Making Gripfids

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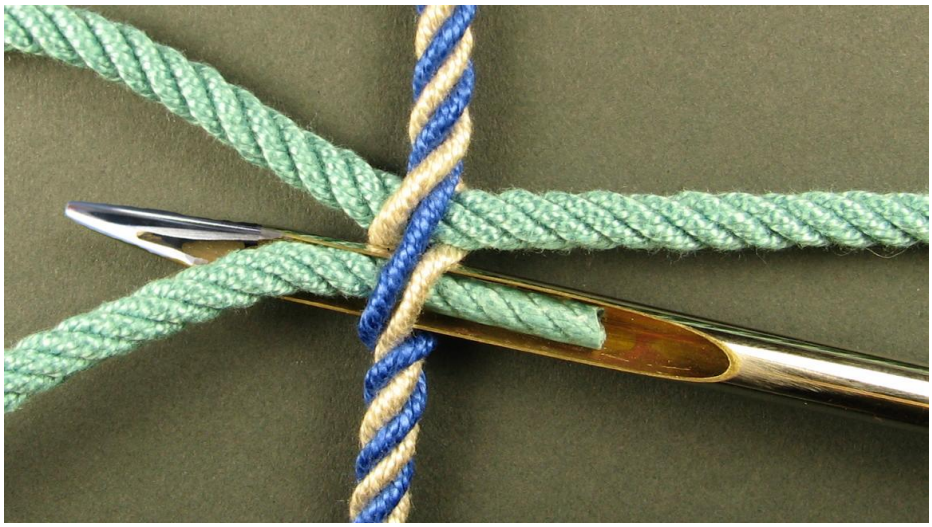


SUMMARY

The goal is to make high quality gripfids quickly, reproducibly to a specification, and burr free. Our method has 6 steps:

1. Grind a hollow knitting needle to proper depth.
2. Cut a slot to elongate the internal vee groove (see below in step 4).
3. Remove the big burr with a deburring wheel.
4. Remove remaining little burrs and shape the vee groove with needle file.
5. Hand polish and inspect.
6. Cut to length and glue on the knob.

Each step is done in large batches to minimize setup time. Aside from setup the approximate time it takes for each step above:

1. 40 seconds per gripfid
2. 15 seconds
3. 15 seconds
4. 60 seconds
5. About 2 to 5 minutes depending on work needed
6. 10 seconds

Total time is about 5 to 10 minutes plus setup time, or about a dozen gripfids per hour. We do the steps in batches of 30 to 100 so setup time is low per gripfid. At our price, the retail value of a dozen gripfids is $132 or $11 each. Materials cost for a dozen including abrasives and needles is less than $24 or less than $2.00 each.

INTRODUCTION

A gripfid is a tool for ply-split braiding that (1) splits a multi-ply cord or multiple cords and (2) grips another cord and pulls it back though the split plies. Its key parts are a smooth tip, a hollow cavity into which the cord is placed, an interior vee-groove to grip the cord being pulled, and a smooth shaft that glides easily between the plies. A knob on the end is included to provide better handling.

Our fabrication method starts with a hollow knitting needle rather than a tube. Thus the point is already perfectly formed. We need only make the hollow cord channel and interior vee-groove.

We have two sources for 8-inch double-pointed, plated brass knitting needles. Knit Picks (www.knitpicks.com) makes nickel-plated brass needles, but after they moved their supplier from India to China, we often saw unacceptably poor adhesion of the plating to the brass. Knitter's Pride Nova Platina Knitting Needles are chrome-plated brass. (We have a wholesale account at www.brysonknits.com.) We have not seen plating problems with these. The brass seems thinner and harder than Knit Picks which can enable failure by bending and sharper edges. Nevertheless, Knitter's Pride is currently our preferred source. Cost is about $0.75 per needle or $0.37 per gripfid. We make our gripfids 4 inches long in order to use both ends of an 8 inch needle. We make gripfids in three standard diameters. Special diameters and lengths can be made but are rarely requested.

OUR PROCESS IN DETAIL

Our process is designed for making gripfids as quickly and reproducibly as possible, but always within a defined quality specification.

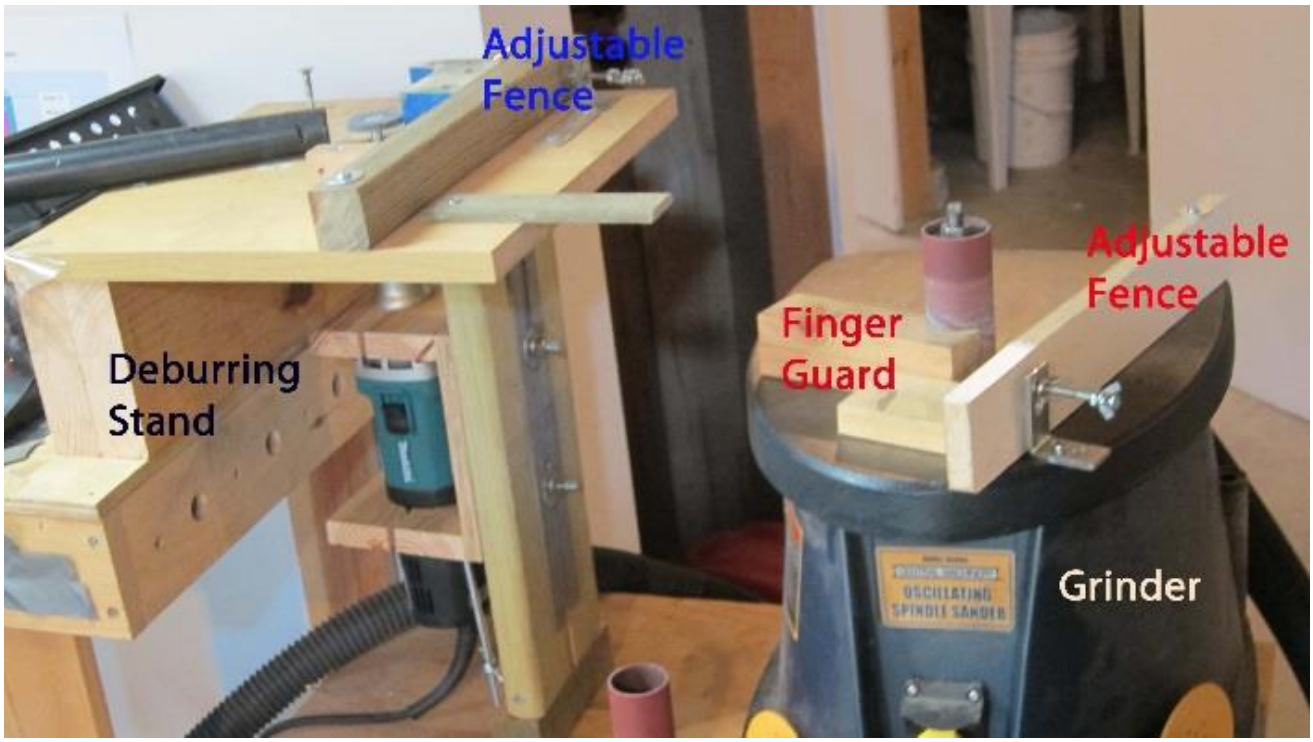
To assure reproducibility, every step has a special jig that minimizes manual judgment of dimensions. The jigs also avoid any manual holding (which is not safe) or use of metal vises that could damage the surface or distort the shape of the gripfid.

Important: Wear goggles as Dremel cut-off wheels can break and pieces fly far. Pay attention to dust control. Hearing protection is also a good idea. Also note the needle tips get hot in the grinding and cutting steps.

Step 1. Grind a hollow knitting needle to proper depth

An oscillating spindle sander is setup with an adjustable fence to set the distance from the back of the jig to the spindle (1.5 inch diameter spindle with 120 grit sleeve).We made a jig to hold the needle parallel to the back of the jig. *Details on page 5.* We set the fence-to-spindle distance to grind the needle to specification. *See "The Specs" on page 7 below*

MACHINE SETUP



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Once setup to grind to the specs, we can grind about 40 gripfids in an hour. The sandpaper sleeve will grind about 10, then needs to be shifted on the spindle to use a fresh portion of the sleeve. The sandpaper sleeve is replaced every 40 gripfids. Sleeves cost about $2 per sleeve, or $0.05 per gripfid.

Grinding the hollow channel

The grinding is done holding the back of the jig against the fence and pulling the jig forward toward the running spindle. The grind depth is set by the distance from the spindle surface to the *back* of the jig. The adjustable fence is used to make minor adjustments to the grind depth. All grinding is then done holding the back of the jig against the fence. Dust is controlled with a shop vac with a HPPA filter.

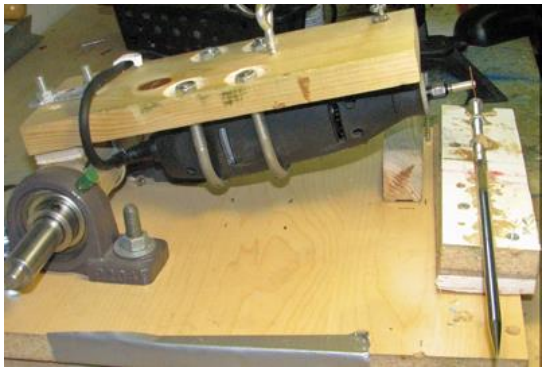
The ground needles have a thin brass burr over the cavity. We call this the "big burr". This is because after the top is ground very thin, it has no pressure against the grinding spindle since the needles are hollow.

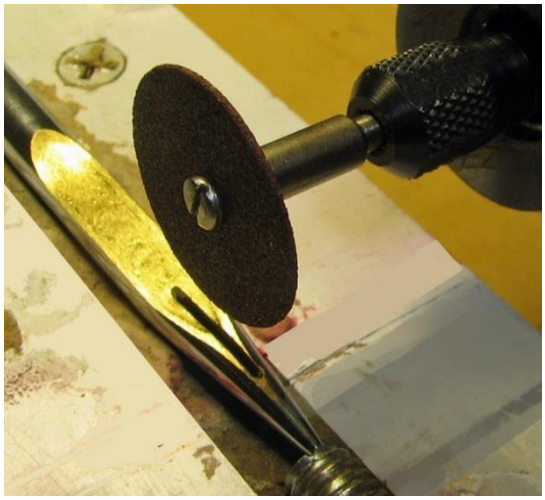
Ground Needle with "Big Burr". Note the 0.75 inch radius on left side.

The use of an oscillating spindle sander, rather than a grinding wheel, gives much more control and keeps the ground surface perpendicular to the jig side. The downside of sandpaper is wear and hence frequent replacement. The back end of the channel has a ground radius that matches the 0.75 inch radius of the spindle**. This smooth radius is important for use in ply-splitting so the tool does not catch on the plies when inserted beyond the channel length.**

Step 2. Cut a slot to elongate the internal vee-groove

We have found that our gripfids perform the gripping function better if the vee-groove has a long taper. To accomplish this, a slot is cut near the tip of the needle with a Dremel cut-off wheel and a special jig to assure the slot is reproducibly positioned and parallel to the needle axis. We call this jig a "Dremel chop saw".





Slotted tip

With it we can very quickly drop a needle in the jig groove, and lower the Dremel on the hinged holder. Only a few seconds per needle is required so a large batch of needles can be done in a few minutes.

Our early gripfids and all the competitors' gripfids we have seen omit this step. This leads to a very blunt vee and inferior gripping. Compare the vee in this photo of finished gripfids made identically except one with and one without this slot cutting step.

Step 3. Remove the "big burr" with a deburring wheel.

See the left side of the Machine Setup photo above.

To remove the burr and minimize the need for handwork, we use a deburring wheel. This is a 1.5 inch diameter ¼ inch thick wheel made of abrasive similar to 3M Scotch-Brite material. (1-1/2" Diameter, 1/4" Thickness, Fine Grade, Silicon Carbide Deburring Wheel from MSCDirect or Abrasive Specialties). The softer wheels do a better job on deburring inside the edges, but wear fast. Cost is $.25 to $0.50 per gripfid, so it is not insignificant.

Remount the needle in the jig. With experimentation, the right depth is set with adjustable fence. Frequent adjusting is required as the wheels wear quickly. Also, "dressing" the wheel is needed frequently to keep the wheel edge flat. The "big burr" is now barely attached and can be pulled off by hand or needle-nosed pliers.

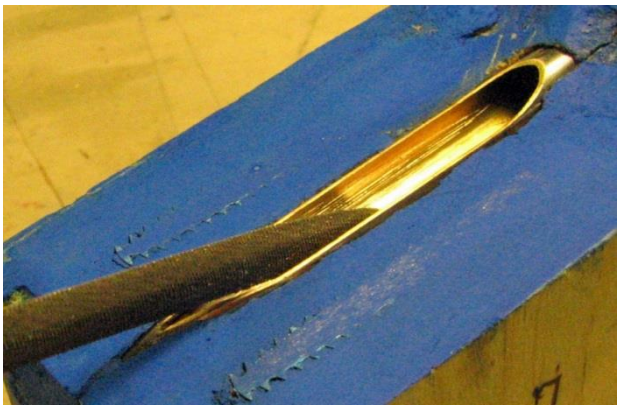
Step 4. Remove any remaining little burrs and shape the vee groove with needle file and deburring tool.

Use a Vargus Twist-a-Burr or Shaviv UB38 deburring tool (on right in this photo) to remove any remaining burrs.

Draw a "crossing" shaped needle file along the inside tip to gently file and elongate it to shape the vee-groove.

"Crossing Shape"

(A knife file and a few other shapes would probably do as long as they have a narrow profile).



Then use various needle files to remove the burrs and round the edge of the channel so that the cord doesn't catch anywhere but the inside vee-groove. Assure that the edges of the cavity are not sharp; a polished stainless steel burnishing tool can help with this.

Step 5. Hand polish and inspect.

(*Hand work is a bit time consuming*)

Final removal of tiny burrs and smoothing and polishing of the channel edges is done by hand sanding using progressively finer abrasive papers from 400 grit to 2000 grit 3M Wet-or-Dry sandpaper. Usual progression is 400 grit sandpaper, 1000 grip sandpaper and 2000 grit sandpaper. This can be quick, but the initial grit often reveals small defects that need attention with a needle file. We finish with a burnishing tool again to eliminate any sharp edges.

This gives an attractive polish to the gripfid and assures that sharp edges don't fray the cords. Wash the gripfids with soap and water.

Step 6. Cut to length and glue on knob.

We use a Dremel cut-off wheel as it causes far less bending pressure than using a hacksaw**.**

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Glue on knobs

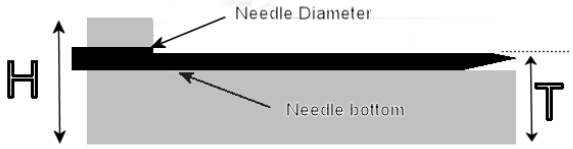
We found that instant glues (cyanoacrylate) are not strong enough. 3M High Strength Adhesive works great.

ADDITIONAL AND OCCASIONAL EFFORTS

Make the jigs.

The jigs are all made with the same distance from the back of the jig to the top of the cord channel so that various sizes of gripfid can be made without major resetting of the adjustable fence.

To do this, for each needle diameter separate jigs are made with the needles set in the jig at a placement determined by needle diameter. This is figured using the diagram below. The adjustable fence is used to make minor adjustments, but once set, the fence is adjusted only to compensate for grinding surface wear, etc.



T is the distance between the adjustable fence and the grinding surface. The needle bottom is typically set 75% of the needle diameter below the top surface so that 25% will be ground away.

H is not a critical dimension as long as it is high enough to help hold the needle securely.

We typically use T=47 mm and H=75 mm

We start with two pieces of hardwood and make a needle channel the length of each piece parallel to the edge of the wood.

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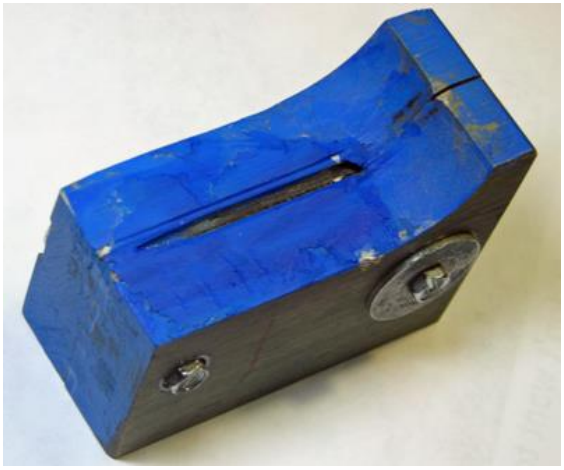
Since we find it difficult to drill a long straight hole parallel to the side of the hardwood pieces, we use a table saw to cut a groove through the length of each wood piece parallel to the long edge. The grove is the width of the needle and slightly less than ½ the

diameter of the needle depth. Assembled this is a square channel the height of the needle and slightly undersize in width so the needle is held securely when the screws are tightened. The wood pieces are then shaped as shown here. We add a bit of Plastic Wood to the groove, and then insert the needle while it is still soft; when dried, it gives us a great snug and reproducible fit.

Assembled it looks like this:



The blue color on the top surface is not needed in our current method; it was a wear indicator.

These jigs last for years and are rarely replaced, but the deburring wheel can wear the wooden edges of the holding groove. Apply some plastic wood occasionally to correct this.

Drill the knobs

With a good drill press, the 5/8 inch diameter hardwood knobs are drilled slightly larger than the needle size. The holes are blind drilled, that is, they do not go all the way through.

Centering the holes is a challenge: we drill a ½ inch hole in a flat wood base plate to hold the ball. , Then without moving the plate or the drill press, we remove the ½ inch bit and insert the smaller bits specified below. This holds the ball still centered on the drill press axis to drill the holes on center for the gripfid needles.

Color	Size mm	Ball drill
	1.0	3/64
	2.5	7/64
red	3.8	5/32
	4.0	11/64
brown	4.5	3/16
	5.0	13/64
black	6.5	17/64
	8.0	21/64

Color the knobs

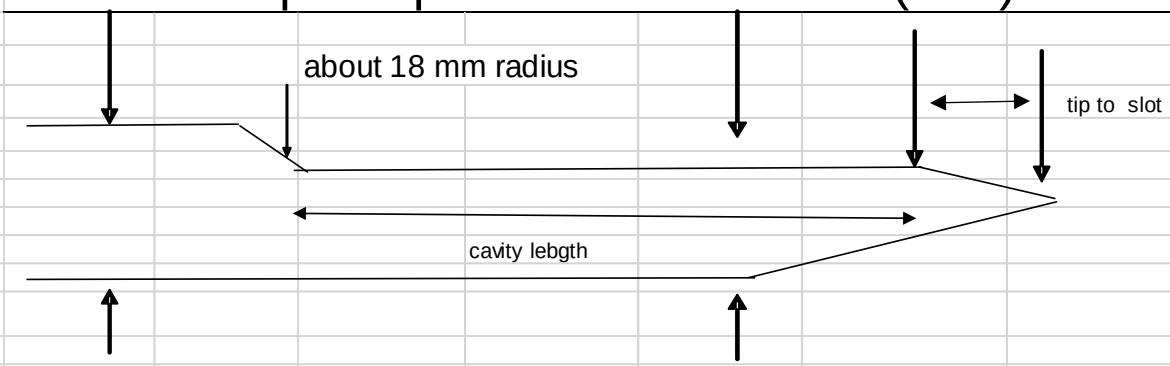
We use a color key for the each size for easy identification of the gripfid size. Our color choices for the three standard sizes are indicated above. Spray paint works well with the drilled knobs set on pegs. We previously used brown paint for 4.5 mm size. This was unneeded effort so now we leave it natural wood.

THE SPECS

(For the three standard sizes)

The specifications are in mm. The key measurements are thickness of the gripfid at the ground surface ("threshold") and the length of the hollow cord channel. OD-Threshold is simply the amount ground away. The specs list this as a percent of the needle diameter. Although not listed, the ground surface should be very flat and parallel to the back of the needle. The OD varies by trivial amounts and depends on supplier; this is not important.

Gripfid Specs and tolerances (mm)



		OD	Cavity length	Threshold	OD-thres	1-thres/od	Cavity ID width
Large	Thickest	6.44	45	5.30	1.14	18%	
	Spec	6.44	39	5.00	1.44	22%	5.28
	Thinnest	6.46	32	4.70	1.76	27%	
Mediur	Thickest	4.44	45	3.47	0.97	22%	
	Spec	4.43	36	3.28	1.15	26%	3.28
	Thinnest	4.42	32	3.09	1.33	30%	
Fine	Thickest	3.74	45	2.95	0.79	21%	
	Spec	3.73	39	2.78	0.95	26%	2.53
	Thinnest	3.72	32	2.60	1.12	30%	

tip to slot	mm
Large	10
Medium	8
Small	7