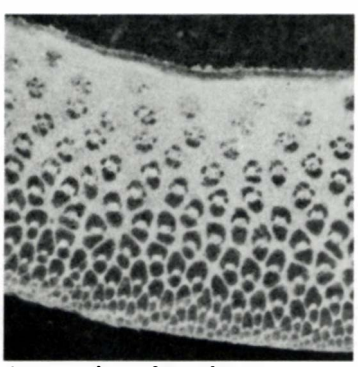
Fly Rods from Split Bamboo

With a hand plane and lots of gadgets

by L. U. Beitz

The anonymous craftsman who in 1859 tried fastening a split-bamboo tip to the butt of a hickory fishing rod started a revolution in rod technology and craftsmanship. Charles F. Murphy of Newark, N.J., soon became the first builder to make a complete six-sided split bamboo rod of Calcutta cane. Previous rods were turned and shaved from the springiest woods available: lancewood, greenheart, ash, hickory. They were heavy by any standard, up to 15 or 20 ounces, and positively limp compared with bamboo.

A typical flyfishing rod before bamboo was about 12 ft. long, consisting of two or three sections connected by thread wrappings or metal ferrules. The rod would have been turned round to about ¾-in. diameter just above the handgrip, and would have tapered smoothly to about ⅛ in. at the tip. When they discovered bamboo, last century's makers reproduced the shape of the rods they already knew. To do this, they split and planed Calcutta cane into triangular sections, tapering in length, then they glued the strips into a hexagonal shape. People tried turning the rods on the lathe to round them, but quickly discovered that turned rods lacked strength—the cane is weakest toward its pith, and every precious fraction of its outside surface must be conserved. You can't sand away protruding edges when you make fly rods. If you do, the rod will be stronger in one direction than in the other, resulting in an erratic action. For the tip of a fly rod, a four-foot sliver of bamboo has to be beveled to a perfect equilateral triangle, and tapered from ⅛ in. to 1/32 in. Then five other pieces have to match it exactly—all this using a material that, ounce for ounce, resembles wood less than it does steel (see Bamboo, p. 70).



Section shows fiber density.

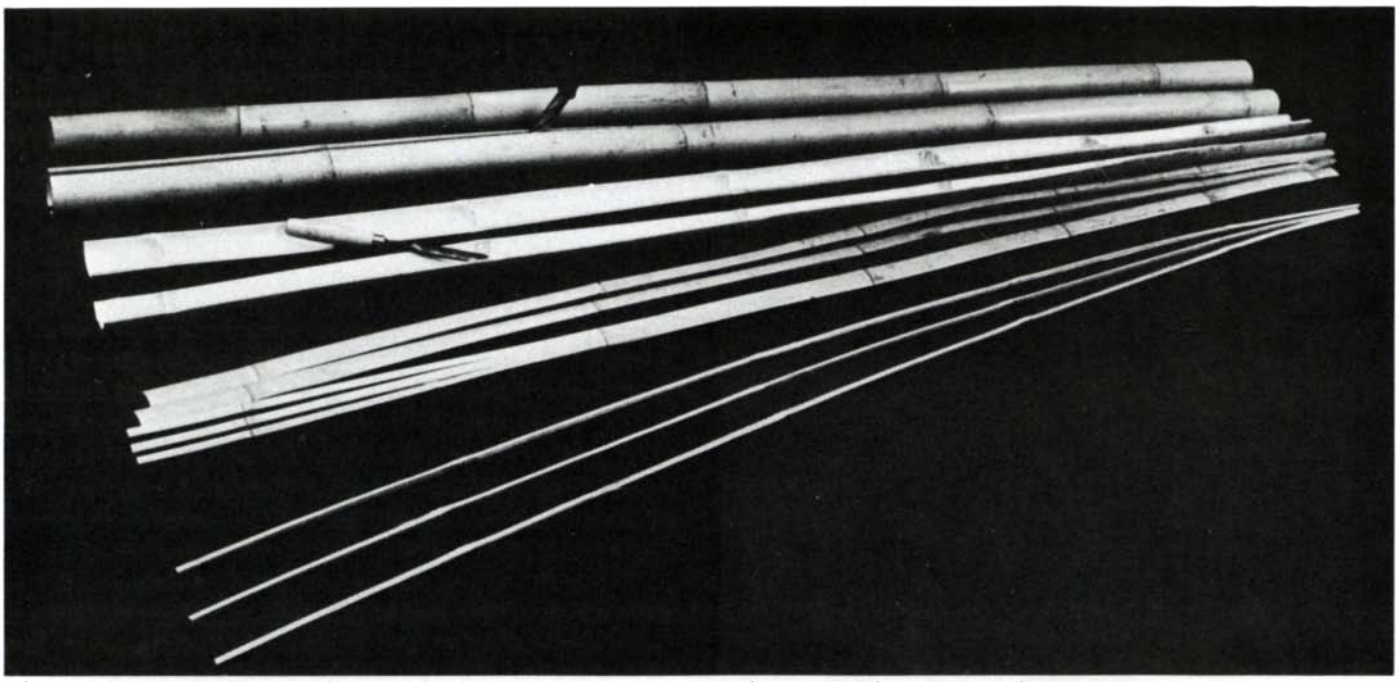
A fishing rod is basically a spring used to store energy. In spinning or baitcasting rods, the energy is transmitted to a relatively heavy lure that then pulls the light line from the reel. In flyfishing, however, it is the weighty line itself that is cast (almost like snapping a whip), and the nearly weightless fly goes along for the ride. A good caster is able to put as much energy into a long cast as he would into driving a railroad spike—just about all he has. Sometimes that's what it takes to get the fly to the wily trout. A thick rod suffers too much from air resistance. A weak rod can't store enough energy for decent casts—it merely breaks. The test of strength-for-weight makes bamboo the finest natural material for fly rods. Its only competition comes from man-made materials (fiberglass and graphite) that closely imitate its structure—long, stiff fibers in a binding matrix.

Rodmakers since Murphy's day have refined their techniques and their concepts of what a good fly rod should be. The old rods were long: 12 ft. to 15 ft. was not uncommon. Length, in a wooden rod, compensated for weakness—if you couldn't make a long cast, the rod got you halfway there anyway. The early bamboo rods were nearly as heavy as wooden ones. They were way overbuilt, but fishermen took generations to get used to a weak-looking rod. Toward the end of the century, progressive makers (Hardy in England, Leonard in America) introduced lighter and shorter rods at every opportunity. Then Tonkin cane replaced the weaker Calcutta cane. By the mid-forties, fifties, and sixties, master rodcrafters and designers such as Everett Garrison, "Pinky" Gillum, Lyle Dickerson, George H. Halstead and Jim Payne, were making the finest rods ever produced in the world. Their rods are now collector's items, selling for four figures. About a dozen companies are still engaged in bamboo rodcrafting. Although their output is excellent in quality, many people have had a hand in the making of each rod. Some of these production rods are priced in the $500-$600 range. Today, a few dedicated builders carry on the tradition of the hand-split, hand-planed, precisely balanced split-bamboo fly rod. In this article I'll describe the building of such a rod. I've included the taper specifications of a rod by Garrison, from which I made the 7½-footer shown along the bottom of these pages. At the end there's a source list for the materials and equipment you need to try these methods yourself.

Selecting and splitting the cane—Let's start building a two-piece (butt and tip), 7½-ft. fly rod, plus an extra tip. Alternate use of two tips prolongs the life of the rod, and if one tip is damaged while fishing, the angler isn't cast adrift.

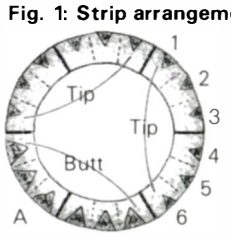
The Tonkin cane pole, or culm, runs a standard 12-ft. length, with a diameter of 1¾ in. to 2½ in. Its nodes—humpy rings around the circumference—are closer together toward the bottom, about 10 in. apart, spreading to near 16 in. at the top. It is from the thin-walled top that we plot out the

Author's 7½ ft. split-bamboo fly rod shown actual size, with ebony ferrule plug.

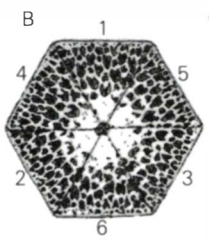


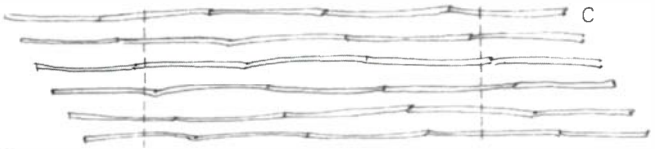
The long fibers in Tonkin cane allow it to be split into many narrow strips that retain lightness, strength and resiliency.

Fig. 1: Strip arrangement



A. To arrange the strips that will become the finished rod, split the culm into at least 18 pieces (dotted lines), choosing pieces for each butt and tip section from adjacent parts of the culm. Tapered triangular strips will be planed from the dense outer part of the culm.





B. Strips will be alternated for balanced action in the glued-up rod. C. Stagger the brittle nodes to avoid weak spots, then trim rough sections to length before filing and planing.

sections of a 7½-ft. rod. The stouter end can be used for making an 8-ft. or 8½-ft. fly rod; these use thicker strips.

Saw the 12-ft. culm into two 6-ft. lengths. Put aside the thicker piece and place the other piece on the bench to be split up. We'll aim to split strips the full length of the piece, and it's not hard to do—the fibers run very straight.

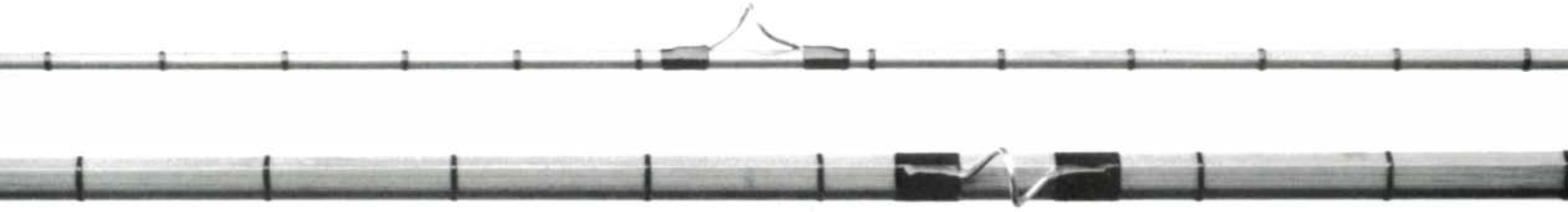
Study the culm carefully, planning to avoid scuffs, scars, water stains and other imperfections. A few minor water blemishes are bound to show up, since only one culm in a thousand is absolutely perfect in all respects. Look for an overall light-straw color. Greenish culms, or deep yellow ones should be allowed to season several months longer.

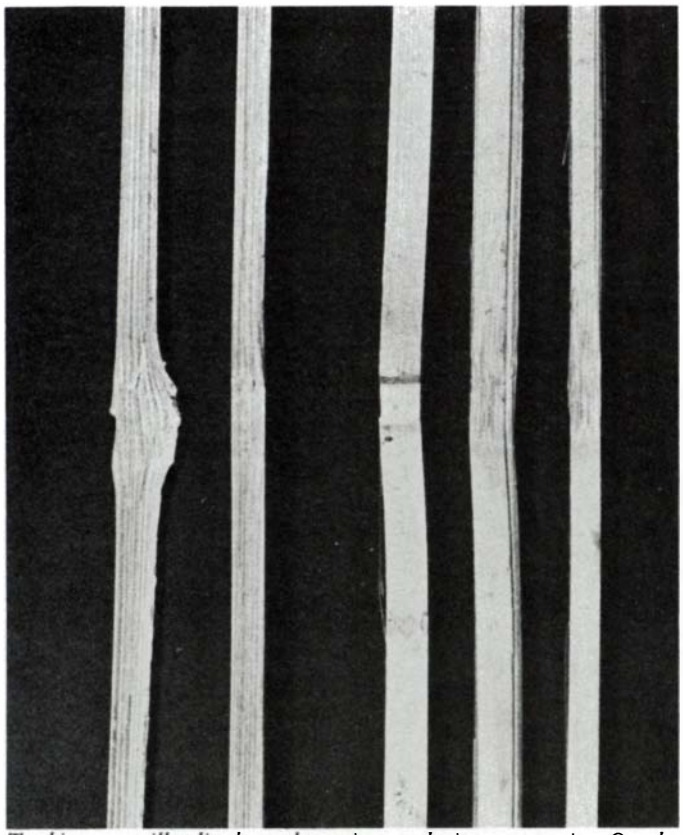
Now using a stout knife split the culm down its length into halves, starting at the thicker end. Be careful—bamboo edges can be glass-sharp. Along the U-shaped split half, at each node, is a solid interior wall or dam which must be cut out with a gouge before further splitting. After you've leveled the inside of the culm, split each half into three preliminary pieces, each about 1 in. wide. Then split each of these 1-in. pieces into three or four strips—you'll need at least 18 good strips for the three rod sections. These strips are considerably wider than they will be after planing. Because the culm structure varies slightly in density around its circumference, number each strip so you can make each rod section from adjacent parts of the culm, as shown in figure 1A. To even out irregularities and keep the rod's action uniform, strips that were adjacent in the culm should be placed opposite each other within each rod section (figure 1B).

Next, stagger the nodes. Lay the six strips that will comprise the tip section of the rod in their proper sequence on the bench. The first strip stays put. Move the next strip about 2 in. along the length of the first. Shift the following strip another 2 in., and so on (figure 1C). This will stagger the nodes in a helix along the finished rod. Check the positions of the nodes along the entire length of the tip. If any are too close together, move the strips a little to balance them out.

Now mark and cut all the wood to length. Cut the 12 strips for the two tip sections to 47 in. long, the butt strips to 46½ in. These lengths allow 1 in. to be cut off each end after the strips have been glued together.

Filing and straightening the nodes—The 18 split strips are considerably oversize at this stage. Before proceeding with the planing, we must remove the bumps at the nodes. To flatten the nodes, place each one in a metal vise and file it down level with the enamel on the outer surface of the cane. The upper





Tonkin cane will split along the grain, producing wavy strips. On the left is the side view of a node as split from the culm. The second piece has been leveled inside and out. To maintain fiber continuity, split the culm (third piece, enamel face), file the nodes level with the surface of the enamel (fourth piece), then heat-bend the strips over an alcohol lamp until they are straight (far right).

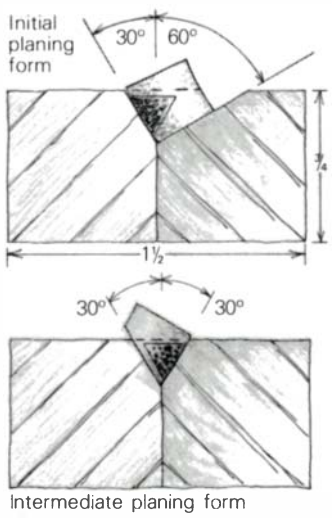
Bamboo

Bamboo is technically a grass—and the fastest growing plant in the world. Researchers have clocked some of the Orient's 1250 species at a growth rate of nearly 4 ft. a day. The type used for fly rods *(Arundinaria amabilis)* is cultivated on high, windy bluffs where a less hardy plant would fail. It grows hollow, its ¼-in. walls reinforced by solid plugs every foot or so at the nodes. The 3-in. diameter stems break through the ground and shoot up to 40 ft. tall in just two months. After this initial spurt, the walls toughen over the next 5 or 6 years until they are densely packed with long, resilient fibers. If you break a piece of high quality bamboo, the fibers will stand out in a bundle of 6-in. lances. Poor quality bamboo breaks leaving fibers only half-an-inch long. The growing conditions are part of the difference, and nowhere are they better than in a 25-sq. mile area around Tonkin, China. Tonkin cane is currently available after a 50-year hiatus in trade with China. While synthetics such as fiberglass and graphite fiber may match its lightness, stiffness and strength, they can't match the beauty and traditional appeal of Tonkin cane.

surface is now level (as shown in the photo, left), but the strips are not yet straight. Straightening the nodes is not easy, but it's critical—we want the longest fibers possible in the finished rod. If you leave a little crook or bump in the node area, the plane will rip the fibers there, undercutting the cane, which will weaken the finished fly rod.

We straighten the strips over an alcohol lamp, wearing gloves. At each node, hold the concave underside of the strip over a low flame until it becomes pliable. Then you can bend it straight. Easy does it. Too much pressure or too little heat will crack some of the fibers in the strip. The flame may scorch the underside, but these areas will be planed away.

Preliminary planing and removal of enamel—Each strip must now be planed to a tapered triangle. We use two planing forms. The first, shop-made from hard maple, has a 90° V-notch, oriented 30° to one side, 60° to the other. This V will hold a rectangular strip with its enamel side down, so a 60° angle can be planed on one of the inner sides. Don't plane the enamel face. It is the strongest part of the cane and it must be conserved. When you've planed one side of the strips to 60°, they're ready for another planing form, this one with a 60° V-notch. You can make a 60° wooden form. The easy way to do this is to joint two 1-in. by 2-in. maple boards (5 ft. long, more or less) and then bevel them to the correct angle on the jointer. Place these beveled edges together to form a V-groove. Then taper the edges of the boards until the groove has the correct size and degree of taper. The width of the faces on each strip should conform to column C in the rod-taper chart (p. 73). Fasten the boards together, and you will have a non-adjustable form—good for a rod or two. This form is so easy to make that you might as well make a few of them in graduated sizes, saving the most precise form for those last few strokes with scraper or plane.



Intermediate planing form

Instead of a series of wooden forms, I now move over to the same adjustable machinist-made form that I use for final planing. I set it wide enough to give the strips good support. Place a strip, enamel face down, snugly in the 60° V-notch and plane a 60° angle on its other inner side. Then turn the strip in the form and lodge it with the enamel surface up. We want to remove as little as possible from the enamel face, but we have to true it so it registers in the form. Using a scraper (since the plane would remove too much material) take two or three passes to remove the thin layer of enamel, making the surface true and flat and bringing out the nice grain beneath. There will be no further scraping or planing on this surface.

Binding and heat-tempering—When you've planed the sides of each of the 18 strips down to approximately 50% larger than the rod designer's specified tapers, they're ready for a heat treatment to dry and toughen the cane's fibers.

The six-strip sets for each of the three rod sections (one butt, two tips) are nestled into shape, then tightly wrapped with cotton twine by a binding machine—this will keep them from warping when they're in the tempering oven. The binding machine operates by means of a stout linen cord wound into a double loop over the hex section, as shown in figure 2. A weight suspended from a pulley provides the proper tension, a couple of pounds. Turning the crank moves the rod section along a cradle. Cotton cord, feeding off its spool through a tension device, wraps around the hex in a spiral for the full length of the section. When you reverse the linen loop you get a snug criss-cross wrap.

After the three sections have been bound, they're heat-treated in an oven to temper the bamboo and increase its resilience. My oven is a length of heavy-gauge aluminum pipe with a perforated propane-fueled gas pipe underneath. The three rod sections are placed inside and rotated by a small rotisserie motor. The sections cook for two hours at about 350°F. Then they're turned end-for-end for another two hours. The once-tight binding is now quite loose, because the cane has shrunk from moisture loss.

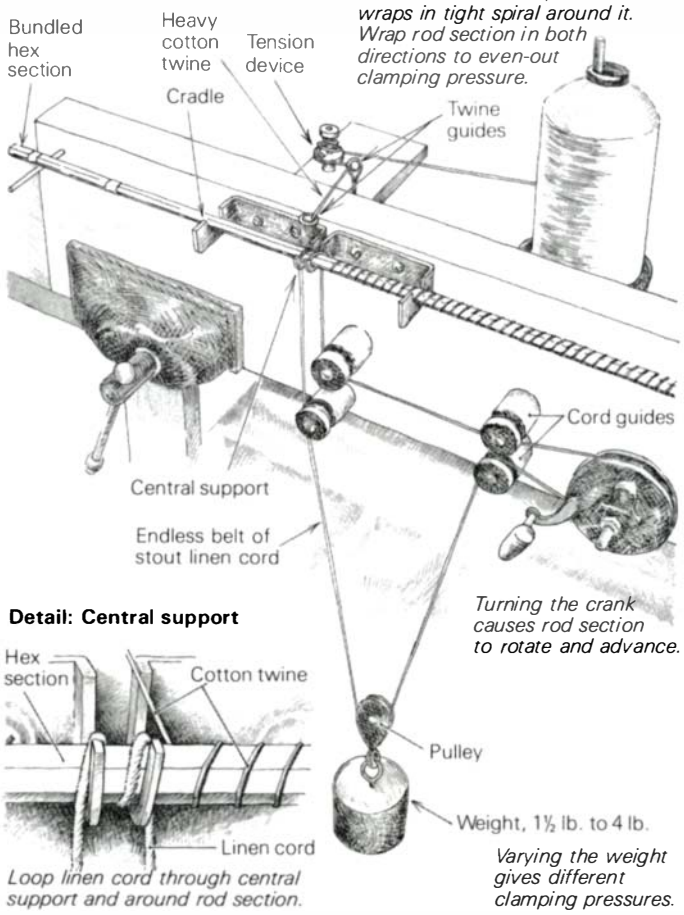
Final planing—With the binding removed, the 18 strips are ready for final planing. My final planing form, made of twin steel bars, as shown in the photo on the following page, has screws set every 5 in. One-eighth turn of a screw opens or closes the notch 0.001 in. A 30° angle on the inside edge of each bar forms the required 60° V-notch. The angles are machined on both top and bottom of the form—one for thin tips, the other for hefty butt sections.

I start with the screws of the form adjusted larger than the final taper specifications. I gradually plane the sections, still oversize, to their required taper, alternating the two inner faces. I prefer to begin with a Stanley No. 60 low-angle plane set to take a 0.004 in. or 0.005 in. shaving. Measure the shavings with a micrometer—you want to know how much bamboo you're removing with each pass. Keep the plane level with each sweep to maintain a perfect triangle. Flip the stock between every couple of passes.

You will note that the strips are becoming quite flexible when they are bent in one plane (perpendicular to the enamel face), yet are much stiffer when bent sideways. The hexagonal glue-up will maximize this directional stiffness.

The strips will still be considerably oversize. What we are aiming for is not the final size but the correct taper, so we can take full-length passes. When the taper is right to within 0.010 in., go to a precise plane such as the Stanley No. 9½. This tool, like the low-angle plane, must be razor sharp. Taking off shavings of 0.002 in. with each pass, work each strip down. It's a slow process. Check each strip frequently with a micrometer, as you plane the bamboo down closer and closer

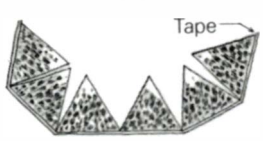
Fig. 2: Rod-wrapping machine



Drawings: Christopher Clapp

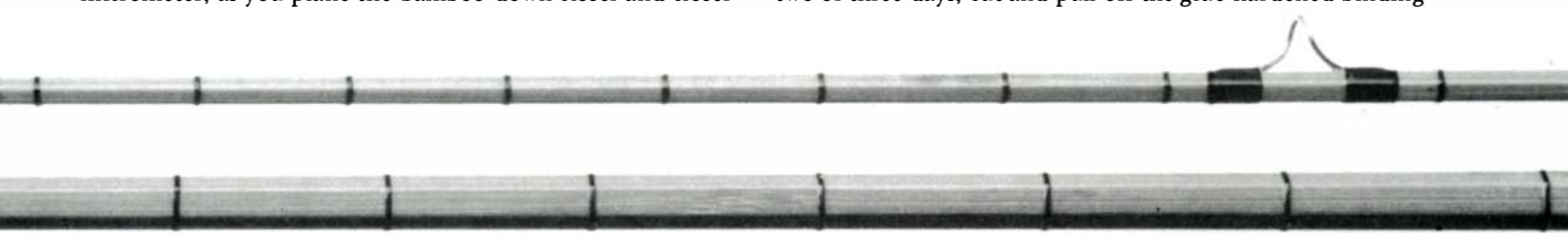
toward the perfect taper. Perfection is when each strip conforms precisely to the design at every 5 in. along its length.

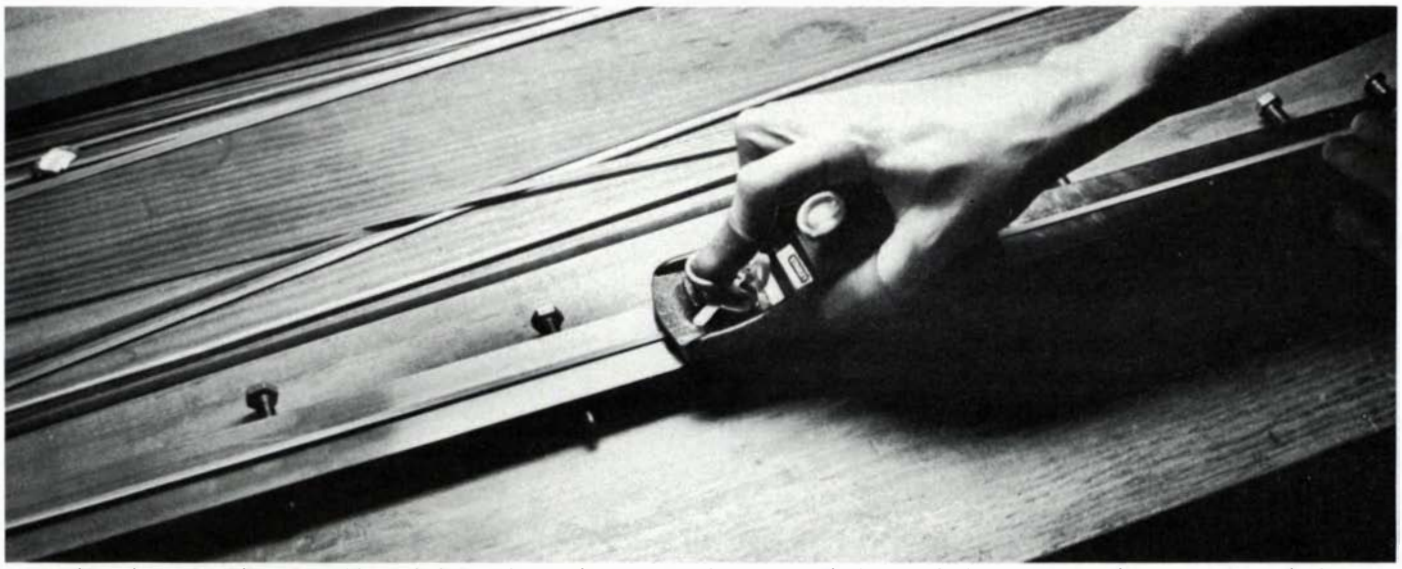
Gluing—Now bundle the thin strips together in proper order, and bind the sections with masking tape every 10 or 12 inches. Using a razor blade, cut each tape so the hex can be opened up and spread apart on the bench. Saturate the exposed edges with strong waterproof and heat-resistant glue, using a wide bristle brush. I use Nelson's Urac 185 or Elmer's resorcinol glue. A 7½-ft. rod with an extra tip will show more than 60 linear ft. of glue line. The Urac formula is honey-colored and thus invisible. The Elmer's will leave a purplish threadline joint.



With glue applied to all surfaces, fold the strips back into their hex shape (the tape indexes them) and wipe off excess glue. Then re-bind the section with the wrapping machine and wipe off as much squeezed-out glue as you can. Before hanging the section up to dry, hand-twist out any curves to minimize the final straightening procedure later on.

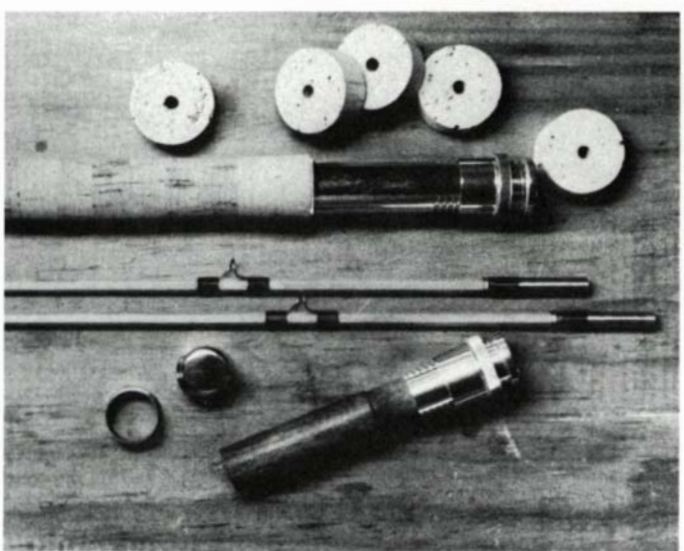
Filing and sanding—After the glued sections have cured for two or three days, cut and pull off the glue-hardened binding





A machine shop made this adjustable steel planing form. The top side is for rod tips, the bottom for butts. Turning the screws adjusts the form to 0.001-in. tolerances at 5-in. intervals along its length.

Heat from an alcohol lamp softens the bamboo fibers and allows rod straightening. Keep the rod moving to avoid scorching it.



Cork rings, reel seat, mesquite insert, and butt cap, together with a finished rod grip that has been turned to shape.

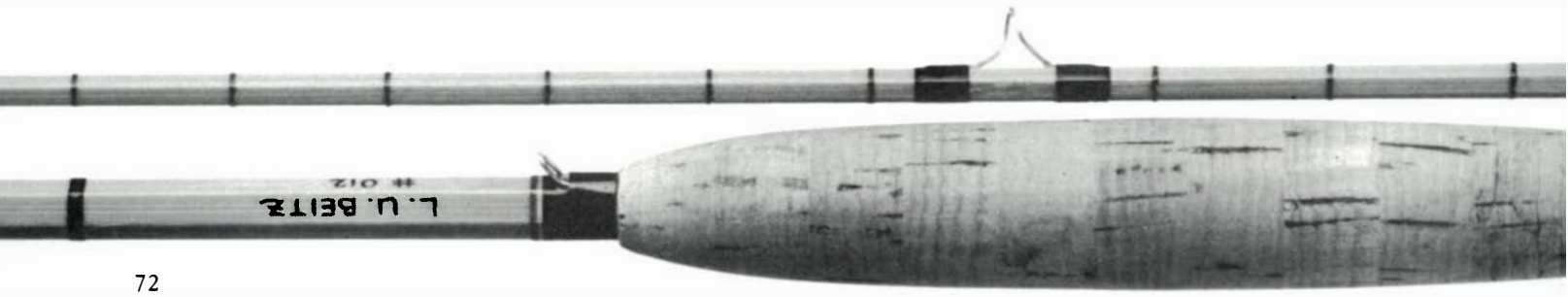
cord. With a smooth file, clean off the bumps and humps of remaining glue. But remove only glue residue, don't disturb any of the cane surface. Take care to file flat and not to round any edges off the hex. The butt is fairly easy to file, but filing can be mighty tricky on the last 15 in. of each tip, where the diameter goes down to 0.063 in.

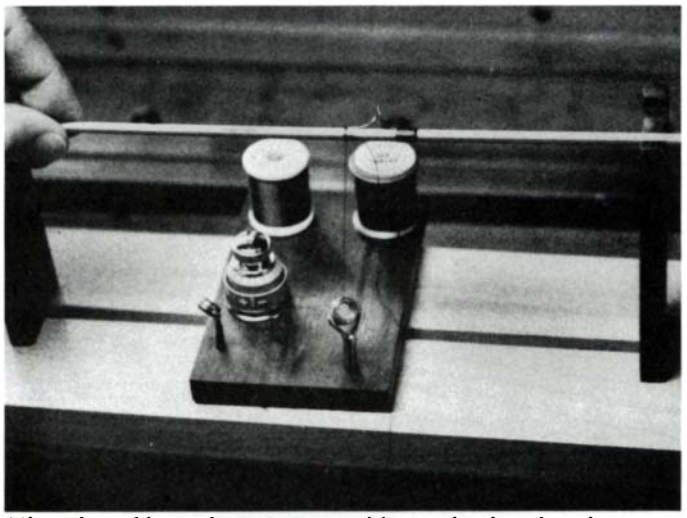
Now run a sanding block with 400-grit sandpaper over each surface. Finish up with 600 grit. When I have completed this painstaking business of filing and sanding one of my rods, I usually knock off for a day or two and go fishing.

Final straightening, fitting of hardware and reel seat—Now sight down each of the flats for any bow, curve or twist. Over the alcohol burner, heat the cane where it requires corrections, moving the section actively to keep from scorching it. When cane and glue become pliable, crooks and curves can be eased straight. This trick also works to straighten older rods that have gone out of shape.

To mount the nickel-silver ferrules that will connect the rod sections, round off the edges at the end of the hex in the lathe. Removing too much bamboo will result in a weak point in the rod, so don't use too small a ferrule size. You want a pretty tight slip-on fit. Glue the ferrule on with a five-minute epoxy, which sets with slight expansion. Handgrips are made from cork rings that can be bought with various sized holes through their centers. Boil the rings to soften them, slide them up the butt section, and glue them together. When they have dried, turn them down on the lathe to shape. Then fit the reel seat and its wooden sleeve insert (I use mesquite).

Wrapping of guides, varnishing—Well, you now have a handcrafted split-bamboo rod blank. All that's needed for completion is to wrap on the line guides, install a tip-top guide on each tip and varnish the cane. Most commercial rods use strong but bulky nylon for wrapping, but a fine split-





This adjustable guide-wrapping tool keeps the thread at the proper tension. Turning the rod produces a silk-smooth wrapping that secures the guide. The wrapping will be varnished for protection.

bamboo rod calls for traditional pure silk. A rod-wrapping tool, which works like a simplified, finger-powered version of the binding machine, keeps the correct tension on the thread by means of a clutch or by the pressure of a spring against the spool. The rod section is turned against this tension until each guide is snugly wrapped in place. For the sake of tradition, I've added decorative intermediate windings between the guides on this rod—they are not necessary for strength.

After you have wrapped the guides along the rod section, at appropriate intervals which you can judge from the full-size photograph, treat the silk with a coat or two of color preserver to prevent its darkening when it's varnished. Then clean the bamboo thoroughly. It is traditional to write the maker's name, the rod length and the weight line for which it was designed on the flats of the shaft near the grip. Use permanent India ink; the rod may last a hundred years.

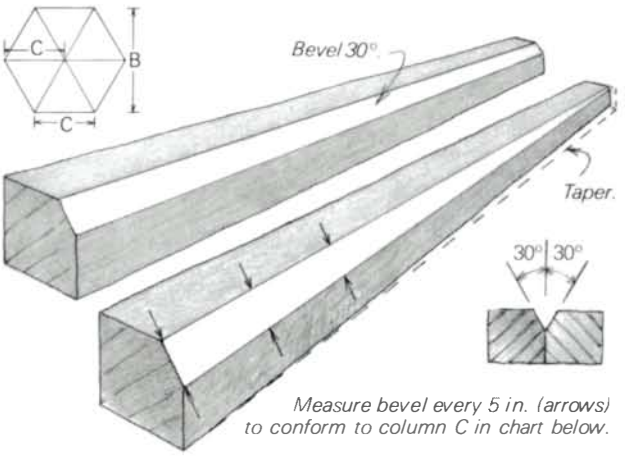
Varnishing is another meticulous job and must be done in a warm, dust-free room. I use tung-oil varnish and red-sable brushes. While the varnish is drying, I make a ferrule plug to keep the female ferrule free of dust or dirt when the rod is not in use. I use ebony, but any hardwood will do. Turn a 2-in. long, ⅜-in. sq. piece to about 1/32 in. less than the male ferrule, leaving a larger decorative knob on one end. Then glue on a ½-in. wide cork ring to the part that will fit into the female ferrule. When it's dry, turn the cork to the exact size of the ferrule, and cut off the excess wood.

In between coats of varnish (three or four coats applied over a span of some six or eight dry days) you can sew a cloth sack partitioned to fit the rod sections. An aluminum tube for storage and travel will protect your work. □

Les Beitz makes split-bamboo fly rods in Austin, Texas, researching and working from rod specifications that were developed by the craft's most notable designers. He spends about 95 hours working on each $600 rod.

Photo: White Light Studios

Forms, tapers and materials



Measure bevel every 5 in. (arrows) to conform to column C in chart below.

To make the tapered planing form, square-up and joint two hardwood pieces. Bevel a corner of each piece to 30° for its full length. Then taper one face of each piece, so the bevel will match column C in the rod-taper chart. Fasten the pieces together to form a tapered V-notch. Several graduated sizes can be made for planing the rough bamboo to final size.

Rod taper specifications:

Below are the measurements for the fly rod that appears full size along the bottom of these pages. It is a medium Garrison pattern, designed for a No. 5 line. The intermediate silk windings between the guides on the L.U. Beitz rod are decorative and optional.

—Column A measures inches from the tip to the butt.
—Column B is diameter of the rod from face to face.
—Column C is the width of the bevel in the form.
—Ferrule size is 13/64 in., and the guide spacing may be judged from the photograph.

Tip Section			Butt Section		
A	B	C	A	B	C
0	0.063	0.036	50	0.206	0.119
5	0.078	0.045	55	0.220	0.127
10	0.100	0.058	60	0.233	0.134
15	0.117	0.068	65	0.247	0.143
20	0.131	0.076	70	0.260	0.150
25	0.144	0.083	75	0.275	0.159
30	0.156	0.090	80	0.306	0.177
35	0.168	0.097	83	0.309	0.178
40	0.181	0.104	90	0.317	0.183
45	0.194	0.112	No. 4½ top guide		

Sources:

- □ **Tonkin cane culms:** Charles H. Demarest, Inc., 45 Indian Lane, P.O. Box 67, Towaco, New Jersey 07082.
- □ **Steel planing form and binding apparatus:** Hoagy Carmichael, Cliffield, Indian Hill Rd. Bedford, N.Y. 10506.
- □ **Reel seats, ferrules, aluminum tubes:** Rodon Manufacturing Co., Inc., 123 Sylvan, Newark, New Jersey 07104.
- □ **Guides, tip-tops:** Perfection Tip Company, 4550 Jackson Street, Denver, Colorado 80216.
- □ **Silk thread, cork rings, color preserver:** E. Hille, The Anglers Supply House, Inc., P.O. Box 996, Williamsport, Pennsylvania 17701.
- □ **For further reading** about rodcrafting and Everett Garrison's influence, see Hoagy B. Carmichael's *A Master's Guide to Building a Bamboo Fly Rod*, 1977, from Martha's Glen Publishing Co., Katonah, N.Y. 10536.
  For the views of an innovative fisherman/rod-designer with tournament flycasting in the back of his mind, read Charles Ritz's *A Fly Fisher's Life*, 1979, Max Reinhardt, London.