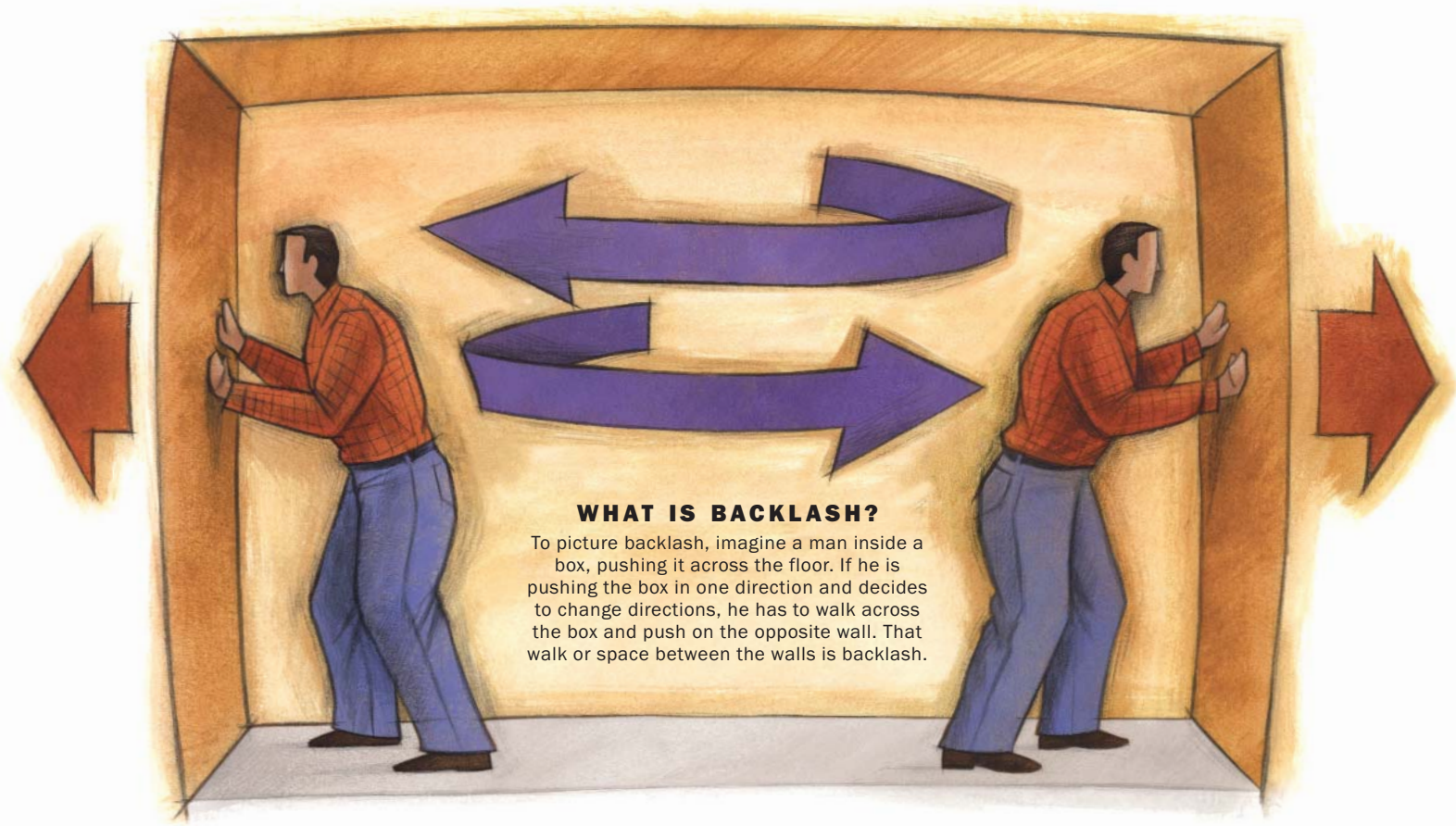
Fight Backlash

Taking the slop out of machine adjusters makes for more accurate work

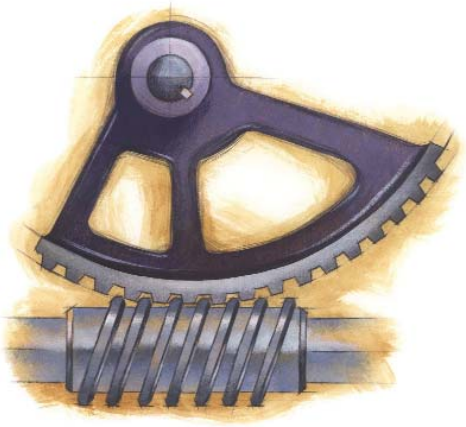
BY GEORGE WALKER



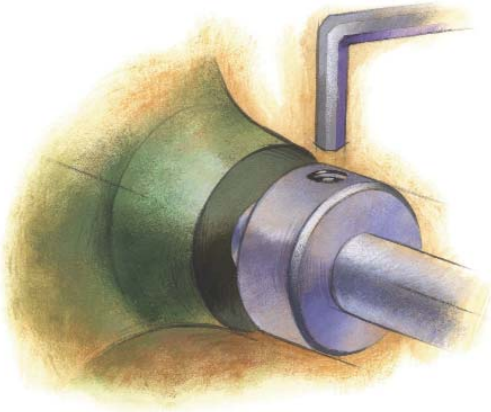
WHAT IS BACKLASH?

To picture backlash, imagine a man inside a box, pushing it across the floor. If he is pushing the box in one direction and decides to change directions, he has to walk across the box and push on the opposite wall. That walk or space between the walls is backlash.

Tracking down loose adjusters



WORN GEAR TEETH
Rotation of the worn gear pushes against the gear segment, causing the two parts to wear over time, creating more dead space and backlash.



LOOSE COLLARS
The vibration caused by normal wear and tear on machines can cause setscrews to rattle loose.

WORN PINS
The pin that holds the adjusting arm on any machine can wear away, causing the adjusting arm to slide around. The easy fix is a new pin.

When I served in a traditional machinist apprenticeship nearly 30 years ago, apprentices were expected to pay their dues, which meant running old, worn-out machines and completing jobs the more experienced journeymen didn't want to fiddle with. I manned an ancient, dilapidated lathe that had spent its better years in Brazil. One journeyman, the cigar-puffing Dom, took me under his wing. He could run rings around me on a lathe, simultaneously whipping up sardine and cheese concoctions for both of us. Dom enjoyed watching me struggle with that old machine, occasionally offering strings of Portuguese curse words that he thought the lathe might remember. I never developed a fondness for sardines, but I did learn solid fundamentals. One of them was how to overcome backlash, a common problem that occurs in machine and woodworking shops alike. You may have a jointer, a tablesaw, a planer or a handplane that has a temperamental streak, that occasionally requires a little voodoo or that is just plain evil. Backlash may be the root of the problem.

Backlash is a necessary evil

Backlash is defined simply as the play between moving parts, such as gears or threads, and is most noticeable when changing directions. Although backlash is usually associated with old or worn machines, it's actually a necessary part of any machine design. Without the play, or clearance, between moving parts, mechanisms would seize up, shafts wouldn't turn, tables would not tilt or adjust. Backlash becomes a problem when that play is excessive—typically resulting from loose-fitting threads, gears or other mechanical connections—and often shows up as slop in adjustment mechanisms like the crank handles on a tablesaw.

To illustrate backlash, imagine a man inside a large, overturned box. If the man wants to move the box to the right, he must walk to his right and push on that side. If he wants to push left, he must step back over to the opposite wall before he can make the box move left. The gap he must traverse is backlash. It is a dead spot: Although the man is moving, the box is not. This is why a threaded shaft that is worn may feel like it has a mushy or dead spot when you change directions.

Backlash also can cause false readings on an adjustment scale, such as planer blade height. The scale may indicate that you moved the blade 1/32 in., yet the blade cuts nothing, or, worse yet, it suddenly bites off 1/8 in. It can plague the tilting table on a bandsaw or drill press, causing the table to shift or drop unexpectedly. The pattern here is loss of accuracy or pesky shifting of cutting tools, tables or fences. If a machine has adjustments driven with a screw or a linkage with moving parts, backlash may occur. Almost any machine in the woodshop can be affected. You might not see symptoms as drastic as these, but backlash can make it increasingly difficult to make fine adjustments on a machine or require you to make more trial cuts.

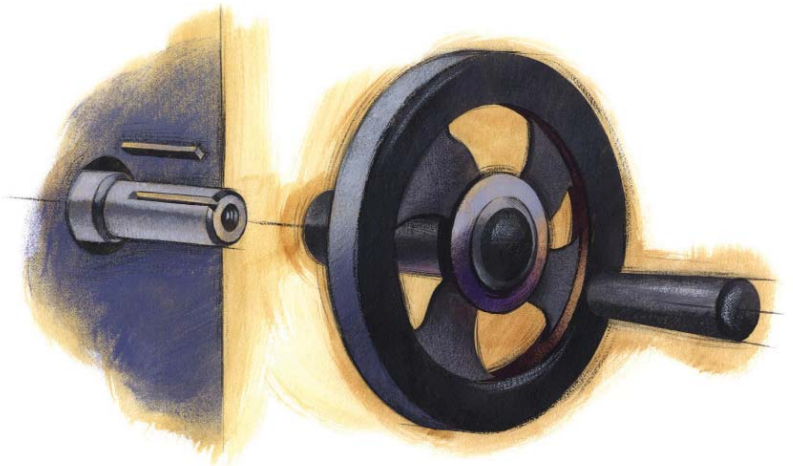
Although backlash is usually associated with old or worn machines, it's actually a necessary part of any machine design.

But there are ways to overcome the effects of backlash once you understand what causes it.

What causes backlash?

The most common cause of backlash is normal wear and tear. In a woodworking shop, sawdust is inevitable, and it works its way into the threads or moving parts of a machine. Most wear is caused by contamination and a lack of lubrication. Sawdust is pesky on both counts because it is a contaminant that soaks up lubricants. As the shaft and nut wear, the amount of dead space that must be traversed increases. You find that you have to turn the shaft further before you feel the threads reengage.

To transfer motion from a crank handle to a cutting tool, there may be a series of shafts, bearings, connecting links, gears and slides. Any of these can vibrate loose or wear out and add play. Loose connections create excessive backlash in a slightly different manner. Think of an adjustment mechanism as a metal chain. For



WORN KEYS
Over time, keys may become round or misshapen, creating a rattle and looseness in the adjustments.

PLAY IN ADJUSTER
The adjuster on this handplane has slop in the adjustment because the link fits loosely in the adjustment knob's groove.

Drawings: Brian Jensen

TROUBLESHOOT A TABLESAW

REPLACE WORN KEYS

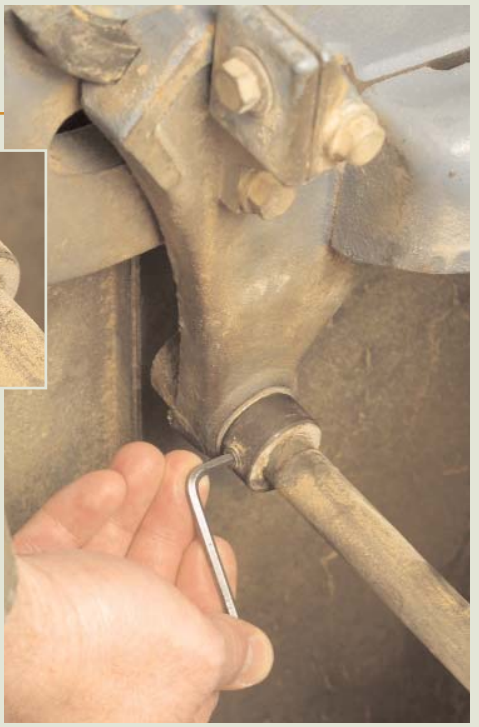
On this tablesaw, the handle itself has slop. Begin inspection by loosening the setscrew on the adjusting wheel and remounting it.

Pull things apart. *With the handle removed, you see that the key that locks the handle to the adjusting rod has worn out.*

Out with the old. *Clean and lubricate all of the parts, then slide a new key into place, which should eliminate any slop in the adjustment.*

TIGHTEN A LOOSE COLLAR

Inside this tablesaw, a setscrew has worked itself loose and allowed the collar to loosen (above), which creates slop in the height adjustment.



that chain to transfer motion, the links must be in tension. Motion applied to a crank transfers power when all mechanical links are pulled tight; until then you are just taking up slack.

Backlash also can be inherent to the design of a tool. Loose tolerances and sloppily fitting machine parts are typical indicators of poor quality control in manufacturing. Woodworking machines are not all born equal; some, unfortunately, start life with excessive backlash. A good, solid machine with minimal play will more than make up for differences in price over the life of a tool. The old phrase, "You get what you pay for," often is true where backlash is concerned.

It also is important to understand that adjustment mechanisms are designed with a twin role. The primary purpose is to make fine adjustments. But they also act as support when all of the parts are engaged and in tension. Adjustment cranks often are equipped with a lock or brake. If you use a lock but ignore whether the mechanism is in tension, it is like stopping a car with a hand brake only. You compromise much of the stability built into the machine.

Preventing and handling backlash

What can be done to remedy the situation? Short of going out and buying a new machine, you should be able make some minor corrections to reduce backlash. You also can develop work habits that minimize the effects of backlash.

Small adjustments can have a major effect—Excessive backlash usually is caused by several loose or worn parts, so correcting even one or two can give you good results. Give the machine a thorough once-over, which will help you find problems and give you a clear understanding of how motion is transferred.

Always begin by disconnecting the power source and removing cutting tools. Remove inspection plates and guards, then vacuum out debris. Put the adjuster through the entire range of motion; reverse directions back and forth at intervals all along the range. Feel each part of the mechanism separately with your hands—push up, push down and push side to side—and look for any play or looseness. Carefully check all mounting bolts, setscrews, keys or pins, making sure they are solid and tight. Before tightening loose bolts, disassemble and remove any sawdust and make sure contact surfaces are free of burrs. When possible, I like to replace standard screws with Allen screws because they are easier to adjust. Be sure to check for missing bolts, broken springs or worn connecting pins.

This is also a good opportunity to test the locking mechanism to see how solidly it locks in the zone where you make the most frequent cuts. Once minor repairs are complete, put the mechanism back through the entire range of motion, and be sure to lubricate parts before replacing covers.

There are a number of potential sources of backlash that are beyond the scope of this article. However, I would suggest only moving forward on these repairs—the replacement of feed screws, bearings and gib adjustments on slides, for example—based on your confidence level and the availability of manuals and parts.

Working around backlash—Several techniques can negate the effects of backlash. First, avoid taking a cut while adjusters are in the dead zone. Make sure there is tension in the mechanism before locking down an adjustment or cutting anything. In practice, this means simply being aware of the feel of the mechanism when it is solidly in tension. If you want to reverse just a small amount, crank

Photos: Tom Begnal

CORRECT BACKLASH IN A BLOCK PLANE

Feel the dead space. *The depth adjustment on this handplane experiences severe backlash because the knurled knob is narrower than the adjuster it keys into.*

Reduce the gap. *Close up the slot on the adjuster with a pair of pliers or vise grips.*

the handle back anywhere from half to a full turn or until the threads fully reengage. Then creep back up to the setting you want, making sure it feels solid.

Make a habit of using the machine's normal forces to keep adjusters in tension. Think back to when you inspected the mechanism. You should have a clear idea of how it works and how forces act upon it. Usually you have the force of the wood resisting the blade, plus gravity itself. On a tablesaw these forces tend to push down; on a planer, whose cutterhead is above the work, the forces push up. This affects how you should make adjustments. Even if the mechanism is in tension, it is in tension in only one direction. If those normal forces push from the opposite direction, they can push the mechanism into the dead zone. Think of towing a car with a chain: If you tow down a hill, gravity may take over, and the car you are towing can drift forward. On a tablesaw, adjustments always should be made uphill. If you take the blade too high, back off a turn or two and approach back up. This keeps the mechanism in tension and avoids the dead zone. The blade responds to the smallest adjustment of the crank handle, and the forces from cutting and gravity cannot cause the blade to shift.

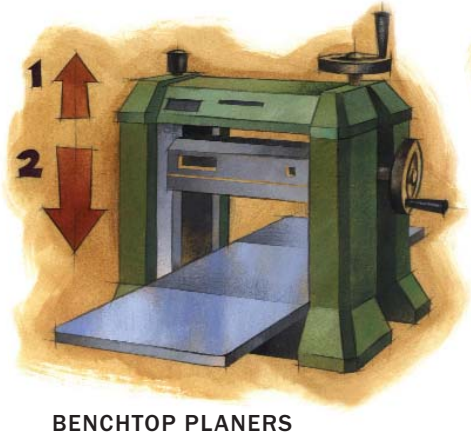
It's good practice to take a look at sloppy machines, because more often than not, excessive backlash can be corrected. But also remember that some backlash is inherent in adjustable machines, so you need to develop habits that use backlash to your advantage. The methods become second nature with only a little practice. Once the techniques have been mastered, backlash should cease to be a frustration, and you don't have to learn to curse in Portuguese. □

George Walker builds furniture in Canton, Ohio.

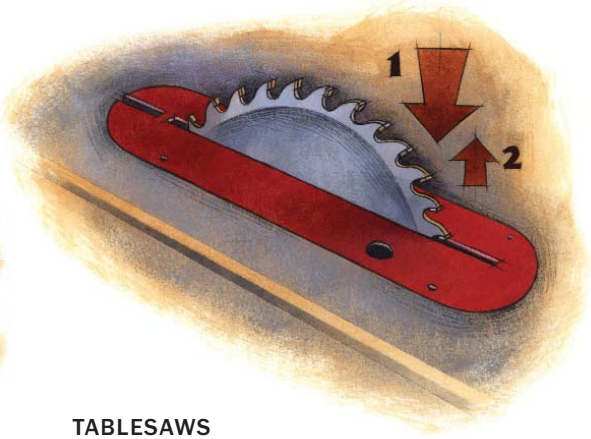
Living with backlash

No matter what you do, some backlash is inevitable. Understanding how backlash works and adjusting your habits to work around it will keep you cutting square and smooth.

HANDPLANES
To deal with backlash in a handplane, back off the blade more than necessary, then turn it forward a bit to get your final setting.



BENCHTOP PLANERS
The carriage should be lowered into the cut so that the pressure is against the thread on the adjuster.



TABLESAWS
When working at a tablesaw, adjust the blade by raising the arbor assembly to the desired height instead of lowering it. If you need to lower the blade, lower it more than necessary, then raise it to final height.