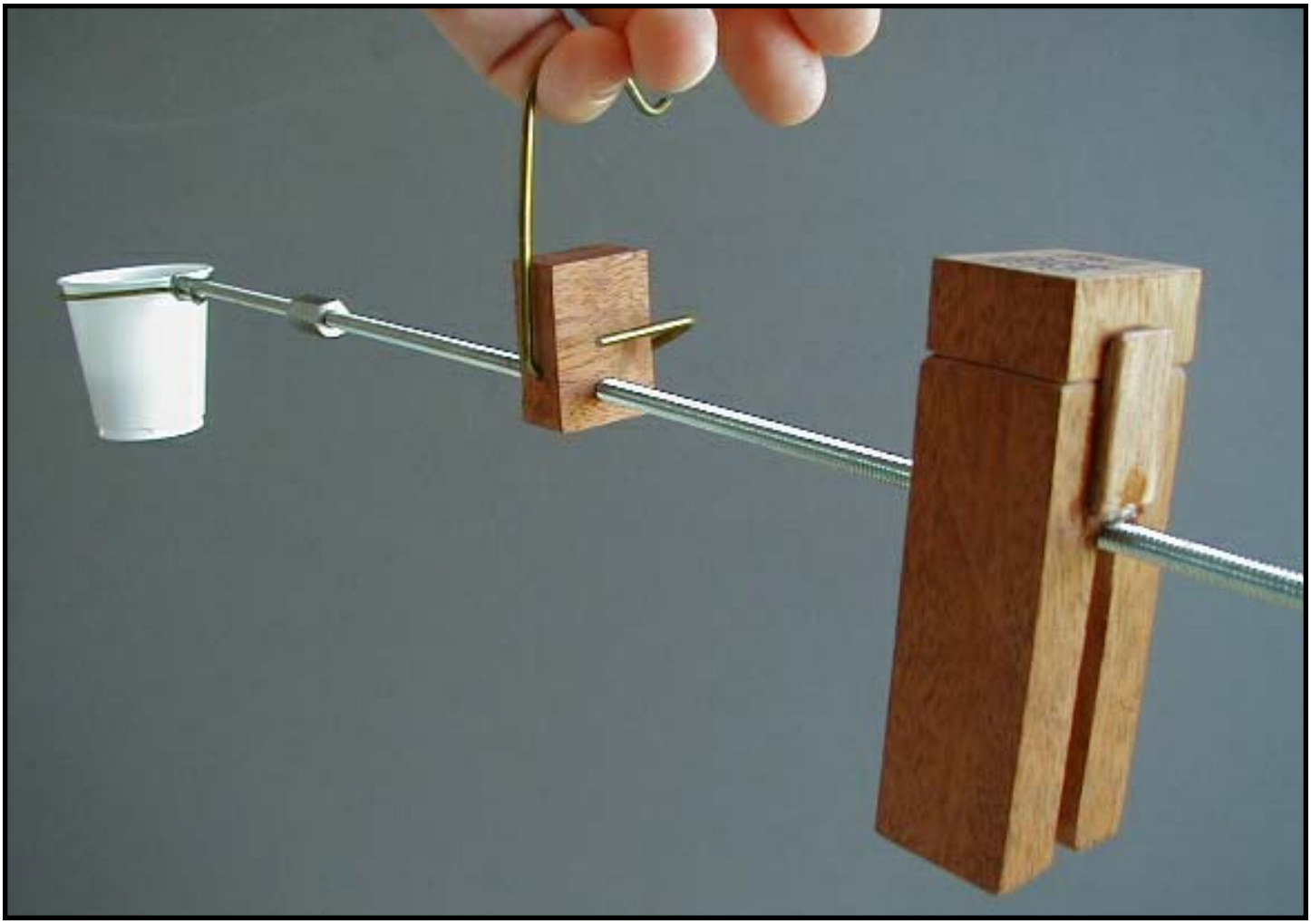


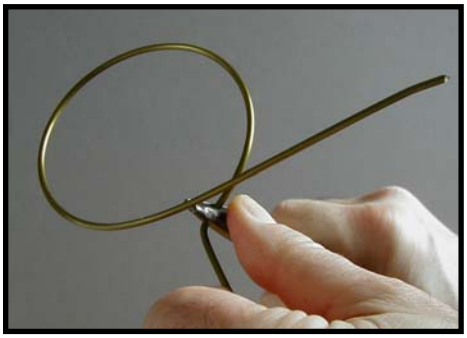
Accurately Measuring Epoxy Proportions with a Shop-Made Balance

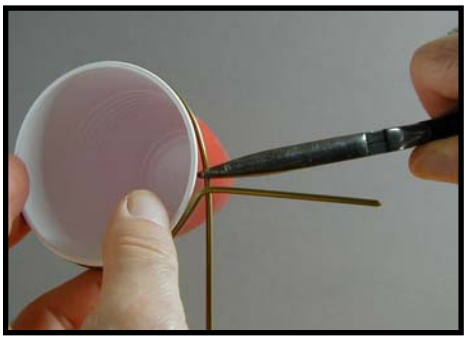
By Philip Zhivago

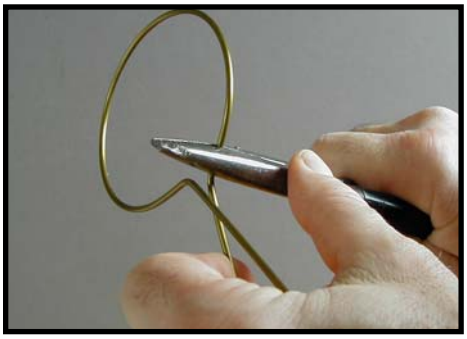
Using this balance, which you can make yourself, you can accurately and conveniently measure the amount of epoxy that you want. No more oversized batches. You can measure out a thimbleful if that's all you need. No more sweating over the accuracy of the mix when the pump spits out an air bubble and lurches down.

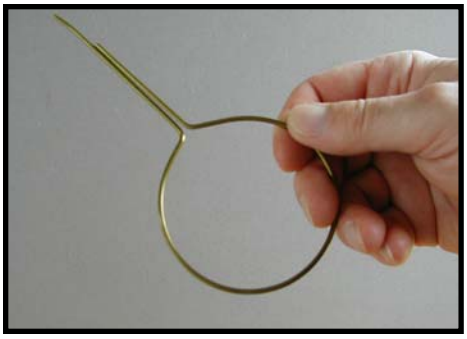
To measure out a batch, put the amount of resin you expect to use into the cup. Place the resin weight on the threaded rod and adjust its position until it counterbalances the resin in the cup. Place the appropriate catalyst weight (for the type of catalyst you are using) on top of the resin weight. Add catalyst to the cup until the balance is horizontal again. That's it. Stir away.

The photographs in this article show two different balances. The smaller one, with the wood parts made from mahogany, uses 3-ounce disposable cups, available in grocery stores. It has measured the epoxy for dozens of projects, and has been very satisfying to use. The larger balance takes an 8-ounce cup and is made from spruce.





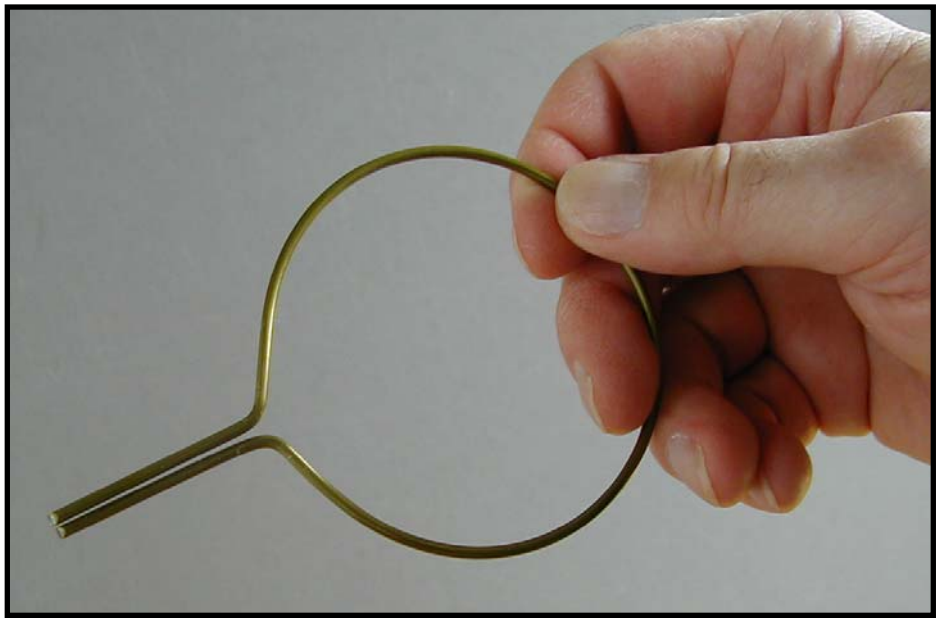




Making The Cup Loop

The loop that holds the cup is made from a coat hanger. The heavier the wire, the better. You will need something to bend the loop around, a bit smaller in diameter than the cup, to allow for springback. Bend a length of coat hanger wire around the form, a bit more than a full turn. Adjust the bend slightly to fit the cup, if necessary.

Using pliers, bend one leg out, to run along the threaded rod. Place the wire around a cup. Grip the wire at the right place to bend the second leg. Remove the cup and bend the second leg into place. The cup should drop in easily, and seat solidly on its rim.



Temporarily attach the loop to a two-foot length of threaded rod, using nylon wire ties, some wire, string, or whatever you've got. Test it to make sure the cup fits, then epoxy the legs of the loop to the threaded rod.

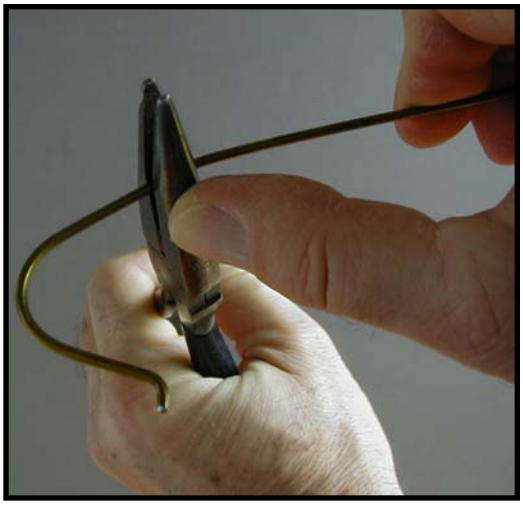
A 10-24 rod is strong enough for a three-ounce cup. A 12-24 or 1/4-28 rod would be better for an eight-ounce cup. A 1/4-20 thread would give up some accuracy due to its coarseness. A 24-TPI rod gives a nice adjustment increment. It is easy to tell when you are in the closest notch to balance, and the precision of the adjustment gives you confidence in the accuracy of the mix. When mixing small batches, this precision makes last-drop accuracy routine.

Making The Pivot

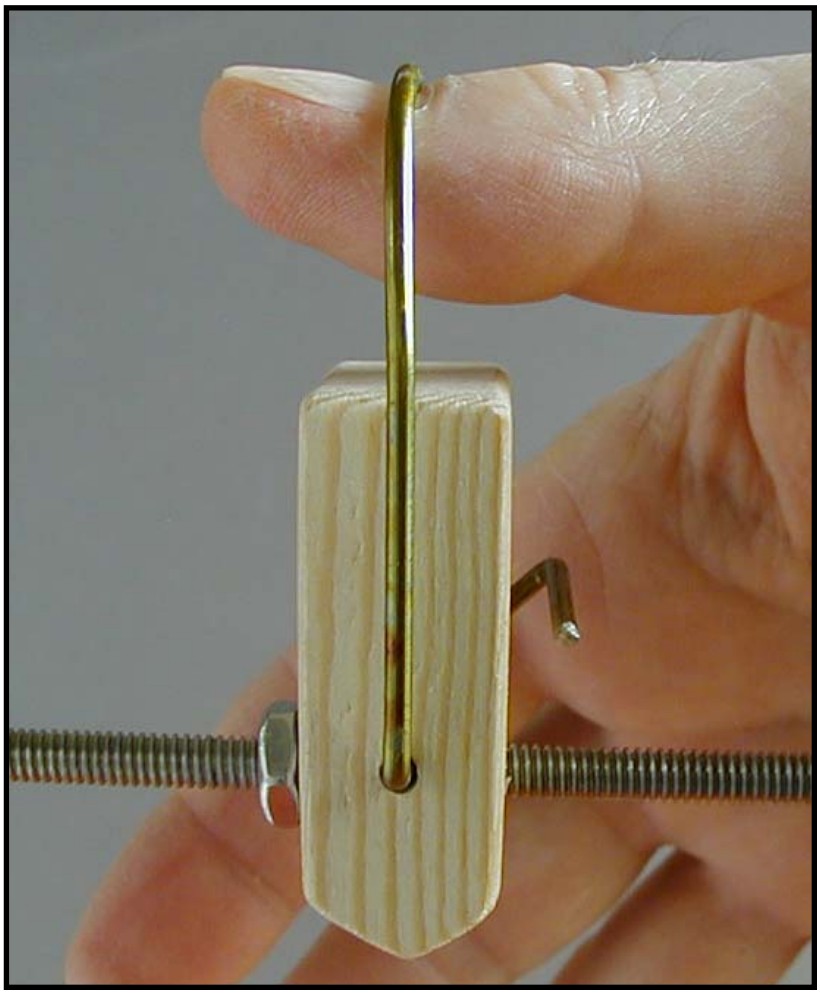
The pivot block is made from a scrap of three-quarter-inch wood, about an inch and a quarter by an inch and three quarters. The bottom is beveled to form an edge that can rest on your finger for rough balancing.

Holes are drilled for the threaded rod and the bent-coat hanger suspension hook. The threaded rod should be as low as practical, and the hook hole just above it.

The hook hole should be just a little bit larger in diameter than the coat hanger wire. The friction this crude pivot provides is helpful in damping the swing, and is easily overcome with a little wiggle for final trim.

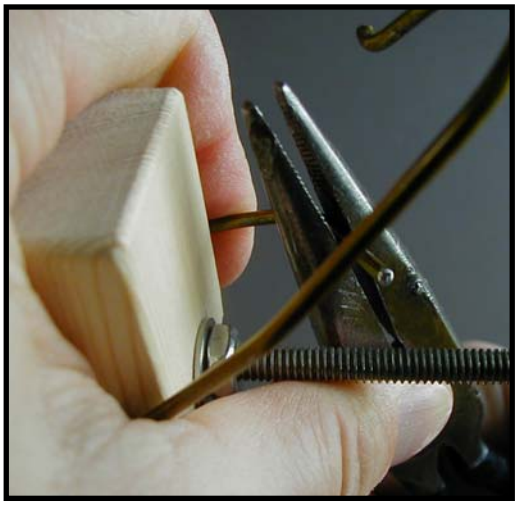


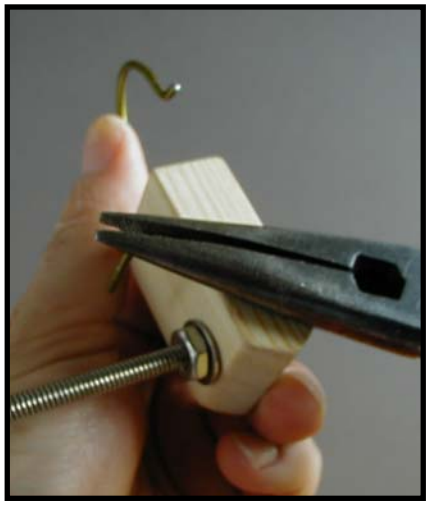
Bend the hook to shape with needlenose pliers to the stage shown, below left. Insert it into the block to test for parallelism. If necessary, tweak the bend at the bottom of the hook until the side of the hook lies parallel to the side of the block, not canted in or out. In use, it is easy to see (just by looking down, without having to crane your neck into an uncomfortable position) when the hook is parallel to the faces of the block, which indicates that the rod is horizontal and in balance.

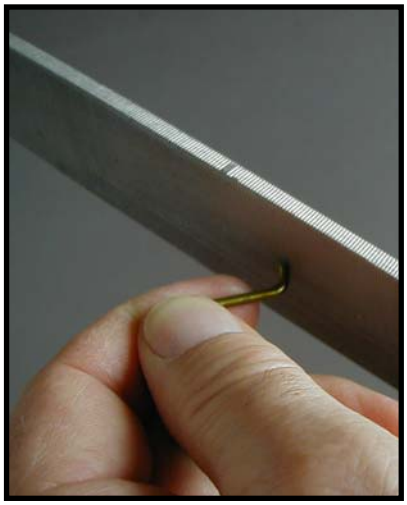


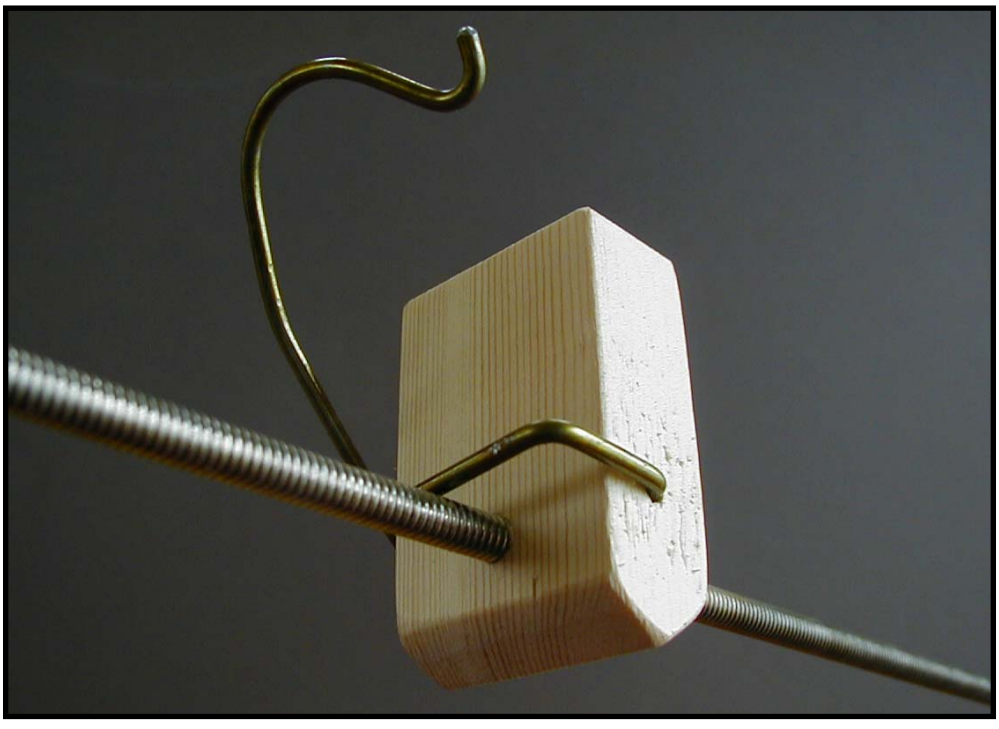
A nut and washer will lock the pivot block in place on the threaded rod, maintaining the zero adjustment and keeping the cup loop in its horizontal orientation.

Then bend the tail stop that keeps the hook from falling out and falling over. A thin, temporary spacer will keep the first tail bend far enough from the block that it won't interfere with the free swing of the balance. The last bend in the pivot hook limits the swing of the hook, keeping it in a handy position, and making it easier to control the balance as you are pumping epoxy into the cup. Adjusting the angle between the hook and the tail will give the hook an equal amount of movement on either side of center.



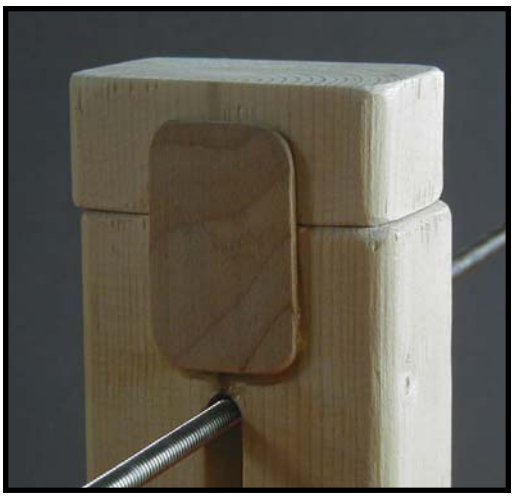


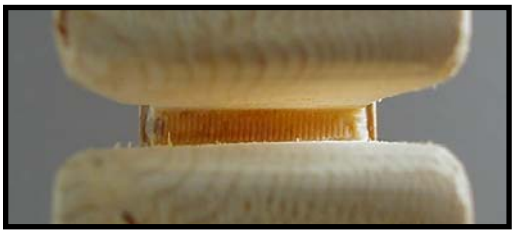




Round off the ends of the coat hanger wire so that you can't snag your protective gloves on the sharp ends.

Making The Weights



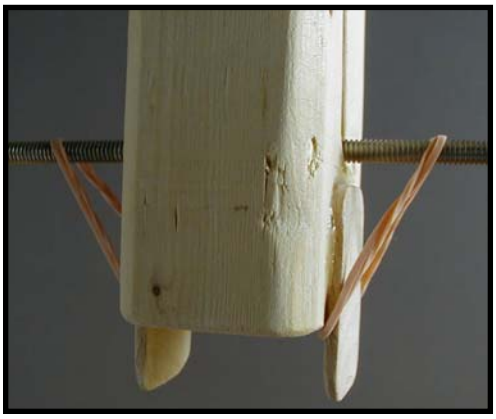


The two weights together should be almost as heavy as a full cup of epoxy. For an eight-ounce cup, it worked out well to use 2x3 spruce, 5 inches long for the resin weight, 1 inch long for the 5-to-1 catalyst weight, and 1.43 inches long for the 3.5-to-1 catalyst weight. The slot should be about three-quarters of the length of the resin weight, so that the center of gravity of the two weights combined is below the rod, keeping the weights upright. There needs to be a thread in the crotch of the slot, to engage the threaded rod and prevent the weight from sliding out of position when the balance tips.

There are a number of ways to create this thread, all a little fussy and none of them clearly superior. Here are my two favorites.

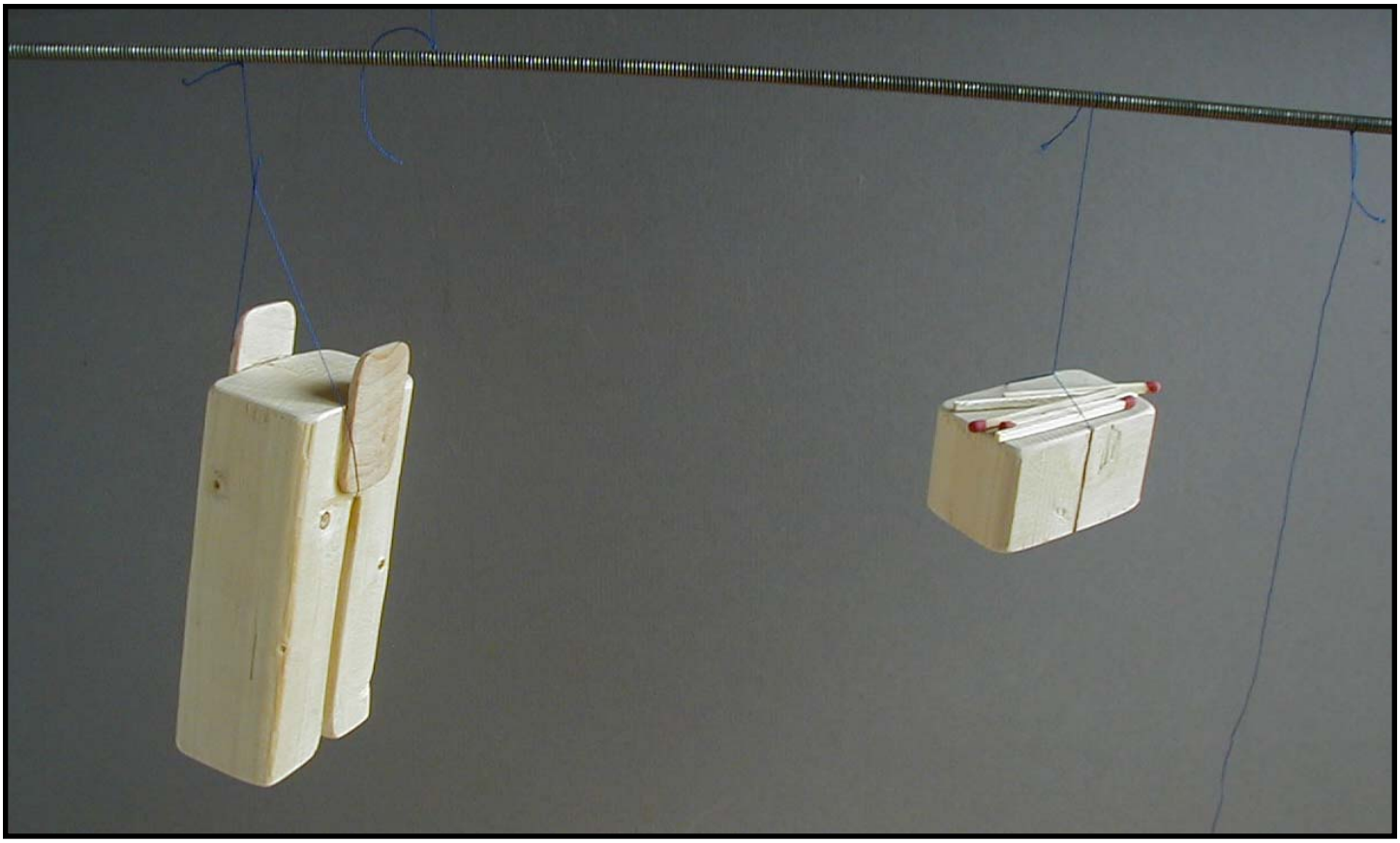
You can drill a hole where the end of the slot will be, using an undersized drill bit, then tap the thread using threaded rod in a drill, and lastly cut the slot. The transition from the saw-cut slot to the thread will need to be cleaned up so that the remaining half of the thread will seat nicely on the rod. This method will work better for hardwood than for softwood.

Or, you can coat a piece of threaded rod with some kind of mold release (I brushed on paste wax with an acid brush), put the rod in place, then create the thread using thickened epoxy. Make sure the epoxy contact is limited to the upper half of the rod, extending the radius at the end of the slot, or the rod won't come out. It is easier to apply the epoxy accurately just outside both ends of the slot, rather than inside it. The rod can be held in place with a rubber band for the epoxying, and a light tap with a hammer will remove it after the epoxy cures.



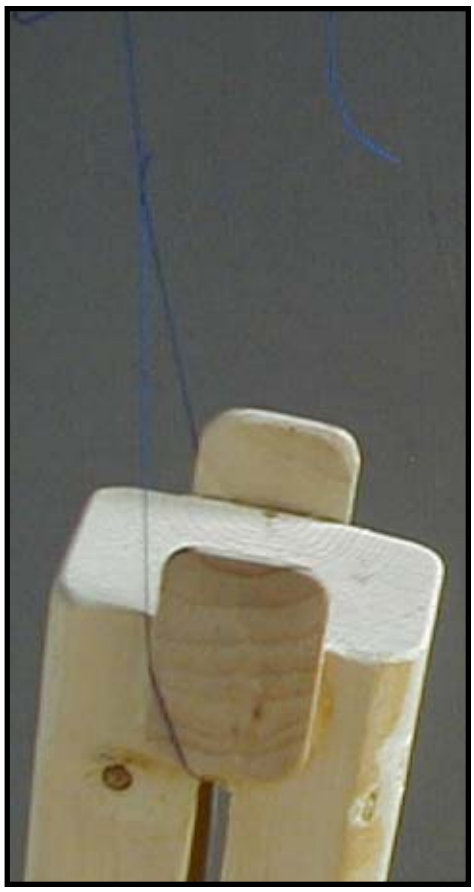
If you decide to experiment with another method of thread fabrication, bear in mind that the thread needs to be simultaneously engaged at both ends of the slot because the weight will shift its load to the uphill end of the slot when the balance tips. If there is only one point of engagement, the weight will disengage and slide down the threaded rod.

The ears above the slot retain the catalyst weight in the correct position--at the same distance from the pivot as the resin weight--and are easily fabricated. I cut these from a paint stirring stick. Epoxy them into position, using a rubber band as a clamp. Remove any squeeze-out from the top of the weight. After the epoxy is cured, a couple of light swipes with a file will give the catalyst weight enough clearance to drop into place.



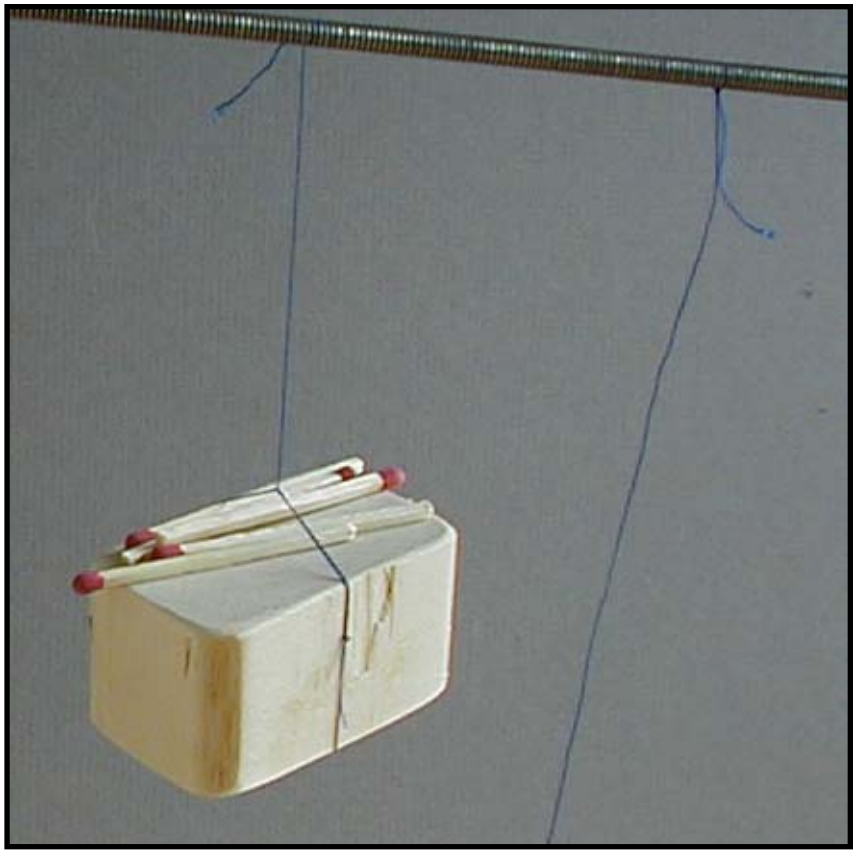
Fine-Tuning the Weights

To fine-tune the weights, I used a balance made from a 3-foot-long 10-24 threaded rod and sewing thread. The rod was suspended from a clamp on a piece of thread, at eye level, with a shelf serving as a horizontal reference in the background. I tied the thread in a figure-eight knot around itself to form a loop that tightened like a noose around the rod and clamp. Then it was easy to adjust the rod into balance by screwing the rod in the right direction through the noose, and checking against the horizontal reference.

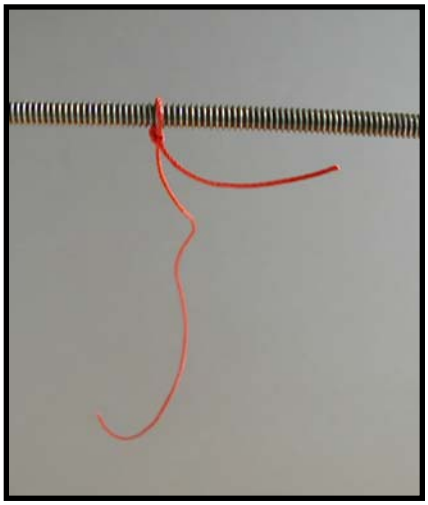


To suspend the large resin weight from the rod, I hung a thread from the rod at 2 inches from the center thread, using a noose. At the bottom, I doubled the thread and tied a figure-eight knot to form an open loop, large enough to hang the weight in it.

To suspend the smaller catalyst weights, I hung threads from the rod at 7 and 10 inches from the center, on the opposite side from the resin thread, providing the correct arm lengths for the weight proportions. The accurately-spaced grooves in the threaded rod made it easy to set the threads at precise distances. I doubled these threads and tied figure-eight knots to make one-inch loops, then pushed the threads through the loops to form nooses that were easily released. These held the catalyst weights nicely.



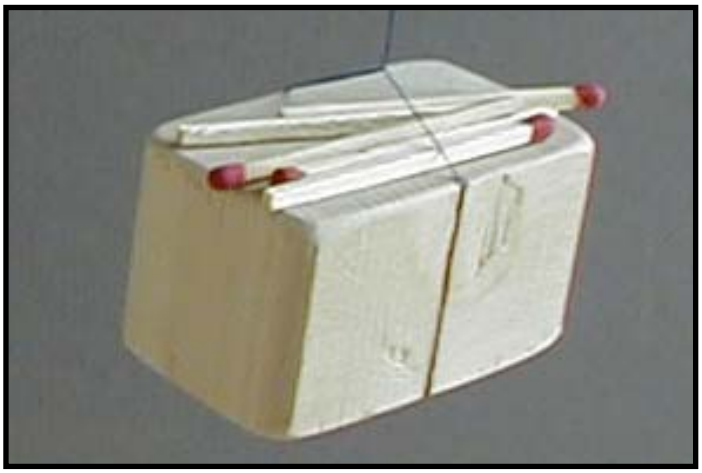
Once all the thread hangers were added, the rod was a little bit out of balance, so I added a piece of string to the light end and adjusted it in and out until the rod balanced again.



Because I had hung my balance from a clamp on a shelf, it was convenient to hook the light end under the shelf--or the heavy end over the shelf--while a weight was removed for lightening.

Both the resin and catalyst weights in these pictures were cut to proportional lengths from the same 2x3, so they were already close to balancing correctly. I added wooden matchsticks to the underweight weights to bring them into balance and get a sense of how much wood to remove from the overweight weights, allowing for the effect of the different lever arms for the two weights. Three matches at ten inches is the same as fifteen matches at two inches (thirty inch-matches each).

After two very light chopsaw cuts off the bottom and a little sanding, the overweight resin weight balanced the 3.5-to-1 catalyst weight. Then a couple of swipes on the beltsander brought the slightly overweight 5-to-1 catalyst weight into balance with the resin weight.

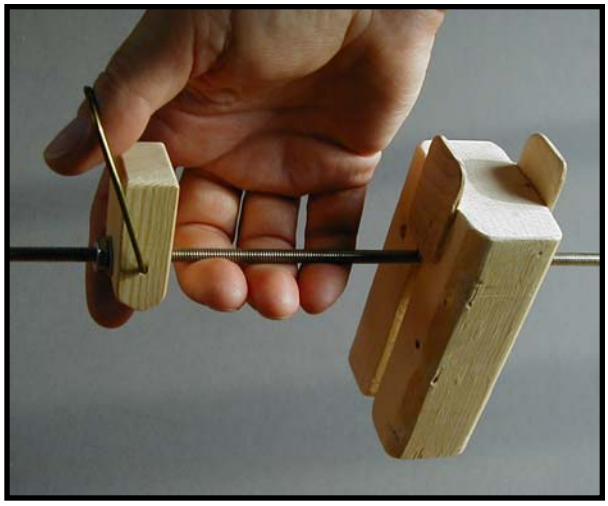


I checked the weights on a fairly accurate commercial beam balance made for kitchen use, and found one weight was within 3% of exact proportion and the other was within less than 1%. And I can't say for sure which balance had the error.

Mark the catalyst weights to remind your helper to use the correct proportions for the catalyst in use.

The fancy typography is obvious overkill. A rough marking pen scribble would have been more appropriate.

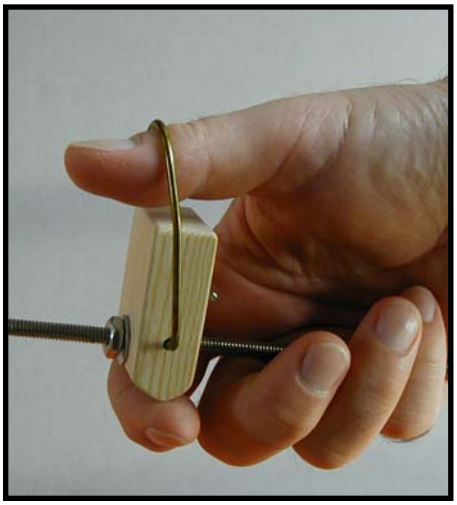
Using the Balance

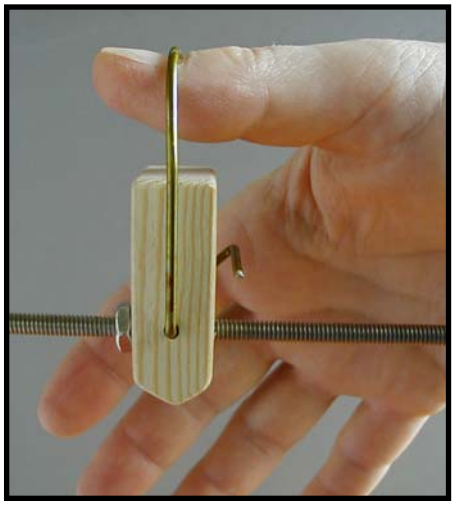


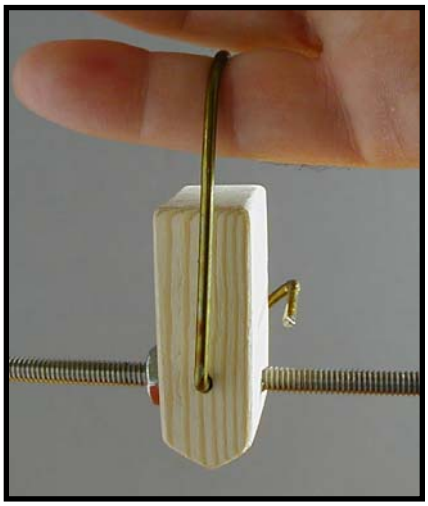
To mix a batch, pump the amount of resin you expect to need into the cup. I usually drop the cup into the loop first, but it doesn't matter.

Position the resin weight to balance the resin in the cup. Resting the pivot block on your index finger and putting your thumb on top of the pivot block makes it easier to handle the out-of-balance rod while you position the resin weight. Once the weight is close to the right spot, switch to suspending the balance by the hook. The threads provide a nice increment of adjustment. Give the hook a little wiggle to overcome the pivot friction when you've got it close. Positioning the weight in the nearest notch to balance is plenty close.

Grasp the balance by the pivot block again and place the correct catalyst weight on top of the resin weight. Begin pumping in catalyst. You should be able to tell when you are getting close to the right amount by the feel of the balance in your hand, and by eyeball estimate in the cup. Switch to the hook again and add the last little bit of catalyst to bring the balance to zero. The proportions are now correct. Mix and use.







Odds and Ends

A optional coupling nut, as shown here, can serve as an adjustment weight, making it easy to accommodate different weights of epoxy vessels. Just bring the balance to zero with the vessel only, by spinning the nut toward the high end.

No adjustment is necessary when you are using cups from the same package, so normally there is no need for it.

If you are mixing very small batches, a modified clothespin (in place of the wire loop) can grip a surprising variety of bottle caps and other small vessels. The rest of the balance ought to be scaled down, too. However, the 3-ounce cup version in the photos will measure out a batch as small as 3/16 of an ounce, about a thimbleful.