

Left: This truing stand from K & L Supply is a good value; it can be used as a balance stand as well. Notice the armature stored on the right-side support. Center: Here the armature is set to radial runout. Notice that the reading is taken from a horizontal surface on the rim, rather than at the edge of the flange. This keeps variations in flange shape out of the equation. Right: The armature has been set to measure lateral runout. Notice that the reading is taken at the base of the rim flange to minimize the effect of irregularities in the flange's shape.

offending zone and tighten it in a small increment, such as a half-turn. Tighten the next spoke on both sides of it slightly less, maybe a third of a turn. Tighten the next spokes away even less, perhaps a quarter-turn. Finally, tighten the next spokes out (now three spokes away from the first) an even smaller fraction of a turn. This method distributes the influence of your efforts evenly, so that it doesn't change the lateral runout, instead of causing an acutely focused shift that is likely to create other irregularities and send you chasing your tail in an endless series of corrections. Next, find the "low" spot and reduce spoke tension in a similar pattern.

This is the kind of thing you will develop an efficiency-boosting feel for with practice. But novices should make small adjustments, even though that may mean making a lot of them. It will still take far less time to do it right the first time—gradually—than to get into—and then back out of—a cycle of overtightening/overcorrections.

Now recheck the radial runout. Is it still

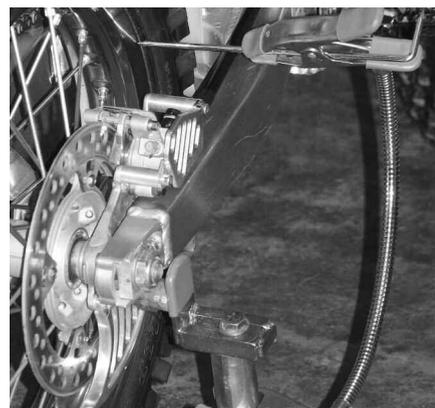
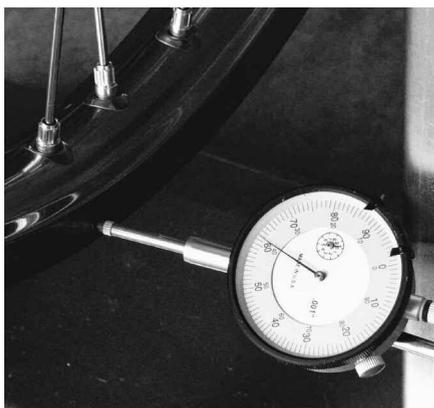
within your margin for error? If not, repeat the previous steps and check it again. Keep doing this until your wheel shows less radial deviation than two millimeters.

Now, it's time to switch the angle of attack, although the battle tactics remain the same. Set your runout detector to check the lateral deviation and rotate your wheel to find the place where it is furthest from the axial centerline. For the sake of simplicity, we'll call that the lateral "high" zone, and in this example let's say you've found it on the *right* side of your rim right next to the rim lock hole. To pull it back toward the center, you'll need to tighten the spokes on the *left* side in that zone while loosening the spokes on the *right* side. Start with the left spoke closest to the middle of the high zone, and tighten it a small amount. Proceed to its next left neighbors on both sides, and tighten them a little less. Continue to spread your influence to the outer edges of the high zone, reducing the amount of rotation as you get further away from the middle, and tightening only the spokes on the left side.

Repeat the same technique while loosening the right side spokes.

Recheck the lateral runout. Next, determine the lateral "low" zone (the *right* side) and make the necessary adjustment, by loosening in the same way. Repeat this process until the rim has less lateral deviation than two millimeters. Note that it's possible by making all adjustments to only one side (for instance, always tightening the left side, rather than tightening/loosening) to make your wheel perfectly even in the left-right dimension, but with the rim centerline *offset* laterally to one side of the hub's axial centerline.

For more precision in achieving this alignment of centerlines, depending on how your wheel is mounted for this operation, you may be able to flip it around in your wheelstand or take measurements on both sides from positions exactly the same distance from the hub's centerline; a straight-edge laid across the flanges might allow this. Note, however, that all *hubs* are not necessarily symmetrical in their axial



Left: Here, a dial caliper is set to measure left-right runout. Center: During the truing process, each spoke is turned only a small amount at a time. Many tiny adjustments get the job done more quickly than larger moves that upset the wheel's shape elsewhere, or set up a cycle of overcorrections that deforms the rim. Right: This simple yet effective truing setup required only a pair of clamps connected by an articulated stalk, about five bucks at a local hardware store. One end grabs the rear workstand, the other end holds a piece of metal stock up next to the rim.