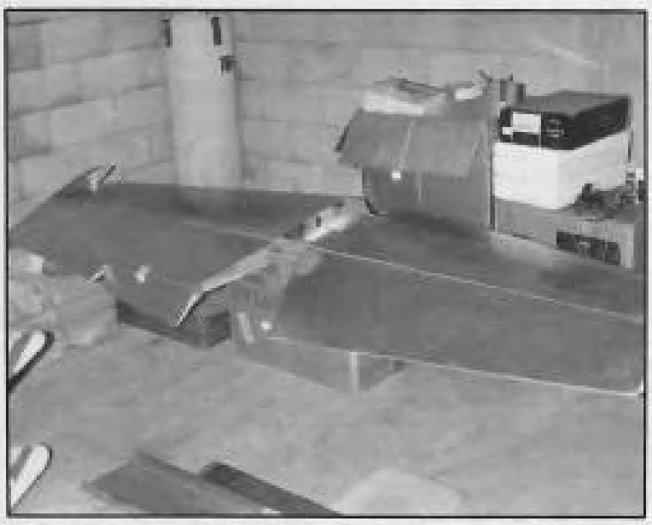
EAA® Technical Counselor News

APRIL/MAY, 1987

This TC-2 Aero Mirage is being worked on by Ronald Fiske of Lecanto, Florida.

Technical Counselor Paul Guay reports that Ron is a first time builder and his occupation is Funeral Director. The work so far looks very good.



This horizontal stabilizer from a Van's RV-4 has been completed by builder Duane Muhle, Jr. Technical Counselor Paul Regan reports that he is doing excellent work!

Components completed include the vertical stabilizer, the horizontal stabilizer and rudder, the elevators, the left hand aileron, the left hand flap, the left hand wing gas tanks, both main wing spars, the F-4 bulkhead and the left hand wing excluding skins aft of the main spar.

TECHNICAL COUNSELOR NEWSLETTER STAFF:

Tom Poberezny - Publisher
Ann Ruby - Assistant Editor
Laura Remer - Assistant

Ben Owen - Editor
Mike Drucks - Art Director
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Composite Corner

FUEL TANKS MADE OF EPOXY

From COMPOSITE AIRCRAFT MONTHLY, October 1986, page 2.

Fuel tanks made of epoxy have been the subject of a lot of discussion recently due to the problems many builders have had with softening and flaking of epoxy in fuel tanks.

I spent some time recently with the folks at Plasticrafts, Inc., concerning this problem.

Plasticrafts is one of the oldest companies in the U.S. dealing with epoxies and resins. Located in Denver, Colorado, they manufacture over 50 types of epoxies and operate a large fabrication plant using these products.

They strongly discourage making fuel tanks out of epoxy resin and aren't too excited about using polyester resin for them, either. They report seeing lots of problems in this area over the years. The best resin system for use in a chemical or fuel container is **Vinylester,** and this is what they recommend. (The Glasair is built using this sytem.) An added benefit of using this system is that it wets out better, maintains strength to a higher temperature and cures in just a few hours.

The following steps show how to easily build a "premolded" fuel tank.

Supplies Needed:

1) One 1 inch X 2 feet X 8 feet polyurethane foam sheet (don't use styrofoam, the resin will dissolve it).
2) Two quarts of Vinylester resin.
3) One tube "liquid nails" or similar glue.
4) One box of toothpicks.
5) Four 2 inch throw-away paint brushes.
6) Four yards of 8 oz. bi-directional fiberglas cloth.
7) Two quarts of polyurethane varnish.
8) One lb. micro-balloons.
9) Four sheets 80 grit sandpaper.
10) Four sheets 150 grit sandpaper.
11) One can paste wax.

NOTE: This tank was made as a fuselage tank, but the basics remain the same for wing tanks.

STEP ONE: Determine the size of tank, allowing room for instruments (9 inches minimum) and location of radio stack (if desired.)

STEP TWO: Cut front and rear tank walls out of foam and set in place. Next, cut pieces for bottom of tank and step in front end of tank to connect to front wall. Fasten foam in place with glue and toothpicks. Allow to dry.

STEP THREE: Cut and fit side walls beginning at bottom, being sure to make a 1 inch wide lip at the top longeron. (The tank will rest on these lips - disregard for wing tanks.) Continue to cut and fit sides and top pieces and glue into place. Allow to dry.

STEP FOUR: If you need to make a cut-out for radio clearance, carefully make that cut out now and then fit and install foam walls as needed to close the tank. Allow to dry.

STEP FIVE: You should now have a "rough shape" foam fuel tank. Remove from the fuselage and using 80 grit sandpaper, carefully sand all joints smooth and round off all corners, lips, edges, etc. (This is a VERY important step or the glass won't lay correctly and the tank will leak.) Tank should also be sanded so that the foam plug is now about 1/4 inch smaller overall than the desired finished size.

STEP SIX: Make a thin slurry of varnish and micro-balloons and "paint" the tank with a thin layer. (Cover every bit of it.) Let dry and apply two more coats, allowing drying after each layer. Let dry for at least 24 hours at 70 degrees F and then carefully sand smooth, being careful not to go thru. (If you do, re-coat and sand again.)

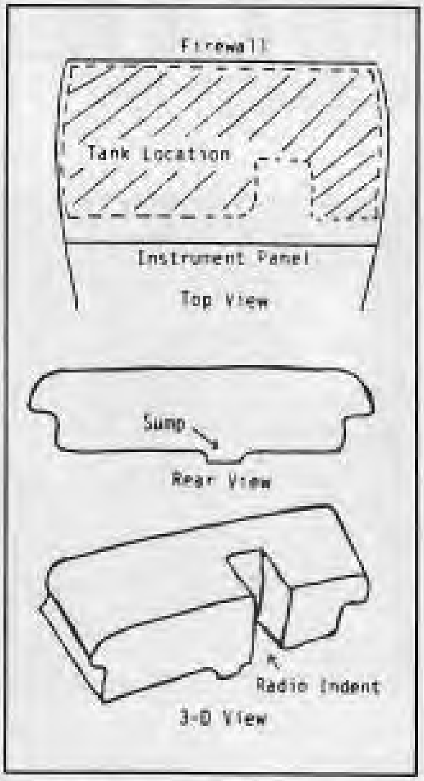
STEP SEVEN: Cut a piece of foam 1 inch thick, 4 inches wide and 8 inches long and taper the sides at about 60 degrees. Glue this to the bottom, center of tank - against the back, running lengthwise fore and aft. This will be the sump.

STEP EIGHT: Take a broomstick or pipe and poke it carefully thru the sidewalls so that you can suspend the tank and rotate it like a rotisserie. Coat the tank with 2 good layers of paste wax and let dry. Buff very lightly.

STEP NINE: Draft a friend for help. Glass the tank being careful to overlap the seams. (Use the "dry-layup" method. Lay on the cloth dry and then brush on the resin.) Work quickly and don't spare the resin here. Put 3 layers on the tank and 4 layers around the lip support areas. Do the whole tank in one session and let cure for at least 24 hours.

STEP TEN: Remove the broomstick. Carefully cut the tank in half vertically. Remove the foam. (If you did a good job sealing the foam, it should pop right out.) Sand out ALL remaining foam and install fittings, gauges, filler, etc. at this time.

STEP ELEVEN: Secure the halves together and cover seam with 4 layers of glass, 6 inches wide. Let cure. Glass over the broomstick holes with 3 layers glass and let cure.



You now have a strong, lightweight, perfectly fitting fuel tank that will withstand all fuels, agents and chemicals. GIVE IT A TRY! YOU'LL FIND IT'S REALLY QUITE SIMPLE AND A LOT CHEAPER!!

TIP OF THE MONTH
by
Roger J. Van de Weghe

Taken from Chapter 199 News, Sarnia, Ontario, Canada.

When laying fiberglass cloth around a corner, sand a radius of at least 1/8 inch or more on the corner. If you don't, the fiberglass will not lay down and you will have an air pocket at the corner. This is a weak spot in the layup and must be avoided.

Design

AIRCRAFT WING BEAM THEORY

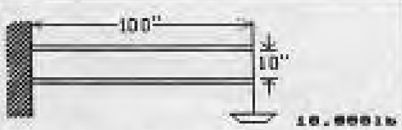
From the "Prop Wash" magazine, EAA Chapter 330. Submitted by Bruce McCollough, from J.G. McClure.

THE CANTILEVER BEAM

To analyze any structural problem, you have to keep everything in equilibrium. That is, for every force there is an equal and opposite force that puts it in equilibrium. If you are pushing down on the floor with your weight, the floor must be pushing you up with an equal and opposite force. If this is not true, you are definitely falling. In that case, the equilibrium force is acceleration, and again, it is equal to your weight, giving you an acceleration of one G.

As for the cantilever beam, it is simply a beam that is fixed at one end, and free at the other. A beam is a structure that supports a load in a bending rather than twisting, stretching, or compression. Of course a piece of structure can be subjected to a combination of forces, and most of them are, but to keep it simple, we will consider a beam with only one load, concentrated at the end.

For the simple "two cap with web" beam we will assume that the web is thin, and adds nothing to the cross sectional area of the caps. Our example beam (fig. 1) will be ten inches deep,



CANTILEVER BEAM WITH CONCENTRATED LOAD

FIG. 1

100 inches long, and is supporting a load of 10,000 pounds at the end. Of course an actual wing will have a distributed load all along the span. We will consider that later.

The most difficult thing to understand about a beam is the web. Most people know that if we make this beam 200 inches long, that the caps would have to be made heavier, but the same people would think nothing of cutting a large hole in the web, or omitting it entirely for several inches. So remember this: **1. The web carries the load.** That is to say, the web of the above beam would have the same stress in it if it were 10 inches long or 1000 inches long. The load designs the web. **2. The caps carry the moment.** The longer the beam, the greater the moment, and the larger the caps have to be. **Moment** will be discussed more later.

THE WEB

Now let's draw a picture of the web by itself (fig. 2), bearing in mind that the

WEB OF BEAM CARRYING LOAD

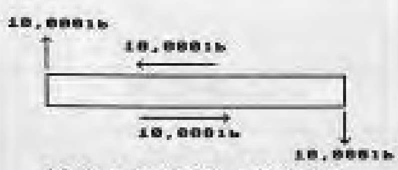
FIG. 2

web must be in equilibrium. Since we are supporting 10,000 pounds, and the web carries the load, the load is pulling down on the web with a force of 10,000 pounds. This can't be in equilibrium, since there is no equal and opposite force. But the only place we can have a force pulling up is at the wall (fig. 3).

LOAD BALANCED MOMENT NOT BLANCED

FIG. 3

But the web is obviously still not in equilibrium, with only these forces acting on it, it would soon be spinning like a propeller. But the only other place to apply loads is at the row of fasteners attaching the web to the caps. So lets assume that a force acts along each line of rivets, in the direction required to put the web in equilibrium, and keep it from spinning off into space. Since the two 10,000 pound forces will cause the web to spin clockwise, the cap forces must apply a counterclockwise spin (fig. 4).

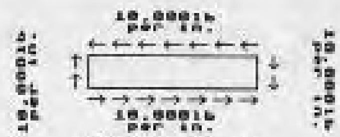


LOAD & MOMENT BALANCED WILL NOT FLY AWAY

FIG. 4

However, to choose the attachment of the caps to the web we want to distribute the forces evenly along the span, so we generally think of the forces in pounds per inch. Since the beam is 100 inches long, the force per inch would be 100,000/100, or 1000 pounds per inch. We call this the shear flow (9). We could think of this as a load of 1000 pounds applied every inch, or a force of 500 pounds every half inch, depending on how far apart the fasteners are.

If we calculate the shear flow at the end of the web, we get 9 = 10,000/10, or 9 = 1000. We find that the shear flows are equal and in opposite direction to the 9 along the flanges in order to keep the web in equilibrium (fig. 5).



SHEAR FLOW - q

FIG. 5

The spining moment applied (the 10,000 pound forces) is 10,000 X 100, or 1,000,000 inch pounds, and since the spinning moment of the cap forces must be the same, and the cap forces are only ten inches apart, the cap forces must be:

$$F \times 10 = 1,000,000$$

$$F = 100,000 \text{ pounds}$$

Now don't get the idea that forces only exist along the edges of the web. If we were to cut the web at any point (fig. 6), we will have to have exactly the

SHEAR FLOWS WITHIN BEAM

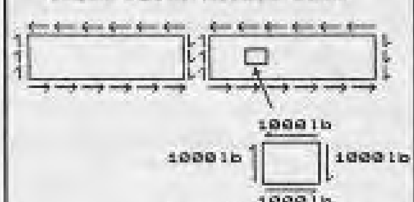


FIG. 6

same shear flow here to keep the sections in equilibrium. If we look at only a square inch of the web, in fact, we will still have the same 1000 pounds per inch on each side, to keep it in equilibrium.

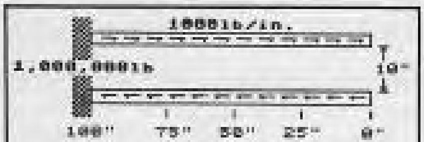
If we were designing this beam in aluminum, the web might be .064 inches thick, and would be carrying a stress of 16,000 psi. If we were to cut a 5 inch hole in the web, the remaining material would have a 9 of 200 pound per inch, or a stress of 32,000 psi, which would be too high for the material to stand. This hole would require a doubler to carry the load.

THE CAPS

As stated at the beginning, the caps carry the moment. But before discussing moment, let us ask the question: "Where did the 1000 pound per inch in the web come from? Or what applied the 1000 pounds per inch?"

Well, that 1000 pounds per inch was applied to the beam or caps, conversely, the beam caps applied the load to the web.

If we draw the caps by themselves,



CAPS SHOWN WITHOUT WEB
SHEAR FLOW REPLACES
WEB LOADS
FIG.7

and show them in equilibrium (fig. 7), the 9 is applied to the caps by the web, the 9 along the top cap is shown acting to the right, because it was acting to the left in the web. (opposite reaction) Since each load is acting in the same direction on the cap, the loads are adding to each other so that

The load at any point in the cap is the sum of the shear flow to that point.

At zero inches from the right end, the cap load is zero, since the distance is zero. The cap load increases linearly from the tip to the root. (This is only true for a concentrated load at the end of the beam.)

The cap load at the root is 1000 X 100, or 100,000 pounds, so the load in the wall is 100,000 pounds. The load from the bottom cap is the same, but in opposite direction. The moment at the wall is created by the two cap loads, and so it is 100,000 X 10 or 1,000,000 inch pounds. This is, and must be, equal to the moment caused by the load on the beam.

We have now broken the simple beam into two elements, the caps and web, and have shown the forces that are actually applied to each element. Please bear in mind that this is not a laboratory exercise, nor is it some long haired theory of some eccentric scientist. It is as true as the fact that night follows day and the sun rises in the east.

MOMENT

We have arrived at the cap load without considering "moment" as such, and now we will show that the solution by moments gives identical answers to the shear flow method. Generally, we calculate the cap loads by the moment method, but the shear flow method is sometimes used.

Moment is simply **force times lever arm.**

Most of us are familiar with getting a longer "cheater" to put on the wrench when we can't break a nut loose. The cheater doesn't help you apply more force (it doesn't make you stronger). It helps you apply more **moment**, because you have a longer lever arm, and if you had a still longer cheater, you found that you could break the wrench.

These same things happen to a beam. The moment at any point in a simple cantilever beam is simply the load times the distance from the point to the load. In our case:

L inches from the load, M = LX 10,000
25 inches from the load, M = 25 x 10,000
= 250,000 pounds-inches
50 inches from the load, M = 50 x 10,000
= 500,000

and at the wall, M = 1,000,000 pound inches.

So we see that in determining the moment, and calculating the cap load from the moment we get exactly the same answer as when using the shear flow method.

The cap load at any point is the moment divided by the distance between the caps, or:

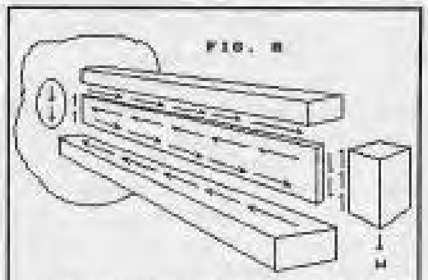
Cap Load = M/H = P

Where P is the total force in the caps, M is the moment, and H is the distance between caps. Calculating the load at the wall by the moment method:

P = M/H = 1,000,000/10 = 100,000 pounds

Again this is the same answer as we got by the shear flow method. Fig. 8

FIG. 8



BEAM BROKEN INTO ITS ELEMENTS

shows us a complete picture of the simple beam, broken down into its basic elements.

SUMMARY

The web carries the load, and the thickness of the web is determined only by the load, and not by the length of the beam.

The caps carry the moment, and the cap area is determined by the load times the distance to the load.

Everything is in equilibrium, and every structure can be broken down into its elements, which can be isolated and put into equilibrium.

Fuel Systems

FUEL SYSTEM

Propeller maker and Technical Counselor Edward Sterba of 3209 South Woods, McHenry, Illinois 60050 has identified a problem with the Posa carburetor. His work and home phone is (815) 455-2575. One of the features of this type of installation is that they are direct gravity feed which provides about 1/3 psi. At high speed, the tank vent usually adds about another 1/2 psi to this. The compression ratio of 9:1 and the fact that the carburetors are usually operated without provisions for carburetor heat, has lead to some problems, principley, lean ground operation and rich air operation. The concensus of opinion from the Chapter members and other people he has talked to, is that it is best to operate on aviation gas instead of auto fuel in these engines as those who have switched to aviation gasoline, have apparently eliminated their problems. Ed has a list of some 15 names who have either had problems or mishaps due to this and strongly suggest the use of aviation gas in any Volkswagen engine carbureted with the Posa carburetor.

PLACEMENT OF SELECTOR VALVES

From Technical Counselor Art Bianconi, Staten Island, New York.

Recently, one of our chapter members had difficulty while attempting to start the engine on his homebuilt parasol. When the engine failed to catch, I got in and ran through a cockpit familiarization prior to my own efforts to start it. I looked at his fuel valve and observed that it was in the OFF position. "No wonder it won't start," I yelled, "It's not getting any fuel." I showed him the position of the valve at which point he said that the valve I was looking at was the one which turns the auxiliary wing tank ON and OFF and that the main fuel valve was elsewhere. "O.K., Where!?" The response I got was disturbing: "It's up front; in the passenger cockpit and can not be reached from the pilots seat. You can only get at it while pre-flighting the airplane."

I immediately gave up any thoughts of flight testing the plane and since a return trip was necessary to complete some brake work, I was in a position to extract a promise that if he expected me to assist him completing the job, he had to fabricate a mechanism for turning the main fuel valve on and off from the pilot's cockpit. I asked what he would do to stop fuel from feeding an engine fire at altitude and he shrugged his shoulders. I was about to ask him how he had gotten the plane past the FAA inspector when it dawned on me that the guy from the EMDO probably made the same mistake I made: He'd seen a fuel valve in the pilots compartment marked ON and OFF and assumed it was the main one.

STROMBERG CARBURETOR FLOAT NEEDLE PROBLEM

Reported by Marsh Collins, Technical Counselor from Crestline, California.

I found the following dissertation on Stromberg Carb float needle problems in the lastest Luscombe Courant, Continental Luscombe Association's monthly. Jack Norris, the author, I know to be knowledgeable about these things, and I have recently been engaged in a tussle with my own carb. I feel it's very germain to many EAAers as the Stromberg NAS 3-A1 and B are on many a Continental-powered homebuilt, as well as many oldies. I will quote verbatim:

The specific reason for the reported trouble with neoprene needles is that neoprene is the WRONG material - those parts are BOGUS parts. Nitrile rubber is the correct type of rubber for fuel systems, including the aromatics in auto gas. The good original Bendix needles were apparently good nitrile material. Mine is perfect after 24 years and is setting in a bottle in Arco regular today. My only mistake was replacing it with the recommeded Delrin needle. My engine began dying on both avgas and auto gas at altitude and on takeoff! ! ! Some klutzy "paid for" work badly fouled up my carburetor, but there is more!

1. There is a practice of setting carb fuel levels 1/16 inch lower so they won't leak. Sounds like a good idea? WRONG!

2. Delrin needles expand a bit in ALL fuel (0.7% in unleaded auto gas over two years, per Du Pont data.) .1% is about .011 inch, about .050 inch lower fuel level with the float lever ratio.

3. Aromatic unleaded is higher density, .73 specific gravity winter to .76 summer vs .71 used for Bendix carb setting, causes the float to float higher, the fuel level to be still lower, about 1/16 inch more.

4. By using lighter solvents for test stand fluids or otherwise fouling up and lowering the in-service fuel bowl level, the carb goes "over the edge". (Mine checked a full 1/4 inch low on avgas, just bad work.) The engine will die at high altitude (low density), or, worse yet, on takeoff on a hot afternoon, max throttle condition.

The best Carburetor House in L.A. failed completely, badly, and walked into all of the above (including a needle stroke that was also way below spec from shimming, which can starve the inlet flow). Only with a good assist from the Man upstairs, did I get it all understood in time safely. Watch it, be careful, know if your carb is OKAY! End of quote.

I'll add some of my own bench-learning. The carb originally had a stainless steel needle. No one who has ever lived with a Stromberg-fed mill isn't familiar with their liking to drip-drip on occasions, - particularly when you didn't remember to shut the fuel off. The needle was changed to the "neoprene" tip, and the edges of the seat were rounded off to keep from cutting the neoprene. Now, some mechanics didn't know about this, and changed the needle without changing to the right seat, and the needle got cut up, and several needle changes later, the seat got changed by accident, and everything seemed to smooth out.

Now, along comes auto gas, and, I understand, some hanky-panky with the refineries (they deny it), and the needles start acting up again. The moral of the story is, - if you do any fiddling with the needle, be sure you've got the right seat. The old sharp-edged seat goes with the steel needle, and the rounded goes with the soft needle. Part numbers I do not have for the old seat, needle, etc., but they're not important. Just take a good look at the seat you put under your needle. And, from Jack Norris' info, - be careful how you adjust the float level. It's tricky.

Incidentally, I found that Univair carries the adjusting shims. They're not shown in the regular catalog, but are in the price list update I received lately. I haven't found them anywhere else.

That's about the shot, Ben.

Operations

OPERATIONS

"Buddy Hops Will Bite You"

This from a tip from Roger Davenport, Technical Counselor from Hubertus, Wisconsin.

It might be a good idea for all pilots not to take a BFR from a CFI who is also a close friend. It is pretty hard for a close friend to comment adversely when he sees something that needs correction. It is to a pilots own best interest to seek out the instructor who is known for his teaching ability even when he is totally unknown to you.

SUGGESTIONS FOR RUNNING FLIGHT TESTS ON AMATEUR BUILT AIRCRAFT BY Steve Wittman

Before any flight test of amateur built aircraft, due consideration should be given to leaving the aircraft in case of emergency. In cabin aircraft, arrangements should be made to easily dispose of the door.

Regarding running the G test, there are several ways of doing it. One way, probably the most common, is to nose the plane down slightly, picking up a little excess speed, and then the pullup. Instead of attempting to reach maximum G loads the first time, I suggest going to one-half to two-thirds load on the first try, then increasing it one-half load factor on each succeeding attempt. For example, if you wish to pull 4 G's, start with about 2-1/2 G's the first attempt, then 3, 3-1/2 and finally 4 G's. Another method of running the G test is using a steep turn or spiral, keeping the nose just low enough to maintain desired speed. This is much faster as the load can be increased or decreased at any time.

To run stability tests we usually start with horizontal stability. Trim the airplane to cruise condition, then pull back on the elevator control until you have lost about 20 percent of your speed, then release the stick. The airplane should nose down until it has attained its original speed, at which time recovery should begin. That is, the nose should start up again until speed is again lost. Each succeeding oscillation should become less. For example, if you originally used 100 mph and on pull-up to 80 mph, the bottom of your first oscillation would probably be 100 to 125 mph, the top of the next oscillation 85 to 90 mph, the bottom of the next 105 to 115 etc. After three or four oscillations, the airplane should be flying reasonably level. If the airplane does the above, it is stable. If on the other hand, when on your pull-up it continues to go higher or on the following dive it continues to dive progressively more, then the airplane is horizontally unstable.

Next let us consider lateral stability. Trim the airplane for cruise condition, hold a definite heading with the rudder, move stick to extreme right position and release. If wing comes up to level position, repeat to left. If it agains comes up to level position, then the airplane is laterally stable.

Now for directional stability. Again trim the airplane to cruise condition, remove feet from rudder pedals and airplane should continue to hold heading. If it consistently turns one way or the other, a trim tab on the rudder will be necessary. If it is impossible to trim it with a tab, it is unstable and will need more vertical fin. If you succeed in trimming it, hold the airplane level with the ailerons and press right rudder and release. If airplane comes back without holding excessive skid, repeat to left. If it also comes back from left without holding excessive skid, the airplane is directionally stable.

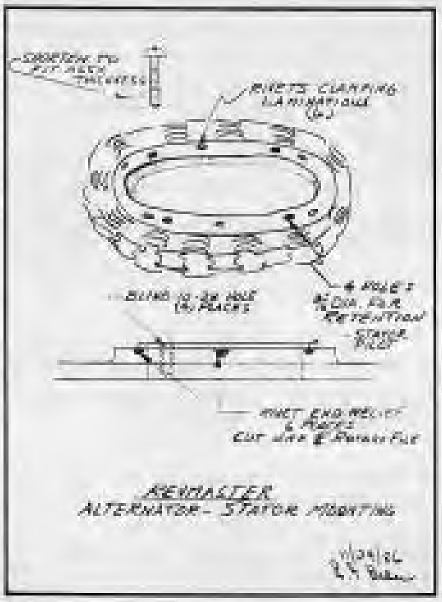
* * * * * * * *

Engines

ENGINES

Gil Baker of Royal Oak, Michigan reports on the condition found in a Revmaster R2100 flying on the front of a KR-2.

A dry rubbing sound was heard at idle and after shutting down, the sound was duplicated by turning the prop, (much like a dry prop hub seal.) The cowl was removed and sounding out the source, it was determined to be from the rear of the engine within the flywheel adaptor housing. The engine was removed and the housing taken off the engine. Considerable dry dust and oxides were found in the housing interior. Inspection of the stator which is mounted concentrically in the housing, revealed that five (5) of the wound coils had been rubbing the rotor. The cause was determined to be a loose stator assembly caused by excessivley long attaching screws which were **bottomed** in their **blind tapped holes**. Perhaps, the stator was secure originally but when removed, we found six (6) rivets which clamp the



laminated core, protruding .060 - .090 inches. No relief provisions had been made in the housing.

The fix was to provide relief in the housing for the rivet heads. This was done with a 1/4 inch ball end rotary file. The four 10-32 screws were deformed so new screws were used after shortening .125 inches.

All seems to be in good order after two hours of flying since making the repair.

A TIP FROM HENRY OLSEN OF ESCANABA, MICHIGAN
Cracked Mag. Coupler

After about 50 hours on my VW conversion (Monnett). I found the coupler badly worn and cracked. I located the trouble in the motor mount. It **was not** machined concentric with the crankshaft.

On the second coupler, I applied a small amount of grease on the slot. It appears to help.

Also, I cannot use my alternator because the rotor drags on the stator.

Notices

PAUL REGAN'S RV-4 VISIT REPORT ON DUANE MUHLE'S PROJECT

Duane says the wing front spar assembly was the most difficult job but went well. The key to a good, strong spar is patience and using a lubricant when drilling through the thick aluminum spar web-flange assembly. He also reports when assembling the gas tank and using the Pro Seal gas tank sealant, be sure you do it in a **well ventilated** area. He assembled his in his basement and after working with the Pro Seal for 16 hours, he woke up the next morning with the worst "hang over" he can ever remember having. Builders beware! Yet to be purchased are the fuselage and finishing kits, and of course the big dollar item - an O-320 Lycoming 160 H.P. engine. Estimated date of finish is another 2 years.

Lee Stevens, Technical Counselor #260 of Yakima, WA took this photograph of Bob Baird's Sonerai II low wing. Bob is Chapter President, and built this press to rivet the spars in it. It is working quite well for him.

Q-2 TIP

One of our Q-2 builders, also a Technical Counselor, has some comments on the Q-2 aircraft regarding incidence.

The first is that there may be some difference on the average set of drawings for the Q-2 between what is given as the "level line" and what is given as the "chord line". On some drawings, there has been about 1/2 degree difference there. Our Technical Counselor reports that he has installed his canard at approximately 2 degrees up from the the "level line", which is about 1-1/2 degrees up from the chord line on the drawing and his aircraft. The main wing is installed at the usual 0 degree level incidence. Apparently, it is necessary to have at least 1 degree difference canard leading edge up from the main wing, and a ground line angle of incidence on the canard of 7-1/2 to 8 degrees to properly slow the aircraft down. Aircraft built with the incidence as stated herein can be landed at about 5 miles per hour slower than aircraft built according to the plans. This particular Q-2 is stalling at about 64 power on and about 65 power off, coming over the fence at about 70 MPH. With the lower landing and stall speed, it's possible for the aircraft to operate out of a 2600 foot strip. This modification on the aircraft to give increased angle of incidence to the canard has been done by quite a few other Q-2 builders, and has proved as effective as it did on the original modification.

TAP REMOVER TOOL

From Gene Darst, Technical Counselor #0290, Beaumont, Texas.

There is a tool, "tap remover", a size for each tap, that will remove broken taps. It is available through industrial tool supply houses. It will remove a tap even if broken flush with the surface. In addition, a special aluminum tapping fluid is manufactured by Relton Corporation, Arcadia, CA 91006. The name is A-9 Aluminum Cutting Fluid and it will allow a perfect drilling and tapping without any galling of the tube.

Obituaries Marion L. Wright, Technical Counselor of Spring City, Pennsylvania passed away in September 1986. Mr. Wright was an inspector for Boeing-Bertol for 20 years in Philadelphia, Pennsylvania. Our sympathies to his wife Janet and to the family.

Stanley L. Mockrud, Technical Counselor of Madison, Wisconsin died April 20, 1987. Stan was a Technical Counselor for 10 years, well known to the builders in the Madison, Wisconsin area. Our sympathies to his wife Nora and to the family.

This is a whittler's glove and it has steel strands imbedded in the glove to protect the craftsman from sharp objects. It will fit either the left or right hand and is available in hardware stores and fishing supply stores locally.

Nuts & Bolts

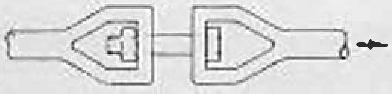


Figure 1: Bolt in tension.

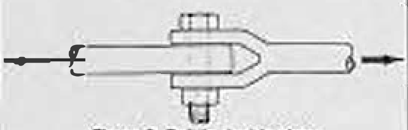


Figure 2: Bolt in double shear.

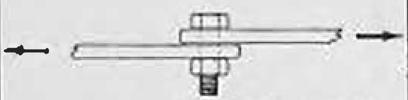


Figure 3: Bolt in single shear.

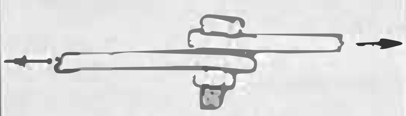
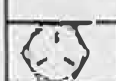
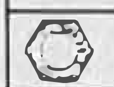
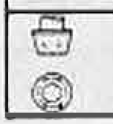


Figure 4: Bending induced by single shear (greatly exaggerated)

HEAD STYLES OF SOME COMMON BOLTS

	SAE Grade 5	120,000 psi	"Automotive grade" tension bolt. Undefined grip length. May be plated or black. Shank dia. may range from pitch dia. through 0.010 over nominal hole.
	SAE Grade 8	150,000 psi	High strength tension bolt. Usually plated. Same diameter tolerance as Grade 5. Undefined grip length.
	AN 3 Series	125,000 psi	General purpose tension or shear bolt. Shank dia. gives 0.001 to 0.004 inch clearance in nominal hole. Threaded length approx. 2 diameters. "X" indicates alloy steel bolt. Cadmium plated.
	AN 73 Series	125,000 psi	Materials and tolerances as AN 3. Head drilled 3 holes for lock wire.
	AN 173 Series	125,000 psi	Envelope and materials identical to AN 3. Close tolerance shank gives 0.0008 to 0.0013 inch clearance in nominal hole.
	NAS 1103 & NAS 1303	160,000 psi	Close tolerance high strength bolt. 1103 series has shorter thread (approx. 1 dia.) for shear application only. 1303 series has longer thread (approx. 1.5 dia.); suits tension or shear application.
	NAS 2903 & NAS 3003	160,000 psi	Salvage bolts identical to NAS 1103, 1303 except shank 0.0156 oversize (NAS 2903) or 0.0312 inch oversize (NAS 3003). Suffix "S" on part number indicates short thread (1103 style).
	MS 21250 & NAS 624	180,000 psi	Twelve-point high strength bolt. Suits tension or shear load. Shank gives 0.0005 to 0.0015 inch clearance in nominal hole. MS version has highly fatigue-resisting rolled form.
	MS 20004 & NAS 144	160,000 psi	Close tolerance high strength bolt internal wrenching head saves space and weight.

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