Benchtop Mini-Lathe

I haven't met too many woodworkers that weren't a little bit intrigued by the thought of turning a project on the lathe. But they always mention the "problem" — spending a few hundred dollars on a lathe just to get started.

Well, if that's the reason you haven't tried your hand at turning, you might want to consider the shop-made mini-lathe shown below. It has all the features you'd expect on a mini-lathe — but instead of buying one, building it might just save you a few bucks.

This mini-lathe is solid and sturdy. So you can be sure it's tough enough to handle a wide variety of turning projects, from pens and table legs, to small turned boxes and bowls. And there's a disk sander and table you can build as an accessory to add even more versatility.

Materials

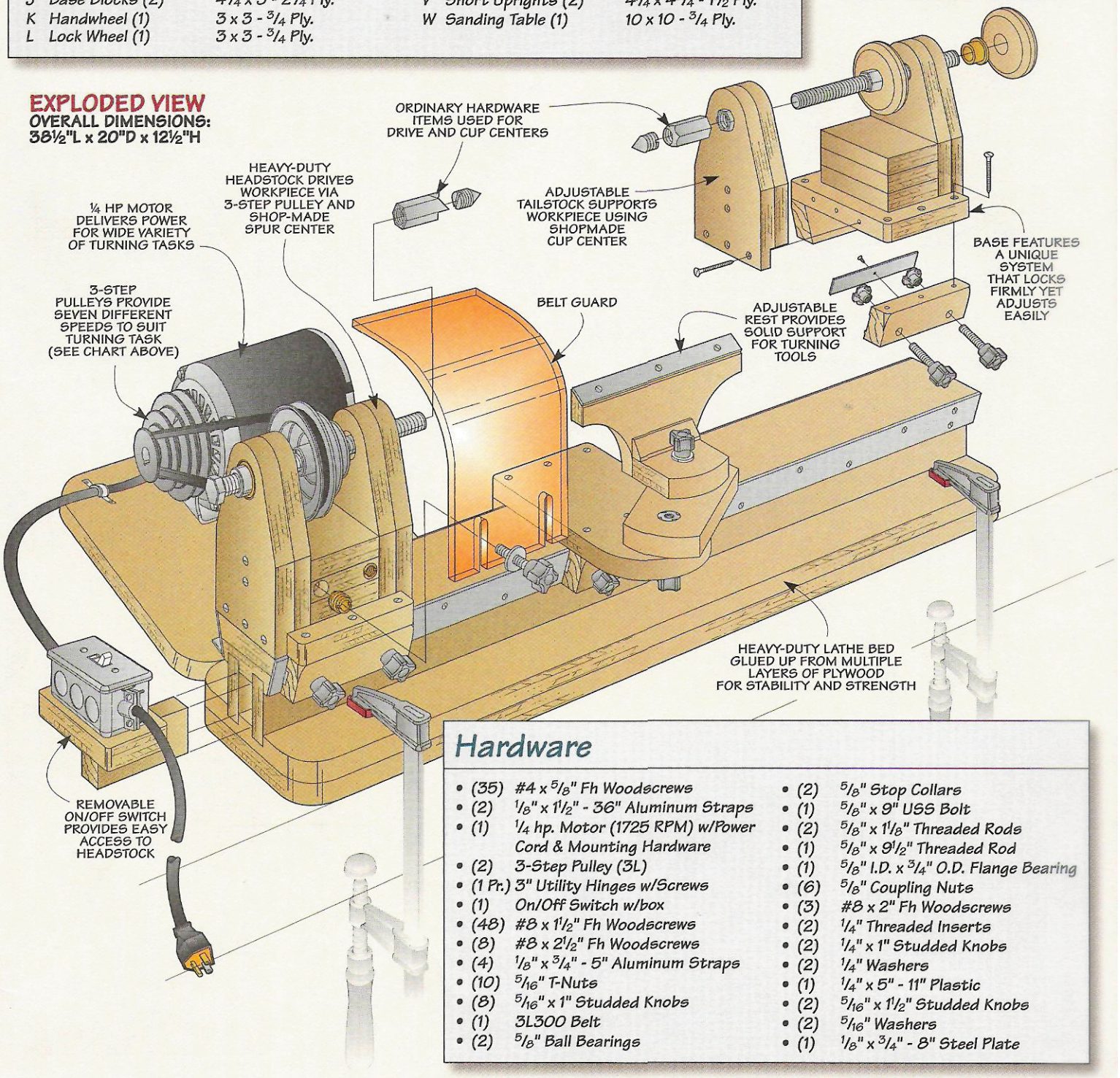
A	Top (1)	4 1/8 x 36 - 1 1/2 Ply.
B	Bottom (1)	8 x 36 - 1 1/2 Ply.
C	Vertical Supports (2)	2 1/4 x 36 - 3/4 Ply.
D	Mounting Platform (1)	12 x 12 - 3/4 Ply.
E	Switch Mount (1)	2 1/2 x 4 1/2 - 3/4 Ply.
F	Mounting Block (1)	1 x 1 1/2 - 5
G	Bases (3)	5 x 6 1/4 - 3/4 Ply.
H	Locking Strips (8)	3/4 x 1 7/8 - 5
I	Uprights (4)	4 1/4 x 6 3/4 - 1 1/2 Ply.
J	Base Blocks (2)	4 1/4 x 3 - 2 1/4 Ply.
K	Handwheel (1)	3 x 3 - 3/4 Ply.
L	Lock Wheel (1)	3 x 3 - 3/4 Ply.
M	Tool Rest Base (1)	5 x 9 1/2 - 3/4 Ply.
N	Tool Support (1)	3 3/4 x 8 - 3/4 Ply.
O	Support Base (1)	3 x 2 3/4 - 3/4 Ply.
P	Filler Block (1)	3/4 x 3/4 - 3
Q	Pivot Arm (1)	3 x 6 1/2 - 3/4 Ply.
R	Faceplate Body (1)	2 1/4 x 2 1/4 - 2 1/4 Ply.
S	Faceplate (1)	5 x 5 - 3/4 Ply.
T	Sanding Disk Body (1)	3 x 3 - 2 1/4 Ply.
U	Sanding Disk Plate (1)	8 x 8 - 3/4 Ply.
V	Short Uprights (2)	4 1/4 x 4 3/4 - 1 1/2 Ply.
W	Sanding Table (1)	10 x 10 - 3/4 Ply.

LATHE SPEED

MOTOR PULLEY	HEADSTOCK PULLEY	APPROX. RPM
Small	Large	700
Small	Medium	1000
Medium	Large	1250
Large	Large	1725
Large	Medium	2500
Medium	Small	3000
Large	Small	4150

EXPLODED VIEW

OVERALL DIMENSIONS:
38 1/2"L x 20"D x 12 1/2"H



Hardware

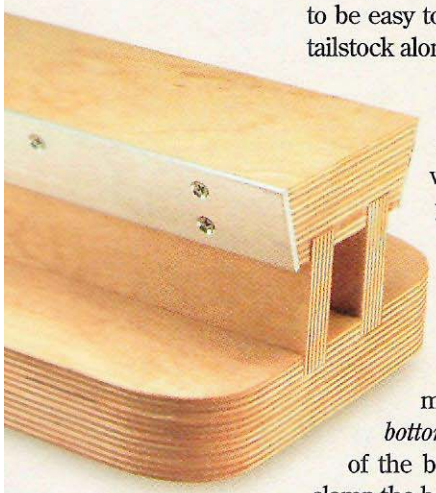
- (35) #4 x 5/8" Fh Woodscrews
- (2) 1/8" x 1 1/2" - 36" Aluminum Straps
- (1) 1/4 hp. Motor (1725 RPM) w/Power Cord & Mounting Hardware
- (2) 3-Step Pulley (3L)
- (1 Pr.) 3" Utility Hinges w/Screws
- (1) On/Off Switch w/box
- (48) #8 x 1 1/2" Fh Woodscrews
- (8) #8 x 2 1/2" Fh Woodscrews
- (4) 1/8" x 3/4" - 5" Aluminum Straps
- (10) 5/16" T-Nuts
- (8) 5/16" x 1" Studded Knobs
- (1) 3L300 Belt
- (2) 5/8" Ball Bearings
- (2) 5/8" Stop Collars
- (1) 5/8" x 9" USS Bolt
- (2) 5/8" x 1 1/8" Threaded Rods
- (1) 5/8" x 9 1/2" Threaded Rod
- (1) 5/8" I.D. x 3/4" O.D. Flange Bearing
- (6) 5/8" Coupling Nuts
- (3) #8 x 2" Fh Woodscrews
- (2) 1/4" Threaded Inserts
- (2) 1/4" x 1" Studded Knobs
- (2) 1/4" Washers
- (1) 1/4" x 5" - 11" Plastic
- (2) 5/16" x 1 1/2" Studded Knobs
- (2) 5/16" Washers
- (1) 1/8" x 3/4" - 8" Steel Plate

Lathe Bed

The bed of a lathe has an important function — it needs to provide a strong and solid foundation for all the other parts of the lathe. Plus, it needs to be easy to move the tool rest and tailstock along the bed.

To accomplish this, the bed is built as a double I-beam structure with an angled top, like you see in the margin.

Make the Bed – I started on the bed by gluing up a couple layers of $^3/_4$" Baltic birch plywood to make the *top (A)* and *bottom (B)*. The extra width of the bottom makes it easy to clamp the bed to a benchtop.



▲ *Solid & Stable.* *Glued-up layers of plywood and a double I-beam design provide a solid support for the mini-lathe.*

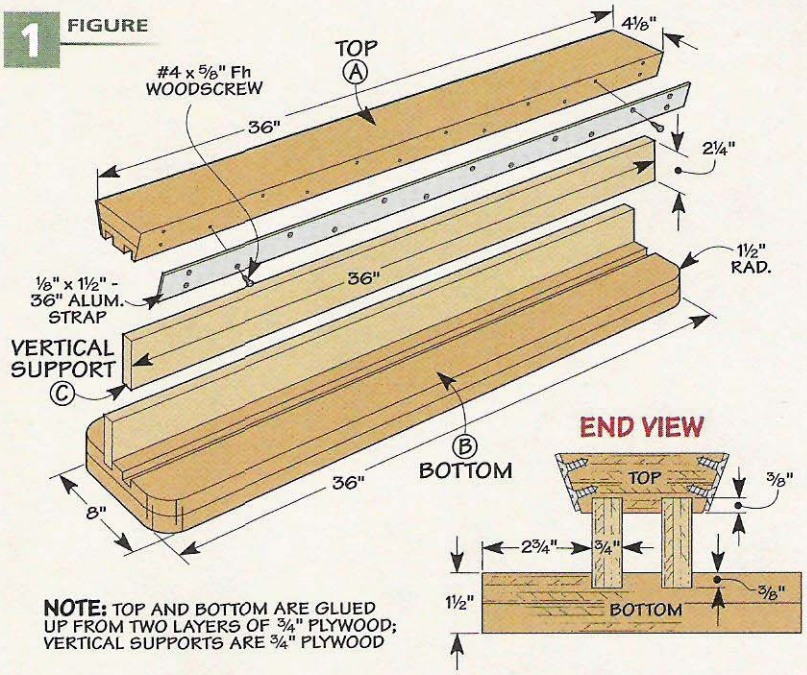
Keeping all the edges of the plywood aligned when gluing up multiple layers can be a hassle. Instead, I cut the plywood oversized ($^1/_2$") in both length and width. Then once the glue is dry, you can trim everything perfectly flush (Figure 1).

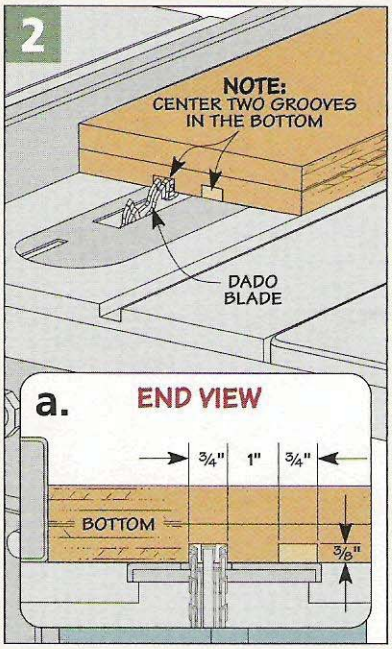
Grooves & Vertical Support – To connect the top and bottom, you'll need to cut a pair of grooves in each piece to accept some vertical supports. So after setting up your dado blade to match the thickness of the vertical supports, adjust the rip fence and cut the grooves in the bottom, as in Figures 2 and 2a.

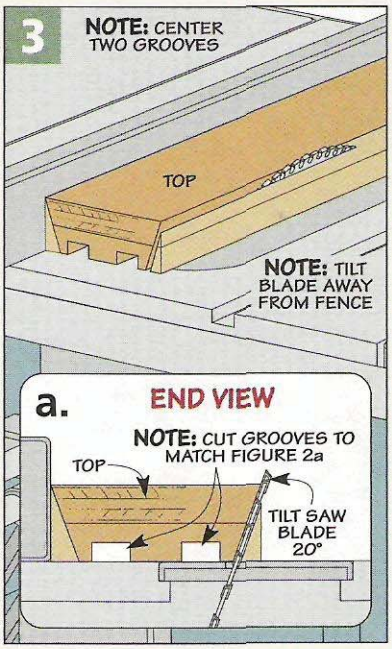
Like the bottom, there are a pair of grooves in the top to accept the vertical supports. But since the top is narrower, you'll need to carefully lay out the location of the grooves so they align with the ones in the bottom of the lathe bed.

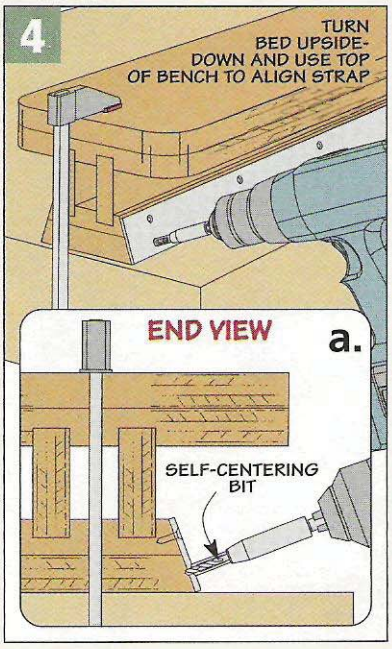
Create the Beveled Top – After cutting the grooves, the next step is to bevel both long edges of the top, like you see in Figures 3 and 3a. Why bevel the edges? The beveled edges provide a connection that interlocks with the headstock, tailstock, and tool rest, yet still allows them to slide easily along the bed.

Assemble the Bed – With the top and bottom complete, all that's left to do is cut the *vertical supports (C)* to size and then join the top and bottom, as in Figure 1.







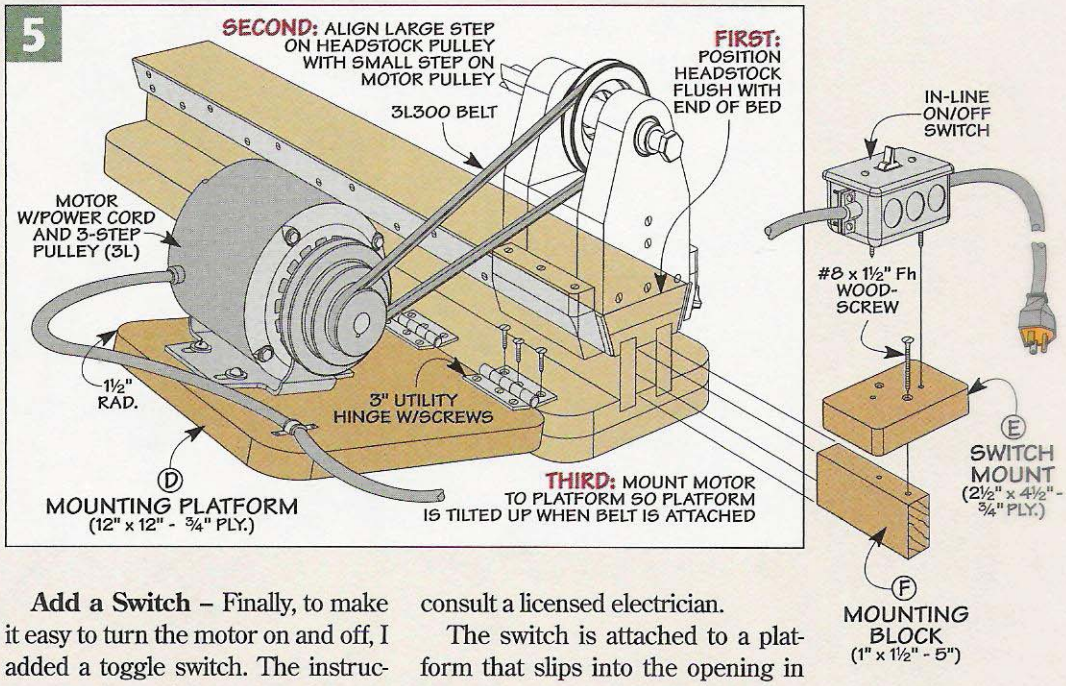


To help strengthen the bed and prevent wear and tear along the edges, I added a couple strips of aluminum to the edges of the top.

I cut each strip from a piece of aluminum angle I picked up at a local home center. And to ensure the strip is flush with the top edge once it's screwed in place, it's best to turn the bed upside-down and clamp it to a bench, as seen in Figures 4 and 4a.

Mounting the Motor – To attach the motor, I used a simple system — a hinged mounting platform. This system makes it easy to change the lathe speed, as you can see in the photo below right.

After cutting the platform to size, you can attach it to the bed with a pair of hinges (Figure 5). But don't mount the motor at this point. Later, when the headstock is complete and the hardware is installed, you can mount the motor as detailed in Figure 5.

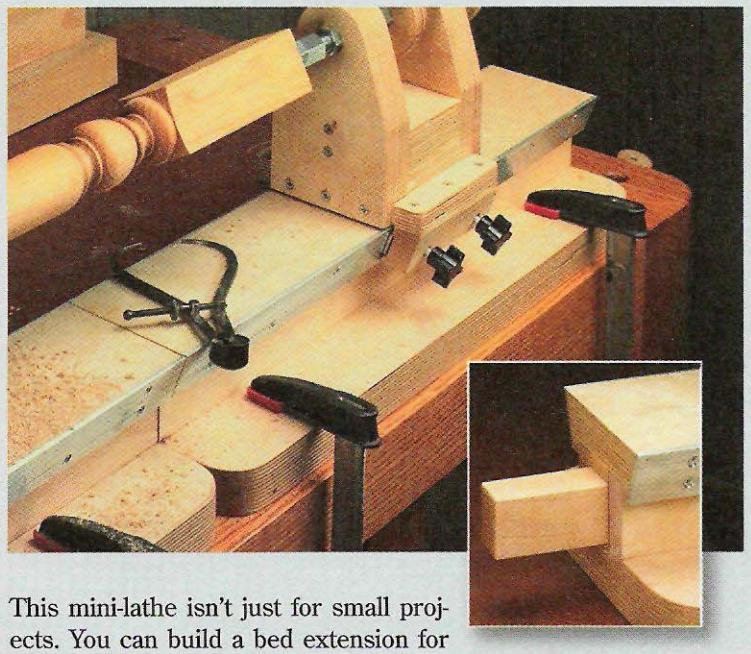


Add a Switch – Finally, to make it easy to turn the motor on and off, I added a toggle switch. The instructions for doing this are included with most switches. If you're uncomfortable wiring a switch (or the motor), consult a licensed electrician.

The switch is attached to a platform that slips into the opening in the end of the bed. In Figure 5 you can see that the mount is simply a plywood pad attached to a hardwood mounting block.

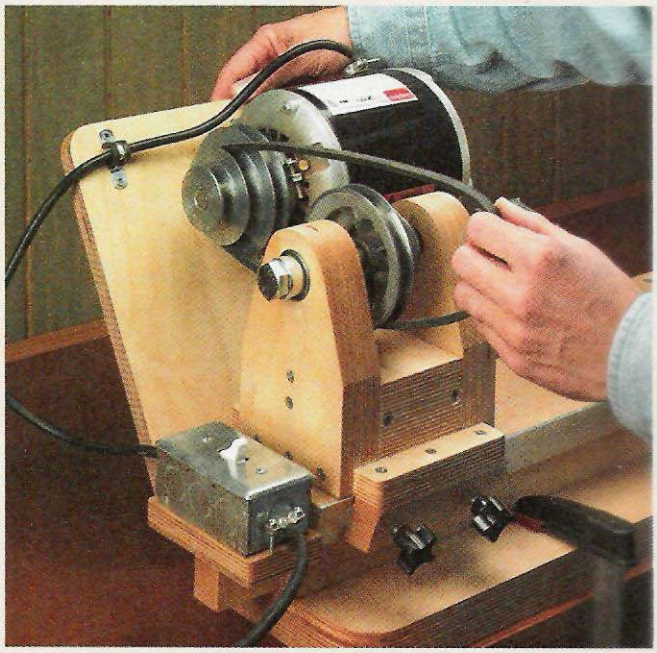
Longer Turnings – One last thing. The mini-lathe will handle workpieces up to 18" long. But if you think you'd like to turn something longer, like a table leg, be sure to check out the box at left.

Lathe Bed Extension



This mini-lathe isn't just for small projects. You can build a bed extension for your mini-lathe that will allow you to handle longer workpieces, like the baluster shown above, or table legs up to 42" long.

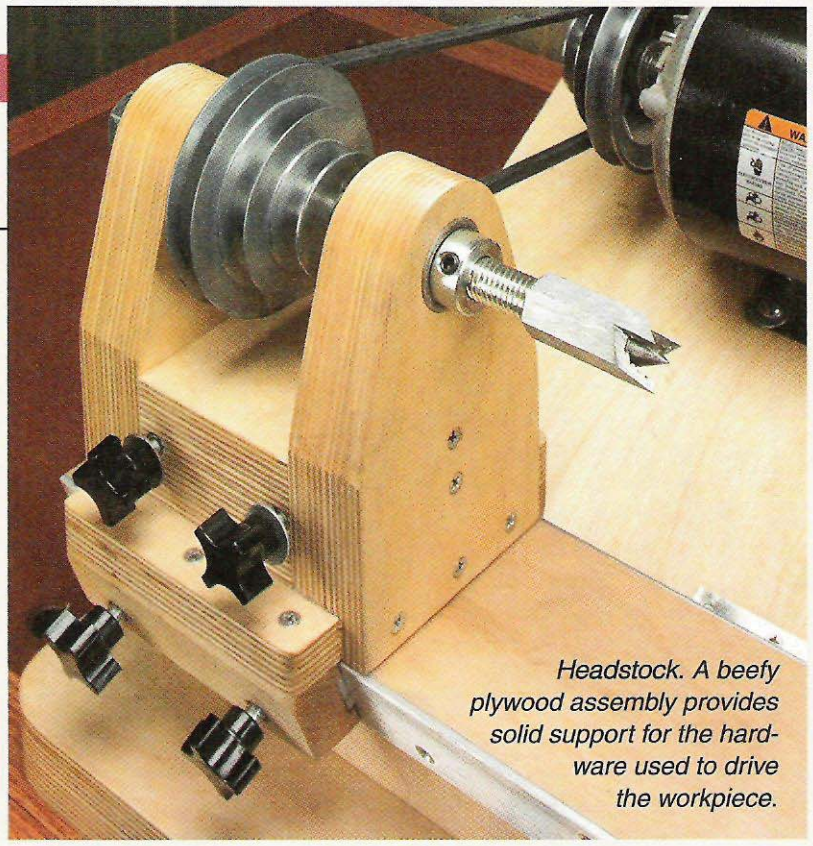
As you can see in the photo above, the 24"-long extension is identical to the main bed of the lathe. If possible, try to build the extension at the same time to ensure the two beds line up exactly. Finally, all you need to connect the extension to the main bed is a mounting block, like the one used for the switch platform (Figure 5).



▲ *Changing Speed. With the motor mounted to a hinged platform, shifting the belt to change the lathe speed is just a matter of lifting the back end of the mount. After adjusting the belt, swing the platform back down to reapply tension.*

FEATURE PROJECT

Headstock & Tailstock



Headstock. A beefy plywood assembly provides solid support for the hardware used to drive the workpiece.

Although the heavy-duty bed provides strength and stability to the lathe, it's the headstock and tailstock that actually support the workpiece you're turning.

Start with the Base – The nice thing about building both these units is the base for each is identical. And the only difference in the uprights that supports the hardware is the size of the holes near the top.

The *base (G)* starts out as a single layer of plywood with a pair of hardwood *locking strips (H)* attached to the front and back edges. These strips are angled to match the beveled top of the lathe.

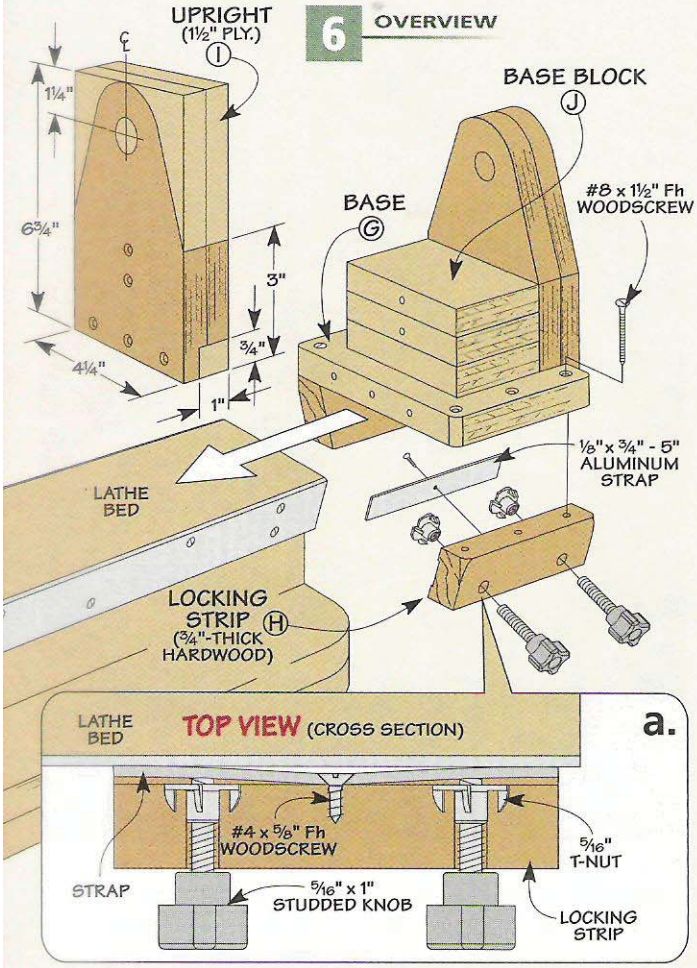
When the knobs installed in the front strip are tightened, they press a locking plate against the top of the bed to "pinch" the base against the bed of the lathe, as in Figure 6a.

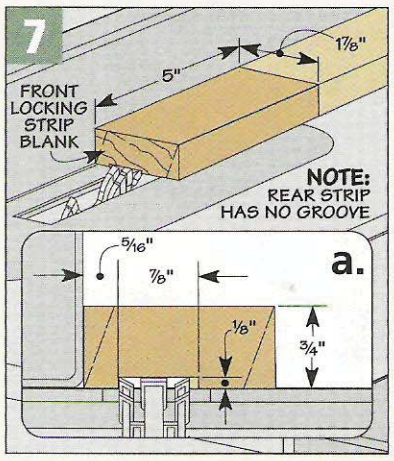
Because the strips are somewhat small, I started with two over-sized blanks, as illustrated in Figure 8. For now you can set one strip aside.

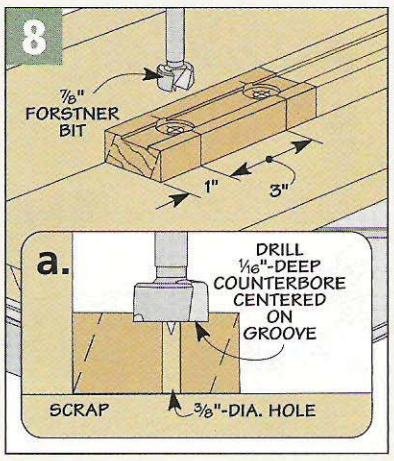
The first step is to cut a groove down the inside face of one strip. This groove is sized to accept the narrow strip of aluminum that locks the base to the lathe bed, as in Figures 7 and 7a. Once that's complete, you can drill counterbored holes in each strip for the T-nuts, as in Figures 8 and 8a.

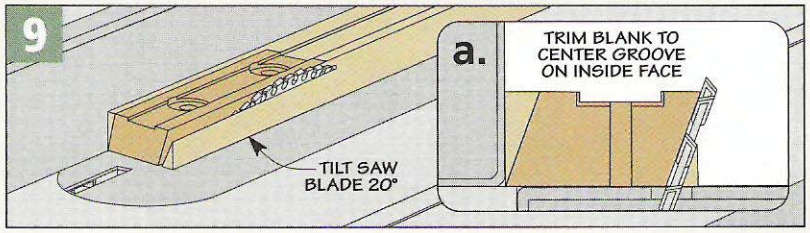
Now all that's left to do is tilt the saw blade and trim both workpieces at an angle (Figures 9 and 9a). Finally, cut the strips to length.

Add the Locking Strap – After cutting the locking strap to size from









a piece of aluminum, you can tap the T-nuts into the counterbores and then screw the strap in place, like you see in Figure 6a.

Attach the Strips – After attaching the front strip flush with the edge of the base, you can turn your attention to the rear strip.

To make it easy to slide the base along the bed, I used a playing card to "build in" some clearance when I attached the rear strip, as illustrated in Figure 10. The strip is glued and screwed to the base and then the corners of the base are sanded to ease the sharp edges.

Make the Uprights – To support the hardware on the headstock and tailstock, there's a pair of heavy-duty uprights attached to each base.

Each *upright (I)* starts out as a rectangular blank glued up from two layers of plywood. You can see this by referring to Figure 6. Then to mate the upright to the base, a large rabbet is cut on one end.

Holes for the Hardware – At this point you need to drill holes for the hardware used to support the workpiece. But it's important that all the holes be aligned.

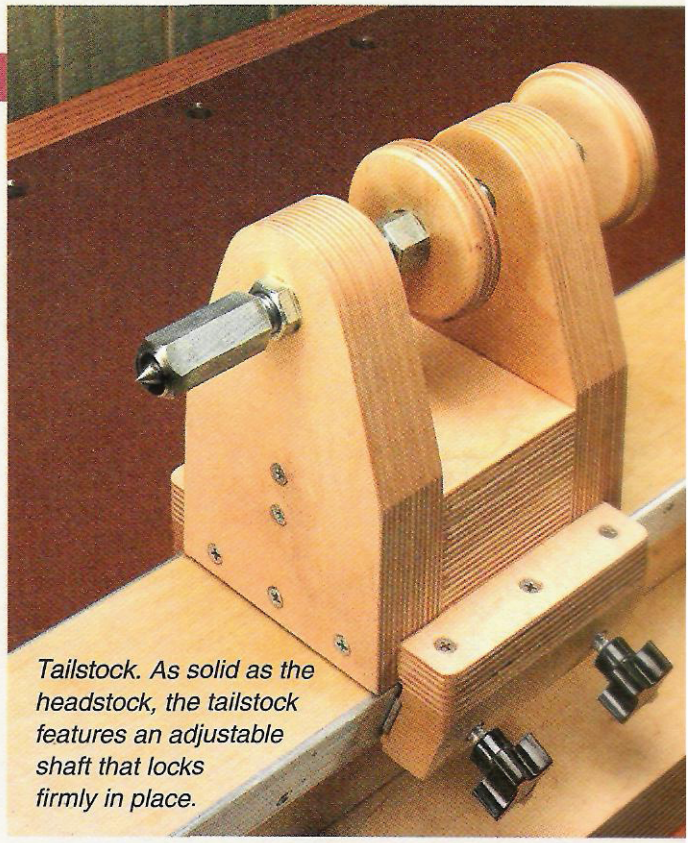
To ensure this, I used a fence and a stop, as in Figure 11 below. The fence ensures that each hole is drilled along the centerline of the upright. And the stop block guarantees that each hole is positioned the same distance from the top.

The uprights for the tailstock have the least work, so I started with them. All you need to do is drill a single through hole in each upright, like you see in Figure 11a.

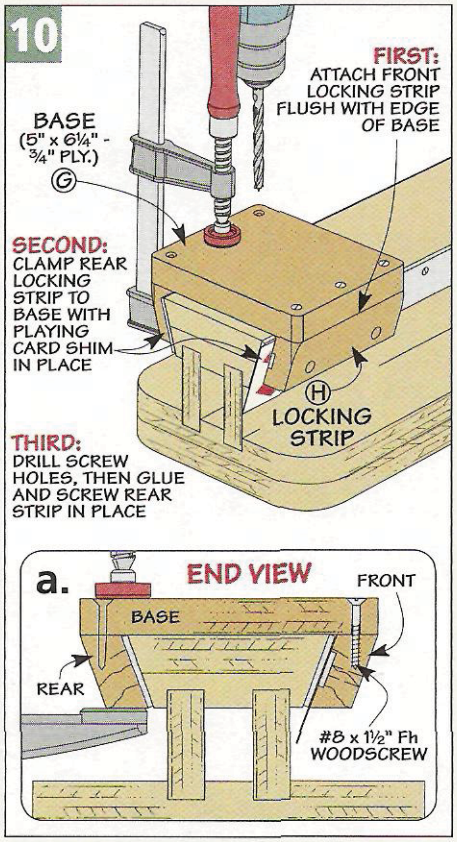
For the headstock uprights you'll need to do a little more work. First, drill a $1\frac{3}{8}$"-dia. counterbore on the outside face of each upright (Figure 11). Then complete each upright by drilling a $\frac{7}{8}$"-dia. through hole.

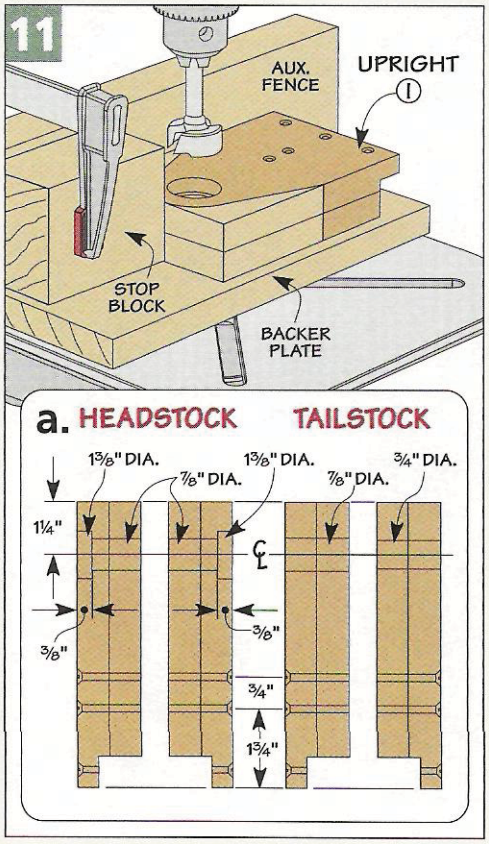
After shaping each upright, glue and screw the uprights to the base. Here again, it's important to keep the holes in alignment. So be sure the front edge of each upright is positioned the same distance from the front edge of the base (Figure 12).

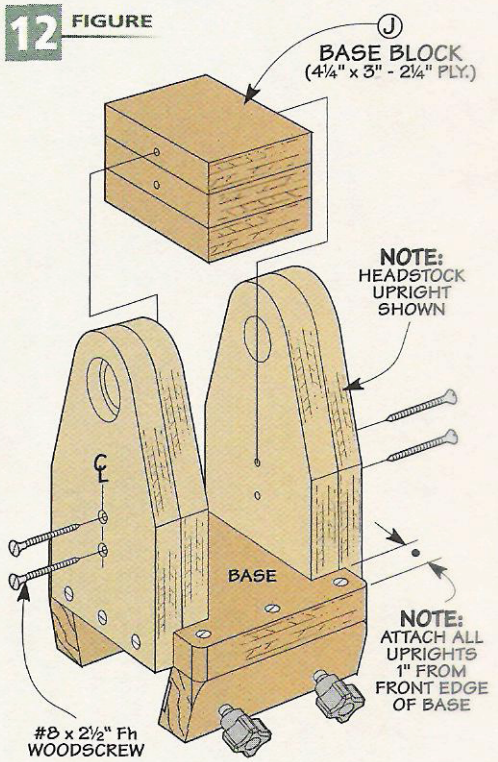
Beef Up the Assemblies – Finally, I reinforced the uprights by adding a *base block (J)* glued up from three layers of plywood. The block is cut to size to fit flush with the edges of the uprights. The block is glued and screwed in place, like you see in Figure 12.



Tailstock. As solid as the headstock, the tailstock features an adjustable shaft that locks firmly in place.

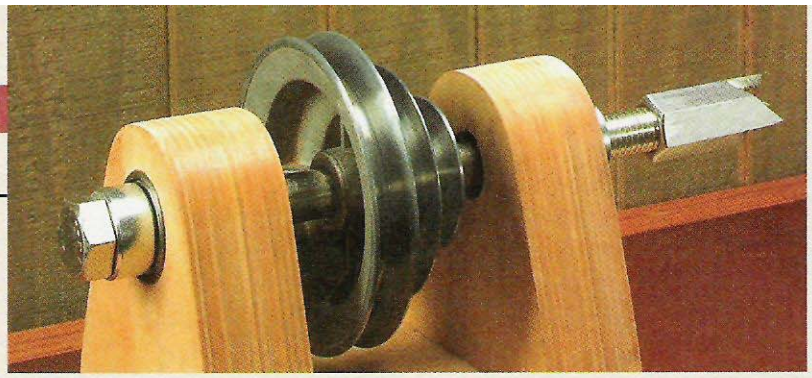


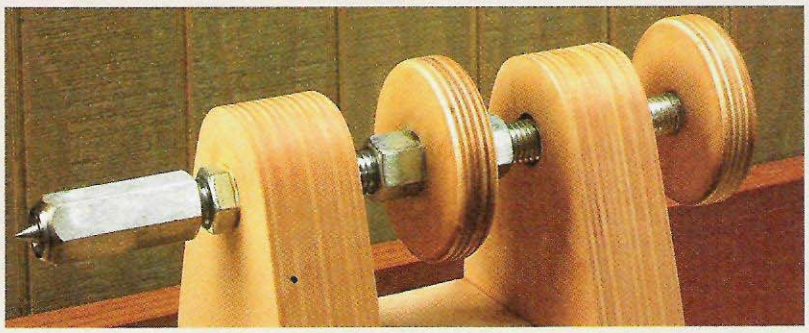




FEATURE PROJECT

Add Hardware





▲ *Drive Center. A few taps with hammer is all it takes to embed the drive spurs in the workpiece.*

Completing the headstock and tailstock at this point is just a matter of adding some hardware.

Headstock – As you can see in Figure 13, the drive shaft is just a heavy-duty bolt that fits through the headstock bearings. The bearings fit into the counterbores drilled earlier in the uprights. (I used a couple dabs of epoxy to hold them in place.)

The shaft is held in place by a pair of stop collars. The three-step pulley (identical to the one on the motor) is centered between the uprights with the largest diameter on the left.

To ensure the stop collars and pulley lock in place securely, I filed a slight flat on the drive shaft where each set screw made contact.

Tailstock – To make it easy to install (or remove) a workpiece, the tailstock hardware needs to be able to adjust in and out easily. To do this, I used a threaded rod attached to a plywood handwheel (Figure 14).

The threaded rod fits through a flange bearing installed in the outside upright of the tailstock. To allow you to turn the shaft in and out, there's a coupling nut epoxied into the other upright. Finally, to secure the shaft when you're turning, I created a lock wheel that fits between the uprights, as in the detail below.

Like the handwheel, the lock wheel is just a plywood disk with a coupling nut epoxied into a hole drilled in the wheel. To lock the shaft, simply "jam" the coupling nut of the lock wheel against the nut in the left upright.

Centers – Finally, you can add the drive and cup centers after checking out the box on the opposite page.

FIGURE 13

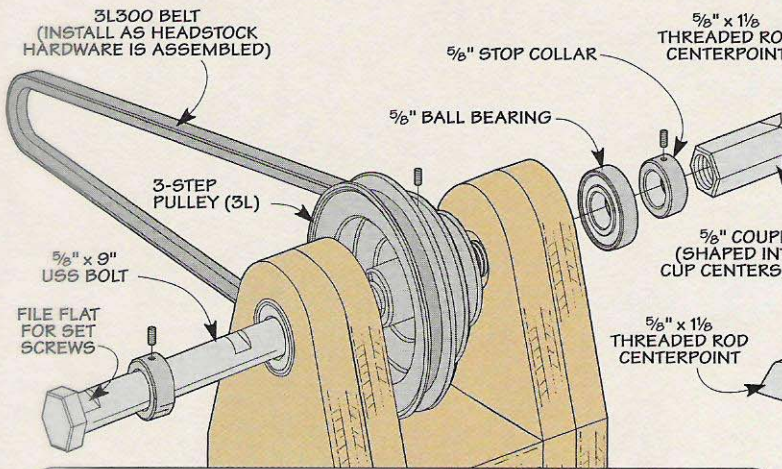
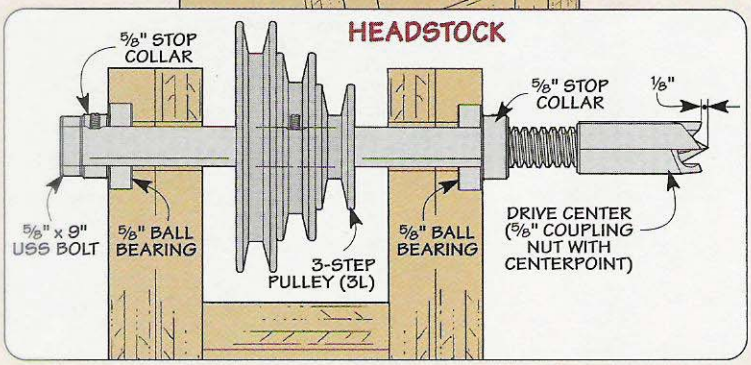
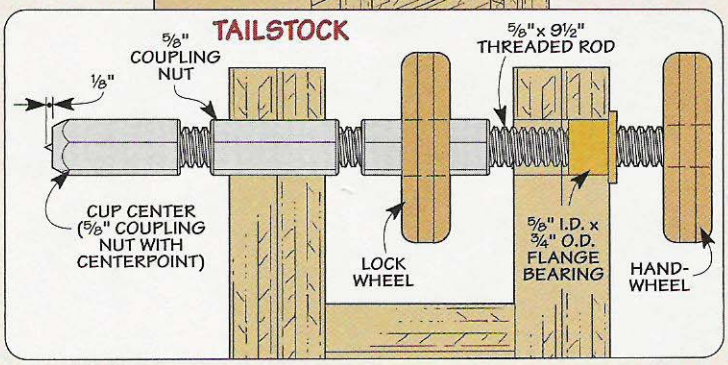
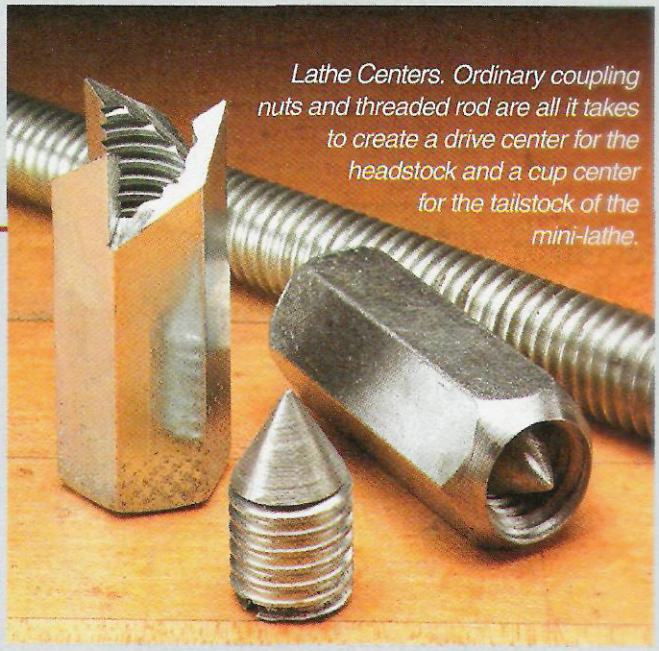


FIGURE 14





Making the Drive & Cup Centers



Lathe Centers. Ordinary coupling nuts and threaded rod are all it takes to create a drive center for the headstock and a cup center for the tailstock of the mini-lathe.

To simplify the centers in the headstock and tailstock that support the workpiece, I turned to common hardware store items — threaded rod and coupling nuts.

As you can see in the photo at right, with just a little work you can turn them into a spur center to drive the workpiece and a cup center to support the workpiece at the tailstock.

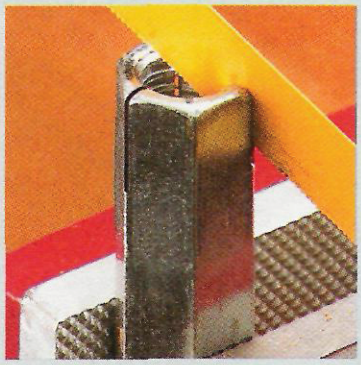
Drive Center – Making the drive center requires the most work, so that's where I started. After clamping a coupling nut in the vise, I made a series of cuts to define the spurs, like you see in Step 1 below.

Once that was complete, I smoothed the spurs with a file to ensure they were all even with each other. All that's left to do to complete the drive center is to add a centerpoint. For that I used a piece of threaded rod that I ground and then filed to a point, as you can see in Step 2. As shown in Step 3, a little epoxy on the threads of the drive center secures the centerpoint in place.

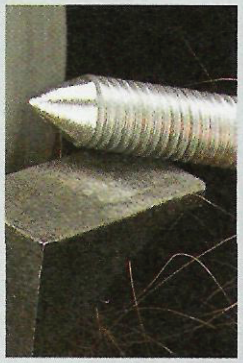
Cup Center – To support the workpiece at the tailstock, I also used a coupling nut. But since it doesn't have to drive the workpiece, I simply ground the outside of the nut smooth and then chamfered the inside edge, as in Step 4.

Here again, I repeated the process in Steps 2 and 3 for adding the centerpoint. What you'll notice is that a small "cup" is formed in the center. Since the center doesn't spin with the workpiece (the workpiece rotates around the center), the cup can be used to hold a dab of grease to lubricate the workpiece as it turns.

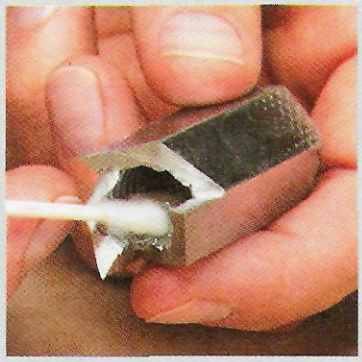
With the drive and cup centers complete, installing them is just a matter of threading them in place on the drive and tailstock shafts.



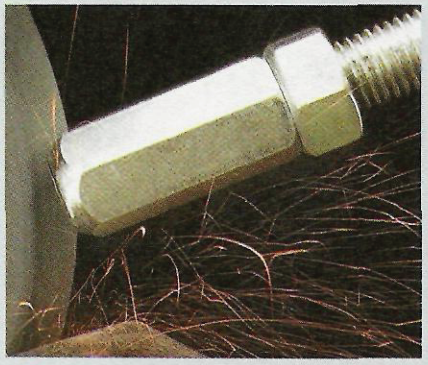
1 *To turn the coupling nut into a drive center with spurs, make a single cut down every other point on the nut, like you see in the left photo. Once that's complete, you can remove the waste by cutting across the nut and then filing the spurs smooth.*



2 *Creating a centerpoint is just a matter of grinding a short length of threaded rod to a point (left). To center the point, file the point while the rod is turning in the drill press (center). Finally, cut the point to length and cut a slot in the end (right).*

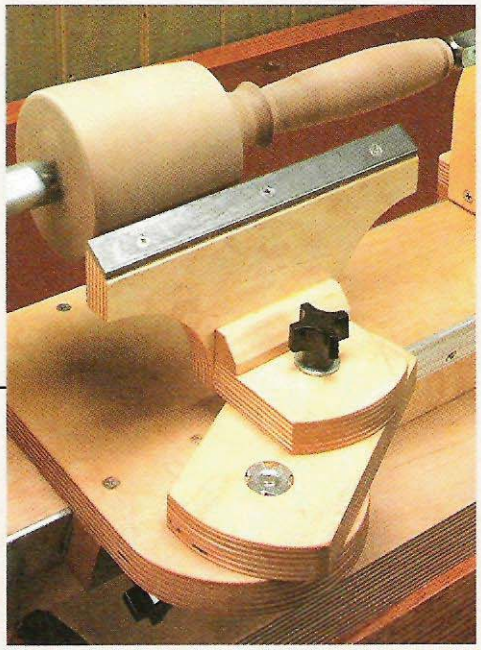


3 *Next, use a cotton swab to dab a bit of epoxy on the threads near the end of the drive center (left). Then turn the centerpoint in until it projects about 1/8" in front of the spurs, like you see in the photo at right.*



4 *To create the cup center for the tailstock, grind the end of a coupling nut smooth (left). Once that's complete, form a sharp edge using a countersink bit (right). Finally, make a second centerpoint and install it just as before.*

Must-Have Accessories for Your Lathe



Tool Rest

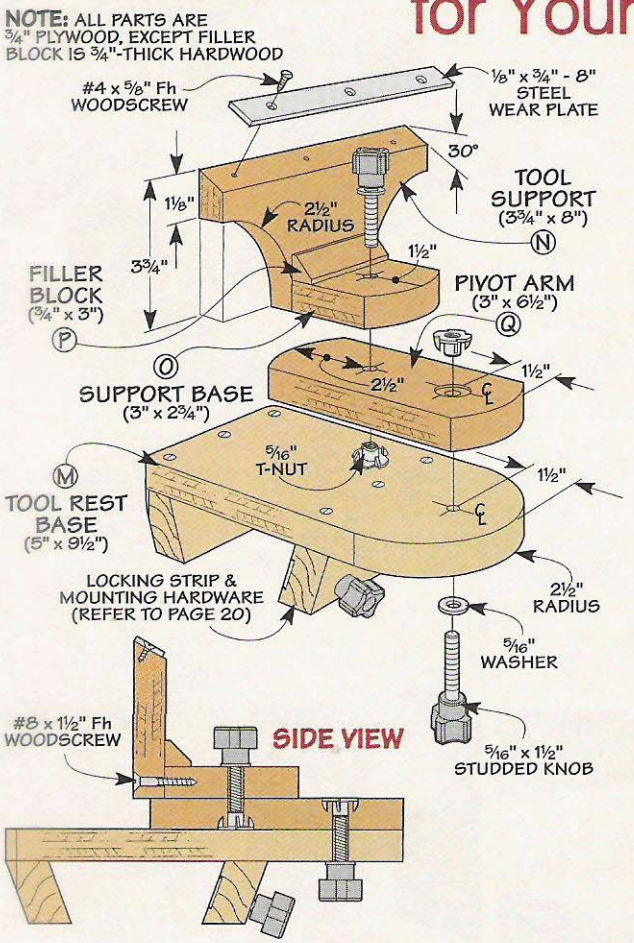
■ A tool rest is a definite must-have for the lathe. Without an easily adjustable tool rest, working at the lathe can "turn" into a chore.

Base – The main part of the tool rest is the sliding base. The only difference between this base and the previous ones is the top extends past the front locking strip to provide for the pivot arm. The pivot arm allows you to adjust the tool rest in almost any position to suit the workpiece and tool you're turning with.

Rest – The rest consists of a tool support attached to a base (see drawing). To reinforce the assembly, I added a hardwood filler block. And a steel wear plate screwed to the top of the rest prevents wear and tear as you turn. (Note: To ensure tools slide easily back and forth, file and sand the wear plate smooth.)

To make it easy to adjust the tool rest to any position, I added a pivot arm between the rest and the base. A pair of T-nuts, washers, and studded knobs lock the rest securely in place.

One last thing. The rest is designed to place the wear strip $1/4$" *below* the centerline of the lathe. Depending on the type of projects you turn, you may find a tool rest that's a different height (or not as long) more to your liking.



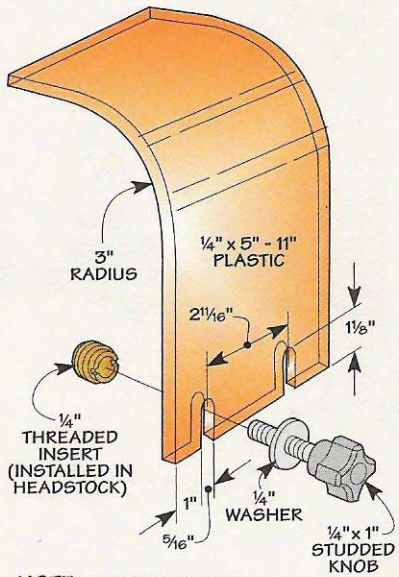
Belt Guard

■ Having a belt spinning at thousands of RPM right near your hand can be a bit unnerving, not to mention unsafe. So to provide some protection, it's best to add a belt guard, like you see in the photo.

The guard is nothing more than a piece of plastic bent to wrap around the top of the headstock (see drawing). The tricky part is bending the plastic just the right amount.

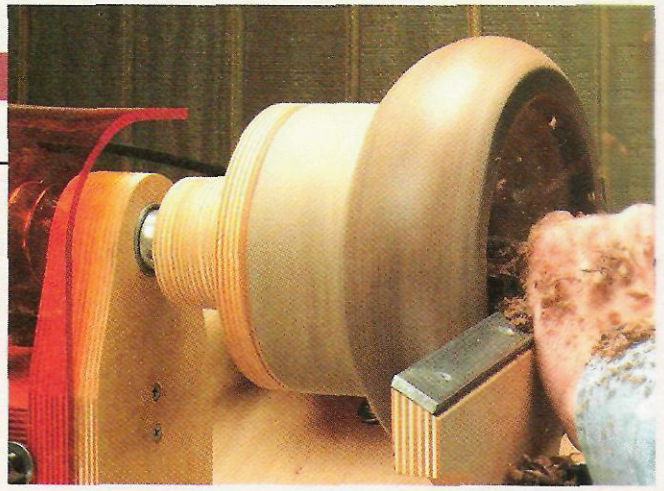
To do that, I used a heat gun to warm up an area where I wanted the bend. Once the plastic softened, a large coffee can provided the perfect radius to match the headstock.

To mount the guard, I added a pair of threaded inserts to the headstock. Washers and studded knobs that pass through slots cut in the bottom of the guard secure it in place.



NOTE: START WITH EXTRA-LONG WORKPIECE. BEND FIRST, THEN TRIM TO SIZE AND CUT SLOTS

Faceplate & Sanding Disk



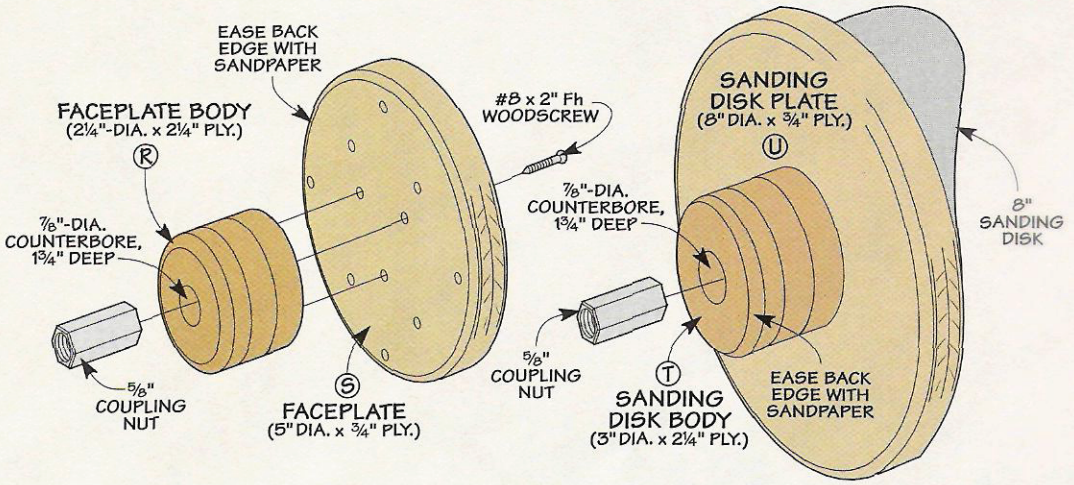
■ To give the lathe more capability, you might want to consider adding a faceplate or sanding disk. Neither one requires much in time or materials to make, but adds versatility.

Faceplate – The faceplate has three main parts: a coupling nut for mounting the faceplate to the lathe, a body glued up from three layers of plywood, and the mounting plate.

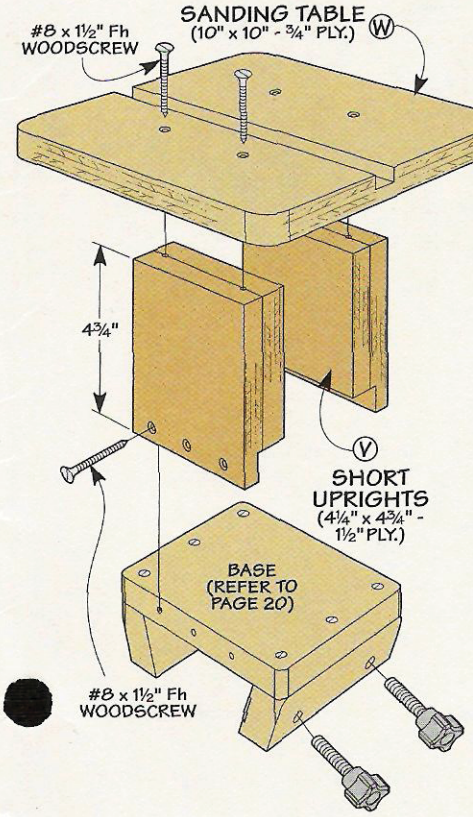
I started by gluing up the body and then cutting both the body and plate to rough size. Once that's complete there are a few holes to drill. In the body you'll need to drill a hole to accept the coupling nut. After gluing it in place with epoxy, you can drill a set of holes for attaching the faceplate to the body as well as holes for mounting the workpiece to the faceplate. Finally, glue and screw the plate to the body.

Sanding Disk – The sanding disk is even easier to make. All you need to do is make a larger body, add the coupling nut, and then glue a large sanding disk in place. I sized my disk for 8"-dia. abrasive disks.

True Up – One last thing. Before using either accessory, mount each one to the lathe and "true it up" so the face is flat and perpendicular to the centerline of the lathe.



Sanding Table

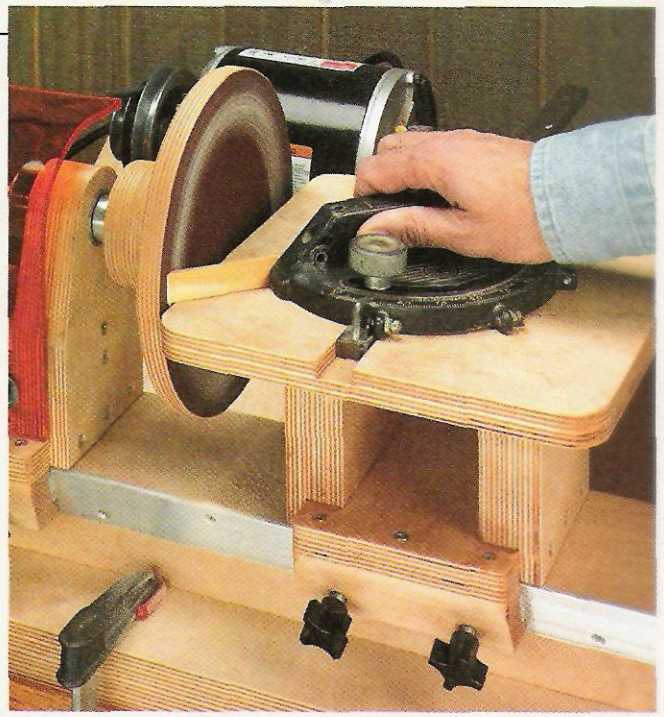


■ To make better use of the sanding disk, I added a sanding table, like the one you see in the drawing (left) and photo (right).

You can start on the sanding table by building a base. Here again, the base is identical to the those made earlier for the headstock, tailstock, and tool rest. (To see how to build the base, refer to page 20.)

But instead of adding full-size uprights to the base, they're cut slightly shorter, like you see in the drawing at left. The uprights are sized in length so the top of the sanding table is right at the centerline of the sanding disk. Note: Because there isn't much stress on the sanding table during use, I didn't add a base block to the assembly to reinforce the uprights.

To allow you to use your miter gauge to support the workpiece as you sand (like you see in the photo), be sure to cut a groove in the table to fit the bar on your miter gauge.



It's important that the groove be parallel to the face of the sanding disk, so I used a combination square to position the top before screwing it to the uprights.