

SKYBOLT NEWS

910 S. HoHoKaam DR. BLDG. 107
TEMPE, ARIZ. 85281

602-968-2556

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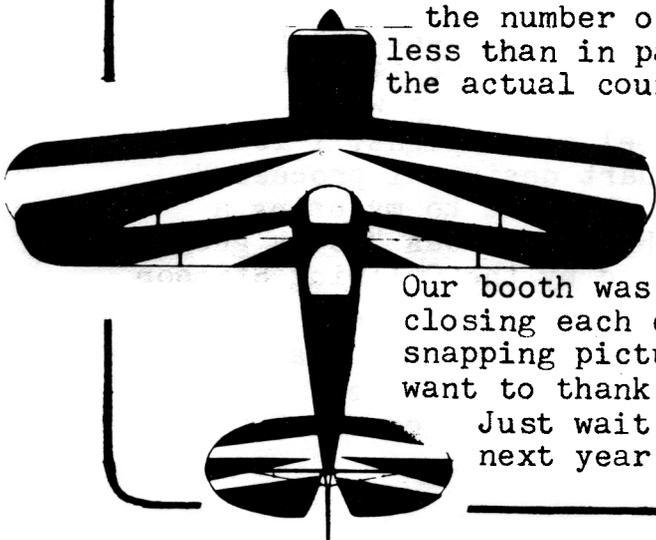
AUG. & SEPT. 1977
(Part 1)

TO:

FROM THE AUTHORS DESK:

With Oshkosh and vacations behind us it is time to get back to the business of building Skybolts and components for same. I want to personally thank every one of our subscribers for their display of patience while our shop was closed and the author galavanting around the country.

The 25th. anniversary of the E.A.A. was celebrated at Oshkosh with a larger crowd than ever. Attendance was 350,00 plus but the number of homebuilts seemed to be slightly less than in past years. We will have to wait for the actual count in the pages of Sport Aviation.



Due to our production load in Jul. we were 2 days late arriving at Oshkosh, so if we missed you on either Sat. or Sun. we apologize.

Our booth was a mass of humanity from opening to closing each day. I've never seen so many cameras snapping pictures of one display in my life. I want to thank all of you who visited or display.

Just wait until you see our fuselage display next year. We have already purchased a 300 HP

Lycoming IO-540-K1A5 to be installed in a modified fuselage for large engines the purpose of which is to obtain better control of the C.G. without resorting to large distribution of weight in the aft end of the fuselage. A truly good aerobatic machine should have the concentration of all heavy weights as close to the C.G. as possible. We will keep you informed of the progress.

OSHKOSH OBSERVATIONS:

There were many beautiful Skybolts at Oshkosh this year. One of them belonging to John Watts of Canada walked off with 2 trophies, the most important of which was the "Best Workmanship" award. It was truly a fine example of the Skybolt. The other Skybolt that was impressive belonged to Dr. Dean Hall of Fullerton, Calif. It won an "Honorable Mention" award in the Custom Class judging. Dr. Hall's Skybolt was fully I.F.R. equipped with a beautiful full canopy (flush mounted), single axis auto pilot (wing leveler), heating and ventilating system, beautiful wing root fairings and a cantilever legged landing gear of the Marquart Charger design. The aircraft is powered with a 200 HP. Lyc. and constant speed Hartzell prop. Dr. Hall states that he is obtaining 150 MPH cruise and I fully believe it. The empty weight is rather high due to avionics, instruments and other modifications (1286 lbs.) but the performance is good. I expect that his high cruising speed is due to 3 main items. First is the canopy, second is the gear design which is beautifully faired right down to the bottom of the wheel pants and third, the wing root fairings. These 3 areas are usually drag dirty on most Skybolts and many other biplane designs. The "I" struts on his Skybolt are also very nicely faired. We will be doing an article on wing root fairings in the Oct. issue of Skybolt News.

THE MARQUART CHARGER LANDING GEAR

In designing the Starfire II in 1974 I was seeking a cantilever gear that would lend itself to excellent fairing, a better shock absorbing system and yet would not weigh anywhere near what the Cessna type Steel gear weighs. I found what I was looking for in the Marquart design. I proceeded to ask my friend Ed Marquart if he objected to my using a modification of his basic design. His reply was "be my guest" The gear design was highly influenced by the Gullwing Stinson aircraft as you can see in the frontal view of the Starfire II in FIG. 1 The gear design uses a stack of rubber discs (5) on each shock tube which are mounted inside of the fuselage. The legs themselves are made from sheared pieces of .090

4130 sheet steel and are welded to form a very strong box section. From the box section leg we go to a vertical member of $1\frac{1}{4}$ " - 4130 tubing. Attached to the bottom of the tubing is the axle (you can make it 2 piece for a bolt on Cessna type axle). The plans for this gear will be available in Oct. 1977 the price of which is yet to be established. For more information, please send a "Stamped, Self Addressed Envelope" to Firebolt Aircraft, Inc. Box 28321, Tempe, Ariz. 85282.

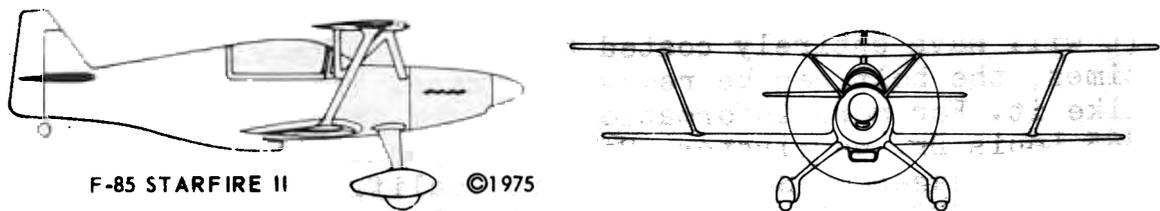


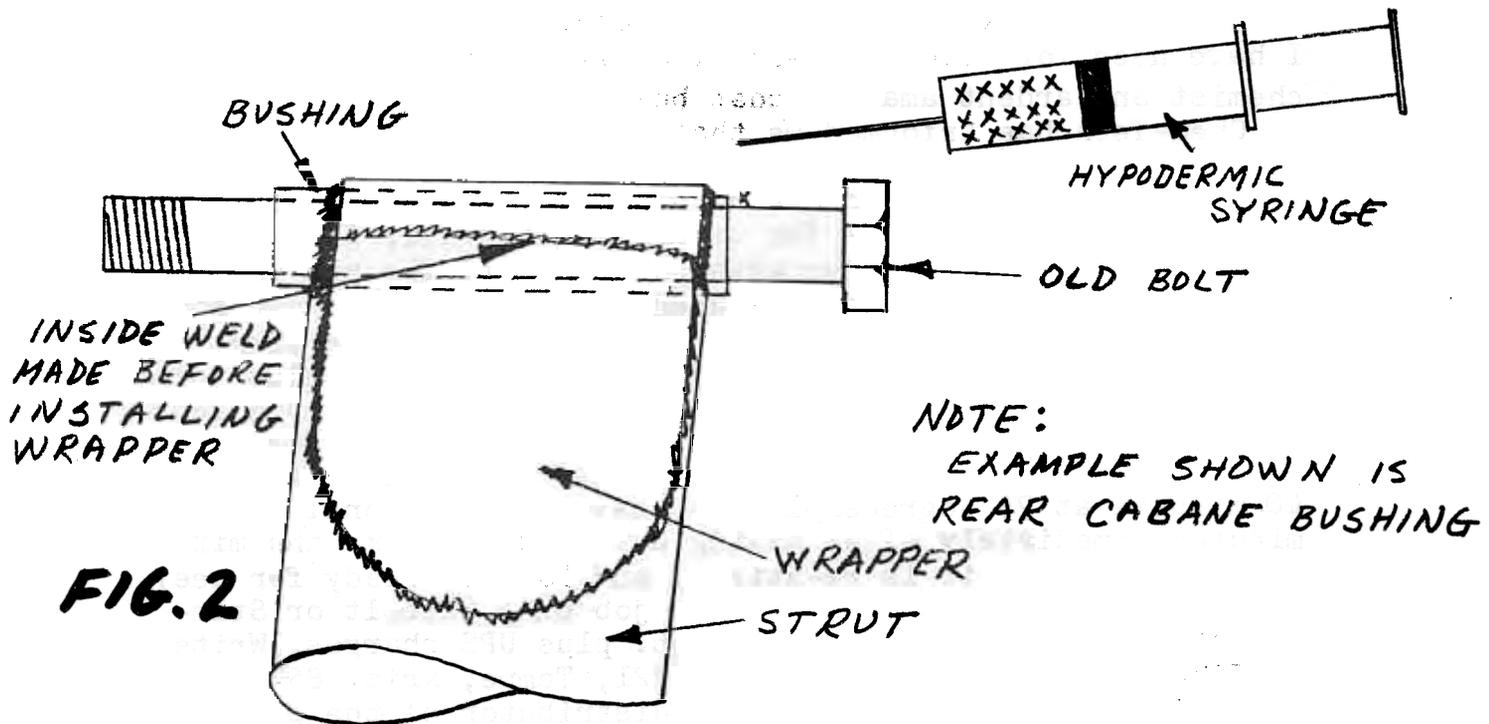
FIG. 1

T-88 STRUCTURAL ADHESIVE (EPOXY) FOR WOOD

T-88 is a relatively unknown epoxy of superior quality which I have used for several years. The mfg. of this product is a chemist and ardent amateur boat builder. He (Jerry Schindler) of Chem-Tech has informed me that our own Tony Bingelis who writes the "Designee Corner" in Sport Aviation and is the builder of an Emeraude and a Turner T-40 is a user of T-88. I don't blame Tony one bit for using it. It really is a fine epoxy. A few of it's major advantages are 1. The mix is 1 to 1 (Equal Parts). 2. It can be used at temperatures just above freezing (35 degrees). 3. It is non-staining (after drying, the color is that of varnish). 4. The thickness of the glue joint is not critical (some epoxies demand a joint of no more than .011 gap). 5. It does not shrink. 6. It is not affected by rot, fungus, oil or gasoline. 7. It has good pot life (35 - 40 minutes at 75 degrees, plus you have an additional 15 - 20 minutes immediately after mixing during which time the mix is heating, then it is re-stirred and is then ready for use). 8. Two quarts will usually do the job on a Skybolt or Starduster. The price is \$13.75 per qt. plus UPS charges. Write to Firebolt Aircraft, Inc. Box 28321, Tempe, Ariz. 85282. Firebolt Aircraft, Inc. is now a distributor of the product.

THE TRICK IN WELDING TO KEEP BUSHINGS ROUND

Just one look at Fig.2 would provoke an immediate uproar of laughter in most gatherings of mechanical wizards, if I stated that it is easy to get the 2 parts separated after welding and that the out of round condition of the bushing will be minimal. Go ahead and laugh Vladimir. The stuff in the hypo needle is an amazing product and no self respecting shop should be without it. The stuff in the needle is CRC 3-36 You can take a welded part, wait until it is cool enough to touch. hold the part vertically, apply a couple of drops to the bottom of the part to be removed and watch the stuff crawl uphill. The affinity for metal is phenomenal. If you wait long enough (approx. 10 min.) it will have entirely coated the bolt in Fig.2 and many times, the bolt can be removed by hand. Try it. You'll like it. For more information, contact CRC Chemicals 885 Louis Dr. Warminster, Pa. 18974 phone 215-674-4300 or 2973 Teagarden St. San Leandro, Calif. 94577 phone 415-352-6000 This same product is also un-surpassed for preventing rust on bare steel during mfg. and assembly of parts. We buy it by the gallon at Starfire Aviation and it costs less than WD-"whats that number" ?



FUEL SYSTEM INSTALLATION AND DIAGRAM

This subject has been the request of many of our readers. The fuel system and it's proper installation is of the utmost importance. Before we can hook anything up we first have to locate and mount the various components in the air-frame. Let's take the Main Fuel Tank first. The plans call for Tank Mounting Straps to be made of 1" x .035 - 4130 steel but the plans do not show any detail for same. In Fig.3 you will see our method of attaching the Tank Straps. The Straps are made from 1" x .025 - 301 Stainless Steel $\frac{1}{4}$ hard. This material has a tensile strength of 125,000 psi. Instead of using AN 4 bolts as called for in the plans, we use $\frac{1}{4}$ " "TEE" bolts and attach same to the straps as shown in FIG.4 I prefer to edge weld the straps as shown but you can also rivet them together. Our method of welding is Heli-Arc. You will notice in FIG. 3 that the Tank Bushings are cut off level with the top edge of the upper longeron in order to prevent the "TEE" bolt and Strap from rubbing or chaffing against the Coaming. A strip of Felt $\frac{1}{8}$ " thick x 1" wide is glued to the Tank Straps with Contact Cement or other suitable adhesive. Tank Straps are now available from Starfire Aviation in blank form 1"x48"x.025 for \$14 per set. If you need the "TEE" Bolts, they are also available @ \$1.75 ea. Tank Straps are shipped with enough stainless welding rod to Heli-Arc them. Please note in FIG.3 that you can bend the "TEE" Bolts on the top Straps to provide even more clearance between the Tank Strap and the Coaming.

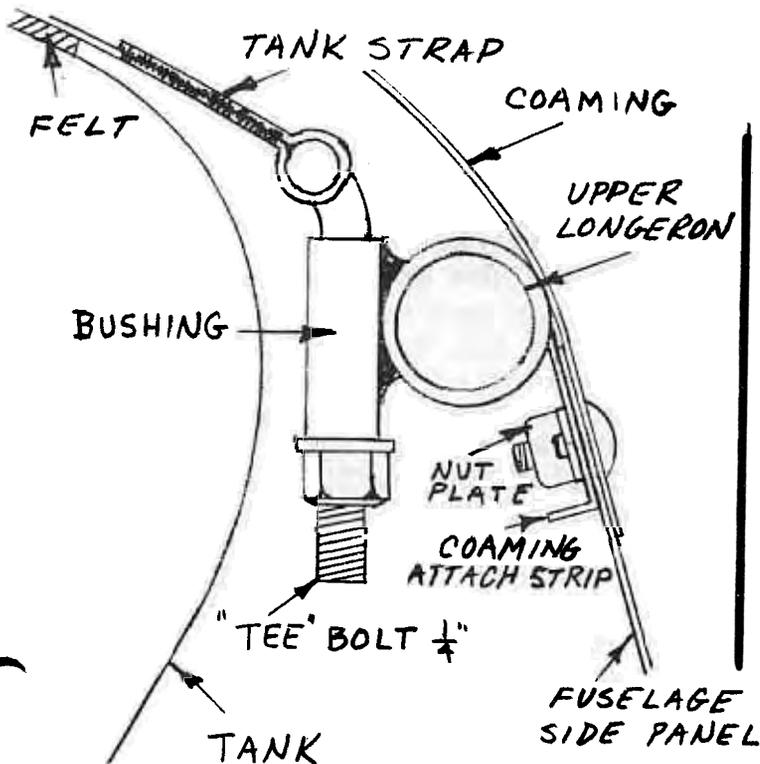
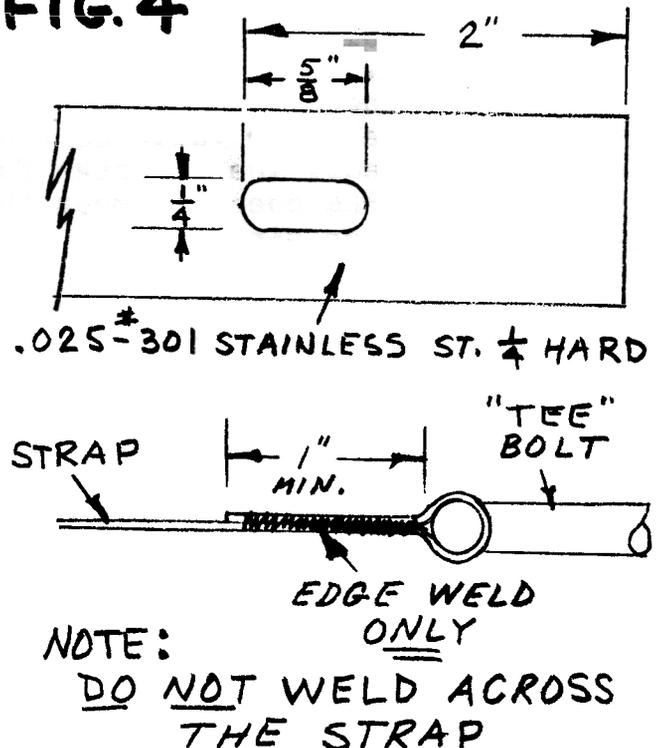


FIG. 3

FIG. 4



The example of Tank Strap installation in FIG.3 is that of a Top Strap because the clearance between the Coaming and the Strap is very small. The bottom Tank Straps are mounted in the same manner except that you will not need to bend the "TEE" Bolts.

We have covered the mounting of the Wing Tank in the July 1977 issue so we will not repeat it.

The next Fuel System component to mount is the Fuel Selector Valve. If we are to control a Wing Tank as well as the Main Tank, we will need a 3 way Selector Valve. I strongly urge you to pick an approved type of aircraft valve instead of an automotive or truck type valve unless you are absolutely sure of it's inner construction. There have been reports in the pages of Sport Aviation on just such valves. The problem valves had molded plastic rotary valve mechanisms and were designed for diesel truck fuel and would stand up to the highly aromatic aircraft fuels. In other words, these valves can fail you. Be sure the valve you select is the all brass or aluminum type and has an easily discerned "Detent" click that lets you know when the valve is properly indexed in an off or on position.

The Fuel Selector Valve must be located in such a way that you can reach the valve or control the valve without releasing your shoulder harness or seat belt. The valve itself can be remotely located and controlled as in FIG.5. A simple shaft with a couple of handles welded to it is easy to fabricate. A placard showing how the Fuel Selector Valve must be operated is an FAA requirement. Be sure that this Placard or Legend Plate is securely attached so that it cannot move which would change the index locations of the "OFF" and "ON" position. If an aircraft can be flown and controlled from either the rear seat or the front seat, it then MUST have a Fuel Selector Valve Control that can be operated from either seat. The Christen Fuel Selector Valve/Wobble Pump Model # 844 does not meet this requirement. The Model #844 is fine for single place aircraft. Where can you mount it in a Skybolt where both the Selector Valve and the Wobble Pump can be utilized by both cockpits? I've exhausted the search for such a location but maybe one of our readers has a solution. In view of the requirements for operating the Fuel Selector Valve other than the simple installation in FIG.5, you might like to consider the Scott Fuel Selector Valve as used in the Piper Aztec. The Valve carries several part numbers depending on which position "OFF" is located. The body of the valve is machined from aluminum and has a rotary insert that seals with "O" Rings. The valve works very smoothly, has good "Detent Feel" and excellent service life. The valve is

a natural when it comes to remote control. It is easily operated with a Push-Pull Cable of reasonable core wire diameter (.050 - .071). I installed a Scott valve in Bud Giffens Starduster in 1973 and it has worked perfectly. Annual inspections have shown no signs of seepage or leakage from the "O" rings. See FIG. 6 for Starduster installation of this valve. The only drawback to the Scott valve is that it must be purchased from a Piper Dealer and the price is approx. \$125 The valve I installed in Bud's Starduster was used and I paid \$12 for it. So give the Salvage boys a try.

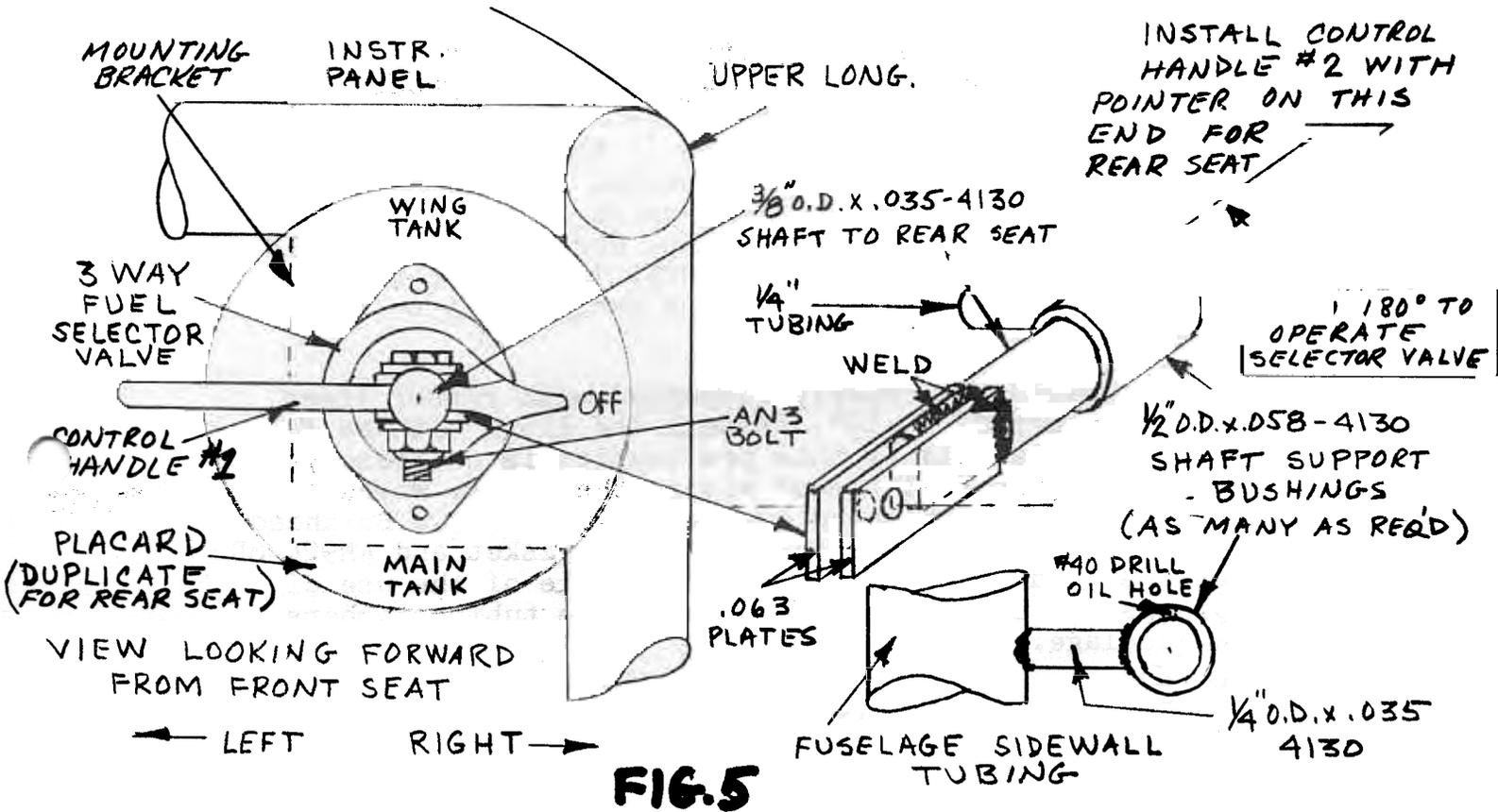


FIG. 5

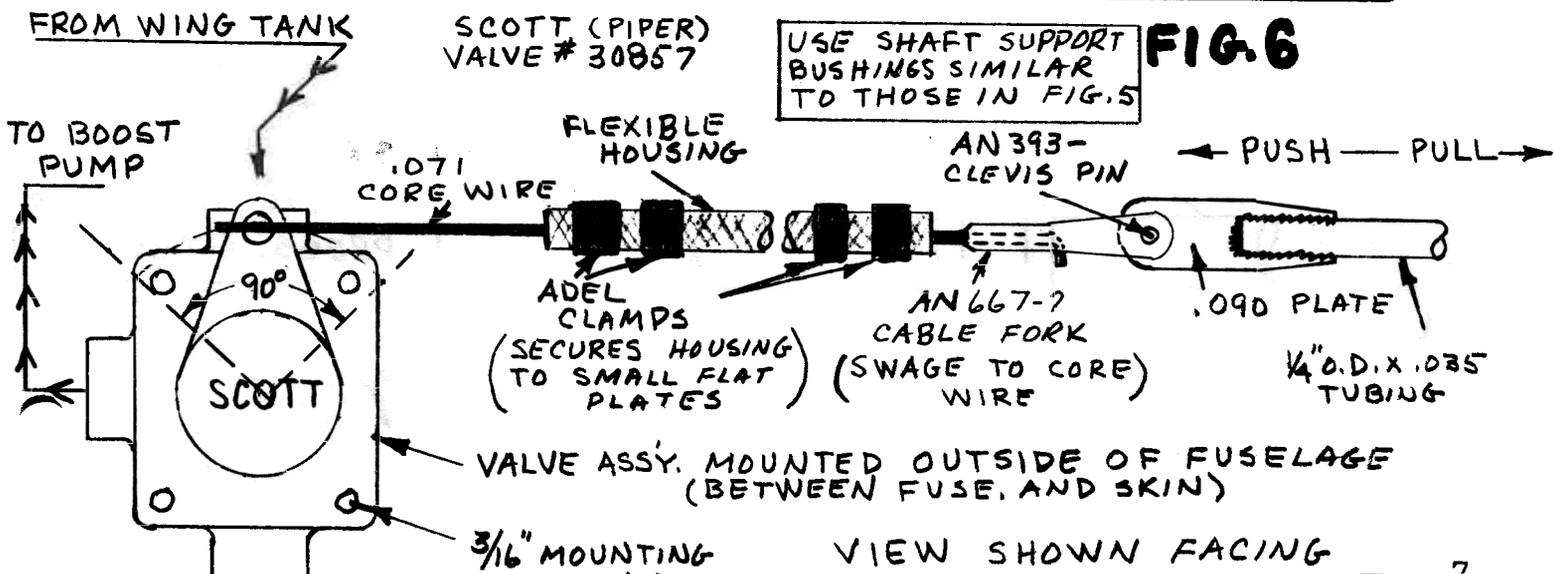


FIG. 6

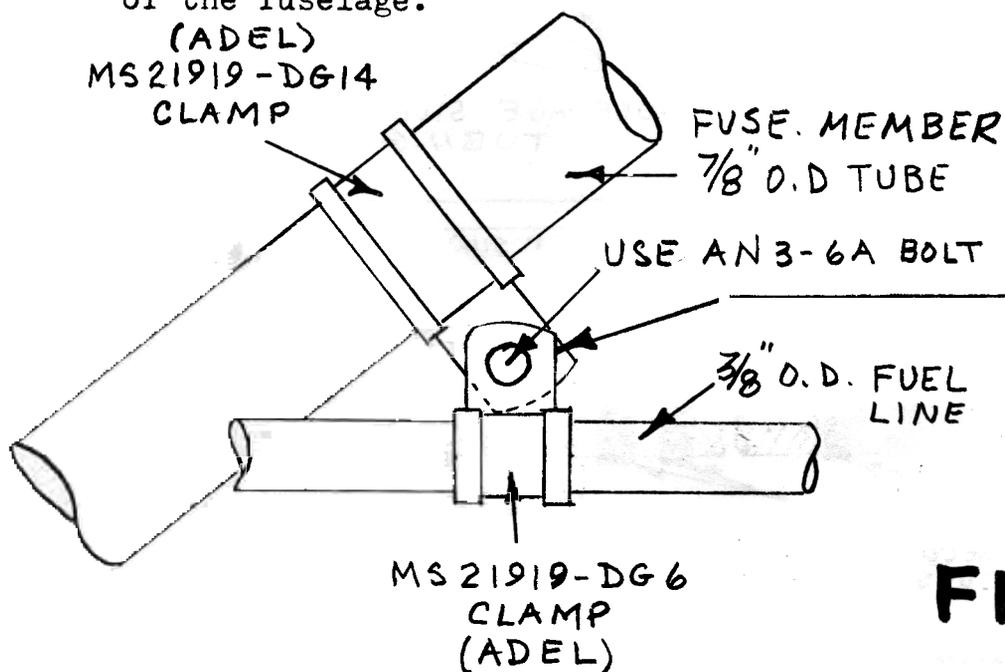
USE SHAFT SUPPORT BUSHINGS SIMILAR TO THOSE IN FIG. 5

VIEW SHOWN FACING

All of the foregoing statements regarding the operation of the Fuel Selector Valve and a mechanical type Wobble Pump are based on the assumption that sometime in the life of your Skybolt, you are going to check out some other pilot while you ride in the front seat or you will be giving some other person instruction. Don't let the well known "Murphy's Law" jump up and bite you. For some reference material, please read "Education Through Error" in the Feb. 1976 issue of Sport Aviation, Page 34 regarding automotive type Fuel Valves.

Fuel Lines may seem like a rather elementary subject but I feel that a few words are in order to possibly refresh your memory. Aluminum Fuel Lines used in the Skybolt are 3/8" O.D. x .035 Wall Thickness and can be made from 3003-0 or 5052-0. Both types of Alum. are in the annealed condition. After forming we DO NOT re-anneal the tubing nor do we do it during annual inspections which is the standard practice with copper tubing. The Bend Radii should be held to a MINIMUM of 1" with NO FLAT SPOTS. The proper Wrench Torque for tightening Tube Nuts is a range of 75 to 125 inch pounds.

Fuel Lines should be properly supported with rubber lined Adel Clamps every 8" to 10". Install the lines with as few bends as possible. All of this pre-caution is necessary to prevent "Vibration Fuel Locks" within the lines. Where a line goes through a bulkhead such as a firewall, a Bulkhead Fitting such as an AN 832-6D w/AN 901-6A Gasket and AN924-6D Nut must be used. See FIG. 7 for an example of the use of Adel Clamps for securing Fuel Lines to the tubing members of the fuselage.



MORE THAN 2 LINES
CAN BE SECURED
WITH A LONGER
BOLT. PUT SPACERS
BETWEEN CLAMPS
AT THIS POINT.
EXAMPLE: PITOT-
STATIC, MANIFOLD
PRESS, ETC.

FIG. 7

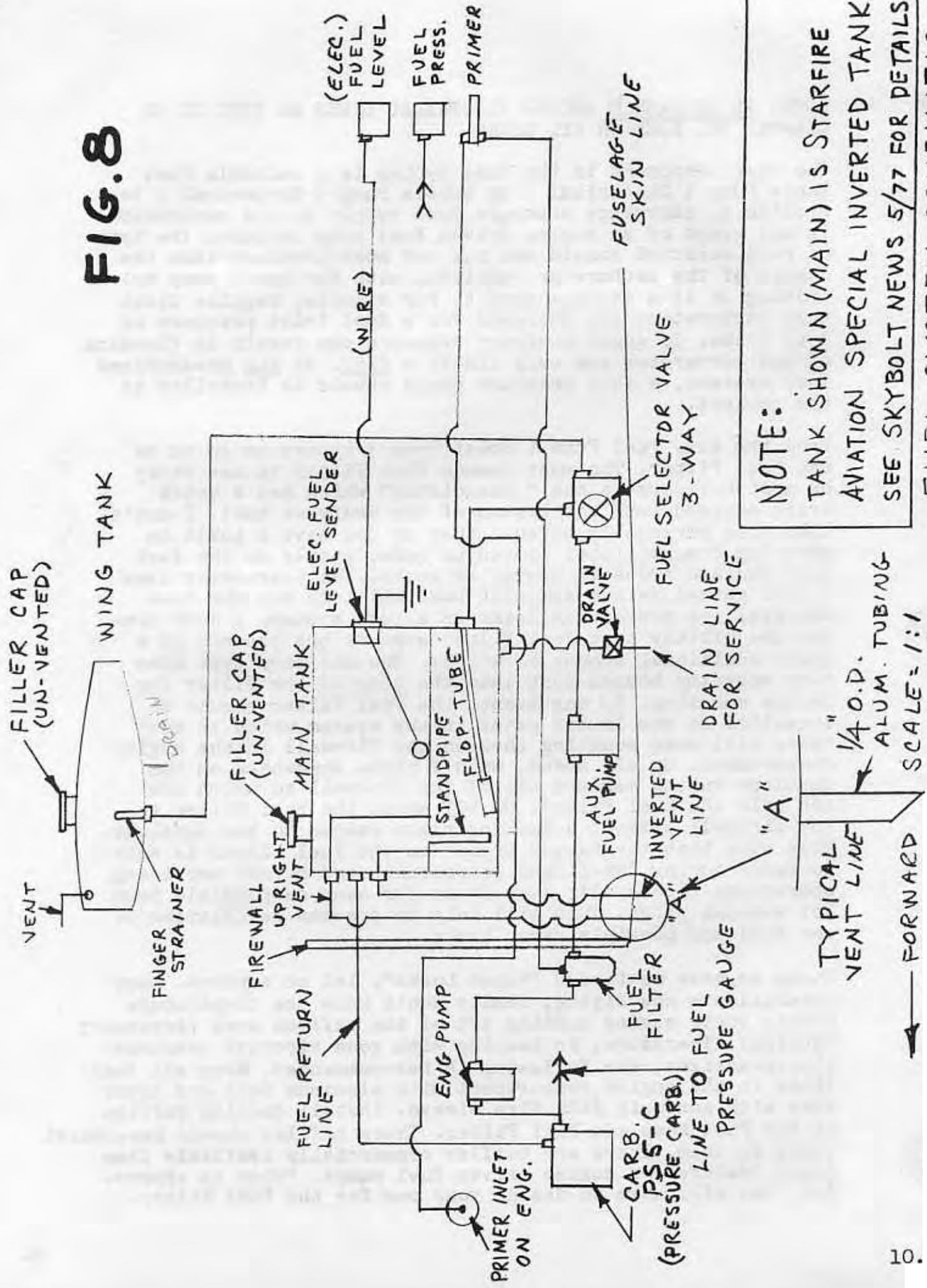
NOTE: IN NO CASE !! SHOULD ELECTRICAL LINES BE TIED TO OR CLAMPED TO, FUEL OR OIL LINES.

The next component in the fuel system is a suitable Fuel Boost Pump (Electrical) or Wobble Pump (Mechanical) to provide an emergency pressure fuel supply to the carburetor in the event of an engine driven fuel pump failure. The type of pump selected should not put out more pressure than the design of the carburetor requires, with the boost pump operating at it's maximum output. For example; regular float type carburetors are designed for a fuel inlet pressure of 3 to 5 lbs. To apply a higher pressure can result in flooding of the carburetor and very likely a FIRE. In ALL pressurized fuel systems, a fuel pressure gauge should be installed in the cockpit.

From the Aux. Fuel Pump (Boost Pump) system we go on to the Fuel Filter. The most common Fuel Filter in use today by most builders is the " Gascolator" which has a quick drain screwed into the bottom of the sediment bowl. I don't like them personally because they do not have a built in mounting bracket, they loosen up quite easily on the fuel line and are prone it seems, to leaks. The Gascolator uses a cork gasket on the sediment bowl which is not the best material for preventing leaks in a fuel system. I much prefer the military type Fuel Filter even at the expense of a small additional amount of weight. The military type also have mounting bosses cast into the body of the filter for secure mounting. In any event, the Fuel Filter should be installed at the lowest point in the system which in most cases will mean mounting them on the firewall in the engine compartment. By all means, weld a plate somewhere on the fuselage tubing members aft of the firewall to which you can bolt the Fuel Filter. DO NOT mount the Fuel Filter to the firewall without a backing plate welded to the fuselage. Make sure that the "Quick Drain" on the Fuel Filter is easy to reach during pre-flight inspections and normal servicing operations. Above all, keep it as far away as possible from hot exhaust pipes. This will help to prevent percolation of the fuel and possible vapor locks.

Since we have mentioned "Vapor Locks", let me expound. Many homebuilders now flying, really don't know the temperature within their engine cowling aft of the baffled area (Accessory Section). Therefore, in keeping with good aircraft construction practices, the following is rec-commended. Wrap all fuel lines in the engine compartment with aluminum foil and cover them with Aeroquip #624 Fire Sleeve. Install cooling baffles on the Fuel Pump and Fuel Filter. These baffles should have blast tubes on them. There are baffles commercially available from Piper Dealers for engine driven fuel pumps. Price is approx. \$16. You will have to design your own for the Fuel Filter.

FIG. 8



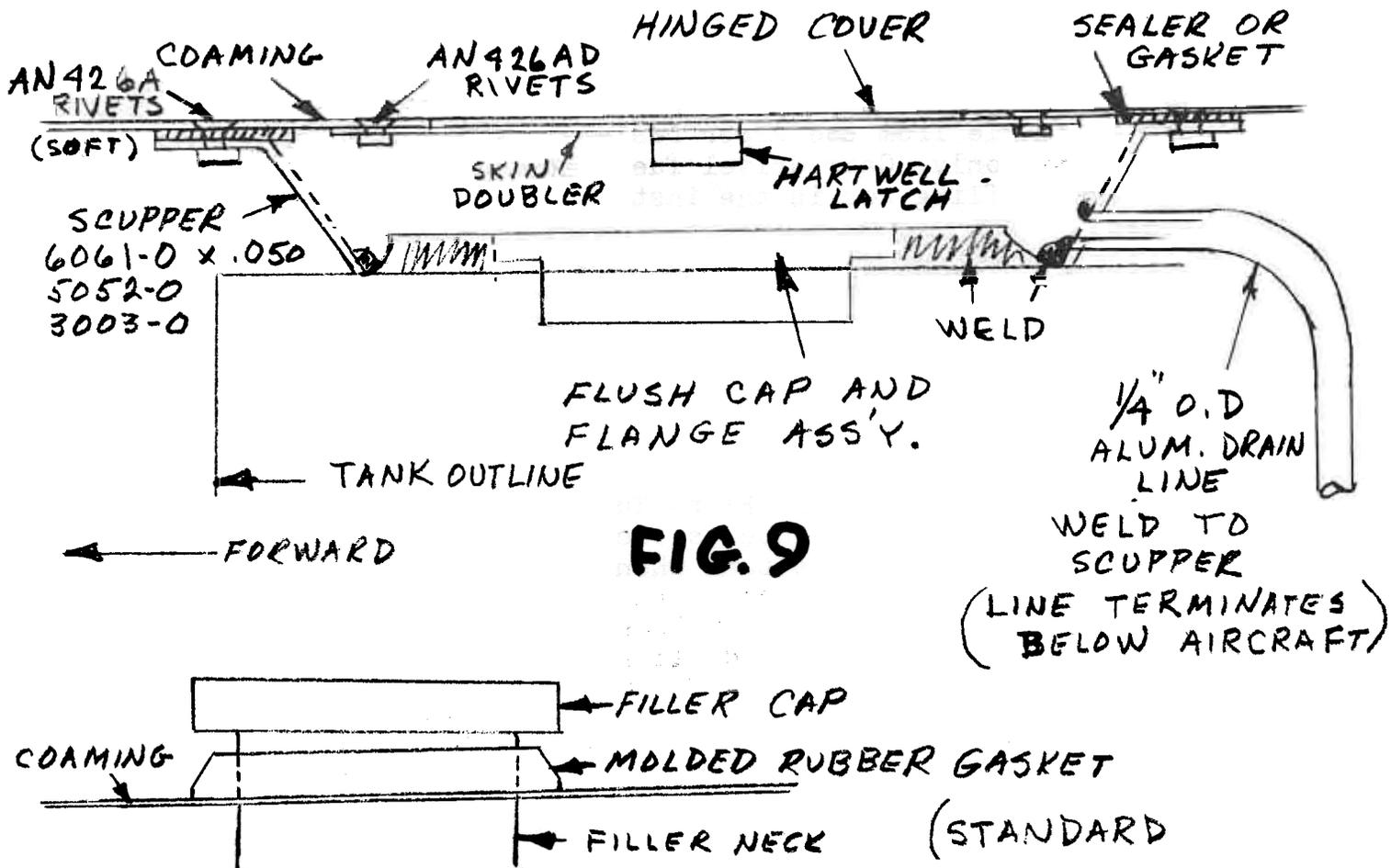
NOTE:
 TANK SHOWN (MAIN) IS STARFIRE
 AVIATION SPECIAL INVERTED TANK.
 SEE SKYBOLT NEWS 5/77 FOR DETAILS
 FUEL SYSTEM SCHEMATIC

To my knowledge, the Fuel Pump Cooling Baffles that are available from the Piper Dealers are for diaphragm type pumps only. Gear driven fuel pumps should not require baffling nor is the installation of same practical.

You will notice in Fig. 8 a Fuel System Schematic using a PS5-C Pressure Carburetor and the Starfire Aviation Special Inverted Main Tank. Please also note that the Flop-Tube enters the tank from the aft side. This has been of concern to some builders who feel that the engine would starve of fuel when the aircraft is pulling up into vertical maneuvers. To dispel that fear please consider the following. The Flop-Tube is operating in a closed sump. The Flop-Tube is flexible and will continue to pick up fuel in this tank when the sump is slightly less than $\frac{1}{2}$ full (5 gallons). At this point, the aircraft is being operated with less than a safe amount of reserve fuel. The sump holds 11 gallons. In the cruise or cross country operation of this tank you will have more usable fuel than a tank whose Flop-Tube is installed from the front of the tank. This could mean the difference between reaching the airport or "Busting Your Butt" in a critical situation.

If your Carburetion system requires a primer to aid in engine starting, the following pre-cautions should be observed. When installing a used primer, be certain that all internal seals and packings are in "tip top" shape. After using the primer, make sure that you fully close it in the off position. Engine induction systems delight in drawing air through a faulty or partially closed primer. This results in a too lean mixture with detonation most likely occurring. Many is the time that I have reached in the cockpit and closed the primer during the "Big War", when an aircraft was returned to the flightline with a rough running engine.

Many of our builders in the desire to build a beautiful Skybolt, recess the Filler Neck assembly on the main tank. This is all well and good provided that a "scupper and drain" are installed. Failure to do so results in a "Very Un-safe Fuel Tank Installation". No matter how cautious you are during re-fueling operations, at some time you are going to over flow the tank or or accidentally drip fuel from the hose nozzle. This excess fuel pours into the fuselage and the vapors linger for a long time. "MISTER, YOU'VE GOT A BOMB ON YOUR HANDS". In Fig. 9 we show how the Scupper and Drain should be installed. We also show in FIG.9 how the standard type of filler neck assembly should be treated to prevent the same situation from possibly occurring.



The Rubber Filler Neck Gasket shown above on the Standard Tank installation is commercially available. If you have trouble locating them locally, send \$2.75 to Firebolt Aircraft Co. P.O. Box 28321, Tempe, Az. 85282 and it will be promptly shipped to you Postpaid (U.S. and Canada Only) Customers outside of U.S. and Canada, please send \$3.25 All checks or money orders must be in the value of U.S. currency.

In the interest of time, this portion of the Skybolt News is being sent to the printer. The remaining portion of the combination Aug. - Sept. issue will reach you within 5 days of the receipt of this first half issue.

The balance of the Skybolt News for Aug. - Sept. includes the following.

1. " FLOORING INSTALLATIONS "
2. " SEAT BACKS AND BOTTOMS "
3. " FLOORING TABS AND OTHERS, INSTALLED THE EASY WAY "
4. " ALUM. SIDEWALL AND BELLY SKIN INSTALLATION"
5. " ELECTRIC SYSTEM SCHEMATIC "
6. " MOUNTING THE BATTERY "
7. " 2 PIECE AILERON PUSH-PULL TUBES W/IDLER ARM "
8. " WING COVERING (PART 1)