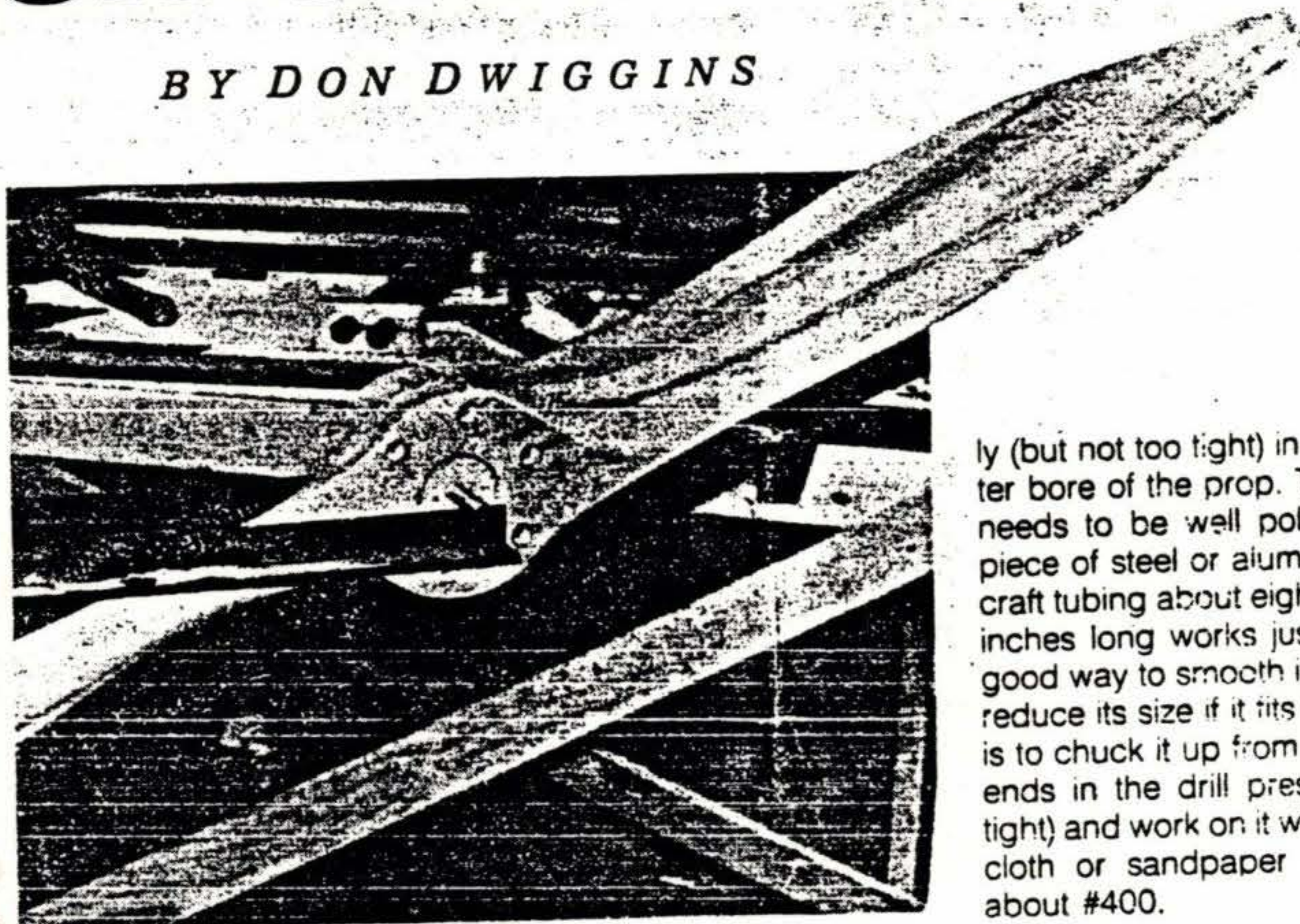


*The fifth and final in a series of how-to articles
on designing, carving and finishing your own blades*

HANDCRAFTING YOUR OWN PROP

BY DON DWIGGINS



In this final installment, we pass along to you Larry Weishaar's instructions for the balancing and finishing of your lovely handcrafted wooden propeller — one that should give you years of happy flying.

For a complete construction manual and large-size templates send \$10 to: Larry Weishaar, 1924 North 6th St., Springfield, IL 62702.

Please do not attempt to build your propeller from these articles, which are presented solely for your information on construction techniques and are not complete. Additional information, corrections and changes not included in these articles are available in the designer's plans.

BALANCING

This is a step that seems to bother a lot of people and, indeed, scare them away from building their own props. Really, it's one of the simpler and most rewarding operations.

You won't need any new tools, but you will have to build a balancing stand which will require a carpenter's level and a couple of pieces of 1½" angle iron six or seven feet long. You won't need any help, either. Balancing is a more or less continuous operation from this point until your prop is finished. This initial balance shouldn't take more than an hour or so, plus a half hour or so to set up the balancing stand.

When balancing your prop, hang it between the rails and allow it to swing to a stop. The ultimate objective is that the prop will remain perfectly stationary in any position.

Setting Up The Stand

This is embarrassingly unsophisticated, but it works. Find a table, bench, bar, or something that is at least 28 inches off the floor. It should be fairly stable, and a kitchen table works fine if there are no family complications. Clamp two angle iron rails to the table top about 4½"-5" apart and parallel to each other, with at least 36" overhanging the table. Level them lengthwise and crosswise with shims at the clamps, and polish the outer eight or 10 inches of the vertical legs of the angle to a smooth finish using, as necessary, a mill file, emery cloth, sandpaper, etc. A knife edge is not needed. The normal shape of the angle leg, smoothed up, is perfectly satisfactory.

The Pivot Axle

You also need a ½" center to fit snug-

ly (but not too tight) in the center bore of the prop. This, too, needs to be well polished. A piece of steel or aluminum aircraft tubing about eight or nine inches long works just fine. A good way to smooth it up (and reduce its size if it fits too tight) is to chuck it up from alternate ends in the drill press (finger tight) and work on it with emery cloth or sandpaper down to about #400.

Balancing

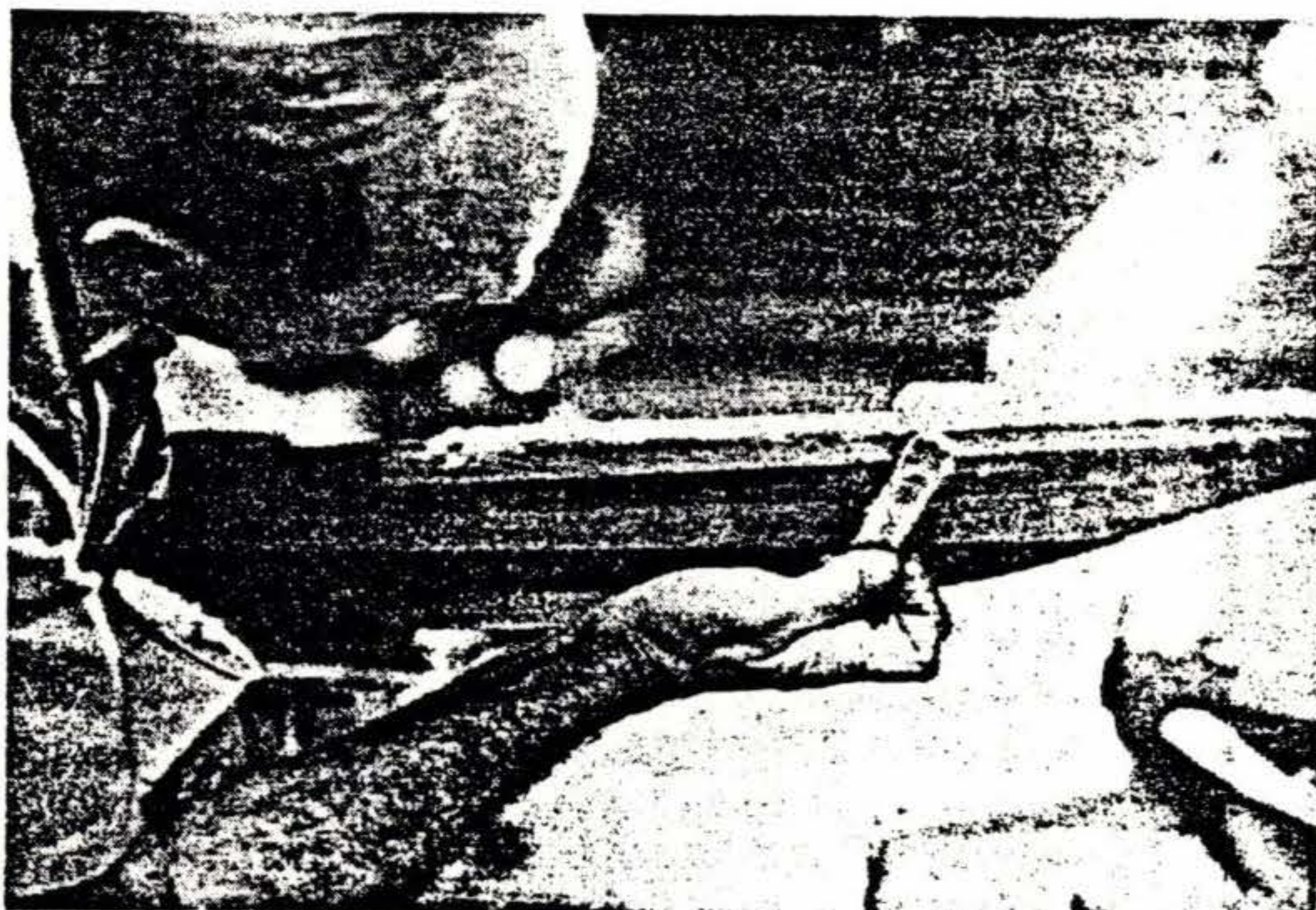
With the axle in the center bore, hang the prop between the balancing rails about four to five inches from the ends. Allow the prop to swing to a stop. Now guess where some weight has to come off. The ultimate (and hard to achieve) objective is that the prop will remain perfectly stationary in any position. If you're lucky, the prop at this stage will stop somewhere within 0 to 20 degrees of vertical indicating one blade is heavier than the other. If it stops solidly crosswise it indicates the axis passes to one side of the center of the bore. However, if it just sort of fools around and decides maybe it likes a mostly crosswise position, it's okay.

In any case, you've got to remove material that will tend to make lighter whatever side or end is down. Take a very close look at your interior shaping and see if there are places where the heavy side/end looks heavy compared to its opposite. You can use your tem-

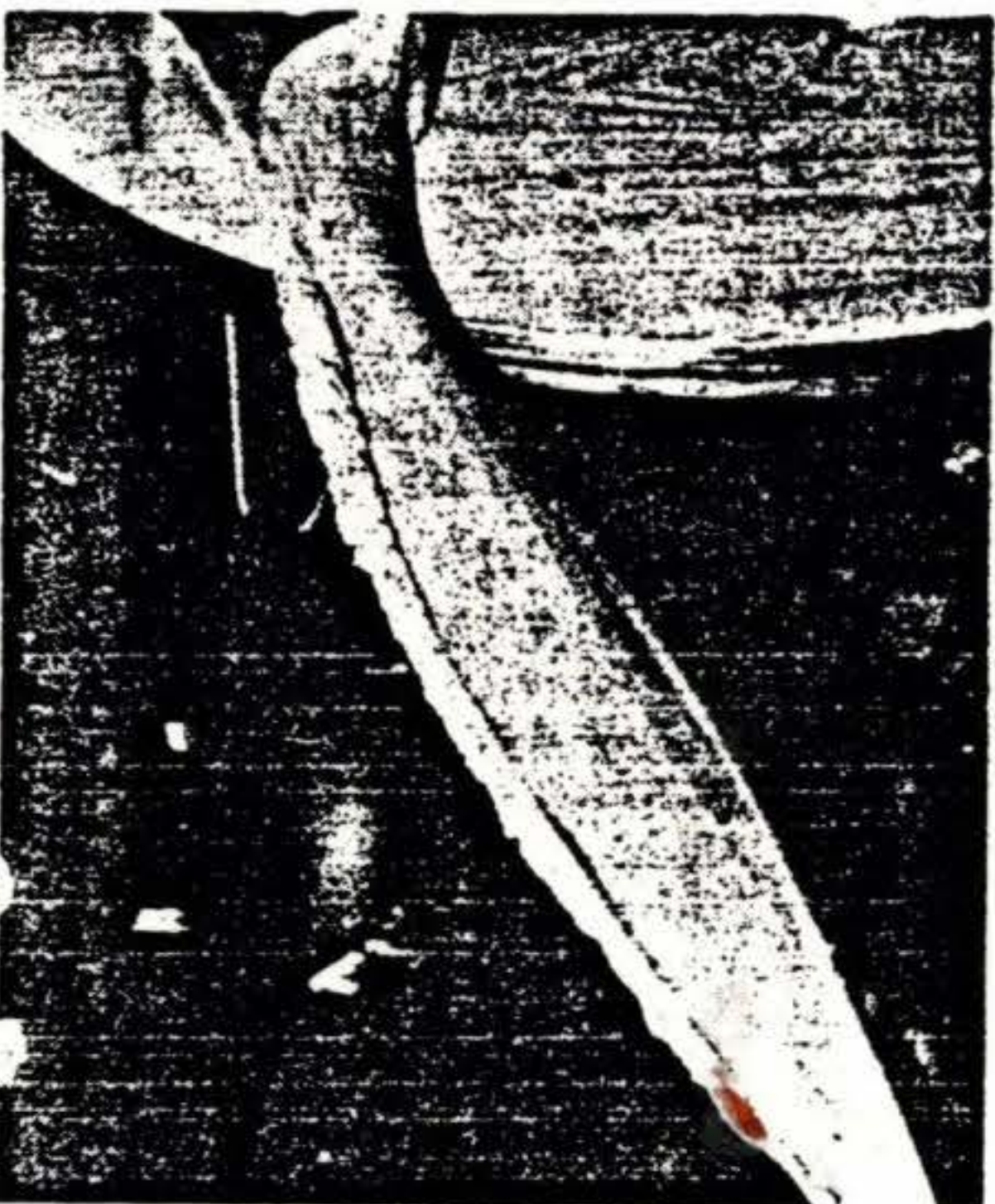
CONSTRUCTION SERIES



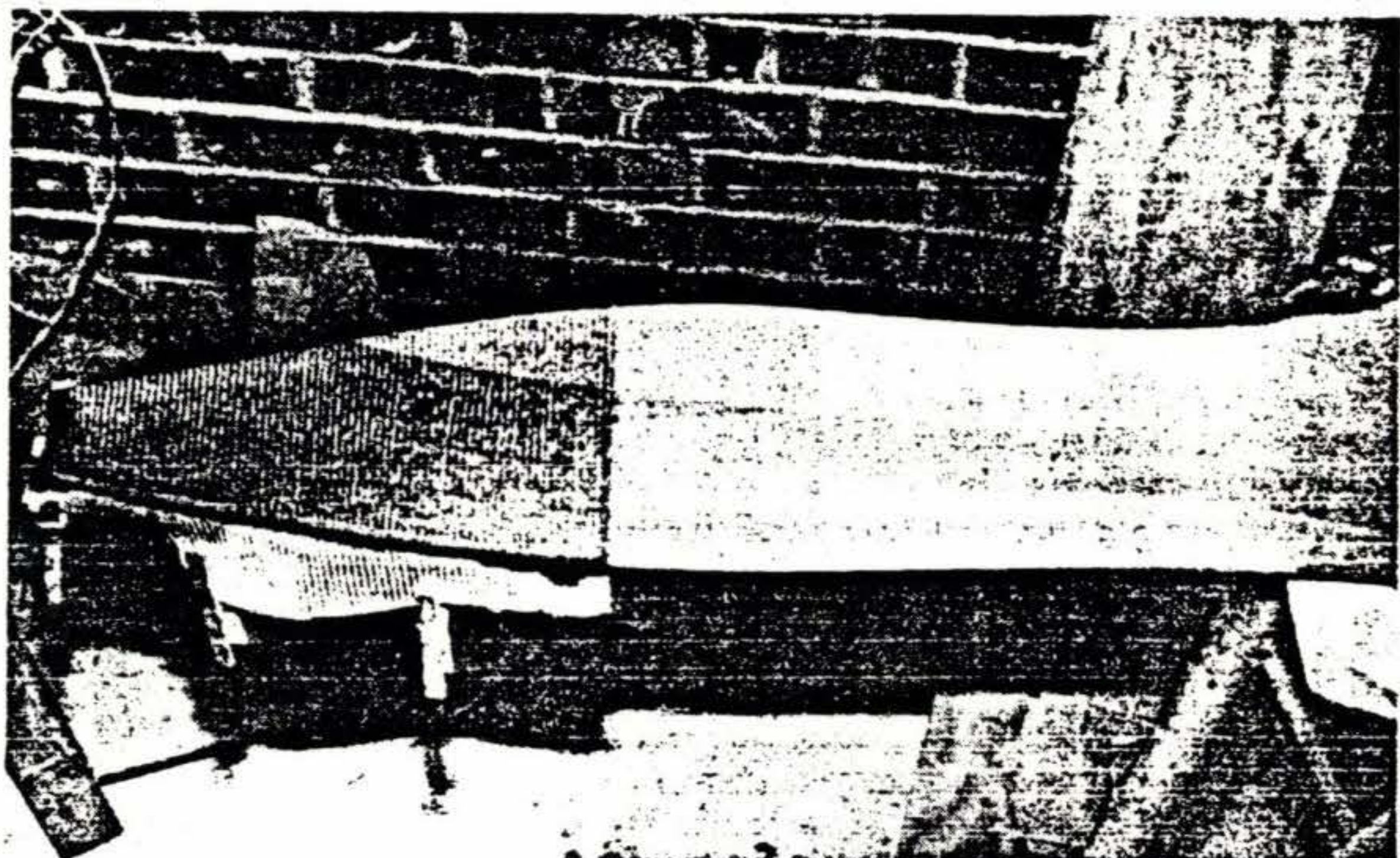
Your finger makes a perfect "tool" for applying Bondo to the leading edge of the prop.



Work the flox or Bondo into the holes you have drilled in the leading edge along the masking tape. This process will harden up the edge.



Wet the exposed leading edge with straight resin before piling on the Bondo.



Use one thickness of BID, or preferably a lighter "boat" cloth, with 45-degree orientation when glassing your tips.



A good way to hold the cloth tightly around the edges is to use peel-ply cut oversize and weighted with clothespins.



Sand the face of the propeller blade for proper balance prior to varnishing. Also use a coat of sanding sealer to fill the pores.

PROP

plates to find slight blade-to-blade differences in the shape and thickness in the outer stations.

About all that can be said is that this is a cut-and-try proposition, and you just have to worry it down to an acceptable condition. Scraper and sandpaper will do most of the work, but you may need to get it on your lap and use the Surform on the interior stations.

What is that "acceptable" point? Well, if you had a heavy end, as you take appropriate material off it will tend to balance in a more and more nearly crosswise, fooling-around position. When the balanced position is within 25 to 30 degrees of horizontal, hang an empty matchbook cover on the end of either blade, one at a time. If the prop rolls over and dumps it off, that's good enough for this stage.

When you're satisfied with the balance, give the whole prop a good going over with sandpaper working down to about #220 and making sure all tool marks and coarser sanding scratches are removed. From now on it should be handled only with clean hands and otherwise protected from scratches, dust, oil, etc.

FINISHING

The finish can greatly add to or detract from the work you have done so far. It enhances the grain of the wood, but it also picks out all the little scratches and discontinuities of line and plane that have not been eliminated and holds them up for the world to see. A little extra effort at the last bare-wood stage pays off handsomely in the appearance of the finished product.

The first step in this process is optional, but strongly recommended. It involves cutting away about 1/4" to 3/8" of that beautifully shaped leading edge and replacing it with VariEze type flox or Bondo. The purpose is to provide a tough and easily repairable buffer against rain and gravel dings.

The remaining steps are our recommendations for filling and varnishing the inner 60 percent or so of the blades and glassing and painting the tips. The only tools you'll need are in your VariEze inventory, although spray painting facilities are highly desirable if you haven't gotten that far on your airplane yet. You need no extra help, and the job will take four or five actual hours of work spread over several days.

Treating The Leading Edge

It takes a lot of guts to do violence to

what looks like a finished piece of work, but we think you'll be sorry the first time you fly through any appreciable rain if you don't grit your teeth and harden up that leading edge. Also, it doesn't detract at all from the finished appearance, in our opinion.

With pencil or masking tape, mark lines on the top and bottom of the leading edge, tapering from nothing at about 35 percent to a maximum of about 3/8" from the edge at 60 percent, and back to perhaps 3/16" out at the tip. The exact alignment is not important, but make them the same on both blades. Steel yourself and cut off everything forward of the lines using a block plane, Surform, sander or whatever. Finish with #50 sandpaper on a rigid block.

Drill evenly spaced 5/32" holes a quarter-inch deep about every two inches straight into the leading edge of the blade. Mix up some flox, just dry enough not to sag. Wet the exposed leading edge with straight resin, removing the excess with a squeegee or finger. Pile huge amounts of flox on the edge, working it into the holes for extra anchorage. When it's cured, reshape the leading edges using your templates and eyeball. Check and refine your balance if need be.

Glassing The Tips

You probably don't need much help on this one. Round the sharp corners off the trailing edge and shape the tips the way you want them. Measure 11 inches in from the tips and lay masking tape completely around the blade to form a sharp demarcation for the edge of the glass. Use one thickness of BID, or preferably, a lighter "boat" cloth, with 45-degree orientation. Apply and cure it in two operations, flat side first.

Do not use micro slurry, but be sure the layup doesn't get starved by resin soaking into the wood. A good way to hold the cloth tightly around the edges is to use peel-ply cut oversize and weighted (clothespins, bondo gobs, nails, etc.) so as to definitely drape around the blade. When the flat side is cured, peel and sand off the excess glass. Turn it over and do the other sides.

When both sides are cured, move the masking tape line about 3/4" inboard and smooth in dry (sorta) micro to provide a transition from the edge of the glass to the wood.

Varnish And Paint

Give the whole thing one last fine sanding and remove all the dust with a brush or vacuum. If you want to stamp or ink in (use drawing ink) a serial

number, pitch/diameter, or personal logo in the hub area, now is the time.

Most woods need a coat of sanding sealer to fill the pores. Be sure your sealer, if you use one, and your varnish are compatible. When the wood is prepared as necessary, mask off the tips and apply at least one coat of good exterior varnish. We like ZAR glossy, and, if warmed slightly, it sprays well without thinning, although you'll want to brush in this first coat. Use Q-Tips or a small bottle brush to thoroughly coat the insides of all holes. When it has dried sufficiently, make a light pass with #400 sandpaper. Be careful at sharp edges and corners not to sand through. Apply decals (if you don't mind advertising our sterling corporate name) to the flat (spinner) side about 40 to 50 percent out, with the right blade reading right-side-up as you view the rear of the airplane.

Add as many coats of varnish (don't varnish the glass!) as it takes to turn you on. Use a tack rag between if you do any sanding. You can check the balance between coats and adjust your coverage to do the most good. Remember, this time you're adding weight to the light side or end.

After the varnish is thoroughly dry, mask off the varnished portion and paint the tips using primer-surfacer or Featherfill to fill the weave and a good exterior enamel. This is your last opportunity to balance, and you can do a lot of it with the filler coats. If it doesn't want to balance exactly in any position (and it probably won't), at least it should "dump" a paper clip hung on either blade. To make you feel good, a paper clip (one gram) attached to the extreme end of a perfectly balanced 58-inch prop at 2750 rpm would create a revolving side load on the front engine bearing of only 1 1/2 pounds.

Well, friend, that should just about do it. Congratulations on your accomplishment, and we hope it gives you a sense of personal satisfaction as well as many happy and efficient hours of flying. Our estimates of working time may be low (although, with experience, our own times are only roughly half those shown), but we hope you'll agree it was worth whatever time it took.

A word about maintenance: Wood propellers should be protected from the weather, if parked outside, with wax and a loose-fitting weatherproof cover of some kind. Park it in a horizontal position. Clean off bugs with soap and water or cleaner-polish. Small dings can be repaired with Bondo or flox. Snug up the bolts after the first five hours and check them regularly thereafter.

Good luck!