNATE HOOKUPS

■ These shop-made hookups provide a quick way to connect your dust collector to a jointer (shown at left) or a router table (right).

■ The dust collector hose is attached to a wood plate that slides between a pair of cleats, just like the dust hookup for the table saw. But instead of mounting baffles similar to those used on the table saw, I simply mounted it to the dust port provided with my jointer.

■ I cut the base to fit over the metal port and attached it with sheet-metal screws.

■ To mount the hookup to my router table, I had to attach it to the back of my router fence. The fence was already adapted for dust collection. So once again, all I had to do was build a base for the cleats. A pair of triangular workpieces supports the base (as shown).



Sandpaper Dispenser

Some shop accessories are just good for storage. Others serve a specific purpose — making the use of a product easier. This handy Sandpaper Dispenser fills both roles easily and inexpensively.



There's one type of sandpaper that I've started to depend on in my shop. The sandpaper comes in 4½"-wide rolls and has a sticky adhesive on the back. It's designed to adhere tightly to a special pad that's mounted to the base of an orbital finish sander. And it comes in a wide variety of grits.

The whole idea is that you can tear off a piece of this sticky sandpaper, slap it on the bottom of the sander, and go to work. And the great thing is, you don't have to fight the clamps that hold the paper in the sander. (For more on how to find adhesive-backed sandpaper, see Sources on page 126.)

DISPENSER. One of the first things you'll want to do after you've bought some rolls of this paper is to find a convenient way to store it. And it would be nice to have a way to measure and tear off the right amount of paper for the sander. I decided to make a dispenser that would do all of this.

This plywood dispenser holds two rolls of adhesive-backed paper. Plus, it provides a measuring surface so you can determine the exact amount of paper you need before you tear it off (see photos on page 107). And a piece of an old hacksaw blade works great for ripping the paper neatly in straight sections.

HAND SANDING. Of course, adhesive-backed sandpaper isn't just for orbital finish sanders. It still works great in situations when a pad sander just isn't practical. Three examples for where you might use it are shown in the Woodworker's Notebook on page 108.

ALTERNATIVE DISPENSER. If you'd rather not take up space on your shelves for the Sandpaper Dispenser, there's another version shown in the Woodworker's Notebook on page 106. It includes a lot of the same features as the Sandpaper Dispenser, but this one is made with PVC pipe. Best of all, it hangs on a wall where it's out of the way.

6¹/₈W x 12D x 4³/₄H

**SANDPAPER DISPENSER 105**

ASSEMBLY

This dispenser is just a box made from $\frac{3}{4}$ " plywood with two hinged lids.

CUT PIECES TO SIZE. To make the dispenser, first cut the base (A) and the two front/back (B) pieces (Fig. 1).

Once the base and front/back pieces are cut, the next step is to cut four sides/dividers (C). Then cut the mortises in the two side pieces the same depth as the hinges (Figs. 1 and 3).

ASSEMBLY. I started assembly by gluing a front/back piece (B) flush to the edge of the base (Fig. 1). Then I glued the four sides/dividers (C) in place onto the base.

Once the sides/dividers are glued in place, the remaining front/back piece can be glued in place.

TOP. The top is actually two lids (D) and a layout board (E). I cut all three pieces from the same blank (Fig. 2).

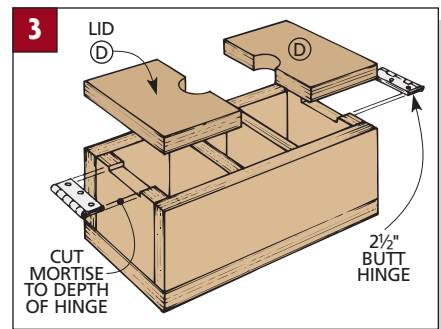
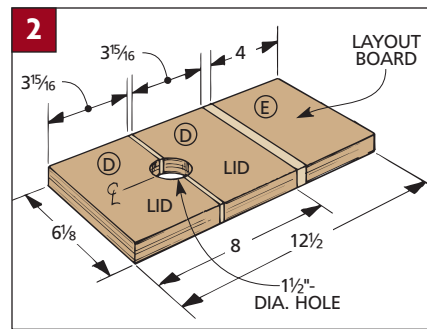
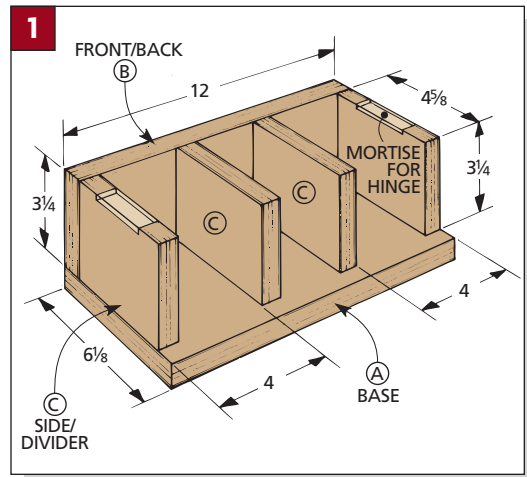
For the lids, cut an 8"-long piece from one end of the blank, and drill a $1\frac{1}{2}$ "-diameter finger hole in the center of the piece. Now cut it in half to produce two $3\frac{15}{16}$ "-long lids (Fig. 2).

ATTACH LIDS. Finally, attach the lids with two $2\frac{1}{2}$ "-long butt hinges (Fig. 3).

LAYOUT BOARD

The next step is to attach the layout board (E). It's made out of the leftover piece from the top blank (Fig. 2). Since this piece is already cut to the correct width ($6\frac{1}{8}$ "), all you have to do is trim it to length (Fig. 2).

The layout board is both a length gauge and a cutting device. The length of the board



WOODWORKER'S NOTEBOOK

This handy roll dispenser doesn't take up any bench or shelf space since it's mounted to the wall.

WALL-MOUNTED DISPENSER

■ You can size your Wall-mounted Dispenser for a variety of grits of paper and as many dispensers as you want.

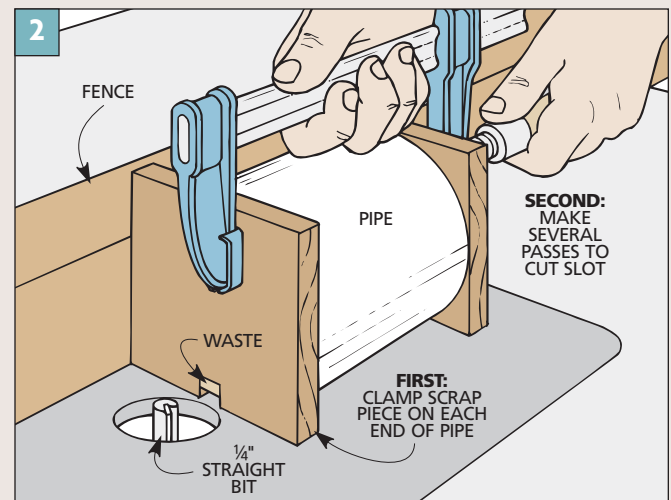
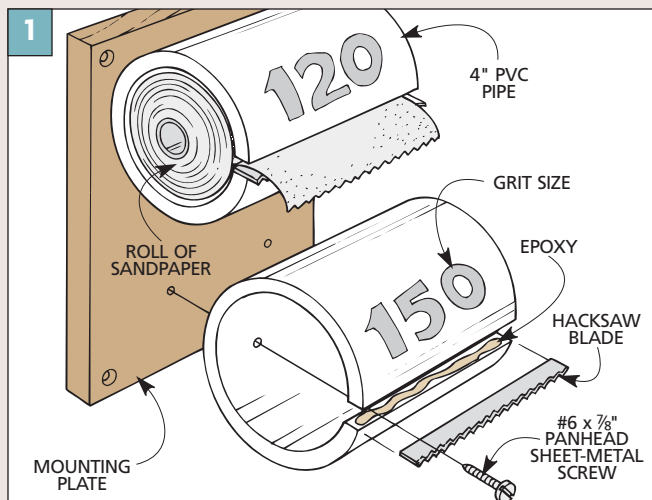
■ Each dispenser consists of a short length of 4" PVC pipe and a cut-off hacksaw blade (Fig. 1). The sandpaper

feeds out of the dispenser through a slot cut in the pipe.

■ The best way to cut the slot in the pipe is to use a $\frac{1}{4}$ " straight bit in a table-mounted router. To prevent the pipe from rotating during the cut, clamp a

scrap to each end (Fig. 2). Then make several passes to cut all the way through the pipe.

■ After securing the hacksaw blade with epoxy, the dispenser is simply screwed to a wall-mounted plate.



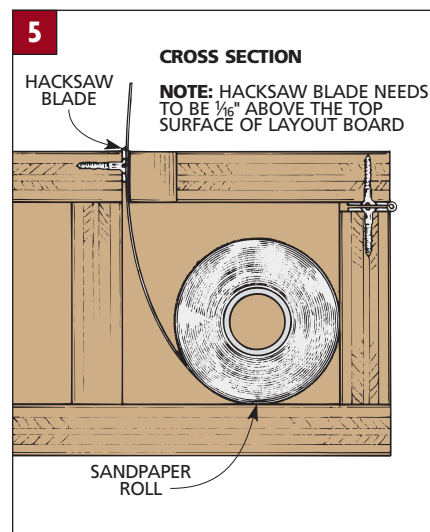
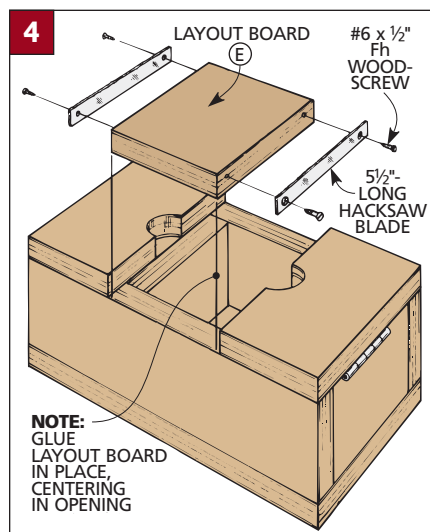
matches the length of paper needed for my quarter-sheet pad sander. This means I can pull out the paper until I reach the end of the layout board, and then tear off just the amount I need. (If you have a sixth-sheet sander you'll need to mark reference lines on the layout board. Refer to the Technique below.)

CUTTING EDGES. To make it easy to tear off the paper, I screwed sections of a hacksaw blade to the edges of the layout board (Fig. 4).

The first thing to do is snip off the mounting holes on either end of a 12" blade. Then, cut the blade into two 5½"-long sections (Fig. 6).

MOUNTING HOLES. The next step to adding the blade is to locate and mark two mounting holes in each blade section with a punch (Fig. 7).

Once the hole locations are marked on both pieces, the mounting holes can be drilled. Because the hacksaw blade is so thin, it's really not necessary to drill a shank hole. I just used a counter-sink bit to drill the hole. This way all you

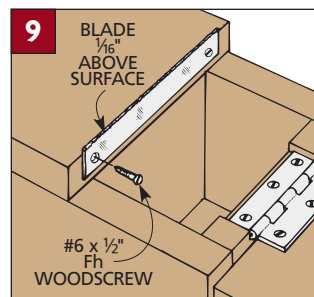
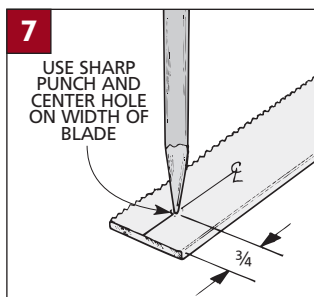
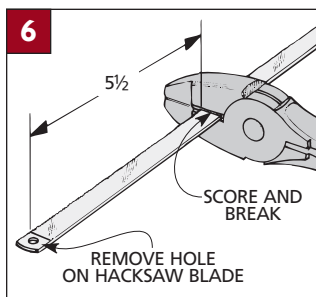


have to do is stop drilling once the widest part of the hole is the same size as the screw head (Fig. 8).

SCREW BLADE ON. Finally, position the blade section so it's centered on the width of the layout board. The teeth of the blades should extend 1/16" above the

surface of the layout board (Fig. 5). Then screw the blade sections in place with No. 6 x 1/2" Fh woodscrews (Fig. 9).

GLUE IN PLACE. Now glue the layout board in place on top of the sandpaper dispenser so it's centered between the lid pieces (Fig. 4).



TECHNIQUE

Using the Dispenser



1 The dispenser can be used for quarter- or sixth-sheet size sanders. If you're using a sixth-sheet sander, mark the layout board to indicate its width.



2 Lift the lid and unroll enough paper to fit your pad. Cover the layout board for a quarter sheet; stop at the pencil line for a sixth sheet. Then close the lid.



3 With the correct length of paper unrolled, hold the lid closed and tear off the paper. The two storage chambers can hold two different grits of paper.

WOODWORKER'S NOTEBOOK

Sanding curves or odd-shaped pieces can be a challenge. Here are three shop-made sanding blocks that use adhesive-backed sandpaper to solve these problems.

FOAM INSULATION SANDING BLOCK

The best sanding block is one that matches the shape to be sanded. But where do you find a sanding block to match the shape of a large cove?

One solution I've come up with is to make a custom sanding block from a 1½"-thick scrap of blue extruded foam insulation board.

SHAPE THE BLOCK. Start by cutting the foam with a band saw or simply use a file to form the foam block to rough shape (Step 1 and the photo below).

Then to smooth out the shape of the foam block, place a piece of adhesive-backed sandpaper across the cove and rub the block across the sandpaper

(Step 2). Extruded foam is easy to shape, thanks to the fine particles the foam is made from.

SAND THE COVE. To use the sanding block, first remove the sandpaper from the workpiece. Then stick a new piece of sandpaper on the newly coved face of the sanding block (Step 3).



1 A piece of extruded foam insulation board can be used to sand an irregular shape, like a cove. First cut the sanding block to rough shape.



2 Smooth the shape of the sanding block by rubbing it across a piece of adhesive-backed sandpaper stuck to the surface of the workpiece.

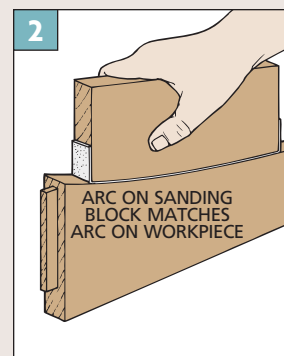
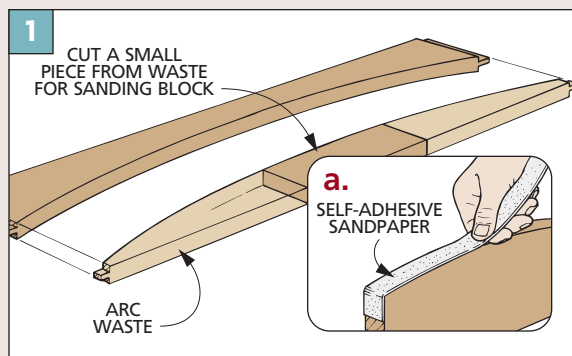


3 Now peel the sandpaper from the workpiece and stick a fresh piece of sandpaper on the block. Then use the foam block to sand the workpiece.

ARC SANDING BLOCK

After I cut out the arc shapes on a project, I've found a good reason to save the waste piece. It makes an ideal sanding block for finish sanding the inside edge of the workpiece.

Just cut a section of the waste piece to fit comfortably in your hand (Fig. 1). Then attach a thin strip of adhesive-backed sandpaper to the curved edge. The long arc on the block follows the arc on the workpiece, making it easy to sand a nice square edge (Fig. 2).



BODY FILLER SANDING BLOCK



Placing too much pressure in one spot when sanding moldings can lead to uneven sanding. The result could be the loss of some of the molding's detail during the sanding process.

BODY FILLER. It's possible to do a good job by hand, but if you have a lot of molding to sand, you'll need something to make the job easier. That's why I like to make a custom sanding block using leftover body filler from my garage workshop and a piece of scrap molding

(see photo). The filler naturally flows to the shape of the molding, making it a lot easier to get to all the rough spots.

MAKE THE BLOCK. So to make it, I start by laying a piece of wax paper over the top of the molding. Then I simply pour in the body filler. And I've found that adding a scrap of wood for a handle helps too (see photo). Once the filler dries completely, I use the block by attaching a piece of self-adhesive sandpaper to the curved face.

Dust Collector

Spend more time making sawdust and less time cleaning it up with this shop-built dust collection system. When you're finished building it, you'll have everything you need to rid your shop of sawdust.



There's nothing I like better than making sawdust. What I don't like is breathing it in and sweeping it up. So recently I decided to get serious about a project that's been on the back burner for some time now — a shop-built dust collection system.

What I had in mind was a scaled-down version of a large commercial system. One that would sit off to one side of the shop and use a vacuum unit and a system of pipes to pick up chips and dust at individual tools. Like commercial dust collectors, this system has two stages.

CYCLONE. The first stage is a metal separator that removes large chips from

the air by starting a whirling motion like a cyclone (refer to *Fig. 1* on page 111).

Because the cyclone removes the chips before they pass through the vacuum, you don't get big chunks of material hitting the fan blades inside the vacuum. As a result, the vacuum runs quiet and the fan isn't as likely to get damaged.

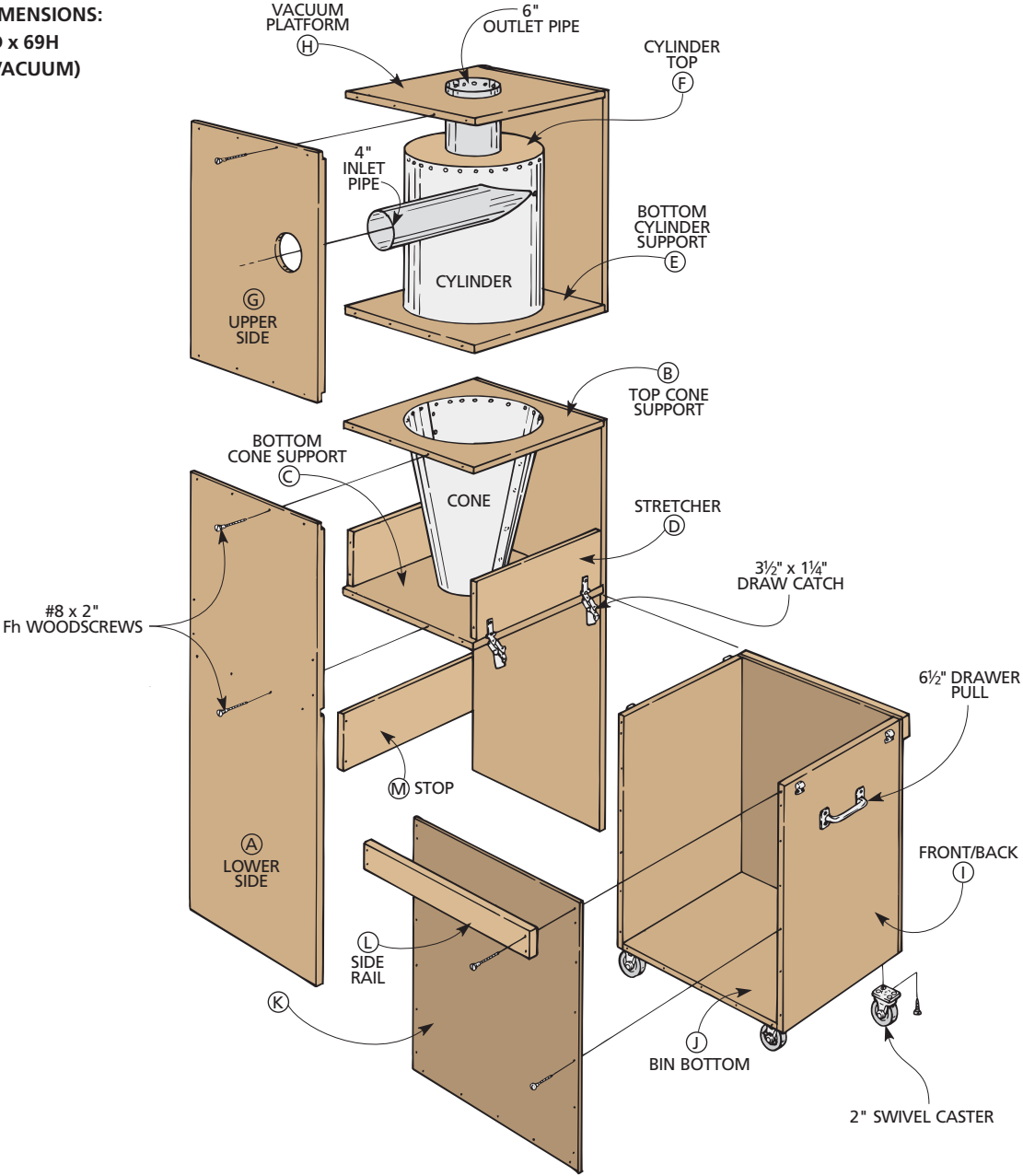
FILTER BOX. The second stage of this system is a filter box that screens out the fine dust particles. Since only fine dust gets blown into the box, it doesn't fill up very quickly. So there's more filter area to do what it's intended to do — clean the air before it recirculates in the shop.

EASY TO EMPTY. The design of this system also makes it easy to empty the chips and dust. A roll-around bin collects chips under the cyclone. And there's a dust drawer to catch the fine dust particles that settle to the bottom of the filter box.

BLAST GATES AND HOOKUPS. But no dust collector is complete without a way to connect individual tools into the system. To control the flow of air at each tool and direct chips into the system, I'll show you how to build a variety of shop-made hookups, as well as an effective but inexpensive blast gate (see pages 122 through 125).

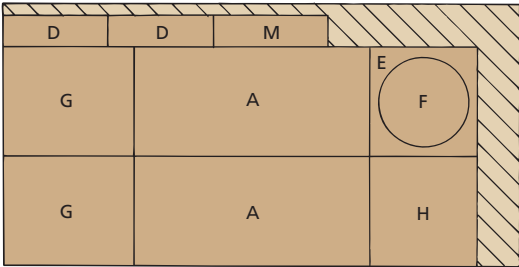
EXPLODED VIEW

OVERALL DIMENSIONS:
21W x 20¾D x 69H
(WITHOUT VACUUM)

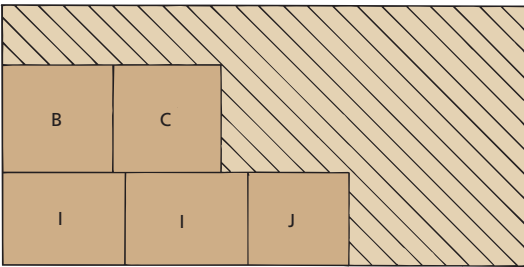


CUTTING DIAGRAM

¾" PLYWOOD - 48 x 96



¾" PLYWOOD - 48 x 96



ALSO REQUIRED:
ONE 24" x 48" SHEET OF
⅛" HARDBOARD FOR SIDES AND
TWO ¾"-THICK HARDWOOD
PIECES (2" WIDE 20" LONG.)

MATERIALS LIST

CONE (Materials for cyclone only. Materials for Filter Box on page 118.)

- A** Lower Sides (2) $\frac{3}{4}$ ply - 20 x 44
- B** Top Cone Spprt. (1) $\frac{3}{4}$ ply - 20 x 20
- C** Btm. Cone Spprt. (1) $\frac{3}{4}$ ply - 20 x 20
- D** Stretchers (2) $\frac{3}{4}$ ply - 6 x 19½

CYLINDER

- E** Btm. Cyl. Spprt. (1) $\frac{3}{4}$ ply - 20 x 20
- F** Cylinder Top (1) $\frac{3}{4}$ ply - 20 x 20 rgh.
- G** Upper Sides (2) $\frac{3}{4}$ ply - 20 x 24
- H** Vacuum Platform (1) $\frac{3}{4}$ ply - 20 x 20

CHIP BIN

- I** Front/Back (2) $\frac{3}{4}$ ply - 17½ x 22⅔
- J** Bin Bottom (1) $\frac{3}{4}$ ply - 17½ x 18½
- K** Sides (2) 1½ hdbd. - 20 x 22⅔
- L** Side Rails (2) $\frac{3}{4}$ x 2 - 20
- M** Stop (1) $\frac{3}{4}$ ply - 6 x 21

HARDWARE SUPPLIES

- (16) No. 8 x $\frac{3}{4}$ " Fh woodscrews
- (6) No. 8 x 1¼" Fh woodscrews
- (68) No. 8 x 2" Fh woodscrews
- (30) No. 8 x 1" Rh woodscrews
- (1lb.) 1¼" ring-shank nails
- (13) Pop rivets
- (10') 20"-wide galvanized sheet metal
- (7') $\frac{3}{16}$ " x 1¼" felt weatherstripping
- (1) 4" x 24" metal pipe
- (1) 6" x 24" metal pipe
- (2) 2" swivel casters
- (2) 2" fixed casters
- (2) 6½" drawer pulls
- (4) 3½" x 1¼" draw catches
- (1) Tube of silicone caulk
- (1) Roll of metal foil tape

CYCLONE

The heart of the Dust Collector is a shop-built cyclone that separates the

large chips out of the incoming air. The cyclone is designed to work together with a vacuum that draws air into the system (*Fig. 1*). With the cyclone

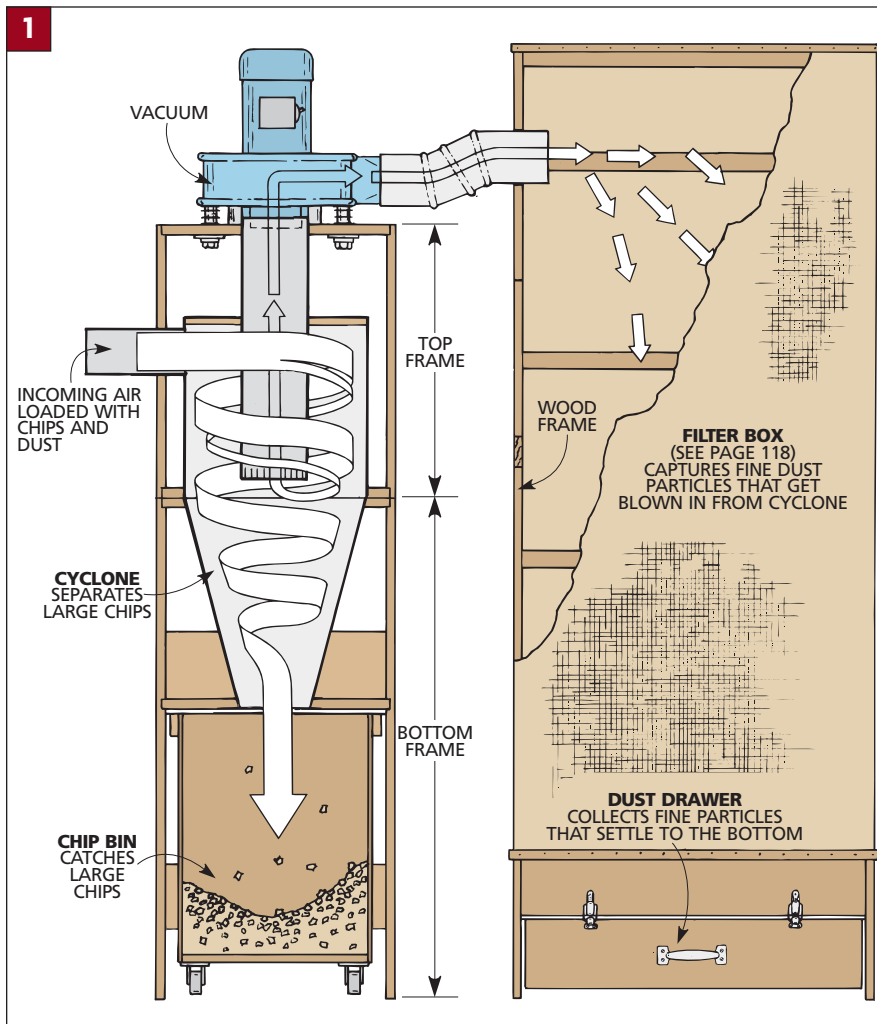
removing the chips *before* they pass through the vacuum, you'll extend the life of some of the moving parts (like the fan blades) inside the vacuum. Another benefit is noise reduction — the vacuum will run a lot quieter.

VACUUM. There are a couple of options for the vacuum. You can hook an existing portable dust collector up to the cyclone (see the photo below). Or you can buy a stand-alone vacuum to mount on top (*Fig. 1*). I bought a vacuum that draws 500 cubic feet of air per minute. See page 126 for sources.

CYCLONE. Regardless of the vacuum, what causes the chips to settle out is the shape of the cyclone. This cyclone is built up from two shapes — a cylinder and a cone. Both shapes are formed from sheet metal. I used 20"-wide galvanized steel flashing.

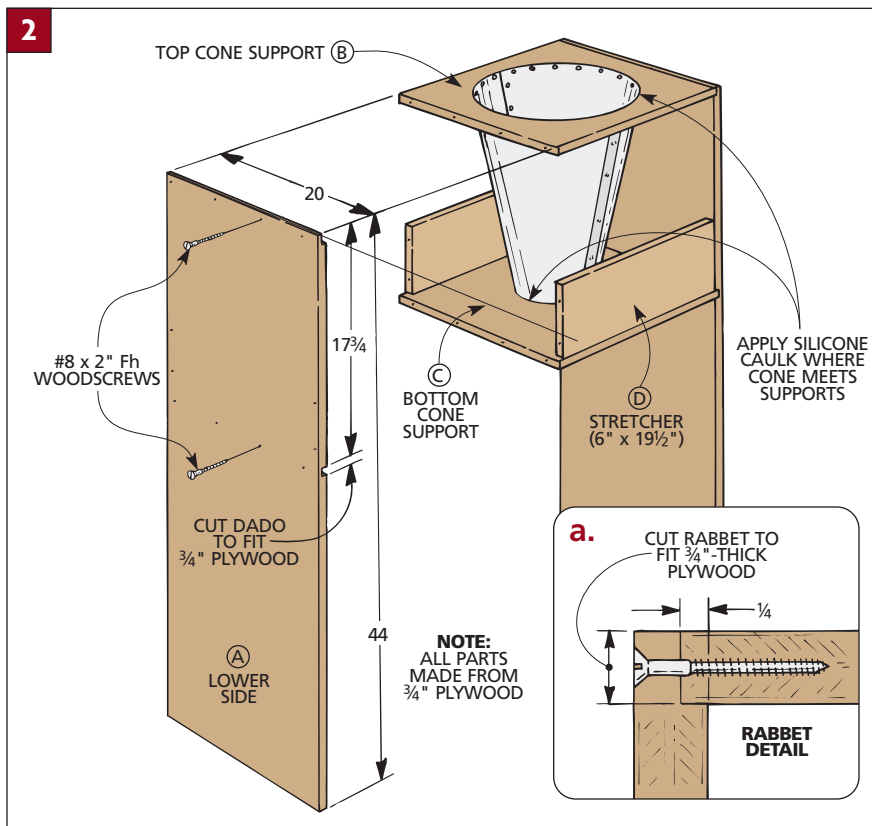
Safety Note: Just to be on the safe side, I always wear heavy-duty leather gloves when cutting metal pipe or sheet metal with tin snips. A sharp edge from the cut off pieces could easily cause serious injury.

The cylinder and cone are held in place by two plywood frames that are stacked on top of each other like building blocks (*Fig. 1*). The bottom frame houses the cone and a bin for the chips; the top frame supports the cylinder and the vacuum.



If you already have a dust collector, the cyclone can make it more efficient by removing the bulk of the sawdust before it gets to the vacuum.

2



CONE

I started work on the cyclone assembly by making a plywood frame for the lower half of the cyclone separator. To provide room for the chip bin, the lower sides (A) of this frame are 44" long (tall) (Fig. 2). After cutting the lower sides to length, I cut a rabet and a dado in each piece to accept two plywood support pieces (Fig. 2a).

SUPPORTS. The supports are just square pieces of 3/4"-thick plywood with holes cut in the center to serve as a form for the cone. Because the cone is quite a bit larger at the top than it is at the bottom, the holes have to be different sizes.

There's a 16"-diameter hole in the top cone support (B), and a 6 3/8"-diameter hole in the bottom cone support (C) (Fig. 4). Because the walls of the cone taper, the edges of these holes are cut at an angle. To do this, I cut both of the holes with a jig saw, tilting the blade to 15° (Fig. 4a).

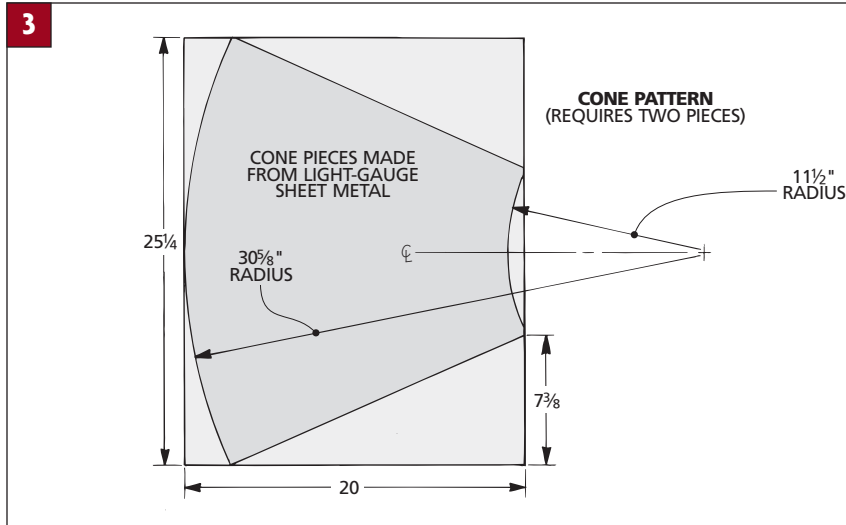
ASSEMBLY. After cutting the holes, the next step is to assemble the frame. This is just a matter of gluing and screwing the top and bottom cone supports to the sides (Fig. 2).

CONE. Once you're finished assembling the frame, you can begin working on the cone. It's made from two wedge-shaped pieces of 20"-wide galvanized sheet metal (Fig. 3).

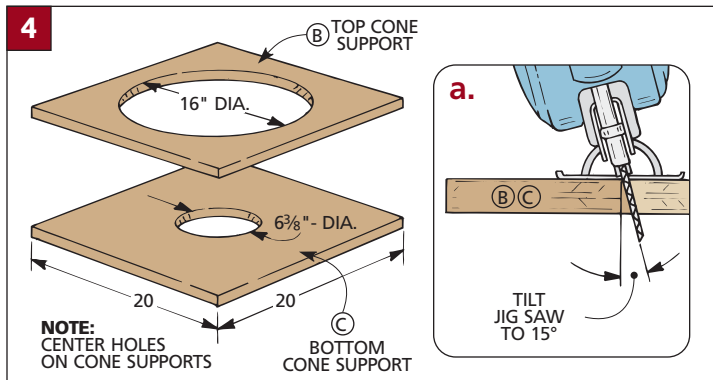
To lay out each piece, you can make a full-size pattern based on the dimensions shown in Fig. 3. Since there is more than one piece, it might work best to make the pattern out of a thick piece of posterboard.

After cutting out the cone pieces with a pair of tin snips, they're fastened together along one edge. To hold these pieces together, I used pop rivets that I picked up at the local hardware store.

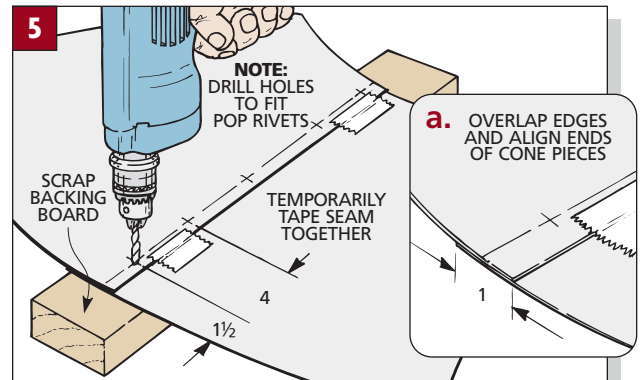
3



4



5



(For more information on how to use pop rivets, see the Shop Info below.)

DRILL HOLES. With the rivets in hand, the next step is to drill holes that match the diameter of the rivets. I found it easiest to lay the pieces out flat so there's a 1" overlap down the center seam (Fig. 5a). The only problem is keeping the sheet metal pieces from moving while you drill the holes.

To solve this, I aligned the top and bottom edges so they're flush, and then used masking tape to temporarily hold the seams together (Fig. 5). Then it's just a matter of drilling a series of holes and installing the rivets.

Note: I used a scrap 2x4 as a backing board when drilling the holes.

FORM CONE. Now you're ready to put the cone in place. At this point, it's no big deal if it's not a perfect cone. Just as long as it's rolled up tight enough to slip the metal down through the top and bottom cone supports.

The thing to keep in mind here is where the seam that's *not* riveted together is located. You'll want to ensure that it faces an open end of the frame (instead of the side). So I centered the riveted seam on an open end of the cone supports (Fig. 6).

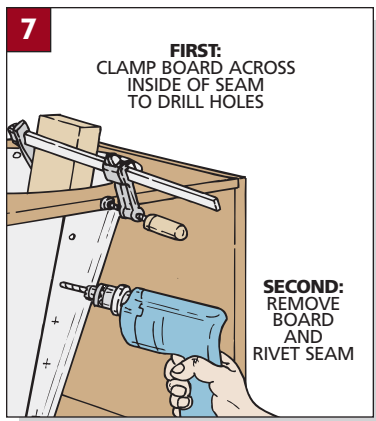
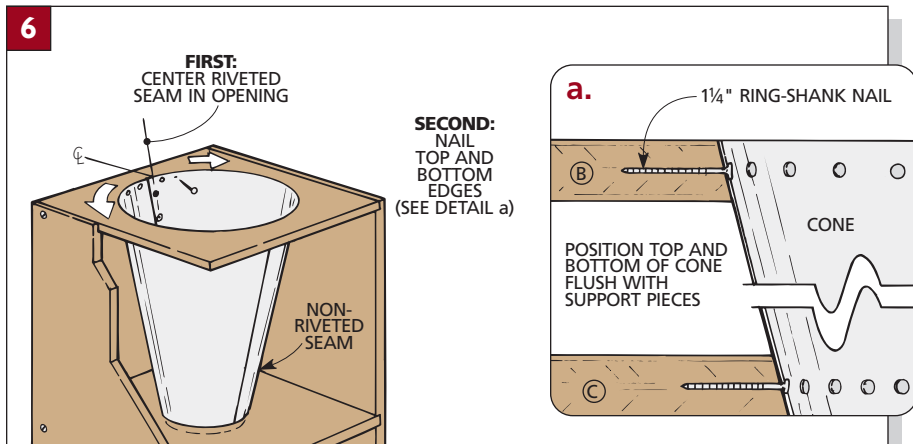
Although this roughly positions the sheet metal, you'll still need to slide it up or down a bit to get the top and bottom edges flush with the cone supports. The trick is to keep both edges aligned while you attach the sheet metal to the supports.

ATTACH METAL. What worked best for me was to tackle a small section at a time. So I started at the riveted seam and worked in both directions, nailing the top and bottom edges in place as I worked my way around (Fig. 6a).

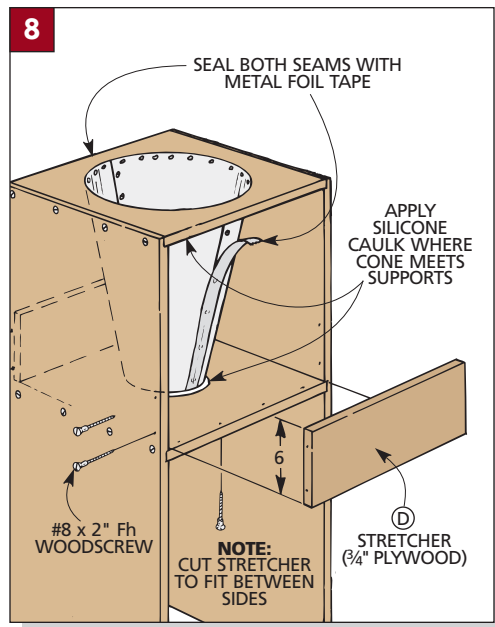
Note: I used hardened ring-shank nails to punch through the metal.

RIVET SEAM. After nailing the cone all the way around, the last seam can be riveted. To prevent the metal from crumpling when drilling the holes for these rivets, I clamped a short section of board (on edge) over the inside of the seam (Fig. 7).

SEAL SEAMS. Now all that's needed to complete the cone is to seal the seams. To do this, I first covered each seam with a short strip of metal foil tape. (You could also use duct tape.) Then simply apply a thin bead of silicone caulk where the metal cone meets the plywood supports (Fig. 8).



STRETCHERS. Finally, to keep the frame from racking, I added two stretchers (D). These stretchers are just pieces of 3/4"-thick plywood that are cut to fit between the sides and screwed in place (Fig. 8).



SHOP INFO

Pop Rivets

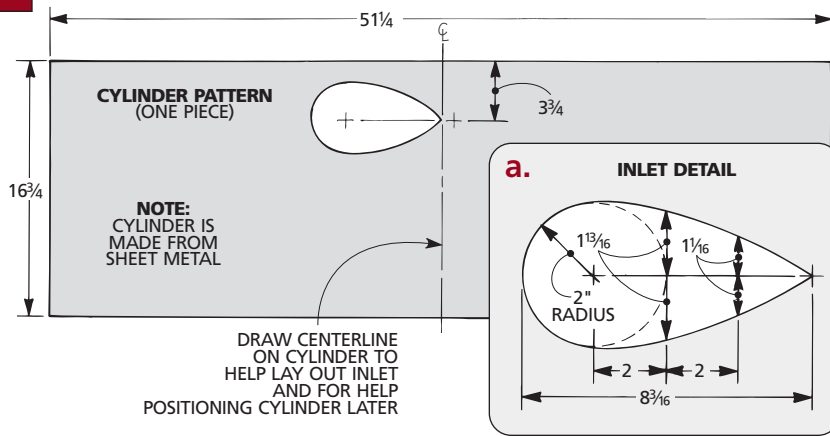
Pop rivets are a quick and easy way to fasten two pieces of sheet metal together securely. After drilling a hole to fit the rivet, a special riveting tool is used to compress the rivet (bottom photo).

What makes this work is a pin that passes through a hole in the rivet (top photo). The long end of this pin is gripped tightly in the gun. The opposite end has a mushroom-like "ball" that's *larger* than the hole in the rivet.

By squeezing the gun handles, the pin pulls back and draws the ball against the end of the rivet. This flares the end of the rivet. Once the rivet is permanently set, the pin "pops" off.



9



CYLINDER

After completing the cone, the next step is to add the cylinder above it. Here again, the cylinder is made from a piece of light-gauge sheet metal that's supported by a plywood frame.

FORMS. As with the cone, I used two $\frac{3}{4}$ "-thick plywood pieces as a "form" for the cylinder. Once they're cut to shape, you'll be able to attach the sheet metal to the edges of the plywood with nails.

To match the opening in the top of the cone, the bottom cylinder support (E) has a 16"-dia. hole cut in it (Figs. 10 and 11). After you've cut the bottom cylinder support, be sure to save the round disk that's removed. It's the perfect size for the cylinder top (F).

To cut out the cylinder top, simply drill a series of small holes along the circle as an entry point for the jig saw blade (Fig. 11a). While you're at it, you'll also want to cut a 6"-dia. opening

for an outlet pipe into the vacuum (Fig. 11). Once again, a jig saw makes quick work of this.

Note: Be sure to set your jig saw blade back to 90° before making either of these cuts.

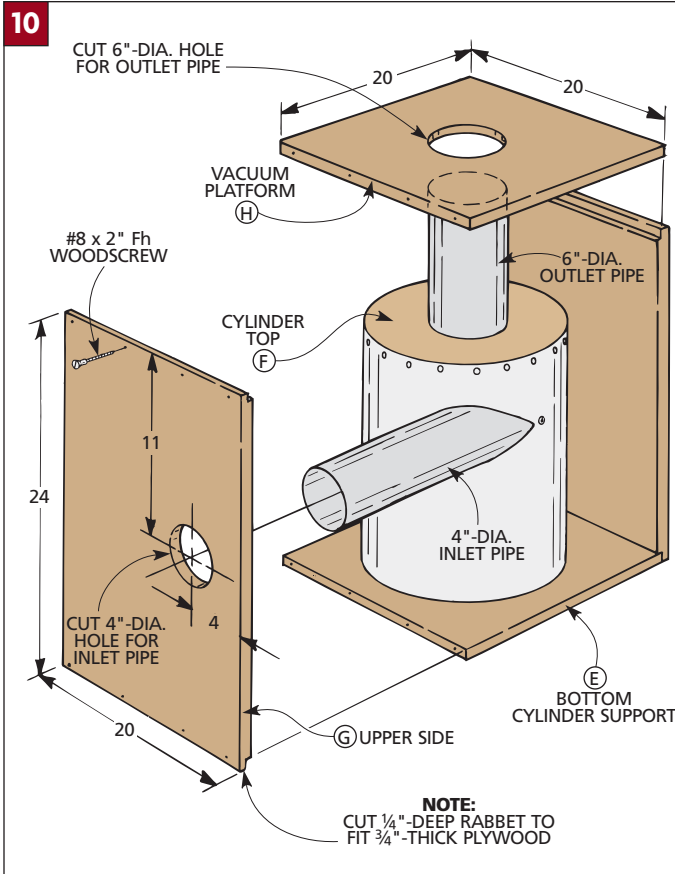
CYLINDER. Now work can begin on the cylinder. Basically, it's just a rectangular piece of sheet metal rolled up to form the cylinder. The only unusual thing is a teardrop-shaped opening that will be cut out near the top edge (Fig. 9).

The reason for this opening is simple. Once the metal is formed into a cylinder, it allows an inlet pipe to fit tightly inside. The thing to be aware of is the tip of the opening is located on a line that's centered on the length of the metal. Later, this provides a reference for positioning the cylinder.

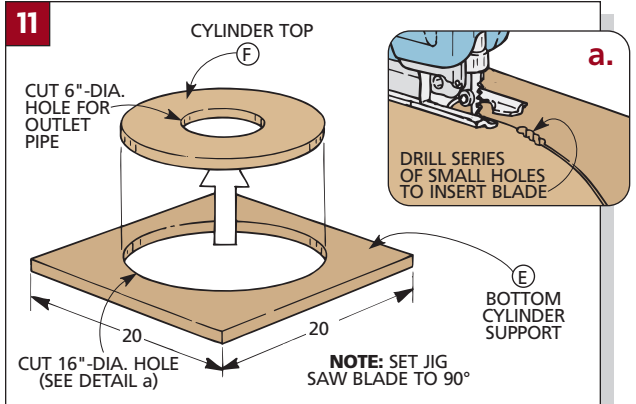
FORM CYLINDER. After cutting the metal to shape, you can form the cylinder. I started by wrapping the metal around the top (F). Then I nailed it in place as I worked my way around (Fig. 12). Just be sure that the metal remains straight as you go.

Note: Once again, I used the same style of ring-shanked nails here that I used earlier on the cone assembly.

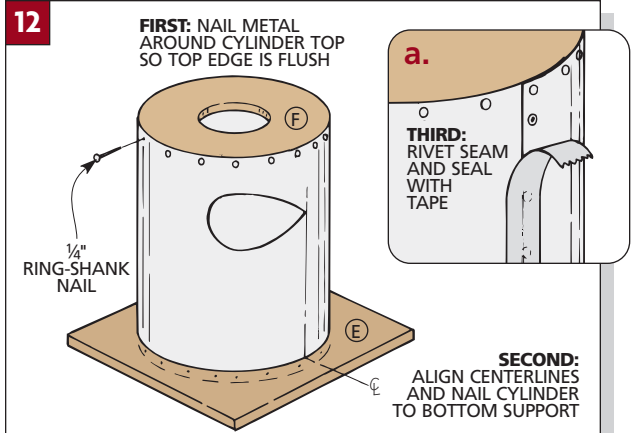
10



11



12



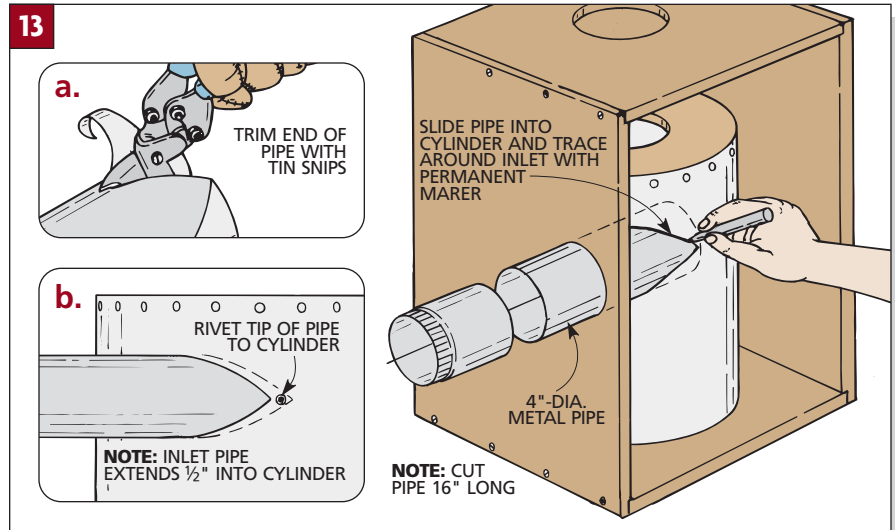
Now the sheet metal cylinder can be fit in the opening in the bottom support (E). This is just a matter of matching the centerline that was drawn earlier on the cylinder with a line centered on the support, then nailing everything in place (*Fig. 12*).

RIVET SEAM. The next step is to rivet the seam. As with the cone, I used a scrap piece as a backing board to support the metal when drilling the holes. Then, after installing the rivets, seal the seam with a strip of metal foil tape (*Fig. 12a*).

TOP FRAME. At this point, the top frame can be built around the cylinder. This frame consists of two upper sides (G) and a vacuum platform (H) (*Fig. 10*). Each side is rabbeted at the top and bottom ends to accept the vacuum platform and the bottom cylinder support.

To allow the inlet pipe to pass through the frame, you'll need to cut a 4"-dia. hole in one side piece of the frame. Also, before screwing the frame together, go ahead and cut a 6"-dia. hole in the vacuum platform. This hole is for an outlet pipe that's added later (*Fig. 10*).

INLET. After assembling the frame, I installed the inlet pipe. This is just a 4"-dia. metal pipe that passes through the hole in the side and into the cylinder. To reduce the amount of pipe that sticks inside, you'll want to trim the end off to match the opening in the cylinder (*Fig. 13*). An easy way to do this is to trace the shape of the opening onto the pipe with a permanent marker



(*Fig. 13*). Then, after trimming the pipe with a pair of tin snips, sneak the end just past the cylinder wall and rivet the tip in place (*Figs. 13a and 13b*).

Next, you'll need to cut off the crimped end of the inlet pipe (*Fig. 13*). This way you'll end up with an uncrimped end for an adjustable elbow added later. And it allows the air to flow smoothly through the pipe (refer to the photo on page 120 and *Fig. 24* on page 121).

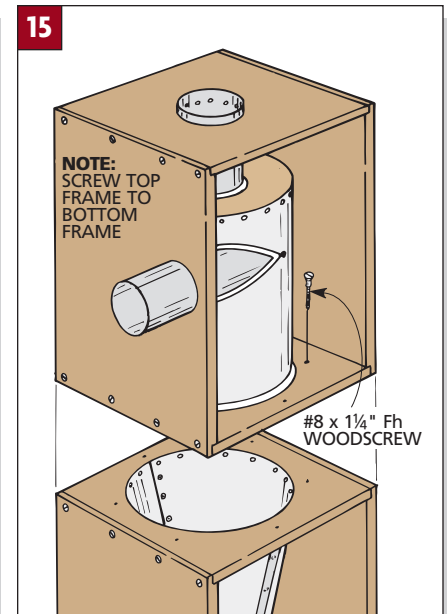
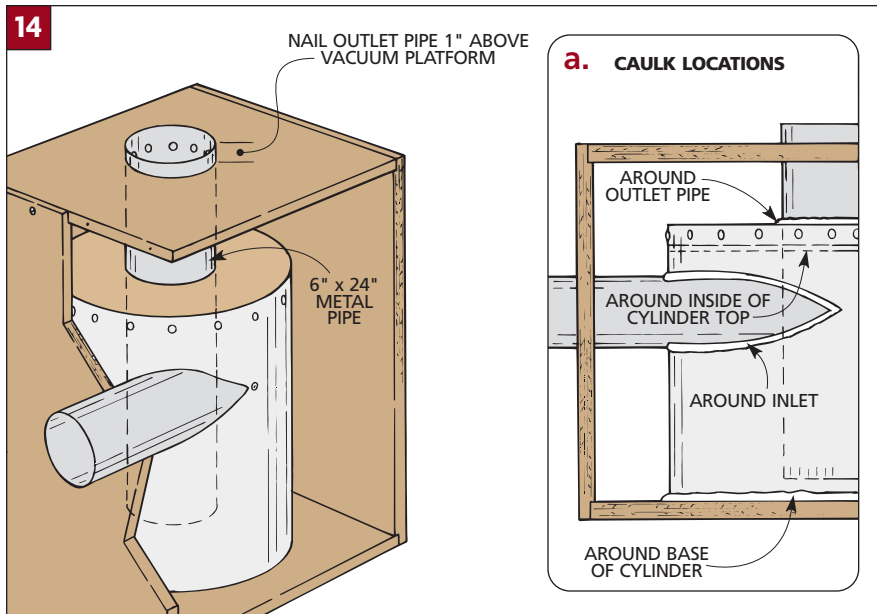
OUTLET. In addition to the inlet, there's a 6"-dia. outlet pipe that helps direct the fine dust into the vacuum. The idea here is to locate the bottom end of this pipe so the vacuum won't suck up large wood chips that are coming into the cyclone.

To do this, I slipped a 24" length of pipe through the holes in the cylinder

top and the vacuum platform (*Fig. 14*). The top end of the pipe is nailed in place so it extends 1" above the vacuum platform. This way, the bottom end extends far enough into the cylinder so it carries off only the fine dust particles.

CAULK. Once the outlet is installed, the cylinder can be sealed (*Fig. 14a*). Except for one place, I caulked on the *outside* of the metal (or pipe), including around the outlet and inlet pipes and around the base of the cylinder. But where the cylinder top meets the metal, you'll need to apply a bead of caulk on the *inside* (*Fig. 14a*).

STACK FRAMES. Now all that's left is to screw the top and bottom frames together using No. 8 x 1 1/4" flathead woodscrews, so the frames are flush all the way around (*Fig. 15*).



CHIP BIN

One handy feature of this cyclone is a roll-around chip bin. I wanted something that I wouldn't have to empty every day, so I made sure the bin was extra large. It measures almost 24" tall and it's 17½" wide and 20" deep.

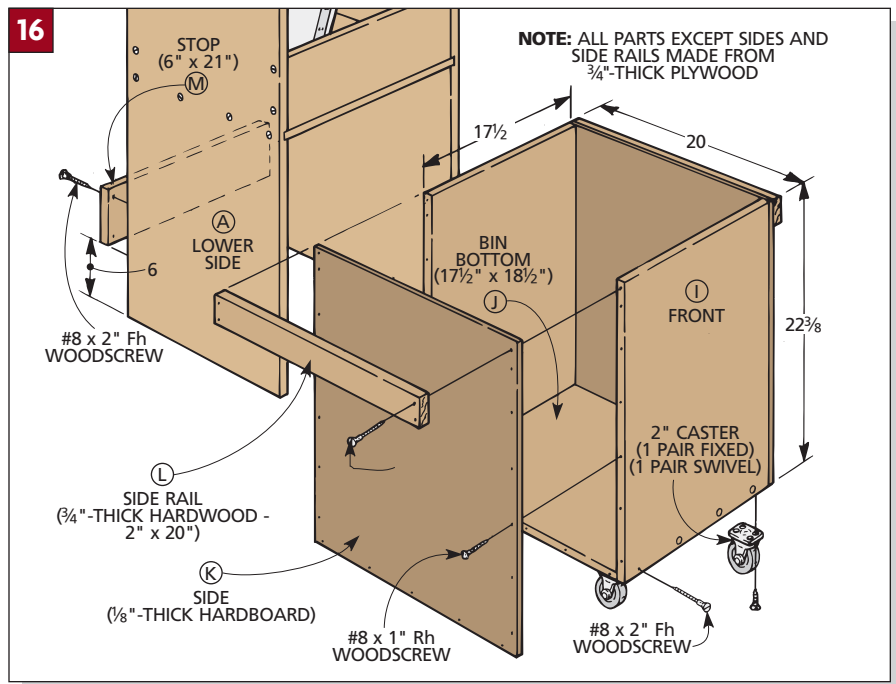
A bin this large could get heavy though, so I added casters and handles to make it easy to empty. When the bin fills up with chips, all you have to do is roll it out from under the cyclone and empty it in the trash.

BIN. There's nothing complicated about building the bin. The front/back pieces (I) are made from ¾"-thick plywood, and are glued and screwed to the bottom (J) using simple butt joints (Fig. 16). And to make the chip bin as lightweight as possible, I decided to make the sides (K) from ⅛"-thick hardboard. Here again, they're just glued and screwed in place.

Note: I used tempered hardboard for the sides. Tempered hardboard is smooth on both sides. This allows the sawdust and wood chips to slide off whenever the bin needs emptying.

SIDE RAILS. Next, to help stiffen the ⅛"-thick sides, I attached a pair of hardwood side rails (L) with glue and screws. These rails also act as "bumpers," protecting the cart when you roll it in and out from underneath the cyclone.

CASTERS. After attaching the rails, I added a set of four 2" casters. To help steer the bin, two swivel casters are screwed in place along the front edge, and a pair of fixed casters along the back.



STOP. Now, to help keep the bin centered under the cyclone, I screwed a stop (M) to the back of the lower sides (Fig. 16). The stop is made from plywood. With it in place, you just push the chip bin in until it hits against the stop.

But just rolling the bin under the cyclone isn't enough. The key is to seal it so chips don't blow out. To do this, I used a two-part system.

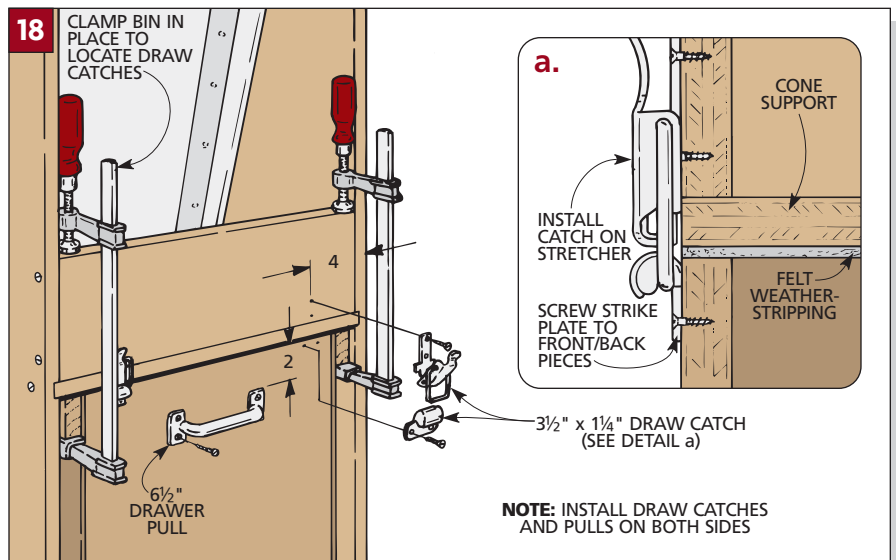
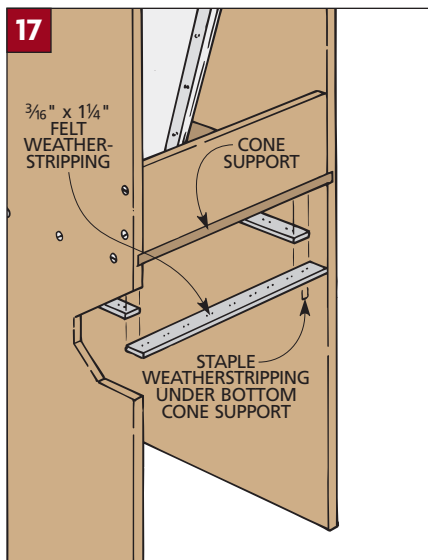
GASKET. The first part is a "gasket" made from pieces of felt weatherstripping (Fig. 17). After cutting strips of this felt to fit under the bottom cone support, they're stapled in place.

But to produce a good seal, the bin needs to draw up tight against the felt.

That's where the second part of the system comes in.

DRAW CATCHES. To raise the bin off the floor, there's a pair of draw catches on the front and back of the cyclone (Fig. 18). When you snap the catches shut, the bin compresses the felt and creates an airtight seal. To locate the catches, I clamped the bin in the "closed" position and screwed a pair of catches to both the front and back pieces (Figs. 18 and 18a).

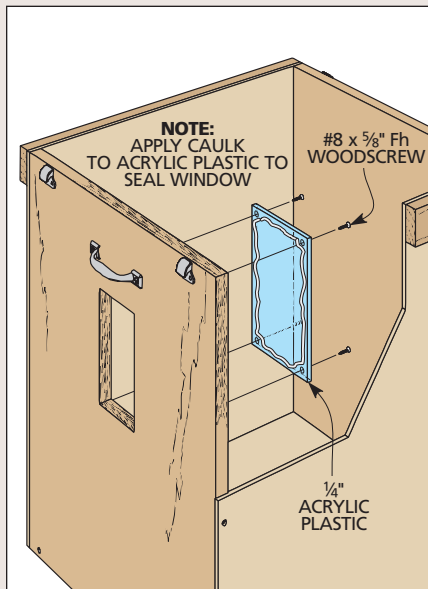
DRAWER PULLS. Finally, to make it easy to lift and empty the bin, I screwed on a couple of heavy-duty drawer pulls, placing one on the front and another on the back of the bin.



DESIGNER'S NOTEBOOK

To ensure the Dust Collector runs efficiently, you'll need to check it regularly. Adding a window will help.

CONSTRUCTION NOTES:



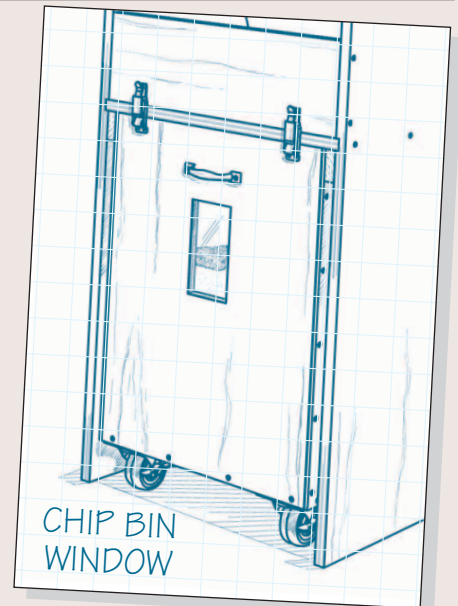
■ The Dust Collector won't work as well when the chip bin is over flowing with saw dust and chips. So to make it easy to check it, you can add a small "window." The window lets you peek into the bin without having to unlatch the draw catches and pull it out.

■ Start by cutting a small hole on the outside of the bin (see drawing).

■ Then cover the hole with a thin piece of clear acrylic plastic using some 5/8"-long woodscrews.

Note: Before screwing the clear acrylic plastic in place, it's a good idea to apply a bead of caulk to stop any air leaks (see drawing).

■ Now when you want to check the chip level inside the chip bin collector, all you have to do is look through the acrylic plastic window.



CONNECT THE VACUUM

At this point, all that's left to complete the cyclone is to connect the vacuum and the motor.

If you're using a portable dust collector, run a length of flexible hose from the inlet to the outlet pipe from the cyclone (refer to the photo on page 111).

Note: You may also need a reducer and a hose clamp to attach the hose.

PLATFORM MOUNT. But another, more compact setup is to mount a vacuum unit on top of the vacuum platform. Here, the inlet of the vacuum fits loosely inside the outlet pipe from the cyclone. Depending on how well the inlet fits, you may need to modify the connection to keep the vacuum from sucking in outside air. So you'll need to make an airtight seal between the inlet and the outlet (Fig. 19).

DOUGHNUT. What worked well for me was to cut a "doughnut" from a piece of 1 3/4"-thick soft foam (like the kind available at most fabric stores). Cut the doughnut to fit around the outlet pipe. This way, when you mount the vacuum, the weight of the vacuum squeezes down the foam and forms a gasket around the outlet.

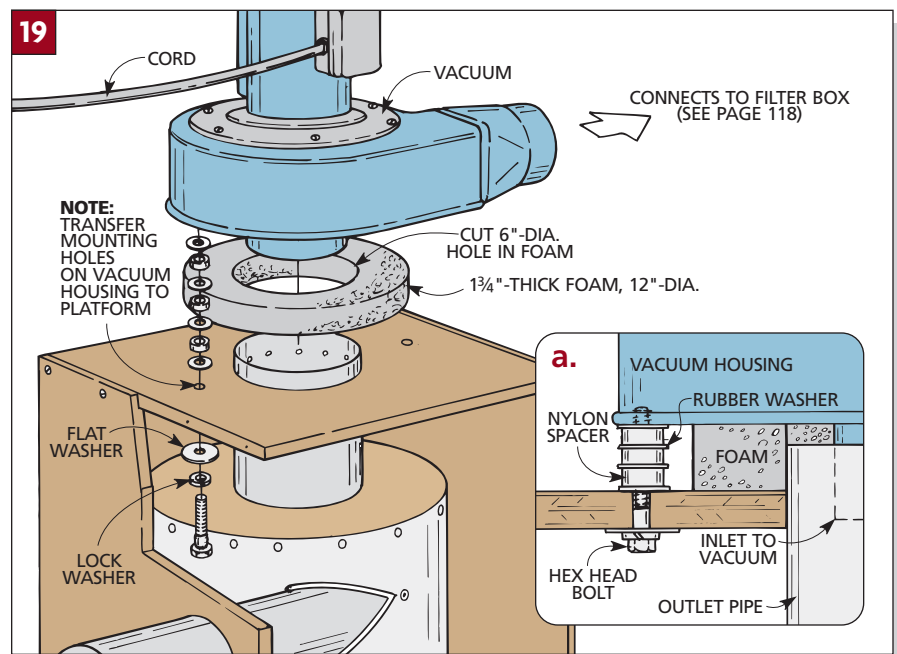
The trick is to compress the foam without having the vacuum "bottom

out" on the pipe. This requires raising the vacuum off the platform. To do this, I used a stack of nylon spacers and some rubber washers at each mounting point (Fig. 19a).

Depending on the vacuum you use, the location of these mounting points (and the fasteners) will vary. The vacuum I used had threaded holes in the housing, so I attached it with hex bolts.

But you may need to drill holes and use self-tapping screws. Either way, slipping on a lock washer keeps the bolts (or screws) from vibrating loose (Fig. 19).

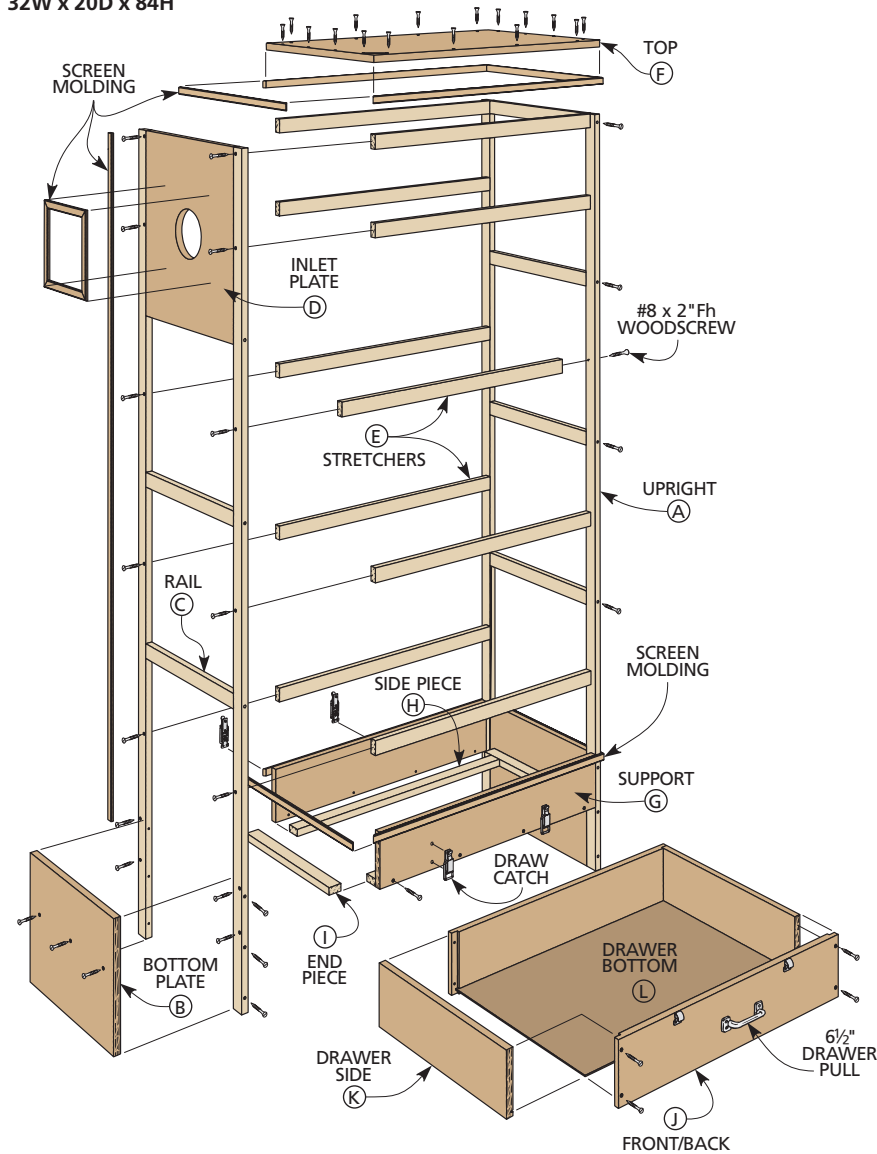
ELECTRICAL HOOKUP. One final note. You can plug the vacuum into an outlet with a switch and receptacle, and use the switch to turn it on and off. Or, simply plug and unplug the unit into a wall outlet to turn it on and off.



EXPLODED VIEW

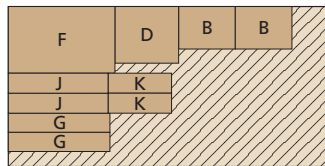
OVERALL DIMENSIONS:

32W x 20D x 84H



CUTTING DIAGRAM

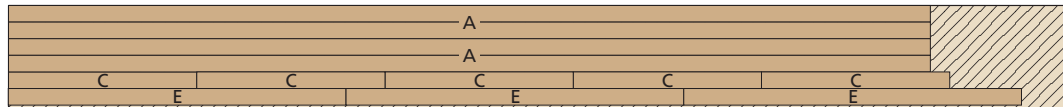
3/4" BIRCH PLYWOOD - 48 x 96



1/8" TEMPERED HARDBOARD - 24 x 48



1x12 (3/4 x 11 1/4) - 96 PINE (7.7 Bd. Ft.)



1x8 (3/4 x 7 1/4) - 96 PINE (5 Bd. Ft.)



FILTER BOX

Most dust collection systems rely on fabric bags to filter out fine dust particles. But there are a couple of problems with these. First, they're expensive. And second, I've found that most bags are too small for the system. When it's turned on, the filter bag quickly inflates, producing a cloud of fine dust that settles over the entire shop.

To solve both these problems, I didn't use a bag. Instead, I built a large filter box (see photo at left). It's just a wood frame wrapped with inexpensive fabric. Since the fabric is stretched

MATERIALS LIST

FRAME

A	Uprights (4)	3/4 x 1 1/2 - 83 1/4
B	Bottom Plates (2)	3/4 ply - 12 3/4 x 17
C	Rails (6)	3/4 x 1 1/2 - 17
D	Inlet Plate (1)	3/4 ply - 19 1/8 x 17
E	Stretchers (10)	3/4 x 1 1/2 - 30 1/2
F	Top (1)	3/4 ply - 20 x 32
G	Supports (2)	3/4 ply - 5 3/4 x 30 1/2
H	Side Pieces (2)	3/4 x 1 1/2 - 30 1/2
I	End Pieces (2)	3/4 x 1 1/2 - 15 1/2

DUST DRAWER

J	Front/Back (2)	3/4 ply - 6 x 30
K	Drawer Sides (2)	3/4 ply - 6 x 19
L	Drawer Bottom (1)	1/8 hdbd. - 19 x 29

HARDWARE SUPPLIES

(26') Screen molding
 (66) No. 8 x 2" Fh woodscrews
 (28) No. 8 x 3" Fh woodscrews
 (4) 3 1/2" x 1 1/4" draw catches w/ screws
 (9') 3/16" x 1 1/4" felt weatherstripping (1lb.)
 (2) 6 1/2" drawer pulls w/ screws
 (3 yds.) 10 oz. cotton duck fabric - 72" wide
 (2 oz. pkg.) #18 x 1" wire brads
 (1) 5"-dia. metal duct for inlet
 (1 pkg.) 3/8" staples

around the frame, it can't collapse. So when the system is turned on — no more dust cloud.

FILTER MATERIAL. In designing the filter box, the first thing I had to figure out was what to use for fabric. I found just what I needed at a local fabric store — 10 oz. cotton duck fabric.

SIZE. The only other thing to decide was how big to make the frame. The height was easy. I sized the frame to fit the width of the fabric (72"). All that was left was to figure out how much filter area I needed.

If the filter area is too small, the dust gets forced right through the fabric like a clogged bag on a vacuum cleaner. So after taking into account the size of my vacuum (500 CFM), I came up with the design shown in the Exploded View on the previous page.

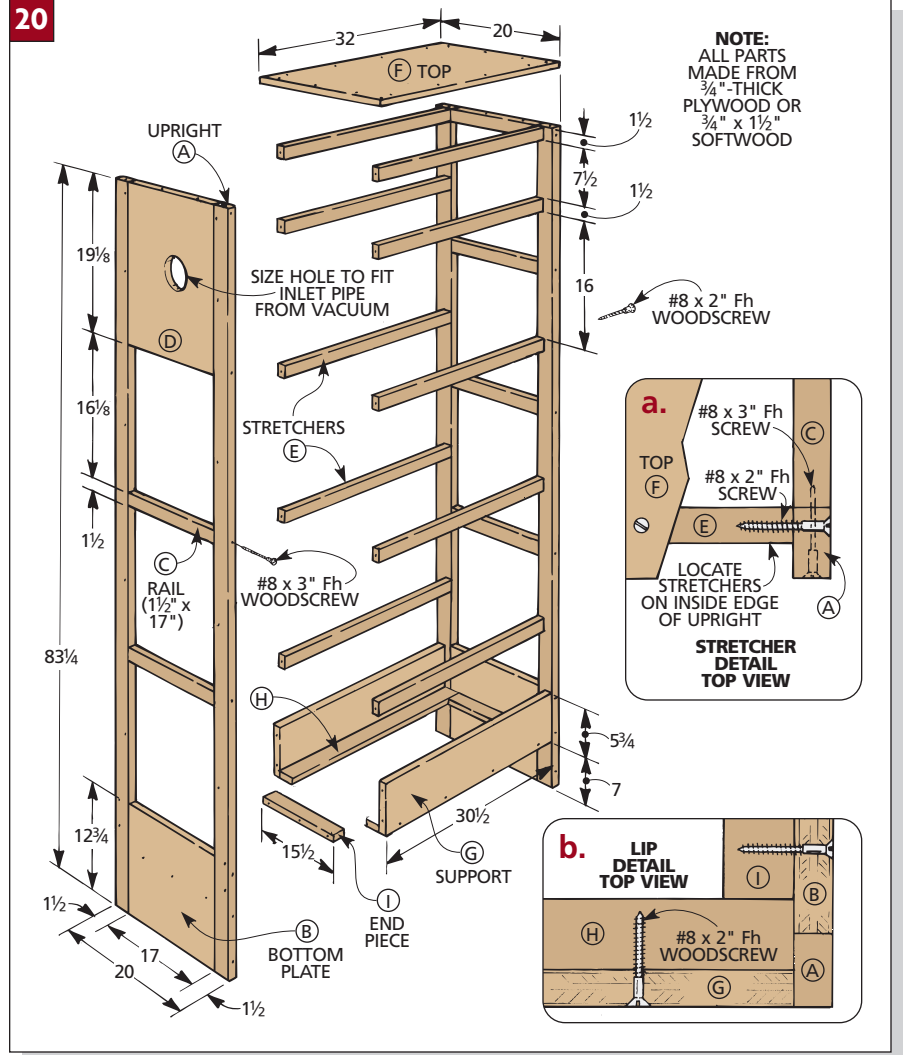
BOX FRAME

The filter box isn't really complicated. It's just a large ladder-shaped wood frame that I wrapped with fabric.

LADDERS. I started work on the box frame by building the two end units (Fig. 20). Each end unit consists of two uprights (A), a bottom plate (B), and several rails (C) screwed in between.

But these two end units aren't identical. To provide support for the pipe that comes into the box from the vacuum, there will need to be an inlet plate (D) made from $\frac{3}{4}$ "-thick plywood (Fig. 20). After cutting a hole in this plate to fit the diameter of the pipe (5") coming from the vacuum, the plate is screwed in place.

STRETCHERS. The next step is to connect the end units with stretchers (E) (Fig. 20). They're attached to the inside edge of the frame uprights (Fig. 20a).

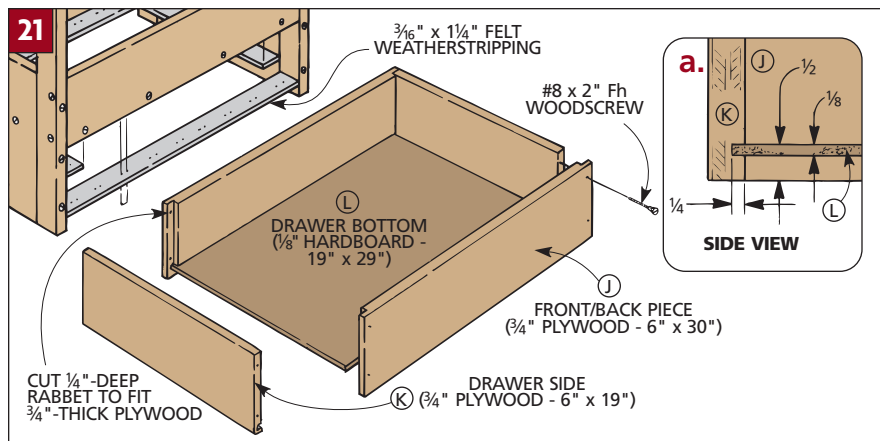


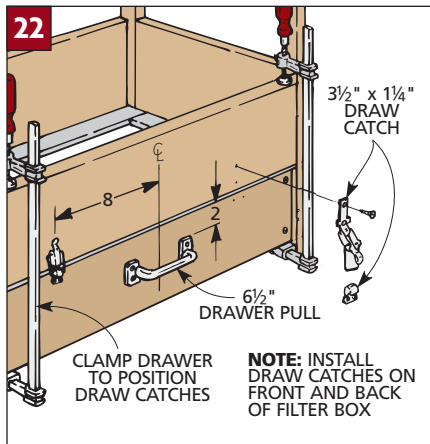
To add rigidity to the top of the box frame, I cut out a 20" x 32" piece of $\frac{3}{4}$ "-thick plywood for a top (F) and screwed it in place (Fig. 20a). Also, there are two $\frac{3}{4}$ "-thick plywood support pieces (G) screwed between the uprights at the bottom to help stiffen the end of the frame.

LIP. All that's left to complete the basic frame is to add a lip around the bottom. Later, weatherstripping is attached to the lip to seal the dust drawer. This lip consists of two side pieces (H) screwed to the supports (G) and two end pieces (I) attached to the bottom plate (Fig. 20b).

DUST DRAWER. With the basic frame complete, I made a shallow drawer to catch the remaining dust from the cyclone. The ends of the front/back (J) drawer pieces are rabbeted to accept a pair of drawer sides (K) (Fig. 21). Before screwing the drawer assembly together though, a groove is cut in each piece for a $\frac{1}{8}$ "-thick hardboard drawer bottom (L) (Fig. 21a).

WEATHERSTRIPPING. Next, to prevent sawdust from leaking out of the drawer, I added another seal made from strips of felt weatherstripping. These strips are stapled under the lip that was installed earlier (Fig. 21).





DRAW CATCHES. As with the chip bin, the drawer needs to be pulled up tight against the felt weatherstrip for it to seal properly. To do this, I installed a pair of draw catches on the front and back of the box frame (Fig. 22). Here again, clamping the drawer in the “closed” position helps locate the draw catches so they snap shut tightly.

STRETCH FABRIC. Once the draw catches are installed, you’re ready to stretch the cotton duck fabric around the filter box. The easiest way to do this is to align the edge of the fabric flush at the top, and staple one end to an upright (Step 1 in Fig. 23).

Then, while keeping the fabric taut, staple the top and bottom edges (not the uprights) as you work your way around the filter box. When you’ve returned to the starting point, staple the remaining end of the fabric to the same upright (Step 1 in Fig. 23).

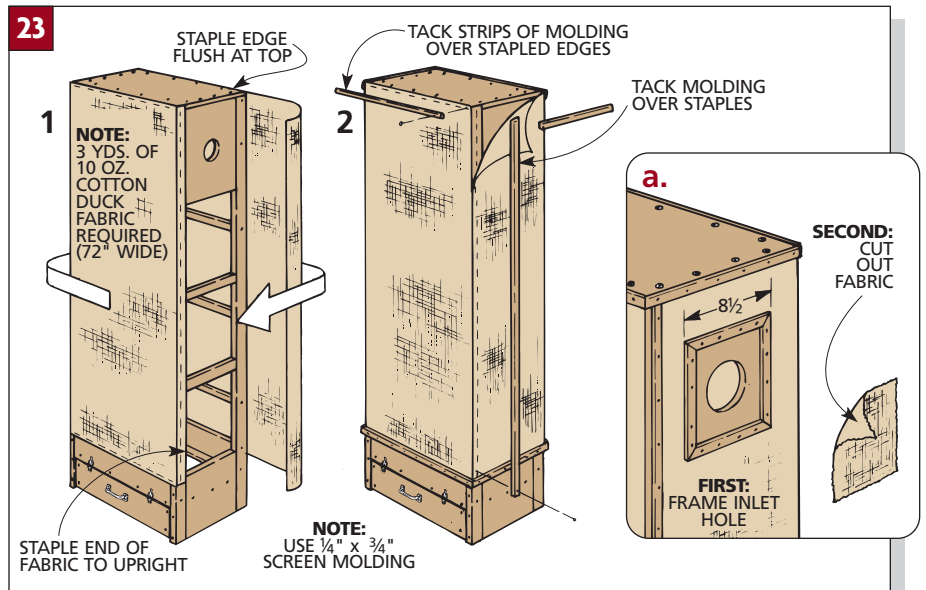
MOLDING. To keep the staples from working loose, I attached strips of screen molding over the stapled edges and the upright (Step 2 in Fig. 23).

Finally, after tacking strips of screen molding to make a frame around the inlet hole, cut out the small square of fabric inside the frame (Fig. 23a).

PIPES & HOOKUP SYSTEM

No matter how efficient the dust collection system is, there’s one thing for certain. To get chips from the tool to the cyclone, you’ll need to add a system of pipes. This takes some well-thought out planning to get it right.

LOCATION. One decision is where to locate the cyclone and filter box. To make it easy to empty the chip bin and dust drawer, the best bet is to find a place that’s out of the way, yet still accessible.



Still, you don’t want to get carried away and put them in the farthest corner of the shop. That’s because the longer the run of pipe, the more pressure is lost along the way, and the less suction you get at each tool.

To maintain maximum pressure, a good rule of thumb is to keep the total length of pipe as short as possible with a minimum number of turns.

Note: For my dust collection system, I used 4"-diameter metal duct pipe from the local hardware store.

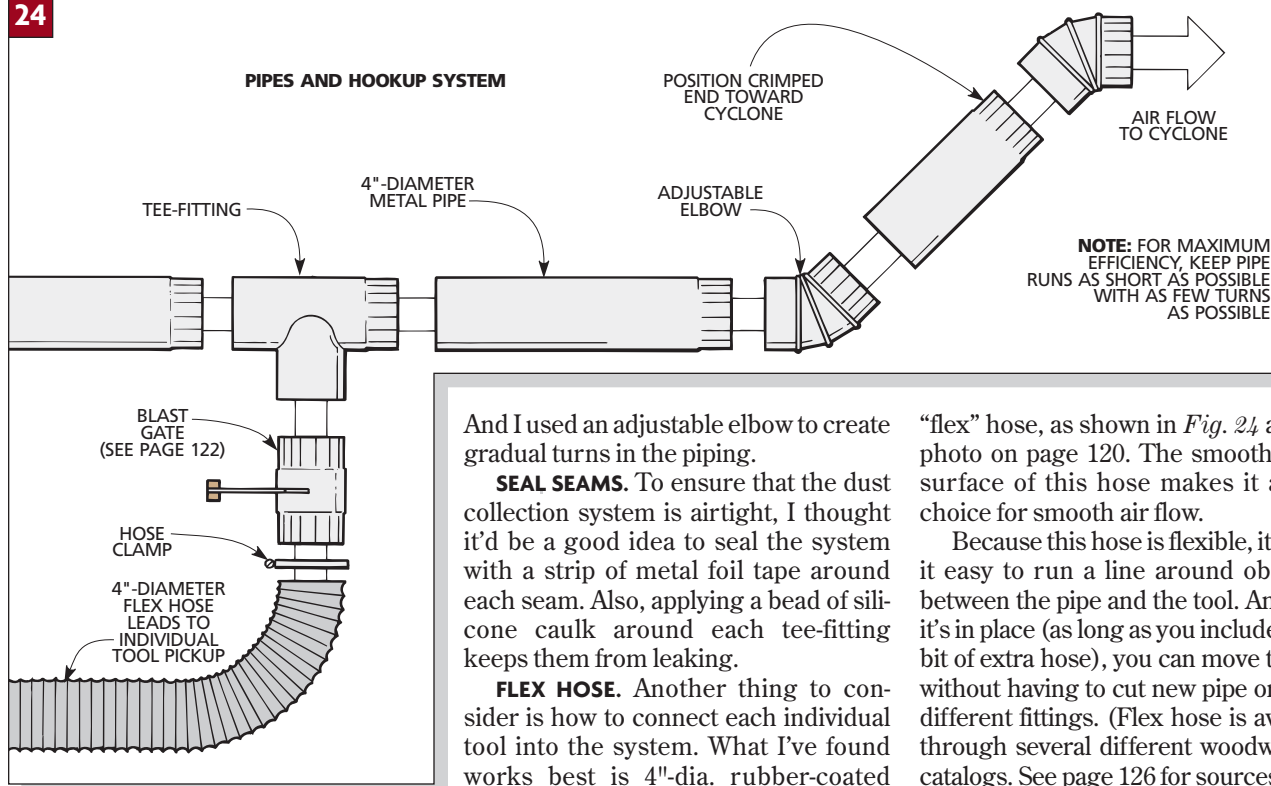
CRIMPED END. Each section of pipe has one crimped end that fits inside the smooth end of another (Fig. 24). The only problem you’re likely to run into

will be when you cut a section of pipe and neither end is crimped on the piece you’re working with. So to crimp one end of the pipe, I built a simple crimping tool. (See the Woodworker’s Notebook on the facing page.)

When installing the pipe, the idea is to position the crimped end toward the cyclone (in the direction of the airflow) (Fig. 24). This way, chips don’t catch on the end, and the air flows smoothly through the pipe.

FITTINGS. In addition to the sections of duct pipe, you’ll need a couple of different fittings to change the direction of the airflow. I used a 90° “tee” to branch off toward individual tools.





WOODWORKER'S NOTEBOOK

Sometimes the right tool for the job, like this crimping tool, is one you can build in your own shop.

CRIMPING TOOL

■ This shop-made crimping tool is just the ticket for crimping the end of the duct pipe (see photo).

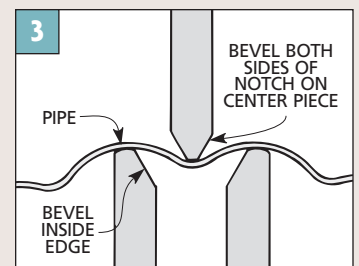
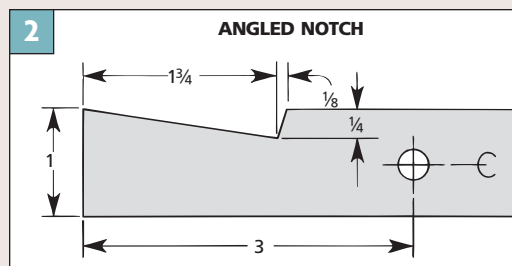
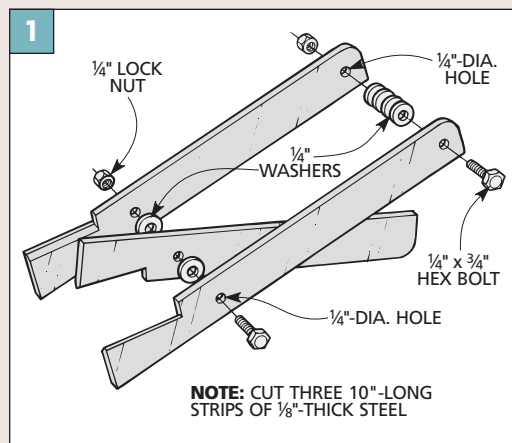
■ To make a crimping tool, start by cutting three strips of $\frac{1}{8}$ "-thick steel to a length of about 10" each (*Fig. 1*).

■ Then cut a notch into one end of each strip (*Fig. 2*). And cut a small radius on the opposite end of each strip to soften the sharp edges (*Fig. 1*).

■ To form a crimp in the metal, the notches on each strip need to be beveled. So I filed a bevel on both sides of the center piece, and the inside edge on each of the side pieces (*Fig. 3*).

■ Next, drill a hole in each piece near the notch (*Fig. 2*). While you're at it, you can also drill the holes on the handle ends of two of the strips (*Fig. 1*).

■ Finally, assemble the crimping tool using the hex bolts, washers and locking nuts. The notches in the two side pieces face the *opposite* direction of the notch in the center piece (*Fig. 1*). And the bevels need to face in (*Fig. 3*).





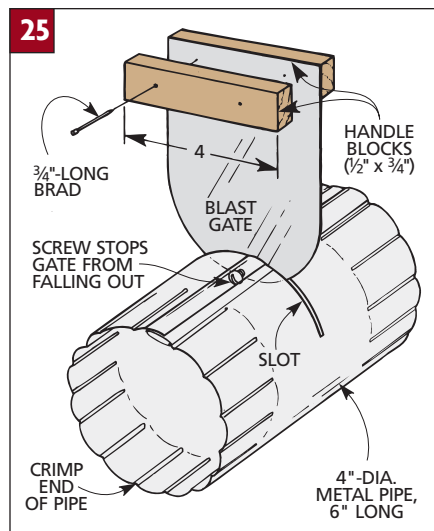
To avoid sharp turns, a pair of adjustable elbows connects the vacuum on the cyclone to the filter box.

BLAST GATES

There's more to getting the Dust Collector working than just setting up lengths of pipe. You still need a way to hook up individual tools to the system.

Although there are a number of manufactured hookups available, their cost can add up quickly (especially if you're connecting three or four tools). So I decided it would be just as easy to make my own.

Basically, I needed two types of hookups: blast gates and dust hoods. The blast gates turn the flow of air on and off at each tool. This makes the system more efficient, by preventing the vacuum from pulling air from more than one tool. And the dust hoods direct chips and dust into the system. (Several styles of tool and dust collection hookups are shown on the following pages.)



BLAST GATES. To control the flow of air in the system so there's only one tool on-line at a time, I added a blast gate at each tool (see photo at right). This way, I can easily turn the suction on (or off) at a tool simply by opening (or closing) the blast gate.

Basically, each blast gate is just a short section of 4"-diameter duct pipe with a slot cut in it. This slot creates an opening for the blast gate, allowing you to slide a piece of sheet metal in and out (Fig. 25).

DISKS. To support the walls of the pipe when cutting the slot, I cut two plywood disks to size to fit inside the ends (Fig. 26). Then just tighten the pipe (and the disks) in a vise and cut the slot halfway through.

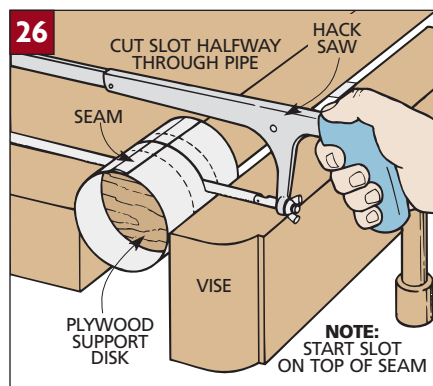
GATE. After removing the plywood disks, the gate can be cut to fit in the slot. The gate is just a strip of sheet metal that's cut to the same width as the diameter of the pipe (Fig. 25).

To keep air from leaking through when the blast gate is closed, the end needs to fit tight against the curved inside wall of the pipe. To do this, scribe the shape of the pipe on the metal and trim the end to fit (Fig. 27).

Note: I used a pair of tin snips to trim the gate, then I used a file to knock down any rough edges left over from cutting the sheet metal. The idea is to make sure the gate slides in and out smoothly without catching.

HANDLE. Next, I sandwiched the square end of the sheet metal gate between two blocks of hardwood and tacked them together to serve as a handle (Fig. 25). Also, to keep the gate from falling out when it's opened, I drilled a hole and installed a small sheet-metal screw near the curved end of the gate (Fig. 25).

CRIMP ENDS. Finally, I crimped both ends of the blast gate pipe (using the



Sliding a shop-made blast gate in and out of a pipe turns the suction off (or on) at each tool.

SHOP TIP

Sharp Corners

To create a sharp corner where needed on the sheet metal, bend the metal over the edge of your saw table with a dead-blow mallet.



shop-built crimping tool described on page 121) and installed it between the metal pipe and the flex hose leading to each tool hooked to the system.

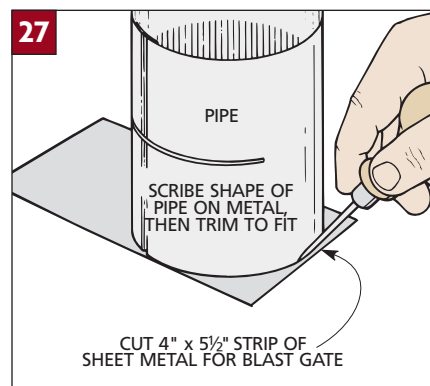


TABLE SAW DUST HOOD

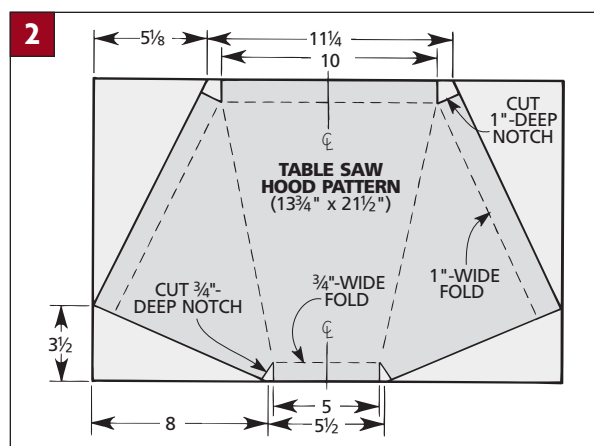
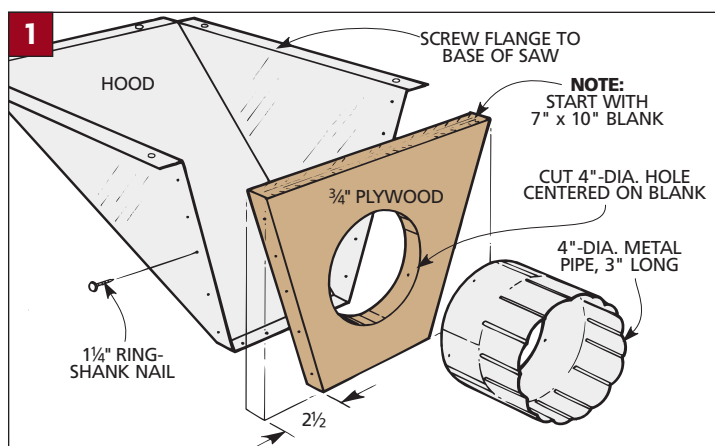
The dust created by the table saw presents one of the most difficult problems for effective dust collection. That's because the rotation of the blade carries the dust below the saw table.

To direct this dust into the system, I added a dust hood that sits in the opening below the blade.

With the table saw dust hood, a piece of sheet metal is formed to fit around a piece of plywood and deflects dust into the table saw by screwing the metal flanges to the base of the saw.

Note: To learn how to create a sharp corner at each of the fold lines for all of the dust collection accessories, see the Shop Tip on the opposite page.

The $\frac{3}{4}$ "-thick plywood starts out as a 7" x 10" blank. Then the sides are tapered from top to bottom (*Fig. 1*). Then when the sheet metal is cut and formed around the plywood (using the pattern laid out in *Fig. 2*), it creates a funneling action, directing the dust downward. The dust hood is attached to the table saw by screwing the metal flanges to the base of the saw.



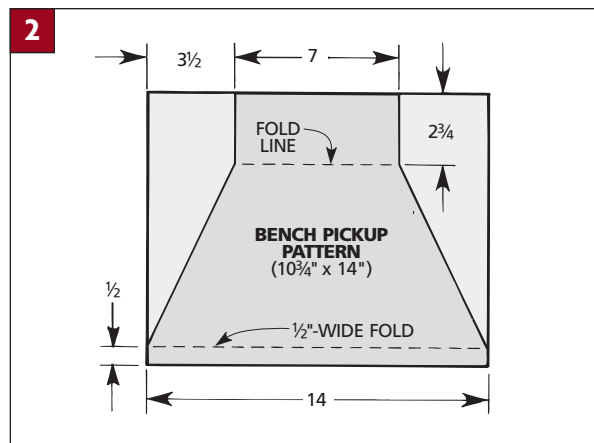
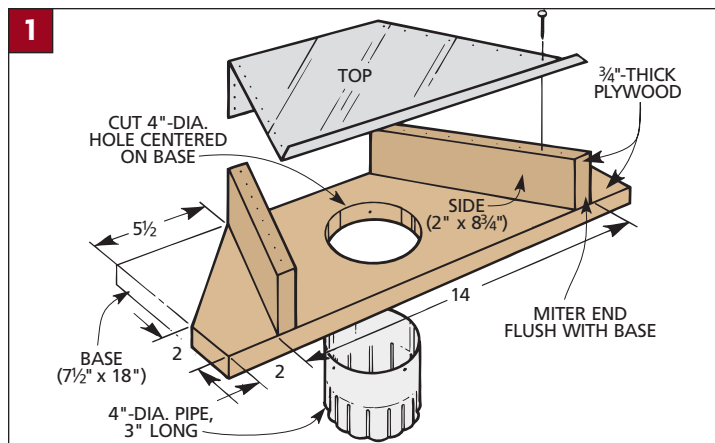
BENCH PICKUP

A hand-held power sander is one of the worst culprits when it comes to filling the air in the shop with fine dust. To capture this dust before it gets airborne, I made a pickup that clamps to the end of my bench (see photo at right).

Basically, this pickup works just like a funnel. As you sand across a board, dust is drawn into the wide "mouth" at the front of the pickup. Then it's directed into the dust outlet by two converging sides (*Fig. 1*).

Like the other hookups, this bench pickup is made by bending a piece of light-gauge sheet metal so it fits around pieces of plywood (*Figs. 1 and 2*). And as before, a 4"-diameter pipe stub is nailed into the base which lets you connect it to the Dust Collector.

But in spite of these similarities, there are a couple of twists. First, to provide room to attach the clamps, there's an "ear" on each side of the base. Second, the ends of each of the side pieces are mitered so they're flush with the base (*Fig. 1*).



ROUTER TABLE COLLECTION BOX

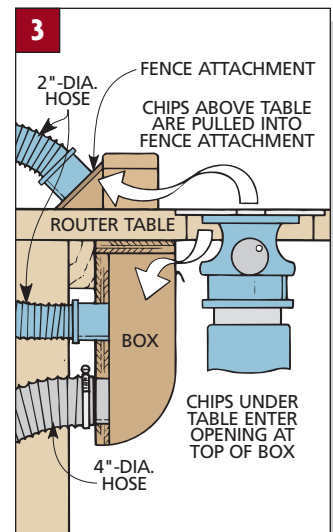
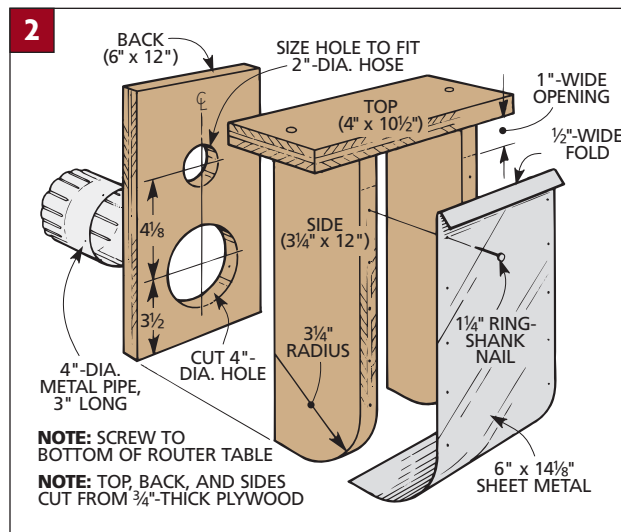
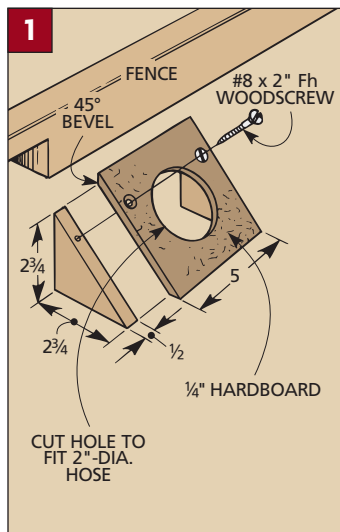
When using a router table, chips always get thrown above *and* below the table. To pull chips into the dust collection system at both places, I built a simple collection box for below the table and another one that's attached to the router table fence (see photo).

Note: Although it's designed to be screwed under an open-base router table (see photo), this box can also be easily adapted to other router tables.

The chips that get kicked out below the table are drawn into a narrow opening in the top of the box (*Fig. 3*).

To collect chips above the table, I screwed a fence attachment to the back of the fence. It's made by gluing a hardboard plate with a hole for a 2" diameter hose cut in it to two triangular pieces of hardwood (*Fig. 1*).

To hook up the collection box, run a 2"-dia. hose between the fence attachment and the box (*Fig. 3*). Then fit a 4"-diameter hose over the pipe stub nailed into the box (*Fig. 2*).



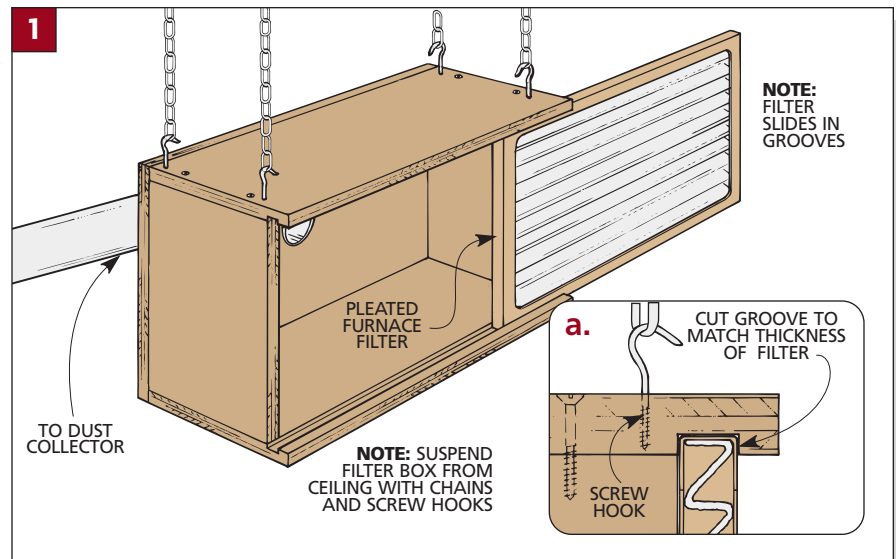
AIR FILTER BOX

Even though all the machines in my shop are hooked up to my Dust Collector, I've noticed there still seems to be a lot of fine dust left floating in the air after making a cut. To solve this, I made an air filter box. It hooks up to the Dust Collector system just like one of my machines (*Fig. 1*).

This air filter is basically a large plywood box with a lip on the front. The lip is designed to hold an inexpensive pleated furnace filter. (See the Shop Info on page 92 for more about filters.)

Note: It's a good idea to purchase the furnace filter before you begin construction on the air filter box. Since filter sizes vary from one manufacturer to the next, you want to be sure of getting a snug fit.

A groove that matches the thickness of the furnace filter is cut near the front of the top and bottom pieces (*Figs. 1 and 1a*). This groove will then create a slot for the furnace filter to slide in and out. And a 4"-diameter hole can be cut in



the back of the box, which lets you hook up the flexible hose or ducting from the Dust Collector.

To keep construction of the box easy, I went ahead and used butt joints and simply assembled the box with glue and several woodscrews.

I've found that you'll experience the best results with the air filter box if you hang it from the ceiling in a central location. And I periodically check it to make sure that the filter isn't clogged — especially after I've completed a round of heavy sawing or sanding.

RADIAL ARM SAW DUST HOOD

Large stationary tools (like radial arm saws) are some of the worst dust producers. To make matters worse, cleaning out behind them usually means having to pull the tool away from the wall. To solve this problem, I built this dust hood to catch the dust that scatters behind the blade of my radial arm saw. I screwed the scoop-shaped dust hood to the tool's metal stand.

The base of this hood is a piece of $\frac{3}{4}$ "-thick stock that has a hole cut in it for a short "stub" of 4"-diameter pipe (Fig. 1). Fitting a 4"-diameter flex hose over this stub connects the hood to the dust collection system.

After nailing the stub into the base, a piece of sheet metal is cut and bent to fit around the plywood (Fig. 2). The fold lines on the outside of the hood are for flanges that protect the user from getting cut on the sharp edges. Then nail the hood assembly onto the base.

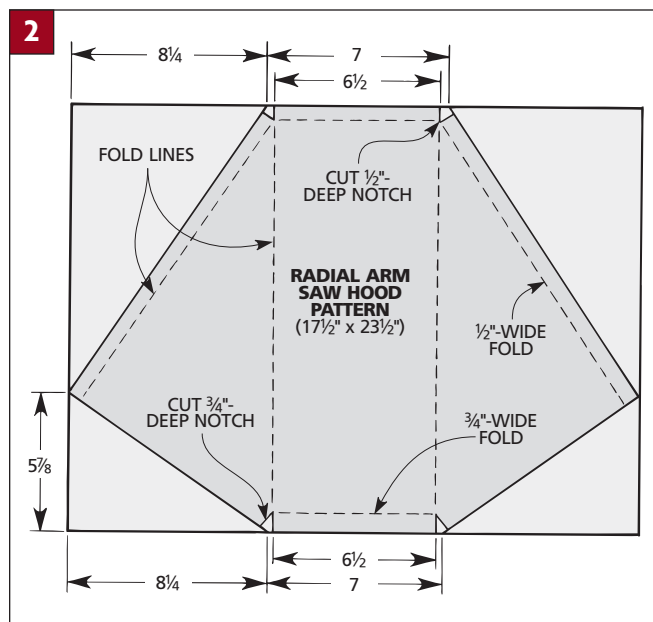
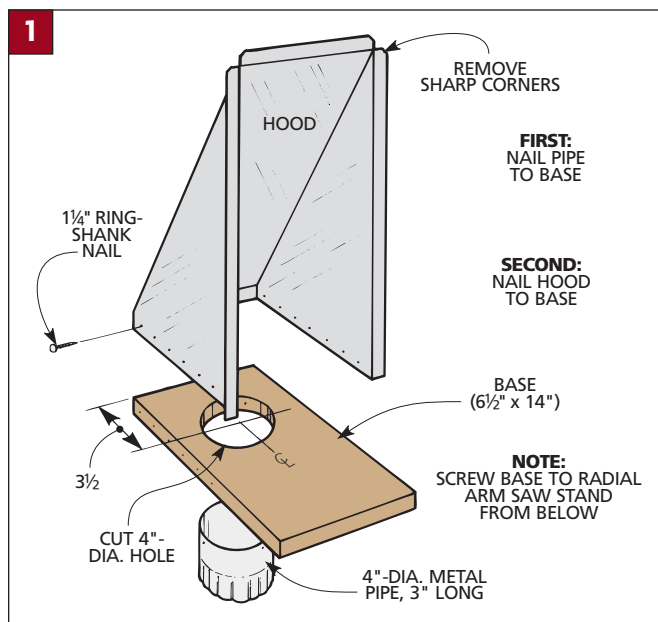


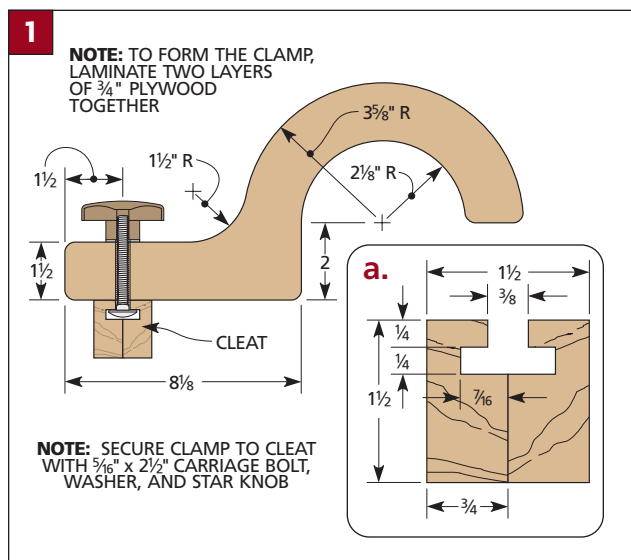
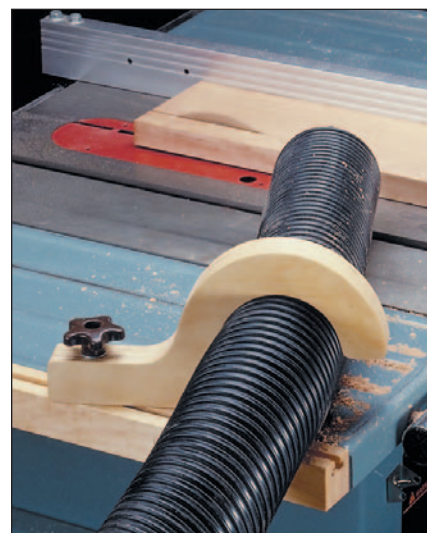
TABLE SAW HOSE CLAMP

Even with a dust hookup below the table, there's always some dust that escapes from the top of a table saw. So I decided to build a simple hose clamp to solve this problem (see photo).

A good way to capture this dust is with a flex hose near the blade. But most methods of clamping the hose just flatten it. So I decided to build a simple hose clamp to solve this problem (see photo).

This P-shaped hose clamp is cut from two laminated pieces of $\frac{3}{4}$ " plywood (Fig. 1). In the "stem" of the "P" is a hole to accept a carriage bolt, a washer, and a star knob.

The carriage bolt secures the clamp in a T-slot that's cut in a cleat (Fig. 1). The cleat is attached to a wing of the table saw. To make the cleat, cut a groove in one edge of two hard-wood pieces. (I used



hard maple.) After gluing the pieces together, cut a centered groove along the length of the cleat to open the T-slot (Fig. 1a). Finally, attach the cleat to the edge of the saw by driving screws from the back of the wing into the cleat. ■

MAIL ORDER SOURCES

Most of the hardware and supplies for the projects in this book can be found at your local hardware store or home center. Sometimes, though, you may have to order hardware through a mail order source. If that's the case, we've tried to find reputable sources with toll-free phone numbers and web sites.

THE WOODSMITH STORE

2625 Beaver Avenue
Des Moines, IA 50310
800-835-5084

Our own retail store with tools, jigs, hardware, books, and finishing supplies. We don't have a catalog, but we do send out mail order items.

WOODWORKER'S SUPPLY

Attn.: Order Dept.
1108 North Glenn Rd.
Casper, WY 82601
800-645-9292
www.woodworker.com

A source of push-button electronic switches. They carry a wide selection of hardware supplies including hinges, draw catches, pulls, fastener's and Conformat screws. You can also find a full line of dust collection items, vacuum clamping supplies, and quiet saw blades.

QUALITY VAKUUM PRODUCTS

43 Bradford St.
Concord, MA 01742
800-547-5484
www.qualityvak.com

A very good source of vacuum clamping supplies and accessories. No catalog is available, but they do have a newsletter and a complete inventory of products at their online store.

Note: We recommend that you have all of your hardware and supplies in hand before you begin building any project.

Also, some of the most important "tools" you can have in your shop are your mail order catalogs. You should be able to find many of the supplies for the projects in this book in one

WOODHAVEN

501 West 1st St.
Durant, IA 52747-9729
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www.woodhaven.com

A wide selection of woodworking tools and accessories, including a complete vacuum kit with or without a regulator.

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560 Airport Industrial Park
P.O. Box 1686
Parkersburg, WV 26102-1686
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www.woodcraft.com

A must! This is a great source for all kinds of hardware including hinges, knobs, drawer pulls, casters, and threaded inserts. You'll also find a full line of dust collectors and dust collection supplies and accessories. They stock anti-vibration pads and link belt and pulley systems.

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800-377-7297
www.pennstateindustries.com

A complete source for dust collectors and dust collection supplies, including vacuum motors.

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A great source of tools and hardware, including pulls, spring hinges, threaded knobs, wing nuts, and a full line of fasteners. They also have link belts.

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