Power Fibers Online Magazine

November 2019 (Volume 64)

Dedicated to the Making of Fine Bamboo Fly Rods

Inside this issue:

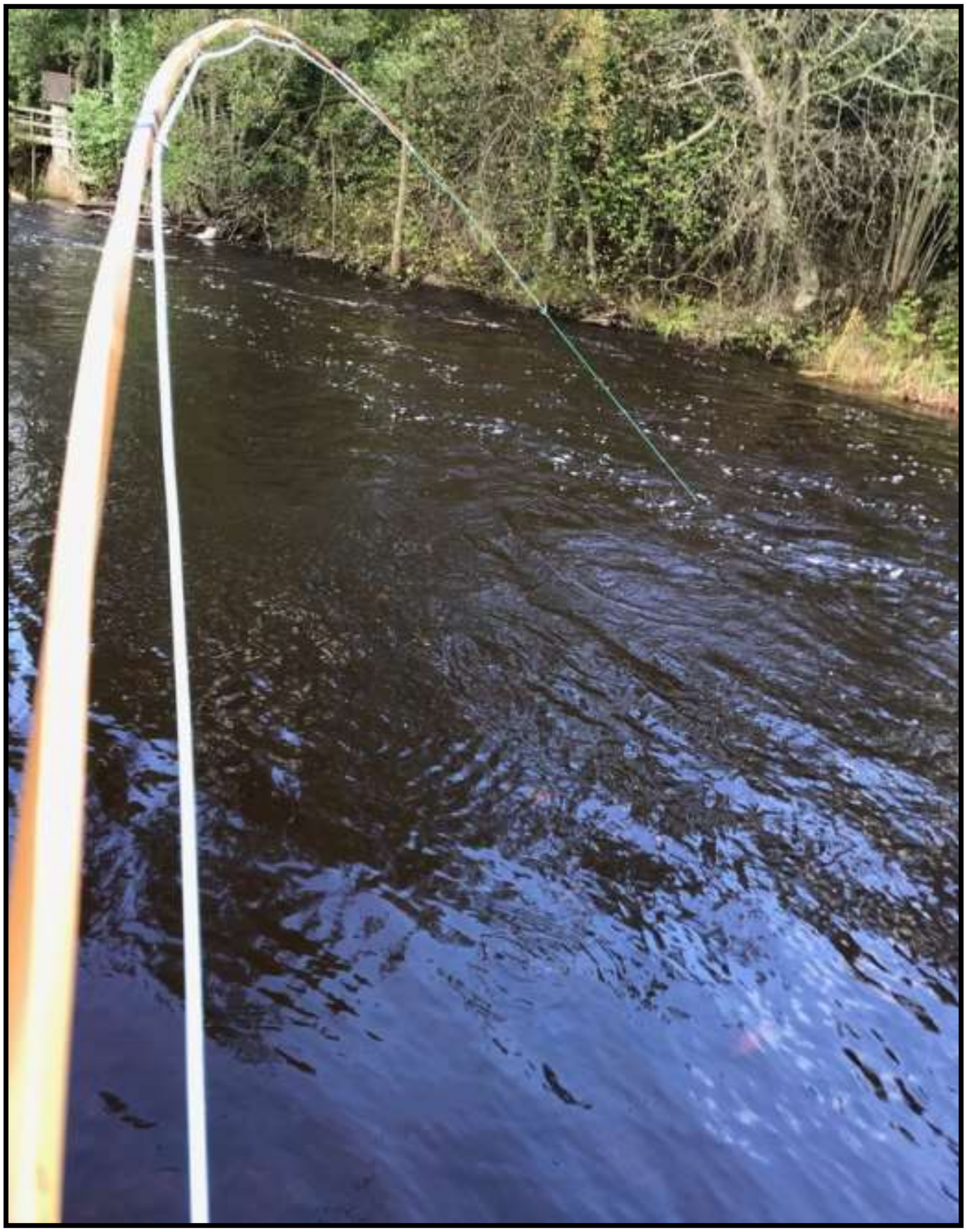

Photo of twisted, spliced quad with salmon hooked from Lars-Goran Dahlin


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The First Cast

Todd Talsma, Editor

This issue is again way behind, but I like how it finally came together. I have almost enough material for another issue ready to go, so I should be able to get it put together and out within a couple of months.

Part of the delay was because of some medical issues I've been going through. Some of these are continuing and I'm going to be having some more surgery on both wrists (carpal tunnel) in the next month or so. This being said, I should still be able to work on some of the background work for upcoming issues.

I'd like to ask the readership for help on a couple of items. First, if you're enjoying the interviews, please let me know if there are any rodmakers you'd like to see interviewed (with contact information, of course). Second, I'm asking for input on how you make your rods. There is more information on page 36, but suffice it to say that I want to hear from as many of you as possible. I appreciate the variety of methods I get to read about and post on the bamboorodmaking.com site and want to bring some of that information to these pages. Thank you in advance for participation with these two requests.

Speaking of bamboorodmaking.com, I have a fairly large update (also past due for an update there) which should be coming soon as well. The site is well over 1000 pages and continues to grow. If you haven't been out there, it's another great repository of rodmaking information. I have some ideas rattling around in my head as to how to improve the site and make it even more useful, so stay tuned on that as well.

I can always use more ideas, feel free to contact me. If you have a suggestion about improving *Power Fibers,* drop me an email at the following email address: power.fibers@bamboorodmaking.com

Warning!

Because many aspects of bamboo rodmaking bring the maker in contact with machinery, bladed tools, volatile chemicals and gases, the editor and advisory board of *Power Fibers* ask you to exercise the utmost caution when attempting to build or mimic any devices or activities mentioned in this magazine.

Please have any devices you build and use in your shop checked by a safety professional before attempting to use such devices. This is to guarantee your personal safety and that of others around you.

If you choose to build any device or use any technique found in this magazine, you are doing so at your own risk.

Power Fibers Online Magazine

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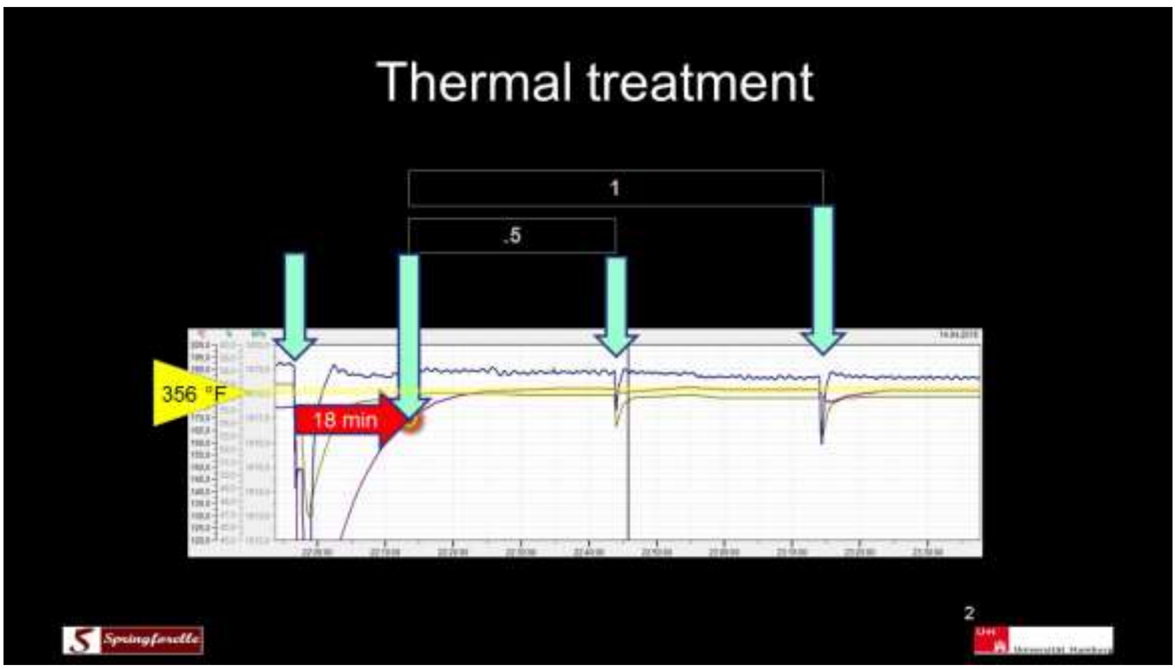
Letter to the Editor

Text and Figure from Peer Doering-Arjes

In Power Fibers 58, page 35, figure 14 there is something you were looking for (*I have found no mention of anyone monitoring actual bamboo temperature in their processes, let alone any mention of it lagging oven temperature*). Unfortunately, I used the term 'temperature sensor' instead of thermocouple. I found it takes about fifteen minutes until the core temperature is the same as the oven temperature. I think you will not detect the correct duration if the thermocouple is not placed inside the bamboo.

Getting the bamboo to the same temperature as the oven is not only due to the good insulation properties of bamboo, but also on the amount of bamboo you place into the oven and medium inside the oven. Most rod makers use hot air, which transports heat badly. Steam, which I use in my oven, conducts heat very well. Moreover, steam suppresses oxidation. Therefore, I would not conclude that *working against improved heat transfer is the need to vaporize the water entrained in the bamboo*. On the contrary, if you soak your strips in water, which facilitates planing, your strips will heat up much faster.



In the figure above, you can see it took 18 minutes until the temperature inside the bamboo reached the oven temperature of 356 °F (purple line, the other lines originate from thermocouples steering the oven temperature). The first green arrow indicates when I opened the pre-heated oven to put the strips in; then I opened it after .5 and 1 hour to remove some test samples. I extended the test up to 8 hours and the bamboo was not overcooked, if you define 'overcooked' as the breaking strength being lower than the untreated sample.

I hope I could fulfill your wish to "publish some measurements of bamboo temperature in their process."

Extreme Hollow Building—Experiences and Explosions

Text and photos from Tapani Salmi

Some years ago there was a challenge on Clark´s classic rod page to make a 7' long #3-4 line weight rod with mass of less than 2 ounces (57 grams). I decided to try. Thereafter I have tried to find simple hollow building techinques for hand tool rod building.

To make any cane rod lighter it is common to use hollow building. The elasticity "power" of bamboo is very high in longitudinal direction as we all know. In the formula of MOE (moment of elasticity), the diameter (D) affects the elasticity at the power of 4 and to the mass at the power of 2. Therefore if we take 50% of the thickness of material away from inside, the mass is the 25% less and the MOE is diminished only 6%. To make the rod significantly lighter we have to take as much as easily possible away and this is called extreme hollow buiding.

The material we take away is the soft and weak pith part of cane and we want to exclude most of the surface material, the power fibers. These are the strongest part of our raw material. The extreme hollow structure has been connected to competition rod building to achieve a long, strong rod for long distance casting.

But we have here some problems - the longitudinal elasticity and strength of power fibers is high but there are only a few circular or oblique fibers in bamboo. We all know that the bamboo strip is very easy to split even by hand with very weak force. If we make a hollow rod with extremely thin walls it may explode when there is a combination of bending and twisting of the structure. This has to be avoided.

In most of techniques there are some "bridge" material left inside the rod to increase the circular strength of the structure. For hollow construction there are several methods like scalloping, fluting, etc. to construct these "internal bridges" to support the rod. In addition to that mechanism, we have a very old method using dense intermediate wraps to support the rod. I have modified this further using a spiral silk wrap for the continuous support along the rod.

I have tried to make triangular (TRI) bamboo fly rods for some years for several reasons:

- The physical properties of TRI rods (Moment of Elasticity, MOE) give clear advantages for long rods.
- TRI construction results in lighter rods.
- TRI construction is especially advantageous for two-hand rods.
- Hollow triangle structure gives wider glue lines and it is more as a stabile hollow structure than hex or quad hollow.

I here describe some of my experiences, both successes and failures during learning the extreme hollow building methods using hand tools.

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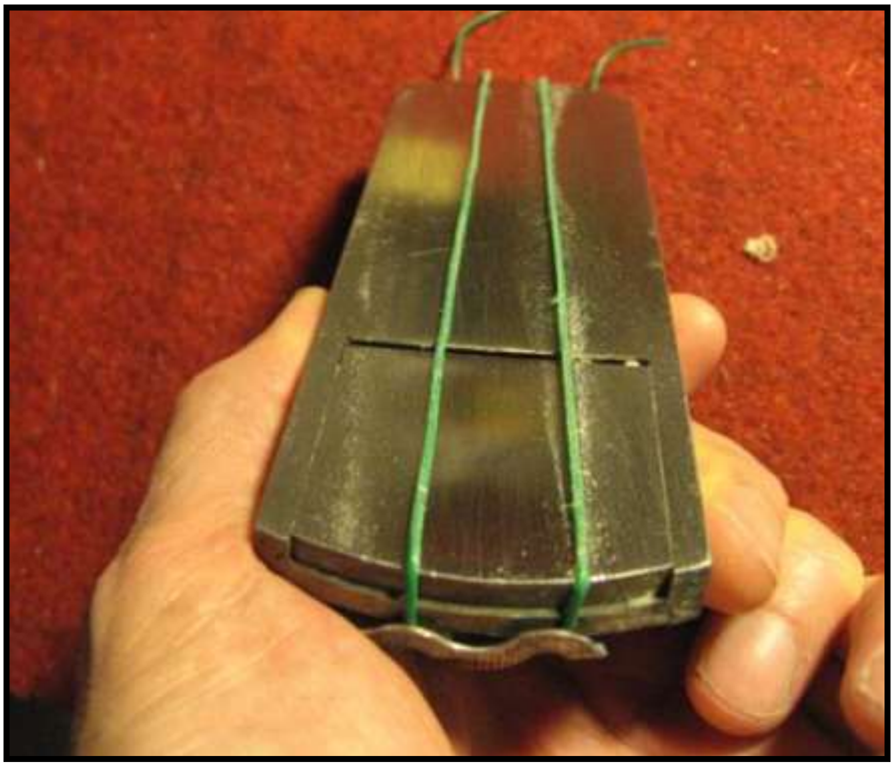
Baginski method for internal bridges

In autumn 2014 at European Rod Makers Gathering, in Waischenfeld, Germany, Rolf Baginski (German professional rod maker) demonstrated a very practical method to make hollow built rods using artificial, very light bridges inside the hollow tube. He took some cotton balls, moistened them with water and added then some drops of common PU glue (like Gorilla, Bison, Cascol etc). This results in foaming and swelling "balls" which are then inserted inside the rod. The foam and cotton swells, strongly forming a very hard composite-type structure inside the rod resulting in "bridges" to support the hollow structure. This results in same sandwich structure as used in manufacturing of skis, using layers of graphite, wood and other materials.

I planed the strips quite thin. The thickness of the strips for the tip part of rod was 1.3 – 1.4 mm and for the butt 1.4 – 1.8 mm.

I make this planing simply using my hand plane.



Simple modification of my plane to make 1.4 mm thick strips.

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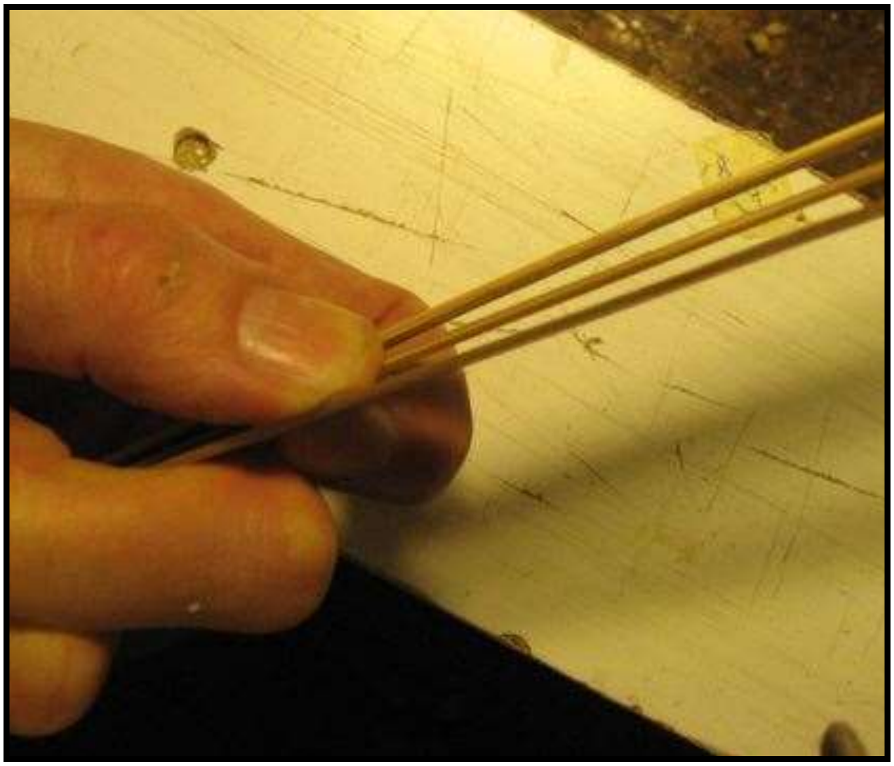


Three strips for a triangle rod.

Thickness of the strip is here 1.37 mm (= 0.054").

(Continued on page 9)

Baginski beveller for 120 degree corners for the triangle rod.

Triangle hollow-built rod cross section.

(Continued on page 10)

For the internal bridges you need some cotton-type soft fibers, PU-glue and water. I have used polyester wadding, like that used in pillows and blankets.

To insert the foam balls inside the rod easily and fast I tied the wadding balls with a thread 10-12 cm apart from each other.

Here I have the thread and cotton balls tied to a thread.

(Continued on page 11)

Then you add some water to each of them using small syringe and then add some drops of PU glue to the balls.

Here you absolutely need protective gloves because PU glue makes your fingers black!

After applying the glue to the strips I simply set the thread with PU balls on the strips and bind the rod to have the wadding balls inside the rod.

The fiber - glue composite is very light but quite strong and much stronger than PU foam alone!

The foam makes firm bridges inside the hollow rod to support the structure and increase the stiffness.

(Continued on page 12)

Here you see the foam inside the hollow scarf joint ferrule.

Is This Possible" -7' #3-4 rod weighting 2 oz (57 gram).

On Clark's Classic Cane Rod site there was a theme "Is This Possible" asking if it would be possible to make a 7' #3-4 rod weighting less than 2 Oz (57 grams).
http://classicflyrodforum.com/forum/viewtopic.php?f=68&t=83322

This certainly is a hard challenge for an amateur rodmaker using hand tools and I decided to try using this very simple technique.

I started by selecting a straight taper, changed the taper into triangle and got a taper with WIDTH of the strips as following (in mm's):

2.06 (.081)
2.54 (0.1)
2.98 (.117)
3.49 (.137)
3.97 (.156)
4.45 (.175)
4.95 (.195)
5.46 (.215)
5.97 (.235)
6.45 (.254)
6.95 (.274)
7.46 (.294)
7.94 (.313)
8.45 (.333)
8.92 (.351)
9.46 (.372)
10.0 (.394)

(Continued on page 13)

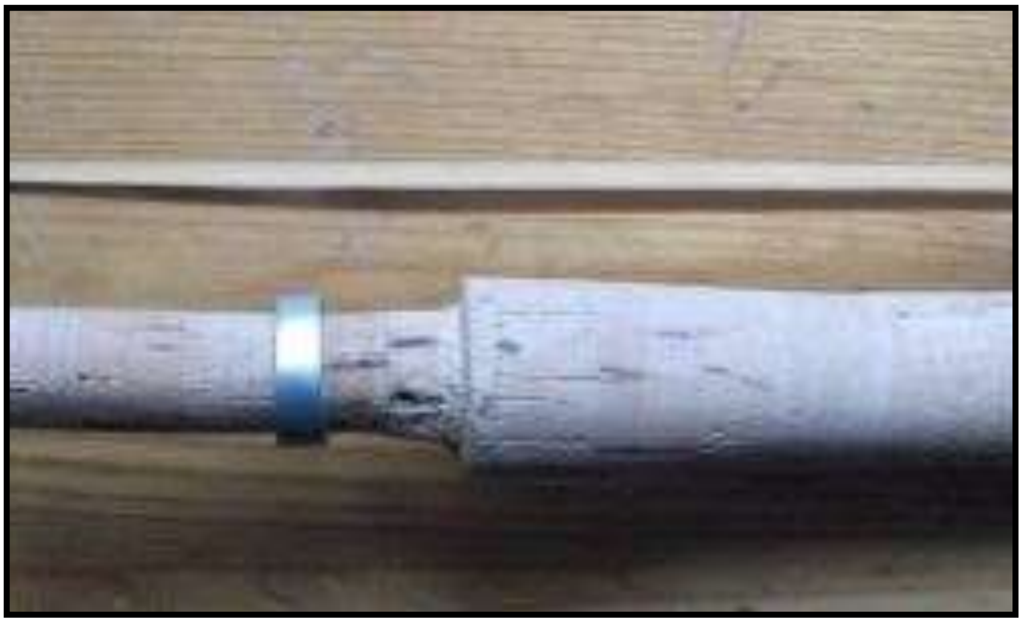
I planed the strips and the planed them into 1.3-1.4 mm thickness. This decreased about 50% of the weight of the strips. To change them into 120 degree corners I used my Baginski beveller to sand 60 degree corners into 120 degrees.

For the bridges I took polyester wadding balls, moistened them using water and added Gorilla glue as described above. I used UHU300 epoxy to glue the strips. The wadding and glue added only about 3 grams to the total weight.

I finished the rod with a single thin layer of PU varnish and I had a 7' rod blank which weighed 45 grams.

To keep the weight low I decided to use scarf joint ferrule. As the hollow scarf joint is not very strong I put a longer part of wadding composite into scarf area.

The blank seemed good but to my surprise cork, reel seat and even line guides are quite heavy. The obvious method to reduce weight was to make a small grip, make the reel seat with aluminum rings and use thin wire line guides.



Here you see the small hand grip and very light hardware.

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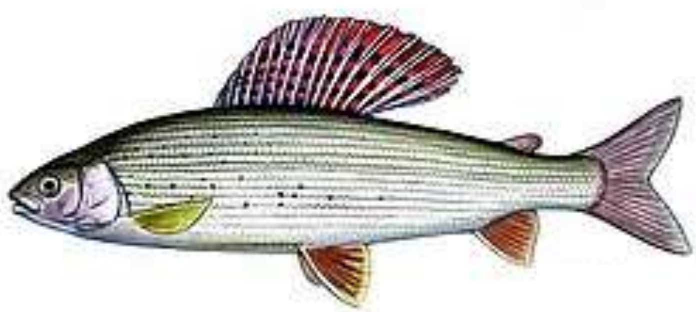

The result was a 56.8 gram rod casting #4 line.

Experiences:

Thereafter I made some heavier rods like #6 trout rod and #8 line weight #10' single hand salmon rod and thought that I had found the Graal Bowl. The success changed to failures. The big rod really exploded in two days fishing, the thin cane did not endure the bending and twisting.

To my surprise even one smaller rod got some longitudinal breaks in fishing. The PU and cotton bridge is not elastic, it does not support the strips in long term repeated stress.

I have not tried any other glue material instead of PU. There are elastic light PU foams and glues which could work. I suggest that you should try those materials to produce a sandwich structure inside the hollow rod!

Exploded rod with PU balls inside.

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AFTER TOTAL FAILURE BACK TO START LINE

After these experiences I had to try something else. It is always a good idea to look back to history. I found the intermediate wraps and other techniques, like graphite rod building, to find circular and spiral fibers of the hollow rod.

Intermediates of a classic Hardy rod

Circular fibers of typical graphite rod

I decided to try dense intermediate wrappings to support the rod. I had some hollow built rods with PU internal bridges and I was afraid to break them. I then made quite dense intermediate wraps on the rod, I then put some cyanoglue (superglue) on the wraps and it did not break in my fishing.

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So, instead of INTERNAL bridges it was possible to use EXTERNAL bridges. To make all those dense intermediate wraps is not the most pleasant work. The next generation of support for the hollow rod will be to use spiral wraps.

Spiral wrap

The spiral wrap is very fast to make, it takes about 10 minutes. I started with silk thread with good results. Then I found a very thin monofilament thread which is used to sew the transparent curtains or "light curtains." The monofilament has a good UV protection and it is really thin. The spiral wrap requires an extra varnish layer to hold it and the final surface is not smooth. I have now used this spiral wrap for my one hand rod and also for the big two hand rods for two seasons and it really seems to work: no failures so far.

HOLLOW RODS AND JOINTS/FERRULES

The joints or ferrules are the weak point of any hollow rod, especially in long and two-hand and spey rods. To make the scarf joint stronger I have put some extra cane and even short pieces of graphite inside the hollow end parts of the sections at the joint.

Typically we just use electrician tape to secure the scarf joint. It is possible to give extra support to the scarf joints externally also. I have used graphite or polyester tube laminated with epoxy or other glues to make a firm tube or sleeve around the joint area. These structures seem to give the extra strength to the joint/ferrule area much more than the simple tape.

In conclusion, it seems that the extreme hollow building may be achieved using simple hand tools. The challenges get harder when we want to make long and two-hand rods in which the hollow building is the most useful feature. By combining old ideas (external intermediate support) and new tools and glues it seems to be possible.

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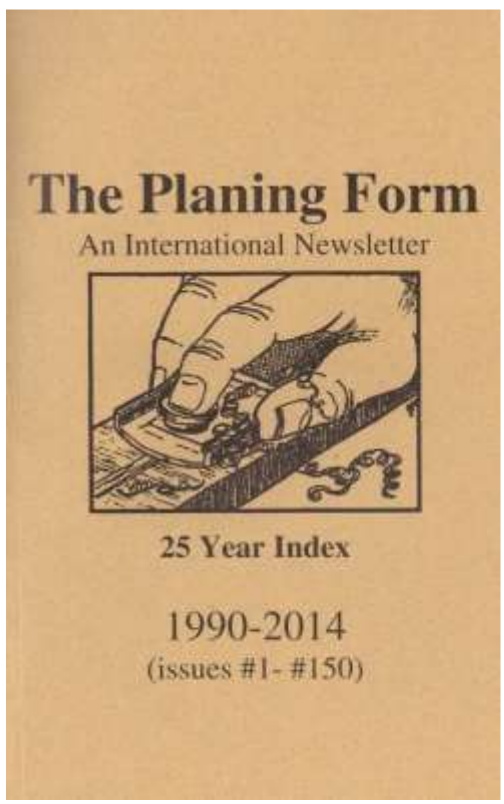

Rodmaker Profile: Bret Reiter

Text, figures and photos by Bret Reiter and Power Fibers

PF: What are your personal favorite streams to fish?

Since moving to Arizona my favorite place to fish is the Colorado River at Lee's Ferry in the Grand Canyon. There is also a small mountain stream a couple hours away called Canyon Creek that I like. Back home it would be in this order, Pere Marquette, Au Sable, Manistee and the Muskegon.

PF: Do you have a memorable story of fishing bamboo or memories of anyone in particular people you've fished with?

I have many fond memories of fishing with bamboo. One in particular was being able to take Andy Royer out with us on the Manistee River. The excitement he had to be able to fish with a rod made from his bamboo is something I will always remember. I also will never forget the night that I was out with some of my friends and hooked into a 29" Brown on a Hex. Rod Lawrence netted that fish for me and I'll never forget how we laughed that it wouldn't fit in the net. I also will never forget all the times I spent in my drift boat fishing the Muskegon with my son, you and my friends.

PF: How did you get into rod making?

I started out by buying bamboo rods from ads in the newspaper in South Bend, Indiana back in the early 70s. A lot of them needed to be redone, either just stripping and re-wrapping or sometimes taking them apart, re-gluing the strips, and then refinishing them. I had bought Garrison's book when it came out and the math intimidated me. Luckily, just before that time I had met Bernard Hills who was Heddon's Master Bamboo Rodmaker and rod shop foreman. I spent a lot of Saturdays in his shop and he taught me about making rods from scratch and showed me different techniques about bamboo rod making.

PF: How did you learn to make bamboo rods?

As I said before, Bernard Hills got me started making them from scratch. I got the tools and equipment to start making them myself and learned from trial and error. When Wayne Cattanach's book and video came out these really helped me in my progress to where I am today. Attending gatherings, talking to rod makers and also watching demonstrations at gatherings have added to my skills.

PF: Who had the greatest impact on you as a rod maker?

There are several people. First and foremost, of course, is Bernard Hills. Also Jack Young, Paul Young's son. He spent almost an entire day letting me see the shop up in Traverse City and showed me how some things worked. I had asked him about an apprenticeship and he told me bamboo rods were going out of style but still spent a day showing me the ins and outs of rodmaking. He sent me home with a

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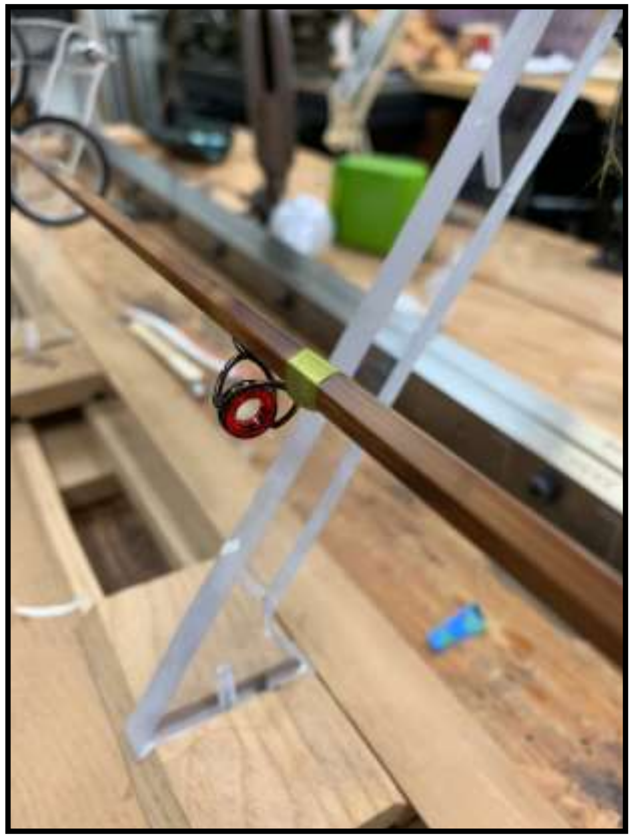
catalog (which I still have today) and a ton of free fly tying materials. Then, Jack Young sent me over to talk to Bob Summers about making bamboo rods. I laugh today because he showed me around but he told me to go find a real job because bamboo was dying. That only made me want to make them more. In addition, there are all the great guys I have met throughout the years in this mad pursuit of making a stalk of grass into a fishing instrument. I thank them from the bottom of my heart. We have a lot of great guys who are making rods today.

PF: What are some life lessons you've learned from building?

Don't take this too seriously as it's only a fishing pole after all and like anything else you get involved in, there will be some great guys that will share a lot of information and give you tips and materials and there are also a lot of horse's rear ends that think they are the only ones who should be able to make rods. They believe everything they do is better than anyone else's, but this is just human nature I think. To each their own.



PF: Why did you choose to make bamboo rods?

When my older brother and I got into to fly fishing our Dad gave us three bamboo rods he had. There was a 7'6" South Bend 290, a 9'0" Heddon Premier and a 8'6" Heddon #10 Blue Water. I still have those rods and just recently fished the #10 at Lee's Ferry. He also gave us his Pflueger reels, some South Bend reels, his waders, his vests, his wooden trout nets and some trout flies. Our Dad also taught us how to fly cast. I always wanted to have more bamboo rods and did buy an H.L Leonard bamboo rod and an Orvis Battenkill. Of course, all the rods I bought that needed to be rebuilt or refinished. Since I wanted to have more rods I figured I better learn to make them.

PF: Do you also make fiberglass or graphite rods? Why?

I have made a few glass rods and a couple

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graphite rods but they never gave me the satisfaction I got from fishing bamboo. I even made a fiberglass 12'6" Spey rod back around 1974 or so. It's funny when I look back at that rod because everyone cussed at me for fishing it for salmon and steelhead back then. Look today at all the Spey rods and switch rods out there, even in bamboo. I am actually redoing that rod now.

PF: What are your personal philosophies about craftsmanship and the making of bamboo fly rods?

My Dad always taught us to do everything the best you can and do it right the first time so you don't have to go back and redo it later. Use the best materials and don't let your ego get in the way because there is always someone better out there at what you are doing.

PF: Who are you most proud to have made a rod for?

My son Adam, I have made him several and I am making him more now. I also was proud to make two rods for my older brother and three nephews. I gave my brother a Garrison 209E and I also gave one of these to my nephew for his birthday in July. I made Adam a Para 15.

PF: Who would you like to see casting one of your rods?

If you mean anyone famous that would be no one. I have known too many celebrities in my day, whether actors or musicians and most aren't worthy of using such a nice thing as a bamboo rod. Hopefully a grandson or granddaughter one day! Other than that I am always happy to see my friends at the gatherings casting rods I have made. They are far more important to me than any celebrity.

PF: What do you think most rodmakers struggle with the most when they're starting out?

I think the biggest hurdle is just getting started. I hear so many guys say that they have a hard

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time having the confidence to just start. Other than that, I think new makers have to overcome the difficulties of splitting strips out and straightening. I hate to wrap rods and I would trade straightening strips for someone who is a good rod wrapper. Call me crazy but I find this part relaxing. I use an alcohol lamp, turn on some good tunes and just take my time.

PF: What was your biggest rod making fiasco?

My second rod was a two piece, two tips 6'3" rod. I had it all glued up, strips sanded and straightened and a coat of tung oil on the strips. I was checking for straightness and heard a noise behind me and turned around and snapped one of the tips on my workbench. I was so discouraged I just laid it down on the bench (after a few choice words) and walked out of my shop almost in tears because I had strived so long to get to this point. I didn't go back into my shop to work on rods for about a month. I tied flies and made leaders. I still have that broken tip in my shop and have used it to check wrap colors before I put them on a rod.

PF: What type of fishing do you enjoy most and how has that affected your taper design?

I have always been a big dry fly fisherman for trout. I do like other forms of fishing but this is my passion so I usually try to make tapers for dry fly fishing. One of my all time favorite tapers is the Garrison 7'9" 209 E and I have made several of these. I have even made it in three piece with the help of Mark Wendt working out the taper for me. Nick Kingston has this rod. Mark and I put it together for him. I also am very fond of the 8013 Dickerson for a slightly longer rod for throwing smaller flies and I made a Nunley Snake Rod I used as my

(Continued on page 22)

main rod out of my drift boat on the Muskegon River in Michigan.

PF: What is your favorite "I reach for this first" rod, and is it a proprietary taper or one based on a past master?

I seem to be fishing larger water these days like Lee's Ferry in the Grand Canyon. I like a 8'6' rod like a Heddon #10 that was my Dad's and has been refinished with original Heddon thread and 9'0" Heddon #17, Petrie Special. Just recently, about three weeks ago, I used a Granger rod that I had refinished. If not fishing there I usually reach for my Dickerson 8013. I do have a few classic rods like a Leonard #51 and another Leonard that I bought when I was in my 20's that is 8'0" six weight. I have about 50 rods so sometimes it is hard to decide. I recently made two PHY Para 15s, one for me and one for my son Adam. I fished this rod exclusively back in Michigan the first week of July. I ended up giving mine to my brother who I started fly fishing with when we were kids. He recently got a clean bill of health and was told he was cancer free so I gave it to him as a celebration.

PF: Where do you feel the future of rod building is headed and why?

If we don't start to see some younger guys start to make bamboo rods this may end up being a very small group. There are a lot of us getting

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up in years with no one in the family following in our footsteps. Heck, I'm pushing 70 and neither my son or nephews show any interest.

PF: If you could do it all over what would you differently in regards to rodmaking?

Not get started! Just kidding. Seriously I would have made sure I attended as many gatherings as I could have. When I lived back in Indiana and Michigan I was pretty close to a lot of the gatherings. Now living down in Arizona they are not very close except for CRR.

PF: If you could offer one piece of advice to new rodmakers, what would it be?

Don't be afraid to do things and try things. The worst thing you could do is screw something up, but that is how you learn.

PF: I know you've fished in a lot of different places. Of all the areas to fish, where would you still like to go? Why there? Is there any other type of fishing you would like to do, other than trout fishing?

I would like to get back up the The Gaspe' Peninsula (Quebec) and fish for Atlantic Salmon again. That has always been my biggest dream for fly fishing. I love tying full dress Atlantic Salmon flies and the first rod I actually finished was an 8'9" three piece eight weight rod. I named it Rivier Matepedia after the river I was going to fish. I actually wrote an article several years ago for *Power Fibers* on this rod about the first fish I caught on it.

PF: Would you share a taper for your favorite rod?

I have several I like that are for different situations. I guess my two all time favorites are the PHY Para 15 and Garrison 290E. I like the Para 15 for Hex and big streamers and the 209E for smaller rivers like The Pere Marquette for dry fly fishing.

My Learning Curve with the Worksharp 3000 and the Wide Blade Attachment

Text and photos from Marcel Duval

Note 1: This article is not a tool review with a full description of all components. I assume that the reader knows the product, its components and how they interact with each other. Where some description is provided it is to zero in on a flaw. I only discuss sharpening on top of the sanding plate using the Wide Blade Attachment so there is no mention of the feature that allows sharpening using the underside of the sanding plate.

Note 2: My go-to plane for final planing is the Veritas Standard Block Plane, which beds the blade at 20 degrees. The primary and secondary bevel angles that appear in some of the pictures are just my preferences for an angle of attack of 60 degrees - it works for me. This article is not about the best angle of attack, nor is it a sharpening tutorial; it is about compensating for the shortfalls of the tool to obtain an accurate and repeatable blade setup, and a sharp edge.

Note 3: I have not yet used the diamond sanding discs available for the Worksharp 3000 so this article only pertains to the standard sanding discs.

Note 4: In preparing this article, I discovered that the manufacturer discontinued the Wide Blade Attachment in October 2018 due to low volume sales.

As a member of a few bamboo rodmakers forums, I am aware that several rodmakers sharpen their blades with the Worksharp 3000 (WS3000) and are happy with the results. I am also aware that this tool has frustrated others due to less than satisfactory results. They have put their WS3000 on a shelf somewhere and have gone back to the sharpening method that works best for them. Hopefully there is something for both groups in this article.

I purchased my WS3000 and the Wide Blade Attachment (WBA) kit (see Photo 1) two years ago after doing research and watching a few YouTube videos. Up to that point I had sharpened my plane blades on water stones using the Veritas MK II honing guide. The results were more than satisfactory, but I found the exercise time consuming. I was also keen on doing away with slurry, flattening stones and clean up. In my view, the design of the WS3000, with the addition of the WBA, some extra tempered glass plates, and sanding discs with grit ranging from 80 to 6000, offered the potential to obtain super sharp blades quickly and with consistency - speed and repeatability.

Photo 01: WS3000 and WBA

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With all the components in hand, I installed the table and made the necessary adjustments to level it with the sanding surface - one glass plate fitted with 80 and 120 grit sanding discs. I put on 400 and 1000 grit discs on a second plate and a third plate received the 3600 and 6000 grit discs. A plane blade went into the Honing Guide (HG), the desired angle was set using the Blade Alignment Fixture (BAF) and I was ready for a test run. Easy process so far. Well, after running the blade through all the grits, the first result was nowhere near satisfactory. The primary bevel was slightly off perpendicular and the sharpness level did not match the water stone method. A few more test runs produced better results, but still not satisfactory, and repeatability was elusive. So, for a few hours over a few days, using two old blades, I set out to figure out this sharpening system.

It is fair to say that the WS3000/WBA combo has a few flaws, but which tool does not have flaws. The key is awareness. Each flaw of this sharpening system is easily compensated for and I can say that for the past two years the WS3000/WBA combo has been my only sharpening method. It has produced super sharp blades with speed and repeatability. So, what did I find out during those few hours of “figuring out”?

Flaw #1. The HG. I love my Veritas MK II HG, even though the blade registration jig is a bit cumbersome to use, I must say that the designers of the Worksharp HG did a great job. Of all the side-clamping HG I have seen so far, theirs is one of the best IMHO. The blade rests on two steel rods perpendicular to the jaws and a ledge to support the sides of the blade is machined into each jaw. The surface of the ledges is level with the top of the rods. In theory, if the machining of all parts is accurate and the rods are exactly perpendicular to the sides, the blade, once tightened, should sit straight in the HG, and it does on mine. However, it was not unusual on my HG to have one side of the blade not fully down on the back rod after tightening. I believe it was a machining accuracy issue with the ledge, which caused that back corner of the blade to be pushed off the back rod when tightening. A little bit of judicious hand filing solved that problem. If not corrected this will cause more material to be taken off on one corner of the bevel and I suspect this was the source of the off-perpendicular bevel problem I noticed on my first, and some of the subsequent test runs. On a few occasions I also noticed that the blade did not rest on the back rod at all after setting the desired angle in the BAF, and tightening. If not corrected, this will definitely affect the bevel angle. I figured out that I was causing that problem in the way I was holding the blade in the HG/BAF assembly during setup, with down pressure applied too far forward on the blade. Once I learned to just let the blade sit on the rods, push it forward against the stop pin and tighten, the blade sat flat on both rods. One should always check that the blade is resting on both rods after alignment and tightening.

Flaw #2. The BAF. This part has a groove at its base to accept the HG feet. The problem to watch for here is that the groove is wider than the length of the HG feet. On my BAF there is a .023” difference between the width of the groove and the length of the HG feet. For repeatability during alignment and angle set up, I always push the HG forward against the front edge of the groove, then push the blade forward against the stop pin - Photos 2 and 3. Photo 4 shows the .023” gap between the HG feet and the back edge when the feet are pushed against the front edge. Holding the HG feet

(Continued on page 27)

against the back edge of the groove will also ensure repeatability; it will just produce a slightly different (shallower) bevel angle. The key is to push the HG against the same edge during every set up. I recently put my BAF aside and replaced it with a wooden jig with bevel angle lines and a groove to accept the HG (See Photo 5). I made it such that the feet of the HG fit snuggly in the groove, so I no longer need to worry about pushing the jig against one edge. This eliminates one potential variable in the set up.

Photo 02

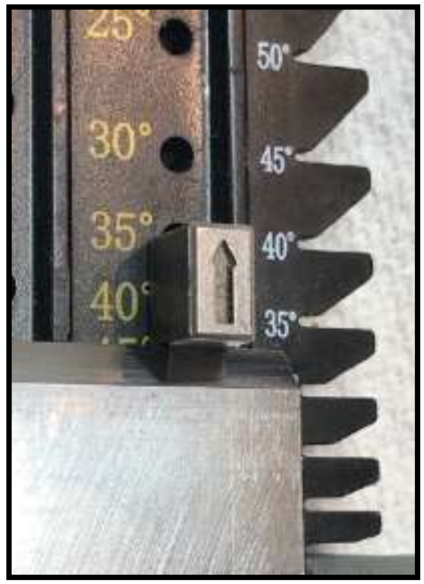

Photo 03

Photo 04

Photo 05

Flaw #3. The last component that can negatively affect the sharpening results is the glass plate/ sanding discs combo. When I was doing my "figuring out" using old blades, I used all six grits from 80 to 6000, as I would if establishing a new bevel on a blade. Combo #1 (80 and 120) quickly established the new angle and produced what felt like a very sharp edge. Combo #2 (400 and 1000) improved both the bevel surface smoothness and the sharpness of the cutting edge. Combo #3 (3600

(Continued on page 28)

and 6000) did not improve the cutting edge but did create a mirror finish on the bevel surface as expected. However, the mirror finish was more pronounced on the back of the bevel. I repeated the "new bevel" exercise a few times with the same results. I concluded that I was dealing with plate/discs combos of different thickness and combo #3 was likely the thickest. Caliper measurements confirmed my thinking as per Table 1. With the table levelled with combo #1, one would expect an improvement to the cutting edge when moving to the thinner combo #2 as it sits slightly lower than the table and it will therefore take more material off towards the front edge of the bevel. The thicker combo #3, being higher than the table, will favor honing the back of the bevel and will do little to nothing to further improve the cutting.

Combo #	Grit	Thickness
# 1	80/120	.417"
# 2	400/1000	.400"
# 3	3600/6000	.424"

Table 1- Combo thicknesses

One obvious solution to this problem is to level the table every time the combo is changed, but that does not meet the intent of a quick process. My next step was to remove the sanding discs from the plates and measure the thickness of my four plates and sanding discs. I measured two plates at .390" and the other two at .386" - not a significant difference. The sanding discs on the other hand showed some interesting variations that I failed to anticipate during initial set up – see Table 2. Note that the thickness of a sanding disc is not uniform, so the numbers in table 2 are averages of several measurements on two new sanding discs for each grit. Used discs will give slightly different readings. With that I opted to mix and match plates and discs to see if I could get combos of the same thickness and, failing that, combos that would get progressively thinner as I moved up the grit scale. The results are at Table 3. Because the 3600 and 6000 discs are thick, I gave each disc its own plate. I opted to use the thicker glass plates for combos #1 and 2, and the thinner plates for combos #3 and 4 to maximize the thickness difference between the two pairs. I am very happy with that choice. I then re-adjusted my table height to the new combo #1. From that point on I have been more than satisfied with sharpening on the WS3000 with WBA. If I need to re-establish the primary bevel, I use all six grits. For touch ups, I may start at 400 or 1000. The process is quick and now repeatable. Changing plates takes less than 15 seconds and once the primary angle is established there is no need to spend a lot of time on each grit to produce a razor-sharp edge.

Grit	Thickness
80	.018"
120	.017"
400	.007"
1000	.006"
3600	.017"
6000	.016"

Table 2 - Sanding discs thicknesses

(Continued on page 29)

Combo #	Grit	Plate and discs thickness	Total
#1	80/1000	.390” + .018” + .006”	.414”
#2	120/400	.390” + .017” + .007”	.414”
#3	3600	.386” + .017”	.403”
#4	6000	.386” + .016”	.402”

Table 3 - New combos thickness - glass plate plus sanding discs

A few final thoughts:

- I must point out the height difference between the table and combos #3 and 4 is nowhere near significant enough to produce a visible secondary bevel. In fact, after running the blade on both combos, I get a mirror finish on the entire bevel. I just know that with those two combos sitting slightly lower than the table, the cutting edge gets a little more attention from the sanding discs.
- I am a fan of the David Charlesworth Ruler Trick which flattens only a very narrow band just behind the cutting edge on the back side of the blade. On my WS3000 I take advantage of the thinner #4 combo to accomplish the same thing. I place the back side of the blade on the table with the cutting edge extending over the sanding disc and I apply light downward pressure towards the front of the blade to contact the disc for a few seconds. That’s it!
- I have the WS3000 leather hone kit and I use it. It is quite a bit thicker than any of my plate/disc combos. I do that final phase of sharpening free hand.

And there you have it! I hope current users can find something useful in this article. For the unhappy owners of the WS3000 with WBA out there, if you decide to allow it back on your workbench or sharpening station and give it a second chance, please let me know how that works out.

May sharpening become an easy chore for all.

Wet Planing

Text and Photos by Tony Spezio

Some years ago, I read where Darryl Hayashida soaked his strips before planing. I was very hesitant to try this because I had been reading about keeping the strips dry. I finally decided to give to a try and have not gone back to dry planing except for the final passes after the strips are dried in the oven.

I have been soaking strips for over 19 years and find it a lot easier on my hands.

I had been soaking 1/4" strips for up to five days before planing. I found if I prep them prior to planing them it saves me four days of soaking. I now am able to soak for only one day. I do not remove the inner dams before splitting the culm. That is done later.

Staggered nodes, note the dams.

Removing the inner dam.

Inner dam sanded recess sanded, this recess is to accept the depressed node.

(Continued on page 32)

Sanding rough 60.

Recessed and rough 60 sanded.

Rough 60 sanded.

Soaking strips.

(Continued on page 33)

The strips are then soaked for a day or two and made ready for planing. I wipe the excess water off the strip with a paper towel and then put it in the form. I have no problem with rust.

Soaked strips.

The node ridge to be filed off.

Heating the soaked node. It takes less than a minute to heat the node. No burning or hardening on the nodal area.

The node is now displaced into the recess previously sanded. Note there is a groove in the plate to accommodate the ridge.

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The node ridge is removed with just a few passes of the file. The bump is displaced so not much of it will be filed. This keeps more power fibers from being removed from the bump.

The ridge removed.

A soaked strip held in the planing form.

.012" is removed on each pass while rough planing. All strips are planed to .025 over the largest number on the butts. Will re-soak tip

(Continued on page 35)

strips after heat setting to plane to smaller size. They are then dried as before and final planed.

Soaked Curls.

Holding planed full length .012 soaked strip.

Bound and ready for drying.

In Oven.

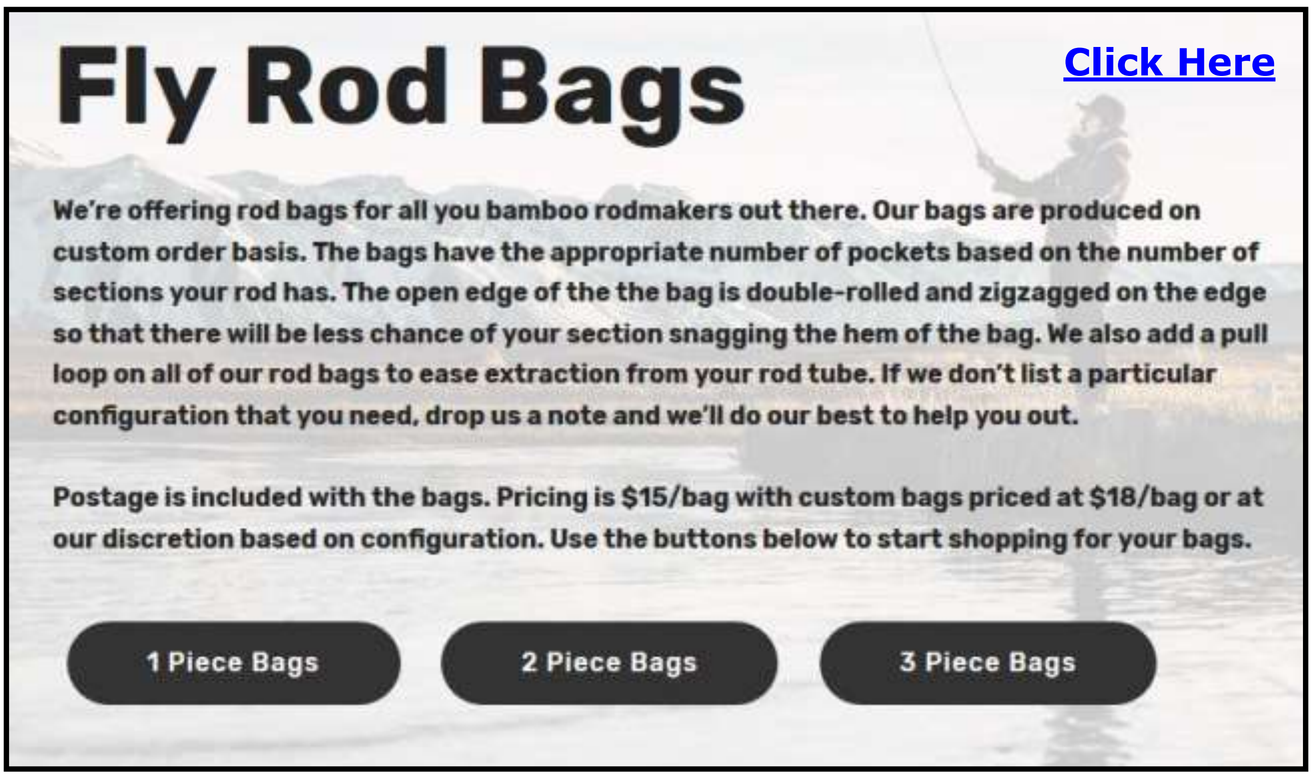
Photo 13 A mirror is used to check for moisture. When no moisture shows on the mirror the strips are dry. Then the strips are ready for heat treating. After heat treating all the strips the butts are now ready for final planing. The tips are ready for re-soaking. The re- soaked tips can then be planed to .20 oversize over final, dried and planed to final. I dry at 120 F.

Call for Input! We need your help!

We'd like to start sharing information on how we all make our rods. There are many different ways to get from culm to finished rod, and we think it may be interesting to hear about all of these methods. Each issue, we'll pose a question which will address some area of rodmaking. We'll then compile the answers we receive and then publish them in a later issue of the magazine. We'll need participation from as many readers as possible, so your input is appreciated.

For this issue, the question is: What is your process for finishing wraps?

Please be a specific as possible with your technique and send your responses to the following email address: power.fibers@bamboorodmaking.com.



Notes on Tapers

Text and Figures by Terry Kirkpatrick (From: http://www.fishtested.com/rodbuild/rebuild/taperqst.html)

Early in my rebuilding experience it became clear that I'd have to learn a little about tapers. I couldn't just glue ferrules on pieces of bamboo and expect them to be anything I'd want to cast. I soon discovered that bamboo rod tapers get passed around and everyone knows a good one, but few know why. Of course, people who are good at evaluating tapers can take one look at a chart, graph, or some other table and tell exactly what a rod will do. I have an idea, but I'm often still not sure exactly what I'm looking at.

There are a lot of ways of judging a rod's character from its taper. Some people chart the taper on graph paper. Others use formulae. Still others use computer models, such as Hexrod. Some use "deflection design." Orvis started doing this with their "flex index" but the idea isn't new.

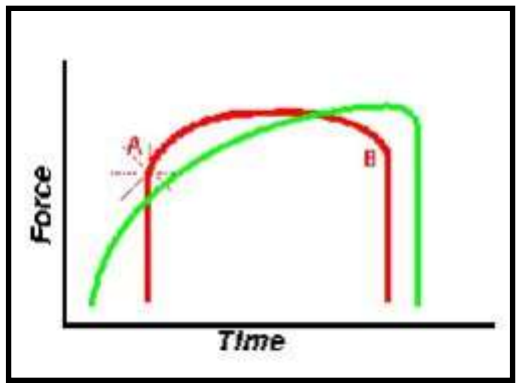
To use any of these methods you must have some idea about what a fly rod is doing and how well it's doing it. Reading this article won't make you an expert but it will give you a starting place. You must go out and cast rods and then compare the tapers.

There are some general rules we can follow.

The Tool

To start to understand tapers you must understand the tool we call a fly rod and how it works. A rod has two basic functions -- to cast a fly line and to fight a fish. Sometimes these functions come into conflict, so most rods are a compromise.

The cast



A good cast is like the green line on the chart. Power is added at a steady rate all the way through the cast until the very end, where it drops off sharply. The red line represents what would be a terrible cast. The rod is jerked into

(Continued on page 39)

motion (extreme stress applied at point A) but very little additional power is added. The cast dies an evil death at point B. Most casters apply power somewhere between these two extremes.

No matter what casting skill the fisher has, the rod must be able to stand up to the forces placed on it.

A rod is both a lever and a spring. The rod acts as a spring when we start and end the cast. As a spring it both stores energy and smooths out the cast. At the end of the cast it can return the stored energy at the right -- or wrong -- time. In fighting fish, it protects delicate tippets from being over stressed which would allow a fish to break off.

How does this apply to a fly rod?

Here's a very simple test that you can try. Hook a pound of lead sinkers on your rod at the stripper guide. While you're standing up, point the rod straight out from your shoulder. Now, move the sinkers out to the halfway point and pick the rod up again. Try it a third time, only move the sinkers out to the tip of your rod. You'll be amazed at the difference in weight you feel, even though the sinkers total only one pound.

As a lever, the rod works just the opposite of most levers. Most levers are used to multiply force from the end of the lever to the fulcrum. In a fly rod, power is delivered through the lever's fulcrum, somewhere under the casting hand of the fisher. From there power is passed outward to the tip. There is a formula that is used to figure the center of gravity for aircraft. The force it measures is called moment. What it says is for every foot a pound is moved away from the center of gravity, its effect increases in foot/pounds (ft/lb). Something that weighs a pound that is 2 feet from the C.G. (center of gravity) is said to be 2 ft/lb. While a pound of something that is three feet away is said to be 3ft/lb. The difference is 1ft/lb. With a fly rod, we can also measure in/oz.

Think of the old bamboo fly rods that were six, seven and even eight ounces. Today's rods are all around 2 ½ to 5 ounces. Most of us wouldn't think much of a difference of 4 or 5 ounces. That's not even half a pound. But when you start waving it around in a 9-foot rod, you'll soon feel how the weight is multiplied. In addition, you've got the line on the end of that rod. That's even more weight. Where the weight of the rod is distributed throughout its length (mostly toward the butt) and the line weight is *almost all* at the end of the rod. No wonder fly fishing can be such good exercise!

A rod is tapered because of the counter forces applied to the rod. When you're fighting a fish, the force is the same all along the rod (unless you put more force on the tip or the butt). When you're casting, the force comes from your hand and goes through the rod. This force must move the entire rod. Because you cast in an arc, the tip travels further than any other part of the rod. This could be thought of as something a bit like "G" force in physics, though it's different. If the rod wasn't tapered, you'd have to apply a lot of pressure to get the mass at the tip moving. Once the tip got started, it wouldn't want to stop. You would be casting something built like a broomstick. So, the rod is tapered to balance the longer arc the tip travels with lighter weight.

Why not make a rod thin all the way down to the butt? Because the force applied at your hand is a lot higher than the force applied further out the rod. The force at the butt must move everything out to the tip in an ever-larger arc. The middle of the rod moves further than the section above your hand but does less work to move itself and the rest of the rod outward to the tip. The tip only needs to move itself and the line.

Any point on a rod must be able to withstand the counter forces of (1) the power applied by the caster *and* (2) the total inertia of the mass of the rod and line from that point to the tip. If it can't it will break.

So, the taper is always larger at the butt and progressively smaller as you move to the tip. This is often referred to as the "slope." The steeper the slope, the faster the rod.

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In general a slope of .034 to .038 inches in a foot is a *fast* action: .028" to .033" is a *medium* action; .023 to .028 is a *slow* action rod.

Of course, rods are ***thicker*** as line weight goes up. If the tiptop for a 4 weight is .065" then you can expect similar taper for a 5 weight to go around .070" to .072".

A rods general taper will increase by about .006" (Plus/minus) for each increase in line wt.

Two-piece rods have more "flex" then three- or four-piece rods. The ferrules are considerably stiffer than the surrounding bamboo. That area of flexibility has been removed from the taper. While a two-piece rod loses about 2 to 2 ½ inches under the ferrule, a 3 piece rod loses at least twice that.

Generally, the more sections a rod has the faster is will cast.

Now that's some VERY general rules of thumb and not all tapers abide by them. But it is a place to start.

How to measure a rod

In the old days, rods were measured from the butt to the tip. In the seventies, Garrison and Carmichael wrote the book A Masters Guide to Building a Bamboo Flyrod. In that book Garrison used a mathematical model that required starting at the tip. Over the next twenty-five years, almost all rods came to be measured from the tip. Although one, three, and six inch increments are used, the interval most used is five inches because it's easy to use in calculations.

Although some rods were built to 64ths of an inch, today's rod cross sections are measured in thousandths (.001) of an inch. To do this, a special measurement tool is needed. Either a micrometer or calipers can be used to measure a rod. While Vernier calipers can be used (and can be accurate to .0001") most rods are measured with a dial caliper. It's the quickest way and accuracy usually suffers less than .001.

One other thing to take into consideration is you're not actually measuring the bamboo; you're measuring the bamboo *and* any finish on the outside of the bamboo. Usually, you'll want to subtract .002 to .004 inches from your reading for varnish.

I find that my old friend, masking tape, comes in handy when measuring a bamboo rod section. I can put a small strip of tape at each station (say every five inches from the tip) and butt the side of my calipers against this tape. I know that I'll get the same readings each time. And it's a lot quicker than first finding and then measuring each station, one at a time.

Title:

Date:

Station	A	B	C	Avg.	Slope
tip				a.	
5				b.	c.
10					
15					
20					
25					
30					

A typical layout for storing data about one rod section

a. Average tip size

b. Average station 5 size

c. Slope for station 5

Make a chart (see right). It should look something the one above. It contains space for all the basic data you'll need to record about your rod. The title and date are very important. I've got tables of numbers which have no associated rod information with them. It's very easy to create the information in the table, then forget what it refers to. Include as much information as you can. For example: "***Second Tip section for 8 ft. 3p 5wt. Wright and McGill field and stream. To create duplicate tip section for Jimmy. Done July 15, 2001***" Always put down more information than you think you need because you'll always need it somewhere

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down the road.
The fields in the chart are as follows:

- Station is the position along the length of the section in inches.
- A, B and C are the flat to flat measurements of each of the three sides.
- Avg. is the average of the three sides. (you'll find that almost every rod you measure will be off from .001 to as much as .015 between different sides.)
- Slope is the difference between the current and preceding station. An example: Station 5 slope = the number in the station 5 average box minus the number in the Tip Average box.

Some measuring tips:

- Work with a good light. It makes the measuring device easy to read.
- Keep clear of everything else. It's easy to turn around, looking for something and break a rod section on a desk or a table leg.
- Record each reading as you make it. (I usually take all three readings at once and then write them down. i.e. .071,.074, .078)
- If you create the data table using a computer spreadsheet it's easy to calculate the information. In fact, you don't even have to put in the decimal point. (a + b + c)/3000 will convert 71 + 74 + 78 into .074333 or .074.

If you find a station that is under a guide wrap, or in the middle of a ferrule, you have two choices. First, you can interpolate, taking the size above and below and create an increment of the slope, add it to the smaller number. Or, you can measure both sides add them together, and average them. Either one should get you within tolerance. Surprisingly, it's usually the slope that's more important than the actual dimensions.

Once you have all the numbers, you'll be able to see a few things right away. You'll notice the slope can go from .006 to .022 over two five inch stations. You'll also notice that several stations have the same slope or a slope very much alike (.002+/- difference). They could be considered straight.

A sudden change of .005 to .015 in a slope signifies a 'hinge.' They seem like they're increasing stress, but in some ways, they relieve stress around critical points. Hinges give a rod personality.

In looking for the slope of a rod, don't consider the full length of the action ("tip to grip") because tips and the area just in front of the cork grip are often special cases. Let's take a 7½ foot rod as an example. The rod is 90 inches long, but the bottom 11 inches are taken up by the reel seat and grip. The action is 79 inches long (most rod actions don't extend under the grip, but a few do). To find the slope of this rod, divide the action length by two and round to the nearest 5 inches. 79/2 = 39.5 rounded to 40". Next, using 5" increments, add and subtract an equal number of inches from that station. Using 20", we get 40 - 20 = 20 and 40 + 20 = 60. The slope between station 20 and 60 give us the slope in 40". We want to figure the slope in feet, so **slope**/40 gives us the slope per inch. Multiply that slope by 12 for slope in feet.

Notice we don't have to use 20 inches as our base line. We could use 25" which would give us a slope from station 15 to station 65. 30 inches would give us a slope from station 10 to station 70. However, the first and last 10 inches of an action are usually designed differently than the rest of the rod and if we include them in our calculations, they can throw us off.

The slope is only part of the information we use to evaluate a rod. Remember a rod doesn't have to have a consistent slope. Some of the best rods have slopes that change from the tip to the butt. For example, some rods have a hinge close to the butt. This gives them a "kick." Others have stiff butts and tips but a more "modest" mid-section. This rod action is often called parabolic or semi-parabolic, they require a modified casting stroke to get the most out of them, but people who like them won't trade them for anything. It might not be a bad idea to check the slope for each 1/3 of the action length.

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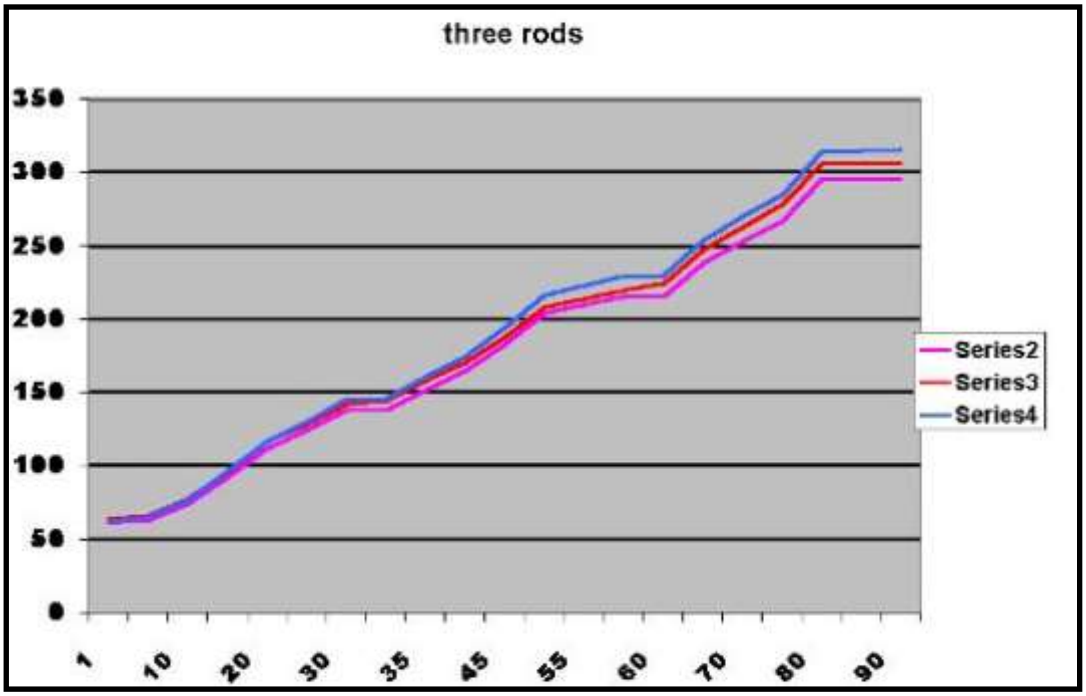
Graphs

Of course, one easy way to compare tapers is to graph them on graphing paper. Things like hinges are easy to see when you compare two rods or compare a rod to its slope (yes, you can chart the slope of a rod to see where it might be above or below the slope). Once again, the tip and butt sections of a rod taper may have special considerations and may not give an exact indication of what they rod will actually cast like, but they are apparent if you're graphing the taper.



The illustration above is a graph of three very similar rods. The rod marked “series 4” is the fastest of the three rods, while “series 3” is the slowest. Beyond this, we see several places where the graph seems to flatten out. Those are the hinges for these rods. Without casting rods with similar hinges, it would be hard to tell if we really wanted a rod with these characteristics.

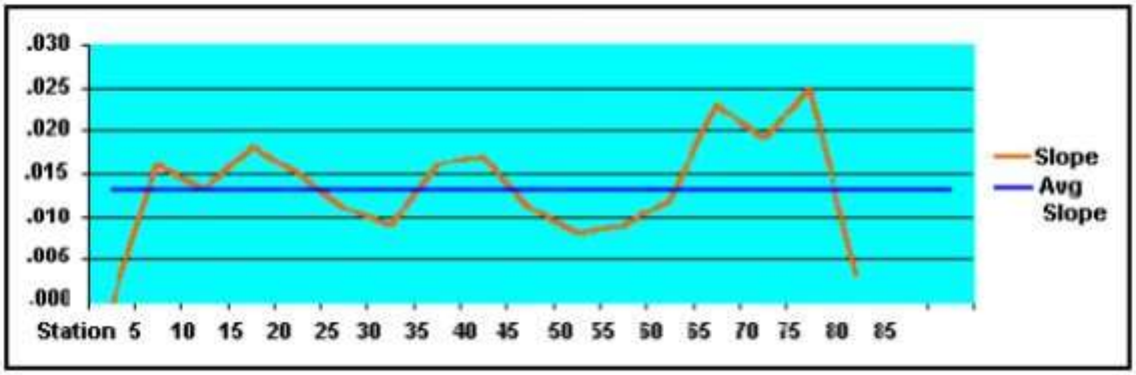
Slope

In the example, measuring from station 15 to station 65.

The rod has a constant slope of about .014 per 5 inches.

If we were to look only at the actual slopes between each point, it wouldn't tell us much. For example, what does the slight drop around station 75 mean? That's where the average slope number comes in. Remember we're only using the main part of the taper for our average. Using the tip and butt can lead to entirely different (and some would say erroneous) information.

(Continued on page 43)



It looks like we'll have a slightly fast tip, with a hinge starting somewhere between stations 20 and 25. That hinge will continue until we get close to station 35. Another hinge is between stations 45 and 65. There will be a slight hinge close to station 75 but it won't be as significant as the other two.

There are many ways to measure slope. It can be the difference between each station or the percent change per station. I once plotted the slope of a rod using four methods and found that the plots all fell almost exactly in line with each other, so use the method you like best. I chart slopes using the "between station" numbers.

Changing tapers using slope

You can change a taper using slope by doing all the work in percents. This allows you the ability to change the length or line weight and still have a starting point. ***DON'T*** expect to use this technique alone to come up with a good taper. To change a rod's length, you'd have to change the slant of the average taper line from horizontal, either up or down. In other words, everything else being equal, an 8 foot rod will have a larger butt than a like taper on a 6 ½ foot rod. They may cast much the same (the hinges will be at about the same relative location and the action will feel about the same), but they'll have different measurements. The use of slopes can be a starting point but proceed with care.

For more information on understanding how changes in slope change a fly rods action check out the articles "A discussion of rod Tapers," by Don Anderson; "Rod Design by Controlled Modification," by John Bokstrom and "Taper Design, by Frank Neunemann, all in The Best of the Planing Form.

Stress Curves

Example of a Stress Curve for a 7½ ft. rod.

Stress curves were popularized in rod building by Garrison and Carmichael in their book A Master's Guide to Building a Bamboo Fly Rod. Stress curves are used to show the amount of stress any given point on a rod can handle. The idea is this will show how the rod will react when loaded. Very simply, where it will bend the most and at what point it will break.

The stress at each point must be calculated before the stress at the next point can be attained. Because the work is usually done in inches, and the calculation is very complex, very few people used them until the advent of

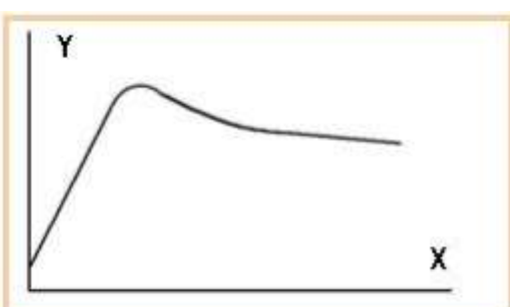
(Continued on page 44)

the PC. The personal computer allowed the calculations to be performed quickly and accurately. The only thing that was lacking was someone to write the program. That person was Wayne Cattanach, who included a floppy disk the first edition of his Handcrafting Bamboo Fly Rods. While the original program was primitive by today's standards, it revolutionized rod building. In the 2nd edition of Handcrafting..., Wayne explains, in detail, the math behind the program.

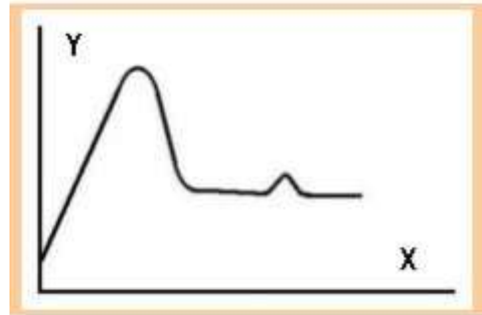
The best short explanation for stress curves and graphs was done by Darryl Hayashida. He's allowed me to reprint it here in its entirety. (I've tried to adapt his ASCII art to graphics. I hope he'll accept my humble attempts.)

"In its most basic use a stress curve shows you how close a split cane rod is to breaking with the weight and length of line you specified. Garrison believed 200,000 ounces per square inch was a good, safe upper level. You can go up to 220,000 or 230,000 without any problems. Garrison himself went up to 220,000 on his lighter rods. Garrison believed that below the 140,000 point the bamboo stopped flexing.

"As you get deeper into stress curves you can begin to pick out certain characteristics that tell you what kind of action the rod has or will have if it hasn't been made yet. A Garrison rod, which I consider to be slow, has a well-rounded "hump" near the tip and a fairly slow drop off as it goes towards the handle.

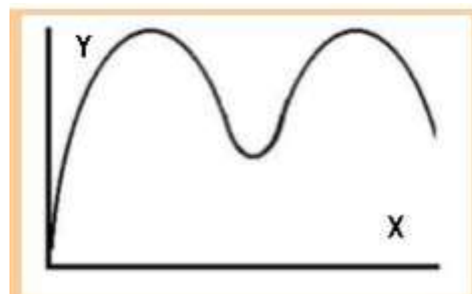


"The rod that I'm always raving about, the Cattanach 7' 0"4 weight, I consider to be fairly fast. It has a stress curve like this:



"The blip near the handle is the Cattanach hinge, and it greatly enhances roll casting. Don't forget to put it in. I did and the rod I made was a terrible roll caster. It isn't as necessary on longer rods, but on shorter rods it's needed.

"A Paul Young Para 15, what is described as a parabolic action looks like this:



"Looking at this rod, and never having cast one, I would guess that it would feel fairly slow, due to the enhanced bending near the handle, but able to throw a lot of line, due to the stiff mid-section. I would also guess that it could roll cast well.

"There are as many variations of stress curves as there are rodmakers. This covers the slow, fast and parabolic actions."

-Darryl Hayashida

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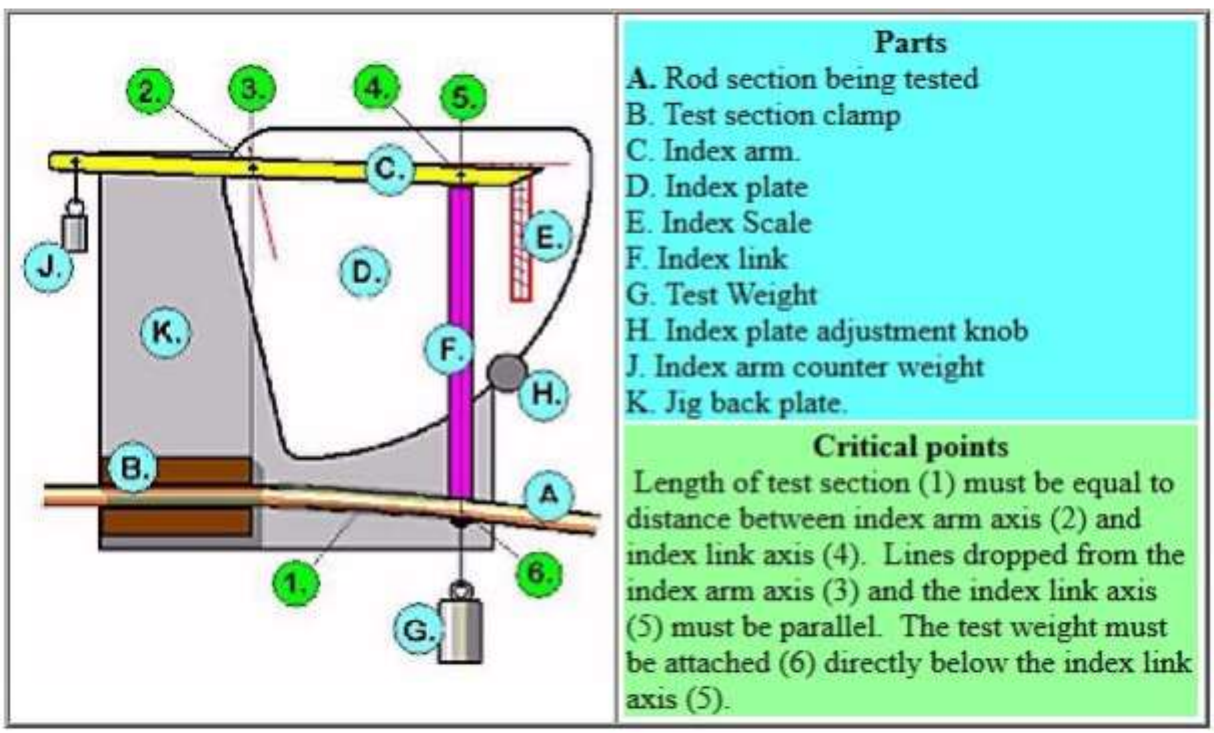
Deflection Graphs

In his book The Technology of Fly Rods Don Phillips expounds on the old idea that you can tell a lot about how a fly rod will cast by placing weight at various places along the rod and measuring how far the rod bends. Don's original article appeared in 1973 in Fly Fisherman, but even then, it wasn't new. Some rod companies would send out a large graph that could be placed on a wall and rigged to hold a rod by its handle. A weight would be attached to the tiptop. The rod could then be compared to lines on the graph, telling the prospective buyer what they were getting.

Today a few companies such as Orvis give information on the action of fly rods by reporting where they "flex." Don comes from an engineering background, so it's not surprising that his explanation is much more detailed and designed along engineering lines.

The idea is simple. If you immobilize a rod at some point, then place a known weight a known distance from the point the rod will bend -- in other words "flex." How far it will flex is measured as deflection. Most deflection measurements of the past were from the handle to the tip. Don points out that there are limitations to this approach. It will tell you how far a rod will flex, (and in Orvis' case, the point of greatest flex) but it won't tell you much more. Don overcame this limitation by testing about five inches of the rod at a time. Do this to enough points and you can come up with a deflection chart. The appeal of this method is its portability. In theory, if two rods have the same deflection, then they should cast the same, no matter what they're made of. Like so much else in the rod building business this isn't completely true. The speed that a material will return from deflection and the material's weight are both variables that won't show up in a deflection curve.

You'll need a jig to do the actual test. Here's a suggestion for building one.



(Continued on page 46)

There are three related variables, the length of the rod section being tested (inch, inch, inch, etc.), the weight placed on the tested section (usually ounces) and the distance the tested rod section deflects, or bends (in inches).

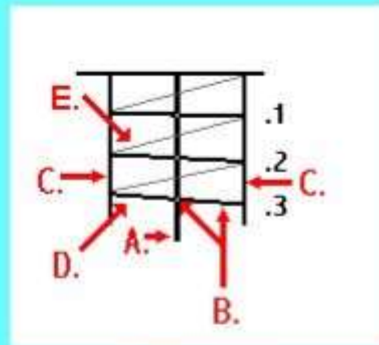
For example, a tip tested at five inches will flex under very little weight. A butt section tested at nine inches will require much more weight to flex the same amount. It's easy to see that a way to give some commonality to the three is needed. Don came through for us again. It's an engineering formula. $\mathbf{El = Pl^3/3y}$

$El = Pl^3/3y$
Where EI = stiffness
P = applied weight
l = test section length
y = deflection.

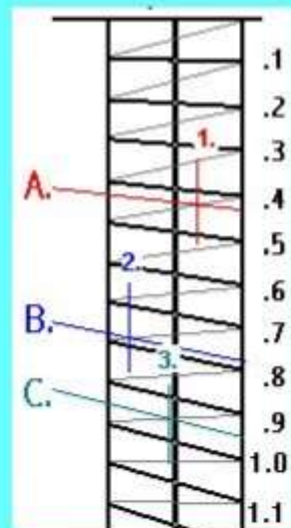
I built a deflection jig using stuff around the workroom. One thing that I needed was a way to be very accurate with the actual measurement. I could adjust the distance between the front of the vise and the weight attachment point by using an old piece of molding, cut to length, as a gauge. I could use the same weights for each measurement. Actually measuring the distance the rod deflected to very accurate tolerances proved to be a problem.

The answer I came up with was to use an idea borrowed from a lot of tools. For example, the micrometer uses a rotating drum to expand very small space into something we can read. Each revolution of the drum moves the head in or out about .1 of an inch, but the drum itself is marked in .01 of or even .001 of an inch.

Picture ***one*** shows how I made my extended scale. I dropped a vertical line from my zero line (**A**). Then I marked it in 10th of an inch (**B**). I had to be very careful here. If this wasn't right nothing else would be. Once I had the 10th marked I dropped two other lines on each side of my measuring line (**C**). These two lines must be the ***same*** distance and parallel to the centerline for this to work. Then lay a straight edge from the index axis through each of the lines at each .1 increment (**D**). Mark from parallel line to parallel line. This line will represent each tenth of an inch at the center vertical line, no matter where you measure it. Now connect the lines as in the illustration at right (**E**). These lines are for more exact measurements. You can read to hundredths (.00) and interpolate to thousandths (.000). You read these lines from right to left.



Picture one



picture two

Picture ***two*** shows how to read the scale. In the example the pointer cuts the index line at **A**, **B**, and **C**. We read the scale vertically for the first reading A is between .4' and .5". We read the scale horizontally (remember to read it from right to left. The major line on the right is .4 and the major line on the left is .5). **A.** is .4 + .030 = .430. **B.** is = .7 + .085 = .785. **C.** is .9 + .055 = .955.

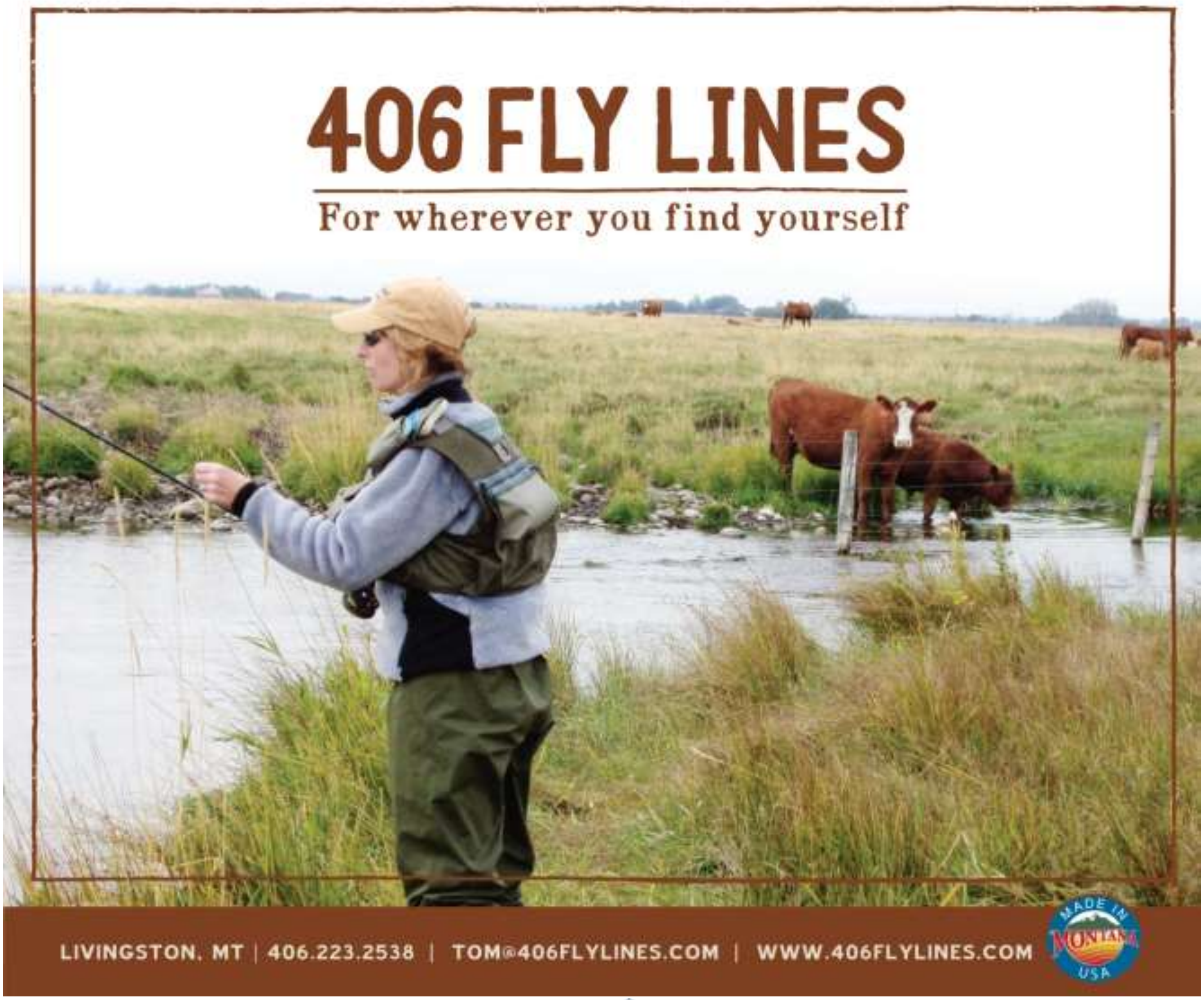
You plot this just like anything else, but Don suggests using a log graph because the amount grows so quickly.

(Continued on page 47)

All these systems are good ways to judge the taper of a fly rod. There are rod builders who swear by each one. Of course, each has its strong and weak points -- just as each has its defenders and detractors. I've only scratched the surface of each system. Once you find a system you like, you'll find all kinds of "tweaks" you can make to it so it will work its best for you.

Until you cast a few rods that you've graphed, or charted, you won't really know what you're looking at. So, go find some of those rods of the old masters (or the new masters, for that matter) and see what they feel like. Then plot them out. Better yet, go to the rodmakers taper page and see if someone has already done a lot of the work for you!

Remember, it all starts with you casting a rod. Nothing else will do.



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