Folding Old Timer Props

by Gene Wallock, Lawton, OK, USA

(Gene Wallock is a very well known personality in SAM and AMA circles. As SAM Librarian, Gene is guardian and provider of practically any article printed in any English language magazine to date, for which you can write to him to his address at the end. For our FFQ readers, Gene wrote this short bio, Ed.)

I started building in 1939 at the age of 5. My first attempts were pretty feeble but fortunately, I was helped along the way by knowledgeable modellers. I became interested in OT Models in 1964 and have never looked back, becoming the SAM Overall FF Champion in 1973. I was the co-founder of P&W Models along with Charlie Partch. I lived and flew in California between 1947 and 1997, and I retired from McDonnell Douglas in 1996. We then moved to Oklahoma and have pretty well concentrated on rubber power since. One thing I wanted to do was compile an accurate, albeit not yet complete index of all the rubber, towline and HL glider designs that have and do exist. Like any such list, it is never complete, but it is a work in progress.. Future projects include a couple of geared OT models. At the present time, I'm SAM VP Rocky Mountain States, SAM Librarian and Chairman of the SAM Design Review Committee.

Introduction

Several years ago, I was talking to Bill Cushenberry about two-bladed folders for Old Timer Rubber Models and how I could never seem to get them to fold properly. A proper fold in my mind is where the hub is horizontal and the folded blades are vertical against the fuselage side. He invited me over to his home and showed me a simple compound angle jig that really works. I have no idea if Bill designed it or if he borrowed it, but it sure works.

The premise is the blade hinge must allow folding in two directions (compound angle) to attain symmetry of fold. The compound angle is built into the hub of the prop. I make my hubs out of spruce for grain strength. The compound angle hub will be ¼" longer than a conventional hub that uses a metal hinge on the back of the hub. This extra required material reduces each blade length by 1/8" to maintain correct prop diameter, per SAM rules. Reduce the balsa blade length at the hub intersection, not the tip.

There have been piles of data written on how to figure the prop blank for various P/D's. On most Old Timers, the prop blank is already defined, on the plan, and is not the subject I'm writing about.

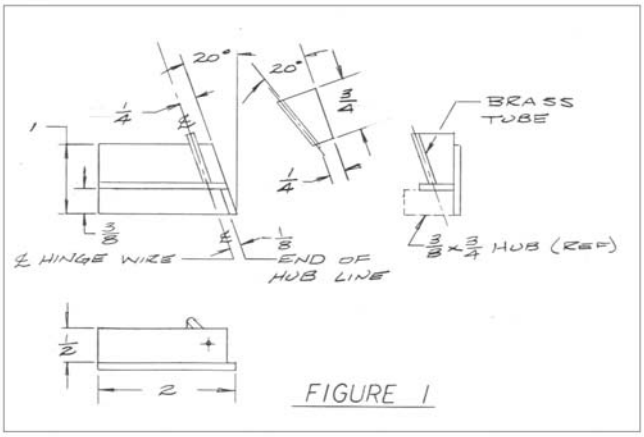

Fig. 1 Sketch of the jig used to drill the hinge angles

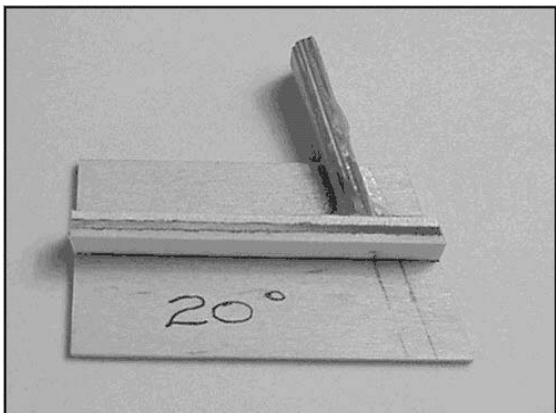

Fig. 2 Top view of the 20 deg. compound angle jig

Fixtures

To begin, I had to make some simple holding fixtures to not only drill the compound hinge angles properly, but a holding fixture to assemble the balsa blades to the spruce hub in the correct orientation.

Figures 1 and 2 illustrate the drilling fixture. I made the fixture out of 1/8" ply and 1/16" ID brass tube, glued together with Cyano. A simple protractor will allow you to measure the correct angles. A small 20-degree cardboard triangle will really make the job go fast. I've found that a 15 x 15° compound works on most of the low pitch Old Timer props. The Lanzo 300 sq in stick, with its 2 x 2" blank required a 20 x 20° compound. The 15 x 15° jig worked on the Lanzo Stick, but the hub was not horizontal when it folded. I used the 20 x 20° on the 300 sq in cabin and the fold was perfect. I'll use the 20 x 20° compound as an example in most of this article. I'm sure someone has, or will, provide a correlation chart of P/D to compound angle, I would be interested in a copy (*see article by John Barker in FFQ# 4, where such relation was developed, Ed.*).. The maximum hub width, on most Old Timers is 3/8". When you make the hub fixture, be sure the hinge hole doesn't break through any closer than 1/8" to the hub edges to maintain hub integrity. Mark a line on the fixture

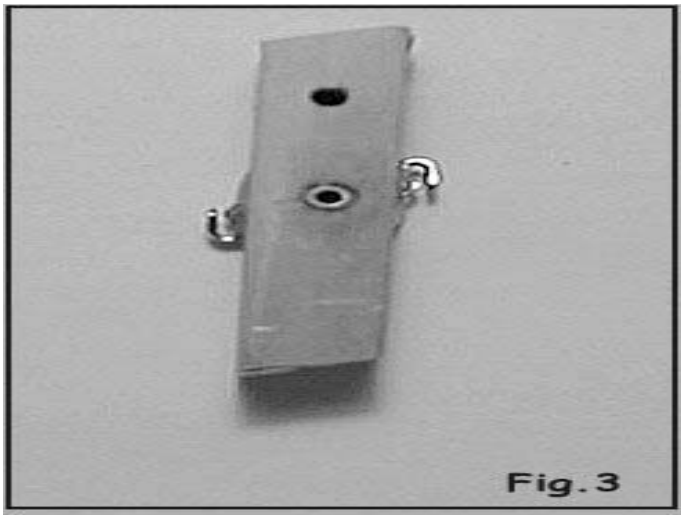

Fig. 3 Front view of prepared hub

base, 1/8" from the hinge center, to fix the hub end location, before drilling I use a pin vise to drill the 1/16" diameter hinge hole. I've also held the hub & fixture, in my bare hand, and drilled the hole with a drill press. You need a fairly strong grip to do this and I don't recommend it.

Hub preparation

Prepare the hub by measuring the length, shown on the plan, and adding ¼" to the length. Cut the ends off at 20° (Figure 3) and verify the correct length. Both ends must be parallel to each other. The sides of the hub should be the same length, but will be displaced from each other by the 20° angle. Drill the 1/16" diameter holes using the fixture. Drill the prop shaft hole and shaft driver hole in the hub using a drill press. I de-burr the holes with a drill center and insert 1/16" OD brass tubes for the hinges and a 3/32" OD brass tube liner for the shaft bearing. I use a 1/16" ID eyelet for the shaft driver bushing. I CA+ the brass tubes, making sure I've left them long to prevent Cyano from leeching down the ID's. After the Cyano sets, I belt sand the tube ends flush with the hub surfaces. De-burr the tube ID's and verify 1/32" wire rotates freely in the hinge tubes and 1/16" wire in the prop shaft bearing. Round the rear hub edges to allow the blade to rotate about the hinge tube (Figure 7). You can do this later but it isn't much fun.

Prop blades

At this point, you have a good hub and no blades. Layout the prop, as described on the plan, with the following exceptions:

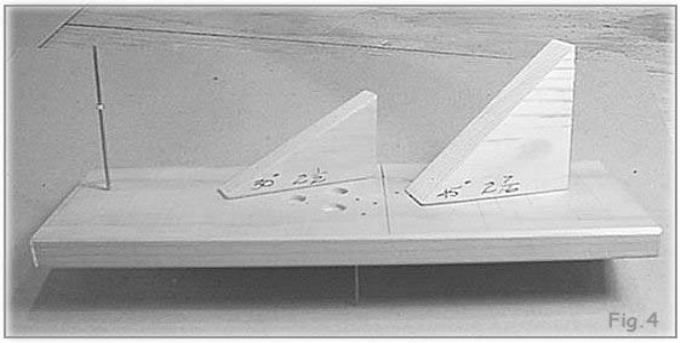

Fig. 4 Fixture for drilling hinge angles and setting proper pitch

-Remember the spruce hub is ¼" longer than the balsa hub, so reduce each blade 1/8" at the hub intersection.
-To minimize the balsa used in making the prop, eliminate the balsa hub entirely from the layout. Lanzo's folders are a good example of this technique.
-Be sure to use a drill press and drill a 1/16" prop shaft hole through the balsa blank before you do any carving. This insures a straight tracking prop.

Carve both blades and set the prop aside. You'll have to make a hub/blade alignment fixture as pictured (Figure 4). This fixture uses a scrap piece of ½ x 3 x 9" pine board. These dimensions are not critical. Using the drill press, drill a

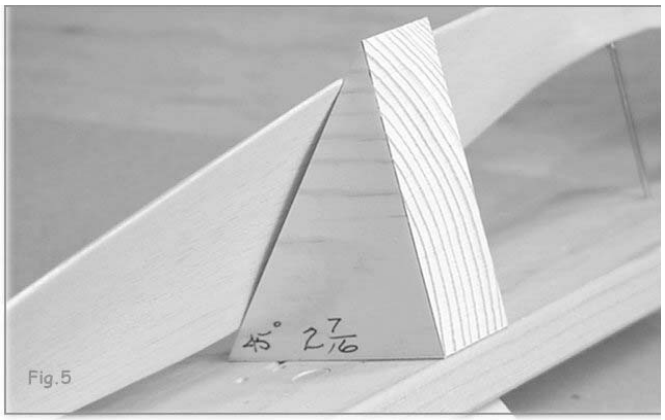

Fig. 5 Blade alignment jig to use with the Fixture of Fig. 4

1/16" diameter hole at one end of the board. The location is not critical, **the perpendicularity is**. Cut a straight piece of 1/16" music wire, de-burr the ends and push the wire into the hole in the board. Check perpendicularity with a square. I use a 1/16 wheel collar as a vertical stop to position the prop on the fixture. Cut a ½" thick 45° triangle with 2-7/16 x 2-7/16" sides. This will accommodate a blade that is 3-3/8" wide. I belt sand all three edges of the triangle to maintain 90° edges. The hub/blade alignment fixture is done.

Take your carved prop and slide it on the 1/16" wire . Adjust the collar so that the prop TE clears the fixture base. Slide the 45° triangle under the blade until the triangle hypotenuse makes contact with the blade LE and TE. Draw a pencil line on the fixture base. Make sure the triangle locating line is perpendicular to the edge of the fixture base. If you carved a full balsa hub, secure the triangle to the base with double backed tape. If you laid out the prop without any

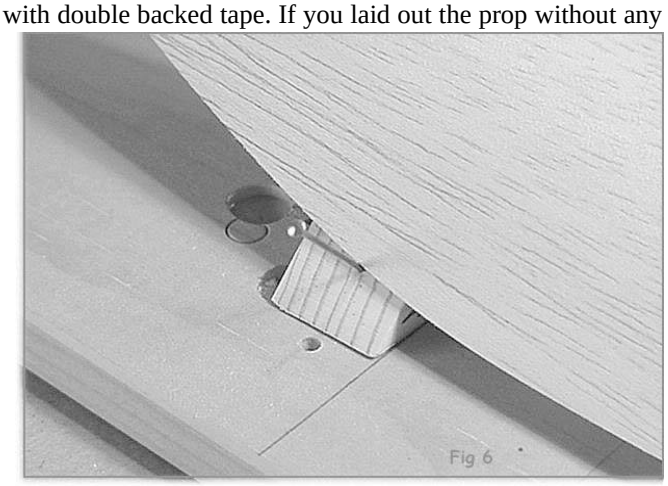

Fig. 6 Blade should clear the fixture base by about 1/4" (6 mm).

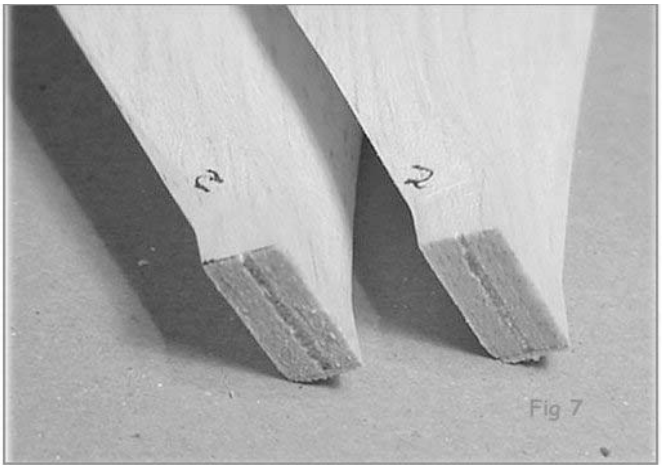

Fig. 7 Blades ready for insertion of new hub

hub, move the triangle outboard from the simulated shaft ½ the length of the spruce hub. You have now established basic setup surfaces you'll need to properly glue the blade to the spruce hub. You use the fixture one blade at a time. If you follow this procedure, your blades will be the same pitch angle. Use a straight pin in the triangle to act as a blade stop (Figures 5 and 6).

Cut the blades apart (Figure 7) making sure you cut them at the 20 degree angle and that the angle matches the hub end direction. This is why you made the hub first.

Attaching the blades to the prepared hub

I use thinned out DUCO Cement to pre glue the hub/blade joint. Remember, you'll cut thru this joint later so don't over glue. The joint must be strong enough to withstand handling. Generally 3 thin coats on each surface works fine.

I use Acetone to activate the DUCO. I brush some on the hub end and the blade end to make them sticky and push them together (Figure 8). I slide the hub onto the shaft and position the blade so that both the LE and TE are touching the triangle and the TE is touching the pin (Figure 5 and 6). I verify that the blade front and side are in alignment with the hub front and side. Now I can see I duplicated the "as carved" condition. Repeat the process for the second blade after the first glue joint has set. I let the assembly set for 1 hour before handling.

Installing the hinges

Sand the hub/blade joint until it's smooth. Remember the hinges slide across the end of the hub as the blade folds. Bend four 1/32" diameter music wire hinges that drop into the hinge tubes and the blades and fit flush to the

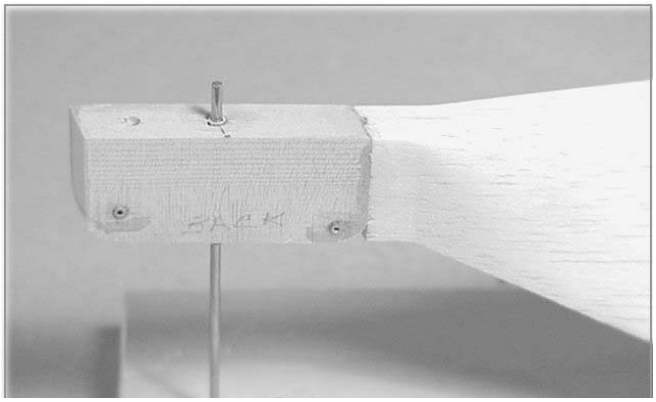

Fig. 8 Blade has been temporarily glued to hub for alignment in the fixture.

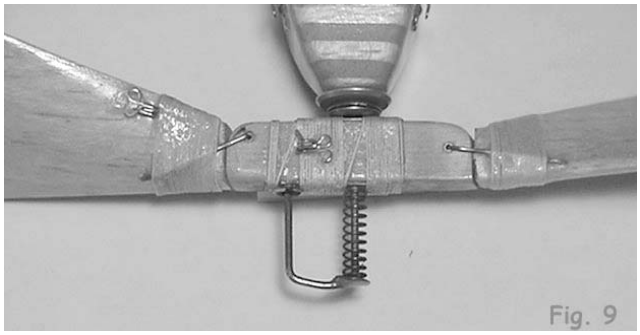

Fig. 9 Completed hub and blades of the folding propeller. Note kook on hub for small rubber band to close low blade when folded.

blade surface (Figure 9). If you used mush wood for the prop, you might want to put a drop of epoxy on the hinge end where it goes into the blade (You'll lose 85% of the prop block weight when you carve it. The model will probably need nose weight, so put the weight in prop strength). Use Cyano to hold the hinge wires down. Be careful of wicking. Wrap the hinge wires to the blade with thread and Cyano.

Carefully cut through the hub/blade glue joints and double check your results. The prop blades should fold vertically and the hub should be horizontal. I use #6 bands to hold the blades folded. It's a bit tacky to have a floppy blade. The blade tips probably wont touch exactly because most OT Rubber blades are 1/3-2/3 ellipses (Figure 10).

Now that you have a set of fixtures for a high P/D, it's a good idea to make a separate hub drilling fixture for the lower P/D props. Make a ½" thick 30° triangle. For future Old Timer hubs, carve your prop first and slide it on the hub/blade alignment fixture. If the 30° triangle fits and touches the LE and TE about halfway out the blade, a 15 x 15° hub fixture is called for. I have both sizes in my prop building kit. Just follow the hub drilling fixture instructions and build the second fixture.

If you have any questions, feel free to contact me by E-Mail at **Velinak@aol.com** or write to me, Gene Wallock at:
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