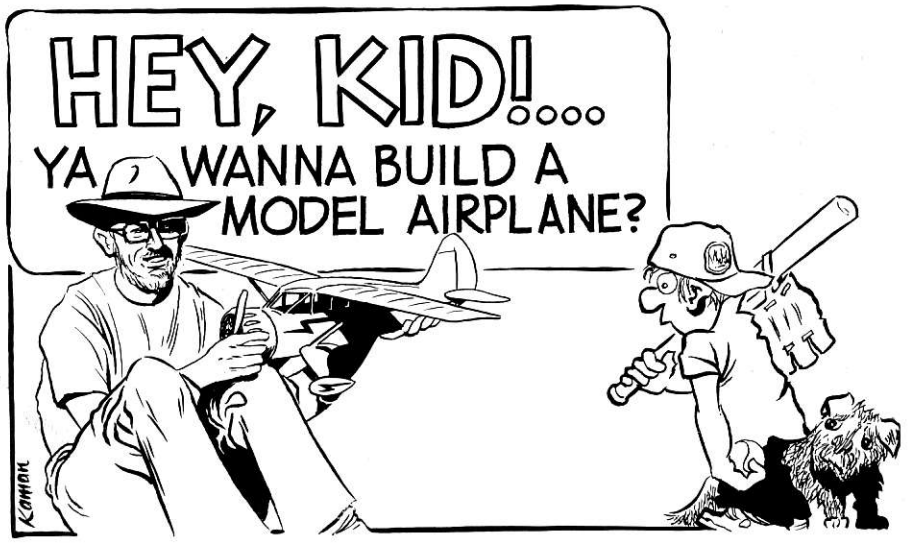
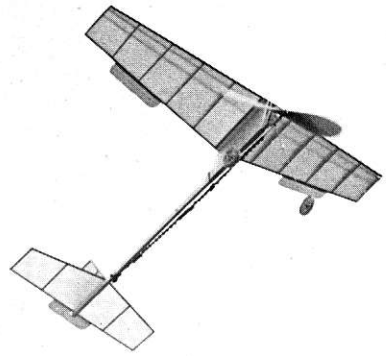


By BILL WARNER

Illustrations by JIM KAMAN



Sky Bunny flies by nice and slow for the camera. Nice proportions and lots of adjustments make the model a cinch to fly.

• Now that you've studied the plans, copied them, gotten all your parts cut out, and lined up your materials, let's build! I assume you remember the basic building setup from the Peck R.O.G. session (February 1988 *MB*)? Flatten your plan on the building board, cover with Saran Wrap, and make sure all the wrinkles are out.

Let's make a notching tool for those little cutout places in the ribs where the spars go on top of the wings. When you cut them out with a knife, they sometimes split and are not too accurate, so we're going to *sand* them in. Take a piece of the hardest balsa you have that is the same size as the notch you need, in this case 3/32-inch, and glue the edge onto a piece of about 100-grit garnet paper. You can glue some finer stuff on the other edge if you want to. As it doesn't take much longer to make six than one, why not make a few extras too? When the glue's dry, trim off the sandpaper even with the sides of the sheet with an old razor blade (it won't be much good after this) and sand the sides of the sheet to bring the edges of the sandpaper even. Use your sanding block for this. Then you will see that you can sand a nice notch just the right size into your ribs! Some modelers glue a strip of balsa on the side of the tool to stop it when it gets just a piece of the 3/32-inch square stringer alongside the business edge of the tool and gluing the stop piece right against it.

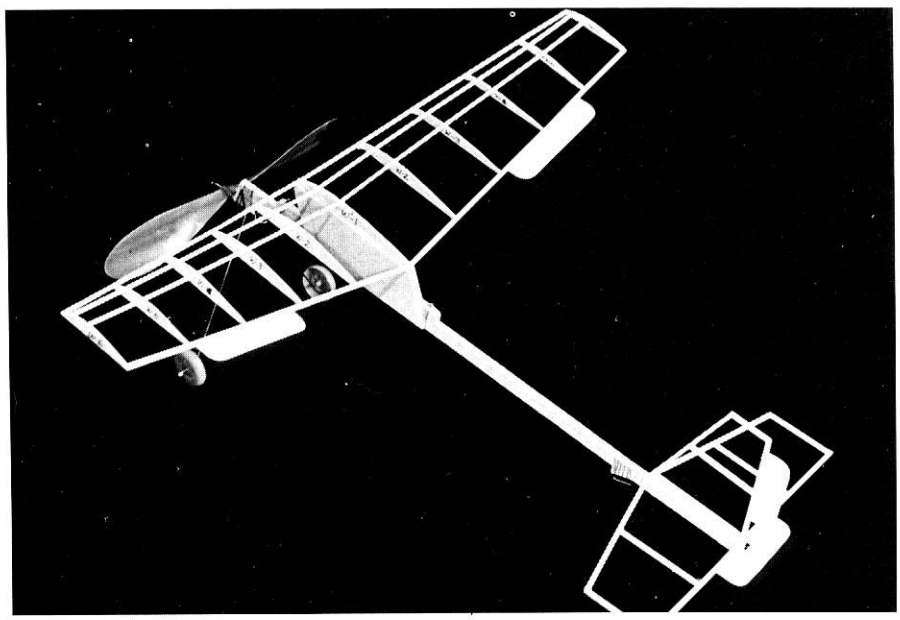
THREE WAYS TO GET THE SPAR NOTCHES LINED UP

Probably the best way to get 'em right is to pin the L.E. down to the plan ("X" the pins, of course), and then to glue the ribs to it in their proper positions. I use one or two pins shoved downward at an angle through the *side* of each rib to hold it in position, though some people "X" pins on them, use little lead hunks of printer's type beside them, or just hope the glue will hold 'em! Then, sight down on the T.E. end of each rib and trim it off even with where the T.E. will go. (You *did* make 'em a little long as I showed on the plan; right?) Glue on the T.E. Now, using the dihedral gauge you glued to some scrap balsa, lean the W-1 root rib inward to match the angle on the gauge. You will need to check this in a few minutes to make sure it has not moved! You can do something else while this is drying. When it is dry, line up a straightedge over the rib-notch locations and mark either the front or back of each notch. Then, saw your notching tool across each location until it is just the right depth to receive the spar. Check with a bit of 3/32-inch square to see that it fits just flush with the top of the rib. Then glue in the spars. They can hang over each end a bit and be trimmed off later.

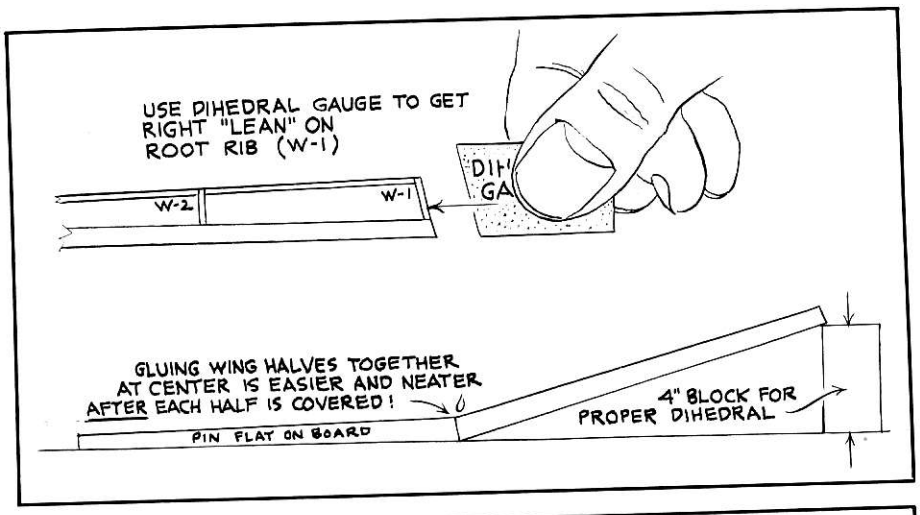
The second way to make a wing is the one most used over the years by millions of modelers. That way involves making all the notches in the ribs first, and then assembling them, usually all out-of-line, with the spar snaking back and forth to connect them all. This is a rather clumsy way to do it, because then notches have to be lengthened to let the spar lie straight and then the unused part of the notch filled in with scrap.

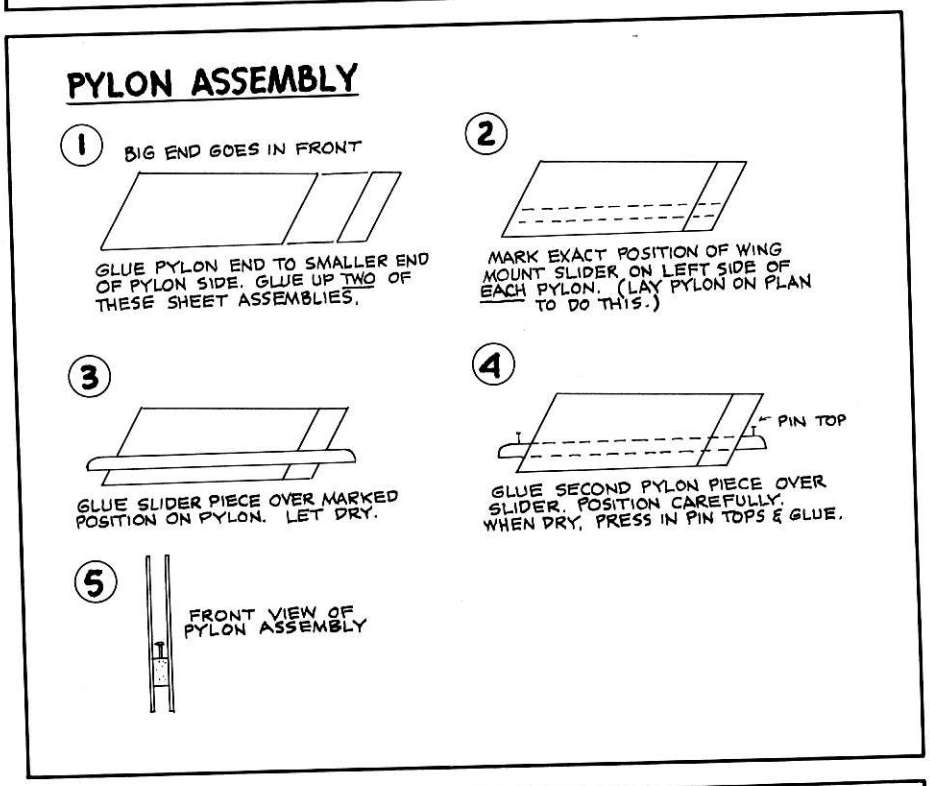
The third way, which is a variation on the above method is to line all the ribs up on the *spar*, rather than using the L.E. as the guide. Then, the ends of the ribs can be trimmed as necessary to let the L.E. and the T.E. touch each one as you go like. I prefer the first, using the L.E. as a starting place, and a straightedge to line up the notches-to-be.

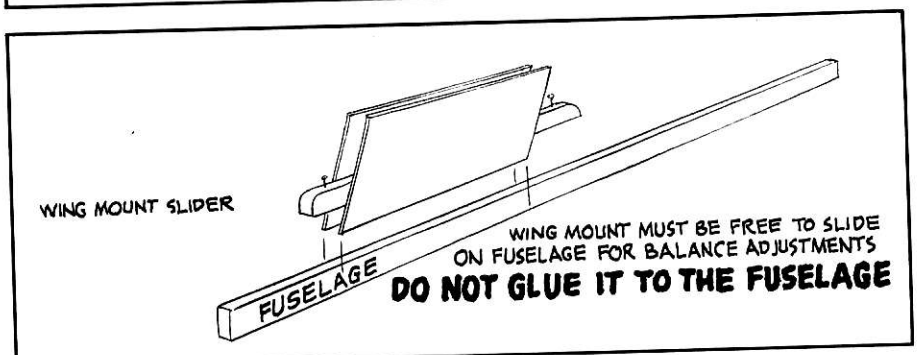
There are two ways to give up your wing. I prefer to get the glue in between the pieces being assembled. Some guys like to pin it all together and then wipe a little glue fillet (a drop with most of the extra scraped off) at each joint. Both ways work. In any case, use a piece of scrap stick to wipe glue into any small cracks, and always get rid of big gobs of glue; they add weight, look bad, and once they dry, are bears to sand or cut! Before your wing dries, double check to make sure that all the ribs are down flat on the building board, that the L.E. and T.E. are touching each rib, and that the spars are all down in their little notches and not sticking part way up. Before we leave this, check to make sure that you have not bent the L.E. or T.E. out of line to make it fit up against any rib. Never allow bends, as they set up a stress in the wing that may later turn into a



The Sky Bunny R.O.G. was designed just for this series. It features techniques in building and flying that will be useful in later models. Bare bones of the Bunny show relationship of the parts. Normally the wing gets covered in two parts before being joined.







warp. Keep the L.E. and T.E. straight, even if it means cutting off that long rib that's pushing it out or filling in the space between it and the rib you cut too short with scrap balsa. Glue alone is not good for filling gaps, though poor craftsmen think it's the way to go!

THE TAIL

After you have made both wings you can do the stab and vertical (rudder). They are made just like the *Peck R.O.G.* (Feb., Mar. 1988 *MB*) and should pose no problem. (Note: As this series started in Nov. 1987, you may want to get some of the back issues by writing *Model Builder*.) Get in the habit of noting how the parts meet each other. The way the L.E. of the stab forms its little "vee," for example, is shown the way it is because a joint on an angle offers more gluing surface, and therefore more strength, than a "butt joint."

THE PYLON AND WING SLIDER ASSEMBLY

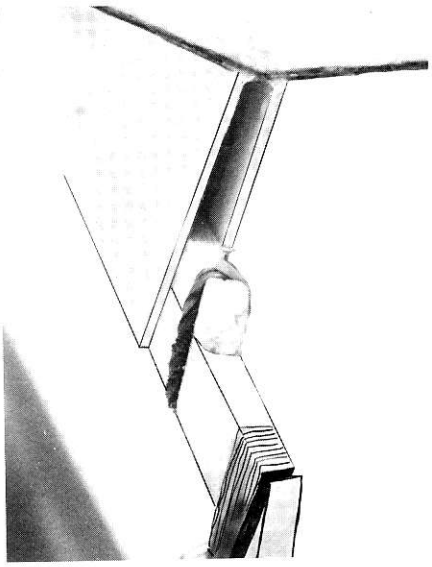
This is the heart of the *Sky Bunny*! It holds the wing at the right angle of attack (front higher than the back), adds some "side area" up front for added stability, helps keep the horizontal stabilizer (stab) out the wing's "wake" a bit, drops the center of gravity (CG) a bit, and also allows you to move the wing forward or aft (rearward) to put the lift of the wing in just the right place in relation to the CG for flight trimming on the field. The main things that you need to be concerned with are making sure that both sides are glued to the slider facing the same way and that when you glue it to the wing that the taller end is in front!

Each pylon side is made of two pieces. The reason for this is so the grain direction can be kept "from-wing-to-fuselage" for maximum strength. I have seen enough kids run the grain on pylons parallel (same direction) to the fuselage to know that it is too weak that way. So, you will have to add the rear to each pylon, hopefully in the right place. I have done it up on the parts layout, so the printing on the side of the large pylon piece will carry over onto the small one. If you copied your parts with the iron-on or thinner methods, you should have no problem assembling these two pieces in the right order. If not, study them when you are fitting them together to make sure everything matches up nicely! Then cut the slider from some fuselage-width balsa and glue it to the inside of the right pylon side, using the dotted lines as a guide. Mark the position front and back by placing the pylon side over the plan if you didn't use the printing transfer methods mentioned above. Then the other pylon side can be added. Test fit the assembly over the fuselage to see if it fits okay, but don't leave it there or it may become permanently attached!

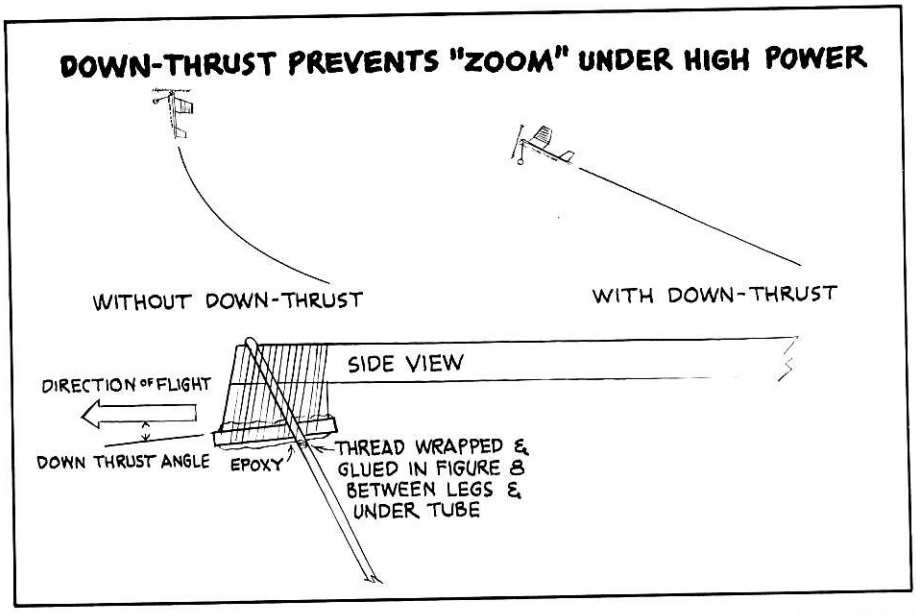
THE NOSE

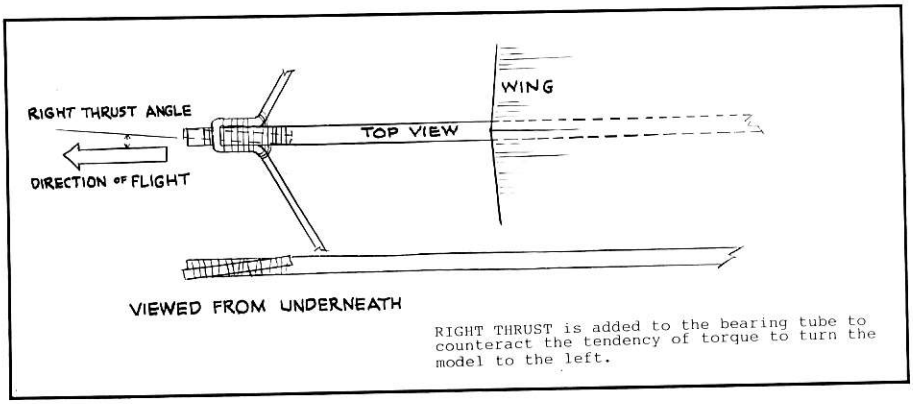
Glue the three "S" pieces together and then glue the lot to the front of your fuselage stick as shown on the plan. *Make sure the big end is at the front to point the thrustline of the prop shaft downward.* About one in five kids who do not understand the purpose of the angle here, does it backwards. The result is then UPthrust, and often a loop under power! The purpose of the downthrust stems from the fact that a rubber motor puts out a big burst of power at the beginning, which then tapers off to no thrust at all when it is out of winds. This big burst of power means lots of extra *speed* right at the beginning of your flight. This means lots more air speeding over your wing giving you lots of extra lift; too much, in fact. To keep the extra lift from just taking your model straight up into a stall or over the top for a loop, the thrust of the prop is aimed a bit downward to pull the nose down under this high-power part of the flight. As the rubber runs down, it has less and less ability to pull it down, but then the airspeed over the wing is less then, too. It all equals out, and when the motor runs down and the plane is gliding, the downthrust has no effect at all on the flight. This is not like radio control, where you can shove the nose down under high power by using a control stick. You are into *pure* model flight, and it has to be *right* because once you let it go, it's *completely on its own*!

You will remember back in the Decem-



Rubber band holds the wing/pylon assembly on the fuselage for adjustment purposes. Short pin helps hook the rubber band onto the wing slider. The slider is glued to the pylon sides, not on the fuselage!



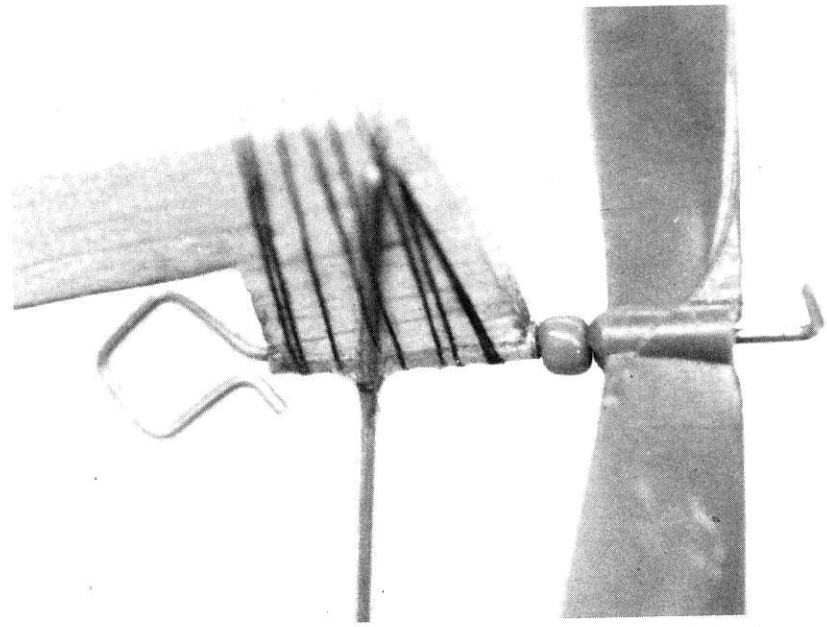


ber '87 *MB*, page 64, we had a drawing of torque reaction and the tendency of the model to roll in the opposite direction of prop rotation? Well, to counteract this, which makes the plane want to go left, we are going to point the propeller thrust a little to the right; just opposite. You will see on the drawing on the plan (page 3) that the aluminum tube is angled to the side. Make yours just like it shows. I have called out a 1/16-inch inside diameter (hole) tube. This leaves plenty of "slop" for a .031-inch prop shaft inside. That is to make sure it will not bind up on you. I have allowed for this looseness by adding just a tiny bit more angle on the right thrust. This will bother some good modelers who like everything to fit nice and snug. They are the ones you see changing prop shafts after every hard landing because their nice, tight fit binds up when the shaft gets bent even a little.

Gluing the aluminum tube on can be done with your Testor's (cellulose) cement, or with five-minute epoxy, where you mix the two parts, "A" and "B" together. The epoxy is stronger, but if you get any in your eye it can be disastrous. I have, on occasion, used "hot-melt" glue from a glue gun, and that works okay. Whatever you use, you will need to *rough up* the outer surface of the tube so the glue can get a grip on it. Use a file, your rough sanding block or whatever, but remember that rougher is better. While the glue is drying, keep checking the position of the tube as shown on the plan for sidethrust (right) and also make sure it sticks a little out in front of the fuselage so that the bead will not be rubbing against the "S" part.

SPLICING

Any time you need to join two pieces of wood, the more of an angle they have where they meet, the more gluing surface there will be. If you do not have a fuselage piece that is long enough, you will need to do the optional splice shown on the plan. I like to overlap the pieces to be spliced and cut down right though both at the same time so the angles will match up. If they don't, dress them a little with your sanding block. Double-glue (let the first coat dry) and put them together. Adding a few wraps of thread and rubbing glue into the thread will complete the job. A properly-made splice will be used for *repairs*. If you used cellulose glue to put on the prop-shaft-bearing tube, now might be a good time to give it an extra coat of cement. There is nothing more frustrating than having this tube come loose and slide backwards, stopping the prop! Don't forget the thread binding. Rub glue into the thread, too!

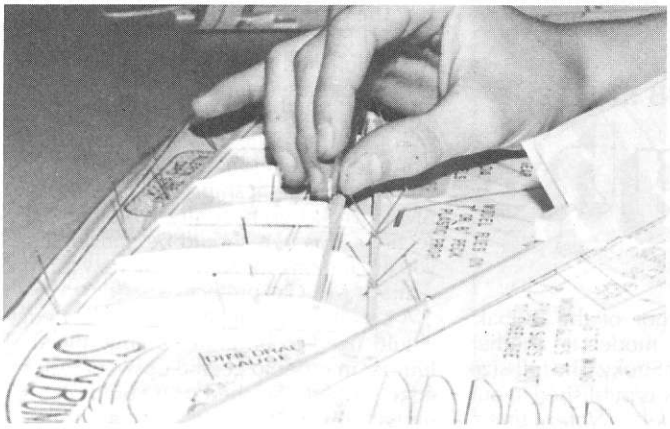


The Sky Bunny front end. Wind with thread as shown and use plenty of glue all around. Bind landing gear legs together underneath. Note bead position.

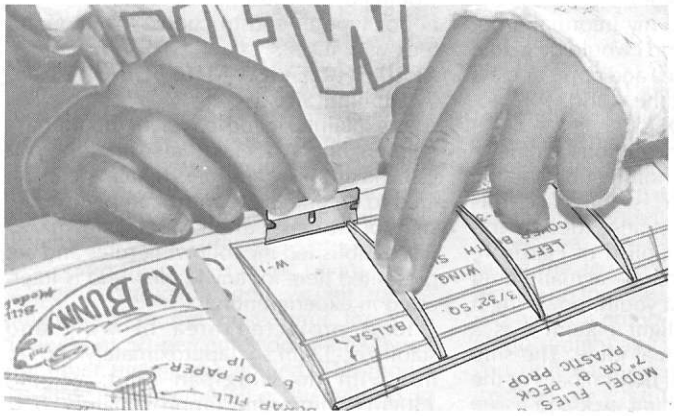
FINISHING THE WINGS AND TAIL FRAMES

With your sanding block first, and then

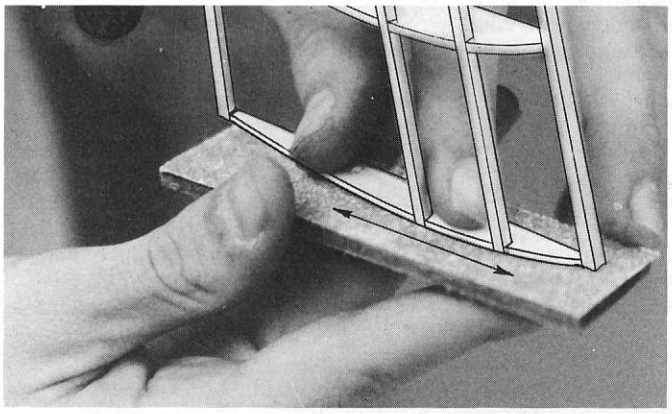
Continued on page 80



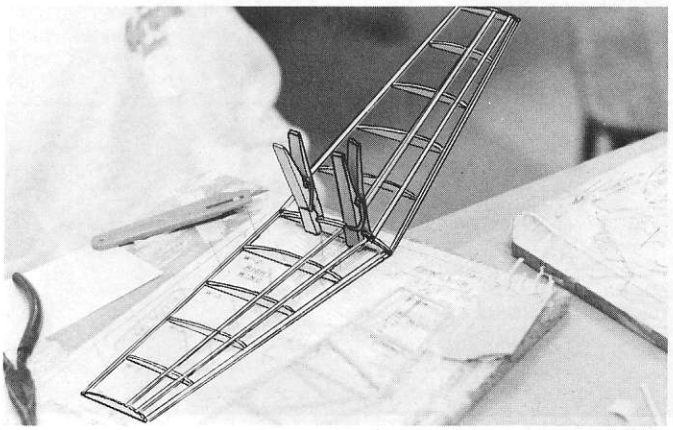
Fit wing spars after notching ribs in position with notching tool.



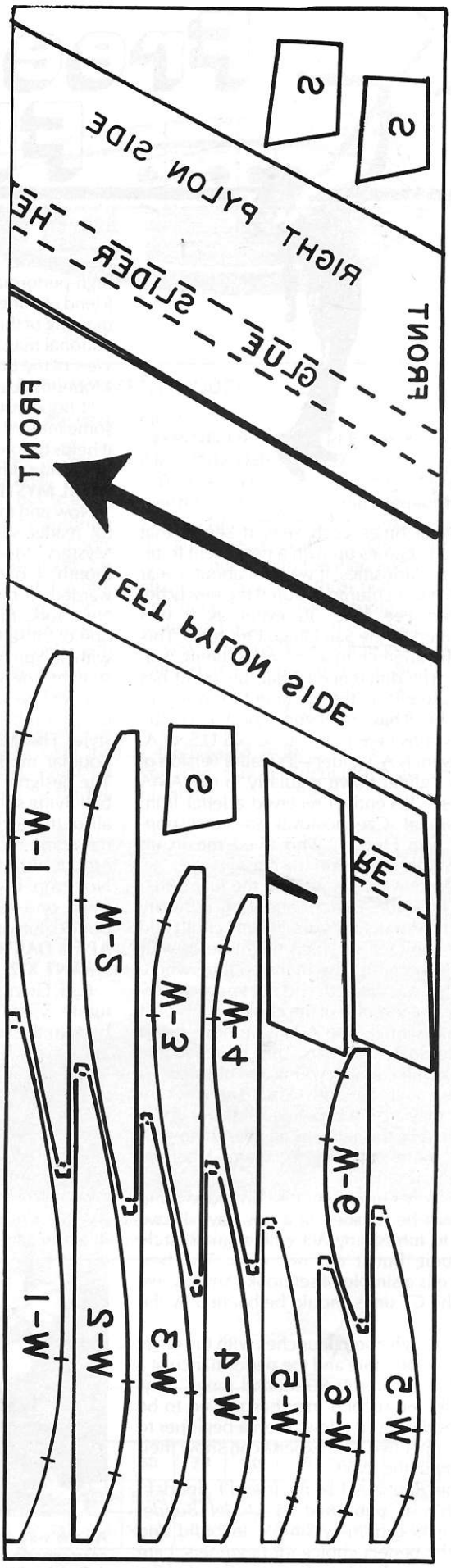
After laying down the L.E. with 'Xed' pins, trim each rib to fit the T.E. exactly. Then glue on the T.E.



When the wing structure has dried, level up any overhangs before joining, and sand entire structure before covering.



Glue wings together before or after covering. Covering each wing separately before joining is neater. Doing it this was is fine, too.



Hey Kid. . . . . . *Continued from page 59*

with some fine sandpaper, (220- to 320-grit) go around and even up all the parts so none

stands out above its neighbor. Tissue will *not* cover up poor workmanship. It will just make a lot of wrinkles which will point at *exactly* what is not taken care of before covering! If something breaks while you're doing this "evening-up" good! Better now than after its covered! Inspect closely for poorly glued joints and give them what they require.

An airfoil shape does not have a piece of square 3/32-inch sticking out in front and in back, so now is the time to round those to blend in with the camber of the wing ribs. This is most easily done with your sanding block, with the piece you are sanding right up to the edge of your building bench. Don't sand it *too* much, or you'll take its strength away.

You can glue both right and left wings together now, which will make for a nice strong glue joint, or you can cover them first, which will make for a nicer covering job. Whichever you do, just make sure you measure the proper dihedral angle, which will come to four inches under the high wing tip with one wing flat, or two inches under each tip. The spars and the L.E. and T.E. ends should all touch the opposite part, or strength will be lost. If the wing does not come out to the right match, or if the dihedral angles are wrong on the root ribs, cut the parts involved loose (or brush acetone or dope thinner on them to loosen the glue) and make them right before proceeding.

I mentioned why dihedral was a help in maintaining lateral (side-to-side) stability back in the November '87 *MB*, but it's worth repeating. You fly your model in a turning pattern. This is easy to do, because the propeller is spinning and wanting to turn the model anyway. But mainly, a straight-line flight will mean you will probably fly right off the field (or into the wall if you're in a gym). Instead of catching and staying in thermals outdoors (those rising "bubbles" of warm air coming up from the warming of the earth), you'd fly right through them! So you turn. But when you turn, not having a pilot to make corrections, the wing on the inside of the turn develops less lift, allowing the plane to slip towards the ground in a sideways spiral. By making the wing tips higher than the roots (W-Is), as the wing drops on the inside of the turn (it's slowing down, while the outside wing is speeding up) it gets closer to the horizontal, which gives it *more* lift, while the outside wing, by going higher, *loses* lift automatically. Imagine a wing in a vertical position as having no lift at all, and the closer the wing gets to being straight up-and-down, the less lift it will have. The dihedral is *very important* to the pilotless free-flight model, and although the pylon side area will help straighten the model up in a sideslip, dihedral in the wing itself makes for an excellent-flying model.

Another effect of dihedral is to think of how the airflow will "see" the model in a sideslip. The "inside" wing will have a "sideways angle of attack" to the relative wind (airflow "coming from" the direction in which the plane is slipping). This can be still air, but as the model is moving, it gives the effect of "blowing" toward the model. In a sideslip it will pick up the low wing (see "sideslip" diagram).

I know that some of you will be so persuaded by the above paragraphs that you will think, "If a little dihedral is good, a whole *lot* will be great!" Well, before you add *more* than called for in the plans, just remember that every bit of dihedral is purchased at the cost of some lift. If you get so much in that both wings point straight up, you'll have a "road warrior" instead of an R.O.G., as it will certainly not "Rise Off Ground." Also, the more dihedral you put

in, the less effective the vertical tail or "rudder" is in keeping your model flying straight. Too much dihedral will give you "Dutch Roll," a condition in which your model wags its tail from side-to-side! The cure is a bigger vertical fin or less dihedral.

Too little dihedral, that is, less than the amount shown, can get you back into a sideslip condition. A smaller vertical fin can help, or redoing the dihedral to the proper amount will be even better if you miss it the first time. I know there is always the temptation to change things about a model that you don't like. All kids like to experiment, and that's good, but realize that most of the features that have been designed into a model have a purpose, and to change any of them on a whim is to ask for trouble. I once took the muffler off a motorcycle I owned because I liked the noise and thought it would go faster. Guess what? It went *slower*! The designers knew more about what that engine needed for maximum performance than I did. Change things on the models you make, but only when you understand the principles involved. I have had dozens of kids who have left the dihedral out of their models over the years, and not a single one of them flew worth beans.

Some of the more adventurous among you will doubtless cover and finish your models now. Next month, we will go over some of the best ways to do this. We will also try our hand at bending music wire, an art which has driven many strong men to the brink. We will talk about dope (model), shrinkage, and finishing tricks. Then we will cover the relation of the center of pressure to the center of gravity and wing incidence, things which may help you early birds understand why maybe your models did not fly!

Materials and kits for this series are available from *Peck-Polymers/Beginners*, P. O. Box 2498, La Mesa, California 92044. Send a SASE for a list. Their full catalog is $2 or free with your first order.

Well, gang, until next time remember that famous quote by an unknown modeler many moons ago, "If at first you don't succeed, read the instructions." See ya' next month! •