SKYBOLT NEWS

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TEMPE, ARIZ. 85281
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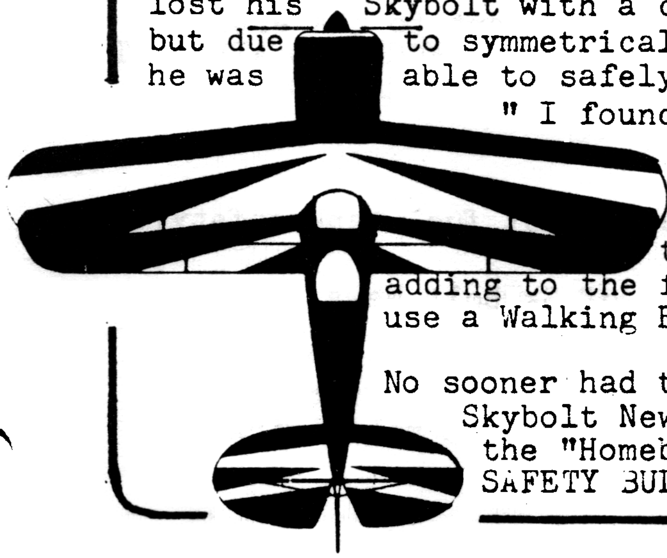
SERIES #4, VOL. #4

TO:

HANGAR FLYING with "MAC"

In our continuing effort to influence builders to build and fly safely, I want to pass on the following excerpt from a letter that I received from Dick Blair of Vincentown, N.J.(author of "Flight Characteristics Of The Skybolt With A 200 hp. Lyc." Skybolt News, Oct. 1977). This report was the result of a Skybolt forum held at the Sun 'n Fun Fly-in 1978, conducted by Dick and the late Freddy Passono of Clearwater, Fla.(Those of you who knew or remember Freddy, will remember that he nearly lost his Skybolt with a case of Aileron Flutter at 125 m.p.h. but due to symmetrical damage of both aileron bellcranks, he was able to safely land his dis-abled craft.).



" I found out that some builders are bending the aileron push-pull tubes to make them clear the ribs and compression members. This SHOULD NOT BE DONE as the bent tube can act as a spring, adding to the flutter problem. The best fix is to use a Walking Beam."

No sooner had the ink dried on the last issue of Skybolt News when I came upon an article from the "Homebuilder - Sept./Oct. 1976" entitled SAFETY BULLETIN by K.C. Alexander. The article was written about the dangerous use of Polyurethane Reticulated Foam in fuel tanks.

" Ever had the engine on your plane quit dead in the air ? I have and it's not a very comforting feeling. If you have any Polyurethane Reticulating Foam in your fuel tank, you are running a strong chance of someday experiencing this feeling.

P.R.F. is similar in appearance to a coarse, orange colored sponge. It has been readily available on the surplus market in nearly every part of the country, in which military jet aircraft have been produced. The fuel tanks of many combat jets are stuffed with it. The main function of this foam is to reduce the chance of an explosion if a fuel tank is struck by bullets, etc. It also reduces sloshing of fuel within the tank.

Some homebuilders picked up on the idea of using this foam in their fuel tanks, instead of baffling. That's where the problem comes in. P.R.F.(Polyurethane Reticulated Foam) was designed to be used in jet fuel. It is not compatible with gasoline and will deteriorate over a period of time. In addition to this major disadvantage, P.R.F. also reduces fuel capacity and therefore range, about 5%. A weight increase of approx. .30 lbs. per gal of tank capacity will also occur. If the foam is not properly packed within the tank, you also run the chance of wear metal being introduced into the fuel system from rubbing within the tank as the foam shifts with the fuel.

CONCLUSION: If you don't have a homebuilt (or any aircraft for that matter) which burns jet fuel and will be involved in combat flying, you should remove any P.R.F. from your fuel tank and thoroughly clean and inspect the entire fuel system."

I would like to add the following comment to the article above. "WARNING": DEVIATION FROM PROVEN, ACCEPTED AIRCRAFT PRACTICES FOR YOUR TYPE OF AIRCRAFT CAN BE HAZARDOUS TO YOUR HEALTH".

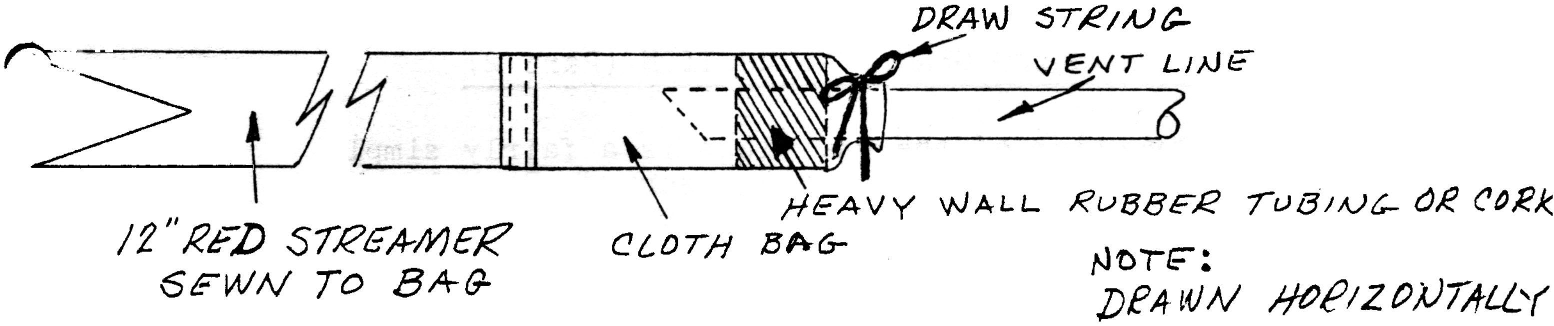
<u>FUEL TANK VENT LINE COVERS</u> (more about fuel tank safety)

Having just read the last issue of Skybolt News, Chuck Smith of Deerfield, N.H. called me to report a case of fuel tank rupture during aerobatic flight of a Pitts. He reported that the owner of the concerned Pitts was in the habit of plugging his vent lines when not flying.

It seems however that he was using hard plugs that fit so tightly that expansion of fuel in the tank led to weakening of the tank seams which ultimately led to the in-flight rupture.

In commenting on the foregoing report I want to thank Chuck for the call and to caution readers against making the same mistake. "SOFT CLOTH COVERS ARE ALL THAT IS NECESSARY TO PREVEVT VENT LINE CONTAMINATION". Since I am not priviledged to first hand knowledge regarding the above fuel tank rupture I must say yes, the hard plugs led to the failure. However, other un-answered questions remain in my mind regarding the construction quality of the culprit tank. Be that as it may, let's stay with soft covers so we won't have to find out the hard way whether the above was true or not.

To prevent your Vent Line Covers from being blown off in the wind as your aircraft sits on the ramp, See FIG. #1 for a suggested cover design. In use, the neoprene hose is slipped over the vent line and then the cover is tied on with the draw string above the hose making a secure attachment yet allowing the vent line to breath.



VENT LINE COVER

FIG. #1

SHELF LIFE OF STITS AIRCRAFT PRODUCTS

Many of our readers and customers of Stits Aircraft Coatings have written or called to inquire about the shelf life of these products. Stits has therefore published a Product Data Sheet #78-2 dated 30 Oct. 1978. You can get a copy by sending a stamped, self addressed envelope to Stits Aircraft Coatings, P.O. Box 3084, Riverside,CA. 92519 or send same to Starfire Aviation, Inc. 910 S. Hohokam Dr. Bldg. #107, Tempe, AZ. 85281. The Bulletin states that the new and still very conservative estimate of shelf life is based on actual aging tests. Tests were made with unopened containers in a protected area away from direct sunlight @ 0 to 100 degrees F.

A few of the items of concern are rated at the following shelf life before use.

2 YEARS : Poly-Tak Cement, Aero-Thane Catalyst #UE-810, Aluma-Thane Catalyst #UE-610, Urethane Varnish Catalyst #UV-560, Micro Putty MP-1100, Aluma-Dyne #E-2300, Aluma-Dyne #E-2310

4 YEARS:Poly Brush, Poly Spray, Poly-Tone Finish, Poly-Dope Reducer RJ-1200, Aero-Thane Enamel, Aero-Thane Clear Finish, Aluma-Thane Enamel, Epoxy Primer #EP-420, Epoxy Primer Catalyst #EP-430, Epoxy Varnish #EV-400, Epoxy Varnish Catalyst#EV-410, Urethane Varnish #UV-550,

INFINITE: Poly -Dope Reducers, Epoxy Reducer #E-500, Metl-Sol Cleaner #C-2200, Tubeseal, Urethane Reducer #UE-820, Urethane Retarder #UR-826.

The above are only a few of the products. Get the full story by writing for the bulletin. The bulletin also tells how to test Urethane Catalyst and the proper resealing after loss of the nitrogen purge.

CANTILEVER LANDING GEAR CONSTRUCTION (Part 2)

The construction of the gear legs is a fairly simple task if a few pre-cautions are observed. Each leg box is made up of 4 pieces of .090-4130N sheet steel and edge welded together. The type of edge welding that is employed is shown in FIG. #2. The method of welding in FIG. #2 allows deep even penetration of each sheet as opposed to the overlapping method commonly used in other weldment designs. Further, either Oxy-Acetylene or TIG welding is satisfactory. We prefer to use Oxweld #32 CMS filler rod since it produces a high strength weldment. For those of you who wish to produce extra strength in the gear leg assembly after all components are welded together including tabs etc., the complete assembly can be heat treated at a competent heat treating shop to produce a tensile strength of 125,000 to 130,000 psi. If you have employed heat treating of the legs, BE SURE TO MAKE NOTE OF SAME IN THE AIRCRAFT LOG BOOK AND YOUR SERVICE MANUAL. At Starfire Aviation we do not feel that heat treating is necessary. The stress analysis that we have done on the design used the"as welded condition" to ascertain the strength of the design.

The nice part of the gaer design is that the gear leg webs can be sheared to close tolerances and then edge ground to exacting measurements. The main points of accuracy are 1. the dimensions at the top of each web 2. The 7 degree alignment of the pivot tube housing as it passes through the front and rear webs 3. The 90 degree alignment of the front web and the top web during set-up and welding 4. The 7 degree angle at the top of,the top and bottom webs.

To hold the front, top and rear webs in alignment for welding requires a simple jig. This jig also aids in the accurate alignment of the pivot tube housing. The jig or welding fixture is made from a piece of 4x6 lumber that has been accurately surfaced to produce true 90 degree corners on all 4 edges. The 3/4" x 3/4" slot to hold the pivot tube housing in alignment is cut with a router. FIG. #3 shows how the welding jig is made.

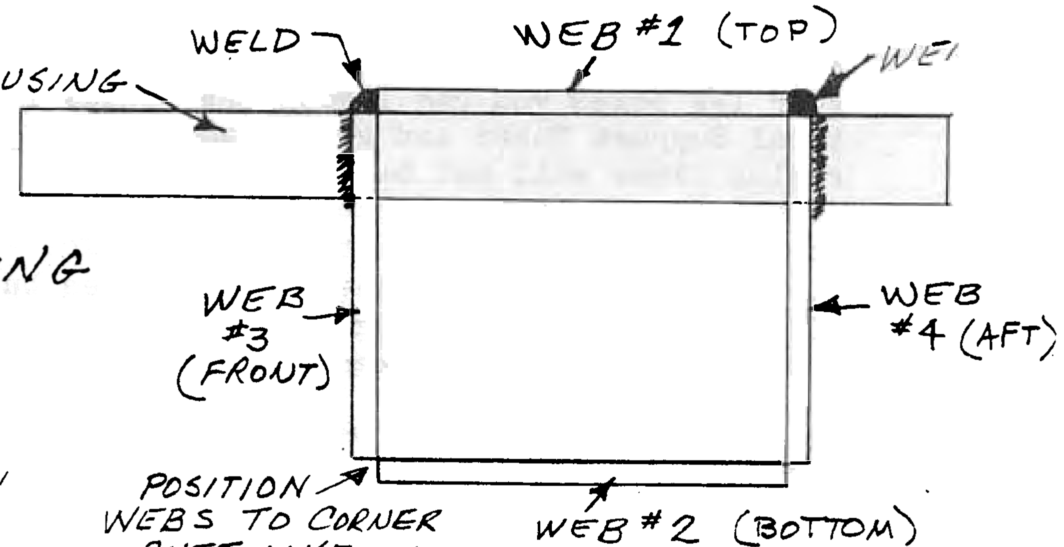


FIG. #2
POSITIONING LEG WEBS FOR WELDING

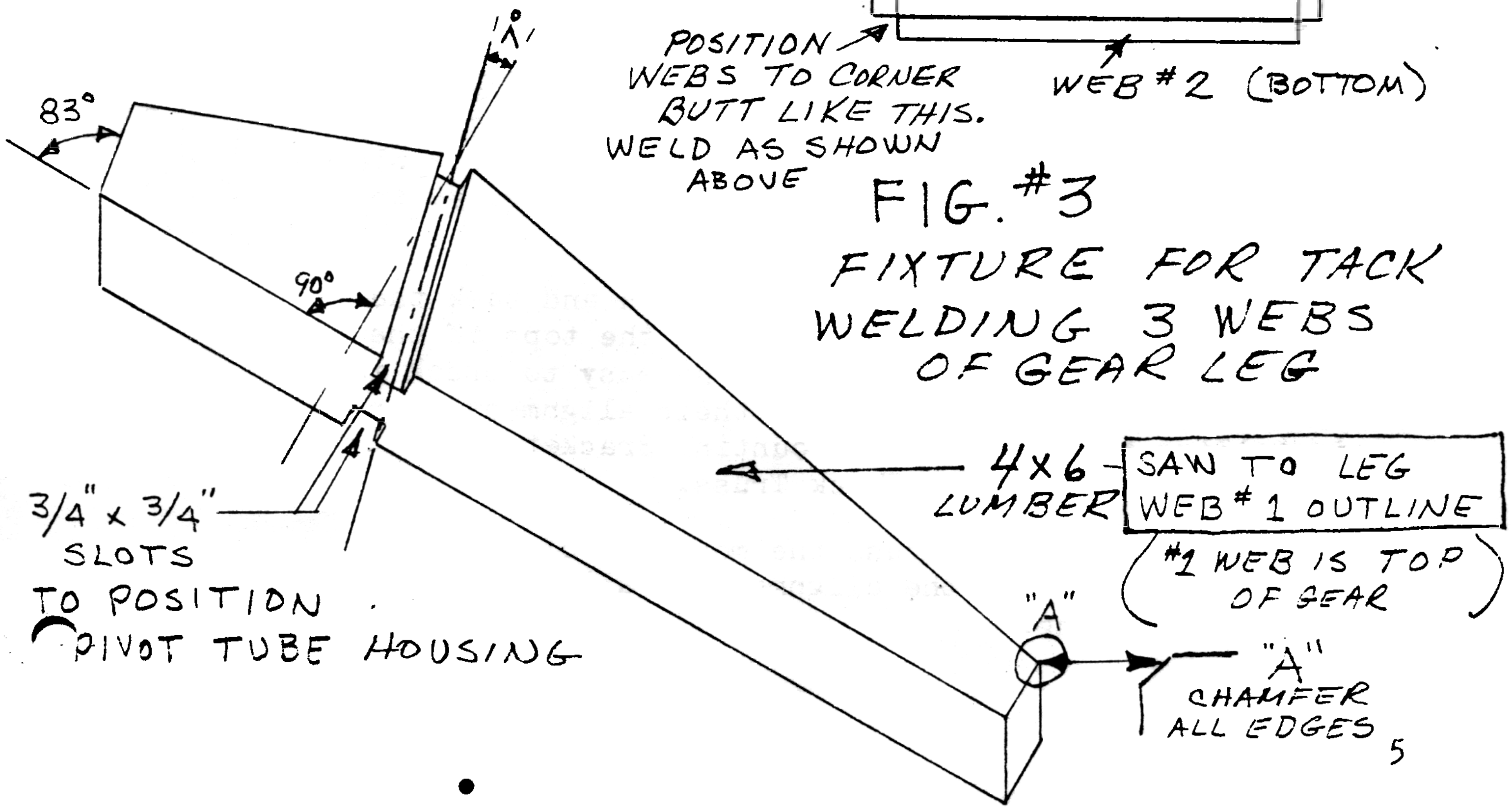


FIG. #3
FIXTURE FOR TACK WELDING 3 WEBS OF GEAR LEG

Since the welding jig is made of wood, naturally we use it only to tack our parts together. To prevent or help to prevent the burning wood gases from hindering the tacking operation, it is best to chamfer the edges of the wood jig at least 1/8"..

The pivot utbe housing that welds into the front and rear webs should be machined to length plus or minus .002 and the inside diameter reamed to .625 A piece of .625 drill rod or .625 cold rolled rod should be inserted into the pivot tube housing prior to welding.

At the bottom end of the top and bottom webs a 3/4" radius is called out on the plans for insertion of the $1\frac{1}{2}$" O.D. x .134 Vertical Support Tube. DO NOT grind this radius prior to welding the leg box. As you weld the edges of the leg box, stop the weld bead $\frac{1}{4}$" from the points at which the radius meets the front and rear webs. As soon as the edge welding is completed on the gear leg boxes you can layout the radius for the Vertical Support Tubes and grind same. REMEMBER that the radius lines will not be round but instead, will be eliptical due to the angle at which the Vertical Support Tube is inserted in the leg box. The Vertical Support tubes can be welded to the axles but they DO NOT get welded to the leg boxes until the leg boxes and Shock Struts have been mounted on the airframe.

After the leg boxes are welded it is time to install the .090 gussets that weld to the Pivot Tube Housing and the Front Gear Leg Web. Prior to welding the Gussets, the Grease Fittings are located. Drill a #40 hole in the Pivot Tube Housing and weld an AN315-428 Nut to the tube. Grease Fitting are located at 2 places on the Pivot Tube (Front and Rear Ends). Fig. #4 and #5 show the Gussets and Grease Fittings.

The next operation will be to position and tack the Upper Shock Strut Filler Bracket to the tops of the Gear Legs. Make the tacks SMALL and easy to break in case it is necessary to change their alignment when installing the Shock Strut Mounting Bracket in the bottom of the fuselage Shock Truss.

In Part #3 we will discuss the mounting of the gear to the fuselage and the alignment of all parts prior to final welding.

ENGINE COWLING INSTALLATION (PART #1 --- THE NOSE BOWL)

The proper installation of the Nose Bowl is not only important from the standpoint of the esthetics of the aircraft profile and blending of the spinner lines, but more importantly,the reduction of air buffeting vibration of the entire cowl assembly which can lead to destruction and constant cracking of the cowling components.

The most important aspect of the Nose Bowl position is to insure that the face of the Nose Bowl is as close to perfect as possible in producing a paralell line between the rear edge of the prop in both plan view(Top view) and side view of the aircraft. Any given station on the aft edge of the prop Must clear the Nose Bowl the same distance no matter what the prop position. Further, this means that if you have built an Engine Mount with 1½ degrees of Down Thrust and 1½ degrees of side thrust, then the face of the Nose Bowl must also be mounted in the same manner.

Keep in mind during the construction of the Cowling and the mounting of the Nose Bowl (along with the rest of the engine installation) that the engine does a lot of shaking and rattling around inside of the Cowl. The amount of engine movement is determined by the type and AGE of it's Shock Mounts. Therefore it is mandatory that we plan for this change in engine position while building the Cowl, positioning the Nose Bowl, designing the air scoop and carb. heat box assembly etc. A good rule of thumb is to leave ½" clearance between any part of the engine or it's components and any stationary part or component. The ½" clearance is a vertical and a side to side measurement between the affected parts. Many is the time I have seen starter gear drive noses trying to pound their way through a Nose Bowl due to aging and sagging engine Lord Mount Rubber Bushings. Apparently the owners or mechanics of these aircraft did little to insure that annual or subsequent inspections were properly carried out. 2 of the most destructive moments in the life of a Cowl and other engine compartment components plus the airframe itself, happen at the moment of engine start-up and shut-down. When you witness those moments in the life of an airframe you can almost feel the anguish of every part.

Most Skybolt builders as well as builders of the Starduster Too choose the Piper Comanche type Nose Bowl for their aircraft since it is readily available from several supply sources. However, the quality of some of the fiberglass copies of this Nose Bowl are of very poor quality due to money hungry people making copies of copies. A good quality Nose Bowl should have fiberglass gussets in the top front of the bowl to support the corners at the radius of the starter ring opening. Many available bowls are flimsy due to in-adequate layers of glass cloth. Distortion and weak recessed trailing edge cowling flanges are the order of the day in some. The Commanche type Nose Bowl is guilty of large cooling drag loses. The problem of cooling drag has prompted me to design a completely new Nose Bowl for the Firebolt to improve efficiency and to provide recognition for this aircraft. At this time, we are working on the male plug but unfortunately we are still many months from production. So working with what is available, lets get on with the job.

In this, the first of a two part article, the parts that we will be concerned with are the Nose Bowl and the 4 Cowling Channels that attach to the Nose Bowl and the Firewall flange. The Cowling Channels are made from .032 - 2024-T3 alum and measure 48" in length.

In making the channels, we cut 3½" x 48" strips of alum. making sure that the grain of the alum. is at 90 degrees to the bendline of the flanges that are bent to form the Channels. The radius of the bend that forms the flanges is a minimum 1/16" to prevent bending cracks during forming the Channels or future cracks due to vibration of the cowling assembly. FIG. #6 shows how the Channels are made. While you are shearing aluminum, it is wise to also shear the shim plates that are necessary between the Cowling sheets and the Cowling Channels due to the fact that the Channels are mounted to the under side of the Nose Bowl flange and the Firewall flange. This will be a little easier to understand when you look at FIG. # 7 that shows the attach points on the firewall with respect to the longerons.

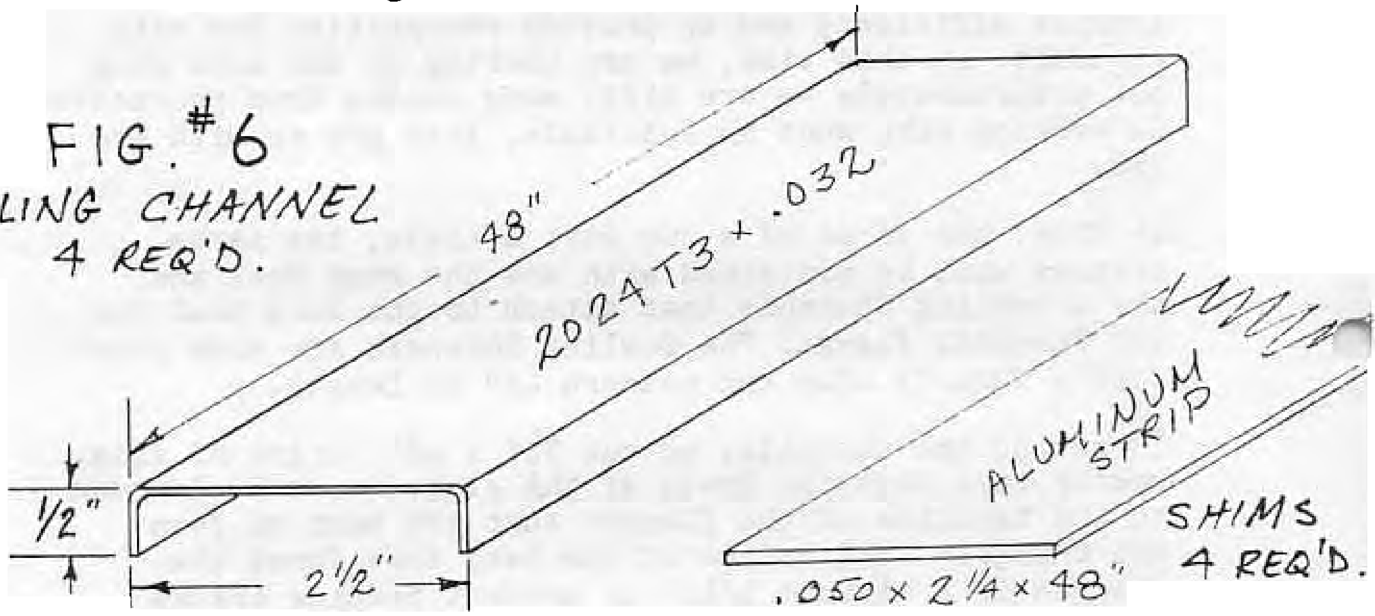
The proper positioning of the Nose Bowl starts with a piece of ¼" plywood fashioned so that it fits the starter ring on the engine. Large holes cut in the plywood towards the outer ends will facilitate the use of padded

"C" clamps to hold the Nose Bowl in position for attaching the Cowling Channels. The ¼" plywood also gives us the proper spacing between the starter ring gear and the aft side of the Nose Bowl face.

When positioning the Nose Bowl for heigth, the use of a long straight edge is a must in order to check the side view profile from the Nose Bowl to the front instrument panel. A smooth transition line is essential in order to prevent unsightly dips and humps in the profile at the firewall station. The heigth of the Nose Bowl should also give the illusion from a profile view, that the prop spinner and the Nose Bowl are made in one piece with a beautiful blend line from the top of the spinner into the bowl. FIG. #8 and #9 will give you some ideas about the mounting of the Nose Bowl.

FIG. #6

COWLING CHANNEL
4 REQ'D.



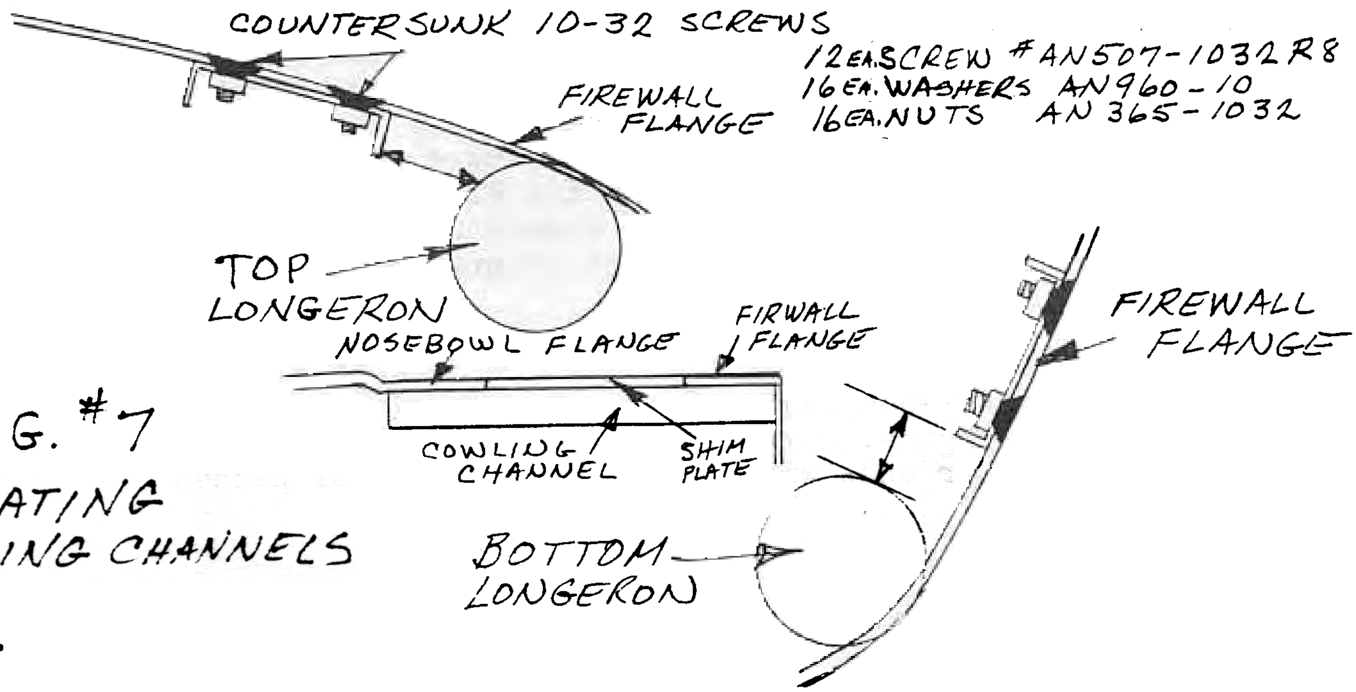
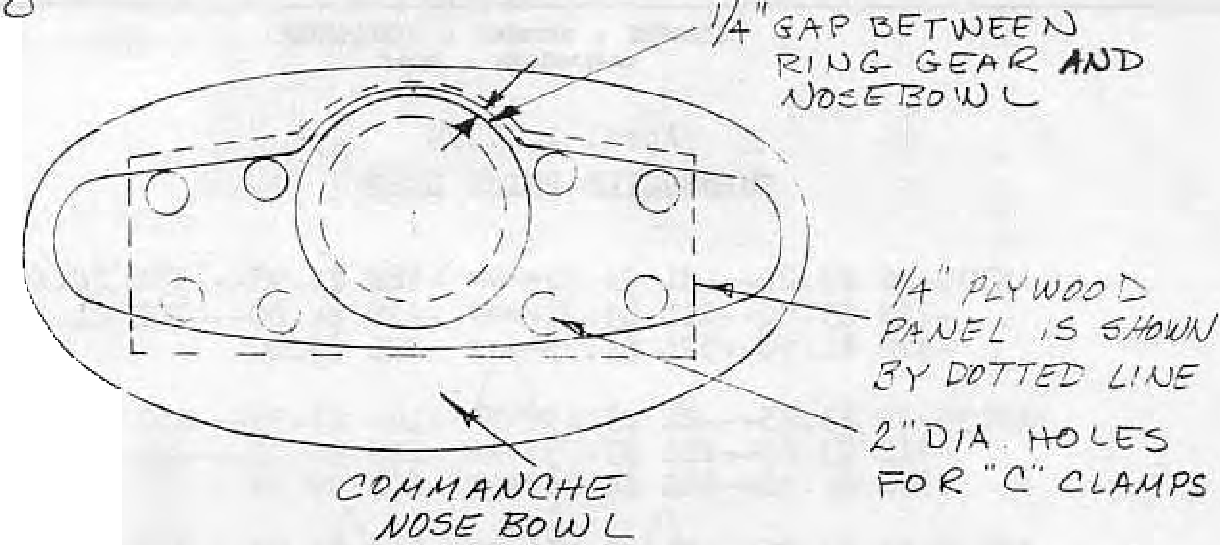


FIG. #7

LOCATING
COWLING CHANNELS

FIG. #8



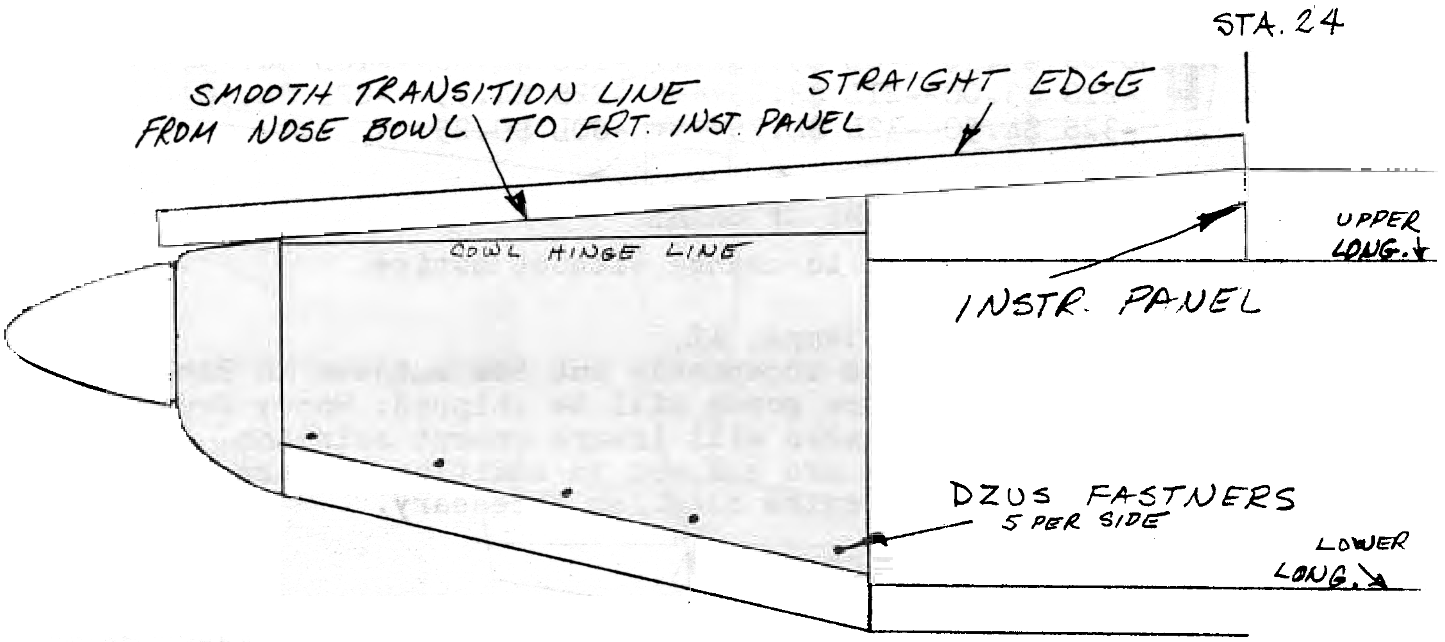
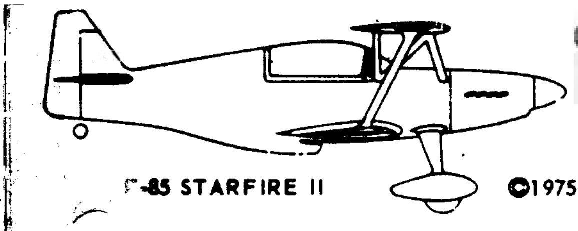


FIG. #9

DZUS FASTNERS AVAILABLE
FROM STARFIRE AVIATION, INC.
910 S. HOHOKAM DR. #107
TEMPE, AZ 85281
$7⁵⁰ FOR COMPLETE SET
OF 10



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April 1, 1979

TURNBUCKLE PRICE LIST

AN130-8S \$3.25---8L \$3.50**** -16S \$3.95---16L \$4.10
-21S \$3.00--21L \$3.25**** -22S \$4.00---22L \$4.30
-32S \$4.50--32L \$4.75**** -80L \$9.00

AN135-8S \$3.35---8L \$3.45**** -16S \$3.95---16L \$4.10
-21S \$3.00--21L \$3.25**** -22S \$4.00---22L \$4.30
-32S \$4.50--32L \$4.75**** -80L \$9.25

AN140-8S \$3.25---8L \$3.45**** -16S \$3.95---16L \$4.10
21S \$3.00--21L \$3.25**** -22S \$4.00---22L \$4.30
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AN150-8S \$3.30---8L \$3.40**** -16S \$4.00---16L \$4.15
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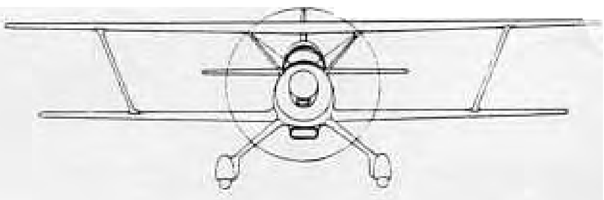
All prices subject to change without notice
NO C.O.D.'s
All prices F.O.B. Tempe, AZ.
Personal Checks are acceptable but are subject to Bank clearance before goods will be shipped. Money Orders or Cashiers Checks will insure prompt shipment.
Overseas Shipments are subject to additional charges for documents and extra handling necessary.

STRENGTH OF TURNBUCKLES

-8 800 pounds, -16 1600 pounds, -21 1800 pounds
-22 2200 pounds, -32 3200 pounds, -80 8000 pounds

-21 Turnbuckles have same dimensional specifications as a -16 except that the thread size is 12-28 instead of 10-32 and are therefore slightly stronger.

4130 • ALUM. • HELI-ARC • OXY-ACETYLENE



THROTTLE, PROP AND MIXTURE CONTROL LINKAGE

This article on engine control linkage should really be used as a supplementary section of the Feb. 1978 issue of the Skybolt News in which we gave you a drawing of our throttle, prop and mixture control quadrant and suggested mounting location on the fuselage.

It would be possible to use the information contained in FIG. #10 to hookup the levers of the quadrants and go on from the front quadrant to the involved engine components via push-pull cable assemblies. To do this you will have to devise your own method of securing the cables to prevent slippage. Personally, I prefer to run hard linkage wherever possible using needle or other type bearings at certain points to make the entire system as silky smooth as possible. If Push-Pull Cables could be used without having to bend them around within the airframe and engine compartment I would be all for them, but alas, this is not the case.

The linkage between thr front and rear quadrant levers is made up of ¼"O.D. 4130 tubing x .035 wall and AN667-2 Cable Forks. The forks are welded to the tubing with stainless steel welding wire or you can silver braze them. Under no circumstances should you braze them with bronze or copper-bronze.

FIG. #11 shows how the needle bearing brackets are fabricated from 3/4" x 1½" x .049 Rectangular Tubing and 5/8" x .035 Round tubing which is used as bushing stock. Before welding the 5/8" tubing into the mounting bracket, it is necessary to ream the I.D. to .5625 to receive the B-66 needle bearings. During the welding of the 5/8" O.D. Bushings it is also necessary to insert 9/16" drill rod or equivalent into the bushings to prevent burn through. The Needle Bearing Bracket Assemblies are best made up using the TIG welding method. After welding is complete, re-ream the bushings to receive the Needle Bearings.

The Cross Shafts that are inserted in the Needle Bearing Brackets to transfer the motion of the quadrant linkage across the firewall to control the Throttle, Prop and Mixture are made of 3/8" O.D x .058 wall tubing. All levers are made of .071 sheet steel and the hub bushings for the levers are made from ½"O.D. x .065 tubing reamed to .375. The levers are welded to the ½" O.D. bushing stock and the bushings are then pinned to the cross shafts with 1/8" roll pins after the correct lever position has been established. It is suggested that only the outboard levers be pinned to the shafts and the inboard levers welded to the shafts. This will make it possible to dis-assemble the entire cross shaft and bearing bracket assembly whenever necessary for plating the parts or painting them to prevent rusting. All parts of the Throttle, Prop and Mixture linkage are made of 4130 steel except the roll pins.

All linkage from the firewall levers to the operated components have an AN276 Ball Joint Assembly at each end of the linkage tubes. The tubes are made of ¼"O.D. x .035 - 4130 with a 10-32 bolt welded into each end. The double ball joints on each linkage rod gives us the flexibility we need to contend with the movement of the engine on it's shock mount rubber bushings.

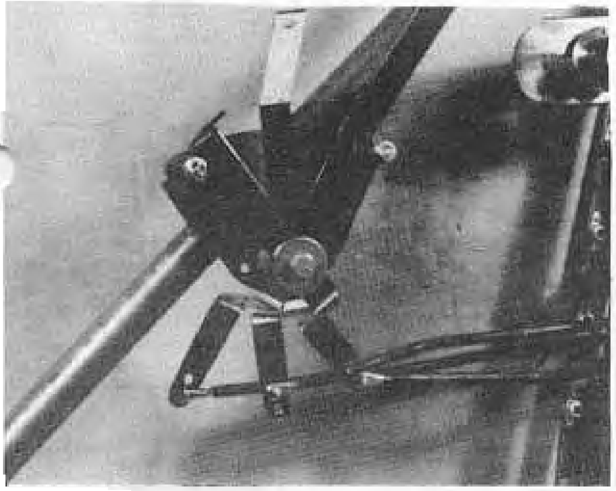
All linkage is adjusted to provide 1/8" of springback. In simple terms this means that the throttle is indeed full open when the throttle lever still has 1/8" left to travel on the Quadrant. Pushing the throttle lever full open against the stops of the Quadrant results in a springback of the lever. The springback adjustment is common to all quadrant levers.

When hooking up the total system as shown here-in along with the quadrants shown in the Feb. '78 issue, we can use hard linkage for all systems on the 320 and 360 Series Lycoming engines. The 540 Series presents an exception since the prop governor is mounted on the left fron side of the engine and it would be extremly difficult to run hard linkage to this component. Therefore, on the 540 Series we use flexible cable from the firewall to the Prop Governor.

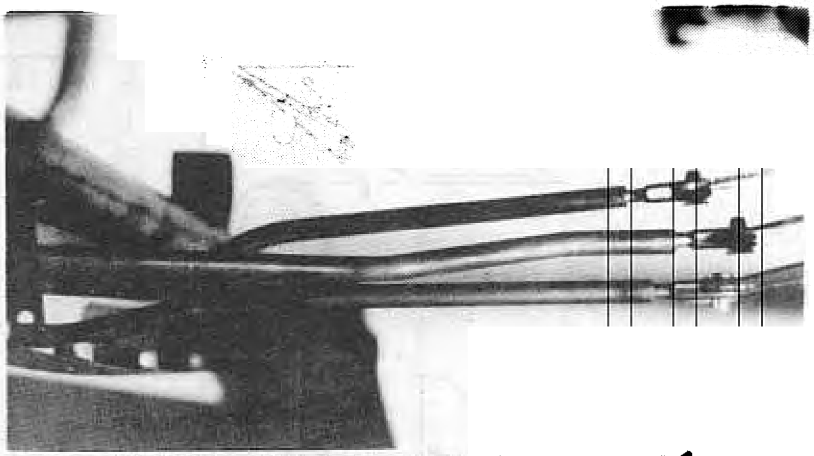
Whether your engine usesa Float Carb., Fuel Injector or Pressure Carb., they all have their hook-up problems, we can make the hard linkage installation. The levers on the Cross Shafts do not necessarily have to be mounted on the most inboard end. The shape of the lever can be changed and the lever mounted anywhere along the shaft.

All dimensions of cross shaft levers as shown here-in refer to our installation of a Pressure Carb.

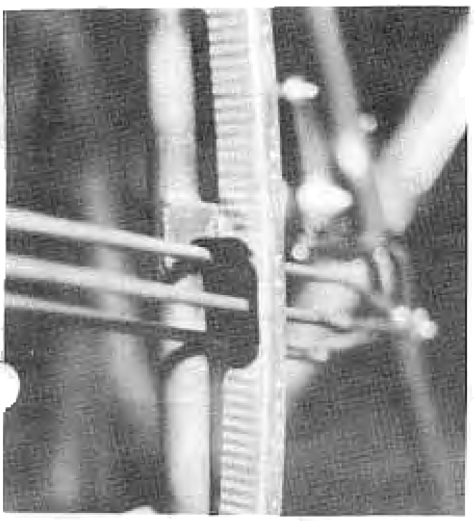
The experienced builder will make up all parts, lightly tack weld where required and make the complete installation and check all mechanisms for proper operation, then remove and finish fabrication.



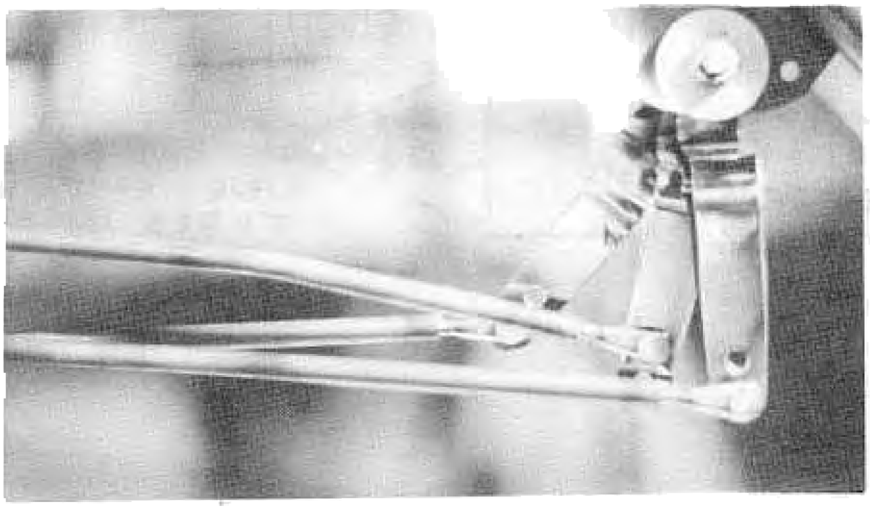
MOCK UP OF REAR QUADRANT LOOKING OUT'BD. FROM COCKPIT



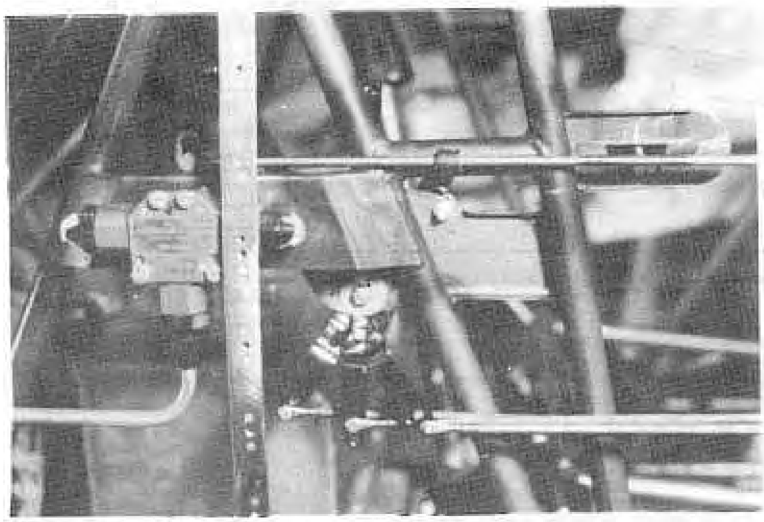
LOOKING STRAIGHT DOWN FROM ABOVE REAR QUADRANT MOCK UP



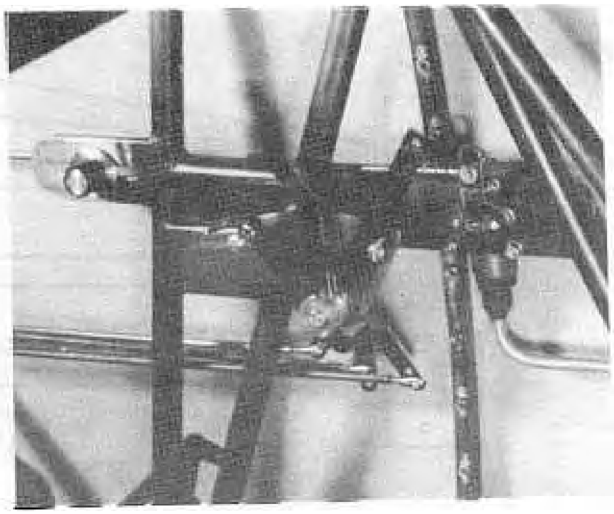
TREATMENT OF REAR FUSELAGE SIDEWALL FORMER



LOOKING IN'BD. AT REAR QUADRANT MOCK UP



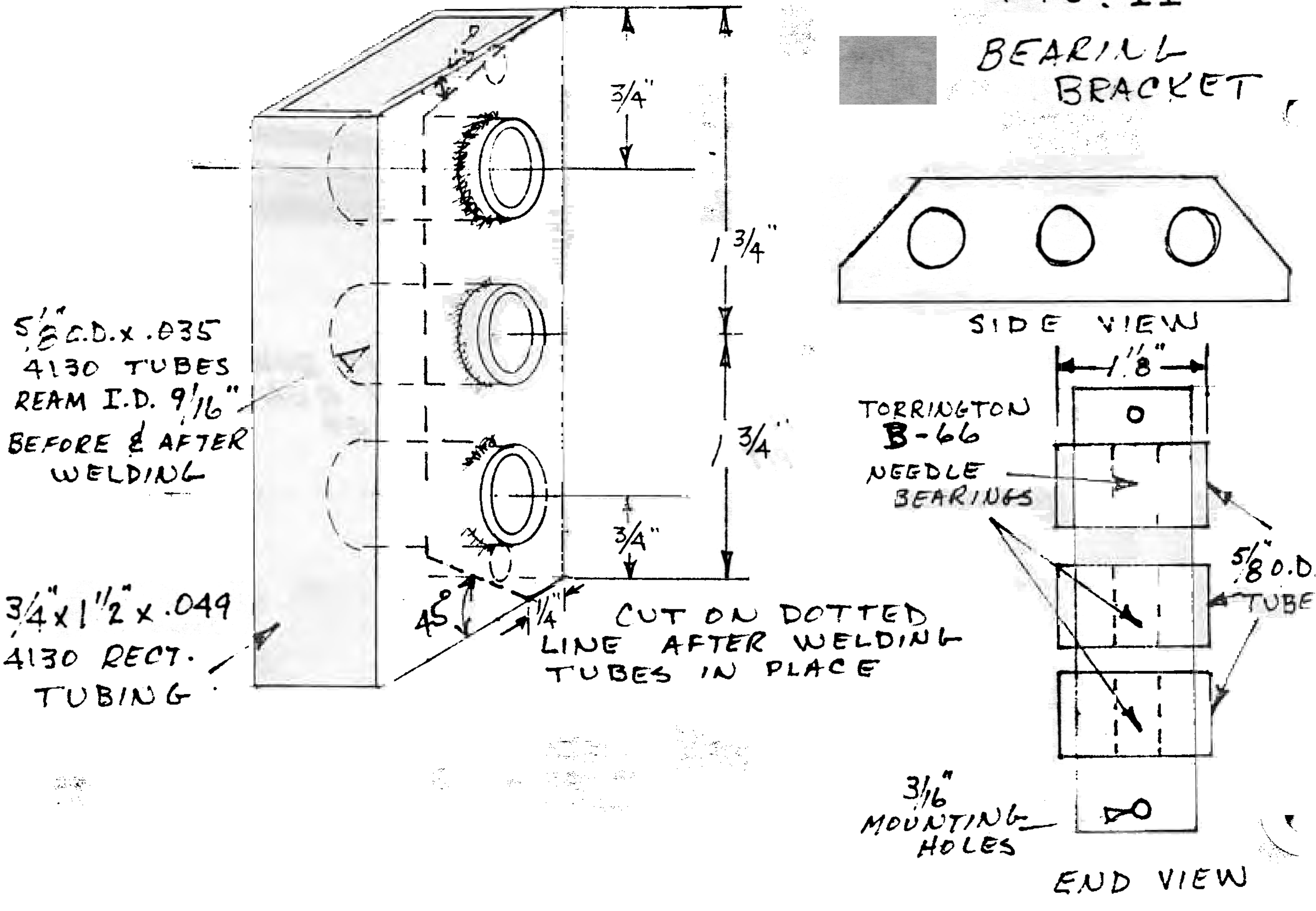
LOOKING IN'BD AT FRONT QUADRANT. ALSO SHOWN IS FUEL SELECTOR VALVE AND CONTROL SYSTEM FOR IT.

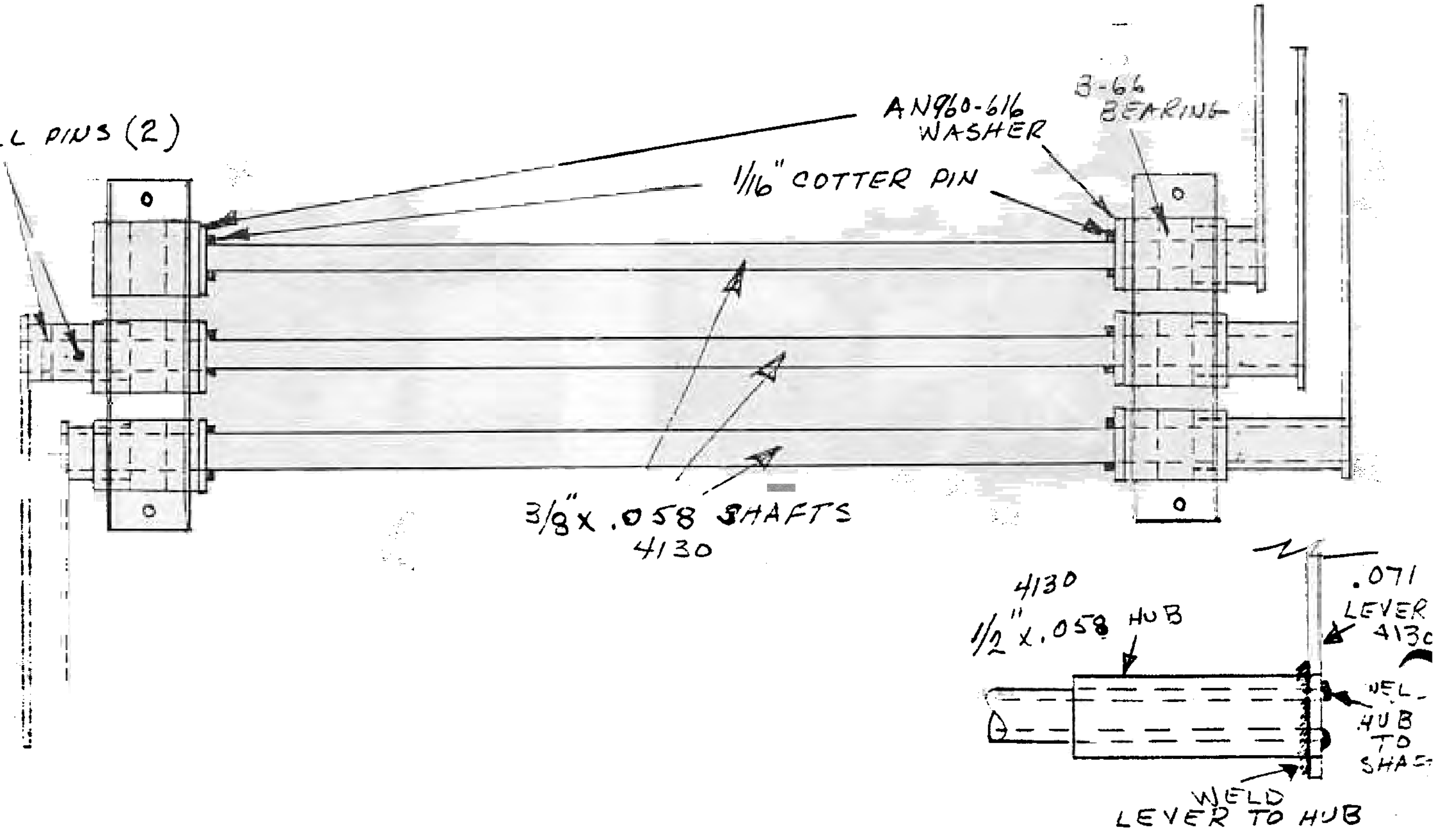


LOOKING OUT'BD AT FRONT QUADRANT MOCK UP AND FUEL SYSTEM CONTROL

FIG. 10

FIG. 11


BEARING BRACKET
3/4"
1 3/4"
1 3/4"
3/4"
5/8" O.D. x .035
4130 TUBES
REAM I.D. 9/16"
BEFORE & AFTER
WELDING
3/4" x 1 1/2" x .049
4130 RECT.
TUBING
45°
1/4"
CUT ON DOTTED
LINE AFTER WELDING
TUBES IN PLACE
SIDE VIEW
1 1/8"
TORRINGTON
B-66
NEEDLE
BEARINGS
5/8" O.D.
TUBE
3/16"
MOUNTING
HOLES
END VIEW


1/8" ROLL PINS (2)
AN960-616
WASHER
B-66
BEARING
1/16" COTTER PIN
3/8" x .058 SHAFTS
4130
4130
1/2" x .058 HUB
.071
LEVER
4130
WELD
HUB
TO
SHAFT
WELD
LEVER TO HUB