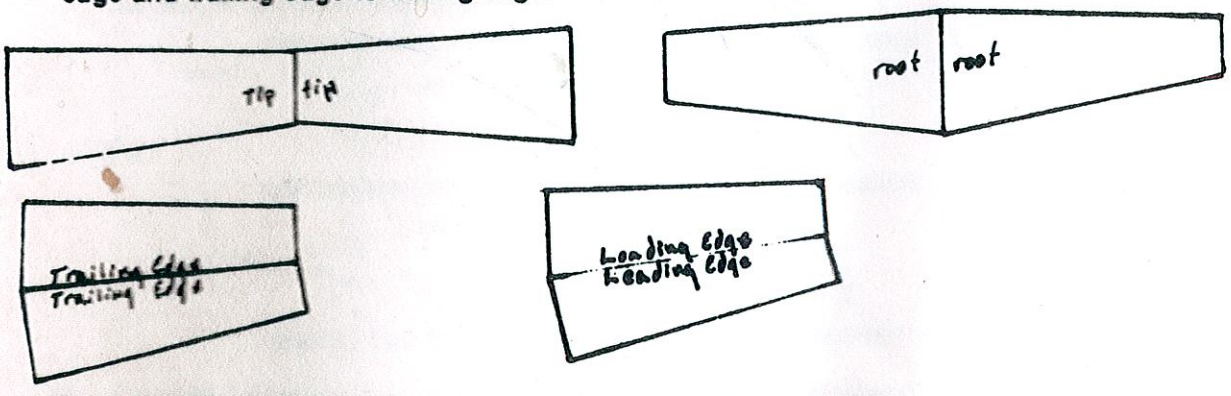
DICK HANSON MODELS
TIPO CONSTRUCTION MANUAL

WING ASSEMBLY

1. Inspect wing cores for proper sweep. Sand at root to correct if necessary.
2. Using a slurry of slow curing epoxy and micro ballons, install 1/4x1/2" balsa spars, 1/4" plywood landing gear plates and 1/8" balsa gear plate tops in the slots. (Balsa not included in the kit.)
3. After epoxy has cured, plane spars and gear plate tops to conform to contour of foam. Fill any dents with Dap and carefully sand to original shape. Don't worry about wire marks and other minor defects.
4. Match both wing core halves by comparing them root to root, tip to tip, leading edge to leading edge and trailing edge to trailing edge.



Carefully sand if necessary to match exactly for contour and size.

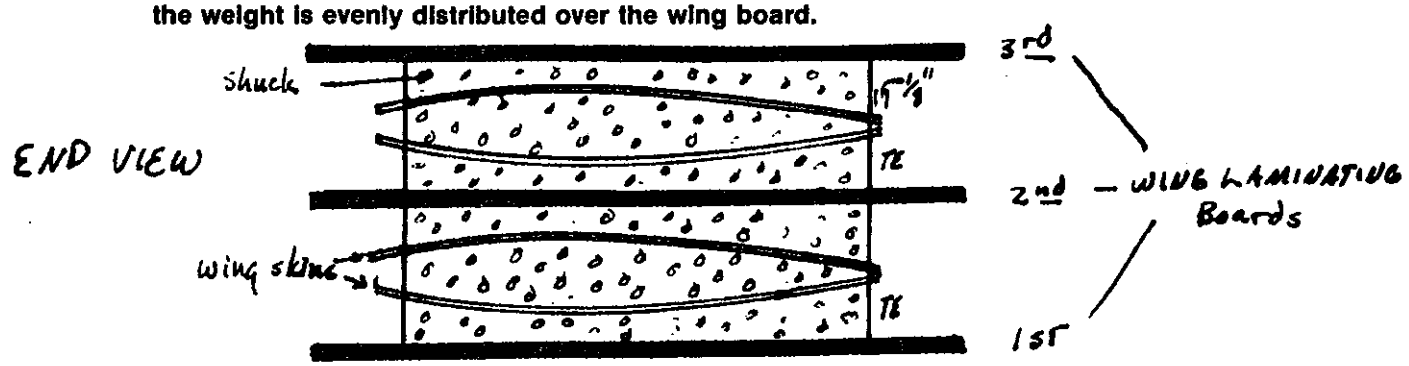
5. Using C.A. adhesive, edge-glue enough matched weight 1/16" balsa sheet to cover both wing panels.
6. Block-sand sheeting to get rid of excess glue and high spots etc. Use 100 grit Openkote followed by 150 grit Openkote. Sand both sides.
7. Using wing cores as a pattern, cut wing skins to size. They should be about 1/2" larger than the core all the way around. Grain must run parallel to the trailing edge. Failure to do this will result in a torsionally weak aileron.
8. Prepare a flat building surface. A table, workbench, etc. is fine, but it must be **FLAT.**
9. For wing laminating boards, you will need three (3) flat pieces of particle board 1x16x48".
10. You will also need a spatula for spreading epoxy. The squeegees available in auto parts stores for spreading Bondo are inexpensive and work well. Notch as shown.

11 About 5 Oz. of slow-curing epoxy are required for the wing. Mix only about 1/2 that amount (2-1/2 Oz.) at a time.

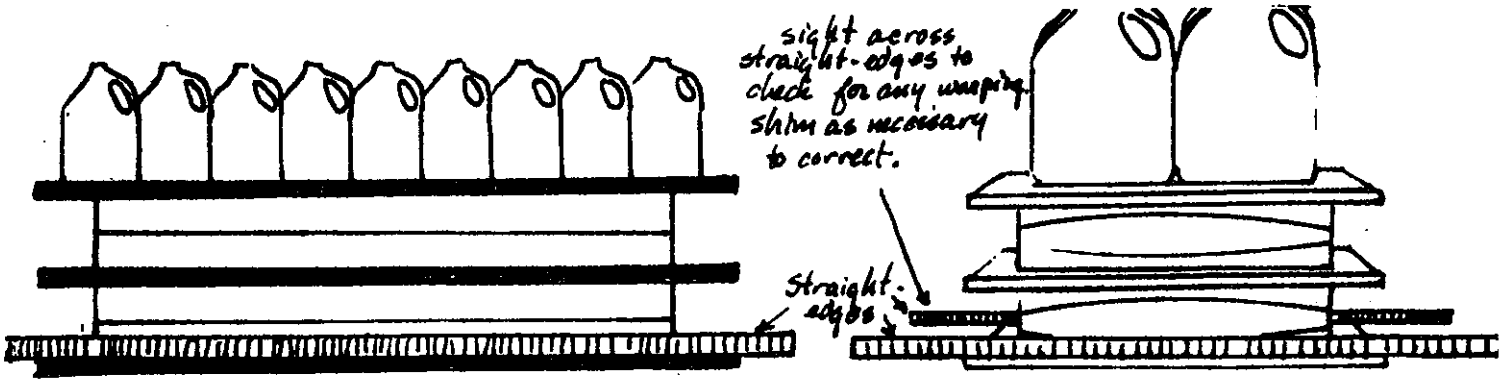
12. Lay one of the laminating boards on your flat building surface, and place one wing shuck on it, core side up. (shucks are the female remainder of the foam block after the core is removed). Using your prepared spatula, squeegee epoxy on the matching wing skin and lay it, glue side up, in the shuck. (Note, it is very easy to get glue on the wrong side of a skin. It will be helpful to mark an x on the glue side of all skins). Position the correct wing core on the skin, allowing 1/8" of skin to overhang the trailing edge of the foam core, Apply epoxy to the next skin and lay it on top of the core, again allowing only 1/8" of balsa to overhang TE of core. Be sure the grain is parallel to the TE. Position the top shuck and second laminating board. Shift all parts until the stack is perfectly aligned. Take your time. The weight from the upper laminating board will help hold things in place, but don't get excited if this weight isn't quite enough to put the skins in perfect contact with the foam. Just get things aligned properly.

13. Repeat step 12 with second wing assembly on top of the first stack, and add the third laminating board on top.

14. Add weights to the top of the stack. You will need 120-140 Lbs. We use sixteen (16) one gallon milk jugs filled with water. Don't stack jugs. Just about anything will work for weights, as long as the weight is evenly distributed over the wing board.

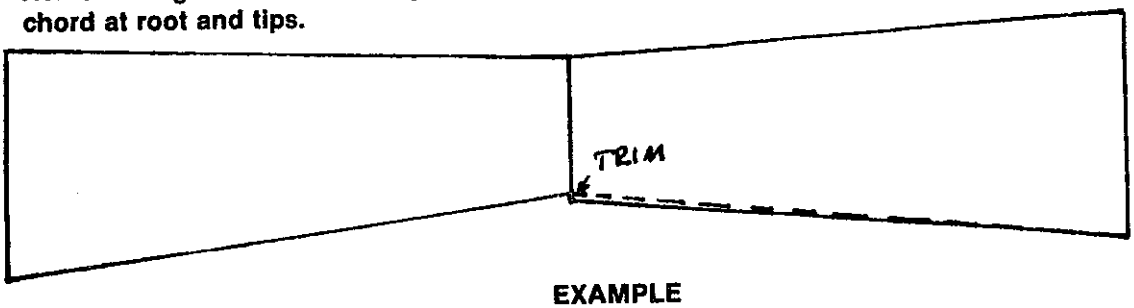


15. Once all the weight is on, and before epoxy cures, inspect for bowing or twisting of the boards or foam. Use a good metal straight edge, and check each side, and across the ends. Double check. The stack will usually bow a little in the middle, so pry up the first wing board with a large screwdriver and insert newspaper shims as necessary. Get the wing EXACTLY straight and flat.



16. Allow assembly to cure for 24 hours before continuing construction.

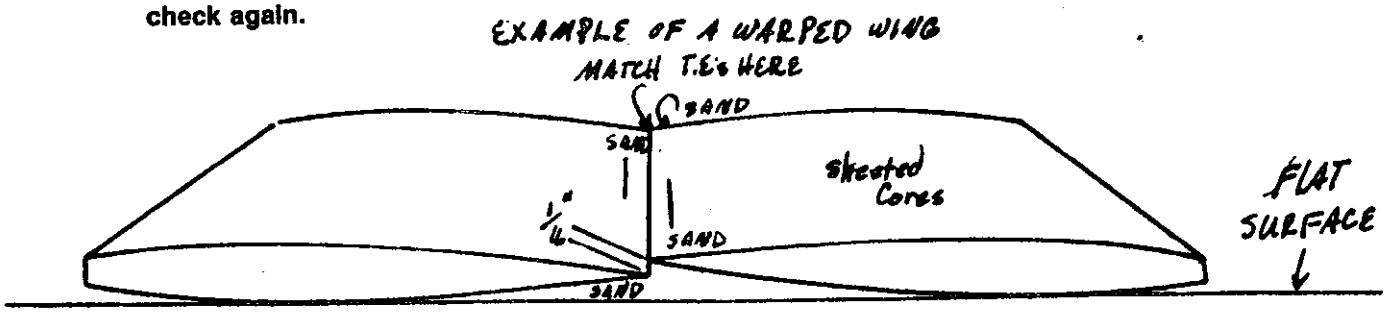
17. Remove wings and trim sheeting to the edge of the core. Match panels so that they have the same chord at root and tips.



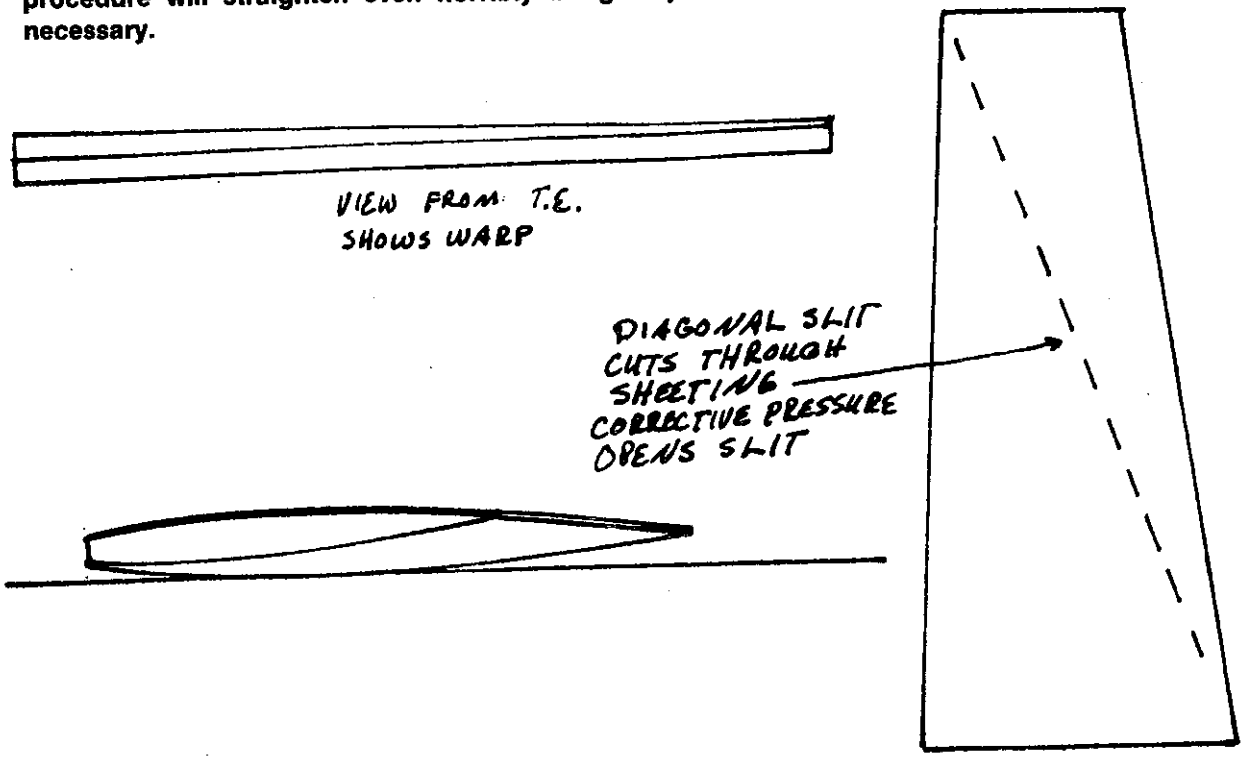
EXAMPLE

It is more important that the panels are exactly alike than that they conform to a particular dimension.

18. On a FLAT table, lay wing panels TE to TE and LE to LE to check for warps. Flip panels over and check again.

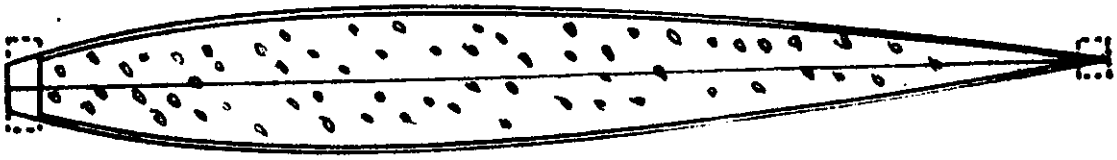


If this test does indicate a warp, and it is less than 1/16", careful sanding will remove it. If the wing has more than 1/16" warp, the cure becomes more drastic. Cut a diagonal slit through the sheeting as shown below. Cut so that when the panel is straightened, the slit will open. Squeegee epoxy into slit while holding corrective pressure to remove warp. Proceed carefully! This procedure will straighten even horribly bungled jobs. Use multiple slits on both sides if necessary.



19. Using white glue, (don't use a yellow "carpenter's" glue such as Titebond) add leading edges, trailing edges, and tips. Masking tape will hold things in place while the glue dries.

20. When glue has dried completely, shape LE, TE, and tips so as to continue the contour of the airfoil. Don't round LE yet.



21. Compare tip to tip and root to root. Sand as necessary for an exact match. Repeat the procedure outlined in step 18 to check for and correct any problems caused during shaping.

22. Establish matched center-lines on tips. Center-lines should still be visible on the foam at the root. Extend center-lines down leading and trailing edges.

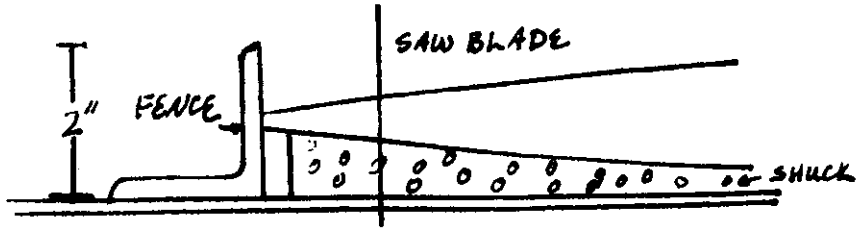
23. Round LE and make final contour of trailing edges and tips. Don't remove the center-lines. Use a long sanding block.

24. Using a straight-edge, check your work for dips and variations.

25. Cut holes for mounting the two aileron servos on the bottom of the wing. The exact size of the holes depends on the size of the servos used. The finished holes, with facings in place, should be slightly larger than the servos. Cut holes with an EX-acto knife and dig out foam with a screwdriver. Face sides of holes with 1/16" balsa, and add hardwood mounting rails.

26. Make a passage for the servo pigtail by cutting a 1/4" slot 3/4" deep from the servo mounting hole to the center section. Cap with a loosely fitting piece of 1/4" square balsa. C.A. in place. See layout drawings.

27. Mark aileron positions on the wing skin, and cut them out using a jigsaw or bandsaw. The panels should be centered and taped to a wing shuck to keep everything straight during cutting. If you do have a bandsaw, the ailerons can be cut quickly and accurately by clamping a rip fence to the saw table.



When cutting the aileron free, be sure to allow for aileron facings. See wing layout drawing.

28. Trim ailerons to accept 3/8" facings, and face using epoxy and firm balsa. Pin and weight if necessary to make them straight.

29. Face wing cutout with medium 1/4" balsa and white glue. Wipe off excess glue and tape in place until dry.

30. Trim and sand facings when dry. Use a long block for sanding.

31. Instead of using molded nylon control horns, mount the ail/elev/rud. linkage in a 1/2" diameter hardwood dowel located as shown on the layout diagrams. The dowel is later drilled for a 4-40 steel bolt to accept linkage. To cut holes for the dowel, use a piece of sharpened 1/2" o.d. brass tubing and twist it carefully. Epoxy dowels in place and sand flush with surface after epoxy has cured. Don't worry about differential in the linkage, but be certain that the bolts are at the same angle to their respective control surfaces.

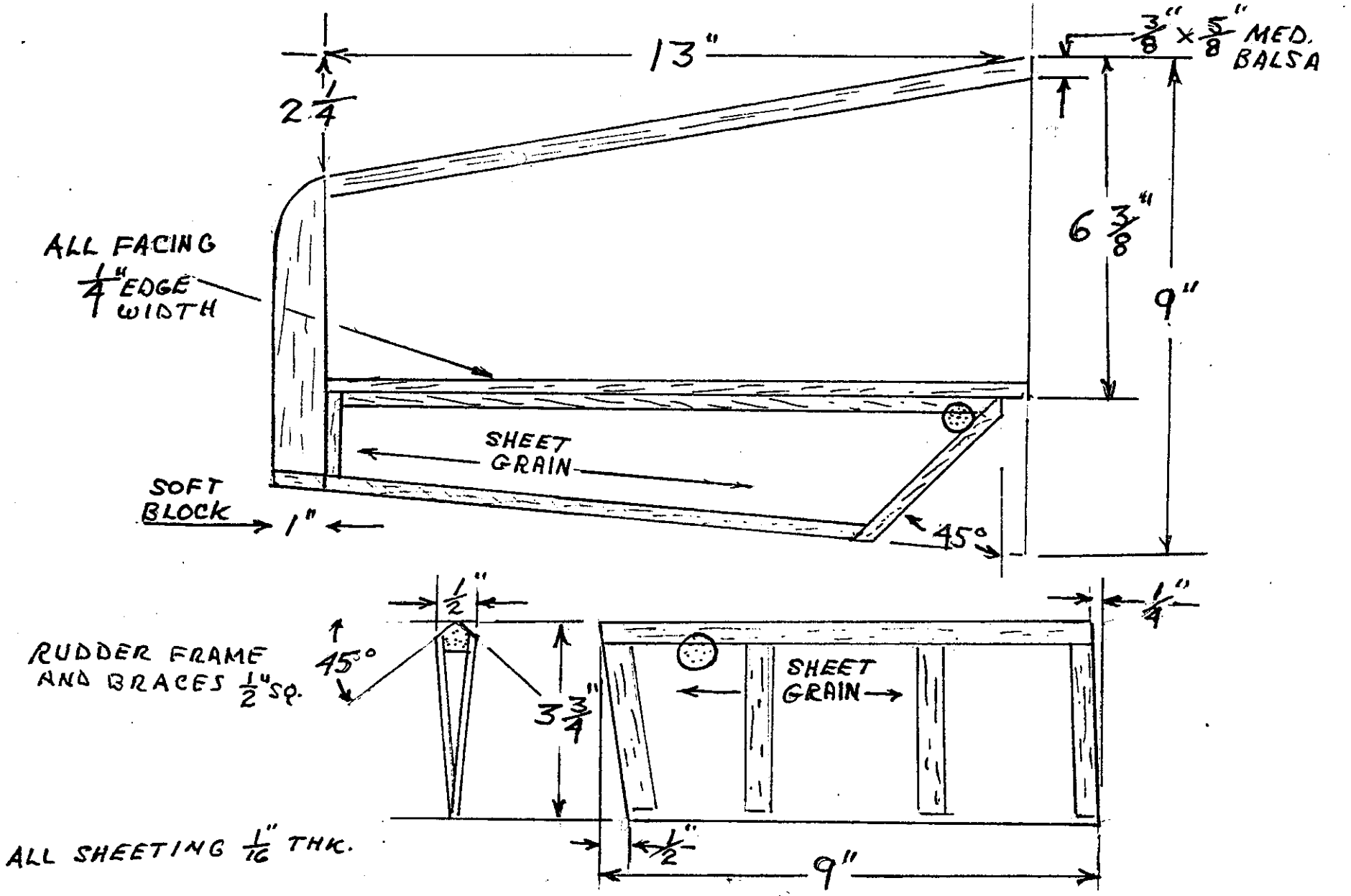
32. Cut dihedral angle. (1-1/2" per panel under each tip.)
33. Align wing halves and join using 5 minute epoxy spread on foam areas only. Keep the glue line thin and even.
34. When dry, check alignment of the tips and when satisfied, join leading edge wood and trailing edge wood at the root using C.A. adhesive.
35. Reinforce the center section with 6 Oz. fiberglass cloth cut to the size shown on the wing layout drawing. Use slow-curing epoxy. Notice that the cloth covers the landing gear area. Add the two overlapping pieces of 4" fiberglass drywall tape to each side, again, with slow-curing epoxy. (This tape is sometimes called scrim tape or "Grout Stop"; it's a flat-meshed fiberglass tape available from builders supply houses.) Gently warm epoxy with a hair dryer and squeegee smooth.
36. Final-sand wing, being careful not to alter airfoil.

STAB CONSTRUCTION

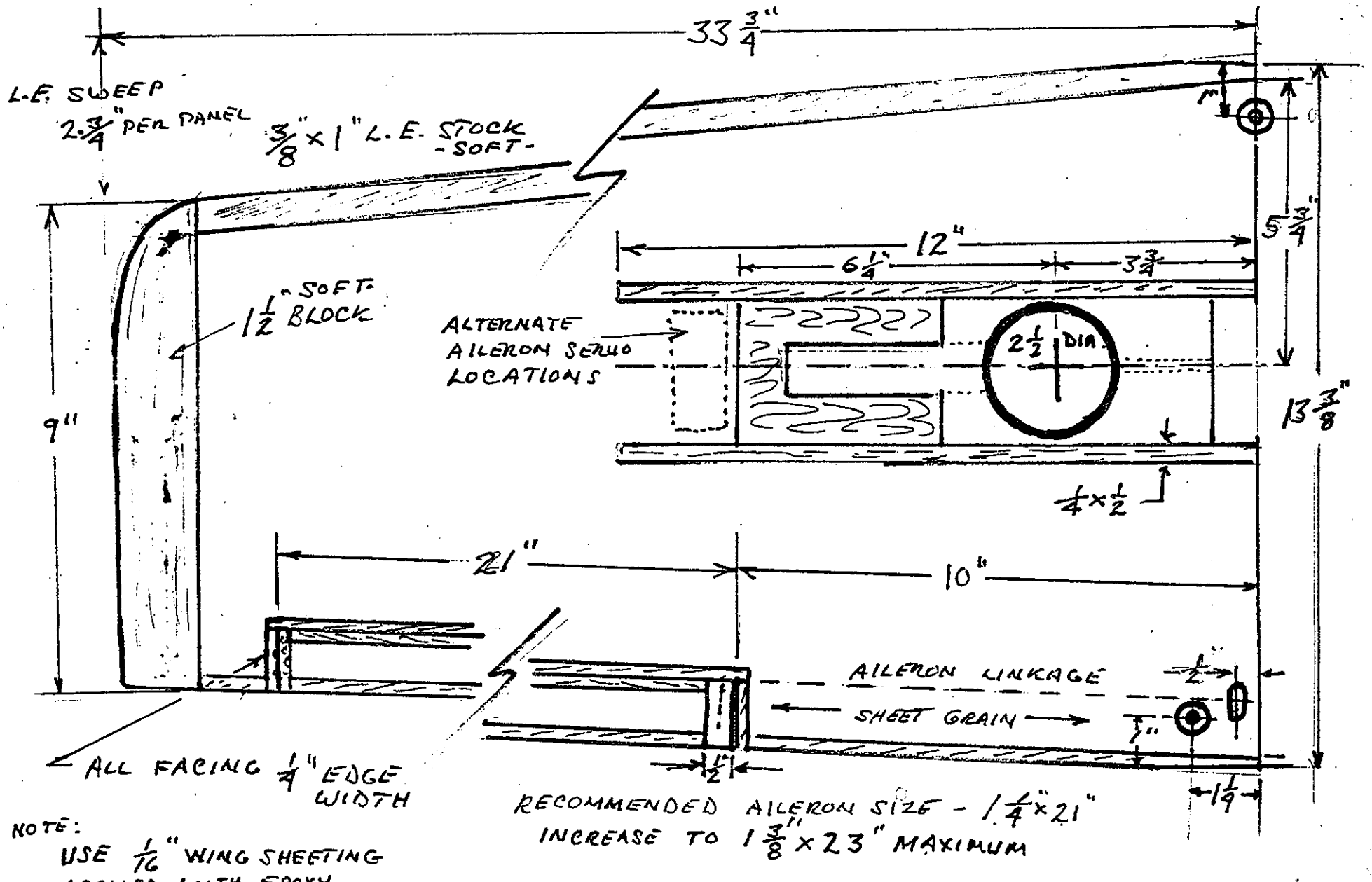
1. Use the same procedure as used for the wings except for the following:
2. Using C.A. adhesive, edge-glue enough matched weight 1/16" balsa sheet to cover both stab panels.
3. See stab/fin layout drawing for all dimensions.
4. The center section is reinforced with chopped fiberglass cloth and slow-curing epoxy.

VERTICAL FIN CONSTRUCTION

(See Stab Drawing)



TIPO 750	VERTICAL + HORIZ STAB	8 NOV '82



NOTE:
USE 1/16" WING SHEETING
APPLIED WITH EPOXY

TIPO 750	WING - 750"	REV 8 NOV 82

FINAL ASSEMBLY INSTRUCTIONS

YOU WILL REQUIRE THE FOLLOWING ITEMS TO COMPLETE THE MODEL.

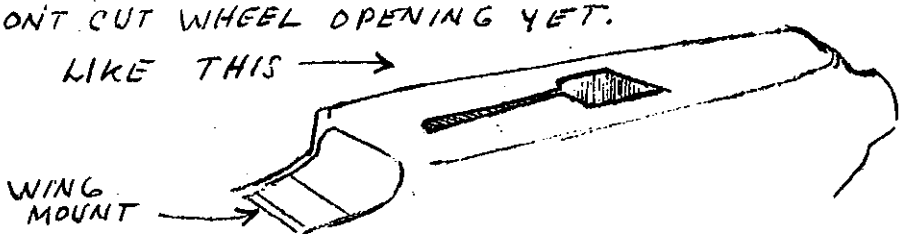
5 MINUTE EPOXY - DEVCON SUGGESTED
MICROBALLOONS - ANY KIND
24 HOUR EPOXY - TAPOX 4-1 OR EQUIV
FIBERGLASS TAPE - 3" WIDE
DRYWALL TAPE 6" WIDE - (SOMETIMES CALLED "GROUT STOP") IT'S A FLAT MESHED FIBERGLASS CLOTH AVAILABLE AT MOST BUILDERS SUPPLY HOUSES.

STEP I START WITH FUSELAGE!

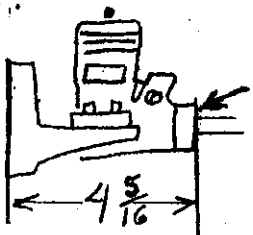
REMOVE THE FORWARD WING MOUNT FROM THE FUSELAGE. YOU CAN NOW REACH INSIDE THE FRONT AREA TO DRILL + MOUNT THE NOSE GEAR. USE A LONG PIECE OF $\frac{1}{8}$" PIANO WIRE SHARPENED TO A POINT AS A DRILL. LIKE THIS 

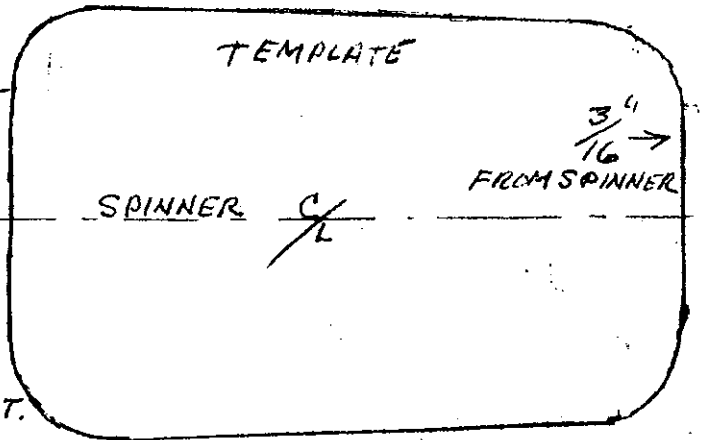
WHEN GEAR IS MOUNTED, MAKE CUTOUT IN FUSELAGE FOR GEAR LEG. DONT CUT WHEEL OPENING YET.

LIKE THIS →



3. MOUNT ENGINE LIKE THIS:
CUT OUT FUSELAGE USING TEMPLATE AS GUIDE.



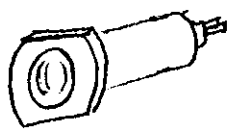


MOUNT ENGINE SQUARE WITH MOUNT. USING DIMENSION SHOWN FOR MOST SPINNERS. ADD APROX $\frac{1}{8}$" FOR GOLDBERG SPINNER. THE FIREWALL IS $4\frac{1}{4}$" FROM THE NOSE. ASSEMBLE ENGINE + MOUNT IN PLACE AND ADD A $\frac{1}{16}$" SPACER BETWEEN SPINNER + THRUST WASHER. LOCATE EVERYTHING WITH HOT-STUFF OR ZAP OR WHATEVER YOU LIKE. LIGHTLY EPOXY MOUNT TO FIREWALL THEN REMOVE SPINNER + ENGINE AND DRILL FIREWALL WITH PIANO WIRE DRILL.

DRILL TWO $\frac{1}{4}$" DIA HOLES IN FIREWALL, CENTERED IN THE MOTOR MOUNT. SPACE THEM FOR FUEL TANK FITTINGS. WE RECOMMEND YOU USE A 16-20 OZ SHAMPOO BOTTLE WITH THE NECK CUTOFF AND A SULLIVAN FITTING INSTALLED.

MAKE A BULK HEAD TO SUPPORT THE REAR OF THE TANK USING $\frac{1}{4}$" THK SOFT BALSA.

LIKE THIS →



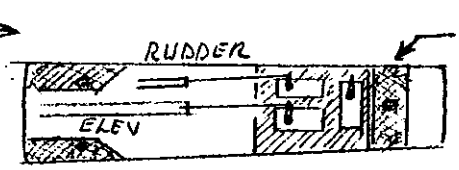
← SLIP FITTINGS THRU FIRE WALL THIS LOCATES TANK SOLIDLY.

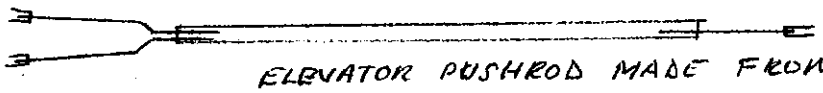
DRILL HOLE FOR THROTTLE LINKAGE USING PIANO WIRE DRILL. THEN INSTALL APROX 12" OF $\frac{1}{8}$" DIA NYLON TUBING AS A LINKAGE GUIDE. LOCATE THE OTHER END OF THE NYLON TUBE IN THE TANK BULKHEAD.

INSTALL THE PLYWOOD WING MOUNT NOW USING EPOXY + CHOPPED FIBERGLASS TAPE.

LOCATE SERVOS + TRAY AS FAR FORWARD AS POSSIBLE.

LIKE THIS →

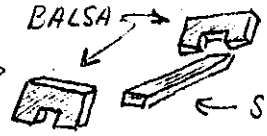




ELEVATOR PUSHROD MADE FROM $\frac{1}{4}$" SPRUCE + $\frac{1}{16}$ PIANO WIRE.

MAKE A HOLD DOWN FOR THE RECIEVER AND LOCATE BEHIND THE SERVOS.

LIKE THIS. →

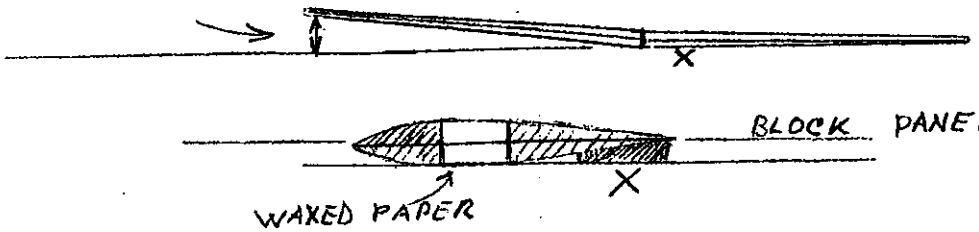


EPOXY PLATES TO FUSELAGE SIDES

WING ASSEMBLY

BLOCK WING ON A FLAT SURFACE AND TRIAL FIT DIHEDRAL

DIHEDRAL IS 3" MEASURED AT TIP BLOCK GLUELINE UNDER ONE TIP.



SPREAD A THIN COAT OF 5 MINUTE EPOXY ON BOTH PANEL JOINTS DO NOT EPOXY SHEETING AROUND SERVO CUTOUT. IT CAN BE ALIGNED AND JOINED AFTERWARD.

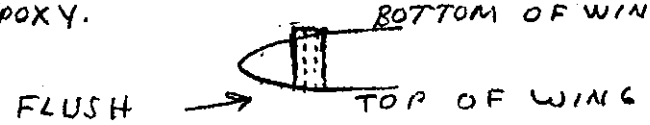
WINGS - CONTINUED

DOUBLE, TRIPLE CHECK PANEL ALIGNMENT AND DIHEDRAL. DO NOT REDUCE DIHEDRAL BY EVEN ¼".

NOW FIT WING TO FUSELAGE. IT SHOULD BE QUITE CLOSE EXCEPT AT L.E. WHERE A LITTLE SANDING ON TOP MAY BE REQUIRED. DRILL A ½" HOLE TO INSTALL FORWARD HOLDOWN BOLT.

USE A PIECE OF SHARPENED ½" BRASS TUBE AND TWIST CAREFULLY MAKE LIKE THIS →

INSTALL THE DRILLED DOWEL IN THE WING USING 5 MINUTE EPOXY.



NOW ADD 3" GLASS CLOTH TO CENTER JOINT OF WING. SQUEEGEE **24 HOUR** EPOXY INTO THE TAPE **THOROUGHLY**, WHILE WARMING EPOXY WITH A HAIR DRYER GUN. THIS ELIMINATES SANDING A LUMPY SEAM LINE.

NEXT ADD THE GLASS CLOTH (DRYWALL TAPE) USING EPOXY RESIN AND SQUEEGEE IN PLACE. OVERLAP APPROX 2" ON C/L. DONT LET IT RUN INTO THE AILERON LINKAGE.

CENTER + FIT WING TO FUSELAGE. MAKE CERTAIN AILERON LINKAGE DOES NOT HIT REAR WING MOUNT BRACE. TRIM BRACE IF NECESSARY.

LOCATE WING AT FORWARD BOLT FIRST. DRILL + TAP ¼ X 20 INTO PLYWOOD PLATE. IF YOU SCREW UP, DRILL PLATE AND INSTALL A "T" NUT.

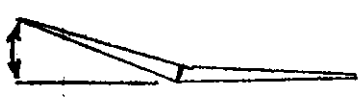
BE PATIENT!

WHEN YOUR SURE THE WING IS CENTERED, DRILL + TAP REAR HOLD DOWNS AND RE-CHECK ALIGNMENTS. THEN BOLT SOLIDLY.

STABILIZER

JOIN STAB HALVES USING 5 MINUTE EPOXY ON EACH HALF.

TIPO 750 - 3½"
TIPO 825 3"

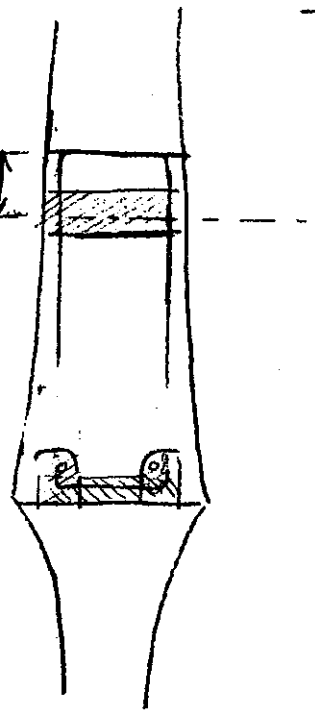


FIT STAB TO FUSELAGE OPENING. ENLARGE CUTOUT AS REQUIRED USING 100 GRIT SANDPAPER AND A SHARP EXACT-O KNIFE. THE FIT MUST BE ABSOLUTELY LOOSE OR YOU WILL DISTORT THE FIN.

LOCATE STAB WITH TINY SPOTS OF HOT STUFF AND SLIVERS OF BALSA. WHEN ALIGNMENT IS PERFECT WITH WING - NOT FIN EPOXY IN PLACE AS DESCRIBED ON "FUSELAGE COMPLETION" SHEET.

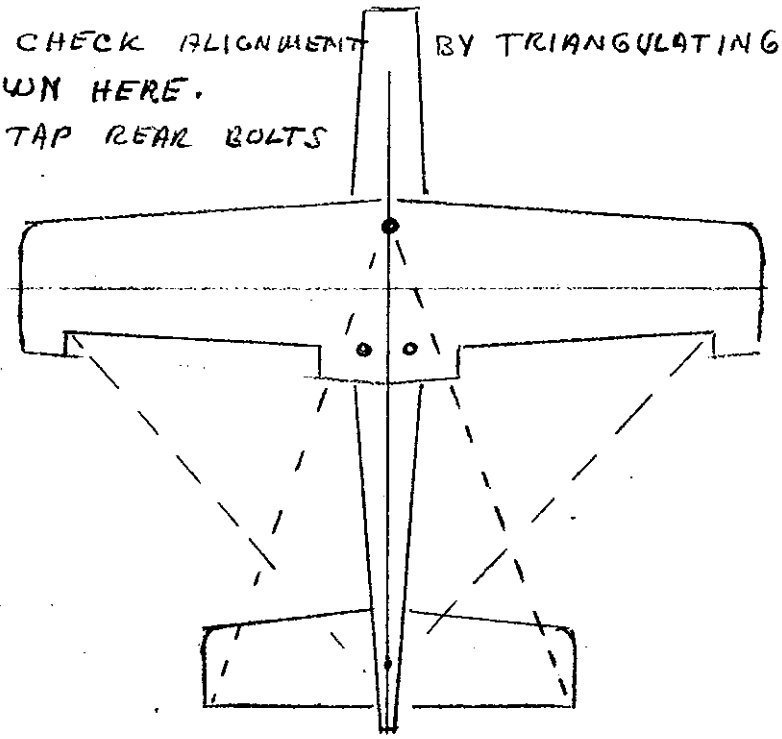
FUSELAGE COMPLETION

MOUNT PLYWOOD PLATES AS SHOWN
FIT CAREFULLY USING MINIMUM QTY'S OF EPOXY AND CHOPPED FIBREGLASS CLOTH. 1/4"



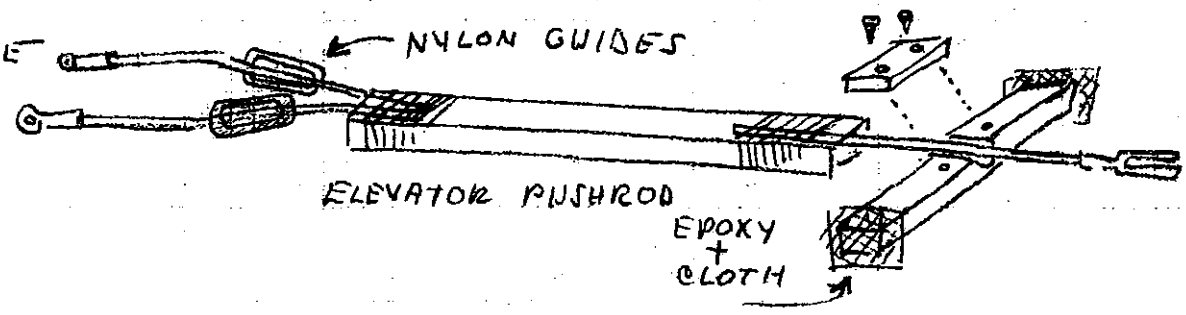
ALIGNMENT

1. CENTER WING EXACTLY AND DRILL + TAP FORWARD BOLT.
2. DOUBLE CHECK ALIGNMENT BY TRIANGULATING AS SHOWN HERE.
3. DRILL + TAP REAR BOLTS



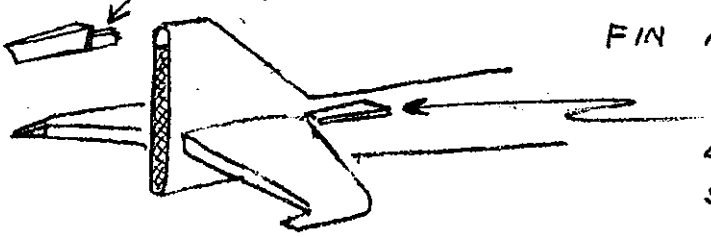
4. WITH WING IN PLACE, LOCATE AND MOUNT STAB ON DATUM LINE. MAKE A TINY EPOXY FILLET INSIDE FUSELAGE AROUND STAB. USE SLOW DRYING EPOXY AND CHOPPED FIBREGLASS CLOTH.
5. INSTALL TAILPOST USING 5 MINUTE EPOXY.
6. MAKE A MINIMUM SIZE FILLET AROUND STAB ON OUTSIDE OF FUSELAGE USING 5 MINUTE EPOXY, MICRO BALLOONS AND A WET FINGER FOR CONTOURING.
7. PUSHRODS SHOULD BE SUPPORTED AT SERVO END AND SHOULD EXIT AT REAR THROUGH LARGE NYLON GUIDES.

EXAMPLE



ADD RUDDER FAIRING LIKE THIS:

CUT END TO FIT

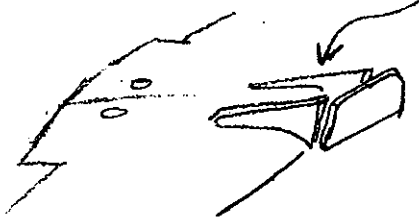


USE RUDDER TAPED IN PLACE AND ALIGNED WITH FIN AS A GUIDE.

STAB BRACE - EPOXY TO FUSELAGE SIDES + STAB L.E.

NOW ADD WING FAIRING PIECES AND SAND TO FIT FUSELAGE

REMOVE WING + FILL CENTER



WITH A VERY COARSE MIX OF RESIN AND MICRO BALLOONS. (PUT CLAY IN BOLT HOLE). OR - CARVE A SOFT BLOCK TO FIT.

DRILL THRU THE RESIN WHEN DRY AND FINISH SAND TO CONTOUR.

RE-INSTALL WING USE A LONG STEEL BOLT FOR FORWARD HOLD DOWN AND NYLON BOLTS AT REAR. CAREFULLY REMOVE REAR BOLTS AND INSTALL PLYWOOD PLATE* USING 5 MINUTE EPOXY ON CENTER OF PLATE AND HOT STUFF EDGES. WHEN DRY, DRILL THRU THE PLATE.

CUT OUT WHEEL WELL SHEETING, INSIDE THE LINES FIRST, THEN FIT YOUR GEAR.

WITH PLANE ASSEMBLED AND WHEELS ON THE GEAR, INSTALL NOSE WHEEL ON STRUT. ALLOW PLANE TO SIT APPROX 1-2° NOSE HIGH. NOT NOSE LOW. THAT DOES NOT WORK AT ALL.

NOW CUT THE WHEEL OPENING FOR THE NOSE WHEEL.

WE HAVE INCLUDED SOME ADDITIONAL INFO WHICH YOU MAY BE INTERESTED IN.

THE C.G. IS CORRECT WHEN THE PLANE JUST BALANCES ON THE MAIN GEAR WITH AN EMPTY TANK.

REFER TO FEB '80 RC MODEL BUILDER FOR FURTHER INFO.**

OH YES, I GOT THE AILERON DIFFERENTIAL INFO BACKWARDS IN THE ARTICLE. IT'S MORE "UP" THAN "DOWN"

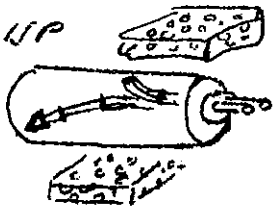
* 825 ONLY

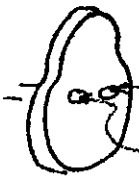
** ORIGINAL TIPO ARTICLE - TRIMMING INFO STILL APPLIES.

ODDS + ENDS

TANK SET UP

16 03 SHAMPOO BOTTLE





USE TWO TUBES AND LOCATE INTO FIREWALL WITH FUEL TUBING.

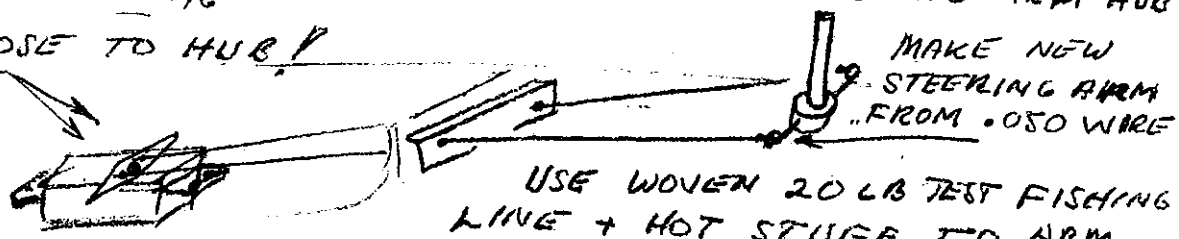
TO CARBURATOR

TO PRESSURE FITTING ON PIPE HEADER.

SPONGE OVER + UNDER TANK.

STEERING:

DRILL 1/16 HOLES ON EITHER SIDE OF SERVO ARM HUB DRILL CLOSE TO HUB!

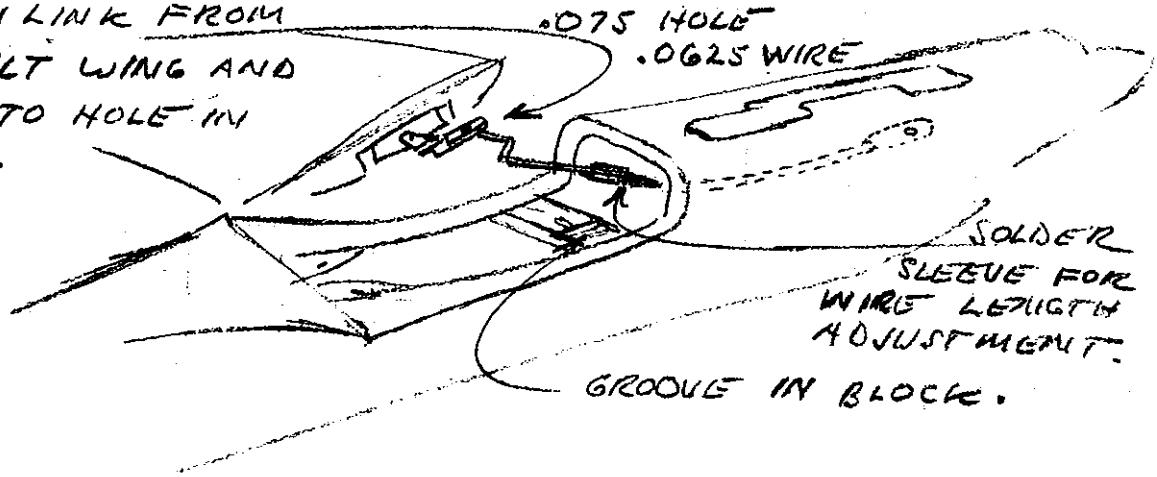


MAKE NEW STEERING ARM FROM .050 WIRE

USE WOVEN 20 LB TEST FISHING LINE + HOT STUFF TO ARM ON ONE SIDE. THEN FEED THROUGH GUIDE, AND BOTH HOLES IN SERVO ARM, THROUGH GUIDE AGAIN AND ATTACH TO OTHER SIDE OF NEW STEERING ARM. WITH GEAR LOCKED "DOWN", PULL LINE TAUT + HOT STUFF THE KNOT. CENTER WHEEL AND PUT A DROP OF HOT STUFF ON THE LINE AT THE SERVO ARM.

RETRACT SETUP

PUT Z BEND IN LINK FROM NOSE GEAR. TILT WING AND SLIP WIRE INTO HOLE IN RETRACT ARM.

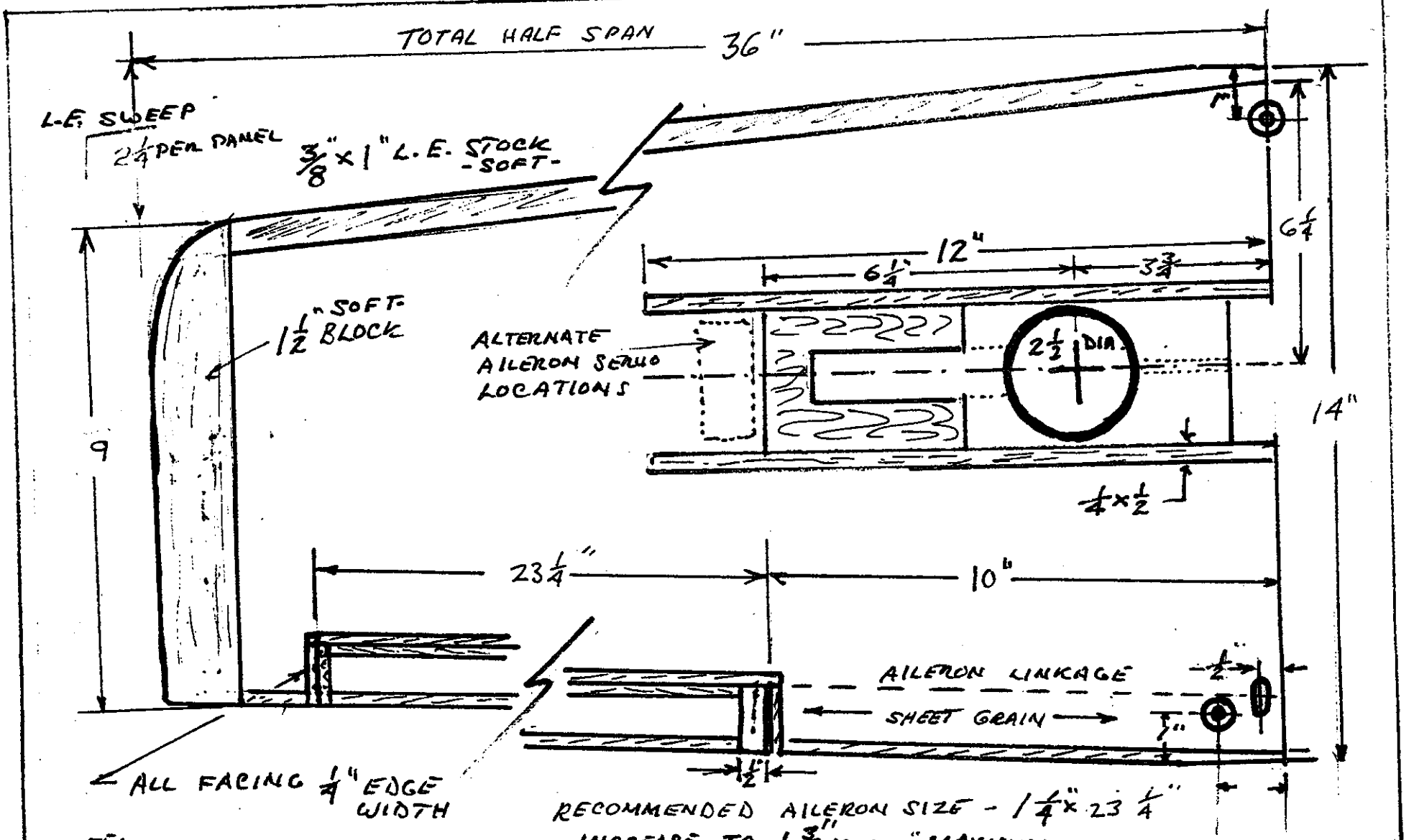


.075 HOLE

.0625 WIRE

SOLDER SLEEVE FOR WIRE LENGTH ADJUSTMENT.

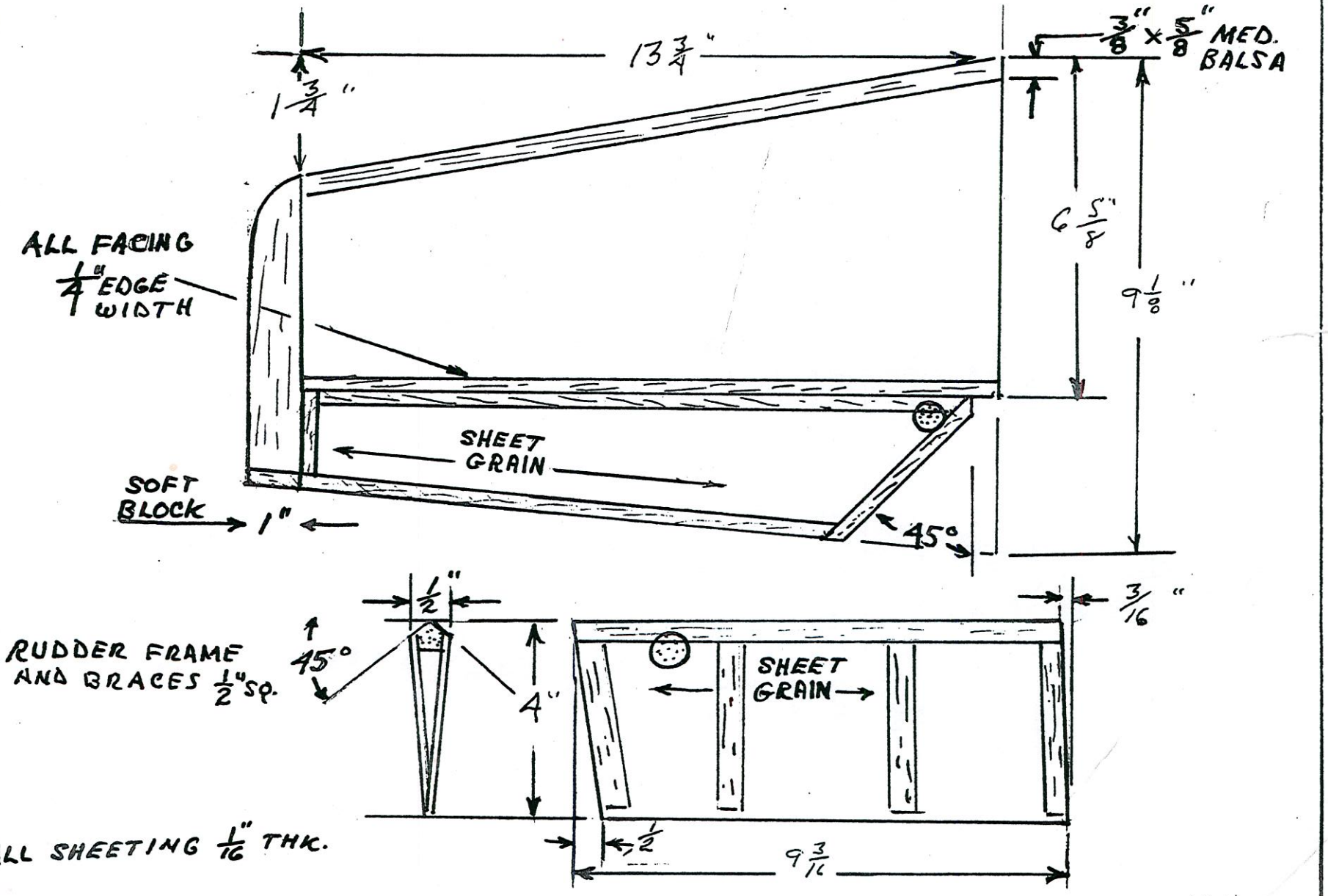
GROOVE IN BLOCK.



NOTE:
USE 1/16" WING SHEETING
APPLIED WITH EPOXY

REV

TIPO 825 "HIPPO"	WING	1-SEPT-83



TIPO 825 "HIPPO"	VERTICAL + HORIZ STAB	1-SEPT-83

TIPORARE

Mfg. by W-K Hobbies
19 N. Main Street
Centerville, OH 45459

BUILDING INSTRUCTIONS

by

Bill Elliott & Dick Hanson

The TIPORARE is a high competition radio-controlled pattern aircraft, designed for both the experienced flyer and the beginner in pattern competition. Because of this, considerable detail is covered in these instructions that may be familiar techniques to the seasoned modeler.

1. Lightly sand the wing cores and vacuum thoroughly. If retractable landing gear is to be installed, cut recesses in bottom of wing cores using the hot wire technique. Figure 1 illustrates how the cutting wire is bent and installed in a Weller-type soldering gun. Thin plywood templates should be used as a guide when cutting. Figure 2 gives dimensions for laying out the wheel wells and plywood gear mount as well as the spars. Use the set of dimensions that apply to the type gear you are using. DO NOT JOIN THE WING CORES AT THIS TIME!

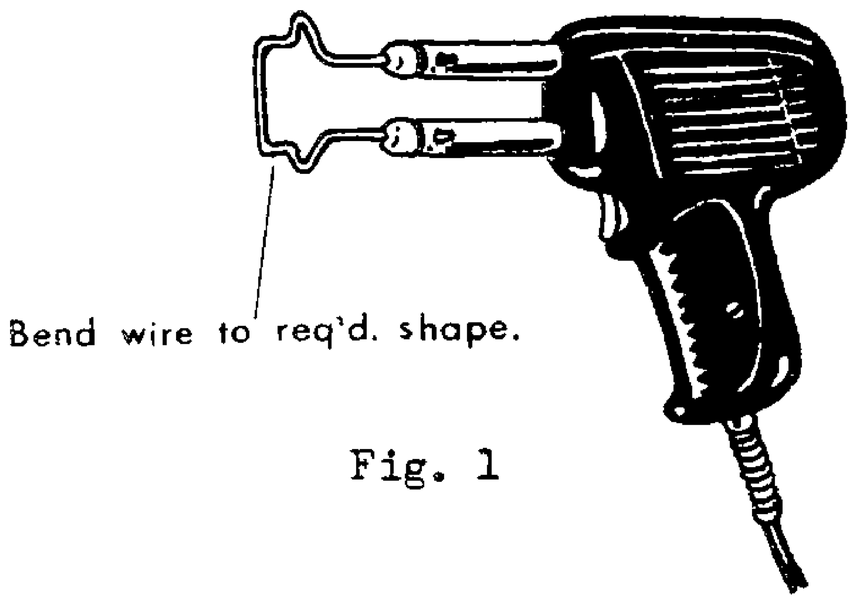


Fig. 1

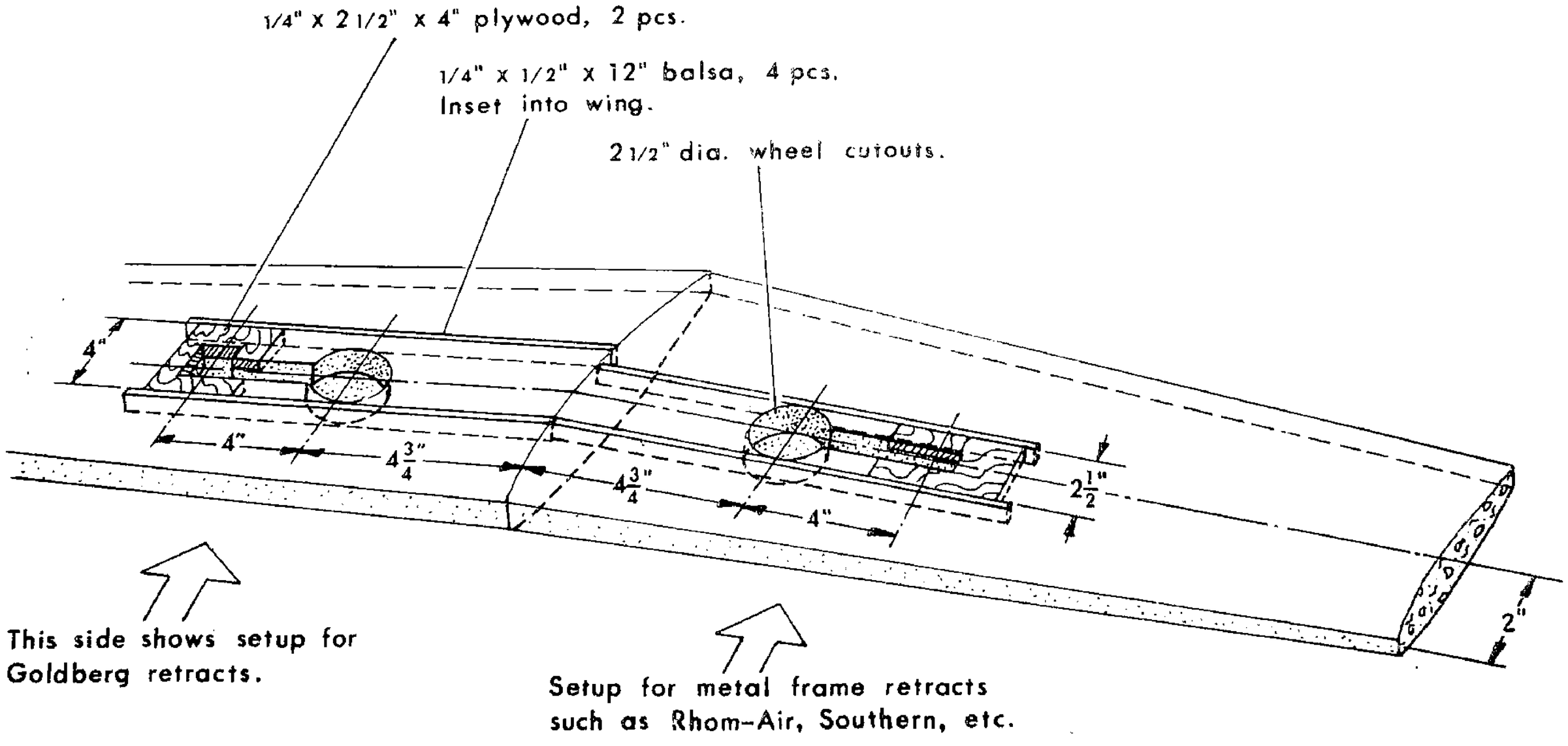


Fig. 2

RETRACTABLE LANDING GEAR INSTALLATION IN WING

2. If fixed gear is planned, cut recess for a 1/2" x 1" x 6" hardwood block into foam wing core. Locate so that main gear leg emerges from wing at same location as retractable gear pivot point. Glue block in place, using slow-drying epoxy.

3. To build the wing, a completely flat work surface is required. Remember that a warp of 1/64" built into the wing will cause undesirable flight characteristics. Select one of the wing cores and lay it in it's foam saddle on the work surface with 1/2" of the trailing edge overhanging. Using shims under the saddle and weights on the core, align the trailing edge until it is perfectly straight. This is illustrated in figure 3.

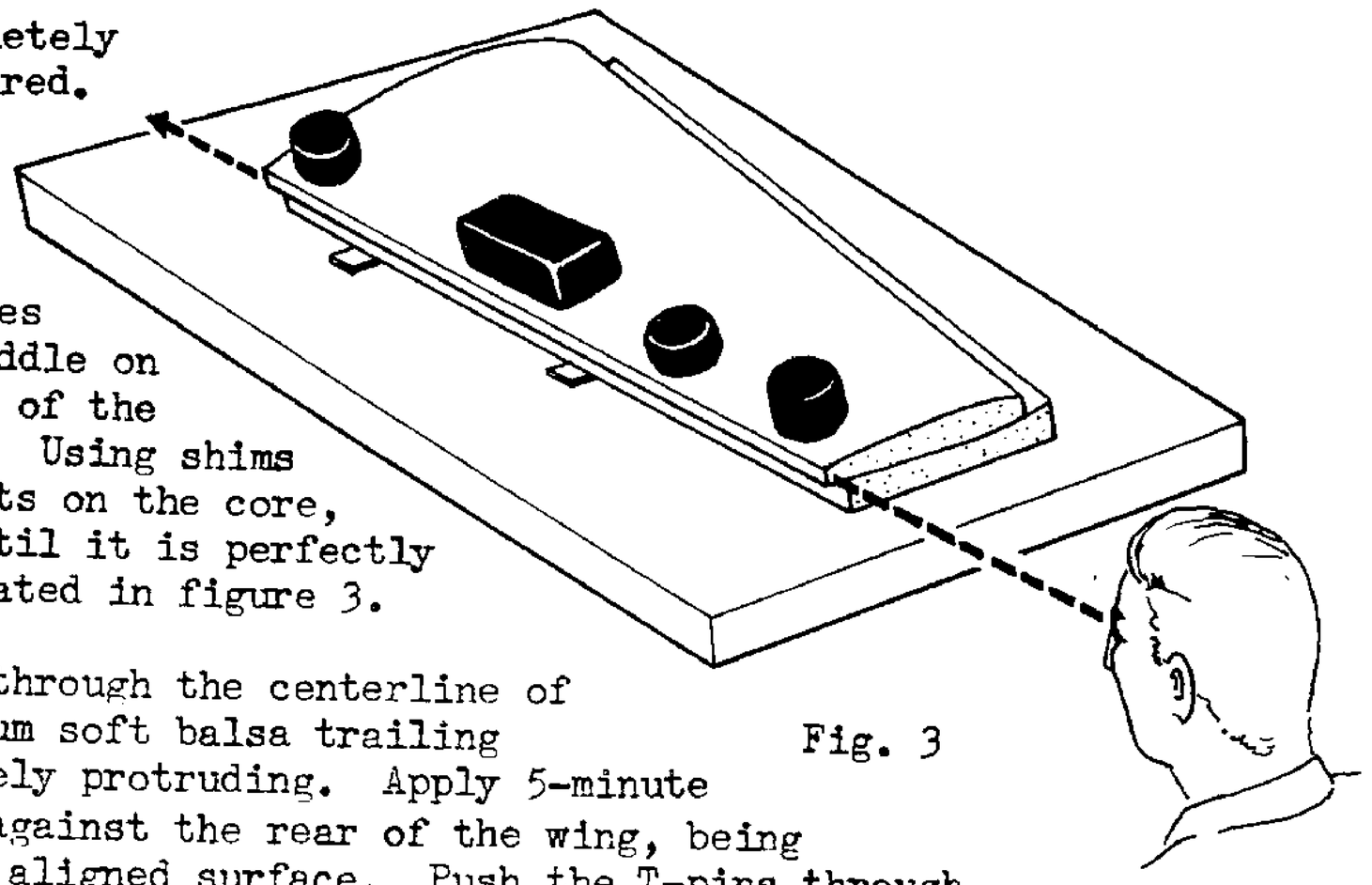


Fig. 3

4. Insert a number of T-pins through the centerline of the 1/4" x 1/2" x 36" medium soft balsa trailing edge with their points barely protruding. Apply 5-minute epoxy and place the balsa against the rear of the wing, being careful not to disturb the aligned surface. Push the T-pins through into the foam to hold the balsa in place as in figure 4. Do not use Hot Stuf in contact with foam as it will disintegrate the foam.

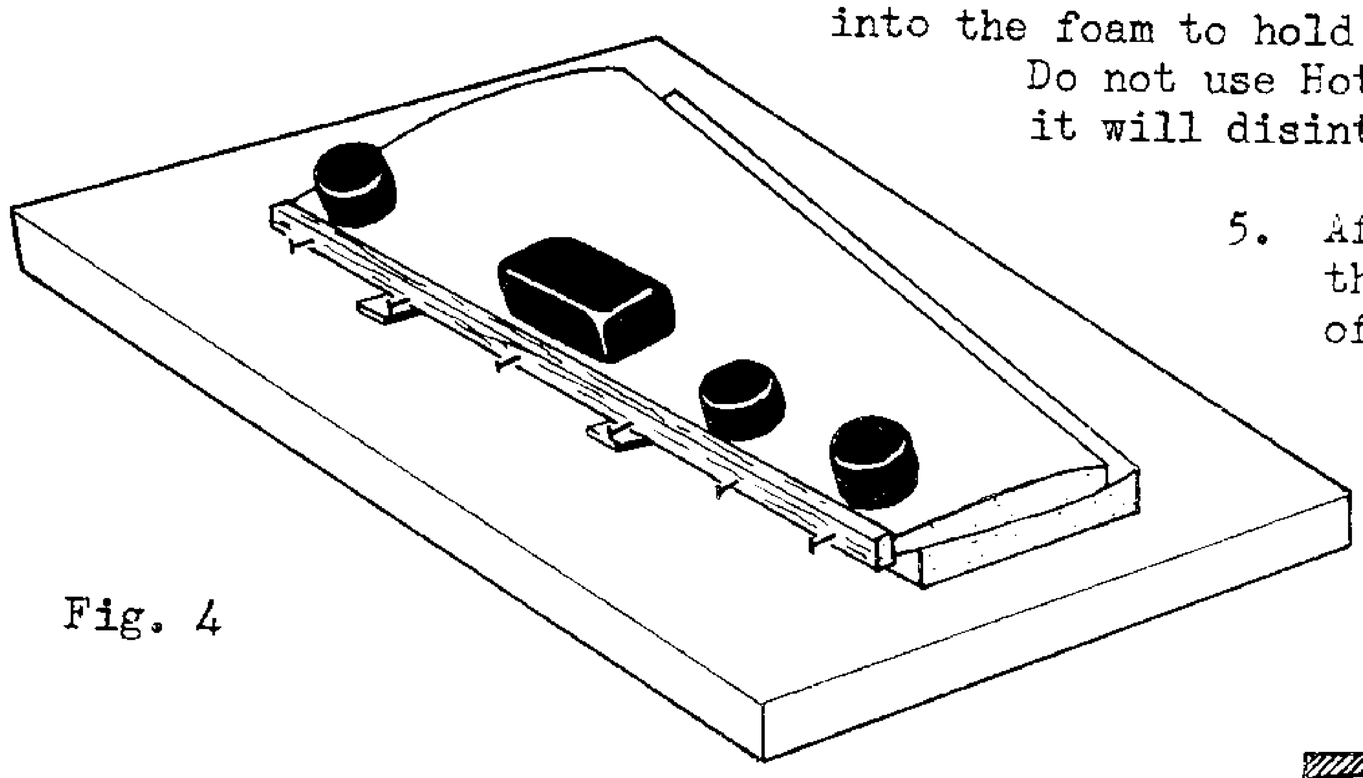


Fig. 4

5. After the epoxy has cured, shape the trailing edge to the contour of the airfoil with a razor plane and sanding block. See figure 5. NOTE: Always use 80 - 150 grit fresh sandpaper on a block 12" to 18" long for all wing shaping.

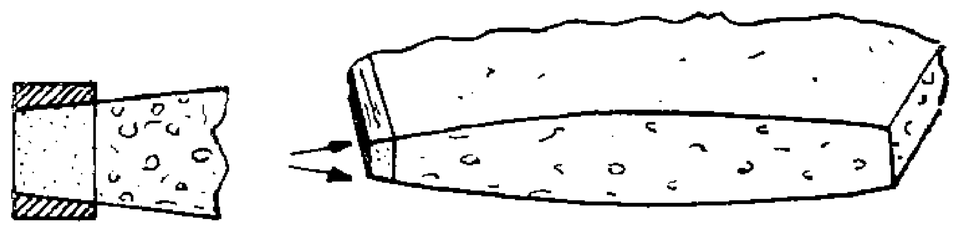


Fig. 5

6. Lay the wing core in the foam saddle back onto the work surface. Glue sufficient pieces of 1/16" thick balsa with Hot Stuf to cover the wing. Use firm wood if the wing finish is to be an iron-on covering. Be sure and match sheeting wood by weight. Use the heavy wood on the left wing panel. Rough cut the sheeting to the outline of the wing. Coat one surface of the core and one surface of the wing sheeting with contact cement. Allow it to dry thoroughly before proceeding further. Note in figure 17 that the grain direction of the wing sheeting is important.

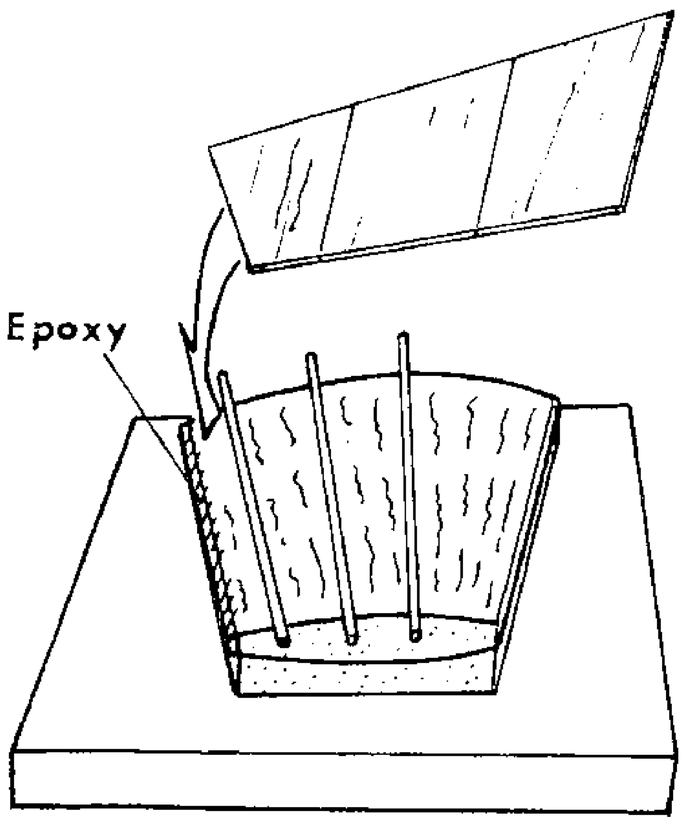


Fig. 6

7. Refer to figure 6 for this step. Lay three 1/4" dia. wood dowels on the top of the wing core as shown. These are to prevent the cement on the sheeting and core from coming into contact before you are ready. Lay a strip of 5-minute epoxy along the trailing edge of the wing. This next step calls for team-work between two people. While one person holds the wing core perfectly flat on the work surface, the other person applies the sheeting to the core, starting at the trailing edge. As the sheeting is being worked forward, the dowels are removed one by one to allow the surfaces to come into contact. Remember that constant pressure to hold the cores flat must be applied during this operation.

8. Apply sheeting to the other side of the wing in this same manner.

9. Lay the wing half back into it's foam saddle and replace it on the work surface. Using your long sanding block, being careful to keep the cutting edge vertical, sand the sheeting even with the edges of the wing core.

10. Epoxy the 3/8" x 1" x 36" balsa leading edge in place and shape as in figure 7.

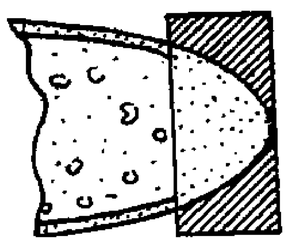


Fig. 7

11. Build the other wing half as in steps 3 through 10.

12. Examine the wing halves carefully. If constructed per instructions, they should be perfectly straight. If somehow, a gremlin has crept in and they are warped, they can be corrected at this stage fairly easily.

A. If leading edge is warped down at tip (or trailing edge is up at tip), slit sheeting on bottom of wing as in figure 8.

B. If leading edge is warped up at tip (or trailing edge is down at tip), slit sheeting on bottom of wing as in figure 9.

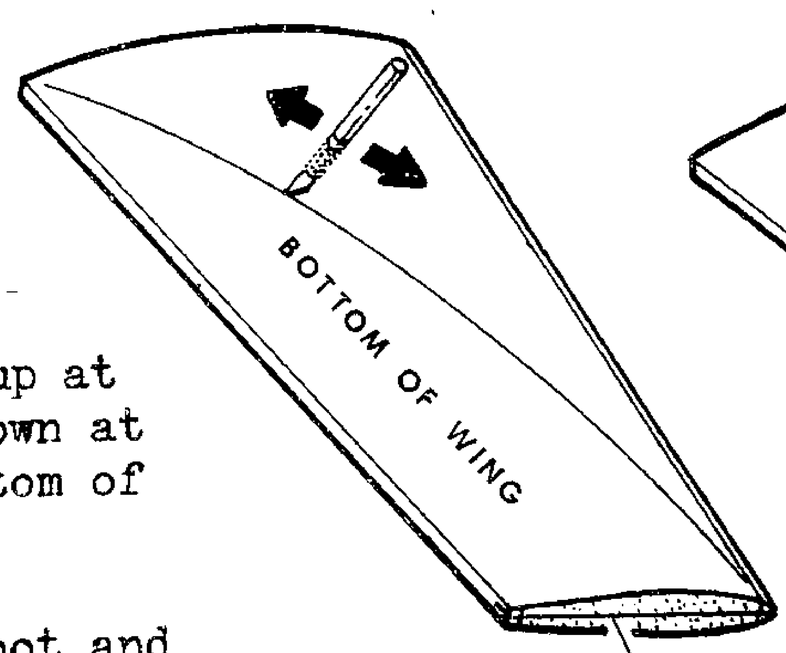


Fig. 8

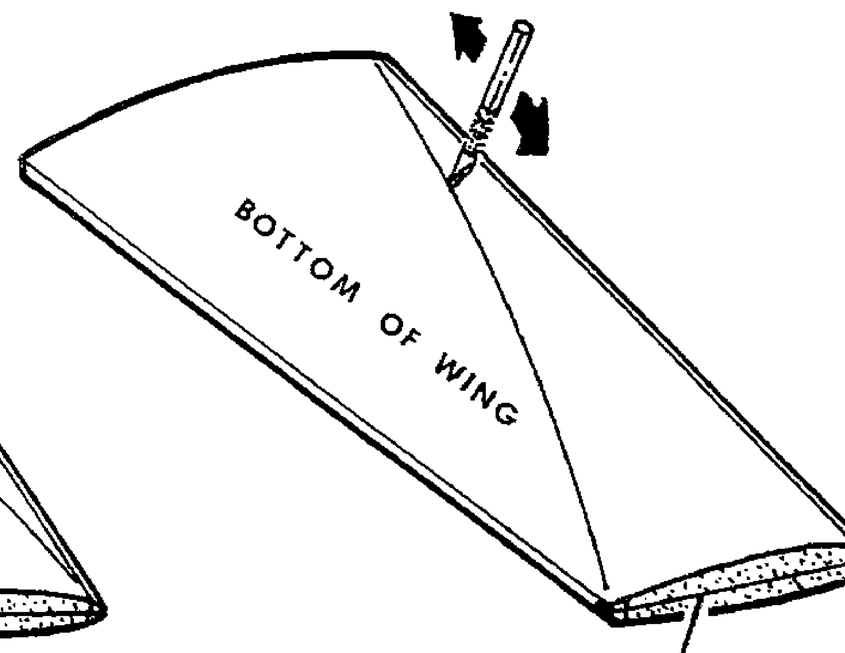


Fig. 9

C. Draw a centerline on the root and tip airfoil. Block and weight wing on your work surface and check with a spirit level until both center-lines are level. Figure 10 illustrates this procedure. When you are satisfied that the wing is straight, squeegee 5-minute epoxy into the slit and let it cure.

13. Block up wing tip for proper dihedral as in figure 11 and sand wing roots to match. Join wing halves using 5-minute epoxy.

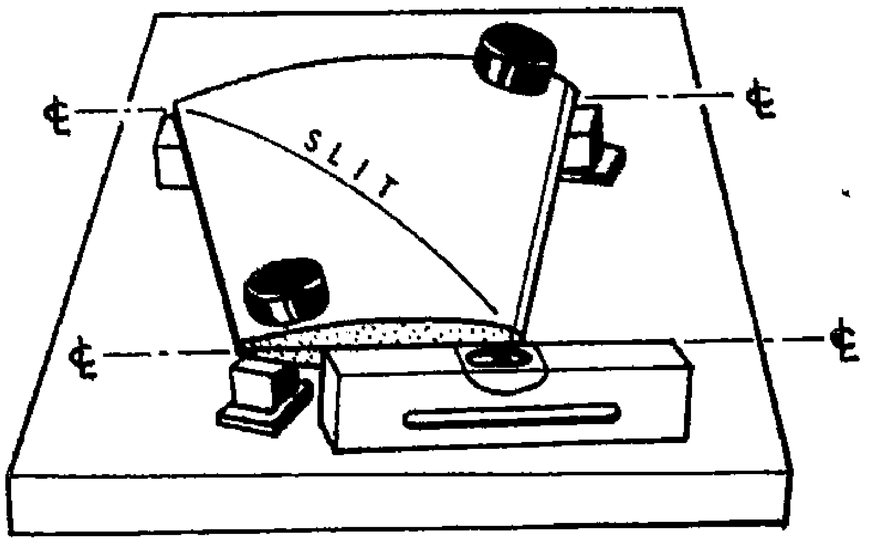


Fig. 10

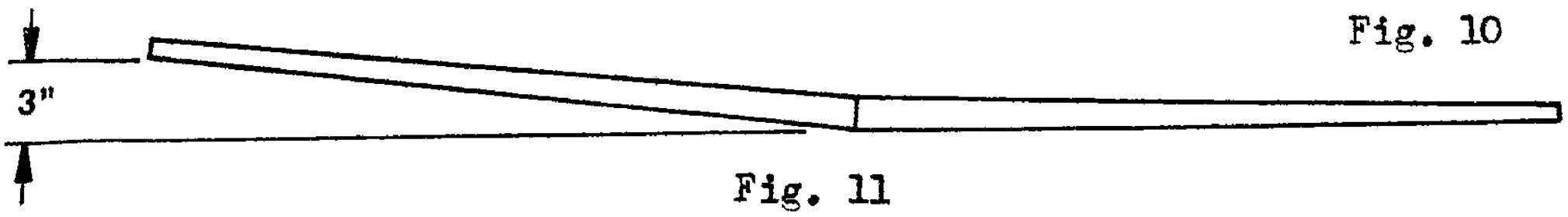


Fig. 11

14. Refer to wing assembly construction drawing (figure 17) and install aileron actuating assemblies. Fabricate ailerons from two 1/4" x 1-1/4" x 20" triangular balsa laminated together. Refer to dimensions given in figure 17 and mark where aileron joins the wing. Cut slots for aileron hinges exactly on centerline of trailing edge. Cut matching slots in ailerons and trial fit, but DO NOT glue in place.

15. If you have not already drawn a centerline on the tip airfoil, do so now. Take a piece of soft balsa, 3/4" x 2" x 10" and also draw a centerline on it. See figure 12. Match centerlines and glue tip block in place as in figure 13. Glue fixed portion of outer trailing edge in place, lining up on tip block centerline. (Figure 14). Sand wingtip block to shape, being careful to taper into centerline (figure 15). Use full scale outline on template drawing to determine wingtip plan shape.

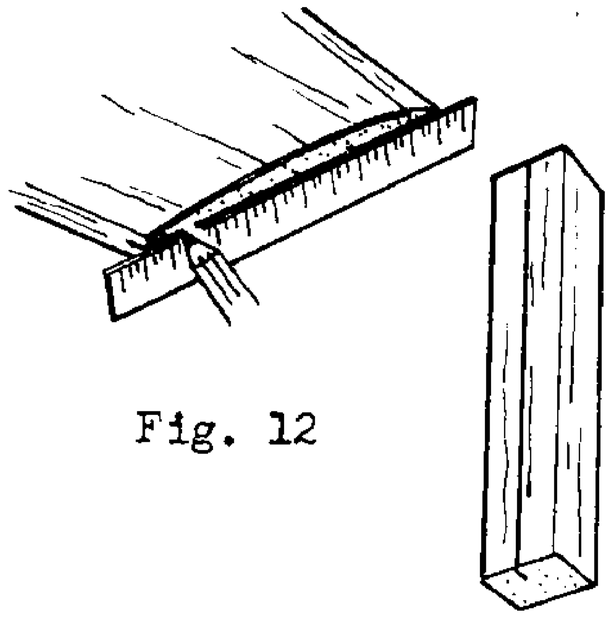


Fig. 12

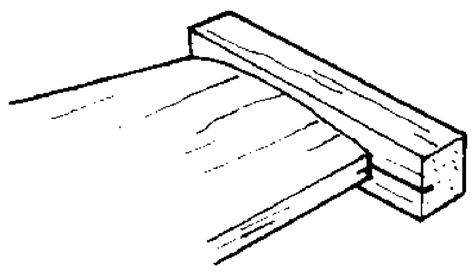


Fig. 13

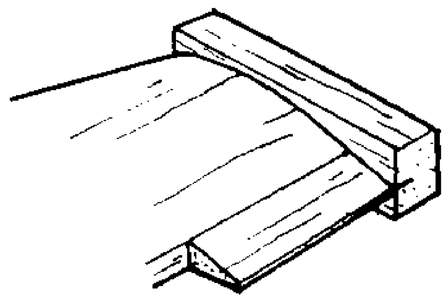


Fig. 14

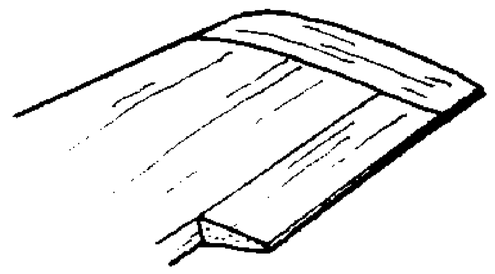


Fig. 15

16. Repeat procedure for other wingtip.

17. Complete center portion of fixed trailing edge, being sure that tips, ailerons and trailing edge are aligned. Remove ailerons and lay them aside.

18. Wrap wing center section with 2" wide glass drywall tape or 6 oz. fiberglas cloth and squeegee 5-minute epoxy through to the wood. After this application has cured, wrap the center section with 6" wide 4 oz. fiberglas cloth and squeegee slow-drying epoxy through to the wood. Lay strips of toilet paper onto the wet epoxy to absorb the excess. Do not allow the toilet paper to remain on the epoxied area. Remove and discard.

19. After the wing center section has cured, if you are using retracts, take a Dremel tool and remove the balsa sheeting from the landing gear openings.

20. Lay aside the wing and lightly sand the stabilizer cores and vacuum. Weight and align the stab in the foam saddle on the work surface as you did the wing in step 3. Attach the 1/4" x 3/8" balsa trailing edge and sand to the airfoil contour as in figure 5. Glue 1/16" balsa sheeting in place using the procedure described in steps 4 through 11. Epoxy the 3/8" x 1/2" leading edge in place, and shape as in figure 7.

21. Mark centerline on tip airfoil, install 1/2" x 3/4" x 5" soft balsa block and shape as shown in figure 16.

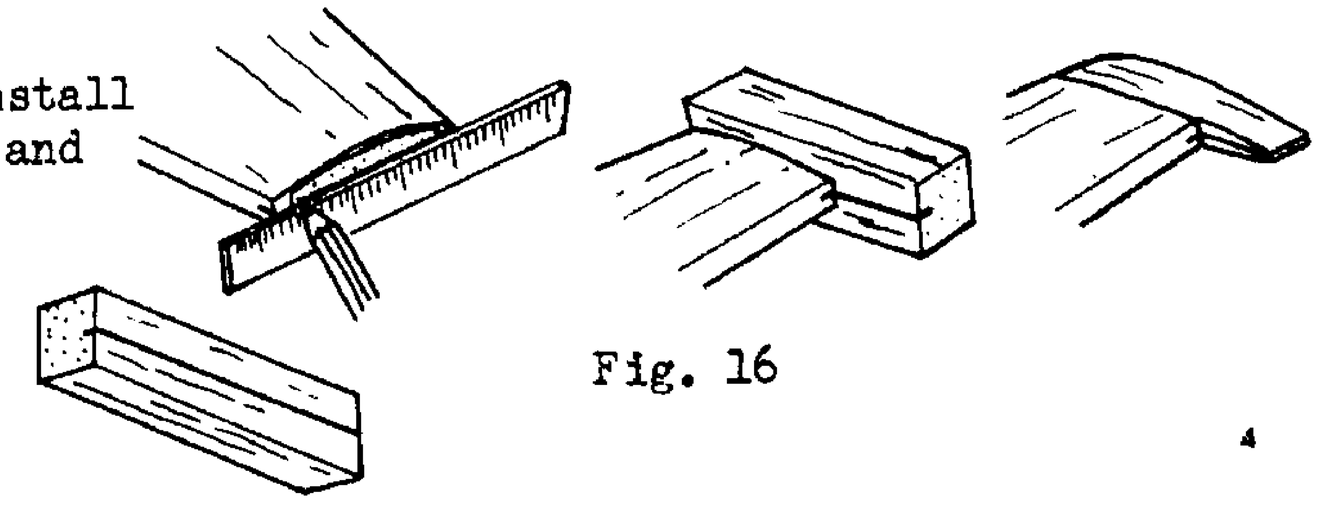
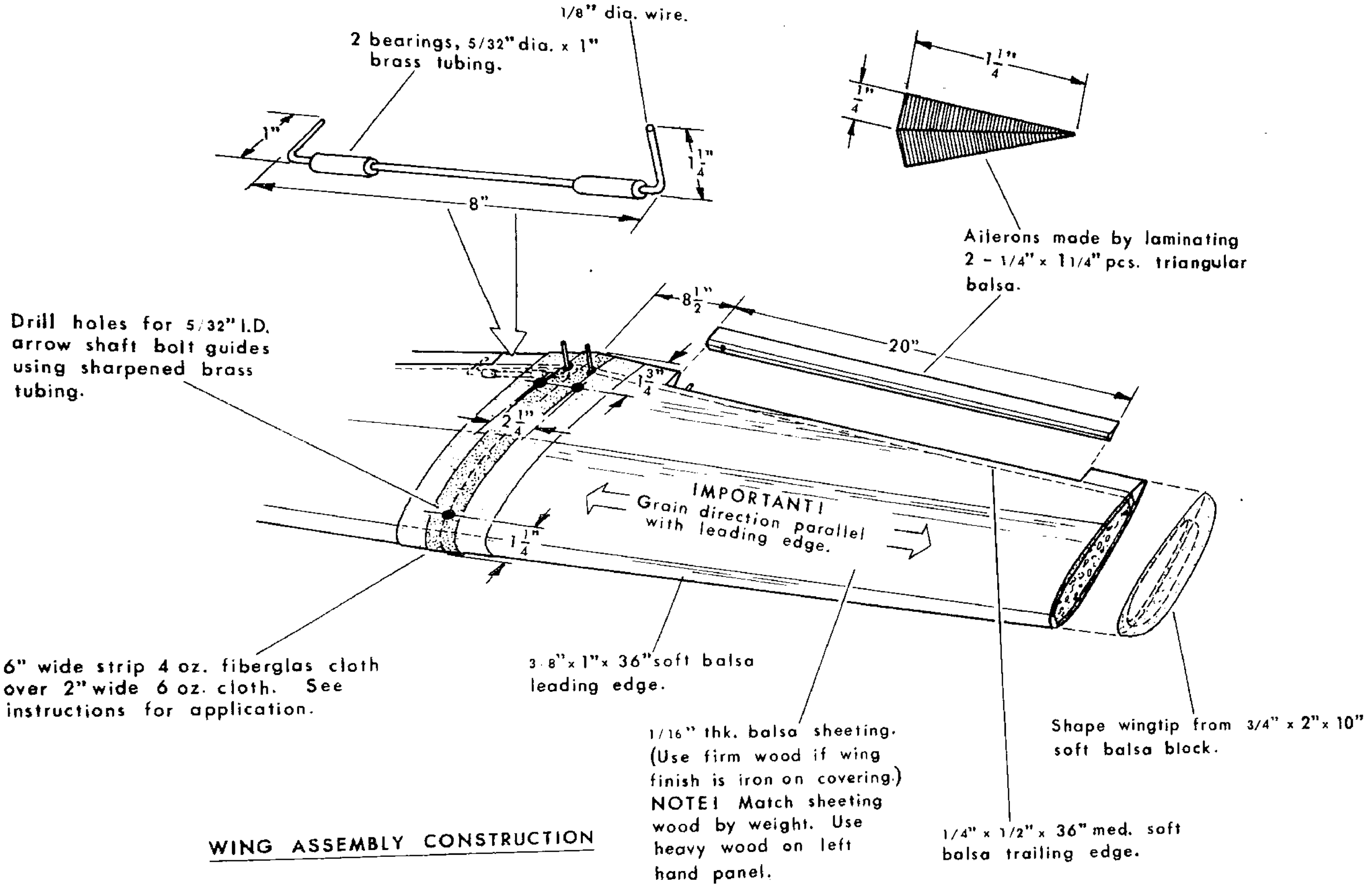


Fig. 16



WING ASSEMBLY CONSTRUCTION

Figure 17

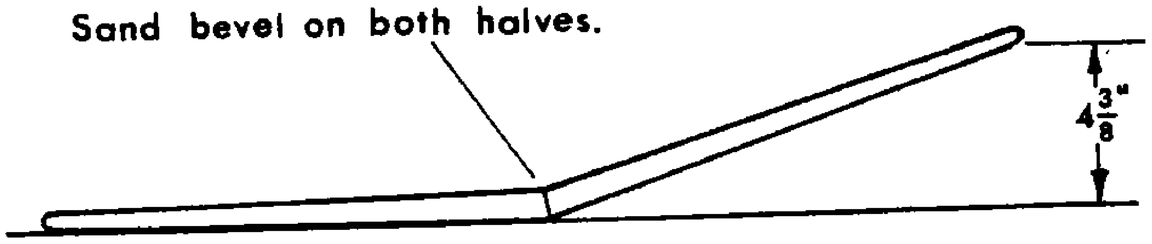


Fig. 18

22. Build other half of stabilizer and join stabs with 5-minute epoxy using anhedral dimension shown in figure 18. Wrap center section of stab with 1" wide strip of 6 oz. fiberglas cloth and squeegee slow-drying epoxy through to wood. Lay stab aside to cure.

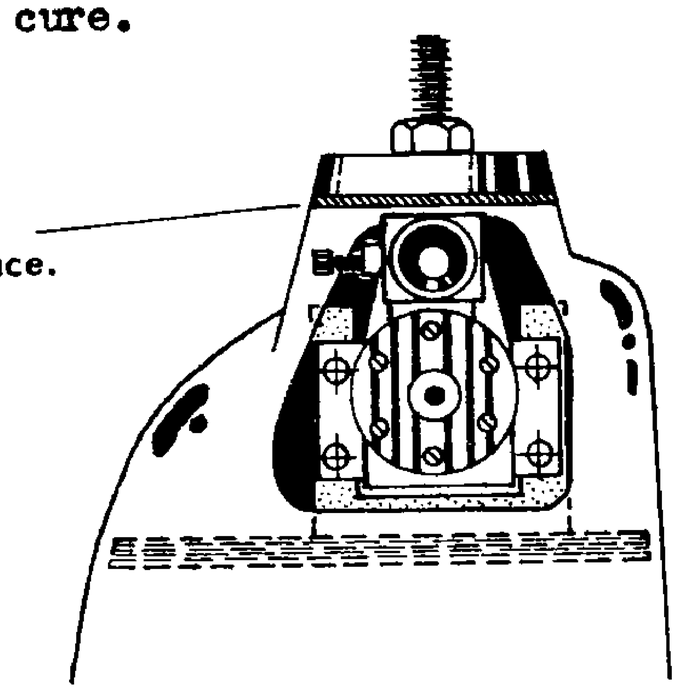


Fig. 19

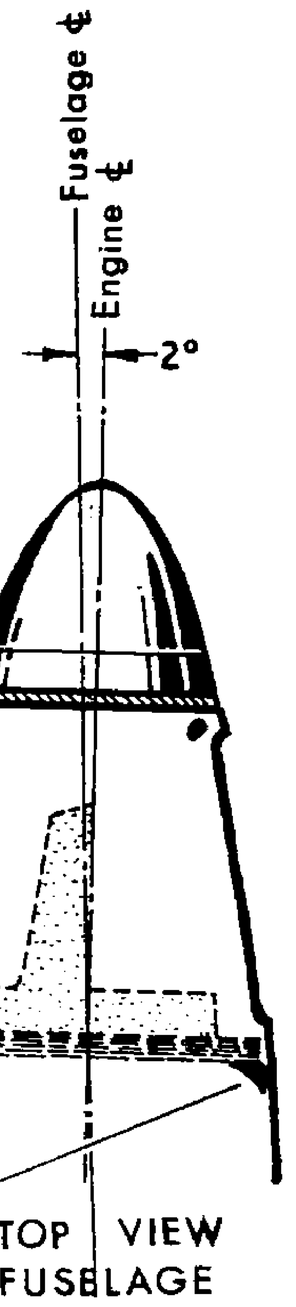


Fig. 20

23. Using a Dremel tool, cut away front side of fuselage to clear engine. Make a 2-1/4" dia. ring from 1/16" thick balsa. Drill a hole through it's center to tightly fit your engine's prop shaft. Mount engine in the motor mount and insert into the engine compartment. Place balsa ring on the prop shaft and tighten the rear plate of a Goldberg 2-1/4" spinner onto it. Hot Stuf the ring sparingly to the fuselage as in figure 19. Coat rear of the motor mount with 5-minute epoxy. Insert firewall through the wing saddle opening and press it against the motor mount. Note that the engine has a 2° offset built in (figure 20). Glue firewall to fuselage at several places with 5-minute epoxy. When cured, remove engine leaving the motor mount in place. Securely glue the firewall to the fuselage with slow-drying epoxy and fiberglas cloth. When the firewall has cured completely, drill holes through the motor mount into the firewall and install mounting bolts and blind nuts.

24. Using the stabilizer cross section shown on the template drawing, trace the outline on the fuselage at the location shown in figure 21, using the alignment marking molded into the fuselage. With a Dremel tool, cut an opening in each side of the fuselage. Note that these openings are slightly larger than the stab to allow for alignment.

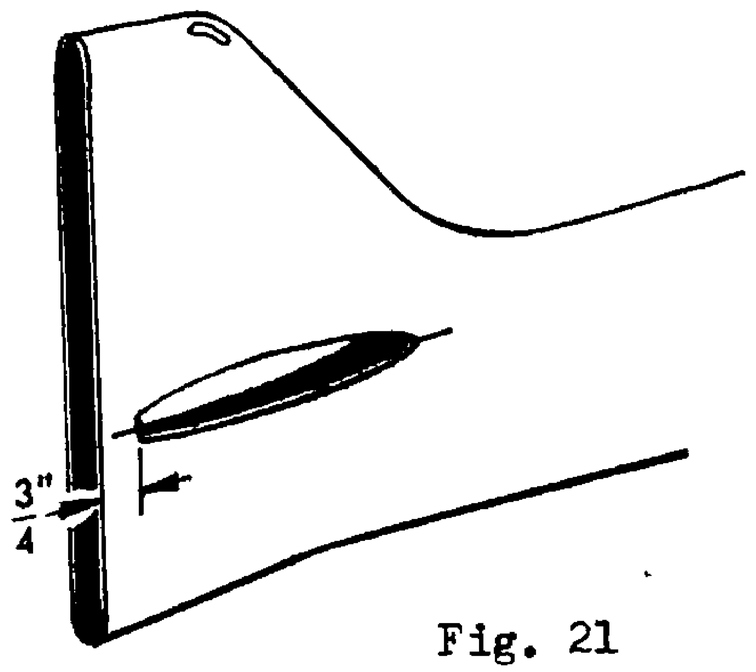


Fig. 21

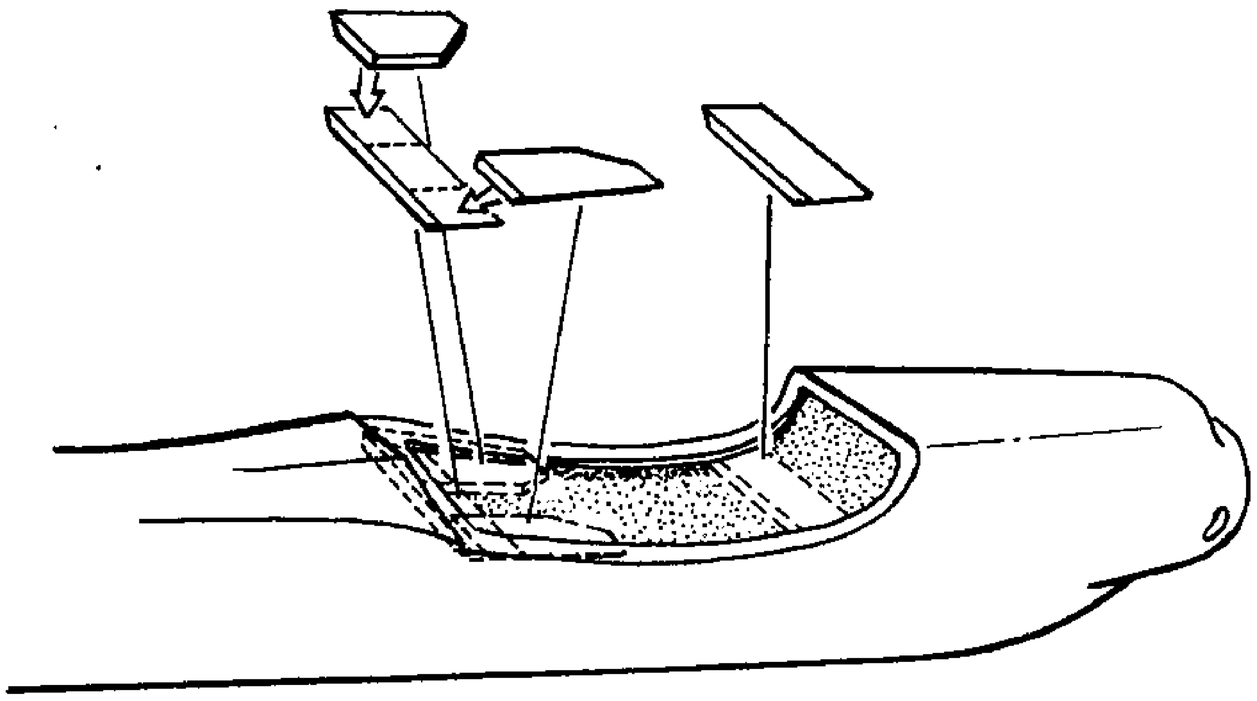


Fig. 22

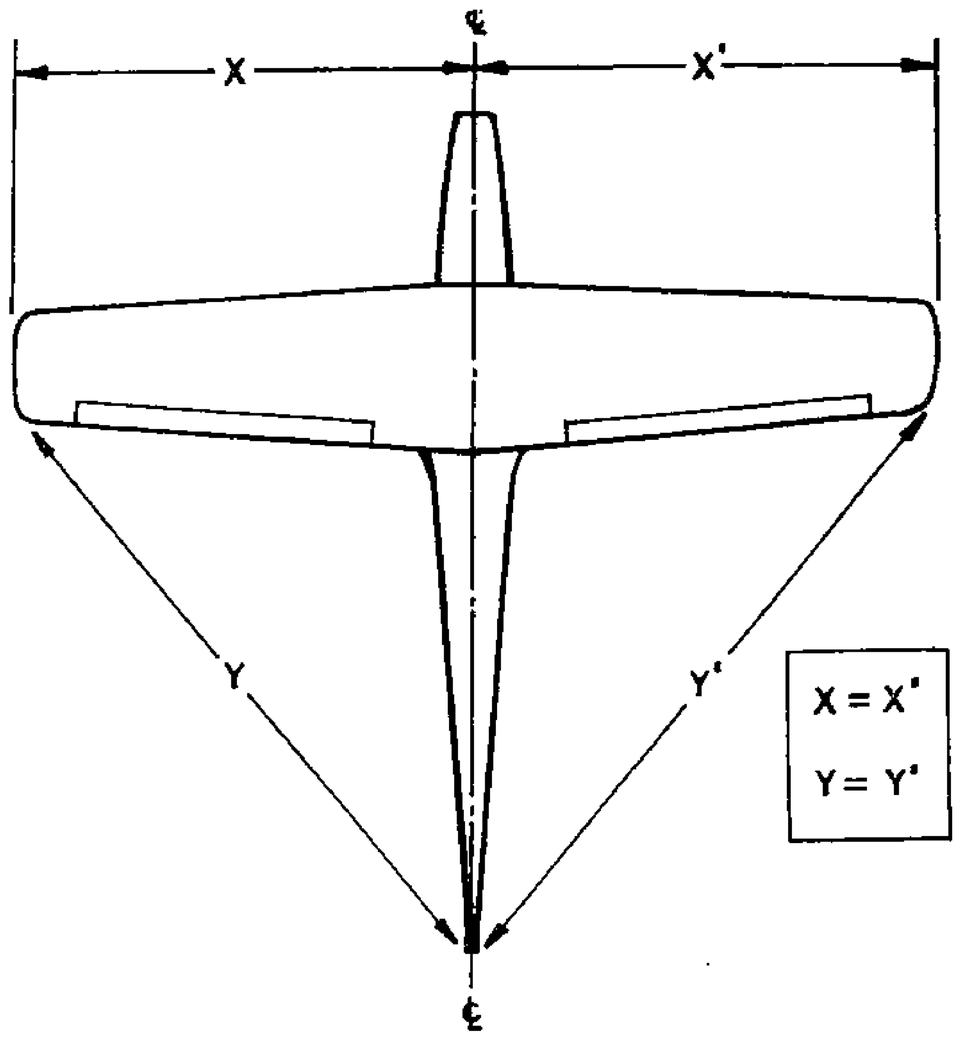


Fig. 23

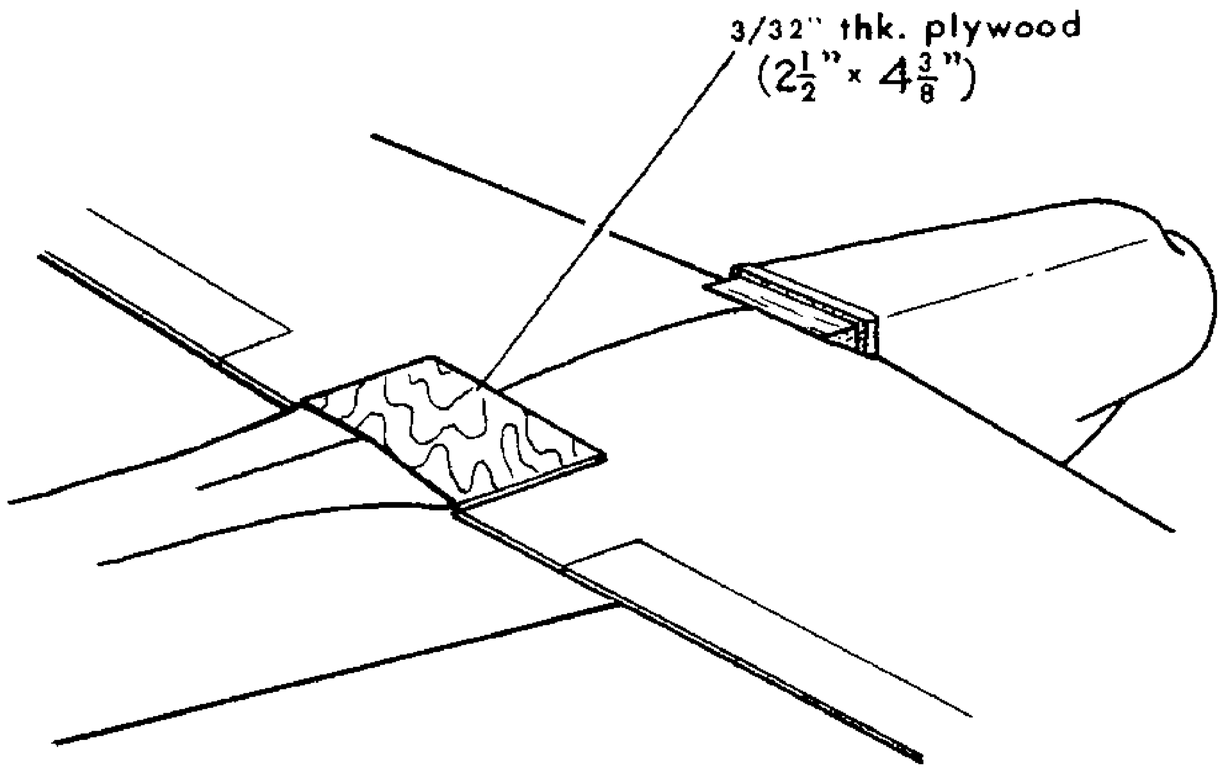


Fig. 24

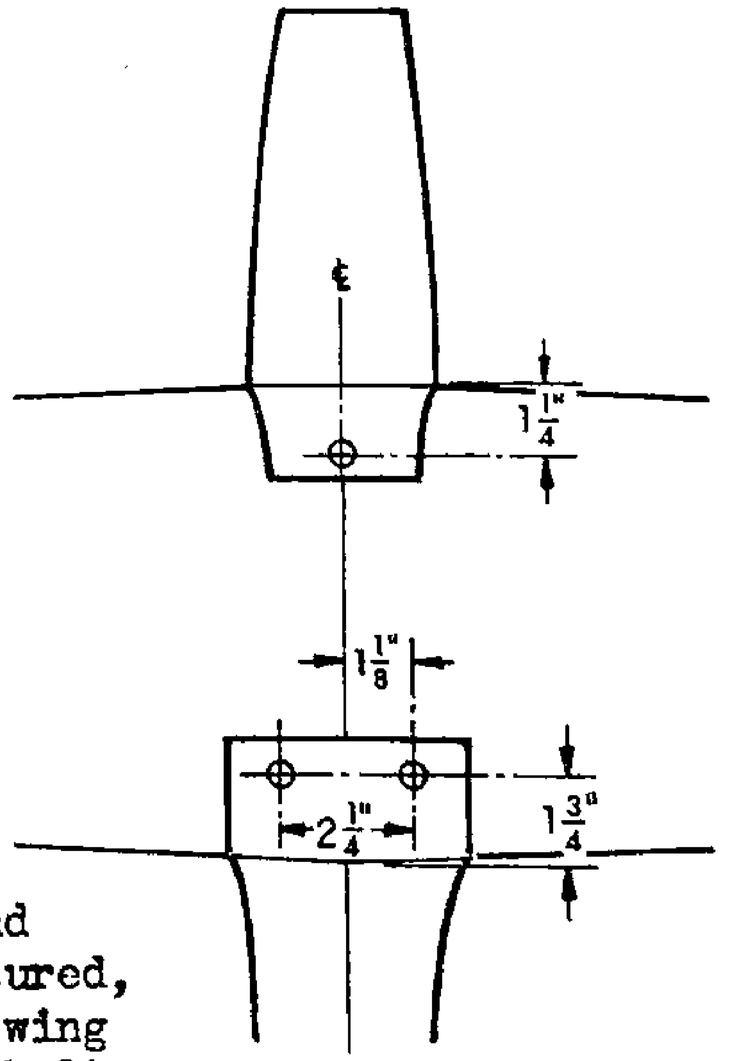


Fig. 25

25. Glue the plywood wing mounting blocks in place with slow-drying epoxy as indicated in figure 22. Lay wing into fuselage saddle and align as in figure 23. Glue fuselage fairings onto wing as in figure 24. Using a mixture of 5-minute epoxy and micro-balloons, build up the front fairing. When cured, sand to contour with fuselage. Check alignment of wing again, then drill holes for 5/32" I.D. arrow shaft bolt guides through wing using sharpened brass tubing. Figure 25 gives location dimensions. Cut bolt guides from fiberglas arrow shafts and epoxy in place. Check alignment a third time, making absolutely sure that it is correct. Drill through bolt guides into plywood wing mounts, tap holes and bolt wing to fuselage using 1/4-20 x 2" long nylon bolts.

26. Slide the stabilizer into the fuselage opening and align it with the wing as shown in figure 26. Spot glue it in place with 5-minute epoxy. When the epoxy has cured, check the stab again to be certain that it is still aligned. If it is, glue securely in place inside the fuselage with slow-drying epoxy. Make a fillet to fair the stab into the fuselage using a mixture of 5-minute epoxy and micro-balloons, working fairly quickly and smoothing the fillet with your finger dipped in water.

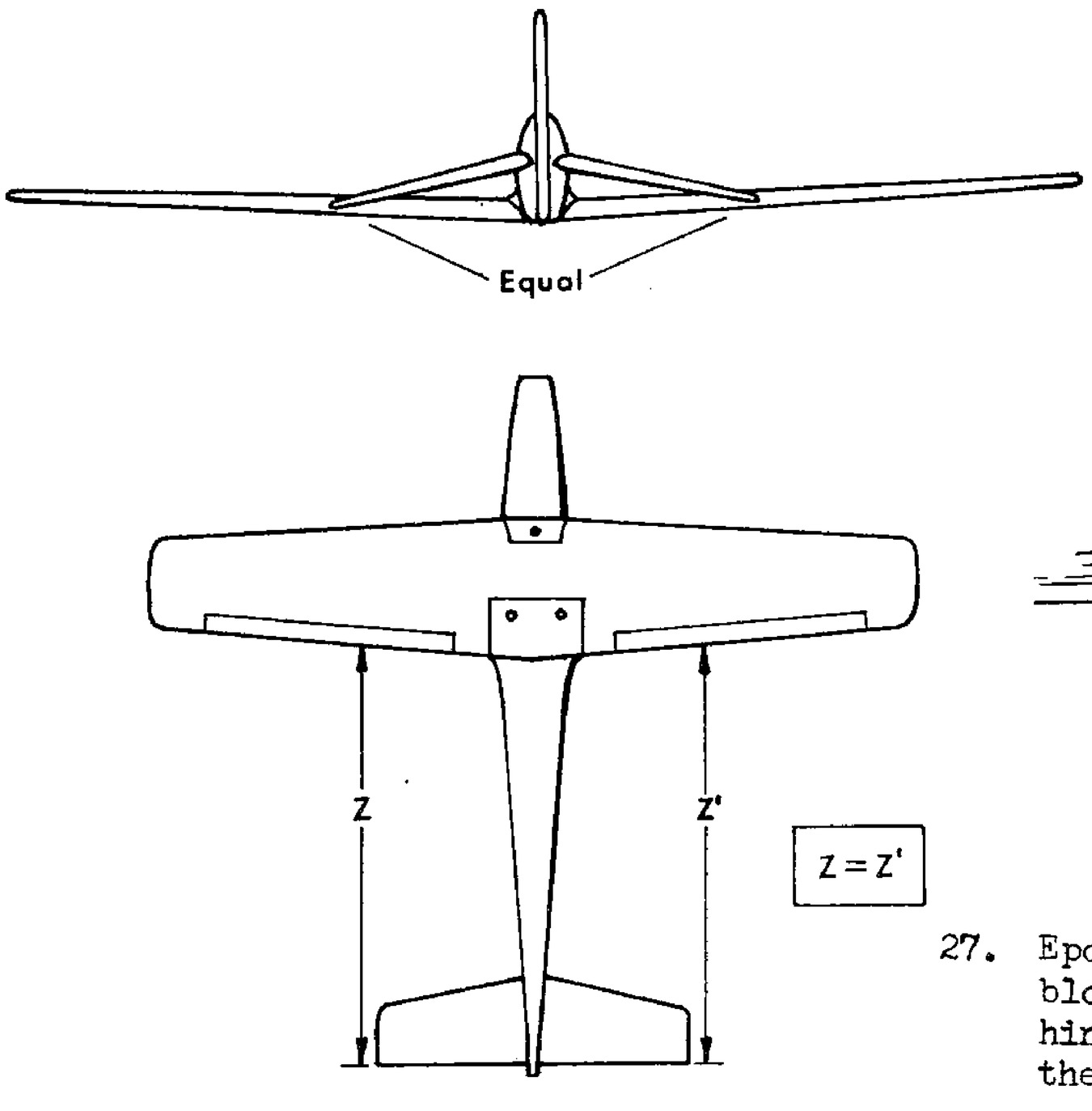


Fig. 26

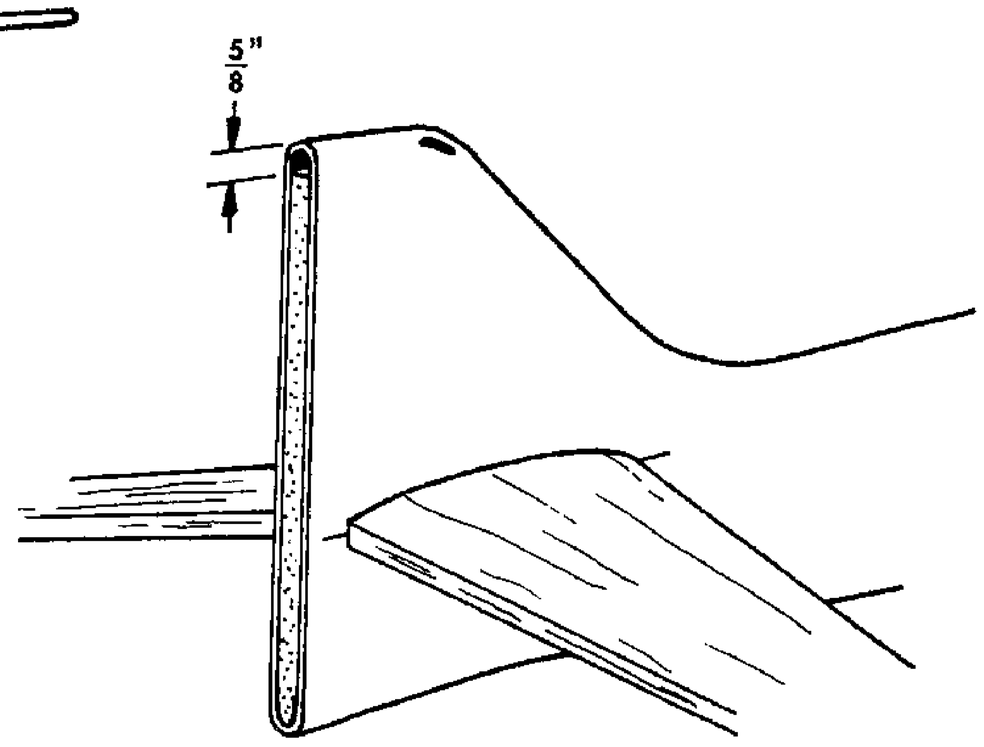


Fig. 27

27. Epoxy a 3/8" x 3/8" medium hard balsa block into the opening at the rudder hinge line, leaving a 5/8" opening at the top for the fin tip (figure 27).

28. Construct the rudder as shown in figure 28 from 1/16" thick balsa and 3/8" square balsa blocks, using the outline on the template drawing as a guide. Bevel the leading edge (figure 29), being careful to locate the centerline. When the rudder is completed, drill a hole and add a 1/2" dia. hardwood dowel at the location shown on the template. Sand the dowel to contour it with the rudder. The purpose of this dowel is explained in step 31.

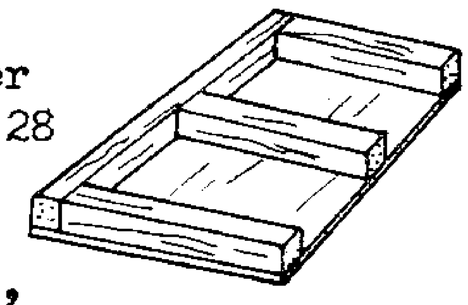


Fig. 28

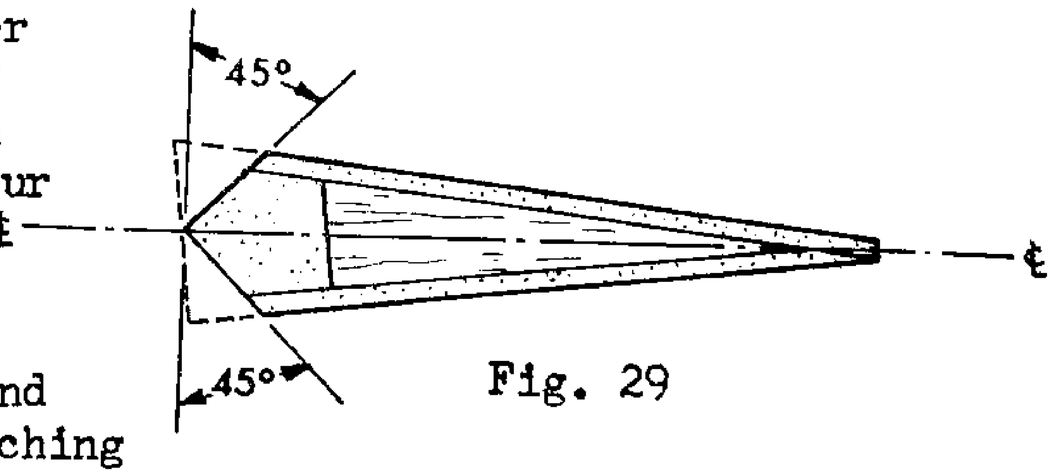


Fig. 29

29. Draw a centerline on the fin hinge line and cut slots for the rudder hinges. Cut matching slots in the rudder. Attach but DO NOT GLUE the rudder to the fin. Sparingly Hot Stuf a 1/4" square balsa piece to each side of the fin to align the rudder in the neutral position. Construct the fin tip by laminating 1/8" thick plywood to 1/2" thick hard balsa and carve to fit inside the fin as shown in figure 30. Glue securely in place and shape fin tip to contour shown on template drawing. Leave rudder and 1/4" sq. pieces temporarily installed to help protect the fin tip during subsequent construction.

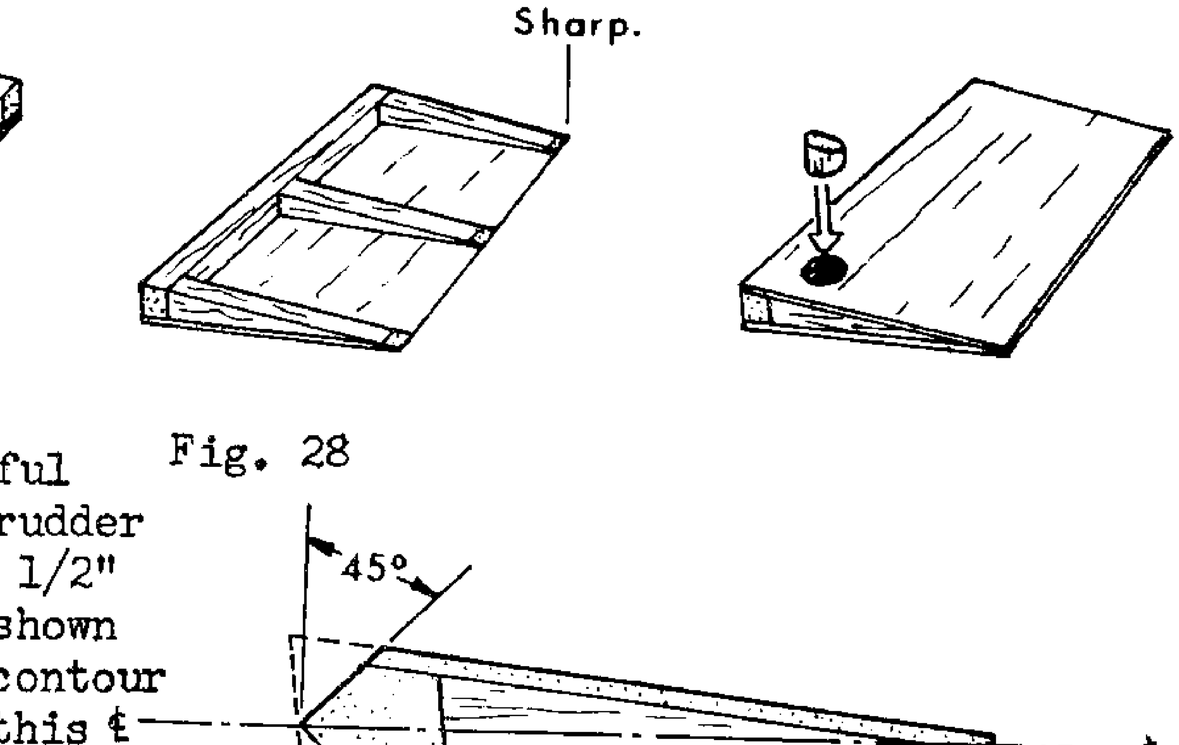


Fig. 30

30. Cut elevators from 1/2" thick balsa using the template on the template drawing. Spot glue them to the rear of the stabilizer and contour to airfoil shape, using a razor plane and sanding block. Place tape on the stab sheeting to prevent gouging (figure 31). Be careful to maintain centerline on elevator trailing edge.

Fig. 31

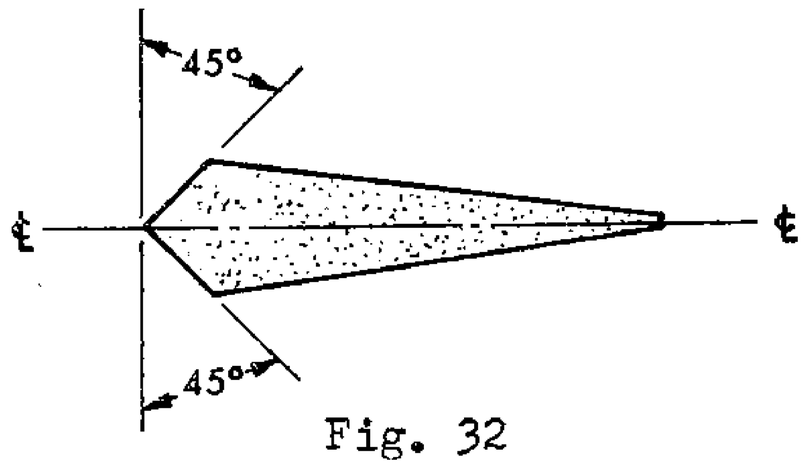


Fig. 32

31. Cut elevators away from stab and bevel the leading edges (figure 32). Drill holes and install 1/2" dia hardwood dowels in elevators at locations shown on template and figure 33. Sand dowels to contour of elevator. Drill and tap a hole into each dowel to accomodate a 4-40 bolt. As shown in figure 34, the bolt head is then removed to accept a standard Rocket City aileron clevis. This same procedure is used on the rudder.

Fig. 33

32. Hinge, but DO NOT GLUE the elevators to the stab. You may remove the 1/4" square balsa pieces from the fin at this time.

33. Glue in place the plywood fuel tank floor. Drill holes for fuel tubing. Install fuel tank. Reinstall the engine. Mount retractable landing gears and servo tray. Install all control linkages. Check for smooth and non-binding operation.

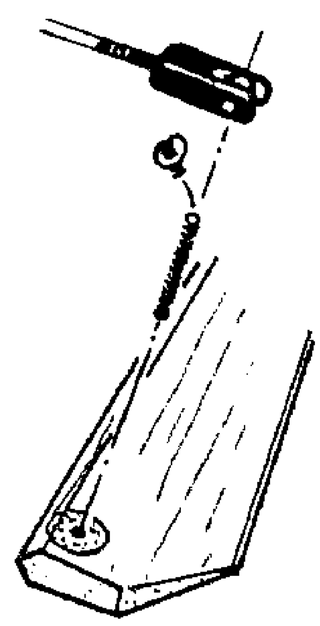


Fig. 34

34. Remove all equipment and control surfaces from the airframe and prepare for finishing. Sand exterior of the fuselage thoroughly. Fill and sand seam where necessary. Fill all surface blemishes with a body filler such as Snow White or Black Magic. Brush on two coats of Hobby Poxy primer to wood surfaces, sanding well after each coat. In order to keep the plane as light as possible, you might want to consider finishing the flying surfaces with an iron-on film covering. We recommend Econocote because of it's low heat sealing characteristics.

35. Permanently install the control surfaces. They should fit tightly (without binding) to insure minimal air flow or "leakage" through the hinge gap. Recommended control surface movement is as follows:

Ailerons - 3/8" total travel on high rate.
Elevators - 3/4" total travel on high rate.
Rudder - 3" total travel on high rate. Reduce 75% for low rate.

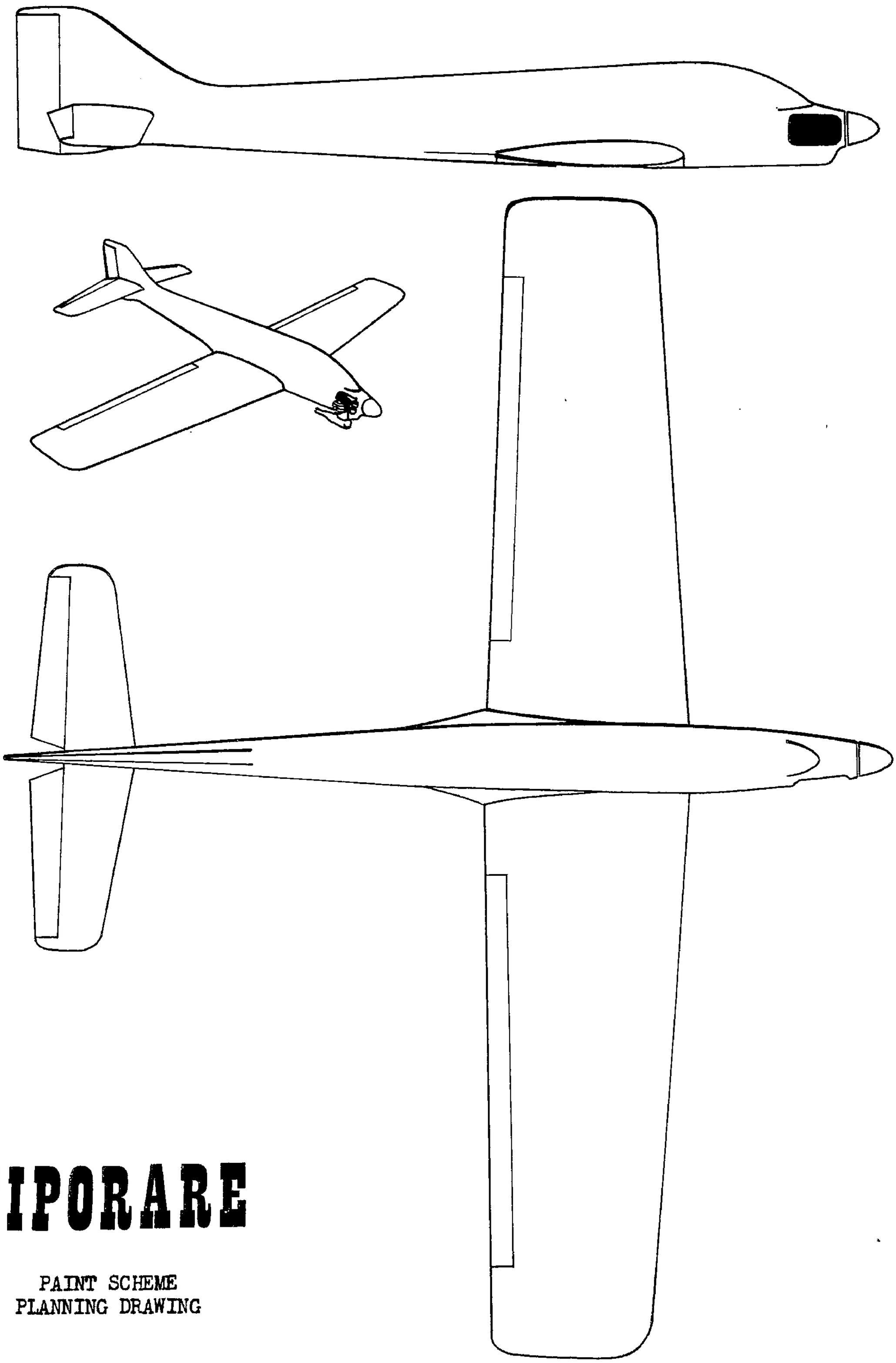
NOTE: If more than 1/8" of elevator "up" trim is required, shim trailing edge of wing down. Do not trim ailerons down or up more than 1/16", because doing so will adversely affect the performance of the airplane. It is advisable to seal all hinge lines after painting the airplane with "Fas-cal", "Sticky-cote" or a very flexible tape.

36. Clean the fuselage thoroughly with thinner before painting. After using a tack rag to wipe down the entire airplane, apply the paint scheme of your choice. Note that included with these instructions are 10 sheets of illustrations of the TIPORARE to be used in planning your paint scheme.

37. After painting, reinstall the equipment and check the center of gravity. We recommend that you start with it 3/8" to 1/2" forward of the landing gear centerline. You may then adjust it to your personal preference. Check lateral balance. Add weight to the wing tip to adjust.

38. FLYING INFORMATION: If you use a tuned pipe, sling it under the fuselage for best results with the anhedral stab. Lower or raise the pipe for trimming rudder pitch problems. Use a dual rate elevator and ailerons radio for best wide speed variation performance. Use the largest diameter and flattest pitch propeller that you feel is suitable to your engine. Try a 11-1/2" x 7 cut to 11-1/4" or a 12" x 6 cut to 11-1/2" to make the engine turn fast and run cool. The TIPORARE flies best at moderate speed. Do not use soft props or thin hub propellers. They don't pull well and will occasionally come apart.

39. Clear a space on your mantle for additional trophies.



TIPORARE

PAINT SCHEME
PLANNING DRAWING