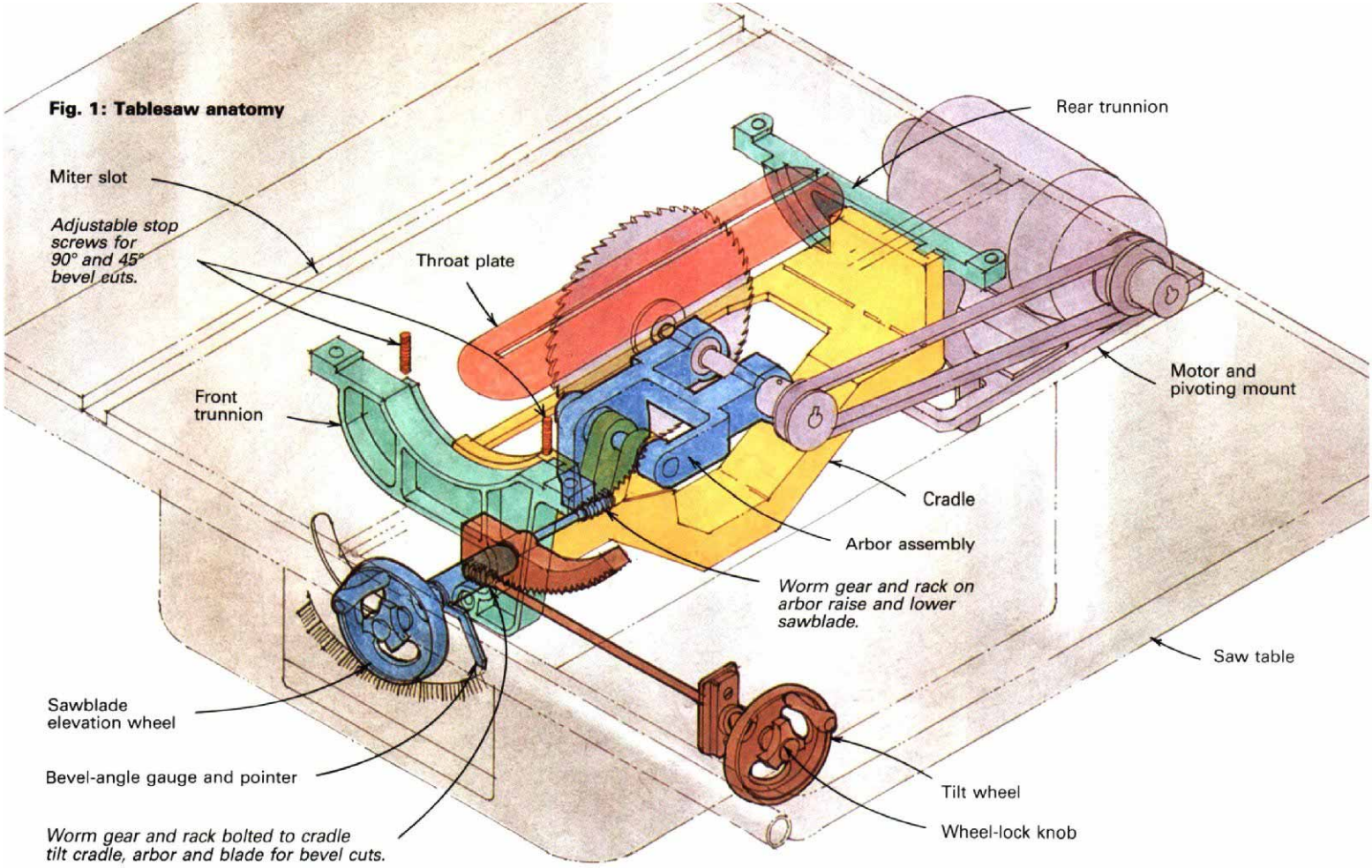


Tuning-Up Your Tablesaw

Basic adjustments for accuracy and safety

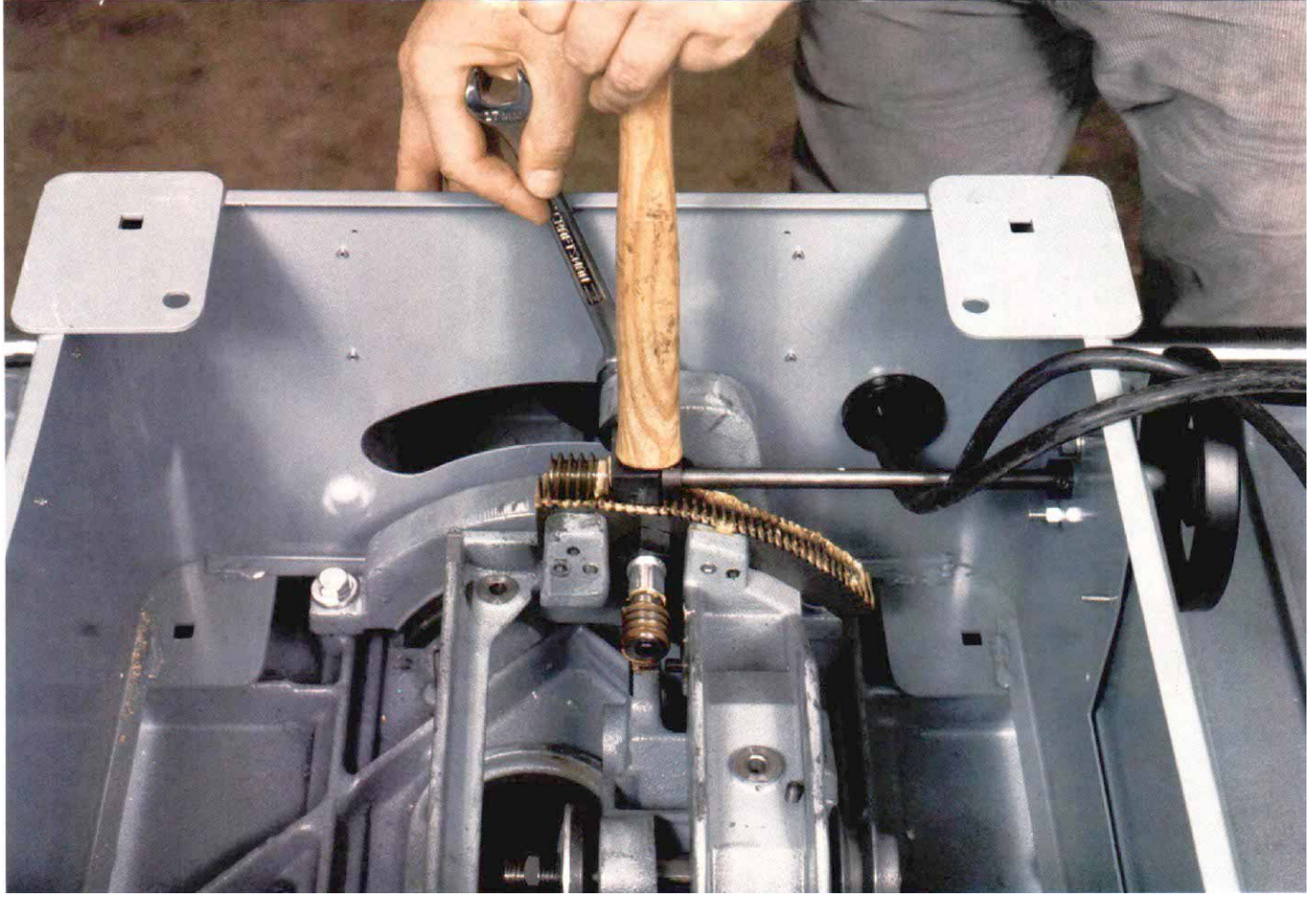
by Mark Duginske

Of all the machine tools in a woodworking shop, the tablesaw is the workhorse. But whether you own an 8-in. hobbyist's saw or a 12-in. production model, you won't get maximum accuracy and efficiency from your saw unless it's tuned up. This means that its working parts, including the trunnions, bevel stops, miter gauge and rip fence, must be properly adjusted and aligned. Safety is also a major concern; many woodworking accidents, especially those caused by kickback, can often be traced directly to poor saw setup.

Fortunately, tuning up your saw is fairly simple. It doesn't take any special tools or require either esoteric knowledge or brute strength. Even a cheap saw can be tuned to perform admirably. And the small amount of time that must be invested in a tune-up is more than repaid in workpieces that are cut accurately the *first* time. In this article, I'll show you a simple step-by-step procedure for testing and tuning up your tablesaw, including how to adjust the tilt mechanism, the miter gauge and rip fence; how to square the blade to the table; and how to align the blade parallel to the miter slots. But before we delve into the tune-up, let's get better acquainted with the different internal parts of a tablesaw.

Tablesaw anatomy—Figure 1 above illustrates the internal components of a typical tablesaw; this example is similar to saws made by Delta, Powermatic, Sears and Taiwanese manufacturers. Bolted to the underside of the saw table is the saw cradle (or carriage) and trunnion assembly. The cradle supports the saw arbor, which is basically a shaft held by either sleeve or ball bearings. The arbor has a sheave on one end for the V-belt, and the sawblade is secured by a flange and nut on the other end There are two trunnions, one at each end of the assembly, that support and align the cradle, as well as the motor on most saws. Because the trunnions are semicircular, they make it possible for the cradle to be tilted

Drawing: Joel Kalzowilz



Removing backlash between the gears of a tablesaw's tilt mechanism, is crucial to eliminating the play in the cradle that supports and aligns the arbor and sawblade for accurate cuts. Here, the backlash between the worm gear and rack on a Delta 10-in. Tilting, Arbor Bench Saw is taken up by using the handle of a hammer to press down on the block that supports the worm gear.

for bevel cuts. The tilt mechanism itself generally has a worm gear that engages a semicircular rack on the front trunnion; when the saw's tilt wheel is rotated, the angle of the cradle, and in turn the angle of the blade, changes. Two adjustable screw stops set the limits of trunnion travel, usually at 90°- and 45°-blade positions. Another wheel-driven system similar to the tilt mechanism pivots the arbor to raise and lower the blade.

While many of the tune-up steps I'll describe involve adjustments atop the saw table, the first step in the tune-up procedure takes place inside the saw: adjusting the trunnions and tilt mechanism. It's important that you follow the tune-up procedure in the same order as the steps are presented here because the accuracy of subsequent adjustments is often dependent on previous steps.

Adjusting the tilt mechanism-As we have seen, the trunnions and cradle are ultimately responsible for keeping the sawblade running straight and true during both square and bevel cutting. But excess play in the tilt mechanism can make the whole cradle shift, causing the blade's angle to shift during the cut. This not only decreases the accuracy of the cut, but it increases the tendency for the blade to bind or pinch, which can cause a dangerous kickback. You can detect excessive tilt-mechanism play by making trial crosscuts with the miter gauge. You have a problem if the cut is square at the beginning of each cut, but not at the end. This problem shows up even more with beveled cuts in thick stock.

There are several ways to adjust the tilt mechanism depending on the particular design of your saw. Unless your tablesaw is an industrial behemoth, you'll want to flip it upside down to make the adjustment. First, remove the motor assembly to reduce the weight of the saw, then flip it over on a low table or blocks. If you leave the motor in place, be sure to unplug the saw; you'll want to leave it unplugged for most of the tune-up. Now, grab the cradle by the motor-mounting plate and wiggle it back and forth to determine the amount of play.

The most common tilt mechanism on many Taiwanese saws and Delta and Powermatic models relies on the worm gear and rack mechanism illustrated in figure 1 on the previous page. With this design, the solidity of the cradle depends on having a close fit between the worm gear on the tilt mechanism and the rack on the front trunnion. Tightening the lock knob at the center of the tilt wheel only locks the position of the tilt mechanism—it doesn't tighten anything inside the saw. While the basic design of the tilt mechanism is shared by many saws, manufacturers provide several ways to snug up the fit between the worm and rack gear, and get rid of any play, known as backlash. On the Delta 10-in. Tilting Arbor Bench Saw, a lockout secures the position of the block that houses the worm gear shaft. By loosening the locknut and pressing down on the block, as shown in the photo above, backlash is reduced. On Powermatic's Artisan saw and on some Sears models, reducing backlash is a matter of pivoting the tilt-adjustment wheel's shaft. Loosen the two screws that hold the tilt wheel's mounting plate to the outside of the saw housing, and shift the wheel opposite the direction the worm gear moves. Once you make the adjustment, tilt the blade a couple of times to make sure the tilt mechanism operates smoothly. If it doesn't, the gears may fit too snugly, which can cause premature wear. In this case, loosen the backlash adjustment a bit.

In addition to the tilt mechanism, some tablesaws, such as the Boice-Crane and some Sears models, employ a separate tilt lock that clamps the front trunnion and the cradle together. Once the

angle of the blade has been set with the tilt wheel, a spring-loaded handle on the front of the saw locks the setting. On these saws, gear mesh isn't crucial and requires no adjustment because the handle secures the cradle. But remember to use the lock whenever you change the blade angle. Also, tightening the lock can change the blade angle slightly, so recheck the blade angle after the lock is tightened. On Shopsmith saws, some Inca saws and most older saws, the table tilts instead of the blade for angle cuts. If your saw isn't based on one of the tilt systems described here, consult your saw's manual or contact the manufacturer for instructions.

You can reduce wear on the trunnions and tilt mechanism parts by lubricating the trunnions, cradle and gears. First, blow sawdust out of the gears with compressed air, and then lubricate the gears with a dry spray lubricant, which is usually based on Teflon or silicone, Be sure to lubricate the gears' hard-to-reach areas using the long applicator nozzle included with the spray can. You should avoid using machine oil or grease because they will attract sawdust, which will gum up the gears.

The saw cradle may still have play after the gear mesh has been set and/or the tilt lock has been tightened. In this case, a small clamp can be used as a homemade trunnion lock to secure the cradle to the rear trunnion, as in the top photo on pg. 73. A word of caution: *Because vibration may loosen the clamp, make sure it's impossible for the clamp to fall into the running sawblade.* After adding the clamp, you should recheck the blade angle to ensure that the locking action didn't change it.

After you've made these adjustments and are satisfied with the firmness of the cradle, you're ready to flip the saw back over and perform the remaining adjustments from atop the saw.

Squaring the blade—The next steps are to adjust the level of the saw's throat plate, square the blade and set the stops for 90° and 45° You've probably made these adjustments on your saw in the past, but even so, do them again now because they are important prerequisites for the steps that follow.

The saw's throat plate, or table insert, should be adjusted so that it's a couple of thousandths of an inch lower than the saw table in front, and about the same amount higher than the saw table in back. This prevents the workpiece from hitting the plate before the cut or binding on the table after the cut. Throat plates on some Delta and Powermatic saws provide Allen screws for adjusting throat-plate height. On saws without screws, you may have to do some filing or use tape or cardboard shims to change the level of the plate.

The next step is to square the blade. Release the saw's tilt lock and remove the rear trunnion clamp, if you're using one, and raise the blade as high as it will go. Optionally, you can remove the throat plate so that the body of a try square will sit flat on the saw table. To check blade squareness, use a high-quality try square that's dead on 90° My favorite is an all-steel Starrett square, available from the L.S. Starret Co., 121 Crescent St., Athol, Mass. 01331; (508) 249-3551. Place the blade of the square against the sawblade, making sure you're not on a tooth, and look for a gap between the square and blade. Fiddle with the saw's tilt adjustment until, the gap of light disappears. If the blade won't tilt far enough, you may have to loosen the stop screw (see figure 1 on pg. 69). Next, secure the cradle with the trunnion lock or clamp, as previously described, and recheck the blade for squareness.

Now that the blade is square, adjust the stop for 90°. On the Delta 10-in. Tilting Arbor Bench Saw, the tilt stops are screws that are accessible through the saw top. But on most saws, you'll have to reach up under the saw to loosen the locknut and screw the stop in or out. Once again, make sure the saw is unplugged and consult your saw's manual. Ideally, the blade should reach 90° just as you start to feel resistance at the tilt wheel, which is a sign that the trunnion is hitting the stop. Never apply excess pressure to square the blade; if the blade goes past 90°, the stop should be reset. Also, don't depend on the stop to square the blade perfectly every time: For critical cuts recheck using a try square. You can follow the same procedure for setting the 45° stop, but use a plastic drafting triangle for checking the angle. Finally, realign the bevel gauge by zeroing the pointer on the front of the saw. This will make the gauge a rough yet fairly accurate indicator for quickly setting odd-angle bevel cuts.

A snug fit between the miter gauge bar and the table slot is key to making accurate crosscuts on the tablesaw. Here, the author peens the bar, which causes the metal around each indentation to expand, and increases the width of the bar for a tighter fit in the slot.

Adjusting the miter gauge—The miter gauge bar usually fits too loosely in the slot in the saw table to yield accurate crosscuts. Since it's easier to rework the bar rather than remachine the slot, the first step is to adjust the bar to fit more snugly, The best way to do this is to peen the side of the bar, as shown in the photo above, using a pin punch to make small, dimple-like indentations. The peening expands the metal around each indentation, effectively making the bar wider. Peen only on the side of the bar nearest the blade and dimple every inch or so. Stagger the dimples width wise on the bar so they won't wear a groove in the side of the slot. When you're finished, the bar should slide smoothly along the length of the slot without hanging up, and there should be a minimal amount of side-to-side play. Check the fit in the table slot you use most often; most right-handed people use the left slot for crosscutting. Unless the slots on your saw are identical, the bar probably won't fit as well in both slots. If the dimples in any one area cause the bar to stick in the slot, smooth them with a flat mill file, Use a non-silicone wax to lubricate the table slot and the bar; silicone wax may transfer to the workpiece and later cause finishing problems.

Next, use your square to set the head of the miter gauge perpendicular to its bar. Although you may be tempted to square the head to the sawblade, don't do it; that won't produce good crosscuts unless the miter slot and the blade are parallel to one another. This isn't always the case though, and we'll be checking and adjusting this alignment later in the article. After squaring the head and tightening the gauge's lock screw/handle, set the adjustment screw on the 90° stop if your miter gauge has one. Don't trust these stops for fine work though. Like the tilt stops, they're not perfectly accurate.

Aligning the blade to the miter slots—For the miter gauge to crosscut accurately, the blade has to be perfectly parallel to the

Parallelism of the sawblade with the saw table's miter slot is essential for smooth, accurate crosscuts. To test for parallelism, the author rotates the blade by pulling on the motor's V-belt, and he listens to the sound of the sawblade rubbing against a test piece, which is clamped to the miter gauge, to determine whether the slot is parallel to, closer to or farther from the slot at the back of the blade.

path the workplace travels during the cut. This means the miter slot has to be parallel to the blade. When the blade and slot aren't parallel, the sawblade is heeling and has a tendency to recut the workpiece at the back of the blade. This double cut is not only inaccurate, but also dangerous because the back of the blade can lift the binding workpiece and kick it back.

The first step is to test the saw's alignment. Raise the blade as high as it will go and clamp a piece of wood to the miter gauge; a ¾x2x12 piece is big enough. Crosscut the test piece and unplug the saw. Now, slide the miter gauge with the test piece still clamped to it next to the front of the sawblade, and rotate the blade by hand-turning the belt or using a motor pulley. Don't grab the blade because your hand may deflect it. As you rotate, one or two teeth will rub against the wood the hardest, making the loudest sound. Mark those teeth and slide the test piece to the back of the blade (see the photo above). The same teeth that rubbed against the workpiece at the front should rub against it at the back, making the same sound. You may have to move the piece to the front and the back several times to test the sound. If the sound is the same, the table slot and the blade are in alignment and you will not have to make any adjustments. If you get a louder or softer sound at the front than at the back, the distance between the blade and the slot will have to be increased or decreased accordingly.

Realigning the blade parallel to the miter slot is fairly straightforward and involves rotating the trunnion relative to the table. Most contractors' saws have four bolts, two in front and two in back, that secure the trunnions to the underside of the table. On cabinetmakers' saws, such as the Delta Unisaw, the saw table is usually secured directly to the saw's shell or frame rather than the trunnions. In either case, the bolts must be loosened, with one of the front bolts left a bit snug to act as a pivot point for the top—the right front bolt if the top must be rotated clockwise and the left front bolt for counterclockwise. Also, the trunnion lock (if your saw has one) should be tightened and the back trunnion should be clamped, as described earlier, to keep the two trunnions in alignment during the operation.

To rotate the trunnion assembly, a wooden wedge is driven between the trunnion and the table casting at the back of the saw, as shown in the top photo on the facing page. This is the most civilized method, but if there isn't room for a wedge, you can use a pry bar or a rubber mallet to move the trunnion. If the mallet isn't effective, use a hammer. Put a piece of wood on the trunnion and pound the wood; don't hammer directly on the saw or you could crack the castings. Make a slight adjustment and slide the test piece by the blade as you did earlier. Keep rotating the trunnions until the sawblade bears against the test piece and sounds the same at the front and back. When you're satisfied, tighten the bolts, plug in the saw and make another test cut to make sure the saw isn't double cutting. It may take several attempts, but stay calm and take your time. Once the slot in the top is aligned with the blade, you should, theoretically, be able to crosscut with the miter gauge in either slot. Unfortunately, it's my experience that the slots in many saws aren't perfectly parallel to each other. For this reason, you should employ the slot you use most often to make the final test cut.

Rip fence alignment—In theory, the rip fence should be aligned so that it's perfectly parallel to the blade. But in practice, it works best if the fence is slightly farther from the back of the blade than from the front. This prevents the wood from binding between the blade and the fence if the workpiece warps as it's being ripped.

By lowering the sawblade below the table, you can use the same test piece used for crosscut alignment to set the rip fence. After loosening the bolts that lock your fence's angle relative to the guide rail, set the miter gauge with the test piece at the front of the saw and lock the rip fence against it. Then, slide the test piece until it's over the back of the saw's throat plate. There should be about 0.015 in. (about 1/64 in.) clearance between the test piece and the fence. To gauge the amount of clearance, use a feeler gauge, as shown in the middle photo on the facing page, or a dollar bill folded over twice. Finally, tighten the fence's bolts and make a test cut.

Feedback from the workpiece—Once you've tuned up your tablesaw, it's worthwhile to get into the habit of checking its accuracy often, especially if you have an important job that requires great precision or if the saw has been moved. This accuracy check takes only a few minutes and a single cut on a scrap of wood. Just clamp a test piece, like the one used to check blade-to-slot alignment earlier, to the miter gauge and cut it in half. Unclamp the piece, put the two halves back together the way they were before the cut and mark both with an X through the saw cut. Now, flip one piece so that the X faces the opposite direction and match the two pieces back together, as shown in the bottom photo on the facing page. With the pieces either on edge or lying flat, the saw cut should match as well as it did before one piece was reversed. Any error that is present will be doubled and a glance at the test piece will show you which adjustments are still good and which must be redone. For instance, if the test cut is off with the pieces lying flat, only the squareness of the blade to the table is off and needs adjustment. The test piece also shows the direction in which you'll need to make corrections, as well as how much of an adjustment is needed. □

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