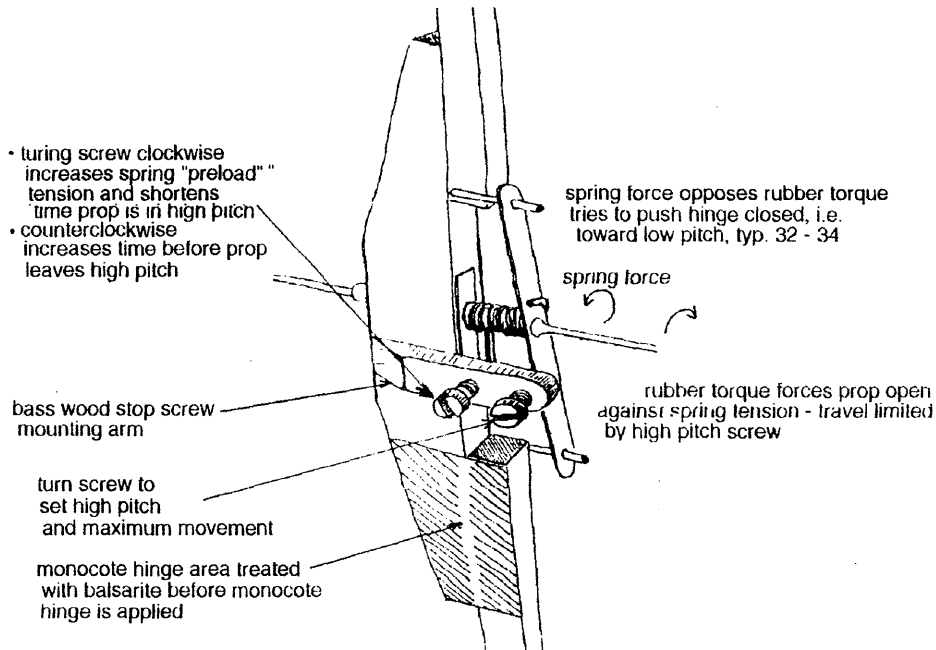


Construction Of Variable Pitch Props For Indoor Models by Steve Brown, illustrations by Steve Gardner

Variable pitch propellers, or "VP" props, have become common place in F1d indoor flying. The performance improvement they offer is important to the competition flyer looking for really good times, and the modeler responsible for the prop detailed here can really talk about good times. His unlimited stick just did 63:54, breaking the magic hour barrier in a big way.

CURRENT F1d VP PROP CONSTRUCTION

low pitch built into prop when hinge is fully closed. adjustments are high pitch position and torque load at high pitch



Great care has been taken to retain the original information supplied by Steve Brown while getting his art and text into this format. Any mistakes are probably due to the transference and not to the original design.

1. The first step is to make the hub, or center spar, to the dimensions given in fig 1. Don't omit the aluminum bearings. The holes should be just large enough for the prop shaft to rotate freely without any wobble. The bearings are attached with Ambroid or Duco cement.

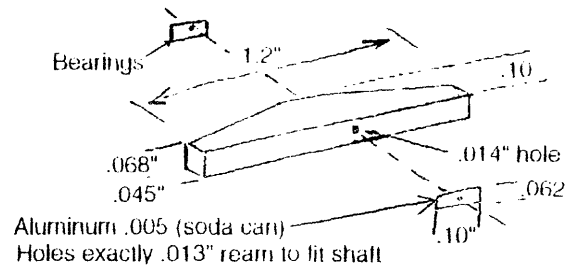
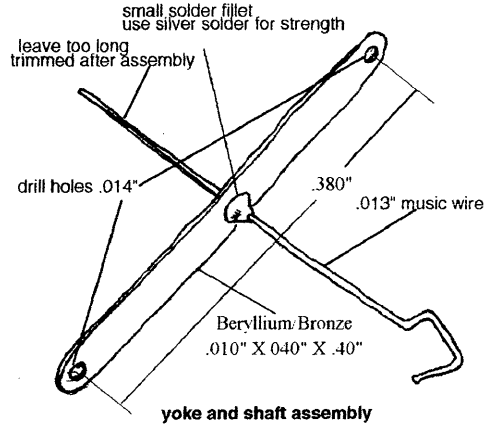
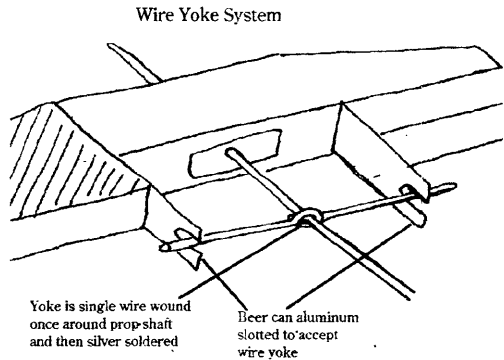


FIG.1

2. Make the prop shaft and yoke assembly next. The dimensions are given in FIG.2. Make certain that the solder joint is very strong. Use a silver solder such as sta-brite and build up a small fillet to reinforce the joint. Use a jig to insure proper alignment. After soldering place the assembly in warm, soapy water and scrub off all of the flux. Rinse thoroughly and inspect to make certain all the flux is gone. Flux will cause corrosion that will fail this important joint.



3. Tack glue the prop spars to the hub using a jig block as shown in fig. 3. The jig is used to space the first spar then it is swung around to space the other spar the same distance from the shaft hole. The spars should be to finished dimensions and matched for flexibility before they are tacked to the hub.

4. Install Monocote hinges. The area under the hinge is primed with balsa-rite from the Coverite company to insure a very good bond with the spar and hub. Japanese tissue strips were originally used to reinforce the hinge

5. The actuator arms are added to the spars now. Use the shaft / yoke assembly to space the actuator arms. They go on opposite sides of the hinges as shown in fig. 5.

6. At this point the complete assembly is placed on the prop jig and the outlines are added. This is to avoid interfering with the adjuster screw arm that will be installed later.

7. Make the adjuster arm from 3/32 X 3/32 model railroad basswood or the wood from a tongue depressor. The bass wood is both lighter and easier to work with. Drill two holes .037" in diameter in the basswood stick a distance from the end that will preclude splitting. These holes should be the same distance apart as the length of the spring plus a .010" to slightly spread the spring when it is in place on the prop. These

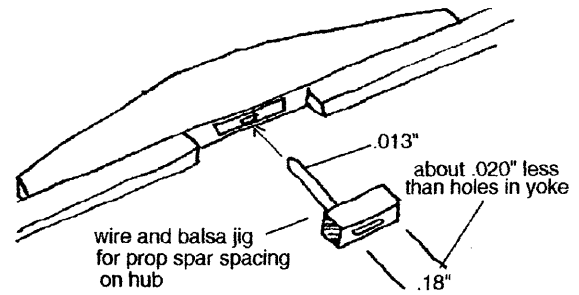
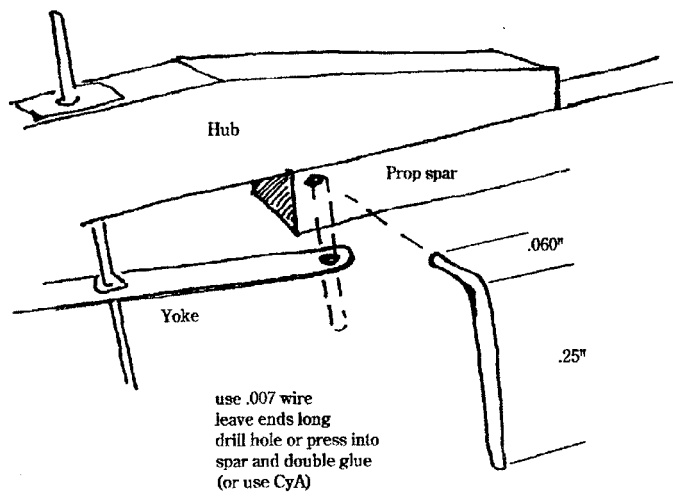
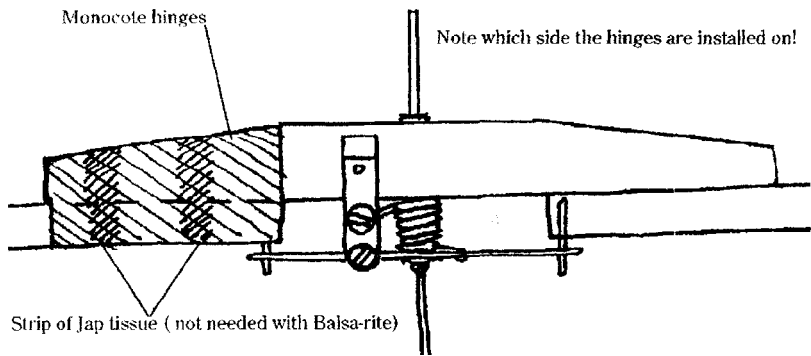


FIG.3



Actuator arm detail

hole are now tapped with a 00-90 tap, reinforced with a drop of thin CyA glue, then tapped again to get clean strong threads for the stop screws. Make certain that the glue is hard and dry before tapping the holes the second time.

Once the holes are properly tapped the end of the arm is rounded off close to the hole so as to save weight. To prevent splitting add a bit more CyA to the end of the arm where it has been rounded, then trim the thickness down to .055" and cut the notch .020" deep as shown in FIG.6. Once the actuator arm is shaped it is placed against the hub to determine the proper length and then it is cut to size. Assemble the shaft/yoke and spring onto the hub and arrange everything in the proper position, then add the adjuster arm using Titebond. Once this is dry drill a .025" hole and add a hard balsa peg through the arm and the hub to strengthen this joint. See FIG. 7

8. Now remove the shaft /yoke assembly and carefully soak the tack glued spars loose so that the hinges can operate. Be very careful not to soften any other glue joints and let things dry for 4-6 hours.

9. Drill a .037" hole in a piece of Plexiglas or metal about 1/16 or so thick and tap to 00-90. Screw a 00-90 nylon screw through until it is just sticking out of the back side of the piece. The idea is to slice and sand off the conical point of the screw so that the end of the screw is nice and flat. Repeat for the second screw, but after you have flattened the end drill a .010" hole into the end of the screw while it is still in place. Use good magnification to insure that the hole is

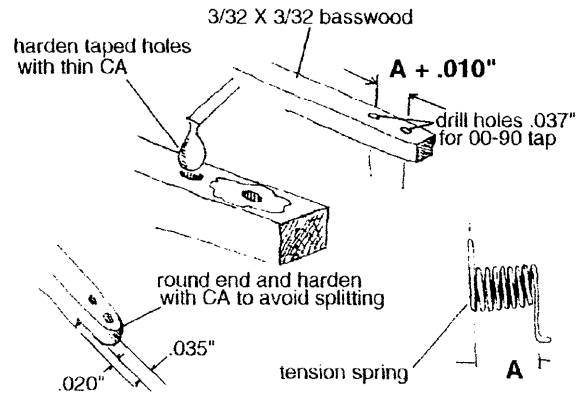
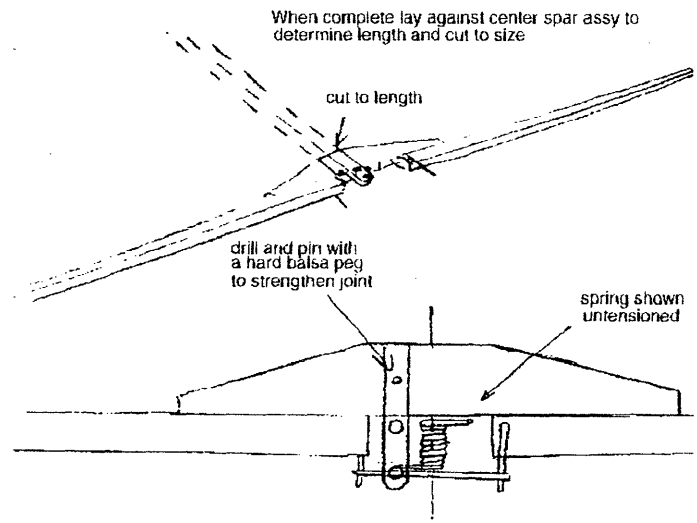
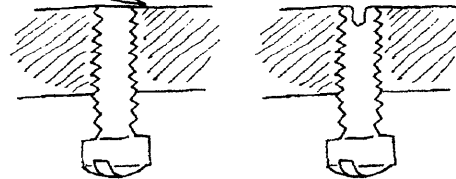


FIG. 6



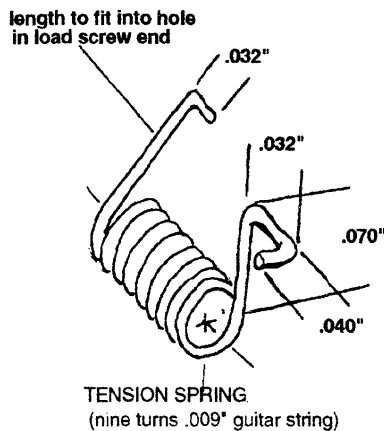
screws turned into tapped holes in 1/16 or 3/32 plexiglass or metal until just the very end protrudes

slice "cone" end off of screws and sand smooth then enlarge to .020" with second drill (one screw only)



00-90 stop screws end finishing detail

FIG. 8

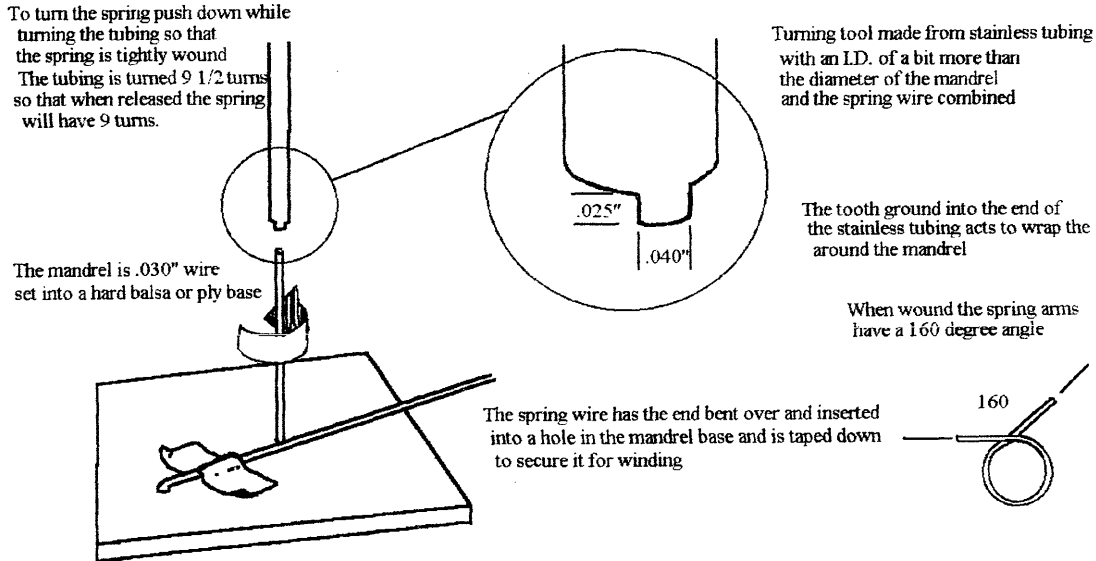


TENSION SPRING
(nine turns .009" guitar string)

FIG. 9A

in the center of the end of the screw. Enlarge the hole to .020" about .032" deep and nice and clean as shown in FIG. 8.

10. Wind the spring around a .030" mandrel using a driver made from a piece of stainless steel tubing with a .040" wide by .025" tall tooth ground into the end of it. The I.D. of the tubing should be a bit more than the O.D. of the mandrel and the spring wire combined. The spring is wound 9 1/2 turns so that it relaxes to about 9 turns total with an angle of 160 degrees between the arms. See FIG.9.



11. Carefully assemble the prop in the following manner. Add a piece of .035" O.D. X .013" I.D. Teflon tubing to the shaft to center the spring around the shaft and prevent binding. This tubing will ride inside the spring so it has to be shorter than the spring a bit. Add the stop screws with the drilled one in the front hole nearest the hub. Place the spring onto the shaft and push the whole assembly together until you can get the front end of the spring into the hole in the screw. At the same time hook the rear arm of the spring onto the yoke and twist, opening the spring and sliding the yoke, onto the actuation arms of each prop spar. You may need needle nosed pliers to walk the front arm of the spring into the hole in the front screw.

When it is all together the mechanism will be under tension with the spring holding the prop closed, (the hinges fully shut and the prop in low pitch). Add a small Teflon washer or a .030" long bit of Teflon tubing to the shaft to retain the hub. This washer should be a very snug fit and it is further retained by gluing with ambroid to just the shaft in front of the washer. The shaft and actuating arms are now trimmed to length. See FIG. 10

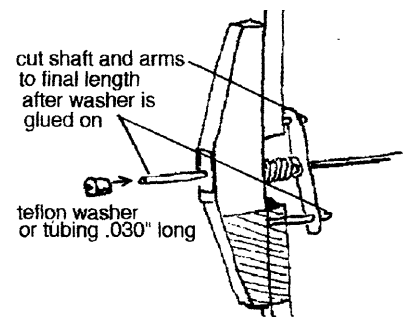


FIG.10

12. To adjust the propeller for flight start with the front screw, the one with the hole in it. Screw this in about half way to start with. Steve Brown made a small torque meter to help set the pretension to where the prop blades just start to open (viewing the hinge line under magnification) at about .14 - .17 in/oz of torque. This is just a starting point and will most probably need to be adjusted further. Screw the rear screw (high pitch limit screw) about 2/3 to 3/4 the way in to start with a fairly low setting for the highest pitch. Install prop and test fly the model. First use the rear screw to set the high pitch - high torque setting to get the altitude needed, then use the front screw to set the tension and so vary the point when the prop starts to switch over to lower pitch. In some cases you will have to take the prop apart to adjust the spring tension by "tweaking" the spring if you run out of travel on the front screw adjustment.

WARNING.

Watch the shaft/yoke solder joint! When it starts to fail (and it will!) the shaft will start to rotate slightly in relation to the yoke. This will cause the prop to tend to remain in high pitch too long and so spoil the flight. This is a sign that the joint is failing. If a prop that flew fine suddenly needs the high pitch reduced a great deal, and the adjustment has little effect, check to see if this joint has shifted and so is about to fail. Stop flying and repair immediately!

