PROPELLER AND SPINNER INSTALLATION

Propellers are a long lead time and an expensive item. There are a number of reputable prop manufacturers that cater to homebuilders. My personal preference has been Ted's Custom Props of Snohomish, Washington and the diameter/pitch combinations listed here assume that they are Ted's propellers. For A-75 and A-80 engines use a 62 inch diameter 65 inch pitch prop. For A-65, C-75 and C-85 engines use a 62 inch diameter 68 inch pitch propeller. Be sure to specify the type of bolt pattern required; SAE-0 for tapered shaft engines or SAE-1 for flanged shaft engines.

The Adventure uses a 12 3/4 inch diameter spinner which is about 16 inches long. This spinner is manufactured by Ken Brock Manufacturing and comes equipped with all mounting hardware installed which insures proper alignment. A rear bulkhead and a forward stablizing disc are used. You will need to cut the spinner dome to fit your propeller shank. This should be done carefully to allow only 1/8 inch clearance between the spinner and prop. Be sure to align the holes in the spinner back plate, propeller, and spinner dome before locating the cut outs in the dome.

Ted's propellers are usually 3 3/4 inches thick at the hub. Allowing for the thickness of the prop hub front plate (P/N 3991) and spinner bulkheads, AN6H-46A prop bolts should be the correct grip length. You should check the thickness of your individual components before ordering bolts.

A wooden prop uses its center hole (2.250 diameter) to locate the prop on the crankshaft. The propeller bolts only provide clamping pressure between the prop flange and the propeller. Proper torque on the attach bolts is vitally important. For a typical 3 3/4 birch prop hub the prop bolts should be tightened until barely snug then in 1/4 turn increments each bolt should be tightened 5/8 to 3/4 of a turn. Don't tighten bolts individually. Tighten all bolts 1/4 turn, then to 1/2 turn, and then to the final 5/8 to 3/4 turn so that none of the bolts is ever more than 1/4 turn looser or tighter than the other five. This procedure provides about 170 inch-lbs of torque on the prop bolts.

The prop and spinner assembly goes together in the following sequence as you move from the engine prop flange forward: engine flange, rear spinner, bulkhead, propeller hub, spinner front disc and last, the prop hub front plate.

Install the spinner or full spinner/prop assembly on the engine for the cowling buildup.

NOTE: The Adventure prototype was constructed and operated without any propeller shaft extension. This configuration is the lightest and cheapest but dictates that the cowling cheeks be somewhat bluff. Adding a four to six inch long prop extension would allow a more pleasing contour up forward and cause about $150 increase in cost. There is no known reason not to use an extension if you want to do so. The weight penalty is about 5 pounds.

COWLING

Prefabricated cowlings are very expensive, normally $250 to $300, heavy and generally don't fit as well as a "home grown" cowl. Therefore, no prefab cowls are being offered for Adventure. The basic bill of materials provides for glass and epoxy to make a cowl as well as the Camloc fasteners for it.

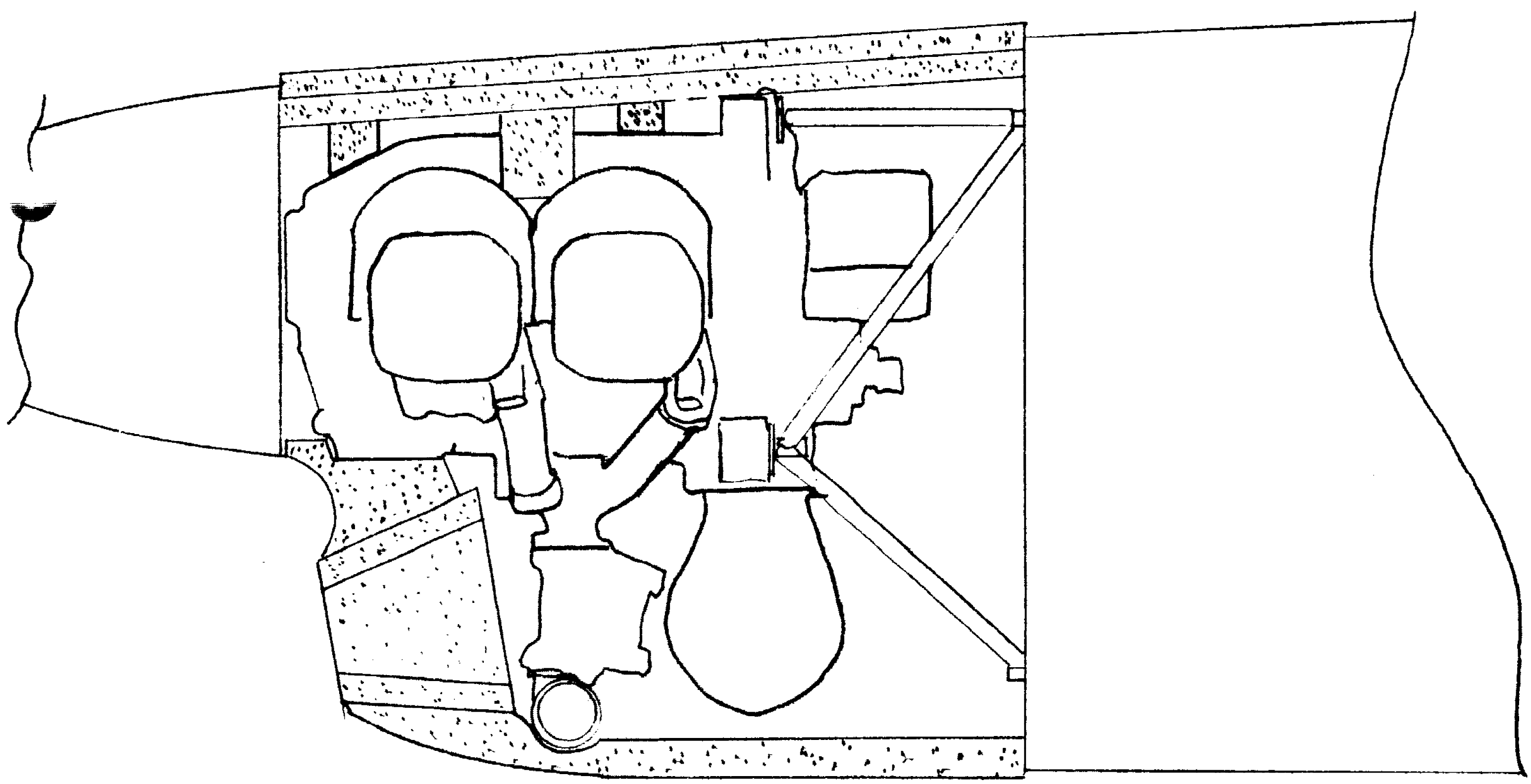
The cowling sequence is simple enough, cover the engine with blocks and strips of foam, carve to shape, glass, then remove the foam plug and install fasteners. The contours of the cowling are noncritical except in the cooling air inlet and outlet. With the exception of these areas you can exercise your artistic urges without much risk. Adhere to the inlet and outlet configuration as closely as possible to insure proper cooling.

Start the cowl buildup process by protecting the engine from dust contamination. Cover the carburetor air manifold openings with a Baggie and tape it in place.

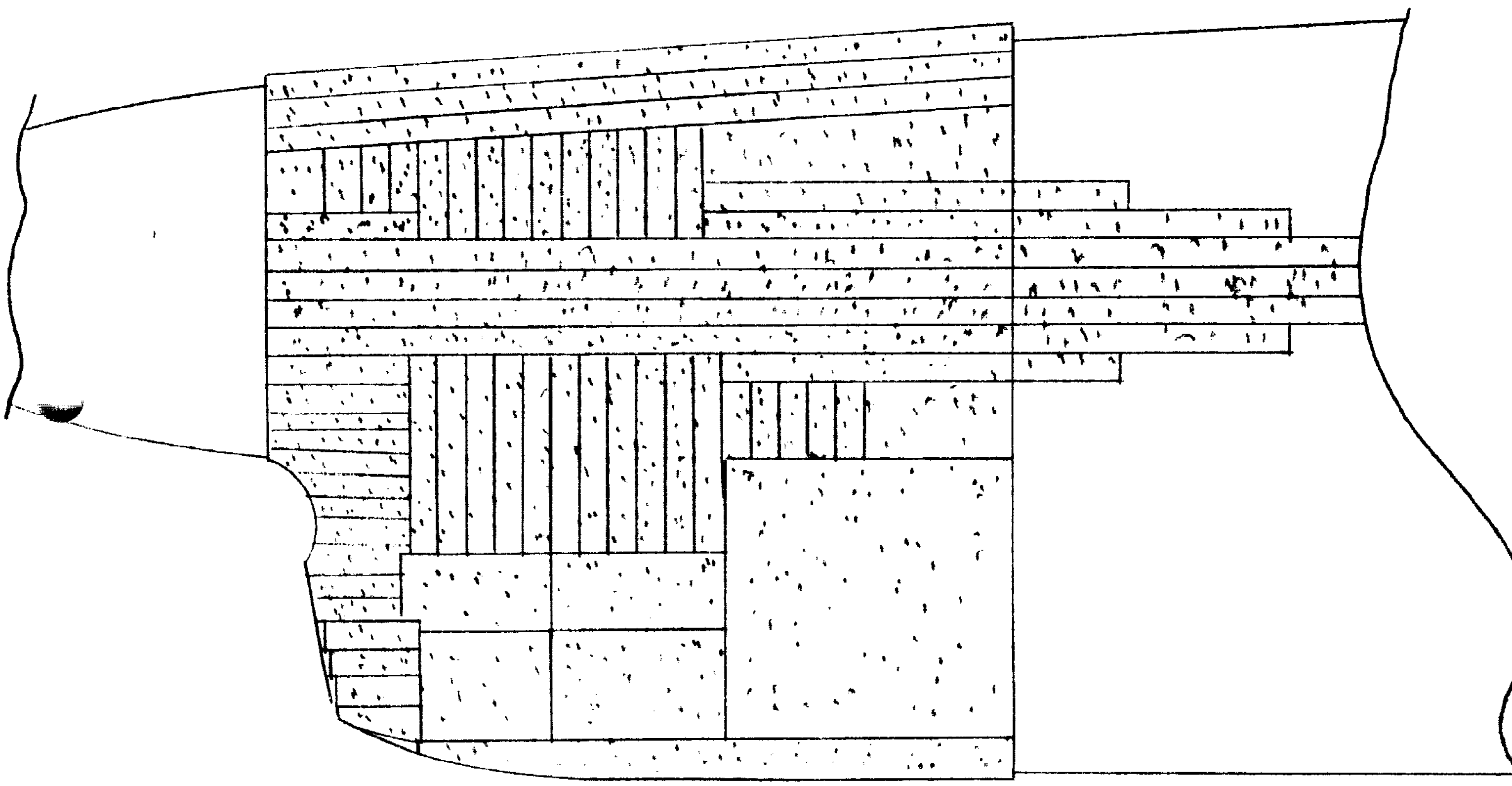
Wrap the rear two inches of the spinner with gray duct tape or multiple layers of masking tape to prevent sanding directly on the spinner while shaping the foam plug for the cowl. Install your spark plugs both to keep sanding dust out of the cylinders and to assure clearance between the spark plugs and cowling. Conventional shielded plugs and ignition wiring will stand up considerably taller than the unshielded ignition system plugs and wires. A low profile shielding system was used in the Ercoupe years ago which simply placed a short aluminum can over the unshielded spark plug. This system allows both low profile and the use of cheap, unshielded spark plugs.

Section cuts showing the cowling's shape are shown on pages 165 through 169 . The prototype cowl was constructed completely with the aircraft right side up, sitting on its own landing gear. This method gives acceptable results but does make the lower cowl layup a bit of a mess. If you have three or four strong helpers available you can turn the airplane upside down to work the lower cowl half, but this is just as much of a hassle as the other method so choose your own poison.

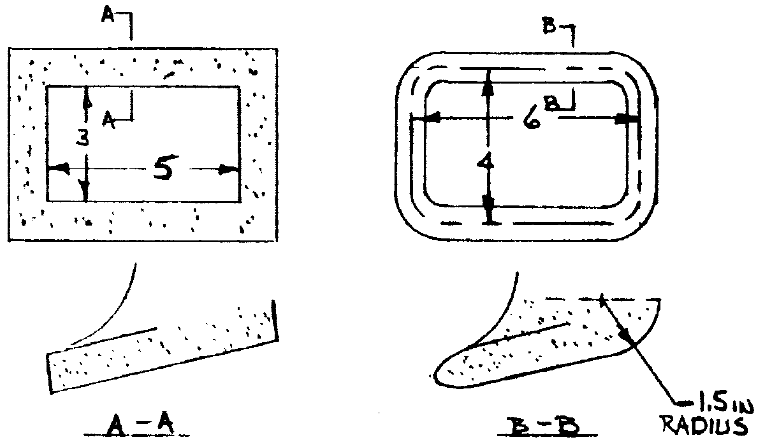
The prototype cowl plug was built up using one inch thick styrofoam, but urethane foam, or foam-in-place materials would work well also. Strips and slabs of foam were cut to just barely clear, if not rest against, the engine and to the approximate shape of the outside cowl contour. The strips were left about 1/4 to 1/2 inch oversize to allow some margin for error in the final carving. The following sketches give the general sequence of the buildup.



First, the cooling air inlet foam core was assembled as shown on page 169 using 5 minute and Micro. The whole cowl plug was assembled in this way, exercising caution to keep the 5 minute dabs INSIDE of the final contour to avoid having to sand through hard spots. The cooling air inlet core was then positioned (as shown in the preceding sketch) centered on the engine with the inlet lip inclined aft about 10 degrees. Another foam chunk was 5 minute bonded to the engine and to the top of the inlet to maintain the inlet's position. Strips were then cut and bonded to the fuselage and inlet as shown to provide the bottom of the cowl plug. A slab of one inch foam was bonded in place between the top center of the firewall cowl lip and the top center of the spinner. Strips were then added along each edge progressively lower and wider to form the upper cowl plug surface. A few blocks of foam were also bonded in place between the top surface of the engine and the top foam slab to provide support while carving the foam to shape.



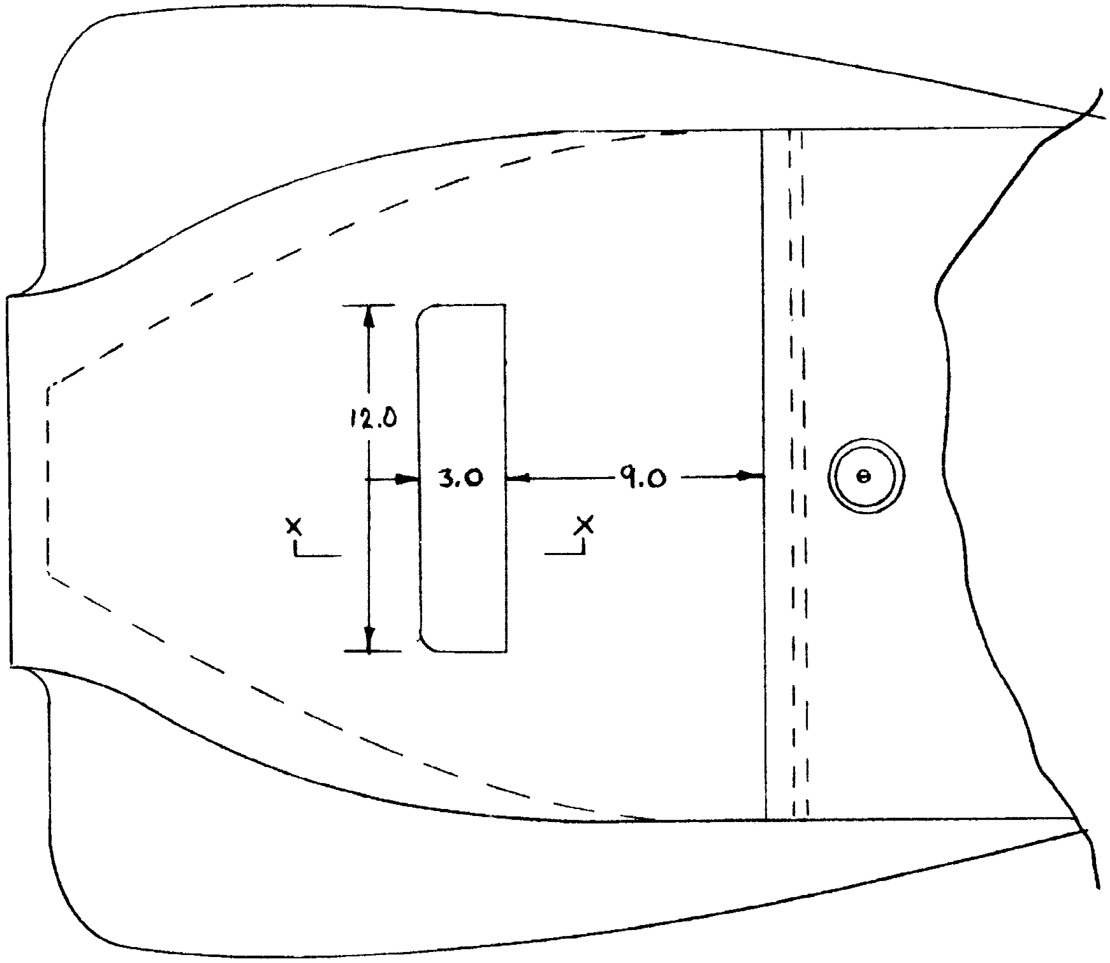
Carefully build up a patchwork of foam blocks and strips that will provide material to carve down to the loft lines shown on pages 165 and 166 . A Stanley Shurform file and some 36 to 60 grit sandpaper are good tools for the rough shaping of the foam plug. Once the shape is fairly well defined switch to 100 grit paper. If you use urethane foam a self abrading scrap of the foam can be used with good results. DON'T EXPECT PERFECTION. The cooling air outlet will be shaped last after the exterior shape is final. Use the following sketches of the inlet and outlet for guidance in their final contouring.

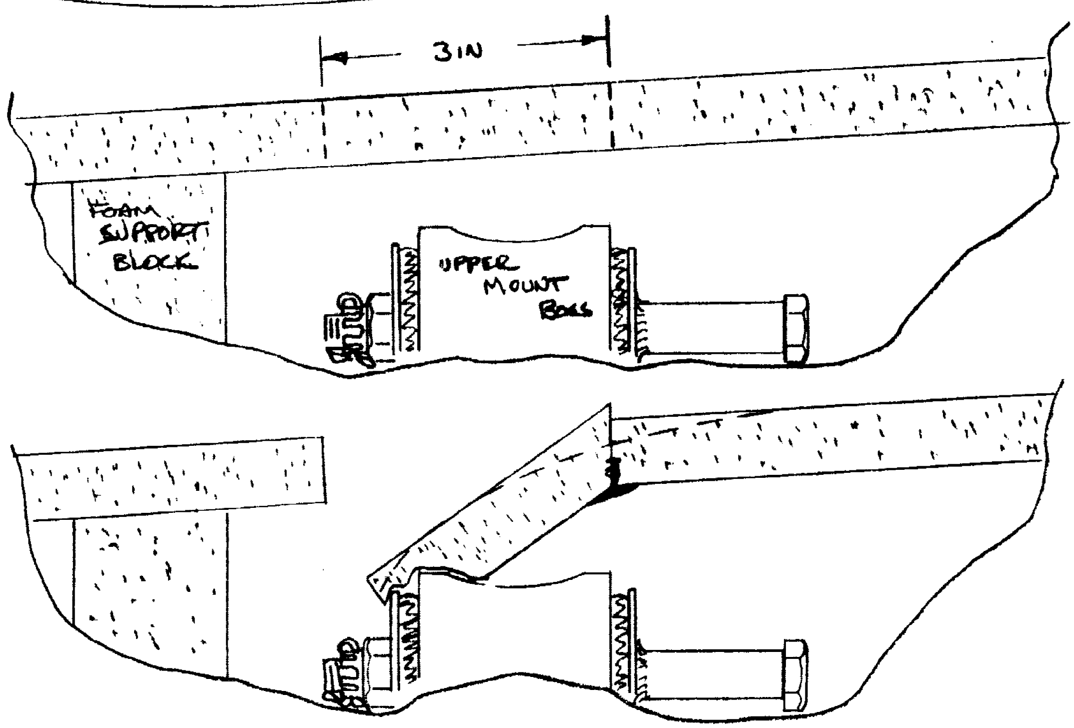


AIR INLET BEFORE AND AFTER SHAPING

The lips of the air inlet are sanded to about a 1/4 to 5/16 inch radius and smoothly faired in to the INSIDE as well as outside contour. The 1 1/2 inch radius at the rear of the inlet duct cannot be formed until the cowling is removed from the engine after glassing the outside surfaces.

The outlet is formed by first cutting out a 3 inch by 12 inch rectangle of foam from the finish carved top surface of the cowl plug. Second, sand the rear edge to a bevel and route out the bottom side of the foam to clear the engine mounts so that it fits as a ramp down into the engine area. Carve a smooth curvature into the angled foam block to provide the final contour shown in Section E-E on page 167 . Small foam scraps must be added to the left and right corners of the outlet to provide a smooth transistion to the exterior.





SECTION X-X

AIR OUTLET BUILDUP

As the foam block buildup progresses, try to save the area around the exhaust stacks until last. Leave the exhaust pipes on the engine to provide a reference while the surrounding foam plug is shaped. Mark out a narrow rectangle which will enclose both stacks plus about one inch on the edges. Leave the rectangular area free of foam for the initial cowl lay up.

Glass the cylinder cheeks aft of the firewall cowl mount lip first. Refer to Section H-H on page 168 . The fairings aft of the mount lip are bonded to the fuselage permanently. Let this two ply BID layup cure, knife trimming the fuselage interface and even with the cowl mounting lip. Masking tape can be used to protect the adjacent foam and fuselage from overslop. If you are really feeling clever you can carefully carve a joggle into the foam where the cowl overlaps these cheeks which will give you a smoother cowl when finished. Cure completely.

Next layup the bottom cowl half from the middle of the cylinders down. The fuselage mounting lip should be protected with masking tape first and followed up with a coat of auto paste wax. Start with the cooling air inlet area and work your way aft. It is necessary to use lots of small pieces of cloth (BID) to achieve full coverage of the foam plug. You need a minimum of two plies everywhere but don't be surprised if you build up to four or five in overlap areas.

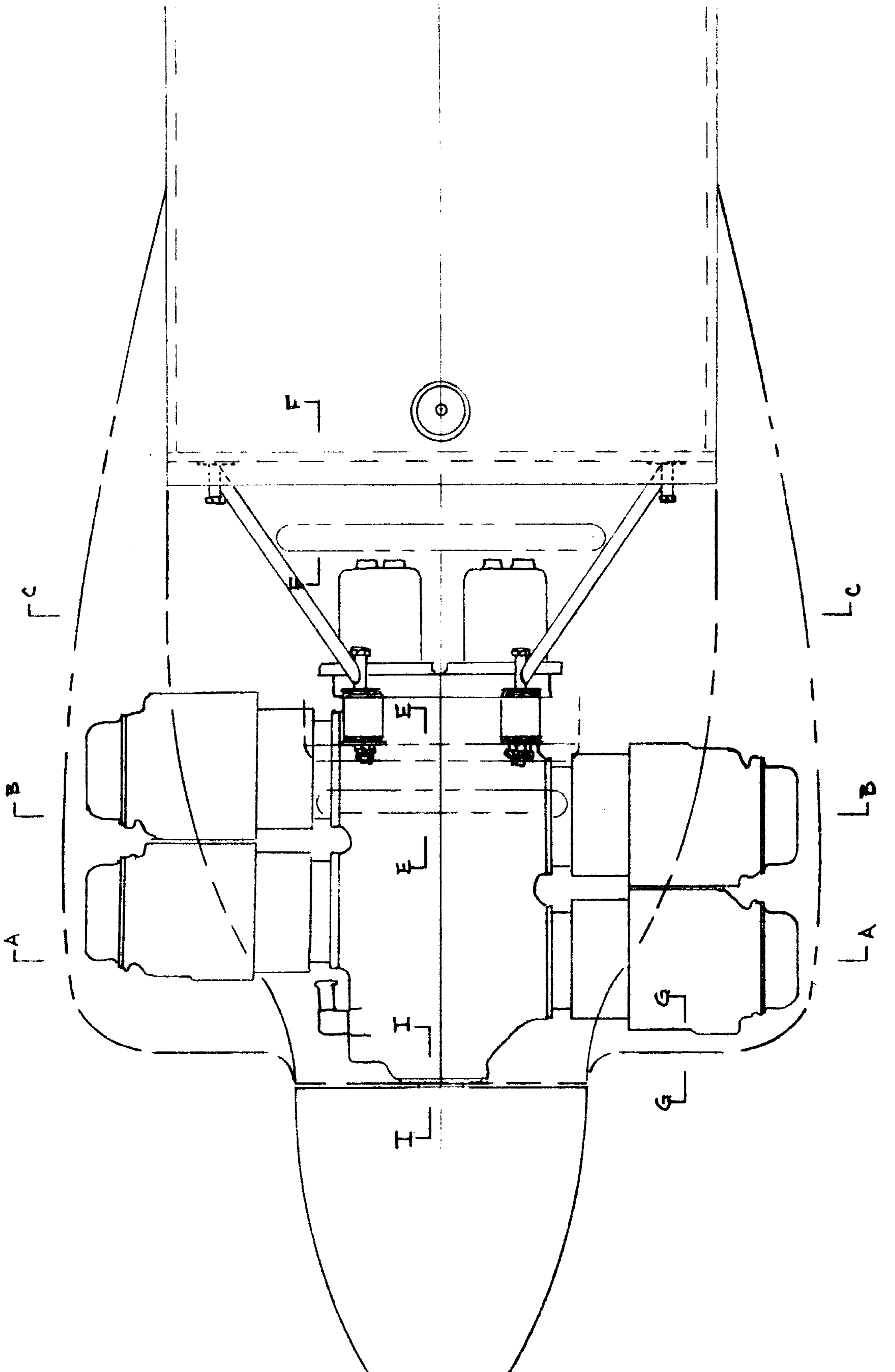
Add one strip of the two inch wide BID tape along the mounting lips and along the mating edge with the top cowl. The prototype layup was made with the airplane right side up but with the main wheels up on blocks and the tail weighted firmly to the floor, to give a steep nose high attitude. The inside surfaces of the cooling air inlet should be glassed later after the exterior has cured and been removed from the airplane. Knife trim the edges and cure. The cowl must overlap the mounting lip on the fuselage!

After a full cure on the bottom cowl, protect the edges with tape and wax as the fuselage was done so that the top cowl can overlap the bottom without bonding. The top cowling layup is done in the same fashion as the bottom, starting with the outlet this time. Again a minimum of 2 plys everywhere with a third strip of 2 inch BID tap along the mounting edges. Knife trim and cure.

Locate and drill a pilot hole for a Camloc fastener every four to five inches along the fuselage mount lip and around the top cowl to bottom cowl overlap. Try to avoid conflicts with the engine and Camloc receptacles. These holes will help relocate the cowl after it is removed from the foam plug. Cut a slot aft to allow the bottom cowl to slip past the nose gear leg. Remove the spinner and prop from the engine and layup the front ring shown in Section I-I, page 169 . Check for spinner clearance first! The ring stiffener is split along the cowl split between top and bottom cowl halves.

Remove the cowl and foam plug from the airplane. Try not to destroy the cowl in the process, but the foam plug will doubtlessly sustain some major damage. Once removed from the airplane, chip, hack, sand, grind or dissolve the foam from inside everwhere except the cooling inlet. Shape the inside surfaces of the air inlet and layup a one to two ply BID cover over all of the bare foam.

Shape strips of foam to mate with the upper cowl's inside surface and make the stiffeners which extend the full width of the outlet opening and around the mounting edge. Review Section E-E and Section F-F on pages 167 and 168 . After shaping, these stiffeners are covered with a two ply BID layup. Reinstall the cowl on the fuselage with clecos while the stiffeners cure. While the cowl is in position you can shape a foam plug around the exhaust stacks to fill the rectangular opening. Protect the cowling around the opening with tape and wax, then layup a three ply BID exhaust system cover plate which overlaps the bottom cowl about 3/4 inch. Knife trim and cure. Drill pilot holes once each two inches (roughly) for screws to mount the cover plates. Install the Camlocs and Camloc receptacles in the approximately forty locations pilot drilled. Model 2600 Camlocs (Button Head) and 212-12N receptacles are recommended. You may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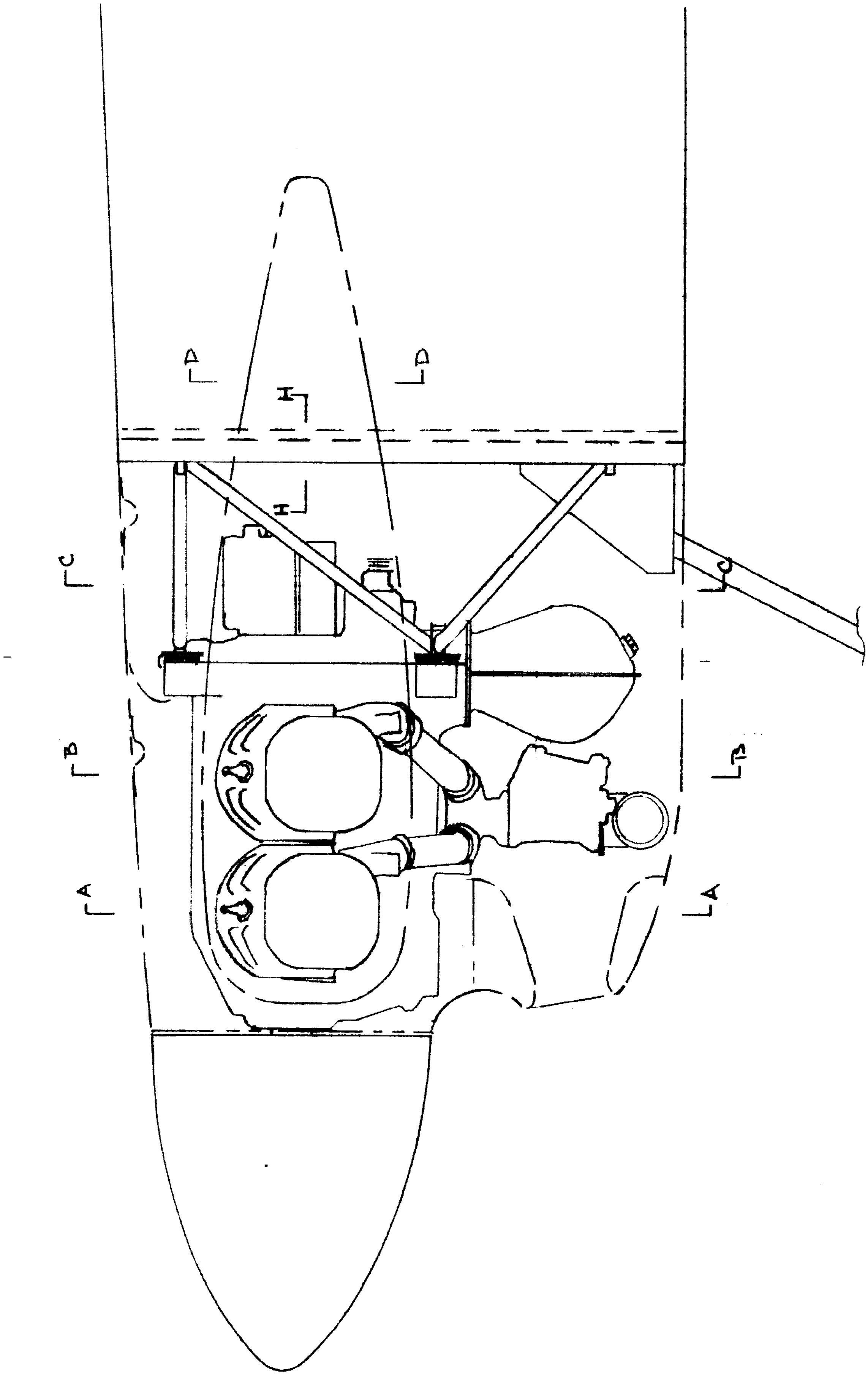
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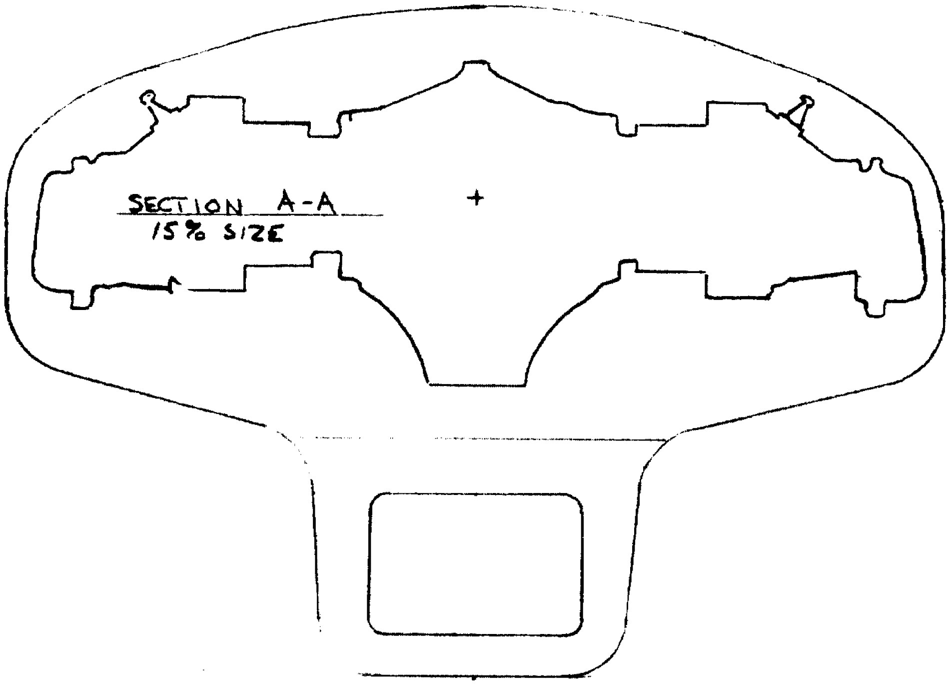
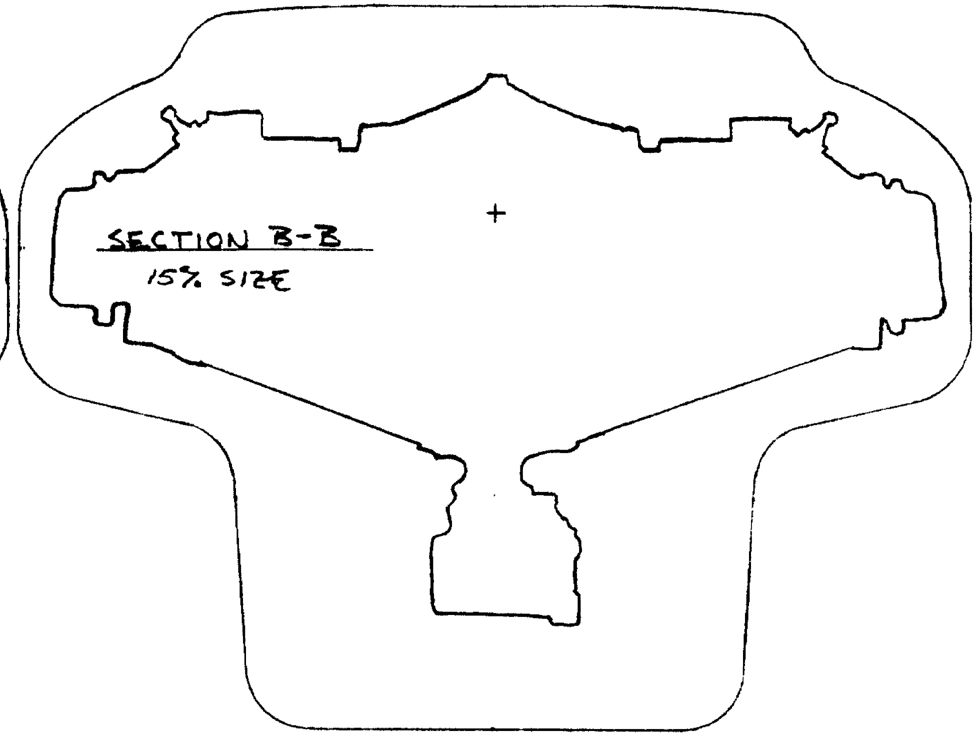
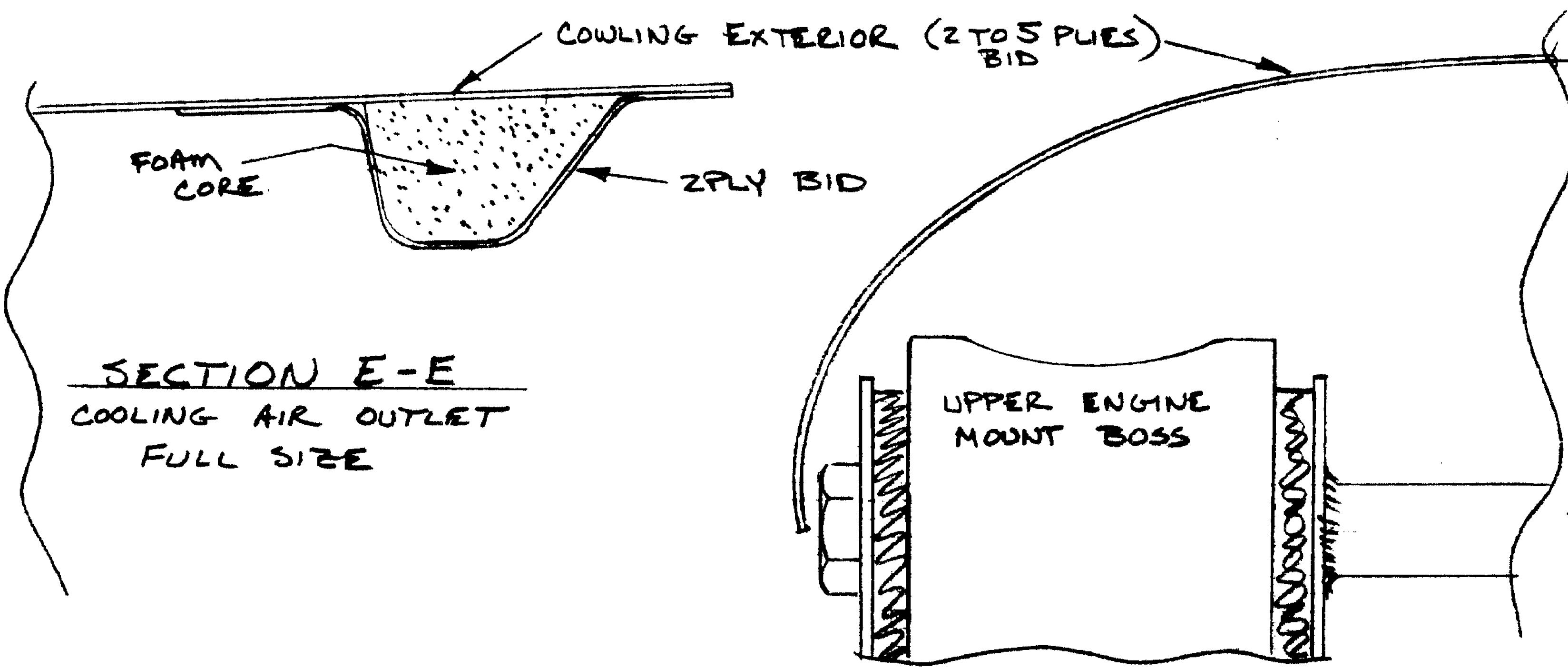
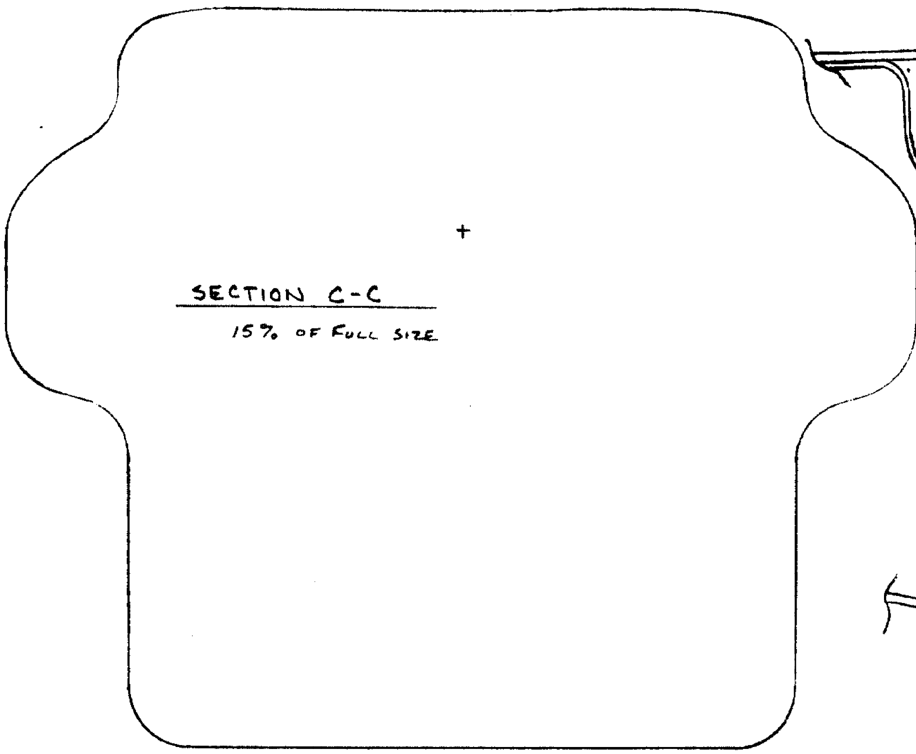


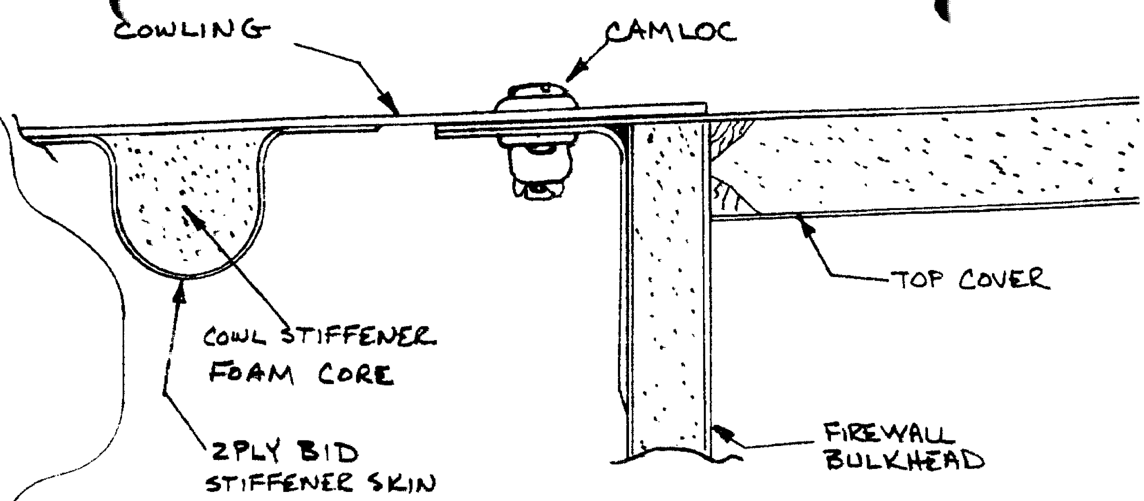




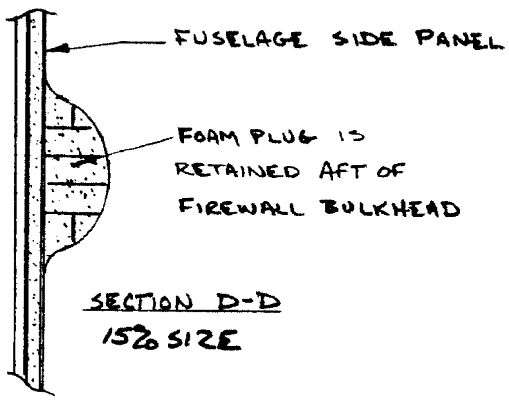
SECTION E-E
COOLING AIR OUTLET
FULL SIZE



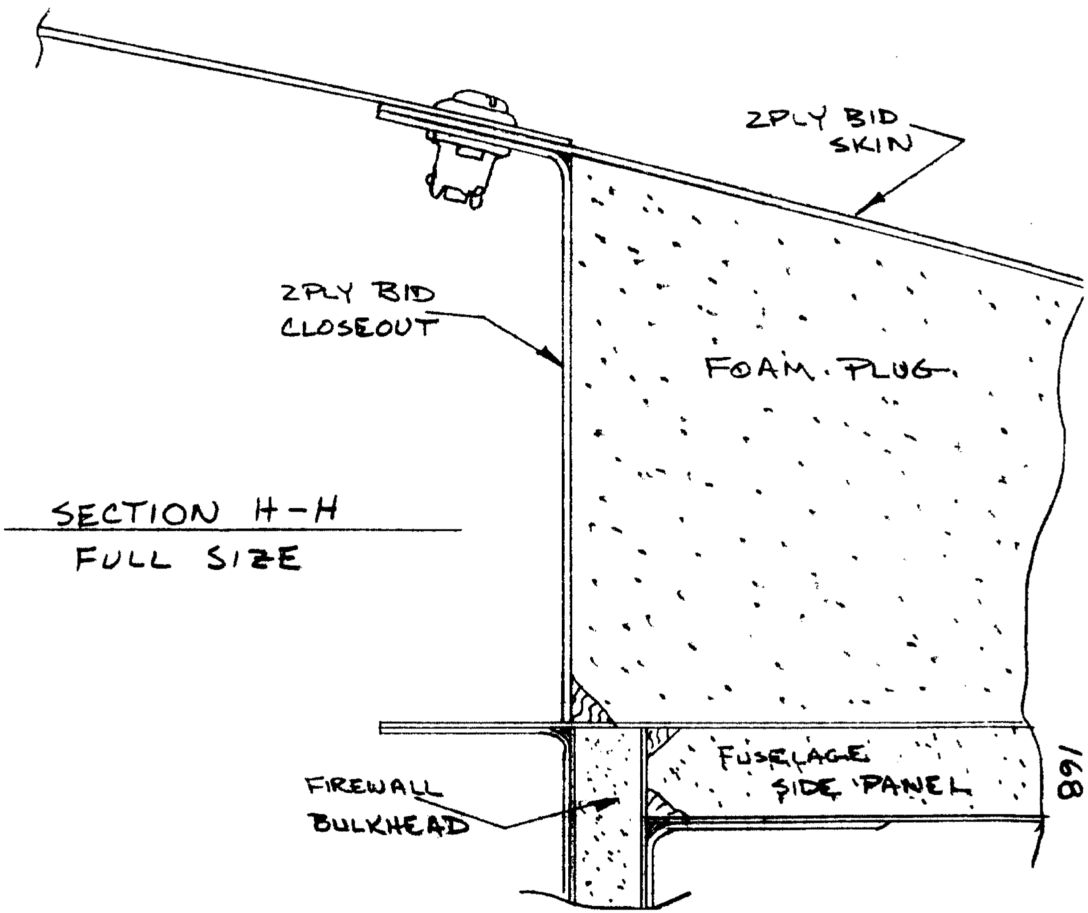
SECTION C-C
15% OF FULL SIZE



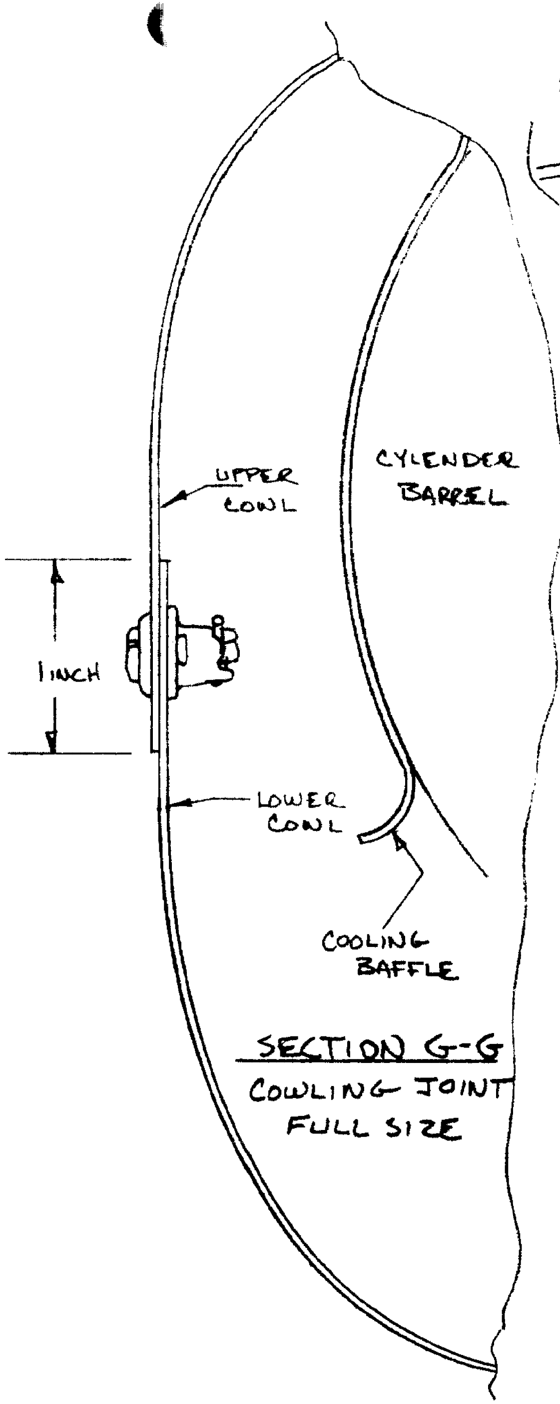
SECTION F-F
FULL SIZE



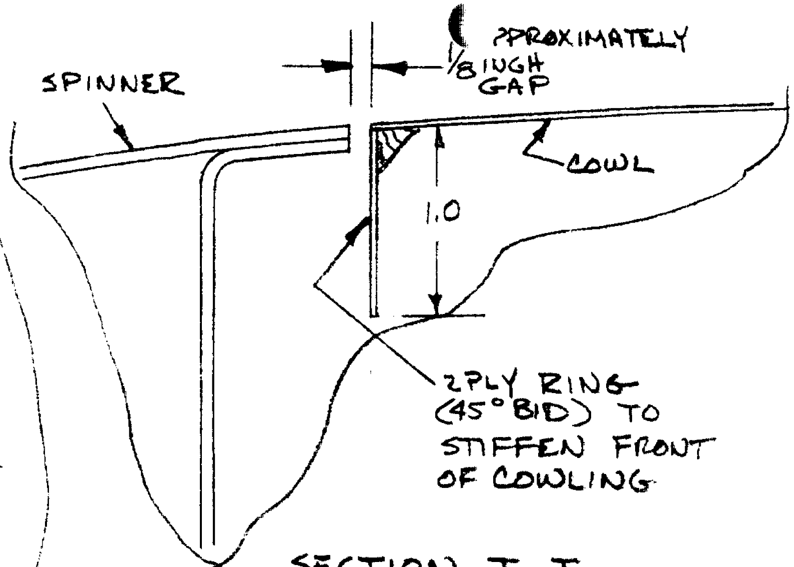
SECTION D-D
15% SIZE



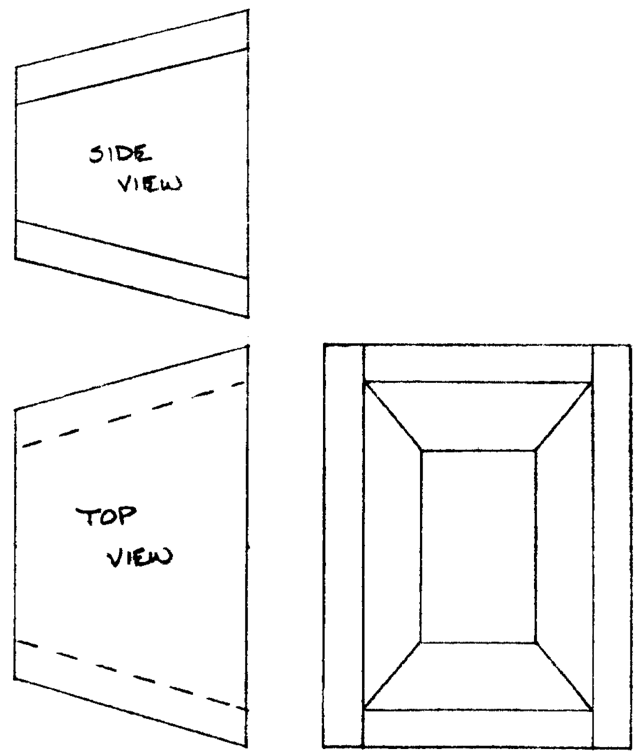
SECTION H-H
FULL SIZE

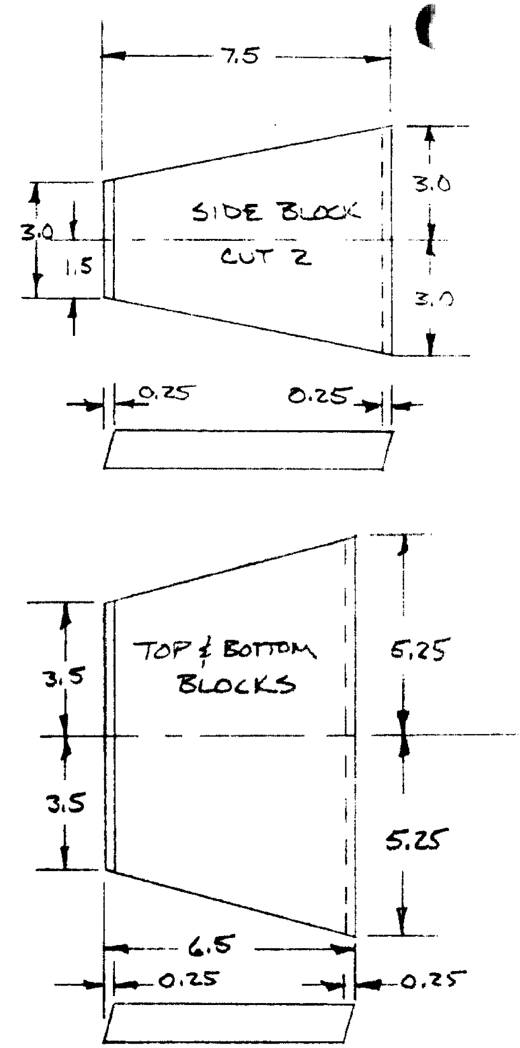


SECTION G-G
COWLING JOINT
FULL SIZE



SECTION I-I
FULL SIZE





AIR INLET FOAM BLOCKS

want to survey your own cowl and order specific grip length fasteners but 2600-3 and 2600-5 should cover all but the most unusual spots. The exhaust system cover plates should be attached with AN 526-832R-6 screws and K1000-08 nut plates. The cover plates have to be removed to drop the lower cowl. You may have to slot the lower cowl forward of the nose gear strut to allow the cowl to slip aft and down to clear the exhaust pipes before coming forward. The slot should be closed with a strip of sheet metal to within one inch of the gear strut, and a flexible seal of inner tube rubber should be used to seal the strut within that last inch. Any holes in the bottom cowl must be sealed to prevent your cooling air from excaping. Use asbestos/rubber sheet around the exhaust pipes if necessary and keep the breather tube hole tight. Keep the breather tube outlet in between the two right side exhaust pipes in the removable cover plate.

Once the cowl is complete, you can trim the exhaust pipes so they only stick outside the surface about one inch.

COOLING BAFFLES

Next to building your cowling, the greatest challenge that you face are the cooling air baffles. These pesky little sheet metal constructions serve to direct the cooling air through the cooling fins of the cylinder heads and barrels and to keep it from leaking past the engine without cooling it. The philosophy is simple enough but the detailed execution of the philosophy escapes most builders and manufacturers alike. The shapes of the engine parts that need to be baffled are complex as are the cowl shapes that they mate with. In the face of such a complicated problem, how do you proceed? The time honored method is to start with a stack of lightweight cardboard, a pair of scissors and a roll of masking tape. You use these easily worked materials to make patterns for the sheet metal baffles which follow. Fortunately, the .025 thick 6061-T4 aluminum used in the baffles is softer than structural sheet metal and can be formed around the edge of a 1X2 or 2X4 by hand or with a rubber mallet and doesn't require an expensive brake or other specialized sheet metal tools. A pair of tin snips, a file to smooth the sharp edges and patience will do most of the job. A bag of pop rivets to join the baffle sections will be required and a couple of tubes of silicone rubber bathtub caulk (RTV) will fill in all of the gaps that just can't be avoided.

The following photographs and sketches depict the intended baffling configuration. Any reasonable approximation of this system will get the job done. Remember that "Murphy's Law" does apply here and if you leave a place for air to leak by the engine without cooling, it is certain to do just that. Your sheet metal should be trimmed so that about 1/4 to 1/2 inch gap exists between the sheet metal and the top cowl fiberglass. A pliable rubber seal is added to the top of the sheet metal to seal off this gap as shown in the photos and sketches. The prototype used a discarded truck inner tube for the rubber seal material.