spinning daily presents

DIY Spinning Equipment

Handspinning naturally attracts DIYers. After all, if you can make your own yarn, why not make the tools to spin it with?

You might be tempted to try to make a spinning wheel at home (see www.spinningdaily.com for our free Dodec Wheel plans; search "dodec"), but wheels generally require advanced woodworking expertise to run smoothly. Start with more straightforward handspinning tools and work your way up!

Handspinning tools such as a yarn balance, niddy-noddy, or swift involve a lot less work, and they're important for efficient handspinning. The yarn balance discussed here will measure yardage for your handspun as well as commercial yarns. Our versions here use easy-to-find and inexpensive materials such as PVC pipes and yardsticks. More challenging projects in this collection are hand spindles. We've included two sets of directions here, one for drop spindles made with hand tools and a power drill and one for high-whorl spindles that will require a serious workshop. Even if you never make your own spindles, you can learn more about what makes spindles work well as the authors talk about how they designed their earliest versions and how they adapted when they saw what else was needed.

Add to your handmade repertoire with these DIY spinning tools, and remember, *Spin·Off* always has advice on using this equipment.

Spin (and make) happy!

Anne

Anne Merrow
amerrow@interweave.com

Demystify MYSTERY YARNS with an easy-to-make yarn balance

So you have boxes of mystery yarn that came with the loom you just bought for a bargain price. And you've long been amassing unknown cones from guild auctions, yarn trades, and the occasional garage sale. How to use them? Many projects in Handwoven *(and ideas of your own) call for using a variety of specific yarns you don't have. Or, a project calls for a certain yarn in green, but you have an unknown green yarn—can you substitute? If only you knew the yards per pound of the yarn on your mystery cone! If you did, you'd also be able to figure out how many yards there are.*

CHRISTINA HAMMEL

Weavers have long been lucky to have available the McMorran yarn balance to determine the yards per pound of an unknown yarn. To use the balance, you fold a piece of yarn over the triangular cutout with equal yarn length on both sides (see Photo a; for fine yarns note that the balance must be at the edge of a table or counter so the length of yarn can hang freely). Then you trim the ends until the balance becomes horizontal (Photo b). Next, you measure the length of the trimmed strand in inches and multiply by 100. The result is the number of yards in one pound (8" or 800 yards per pound for our yarn; see Photo e).

The equation that is the basis for how the balance works looks like this (if you are not fascinated by math, skip to "Making your own balance"):

$$\frac{1}{3{,}600} \times 3{,}600 = 1$$

1/3,600 represents the weight (in pounds) of the triangle that is missing from the balance. It also represents the weight of the yarn that is responsible for bringing the arm into balance. The yarn's length (in inches) equals the amount found in 1/3,600th of a pound.

When that yarn's length is multiplied by 3,600, the result is the number of inches in one pound of that yarn. The inches per pound are then divided by 36 to find the yards per pound. For an 8" strand, for example, 8" × 3,600 divided by 36 (inches per yd) = 8 × 100 or 800 yards per pound. Users are therefore instructed simply to multiply the yarn's length by 100 to find the yards per pound.

Christina Hammel of Southampton, Massachusetts, teaches workshops and is the Director of Weaving at the Hill Institute.

Making your own balance

The bamboo skewer (or wooden dowel) balance works on the same principle as the McMorran Balance with only a slight difference. Start with a #12 Extra Thick Bamboo Skewer sold in grocery stores (trim off the pointed ends, leaving it about 11" long) or use hardwood dowels, 3⁄16" in diameter by 12" long, sold in craft stores.

Fold a 12" piece of yarn (such as 5/2 pearl cotton) in half and tie the ends in an overhand knot. At the looped end, form a lark's head knot and slip it around the bamboo skewer; see Photo c. Position the lark's head knot at the center so that the bamboo skewer rests in a horizontal position when you hold onto the knotted end. Glue larkshead in place.

Now, instead of *removing* a triangular piece equaling 1/3,600th of a pound at one end of the skewer, *add* a piece of yarn that weighs 1/3,600th of a pound (the control yarn). To determine the amount of a control yarn to add, multiply the yards per pound of that yarn by 36 to get the number of inches per pound and then divide by 3,600: for 5/2 cotton at 2,100 yards per pound, for example, there are 75,600"/pound, so a piece measuring 21" should be used:

$$\frac{1}{3{,}600} \times 75{,}600'' = 21''$$

You can use 5/2 cotton or determine the appropriate length for another yarn.

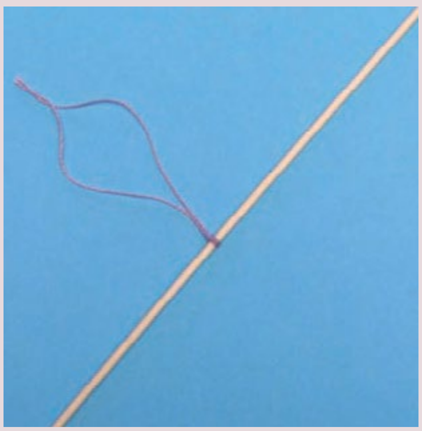
Using the skewer balance

To determine the yards per pound of an unknown yarn using the bamboo skewer balance, start by taping a pencil or another skewer onto a flat surface such as a table or a countertop with at least half of the pencil extending out from the surface so the balance can move freely (Photo d).

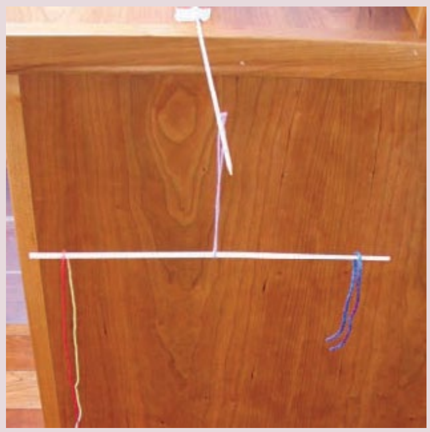
Slide the loop of yarn at the center of the balance over the pencil. Fold the control yarn in half and form a lark's head knot at the center. Slip this knot around the bamboo skewer and position about 1" from one of the ends. At the same distance from the other end, attach a long piece of the unknown yarn. (You can use

a. Place a strand of the unknown yarn in the triangle of the balance (let the yarn hang off the edge of table or counter).

b. Trim off small pieces of the yarn until the balance swings to become horizontal.



c. Attach a cord to the center of the skewer with a lark's head knot.



d. Place the control yarn on one side, the unknown on the other; trim until balanced.

e. Measure the trimmed yarn.

Yards to the unit

Cotton, Tencel, rayon	840
Spun silk (English system)	840
Spun silk (French system)	496.5[1]
Wool (worsted)	560
Wool (woolen, Philadelphia system)	300[2]
Wool (woolen, American system)	1,600
Linen (hemp, jute, and ramie)	300[3]

[1] I reached this number by converting 1,000 meters in one kilogram to yards in one pound.
[2] Davison's *A Handweaver's Pattern Book* lists 300. Elizabeth's Fiber & Yarn Store gives 256.
[3] also from Elizabeth's Fiber & Yarn Store.

a lark's head to secure this yarn, too, to prevent the yarn from sliding off the end of the skewer.) Trim off the ends of the unknown yarn until the balance comes to rest in a horizontal position as in Photo d. Pull the trimmed yarn off the end of the skewer, measure its length in inches as before (Photo e), and multiply this number by 100. The answer is the number of yards per pound.

Other applications

Once you know the yards per pound of the unknown yarn, you can figure out the yarn's size (3/2 cotton, 8/2 wool, etc.). You'll need some additional information: yarn type, yards to the unit, and the number of plies. What is meant by "yards to the unit"? Every type of yarn (cotton, wool, linen, etc.) has a unit of measurement per pound. Cotton yarn is measured according to the number of 840-yard hanks that weigh one pound (see the Yards to the Unit chart).

For example, a singles No. 1 cotton yarn (1/1 cotton; the top number is the size and the bottom number is the ply) has 840 yards per pound. 10/2 cotton is ten times finer so it has ten times the yards per pound (840 × 10), but since it is 2-ply it reaches one pound twice as quickly (divide 8,400 by 2 = 4,200 yd/lb).

If you have an unknown 2-ply cotton yarn that you have determined with the balance is 1,250 yd/lb, use this formula to determine its size:

$$\text{yd/lb} = \frac{\text{size} \times \text{yd to the unit}}{\text{ply}}$$

or

$$\text{size} = \frac{\text{yd/lb} \times \text{ply}}{\text{yd to the unit}} \qquad \text{size} = \frac{1{,}250 \times 2}{840}$$

size = 2.97 or 3/2 cotton

Resources

Davison, Marguerite Porter. *A Handweaver's Pattern Book*. Swarthmore, Pennsylvania: Marguerite P. Davison, 1977, p. ix.

Grandor Industries (McMorran Balance), 1613 Baccharis Ave., Carlsbad, CA 92009, (760) 929-8581, egdjackson@webtv.net.

Griswold, Alice. *Weaving Solutions: Shortcuts, Tips and Ideas for the Handweaver*. Milan: A & G Publications, 2000.

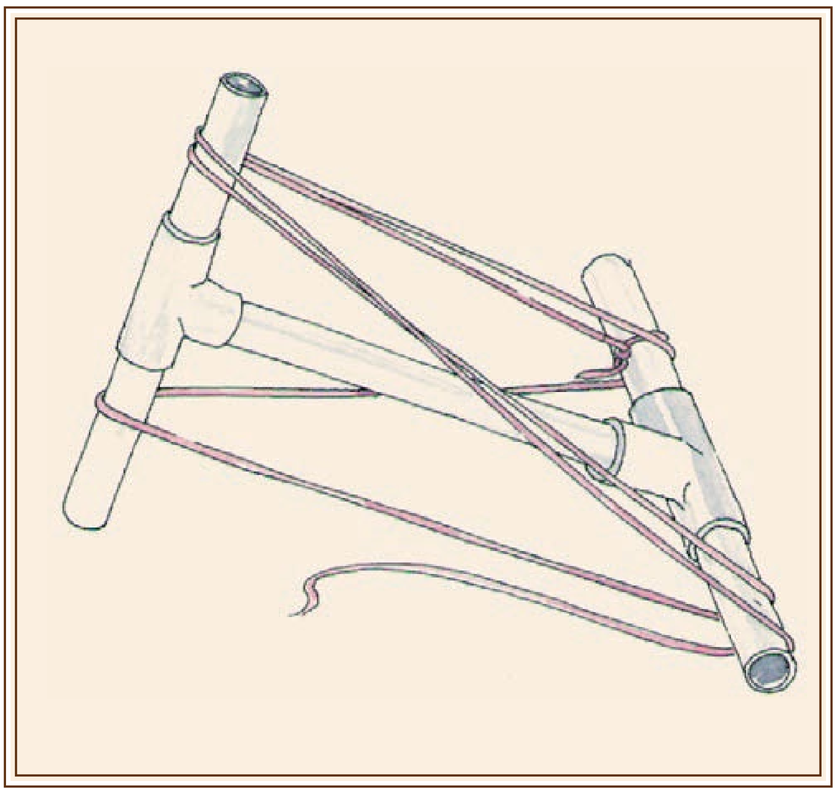
Ligon, Linda, and Marilyn Murphy, eds. *The Weaver's Companion*. Loveland, Colorado: Interweave Press, 2001.

Osterkamp, Peggy. "Table of Base Counts of Threads." *Winding a Warp and Using a Paddle. New Guide to Weaving Number 1*. Sausalito, California: Lease Sticks Press, 2005. pp. 113–114.

Making a Plastic Niddy-Noddy

Shannon Stoney

To make a waterproof niddy-noddy that measures about one yard, get a piece of ¾-inch PVC pipe about 24 inches long and two T-connectors to fit that size pipe. With a fine-tooth saw, cut the pipe into one 6½-inch piece and four 4-inch pieces. Sand the ends a little so they are not rough. (Hardware stores carry a special tool for sanding PVC pipe, but regular sandpaper works okay.) Stick the four 4-inch pieces into the T-connectors to make the two arms of the niddy-noddy. Then put the T-connectors on the ends of the 6½-inch piece, turning them so the arms are perpendicular to each other. I don't glue the pieces together because I like to be able to take them apart for traveling.



Make Your Own Yardstick Umbrella Swift

Use recycled materials and a little ingenuity

Marilyn Rishel Sult

UMBRELLA SWIFTS are wonderful tools—they are cleverly designed, tremendously helpful, both collapsible and portable. Without whining or complaining, they will hold a skein of yarn just where we want it with just the right tension while we wind yarn into balls, or onto bobbins.

Many years ago I decided to challenge myself to make an umbrella swift. I didn't have a swift to measure but I had several pictures. It turned out that making all the parts was fun and easy. The real challenge came when it was time to put the parts together.

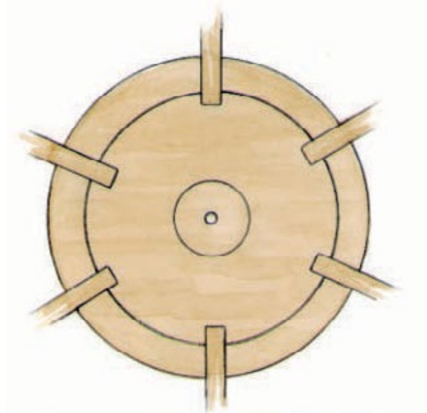
With open eyes and a little bit of creativity, you can find construction materials everywhere. The most visible parts of my umbrella swift were made from yardsticks given away by local businesses as advertisements. I used wire from old Christmas tree lights—it's covered with plastic insulation and will never rust. I found many of the remaining parts at a flea market.

Making round parts can be difficult for people who don't have access to a wood lathe. I found parts that were already round and then finished shaping them to fit my needs. I used a drawer knob as the lower stop that moves up and down the central dowel and holds the bottom of the swift in place. I bought an old rolling pin for one dollar and sawed it into slices to make the upper and lower disks. Make sure that the hole goes all the way through the pin by turning one handle to see if the other handle turns with it.

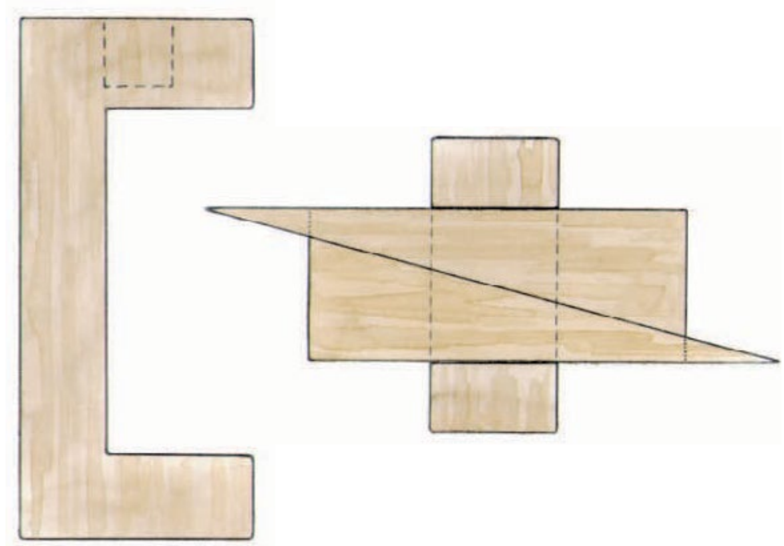
When I made my first swift I thought it was a little crude looking, but after a while its recycled appearance grew on me.

Marilyn used recycled materials, such as yardsticks from hardware stores, wooden bowls, rolling pins, and the wire connecting Christmas tree lights, to make her umbrella swift.

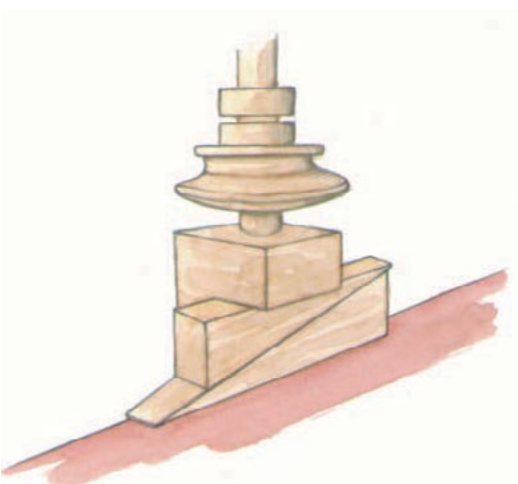
1. Marilyn used an old rolling pin to make the disks that hold the yardsticks in place. Clamp each disk into a vise to cut the ½ inch slot around the outer edge.



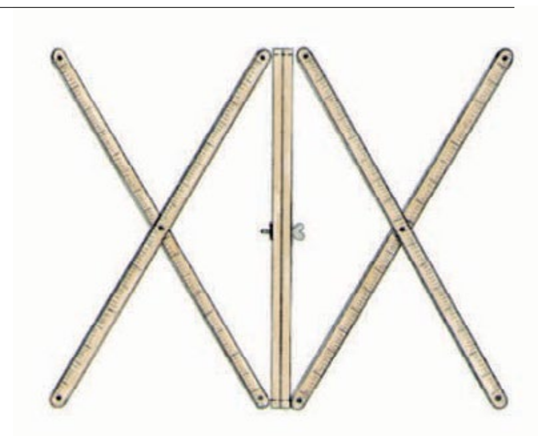
2. Mark the location of the slots that radiate from the center of each disk. Holding the disk in the vise, cut these slots with the coping saw and use the file to make them wide enough to hold one end of the yardstick pieces.



3. The clamp and the wedges hold the swift upright and secure it to a table.



4. Glue the bottom of the dowel to the hole in the top of the clamp. Using the wedges, clamp the uncompleted swift to a table. Working at the top disk, place a single stick (the same one, right or left, from every pair) in each slot while drawing the wire through the holes. Pull the wire tight and into the slot. Twist the wire ends together and cut them so that there is a ½ inch of wire after the twist.



5. Pick up 2 of the unattached Xs and hold a stick end from each X with the top of one of the attached sticks between these two. Draw a string through the holes of all three sticks and make a square knot. Tie the bottoms of these three Xs together in the same way. Now tie the loose ends of these newly attached Xs to the next attached Xs.

Instructions for making Marilyn Sult's Yardstick Umbrella Swift

Parts List

- 6 yardsticks
- 1 dowel, ⅝-inch
- Fine, rustproof wire
- 1 large drawer pull, 2½ inches
- 1 small wooden bowl, 2½ inches
- 2 wooden disks, ½ by 3 inches
- 14 cotter pins, ⅛-inch by 1 inch
- String
- Scrap wood (1 piece 1¾ inch by 2 inches by 4½ inches for the clamp and 1 piece 1½ inch by ¾ inch by ¾ inch for the clamp wedges)
- Wood glue
- Sandpaper

Tools

- Vise, any size
- Coping saw
- Small file (like a jeweler's flat small file or a nail file)
- Needlenose pliers
- Drill and drill bits (⅝-inch and ⅛-inch bits)
- Small screwdriver

Preparing the yardsticks

Saw the yardsticks in half crosswise, then saw them in half lengthwise. This produces 24 sticks. Round the ends of the sticks and sand all the edges smooth. Drill ⅛-inch holes ¼ inch from both ends of each stick. Drill a hole in the very center of each stick.

Holding two sticks together, insert a cotter pin through the center holes. Curl the ends of the cotter pins on the backside of the sticks so the pins are held in place. Assemble all the sticks in this manner. You now have 12 crossed-stick components (12 Xs).

Preparing the center dowel

Cut the dowel 20 inches long. Beginning 3 inches from one end (this will be the bottom end), drill a hole all the way through the dowel every inch for 7 inches. Then drill a hole 1 inch from the top of stick. Drill a ⅝-inch hole in the center of the wooden bowl and glue it to the top of the dowel.

Preparing the disks

Draw a center line around the outer surface of each 3-inch disk (1). Secure a disk in the vise and cut a ½-inch deep groove with the coping saw, following the line, all the way around the disk. Use the file to make the slot wide enough for the wire to fit inside.

Use the diagram (2) to mark the location of the slots that radiate from the center of each disk. Holding each disk in the vise, cut these slots with the coping saw and use the file to make them wide enough to hold one end of the yardstick pieces.

Glue the drawer pull to one of the disks and then drill a ⅝-inch hole through the center of both the drawer pull and the disk. Drill a ⅝-inch hole through the remaining disk.

Making the clamp and the wedges

The clamp and the wedges hold the swift upright and secure it to a table. (3) You need to make the clamps and wedges now so you can use them while you assemble the swift.

Commercially available wooden umbrella swifts have a wooden screw that comes up from the bottom of the clamp and holds the swift securely to the table surface. Making a wooden screw and threading the clamp hole requires a tap-and-die tool for wood that I don't have. The wedges provide an easy alternative that won't leave an indention on the underside of your table (the way that the end of a wooden screw can).

Follow the diagram for cutting and shaping the clamp and wedges. Do not sand the wedges. They need to be rough to grip each other firmly. Drill a ⅝-inch hole in the top center of the clamp. Don't drill all the way through the top of the clamp.

Assembling the swift

Slide the top disk (the one that isn't attached to the drawer pull) onto the dowel and up to the bowl. Put a cotter pin in the hole to hold it at the top. Slide the drawer-pull disk onto the dowel, holding the drawer pull toward the bottom of the dowel.

Glue the bottom of the dowel to the hole in the top of the clamp. (4) Allow this to dry. Using the wedges, clamp the uncompleted swift to a table. Working at the top disk, place a single stick (the same one, right or left, from every pair) in each slot while drawing the wire through the holes. Push the stick ends into the slots with a screwdriver if necessary. Pull the wire tight and into the slot. Twist the wire ends together and cut them so that there is a ½-inch of twisted wire left, then press the twisted wire into the slot.

Follow this same procedure with the bottom disk. You should have 6 Xs pointing out at you and a pile of 6 unattached Xs (the rest of the yardsticks that were assembled with cotter pins). Pick up 2 of the unattached Xs and hold a stick end from each X with the top of one of the attached sticks between these two. (5) Draw a string through the holes of all three sticks and make a square knot. Tie the bottoms of these three Xs together in the same way. Now tie the loose ends of these newly attached Xs to the next attached Xs. Continue working around the swift, tying the tops and bottoms of the unattached Xs to the tops and bottoms of the attached Xs until all of the stick ends are tied.

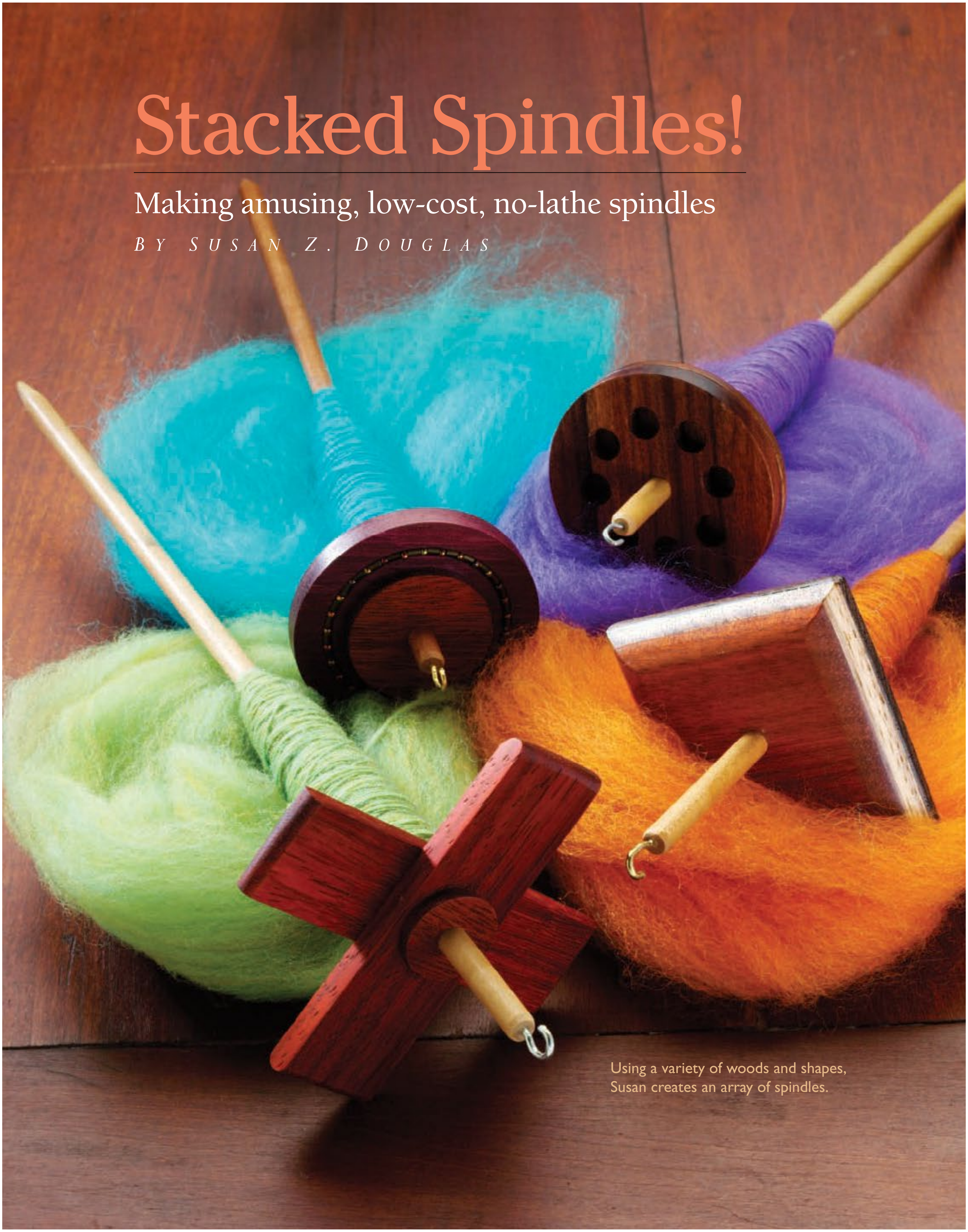
Now your swift is ready to turn those loose lanky skeins into plump happy balls of yarn.

Marilyn Sult *lives in Kalamazoo, Michigan. Her husband Dale taught her everything she knows about woodworking. They have been married for forty years.*

Stacked Spindles!

Making amusing, low-cost, no-lathe spindles

By Susan Z. Douglas



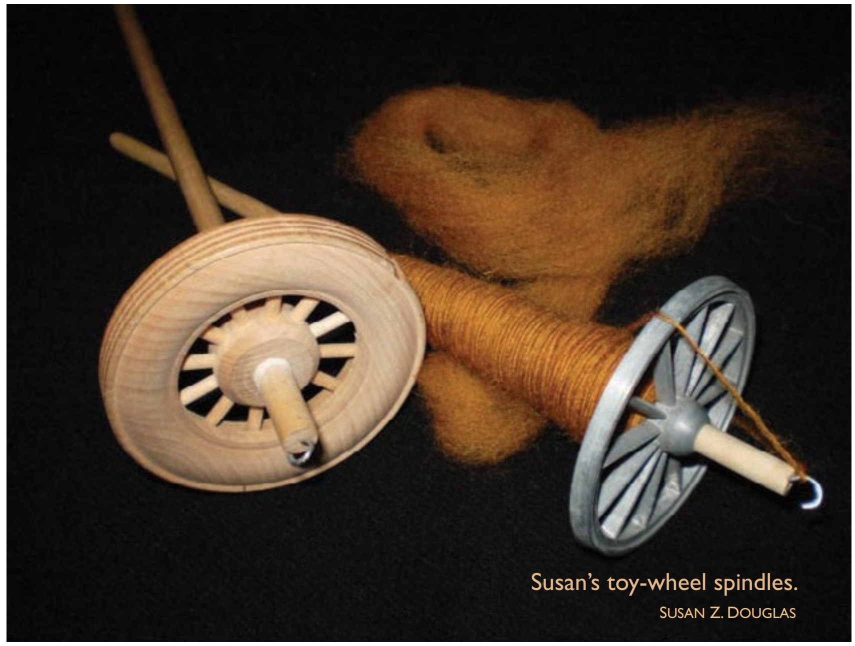
Using a variety of woods and shapes, Susan creates an array of spindles.

If I were a nomadic wanderer with only rocks and sticks at my disposal for spinning, I think that I would amass a collection of spindle rocks that were too good to leave behind (Pretty! Smooth! Nice shape! Perfect weight!). Then I would think, "Can I lash two rocks together? Will they spin faster? Smoother? Better?" My fellow wanderers would laugh at me as I carried my favorite rocks from camp to camp, picking up more along the way.

I've been spindle spinning since I was introduced to the subject in the Spring 1995 issue of *Spin·Off*. I started with toy-wheel spindles. After creating an assortment of these very basic spinning tools, I began to purchase some lovely professionally made spindles from Fournier, Hatchtown Farm, Mongold, then Bosworth, David Reed Smith, Forrester, Golding, and more recently from Eichheim, Grafton Fibers, and Kundert, among others. Of course, along the way I also had to buy examples of Turkish, Tibetan, and tahkli spindles. But each time I purchased a spindle, I wanted still more. I wanted to experience the spin of every spindle I saw. I would read about the effects of even weight distribution, rim weighting, and center weighting until my eyes glazed over, but I needed to feel those effects to understand them. Finally, I decided that, to satisfy my desire for more spindles, I would have to take matters into my own hands.

I returned to my toy spindles, this time modifying solid toy wheels. I made Swiss-cheese spindles using a drill press to add air and subtract center weight. These were pleasant to use, but I found the selection of toy wheels to be limiting. From then on, I decided that I wanted to make my own whorls, as opposed to modifying or using ready-made components.

I went to a home-supply store and found some inexpensive maple planed to ¼-inch and ½-inch thicknesses and available in various widths and lengths. I chose a couple of the straightest ¼-inch dowels I could find. (How do I check for straightness? I roll them on the floor. The dowels that are warped don't move. The ones that roll freely come home with me.) My husband very graciously allowed me the use of his workshop and tools. I must admit here that I might not be as generous if he asked to use my workroom and spinning wheels! I chose to use a drill press, a table sander, my father-in-law's thirty-five-year-old scroll saw, a coping saw, and a vise. A lathe sits in the workshop singing its siren song, but for now these other tools are less intimidating to me.

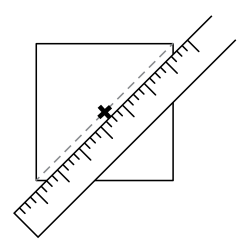


Susan's toy-wheel spindles.
SUSAN Z. DOUGLAS

Susan's first simple square-whorl spindle.
SUSAN Z. DOUGLAS

MAKING A SQUARE-WHORL SPINDLE

I had seen square spindle whorls, and I read that, by its nature, a square spindle is rim weighted. Reading about this was one thing, but I wanted to feel it. Using the coping saw, I cut a 2¾-inch square from the maple and sanded it. I determined the center point by placing a straight edge diagonally from corner to corner and marking the middle spot on the top of the square with a pencil. I used an awl to poke the center, and using a 3⁄32-inch bit, made a hole with the drill press. I drilled again using a



Techniques, Tips, and Suggestions for Beginning Spindlemakers

These aren't step-by-step instructions. Rather, this is a collection of techniques that I use and tips that I learned while making my spindles.

At a minimum, you will need the following items to create a square spindle.

- Wood planed to ¼" thickness—½" and ⅛" thicknesses are useful, too
- Saw (a coping saw will work)
- Vise to hold the wood for sawing
- Scrap wood to place underneath wood being drilled
- Drill with a variety of bits: ¼", 3/32", and 5/32" (a drill press is ideal, but a hand drill can work)
- Masking tape
- Pencil
- Awl or similar pointed object
- Wood glue
- ¼" dowel cut into 12" lengths
- Small screw eyes (I use 7/16")
- Sandpaper in various grits from 220 to 600
- Finishing oil (I use Watco Danish Oil)
- Dry, clean cloths for removing dust and applying oil

Drilling holes: To ensure neat holes, stick masking tape on both sides of the wood to be drilled, and place a piece of scrap wood underneath. Drill using a small bit (such as 3/32"), then a larger size, then a ¼" bit. It is important to drill a straight hole. If it isn't straight, the spindle will be wonky. If you need help drilling straight holes using a hand drill, there are online discussions concerning drilling methods and the use of templates and jigs. One example is www.sawmillcreek.org/showthread.php?80343-no-drill-press-how-to-drill-straight. Suggestions include using a mirror to help with aligning the drill and using blocks of wood to make a square hole that can be used as a jig.

Sanding: How much you sand is your call. At a minimum, the whorl should be smooth enough so that it doesn't snag the fiber or yarn. I sand components before gluing.

Gluing: I usually, though not always, glue the whorl components together, but I do *not* glue the whorl to the shaft. I like to retain the possibility of moving the whorl along the shaft. Sometimes placement closer to the hook or closer to the center produces a better spin. Also, shafts can break or become warped, and I like to be able to replace them easily.

Shaft length: It's personal preference. I use 11" or 12" for larger whorls, 9" or 10" for smaller whorls.

Finishing: A couple of coats of oil provide a nice finish.

Friction fit: Sometimes a ¼" dowel doesn't fit a ¼" hole; those from different manufacturers have different tolerances. I prefer dowels that fit tightly; with just a little sanding of the end of the dowel, the whorl can be twisted on. If the whorl fits the dowel loosely, I place a strand of singles yarn over the top of the shaft and jam the whorl over it and the dowel. This is usually sufficient to create a secure fit. I cut off any bits of yarn that show.

Hooks: Hook tweaking is a skill worth acquiring and indeed is essential for creating a successful top-whorl spindle. Jim Child of Hatchtown Farm has written an excellent tutorial on hook tuning, and he creates mighty fine spindles as well (see Resources).

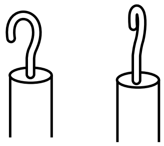
Susan's supplies in the workshop.

SUSAN Z. DOUGLAS

Safety precaution

Rule #1 is safety. Wear eye and mouth/nose protection. Use earplugs. Learn how to operate your power tools, and don't operate them if you are not feeling alert. Keep a first-aid box nearby.

$\frac{5}{32}$-inch bit, then again with a ¼-inch bit. I popped in a 10-inch length of ¼-inch dowel that I had sanded into a point on one end. I marked the center of the flat end of the dowel with a small brad and twisted a $\frac{7}{16}$-inch screw eye into the hole. Using one pair of jeweler's pliers, I held the base of the screw eye, and using another pair, I opened the eye into a hook, tweaking it so that the yarn would be centered north to south, if you will, over the shaft. I also bent the hook ever so slightly to one side so the yarn (not the hook) would be centered east to west. A notch on the rim of the whorl is unnecessary on a square whorl.



So how does a square spindle spin? I love it! It may take a bit more energy to get going with a thigh roll than does a round whorl, but it has a lovely "floaty" feel as it spins. Mine makes a pleasant whooshing sound. I believe this is caused by wind resistance, which leads to a subsequent loss in spin, but I find there is still plenty of time to draft as much as I desire. The whorl is slightly warped (I know this by laying it on a perfectly flat surface and noticing that it rocks slightly). This may contribute to the whoosh, but it doesn't seem to hamper the spin.

The success of the simple square spindle led me to wonder how the square form would work if more weight were added to the center. I cut smaller squares, drilled holes, and stacked them in various configurations. I never tire of experiencing each new spindle's particular spin.

FROM SQUARE TO ROUND

As I was exploring the possibilities of the square spindle, I figured out how to cut disks with the drill press. Using a 2½-inch hole saw and some helpful advice from hubby (such as put masking tape on the top and bottom of the piece to make a neater hole where the drill and saw enter and exit the wood; place scrap wood of an even thickness under the piece; and if the scrap wood is not even, the drill will enter the good piece at an angle and the hole will not be straight), I was able to make a basic spindle disk. With a series of smaller-sized hole saws, I made assorted disks and stacked them together. Combining squares *and* disks provided me with further spinning thrills by altering the balance, speed, and length of the spin. I have decided, at least so far, not to notch my circular whorls. I've found that crisscrossing the yarn into a football-shaped cop not only allows for storage of plenty of yarn, but it reduces the need for a notch.

Susan's first made-from-scratch spindles illustrating several combinations of square and circular components. Some have metal washers between layers, both for aesthetics and to increase the center weight.

SUSAN Z. DOUGLAS

An assortment of Susan's spindles made with exotic woods.

SUSAN Z. DOUGLAS

GETTING FANCY

About the time I was becoming comfortable with the tools and developing my spindle-making skills, I discovered that beautiful exotic woods could be purchased in ¼-inch and ⅛-inch thicknesses.


The spindle resulting from Susan's "science experiments" with asymmetrical shapes.

SUSAN Z. DOUGLAS

Though pricier than the generic maple I had been using, these colorful woods opened exciting possibilities. Purpleheart, for example, is quite dense and heavy and therefore creates a different spin. Using ⅛-inch-thick woods allowed the use of decorative treatments that added color and contrast but little weight to my spindles. Layers of thin 2½-inch canary wood squares made a spindle that seems to just glide on air. The prospect of various combinations of color and shape, density and size set my imagination ablaze. I found that applying a couple of coats of an oil finish brings out the beauty and depth of the exotic woods.

Last, I must mention my science experiments. I read that any shape could be point balanced. This hadn't occurred to me before. Did this mean that I was not limited to symmetrical shapes? I made a sort of random triangle out of the maple, rounded its points, and found its center by balancing it on the head of a finishing nail. I drilled a ¼-inch hole through the center spot and added a couple of exotic wood disks for fun. I looked at the scraps from this spindle and started thinking: Could I take these random shapes (sanded and rounded for aesthetics) and balance each one? And then, if each shape is balanced, would a whorl composed of, say, three of them, be balanced as well? How did these experimental spindles spin? Well, even though they are pretty well balanced, I hadn't considered the effects of drag. The irregular shapes can slow the spindles down rather quickly. On the other hand, the spindles are just right for making softly twisted, thick yarns.

NEXT STEPS

Thus far, I have made top-whorl spindles exclusively, but I plan to investigate bottom whorls and support spindles as well. Because my spindles combine several elements, I sometimes have difficulty defining spinning properties such as rim weighting, even weighting, and center weighting. However, I can tell by feel whether the spindle is best suited for laceweight, fine, medium, or thick yarns. My spindles are full of quirks, and very few of them spin perfectly. I love them, though, because they are mine. ⌘

Susan Z. Douglas of Topsham, Maine, enjoys lying in bed on weekend mornings, pondering knitting and spinning problems. Some of her Saturday morning solutions actually work in real life and some do not, but for Susan, that's all part of the fun.

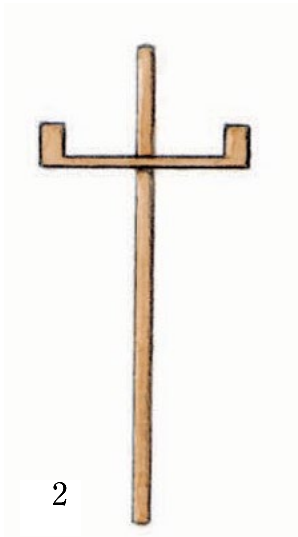
RESOURCES

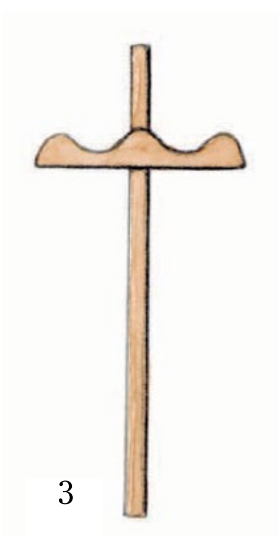
Jonathan Bosworth, www.journeywheel.com/content/section/4/85/.
Jim Child (spindle-hook tuning), www.hatchtown.com/tools/spindles/spindle-hook-tuning.
Tracy Eichheim, www.woollydesigns.com/spindles.
Tom Forrester, Carolina Homespun (United States), www.carolinahomespun.com; Gemini Fibres (Canada), www.geminifibres.com.
Fournier, no longer in production.
Golding Fiber Tools, www.dropspindle.info.
Grafton Fibers, now DyakCraft, www.dyakcraft.com.
Hatchtown Farm, www.hatchtown.com/tools/spindles.
Kundert Spindles, www.kundertspindles.com.
Lowe's (maple, Watco Danish Oil), www.lowes.com.
Mongold, no longer in production.
Rockler Woodworking and Hardware (exotic wood), www.rockler.com.
David Reed Smith, www.davidreedsmith.com.

Making a Handspindle

The fine points of spindle design and construction

BY DAVID REED SMITH



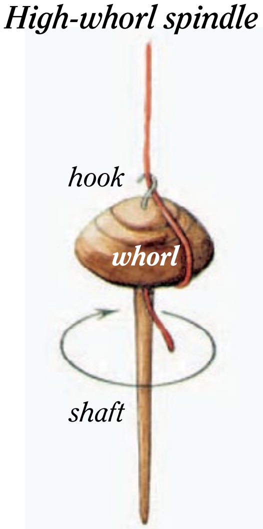


(1) This whorl looks shapely but the weight distribution is backwards. (2) This whorl has all the weight on the rim but has neither rigidity nor strength at the shaft. (3) This whorl isn't as radical in design as the other two but it is practical when made in wood.

Spinners often wonder what makes the difference between one handspindle and another. Some are delightful to use, while others make you frustrated. There's more than personal preference at work here. Physical differences in how spindles are designed and made determine how well they function—how fast they twirl, how long they keep twirling, and whether they wobble.

In this article I'll explain how I make high-whorl spindles. The procedures described here are more elaborate than those used by casual do-it-yourselfers. But if you have a dream spindle in mind, my directions may help you talk a wood turner into making it for you.

High-whorl spindle



The ideal whorl

You could, I imagine, use a rock as a handspindle, but obviously rocks are not ideal tools. There's no place to wind on the yarn, it's hard to start a rock spinning, and most rocks are likely to wobble. Adding a shaft would make a rock easier to twirl and provide a place to store the spun yarn, and using a symmetrical rock would reduce wobbling and make it spin longer.

But that's not all there is to spindle design. After I had been making handspindles for a while, it dawned on me that what I considered the most natural and easy whorl design—fat in the middle and tapered towards the edge—was contrary to the concepts I dimly remembered from high school physics. The profile of the whorl and the distribution of its weight affect how long and how fast a spindle spins. Weight close to the shaft contributes very little to the rotational inertia or momentum—the force that keeps a spindle spinning. Weight away from the shaft, out on the rim of the whorl, contributes much more rotational inertia.

But there are practical limits to designing whorls. A spindle with too wide a whorl would be awkward to use and carry. In wood at least, enough mass must be left at the center of the whorl to make a strong join with the shaft, and the whorl must be thick enough between the center and the rim to remain rigid.

Concentricity

Another factor in spindle construction that affects spin time is the concentricity of the axes of the shaft and whorl. They must have a common center. Lack of concentricity leads to wobble, and wobble saps energy from the spin. But absolute accuracy in gluing wood to wood is made more difficult by the fact that a gap of approximately

.005 inches must be left for the glue. That sounds like a tiny gap, but if a ½-inch-thick whorl is set ajar, so that the top of its center hole touches the shaft at one side and the bottom of the center hole on the opposite side, the tip of the shaft will be almost ¼ inch off-center. One way to get around this is to glue the shaft to the whorl before it's turned. I attempt to minimize the concentricity error when I make my spindles by holding the rim of the whorl in a chuck and turning the whorl and shaft as one piece. This minimizes the error because the rim of the whorl is first turned true and concentric to the hole, then the shaft is glued in place. Even though error is unavoidable at this point, the shaft is bigger than it needs to be and so the excess wood (and any error) are turned away. The spindle is mounted in the chuck held by the rim so the axis of rotation is where the center of the shaft should be.

Hooks

Another area that can affect spinning duration and balance in handspindles is the way the yarn gets attached to the shaft. If the yarn isn't attached at the exact center of the spindle's axis, the spindle will wobble.

Mounting a hook on top of the shaft can provide a central attachment point. But cup hooks, the easiest kind of hooks to find, aren't very suitable for spindles. They're threaded, and threads don't hold well when screwed into the end grain at the tip of a shaft. What's worse, the broad, round top of the hook is an imprecise attachment point; the yarn can slide off center. Finally, cup hooks are too thick and stiff to adjust.

I make my own hooks from 0.043 inch stainless steel wire. The wire is labeled as fishing leader, so it would probably be available at a large fishing tackle supply store. At first I tried imitating cup hooks, but found it hard to bend a uniform curve. Now I make sharp bends of about 45 degrees with needle-nose pliers (page 19). This is easy to do, and it produces a single, consistent point for attaching the yarn. It is also possible, after inserting the hook into the spindle, to center the bend of the hook so that it is positioned directly over the axis of the shaft.

Preparing the whorl and shaft

My *Judi* drop spindle has a whorl that is about 3¼ inches in diameter and ½ inch thick. To make the whorl, I start with a padouk board that is a little more than one inch thick, so I won't have to waste much of it. First I rip (cut lengthwise) the padouk with my table saw into boards about 3½ inches wide. Then I slice each board into two boards about ½ inch thick with my bandsaw.

I've tried doing the next series of steps several different ways. I've tried drilling holes first, then using a circle-cutting jig on the bandsaw; drawing circles, then cutting freehand, then drilling; etc. Now I cut the board into squares, then drill the hole for mounting the shaft on my drill press. By cutting the blank square first, I can use a jig to accurately and quickly locate the hole for drilling.

After drilling, I cut the blank to a roughly circular shape on the bandsaw. As a template for cutting the whorl, I use a special whorl with a very short and slightly undersized shaft glued into the center hole. I set the template into the drilled blank and cut, making sure that the sawblade stays slightly outside the template. I find that

David starts with padouk and maple boards like these to shape the whorls for his spindles.

David fits the square whorl blank into the L-shaped jig to mechanically locate the hole center.

After drilling the hole for the shaft, David cuts the blank to a roughly circular shape on the bandsaw.

PHOTOS BY DAVID REED SMITH

To refine the shape of the spindle, David turns it on his lathe. The headstock spins the wood, the chuck holds one end of the wood, the tailstock supports the other end of the wood, and the toolrest steadies the tool that David uses to shape the wood.

cutting the whorl with a three-dimensional template is easier and faster than drawing a pencil line, then cutting.

To ready the shaft stock for turning, first I plane a maple board down to ½ inch thickness. Next I rip the board into strips ½ inch wide, and then I cross-cut the strips into shaft blanks 10½ inches long.

First turning

Since the whorl is only roughly circular in shape (even with the circle-cutting jig), the first step in turning is to make the whorl perfectly circular and exactly centered on the hole for the shaft. To do this I mount a plain disk on the lathe and hold the whorl up against it with the tailstock pressure through the hole in the whorl. The tailstock is centered exactly on the rotation of the lathe, and the cone mounted on the tailstock centers itself in the drilled hole in the whorl. I use a bowl gouge to cut the rim of the whorl straight across, and a shear scraper to refine the surface.

Next I prepare the shaft for gluing into the whorl. I mount the shaft between the tailstock and a wooden faceplate with a square recess on the headstock. I turn what will be the top 2 inches or so of the shaft to a roughly cylindrical shape. Then I cut the tenon—a piece of wood on the shaft that is shaped to make a join with the hole in the whorl. To get its thickness right, I use a gauge made from ⅛-inch steel with a recess cut; it's filed to match the hole drilled in the whorl. There's a piece of duct tape mounted on my tool rest that reminds me how long to make the tenon.

Mounting the whorl on the shaft

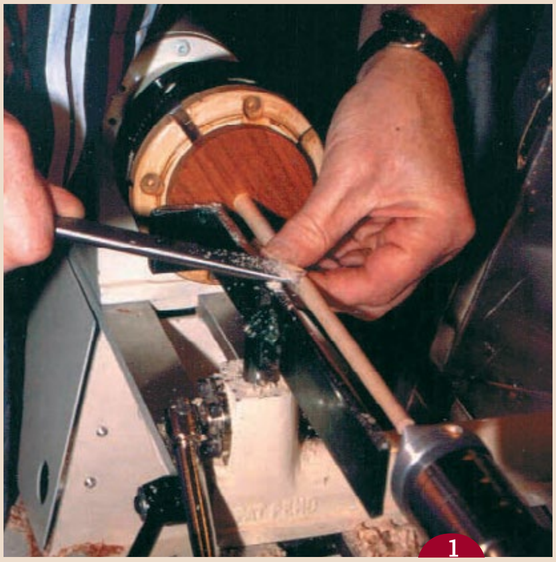
After truing the whorl and cutting the tenon on the shaft, I glue the shaft into the whorl. I spread some wood glue in the hole in the whorl, then tap the shaft into the hole with a wooden mallet. The tool I use for cutting the tenon has a tendency to compress the wood a bit, but after the wood is dampened by the glue, it expands and locks in place nicely, so it doesn't need to be clamped. Unfortunately, it won't self-center as it does this, so I still have to worry about inaccuracies resulting from the gap that allows it to be inserted in the first place. If the wobble is greater than ¼ inch then I need to start over.

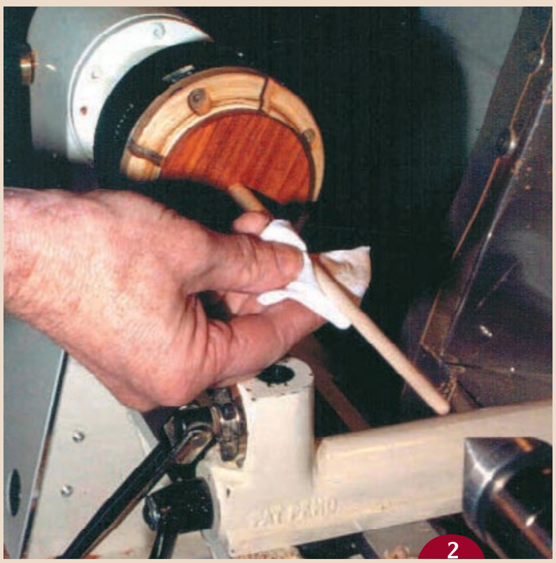
Second turning

After the glue has a day or so to dry well, I mount the spindle on my lathe to turn the bottom of the whorl and the shaft. For this, I use a four-jaw scroll chuck with homemade wooden jaws to hold the whorl by its already trued rim. The wooden jaws won't mar

David sizes the tenon on the shaft of the spindle.

David mounts the whorl on the shaft and uses a wooden mallet to tap it into place.





(1) David takes a finishing cut on the shaft with a skew.

(2) After sanding, David cuts off the little nib on the end of the shaft and applies a rubbing finish with a rag.

(3) David hollows the whorl with a bowl gouge, (4) then refines the whorl surface with a shear scraper.

the spindle even after it's finished. I mount the spindle securely in the chuck and then engage the tailstock rather than forcing it into the center of the shaft. This compensates for any errors in gluing. I use a roughing gouge[1] to turn the shaft to a cylindrical shape, then finish the surface with a skew chisel,[2] steadying the shaft with my hands to suppress vibration.

I next use a small bowl gouge[3] and a shear scraper[4] to smooth the bottom surface of the whorl, then I sand it with progressively finer sandpaper. After sanding, I cut off the little nib on the end of the shaft and apply a rubbing finish[5] with a rag. You'll notice in the picture above that the end of the shaft isn't supported now. If the spindle turns on the lathe without wobbling here at close to 2,000 revolutions per minute, I'm fairly confident that it will run well at the speeds of hand spinning (approximately 500 RPM).

Third turning

After the second turning is completed, I reverse the spindle in the chuck to turn the top of the shaft and whorl. Since the headstock of the lathe is

[1] A roughing gouge is a woodturning tool with a U-shaped cross-section.
[2] A skew is a woodturning chisel made from flat steel that is sharpened from both sides so that the edge is about 15 degrees from being straight across.
[3] A small bowl gouge is a turning tool with a U-shaped groove cut into a round metal rod.
[4] A shear scraper is a homemade tool used with the cutting edge about 45 degrees from the direction the wood moves into the tool.
[5] A rubbing finish is a finish designed to be applied with a rag, the polish resulting from friction between the rag and wood.

hollowed to 3/8 inch, the shaft will fit inside. First I turn the top of the shaft while it is still well supported by the full thickness of the whorl. Then I use a bowl gouge to rough out the hollow of the whorl.

Next, I use a round-nose shear scraper to smooth the surface of the whorl so that it doesn't require as much sanding. After the whorl is shaped, I sand and apply the rubbing finish to the top of the spindle.

Inserting the hook

I drill a hole for the hook while the spindle is still mounted on the lathe, using a drill bit that matches the size of the stainless steel wire I use for the hooks. The drill bit, mounted in a wooden handle, is pushed into the spinning spindle to create the hole for the hook. I drill the hole about 5/8 inch deep.

To make the hooks, I cut the wire about 1 1/4 inches long to allow for the depth of the hole and the bends in the hook. Then I use a grinder to round one end of the hook so that it won't cut your fingers. Next I bend the hook to shape with needle-nose pliers and insert the hook into the hole. I glue the hooks in place with cyanoacrylic glue. I find it easiest to apply the glue by putting a drop or two on a plastic card, then dipping the hook into the glue before inserting it into the shaft.

These are two hand-bent hooks of 0.043 inch stainless steel wire. The hook on the right is bent as described below. The hook on the left is an experimental version intended to center and attach the yarn accurately and quickly.

David drills a hole for the hook.

David cuts notches in the whorl.

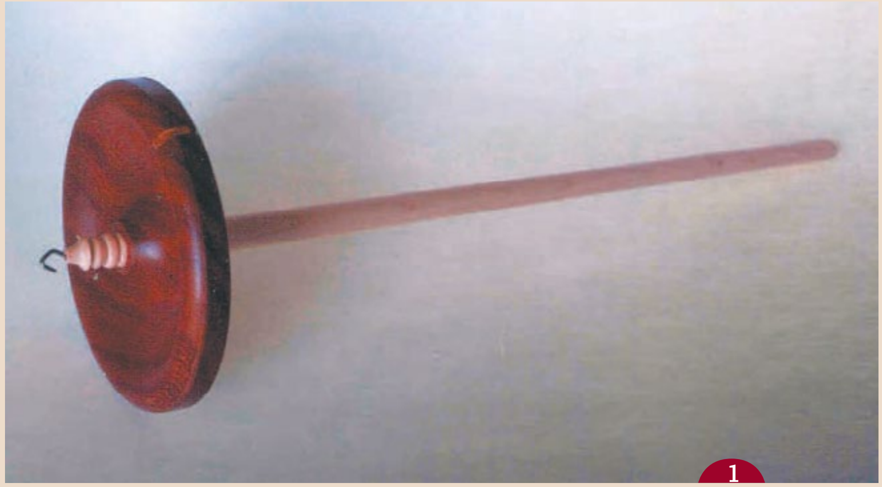
Cutting notches in the whorl

The last step is to cut notches in the whorl. I like the notches to have square sides so that the yarn is less likely to slip out during spinning. I use what may very well be the ugliest jig in the known universe to hold the spindle. The jig is loosely based on the old-fashioned shaving horse, with a foot-operated lever that holds the spindle between leather pads. I've marked the interval between the notches on the jig so that I don't have to measure each time. To cut the notch, I use two hacksaw blades mounted together in the hacksaw frame. It works nicely but the notches look a little rough. In the future I want to experiment with a different method.

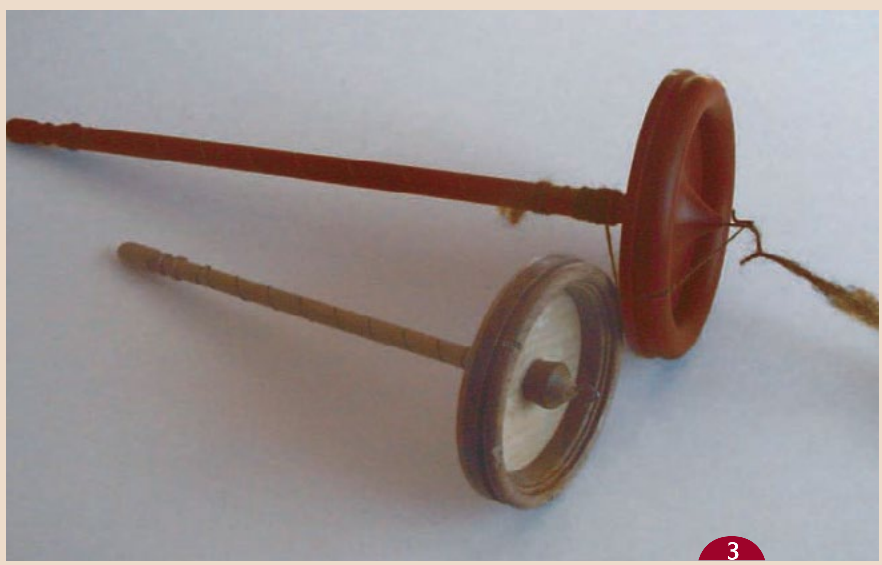
Possible variations

The techniques of hollowing the whorl and turning the pre-assembled spindle can be used to create a variety of handspindles. The size, wood selection, and details of the shaft and whorl can easily be changed to give a wide range of designs. The spindles in the photograph (right) are made in much the same way as the minimalist Judi, but the details of the whorl and the spiral-inlaid brass wire on the shaft make them appear to be very different spindles. The Judi weighs about 1.4 ounces, but the basic design can easily be scaled up or down to create spindles of different weights.

David Reed Smith *lives with his family in Hampstead, Maryland. When he's not working at his day job—taking X-Rays at a small hospital—he makes tatting shuttles and drop spindles as an excuse to indulge and finance a serious tool fetish. He invites you to contact him directly at David@DavidReedSmith.com. An expanded version of this article with more pictures will be available on his website at www.DavidReedSmith.com.*


1


2


3

David's spindle designs: (1) Anke spindle that weighs about 1.4 ounces, (2) Purpleheart spindle with brass wire inlaid on the shaft, and (3) Leslie spindle, weight about .5 ounces, made with white oak and maple and a brass wire inlay.