Making a Froe

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If you read books or watch videos on green woodworking, you may have seen a froe in use. A froe is an ancient tool, traditionally used to split wood along the grain. Splitting wood along the grain is much more efficient than sawing wood. If you have ever prepared firewood from large logs, you will know that once the logs are cut down to length, most woods are very easily split down to size with an axe. There are a few cross-grained pieces with crotches that can be extremely stubborn, however a couple of wedges and a beetle (large wooden mallet) will soon sort those out.

For fine woodworking, before the advent of machines, straight grained wood was routinely split from the log. You can use an axe for this, but a froe offers much more control. This picture from Roy Underhill's book (The Woodwright's Guide – Working wood with Wedge and Edge) shows the technique.

Unfortunately, I had not been able to find a froe for sale locally in South Africa, so I decided to make one. If one is a competent black smith, apparently, they are easy to make – not that I have many blacksmithing skills yet.

The Design

Froes are offered by various tools suppliers in Europe and the USA, which provide a good starting point for choosing a design. Unfortunately, without being able to handle one or use it, it is difficult to select a suitable design. Most of the designs seem to follow a similar pattern, and fall into a similar range of sizes. Blade lengths range from 250 to 400mm, widths up to 70mm and thicknesses from 6 to 10mm. It seems that the steel is not too critical, with even mild-steel being suitable. I managed to find several designs that were used by well-established green wood-workers, such as Jennie (John) Alexander, Drew Langsner, and Peter Follansbee.

In particular, Drew Langsner collaborated with Lie-Nielsen Toolworks to make up a design that is particularly well suited to green-woodworking and chair making in particular.

Peter Follansbee explains in a blog (https://blog.lostartpress.com/2012/07/19/the-new-lie-nielsen-froe-designed-by-drew-langsner/) how Drew evolved this design and collaborated with Lie-Nielsen:

> "Many years ago, Drew Langsner needed a number of froes for his students at his green woodworking school, Country Workshops. Getting frustrated trying to line up a bunch of antique froes that would all work about the same, Drew set about to make a new froe. Having split and rived stock for decades, Drew analysed what really happens with the leverage forces when using a froe. He then designed a tool that looks a little funny at first, but it works like a charm. There is a reason for its appearance.
>
> Drew has studied exactly what happens when you twist the froe blade in the split, and based on his research, he developed

a froe with a smaller blade than many antique examples. And this is really a situation in which bigger is not really better. His froe has a blade that is even in thickness, (not wedge-shaped) has convex bevels and is narrower from top to bottom than many old froes. In addition, the eye is not tapered like most, but cylindrical. This allows a tight-fitting turned handle, now fastened in place with a washer and lag bolt. Jennie Alexander adopted this froe as soon as Drew began making them, and never used another.

After years of making these froes himself, Drew has teamed up with the folks at Lie-Nielsen Toolworks and now the Langsner froe is in production in Maine. What you get is a tool that is designed by a world-class master of riving, and produced by a company known for its attention to detail and high standards of production. The larger froe shown in the picture is $85. The small basket makers' froe is $75.

Not wanting to reinvent the wheel, I thought I would follow the sages' advice and make one that follows this design for myself. (Of course one could always import one, but with shipping and duty, I expect one would be lucky to get away with R1700-.
In a newsletter on Drew's website, he gives enough detail for me to make one.

Drew's account of how he developed the design can be found here:
http://www.countryworkshops.org/newsletter34/

FROE STORY

by Drew Langsner

I vividly remember the day that I first saw and actually used a froe. It was the mid-summer of 1972 in the Swiss Alps. Louise and I had just driven south from Scandinavia with the hopes that master cooper Ruedi Kohler would consider taking me on as a student. Because we didn't speak a common language *Kufermeister* Kohler didn't quite realize that I was serious about staying for lessons. But he kindly took me to a neatly piled stack of conifer firewood. He selected several billets which were then taken into the workshop and band-sawed into lengths of about 20 centimeters. Then he picked up a froe and a wooden club -- I don't remember what the club looked like -- and proceeded to split about 15 radial blanks that would hopefully become staves for my first bucket. By mid-October I had gone through the full coopering process several times when Herr Kohler announced that it was time to bring my training to a close. Kohler was not only a very skilled cooper; he was also a kind and patient teacher who seemed happy to put up with me for almost 3 months. At the time Kohler was 71 years old and still coopering 6 days a week.

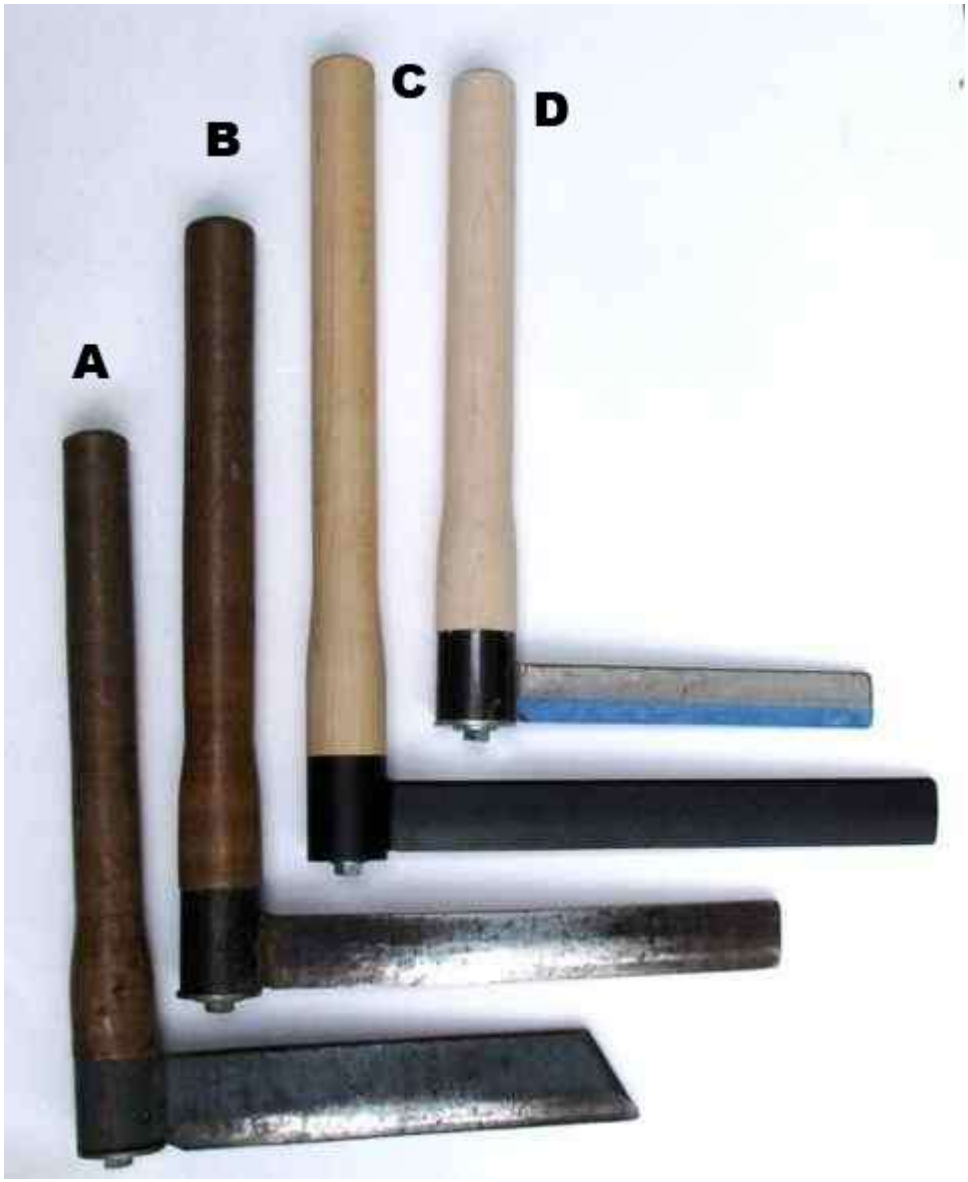
A few of the old froes in the Country Workshop collection ... collecting dust.

In 1974 Louise and I moved to what became our farmstead in the Blue Ridge Mountains of western North Carolina. Of course, I wanted to continue with coopering, and I was also interested in other traditional ways of working wood. Among my few tools I had a froe with an 8-inch blade brought from Switzerland. This was a nicely made tool, but at times I needed something larger and heftier: for riving tool handles, chair parts and oak shingles. After a search (pre-internet age) I bought a new froe made by Snow & Nealley (the old Maine axe company) that had a 15-inch blade.

I immediately realized that this new froe had problems. It was too long for anything that I was about to do. If you use hand tools you know that balance and proportion of every tool is important. This extra length was corrected with a hack saw, removing 3 inches. The next problem was that the included angle of the bevels was far too wide. This froe might penetrate very soft wood, but it was no-go for hardwoods. A trip to a grinder plus some filing reduced the included angle to 30 degrees. And I quickly found that the handle was always coming loose. With a froe you're always smacking the back of the blade and this repeated force tends to loosen and drive off the handle. The factory made the ferule by bending one end of the froe blade stock into a (sort of) circle. Because the ferule wasn't at all round a tight fitting handle couldn't be turned on a lathe. Hand carving was necessary. Also, wedges seemed to always work loose. This was when I decided to secure the blade using a large flat washer and a hefty lag screw. It was interesting to see that on the smaller Swiss froe the ferule was a piece of thin gage tubing that was welded to the blade. I liked this because it was round and not un-necessarily heavy.

Forward to 1988. By this time, I've looked at, tried and even purchased too many unsatisfactory froes. This is a simple tool, but no one seems to make a reasonable one. I decided to design a proper froe and to make it available through Country Workshops. I brought my drawing to Greeneville Machine & Iron Works, a welding and fabricating shop in Greeneville, Tennessee. The

nice people there agreed to do the preliminary steps (welding and angle grinding) and in small enough quantities that we could market.



Froes from Country Workshops:
A. This is one of the first CW froes, with the 10 inch blade.
B. Our production model from about 1990 to 2011.
C. The new/old Langsner froe now made by Lie-Nielsen Toolworks.
D. Blade for the smaller basketmaker's model.

I decided on the welded ferule construction and a compromise blade length of 10-inches. I had the shop cut the end of the blade at an angle, like I had seen on the old froes that came our way. The specs called for an included angle at 30 degrees. When the blades were back at CW I did more finish work, using an angle grinder, then a belt sander, followed by some filing. Handles were turned from kiln-dried clear hard maple. The lag bolt and washer attachment was continued.

I realized that some changes could result in improvements. 10 inches was a bit too short; 12 inches seemed just right. To increase leverage the blade width should be narrower. For strength the blade then had to be thicker. A narrower blade meant that a matching ferule would be shorter, and therefore not so good for holding the handle. Since the ferule is steel tubing, we made it longer than the width of the blade. Looks different, but right. We also realized that the end of the blade should be square and not angled like on the old froes. The angle on blacksmith made froes came about because when smiths hammer forge the bevels, the edge tends to lengthen. A square end gives the user more striking surface without lengthening the tool.

In 2000 I met Joe Adorante, a Greeneville, TN machinist who operates a one-man shop. I asked Joe if he could do a more accurate job on the froe bevels and also a neater weld. Of course. From 2000 through 2011 Joe supplied our now beautifully made, machine milled froe blanks. Either I or a summer intern did the finish grinding, belt sanding and a bit of filing. There were no changes in the design for either the standard (chair and shingle) froes or the small (basket) froes.

Last winter while I was doing finish work on a batch from Joe, I began to wonder if there was another way to have our froes made. I had been doing this for 24 years. I decided to e-mail Lee-Nielsen Toolworks to see if they might be interested in making and selling a very good froe.

I received a reply from Thomas Lie-Nielsen the next day. Yes, he was interested. Could I send samples of what we had been producing? Of course. We discussed details of design and construction. After a short wait Thomas sent 2 prototypes for review and testing. A few corrections were required. I then received a corrected prototype. Thomas agreed to put my *Langsner* name stamp on the production model.

The Lie-Nielsen Langsner froes are available in the same two sizes that we have been producing at Country Workshops. No changes have been made to the design. The finish is now a handsome baked powder black enamel. (It's really tough.) Lie-Nielsen also came up with a very nifty 2-step black washer for securing the lag screw. The handles are still kiln-dried hard maple. And with more efficient production the price has actually been reduced.

The blade of the standard froe is 3/8" thick by 1-1/2" width by 12" length (9.5 x 38 x 300mm). The handle is 17-1/2" over-all. The blade of the smaller basket froe is 1/4" thick by 1-1/4" wide by 8" length (6 x 32 x 200mm). "

Making a Froe

I chose to make a froe based on the larger County Workshops / Lie Nielsen design with a 12" blade. I drove past one of our local spring makers to see what scrap they had. I was hoping they had an old leaf spring that I could buy for scrap. I was lucky to find one that probably came from a pickup of some sort. The material was 70 x 7mm in section, with an eye at each end. I enquired about the spec of the steel and was told by two different people that it was either EN45 or EN47. For those that understand a little about metallurgy, these are the specs:

Grade	Carbon	Manganese	Sllicon	Chromium	Vanadium
EN45	0.5 to 0.6%	0.7 to 1.1%	1.5 to 2.0 %	-	-
EN47	0.45 to 0.55%	0.5 to 0.5 %	0.1 to 0.35 %	0.9 to 1.2 %	0.1 – 1.2 %

I think that EN45 is more likely. The most important attribute is the carbon content – it is a medium-carbon steel, which is very well suited for striking tools, such as a froe.

Using an angle grinder, I cut off a length from the end of 350mm (14"). This is longer than the one given above, but I decided to err on the long side, as shortening it is easy. The thickness given is 3/8" = 9.5mm. My spring stock was 7mm – close enough. Using a thin 1mm disc in my 115mm angle grinder, I cut the width down to 40mm, before heating it up to red heat and flattening it on my anvil. The eye of the spring is intended for a bush and it was quite accurately round with an ID of 30mm. I then ground the two-sided bevel to the 30º included angle using my angle grinder. This was done free-hand and took quite a long time. Even though the steel had been heated to red heat and cooled slowly, it was still quite hard. It can be filed, but not easily. This is why it took nearly two hours to grind the bevel!
Even though the eye is not welded, I don't expect 7mm medium carbon steel to give way to a 30mm wooden handle – it still certainly didn't open up though all the abuse it received in the previous life it experienced under a pickup, which was enough to distort the body of the spring.

My experience with medium carbon steel is that even in the annealed state, it is a lot harder than mild steel. I did read that a froe made from mild steel is quite satisfactory, so I wasn't concerned about the loss of hardness. As it turns out, it is still quite hard.

I turned a handle 450mm long. I used a plain washer, not the stepped one used in the Lie-Nielsen design. If it doesn't hold up, I will make a stepped one on my metal lathe. The handle is held in place using a 90 x 8mm lag bolt and washers in the same way as the Langsner design.

I must confess that the present handle is the third one. The first two were made from White Stinkwood (Celtis Africana) as I have found it to be well suited for use as tool handles. It looks like European Ash, being a diffuse-porous wood, albeit a bit yellower and greyer in parts. When dry, it seems to be quite tough. The picture ► shows the two broken handles – both broke around the eye. The first one (top) was made from a reject stool leg. It broke in use, partly due to short grain around the eye, which was one of the reasons it was rejected as a stool leg.
For the second handle (bottom), also made in white stinkwood, I made sure that the straight grain continued through the eye. A 30mm socket is quite substantial, so I expected it to easily withstand the large twisting torque in use. Unfortunately, I managed to break this handle around the eye as well – although I was probably abusing it by attempting to split a 200m log of Casurina, which can become very hard when dry.
The third, and hopefully final handle has been made from Karee. *(Rhus Lancea – now called Sersia Lancea – Why must they keep changing botanical names! I have enough difficulty remembering them anyway.)*
I am hoping that this handle will stand up to use!

The back of the froe is intended to be struck by a wooden club or beetle. A steel hammer should not be used or the back will mushroom. I made a club from some reject Karee. If you have used Karee you will know that once dry, it becomes exceptionally hard and tough, which makes it ideal for use as a club for beating on froes and wedges. Karee also makes good hammer handles due to its toughness – we will see how long the third one lasts!