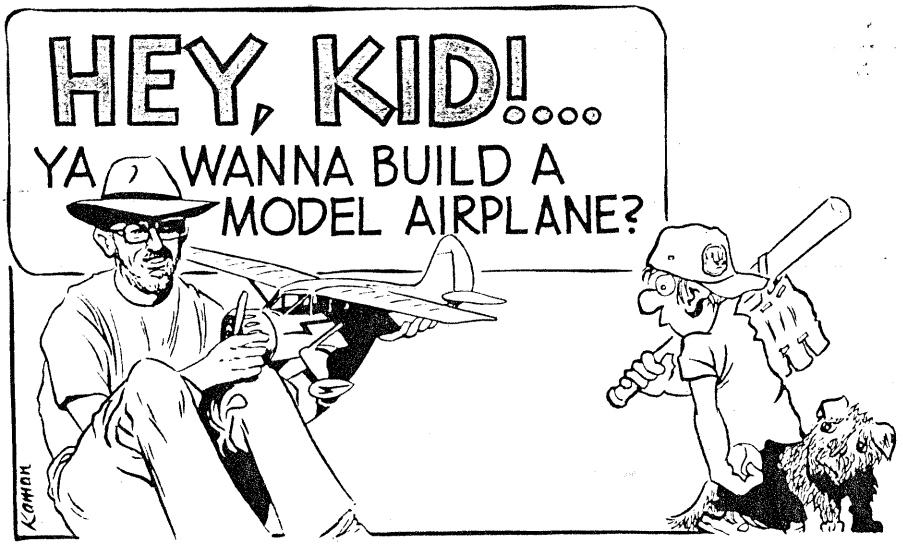
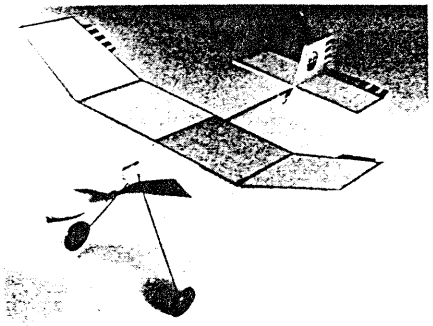
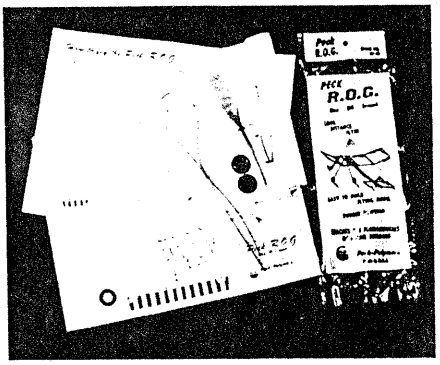




Finished model ready for indoor or outdoor flight. Check the trimming chart for advice on how to get your model to fly right!

By BILL WARNER

Illustrations by JIM KAMAN



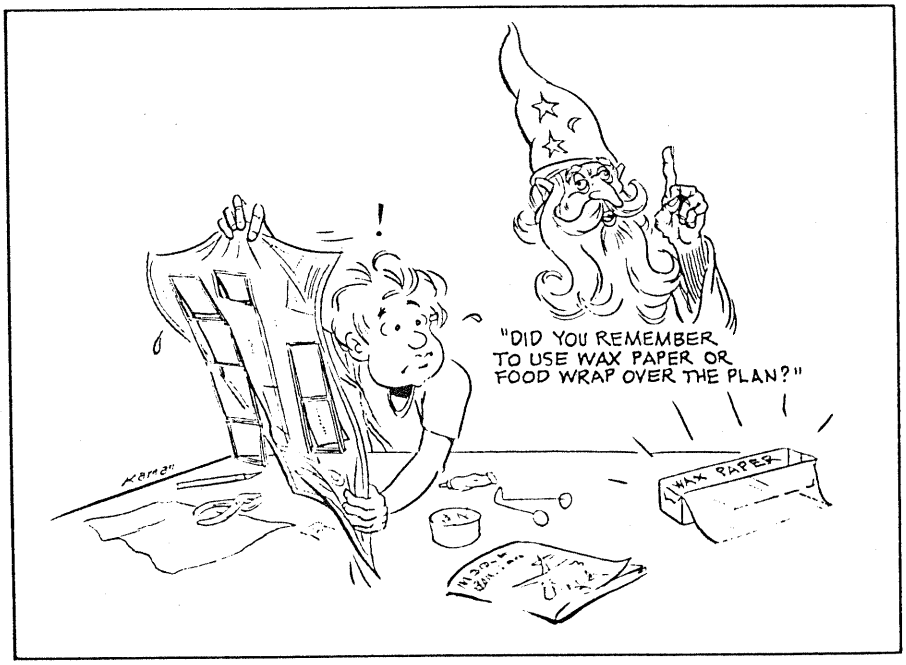
The Peck-Polymers 'Rise off Ground' model.

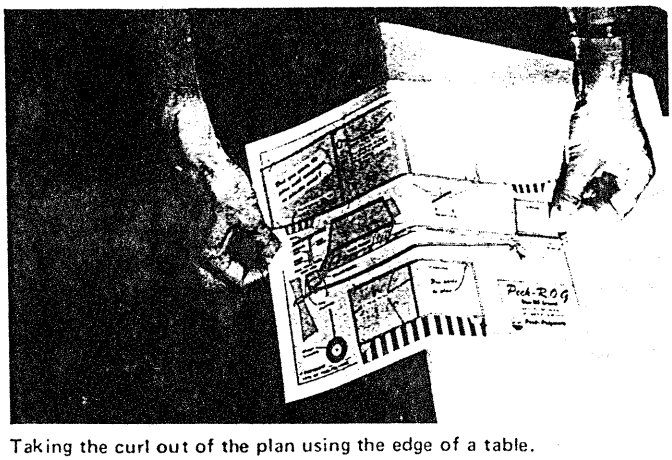
• There's just *something* about opening a model kit that makes you want to start sticking balsa together! Most kids make the mistake of starting with something way too hard, usually something from World War II that had a pretty picture on the kit box cover right over the words "Flying Model." This, of course, is sheer nonsense in most cases, as most of them get so messed up by the time they are finished, if they ever are, that you couldn't tell if it was a B-24 or a Piper Cub. Fly? With the wood and heavy plastic-formed parts most kits contain, even an expert could not get it to fly, let along a beginner. Well, you're not a beginner anymore if you've faithfully followed our series. You know the names of some things, some things to do and some things not to do. Lets take it from there. If you're just joining us, why not subscribe to *Model Builder* so you won't miss a single exciting installment of coming articles!

If you haven't sent for the free list of all the kits and materials for this series, send your self-addressed, stamped envelope today to Peck-Polymers/Beginners, Box 2498, La Mesa, California 92044. If your dealer doesn't carry beginners kits like the Peck R.O.G., ask him why not.

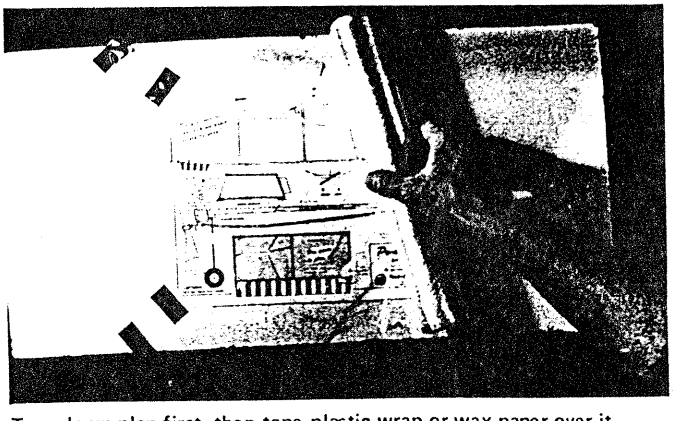
The first thing you want to do is read over the instructions which come in the kit and then read over this article, making a list for yourself of the things you'll need that you don't have.

It may seem like we're taking a long time just to build a couple of simple models, but I want you to remember that the basic stuff you are learning applies to *all* models you will build, and even to full-size airplanes, too. Remember how you balanced your

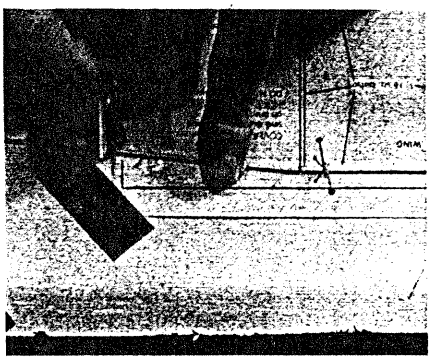




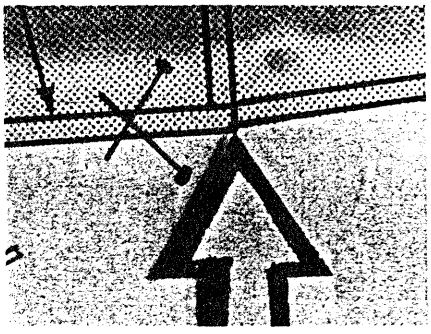
Taking the curl out of the plan using the edge of a table.



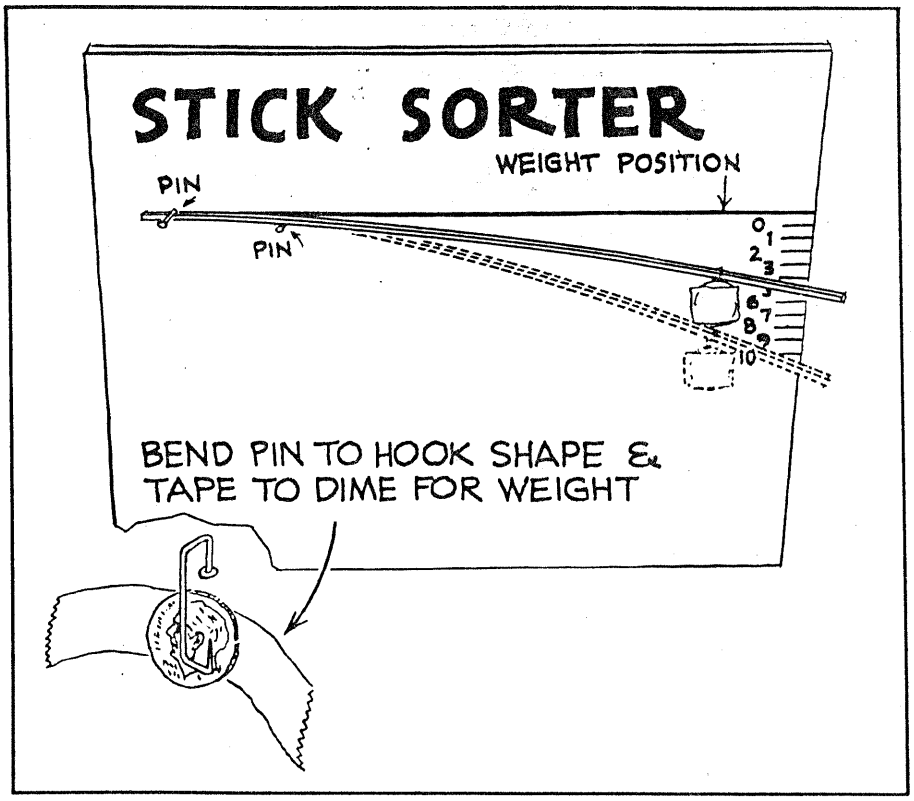
Tape down plan first, then tape plastic wrap or wax paper over it. The building board is 1/2-inch Celotex.

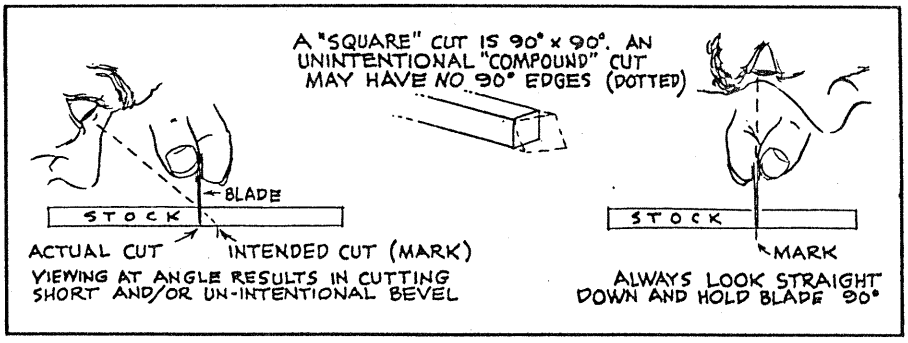


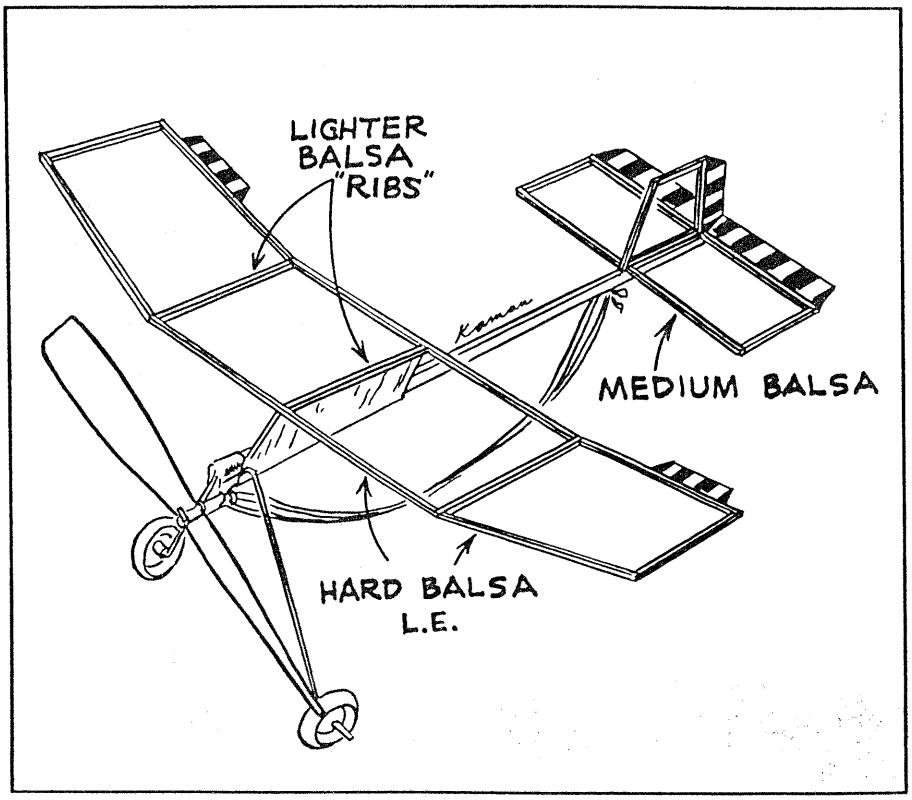
Trim parts even with lines on plan using a razor blade. Be careful when cutting!



Note where parts meet. Three 1/16-inch sticks come together here. Arrow points to dihedral joint cut which is not glued until later.







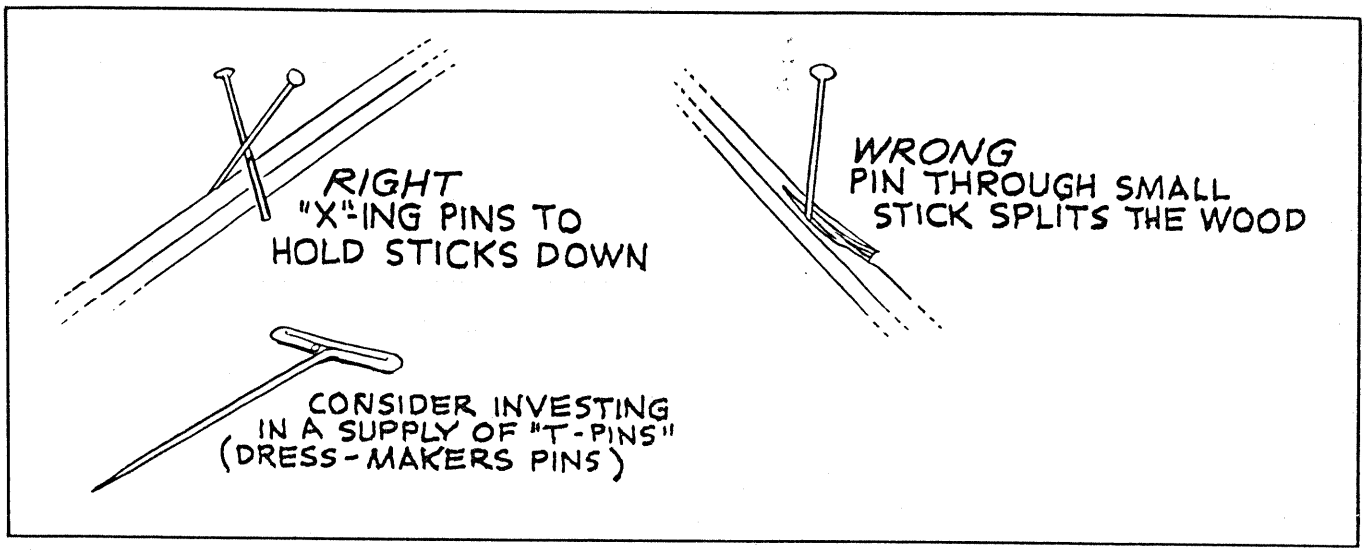
Sleek Streek R.O.G. so you'd get the wing on in the right place? I just got a snapshot from a friend who's building a full-size airplane, and he had it off the ground balancing it!

THE BUILDING BOARD

One of the things that makes life easier for a model builder is the building board. This is a flat board on which the pieces of the model are pinned down to dry, insuring an untwisted framework. It should be soft enough to stick pins into easily. "Celotex" wallboard 1/2-inch thick is the best thing I have found. It's made of soft fibers and painted white on one side. You can get it at your local lumberyard in a sheet four feet wide by eight feet long for not much more than you'll pay a hobby dealer for a small piece (about eight dollars or so). You can cut it up with a knife to get it into the family car. Just make a cut part way through and you can break it the rest of the way. You can sell the extra to friends to make models on or, as I do, have three or four models going at the same time. You'd be amazed how many 14 x 24-inch boards with partly built models on them you can stuff under the bed! Or you can pin pictures on it and use it for a dart board! If you can't get Celotex, heavy cardboard like they use to pack refrigerators in is the next best. If it isn't flat, maybe you'd like to glue it down to a board or old bench that is. Flat is where it's at.

THE CUTTING BOARD

There are two reasons for not cutting on your Mom's formica kitchen table. One of them is that you'll dull your knife, and I'll let you guess what the other one is. One modeler I know uses old phone books to cut out parts on, tearing off a few pages when the surface gets too cut up. Another uses old linoleum tiles. I like heavy, solid cardboard about 1/8-inch thick, but I have no idea where you can get it outside of an art store. Don't cut on your plan or building

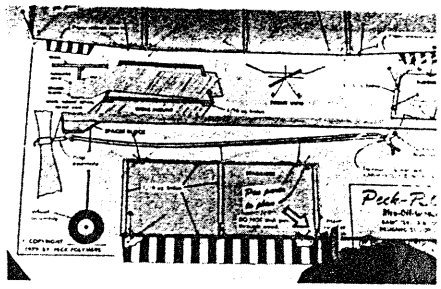


board if you can help it; it really makes a mess.

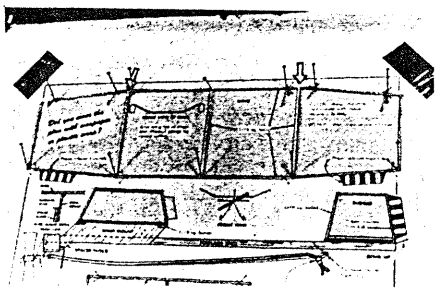
THE PLAN

Model airplanes are built right on top of the plans. Because many structures like wings and tail parts have to be pretty flat to fly, this is a good idea, but if your plan has been rolled or folded up, it may be hard to use. Hold it by the ends and run it over the edge of a table a few times, putting a little pressure on it to "erase" the curl and ridges. You can iron it if you aren't in a hurry! Then, tape it down on your building board, pulling out the wrinkles. I usually use frosted "Magic Mending" tape, but for the pictures I used vinyl black electrical tape so you could see it. Pinning your plan down isn't good enough, as it won't stay flat.

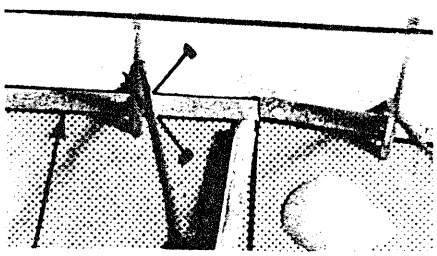
Once the plan is taped down, tape a layer of plastic wrap or Saran Wrap over the plan to keep the parts from getting glued to the plan. I used to use waxed paper, but the wax seems to get into the glued joints and keeps the glue from drying as well as it should. Some older modelers rub the parts of the plan which will come in contact with glue with a wax candle or a dry bar of soap. I even knew a guy once who glued all his parts to the plan on purpose, so he would have less covering to do. He just cut out around the edges of the wing and tail parts!



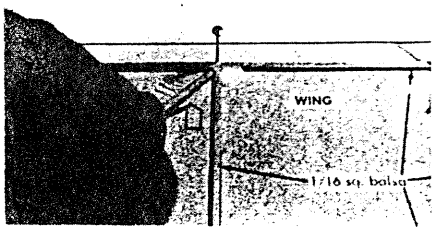
Trimming parts to length. Sight straight down over plan line, cut straight down.



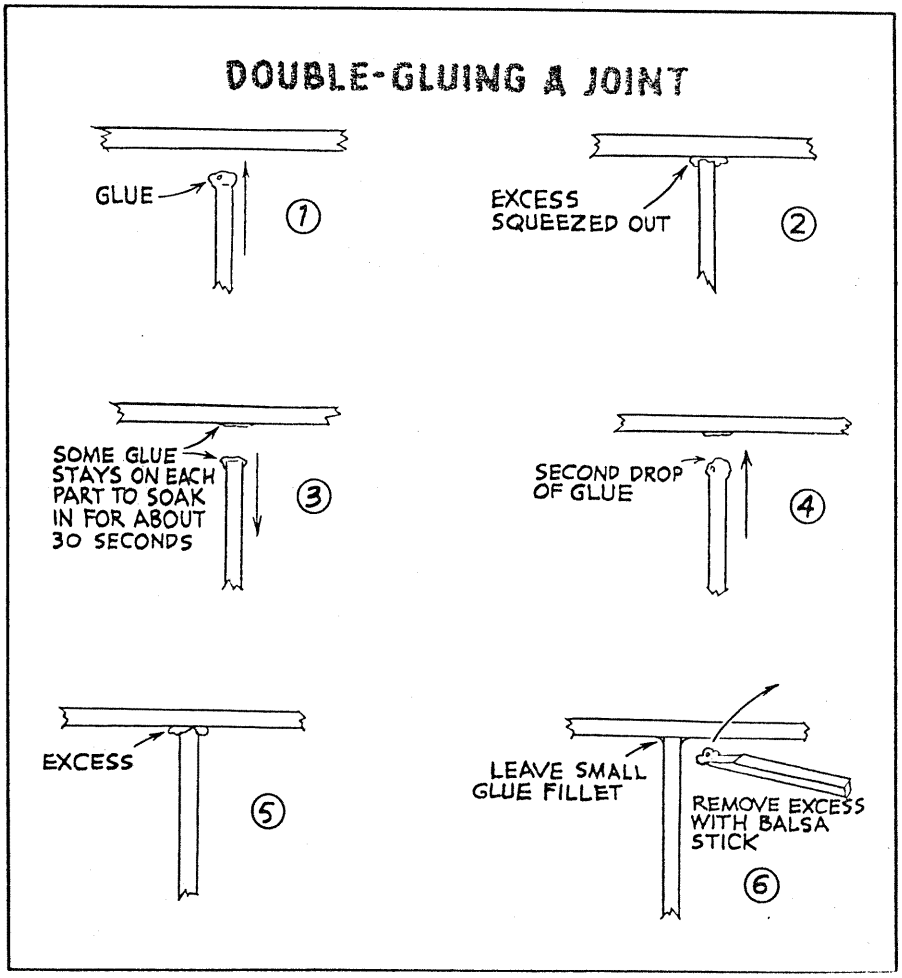
Pin L.E. down as shown. Add 'rib' sticks, trimmed to correct length before adding T.E. The arrows show joints left unglued.

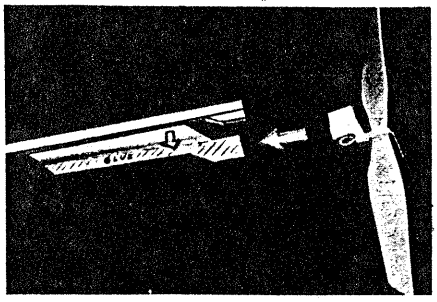


Put drop of glue on part you are gluing to make sure parts are wetted with glue. By double-gluing joints, you make a stronger union. Note drop of white glue for dipping ends of 'rib' sticks.

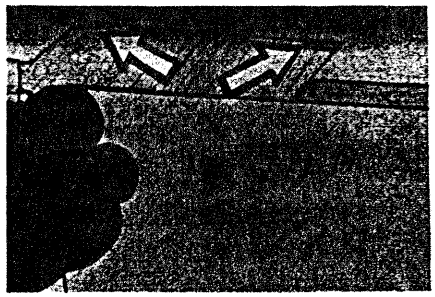


Wipe excess glue out of joints with balsa stick. Leave small fillet of glue for strength.

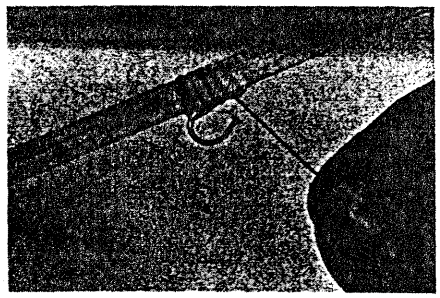




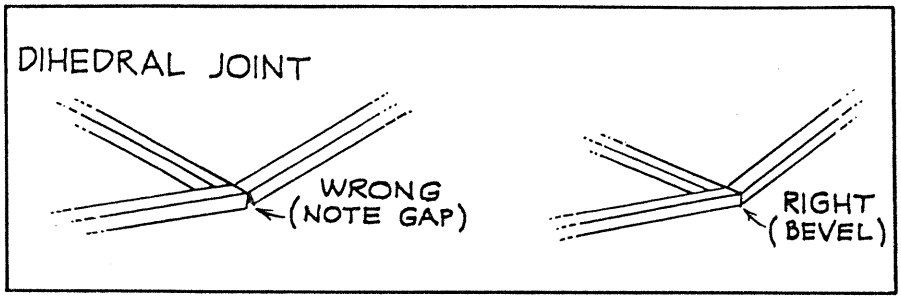
Now assemble pylon and spacer block to fuselage stick.

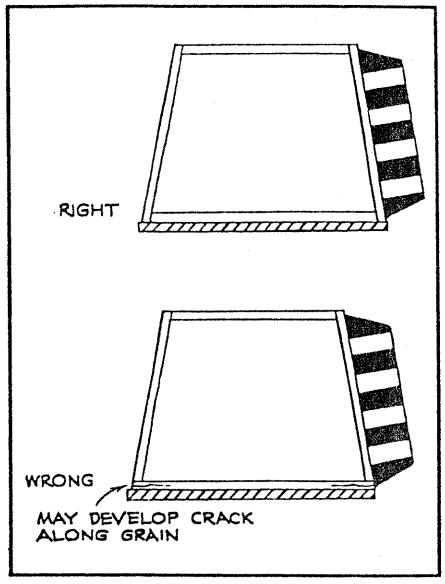


Arrows indicate positions of small bits of scrap balsa which help hold wing on.



Attach special rear motor hook with glue and thread. Rub glue into thread.





You can do this if you don't intend to fly the model, but you really *don't* need all that weight on a Peck R.O.G.! It will weigh too much to fly for long. Some kids like to try to use the Saran wrap to cover the model, but glue doesn't want to stick to it. That's why we're putting it over the plan, right?

PICKING THE STICKS

Before you start cutting parts to length, it's a good idea to separate them: hardest to softest. The hardest ones will make great leading and trailing edges, as they have to take a lot of stress. The sticks which make up the "ribs" (pieces which connect the L.E. to the T.E.) can be weaker. The tail parts need to be kept light, but not so light that they tend to warp out of shape. Save the "medium" for those. A simple "stick sorter" can be useful here. The more complicated your models get later, the more important it is to put the strength where it is needed, and the lightness where it counts.

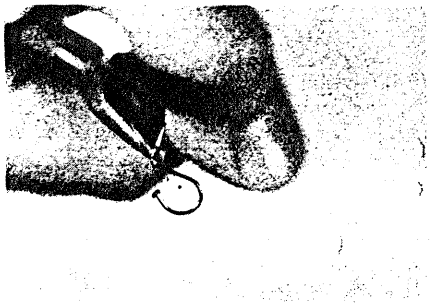
You can make your own sorter out of a piece of cardboard with something on it (two pins, a bit of soda straw, a clothespin or ?) to hold one end of a stick. The end of the stick can be weighted with a small nut or a dime hung on with a taped-on pin or wire bent into a hook. The little lines are just for comparison to see which ones bend down the farthest.

You may think that this is no big deal, but I have seen three out of four kids use the spruce (harder wood) tail boom included in a popular beginner's kit for a wing part, using soft balsa to hold the tail on. Guess what usually happens on the first flight. Now is the time to begin thinking about what takes the most strain.

CUTTING THE "STICK" BALSA TO LENGTH

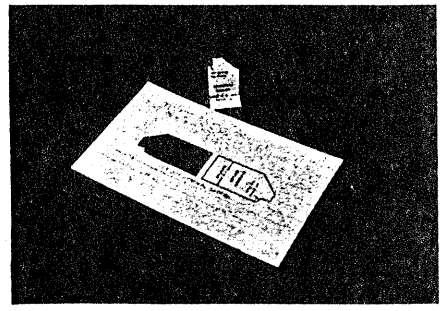
When I was a kid, all we had to cut balsa with were razor blades, usually dull ones at that that Dad had shaved with. They made 'em out of real steel in those days, and they cut pretty well. Today's blades that you get in the market are garbage, having softer but non-rusting metal mixed in with the steel to make them better for shaving, but lousy for anything else. You can get "industrial" single-edge blades at paint or hardware store which are still pretty good. If it says "stainless" on the package, pass it by. There

Continued on page 83

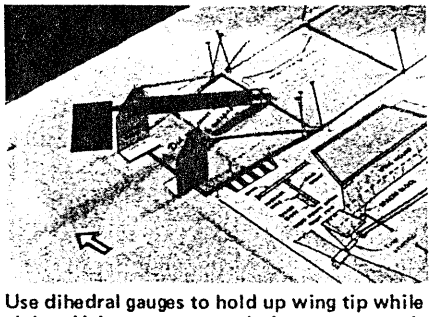


Bend pin for rear motor hook to replace the straight one shown on plan.

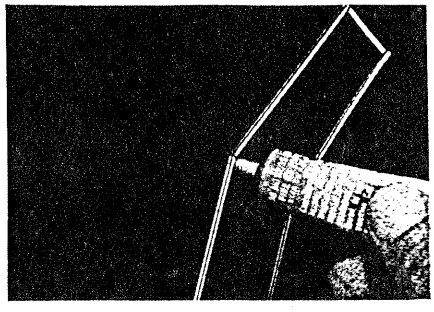
Using sanding block or sanding stick, make an angle on end of L.E. and T.E. before gluing in the dihedral. Careful, sticks are fragile.



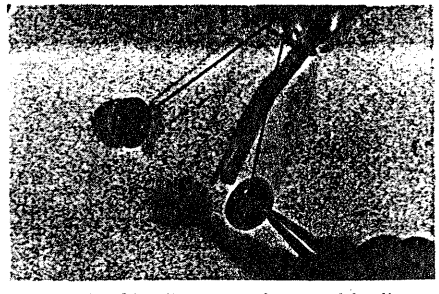
Glue dihedral gauges from plan to a piece of card stock, cut out.



Use dihedral gauges to hold up wing tip while gluing. Using two on one tip insures a no-twist structure. Do other tip in one hour.



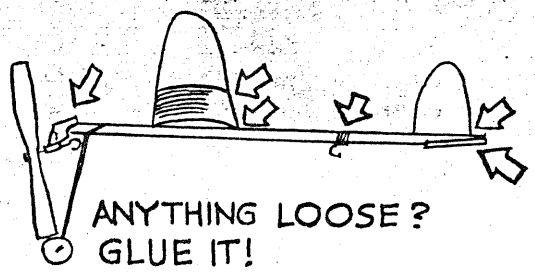
Add extra glue to dihedral joints when dry for added strength.



Bend ends of landing gear wire up with pliers to keep wheels from falling off. Wheels should be free to turn.

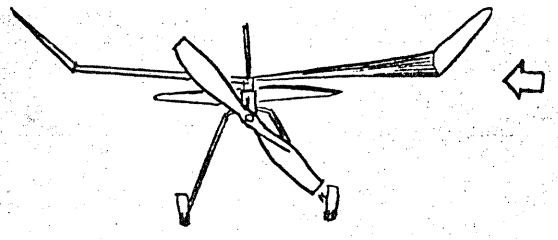
PRE-FLIGHT CHECK

1



ANYTHING LOOSE?
GLUE IT!

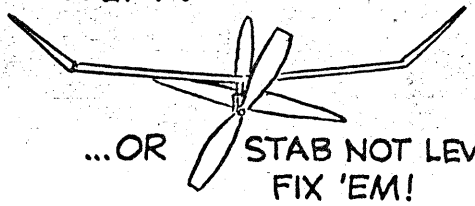
2



ANY WARPS? STEAM 'EM OUT WHILE TWISTING IN OPPOSITE DIRECTION

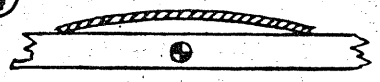
RUDDER KICKED RIGHT OR LEFT?

3

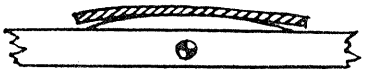


...OR STAB NOT LEVEL? FIX 'EM!

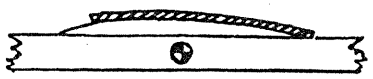
4



WING MOUNTED LIKE THIS

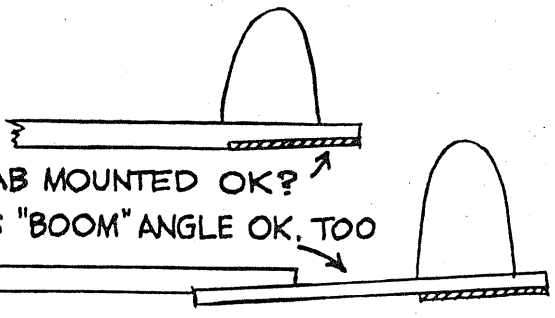


...NOT THIS

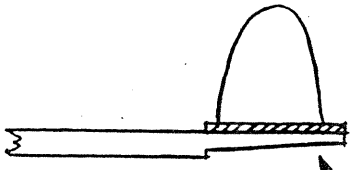


... OR THIS

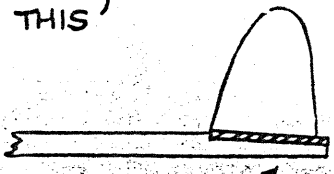
5



STAB MOUNTED OK?
THIS "BOOM" ANGLE OK, TOO

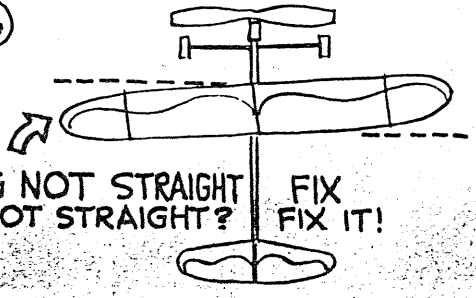


NOT LIKE THIS



OR THIS

6



WING NOT STRAIGHT
WING NOT STRAIGHT?
FIX
FIX IT!

Note: Disregard chart published in the December issue! This revised version supercedes it and is correct!

helicopter engines. O.S. had the first built-in helicopter heat sink, three-way adjustable carburetor, 90-degree muffler adapter. . . I could go on and on. Now the 61 long stroke is their hot item, along with a 32 H with rear cone start—both of which I'll be reviewing in the next few months. Next up: rear cone starting on their 61H engines. Throw away your dial indicator, and you can use all those spare starting belts as rubber bands.

Great Planes Distributing, Urbana, Illinois 61801.

RAVES R/C

Raves is a tiny company, but they're hard to ignore. They keep coming up with all these neat products. They've modified their H & R True-Start system to eliminate the "rounding out" problem, and they've come up with adapters for virtually every chopper made, including GMP, Schluter, Heim, and the O.S. 32H and 61H with rear cone starts. A very efficient blade balancer is also a big seller for them.

Rave's Manufacturing, U.S.A., 2007 Mount Vernon Avenue, Alexandria, Virginia 22301; phone (703)273-9760.

MATRIX

If you ever want to transport your helicopter by plane, you will wish you had the Helicopter case made by Matrix. It is already molded to take any pod and boom choppers, and they have a special model for the Bell 222/Airwolf. The Robbe entourage used several of these cases to bring their helicopters to the show. These are very spectacular-looking cases, and walking to the gate at the airport you will attract more attention than Robert Redford. Great conversation piece, too.

Matrix Enterprises, 7015 Carroll Road, San Diego, California 92121; phone (619) 450-9475. •

Hey Kids!. . . . *Continued from page 46*

are two reasons why I like razor blades better than model knives for cutting balsa sticks off. First, they are cheap and can be thrown away when they are dull. Most modelers use the "throwaway" model knife blades far too long, and most no one knows how to sharpen one any more. The next reason is that a razor blade is easier to line up for a straight cut than some knife you hold like a pencil, off at some funny angle. By sighting straight down over the blade, you can make those cuts square and right where you want them. Model knives come in handy when you need to cut out ribs and other parts from sheet balsa on more complicated models.

CUT WHERE THE PLAN SHOWS

"Jeezz, I've cut it off three times and it's *still* too short!" Hard as it may be for you to believe, some people are *almost* that dumb when it comes to cutting parts off right. Study the plan carefully and try to figure out *why* a part should be cut where it is. I once had a kid cut a leading edge off every time it came to a rib. When I asked him why, he just said, "I dunno." Brain damage? Not really. He just didn't stop to think that the *purpose* of the L.E. was to add strength to the front of the wing, and that cutting it up made it weak. When the guy who drew the plan doesn't show a line crossing the stick, don't cut it off! Often when two sticks cross, you will have to decide which gets cut and which goes on through the intersection. Careful inspection of the plan will generally tell you which one the designer of the plan wanted left in one piece. Trust him. Ninety-nine times out of a hundred, he had a reason for drawing it that way, and it may be just a little better than leaving it to chance.

BUILDING THE WING

We build the wing right over the outline shown on the plan. Even though the wing tips are raised to give "dihedral" on the finished wing, we build the whole thing flat for now. The leading edge or "L.E." is made in three parts. Cut them from the hardest sticks in the kit and pin them down to the plan. *Do not stick pins through the wood!* Use the "X-ing" method as shown, leading the pins, which face each other on opposite sides of the stick, onto the wood just enough to hold it down without leaving a big dent in the balsa. Don't glue them together now, or you'll just have to cut them apart later when it is time to raise the wing tips! Now cut all the "ribs" from the softer sticks in the kit. They get glued to the leading edge, then any long ones trimmed to length to let the T.E. contact each one equally without bending. You can't very well stretch the short ones, so try not to cut them too short!

The way you get parts the right length is to

cut them out directly over the plan. I suggest that you cut them just a wee bit on the long side and then sand them to exact length and snug fit with your sanding block. If you have to force a part in place, it may wind up giving you a twisted structure when you take it off the board due to the stresses you put on the fragile framework. Better to make it just an easy snug fit.

It's also a bad idea to try and fill up the space between two poorly fitting parts with glue. It adds weight, it takes forever to dry, it looks bad, and a few other minor things like that. Either make another part the right length or glue in a bit of scrap balsa to fill in the gap.

If you have several parts to cut to the same length, you can cut one the right size and then use it as a pattern to cut the others. If you do this, be sure and use the *same* part as your pattern each time, and not the one you just cut off with it. This prevents the length from "growing" as you go along.

Again, remember to cut on your cutting board and not on the plan. You may want to use the plan again. I generally start a cut over the plan and finish it on the cutting board.

Another tip for good cutting has to do with keeping the blade perfectly in line with the line on the plan, both side-to-side and up and down. Pushing the razor blade slightly forward as you cut generally works better than just crushing straight down. Remember, a *sharp* blade is essential.

When you have all the ribs glued in place, then you can fit the T.E.

GLUING THE PARTS TOGETHER

You may use white glue such as Elmer's or Titebond aliphatic resin glue if you have them. If you use Testor's "Fast Drying Cement for Wood Models," as I do, you will put a drop on the end of each rib and then dab the drop quickly against the place on the L.E. where it goes. Getting glue on both halves of the joint is important. If you wait too long, it will be too dry to stick well to the L.E. Then lay it in place and "X" a couple of pins to hold it, with a third pin pushing it toward the glue joint at the place where the T.E. will go later. With the end of a stick, wipe out any extra glue which squeezes out of the joint to save weight and make it dry faster. Blobs of glue get a skin on them like an egg and do not dry inside. If you use white glue, the easy way is to put a few drops on the Saran wrap and dip the ends of the sticks in it. Allow the wing to dry "as is" for about a half hour or so while you go on and do the stabilizer and rudder. Pay attention to which sticks run all the way to the edge and which butt into the part they are glued to. Study the plan carefully instead of just assuming you know. Sometimes it makes a difference in strength. Notice, for example, on the plan the rubber drawing. Do you see that the L.E. and T.E. of the rudder go all the way to the part with the little angled lines on it (the side view of where the stab will go) and the top and bottom pieces of the rudder glue up against them? That will help keep the rudder from tipping to the side and breaking off. Before you glue the T.E. on the stab, go back and put the T.E. on the wing, as the ribs are probably dry by now.

Take the pins out that you used to apply end pressure to the wing ribs while they were drying, cut the T.E. sections and glue them to the rear ends of the ribs, using the end of a piece of scrap stick to apply a drop of glue to each joint before you touch the balsa together. Don't glue the T.E. sections to each other (remember how you did the L.E.?). A pin behind the T.E. at each rib location will hold enough pressure against it to keep it in place while it dries. Do the same thing with the stab.

THE FUSELAGE

While the wing and tail frames are drying for about a half hour, study the side view of the fuselage assembly on the plan. Glue the spacer block to the front end of the fuselage stick, on the narrow edge, not the fat part. Hold it over the plan to see if you did it right. Then, take the 1/16-inch thick balsa sheet wing mount and glue it on the *left* (pilot's left) side of the fuselage. Do you notice the broken or "dotted" line on the plan which runs just under the word "wing mount"? That means that you cannot see

that part of the fuselage when the wing mount is in place. That is how you know it is on the left side. Now glue the two tiny bits of 1/16-inch square balsa on to the wing mount as shown. They are on the left too, as they have no dotted lines. Now look at the center drawing on your plan by the left-hand margin entitled "Wing Mount Detail, Front View." What you are looking at is what you just did, as seen from the front (minus the wing, of course). If your work looks different, try and figure out what went wrong. Set the parts aside to dry.

Bend a rear motor hook from a pin as shown. It works better than the straight pin shown on the plan. Bind with thread and rub glue into the thread. Make sure that you glue the pin itself, as the thread alone is not going to hold it.

DIHEDRAL

Making sure the wing tip (three sticks glued together) is dry, slide your razor blade or a table knife blade between the sticks and the Saran Wrap. Pry the parts off gently, as they do stick just a little, and you could break the tiny structure easily. You are now going to glue the tip on at an angle, with the tips raised one inch higher than the center section of the wing. To make the L.E. and T.E. fit better, you will need to sand just a little angle where they join. Leave the center section of the wing pinned down and do your sanding of a slight bevel on the L.E. and T.E. of the tip, grasping the stick as close as you possibly can to where you are working on it with your sanding block. Take it easy. It is always easier to go back and sand a little more after you try the fit than to throw away the part because you sanded too much off. Cut the dihedral gauges out of the plan and glue them to thin card stock. Use them to check the proper angle as you sand the ends of the dihedral joint.

When gluing the tip onto the center section, always double glue and allow it to dry overnight if you can, especially with white glue. I recommend using *both* dihedral gauges under one tip, one near the L.E. and one near the T.E., to keep the tip from twisting. A little weight will hold it while it dries. I find that a video cassette is just the right height and saves making dihedral gauges. A block like that can be pushed farther in if you need more height at the tip.

THE FRONT END

I found that I had to cut a little off each side of the landing gear where the wheels fit on before I bent the ends up to hold the wheels on. Some modelers prefer to nick with a file just outside the wheel and then wrap glue-coated thread around the nicked area to form a knob big enough to keep the wheel on. Slip the landing gear wire into the white nose bearing and try the fit onto the front of the fuselage assembly. Chances are that it will not fit and that the balsa will have to be sanded down a bit before it will go into the plastic socket. *Do this a little at a time,* for if you take too much off, the nose bearing will be loose and will be pulled *downward* when you wind the motor. This will give you extra downthrust and prevent your model from climbing well. A little downthrust is built into the bearing to help prevent stalls or loops at the beginning of the flight when the rubber motor is putting out the most power. The downthrust has no effect at all when the motor has run down.

TACKING IT TOGETHER

At this point, you may want to tack everything together to see what it will look like. Just a tiny drop of Testor's or other cellulose glue is needed to hold the wing and tail on. When you are ready to cover, brushing a little acetone or dope thinner on the "tack" will loosen it so it can be taken apart for easy covering.

SO YOU CAN'T WAIT UNTIL NEXT TIME TO COVER, EH?

Well, you can always stick your tissue on now with a mixture of about two parts white glue to one part water, but it might be better to wait until our complete tissue covering session next month. We'll discuss ways to do it so your wing won't look like a Pringle when you're finished! Until then, happy building! •

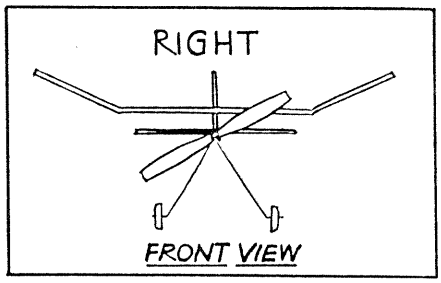
Counter. . . . . . *Continued from page 10*

* * *

Here's a novel idea, in the form of an instructional videotape from Great Planes: How to Build and Fly a Radio-Controlled Model Airplane. This 85-minute cassette will give you 28 chapters on how to build and fly an R/C model. The Great Planes PT-40 plane is featured, but the information applies to any balsawood kit. Directed by Victor Milt, an accomplished video producer and R/C modeler, and featuring well-known modeler Bill Fries, this tape should

By BILL WARNER

Illustrations by JIM KAMAN



Correct alignment of wing and tail section is most important for proper flight.

• I had a kid once in my junior high model club who insisted on trying to glide his models before he covered them. They did not so much glide as plummet. Another young man in my science workshop classes took his Piper Cub home to cover it and lost the tissue, so he covered it with toilet paper! You can imagine how *that* looked! I have had kids cover with the Saran Wrap that was supposed to protect the table (actually it would work if you used contact cement, but they didn't). I have had kids bring in models with so much model dope (a liquid plastic that modelers use to paint on tissue) on them that they looked more like cartoons all shriveled up than flying models. You may not be able to judge a book by its cover, but you can sure tell a model by its covering!

PRE-SHRINKING TISSUE

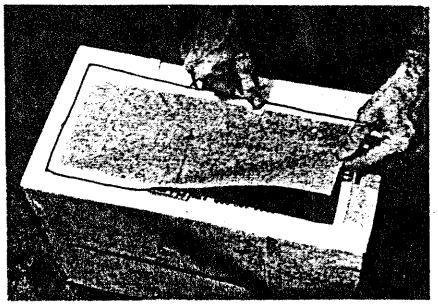
There are lots of ways to shrink tissue up before it gets on the model. If you don't shrink it first, it will find a way to shrink itself later when it picks up moisture and then does what tissue loves to do, tighten up. One guy I know tapes his on the window pane and sprays it with water. Another wads it up into a tiny ball and then spreads it out and irons it to give it an "alligator-skin" look which allows for some shrinkage by accident after it's on the model. One guy out in Oklahoma sprays his with a water mist and then irons it between two sheets of newspaper until its dry. All of these methods work, and you can take your pick. The method I personally prefer is to cut a hole out of the side of a good-sized cardboard box with a model knife about a half of an inch smaller than the piece of tissue I have, and then glue or tape the tissue over it. Using an old hairspray bottle filled with water, I spray it until it's good and wet and then set it side to dry. Use a hair dryer on it at your own risk, because tissue has almost no strength at all when its wet, and you can easily blow a hole right through it. I usually use a dryer after its already dried out, just to make sure.

If you live in an area where it is damp, or where the model may get wet on damp grass, you may want to use spray lacquer like Testor's Dull-Kote or thinned (mix dope thinner with it half and half) model airplane dope. Any dope will do, but clear is the lightest. There is nitrate dope (tautening and non-tautening) as well as hot-fuelproof dope on the market. Old timers prefer the tautening nitrate dope for most models, even though it can warp thin wings and tail parts. It has one advantage, and that is that it does its shrinking and gets it over with, and some models can stand the tightening effects easily. Because we're not doping the tissue on the model, but on a pre-shrink box-frame, who cares how much it shrinks? After giving the tissue a spray or brushing with the thinned dope, let it dry. Then let it dry some more. Ideally, you would let it age a couple of weeks to make sure it had stopped tightening up. Now's when a few minutes with a hot hair dryer can speed up the aging process.

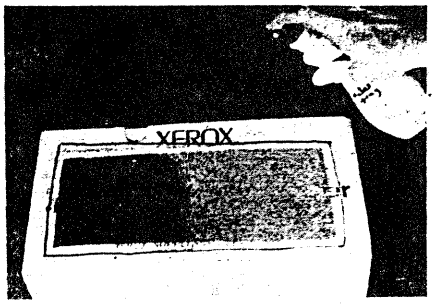
Now that the tissue is ready to use, you can either cut it out of the frame or you can stick flat parts directly to it while it is stretched. I like to take it out of the frame and put it on the model. It doesn't give as smooth a covering job, but then, I want a slightly imperfect job so it will heve a little bit more than it could shrink up without twisting my wing. Also, people will know I did it, whereas they might think someone built it for me if it looked *too* good!

Modelers use about anything to stick tissue on, ranging from shellac to glue sticks. One popular way is to coat the part of the model frame that the tissue will touch about three times with dope and let it dry. The tissue is applied dry, and dope thinner brushed on so that it soaks through the tissue and sticks it on "from the bottom up." This is a lot of work, but gives nice results. Lazy modelers like me, however, prefer to mix about two parts white glue with one part water and brush one coat on the bare balsa. Then we position the tissue carefully and let it down onto the frame. You then lift it at any corner where there is a wrinkle and gently lay it back down, pulling out the wrinkle. Using your thumbs, start at the center and gently apply a little pressure

Covering your model need not be the arduous chore illustrated above, if you follow the simple guidelines presented this month.

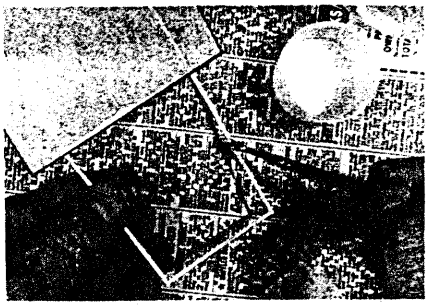


Gluing tissue over hole in cardboard box prior to spraying it with water to pre-shrink tissue.

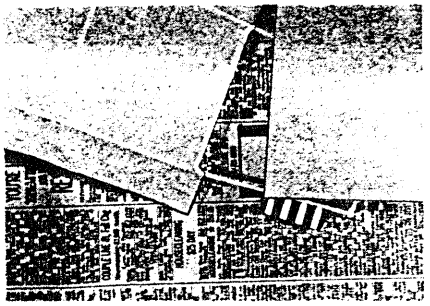


You don't have to do this, but it is a good idea in order to prevent warps later on.

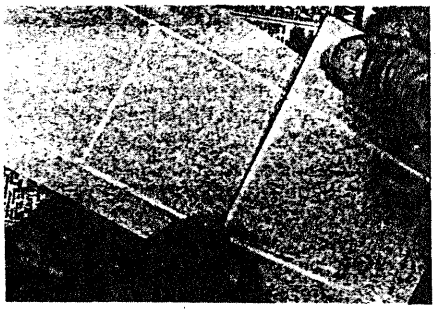
Tear a tiny bit of a corner of tissue to find the grain direction. Grain direction goes from tip to tip on the wing.



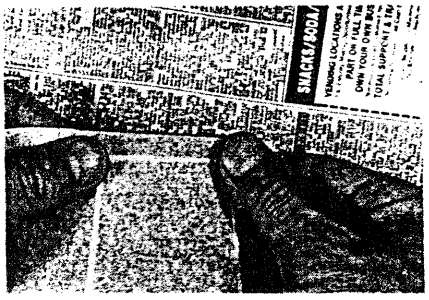
Brush on white glue mixture(60% glue, 40% water) on top of surfaces to be covered.



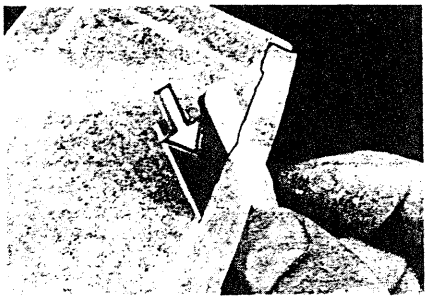
Cover the top of the wing in three pieces. Do the center first, overlapping tips just a bit.



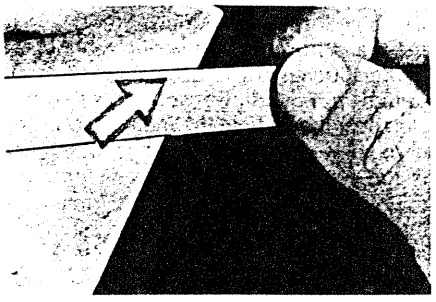
Carefully locate tissue over area to be covered, lower onto wet glue mixture.



Smooth wrinkles out with thumbs. Keep them dry or tissue will stick to you and not model!



When tissue is dry on frame, trim using a shearing motion along edge with new razor blade.



Using a sanding stick to clean up the edge of the wing after trimming the tissue off.

down on the tissue, sticking it onto the wood while *very* carefully moving them outward, pulling out little wrinkles as you go around the edges. The trick here is to *keep wiping your thumbs on your fingers* every couple of seconds to keep them dry. Once they get sticky, you'll pull chunks out of the tissue as it sticks to *you* instead of the wood!

If you like to do neat work, or if you are short on tissue, take some newspaper and cut patterns just about 1/4 inch larger all around for each piece of covering you need. Leave less on the edges of the center section and none at all on the inside of the two wingtip pieces where they will just slightly overlap the center piece. When using the pattern to cut the tissue, pay attention to the "grain" of the tissue (the direction in which it tears easiest. . .try a corner). The grain should run from tip-to-top on the wing or "spanwise." This will become more important when we begin building wings with cambered (curved on top) ribs.

You will have to decide whether or not you wish to cover all your parts and then glue them together (a very neat way to do it) or build the airplane and then tissue it. What I like to do is "tack glue" the model together with little dots of glue, just to see how it looks, and then soak the places apart with some acetone on a brush where I tacked it, cover the parts, and then reassemble them.

Another decision on the Peck ROG, which gets covered on one side only of each part to save weight, is whether to cover on the top or the bottom side. Most of us cover on the top because it looks right, but covering on the bottom may give a wee bit more lift, and also allows the wing to be covered with one piece of tissue all the way across instead of in three parts, which is the way we are going to do it on the top.

After the glue has dried for about a half hour, it can be trimmed off with a *new* sharp razor blade. Use old ones at your own risk, you'll see why. It takes a gentle touch to move the blade along right up against the L.E. or T.E., holding it at an angle and moving the blade downward with a sort of "sawing" stroke as you go. The idea is to shear it off even with the wood. Some modelers prefer to use a sanding block and sand through the tissue along the sharp edge of the wood. This can make a very neat job, but be careful and not remove too much of the wood underneath, and don't break the balsa sticks. I like the razor blade. When you have finished, go along the edge with a finger wetted with a little white glue and rub down any rough edge remaining.

If you mess up the covering badly, you can always soak the whole thing in water to get it off, as white glue is water soluble, but the cellulose glue you built the model with is waterproof. If you have to do this, pin the parts down flat for a couple of days until they are thoroughly dry. Nobody messes up the job a second time! Well, almost nobody.

When you assemble covered parts, it is not a bad idea to scratch away a little of the tissue where the part attaches. Gluing wood-to-wood is always stronger than wood-to-tissue! Before everything dries completely, give the model a quick once-over (with one eye closed) at arm's length just to be sure everything is straight (see the December '87 issue of *MB* for preflight instructions).

ADDING THE ADJUSTMENT TABS

The adjustment tabs on the wings and the tail of the *Peck ROG* are not just there for decoration. Due to its short wingspan (we say the model has a *low* aspect ratio when a wing has a fairly short wingspan for its *chord*, or distance from the L.E. to the T.E.). The *Sleek Streek* we made earlier had a higher aspect ratio and did not tend to roll quite as much on torque. I suggest replacing the tabs cut out of the plan with ones cut from a 3 x 5 card, as they will be harder to knock out of adjustment. The aileron tabs are important to control the roll, keeping the bank (dropping of a wingtip) to a minimum. The elevator tab is really essential on this model because the amount of positive

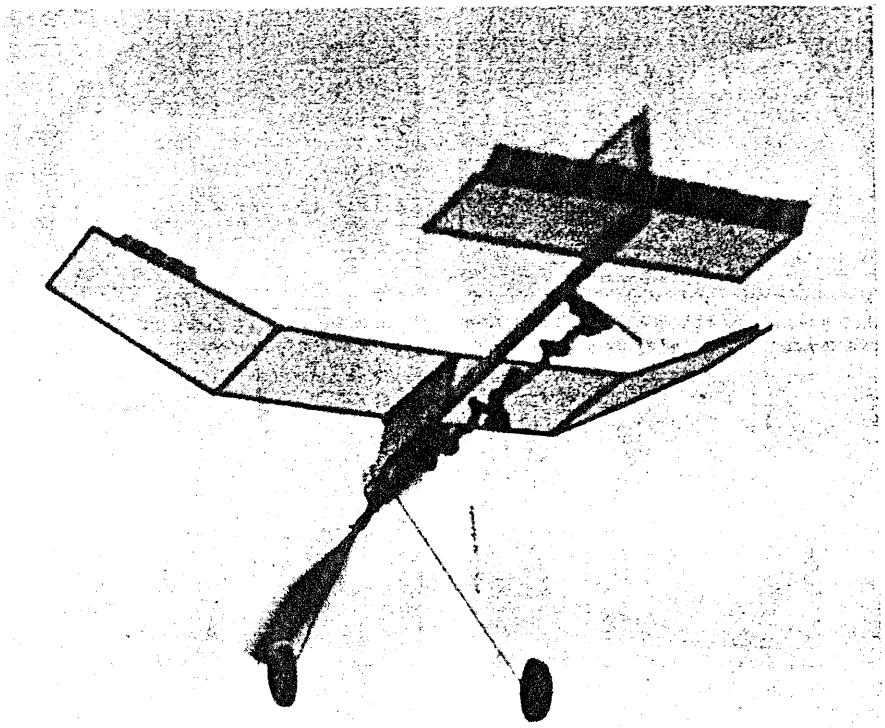
incidence or angle of attach built into the wing mount is pretty small. Without some "up" elevator, the model will dive into the dirt and return itself to kit form on the first flight. You can cut down on the amount of tab needed for elevator if you sand a small angle (negative) under the rear of the fuselage and mount the stab on the bottom. Taking about half the 3/16-inch thickness off at the very end and tapering it to full width about two inches forward should do it. Then you can use about a third of the original tab size, as its purpose will be minor adjustments, not something necessary to make the plane fly.

POWER

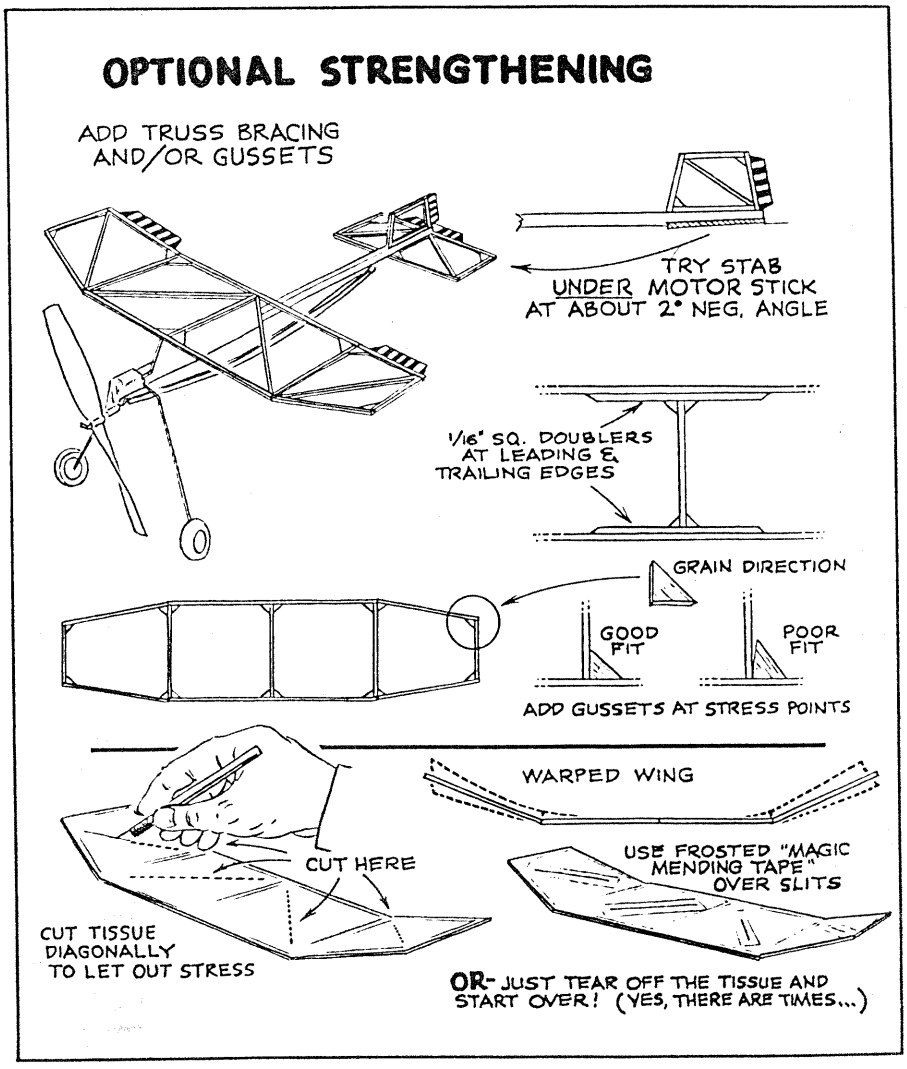
I have had Peck ROGs fly very nicely on 1/16-inch FAI rubber indoors in a gym, with times over a minute. The less power you need the better, as flying fast makes any small warps become *very* effective in ruining your flight. I'd suggest using a 1/16-inch motor about 12 inches long for your first test flights even outdoors. You can go up to 3/32-inch rubber when you get it flying well. Remember that the Peck is quite a bit more fragile than your Sleek Streek, and testing under fewer turns in the motor is a good idea, slowly building up to full winds and bigger motors. Indoors, the idea is to make a motor just long enough so that the model touches down just as the last couple of turns run out. If the model has the prop stop near the ceiling, the motor is too short or too powerful. If it lands with winds left, it is too long or too weak. Sometime you might want to try adding a little more twist into the blades of the prop so that it will turn a bit slower indoors and give you a longer motor run. Outdoors, you'll probably want the extra prop speed for a high climb. I suggest you take the January issue of *Model Builder* with the flying instructions and trouble-shooting chart to the field or gym with you.

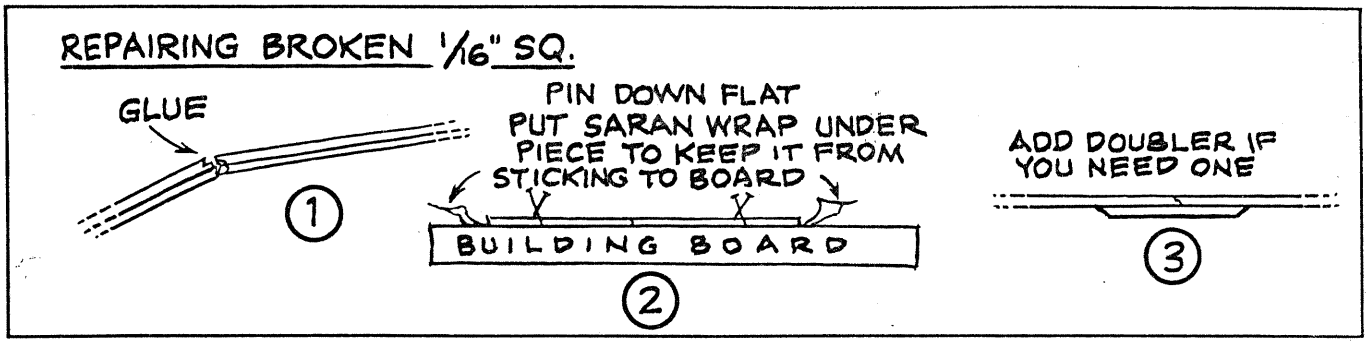
REPAIRS

Although you will do your best to avoid damage, things always seem to get broken on models, either while building, on the way to and from the site, or, once in a great while, in a crash. A good thing to remember is that your model is never as bad-off as it looks! I have had kids in my classes throw perfectly good models away with only five or six breaks. Remember how many places needed to be glued together when you started making it? Well, it probably needs fewer joints now! The main thing is to try and get as much gluing surface as you can. Gluing two sticks together end-to-end is never as strong as sanding or cutting an angle on each one and gluing the longer surface together. A 1/4-inch fuselage "butt-jointed" end to end gives 1/4-inch of gluing surface (for purposes of illustration), whereas if you cut the wood at 45 degrees, you'd increase the gluing area to 1/2 inch! The more gentle the angle, the more surface. Of course, you need an extra piece added into the joint (see fuselage-break illustration) or you will be too short! Sometimes, if you're lucky, the break will cover a fairly large area, and, when glued back together, will probably be stronger than the original place where it broke. Always double-glue.



The finished model on the wing with rubber band knots unwinding in the air. Note trim tabs on wings, stab, and rudder. Built correctly, your model will fly just as good as this!





A quick field repair on a broken model can often be made by adding a splint made from scrap balsa to the repaired joint. This adds strength and can help get it straight again. An extra thickness of balsa is often called a "doubler," and is sometimes added in places where breaks might be expected before they happen. Where the wing L.E. and T.E. attach to the pylon wing mount, for example.

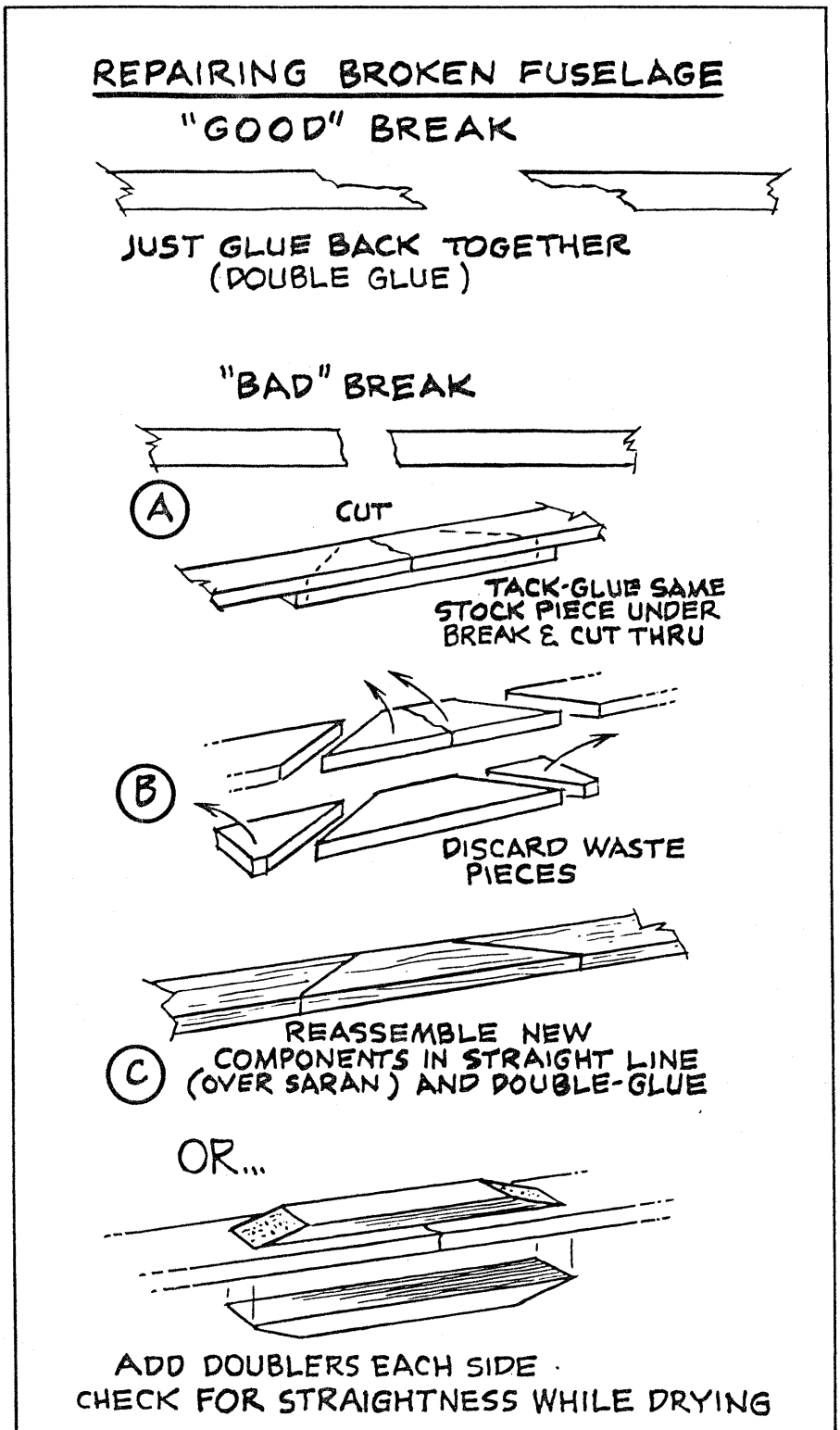
After gluing a broken section, it is a good idea to pin it down to something flat, or to put some weight on it. If you use the corner of your model box top for this, and have no Saran Wrap handy to keep the glue from sticking, you had better make sure all extra glue is squeezed out first and wiped off so the model will not become part of the model box on a permanent basis. Pieces of balsa sheet, if they are flat, often make good devices to pin wing tips and such to while the model is sitting on its wheels. This way, two or three repairs can be during at the same time.

Leading edges (L.E.s) of wings often get damaged, as they hit first. A good way to add a doubler is *behind* the break, making it hard to see and out of the airflow to keep drag down. Cut the ends of the repair doubler at angles or taper it toward each end from the middle to make it lighter and a bit more flexible.

At this point in the article, the author sidetracked for a moment to take a strong stand against the use of cyanoacrylate glues, not only by youngsters and beginners toward whom this series is aimed, but also to include modelers from all experience levels. We acknowledge *and understand his concern about the safety hazards related to the use of cyanoacrylate glues, however, we cannot agree with his contention that its use should thus be avoided entirely, by everyone. . . not any more than we would warn against the use of model knives and razor blades, or being around high-revving engines turning sharp-edged propellers, or taking even one "sniff" of model cement or dope. Safety hazards occur in all activities of life, some more publicized than others. We cannot ignore them, and we cannot avoid them; we can only point them out, educate our readers on taking precautions, and hope for the best. WCN.*

After making repairs, and before the glue dries completely (a luxury you don't have with "instant" glue), line up the parts to make sure the fuselage is straight and the wing is unwarped. Move the parts into

Continued on page 79



26, 1987, as follows:

"Please find enclosed one of the very finest examples of the Irvine-Mills .75cc replicas (serial number 0005). Reaction from the domestic market has been fantastic. Modelers of all ages ringing up just to say thanks for producing such a great little engine—easy to start, good power, and it *looks* great. After 20 years of serving modelers' needs I have never experienced such a reaction. Give the engine a run to clear out the preserving oil, then if the settings are anywhere near correct a couple of chokes and a couple of flips should produce a running engine. With luck and a tailwind (from Britain) supplies of these new Mills .75s should be in the USA about March 1988. I hope you get as much pleasure from the enclosed engine as we all have from making it." My Irvine-Mills .75 turns the 8-4 test prop at—you guessed it—*better* than 7600 rpm!

RATINGS

My old original .75 from the 1950s only rates a "5" for manufacturing excellence. They were made in smaller numbers than American engines of that time and lacked the elegance of casting and machining pretties. It rates an "8" for design and rates a perfect "10" for performance. The *new* Irvine-Mills .75 is beautiful. It corrects the design flaws of fuel tank bowl mounting and the problem prop driver. The shaft is bigger, and the case casting is thickened for more strength. It is a "10"-"10"-"10" engine for 30 total perfect points!

NEWS FLASHES

A six-inch diameter turbine with 46 pounds static thrust flew an R/C target drone at 226 mph during acceptance trials in December. Catapult-launched and skid-landed. Developed for U.S. Army. British Davies Charlton (DC) diesel engine in four to five sizes back in production. USA's Davis Diesel is exclusive importer. Watch for ads. •

Hey Kid!..... *Continued from page 45*

alignment as many times as you need to until it's right.

Repairing tears in tissue can be done with a little line of cellulose cement (our trusty old Testor's "Green Tube" or Ambroid) along the tear line if it matches up pretty well. Not too much, as it will shrink a little. Frosted "Magic Mending" tape can be used in a pinch. The ideal would be to cut the injured section out all around the balsa "frame" and make a patch to cover the whole area. You can use the square you cut out as a pattern for the new tissue, cutting it a little bigger so there will be something to glue to, and just recover that part. If you only tissue-patch a part of the area between the ribs or between the L.E. and T.E., it will stand out like a sore thumb.

A final note on repair concerns added weight. If you added weight on the fuselage behind the wing with your repairs, you will probably need to add some weight to the nose with a little modeling clay to move the C.G. back where it belongs (unless you were nose-heavy to start with!). A heavier, repaired right wing may force you to add a little weight to the left wing (unless you want some right turn!).

DEALING WITH WARPS

Thin wings and tail surfaces will warp or twist until they look like Pringles at the least excuse. The main causes are weak balsa structure and tissue which shrinks when it gets wet or damp and then dries out. Adding gussets at the corners of wing and tail structure as shown in the drawing helps. A "gusset" can be a little triangle of balsa glued in a corner, or it can be a 1/16-inch square bit of balsa with the ends sanded at little angles about the same length as the wide end of a triangular gusset. Angle braces or "truss" bracing can be added from corner-to-corner across the wing "bays" as shown. A strong wing-to-pylon joint will help, too, as when one side of the L.E. warps "up," the opposite side warps "down." The heavier the grade of balsa sticks used for L.E. and T.E., the less warping you will get. All these additions make the plane heavier and cut down on flight times, but then a badly warped wing makes flight *impossible*.

Using pre-shrunk and/or pre-shrunk and pre-doped tissue as mentioned earlier is a big help. Even so, the weather can do you dirty tricks. I live near the beach, and anything I cover is a tiny bit damp. Tonight, the wind is blowing from the desert, and I can tell how dry it is by looking at my Peck ROGs. . ."Pringle City!" I could avoid this by covering models out in the desert, or at least waiting for the driest, sunniest day I

can find! Some indoor model builders even make cardboard boxes with electric light bulbs in them to dry the air, and cover their models inside, making sure no damp air can get in by sticking their arms through holes cut in the box while they work!

On the flying field, most modelers try to take warps out by breathing moisture on the wing and then twisting it in the opposite direction. If that does not work, they may try to crack the L.E. or the T.E. and reglue it without the warp. Then if that does not work, they try to overpower the warp with a control tab made of card stock or balsa glued to the T.E. and bent opposite the warp to try and cancel it out. The next step might be to try slitting the tissue as shown and then, when the wing is flat again, covering the slits with tape. Really bad warps might require removal of the part from the plane and the soaking of a wing or stab (uncovered) in water overnight and then pinning it down flat for a few days (or cooking in the oven while pinned to a flat surface at *low* heat for an hour). Then re-cover it with preshrunk tissue. The worst thing that can happen is to have to make a new wing, which only takes about ten minutes.

WARREN SHIPP VS. THE PECK ROG

Warren Shipp used to be a guard in the New York Subway. As this was a pretty boring job, arresting muggers, critiquing spray can art, and the like, he used to dream of retiring and building model airplanes. When he did retire, he turned to crazy stuff like autogiros. Probably the result of too much carbon monoxide down in the tubes or something. When he saw the *Peck ROG*, something in his mind snapped, and he began a campaign to drive Bob Peck nuts, too. Each time Bob would see him, he would have a new modified version of Peck's wee wonder. One time it would be a canard (tail-firster), the next time would be a biplane, etc. You may want to try some fun things with it yourself, but I warn you, Warren has probably beat you to it!

Just a reminder, in case your local hobby dealer doesn't have the stuff you need to make the models in this series, you can get a price list to order them by mail from: Peck-Polymers/Beginners, Box 2498, La Mesa, California 92044. Include a self-addressed, stamped envelope. For $2 you can get their full catalog of goodies, but the *Hey Kid* list is free.

Next month we begin the next step up the model-building ladder with the *Sky Bunny*, a special ROG (rise-off-ground) model designed just for this series. Plan to join us! Happy landings! •

Futaba Review. *Continued from page 39*

And there is a Throttle Hold Switch and trimmer for those practice auto-rotation landings. An Idle Up Switch with its associated trimmer permits a constant rotor speed when the pitch needs to be reduced during rolls and other maneuvers. High and Low Pitch Curve trimmers permit adjustments of the pitch at either extreme of their best positions. The all important throttle operation is further improved with Throttle ATL (Adjustable Throttle Limiter), which permits in-flight low end changes to be made without affecting the top end.

One never tires of seeing R/C helicopters fly inverted! And as soon as your skills permit it, you'll be ready to try it. The T6NHP comes with an Inverted Flight Switch, which reverses the pitch, elevator, and rudder controls for normal flight reactions while your machine is on its back. A second generation fail-safe system is included, which is activated at the touch of one push-button, and does not require resetting for each flight. There is also a Power Warning LED, which flashes when the battery reaches a critical level. And if you prefer gyro stabilization in your helicopters, a toggle switch is available for in-flight rate gyro output adjustments with one of the Futaba gyros.

The T6NHP, available only in a two-stick version, is the same size and general configuration of the well-known Conquest transmitters, with the exception of a flip-open door at the bottom which exposes all the set-and-forget adjustments. It is powered by the common eight-cell 500 mAh battery. The current consumption is stated to be 230 mA, which should give a safe operating time of two hours.

The companion R116GP receiver is a beautiful example of modern miniature electronic and mechanical design. Considering what is contained in it, including a microprocessor IC and narrow-band ceramic filters, it is amazingly compact, being only 2.23 x 1.65 x 0.94 inches in size and a mere 1.85 ounces in weight. It incorporates Fail Safe and Battery Fail Safe features and a Servo Hold function which keeps the servos from operating during any period of no-signal for any reason. An externally visible LED provides a visual indication of any normal or abnormal conditions of the received signal. The R116 is powered by the normal four-cell Ni-Cd pack, which it shares with the servos, and its current drain is claimed to be 24 mA. The servo and power plugs are of the female-type known as Futaba type "J." Four S-148 low-profile servos are included with the FP-6NHP system. This recently introduced servo incorporates all of the latest developments in servo design and is slated to replace the 28/38 servos in systems now so equipped. It measures .77 inches wide

By BILL WARNER

Illustrations by JIM KAMAN

• "Who reads the plans? They only slow ya' down!" One of my nieces has a bumper-sticker on her car that says, "I may be lost, but I'm making good time!" That's the way a lot of kids build models. The plan is your road map. The printed woods are there to help you over the trouble spots. No driver with any brains just starts out driving in a strange city without first studying the map. No model builder can afford to ignore the instructions, either.

The Sky Bunny R.O.G. is going to be your first "scratchbuilt" model in the series. That means that you have to get your own supplies together to build it. Scratch building is a lot cheaper in the long run than building kits, and it also lets you pick and choose the right wood, whereas kits may give you stuff that is almost, but not quite right. I could name a popular kit company that gets their wood from the petrified forest it's so heavy! Even if you buy your balsa mail-order, you'll be able to afford to get enough of it extra so that you can pick and choose a little.

The first thing you will want to do is go to a place that has a photocopy machine and have them Xerox both your plan and your parts layout for you. You don't want to cut up your magazine! Photocopy machines can sometimes blow up or reduce plans, too. You could even reduce the Sky Bunny plans down to use a smaller prop if you have one around, and you could substitute 1/32-inch wood for the ribs and use 1/16-inch square for the rest. Or you could go bigger and power the model with a gas engine like a Cox .02! For now, we'll stick with the magazine size.

TRANSFERRING THE PARTS TO THE WOOD

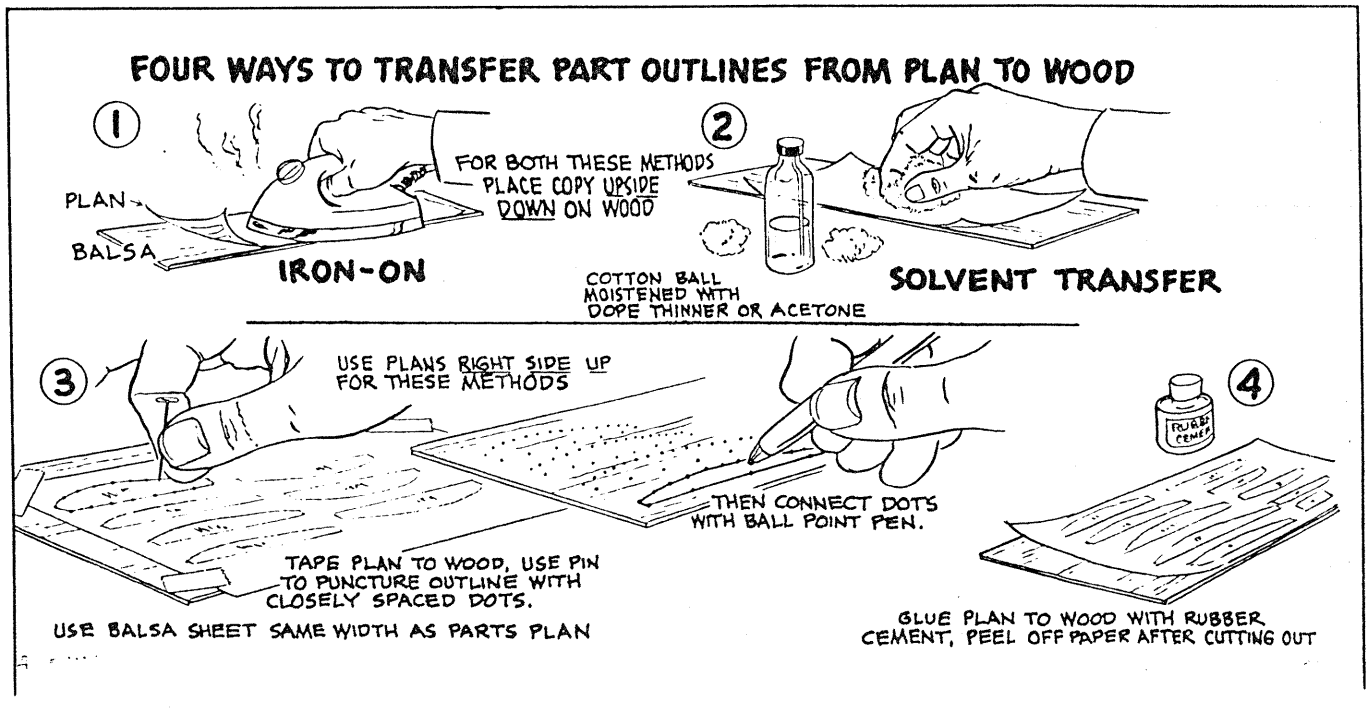
There are many ways of doing this. Some photocopy machines deposit carbon lines on the copy that can be ironed on to your sheet wood with a hot iron. Some can be transferred using a cotton ball moistened in dope thinner or acetone. Then again, some copiers use an ink that won't do a thing but sit there and look stupid! You might try two or three machines on the parts sheet and experiment. To make the ribs and other parts come out on the balsa, lay the copy face down on the wood, making sure the grain direction is the right way (from L.E. to T.E. on the ribs, W-1 through W-6, and top-to-bottom on the pylon). Then iron or swab applying slight pressure, checking under one corner occasionally to see if anything's happening.

Another way to do it is to glue the parts sheet onto the balsa sheet using rubber cement. Then cut out the parts and peel off the paper (you'll need paint thinner to help you if you leave it on very long). I ran a practice session on Sky Bunny-making after school for a few days, and we used this method with success.

If you want to make more than one model, you might consider cementing the parts sheet to thin card stock and cutting out "templates" or part outlines to draw around on your balsa. If you do this, cut the templates to the *inside edge* of the part outline to make the template just a bit small. That is so that when you draw around it, the width of your ball-point pen line will bring the part outline on the balsa back up to normal size. If you cut your lines in the middle on templates, the part will come out oversize.

Some people like to use the "connect-the-dot" method, and lay the parts sheet over the wood (always checking grain direction) and then poking little holes with a pin around the outline and through into the balsa. How far apart? On small curvy parts, maybe every 1/8 inch, making sure to poke a hole at each corner where you change direction. The tiny holes on the balsa sheet can then be connected with a ball-point line.

On harder sheets, you might even try carbon paper (new), which works fine some-



times. As in any method, make sure the parts layout or the wood doesn't move while you're working! Using some Scotch tape at the end or side can help out here.

CUTTING OUT THE PARTS

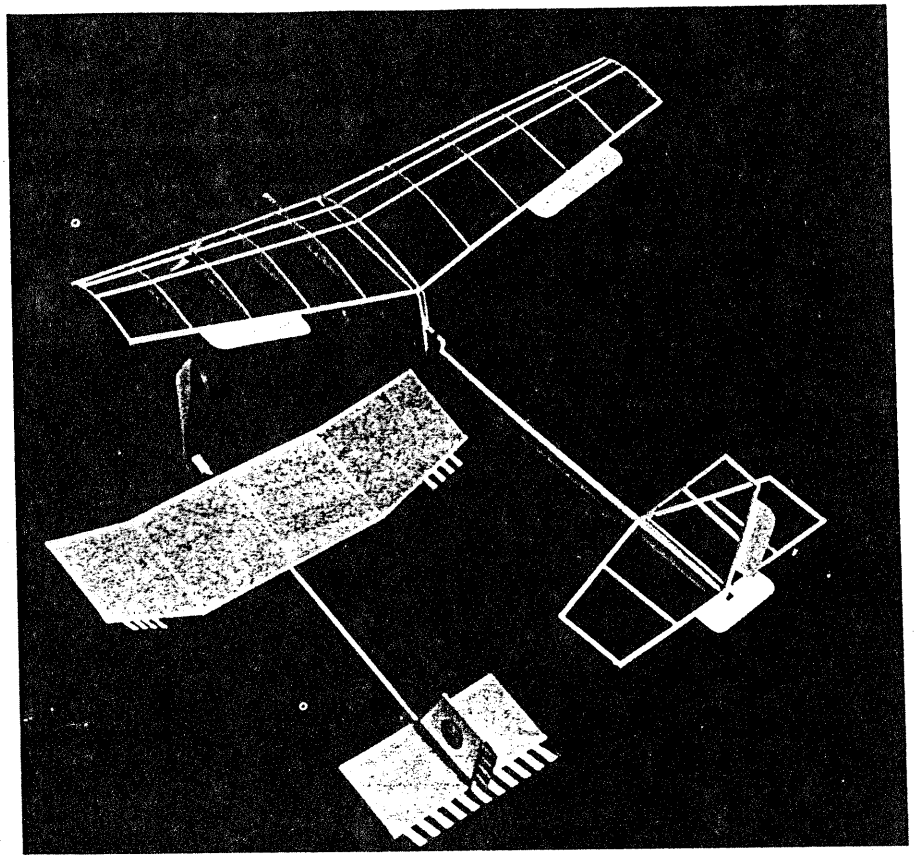
When you cut out your parts, you have to decide where to cut on the line, which is always wider than your knife cut. If you are an experienced modeler, go ahead and cut right down the middle of the line. If you are more cautious, cut to the *outside* of the line and sand it to size later. Some even cut a little way outside the line and sand to size with a sanding block just to be on the safe side. Now, printed outlines and ball-point pen lines on balsa help you cut out the parts, but they *look like the devil* smiling at you through your tissue paper! This won't hurt the flying, but can be avoided by lightly sanding off any ink that's right where the tissue goes.

CUT THE RIBS A BIT LONG

You may notice that I have left a little extra on each rib at the small (T.E.) end. That is so you can trim each one to fit exactly where it goes. It is always disappointing to find that something is too short. It's much easier to take it off than to put it back on!

CUTTING BOARD

I know that you aren't cutting on your mom's table, but I just want to remind you to use something other than your building board or plan to cut on. As we mentioned before, a bit of solid cardboard, linoleum tile, a telephone book, or the like will work fine. If you've been using the knife or razor blade for some time, it may also be getting dull and require sharpening or changing. The same X-Acto blades can be turned around to the new, sharp end. An Uber Skiver stainless blade will remain sharp much longer than a carbon steel blade. Resharpening is an art which requires a coarse and a fine whetstone, a length of leather belt, some light oil, and a bit of jeweler's rouge. If you have all these, it's just a matter of drawing the blade across the stone, at just a little more angle than was on the cutting edge originally, until dull spots on the edge are gone. Then the blade should be "stropped" on the belt (glued down to the edge of a piece of wood makes it easier to use). A little jeweler's rouge stick rubbed on the belt makes a fine, polished edge that you can shave with (if you've a mind to). Still, this is a beginner's series, and maybe you're rather just buy a few spare blades. Using a dull one can be very frustrating when cutting (tearing) across the grain! In actual use, a dull blade is more dangerous than a sharp blade. Think about it!



The Peck R.O.G. and uncovered Sky Bunny models.

SEPARATE THE PARTS FIRST

Once you have the parts all laid out on your balsa sheet, take your knife and cut between them, staying away from the part outlines. This will make each one easier to handle. Then, trim away the scrap down to the line, making *several small cuts* when cutting *across* the grain to keep the wood from splitting or tearing. It is about three times as hard to cut across the grain as with it. If you can't tell which way the grain runs from the grain lines on the wood surface, you'll find out soon enough when you try to cut it! *With* the grain, it usually cuts like hot butter.

PAYING ATTENTION TO GRAIN DIRECTION

Balsa's strength runs with the grain. You can tell this by noting how much pressure it takes to break balsa *with* the grain, and how much it takes to snap it *across* the grain. The reason we run the grain from end-to-end on a wing rib is because that is the way it needs to be strong and not buckle. The grain in the pylon goes vertically (the short way) because the strength of the pylon is needed to keep wing and fuselage together. If the grain went the "long" way, the wing could easily wobble or break off. Why do you think the pylon parts are laid out *across* your sheet of balsa instead of the long way, where the whole piece could fit on the sheet? Right! Grain direction. The problem with doing this is that some kids, who are not reading their "road map" or plan very well, are going to mess up and glue the pylon sides together with the little end piece we couldn't quite get to go across a standard three-inch wide balsa sheet on the wrong end of the big pylon piece! You're smarter than those guys; right?

STUDYING THE ROAD MAP

Just as a road map of Massachusetts is probably not going to have Henry's Bar and

A NOTE ABOUT THIS MONTH'S INSTALLMENT

The April '88 installment of "Hey Kid" probably looked OK to you, but it really wasn't. The explanation is more complicated than the interweaving plots of a radio soap opera, but we'll give it a try.

As you read this month's article, and study the illustrations, you'll come to realize that it was supposed to precede the April article and illustrations, and was also supposed to accompany the full-size plans for the "Sky Bunny," instead of the article and illustrations that did accompany the full-size plans!

For those of you who are closely following this series, and are maybe even copying the material and putting it together in sequence for club or school building sessions (which we don't mind your doing as long as you credit Model Builder as the source), let us give you the proper sequence of the material:

Parts 1 through 5: As published in the November '87, December '87, January, February, and March '88 issues.

Part 6: Includes text and illustrations in this, the June '88 issue, and the plans for the "Sky Bunny" from the April '88 issue.

Part 7: Text and illustrations as published in the April '88 issue.

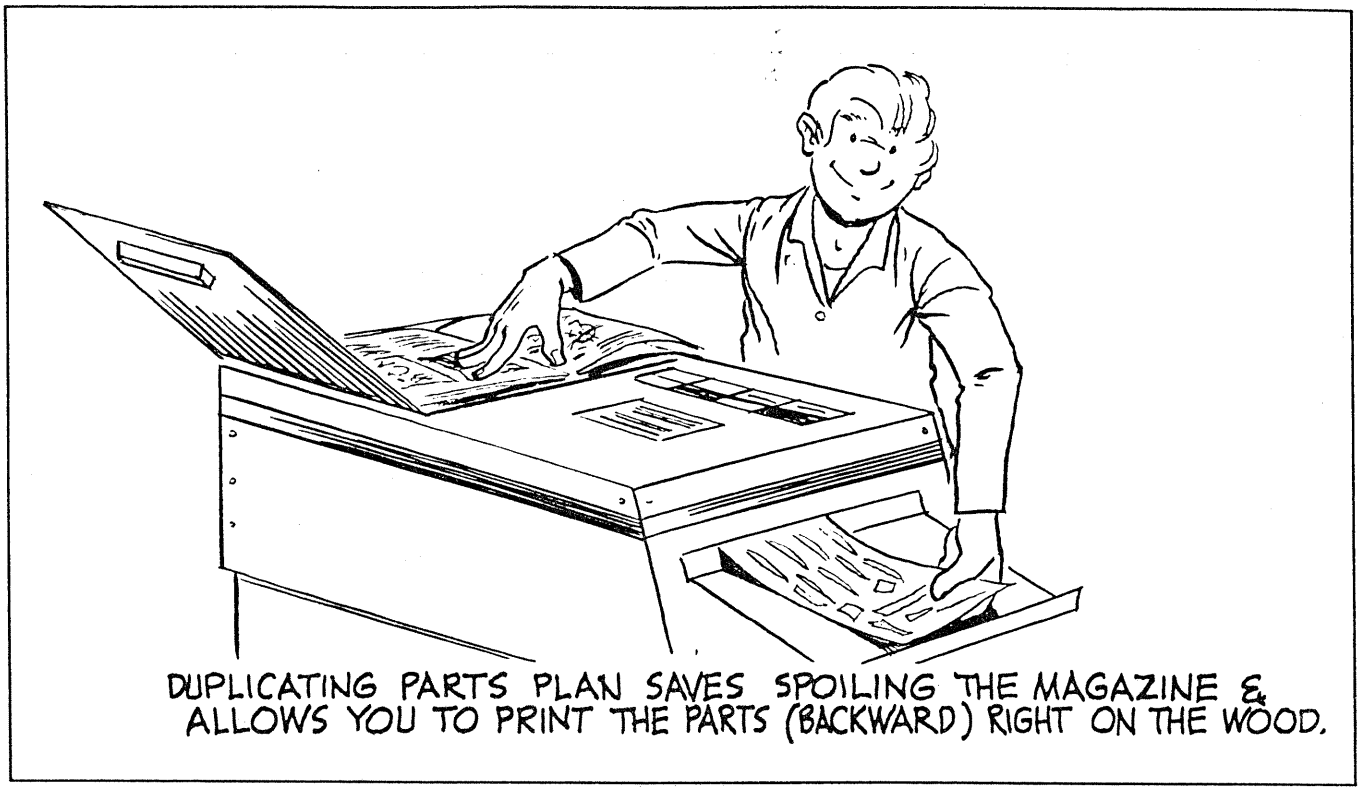
Part 8: As published in the May '88 issue.

Part 9: To appear in the July '88 issue.

. . . and so on . . .

One more thing . . . the parts layout drawing on page 59 of the April '88 issue was reduced somewhat during the reproduction process, so the parts will not fit if cut to the sizes shown. The layout is reprinted to the proper size in this issue, and the text explains how to use it.

Hopefully the above will clean up and redo the slate, and there won't be any more mixups in future installments. This series was meant to help newcomers in the hobby, not to hinder them! wcn.



DUPLICATING PARTS PLAN SAVES SPOILING THE MAGAZINE & ALLOWS YOU TO PRINT THE PARTS (BACKWARD) RIGHT ON THE WOOD.

Grill in downtown Framingham on it, a model plan is probably going to leave some question unanswered that you will just have to figure out for yourself. I have never yet seen a perfect plan. Still, the main stuff is usually there, and you should be able to find it. Most of the information is drawn out in outline form, and you build your structure right on it. When I worked in the full-size aircraft industry, plans always warned you not to "scale the plan," and preferred giving you dimensions which often went down to a couple of ten-thousandths of an inch! Nothing on most models is that close, unless you make your own engines! Sometimes, though, scaling the plan can get you into trouble. I have seen many plans where the ribs shown on the plan were a different size than the same ribs printed on the balsa! That has to do with the fact that sometimes printing machines go a little bigger or a little smaller. Be sure that the parts you copy onto your balsa match the size of the ones on the plan! Photocopy machines do not always copy exactly the same size as the original.

Let's just look over the plan to make sure you understand what the person who drew it had in mind. Starting at the nose of the fuselage, can you tell how the thread is wound on after the front end is glued together? Notice that it is spaced a little ways apart between winds. It is the glue which does the job, not the thread. It just helps. You are going to rub glue on the thread to keep it in position later. Next, if you get your fuselage wood from Peck's, it will be shorter than your fuselage on the plan, and will need to be "spliced" as shown by the angled dotted line. If you have a long stick, ignore this splice. That is why we call it "optional." Looking in the pylon area, you will note that I took pains to make sure you knew the whole pylon assembly could slide back and forth so you could move and remove the wing later. This is an important feature of this model, but I'll bet some people will glue it on anyway, if past experience is anything to go by!

You will notice that I have not drawn in the little notches on the ribs. That was on purpose. If I drew them on, you'd cut them out when you cut out the ribs; right? But then, they would probably not all line up when they were glued into the wing frame. They never do. In the next article in this series, I'll explain three different ways to do your wing structure. You will pick the way that works best for you. If you are one of those who can't wait until next month to get going, then you'll just have to figure out for yourself how to get the notches all in and lined up. Next month you'll see if you did it "right"!

Sky Bunny zooms skyward above California's airplane-catching palm trees on its way to a fine flight.

Continuing to study the plan, you will notice that the "W-1" rib, or "root" rib is not perpendicular to the plan (90 degrees, straight up-and-down). It is leaned toward the tip a bit. How much? Look at the third page of the plan and you'll see something called a "dihedral gauge" which should be glued onto card stock or balsa and used as a tool to get just the right amount of "lean" to the W-1. There is also a "dihedral sketch" to show just how much the tips of the finished wing will be higher than the roots. It shows four inches under one side with the other flat down. That means two inches under *each* tip. This is necessary for lateral stability, which we'll go into later.

You will notice that two styles of propeller shaft are shown. We'll go into how to bend these later.

On the third plan page is a side view and a bottom view of the nose. Study those carefully, for downthrust and sidethrust angles here are quite necessary and not optional. Again, we'll tell you why later. Everything is done for a reason, take my word now for that.

When I was a kid, we used to go to the movies every Saturday morning (no TV then). One of the things they'd show was a short part of an adventure series that always ended with the hero diving in a plane with the controls stuck, sinking in the quicksand, or hanging off a cliff while the villain stomped on his fingers. That was called a "cliff-hanger serial." As much as I want to get you into the air, due to the space we have in each issue, we have to call it quits

before we finish what's hanging! Sorry about that! Come back next month for the next installment if you can wait that long! One neat thing that has been happening since we started is hearing about youth groups being formed to build models together at a one-shot meet or with regular meetings. Even two kids in a neighborhood building models together can do a much better job than one alone, and with adult guidance. . .well, the sky's the limit! Another advantage is that when you send away for supplies, it's cheaper. Two or three kids splitting the cost of a bottle of dope or a winder helps a lot.

For those of you just joining us, there have been six articles in this beginners' series, starting with the November 1987 issue of *MB*. Back issues are available if you missed any. Also, Peck Polymers/Beginners, P. O. Box 2498, La Mesa, California 92044, telephone, (619)448-1818, will send you a sheet with the materials and models used in this series for an SASE. They have the supplies to make the Sky Bunny, though you'll have to splice two sticks together to make the fuselage. The materials sheet is free. Their regular catalog is $2, or free with your first order. After we finish with the present project, we are going to tackle the fantastic Flying Aces Moth kit, and finish up the small rubber model building and flying with the Nationals-winning Lacey M-10 scale model, just in case you're interested in ordering ahead. Happy landings! •

BILL OF MATERIALS

(Available from Peck-Polymers except as noted.)

1 sheet—1/16 x 3 x 11-3/4-inch balsa.

14—3/32 sq. in. balsa sticks (get two 10-packs from Peck).

1—3/16 x 3/8 x 24-inch balsa (or two 11-3/4-inch lengths from Pecks and splice, as they don't ship long sticks).

1 piece—Aluminum tubing 3/32-inch outside, 1/16-inch inside diameter.

1 large glass bead or two or three 1/8-inch brass washers (PA-31) from Peck, .050-inch hole.

1 piece—.046 or .031-inch music wire 11-3/4 inches long for landing gear. (.046 inch best, but harder to bend for kids).

1 pair—1-inch wheels.

1 sheet—Domestic (cheaper) or Japanese (better but four times as expensive) tissue.

1—8-inch plastic propeller (PA-23) or 7-inch propeller (PA-22). (8-inch was used on ours, but 7-inch will work if you have one.)

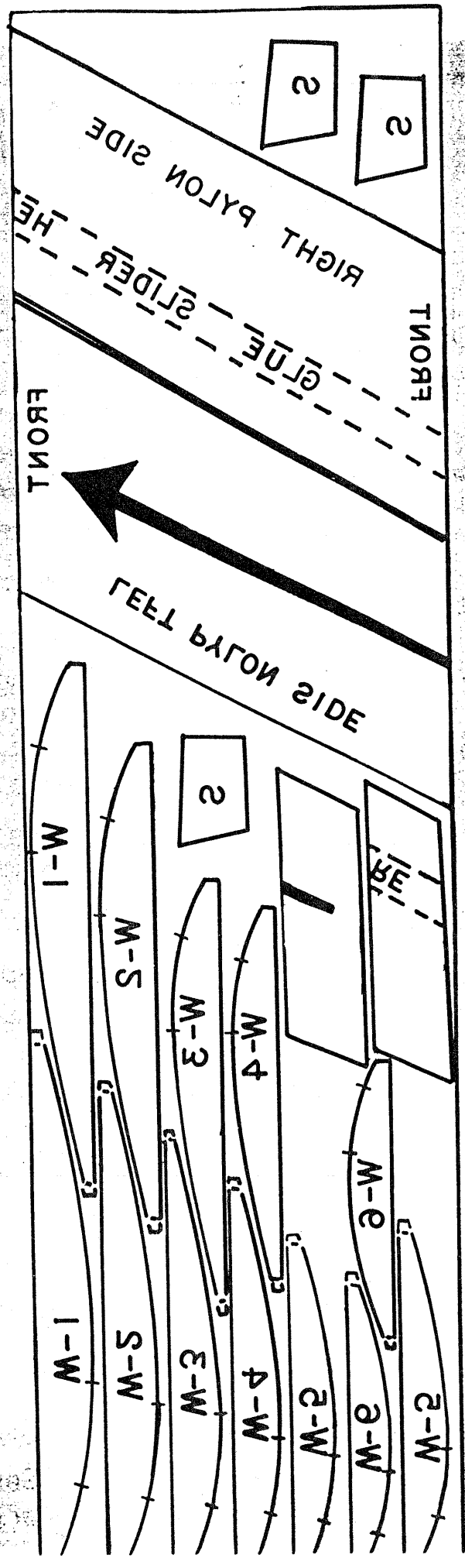
1 piece—.031 music wire for prop shaft (4 inches long) or order ready-made shaft pack of 10 (PA-44) from Peck.

1 small can—Sig "Lite-Coat" or similar *non-shrink* clear model airplane dope.

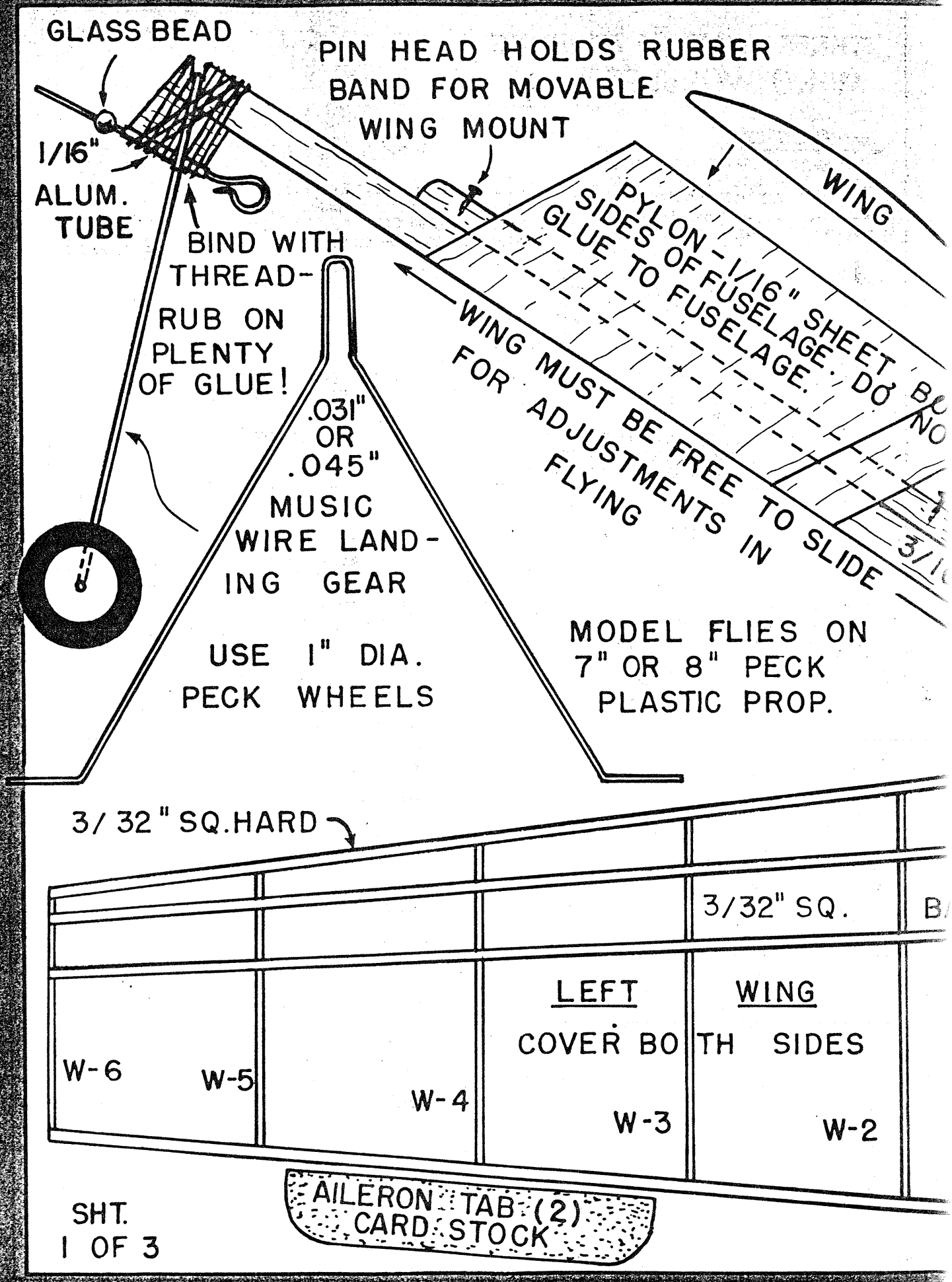
1 bottle or can—thinner for the above (same size for mixing 50-50).

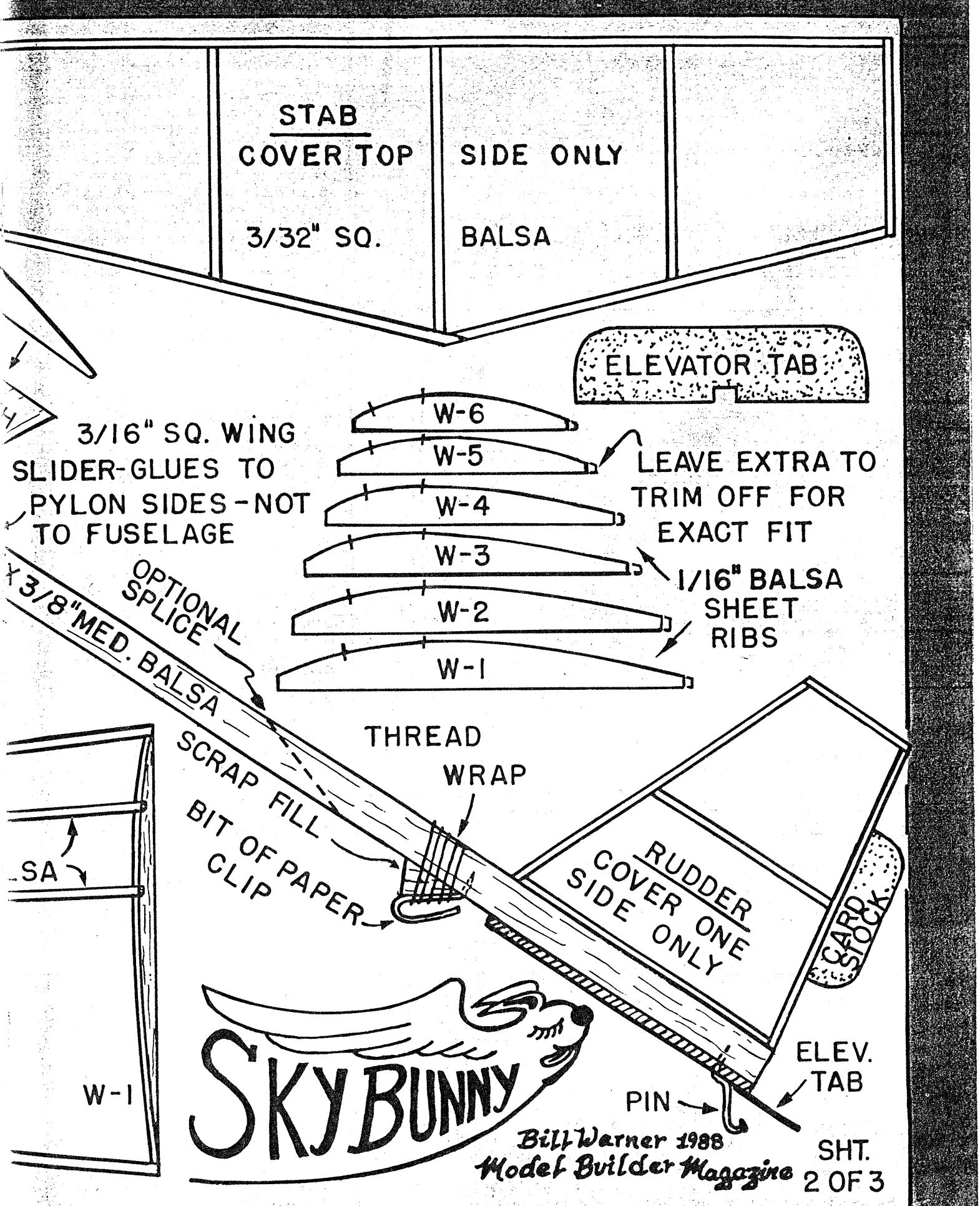
1 tube—Testor's "Cement for Wood Models—fast drying." (Some 5-minute epoxy for the nose-bearing tube is nice, but not essential.)

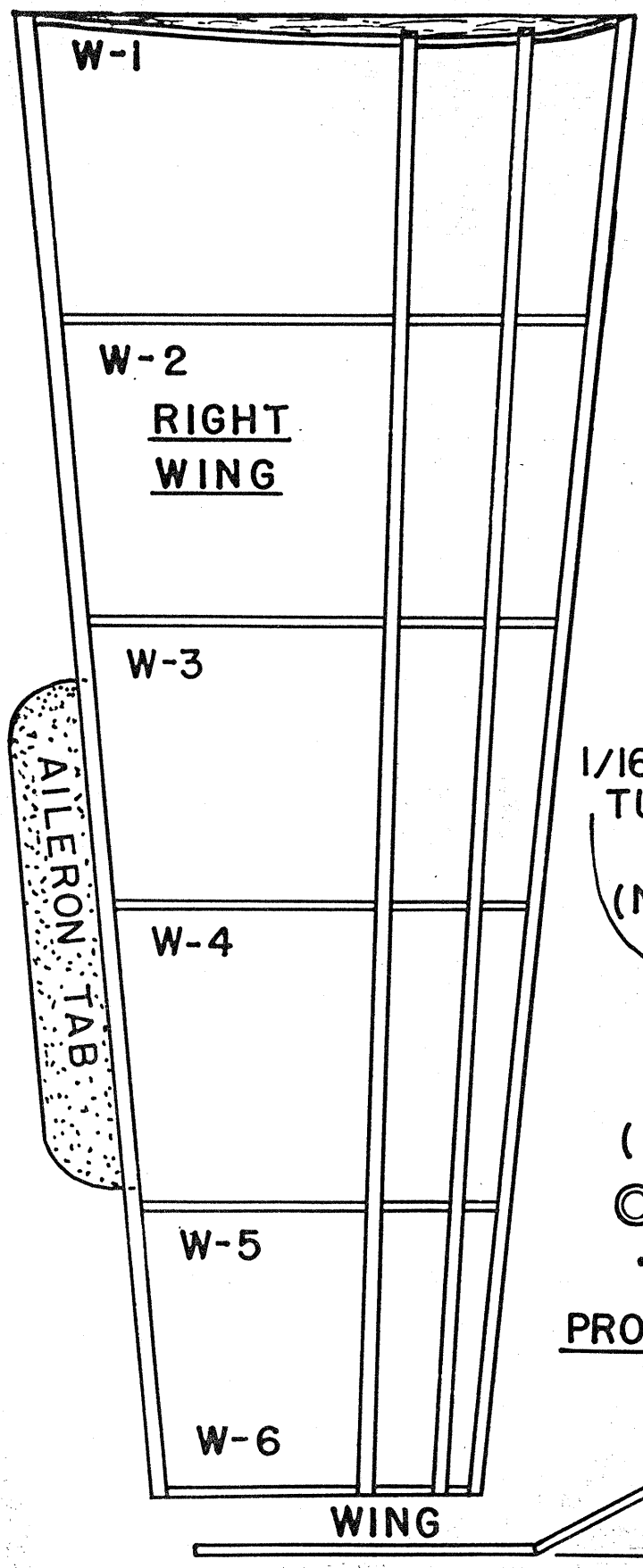
1 spool thread, some pins, a modeling knife, Saran Wrap, and a building board will finish up what you need.



NOTE: Here are the parts needed for the Sky Bunny. They are printed backwards so that when you transfer them to your balsa sheet they will be reading right-side up.

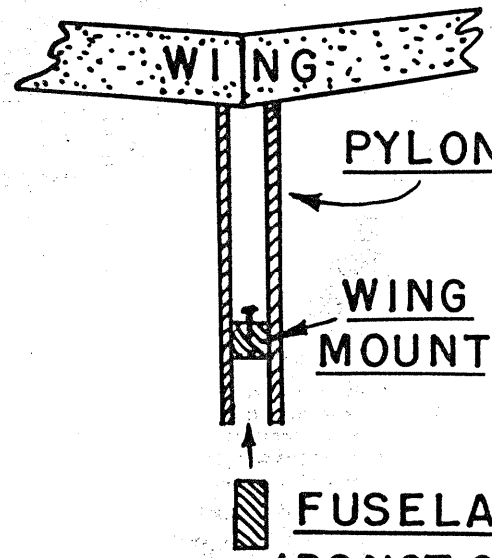

GLASS BEAD
PIN HEAD HOLDS RUBBER BAND FOR MOVABLE WING MOUNT
1/16" ALUM. TUBE
BIND WITH THREAD-
RUB ON PLENTY OF GLUE!
PYLON - 1/16" SHEET SIDES OF FUSELAGE. DO GLUE TO FUSELAGE.
WING
WING MUST BE FREE TO SLIDE FOR ADJUSTMENTS IN FLYING
.031" OR .045" MUSIC WIRE LAND-ING GEAR
USE 1" DIA. PECK WHEELS
MODEL FLIES ON 7" OR 8" PECK PLASTIC PROP.
3/32" SQ.HARD
3/32" SQ.
LEFT WING
COVER BOTH SIDES
W-6
W-5
W-4
W-3
W-2
AILERON TAB (2) CARD STOCK
SHT. 1 OF 3

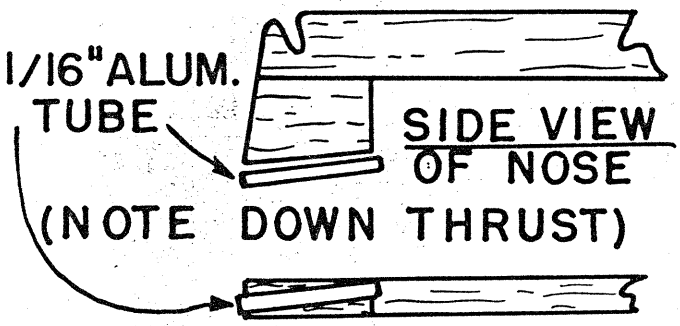

STAB
COVER TOP
SIDE ONLY
3/32" SQ.
BALSA
ELEVATOR TAB
3/16" SQ. WING SLIDER-GLUES TO PYLON SIDES-NOT TO FUSELAGE
W-6
W-5
W-4
W-3
W-2
W-1
LEAVE EXTRA TO TRIM OFF FOR EXACT FIT
1/16" BALSA SHEET RIBS
OPTIONAL SPLICE
3/8" MED. BALSA
THREAD WRAP
SCRAP FILL
BIT OF PAPER CLIP
RUDDER
COVER ONE SIDE ONLY
CARD STOCK
ELEV. TAB
PIN
W-1
SKY BUNNY
Bill Warner 1988
Model Builder Magazine
SHT. 2 OF 3



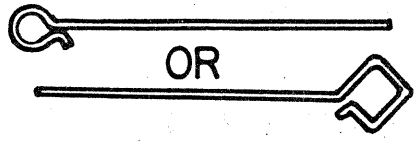
DIHEDRAL SKETCH - FRONT VIEW

FRONT VIEW

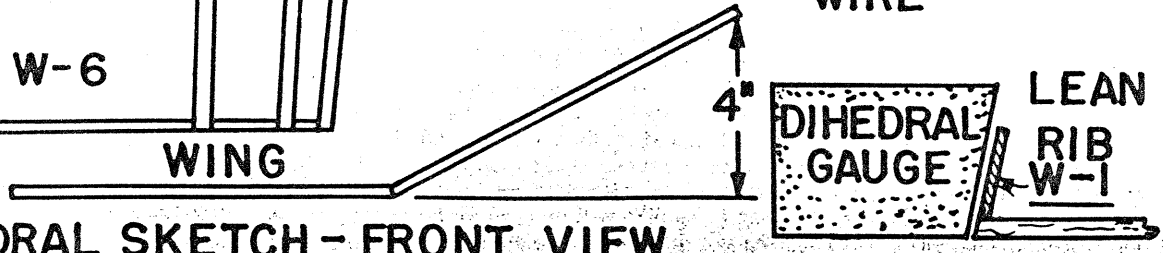




BOTTOM VIEW
OF NOSE
(NOTE RIGHT THRUST)



PROP SHAFT - .031" MUSIC WIRE



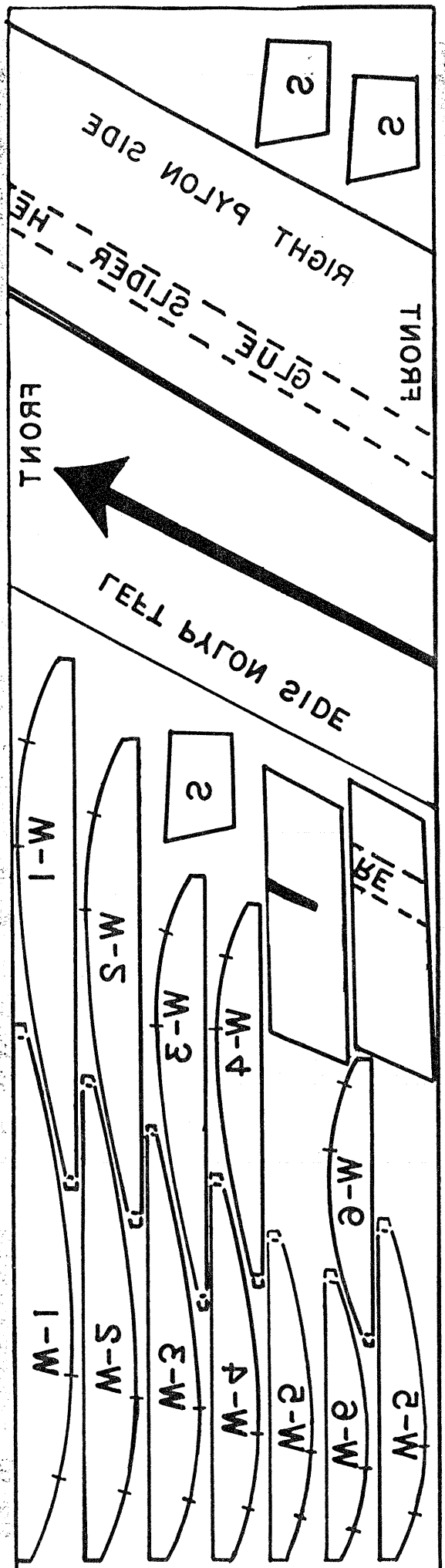
e we finish what's hanging! Sorry that! Come back next month for the nstallment if you can wait that long! neat thing that has been happening we started is hearing about youth s being formed to build models to- r at a one-shot meet or with regular ngs. Even two kids in a neighborhood ng models together can do a much job than one alone, and with adult nce. . .well, the sky's the limit! An- advantage is that when you send away pplies, it's cheaper. Two or three kids ng the cost of a bottle of dope or a r helps a lot.

those of you just joining us, there have six articles in this beginners' series, g with the November 1987 issue of ack issues are available if you missed lso, Peck Polymers/Beginners, P. O. 498, La Mesa, California 92044, tele- e, (619)448-1818, will send you a sheet he materials and models used in this for an SASE. They have the supplies to the Sky Bunny, though you'll have to two sticks together to make the ge. The materials sheet is free. Their r catalog is $2, or free with your first After we finish with the present pro- ve are going to tackle the fantastic Fly- ces Moth kit, and finish up the small r model building and flying with the nals-winning Lacey M-10 scale l, just in case you're interested in or- g ahead. Happy landings! •

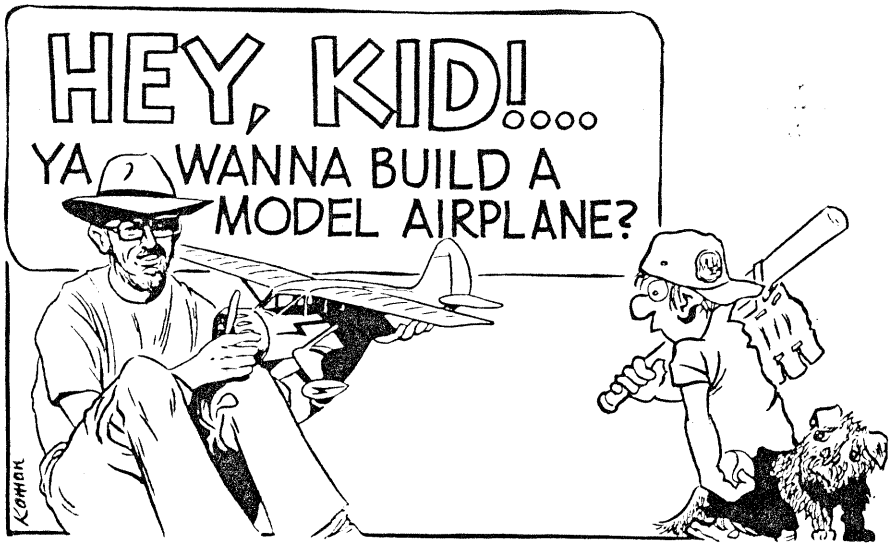
BILL OF MATERIALS

vailable from Peck-Polymers except oted.)

sheet—1/16 x 3 x 11-3/4-inch balsa.
—3/32 sq. in. balsa sticks (get two acks from Peck).
-3/16 x 3/8 x 24-inch balsa (or two 4-inch lengths from Pecks and splice, ey don't ship long sticks).
piece—Aluminum tubing 3/32-inch ide, 1/16-inch inside diameter.
large glass bead or two or three nch brass washers (PA-31) from Peck, -inch hole.
piece—.046 or .031-inch music wire 4 inches long for landing gear. (.046 best, but harder to bend for kids).
pair—1-inch wheels.
sheet—Domestic (cheaper) or nese (better but four times as expen- tissue.
-8-inch plastic propeller (PA-23) or h propeller (PA-22). (8-inch was used urs, but 7-inch will work if you have)
piece—.031 music wire for prop shaft ches long) or order ready-made shaft of 10 (PA-44) from Peck.
small can—Sig "Lite-Coat" or similar *-shrink* clear model airplane dope.
bottle or can—thinner for the above ne size for mixing 50-50).
tube—Testor's "Cement for Wood dels—fast drying." (Some 5-minute xy for the nose-bearing tube is nice, not essential.)
spool thread, some pins, a modeling e, Saran Wrap, and a building board finish up what you need.

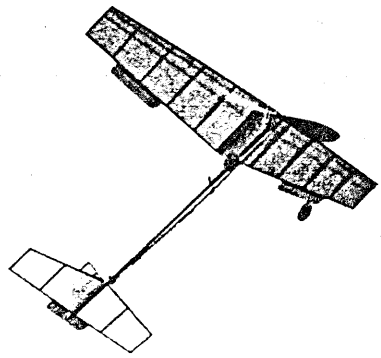


NOTE: Here are the parts needed for the Sky Bunny. They are printed backwards so that when you transfer them to your balsa sheet they will be reading right-side up.



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.

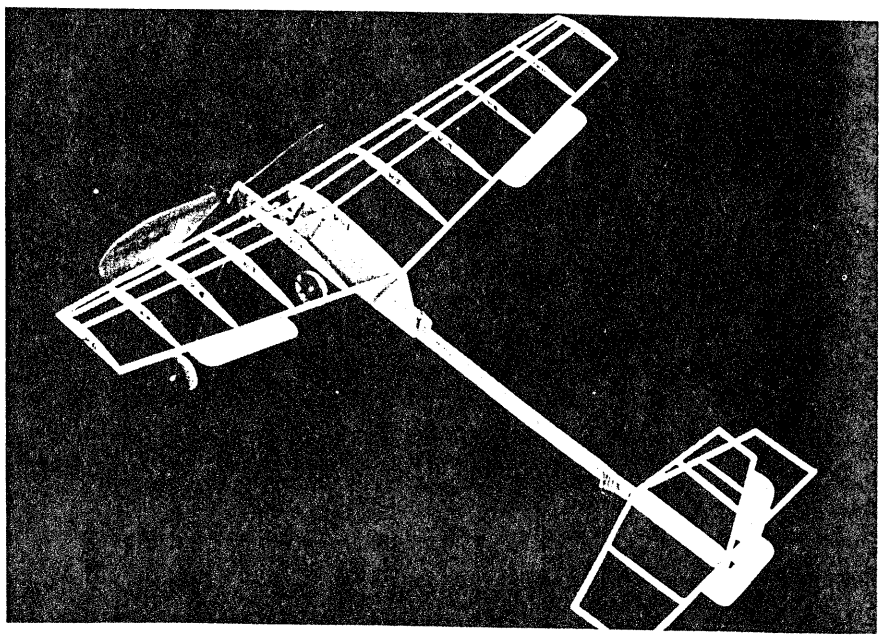
THREE WAYS TO GET THE SPAR NOTCHES LINED UP

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



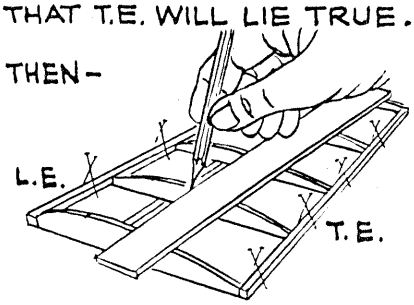
The Sky Bunny R.O.G. was designed just for this series. It features techniques in building and flying that will be useful in later models. Bare bones of the Bunny show relationship of the parts. Normally the wing gets covered in two parts before being joined.

THREE WAYS OF AVOIDING WING WOBBLES

METHOD ONE

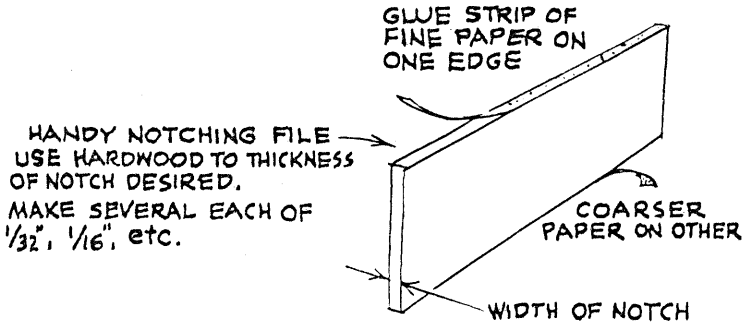
PIN DOWN LEADING EDGE. GLUE UN-NOTCHED RIBS TO L.E. ADJUST T.E. OF EACH RIB, REMOVING OR ADDING WOOD SO THAT T.E. WILL LIE TRUE.

THEN –

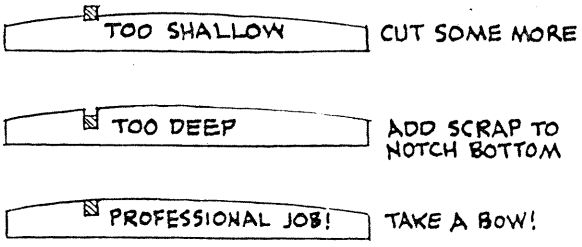


LOOKING STRAIGHT DOWN ON PLAN, MARK SPAR POSITIONS ON EACH RIB USING STRAIGHT-EDGE AS A GUIDE

THEN USE YOUR NOTCHER TO FILE NOTCHES

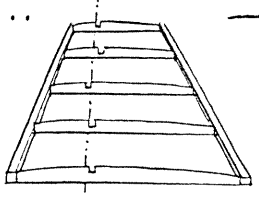


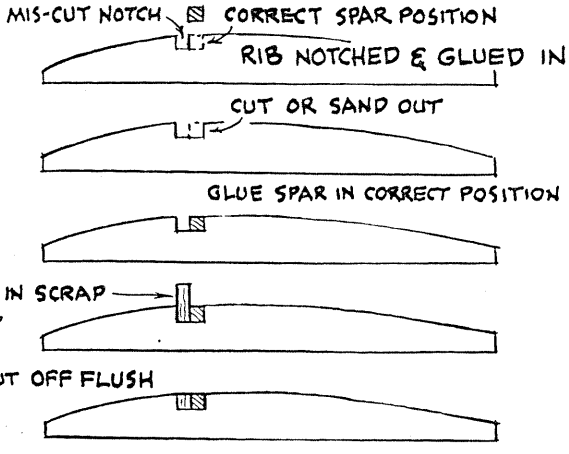
WHEN NOTCHING TRY EACH CUT BY FITTING THE SPAR TO IT. IF NOT PERFECTLY FLUSH, ADJUST CUT.



METHOD TWO

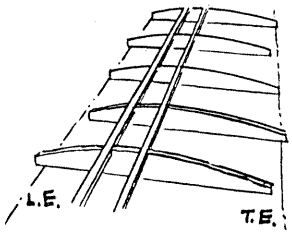
NOTCHING RIBS BEFORE ASSEMBLY ALMOST GUARANTEES POOR ALIGNMENT. TO CURE IT...



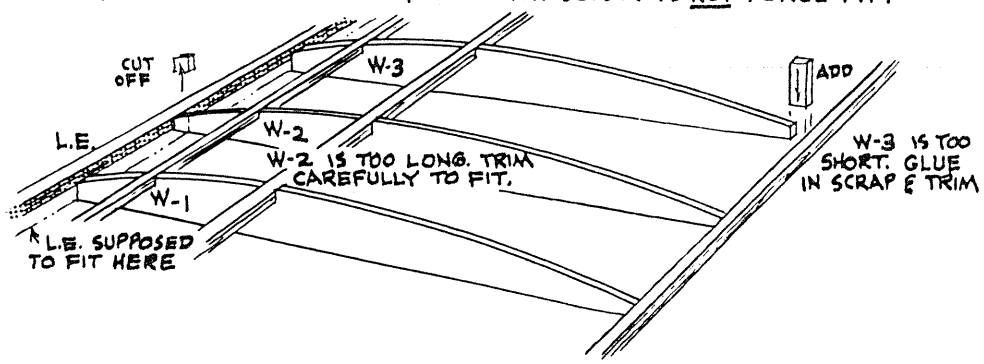


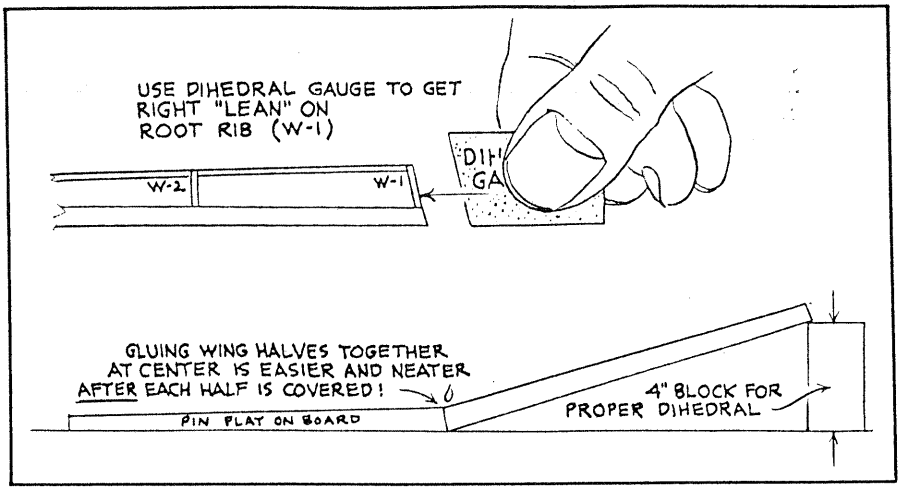
METHOD THREE

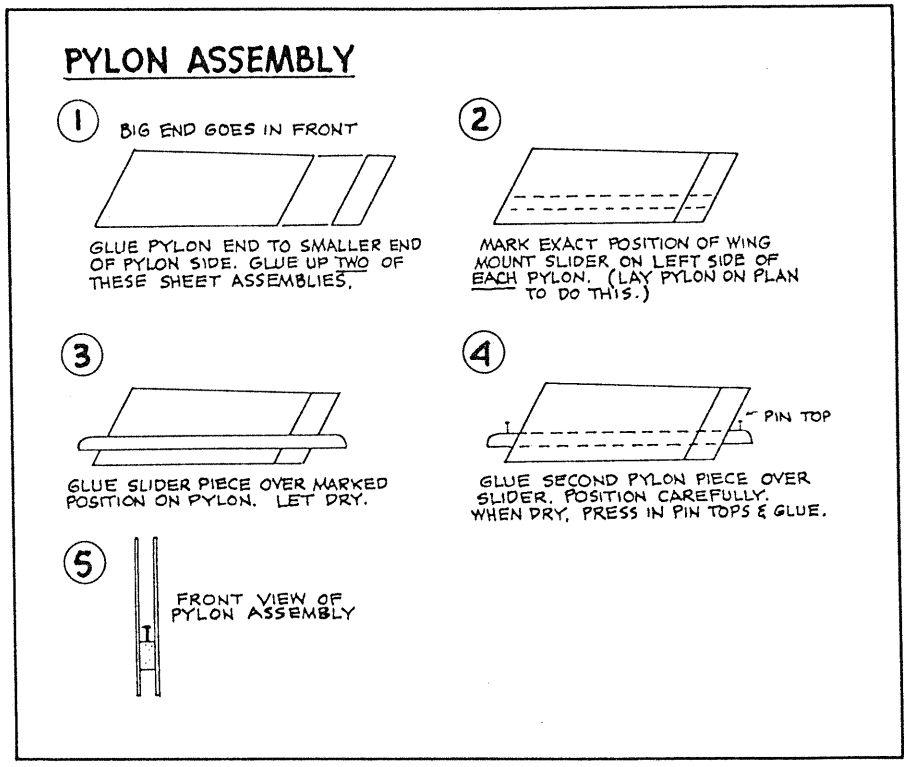
NOTCH EACH RIB AND PIN IN PLACE OVER PLAN. RIBS SHOULD BE FREE TO SLIDE BACK & FORTH. LINE UP ALL NOTCHES BY INSERTING SPARS.

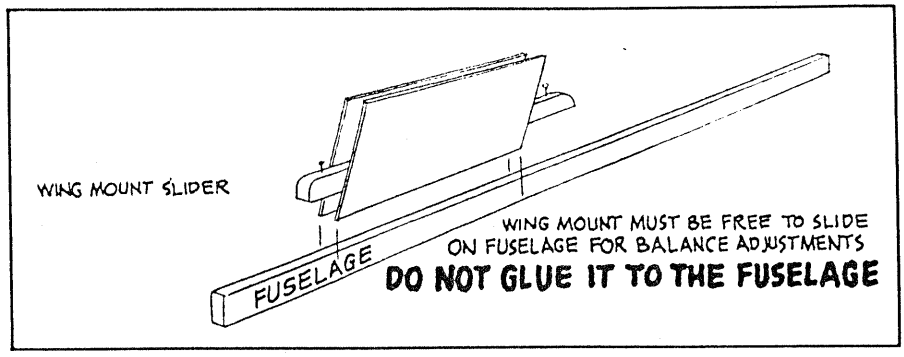


FIT L.E. & T.E. TO GOOD STRAIGHT FIT BY SANDING OR CUTTING RIB ENDS. IF GAPS OCCUR, FILL WITH SCRAP. DO NOT FORCE FIT!









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

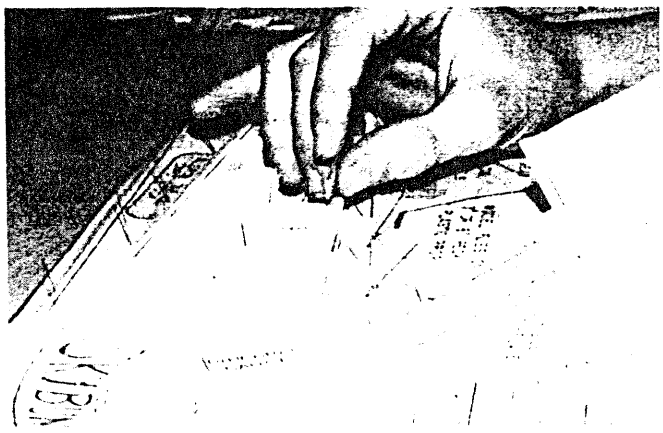
This is the heart of the *Sky Bunny*! It holds the wing at the right angle of attack (front higher than the back), adds some "side area" up front for added stability, helps keep the horizontal stabilizer (stab) out the wing's "wake" a bit, drops the center of gravity (CG) a bit, and also allows you to 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!

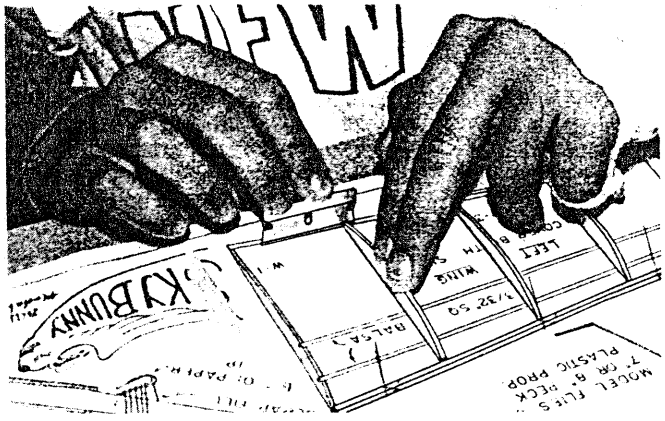
THE NOSE

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*!

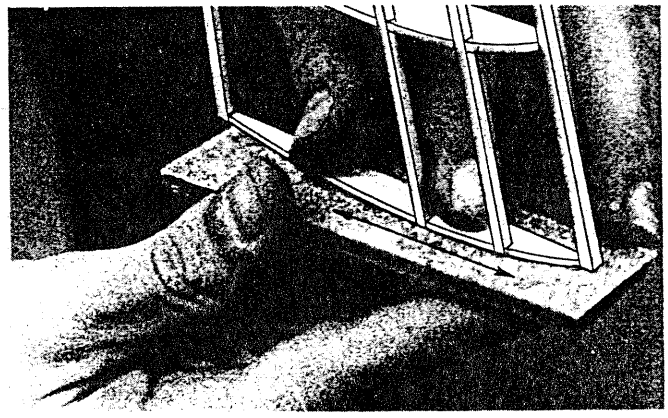
You will remember back in the Decem-



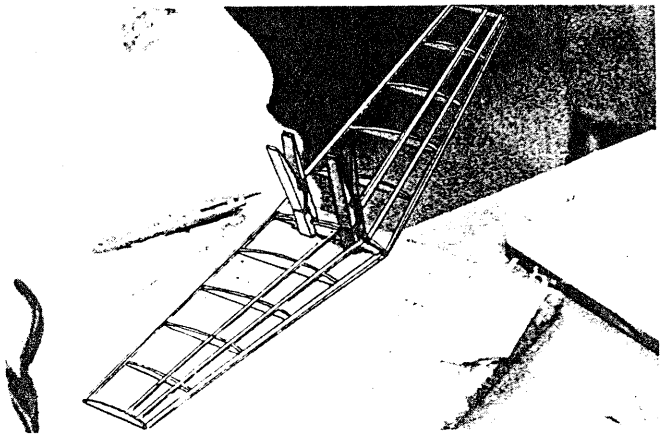
Fit wing spars after notching ribs in position with notching tool.



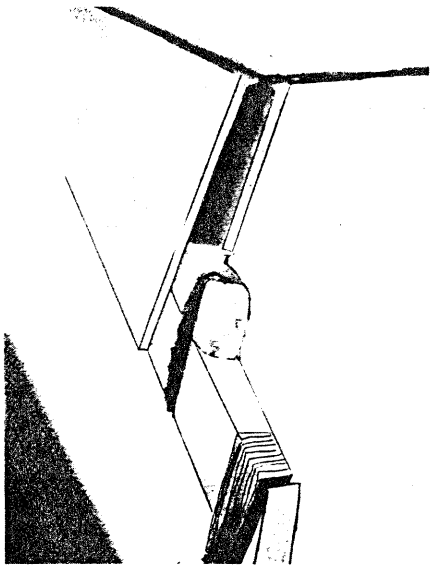
After laying down the L.E. with 'Xed' pins, trim each rib to fit the T.E. exactly. Then glue on the T.E.



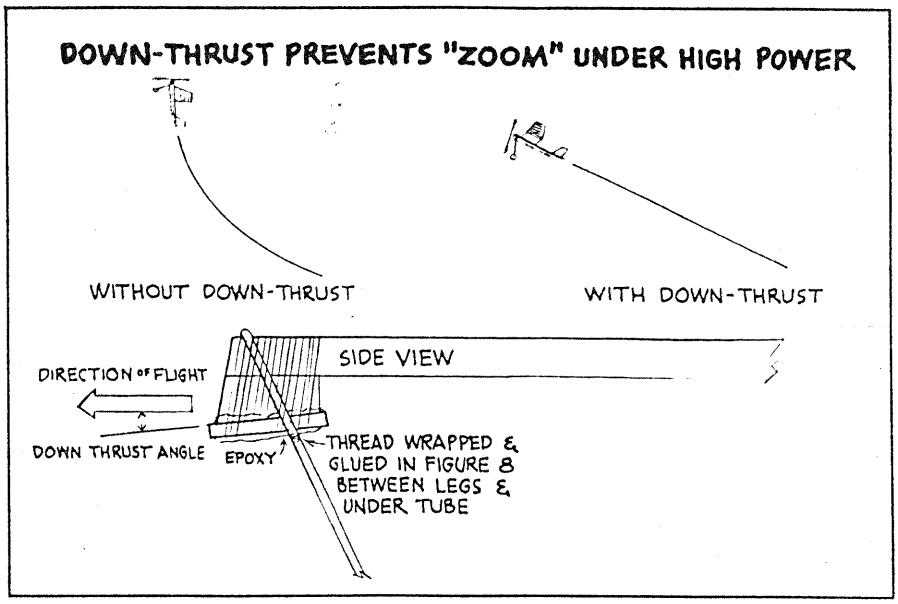
When the wing structure has dried, level up any overhangs before joining, and sand entire structure before covering.

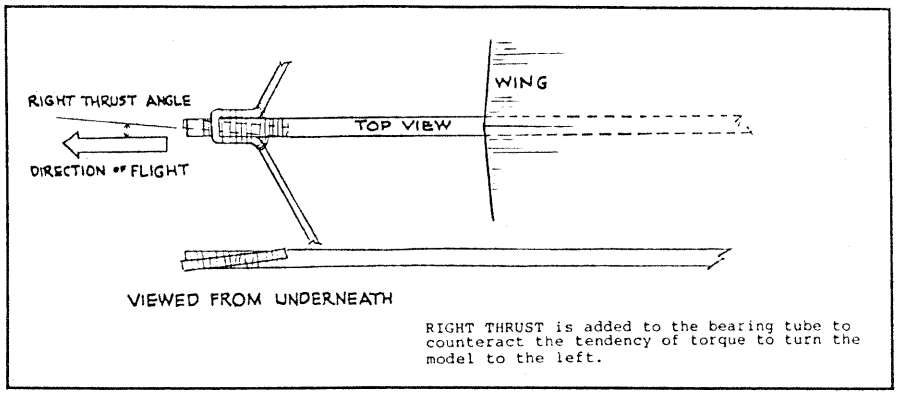


Glue wings together before or after covering. Covering each wing separately before joining is neater. Doing it this was is fine, too.



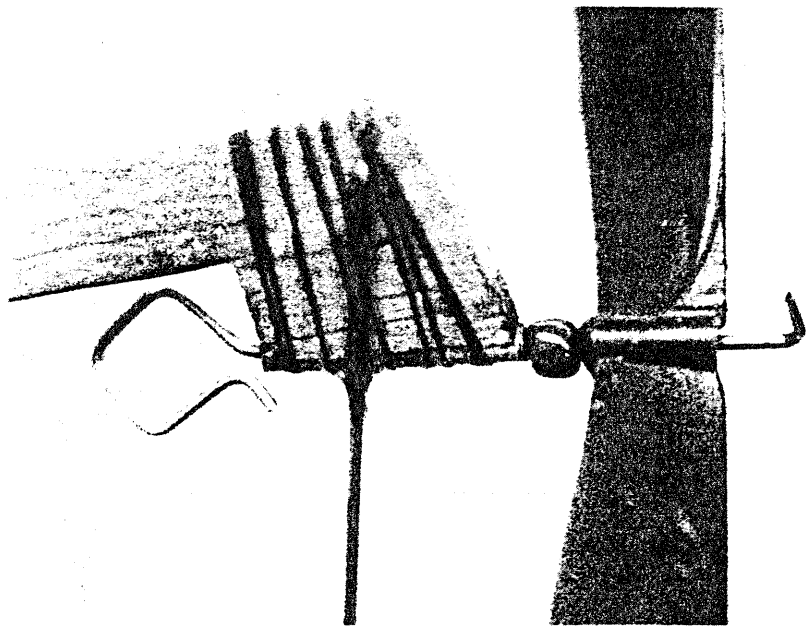
Rubber band holds the wing/pylon assembly on the fuselage for adjustment purposes. Short pin helps hook the rubber band onto the wing slider. The slider is glued to the pylon sides, not on the fuselage!





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.



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.

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!

FINISHING THE WINGS AND TAIL FRAMES

With your sanding block first, and then

Continued on page 80

The true purpose of the geometric twist (washout) in a lifting surface is to reduce lift to near zero at the tip where aerodynamic drag is the highest. As lift is reduced to zero, drag is reduced to near minimum. The surface sort of becomes an infinite span without a dragging wing tip. Are you washing out your new successful helicopter blades?

Les: "No, they're straight.

MB: "Same for most full-size helicopters; but lately I see they're starting to use washout.

Les: "It's almost/totally impossible to tell what a helicopter rotor blade is doing, and it's the same with propellers. The only thing you can do is suck and see.

MB: "Suck and see?

Les: "Yea, Stu, that's Australian for try it and see how it works.

MB: "Who's your competition?

Les: "That's a hard one, really. There aren't many people who do what I do. In Australia there are probably 20 to 30 people who make fiberglass props, but they'd only do a dozen a year, just for themselves mostly, except for a fellow in Sydney who probably makes 50 to 100 a year.

MB: "How many might Bolly make a year?

Les: "I have no idea. I guess it's in the thousands.

MB: "What age are you, Les?

Les: "I'll be 29 in a few days.

MB: "Congratulations! As a manufacturer you're pretty durn young. What'd you do before props?

Les: "I worked in a bank for a while—totally boring, uninspiring. Guess who else works in a bank, me wife! I spent a bit of time as a maintenance man in a hotel, stuff like that. I've been an active modeler since I was knee high to a grasshopper. Modeling's where it is. Stu, there *is* competition out there, but it's specializing in areas. Germany is making props for electrics, and there are makers for control line this and that. One area being long missed is for big R/C props. Most are only copying wood, and they're only getting rubbish, not really good products.

MB: "Les, it's interesting to talk with you here on the other side of the world from home. I think the *MB* readers will enjoy your philosophy. What's in the future for Bolly?

Les: "A difficult question. Probably a lot more of what we're doing now. We really can't automate any of our prop manufacturing. (*Carbon and glass fiber prop production parallels radial tire making. There's a tremendous quantity of skilled hand lay-up work before curing—Stu*) I design our own props, make our own molds, train our own people. We're hiring slowly and sales are growing nicely.

MB: "Les, many thanks for talking with the *Model Builder* readers." A stamped, self-addressed envelope mailed to Tom Dixon (he also advertises here in *MB*) will get you a full listing of Bolly props as well as the specially produced Merco engines he imports. For you readers in the southern hemisphere, write to Bolly, 11 McKinley Street, Elizabeth Downs, S.A. 5113, Australia. The new line of Four-Bladed Bolly props is an eye-opener. Also, *R/C Report* ran a prop survey in 1987, and the Bolly blades sure scored well.

BACK TO THE NATS

The indoor events of the Australian Nats drew the largest (150 to 200) spectator crowds, and they *applauded* the flights! Something I've not seen in my 50 years of model building/flying.

USA's *Model Builder* magazine has a bigger impact on Australian National contests than Bill Northrop knows about. In August 1979 *MB* published a cute little Hangar Rat R.O.G. rubber job for *indoor* flying designed by Harry Barr. So the indoor section of their Oz Nats features a Hangar Rat contest in addition to their regular indoor events. It's a one-design endurance contest (kits can be bought at their Nats for $5 and whatta bargain they are). This was a small Nats, but it drew 26 Hangar Rats, and our own *MB* columnist John Pond placed a mighty second and brought to the USA a prize plaque from Oz. John, we're proud of you!

Next month we ramble across a section of Australia's "outback" to reach Sydney. Stay with us, 'cuz lots happens. We'll talk with Gordon Burford about model engines 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.

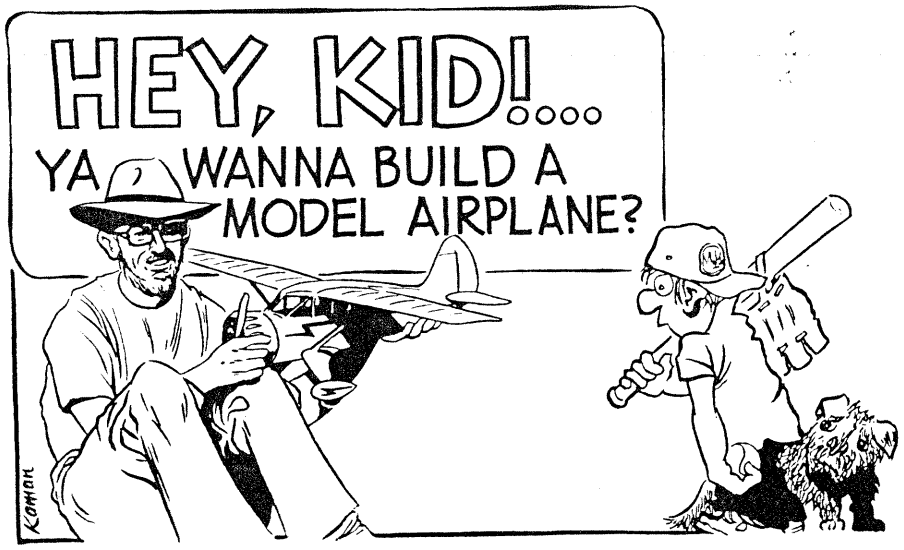
Well, gang, until next time remember that famous quote by an unknown modeler many moons ago, "If at first you don't succeed, read the instructions." See ya' next month! •

Plug Sparks. . . . *Continued from page 34*

Master: Piper Cubs.

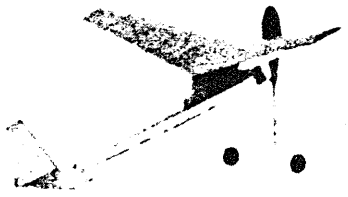
8. Glues they use.
Hacker: Mucilage.
Builder: Super glue, epoxy.
Expert: Cyanoacrylates in three viscosities, aliphatic resins, four different epoxies, contact cement, and has a relative in the chemical industry.
Master: Makes own glue from celluloid and solvent.

9. How they fly them.
Hacker: Crashes on takeoff.

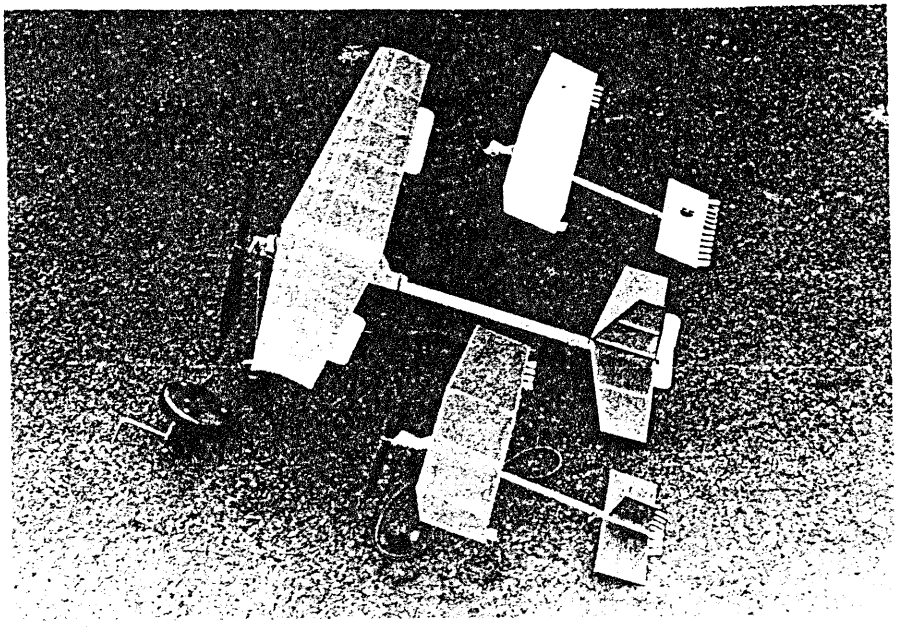


By BILL WARNER

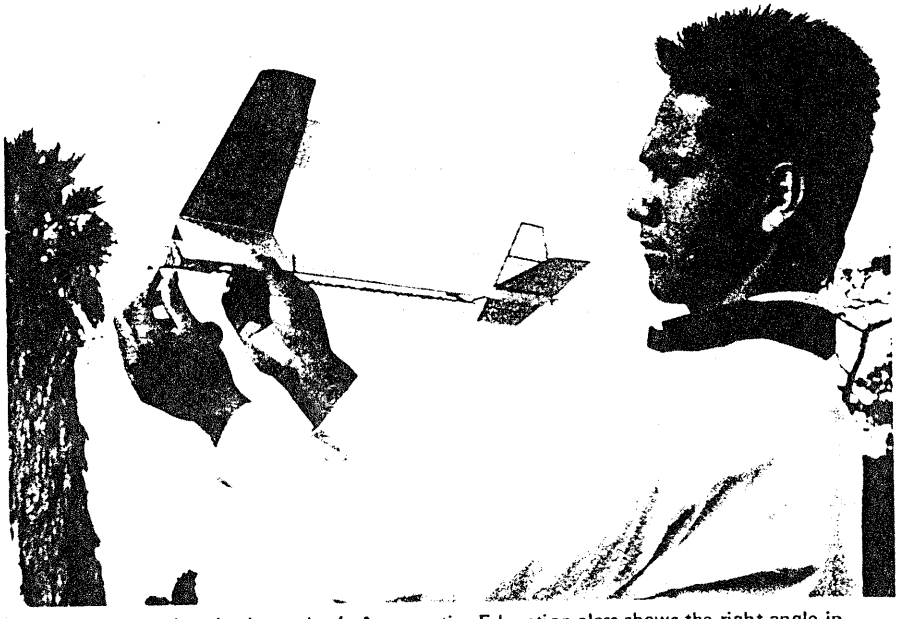
Illustrations by JIM KAMAN



Flight-trimmed Sky Bunny off on a hop to the clouds.



Sky Bunny flanked by two Peck ROGs, ready for the air.



Ed Arteaga, a student in the author's Aeronautics Education class shows the right angle in which to launch the Sky Bunny successfully.

• One of the hardest things about making model aircraft is making the bends in the music wire prop shafts and landing gear. Music wire is a special steel often called "piano wire" because it is used in pianos to produce the sounds. It is hardened, and that makes it hard to bend. One good way to practice bending is to get some soft wire such as used by mechanics and try that first. Most bends can be done with slip-joint or needle-nosed pliers, but often a bending jig made from a piece of wood and a couple of nails or screws can be helpful. They are cheap and quickly made. We'll use two, one for the landing gear and one for the prop shaft. The cutoff nails on the prop-shaft jig are just close enough together to let the wire slip between them. The landing gear jig has the bending posts about a half-inch apart. When the wire is going to bend all the way around the post to form a prop hook or to come back in the same direction as it started, the bending post can be made the same size of the dimension needed. A 3/16-inch diameter hook can be bent around a 3/16-inch diameter screw, etc. Cutting the heads off makes the bent parts easier to remove.

BENDING THE LANDING GEAR

When we started making the Sky Bunny with an after-school group of junior high kids with some model building experience, we had no idea of the exact problems that would arise. The biggest one was bending the wire. I had chosen .046-inch diameter music wire to help make the design bullet-proof. This heavy wire would take up a lot of the shock of bad landings. The only problem was that the kids couldn't bend it with pliers! Putting the twisting force sideways on a pair of pliers just would not do the job! Hence the bending jig.

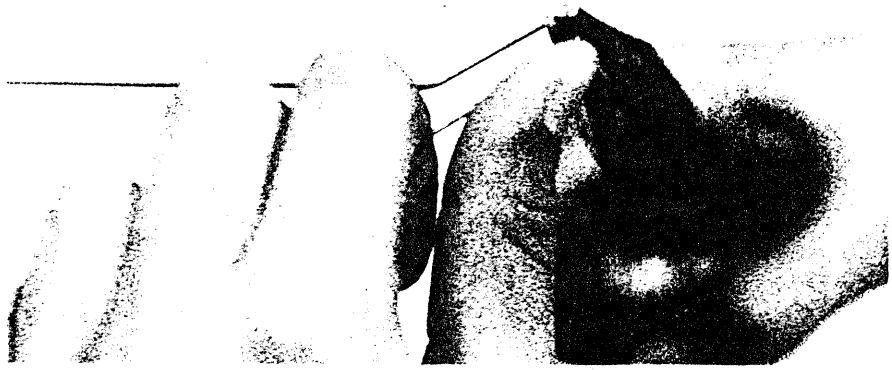
The first thing to do is mark off where the bends are supposed to be. I usually just grab the wire at the place I am going to bend it (holding it over the pattern on the plan), grasp it with the pliers right up against my fingers which "marked" the spot and bend away, holding it back over the plan to see if it was right, and making the necessary adjustments. The kids had a hard

time getting it anywhere close, and the bends were definitely not all in the same plane.

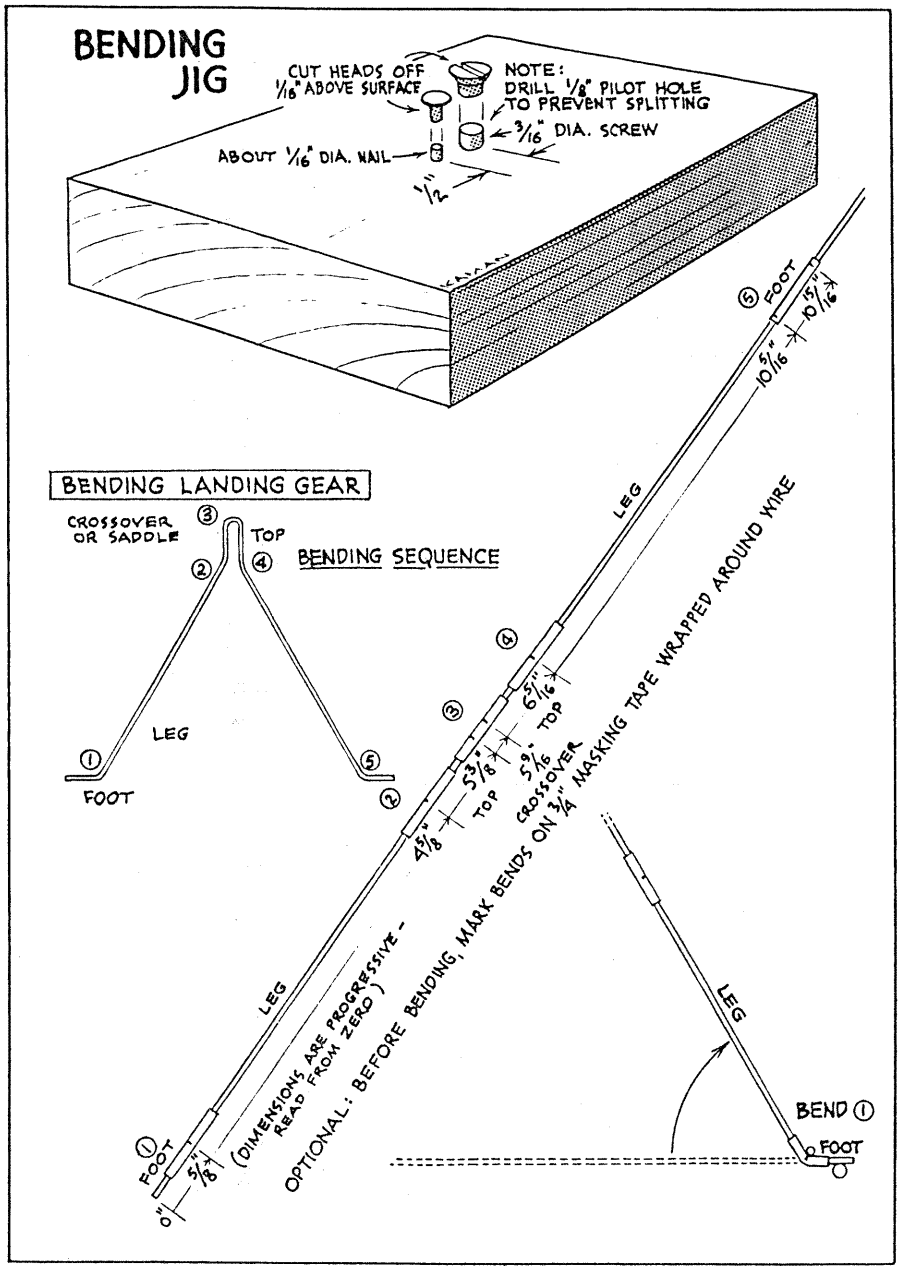
The dictionary defines "plane" as "without elevations or depressions; even; level; flat." That means that when you have finished bending up your landing gear wire, and you lay it on the table, all parts of it should touch at the same time. Sound easy? I have seen grown men cry trying to get a bent-up part to come out with all surfaces in the same plane. The jig method can help here, for the *surface* of the board you are using is a flat plane!

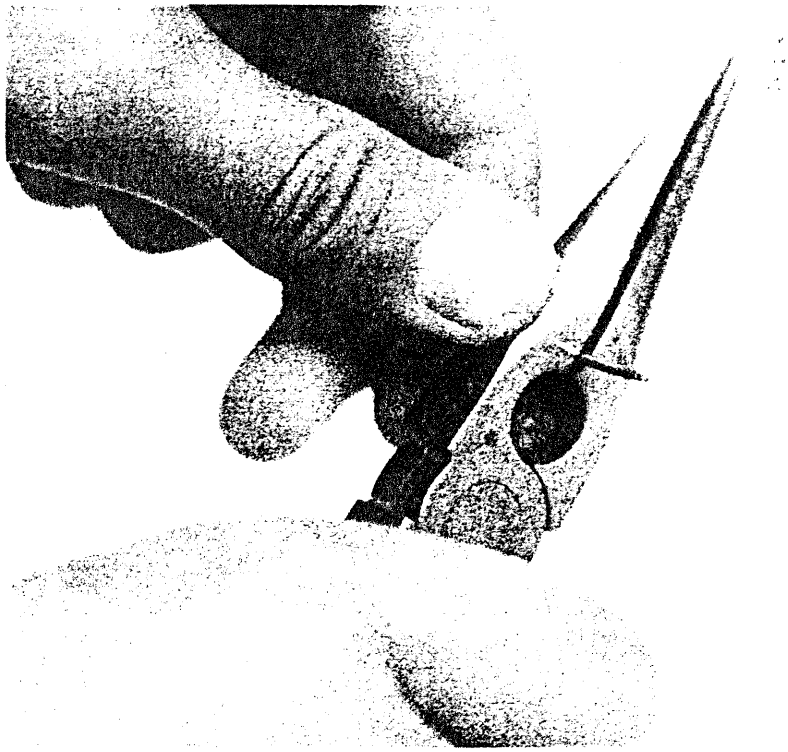
Knowing exactly where the bend should be will be easier if you mark the bend locations on the wire and check by holding it over the plan after you bend each bend (just a little) before you commit it to a full-scale heavy bend. You can take little "test" bends out, but once you bend it very far, you may have it snap off from metal fatigue. Marks do not show up too well on wire. I suppose you could paint them on. Masking tape works okay, with only a couple of wraps around at each location to mark on. Look at the diagram. You will notice that I have given names to the parts of the landing gear to make them easier to discuss. The place the wheel fits, or "axle," I have called the "foot." The long strut that goes from there up to the fuselage I call the "leg." The part that goes up, over, and back down on the fuselage fit is the "saddle" or "crossover." You should note that all the dimensions I have laid out in the diagram are measured *to the same place*, the *end* of the wire. Measuring from one bend to the next is not too good, as if you make a tiny error at each place, you can be quite a ways off by the time you get to the other end!

Bend No. 1 (see diagram) will be the easiest, because it does not have to line up with anything! Check the bend to see if it is the correct angle by holding it over the plan. Use your pliers to make minor changes. When you make bend No. 2, you have to be sure that the "foot" you just formed is *lying in the same plane*, that is, flat against the top surface of the bending jig. Have someone hold it down flat on the board if you need both hands. Take the marking tape off after each bend if you wish. Bend No. 3 will round the crossover, but it will still work OK. You could do this bend with needle-nose pliers if the wire wasn't so hard. Sometimes heating the wire over the stove until it is red hot will make it easy to bend, but is dangerous to handle when red hot and may become brittle when it cools. Again, take special pains to make sure the parts you have already bent lie *flat* while you are bending. When you have finished all bends, cut off the excess wire. This can be fun, as the hardened wire will ruin the cutting edges of cheap pliers. Making a nick with the corner of a file and then bend it back and forth with pliers at that spot to produce a break. Then you can clean up any sharp edges with the file. Really hard wire can ruin a good file, so be careful! The way I do it is to use a *Dremel Moto-Tool* with a No. 409 Cut-Off wheel. This is one of the handiest little things in any workshop, but should be used only with glasses or a face shield. Grinding anything, or even cutting

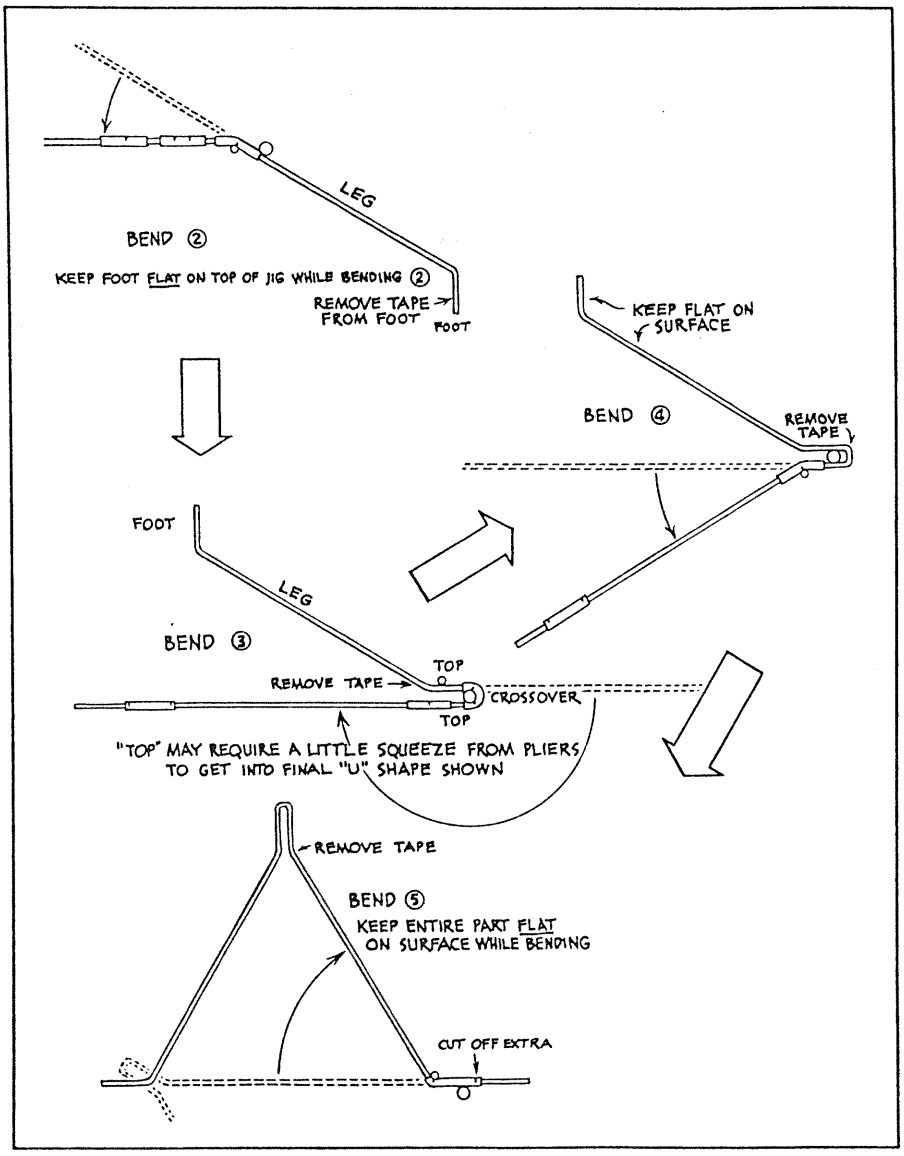


Bending the landing gear wire without a jig. Note the use of the thumb to apply back pressure to get a sharp bend.





When bending wire with pliers, use thumb to apply pressure against the wire close to the jaws as you twist pliers in opposite direction.



off the ends of wire with pliers can endanger your eyes. When you cut off wire with pliers, the end can fly several feet! The cutoff wheel breaks often and bits can go in your eye. Just be careful; OK? One last note, if you really *can't* bend the .046-inch diameter wire, try it with .031-inch (1/32 inch). It won't be as strong, but will be better than nothing. Oh, yes, you can fly the Bunny without landing gear, but then it won't be a Rise-Off-Ground; will it?

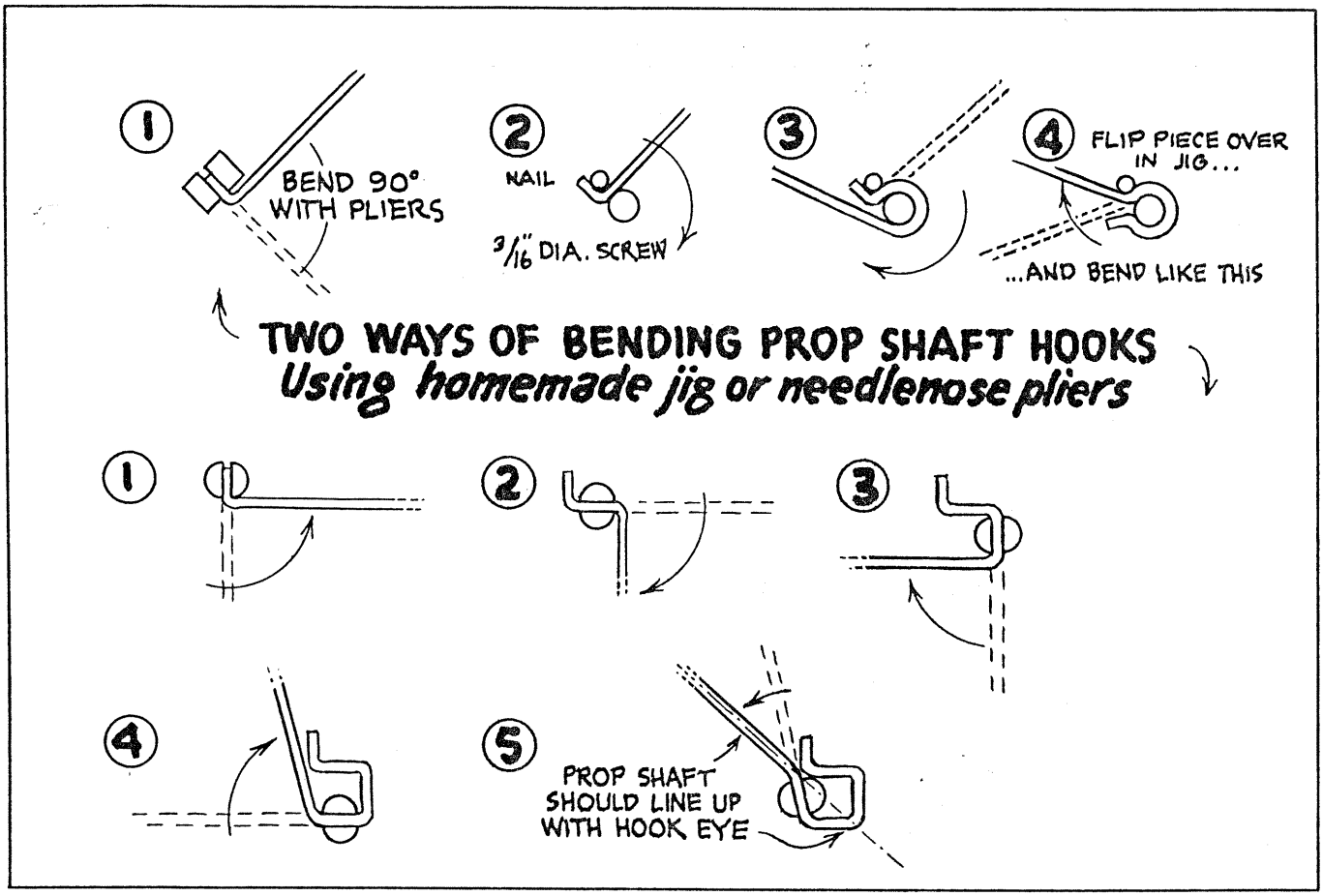
The prop shaft can be bent with needle-nose pliers in a "diamond" shape, with the ends squared off. The trick is to make sure the part where the rubber will hook on is *directly opposite* the shaft. If it is not, you are going to be in for a lot of *shaking* as the off-center rubber hook whips around! Spin the finished shaft between your finger to make sure it is going to run true. Also, the hook should lie in the same plane as the shaft. Try it on a flat surface to check this. While you are at it, make a few extra shafts. Use the best one, and save the rest in case you bend one while flying. A classy way to finish off the business end of your prop hook is to shove a bit of wire insulation plastic or fuel tubing over it to help protect the rubber from being cut by the wire. A little saliva helps the tubing slide on. Heat-shrink tubing is easy to put on.

Making a "jig-bent" shaft is about the same. The "bend-back" on the last bend is necessary to get the hook in line with the shaft. Check it the same way you did to get your diamond hook centered. If your wheels will not fit the size wire you have used, either drill the holes bigger (a red-hot wire can be used in an emergency but can burn you if you're not careful). If the hole is too big, you can "bush" it by drilling oversize to fit a piece of aluminum tubing the right size in. A rolled-paper bushing, or a bit of hardwood drilled the right size can be glued in the wheel. Hold the wheel on with a drop of cellulose glue on the end of the axle. A better way is to file a nick near the end of the axle and then wind some thread around until you have a little ball locked onto the notch. Use glue on the thread while you're winding. Sometimes wheels with large holes can work themselves around the first bend and find themselves on the leg. If this happens, you may want to do the "thread-ball" number in the inside of the axle to stop the wheel.

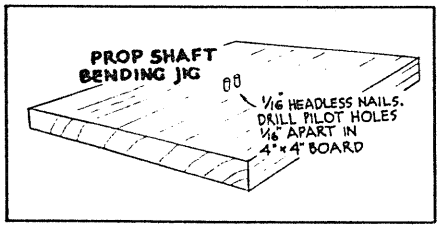
COVERING

First, I suggest you review the covering information from the March '88 *MB*. The only difference is that this time you are covering *both* sides of the wing. The tail parts are the same. They *can* be covered on both sides to prevent warps, but it will add a little weight to the tail. One ounce of weight in the tail means adding five on the nose to balance it. On this model, the wing can be slid back a little to compensate, but as the tail moment (distance from the wing to the tail) gets shorter, the plane gets more unstable and less forgiving.

If you haven't glued the wings together at the roots yet, make sure they are well sanded, with no bits of glue of balsa part mismatches standing "proud" from the surface. Did you remember to round the L.E. and T.E. to blend in with the airfoil shape of



the ribs? Use a separate sheet of tissue for the top of each wing and for the bottom of each wing. Don't try to "wrap it around." Attach the tissue with thinned white glue (60/40), pulling out the wrinkles with your thumbs. Again, keep your thumbs wiped off so they won't stick to the tissue! Cover the top first and let it dry. Then trim with a sharp razor blade or use your sanding block. Then do the same with the bottom. The L.E. and T.E., which show plain balsa color, can be color-doped or colored with a felt pen. (Yellow is the easiest color to make blend in.) For the more adventurous of you, cover the bottom first, trim when dry, and then do the top. Do not trim the top even, but use scissors to cut all around the wing staying about 1/8 inch out. This part can then be glued over the exposed L.E. and T.E. to just overlap the bottom. You will need to make little cuts at the corners so it will overlap without wrinkling. You will not have to use pre-shrunk tissue for this wing, as it is a lot stronger than the *Peck R.O.G.* The tissue can be shrunk right on the wing using a light



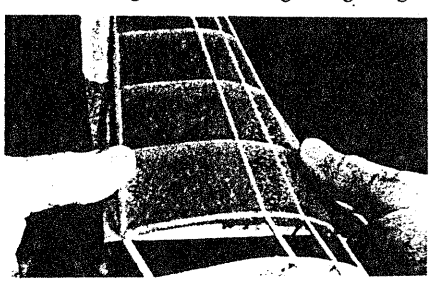
water spray or a cotton swab soaked in rubbing alcohol. It is still a good idea to preshrink the tissue for the tail parts.

Note: If you already have the wing all glued together before covering, you will find that you will need to prepare two special sheets to do the top. Tissue will not bend to fit the dihedral and still fit the curved shape of the top of the wing. Where the two halves meet at the root, cutting the edge of the sheet to a slight curvature inward will help it fit. Start with a longer sheet than needed and do some "cut-and-try."

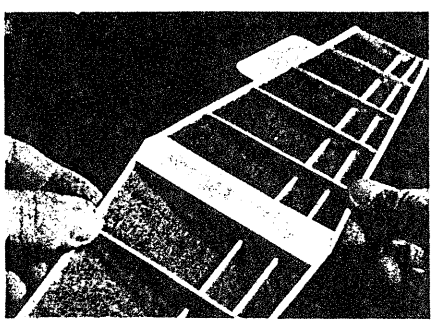
DOPE

There are several types of "dope" or special liquid plastic used to treat the tissue. The purpose of using dope is to make the tissue waterproof, airtight, and often to tighten it. There is clear dope, and there is colored dope. Colored dope has coloring material added and is therefore heavier. I suggest using colored tissue and clear dope for the lightest structure. I have seen kids use colored dope and put several coats on to make it cover. Put enough of this on and you can forget about flying!

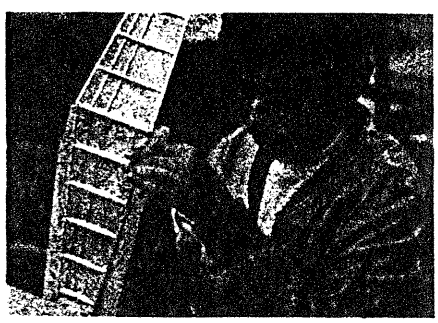
In the past, there used to be nitrate dope, made of the same stuff as old movie film (celluloid). It was, and still is, used on full-size planes to tighten and seal the fabric. It does tighten, but then it stops, and you know where you are. It goes on beautifully. It's main problem was tightening too much sometimes, a problem which was usually solved by adding "plasticiser." This could be any substance from oil of wintergreen to castor oil. "TCP," tricresyl phosphate is still very popular for this. To make nitrate dope usable, you first mixed it half and half with dope thinner so it would flow on nicely and not add too much weight. To each fluid



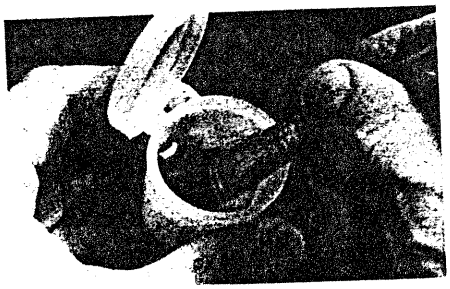
Using 60% white glue, 40% water mixture, cover top of wing in two pieces. Attach with thinned white glue, then pull out the wrinkles with your thumbs.



Optional reinforcement made from card stock added before covering at the wing root.

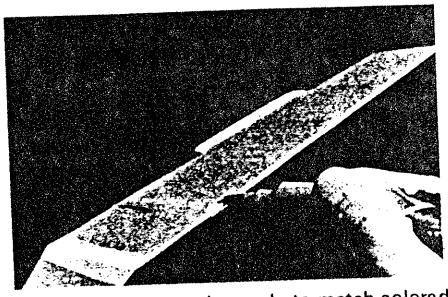


Joel Wagner uses razor blade to trim tissue. He is cutting away from his fingers.



Dip brush in dope thinned 50-50 and wipe off one side of brush on lip of container.

Brush dope from L.E. to T.E. and overlap the strokes. Use light reflected off surface to see places you missed. One coat of 50/50(1/2 dope, 1/2 thinner) should do fine.



Uncolored balsa can be made to match colored tissue covering with help of a felt marking pen.

ounce of dope, you'd add about ten drops or so of plasticiser. You could control how much the dope tightened up your tissue by controlling how much you added. The other main type of dope was called "Hot Fuel-Proof" or Butyrate. Because many people used engines with wonderful things in them like nitromethane, nitrate dopes did not hold up. Even though butyrate dope did not go on as nicely as nitrate, it soon began to replace nitrate in hobby shops as gas-engine use increased. Today, even buying something that says "Nitrate Dope" on it may not be the good old stuff. Paint makers have gone nuts in the last few years and keep putting in plasticisers, acrylics, and all sorts of things which give unpredictable results. Sig's "Lite-Cote" plasticised dope is probably the best bet for you right now. It won't shrink your tissue too much. Don't use over one or two coats of 50-50 mixture, however.

APPLYING THE DOPE

An old baby food bottle is good for mixing your dope with thinner. You *can* apply dope as you buy it, right out of the bottle, but it will be thick and will not cover evenly. After you mix up some thinned clear dope, put down some newspaper so as not to make a mess, and get about a 1/2-inch soft-bristle brush. Cheap brushes will leave bristles as they go, and you will need to keep dabbing them off with your brush and wiping them off on the newspaper.

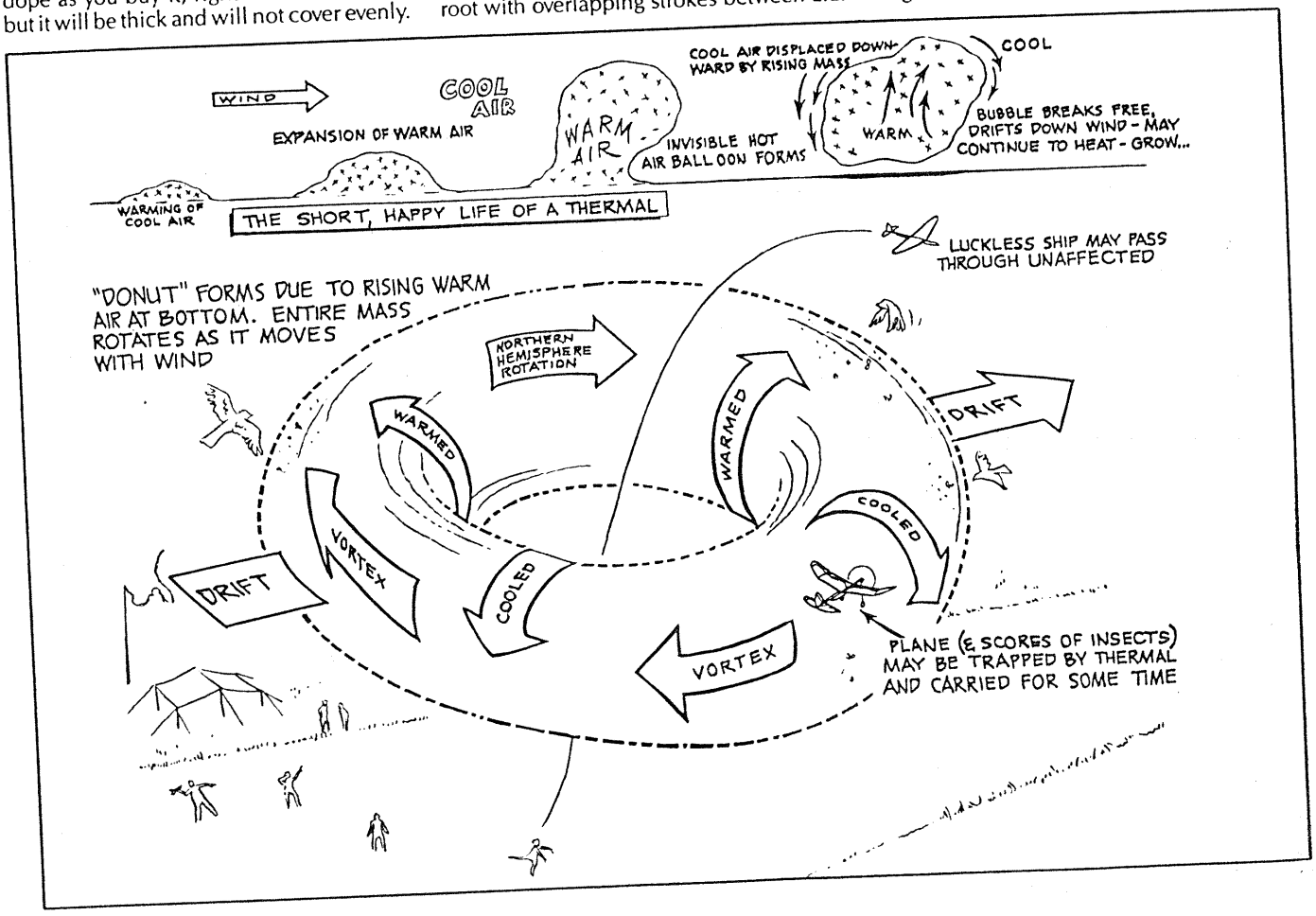
Dip the brush into the dope about halfway or so up on the bristles. Then, as you take it out of the jar, wipe off one side of the brush on the lip of the jar, keeping the full side up to prevent drips. Hold the wing so the long dimension is in line with your forearm. Start at the center and apply the dope by a twisting motion of your wrist and forearm. Do not push the brush back and forth away from and towards your body, you have no control that way, plus it is tiring. Overlap your strokes.

Holding the wing so that the light will shine off its surface to help you see if you are covering well or leaving dry places. If you begin to see it leaving dry spaces, get more dope on the brush. Keeping the brush full and advancing out to the tip from the root with overlapping strokes between L.E. and T.E. should do the trick. Never just keep going over the same area with a "dry" brush trying to spread out the dope. Flow it on. If you see it beginning to "run" from too much dope on the surface, pick up the extra with a dry brush. Never do just the top or the bottom. Do them both at the same sitting as they will pull up equally.

Finally, if you do use regular nitrate dope, realize that there are two kinds: "tautening" and "non-tautening." You can't tell by looking sometimes. The last time I used Sig's nitrate dope, I was surprised to find that it *loosened* the covering! That is nice to know ahead of time. For the Sky Bunny, you might want to try a small surface like the rudder first and look at it after it dries well to see if it tightened up, went slack, or stayed the same! You can always re-cover it if it warped from over tightening. Plasticise your dope if that is the problem. Loosening won't hurt it too much. Just makes it look sloppy.

CLEANING UP

Wiping off the threads of the bottle and applying a little vaseline will pay off when you try to open the bottle next time. If you forget to do this, set the bottle upside down



and flow a little thinner in between the bottle and the cap and let it sit for a few minutes to loosen it.

If you forget to wash your brush in thinner, you will know it next time you want to use it; rock hard. The best way to clean it is to wipe off the excess dope and then slosh it around in thinner. Then you can wash it carefully under the tap with soap and cool water, smoothing the bristles into their original shape to let them dry.

FLYING

Consult the preflight instructions and flying instructions in the December '87 *MB* and January '88 *MB* articles. Steam out any warps in the wings. A tiny bit of washout, about .030 inch, is fine and will actually help your model fly better! A little less angle of attack at the tips means that the center section of the wing will stall first if it comes to that, meaning that your plane will have less tendency to fall off on a wing tip. Some builders put washout in all their models! You will have adjustment tabs to help you fly also.

Try about an 18-inch loop of 3/16-inch flat rubber to start your test flights. Slowly build up the number of winds on each successive test flight, making whatever adjustments are necessary. The model can be hand-launched or R.O.G.'ed. Don't throw it. Take the troubleshooting chart printed this month.

Gradually increase the number of turns until the Sky Bunny is boring a hole in the sky. Experiment with different sizes and lengths of rubber until you get the type of flight you want. A smaller prop will give a faster spin and a zippier climb. A longer rubber motor will mean a long, slow cruise.

The Sky Bunny seems to be happy with a wide right climbing turn. The pylon and the right thrust contribute to this tendency. I use left rudder to control the diameter of the circle. If the model turns too much to the right, bend in a little more left rudder, and vice-versa.

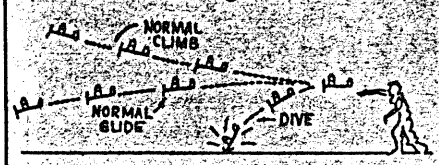
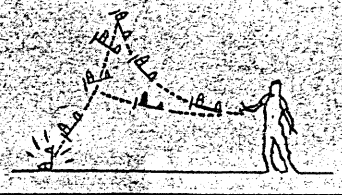
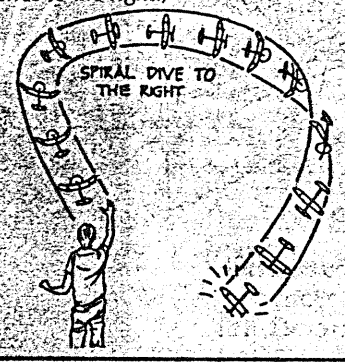
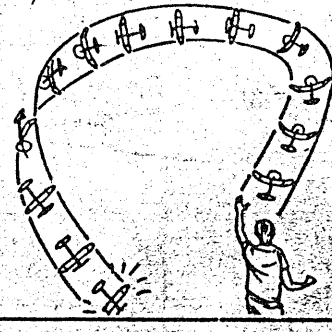
Another feature of the sliding pylon is that you can slip a shim (small thickness of balsa or anything else) under the front or the back of the slider and change the angle of attack of the wing. If you need more lift, slipping a bit of 1/16-inch or 1/32-inch sheet between the front of the slider and the fuselage will increase your alpha and give more lift. A stall might be cured by shimming the rear of the pylon assembly, thereby decreasing the alpha and reducing lift.

Have fun with your Sky Bunny, and if it breaks, tear off part of the tissue, fix it, and re-cover it. Don't just throw it away when it looks broken up. Wrecks are never as bad as they seem!

Next month we will start the famous *Flying Aces Moth*! As with all the projects in this series, you can get the kit of supplies from: Peck-Polymers/Beginners, P. O. Box 2498, La Mesa, California 92044. We're going to start with the Moth right from the Peck kit and then are going to show you a couple of modifications to jazz it up. Send Pecks a SASE for their free sheet of materials for our series, or get their whole catalog for $2.

Keep 'em flying! •

TROUBLE SHOOTING CHART—NO WIND BLOWING, MODEL LAUNCH NORMAL

THE PROBLEM	WHAT MIGHT FIX IT
1. Model dives straight in. 	1. Bend the trailing edge of the stab or the elevator tab up .030 inches. 2. Add a bit of modeling clay about the size of 1/2 a pea to the tail. 3. As a last resort, reglue the wing 1/2 inch farther forward.
2. Model stalls. (Nose first goes up, hesitates slightly, then drops to a dive. Roller-coaster.) 	1. Bend the trailing edge of the stab or the elevator down .030 inches. 2. If the model wasn't turning, bend the rear of the rudder or the rudder tab about .030 inches left (as seen from rear). 3. Try a bit of modeling clay about the size of a pea on the nose as far forward as it will go.
3. Spiral dive to the right. (Model raises its left wing—pilot's left—and finally crashes to the right.) 	1. Hold model at arms length. Close one eye and see if wings are warped. The right wing should be untwisted, but the left should have about .070 inches wash-in. If too much wash-in, breathe on it and twist in opposite direction. Recheck. 2. Bend rear of rudder or tab about .030 inches to the *left*. 3. Bend the trailing edge of the stab *up* about .050 inches (or a tab). 4. Add about a 1/2 a pea of clay to the tail. 5. Bend right aileron tab down .050 inches and left tab up .070 inches.
4. Spiral dive to the left. (Model raises its right wing—pilot's right—and finally crashes to the left. 	1. Hold model at arm's length. Close one eye and see if the wings are warped. The left wing should have about .070 inches wash-in. If not enough wash-in, breathe on it and twist leading edge higher. 2. Bend rear of rudder or tab about .050 inches to the *right*. 3. Bend the trailing edge of the stab or elevator up about .050 inches. 4. Add about 1/2 a pea of modeling clay to the tail. 5. Bend left aileron tab down .050 inches and right tab up .070 inches.
5. Model refuses to fly left, even though you try everything.	1. Go with the flow. Fly right. Why fight it? You may have built it as a RH model without knowing it.
6. The model flies great until it runs out of power, then it dives, stalls, or goes straight.	1. Remember that the rubber spinning the prop makes the plane roll left. When the motor runs down, this force is missing. Try adjusting the model so that it glides well, and then play with the prop shaft part of the nose bearing. Twisting it a little right will open up a too-tight left turn, a little left will turn a straight climb into a left circle, etc.