April 1983

ACRO SPORT NEWSLETTER

Editor: Ben Owen

ISSUE 3

EDITORIAL

By Paul H. Poberezny

Interest in the Acro Sport newsletter continues to grow, and we want to thank Stits Poly Fiber and Wag-Aero for their support. Both organizations have supported the activities of the EAA and sport aviation for many years.

Though the recession has effected much of general aviation, and the manufacture of single engine aircraft has dropped off dramatically, this is not so in the Homebuilt movement. Interest and enthusiasm and creativeness expressed itself, and Homebuilt aircraft flourished in many states, including Wisconsin. This continued until December 8, 1941, a day after the attack on Pearl Harbor, when emergency rules restricted much of the United States' flying.

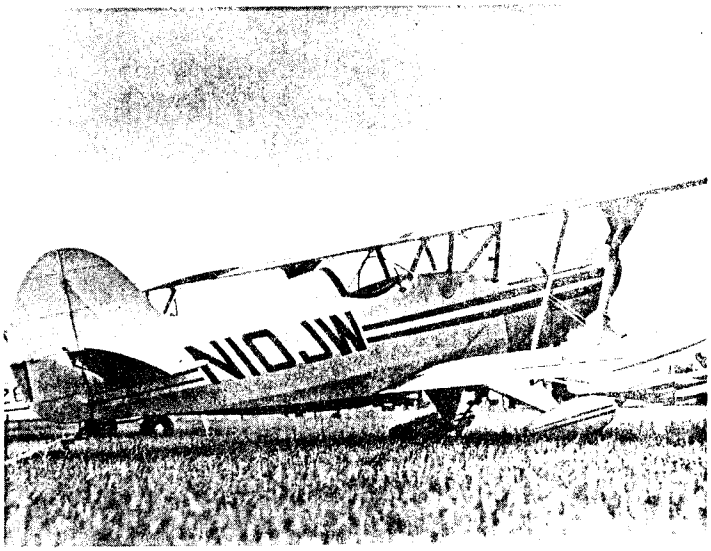
The forming of EAA, some thirty years ago, brought back the enthusiasm of working with hand and mind for the cause of aviation and development of the airplane. Though the idea occurred to me as early as 1948 while building up the first clipped wing Taylorcraft, (this was a greatly modified 1938 model in my garage, as a local homebuilders club). It was only after my Korean tour as a USAF pilot, and my return home, when I had several requests from the 1930's homebuilders who attended a number of informal meetings in my garage and at the local airport during 1948-1951, that I established the first meeting. The first meeting was held on January 23, 1953 and thus began the fledging Experimental Aircraft Association. At this time we had no idea that during the thirty year history, the EAA would touch so many peoples' lives throughout the world.

Lets take a look back at those early days of the famous Midget Goodyear Racers and the few Homebuilts that were available. When we compare the quality and craftsmanship along with the development of new materials, it is only then that one realizes the progress that has been made. To build your own airplane is quite an accomplishment. The enthusiasm one experiences, plus the self-education, brings about the end result of successfully completing your own airplane. The airplane, built by the amateur builder, is a product to be admired, as seen at events such as Oshkosh, Chapter fly-ins or air shows. Because you, as an amateur aircraft builder, have maintained these fine standards. In working with the FAA these past thirty years, we have improved our area of interest with diminshing FAA restrictions, and this has been a relatively easy task. This is the result of self policing and our high building standards.

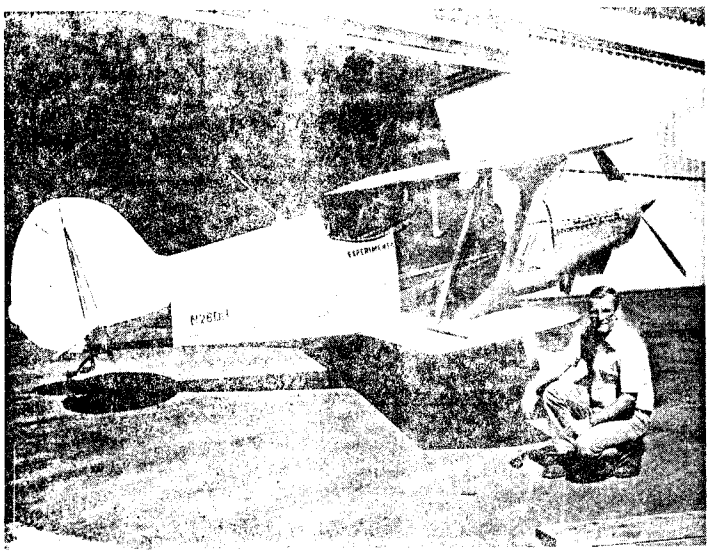
However, there is one area of caution. After working many hours or even years on your project, there comes that proud day - your airplane's first flight. Don't make waste because of haste. Be positively sure that when you open the throttle for that first flight, you are totally qualified to fly your creation. You must insure you know not only the limitations of your airplane, but yourself as well. If you are building the two-place Acro II, dual instruction by a qualified person is recommended. If you elect to have your aircraft test flown by a more competent person, be sure they too are qualified.

All three designs, the Pixie, and the Acro I and II, have very good landing characteristics. This includes wide landing gears, and good stall characteristics. But as with all airplanes, it is match of your skills against the airplane.

Each year at Oshkosh and Chapter fly-ins, you will see an increasing number of Acros and Pixies. As you know, it takes time, but they are beginning to hatch.

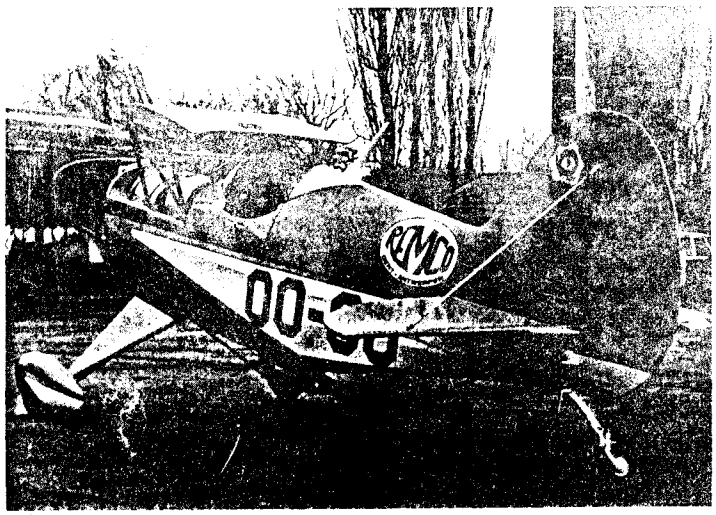


This aircraft was constructed and flown around July 1977. Hugh Moreland of Havanna, Florida, may have had a hand in its construction. It was sold to Cobb Braynton of Woodville, Florida, and is currently owned by Alva Chastain of Talahassee, Florida. Does anyone know who the builder of this aircraft is?



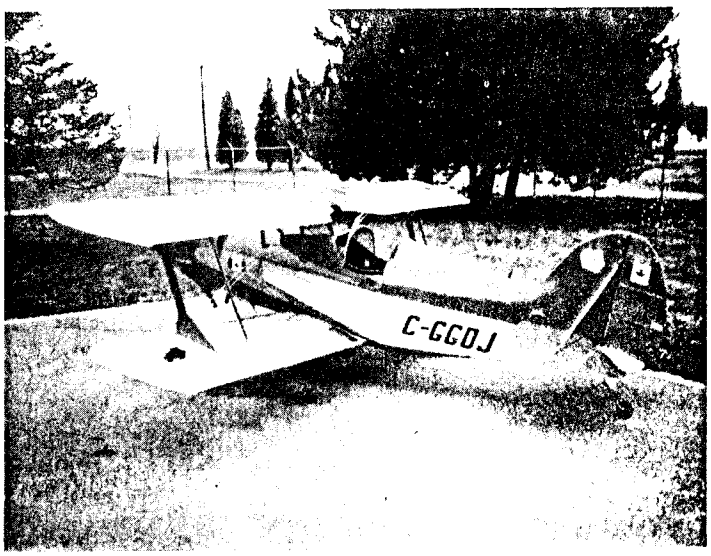
Donald Hoelzen (EAA 26625) of 29665 170th Place, SE, Kent, WA 98031. This Acro Sport I has an O-360 engine and at 7,000 feet of altitude climbs 1,500 feet a minute.

ACRO SPORT

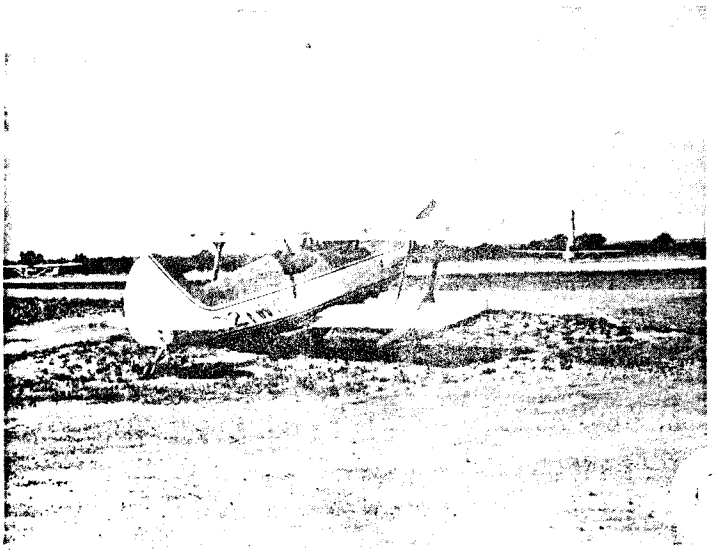


The builder of this aircraft is Georges Cossement, Boomsestasnrug nf-ng, 2640, Belgium.

FIGHTER



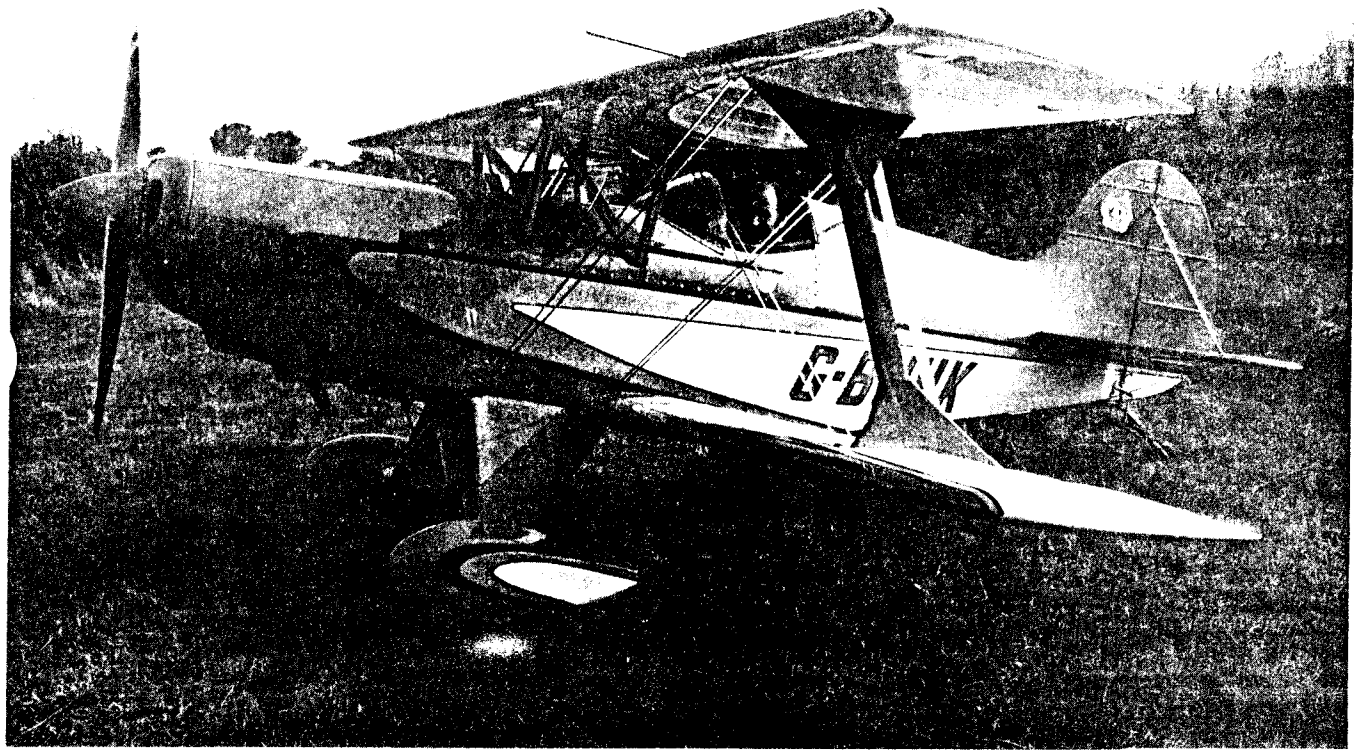
This aircraft was built and is still currently owned by Paul D. Brooks of London, Ontario Canada. The first flight for the aircraft took place on August 8, 1975. It has a Lycoming IO-360A1B of 200 hp and has been flown extensively in aerobatics.



This aircraft was built by Warren Curd and had its first flight in May 1974. The sponsor of the aircraft was Dick Browne. The aircraft was sold to Tom Herr of North Hollywood, California, and is currently owned by Roy Sullivan of Arab, Alabama.

JOHN KIMBER'S ACRO SPORT
G-BJHK

This aircraft won a special award from Acro Sport, Incorporated for excellence in construction. This was awarded at the 1982 EAA Convention.

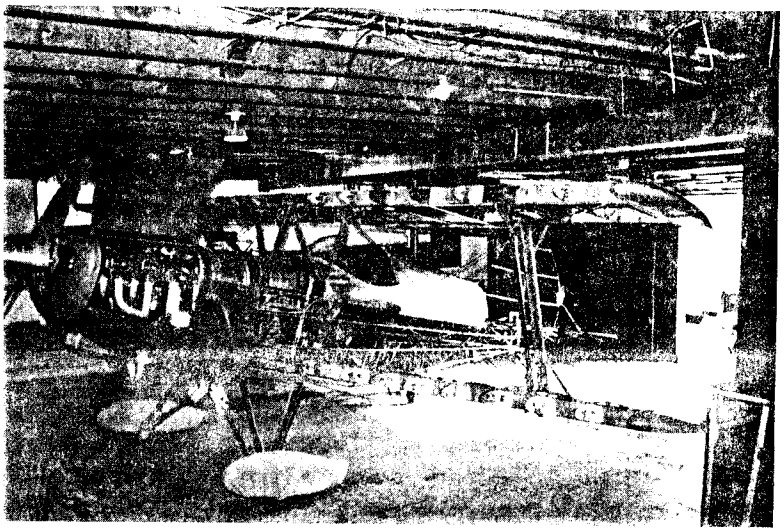


Builder John H. Kimber, EAA 137006, South Ockendon Essex England, Acro Sport G-JHK. Powered by Lycoming IO-360-B4A with inverted oil and fuel system. First flight took place June 1980. Building time 17 months. Empty weight was 955 lbs., and cruise 120 mph. It has flown 180 hours in two years and has won best homebuilt England 1981, Lexystad Holland 1981 and Hasselt Belgium 1981.

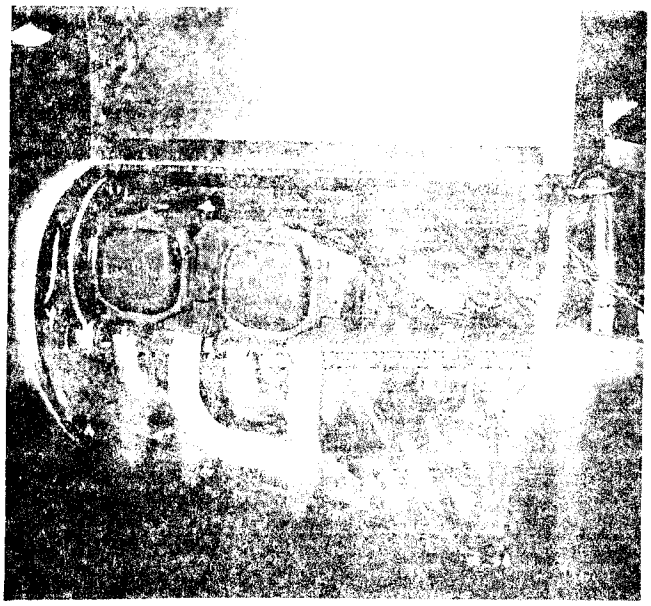
"I am sorry to tell you that my son now flies the Acro Sport much better than I can, maybe I have been flying upright too long (24 years) but I am very proud of him! He has also been taking part in air displays and competitions."

This aircraft also won the best homebuilt at the Popular Flying Association annual rally in 1981. It was on the cover of the magazine "POPULAR FLYING" for September/October 1981.

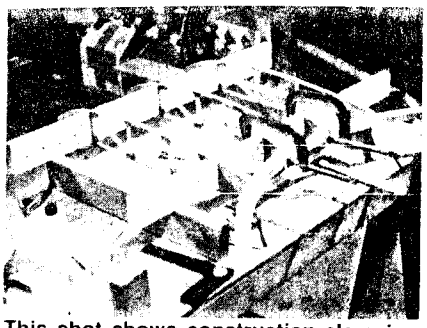
ACRO SPORT CONSTRUCTION



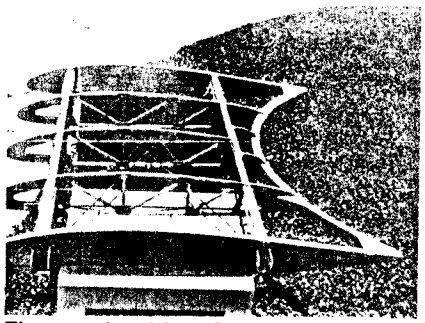
Warren Curd of Raytown, Missouri and Richard Browne of Kansas City, Missouri were well down the road on their Acro Sport when these photo's were taken January 1, 1974. This airplane was started in January 1973 and uses an 0-360-A4A of 180 hp. It also carries a full electrical system.



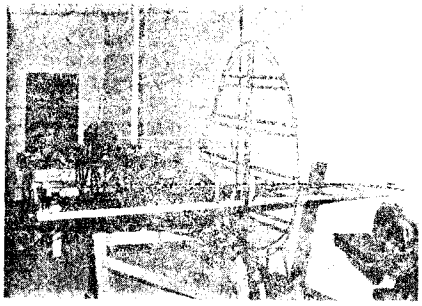
Fine workmanship are evident in this close up of the engine section in Warren Curd's and Dick Browne's Acro Sport.



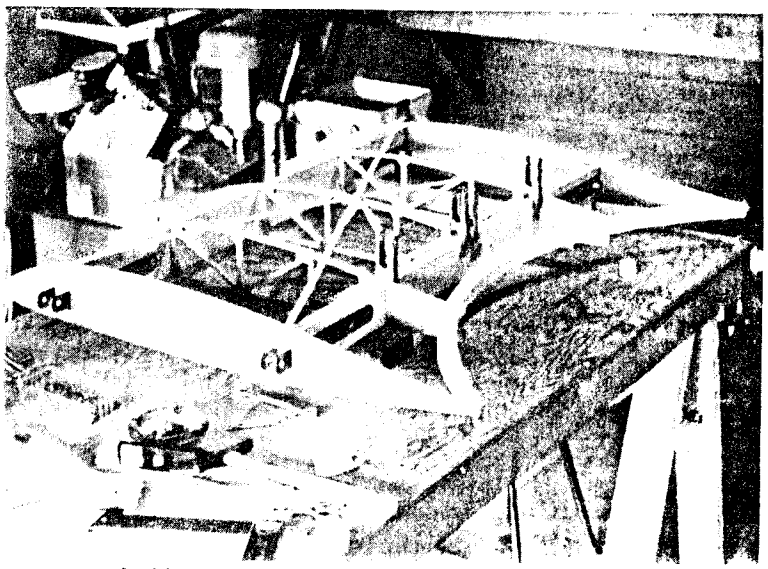
This shot shows construction clamping of the center section bow.



The completed Acro Sport I center section with drag/anti drag wires in place.

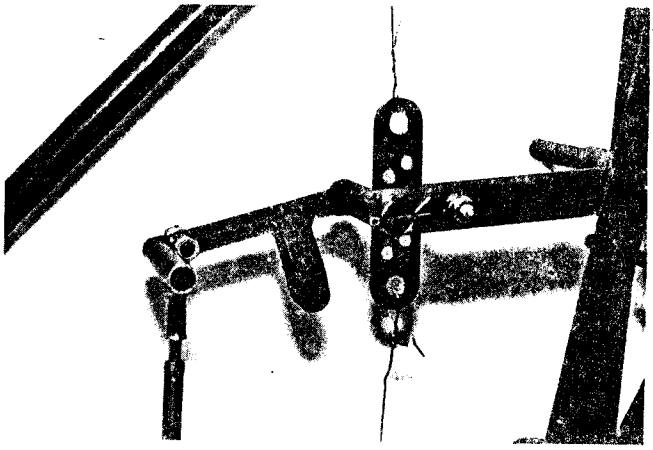


Gear fuselage stabilizer rudder tin and tail wheel assembled on Dave Blanton's Acro Sport II.

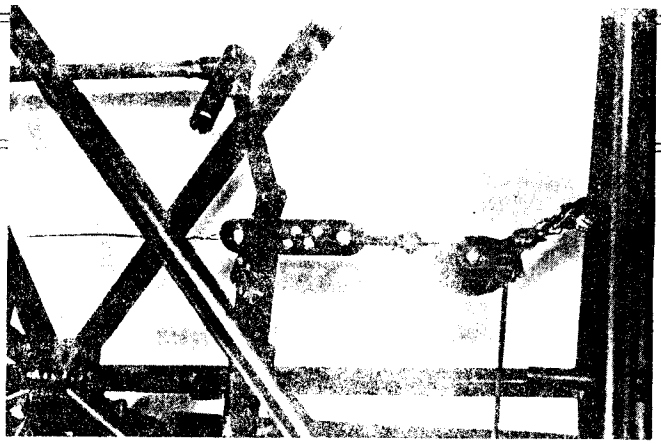


At this point the aircraft center section has been completed for this Acro Sport I and is temporarily held in place by wood battens nailed to the ribs.

Dave Blanton, Jr., of Valley Center, [illegible] Sport II well on the way. This shot shows [illegible] prepared for welding.

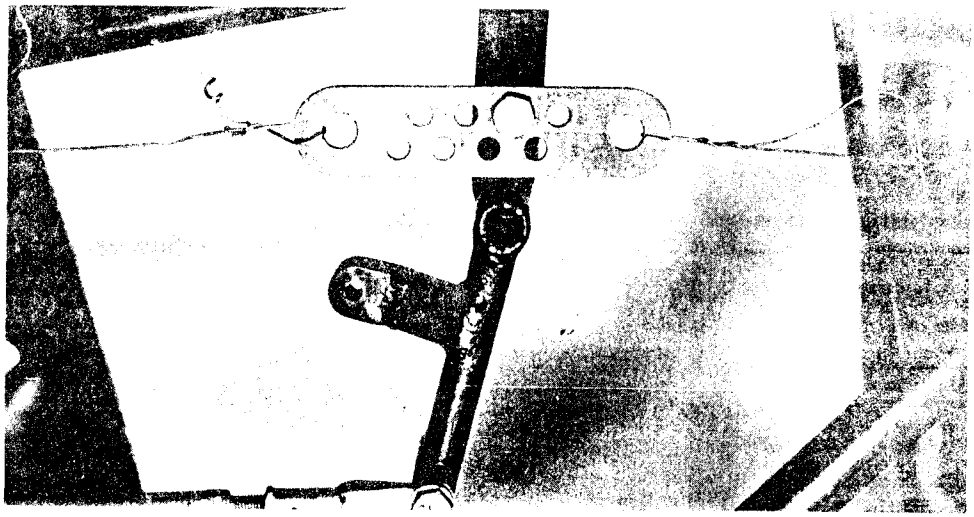


Detail of the rudder pedal and brake arm.

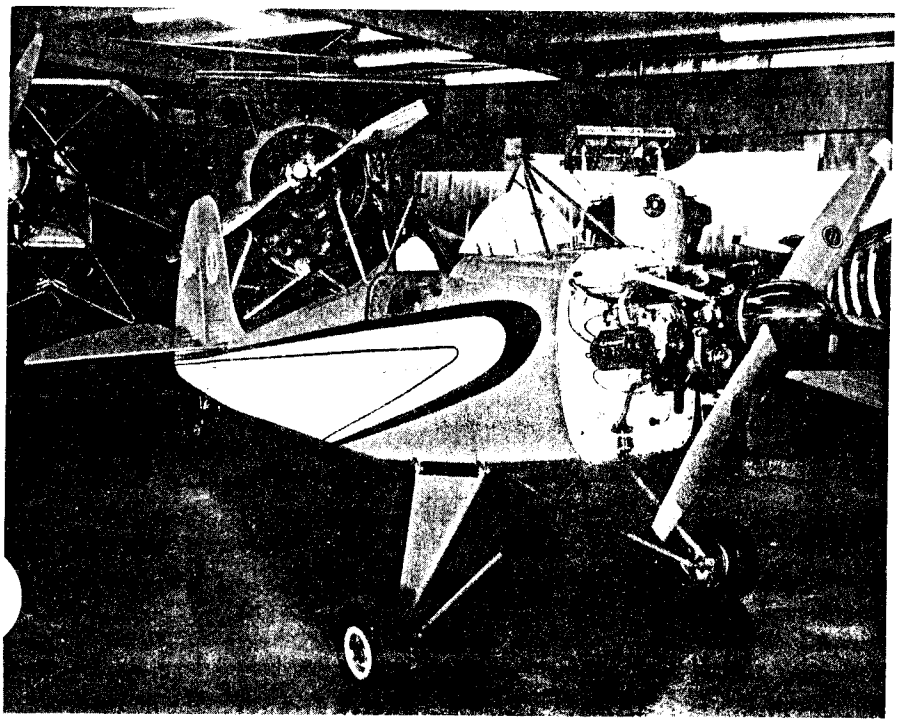


Detail of the closed loop pulley system at the fire wall.

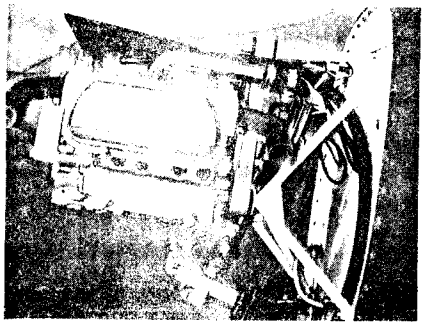
Details on corrections to the Aero Sport II rudder pedal area were presented in the Aero Sport Newsletter No. 2. The following pictures may be of some help to the builder.



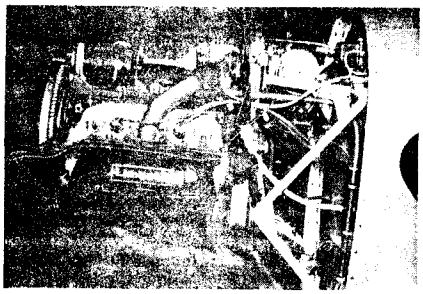
Detail of the brake inter-connect push rod and fork end.



Detail of the complete fuselage of the prototype Pixie with the Limbach engine.

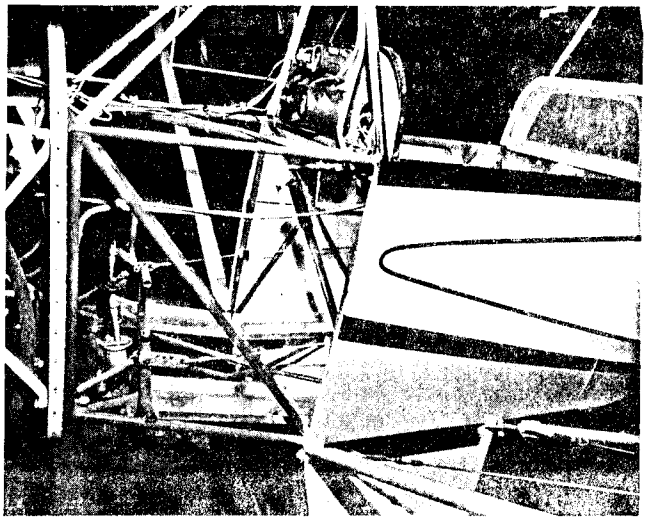


Detail of the Monnett conversion engine using the Posa carburetor on the prototype Pober Pixie.

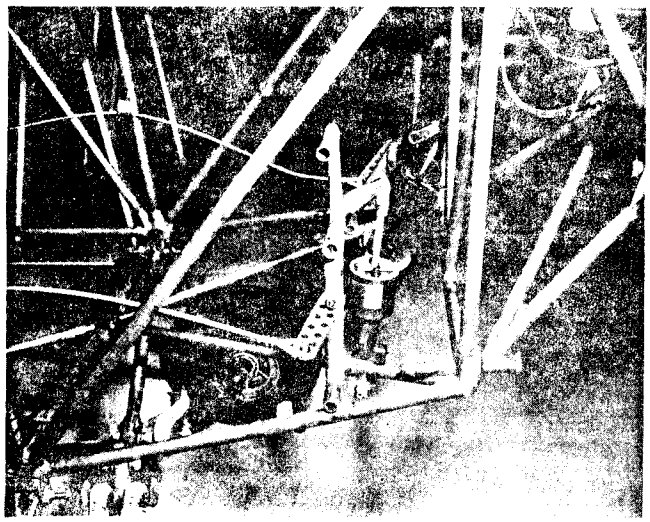


Detail of the Limbach VW conversion in the prototype Pixie.

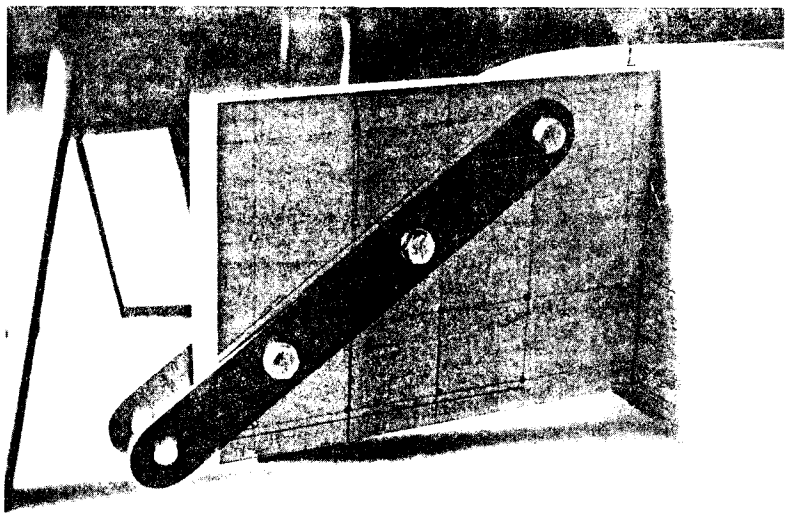
ACRO SPORT CONSTRUCTION GALLERY



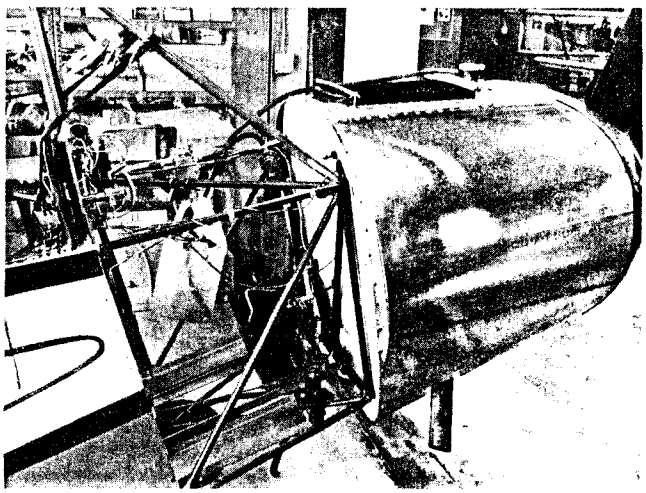
Front cockpit area on the Pixie prototype.



Pober Pixie brake cylinder actuating area on the prototype.



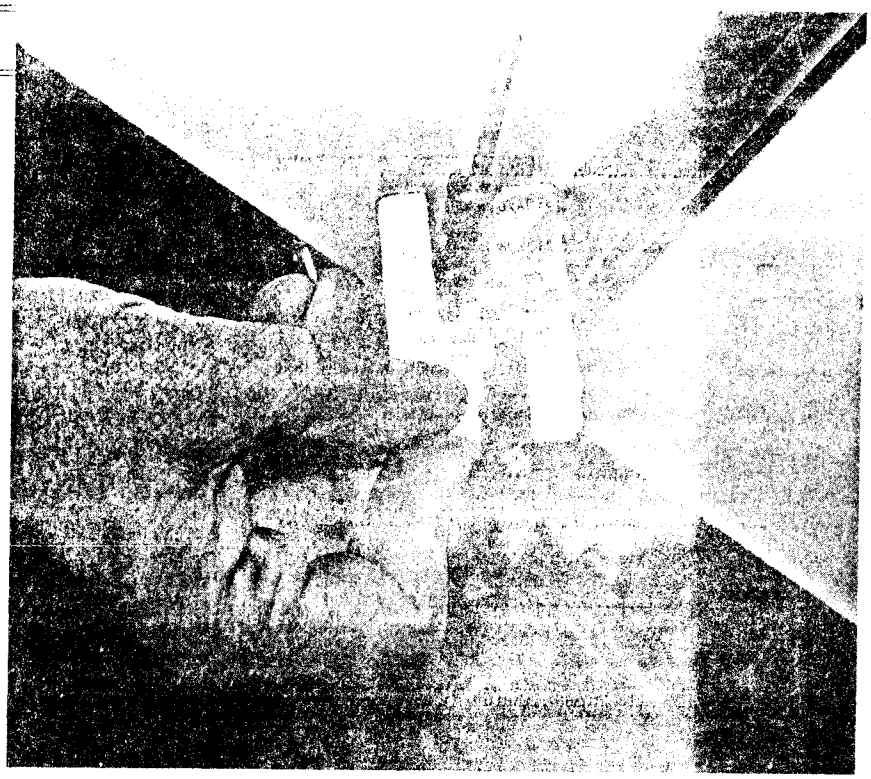
The proper gluing pressure pencil mark intersections give a guide for nailing for even gluing pressure on reinforcing plates.



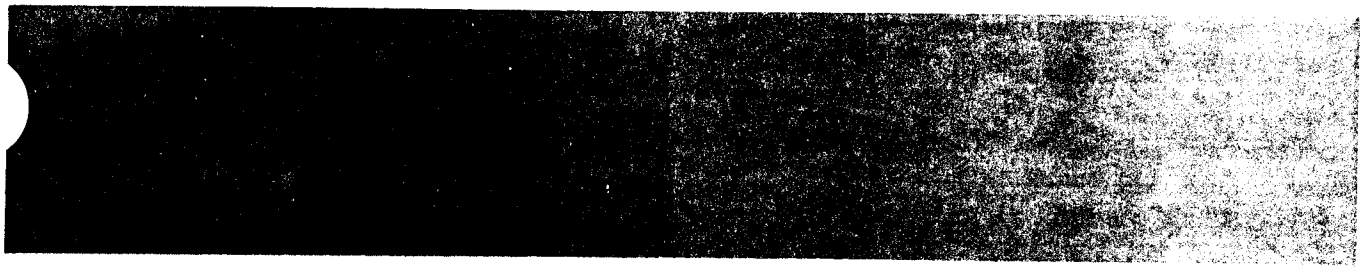
Water cooled engines are useable for the Pober Pixie. In this installation, the Rotorway 133 engine was installed but never test flown. The radiator lies horizontally on the top of the cowling. As you can see this particular installation has a battery mounted just aft of the fire wall.

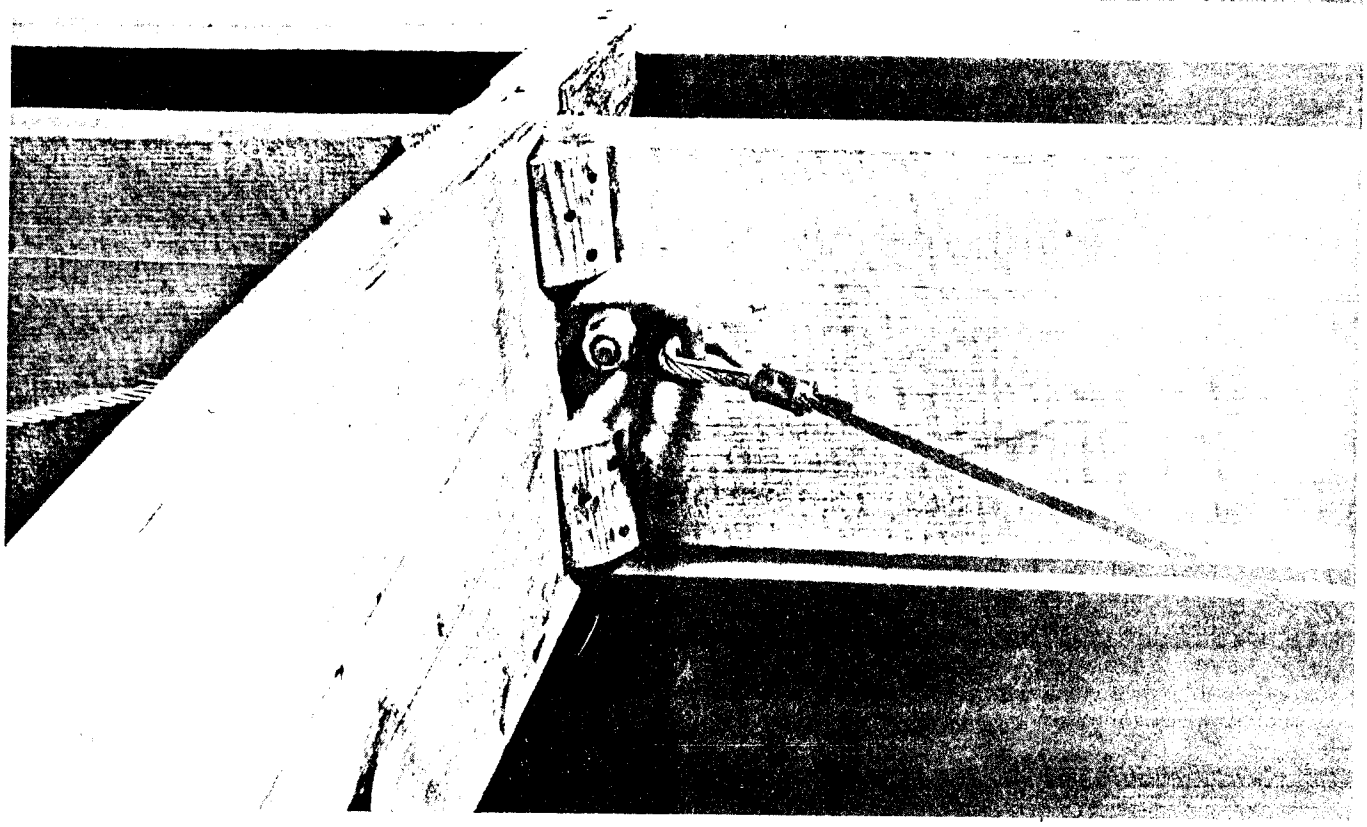
Detail of covering technique used on the reinforcing tape on the wing tip bow of the Pixie. Some builders think it is necessary to use Grade A fabric to get it to conform to the wing tip bow but Dacron can be heat sealed around the edges.

The Nicopress system was invented by National Telephone Supply of Cleveland, Ohio. It is imperative that a "Go-No-Go" gauge be used when Nicopressing is completed. Here the gauge is being used on a Nicopress that has been improperly compressed. There are two ways to check Nicopress sleeves. 1. With the gauge 2. By putting the intended load on the cable to see if the oval slips or breaks. This information comes to us directly from the supplier, National Telephone Supply. Always check your Nicopress swedges with the gauge.



Detail on the Nicopress on the Pixie spar - rib junction.



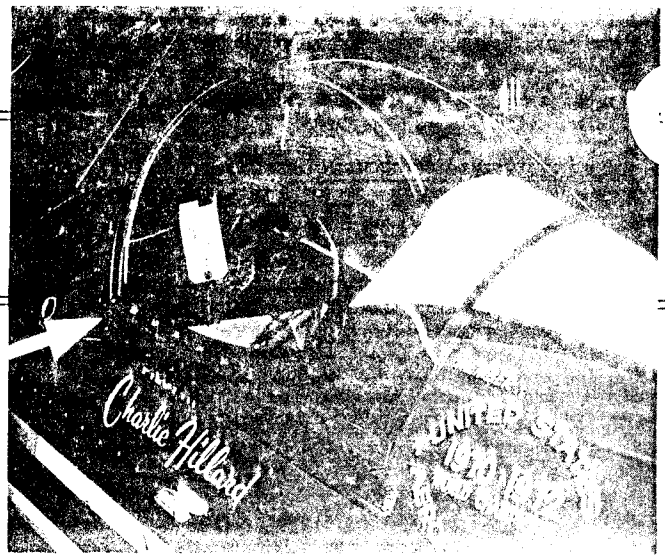


CANOPIES FOR THE ACRO SPORTS

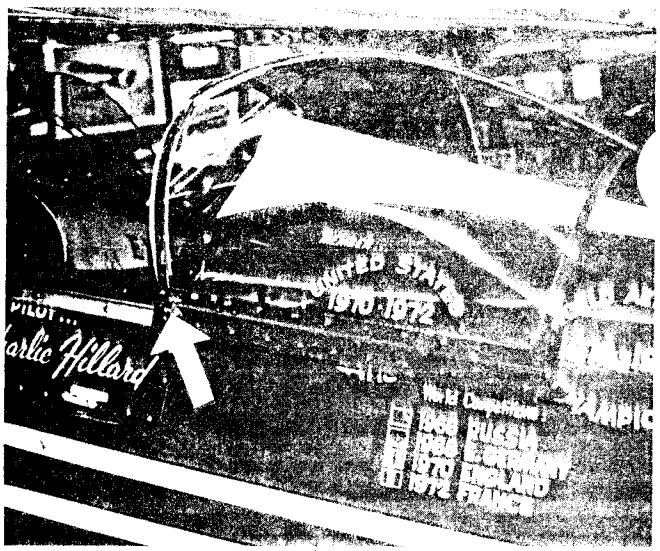
There is a canopy system available for the Acro Sport that is very similar to that used on the Pitts Special. The Pitts Special pictures are included with this article as there is a canopy latch on Charlie Hillard's aircraft that is a very neat installation. Please see the drawing attached for the spring for this latch.

The canopy supplier is Jim Miller, 4733 Harvard, Kansas City, MO 64133. Telephone, (816) 358-5086. Jim has a kit on the Acro Sport I but his distributor for the Acro Sport II canopy is the firm of Wag-Aero.

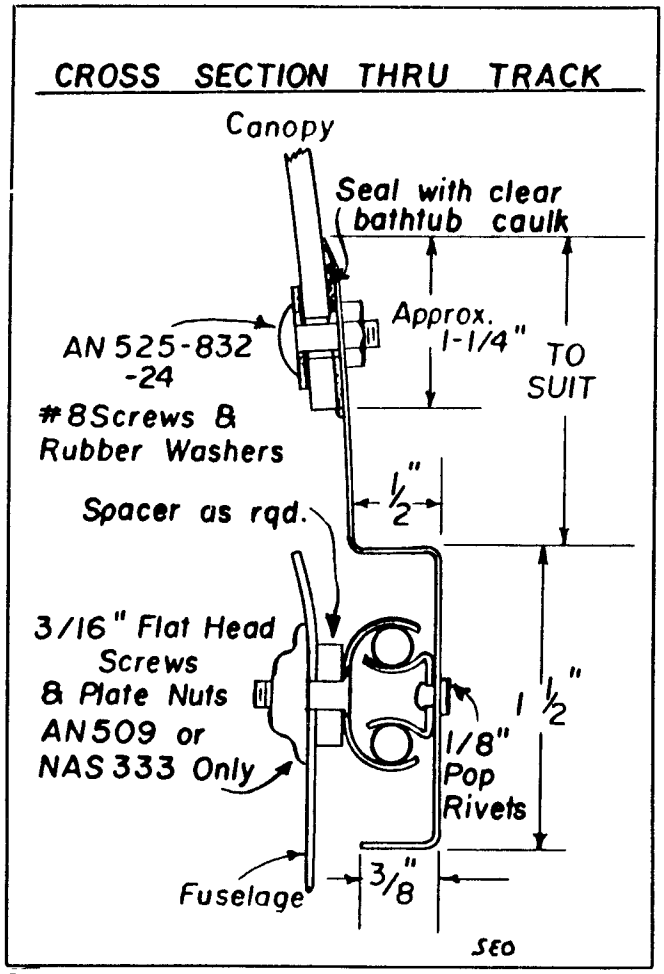
The windshield on the prototype Pober Pixie was one of Jim's units and is the same as the Pitts S-1 windshield. His Pitts canopy and windshield is dimensionally and physically interchangeable with factory Pitts components but not built under the FAA's parts manufacturers approval required for type certified Pitts. If you would like to write or call Jim for further information, he would be happy to answer any canopy questions.

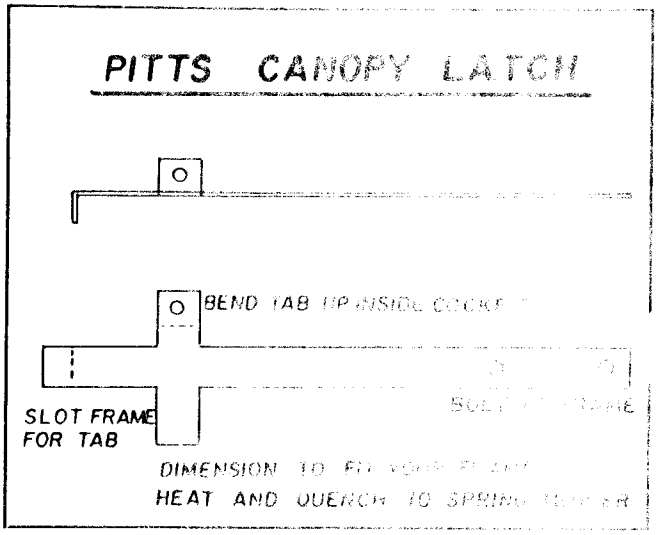


This canopy open shot of the Hillard Pitts sport [illegible] the location of the small spring tab. In order to open the canopy from the outside it is necessary to [illegible] and reach across the canopy to pull the other one up over the inside the cable goes to the top bow of the [illegible] is covered by a piece of hose. Pulling back on the [illegible] releases both spring clips at the same time to get out of the cockpit.



Charlie Hillard's Pitts uses a Miller canopy. Foam tape is used to seal the aft part of the canopy plexiglas to the turtledeck.





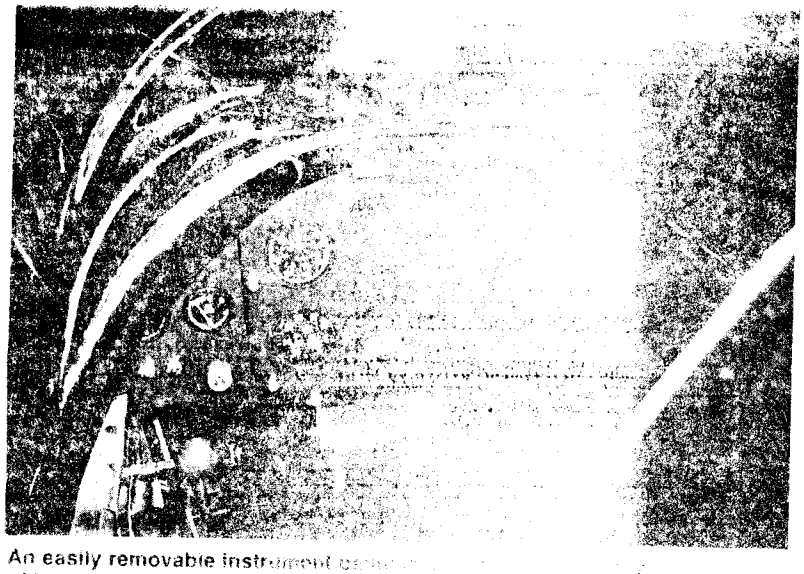
=ACRO SPORT=
=INSTRUMENT PANELS=

Paul Poberezny's philosophy on accessories on an aircraft has always been that the lighter you can keep the airplane, the better. You are required to have certain flight and powerplant instruments for your amateur built aircraft and you are given a great deal of latitude as to how you install them on the instrument panel.

Those required powerplant instruments would include a fuel quantity gauge, oil pressure, oil temperature and a tachometer. In plain words three basic powerplant instruments and one fuel quantity sight gauge will suffice. If you do have a fuel pump fed engine you will need a fuel pressure gauge, in addition. You will also need a manifold pressure gauge if you have what the FAA likes to call an "altitude" engine. Basically, what this means if you use a constant speed prop you will probably be required to have a manifold pressure gauge.

In addition, you are required to have three flight instruments, airspeed, altimeter, and magnetic direction indicator. Part 23 of the FAR's suggest that the airspeed be on the left top row, and the altimeter be on the right top row. They suggest that the attitude instrument, which you don't need, be on the top center. Usually that space is reserved for the magnetic compass as it gets less interference there.

Other instruments that would be nice in a sport aircraft would include a "G" indicator and possibly a cylinder temperature with a switch you can switch from one to four. I noticed that Charlie Hillard's Pitts in the museum also has an exhaust gas temperature gauge which can be a useful added instrument. Also the ball "bank" instrument

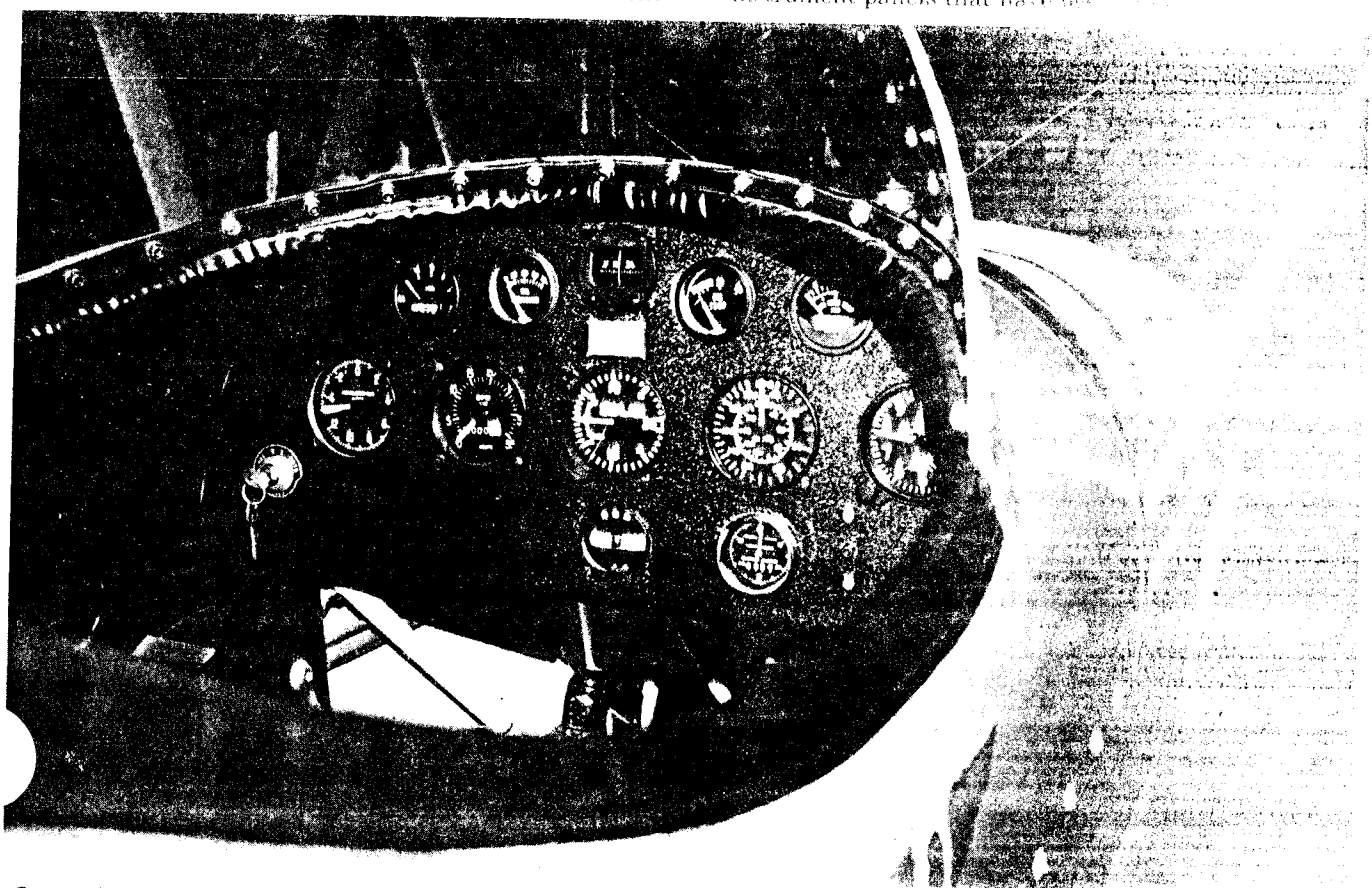


An easily removable instrument [illegible] of Warren Curd's and Dick [illegible] indicator and [illegible]

is sometimes useful and I [illegible] inverted flight. For aerobatic [illegible] leave the center of the [illegible] aerobatic flight sequence [illegible]

It is also an excellent [illegible] and other switches [illegible] to avoid injury in the [illegible]

You can install a complete [illegible] gauges are available [illegible] logs are required and [illegible] in particular, that the [illegible] You have the Federal Aviation [illegible] guideline for the instruments [illegible] good idea to follow their [illegible] in the fuel indicator [illegible] instrument panels that [illegible]



George Coussement's Acro Sport I shows the different approach with all the instrument gauges on the [illegible] easier to spot.

SPARK PLUGS SELECTION

Although you don't have much of a selection for aircraft spark plugs as they are called out by the manufacturer, there is a pretty good selection for those of you assembling aircraft engines from a variety of components and also for those using Volkswagen engines as in the Pixie.

The heat involved in the cylinder is often as high as 5,500°F. The plug insulator is right in the middle of all the burning and it gets extremely hot. To keep it from burning up a plug must be designed to dissipate most of that heat.

If a plug dissipates too much heat it will operate at too low a temperature or run too "cold". The insulator won't be hot enough to burn off the oil. Other bi-products of combustion will then accumulate. Since most of these contaminates can conduct electricity, their accumulation will cause the plug to short out or "foul".

At the other extreme, is a "hot" plug, one that doesn't dissipate enough heat. Its insulator remains at too high a temperature causing pre-ignition.

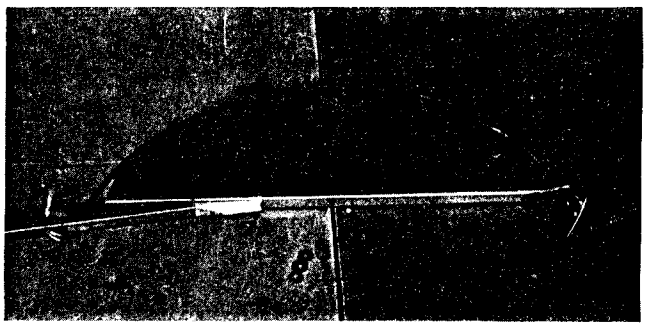
Pre-ignition is the igniting of the fresh fuel charge before the spark can do it. That can lead to engine seizure and/or piston failure, not to mention reducing the power output.

To avoid either condition the operating temperature of the insulator should stay above 800°F to prevent fouling but below 1,600°F to prevent pre-ignition. Because of differences in plug location, combustion [illegible] cylinder head design, etc., no one plug [illegible] that 1,000°F range in all engines [illegible]. Plugs are made in a wide variety [illegible] so the proper range can be selected.

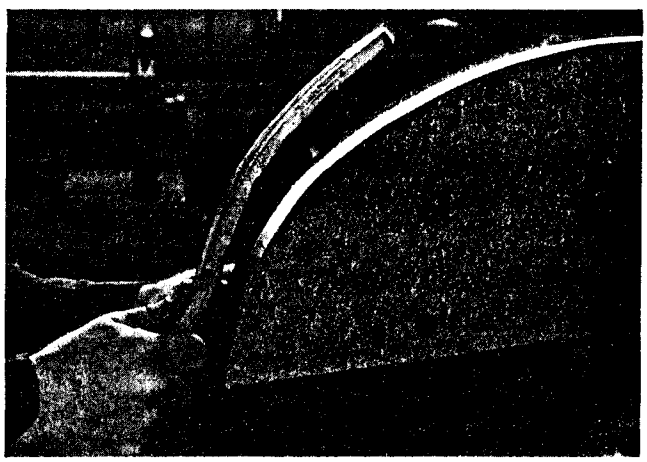
The heat range is determined [illegible] length of the insulator around the center electrode. The longer the insulator the more heat it retains [illegible] the plug. The opposite is also true [illegible] sulator the "colder" the plug. If you are operating [illegible] is burning a great deal of oil [illegible] plug to burn off the oil, you can get [illegible] temperatures leading to pre-ignition. [illegible] of spark plugs, "conservative" is making a choice [illegible] plug in any given situation. It's considered [illegible] to clean plugs more frequently rather than [illegible] damage caused by pre-ignition. If the [illegible] engine is run at a lean mixture setting [illegible] over revved, it can very easily [illegible] plug is too "hot" for a particular [illegible]

FLANGE "SHRINKING"

Forming the flange on the instrument panel and turtledeck should not be a difficult process. The pictures below show two different ways to form flanges. One is with a lead bar that is slapped over the flange to bring it down after it is hammered. This process also shrinks the metal. The second method is by use of a level and a clamped on banding strip which is hammered to shrink the metal.



This photo shows the lever and the steel banding strap and the method of attachment of the banding strap.



This shows the lead bar being "slapped" onto the flange to shrink it further.

EAA Aviation Mechanic, Steve Dawson, of the EAA Foundation Shop is shrinking the flange with the hammer while holding down on the flange with the lever bar. It is necessary to put another Masonite board on the other side of the metal in order to hold it up tight against the template

WEIGHT AND BALANCE INFORMATION FOR THE PIXIE AND ACRO SPORT AIRCRAFT

Weight and balance information given below has been carefully checked but . . . "To Err Is Human", please check your weight and balance figures carefully. The weight and balance figures are given to represent individual aircraft and your weight and balance **may** be different. It is up to each individual builder to determine the weight and balance envelope and the limits for his particular aircraft.

Allowable Maneuvers: Pixie

Pixie's category of allowable maneuvers include stalls, lazy eights, chandelles and steep banks not to exceed 60°. The Pixie is not actually an "aerobatic" aircraft but it is close to the category known as "normal" for certified aircraft.

Acro Sport I and the Super Acro Sport:

As long as the weight of the aircraft does not exceed 1,350 lbs., and the positive "G" of positive six and the negative "G" of minus three, any aerobatic maneuvers can be flown in these aircraft.

Acro Sport II:

As long as the gross weight doesn't exceed 1,520 lbs., and the allowable "G" load of positive six and a negative three "G's" the Acro Sport II can do any aerobatic maneuver.

Gross weight and allowable "G" loading are tied together in an inverse ratio. The formula for determining allowable "G" if your actual weight is higher than that published is the following.

$$\text{allowable "G" load} = \frac{\text{allowable gross weight} \times \text{allowable "G"}}{\text{actual gross weight}}$$

This has to be calculated for both a positive and negative "G" loading.

If your aircraft is built similar to the prototypes, a good way of determining balance is to check the tail weight in the level flight position. Tail weight is included in the tables below.

Type A/C	E.W.	G.W.	"G"	Datum	Empty C.G.	Forward C.G.	Aft. C.G.	Tailwheel weight with aircraft empty in level flight
Pixie N9PH	536.5 lbs.	950 lbs.	+3.8 −1.52	crank shaft front face of rear prop flange.	55.19"	57.653"	59.776"	35.5 lbs.
The length from the fire wall to the Datum equals 27¾" on the prototype).								
Acro I - "Book" (N1AC prior to paint wheel pants, spinner and tail weight)	715.5 lbs.	1350 lbs.	+6 −3	the front face, prop	57.1"	61.57"	64.98"	24.5 lbs.
N1AC complete 180 hp without tail weight	878 lbs.	1350 lbs.	+6 −3	" "	57.98"	60.50"	66.75"	24.4 lbs.
N5AC, 200 hp	917.1 lbs.	1350 lbs.	+6 −3	" "	54.26"	58"	64.25"	28.04 lbs.
N6AS, 100 hp no starter no generator	718 lbs.	1350 lbs.	+6 −3	" "	59.744"	61"	66"	32 lbs.
Acro I alternate method	718-926 lbs.	1350	+6 −3	leading edge lower wing	-	8 1/16" forward of the leading of the lower wing.	1 7/16" forward of the leading edge of the lower wing	
Acro II N9AS includes 10 lbs. of oil	875 lbs.	1520 lbs.	+6 −3	The front face of the prop	61.31"	66.09"	74.083"	45 lbs.
Acro II Sportplane	-	2280 lbs.	+4 −2	" "	-	-	76.661 lbs.	-
Acro II Alternate Method	875 lbs.	1520 lbs.	+6 −3	leading edge of the lower wing	8.0" ahead at the leading edge lower wing	1.5" ahead of leading lower wing	5" back of leading edge lower wing	45 lbs.

In the above example of weight and balance the Acro Sport II "Sportplane" which lists at a gross weight of 2,280 lbs., and a "G" loading of plus 4, minus 2 has been given as an example only to show you the deterioration of allowable "G" loading with the increase weights over 1,520 pounds gross weight. It is not recommended that the Acro Sport II be flown at an all up gross weight of 2,280 pounds. The more weight an aircraft is flown at, the lower the "G" will be and also the more critical the C.G. location aft is. It is up to each individual to determine these limits, particularly if he goes over the gross weight recommended.

APPROXIMATE ENGINE WEIGHTS

Continental

Type	Weight
A50, 65, 75, 80(-8)	170-177 lbs.
C85-8, C90-8	158-159 lbs.
C75-12, C85-12	168 lbs., approx.
C90-16F, 0-200	170.18 lbs.

Lycoming

Type	Weight
0-235	240 - 255 lbs.
0-290	260 - 265 lbs.
0-320	268 - 285 lbs.
IO-320	280 - 294 lbs.
AIO-320	306 - 307 lbs.
0-360	282 - 301 lbs.
IO-360	294 - 332 lbs.

Volkswagen

Type	Weight
Minimum Engine	117 - 145 lbs.
Monnett Conversions	151 lbs.
HAPI 1600cc and 1834cc	152 lbs.
Revmaster, 2100cc, Roller Crank	178 lbs.
Revmester, 2100cc, Babbit Mains	160 lbs.
Limbach 1800cc	164 lbs.
Limbach 2000 - 2600cc	201 - 205 lbs.

The above weights include carburetors, magnetos, ignition harness, spark plugs, tachometer drive, starter and generator/alternator drives and starter and generator or alternator. The only exception is the Volkswagen engine listed as the "minimum engine".

Engine and propeller attaching parts will run another 3-5 pounds and if your remove the starter and generator or alternator this will remove about 2½ to 4½ pounds in most aircraft style engines. It is suggested that if you do take these off that you weigh them. Also, for electrical system accesories add about another three pounds for an engine driven fuel pump at about 2-3 pounds. It is recommended that engines used in aerobatics have the solid crank shaft. Don't forget to weigh the engine baffles! You do need to add the inverted oil system weights of components lines, fire shields, etc. It is recommended for accuracy that you put your engine on the scale with all the accessories from the fire wall forward that will be used. It is also recommended that you do this before you build a mount. The Acro Sport II engine on N9AS weighs about 257 lbs., without the starter and generator. Lastly, if you are building an engine from matching parts, get the service bulletins or service bulletins, letters and instructions from the engine manufacturer for aircraft engines. The use of a good Volkswagen book is recommended for those building their own Volkswagen engine.