



CUSTOM AIRCRAFT BUILDING

TIPS

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TIPS Volume 1

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Winner Of First AC Spark Plug's "Tip Of The Month" Contest

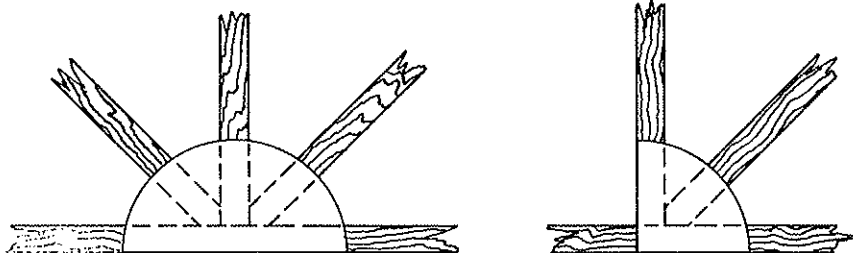
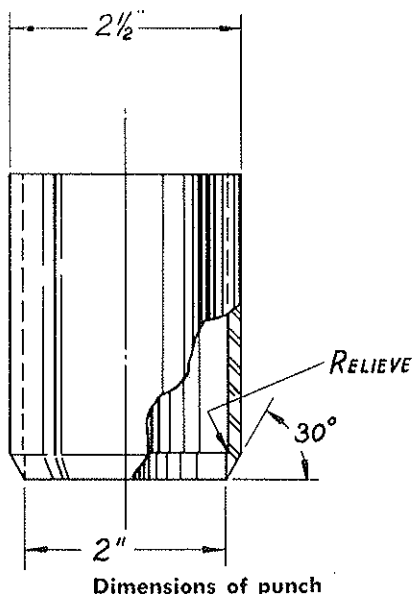
Practically every aircraft homebuilder has at one time or another developed a short cut or a building tip that has saved him both time and money. Realizing this, the AC Spark Plug "Tip of the Month" contest was inaugurated by SPORT AVIATION in 1960. Since that time a gold-mine of ideas have been uncovered. You will find a collection of many of these invaluable tips on the pages that follow. (If you have an aircraft building tip, please forward to EAA Headquarters).

Winner of the first AC Spark Plug "Tip of the Month" contest this month is Randy Varner, 60 Raines Park, Rochester 13, N. Y., EAA 4187 and a member of Chapter 44. Second place winner, who will be awarded an EAA lapel pin for his efforts, is Charles Putnam, 2659 Carleton Ave., Los Angeles 65, Calif., EAA 2859.

"My tip of the month is a punch to punch out wing rib gussets from 1/16 in. mahogany plywood. I made mine from a scrap piece of chrome vanadium steel 2 1/2 in. O.D. by 3 in. long. I drilled and bored a hole lengthwise 2 in. I.D. I then chamfered the outside edge of what is now a tube on a 30° angle, making a razor sharp cutting edge. Next I hardened the cutting edge in oil and polished it to a mirror finish on a buffing wheel, being sure to buff away from the sharp edge.

"I use my punch in an arbor press, and I can punch out 400 gussets per hour. It can also be used in a vise or by laying a piece of flat stock on the top of the punch and hitting it with a hammer. Be sure to place a piece of hard wood beneath the gusset material when doing this so as not to damage the cutting edge.

"After cutting out the circular blanks, I tack ten of them together with a 3/4 in. very fine brad. I then draw two lines 180° apart on 90° angles on the top circle and cut them on a band saw. This gives me 40 quarter circle gussets. I find these make much neater gussets than the rectangular ones and production rate is terrific. Almost every chapter has a machinist who can make these punches for pennies of scrap steel."



Typical gusset applications

Charles Putnam offers this tip:

"Here is a method of sawing .063 and up aluminum and aluminum alloys of all types on home workshop equipment. To the best of my knowledge it has never been used or printed before. With it I have sawed 12 ft. x 4 ft. x 3/16 in. 24 ST plates, ripped 22 ft. x 2 in. x 3/16 in. channels into angles, and cut up 1 in. material into small pieces.

"I did all of this on a 6 in. Sears Dunlap table saw powered with a 1/4 hp motor. I used a \$2.00 Sears 4 in. plywood saw blade, turning 3400 rpm which was all the 1/4 hp motor would pull. The saw blades and the material were lubricated and cooled with beeswax. The beeswax was applied in the following manner:

"1. Coat the blade with as much wax as is practical before starting a cut of any size. Heat will gradually melt the wax and throw it into the cut.

"2. Rub a line of wax along the line of the cut on the material. Wax on the bottom of the material sticks it to the saw table.

"3. Lightly apply wax on the teeth of the saw blade at the joint of the cut at about 1 in. intervals while cutting.

"4. Feed the work with a light pressure. Too much pressure will overheat and load up the blade.

"5. When the work is finished, wash off the wax with gasoline.

"With care a blade will cut 400 to 600 ft. of 1/8 in. material between sharpenings. You'll find that .063 aluminum cuts at about the same speed as a 1 in. board. With more speed I think the saw blade would do better and faster work. I have tried many lubricants and saw blades but I find the Sears plywood blade and the beeswax were by far the best."

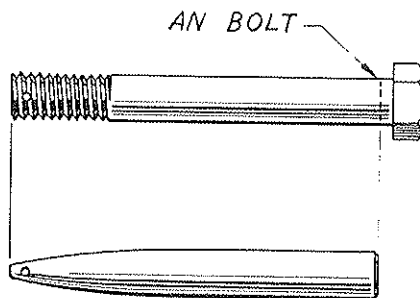
Bullets For Alignment

By Bud Oliver, EAA

On all the excellent material that I've seen presented in *SPORT AVIATION* and *Amateur Builders Manuals*. I've never read anything on assembly and rigging techniques. Many times I have shivered and cringed as I watched fellows hammer bolts into strut and wing fittings as they assemble and rig an aircraft. In many cases the assemblers are unaware of the proper techniques to use to avoid trouble.

When you are holding something in alignment, such as a wing to fuselage root fitting, and then proceed to take the actual bolt that you are going to secure it with and attempt to drive it into place with a hammer, you are certain to get varying degrees of the following results (sometimes all of them): ruined bolt threads; galled bolt and fittings; bent bolt; elongated fitting holes; bent, twisted and cracked fittings; loss of paint or plating.

Two persons can assemble any plane whose component parts they are able to lift with absolutely no



BULLETS

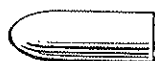


Fig. 1

the actual bolts will go in. In this way the entire plane will easily go into approximate alignment and the bolts will go in easily by inserting them with the fingers. (Fig. 2).

Now make a bullet of the proper diameter and length for the alignment of all fittings. To make the bullet, just take an old bolt that is

the same diameter that the fitting requires and grind one end to a bullet nose shape and cut the other end off square. Only the unthreaded bolt shank is used. The head of the bolt is cut off and the threaded end is used for the bullet head end so that the threads are ground away (Fig. 1). For tight places where a long bullet cannot be used, make up a short one as shown.

The bullet is given a thin coat of Parker Threadlube or Lubriplate, or white lead and oil (to stop galling of similar metals) and inserted into the fitting in the same direction that the final bolt will go in. The bullet is then tapped in place with a soft drift and hammer until it is flush with the face of the fitting (Fig. 3). The bolt is then tapped into place. It will push the bullet out of the fitting ahead of it (Fig. 4).

You may notice that I illustrated one bullet with an eye at the point. This is the cotter pin hole of the original bolt from which the bullet was made. Often there are places

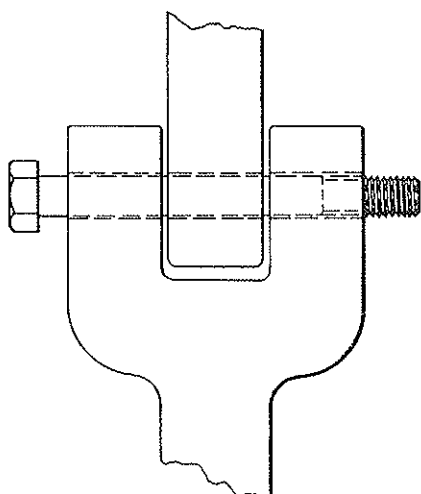


Fig. 2

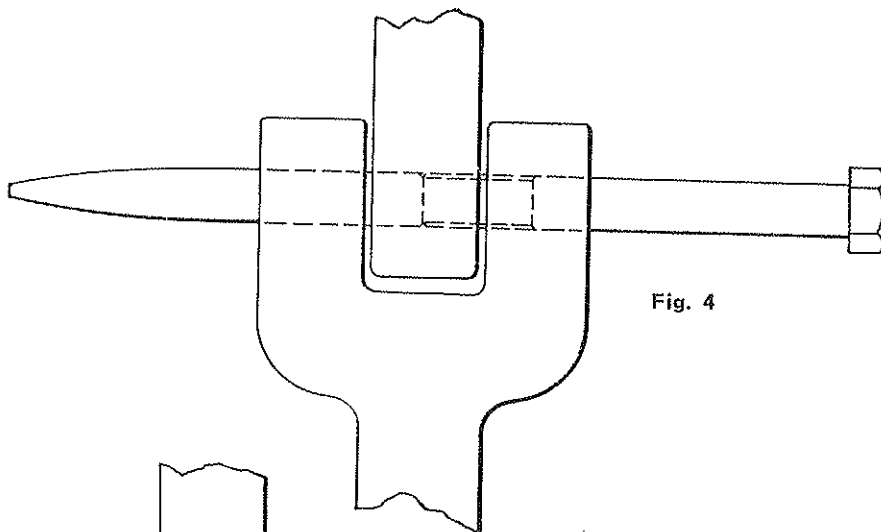


Fig. 4

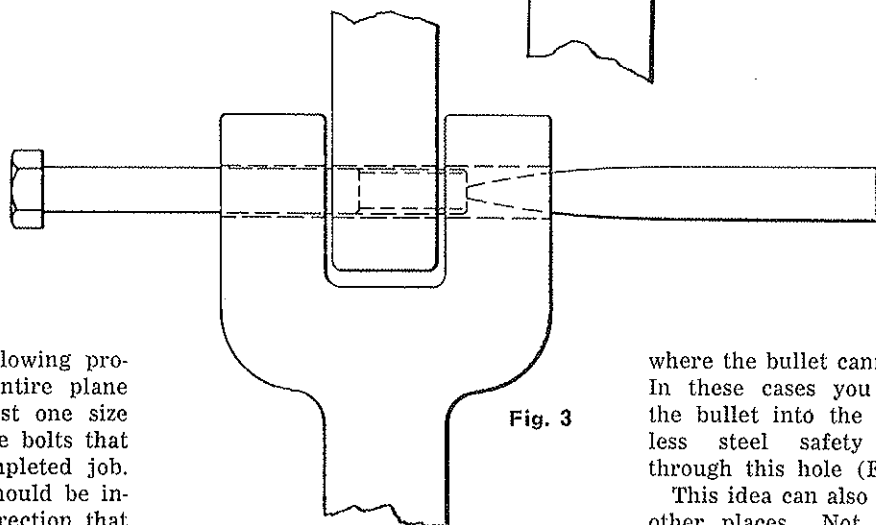


Fig. 3

damage by using the following procedure. Assemble the entire plane by using bolts of at least one size diameter smaller than the bolts that you will use on the completed job. If possible, these bolts should be inserted opposite to the direction that

where the bullet cannot be driven in. In these cases you can often pull the bullet into the hole with stainless steel safety wire inserted through this hole (Fig. 5).

This idea can also be used in many other places. Not too long ago I

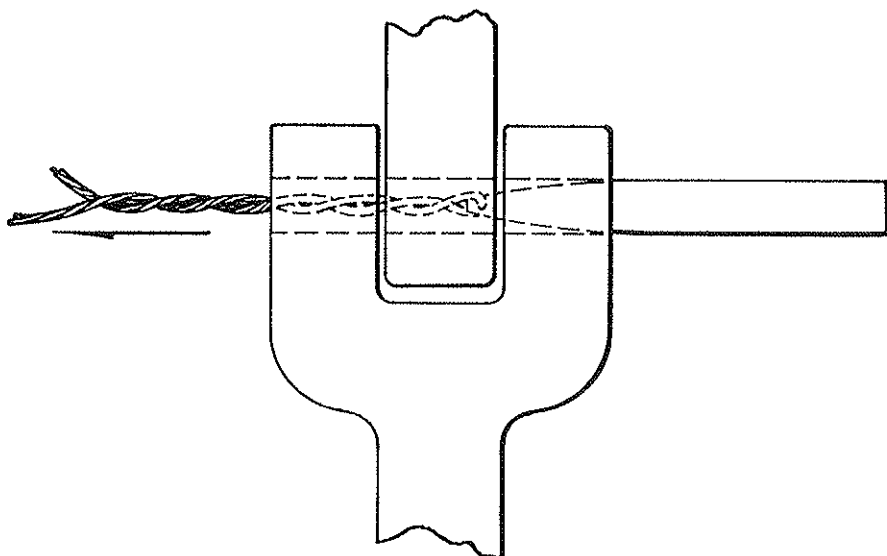


Fig. 5

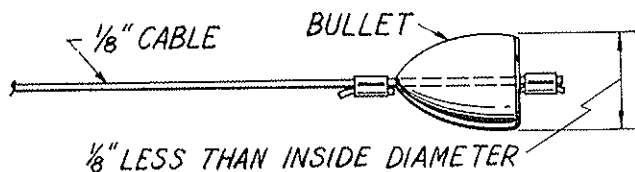


Fig. 6

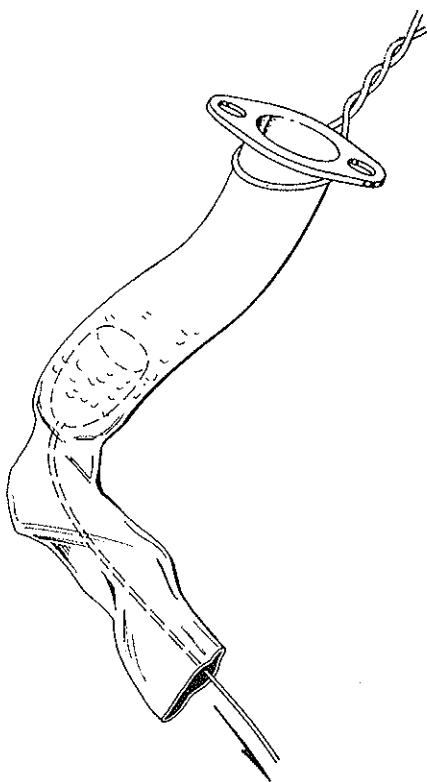


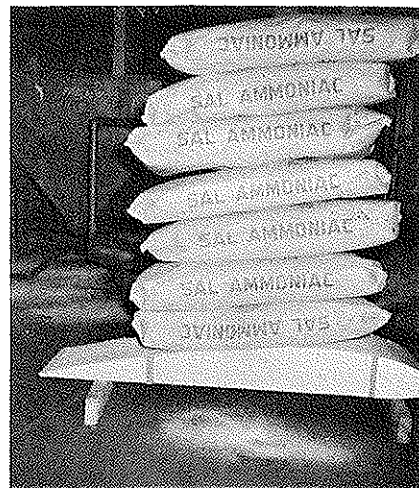
Fig. 7

bought a new Piper PA182 that had stalled out at 250 ft. and augered right into the ground with full load. The airplane was so bad that only the rudder and one aileron were usable. You can imagine what the cross-over exhaust that passed across the front of the engine crank-case looked like. It not only was flat, but it had the impression of one of the case studs driven into it until the metal failed.

I made a bullet out of cold-rolled steel and drilled a $\frac{1}{8}$ in. hole through the center to take $\frac{1}{8}$ in. control cable (Fig. 6). I pushed a $\frac{1}{4}$ in. steel rod into the collapsed exhaust tube until I was able to push the cable through it. Then I had it made. All I had to do was to tie the exhaust tube to a post and pull on the cable with a chain hoist, tapping on the exhaust tube in the area around the bullet (Fig. 7). When the bullet came through - presto! A good exhaust pipe again! In this case I only had to weld up the one little break where the stud was driven through. All this work is done cold, because getting stainless steel red hot doesn't make it form any easier.

Storage Should Be Watched

Do not store fresh lumber near furnaces, radiators or other sources of dry heat. Warping and end-splitting is probable. If stored on edge, sheet plywood is apt to develop permanent distortion; it should be stored flat. Wooden propellers should never be stored standing against a wall with one tip on the floor.



EAAer's Testing "Laboratory"

Seven 100 lb. bags of sal ammoniac are supported by this wing section built by Raymond Reed, Wonewoc, Wis. STRUX plastic is used between $\frac{3}{4}$ in. wood spars, whole being fiberglassed. Advantages claimed are no leading or trailing edge strips, no doping, no ribstitching, no drag wires and fittings, hailproof, true airfoil shape. Test section weighs 10 lbs.

RESINS AFFECT STYROFOAM

Here's a tip which may save others a lot of trouble. The wing tips on my Tailwind are formed of Styrofoam, which I had carefully formed to shape. I then attempted to cover the wings with fiberglass, using a polyester resin. To my dismay, the Styrofoam soon began to dissolve or melt under the influence of this resin and in the end my nice wing tips had shrivelled about half an inch. Two weeks work went out the window! Another two weeks were spent in making some balsa wing tips and the polyester went onto them fine. I found out later that if I had used an epoxy resin I would have had no reaction from it with the original Styrofoam tips.—George M. Sager, Williamsburg, Va.

FIREWALL FLANGE AND SUPPORT

by *Gerald Landes*
3201 Vassar Drive, Irving, Texas

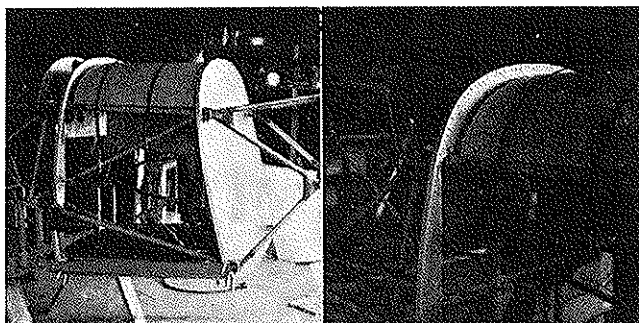
This is a tip on construction I believe worth passing on to other members who may be having trouble in building a neat, light and strong firewall flange and cowl support for the wrap around. Many may already use this method but others may be stymied as I was for awhile. Although it is not wholly my idea, the method results in a light and very strong simple component.

The major material is aluminum angle with $\frac{1}{2}$ in. sides and $\frac{1}{16}$ in. thick. We acquired ours from a scrap metal dealer at 30c a pound. A pound is a piece about 16 ft. long, so you see it is very light and cheap. The angle must be hard and yet easily bent without fracturing. I have used 24 ST and 53 ST successfully.

After the firewall has been cut to shape from light stainless steel, usually .012 to .020 in. thick, the angle

be. For mild curves a $\frac{1}{16}$ in. wide cut is sufficient — for most corners $\frac{1}{8}$ in. is needed. Then the angle is ready to be riveted.

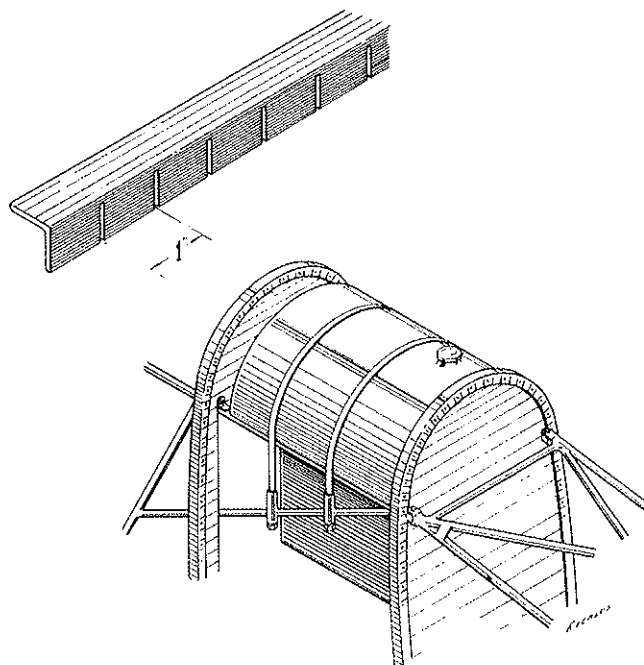
The proper rivet spacing is about 2 in. apart, or in the middle of every second saw cut. This will provide enough rivets to secure the angle to the firewall. All holes should be drilled through the angle and then the firewall at the same time. This will leave a burr on the front of the firewall which must be removed before



Close-up of rear support
Firewall and rear cowl support on
Gerry Landes' "Skyhopper"

can be riveted to the back side to form a mounting flange for the wrap-around cowl and to provide a good stiff firewall free of anything but rivet heads.

To prepare the angle so it can be formed to the circumference of the firewall, it must be cut so that it can be bent easily. By making saw cuts one in. apart on one side it can be formed to any desired arc or curve. The shorter the turn radius, the wider the saw cut must



riveting. The rivets are inserted so that the rivets are on the front of the firewall.

The rear supports are made in the same way, only ST aluminum is used in place of the stainless steel. These supports are bolted onto the fuselage by clips welded to the structure. Vibrating cowl problems should be eliminated with this arrangement. •

BENDING LEADING EDGE ALUMINUM

At first thought the logical way to apply aluminum sheet to the leading edge of a wooden wing would be to attach the edge of the metal to the bottom of the spar, bend it up around the leading edge strip, and back down onto the top of the spar. But an attempt to do it this way often will lead to an irregular, rough bend that makes the leading edge aerodynamically unsatisfactory.

From Athens, Greece, comes a letter written by member Jim Schnell. Jim says that over 20 years ago he dropped into a well known lightplane factory to pick up a ship and was invited to tour the place. There he saw workmen bending leading edge aluminum in a simple but effective way.

They had two long planks set up at bench height on suitable legs, with a suitable gap of a few inches between them, and their edges rounded off. The flat metal was then set over the planks and a long iron pipe was put on top of the metal, directly over the gap in the planks, and pressed down into the gap. The pipe had a radius slightly less than the leading edge radius of the airfoil to allow for spring. This put a smooth bend of perfect radius into the metal, giving it a "U" shape such that it was a simple matter to slide it over the nose of the ribs and tack it down onto the spars.

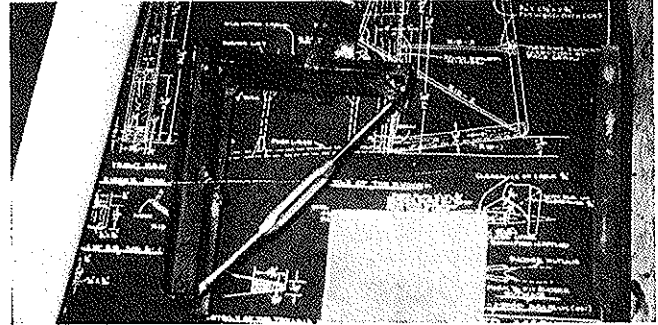
Jim is with TWA in Athens, has a plane, and invites any EAA members passing through to drop in for a visit. •

A SCARFING JIG

by Doug Watson and Gord Maunder
R-1, Lindsay, Ontario, Canada

When Gord Maunder and I decided to build a Jodel D-9, an all-wood single seater design, it didn't take us long to realize that with all the scarf joints to be made on the skins for the fuselage, box spar, etc., using a hand file was for the birds! So we kicked around a few ideas we had for a mechanical method of turning out a near perfect scarf consistently.

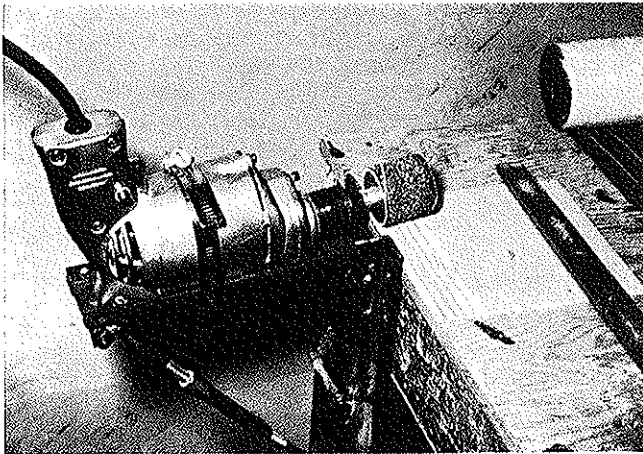
We finally came up with a simple jig, shown in the accompanying photos. Using a $\frac{1}{2}$ in. electric drill (a ball bearing drill is best), clamp it on the base channel of the jig, insert a sanding drum (obtainable at most hobby or auto stores) into the chuck of the drill. The drill can be adjusted to any angle or height to accommodate various thicknesses or lengths of scarf. If used



flat, it can double as a thickness planer for pieces such as cap strips, etc.

We used special "U" channel 10 in. long. The sides of the channel were short and just nicely held the drill body. Two pieces of $\frac{3}{4}$ in. x $\frac{3}{4}$ in. angle were used for the vertical bracket of the jig, with $\frac{1}{2}$ in. x 2 in. slots milled into them near the top, so that when bolted to the bench or table the whole jig can be raised or lowered. A small turnbuckle is attached to the lower end of the vertical member and to the aft end of the channel, via bolts as shown. A strap clamp completes the jig and hold the drill in place.

We found that we could produce perfect scarfs with about three to four passes under the drum, taking off a little material at a time so as not to tear the feathering edge. In $\frac{3}{16}$ in. birch plywood we did 13 in. of scarf in one minute. It took from 20 to 30 minutes to do a 7 in. scarf with a file by hand. We'll be glad to furnish further information to anyone who wants to write. •

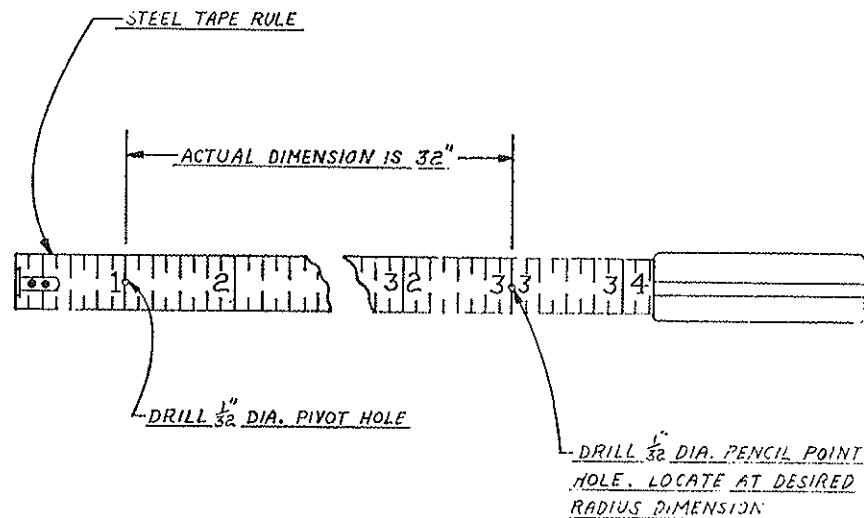


A Simple Method For Drawing Large Radii

By Chet Klier, EAA 4980

My tip is a method for drawing large radii, such as an arc for wing tips, engine cowl layout, tail surfaces or bulkheads. The material required is simple - a steel measuring tape. Drill a $\frac{1}{32}$ in. diameter hole in the center of the tape on the 1 in. increment line (see drawing). This hole will provide a pivot hole around which the steel tape will revolve. A scriber or nail should be used for the pivot point.

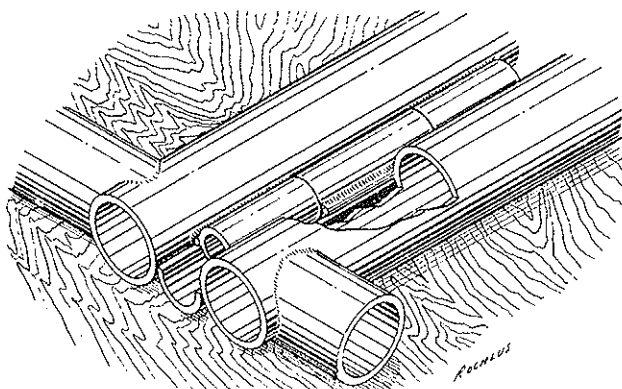
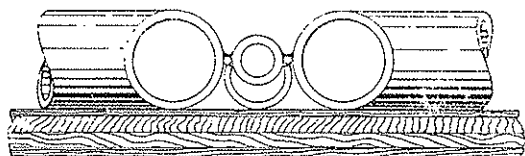
The location of the next $\frac{1}{32}$ in. diameter hole or holes will depend on the radius of the arc you wish to draw. A pencil point is inserted in the second hole and you simply walk the arc around, holding the tape taut. One word of caution - be sure to add 1 in. to all radius dimensions because you have lost this on the location of the first hole. •



OWN BY CHET KLIER
EAA 4980

JIG FOR HOLDING HINGE TUBING

by James H. Campbell



There are numerous little items overlooked by the average person when building an airplane, such as the hinges on the tail surfaces and the little pieces of tubing forming them. When I was putting the hinges on the tail surfaces of my Model D Baby Ace, I ran into the problem of properly aligning the tubes for the hinges and a way to be certain they would be in the center of the leading and trailing edges of the tail surfaces.

The tubing used for the hinges of my particular bird are $\frac{3}{8}$ x .065 x $\frac{7}{8}$ in. 4130. When laying out the tail surface jigs I made the gap between the leading edge and the trailing edge of the respective tail surfaces to be $\frac{1}{2}$ in. This was to let me use the idea of aligning hinges and getting the hinges properly centered on the tube edges.

I selected a piece of .049 x $\frac{1}{2}$ in. tubing approximately 3 in. long, then cut and ground it down as shown in the accompanying drawing. Mount this tube section between the leading and trailing edges of the tail surfaces as shown. This will allow the $\frac{3}{8}$ in. hinge tube to be held right in the center of the gap, with a ledge on each side for laying a piece of 1/16 in. weld rod for a filler.

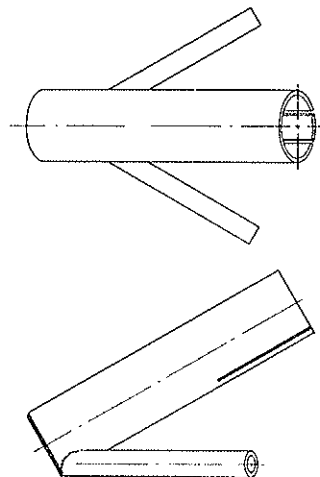
Protrude a $\frac{1}{4}$ in. bolt through the hinge stock, and apply the torch and welding rod to the hinges and respective bearers. Remove the jig fixture to the next location and repeat the process. This will give you perfectly aligned hinges and no zig-zag pattern for prospective eyeball engineers to criticize. •

SMALL NAIL DISPENSER

The winner selected this month is Dale Johnson of Midland, Mich., who has applied some ingenuity to a sticky problem.

In his words, "small aircraft nails are hard to handle. This nail dispenser is quickly made and will save twenty minutes on each rib. The nails are put inside, then tip upright, the thumb over the hole. Shake gently, and nails will hang through the slot, retained by their heads. Several nails can be removed at a time with the thumb and finger."

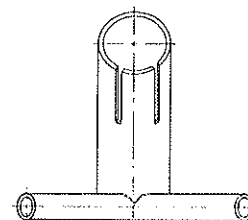
"The sketch is self-explanatory. I used one one-inch diameter tube for the holder and two one-quarter inch diameter tubes three inches long for the supporting legs. A one-inch diameter disc closes the bottom of the tube. Saw the slots, and file the edges smooth." Fill with nails and shake away. •



NAIL
DISPENSER

BY

DALE JOHNSON
MIDLAND, MICHIGAN
EAA #4258



MAKE A "TEST" WING

Various articles and textbooks on aerodynamics all stress the importance of maintaining correct airfoil curves and providing a smooth surface when building wings. In particular, stress is laid on the importance of avoiding ridges and sharp edges running in a spanwise direction on the forward third of the upper surface of a wing. One way of making certain that the shape of your ribs, method of applying leading edge material, fabric sag characteristics and other factors influencing the fabric's surface contour will result in a smooth surface is to

make a dummy wing. Ribs can be sawn from low cost interior plywood and three or four of them assembled on scrap lumber "spars". Such common material is all right provided an exact duplicate of the real wing parts' shape is made. Covered with cheap muslin and given enough coats of clear and silver dope to develop a taut surface, this dummy wing will show exactly how fabric will look on your real wing, and any needed smoothing-up can be done while building the real wing's structure. •

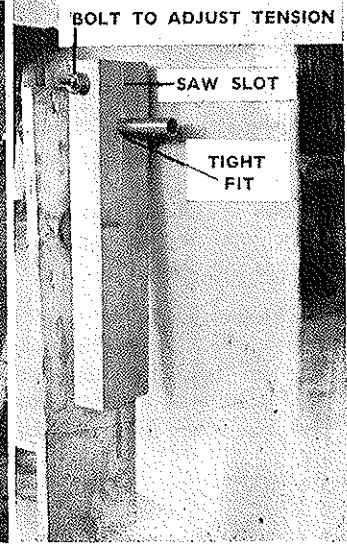
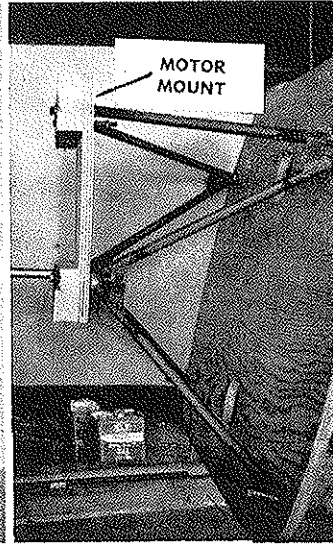
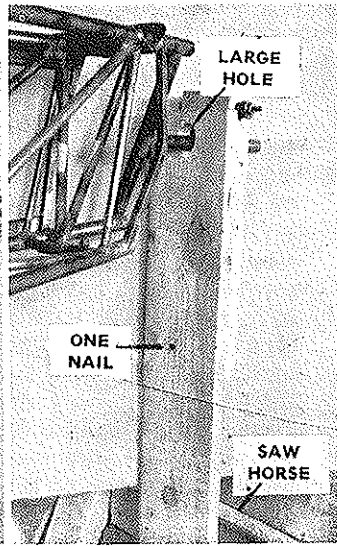
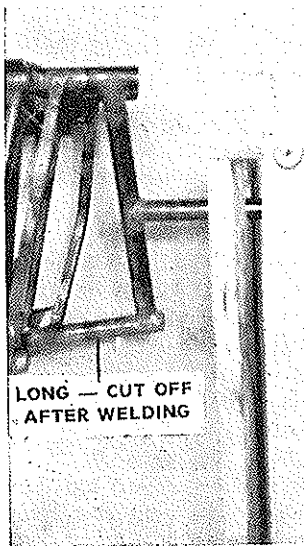
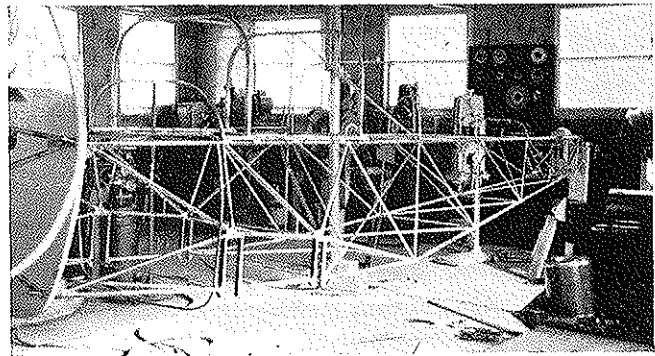
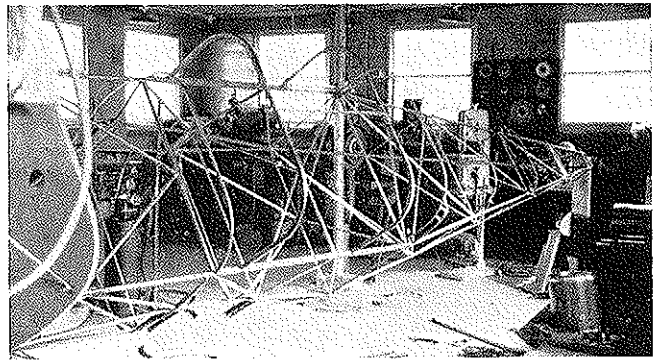
Rotate Fuselage To Aid Welding

by E. A. Fessenden Lafayette, N.Y.

I find it a big help to be able to rotate the fuselage while welding. Leave two of the longerons (one top and one bottom) long on the rear of the fuselage and weld a piece of scrap across the corners. Weld another piece of scrap 90 degrees approximately in the center.

I drilled a $\frac{3}{4}$ in. hole with a steel drill in the jig for the motor mount and drove in a scrap piece of $\frac{3}{4}$ in. tubing to rotate the front. Take a couple of scrap boards and bore a $\frac{7}{8}$ in. hole through and nail to a saw horse for end supports. Take a piece of hardwood 2 x 4 and drill a $\frac{3}{4}$ in. hole, then saw a slot through the hole. Drive one large nail through the board into the 2 x 4 (see photo). Bore a $\frac{1}{4}$ in. hole through the 2 x 4 at 90 degrees and insert a carriage bolt. Tighten to obtain the correct tension. The large hole in the supporting board and the nail will allow the 2 x 4 to move and correct for misalignment of $\frac{3}{4}$ in. supporting tubes. Make one for each end.

The accompanying photos will clarify any questionable points.



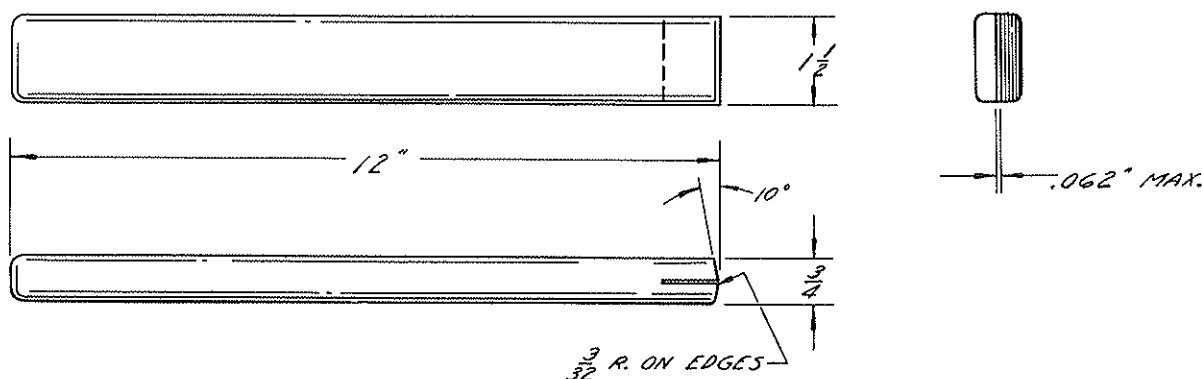
Welding Cluster Joints

Member Jim Frost of Tulsa, Okla., tells us that when building his Stits Playboy he encountered trouble doing a good job on some of the cluster joints in the steel tube fuselage. Due to the thin walls of the tubing, it was essential to use a small torch tip, otherwise the tubing would burn through quickly. However, the comparatively large amount of metal at the cluster was able to draw heat away from the weld so fast that good penetration and a smooth head was hard to achieve. Jim got a

common blow torch and set it up so that its flame would play onto the cluster joint as a whole, keeping the metal mass at a uniform high temperature. Then the small tip on the welding torch was able to melt the metal at the actual joint easily, but without burning through the tubing. This is the kind of practical tip we love to pass along to readers so, fellows, if you have hit upon some way of handling a job better, don't procrastinate about telling us!

Suggestions On Metal Ribs

By Paul E. Best, EAA 2441

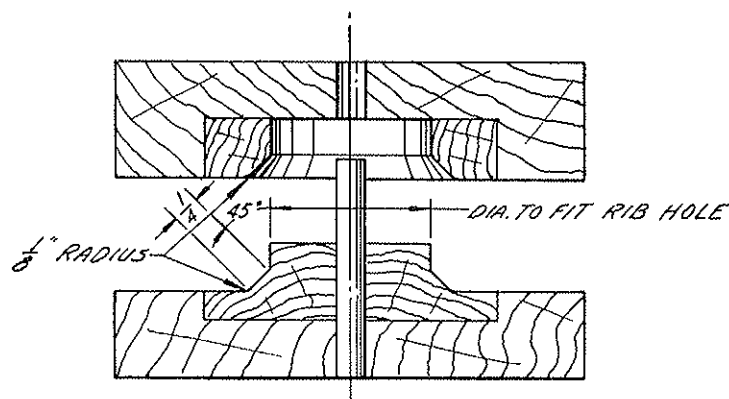


The customary method of making wing ribs and parts like fuselage formers of sheet metal is by means of form blocks and a hammer. Two hardwood boards are sawed to the outline of the desired part and the sheet metal blank is clamped between them. Then the projecting flange of sheet metal is hammered over, crimping where needed to remove kinks from the flange. The process was fully described on pages 5 and 6 of the July, 1957 issue of this magazine.

However, three years later amateurs still seem to prefer wood truss ribs, and it seems to me that the reason for their reluctance to change over to metal ribs may be due to a lack of awareness of the difference in cost and fabrication time between wood and metal. Many

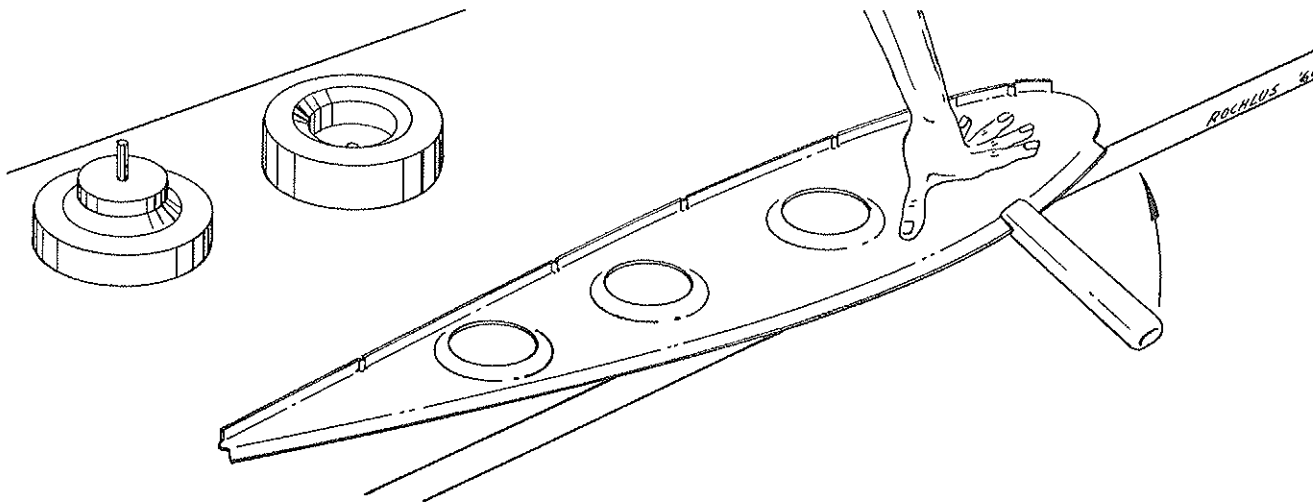
was the important one of cost . . . the cost of the material and the amount of labor required to form it.

The average wooden truss wing rib using spruce strips and mahogany plywood gussets calls for about \$2.00 worth of material and takes 75 to 90 minutes to assemble. To cite a common example, take the Baby Ace rib. It has a total of 38 small gussets, one on each side of every joint. With 26 ribs in the wing this means 988 gussets per plane. Each gusset has an average of six tiny nails in it, or a total of 5,928 nails in the whole wing! It is no wonder that even in the early C-3, the Aeronca people tried to get away from the cost of mahogany plywood and the labor of driving endless tiny nails by adopting fiber gussets, glued on in a jig designed to keep them from shifting as pressure was applied. On page 10 of the August, 1958 issue of this magazine is shown the Jurca type rib, in which strips of veneer are used in place of gussets. The required width of veneer could be home-made by slicing material off a board of the proper thickness with a table saw, and doubtless a jig can easily be made to position the truss members and veneer strips accurately to eliminate the need for nails.



years ago the lightplane factories gave up wood ribs, and planes such as the Cub, Taylorcraft and Aeronca all had metal ribs even though wood spars and fabric covering were retained. As you might suppose, the reason

However, my interest in metal ribs was such that I have studied them carefully and would like to share my discoveries with others. A rib made of .020 ga. 2024 ST aluminum requires 2.5 sq. ft. of metal costing \$1.50 as compared to the \$2.00 average for wood. If a small plane needed 24 ribs, a savings of \$12.00 could be made on material alone, and about six hours of labor would also be saved. Utility grades of sheet aluminum available from building supply houses and mail order stores are even cheaper and while at present the use of non-aeronautical materials is frowned on, I feel that with sufficient testing and investigation to establish their reliability,



ribs made of this aluminum could work out well and be the cheapest one could imagine.

In the Air Force I came in contact with a \$40,000 machine in a sheet metal shop. This little gadget forms ribs, bulkheads and other parts rapidly in a rather simple way. A metal blank for the part is cut to shape, with the desired flange width added to the circumference. This is put into a holding die and held in place by an overhead clamp arm fitted with fingers. The hammer, in principle, amounts to an upward-swinging "trap door", the arc of motion of which can be set at any desired angle. The operation is very rapid, there being a choice of 60 or 120 cycles per minute. The hold-down and the hammer are synchronized; the hold-down grips the sheet metal, the hammer comes up, drops down, then the hold-down releases its grip slightly so that pressure applied to the part being formed lets it be moved along so that, in what resembles sewing-machine fashion, the flange is rapidly bent up. To minimize warping and distortion, it is customary to pass the work around the machine three times, putting a successively greater bend into the flange until the 90-degree bend is attained.

Inspired by this, I eventually hit upon a method of reproducing the forming action with simple hand equipment. My tool is nothing more than a maple or oak stick about a foot long, $\frac{3}{4}$ in. thick and $1\frac{1}{2}$ in. wide. One end has a slit cut in it with a thin-blade saw, this slit being of the same depth as the desired flange width. You lay out the part on the metal, being sure to add the flange width to its circumference. Hold the metal flat on the edge of a smooth table, push the tool over the metal's edge, and bend up about 20 degrees. Move the tool along on the metal a distance about half the tool's width and bend up again, and just keep going all around the part. On the second time around bend the flange to 40 or 50 degrees, and on the last time to 90 degrees. The first pass puts in the bends which establish the contour of the part. Moving along half the tool width at a time assures a smooth bend and uniform contour. It is even possible to work at flange-bending while watching TV or baby-sitting!

When the work with this tool is done, the rib or bulkhead will probably be twisted due to the strains in the flange metal. Fluting or crimping the flange will take this out. A pair of cheap pliers can be modified by

brazing a pair of small shaped blocks to their jaws after this fashion: ((. Another way I have tried successfully is to get a piece of $\frac{3}{16}$ in. steel rod. The end is given a few wraps of tape to avoid scratching. Open a vise about $\frac{3}{8}$ in. and lay the flange over the end of this opening. Lay the rod on top of the flange and tap down with a hammer to put the flute in. Space the flutes as needed to remove the twisting, usually one each several inches will do. Flute all ribs the same using the first as a guide.

For making the stiffening flanges in the lightening holes, simple male and female dies turned from hardwood can be used. The male die can have a pilot pin in its center which fits a hole in the female die. This will keep the two in alignment while they are squeezed together with a vise, an arbor press, a hydraulic jack or even just a bolt and nut. For most ribs it is necessary to make two or three dies for holes of varying size. Finish off the ribs by burring the raw edge of the flange so it will not chafe the wing fabric.

The advantage of my method of flanging is that troublesome, time-consuming distortion due to hammering is eliminated, and an accurate form block need not be made for each part in the airplane.

And here are a few extra tips. The approved manner of attaching metal ribs to wood spars is through a flange bent 90 degrees at the rib hole. At least three aircraft nails should be used in each flange. If ribstitching cord is used to attach fabric in normal manner, when it is drawn up tight after each loop the unsupported edge of the flange could be pulled down, possibly weakening or warping the rib. Also, the metal's edge could cut the cord in time. Partly for this reason and partly to speed up work, production planes use a variety of clips and strips to attach fabric to ribs. For the amateur, common self-tapping sheet metal screws are probably the best. A tiny washer is used under the head of each screw, partly to distribute pressure over the rib tape and partly to prevent the tape from developing unsightly twists and lumps when the screws are snugged down. In the November, 1959 issue of Popular Science Magazine a simple home-made sheet metal brake was described; I made one 28 inches long and found that for straight bends it works well and would recommend it to other EAA members.

RIB STITCHING — WITHOUT A HELPER

By Richard W. Gleason, EAA 3131

When building my airplane I was faced by the problem of marking for rib stitching on the fabric of the wings without a helper to hold one end of the chalk line. The idea I hit on worked so well that I am telling others about it.

I got a length of electrical conduit long enough to stretch from root to beyond the outboard ribs. About 3/8 in. in from each end I drilled a hole, going through one wall only and making sure both were on the same line. The holes were tapped

for 10-32 screws and into each went a machine screw about 1 1/2 in. long, with a plain nut threaded onto each up to its head. The screws were turned up tight against the opposite, inner side of the tubing.

The chalk line was stretched tight between the two screw heads and the nuts snugged up to hold it against the bottoms of the heads. The result was something similar to an oversize violin bow.

The rib spacing was marked on the end ribs with a black pencil

to get a good, dark mark. One end of the chalkline is lowered onto the rib on the far end from where one is standing, and the near end lowered onto the mark at the near end of the wing. Then it is quite easy to snap the line and move on to the next mark. All ribs will be uniformly marked. It is possible to mark a wing the size of a Cub with this gadget in five minutes.

To further simplify rib stitching, do the marking on the bottom surface of the wing while it is sup-

CIVIL AERONAUTICS MANUAL 18

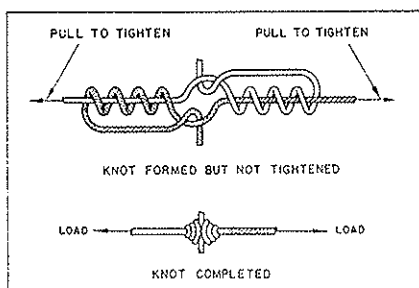


FIGURE 3-4. Splice Knot.

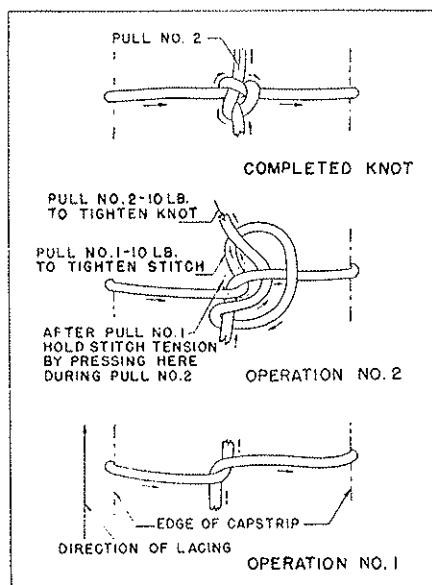
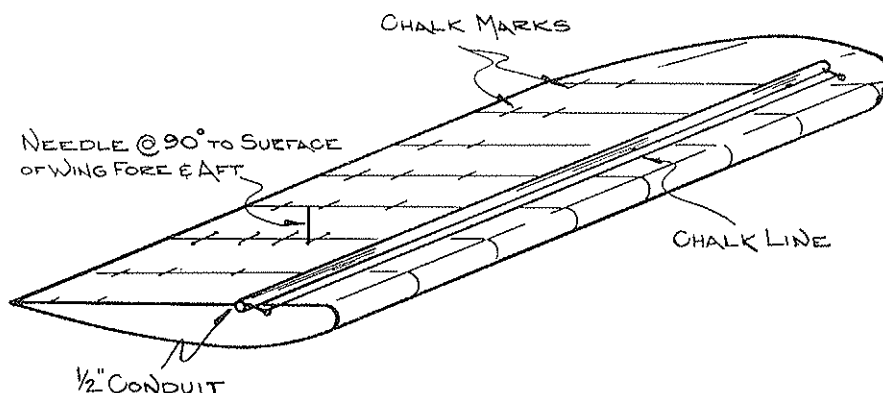
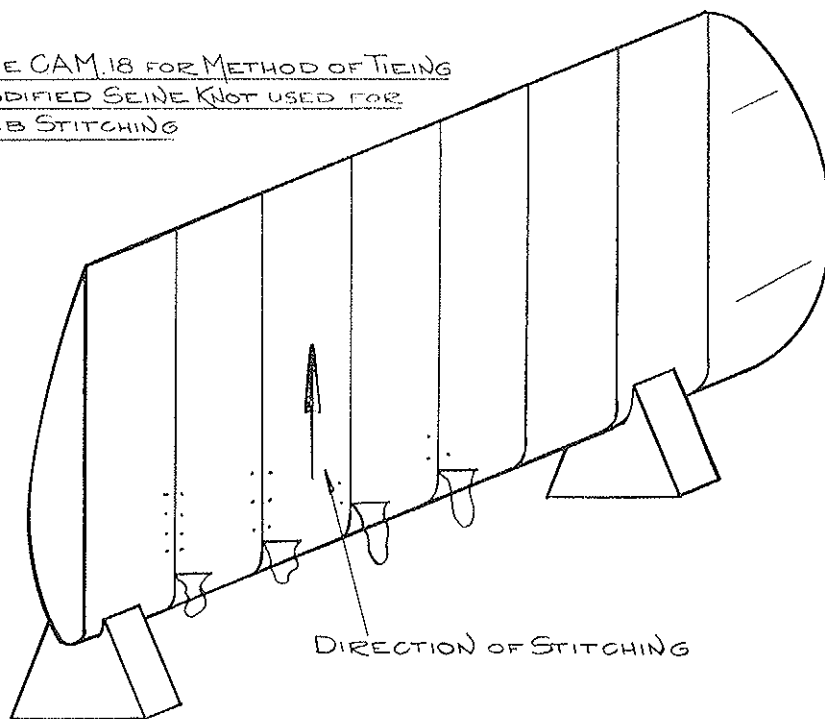
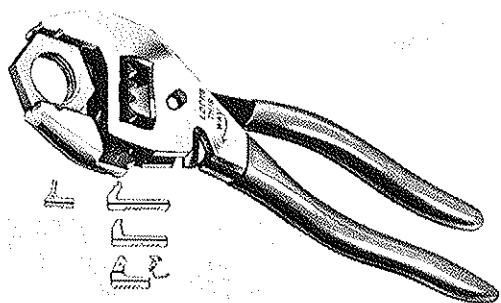


FIGURE 3-5. Standard Knot for Rib Lacing (Modified Seine Knot).

How to tie the knot for rib stitching. Knot is shown in center of cap strip for clarity; on an actual rib the line of knots would run along one side of the capstrip so that knots can be pressed down with the thumb and avoid having them show through as lumps in the pinked tape.

SEE CAM 18 FOR METHOD OF TIEING
MODIFIED SEINE KNOT USED FOR
RIB STITCHING





Tips On Vise Grip Pliers

QUITE BY COINCIDENCE, we received a news release and a letter on the same subject at about the same time. Our friends at Cooper Industries, Inc., 2149 E. Pratt Blvd., Oak Grove, Ill., sent the accompanying photo of their new **PLIERENCH**. According to their release, the tool is geared for a 10-to-1 leverage ratio and has 100 percent parallel jaws. Selling for \$12.75, it is quality made and the kit includes a variety of jaws and cutters.

From member Hap Wilson, president of Chapter 17, Marysville, Tenn., we have the following tip:

"When buying any kind of vise grip plier, get the type which keeps its jaws parallel as it opens and closes. Instead of concentrated pressure, the load is distributed and the tendency of the plier or wrench to slip is much reduced. Such a tool also prevents localized marring of work. It will hold onto a nut in some inaccessible place while one man turns the bolt from the other side of

a bulkhead, etc. Two pieces of sheet metal can be firmly clamped together for drilling, with little danger of their twisting out of alignment. When working around firewalls, tail surfaces, etc., one-man assembly is a cinch; clamp the tool onto the bolt head and put the bolt into its hole from inside the aircraft. Rotate the tool until the end of its handle binds on a nearby flange or projection, and then run the nut on from outside.

Another firm, Precision Equipment Co., 4407 Ravenswood Ave., Chicago 40, Ill., sells a gadget consisting of two common vise grip pliers which are attached to a base clamp by means of ball-jointed, adjustable arms. It looks approximately like the arms and jaws of a lobster. Clamped to the workbench, it will hold two parts in any desired position for welding or assembly. Price is comparable to the above-mentioned tool and details can be had from Precision by writing to them. •

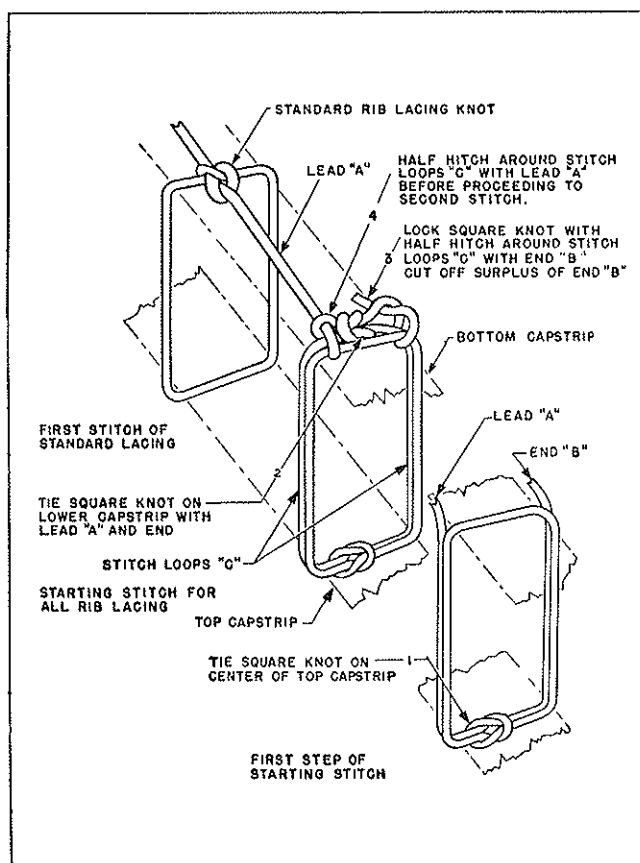
Continued from preceding page

ported bottom-side-up on sawhorses. Guide holes are punched through the bottom fabric to each side of every rib at the stitch locations, with the needle. Hold the needle at right angles to the lower surface, feel it up against the upper cap strip and push it out through the top of the wing. This is done with no lacing cord in the needle's eye. When all holes have been punched on top and bottom, the spacing on the top surface will be automatic and no further measuring or marking will be needed.

A further simplifying step is to mount the wing panel in a vertical position with its leading edge down. To save many steps, get four or five ribstitching needles and run all of them through at the same time, thus pulling through that many for each movement from one side to the other. When pushing a needle through, put your eye close to the hole in the fabric directly above the stitch being worked, and guide the needle point quickly and easily into the proper pre-punched hole on the other side. If five needles are used at a time, you can do five stitches while walking back and forth only once. •

← Drawing by Don Cookman

Note: For a smoother finish, knots can be slipped to one side of cap strip. →



Making Metal Trim Tabs

Another month has rolled around again and another award has been made for the best tip received, this one from Henry E. Winslow, EAA 595 of Inglewood, Calif.

Here in Hank's own words is a tip on making metal trim tabs:

One of the most fascinating things about building one's own plane is the variety of materials available to use in its construction. Too often, however, the builder seems unwilling to change the choice of materials to suit the unit. Because of this a great many homebuilts have ugly looking rectangles of tubing covered with fabric for their trim tabs, when a neat, lightweight one could be constructed of aluminum. (Refer to Fig. 1).

The trim tab described in this article is easy to construct and will give a professional look to your homebuilt. See the example on Fig 2.

The only tools needed are ordinary hand tools with the exception of a sheet metal brake. The skin could be hand formed, however the time involved in making a form and a clamp to hold it is much too great when less than five minutes at the brake will finish the bending operation.

The three micarta ribs are made up first, then the brackets are made and attached with a couple of 6-32 countersunk headed screws and stop nuts. One of the outboard ribs is notched for the tab horn so the countersunk holes will be in the horn on that side.

Bend up the skin over a 3/32 in. radius bar to about 70 deg. on the first bend, then you will be able to get a 70 deg. angle on the second bend. Clamp the trailing edges together and put the skin back in the brake with about 1/2 in. of the leading edge protruding from the radius bar. Now clamp down LIGHTLY until the skin forms the proper contour.

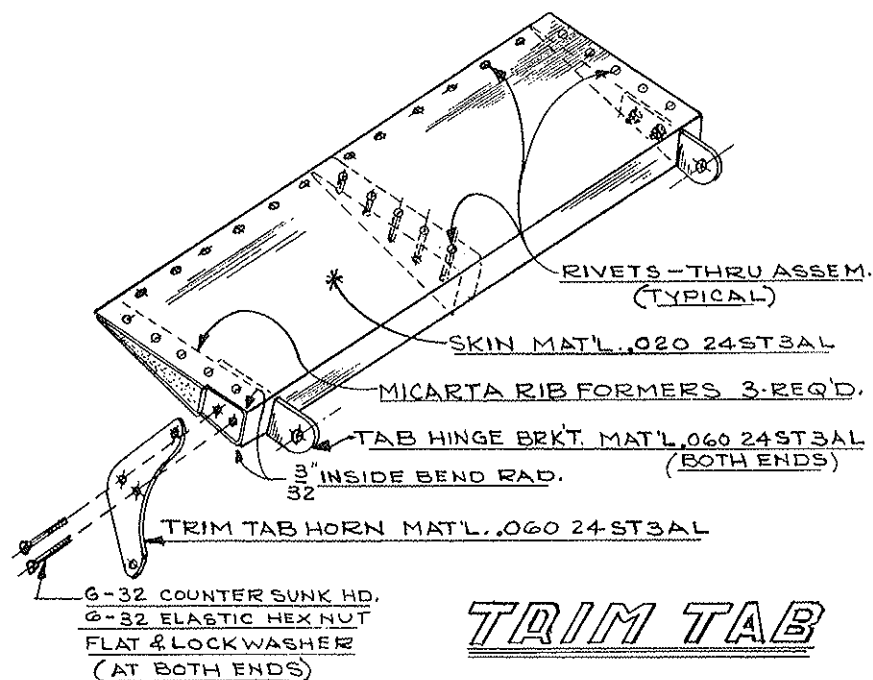


FIG. 1

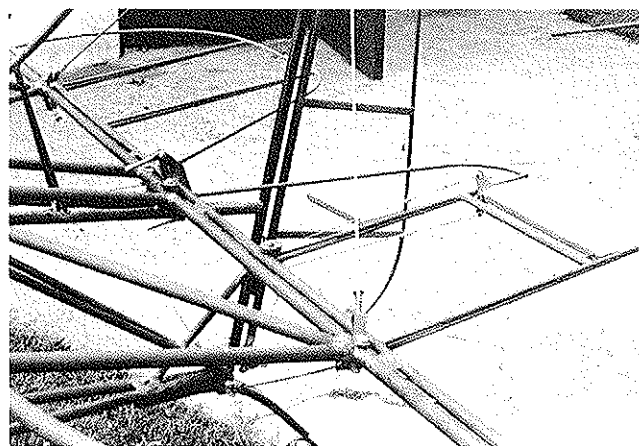


Fig. 2

Slip in the center rib and drill the rivet holes through the assembly. Select the proper length rivets and rivet in the rib. This can be done with a ball-peen hammer but care must be taken not to crush the micarta as it is quite brittle. Now fit the end ribs by cutting slots in the leading edge of the aluminum tab for the two brackets to extend through and drill and rivet as with the center rib. Now drill and rivet the trailing edge and the tab is complete.

It is a good idea to spray zinc chromate on the inside of the skin before riveting it up. I used brazier head rivets on the tab as the skin is too thin to countersink and dimpling requires much more work especially as the trailing edge cannot be dimpled anyway. It is good design practice to have the horn arms tilt forward so that the center line of the bolt holes passes through the center of the bracket bolt hole. If the trailing edge on your control is not straight the proper contour can be followed by varying the length of the micarta ribs to suit and trimming the trailing edge to the proper curve.

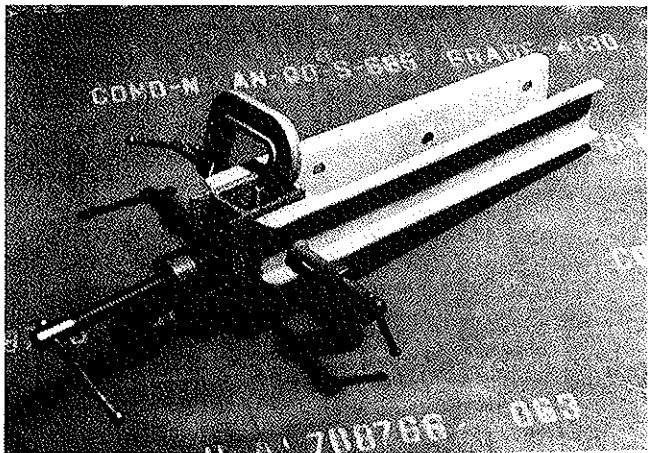
The question may be raised as to the forming of a streamlined leading edge. It should be easy to form but I am not sure that the gradually curved nose will be stiff enough to resist the flexing and warping it will encounter in service. However, as the tab is very simple to construct, the reader might try building one up and see if that configuration still has the necessary stiffness. Again the use of formed metal ribs instead of micarta might be tried. The problem of riveting the skin to the ribs near the trailing edge will tax one's patience, however, and unless the builder has had quite a bit of sheet metal experience I suggest that he stick to the simpler tab described in this article.

A Recipe For Wing-Root Receptacles

By Tom Roddy, EAA 3705
Box 92, Rockwood, Tenn.

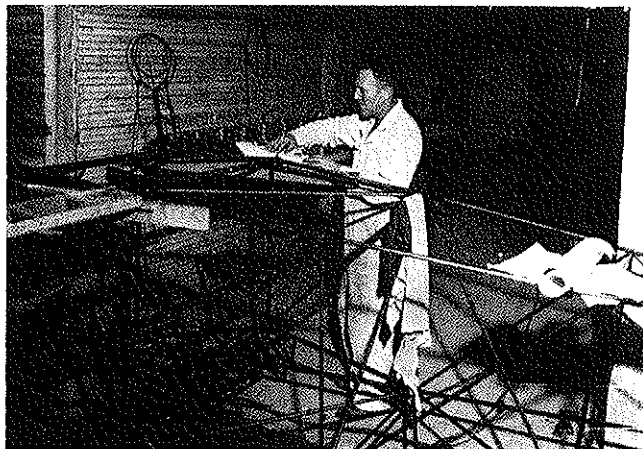
WANT TO BE sure you have a snug fit between the wing root and the fitting on the fuselage? Then combine the following, as in the accompanying photograph:

1. Cut sheet stock for fuselage fitting; fit into wing root before wing root has been bolted into wing; secure with C clamps.
2. Weld up accessible seams; tack-weld any others. Remove clamps from structure and finish welding remaining seams.
3. Place structure back inside wing root, block up under drill press and drill through the two at once for main wing-root bolt to fit into.



A recipe for wing-root receptacles on Tailwind by Tom Roddy.

4. Separate pieces again and cut pieces of tubing for compression member in fuselage fitting; weld compression member in place.
5. After wing-root fitting has been fastened into wing, slip fuselage part of fitting into the wing-root part, insert bolt through pre-drilled hole.
6. Position wings in correct attitude, butted against the fuselage, as shown in accompanying photograph. Tack-weld fuselage part of fitting to fuselage, using several ply of sheet asbestos to prevent scorching wing. Pull bolts; remove wings.
7. Jig fuselage fittings securely to prevent any shifting during welding; complete welds.



Wing-root receptacles on Tailwind by Tom Roddy. Gene Lewis is preparing fitting for welding with sheet asbestos.

Getting Smooth Cuts

Neatness and accuracy being as important as it is in aircraft work, there is much interest in proper tools and methods for getting clean cuts in wood. Most of us have used ordinary table saws with rip and combination blades and have been unhappy with the rough cuts which result. Yet, it is quite possible to get cuts with a table saw that are so smooth that a few light passes with sandpaper afterward will eliminate tooth marks nearly 100 percent.

Low-price blades are often of thin metal, and blades made for general ripping work are also quite thin so that their kerfs will be as narrow as possible with subsequent savings of wood. The trouble with any thin blade is that it is apt to "chatter" at high speed and thus throw tooth marks into the wood. It can also produce wavy cuts by reason of a tendency to follow the grain. Ripsaws almost always have some set to their teeth, to make the kerf wider than the blade and minimize binding, warping and crooked cutting.

The correct saw to use for aircraft work is a "cabinet maker's blade". They come in different designs; some are hollow-ground with thick teeth, thin disc, and thick hub. Some have thick hubs with a step-down out near the teeth to keep kerf reasonably narrow. The teeth have no set to them and usually are quite thick as compared to the lighter general purpose blades. Some have very small

teeth but others have fairly large ones, while retaining the essential feature of no set and a thick, stiff disc.

When cutting long, thin strips it is desirable to make some kind of guide, perhaps of wood with spring "fingers", which will hold the wood snugly against both the table and fence and keep it from bending. When wood bends or chatters, tooth marks are put into it. Feed wood in at as nearly uniform a rate as possible because halts and jerks also make tooth marks.

Many firms make good cabinet maker's blades but to get EAA members started on the right track it can be mentioned here that Sears, Roebuck and Co. has a "Thin Rim—Satin Cut Combination Blade", Cat. No. 9-3254, which upon trial has produced wonderfully smooth cuts in spruce, fir, pine and mahogany.

Owners of cabinetmaker's blades should not use them to cut plywood. The glue lines in plywood are surprisingly hard and brittle and can dull a fine saw rather quickly. Special blades for cutting plywood are also available, which feature very small teeth to keep edge splintering to a minimum.

SAVE THAT GARAGE FLOOR!

Before starting to use a spray gun in a garage or other building having a concrete floor, wet the floor with a garden hose. Dope and primers in the form of spilled drops and overspray globules will not adhere to the concrete and a much better cleanup job can be done after dopping.

Shaping Tube Ends On A Metal Lathe

By Francis H. Spickler, EAA 4209

One of the most important steps toward making a good weld is to produce parts that fit accurately. The writer is using a simple attachment for a metal lathe to shape tube ends to fit other tubes accurately and quickly and at any angle.

The main body of the attachment is made of hard maple 2 in. x 2 in. x 4 in. A $\frac{3}{4}$ in. x $4\frac{1}{2}$ in. hexagon head machine bolt is turned as shown for a 9 in. South Bend metal lathe, or modified as necessary to fit the lathe available. The small piece of mild steel is fitted to the block and screwed in place in order to keep the block in proper alignment with the compound rest at all times and yet permit easy exchange of blocks for forming any desired size of tubing.

Slide the head of the bolt in the "T" slot on the compound rest and slip the block on the bolt through the $\frac{11}{16}$ in. hole. Seat the block so that the piece of mild steel slips into the "T" slot and fasten the block securely with a washer and nut. Place a drill of the desired size tubing in a chuck on the spindle of the lathe and drill a hole through the block. A second hole for a different size tube is also drilled the same way. Remove the block from the lathe and split it in half by sawing on a circular saw and the attachment is completed. As many blocks can be made as desired to prepare for tubing of various sizes. By placing the $\frac{11}{16}$ in. hole slightly off center a larger hole and a smaller hole can easily be accommodated on one block.

In using the attachment the piece of tubing is clamped in place on the compound rest, the compound rest is set to the desired angle and tightened. A standard reamer with the diameter of the tube against which the shaped tube will butt is mounted between centers of the

lathe. Flood the reamer with cutting oil, feed the tube into the turning reamer with the cross feed, and in a matter of moments one has a perfectly fitted pair of tubes.

Fitting tubes on an angle is no problem. One only has to measure the angle of the center line of the tubes on the jig or from an accurate plan, set up the compound rest for the desired angle, and feed the tube into the reamer as it turns. The fit will be better than absolutely necessary with less than a minute spent in making the cut.

To obtain the proper length, cut the raw stock as closely as possible to length, form one end, form the second end being careful to align the tube in the block so that the two ends will be on the proper angle with each other. Next try the tube in the jig. At this point it is easy to measure how much must be removed to achieve the proper length. If the lathe has a graduated cross feed it is a simple matter to remove precisely the required amount. With practice one can usually cut the tube to the proper length so that it fits accurately the first time.

The writer first tried the idea without the mild steel guide block. It worked satisfactorily, but alignment of the tube was tedious, and took more time than forming the tube end. Cutting and fastening this small item saves much time on setting up the tubes for forming.

Carbon steel reamers are satisfactory as long as plenty of cutting oil is used with relatively slow speeds. Of course high speed reamers will stand up better.

Be sure to remove all cutting oil before welding in accordance with good welding practice. •

ERASE THOSE BAD HABITS

by Bill Porter, Jr.

Tucson, Ariz.

Use an ordinary firm eraser to get rid of fuzz, or splinters, or curls of wood that are ever present after cutting or sawing wood items, such as gussets, longerons, cap strips, etc.

It is quite often most inconvenient and time consuming to fashion a sandpaper "tool" for this work and even then extremely difficult to reach some areas initially forgotten.

The eraser can be cut to reach or to fit any area or shape. It is very inexpensive. It is convenient to use and removes the "fuzz" faster and cleaner than sandpaper. The rubber will not snag a small edge splinter and end up tearing out a large sliver of wood thereby ruining, or at least marring, an otherwise nice piece of work. It can't **round-off** an edge meant to be **square** — as sandpaper will.

The eraser has been a valuable "tool" during the construction of my all-wood fuselage. But then I've been very particular about the workmanship — it apparently paid good dividends, the FAA Inspector OK'd it on the first inspection — found no discrepancies — and commended the workmanship.

The eraser can be cut to any size or shape to use

on holes, inside cuts, or what have you

Try it awhile — you'll use it thereafter! It's a real inexpensive and effective time-saver, and adds that extra little bit making for good workmanship.

Bounce into that group practicing good workmanship by erasing those bad habits! ! ! •

CONSTRUCTION TIP

For those who are restoring planes using 8 cylinder engines such as OX5, Hisso's etc. Such engines originally used the Dixie type 800 magnetos. The Bendix-Scintilla VMN-8 is almost a direct replacement, requiring very little modifications. The VMN-8's are modern magnetos and are very reliable, where the Dixie 800 was not. These mags are no longer made but can be obtained from the M & J Magneto Service Co., Wichita Falls, Texas. They have these in stock in both new and used condition. I offer this tip because it took me several years of searching to locate a source on these magnetos. •

HOW THE PROFESSIONALS DO IT!

One light airplane factory uses a trick you wouldn't believe if you had not seen it done. They strike longerons with a rubber mallet to bow them out about a quarter of an inch. When dope tightens the fabric, it pulls them in so they are straight rather than bowed in between cluster joints. On fuselages where the longerons are quite thin and long between joints, put fabric on with less than normal tension to prevent dope from pulling it too tight for the good of the longerons. If too much heat is applied to Ceconite it will shrink even more when doped and can even make the structure collapse.

* * * * *

It is considered good aircraft practice to drill holes slightly undersize in vital fittings and then ream the holes to true and accurate final size. Due to shifting of the work, bending of the drill, variation in grind, increasing dullness with use, etc., twist drills cannot be relied on to make consistently accurate holes. M-M-A, Inc., Lancaster, Pa., makes tap guides sold under the trade name 3-I-Q which hold hand-turned taps at exact right angles to the work and insure true, uniform tapping. When

taps go in crooked, they bite a lot of metal from one side of the hole and too little from the other side, giving unreliable threads and causing tap breakage.

* * * * *

Don't use a scribe to mark steel tubing for cutting; scratches that deep are sure to be starting places for cracks. Get a silver colored pencil of the type used to mark blueprints. It marks steel tubing well, even when oily or greasy, and can be seen even when the metal is heated for tack welding.

* * * * *

To make the cutting of steel tubing faster and neater try one of the chromeplated tubing cut-off wheels for table saws, available from Sears and power tool dealers. An ordinary plumber's tubing cutter works well, too.

All steel tubing fits should have gaps not over 1/16 in. Slight looseness at the ends of tubes is used to allow for heat expansion and avoid a weld at one end pushing things out of alignment at the far end. But too-large gaps lead to excess use of rod for filling, with weak joints and danger of burning through tube walls.

GRINDIN'EST WOOD GRINDER EVER

Not having a spare power table saw (or a table saw, period), the 'Grindin'est Grinder' came into existence about two hours after latching onto a Montgomery Ward "Power-Grit" metal disc. It was built from loose parts and scrap wood as a temporary-temporary no cost tool. After two sets of wing ribs and various other items, it has become a standard. The pictures tell the story, except how useful and fast it is. A few items of note are:

1. Take all of the end play out of the electric motor.
2. Notch out the bottom of the table top for the motor arbor and disc clamping washers. Notch so that the washers extend almost through the table top. Place the coarse side of the disc outward for main use.
3. Face the table top with hard sheet material, as otherwise the plywood becomes gouged and makes grinding real jerky, and can ruin parts.

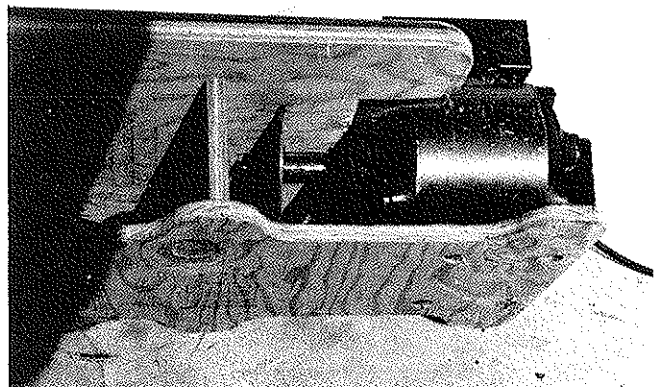
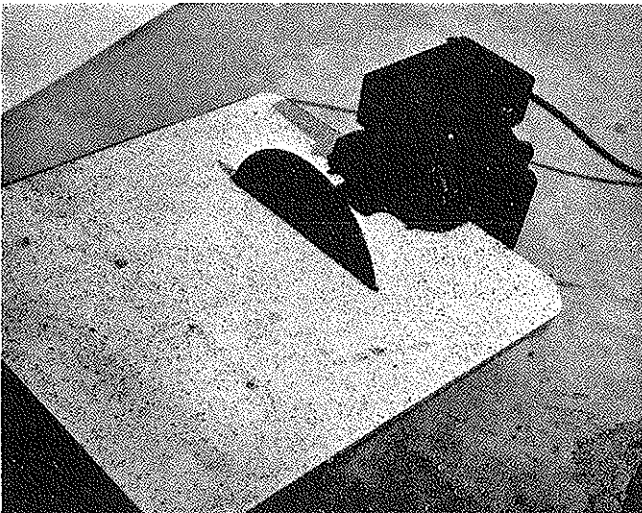
4. Grind only the non pitch woods — mahogany, birch, spruce, hemlock, fir and such. GRIND NO METAL.

5. If you goof up and gum up the disc, try cleaning with turpentine or paint remover and a wire brush. If you have really burned the gum onto the disc, try Sear's "Gum and Pitch Remover", catalog No. 9K4918 (8 oz. for \$.45).

Costs (approx.), including loose parts when not on hand.

Sears' 8" Karbo Grit Disc	\$4.47
Cat. No. 9K3000	
Ward's 8" Power-Grit Disc	5.98
Cat. No. 84B4103	
Used 1/4 horsepower electric motor	5.00
Tool Arbor for motor70
Switch and box60

J. Floyd Blair
8612 Bangor Dr.
Ft. Worth 16, Tex.
EAA 5157
Chapter 34



Hole Aligning Made Easy

Photos by the author

This month's award goes to Harry A. Scott of Inglewood, Calif., for a simple tip which should help improve workmanship with more precisely aligned parts. "To obtain drilled holes perpendicular to the surface of a part, one must align the drill press table normal to the cutting tool. This insures holes that can mount matching parts on opposite surfaces such as the wing attach fittings shown in Fig. 1."



Fig. 1

"A means to accomplish this is to use a dial indicator. (Can be purchased from either a tool store, hardware,

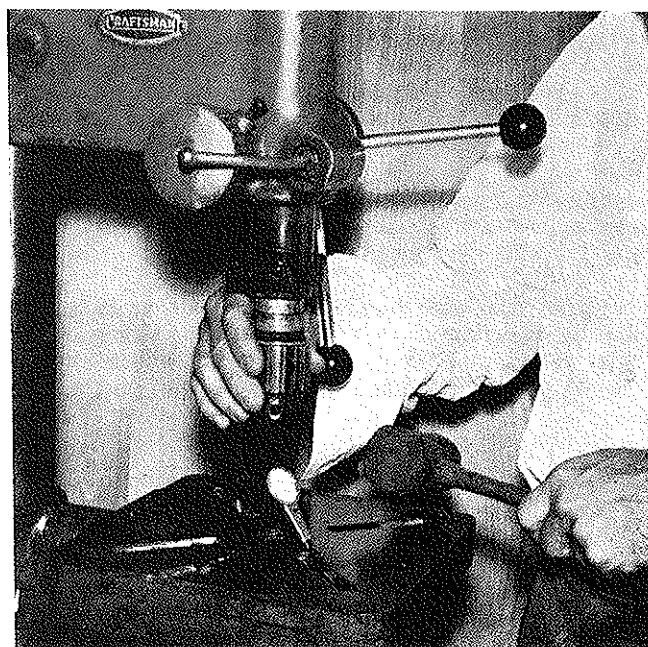
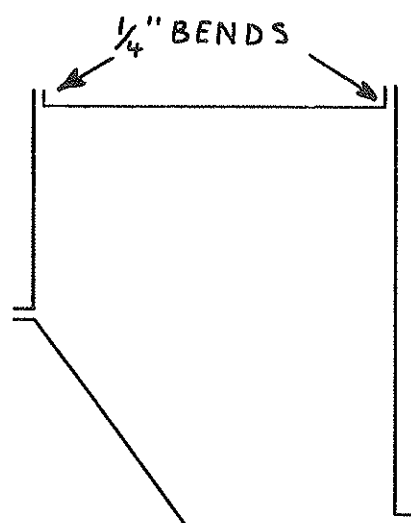


Fig. 2

or automotive store). First, locate the drill press table in the position that is going to be used. Then insert the indicator in the chuck adjusting it so as to reach the lever as far out from the center line of the chuck as is practical. Lower the chuck until the indicator lever contacts the table, lock the spindle, and set the dial to read zero. Now, by hand, rotate the chuck to determine the slope of the surface of the table. Make corrections by slightly tapping the table with a mallet. These steps are all illustrated in Fig. 2.

"This procedure will result in good aircraftmanship and the accompanying personal gratification." •



Making Gasoline Tanks

When making up welded gasoline tanks, it is a good idea to put all seams on the outside as shown in the accompanying sketch. There are good reasons:

1. It helps the amateur to do a good job because tolerances are not critical.
2. The different sections are easy to clamp together for welding.
3. The lips act as stiffeners for the tank.
4. It keeps the heat of welding away from the main body of

the tank, thus minimizing warpage.

The bends are about one-fourth inch wide and are fusion-welded.

Another important thing to keep in mind when making gas tanks is to provide them with internal baffles. These not only keep gasoline from sloshing around, but strengthen the tank and help it withstand the weight of the fuel when flying through maneuvers, in rough air, etc. — Dick Blair, Vincentown, N. J. •

WATER IN THE TANK

A large proportion of aircraft engine stoppages are due to water in the fuel system, and this means that amateur aircraft builders must give careful thought to their tank arrangements to preclude this kind of dangerous and costly trouble. The mere inclusion of a common fuel strainer in the line between tank and carburetor is not always dependable insurance against water in the carburetor. Some gas tanks have "standpipes" in their outlets, some have sumps, their shape varies widely, and where some planes sit level on tricycle gears, others sit on the ground in tail-low attitude on conventional gears. During climbing, turning and gliding flight the airplane's position changes. You may remove water from the gas strainer on the firewall and feel a sense of security, but it has been shown by experience and tests that there can sometimes be an appreciable quantity of water in the tank, confined there by some peculiarity of the tank shape, airplane position or outlet design. In flight this

water can get into the fuel lines as the gasoline sloshes around. Engine failures attributed to "carburetor icing" often turn out to have been caused by unsuspected water in the tanks. Therefore the prudent homebuilder should study his contemplated fuel system carefully to see if water, which always settles to the bottom, can be accumulated in sizeable quantity before finally flowing out of the tank and showing up in the fuel strainer. The best safeguard of all is to have a quick-acting drain cock in the lowest part of any fuel tank, and to drain a few ounces of gasoline from it after each refuelling. With this positive means of testing for water, the fuel filter can then serve as a double safeguard in addition to catching bits of dirt suspended in the gasoline. The most carefully designed and built amateur airplane can still get into serious trouble when a tested and proven factory-built engine quits through water in the gas. •

A Simple Fuselage Jig

By Frank C. Sabo, EAA 269

This fuselage jig is easy to construct and saves on the amount of wood needed for the job. First thing to do is to check your plans for the length of the fuselage so that you can determine how long to make the jig. I used two 2 x 6 pieces of pine 14 ft. long for my jig. Next I obtained some $\frac{5}{8}$ in. plywood and cut strips 8 in. wide and as long as the needed width of the fuselage with extra space to spare. These are nailed to the 2 x 6's starting about 3 in. from one end so that when you come to join the two halves of the fuselage you will have room to tack weld the front cross tube in place (see Fig. 1). The pieces are spaced according to the distance of the cross members of the fuselage as shown. Place on two saw horses and level and you're ready to use the jig.

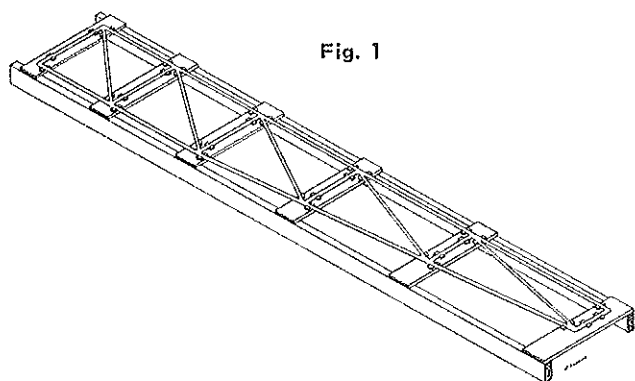


Fig. 1

By using plywood cut into narrow pieces, only half the material usually used is required. I used white pine blocks $1\frac{1}{2}$ in. by 2 in. by $\frac{3}{4}$ in. thick to hold the tubing in place for tack welding. For the cutting and fitting of tubing refer to the Amateur Builders Manual.

Upon completion of the two sides of the fuselage,

the jig can be used to hold the sides upright while tacking the top and bottom cross pieces into place, also all diagonals. Square off the ends of the 2 x 6's and nail a piece of $\frac{5}{8}$ in. plywood on the end so that it will come up about two-thirds of the way on the front of the fuselage (see Fig. 2). Next use a square to make a center

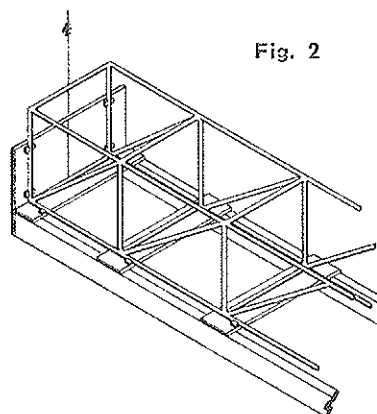


Fig. 2

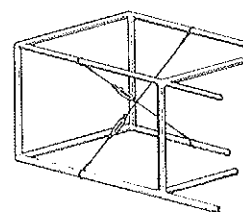


Fig. 3

line vertically on the plywood, and then take a string to run a center line the full length of the jig. You will do all of your measuring for the tubes from this point. Nail blocks to hold up the sides as shown. Remember to always work from the center line — take half of the diameter of the tube you are using and mark on each side of the center of a tube so you will know where the blocks are to be nailed.

Try to keep the fuselage as square as possible during tacking. I used small turn-buckles and wire as shown in Fig. 3 to keep my fuselage square while working on it. Wrap wire around the longeron and into one eye of the turnbuckle, and another wire from the opposite diagonal into the other eye. Take up on the turnbuckle to line up the fuselage. By forming the X close to the clusters it is easier to square up each bay as you weld up the fuselage. I used this in tack welding also. •

Sportplane Headrest

By Henry E. Winslow, EAA 595
314 East Hazel St., Unit 2,
Inglewood 3, Calif.

It is very interesting to note the reaction an article sometimes receives. A short time ago I submitted a description of a baggage compartment I built in the turtle-deck of my Stits Playboy, enclosing a photo of the installation. Only two days after the article was published in SPORT AVIATION I received a letter from a member in Florida. He agreed with my baggage compartment construction but having noticed the headrest in the photo wanted information on how I had constructed it. And so it goes! Often that which the writer overlooks is a most interesting project to the reader; which leads us to the reason for this article on how to build an aluminum headrest in one easy lesson.

The materials for the project consist of a piece of .025 aluminum 16 in. by 28 in., a small piece of ¼ in. plywood, some foam rubber and a bit of imitation leather.

The aluminum is rolled to about an 8 in. diameter. Then the plywood head is cut out and fitted to the turtle-deck. When this is accomplished the plywood is inserted in one end of the rolled aluminum and nailed down. Draw a center line down the aluminum and then draw two more lines from the bottom side of the plywood head to intersect at the center line. This gives the bottom contour of the headrest.

Before cutting off the excess aluminum mark out the tabs. (I used four to a side on mine). Make up some wood

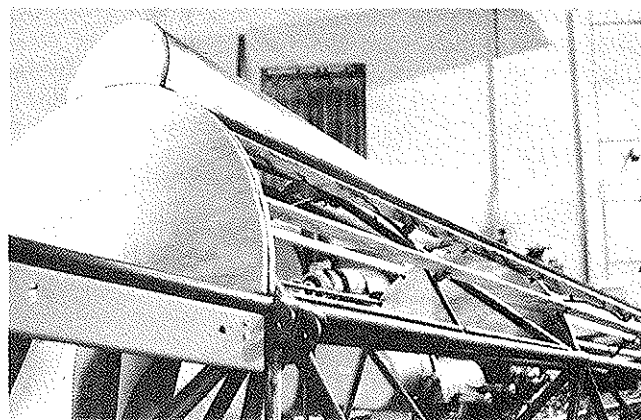
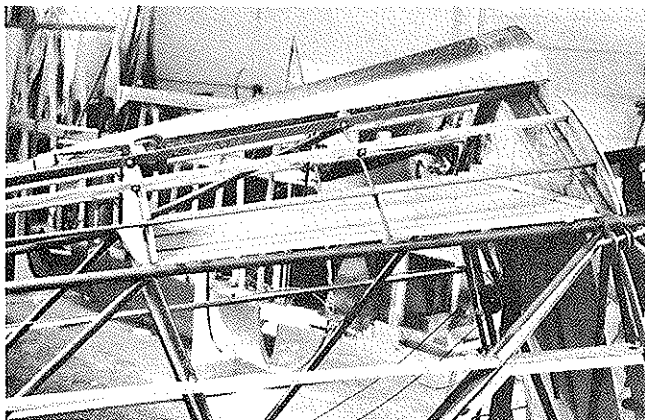
blocks and glue them between the stringers on the turtle-deck. This forms a support to screw the tabs to. Now you are ready to trim the excess aluminum from the headrest leaving the tabs to be bent up.

Pieces of "U" channel rubber glued to the edges of the aluminum finish off the sides that rest against the fabric.

Sponge rubber trimmed and glued to the face of the plywood and covered with imitation leather finish up the front. Any good contact cement fastens the rubber and leather securely. My own preference is "Grip" cement. The plywood head is nailed or screwed flush with the forward end of the headrest and screwing the headrest to the turtle-deck blocks completes the job.

If more than one headrest is to be constructed the builder could very easily use the first aluminum headrest as a mould to make up any number of fiberglass copies. In that case it would be well to make the dimensions slightly larger (¼ in.) and use the inside of the aluminum as the mould. In this way the outside of the fiberglass will be smooth and requires but a minimum of sanding.

Plywood formers must be fitted around the outside of the headrest to hold the aluminum rigid to the dimensions of the turtle-deck while the fiberglass is setting up. •



WORKING WITH 75ST

The aluminum alloy known as 75ST is rather prone to have small edge cracks spread and to avoid this certain points should be observed when forming it. Parts which have been cut out of this metal in a shear should be filed back one metal thickness to remove edge cracks. Holes should be drilled, not punched, because punching leaves edge cracks too. Avoid cold dimpling because the dimples will crack. However, hot machine dimpling is acceptable.—A. E. Griffin, EAA 2426. •

DON'T NAIL CAPSTRIPS

Everyone knows that a wing rib picks up air loads from the covering material and serves to transmit them to the spars. To do this job, ribs are built in the form of trusses, and we test and analyze them as such. But, points out member Bob Waaser of Key Largo, Fla., it is essential to remember that the cap strip material is also subject to concentrated shear loads where it passes over the spars and transmits the air load. Driving nails through typically thin cap strips will appreciably weaken them at this critical location. So, don't do it! Instead, drive nails through the vertical members of the rib at the spar opening. •

Sheet Metal Brake

By Grover A. Chaplin, EAA 5507
4748 W. 162nd St., Lawndale, Calif.

FOR A LONG time I have read with interest various articles in SPORT AVIATION on the different ways the boys have described their ways of bending sheet metal parts. As I work with sheet metal in the aircraft industry I got to thinking how much simpler it would be if a small sheet metal brake was designed that could be cheaply and easily built and eliminate form blocks, hammering on material, heating to bend, etc.

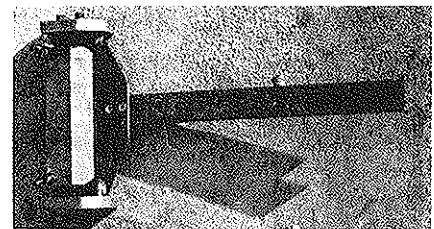
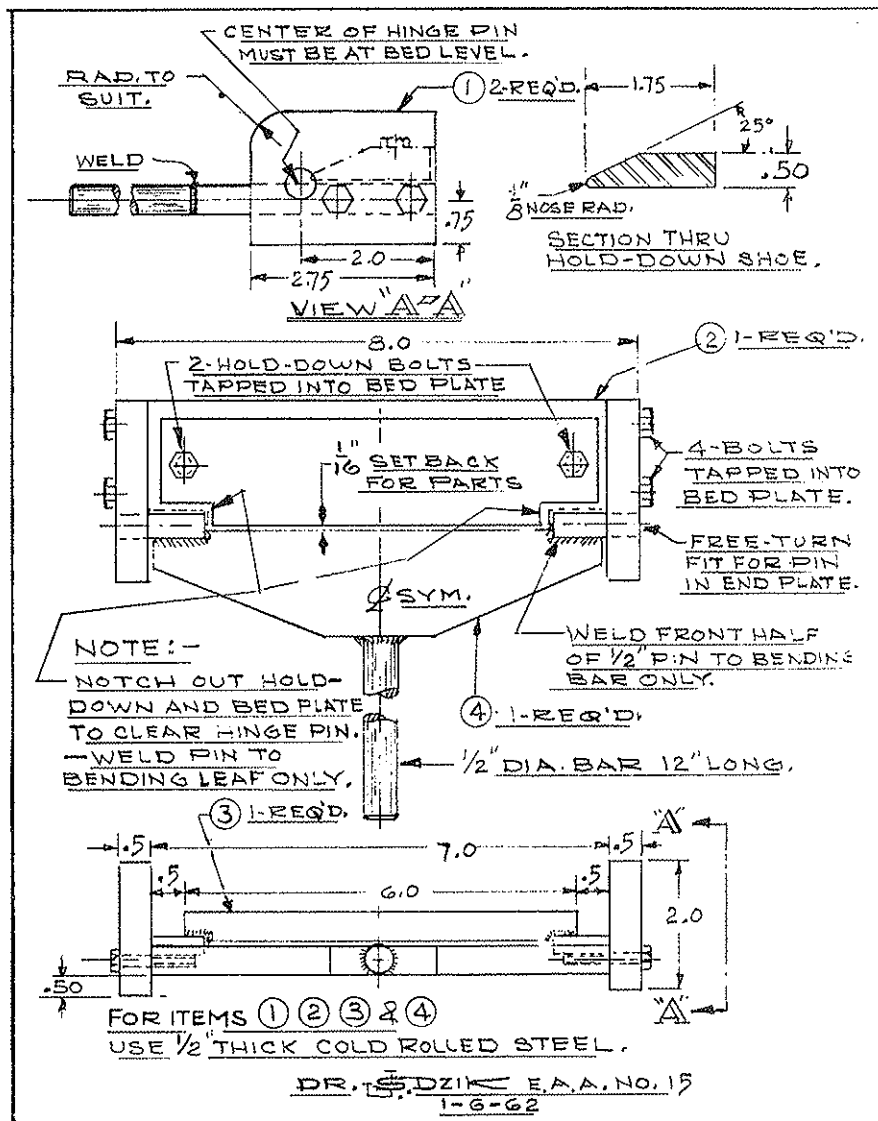
The brake I have designed is rather small in its present form, but this was a matter of choice as all I wanted was a brake to bend small brackets. The drawing could be enlarged to most any scale to suit the individual needs. The basic form could be lengthened or widened to suit.

The brake in its present form will bend .062 chrome moly with a $\frac{1}{8}$ in. radius with a nice clean brake and will form "U" brackets with an inside dimension of $\frac{9}{16}$ in., $\frac{1}{2}$ in. with a little forming on the second flange.

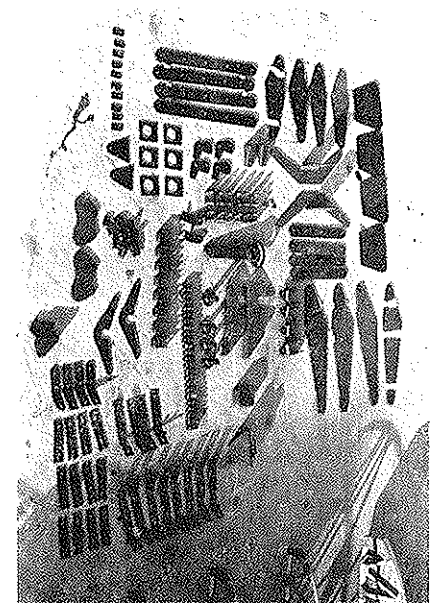
The simplest method I have found on a "U" bracket is to bend the first flange and then use a spacer from the inside edge of the bent up flange to the hold down shoe to set your dimension. This spacer should be the size you want the inside dimension to be.

The only other point I would like to bring up is that the center of the hinge pin must be on the exact center of the bottom plate in both planes; failure to do so will result in either a very sloppy bend or a brake that will not bend a full 90 deg. bend as it will jam if it is too low.

The brake now will bend up to 5 in. long pieces. Rather than design a complex hold-down for the shoe, I have found that the simplest way to get the pressure is to clamp the brake in the vise. One more thing to bring to mind, if the brake is to be lengthened I would advise that the metal thickness be increased in proportion to the increase in length.



Top and side view



These parts were made with the brake.

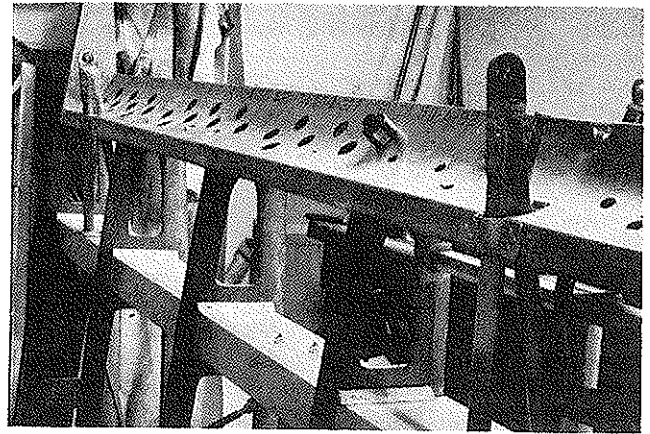
AILERON WELL HOLES

Sometimes a little forethought can save many hours of repair work. This idea is to forestall a time consuming repair should the fabric loosen from the metal in the aileron well.

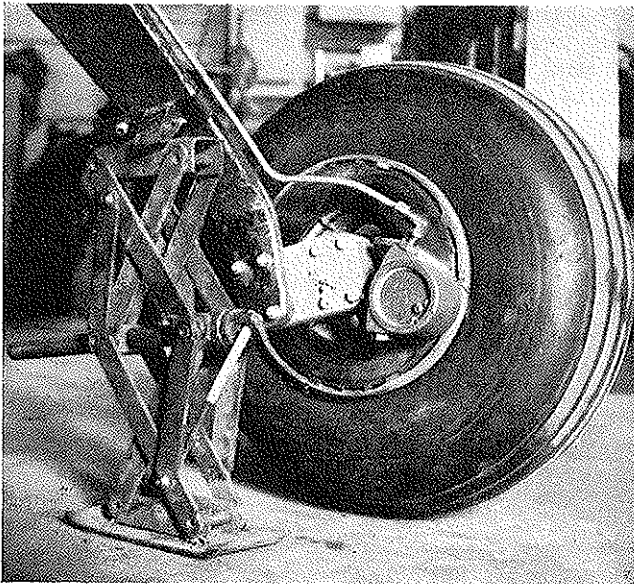
Especially, if the construction of the aileron well has a reverse curve to it, this idea will solve the problem of fabric pulling loose from the aluminum and causing interference with the aileron.

The secret is to punch holes in the aluminum, then dope fabric on the back side of the well over the holes. When the wing is covered the dope will bond to the other fabric on the back through the holes so that it will not pull away even if the dope fails to stick to the aluminum.

To make neat holes first lay out a hole pattern in the aluminum then drill out $\frac{3}{8}$ in. holes with a hand drill. These holes will take the stud for a $\frac{3}{4}$ in. chassis punch. It is a simple matter to screw down the punch to cut



clean $\frac{3}{4}$ in. holes. Fastening down the fabric to the inside of the well makes the job ready for covering.



GEAR JACK PAD

Many EAAers have the Wittman type spring steel gear on their homebuilts. This jack pad is designed to make the job of changing brake pucks, or the wheel, a safe and easy one. Just slip it on and then jack up the gear on that side and there you are all set to work on the wheel.

The pad is made of a strap of $\frac{1}{8}$ in. cold rolled about $1\frac{1}{2}$ in. wide. Heat with a torch and bend the strap into a "U" shape $\frac{5}{8}$ in. wide across the inside of the "U". 5 in. legs should be long enough.

A "V" is next bent up from the same material and welded across the strap. Slide the assembly onto the landing gear leg as far up as desirable, then mark for the bolt hole.

Drilling the bolt hole finishes the operation. To try it on for size, slip it on either gear leg with the "V" down, insert the bolt and then slide it up the leg till it binds. The face of the jack goes between the leg and the "V" (see photo) and all that is left is to raise the jack. Of course we have already chocked the other two wheels, haven't we!!! (?)

TOOL FOR BENDING ALUMINUM EDGES

Necessity is often the mother of invention! That thought is not new but was certainly proven recently. After fastening down the leading edge on a pair of wings recently it was noticed that the edges had not been bent down.

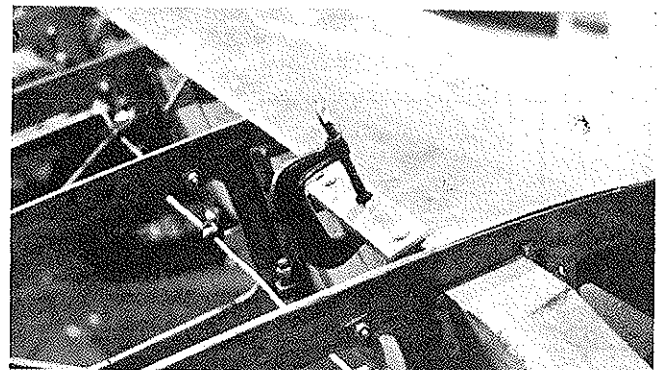
The first attempt to do the job was with a pair of pliers that had wide jaws silver soldered to them. This was not satisfactory as it was not only hard to hold the pliers so they would not slide around but the drag and anti-drag wires were in the way of the pliers when the bending operation was tried.

The next try is shown in the photo. It worked very well giving the same edge distance to the bend every time.

All the tool consists of is a couple of bars with a hole drilled near each end. The holes were spaced back of the edge so that the forward edge of the bolt was $\frac{3}{8}$ in. back. The bars were made $\frac{3}{4}$ in. shorter than the length of edge to be bent down. This is necessary in order that the metal close to the rib is not torn during the bending operation. Also a radius was filed on the edge of the bars to make a gentle curve to the bend.

To operate, slide the assembly over the edge to be bent down until the bolts touch the edge. Be sure to leave an equal space between each end of the bar and the rib. Then clamp the bars together with one or two "C" clamps. A steady pull on the clamps bends down the edge.

A 30 deg. bend is more than sufficient and after one section is bent unclamp and move to the next till all edges have been bent down.



Hints For The Homebuilder

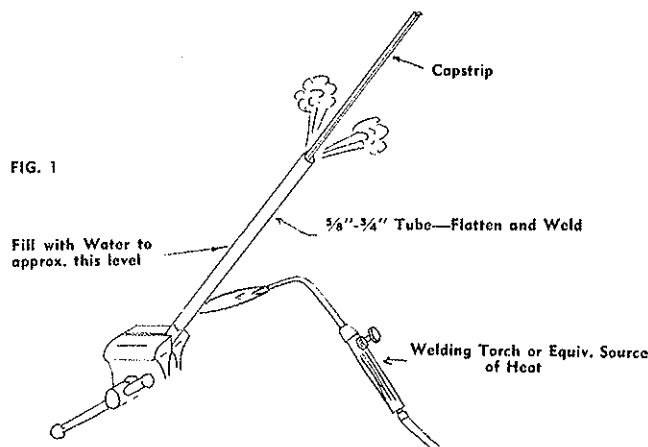
By Donald K. Howard
22 Arch St., Brockton, Mass.

SIMPLE THOUGH any operation may seem, we usually find that there is a right and wrong way, and this is also true when bending a steel tube. Often in welding we find that we build in stresses that result in deformation of the structure so that it will no longer meet points of attachment, etc., or we may want to curve a tube for some reason or other. Common practice is to heat the tube red hot and push, but we find that in doing so we usually flatten the outer radius and wrinkle the inside surface. The following method enables us to "shrink" the inside radius and retain a true circular cross-section.

At the beginning of the desired bend heat a spot locally bright cherry red approximately the diameter of the tube on the **inside** of the bend. Apply a load by hand in the direction of the bend and watch the color of the spot. As the color darkens to a dull red "flash" the tip of your flame across the **outside** of the bend directly in line with the spot. Several light passes will be enough. Do not

heat the outside surface to a red heat. This operation expands the outside of the bend as the inside cools under a load, and causes it to compress or "shrink". If a long curve is required progress along the tube spot by spot until the desired radius is obtained. To reposition a tube pulled out of alignment by welding, spot close to the weld. Remember, let the heat do the work and apply only enough load to shrink the inside surface as the heat is applied to the outside. Don't hurry.

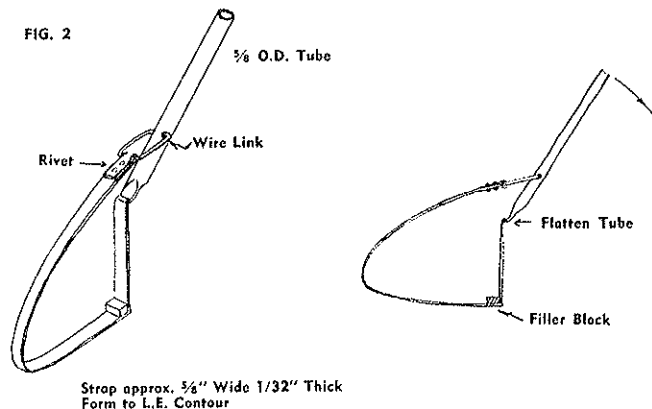
Sounds complicated? Try it and see.



STEAMING RIB CAPSTRIPS

FIG. 1

In the "good old days" of wooden ribs the following method was used in lieu of a steam box. Flatten the end of a $\frac{3}{8}$ in. or $\frac{3}{4}$ in. dia. tube about 3 ft. long and weld tight. Insert this end in the vise with the open end up. Fill with water for a depth of eight or so inches and insert one or two capstrips. Apply heat locally using a welding torch, blowtorch, or what have you to boil the water rapidly. This will allow you to bend the sharp area at the leading edge of the upper capstrips. With one "cooking" while you are nailing the other in your rib jig, you will always have one ready.



LEADING EDGE INSTALLING STRAP

FIG. 2

New leading edge material is always a problem to apply. Many an otherwise fine job has been second rate in appearance because of an uneven or irregular leading edge. Remember, perhaps the most important section of your airfoil is its leading edge and the forward upper third of the upper camber. The simple clamp shown will enable you to pull the L.E. skin down tightly to the rib contour. Actual practice is to have one man work the clamp while the other fastens the skin. Start by fastening the skin to the lower capstrip at the back edge. Using the clamp wrap the skin around the L.E. and temporarily fasten in several places. Start at one end and pull each station tightly to the rib and fasten permanently. The handle may be approximately 2 ft. of $\frac{3}{8}$ in. tube flattened on one end. The strap may be light sheet steel or a length of spring steel strapping used to tie large bundles. The filler block shown is the depth of the lower capstrip and prevents the strap from pulling around the spar at this point. Coat hanger wires make a good link.

Don't trust every last detail in your plans. Most plans turn out to contain at least minor errors of commission or omission. If things don't jibe, look for such mistakes before tearing apart the work you have done. It is better to write to the designer and clear up a vague point rather than to have it haunt you while flying.

tion will cause early failure. Failure of exhaust pipes inside a modern tight cowling is much more hazardous than in an open cowling of older type.

Never build a fuel tank without first making a cardboard mock-up to check for dimensions and fit.

In designing your own exhaust pipes of steel tubing, always give careful thought to the effects of expansion under running heat. If design does not take this into account, the combination of expansion strain and vibra-

Lufkin Tool Co. has a very useful tool which many homebuilders would find great use for. It is a steel tape graduated in consecutive inches, with decimal graduations, 50 feet long. The list price is \$14.80, Catalog No. C213CX.

Tips For Builders

Don't use a scribe to mark steel tubing for cutting; scratches that deep are sure to be starting places for cracks. Get a silver colored pencil of the type used to mark blueprints. It marks steel tubing well, even when oily or greasy, and can be seen even when the metal is heated for tack welding.

* * * * *

Never build a fuel tank without first making a cardboard mock-up to check for dimensions and fit.

* * * * *

Don't trust every last detail in your plans. Most plans turn out to contain at least minor errors of commission or omission. If things don't jibe, look for such mistakes before tearing apart the work you have done.

It is better to write to the designer and clear up a vague point rather than to have it haunt you while flying.

* * * * *

Keep your FAA agent informed of progress on your project. Notify him before starting construction and before each major component is primed, covered or closed in. Don't cover anything up before he has inspected and approved it.

* * * * *

To make the cutting of steel tubing faster and neater try one of the chromeplated tubing cut-off wheels for table saws, available from Sears and power tool dealers. An ordinary plumber's tubing cutter works well, too. •

CLEANING ENGINE PARTS

By Carl H. Buecker

6603 Coldwater Rd., Ft. Wayne, Ind.

The job of cleaning engine parts during overhaul with facilities available at home is not an easy one. Vapor degreasers and gunk tanks are usually not standard household appliances. The result is the homebuilder has a real job on his hands when he wants to overhaul and clean up an engine. I was recently faced with this problem and after some experimentation, I tried Tide washday detergent. My wife had a large box of Tide and I made generous use of it. I placed the parts in a pan, poured in plenty of Tide and added just enough water to cover the parts. This saturated solution will clean many parts at room temperature if allowed to stand 12 to 24 hrs. To speed the process and for parts having heavy carbonized deposits, place the pan on the stove at low heat (140 deg. to 160 deg. F). Two to four hours at elevated temperature will nicely clean pretty rough looking parts. If they don't come out quite clean give them more time or increase the temperature a little. Crusty aluminum pistons come out shining like a new dime. There is no etching of the aluminum. Steel parts clean up nicely too. Brushing the parts with an ordinary scrub brush and washing in clean hot water, then drying and oiling completes the job. •

* * * * *

LEADING EDGE JIG

By W. H. Hadley, EAA 3511

2690 Heather Dr., East Lansing, Mich.

The leading edge jig and nose trueing jig was made by me in order that I could true up all the ribs on the EAA Biplane that I am building.

First, I made short pieces of spars and put all the ribs for one wing on them in order to hold my ribs firm.

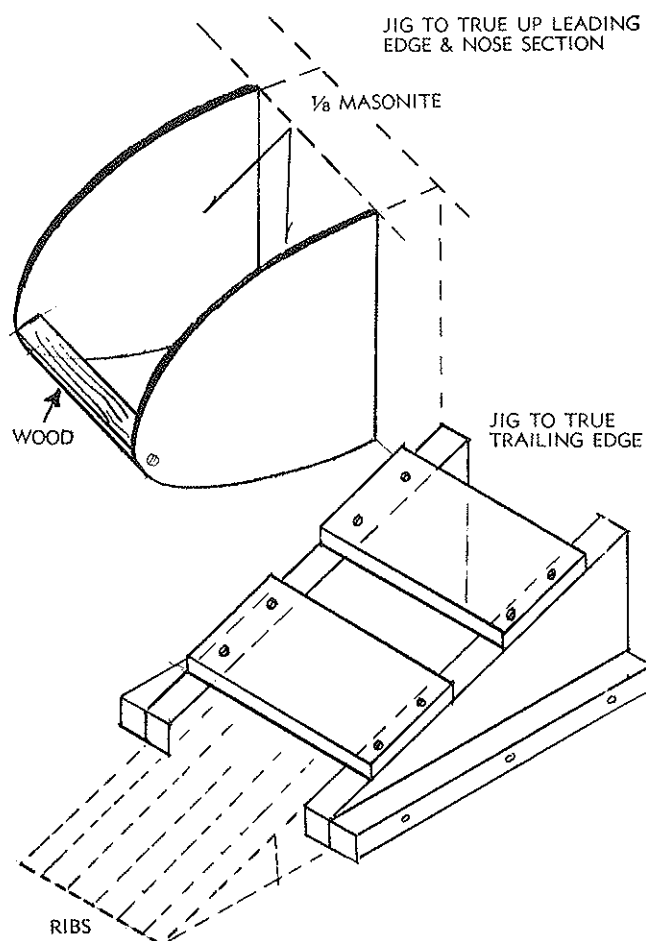
Second, I made two templates out of masonite of the nose section of the rib from the front of the front spar to the leading edge.

Third, I made a short piece of leading edge and screwed this between the two templates.

Fourth, I put the ribs in a vise and filed down the cap strips to line up with the templates.

In this way all the nose sections are even and in line.

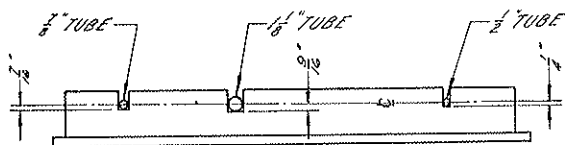
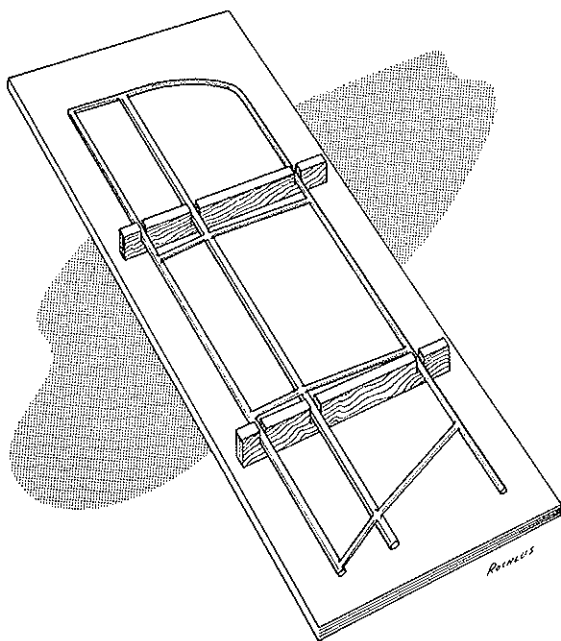
For the trailing edge jig I used scrap pieces of white pine 1 in. thick and as you can see by the drawing I cut



one end of the template off about 3 to 4 in. from the tip of the rib. Alongside of each template I nailed a $\frac{3}{4}$ by $\frac{3}{4}$ in. piece of wood, and across the top of the templates I nailed two pieces of $\frac{1}{2}$ by $\frac{3}{4}$ stock. The distance between templates equaled the width of nine ribs. I then nailed the template to my work bench and slid my ribs on and filed across the cap strips and squared off the ends of the ribs.

I trust that this idea of mine will be useful to someone trying to figure out a way to true up his ribs as I did a lot of monkeying around with a lot of Rube Goldberg ideas before I hit on this one. •

* * * * *



TAIL ASSEMBLY JIGS

By Palmer Johnson
3434 Fairhaven, Salem, Oreg.

Here is an outline of a frame I made to hold the tubing for the stabilizer for my Cougar. I laid out the plans on plywood first, then took two 2 x 4s the length of the width of plywood and nailed on edge of plywood. Drew a center line across 2 x 4s about $\frac{1}{4}$ the depth of the 4 ft. pieces of 2 x 4s cut down past the center line one-half thickness of tubing. These notches will hold tubing in place so short pieces can be cut and spot welded in place. Then all can be lifted out and turned over to weld the rest of the tubing in place. As each side is the same, the form can be used for each side. I used a conduit bender to bend my tubing. (See drawing).

EYEBALL ENGINEER ON THE TAILWIND LANDING GEAR

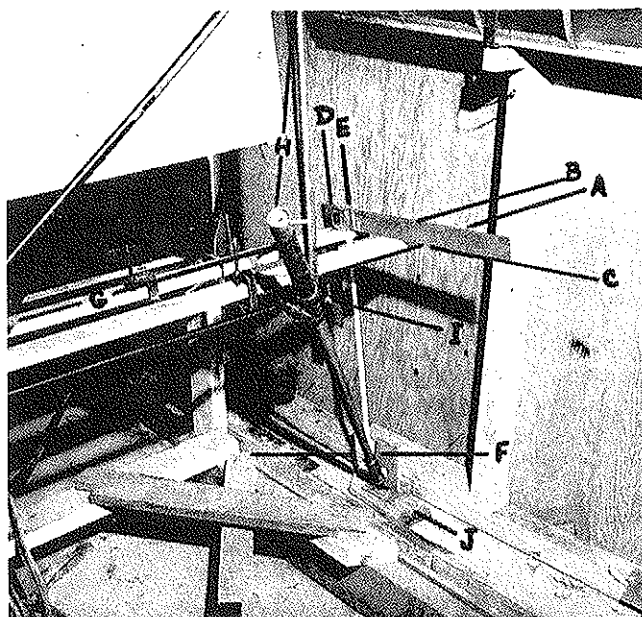
By Tom Roddy, EAA 3705

The first step in installing the Tailwind landing gear, as I see it, is to anchor the fuselage — preferably with the floor level — so that the gear leg, when placed roughly in position, will remain an inch or two off the floor; it should rest on a stack of thin wooden blocks. The top of the gear leg, I suggest, should be secured with wire and/or "C" clamps.

As seen in the illustration, it is necessary to place two unwarped planks (A, B) across the fuselage floor so that they extend about two feet out the side. This is for reference in measuring and sighting straight down on the center of the anticipated bend at the axle.

Incidentally, this bend area should be marked in the center with a small cross mark of a bright, easy-to-see color (F).

Sight your planks (A, B) from both front and sides to insure that they are parallel with each other and the floor itself. The position of plank B must be such as will make its rear edge exactly the specified distance for the axle behind the bulkhead used as a reference, per plans. Then, when framing square (C) is laid across



A and B, and sighted down line D, the projection is the fore-aft position of F. But don't forget that C must be placed so as to give one-half the inside measurement of the gear width, using the center line of the fuselage as a reference. In addition to this, D must be pointed neither right nor left, but straight down — 90 deg. to the floor of the fuselage. This can be done by placing vertically on one of the planks, and in the same plane with the firewall, a small drawing triangle with its 90 deg. corner at AC or BC.

Sight down D and move F into position, fore or aft, left or right. At the same time, slide the gear leg up or down as required for proper depth below fuselage floor, per plans, by measuring down (E) with tape from B plank to F by using blocks (J) to maintain the adjustments. Be sure to allow for half the diameter of the longeron (and also the thickness of the plank if measuring from the top), since the reference is the center line of the longeron and likewise the center of the mount bolt.

When everything checks (this will likely be after much juggling), place tack-welds on tube (which slips over bolt) at "I". Then cut the H and tack weld into position.

When all the foregoing has been accomplished on both gear legs, tack-weld tube G into position. The framework is now triangulated sufficiently so that it will not move out of line anywhere while the other tubes are cut and tacked in to complete the gear mount. Place nuts on all four foundation bolts before making the final welds; weld up the gear mount before jiggling the engine mount.

Don't skip anything — but HURRY; you want to get the legs bent at the bottom and wheels on this thing! •

FORMING LEADING EDGES

By Bernard J. Schaknowski
127 Ruth Ave., Syracuse, N.Y.

Just came up from the shop in the basement. I formed and temporarily attached the plywood leading edge on the Jodel D-9 wing. Total time on this operation — 3 hrs. To steam the plywood I rented a small portable wallpaper steamer. The steam from this was very effective, about 10 minutes on a 6 ft. section and it was ready to form on the leading edge. It worked far better than expected.

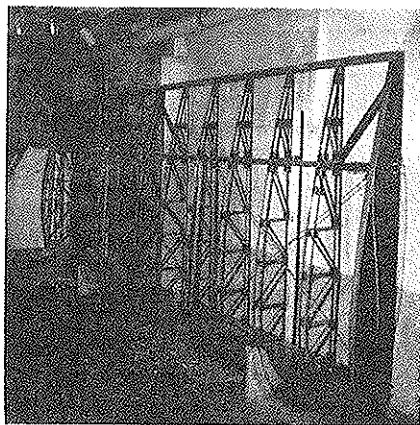
WING STAND

By Raymond Sippel, EAA 6991
12 N. Goodwin Ave., Elmsford, N.Y.

The construction of this wing stand is very simple and of no great cost, for any materials may be used. My dimensions are given because it just so happened that I had these odd pieces of wood available. I made four of these stands, two for each wing panel.

These stands are ideal for rib stitching as well as storage stands for those fellows, like myself, who have to work in confined spaces.

The cut-out in piece No. 3 should be the same as the nose section of your wing ribs and of course may be copied direct from the rib jig of a completed rib.



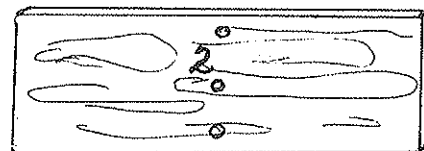
Two wood screws are used to fasten piece No. 3 to piece No. 1. Three wood screws are used to fasten piece No. 2 to piece No. 1. I used glue along with the screws although I don't believe it necessary in the event you prefer to dismantle the stand later. I lined the cut out in piece

No. 3 with foam rubber to cushion the leading edge of the wing as can be seen in the photo.

I believe the sketch of the completed stand is an ample guide for its construction.

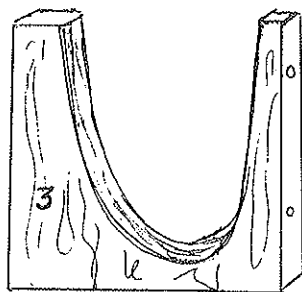


$\frac{3}{4}$ " x 1" x $4\frac{1}{2}$ ft.
Pine

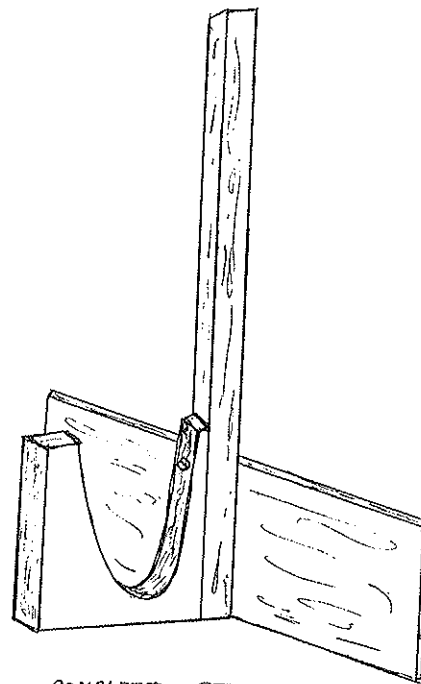


$\frac{1}{4}$ " x 8" x 2 ft. plywood

Materials needed: 5 wood screws, glue



$\frac{3}{4}$ " x 9" x 9" plywood



COMPLETED STAND

APPLYING FABRIC OVER PLYWOOD

By Robert A. Greimel, EAA 9905
69 Burley St., Danvers, Mass.

Many builders on their first try at applying fabric over plywood, attempt to lay the fabric in wet dope and work it toward the edges to remove bubbles and wrinkles. More often than not, when the dope has dried, numerous bubbles appear under the fabric and much time is lost attempting to remove them. The following method has been found to produce uniformly good results.

1. Meticulously smooth the wood structure, using plastic putty in any dents, scratches, gouges or seams, as any imperfections will show through the fabric.

2. Apply at least one coat of dope-proof sealer and allow it to dry thoroughly.

3. Apply two brush coats of clear dope, allowing each to dry, then sand lightly with fine emery paper to remove any bumps or brush hairs.

4. Machine sew the fabric so as to make an envelope with the open end at the wing root. Trim the edges $\frac{1}{8}$ in.

from the sewed seam. Use fabric wide enough to wrap around the wing from trailing edge to trailing edge and long enough so a single length reaches from tip to root. As most homebuilts having a short wing chord, 60 in. or 90 in. wide fabric will do. Turn the envelope inside out so the seam edges are on the inside and slide it over the surface being covered, taking care to remove all stray threads, because they also will show through. Staple, tack or sew the edges in the aileron cut-out and at the root. A word of caution—the fabric should be just snug enough to remove wrinkles, not stretched taut.

5. Soak the fabric with water and allow ample time for it to dry completely. A garden hose, with the nozzle set for a fine spray does an excellent job.

6. Next, brush on a heavy coat of dope (thinned, if necessary, to a smooth brushing consistency), vigorously working it into the fabric for good penetration. Allow to dry, then brush on a second coat.

7. Dope 2 in. pinked edge tape over all seams. To make pinked edge tape lie flat around curved tips, dope down one end a distance of several inches, let it dry, then

stretch with all your strength as you work around the curve, doping down the tape as you go. At the end, use a spring clamp to hold the tape until it dries.

8. Continue applying clear dope over the entire surface, carefully picking loose brush hairs and sanding lightly with fine emery paper, until a glossy smooth surface is attained. Pay particular attention to the edges of the tapes while sanding and when you're done you won't be able to find them.

9. Spray on two coats of silver pigmented dope and follow with the color. If you use enamel for a finish coat, wait a few days for the dope to dry thoroughly.

That's all there is to it, but I might mention that a coat of good auto wax such as Simoniz adds years to the life of the finish; and, in the interest of economy and weight saving, you should consider the use of balloon cloth, or certainly nothing heavier than intermediate fabric, rather than the more readily available Grade "A".

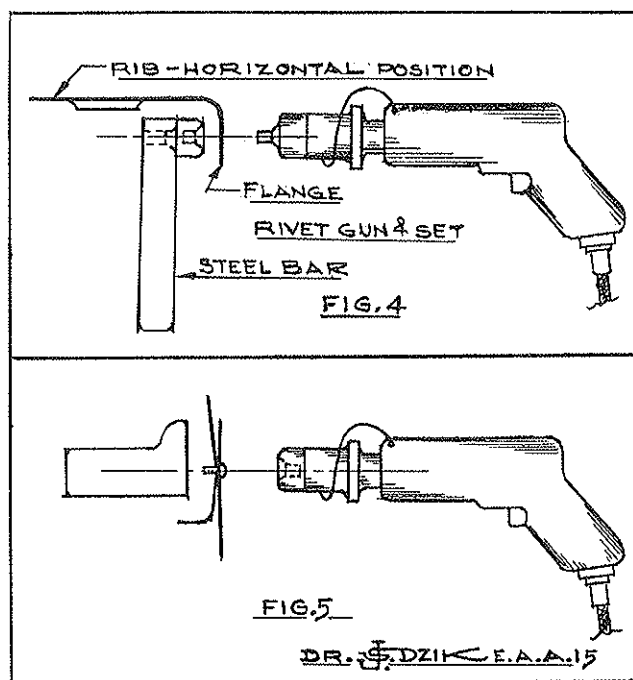
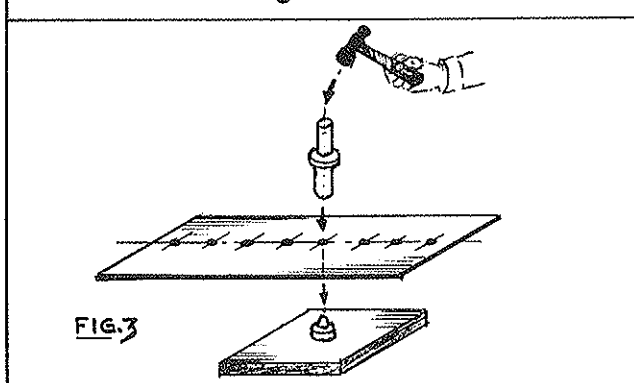
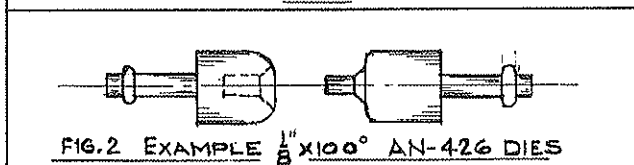
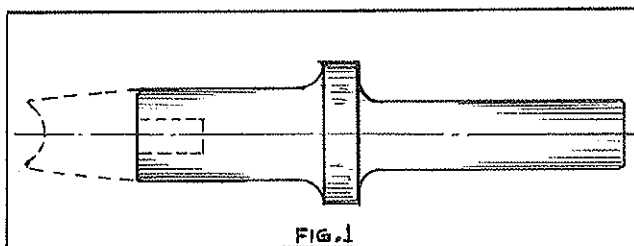
Sounds like a lot of work? Well, it is, but the end result makes it worth the effort, and your "amateur-built" will truly look "professional built".

SKIN DIMPLING

By Jack C. Cummings

5457B Underhill St., Otis AFB, Mass.

Dimpling the surface of sheet metal to be installed on a wing or fuselage appears difficult if one does not have access to an expensive dimpling machine. You can counter-sink the metal, but you lose some strength. I have devised a method of dimpling the skin in preparation to install flush rivets. This method will work well through .032 thickness. Take an old rivet gun set and cut off the tip. See attached Figure 1. Drill a hole 3/16 in. in the center of a depth of 3/8 in. Chamfer off the inside and outside edges for smoothness. Next, pick up from an aircraft parts surplus store or mailing house, steel dies (i.e. dimpling tools, squeezer sets) male and female, for the size



rivet you plan to use. See Figure 2. The dies will fit into the modified rivet set.

Now, for use. For dimpling the skin, take a flat steel bar 1/2 in. thick, 4 to 5 in. long and 1 to 2 in. wide and drill a 3/16 in. hole in the center. Place the male die here. Lay the pre-drilled aluminum over the die with the "pilot" sticking up through the hole. See Figure 3. Take the modified rivet set with female die and place over the "pilot". With a hammer, strike the set with sufficient force to dimple the skin. After a little practice, you will be able to hit the set with the correct blow each time.

You may also dimple holes in the ribs by mounting the male die on the end of a steel bar and placing the modified rivet set into the rivet gun. See Figure 4.

If you can get dies for AN470 rivets, 3/32, 1/8, 5/32, you can use the modified rivet set for riveting. See Figure 5.

All in all, this tool will come in very handy for a number of things.

HAIR DRYER PREVENTS BLUSHING

It is the privilege of all good EAA wives to come to the aid of their husbands, and girls, you can do just that by letting your husband use your hair dryer for quickly drying small doped areas or patches on his plane. Better still, do it for him if you are on the lookout for new ways of making yourself indispensable.

The use of a hair dryer not only makes the dope dry faster, but prevents blushing. This is especially important in an unheated garage or hangar, or in damp weather.

Hold the dryer fairly close to the patch or doped area or use a corrugated cardboard box with the top cut off facing downward and cut a hole in the bottom of the box (facing upward) for the dryer to fit through. The box concentrates the heat on the doped area and makes it dry even faster.

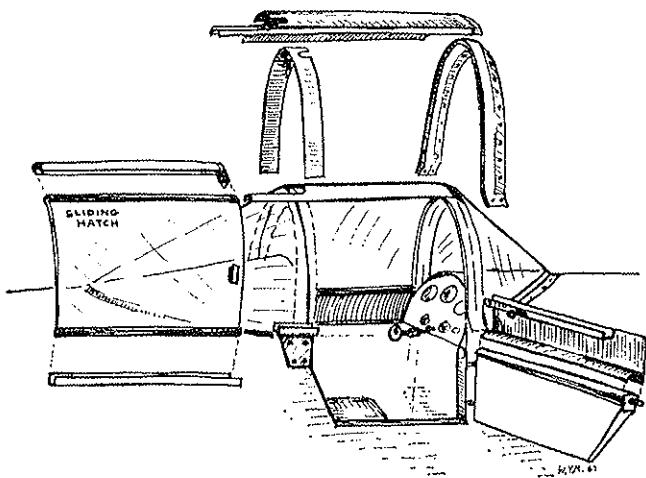
Marian Armstrong

ATTENTION! BABY ACE OWNERS

If you like winter flying but haven't the hot blood to go along with the open cockpit temperatures, here are some pictures of a modification that might interest you. It was engineered by some of the members of Lehigh Valley Chapter 70 for their Baby Ace after noting the picture of Kenneth Halliday's Ace in Sport Aviation, July 1962.



Photo No. 1 shows the aluminum panel added onto the door and the track in which the Plexiglas hatch slides. Our member, Dick Kessler, has his hand on the thumb screw used to lock the sliding plastic in the forward closed position.



APPLYING AN ALUMINUM LEADING EDGE

By Ed Gumell, Chapter 45

When I was constructing the wings for my Stits Flut-R-Bug, I went into the leading edge bending problem with some trepidation, but as it worked out, it came out perfectly with nary a wrinkle or bulge, and pulled in tight. Using .016 H-14 (I think it should work up to .065) aluminum, with the wing upside down, on horses, flat and level, I nailed the first sheet (18 in. x 72 in.)

26

tight to the bottom cap strips using $\frac{3}{8}$ in. cement coated aircraft nails. Then used two straight 2 x 4s and clamped them to the outside edge with the smallest clamps that would fit. The idea was to get the "C" clamps positioned to have as little interference with the final part of the bend as possible. Now, the weight of the 2 x 4 has already started about a third of the bend, so nail it down. Here, while the wing is still upside down, I used rope (tied to the clamps) pulled snugly and brought around about sixty percent. Now, we get wifie or another pair of hands and turn the wing over gently. You should be

able to nail the nose section now and all that's left is to tighten up the ropes evenly, and nail it down the rest of the way. Mine was in six foot sections, but it should work in longer ones as long as the wing is square and true.

And, here is a bonus tip, thrown in free! — The cutting and trimming of tubing up to .065 can be handled very easily with aviation snips. Of course, left and right cutters should be obtained. After a few practice cuts, it's surprising what nice, neat joints can be made with very little finish filing necessary. Straight butts or angles are equally simple and easy.

By Bill Miller, EAA 7908
1838 Termonst St., Allentown, Pa.

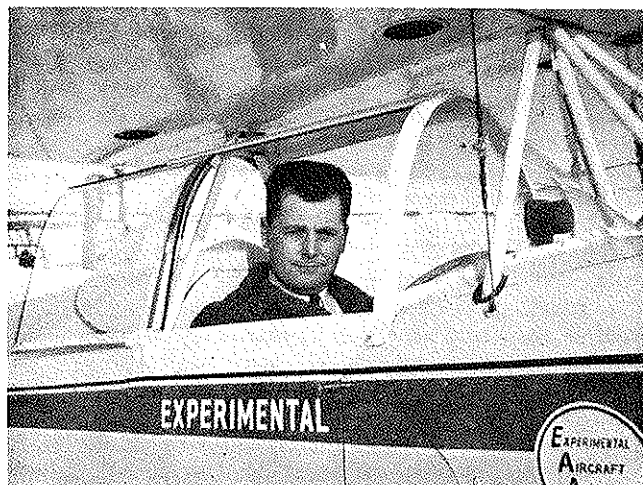


Photo No. 2 has the door closed but the sliding hatch in its open position. Stops are on the front of the Plexiglas to limit the rearward travel in the short track behind the door.



In photo No. 3 you can see the hatch closed and ready for flight. No longer does the pilot need helmet, goggles and those heavy cumbersome clothes that are necessary to keep warm. The FAA approves and so do we members of Chapter 70.

FUSELAGE JIGS UNNECESSARY FOR STEEL TUBING AIRCRAFT

By Harry C. Peterson, EAA 4878

Brown's Mobile Home Park
R. 4, Hwy. 6, Davenport, Iowa

The use of a jig, as we all know, is to insure true and square fuselage ladders; also in the case of the fuselage to have exact duplications of both ladders. My method takes in all these things but does away with all the time, material and effort that goes into the jig.

The only materials needed are the steel tubing, a good flat cement floor, hack saw and welding torch (a wife or helper will come in handy). To begin with we don't make the side ladders, instead we make the top and bottom. Cut your main longerons to the necessary length that the plans call for, four in all. Now lay out a straight line on the floor with white chalk. This will be the center line that will be used to measure to each side and lay out the main longerons. See Fig. 1.

Lay out chalk lines and draw the fuselage out as shown in Fig. 1 to full scale on the floor. Then on two main longerons bevel one end of each so they will fit the stern post and follow the chalk line to No. 3 cross member. See Fig. 2.

Tack weld the two longerons together at the bevel. Cut the No. 3 cross member to the size as called for on your plans and tack on both ends to the longerons; continue to heat these tacked joints and while the aforementioned helper stands on the point end, bend the longeron in to where the No. 2 cross member will be stationed. Repeat this last phase out to No. 1 cross member and you will have the top ladder pretty complete.

Now cut the stern post to size and file the point of the ladder to fit snug on stern post and weld together. The next step is to make the bottom ladder. Follow the method used on the top ladder with the exception that the length will vary slightly. By this I mean, if the bottom ladder has to be bent up to meet the stern post. If this is the case, the most simple way to find out how much longer the bottom ladder must be is to take and cut the upright members for station No. 2, tack them at right

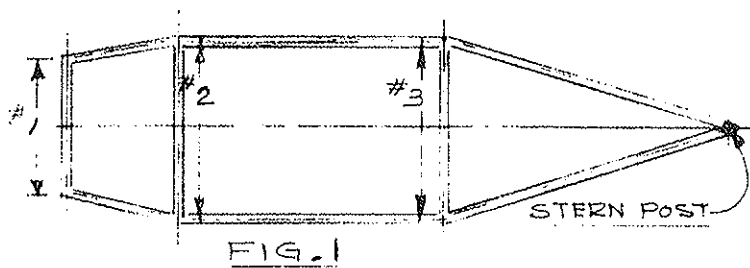


FIG. 1

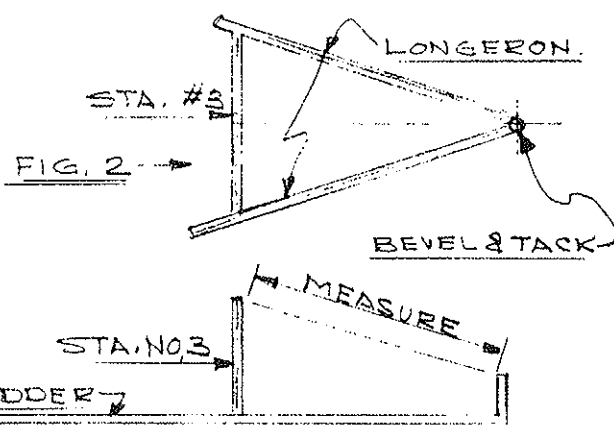


FIG. 3

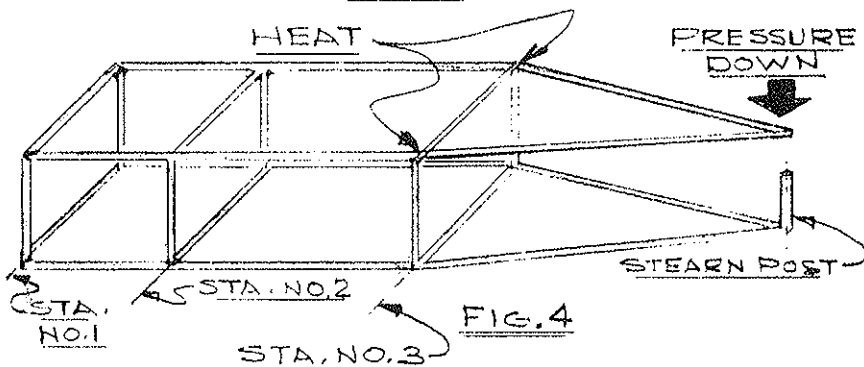
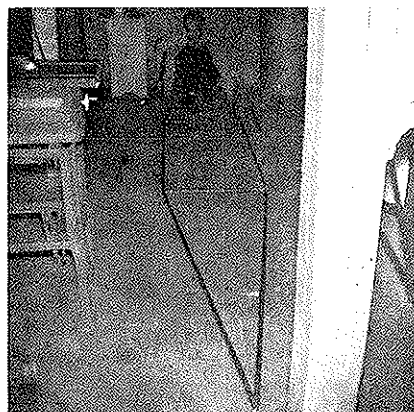


FIG. 4



● FUSELAGE JIG UNNECESSARY
FOR STEEL TUBE AIRCRAFT ●

DR: - I S D Z I K E A A N O . 1 5

angles to the top ladder as shown in Fig. 3 and measure down from these to the stern post.

Complete the bottom ladder the same as the top. Cut and tack the uprights for stations No. 1 and 2 to the top ladder the same as the No. 3 uprights shown in Fig. 3. When this is done take the bottom ladder and tack to these uprights. Heat the longerons on the bottom ladder at station No. 3 and bend down to fit the stern post. (Fig. 4). This procedure can be followed wherever the bottom ladder needs bending. From here on it is just a simple matter to cut and install the rest of the cross members and uprights.

One thing I would like to make clear now. This is not an untried method. Two fuselages have been successfully built this way. The photos accompanying this article should lend proof to this.

• • • • •

ROUTING WITH A CIRCULAR SAW

By John W. Irwin, EAA 4703

18 Orchard Place, Wappingers Falls, N. Y.

Since I have no router, I used my radial saw to rout my fuselage members. Any circular saw can be used. This method tapers the end of the routed portion to prevent sudden change of cross section.

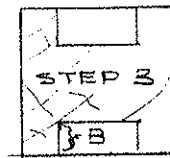
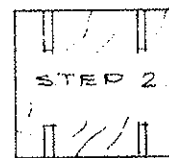
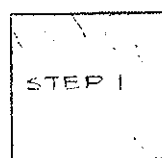
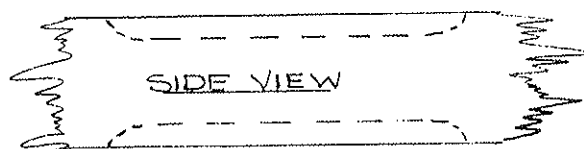
First, mark off the sections to be routed.

Next, set the fence on the saw to dimension "A" in diagram. If using a circular saw, set the blade to protrude above the table the amount of dimension "B"

Lower the member onto the saw blade as on a radial saw lower the blade into the member distance "B". Then

slide the members longitudinally until you have a kerf the length of the portion to be routed. Do this on each side of the member in each section to be routed. In a radial saw remember to raise the blade when crossing areas not to be routed.

Now take a chisel and you will find that the wood between kerfs will lift right out. The kerfs are polished hard by the blade and the chisel will follow them nicely.



ROUTING WOOD MEMBERS ON A RADIAL OR CIRCULAR SAW

DR: - \$DZIK EAA NO. 15

The ends of the kerf are tapered to the curve of the blade. I did all members for a Pietenpol fuselage in one evening.

All that is required is a light sanding to remove any splinters left by the saw blade. The kerfs can be deepened toward the tail where the stresses are less.

• • • • •

USES OF EMERY CLOTH

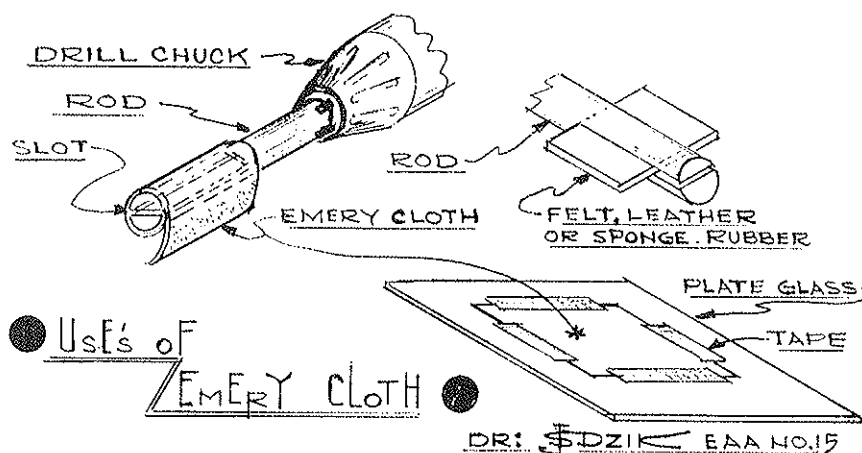
By Kalman Saufnauer, EAA 1201

115 Locust Ave., Hollister, Calif.

Saw slot in rod, insert strip of emery cloth in slot and wrap around rod. Use drill motor or drill press to deburr and smooth holes or edges.

Insert strip of sponge rubber in wide slot and coat with lapping compound to polish inside of hole, felt or leather may also be used as each has its merits. Use also to back up emery cloth for polishing uneven surfaces.

Tape emery cloth to plate glass for surface sanding. Hold part flat, preferably with both hands. Use long strokes or circular motion. Long pieces may be obtained from sanding belts, long glass from auto doors. Use only safety plate, safety sheet sometimes found, will have waviness in its surface, while plate has been ground to a flat surface.



Regarding plate glass — did you know a special Aircraft Safety Plate is available less than 3/16 in. in thickness? It is about half the thickness of auto glass, just the thing for seaplanes or roadables if you wish to use windshield wipers. You might salvage some from the roll-up windows of Fairchild 24's, Stinson's, etc.

GOT COLD FEET?

By Kalman Saufnauer, EAA 1201

115 Locust Ave., Hollister, Calif.

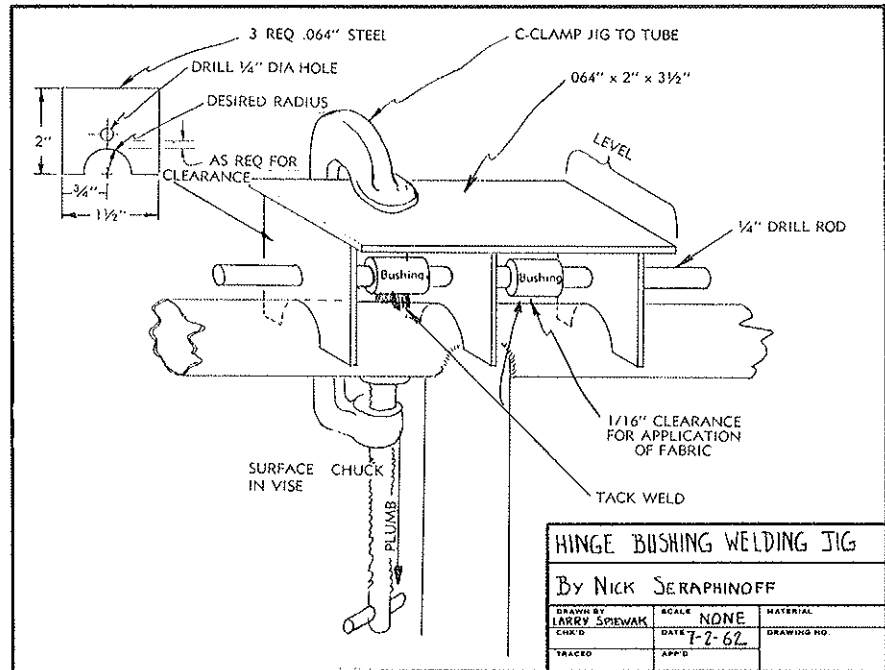
Also, you cold weather types can keep your feet warm with foam neoprene skin-diver socks. They worked fine in an unheated airplane.

Welding Hinge Bushings

By Nick O. Seraphinoff, EAA 9936
11411 Sherman, Warren, Mich.

DO YOU find it difficult welding hinge bushings to pipe control surfaces? If so, try my method.

Make a jig as shown in the drawing. The steel need not be .064, any thickness will do. Drill the holes in the plate as per pipe thickness and keep the 1/4 in. holes spaced as required, weld the pieces to plate as shown. Chuck the control surfaces in a vise, check with level for plumb, next position the jig, keeping top plate level, secure with C clamp, insert drill rod through bushings and through jig, tack weld all four corners, remove jig and continue welding.



Crash Helmet Advice

Among our thousands of members can be found persons having all kinds of specialized knowledge and skills. For example, Vaughn M. Greene of San Francisco knows a lot about motorcycles. In a recent letter he comments that it is an unwritten law among members of the Vincent Owners Club not to get on a bike without wearing a good crash helmet. In respect to our urging amateur aircraft builders using such protective gear, he passes along a word of caution. In hopes of saving money, the airplane builder is tempted to buy surplus helmets. This can be dangerous because sometimes surplus helmets are declared surplus by military agencies for the reason that they have been subjected to shocks. The only way another person or agency can detect some of the hidden effects of such shocks is by X-ray. In buying a surplus helmet that seems to be sound on the surface, one takes a chance on getting one with hidden flaws which could materially reduce the amount of protection afforded. If a man can afford \$1,000 to \$3,000 for an airplane building project, a new \$40 helmet should be within his reach. Greene says he would recommend the full coverage jet pilot type of helmet and suggests the Bell TX and new Buco types. Since we often fly open planes, it is important that the faceplates should be able to withstand wind pressure safely. The two just named have been tested at up to 200 mph.

BENDING CAP STRIPS

By Harvey Hendrex, EAA

Here's a tip on bending cap strips that has worked for me. I latched onto an old steamer for sterilizing baby bottles. It is the type that uses electrical energy going through water to generate heat. It has a hood over it, under which is a rack for holding the bottles.

I took the lifting knob from atop the hood and installed it on one side. Then, using the hole in the top of the hood as a center, I cut tabs and bent them upward. I had a piece of 1 1/4 in. I.D. aluminum tubing about 18 in. long, which I inserted into the hole in the top of the hood and allowed it to go into the hood about an inch. A piece of plumber's tape and a bolt made a clamp to hold the tabs tight against the tubing.

The rack for the bottles was stripped of its grid and a piece of brass screen wire laid on top to prevent the ends of the strips from going through the rack and into the water. The steam coming up through the hood and tube (which makes a flue to draw the steam) will soften strips excellently without soaking them directly in water, which seems to take some of the "life" out of the strips. The 1 1/4 in. tubing will hold four strips easily and allow sufficient flow of steam up the tube. My bending block holds four strips, so the steamer is adequate for my needs.

Attaching Aluminum Fittings To Wing Spars

By Bill Wolleat, EAA 1953
4300 F Ave. N.E., Cedar Rapids, Iowa

I am submitting an exceptionally strong method of attaching aluminum fittings to wing spars or any other member where there are great shear forces.

I think this method is superior to the plug system in that it transmits the shear forces directly from the wood to the attachment fitting instead of to the bolts and thereby spreading the stress over a wider area of the metal fittings.

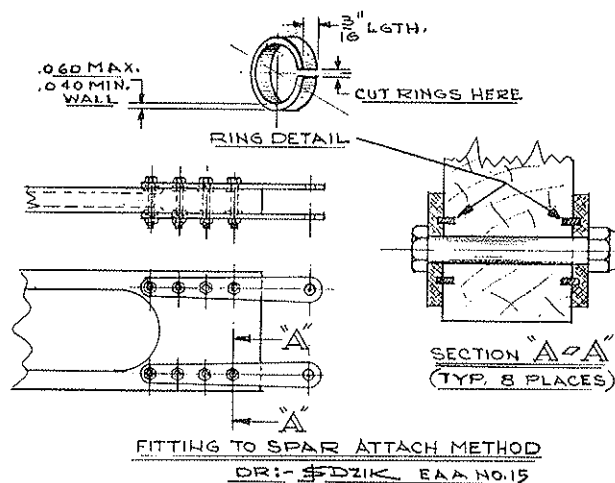
These rings should be cut from steel tubing of .040 and be cut about 3/16 in. long.

Now, using a fly cutter with a steel cutting bit to cut a groove to fit the thickness of your rings and a pilot bit slightly smaller than the holes you will use, set the stop gauge on your drill press and cut your grooves in the aluminum fittings to a depth of 1/16 in., then using the same cutting tool cut the grooves in the wood to 1/8 in.

All rings should be cut through on one side so that they will conform to the grooves better.

When rings are pressed into grooves there should be about 1/16 in. gap in the ring where it is cut open.

Use a diameter best suited to the size of fittings used.



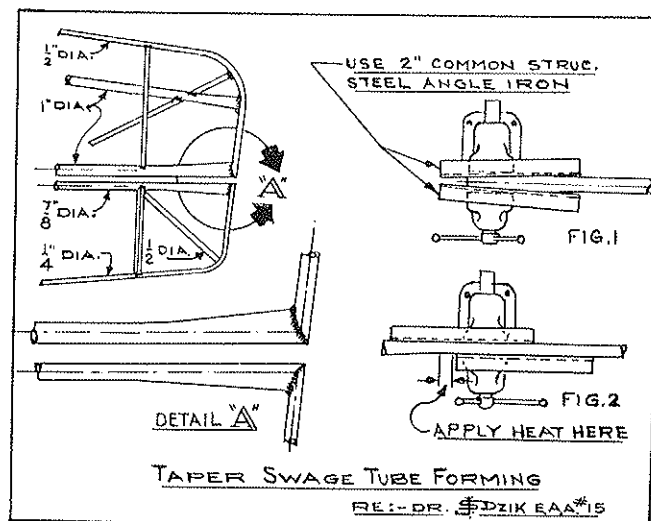
Uniform Swage on Spar Ends

by Bob White
609 N. Lindberg, Griffith, Ind.

To get a uniform swage on the spar ends of the Little Toot tail surfaces I used two pieces of 2 in. angle 12 in. long.

On the inner spar establish where the swage must start in order to clear the fabric as it tapers to the tip. Place the angles in the vise so they form the desired angle as in Fig. 1. Then heat the required distance from the end of the tube to be used. Place the heated tube between the angles and tighten the vise. The operation may have to be repeated depending on the length and the amount of the swage. Be careful to keep the tube hot. A cold tube will crack.

If the swage is to be used on a rear spar, one side may be kept straight by heating at a point where the swage begins and placing between the angles as in Fig. 2.



Before ruining a hundred dollar's worth of tubing with bad welds, weld up a few sample clusters and show or mail them to your FAA agent for his OK on your welding skill. Better to find out this way if you need more practice, or if there are flaws in your technique!

Keep your FAA agent informed of progress on your project. Notify him before starting construction and before each major component is primed, covered or closed in. Don't cover anything up before he has inspected and approved it.

Scaling On Steel Tubing?

If excessive scaling occurs on steel tubing and the base metal is pitted, too much heat is being used for welding. Even a small flame can burn base metal if held too long at one place. Undercutting severely weakens a weld. If edges of weld metal do not taper smoothly into base metal, the welding is too cold. Hack saw your practice welds in half to see cross-sections of your bad work such as undercutting, burning and inadequate penetration.

Tube Bending Simplified

I am submitting a tool tip of the month in AC's contest. Whether or not it merits an award is something else. But I have found it indispensable for forming tubing, formers, wing-tip bows, etc. Square tubing and flat stock can just as easily be formed.

Any old piece of angle iron (at least 5/16 in. or 3/8 in. thick) should be used. It can be clamped in a vise. (I should say, it should be so the forming or bending can be done very simple).

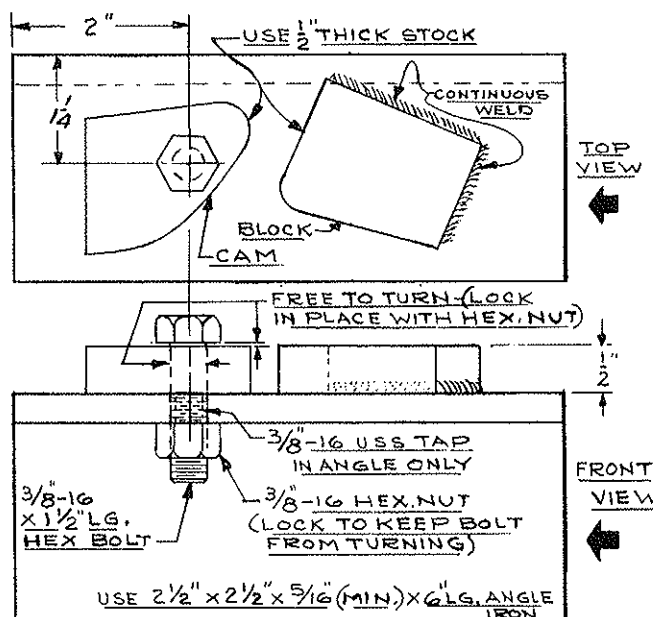
The pivoting block is drilled slightly larger than the 3/8 in. bolt that goes through it, which in turn is screwed into the tapped hole in the top face of the angle iron. If a bend is made beyond the original curvature it can readily be brought back by just turning it in the jig and applying pressure.

The pivoting block automatically adjusts itself to the size material being used.

I made mine up so it would handle up to 1/2 in. stock and in less than 15 minutes formed a set of wing-tip bows for the Stits Playboy.

The material is inserted between the two blocks and bending is commenced where desired and slowly advanced while at the same time you're bending. Do this until the desired shape is formed. The pivoting block could also be made as a round plate and the hole drilled offset, but as I have drawn it, it works marvelously. •

By Iggy Polizzotto
33 Berkeley Pl., Bloomfield, N.J.



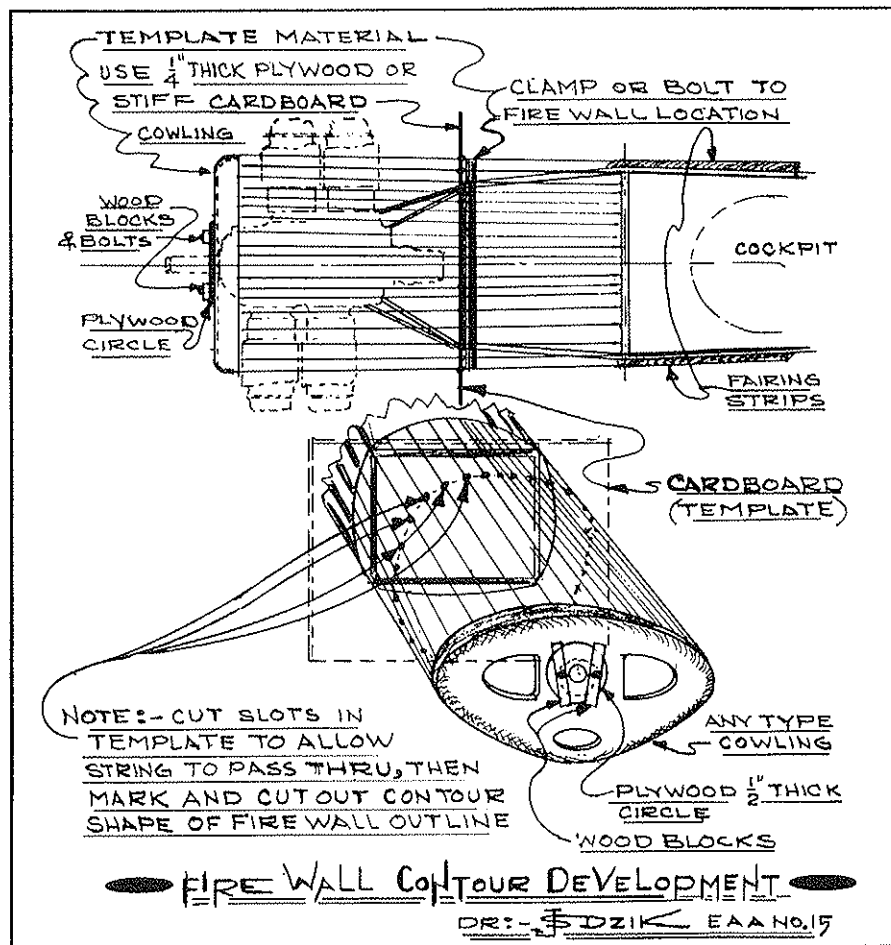
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FITTING COWLS

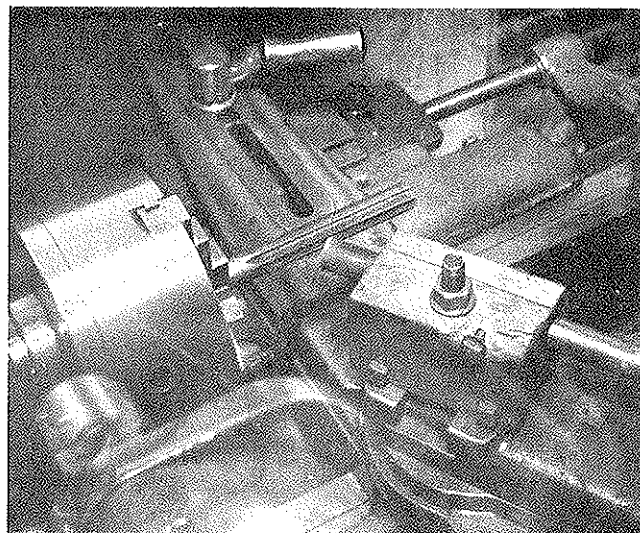
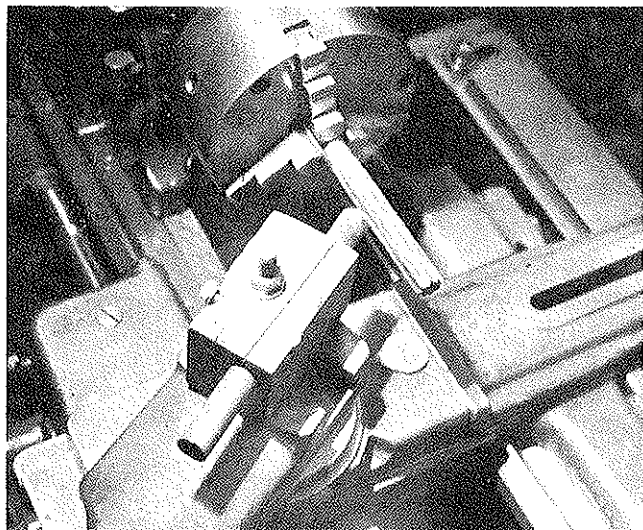
By Frank Wiggins
3356 Clairemont Dr.
San Diego 17, Calif.

IF SHIP is to be metal cowed from cockpit forward, this plan will let you use almost any type nose cowl and will give you the exact temperature for the firewall. On my Mini-Plane I used a P.A. 18 nose cowl and had to figure this out in order to make the firewall to match. Bolt the cardboard where the firewall will be, then run the strings from the cockpit coaming to the edge of the nose cowl. The cardboard will have to be slotted so that the strings will run straight and tight.

I made a plywood adapter to fasten the cowl to the front of the engine. It was a plywood circle cut out with two or four bolts and a block of wood to fasten to the cowl. I then cut out a hole in the exact center and a tight fit for the prop shaft. This will hold the cowl in the exact center for all other measurements. It's hard for me to explain or show you, but it works out well and maybe you can figure it out.



DR.:—\$DZIK E.A.A. NO. 15



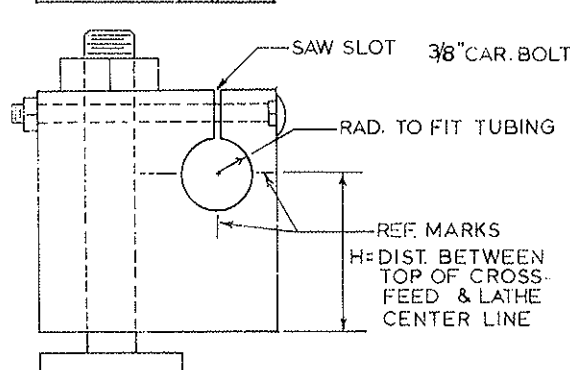
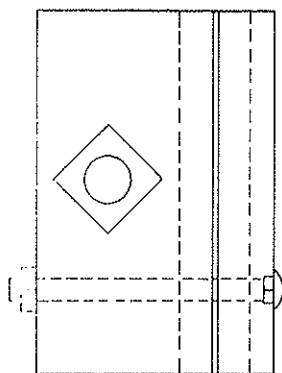
A SIMPLIFIED METHOD FOR FITTING AIRCRAFT TUBING

By Michael R. Smith, EAA 11243
21-R Mills Rd., Clemson, S.C.

I WOULD like to share with other members who have access to a lathe, an exceptionally simple and inexpensive method of fitting aircraft tubing. We used this method of fitting the tubing on our Stits Playboy, and we had the fuselage completed and on the gear in less than 100 hours.

The tubing is held in a block that is mounted on the cross-feed head of the lathe, a reamer is chucked in the lathe head, and the tubing is oriented so that the reamer cut results in an almost perfect fitting member. This method is not only quicker than most other methods, but it also results in stronger welded joints.

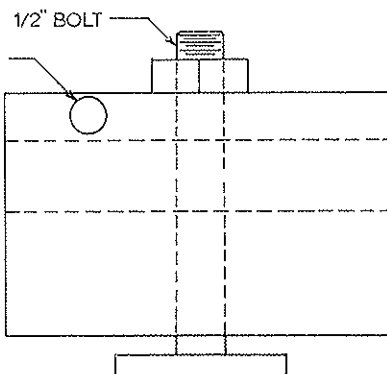
The fitting device can be made from a 4 in. by 4 in. piece of hardwood and several bolts for almost no cost. We made a block to fit each size of tubing, and it usually took about 15 minutes to make each block. We tried making one large diameter block and using sleeves to make it fit the smaller tubing, but this was not satisfactory.



To construct the block, we found that the best way to do it was to cut the block to size and drill the hole for the $\frac{1}{2}$ in. hold-down bolt. Next mount the block on the cross-feed head and locate the center of the tubing hole. Mark the center lines of the hole on the end face of the block so that they can be used as reference lines during the cutting process. Now drill the tubing hole, saw the slot into the tubing hole and install the tubing lock bolt and nut.

A straight reference line is now drawn on the side of the piece of tubing that is being fitted, and the angle between the member to be fitted and an adjacent member is measured with a protractor. The tubing is placed in the block and the reference line on the tubing is aligned with one of the reference marks on the block. Next the cross-feed head is loosened and the measured angle is set up between the piece of tubing and the reamer. The cross-feed head is locked and the tubing is ready to cut. Feed the tubing into the reamer slowly while applying cutting oil. When the first end is cut to the proper depth, measure the angle between the members at the other end and reverse ends of the tubing in the block. Align the reference line on the tubing with the correct reference mark on the block so that the finished cuts will be oriented properly with respect to one another. Now set the tubing at the proper angle and repeat the cutting process until the member is of the correct length.

A little practice on some scrap pieces of tubing will give the operator enough experience to start fitting the tubing on his plane. This method was a great time saver for us and I hope it will benefit other members in their work. •



TIP FROM THE BIRD HOUSE

By Paul E. Best, EAA 2441
5 Oakley Ave., Buzzards Bay, Mass.

WHEN WORKING with fiberglass, often a smooth finish is hard to obtain without hard sanding work and filling. When applying the last coat of resin a glass finish without low spots can be obtained by stretching

thin polyethylene or vinyl plastic over the wet resin and attaching it to any dry place with Scotch tape. The plastic will not stick and when the resin has set it is readily removed. This film forces the resin to lay smooth and fill all indentations completely. If a light weight curved panel is desired, aluminum screen wire may be used in place of fiberglass cloth or mat. Many shapes can be formed without molds as the screen wire can be stretched into shape. Cheap polyester resin can be used with the wire and plastic film taped to the wire will hold the resin in the mesh until set. Engine cowl pieces are suitable for this method and forming a mold over the engine is not required. Use of brushes in polyester resin does not require purchase of expensive solvents such as Keton to clean the brush and the hands. The nearest super-market carries a cheap cleaner which does the job even when diluted with water. It's good old Lestoil. Just soak the brush a short time, then rinse with warm water. •

ENGINE MOUNT CONSTRUCTION AND VERTICAL FIN DESIGN

By J. C. Long, EAA 9436

I built the engine mount for my Playboy using a piece of $\frac{3}{8}$ in. plywood erected in front of the fuselage as a jig to simulate the engine. Ray Stits' instructions for building the Playboy say to use a piece of $\frac{1}{4}$ in. thick hard asbestos, but plywood was available and asbestos was not.

It was very discouraging when the jig board burned to pieces before welding was half finished. I was able to finish the welding by doing part of it on the tool bench and the rest in another jig but was lucky that warpage did not ruin the job in this piecemeal process.

My subsequent experience with modifying the engine mount to support a Continental 90-14 engine came off better due to the lesson I learned building the mount.

The Continental -14 engine has Ford bushings in the mounting holes which makes it necessary to add an additional brace to the engine mount, on both sides, due to the flexibility of the Ford bushings. The top members of the Stits engine mount are cantilevered out, which is adequate when bolted to the -8 and -12 Continentals but not stiff enough for the -14 engine.

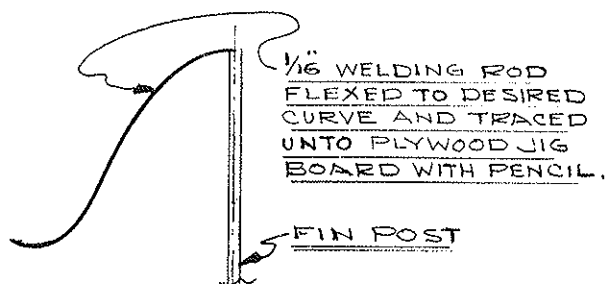
In adding the brace tubes I used, instead of plywood a piece of .065 in. thick sheet steel for jiggling the front of the engine mount. Behind the sheet I bolted two pieces of scrap 2 in. x 6 in. wood for additional stiffness. This proved entirely adequate to hold the front of the engine mount to the exact bolt hole centers of the engine while welding in the braces.

From the experience, my advice on jiggling to build an engine mount is to use the piece of plywood erected in front of the fuselage, but with a piece of sheet steel on the face of the plywood. The plywood furnishes rigidity to prevent warping of the

sheet steel while welding near it, and the sheet steel is a barrier between the welding flame and the plywood. Needless to say, even with this precaution it is advisable to weld the front of the engine mount as quickly as possible so as to finish the job before so much heat is conducted through the sheet and the bolts attaching the mount to the jig that the

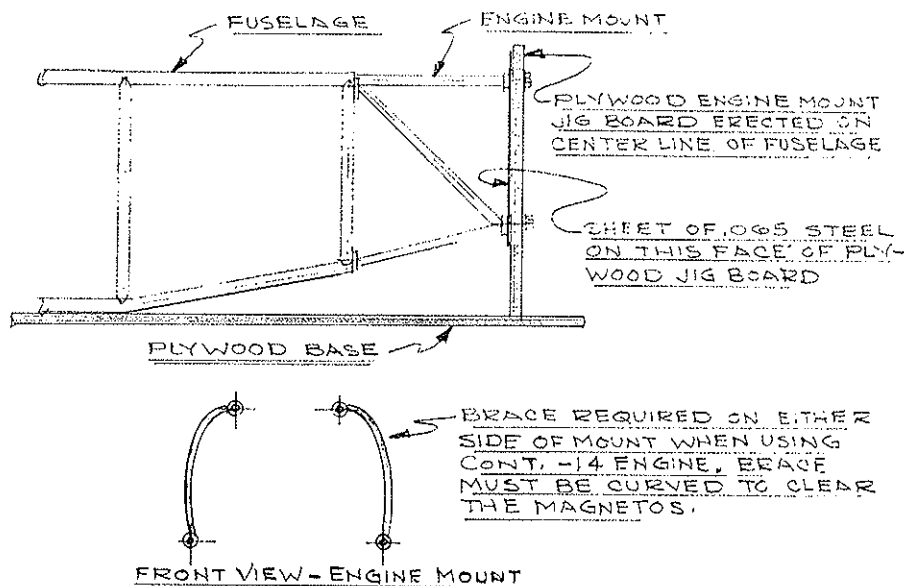
plywood begins to burn around the bolts, as it will eventually if you are slow in completing the welding. This will not be as critical as it is if you do not use the sheet steel facing, however, since the bolt center dimensions will be maintained by the sheet steel.

An additional tip: when necessary to fit a curved piece of tubing to a



LAYOUT FOR VERTICAL FIN DESIGN

DR: J. SZIK EAA NO. 15



ENGINE JIG MOUNT

DR: J. SZIK
EAA NO. 15

structure and the curve must be determined by trial, use a piece of aluminum tube, which bends easily, to determine the length and shape required. Trace the curve of the aluminum tube on a piece of plywood and drive heavy nails at close intervals along the curve. Heat and bend the steel tubing around the curved line of nails. This is also a very fine way of bending tubing for the out-

line of your empennage. Use a 1/16 in. welding rod as a ships curve to draw the shape of the tail surface, in other words hold one end of the rod fast at the top of the fin post for example, and flex the welding rod so as to make it bend to the shape that makes a nice looking outline of the fin. Trace along the welding rod. Drive nails at intervals along the pencil line. Tack weld

one end of the tubing to the top of the fin post. Heat and bend the tubing around the nails. My entire tail group was built using nothing but nails driven on each side of the pieces to hold them in place. Besides eliminating the need for jig blocks, it is faster and less trouble.

P.S.: Somebody please publish an article on building aluminum cowlings around engines.

PORTABLE NICOPRESS SQUEEZE

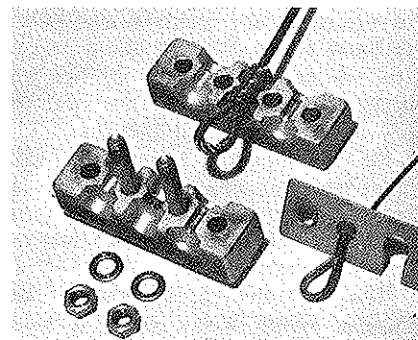
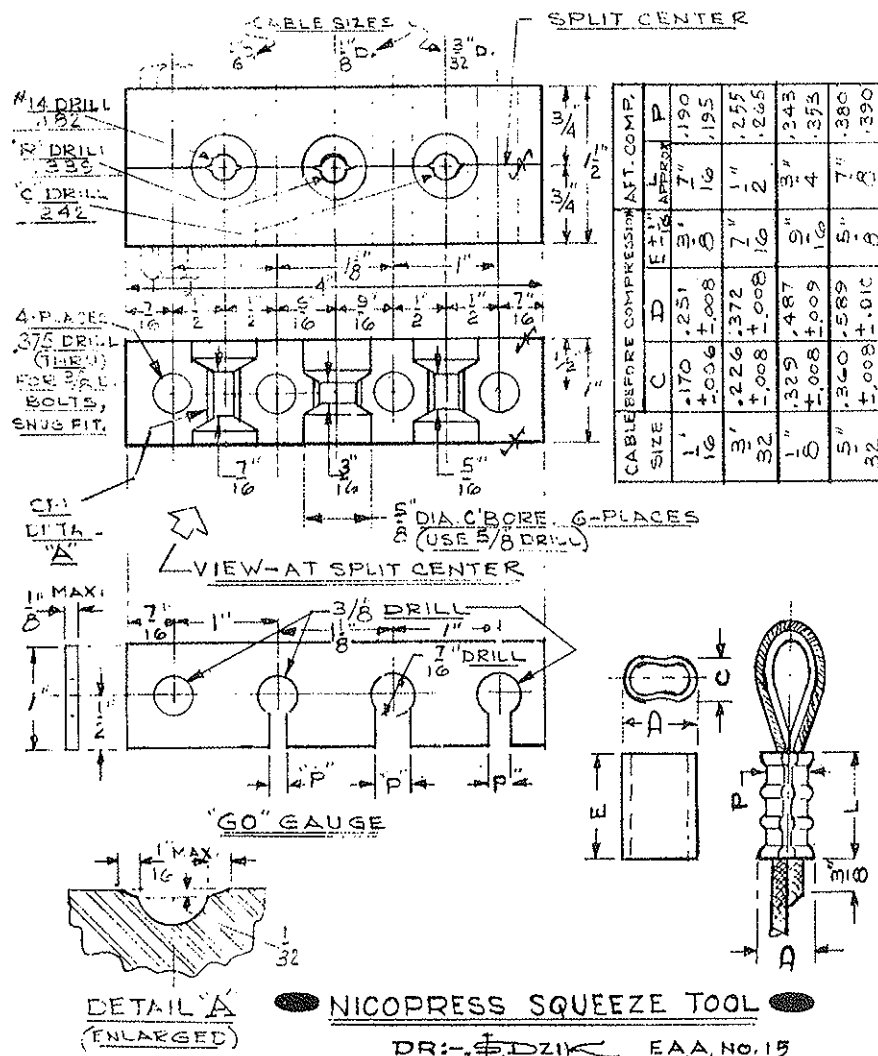
By Kalman E. Saufnauer, EAA 1201

Several years ago a cable splice was required in a hard-to-reach location; removing fairleads to pull the cable out was impossible without damaging the fabric finish. This was a factory goof, not on a homebuilt. Consequently, it was desired to perform the splicing from within the aircraft, even though it could not be accomplished with the standard tool.

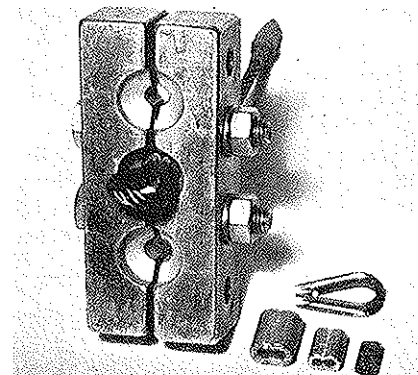
The portable squeezer shown was developed because regular nicopress tools require a large unobstructed area for operation. Homebuilders with limited requirement for a squeeze may not wish to lay out the cash required for two or three sizes even at surplus prices; many A & P

mechanics have only the 1/8 in. size, if any. (The writer was one of these cheapskates who borrowed from a larger shop).

It is suggested a 3/4x1 in. bar of steel be used, although 3/4 square would be enough since the Nicopress sleeve is copper with cadmium plating. Cold rolled is probably satisfactory, however, the one shown was of 4130 C.M. The mating faces must be smooth and straight. A pair of bars should be clamped tightly and drilled for the 3/8 in. bolts which are then installed and tightened. These provide alignment dowels for further drilling and are later used for squeezing. When all four bolts are securely tightened, you may carefully drill pilot holes between the mating faces of the bars. Use of a cen-



View showing finished squeeze and gauge. The 1/8 in. cable in the squeeze has been rotated 90° to better show correct appearance of finished sleeve. Correct use of gauge is shown on 1/16 in. cable, also shown is thimble in cable eye.



View of cable and sleeve being correctly squeezed. Notice sleeve relationship to tool. The three sizes of sleeves are shown, also the 1/8 in. thimble. Note: 1/16 in. and 3/32 in. cables use 3/32 in. thimble not shown.

ter punch and rather heavy hammer may be required to prevent drill chipping or wandering when starting the pilot hole. A machinist's center drill will facilitate hole starting. Please use a smooth running drill press for all operations; the squeeze holes must not be "egged" over-size by a sloppy bearing or imperfect drill bit. Drill these holes 1/16 in. undersize, then slowly and carefully drill to size with a sharp drill, check hole size with drill shank. If a reamer is not available wrap emery cloth around a rod or rat tail file and polish to size. (The rod may be slit at one end to hold the emery cloth which is inserted in the slot, then wrapped around it; a drill motor is used to rotate the rod). This makes a very small diameter sanding drum. The drawing gives drill sizes and all dimensions. For those whose chuck cannot use a 5/8 in. drill it is suggested you use a 1/2 in. drill, then file a slot in one side of each bar to clear the 1/8 in. cable eye; use a 1/4 in. rat tail file. Use emery cloth to lightly round all edges in holes.

Only two bolts are needed to squeeze a cable sleeve, bolts should be hardened, as even AN bolts can only be used a few times on 1/8 in. cable before the threads gall. Use of a thread lubricant is advisable. Hardened bolts may be found in auto connecting rods.

Bolts must not be threaded within 1/8 in. of the mating faces because the shank is needed as an alignment dowel. Short rods or dowels may be used for alignment when using a vise to squeeze. 1/8 in. cable should have three squeezes, 3/32 in. should be squeezed in two places while once will suffice on 1/16 in. cable. When making multiple squeezes, start at cable end and work toward the eye, the sleeve grows lengthwise so will tighten the eye around the thimble which, of course, must be used on primary control cables, the same holds true if a bushing is used.

Note to budding A & P types — tighten each bolt no more than one turn without tightening its mate. Also, leave excess cable on short end so you can pull the eye tight while squeezing. Then cut with sharp chisel and anvil about 3/8 in. from sleeve being careful not to damage the long cable, use a piece of aluminum bent around cable as a shield. Before placing in squeeze, the sleeve may be pinched enough to hold cable eye tight by use of vise-grips on flat sides, do not over do it or the squeeze may not remove your marks. This method may be used to fit cables to correct length on the plane, then carefully remove and squeeze at workbench.

Finished sleeves should not be misshaped and dimension "P" must fit the proper gauge slot. If too small ream the squeeze holes but if too large you must sand or file the mating surfaces and redrill holes or make a new tool. Gauge slots should be carefully filed square in vise and checked with drill shank. Holes in gauge as shown will enable you to fit it to the squeezing bolts for storage. •

MORE ON RIB-STITCHING WITHOUT A HELPER

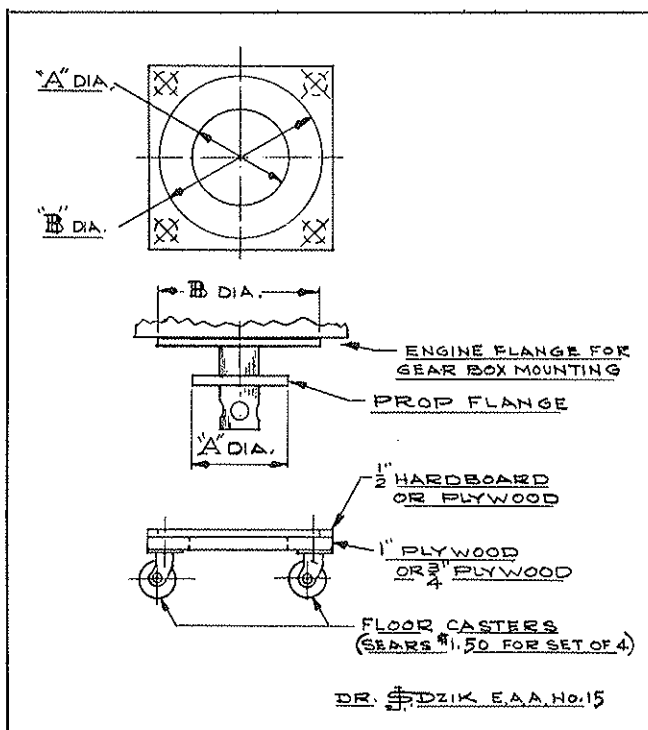
A few months ago this column described a method of doing ribstitching on a wing without a helper. Member John E. Mueller writes in to tell of another method which is certainly worth passing along. Chalk lines are snapped on the wing as usual, to mark the locations of ribstitching. With the needle, holes are punched in the

ENGINE OVERHAUL DOLLY

by Ross Diehl, EAA 8142
4743 East Ave., R-12, Palmdale, Calif.

"Here's a sketch of a dolly I made to facilitate overhaul and handling of my O-290-G4. It uses the gearbox mounting flange to good advantage, until the engine is mounted, then the flange can be cut off.

"The engine rests on its nose, thus taking up a minimum of floor space, allows pan mod, magneto changes and additions, cooling baffle changes, motor mount changes, etc. After the engine is mounted, it is relatively easy to modify engine flange".



Dia. A & B as shown. Dia. A is slightly oversize. Dia. B is a fairly good fit since there is not much flange bearing area. This is why I suggest hardboard instead of plywood of the 1/2 in. piece. •

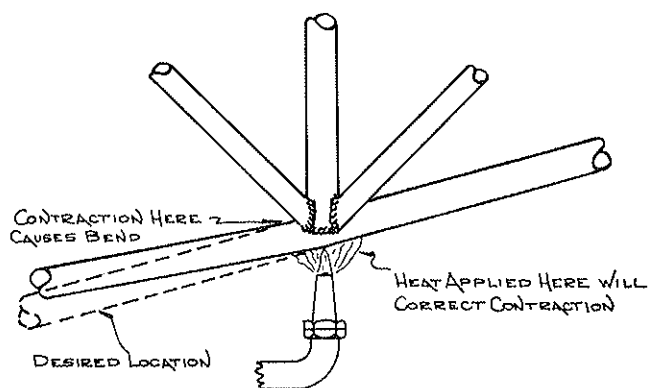
fabric alongside the ribs and at all the chalk marks, on both surfaces of the wing. The wing is then hung or propped up and it is possible by placing one eye very close to an adjacent hole to see through the wing well enough to guide the needle point into the appropriate hole on the other side.

On a wing of average chord, place it horizontally and usually it is possible to push the needle up and down while looking around the leading and trailing edges and do the stitches at the end by visual reference to the chalk lines. Then prop the wing up and do the stitching in the central portion of the wing by this sighting-through method. This greatly reduces the amount of walking back and forth and enables one man to do the job almost as fast as can two men.

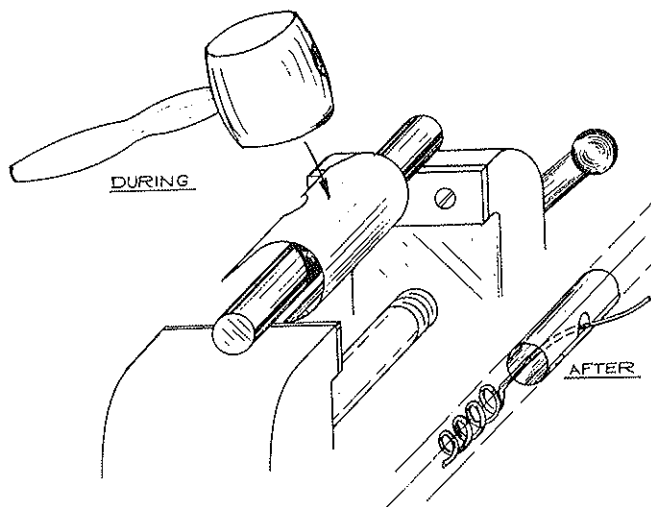
TAKING THE WARP OUT OF TUBING

By John A. Sons, EAA 3588

An interesting letter arrived recently from John A. Sons, of Albuquerque, N. M. He says that his welding experience has shown that a common problem in welding steel tube fuselage is that the longerons tend to bow inward when cross pieces and diagonals are welded into place. This is caused by contraction of the longeron metal at the point of the weld, which is of course mostly on one side of the tubing. It seems to shorten the inner side of the longeron, making it bend inward. The cure is to heat the outside of the tubing as shown in the sketch, just enough to soften it and let the tension in the tubing remove the bend automatically. Trial-and-error will show just how much heat to use: just be careful not to let one spot get so hot that movement of the metal causes a ripple or kink.



Sketch by Don Cookman



DISCOVERS USE FOR RUBBER Mallet

By Stephen du Pont
Buck Hill Farm, Southbury, Conn.

Very few amateur constructors know all the tricks of sheet metal working, and after 30 years of amateur same I discovered the rubber mallet.

The problem was to make a 1-15/16 dural tube about four inches long that could be opened along the side, a thermometer capillary with a sensing coil (not electrical, but gas and fluid operating, such that the coil could not be removed), was to be inserted inside the tube, then a suitable notch having been cut, the tube to be closed upon the capillary not tight but snug, and the short section of 1-15/16 tubing inserted into the ventilator duct of a sailplane. Thus the thermometer coil lay inside the two inch ventilator duct and the capillary passed through the side of the duct. The purpose was for calibration of airspeed instrument static vent position error for FAA flight test, and calibration of airspeed indicator, using an extra airspeed instrument, a trailing bomb with static vent well below, and a movie camera to photograph the panel. Temperature was wanted during the test.

A piece of rod a little longer than the sheet of .032-24ST3 material was set over the vise jaws and the four by seven inch piece of dural was roughly formed onto a very poor tube by hand and in the vise. The bent dural was laid over the rod and lightly hammered with the rubber mallet. The rubber hits the sheet metal, and has a

tendency to form the metal around the rod for a short distance. Even a 3/4 inch rod can be used to work a very accurate 2 inch diameter, and a nearly perfect tube with overlapping seam ready for riveting can be formed. The formed tube of 1-15/16 inch diameter was considerably larger than the rod. It just depends on how hard you hit it, and how much you move the sheet metal around.

The radius can be carried right to the edge of the sheet, and if you put in too much it is easy to unwrap it and start over.

Cone shaped radii, and angle bends with bend radii can be formed this way, depending on what you use as a mandrel, and how you move it around.

The rubber mallet acts like a baby hydro press with a rubber box attached. It appears to be well known by the professional sheet metal worker but missed by many of us who are forced to improvise, or are in a hurry.

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"PANIC CAN" HANDY WHEN DOPING

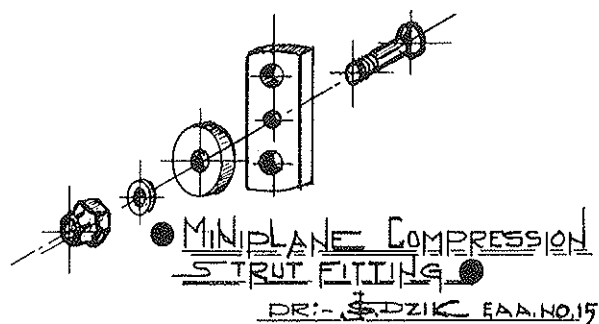
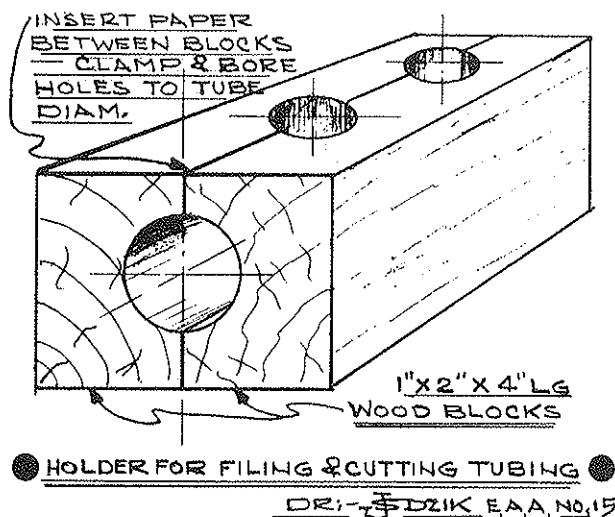
By A. G. Ronay, EAA 7068
923 Bennington, Houston 22, Texas

Undoubtedly, many times EAA'ers, while doping away find that they're fresh out of clear dope for those last finishing touches. Frequently a gallon or less would do the trick, hence the "Panic Can." This would be particularly handy for those EAA'ers like myself, who can afford only minimum purchases of clear dope. The dope normally lost, i.e., drippings on the sides of the can, brush pot, brush handle or that spilled on the workbench or floor is saved with the use of the "Panic Can."

Take an empty, round, one gallon can and clean thoroughly; mark this can in some way and set it aside. Each time after cleaning your brush, pour the thinner into the marked can, seal and set aside. Each time before beginning the next doping session, peel the hardened dope from the sides of the can, brush pot, brush handle or the spillage on the workbench or floor and drop it into the "Panic Can." Don't fret if the hardened dope picks up fabric scraps, dirt, junk, etc. — you'll fix that later.

Now then, Mr. EAA'er, when you find you're fresh out of dope and can't finish that last wing section, do you panic? Nope. You reach for your "Panic Can" filter out (use a commercial lacquer filter, or in a pinch, a section of Ma's nylon stocking), the contaminates and finish the job.

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TACK WELDING TIPS

By Al Griffin

2567 Eleventh Ave., Hayward, Calif.

Here are some tips I will pass along for what they are worth:

1. I cut 4 inch holes in my plywood fuselage jig at the cluster joints to facilitate tack welding. Also makes nice finger holds for removing frame from jig.

2. Put a piece of paper between two blocks 1 inch by 2 inch by 4 inch. Bore holes through block to match the tube sizes you are using. ($\frac{3}{4}$ - $\frac{5}{8}$ - $\frac{3}{8}$). Remove paper and you have a handy holder for filing and cutting tubing.

3. In laying out my tail feathers I swung the radius on the jig by boring two small holes the correct distance apart in a scrap of aluminum.

4. On the Miniplane compression strut fittings a friend turned mine out on a lathe but if I had to make them again I would construct them as follows: Cut a piece of round stock the I.D. of the compression strut. I'd make it about $\frac{1}{4}$ inch long, and fabricate to the $\frac{1}{4}$ inch strap with a countersunk screw or rivet.

DRILLS HOLES FOR LARGER MAGAZINE

By Herman P. Katschke

15227 Hiawatha Dr., Orland Park, Ill.

Since *SPORT AVIATION* magazine has increased its pages, I can't punch holes in it with a hand punch. To overcome this I took a 5/16 inch drill and drilled a hole through the table of my drill press. Then I ground off the opposite end of the drill flat. By putting the drill in upside down I just pull down the lever for a neat, clean hole.

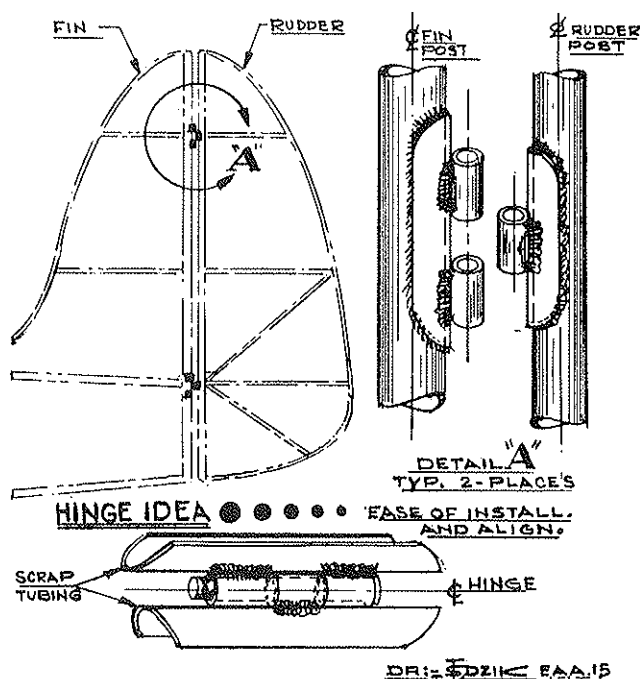
SCREW DRIVER HOLDS SMALL NAILS

By H. C. Foster, EAA 10200

Box 34, Wexford, Pa.

Here is a tip that is particularly helpful in the building of wooden wing ribs or any other construction which requires the use of one-quarter or three-eighths inch long aircraft nails. Any craftsman who has worked with extremely short nails encounters the problem of holding the nail upright prior to the first blow of the hammer. It is virtually impossible to hold an 18, 19 or 20 gauge nail one-quarter inch long with the fingers without these fingers taking the brunt of the hammer blow intended for the nail. It has been common practice to use a pair of long nosed pliers to pick up the nail and hold it in place for the initial blow of the hammer.

An alternate method, quicker and easier than the use of pliers, is the use of a small magnetic screw driver generally available in any hardware store. This type of screw driver with a magnetic tip enables the craftsman to pick up the nail and hold it in place for hammering. With just a little practice it is possible to make considerably better time than any other method that might be used to hold the extremely small nails used in substantial quantities in the construction of wooden aircraft components.



A HINGE IDEA

By Jerry Nolan

648 Soundview, Bronx, N.Y.

Here is a hinge idea: I'd like to see some small outfit pre-weld these hinge assemblies and market them. All one would have to do is finish weld the hinge to the two rudder posts.

FINISHING OF AIRCRAFT

By Orv Lippert, EAA 9159

President, Chapter 134, Central Michigan
Riverdale, Mich.

This concerns the finishing of aircraft. Normally many otherwise fine looking homebuilts suffer from an

"amateur" paint job. This on close inspection shows touch-up marks, paint peel, runs, sags, etc.

First of all on preparing a new surface for finish. Lay out your color plans on a separate sheet of paper, with either oil or water colors. This will help you as a guide for later maskings. You can't pull off the masking tape half way through to know just how it's going to look.

On a dope finish airplane water sand the last coat of dope with No. 220 wet or dry paper, using plenty of water. When it dries check to see if there are any spots that are through, or rough places. If there are, touch them up. Then give the whole surface a wet coat of silver CAB dope. Go away and come back the next day.

Never touch the surface with sandpaper again. Now you are ready for color. If dope, go ahead and shoot your first color in as with the silver. (Make sure that after you use CAB dope once, you NEVER go back to nitrate dope). If enamel, I spray one real light coat over the whole surface. Then I heat the rest of the enamel hot enough that it will spray without reducer, and follow up the first coat with a second heavy coat. (Don't even try to enamel with outside air temperature below 80 degrees F.). Then go away and come back the next day.

Now notice, if the drying temperature has been 80 degrees or more, I usually go right ahead and mask on the fresh enamel. (Wait for the screams on this). First of all when starting to mask, do you have any tape on hand? If so, throw it away, and go buy some FRESH tape. Use only 1/4 inch tape for contact with the fresh painted sur-

face. If the local supply stores don't stock 1/4 inch tape, don't paint until you get some. Then lay out your second color with tape. Mask. Use 1/2 inch or 3/4 inch tape to stick the masking paper to the 1/4 inch tape. NOT TO THE PAINTED SURFACE. Go ahead and spray your second coat of enamel. Go have a cup of coffee, perhaps take the wife out to the local FAA office for a refreshing bit of humor, or something. Don't go to bed just yet, however, as soon as this second coat is dry, approximately two to three hours, remove the mask, being very careful not to touch the last coat. Then get away from the job until the next day. If a two color job is all that you are working for, you are all set. A light hosing down with cold water will harden the enamel before flying the new paint. This will keep bugs from slamming into the soft surface as you take your pride and joy up for all to behold.

This primarily concerns finishing a surface with enamel. However, the 1/4 inch tape works equally well on dope finishes and will not pull along the edges.

In case you are unfortunate enough to have to wait for several days before attempting a second coat of enamel wait for at least a week or 10 days, otherwise the new thinned coat of enamel over the improperly set up first coat will cause an interesting effect similar to an alligator's tail end. This can be preserved if one likes, as an unusual crackle job and will cause comment wherever you show it.

Turtleback Baggage Compartment

By Henry E. Winslow, EAA 595

MOST TURTLEBACKS on the open cockpit homebuilts I have seen are made up from wooden formers with stringers fitted into slots notched into the formers. I use a different type of former which gives me more room to use as a baggage compartment behind the back rest in the turtleback itself.

Instead of wooden formers I used 1/4 in. 4130 tubing bent to shape and welded directly to the top longerons of the aircraft. Next I bent up a quantity of "U" shapes clips from .020 cold rolled plate 1/2 in. wide. These are tack welded to the top of the tubing formers to take the wood

stringers. I held my stringers to the clips with Tinnerman screws and nuts.

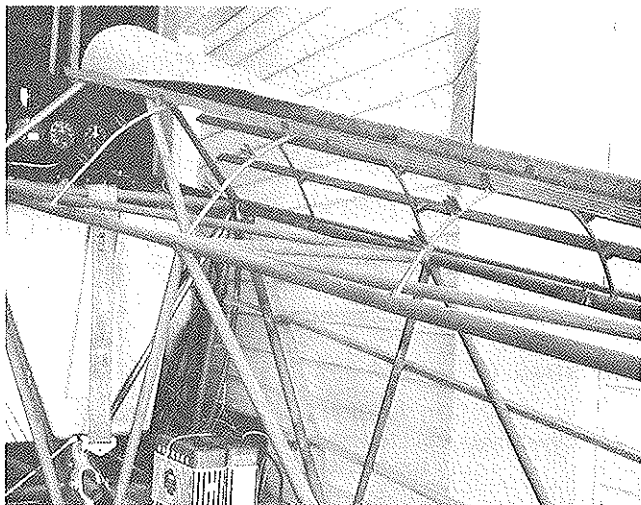
The back of the baggage compartment is made of 1/2 in. plywood fastened to the former tubing with several straps and the 1/2 in. plywood floor is strapped to the top longerons.

The front former is made of 1/4 in. plywood as this gives needed stiffness to tack and dope the fabric to. I cut my former out to leave a 1 1/2 in. edge all around and a cover plate of 1/8 in. plywood is hinged at the bottom to swing forward when the latch on the top is released to give access to the baggage compartment.

Be sure to figure out how much baggage you can carry in the compartment and then it is wise to cut that figure to 80 percent so you will not get too close to exceeding the rearmost center of gravity requirement. Type up or have engraved a plate to be mounted on the inside of the backrest plate giving the max. baggage weight allowable. In almost any ship the CG should be such that 30 lbs. could be carried. This is enough to take care of a change of clothes for an overnight trip and some spares such as tie down kit, spark plugs, spare oil, etc. Some web straps should be screwed or bolted to the floor to tie the baggage so it will not slide around in rough air nor in the case of the tie down rods poke a hole thru the fabric.

As the cover plate hinges and so is not a permanent installation it is a simple matter to upholster it for a neat appearance. Also this area is a good one to screw some transparent holders to for carrying the ships airworthiness certificate, table of limitations, radio license, etc. as they are sure to be seen by anyone entering the cockpit.

Henry Winslow lives at 314 East Hazel St., Inglewood, Calif.

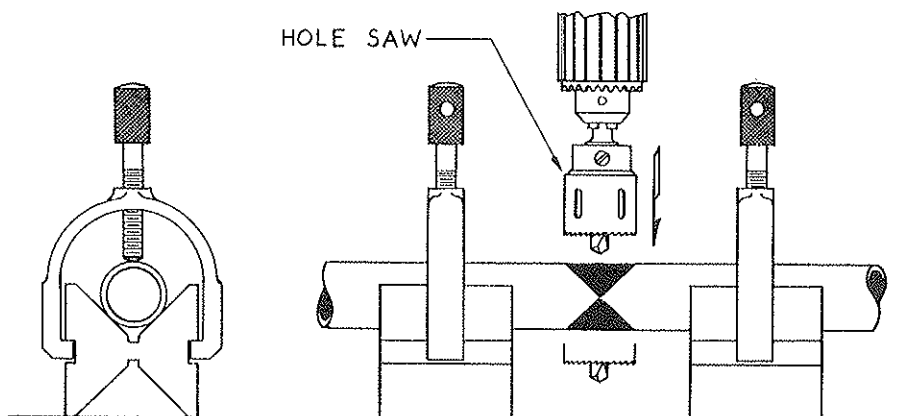


Front, back and floor removed to show metal tubing formers and clips clearly.

TIP FOR CUTTING TUBING

Most mechanics resort to the time-honored method of hacksawing and filing when fitting the ends of steel tubing together for welding. The amateur aircraft builder, however, finds this to be tedious when cutting the many tubes in a fuselage. One of the simpler ways of doing it faster is to get a dressing tool and shape the face of a

with any suitable vee-block and clamp arrangement, making sure the tube is held so that it cannot turn in any direction, and just bring the saw down. These saws will cut over their own diameter in depth and as a result the tube will be severed completely in one pass. The end shape which results is perfect for a 90° joint. I have found this scheme works



Drawing by Robert F. Pauley

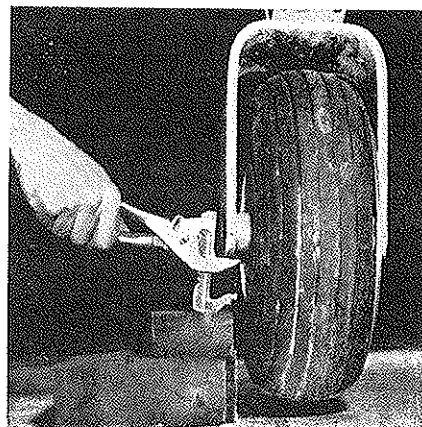
grinding wheel into semi-circular form. However, I have found that there is yet another simple, inexpensive trick, particularly helpful when many tubes have to be fitted.

Purchase a standard hole cutting saw the same size as the tubing. These saws are available at all good hardware stores. Put it into a drill press set for high speed, place the tubing to be cut on the drill table

best on right angle cutoffs, but you can experiment on other cuts if you wish. The "U" cuts made in this way can quickly be deepened with a round-faced grinding wheel or even a rat tail file when 45 deg. joints are needed. One firm which makes hole saws is the L. S. Starrett Co., Athol, Mass., and they are available in sizes from 9/16 in. to 6 in. — Bruce E. Graham, EAA 4303.

PLIERWRENCH AIDS AIRCRAFT WORK

Our friends at Cooper Industries, Inc., 2149 E. Pratt Blvd., Elk Grove Village, Ill., send along this photo of their handy "PLIERWRENCH". Having a geared action, this tool has a 10-to-1 gripping power and is shown here actually raising the nose wheel of an airplane off the floor. It can be used to grip polished and plated nuts to avoid the scuffing action of fixed-jaw wrenches, it will bend springs to shape, gets stripped and chewed nuts off, serves as a powerful clamp, a pipe wrench, tube cutter and internal-external wrench. Tool sells for \$12.75 including pouch, universal jaw, wire jaw, pipe jaw, internal-external jaw and tube cutter.



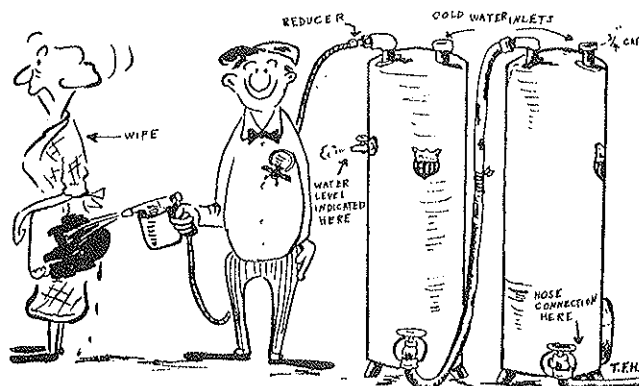
A Low Cost Air Compressor

By Ralph J. Cox, EAA 11804 and
Thomas Hurley, EAA 6675
203 Locust St., Santa Cruz, Calif.

OLD HOT water heater tanks can be had for the asking from friends and relatives, or other EAA members, and with the small leaks plugged or welded closed, they can be used for this project.

Screw a 3/4 in. pipe cap on the cold water inlet on both tanks (one tank can be used, but does not provide the leisure time for spraying), hook a short piece of hose or a pipe connector from the hot water outlet to the bottom drain on the second tank reducer fittings. Connect the spray hose to the hot water outlet on the second tank, and make sure that all of the connections are secure and do not leak.

Lead the water hose to the drain outlet on the first tank, and incoming water at household pressure (usually



close to 40 lbs. in many areas) will maintain steady even air pressure. If you do not have adequate line pressure, then the deal is off! But most areas do, so we seriously doubt that many people will have any trouble. For a water level gauge, use a small petcock brazed into the tank, or a very small hole drilled near the top of the second tank will do the same. When the water comes sizzling out of the small leak provided herein, then you know that the tanks need draining into the petunia bed. Obviously, the system isn't very portable, but then it's cheap, and that's something!

Mayday . . . SOS . . . Mayday

Attention All Homebuilders

By Norm Ginn
Van Nuys, Calif.

THE PHOTOGRAPHS will immediately bring to your attention a very vital part of your plane, the control system push-pull tubes. This is a common type of control on both "homebuilt" and "store-boughten" aircraft.

A recent fatality here on the west coast is the reason for this article. **EVERYONE** who has a plane flying should pull the inspection plates and check **ALL** of your push-pull tubes.

The critical item is the "screw-in ball joints" that we all use on the ends of our push-pull tubes. **MAKE SURE** you have a **right-hand thread** with lock nuts on each end. If vibration loosens the lock nuts, the tube will loosen on one end and tighten on the other. If a left and a right are used the tube will come off and

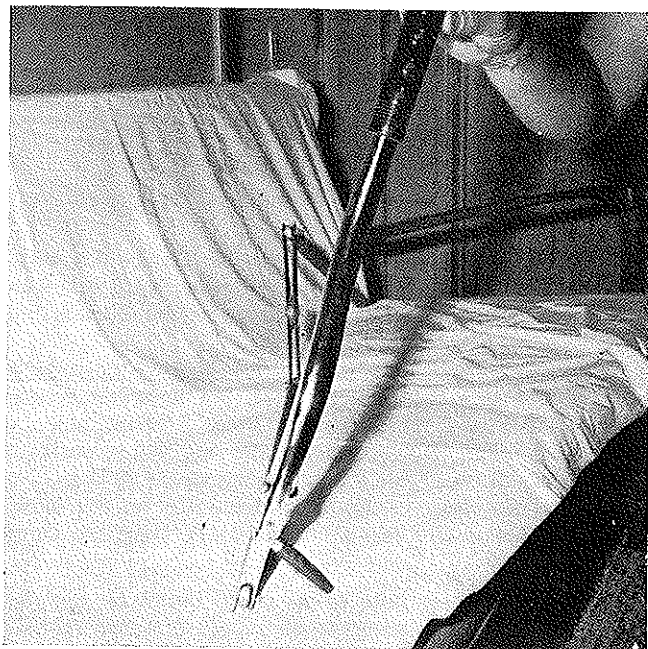
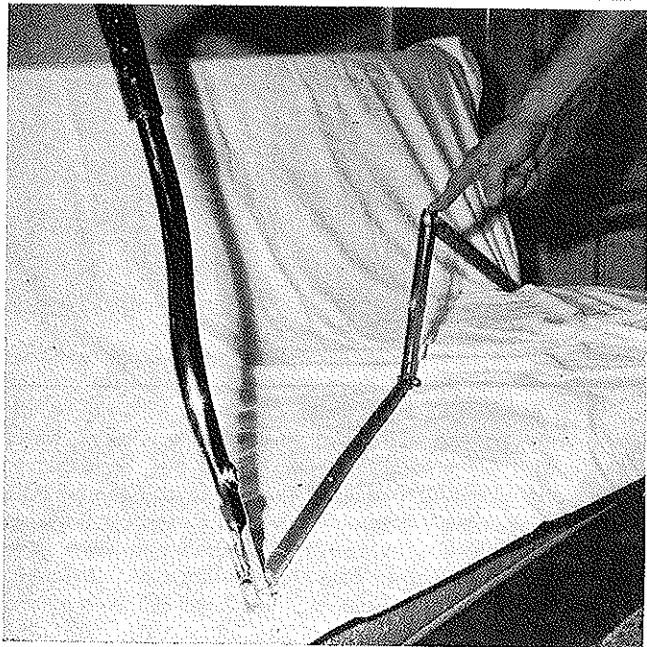
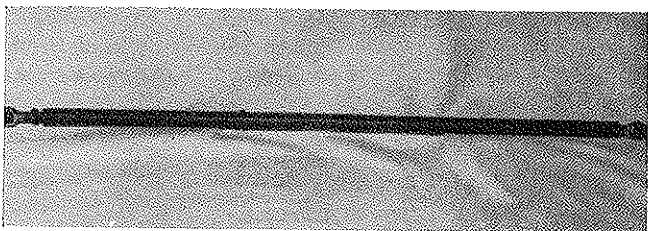
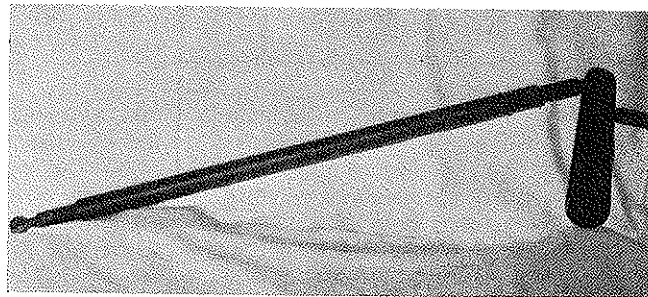
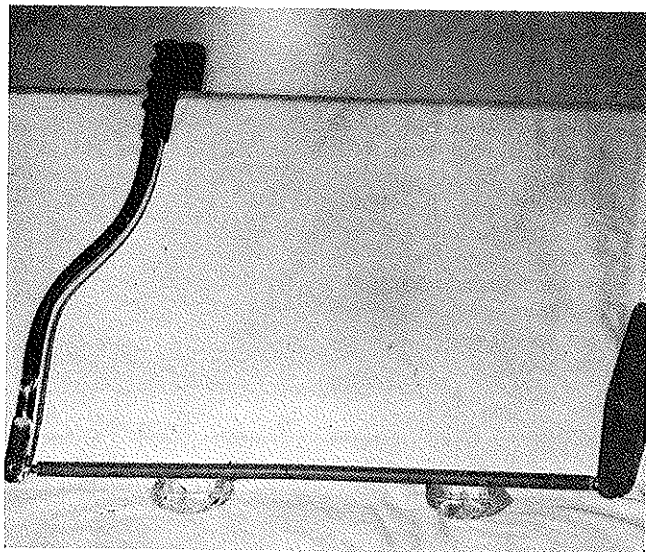
A dab of paint can be applied between the lock nut and the tube. When the inspection plates are removed one can very quickly see if all is secure. If the nut has

started to work loose, the paint will be cracked.

Another very important item is the "control stops." The aileron stops should be at the stick or torque tube and not at just the bell crank in the wings. Aileron movement of the stick with no stops could possibly put pressure on the elevator push-pull ball joint which might cause the lock nut to be loosened.

The stick side movement (aileron action) should not be great enough to twist the self-centering rod ends to such a degree that it is actually starting to turn the rod ends.

Don't say after reading this article, "My controls are OK. I couldn't have made a mistake." **EVERYONE CAN MAKE A MISTAKE.** After the accident, FAA started checking **COMMERCIAL** aircraft and, you guessed it, they found a helicopter with a left and a right hand thread. Bulletins are being sent out to all areas on this subject. Make sure **YOU** are around to read them. •



Some Notes On The Testing Of Non-Standard Fabrics For The Construction Of Amateur-Built Aircraft

By Reed Johnson
1678 Lincoln St., Berkeley, Calif.

THE DESIRE of the homebuilder to experiment and devise in the construction of his "baby" is one of the reasons for the existence of our organization. Most of us are constantly looking for better, easier, or more economical ways of doing things, consistent with safe practices. It was for this reason that I began looking for a material which would be better than cotton and cheaper than Ceconite. I then conducted some tests of a number of easily obtained fabrics that could be used for homebuilts. The following covers the methods used in making these tests and the final results obtained.

First of all, I was interested in the comparative weights of the different fabrics, so I die-cut $\frac{1}{8}$ in. samples of the various fabrics I desired to test. The reason for the die-cutting was the need for absolute uniformity in size due to the very small samples taken. These samples were then weighed on an analytical balance for comparative weights. It must be emphasized that all of the data obtained is comparative. No attempt was made to obtain absolute values. The number of samples and the quantity of material that could have been tested would have been beyond what I wished to concern myself with. Therefore, the samples were all taken, in each case, from the same bolt of fabric and no diversification was made between different runs. In these tests, all material that tested considerably below the tensile strength of Grade A cotton was discarded and no data on such material is presented. It is interesting to note, in this regard, that all of the Dacron-cotton fabrics were inferior.

The apparatus for testing was very simple. Two clamps were made to grip the samples with an even grip and with polished jaws so that the fabric would not be cut by the jaws of the clamps. One clamp was suspended in a doorway and the other was attached to a plastic bucket. The samples were clamped in these two clamps and lead weights were placed in the bucket, in increments of $1\frac{1}{2}$ lbs., until the sample pulled apart. Considerable care was used to insure that the pull was taken by the full width of the test pieces which were $\frac{1}{8}$ in. in width, all cut at the same time.

All samples broke within the length of the piece and not at the clamps. This would indicate that the results were truly comparable. After discarding all unsatisfactory samples, the results in tensile strength and comparative weight were as follows:

Fabric	Comparative Loading	Comparative Weights
Grade A Cotton	49 lbs. 2 oz.	58.65 milligrams
Ceconite	77 lbs. 5 oz.	50.45 milligrams
Polaron	77 lbs. 5 oz.	42.00 milligrams
M.W. 16B1446	70 lbs. 6 oz.	38.95 milligrams
M.W. 16B1233	56 lbs. 11 oz.	25.90 milligrams
M.W. 16B1232	39 lbs. 8 oz.	25.60 milligrams
M.W. 16B1589	49 lbs. 0 oz.	25.40 milligrams

All samples with an M.W. number represent the catalog number in a Montgomery Ward catalog for the Oakland, Calif. supply house. I presume that the numbers are the same for other Montgomery Ward locations. The following is a Summary of Fabrics:

Grade A Cotton is the standard aircraft cotton.

Ceconite is the covering material sold by the Cooper Engineering Co. of Van Nuys, Calif. The price of Ceconite per inch yard is 5.9 cents.

Polaron is the trade name for a flat weave 100 percent Dacron material produced by Travis Fabrics Inc., of New York. One retail outlet is Freifelds' at 2042 University Ave., Berkeley 4, Calif. The price is \$1.49 per yard in 44 in. width, or 3.39 cents per inch yard.

M.W. 16B1446 is sold by Montgomery Ward and Co., and is listed as 100 percent polyester Dacron Uniform cloth. It is priced at \$1.37 per yard in 44 in. width, or 3.1 cents per inch yard.

M.W. 16B1233 is a Dacron Crepe. The crepe pattern disappears when it is shrunk with a hot iron. The price per yard in 44 in. width is \$1.64, or 3.73 cents per inch yard.

M.W. 16B1232 is listed in Montgomery Ward's catalog as, "Dacron Batiste," and sells at \$.97 per yard in a 47 in. width, or 2.06 cents per inch yard. This is a very sheer material that would be suitable for ultra-lights or sailplanes.

M.W. 16B1589 is an all-Dacron material that is available only in a printed pattern, but that matters little since it would be painted anyway. It is listed at \$1.47 per yard in 44 in. width, or 3.34 cents per inch yard.

Summarized, the above tests show that M.W. 16B1233, M.W. 16B1232 and M.W. 16B1589, (which are Dacron fabrics sold by Montgomery Ward and Co.) are equal to, or very nearly equal to grade A cotton in strength, but weigh less than half the weight of grade A cotton.

M.W. 16B1446 is a Dacron material that is a little over 43 percent stronger than grade A cotton and has about two-thirds of its weight.

Polaron is equal in strength to Ceconite but has only four-fifths of its weight and, best of all, is just a little more than half the price.

All of the fabrics listed tighten up with a hot iron the same as Ceconite and all must use reinforcing tape and rib cord of greater life expectancy than cotton or linen. I have been informed that Ceconite is basically Dacron, though only the Cooper Engineering Co. knows for sure just what it is.

In an effort to find something less costly than the \$8.25 asked for a half pound of Ceconite rib stitching cord, I tested a Dacron cord distributed by the Brownell Co. of Moodus, Conn. It is known as: Bonded Dacron type B and used for making archery bow strings. It is sold by many archery supply houses for \$7.50 per $\frac{1}{4}$ lb. Since it is much lighter than Ceconite rib cord, a quarter pound will go as far, or farther than a half pound of the Ceconite product. It tests at $33\frac{1}{2}$ lbs. breaking strength. This is a little less than the standard requirement set up in CAM 18 of 40 lbs. minimum, but it must be remembered that this standard was set for linen cord, which deteriorates at a greater rate than Dacron. The strength standard could be more than met for "do not exceed speeds" in excess of 150 mph by doubling the cord, by using the double loop knot, or by using 15 percent closer

stitching. Even so, it will be cheaper and the smaller bulk, even doubled, makes a neater job.

Herter's of Waseca, Minn., sells a Dacron cord that appears to be the same as Brownell's, even to the spool it is wound on. It is sold plain or pre-waxed at a price of \$1.39 per ¼ lb. spool. The samples I tested broke at 31 lbs. 7 oz. and 29 lbs. 10 oz., respectively. This is not a significant difference from the more expensive Brownell material. Used double, this cord is well above the recommended minimum. The catalog number of the pre-waxed cord is: QN3H1A and for the plain unwaxed cord is: QN3H1. Either type on a ¼ lb. spool sells for \$1.39.

A neat way to double this cord is as follows: start by cutting a length twice as long as required for the stitching. Clip one end of the single cord to some solid object as an anchor. Then thread the other end through the needle and fasten the end to a clip or screw eye held in the chuck of a ¼ in. drill. Stretch the cord and run the drill for only a few seconds, which will tightly twist the cord. If the needle is positioned in the middle of this piece and then the two ends of the cord brought together after disconnecting from the drill and anchor but carefully held taut, the cord will twist itself into a very neat two-ply cord. Some experimentation may be needed to determine the number of seconds to run the drill for each yard of cord. If you have used the pre-waxed material, it will be all ready to use. For my set-up I have a strong spring clip screwed to the door, with another at the correct position to hold the needle at right angles to the stretched cord and at its midpoint. Be sure the thread is stretched in a straight line through the eye of the needle or there will be more twist to one ply than the other. This may tend to make it kink up. Keep the single twisted cords taut or they will twist into a hopeless snarl.

Twisting three lengths together will make the equivalent of the Ceconite cord, but two are strong enough for homebuilts of the average speed class. One strand is probably enough for "do not exceed speeds" of 130 mph. The foregoing does not actually involve the amount of trouble that you might surmise from reading about it. If you are working alone it is convenient to have several needles so you will not need to prepare one at a time. You can make up real long lengths by using two lengths side by side, twisting each separately for the same length of time and then placing them together and allowing them to twist together.

I have found nothing better than the reinforcing tape sold by Cooper Engineering, for use with Ceconite. It looks like and is used like Scotch tape, since it is adhesive on one side and is simply pressed into place. No pins are needed and it is not necessary to impregnate it with dope. The "Super Seam" cement put out by Cooper Engineering is great stuff and obviates the necessity of sewing on the cover. It can be cemented, by following their instructions, for any speed limit.

For wing tape I am making my own from M.W. 16B1446 with a pair of pinking shears. I can cut an awful lot of tape for 15 cents a yard and to any special width I need. Since I made these tests, I find that the fabric used by Pete Bowers on his "Fly Baby" is the same as M.W. 16B1446. Not such a bad idea after all. •

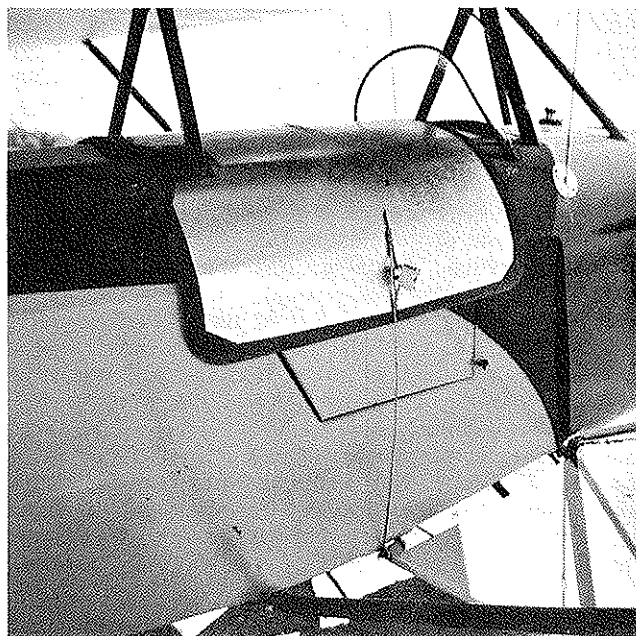
Protection for the Open Cockpit Aircraft

By Rollin C. Caler, EAA 11984

1113 New Mexico St., Boulder City, Nev.

PROTECTION OF the cockpit of my Corben "Baby Ace" from being a source of spare parts for adults, and a playground for children, has very successfully been provided by the use of a simple cockpit cover. This semi-rigid cover goes on quickly, fitting over the windshield and back between the struts, dropping readily into place with very little fore and aft movement. The material is inexpensive .021 in. galvanized iron, obtainable at any builder's supply or hardware store. The edges are wrapped with any kind of cloth tape that has its own adhesive material on it.

A ⅛ in. stranded cable is threaded through ⅛ in. holes in the cover, dropping around the fuselage and brought up from underneath to meet at the solder-spliced eyes, where a padlock can be inserted to seal the cover. The cable used was the clothesline cable that I already



had on hand, but extra theft protection would be provided by the use of hard aircraft cable.

While this is not a cover to take cross-country, it has the advantages of being inexpensive, durable, easy to put on and remove, and easy to make . . . a cardboard template was formed and used as a pattern for cutting the cover from the sheet metal. Besides keeping the children and adults out more effectively than cloth covers, it offers another bonus . . . the cover is locked to my tie-down ring when the airplane is gone, thereby helping to discourage other aircraft owners from parking their airplanes in my spot. •

Leading Prop Edge Clamp

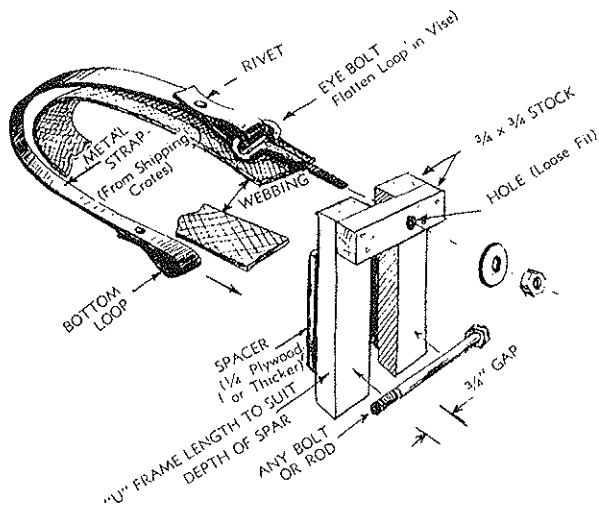
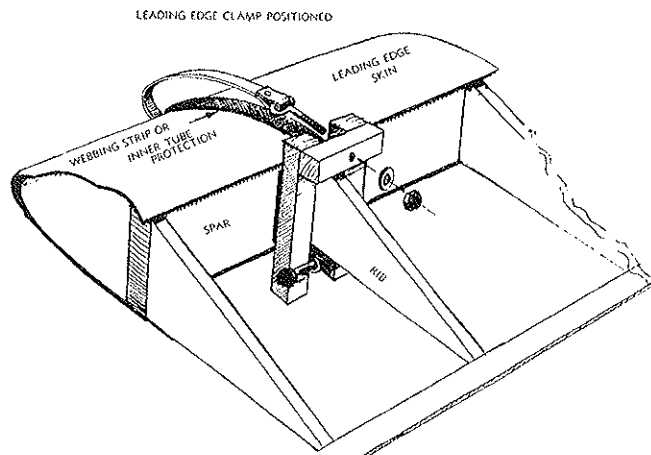
By Maj. Antoni Bingelis, EAA 2643

1111 Carlos Dr., Lincoln 5, Nebr.

THE EXTRA effort taken to insure a good joint when gluing the leading edge skin to flaps, ailerons, or even wings, will help insure maximum strength of structure.

The simple clamp illustrated is easy to make from odds and ends found around the average shop and requires no welding. Its design permits clamping pressure where it is most needed . . . directly over the rib. The clamp is especially valuable if the structure's nose ribs are of thin plywood stock and nail-strip clamping is out of the question. The dimensions are not critical and the device is self adjusting to various spar depths.

For my flaps I made a separate clamp to fit over each rib. The plywood skin was first pre-formed and prepared for gluing. I then cut 1 inch wide rubber loops from an old inner tube and slipped one over each rib and completely around the flap frame. This later pro-



LEADING EDGE CLAMP

vided a cushion under the metal straps and the use of protective webbing as shown in the sketch was not necessary. The inner tube loops also contributed a partial clamping effect and held the skin in place while the clamps were placed and carefully tightened.

NOTE: Be sure your structure is free from warpage and is properly aligned prior to final gluing and clamping of the leading edge.

Notice that the bolt or rod is slipped through the bottom loop of the metal band and is held in place under the rib and behind the "U" frame by tension exerted through the strap when the eyebolt's nut is tightened.

The spacer of plywood holds the clamp frame away from the spar to insure that there is no interference with the untrimmed edge of the plywood cover being glued.

This same gadget can also be used to hold a balky metal leading edge cover in exact position for nailing. •

New Wrought Aluminum Alloy Commercial Designation System

By Harold Passow, EAA 2709

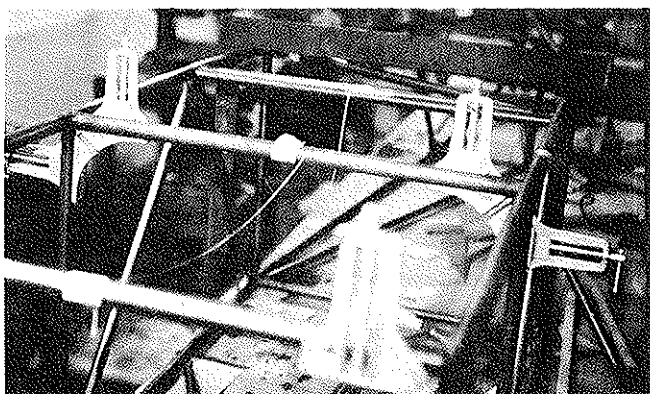
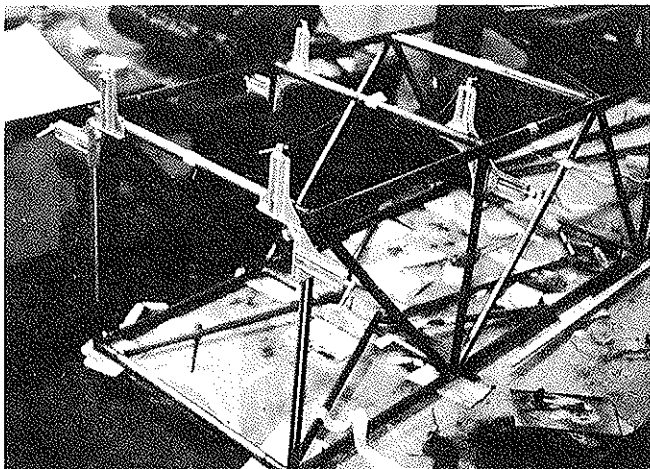
A NEW wrought alloy commercial designation system for aluminum and aluminum alloy products, (sheet, plate, forgings, tubing, extrusions) has been developed by the Aluminum Association. This system of identification became effective on October 1, 1954 and all wrought material produced after that date is marked according to the new system. Casting alloys are not affected.

The temple designations such as —T4, —T6, remain the same and are affixed to the alloy designation in the same manner. Thus, Alclad 24 S-T4 is now Alclad 2024-T4, 61S-0 is now 6061-0 and 75S-T6 is now 7075-T6.

The new designations are number changes only. The alloys are the same, in all respects, as before and like alloys are completely interchangeable.

The old and new designations for the wrought alloys are as follows:

Old Designation	New Designation
2 S	1100
3 S	3003
14 S	2014
17 S	2017
A17 S	2117
24 S	2024
43 S	4043
52 S	5052
53 S	6053
56 S	5056
61 S	6061
62 S	6062
75 S	7075
XA78 S	X7178
78 S	7178



TUBING CLAMPS

By Thomas W. Martin, EAA 12149
Meeting Grove Lane, Norwalk, Conn.

When joining the two fuselage sides of a welded steel structure, it might be helpful to others to suggest the idea which I found very useful.

The tubing will stay right where you want it if you employ Stanley 404 picture frame clamps. These are made of cast metal, and will hold a true 90 deg. angle for welding or tacking.

Trimming Windshields

By P. Richard Coughlin, EAA 7333
109 W. Seneca Turnpike, Syracuse 5, N.Y.

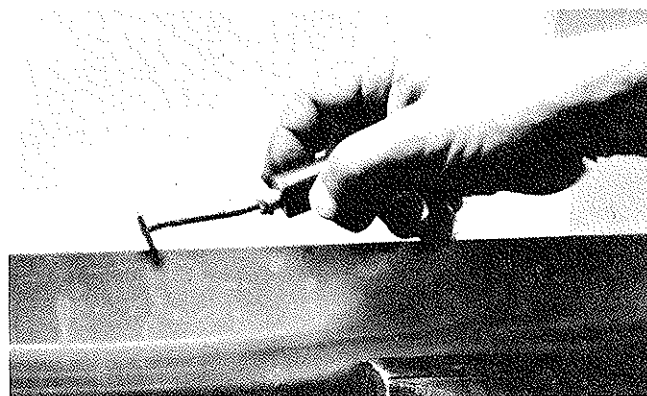
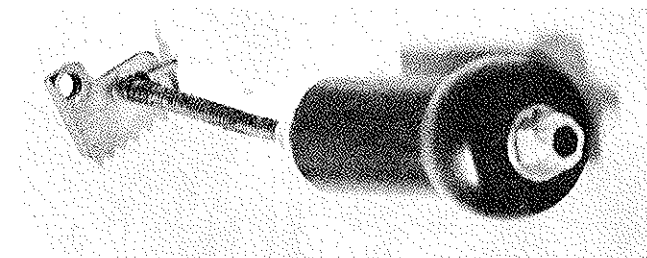
HERE'S AN IDEA on how to apply a very neat, attractive edge moulding to the plastic windshield of an open-cockpit plane. There is on the market a product called "Silvatrim", a plastic channel material of "U" shape, or, to be more accurate, of pear shape as the upper ends of the "U" are tapered down to fair into the surface to which the stripping is applied. It is made by Glass Laboratories, 883 65th St., Brooklyn 20, N.Y., and sold through auto supply shops in strip and roll form. It is supposed to be applied to the rear edges of auto doors for trimming, and for this use it has a chrome-plated plastic exterior surface of good appearance. The inside of the groove is coated with pressure-sensitive material which

DEBURRING SHEET ALUMINUM

By Henry E. Winslow, EAA 595
Mira Loma Circle Apt., Unit 14A
1600 W. 5th St., Oxnard, Calif.

Deburring sheet aluminum with a file is a long, tedious process, and often the results are not as desired. Here is a tool which not only does an excellent job of deburring, but is fast and neat. It also works well on curved edges. The main part is one of the double blades from a wire stripper used by electricians. A rod is fitted through the hole in the blade and peened over. A handle is fitted on the other end of the rod. To finish the tool the rod is bent so that the blade angle to the work is tilted toward the handle about 10 deg. from vertical.

To use it is simplicity itself! One of the half-round holes in the blade is placed on the edge of the aluminum and the tool is pulled toward yourself, deburring both edges as it goes.



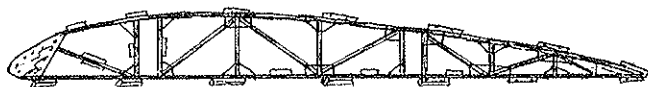
holds tighter with the passage of time. It is very inexpensive, is easy to form, and readily cut. It will bend to any curvature down to about six inches radius. When applied to the edge of an airplane windshield it looks just like a tailor-made metal edging. It is quite weather resistant and besides looking well no doubt can increase the resistance to cracking of a plastic windshield.

BRONZE WOOL RECOMMENDED

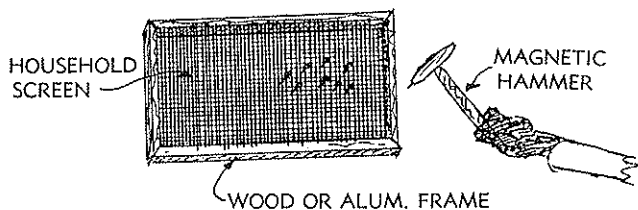
If steel wool is used in maintenance work inside an airplane, tiny steel particles dropped from it will eventually cause rust spots on surfaces upon which they fall. Boat yards use bronze wool, available from marine supply houses, to avoid that trouble. Non-magnetic, too, and particles won't be picked up by charged electrical components — fine for use when overhauling magnetoes, etc.

NAIL SCREEN

By John W. Grega, EAA 3808
355 Grand Blvd., Bedford, Ohio



RIB JIG



The most troublesome operation in nailing gussets, or skinning a wing, is picking up the small nails with a magnetic tack hammer.

With this set-up, all the nails can be picked up right the first time, as all the heads of the nails will be facing up. There will be no need to position the nail on the hammer head so it can be driven straight.

A frame can be assembled out of 1 in. by 2 in. stock, about 12 in. square, and ordinary household screen tacked or stapled to it.

Ready-made aluminum framed screen can be used, providing it is of a convenient size.

The nails are strewn across the screen, the screen is picked up in both hands, and moved sharply sideways, back and forth, until all the nails fall in the screen openings, points down.

The frame is set on the work bench, ready for use. The magnetic end of the hammer is touched to the nail head, the nail picked up and driven home through the gusset.

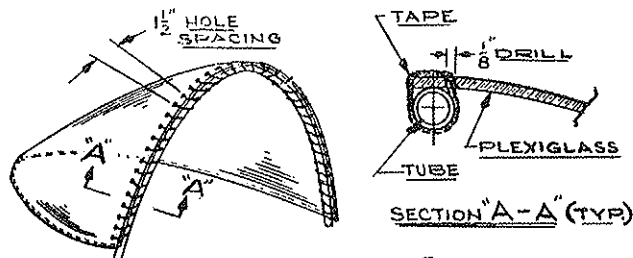
The frame, with the nails on it, can be stored after the job is completed, and when the next job is started, the frame will be ready for use. •

ATTACHMENT OF PLEXIGLASS TO WINDSHIELD FRAME

By Paul Stadler, EAA 7463
1459 Acheson, San Diego 11, Calif.

If anyone has ever worked with plexiglass for their windshield and canopy, they will know how cumbersome it can be in attaching it to the frame. The holes are usually large enough to allow for the rubber bushings, yet too close to the edge to avoid cracks. The bolts are usually too tight to allow for expansion and contraction, and yet you want a tight cabin with as little noise as possible? Why not try this next time?

Drill a series of 1/8 in. holes around the edge, spaced 1 1/2 in. apart, and dull the edges of the holes with fine sandpaper, working also between the holes and the outer edge of the plexiglass, both inside and out. Lace with 1 in. fiberglass tape, but keep it loose. Then mix a small



DR. J. DZIK E.A.A. NO. 15

amount of epoxy-resin, and paint the plexiglass and the tape, beginning at the first hole, drawing it up tight, and then proceeding to each following hole and doing the same. Cover the lacing with a plastic wrapping, and clamp it down with a strip of spruce or plywood to flatten the fiberglass tape against the plexiglass, and let it set.

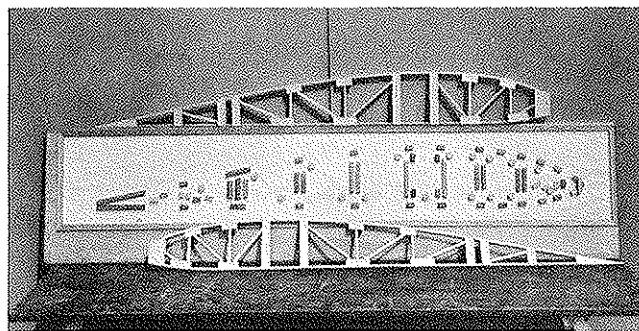
This method will insure a neat job, and a safe and trouble-free installation. A few sheet metal screws may be necessary to hold things in place during this operation, but they can be removed later. •

REMOVING RIBS FROM THE JIG MADE EASY

By Stewart Steinberg, EAA 2128
1638 Churchill Rd., Sarnia, Ontario, Canada

While building the ribs of my homebuilt airplane, I was faced with the problem of getting the ribs out of the jig. I was having trouble with the glue that pressed out sticking to the jig board, so I tried this on the jig board and it worked very well.

When using full-size plans of a rib, to save a lot of time, and get your rib out of the jig easier and with less pressure applied on the rib, try this: Fasten your full-size rib print to your jig board with tacks, or Scotch tape, then cover the print with a medium-heavy clear plastic, and fasten it over the print with tacks or tape. Now you can put your holding blocks around the edge of your print to form your rib by using an Exacto knife. Cut the plastic and



the print through to the wood, slightly smaller than the blocks, then put a drop of Bond-Fast on the blocks and nail them to the jig board. The blocks will help hold the print and the plastic tight to the jig board.

Now you can start to build your ribs. You will find that any glue that is pressed out of the joints cannot stick to the jig, due to the plastic cover under the rib. You will also find that your rib is easily removed from the jig. •

PLATING PRECAUTIONS

By Charles Lasher, EAA 1419

1430 W. 29th St., Hialeah, Fla.

AMATEUR AIRCRAFT builders should be very cautious about chromium and cadmium plating. Seeing highly attractive plated parts on other airplanes, the temptation is to have similar parts of one's own airplane plated.

But, there's more to it than meets the eye! Non-structural parts, such as engine rocker arm covers, wheel hub caps, door handles and so on, can be plated by any commercial plating shop with no precautions other than what may be needed to obtain an attractive job.

Structural parts which are to be plated should be taken only to a shop which specializes in, and is equipped to do, **industrial plating**, as opposed to simple decorative plating. The kind of work coming under the industrial plating classification includes plating done to protect parts from corrosion, to increase the wear resistance of parts, to build parts up to certain dimensions, to repair old parts by building up worn spots, and so on.

The higher the grade of steel used for a part, the more important it is to have such an expert shop do the plating. Improper chemical content of plating solutions—and there are many kinds in use—and improper procedures in doing the plating will often suffuse hydrogen ions into the steel and make it become brittle. Most of the hydrogen can be removed by heat treating, hence the importance of taking the work to a shop which understands such advanced plating processes and is equipped with ovens of suitable size to heat plated parts to 300 deg. F or more.

In general, don't plate structural parts just to make them look nice. If you must plate, pick an ethical shop and make sure they know that they are plating aircraft parts. Be cautious with steel parts such as chrome moly and anything harder. Never replate hard steel items such as streamlined wires, bolts, bearings, AN hardware, rocker arms, etc. If for any reason plating of such items seems essential, consult real experts first.



(Leo J. Kohn Photo)

An example of a highly decorative effect, which plating brings to an aircraft, can be seen in this Druine "Turbulent", where all of the landing gear struts are chrome plated, as well as the engine parts.



(Leo J. Kohn Photo)

Special care should be given to plating of structural parts, such as the "I" struts on this Mong "Sport."

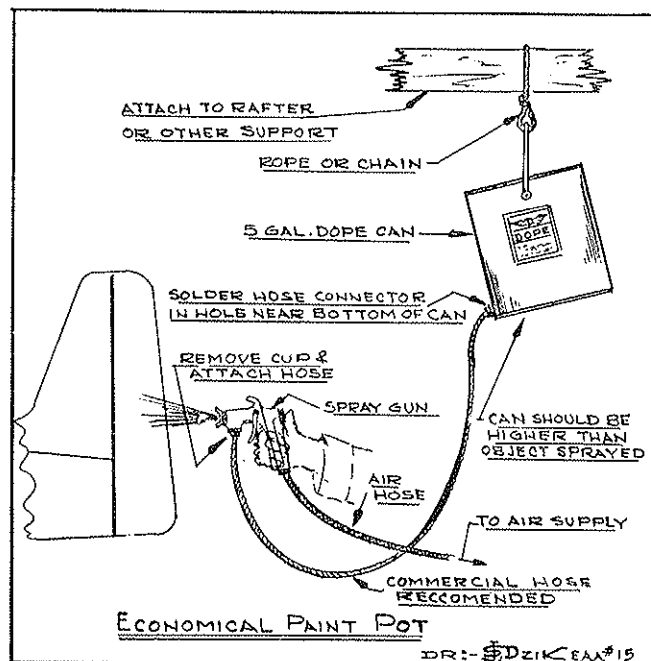
Economical Paint Pot

By Alvin E. Johnson, EAA 6599

R. D. 1, Box 276, Oxford, Pa.

RECENTLY, WHILE looking around in a local A & E shop, I saw this money and time saving idea. Every one who has done a large paint or dope job knows that refilling a quart spray gun cup is very bothersome, and the cost of a big pressure pot is certainly out of the question, especially if it would be seldom used.

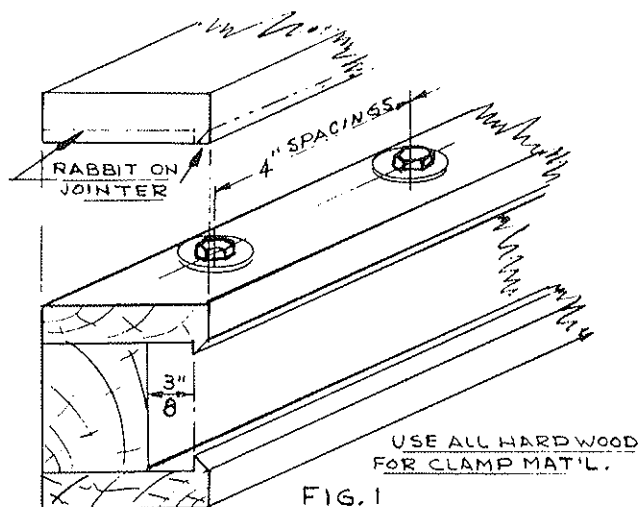
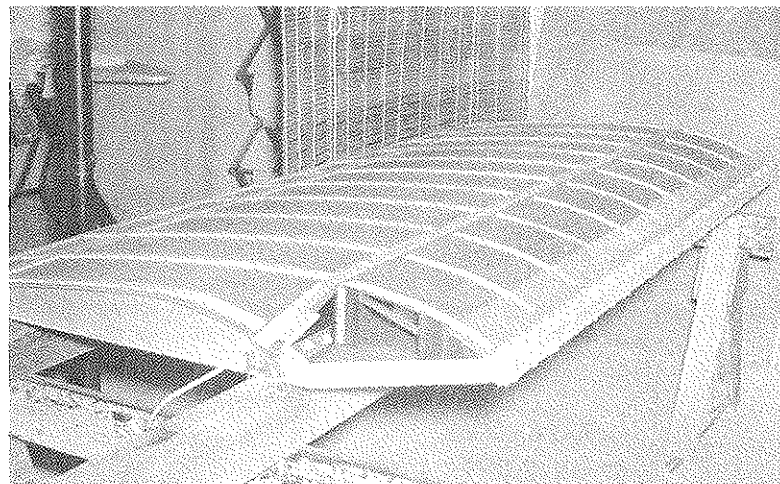
All that is needed for this economical paint pot is a clean 5 gal. dope can, and 15 or 20 ft. of paint hose from Sears and Roebuck. The local hardware or auto parts store should have a pipe fitting that can be soldered near the bottom of the dope can. Cut the top out of the can for ease of filling and ventilation. Connect the hoses, strain the dope into the can, hang it up and you are ready to spray. Let the law of gravity work for you, and save you time and money.



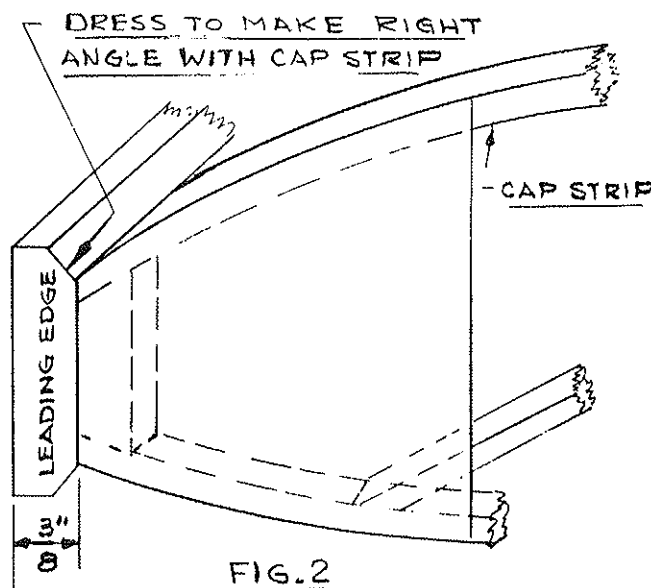
Wing Leading Edge Clamp

PLYWOOD TO SPRUCE

By F/L J. E. Riley, EAA 7118
RCAF Station Vancouver
Richmond, British Columbia, Canada



- (A) DRILL BOLT HOLES THROUGH THE THREE IN ONE OPERATION.
(B) DETERMINE CLAMP PIECES DIM'S. BY REFERENCE TO LEADING EDGE AS SHOWN IN FIG. 3

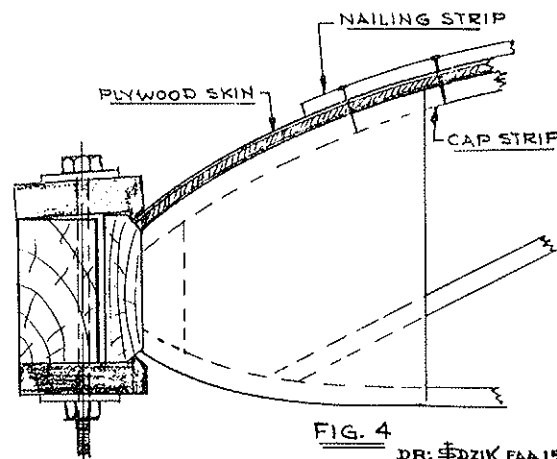
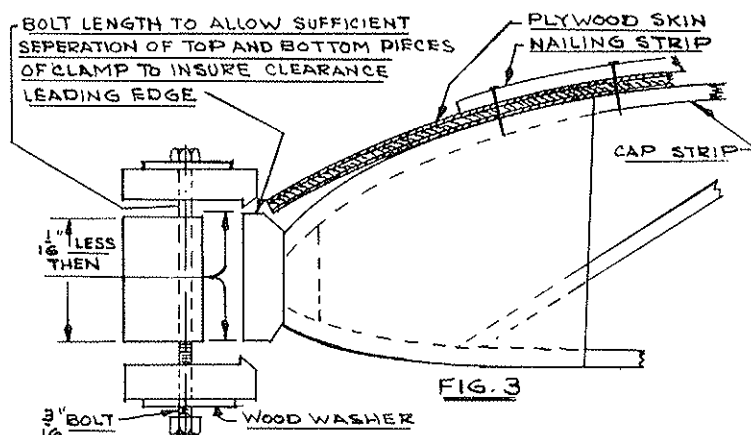


YOU WILL immediately recognize by the photo that I employed Gene Slade's method of nailing down the plywood skin. To review his method, the skin was positioned on the main spar by driving two nails, one at each end, through the skin into the spar and then the nail heads were cut off. The skin was fitted to close tolerance at the leading edge and the root area, and then the skin was lifted free of the positioning nails in the spar. The

wing framework was then coated with glue, the skin repositioned, and nailed down with pre-nailed wooden strips. Sequence of nailing was first along the main spar; down the center rib from spar to trailing edge, and progressively each rib until the aft section of the wing was completed, and then the forward section ribs from the spar to leading edge were nailed.

Instead of nailing at the leading edge, I employed a custom clamp which was easy and inexpensive to con-

(Continued next page)



DR: JEDZIK EAA 15

WING LEADING EDGE CLAMP . . .

(Continued from preceding page)

struct and simple to apply. The resulting mating of the plywood to the spruce leading edge was clean, tight, and perfectly smooth.

Actually, the clamp was born of necessity because I had only myself to skin the wing, and except for help from my wife in applying the adhesive to the frame, I

put on all four skins without help. (I used Epoxy and worked in 60 deg. F. which gave me more than two hours working time).

The accompanying sketches, I hope, will provide sufficient explanation to construct the clamp. I made mine in two lengths for ease in handling. The clamping at the leading edge was the last function of the skinning process. Wax paper was placed between the clamp and the skin to prevent adhesion of skin to clamp. •

INEXPENSIVE ENGINE OVERHAUL STAND

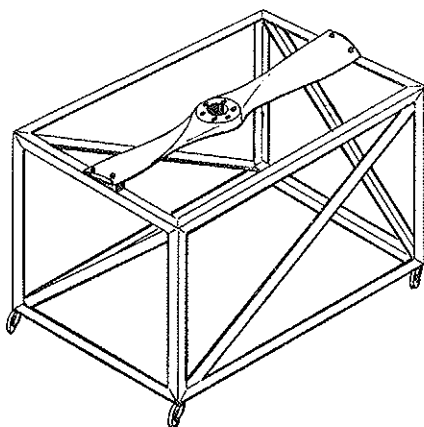
By C. E. Bombardier EAA 9398

4539 N. 49th Ave.

Phoenix, Ariz.

An inexpensive engine overhaul stand can be made from an old or damaged metal propeller that cannot be economically repaired. These propellers are usually badly bent. Therefore, heat the blades enough to roughly straighten them out by hammering or prying. The pitch angle can be taken out at this time if desired. However, it isn't necessary.

The propeller can be bolted to a rolling engine stand made from scrap angle iron, or the propeller can be bolted to a bench or between two benches, whichever you like. I prefer the rolling stand because it can be taken directly to the airplane so that



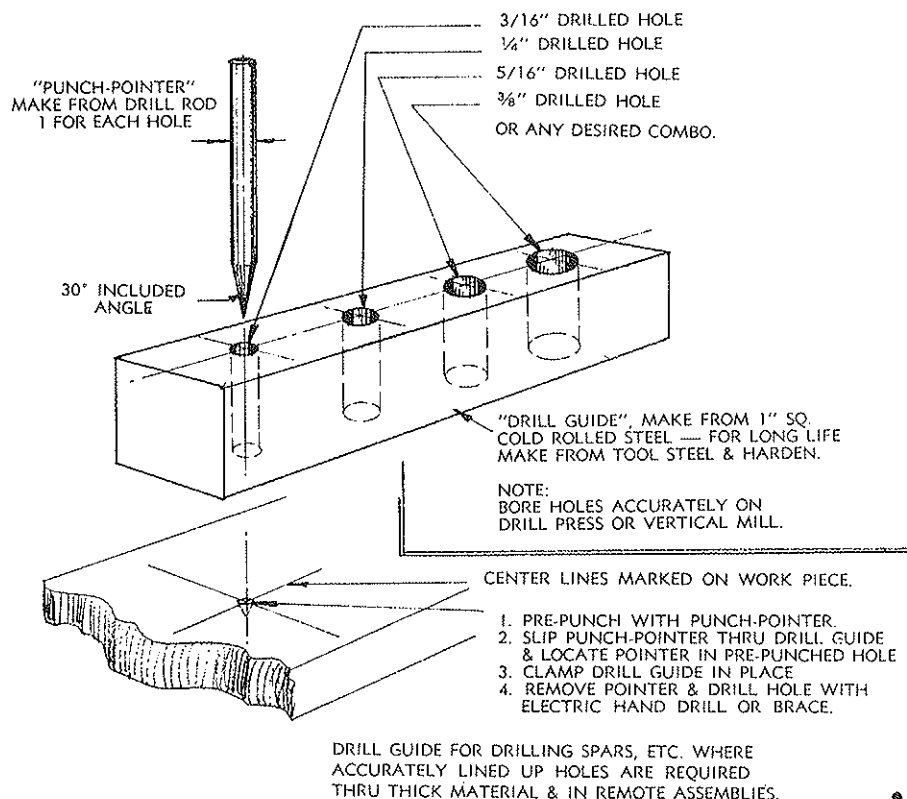
the engine can be removed and placed immediately on the stand for disassembly. If the pitch angle hasn't been removed, wooden wedges will have to be made so that the propeller will lay flat. Drill two holes through each blade and fasten to the bench or rolling stand. Steel bolts of the proper length and either $\frac{3}{8}$ in. or $\frac{1}{2}$ in. diameter will do well.

Various engines use different propellers with differing hubs. I'm sure that a visit to your nearest propeller overhaul shop will net you an old propeller bent beyond repair, and one that will fit the bill. •

ACCURATE DRILL GUIDE

By Joe Kirk, EAA 2023

3405 Harrington, Rockford, Ill.



Safety Alert

U.S. Civil Aviation

FROST

Frost does not change the basic aerodynamic shape of the wing but the roughness of its surface spoils the smooth flow of air thus causing a slowing of the airflow. This slowing of air causes early airflow separation over the affected airfoil, resulting in a loss of lift and early wing stall.

REMEMBER

A heavy coat of hard frost will cause a 5 to 10 percent increase in stall speed.

An airplane with frost may not become airborne at the normal take-off speed because of premature stalling.

It is also possible, once airborne, that the aircraft could have insufficient margin of airspeed above stall that moderate gusts or turning flight could produce incipient or complete stalling.

Remove All Frost From Wings Before Take-Off

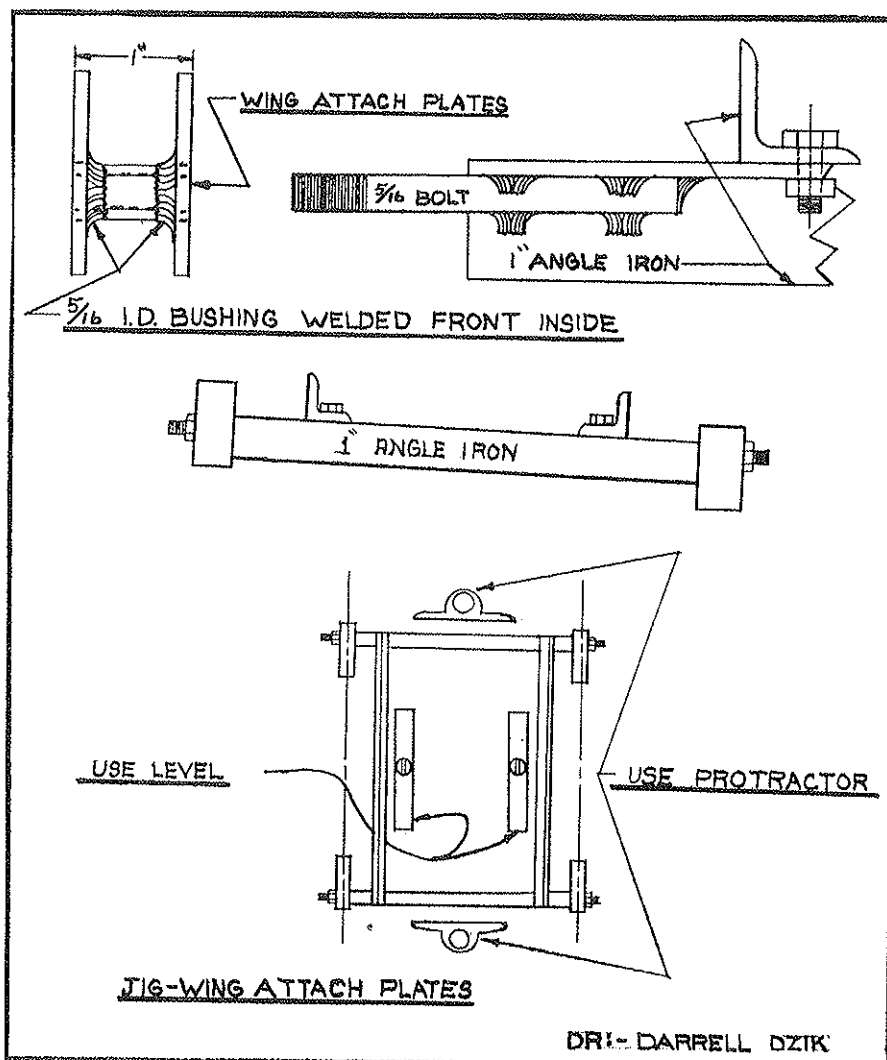
Jig for Wing Attach Fittings

By Dick Albrecht, EAA 11105
52 Eucalyptus Road
Annapolis, Md.

I thought and thought about what kind of a jig to use, to put the wing attaching plates on the fuselage of the Miniplane that I am building. I finally came up with the following:

Took two pieces of one inch angle iron, cut and drilled them to the right size required, and then after cutting the heads off of four 5/16 inch bolts, welded them in the corners. Welded the bushings on the inside of the wing attaching plates and then cut and notched them until they fit in the right position over the bottom longerons. Then I cut two more pieces of one inch angle iron to the right size required and drilled them so that I could bolt them to the other two pieces of angle iron. Put the attaching plates on the 5/16 bolts and snugged them down with nuts and then put the whole jig on the fuselage. After leveling the fuselage out I then used a level on the top two pieces of angle iron and a protractor on the two side pieces of angle iron. (The plans called for 2 degrees from the top longeron). When everything was in place I tack welded the plates, then boxed them in, welded everything up and cut out the jig with a hack saw.

Attached is a drawing of the jig. It worked fine for me.

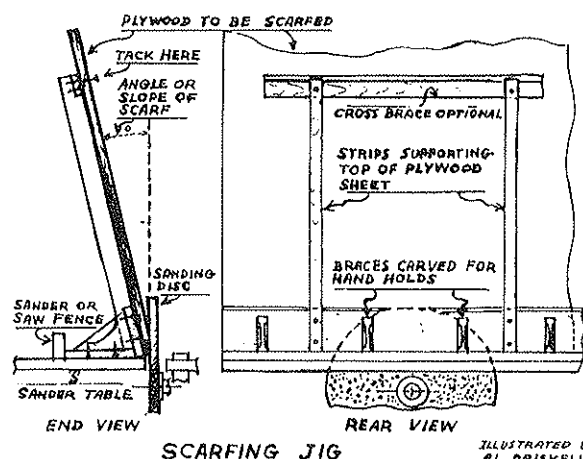


SCARFING JIG

By Harris G. Hanson, EAA 12204
Fort Nelson, British Columbia, Canada

As a metal worker of 25 years experience, I felt some misgivings in tackling the all-wood Jodel D-11. My chief worry was the scarfing of plywood. It seemed that a vertical sander was the logical solution, but how to hold the large flimsy sheets was the real question. The jig used is simple and can be varied to suit available equipment. A sander plate on any bench saw would be satisfactory. Some sort of screw feed inward, on the fence, is desirable so that light cuts can be taken and progress noted. A coarse open grit paper was found to be the best.

Everything was tried to hold the plywood on the jig, but it wasn't until Best Test Rubber Paper Cement, made by Union Rubber and Asbestos Co. of Trenton, N.J. was found that the process became practical. This adhesive adheres but does not penetrate wood fibers. It never dries and is easily removed by rubbing with the fingertips. Coat both the jig and plywood surface. One coating on the jig will do for several pieces. The finished work is easily removed with a putty knife. A few nails can be used where the plywood has a tendency to bulge out. The heads grind off with the wood and the nails pull through when removing the sheet. Liberally



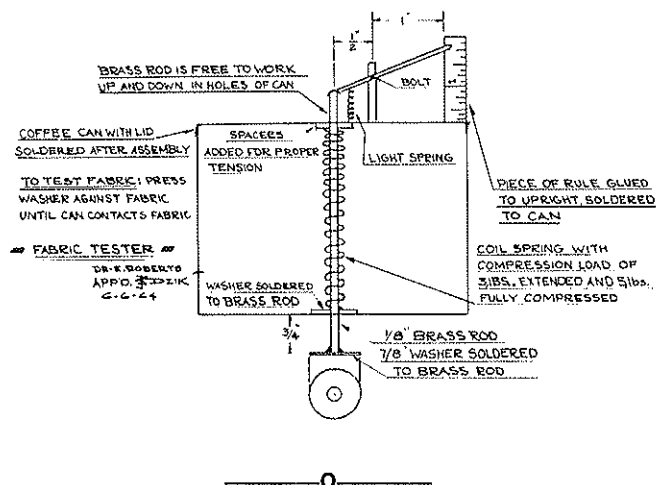
wetting the edge to be scarfed, after gluing to the jig, stops splintering of the feather edge. Similarly, it helps in sawing plywood to wet the bottom ply along the saw line. The rubber cement is also excellent for holding the paper disc on the sander. When using a transparent glue like Aerolite 300, the scarf joints produced by this method are almost invisible.

FABRIC TENSION TESTER

By Samuel R. Bigony

994 Hale St., Pottstown, Pa.

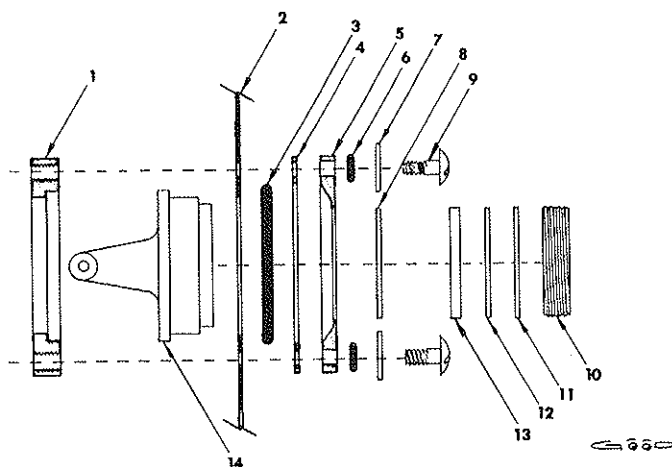
Engaged in the restoration of a vintage aircraft for the past several years, I designed a fabric tension tester for use when covering with grade A cotton or Ceconite fabric. By using this tester, every section of the wing, fuselage or control surfaces can be brought up to the same tension. The springs can be purchased at any good hardware or automotive supply store.



AN INEXPENSIVE LEAKPROOF FUEL GAUGE FOR INVERTED FLYING

By Ross E. Diehl, EAA 8142

4743 E. Ave. R-12, Palmdale, Calif.



I NEEDED A LEAKPROOF fuel gauge for my "Miniplane" that could be used for inverted flying and, since I had heard that some light aircraft use a Model "A" fuel gauge unit, I purchased one from the local salvage yard and proceeded to modify it.

Items 8, 10, 11, 12, 13 and 14 shown in the accompanying figure, were not changed as they were in good condition.

The back plate and fuel gauge housing were riveted to the fuel tank skin since access to the back plate was not possible.

After modifying it as shown, I mounted it on the lower left side of the aft vertical panel of the tank. It proved to be very effective and leakproof.

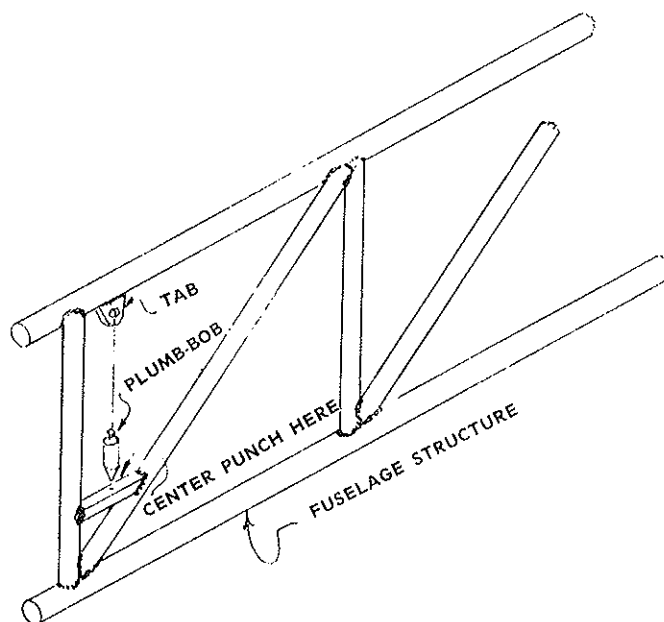
ATTACHING CABANES

By H. P. Whittaker

1243 Popular Ave., S.W.

Canton, Ohio 44710

After leveling your fuselage or aircraft for the purpose of attaching cabanes or for weight and balance check, it is handy to weld a tab on an exposed longeron and drop a plumb bob to a plate and center punch mark. Later this can be used for weight and balance check after the aircraft is completed.



VARNISHING

Ralph R. Driscoll, EAA 10742

2699 Fruitland Blvd. S.W., Cedar Rapids, Iowa

While varnishing between gussets on ribs, in forcing a brush into this $\frac{1}{4}$ in. space the bristles were broken and cut off of the brush. I now use a folded, twisted pipe cleaner, dipped into the varnish and worked well between the gussets. Also, I find this helpful in other inaccessible places and to saturate the drilled fitting holes in wood. Work thoroughly in a circular motion and when the varnish has become tacky, use the bit used to drill the hole and turn counter clockwise to remove the excess varnish and maintain hole diameter.

In forming this, start the fold at $2\frac{3}{4}$ in. from one end. Leave about $\frac{1}{2}$ in. flat at the folded end, then start twisting. The $\frac{1}{2}$ in. flat part serves as an eye and picks up a good supply of varnish. When completed, bend the single strand to a hook. Hook over the edge of varnish container, and it is at hand when needed.

IMPROVING AEROBATIC MOVIES

When taking movies of aerobatic flying against a cloudless sky, if the plane is kept in the center of the view finder there is no background to give a sense of speed and motion. For some of your shots hold the camera still and let the plane move across the view finder. The resulting movies will have a better sense of speed.

GETTING IN THE LITTLE WOMAN'S HAIR

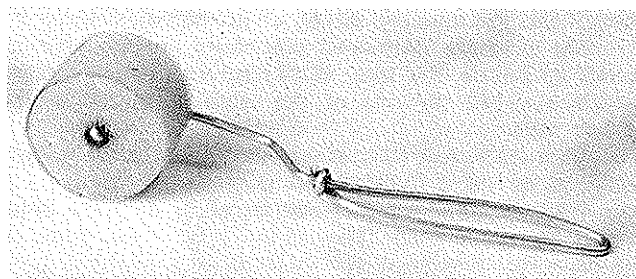
By F. Wiedenmeier, EAA 10009

Palmer Lake, Colo.

You may say that's easy, just start building a plane. I'll agree, but I think I've found a rather painless way. That is, if you don't steal hers and go to the drug store and buy your own. I'm talking about those little urethane hair curler rolls. Mine are $1\frac{1}{2}$ in. in diameter by 2 in. in length, with a $\frac{1}{4}$ in. bore, but have seen some smaller.

When using epoxy, I've lost quite a few brushes as the pot life comes fast to an end. Cleaning is also a messy problem.

One day "The Little Gal" brings home a sack of these little gems and I stole one without getting caught. By bending up a handle, as in the photo, I had the slickest little glue roller you ever saw. It can be done in any width to match the job. When finished, slip it off the handle and toss it in the scrap box, because it has cost



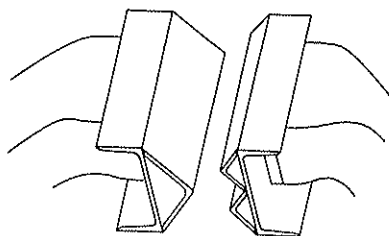
less than a dime for a 2 in. roller or a nickel for the 1 in. job, and performed a fast, even job. It will work as well on other glues or for painting in a hard-to-get-at location.

BENDING WORK MADE EASY

By Edgar C. Smith

Secretary-Treasurer, Chapter 47

Below you will find an inexpensive, easily made, and most useful tool for anyone who has fittings to fabricate in sheet metal. It is not original with me, but was excerpted from the November, 1960 issue of Mill and Factory. I claim no credit, but feel that it is of such universal value that it might perhaps be published in the "mag" as a bonus item, and should definitely be included in any compilation of hints and tools for the aircraft workshop.



Tool makers, mechanics, and maintenance men are frequently called upon to make some brackets, etc., from sheet metal or band iron.

To assist in this work a New York reader made up a

bending tool for use in a bench vise. It is made from angles and channels as shown. He used $1 \times 1 \times \frac{1}{8}$ and $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{16}$ and 3 in. channels.

These sizes match up very well as shown. The angles are secured to the channels by welding inside the angles at each end.

MARKING METAL

By Duane Sunderland

5 Griffin Dr., Apalachin, N.Y.

The single practice which has been the biggest help to me in metal working has been the use of a good marking pencil. Since I find that many homebuilders are not familiar with this technique, I am sure it would be a valuable tip to be published in *SPORT AVIATION*.

For marking tubing and for all layout work on steel, I use a silver pencil. This pencil leaves a very clear mark and can even be seen when the metal is being tack welded and it doesn't blow away as soapstone does. It, of course, makes no scratches on the surface being marked. It marks well even on oiled surfaces. The pencil is made by Eagle and is designated "CHEMI-SEALED" VERITHIN Silver 753. It is commonly used for marking blueprints.

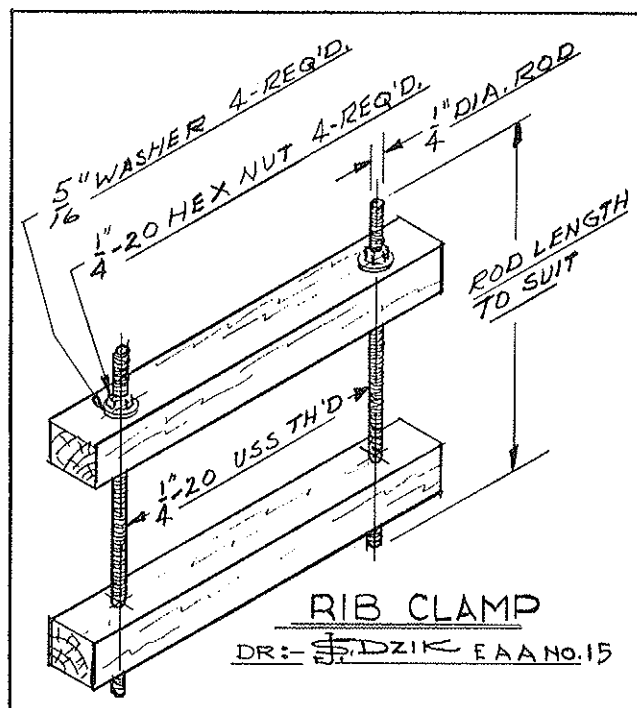
EXPERIMENTS WITH VARNISH

By Edward M. Sampson, EAA 13365

Box 38, Belview, Minn.

The article on covering wood surfaces, which appeared in the December, 1963 *SPORT AVIATION*, has aroused my interest. As of now, I haven't done any covering on my "Fly Baby" project, but have experimented with the effects of dope on the various types of varnish.

I have found that Gilt Edge No. 1000 Spar Supreme marine varnish, manufactured by Farwell Osmun Kirk and Co. of St. Paul, Minn., is impervious to both nitrate and butyrate dope. No lift of the varnish occurs, and there is no penetration. This varnish is a high grade polyurethane type formulation.



"C" CLAMPS MADE OF OAK

By Larry Hawes, EAA 10319

149-06 85 Rd., Jamaica 35, N.Y.

Wanting clamps to add pressure while nail gluing ribs and not wanting to buy so many "C" clamps I cut pieces

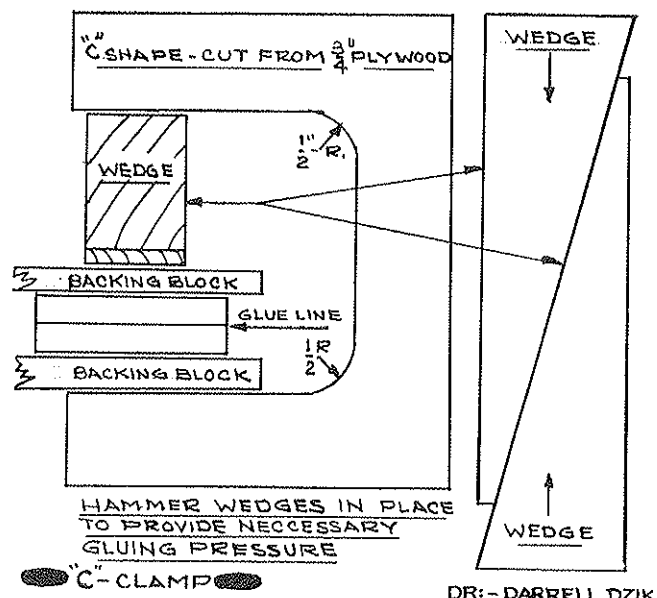
of oak and made the clamps as shown in the sketch. They do all that is needed and are very inexpensive.

The size shown can be varied to suit any other need. For a wider span the size of the wood pieces should be larger and the running thread of greater diameter.

The pressure developed can easily be measured directly on a scale. For some of us steel may be more easily obtainable, but the use of the running thread is the prime idea.

With the use of filler blocks these clamps are equally efficient on other than flat surfaces.

When using wood it is important to drill the holes WITH the grain. Have fun.



MANUFACTURING "C" CLAMPS

By Stan Olive, EAA 12697

Sub Office—90 Union St., Saint John, N.B. Canada

Recently I stumbled on a very effective and inexpensive method of manufacturing "C" clamps, which may be of interest to other members engaged in the construction of a wooden aircraft. Simply cut a "C" shape out of $\frac{3}{4}$ in. plywood. Length and thickness of tangs can be varied to suit the gluing job, and thickness of backing blocks and/or wedges will decide the adjustment for size. A local wood

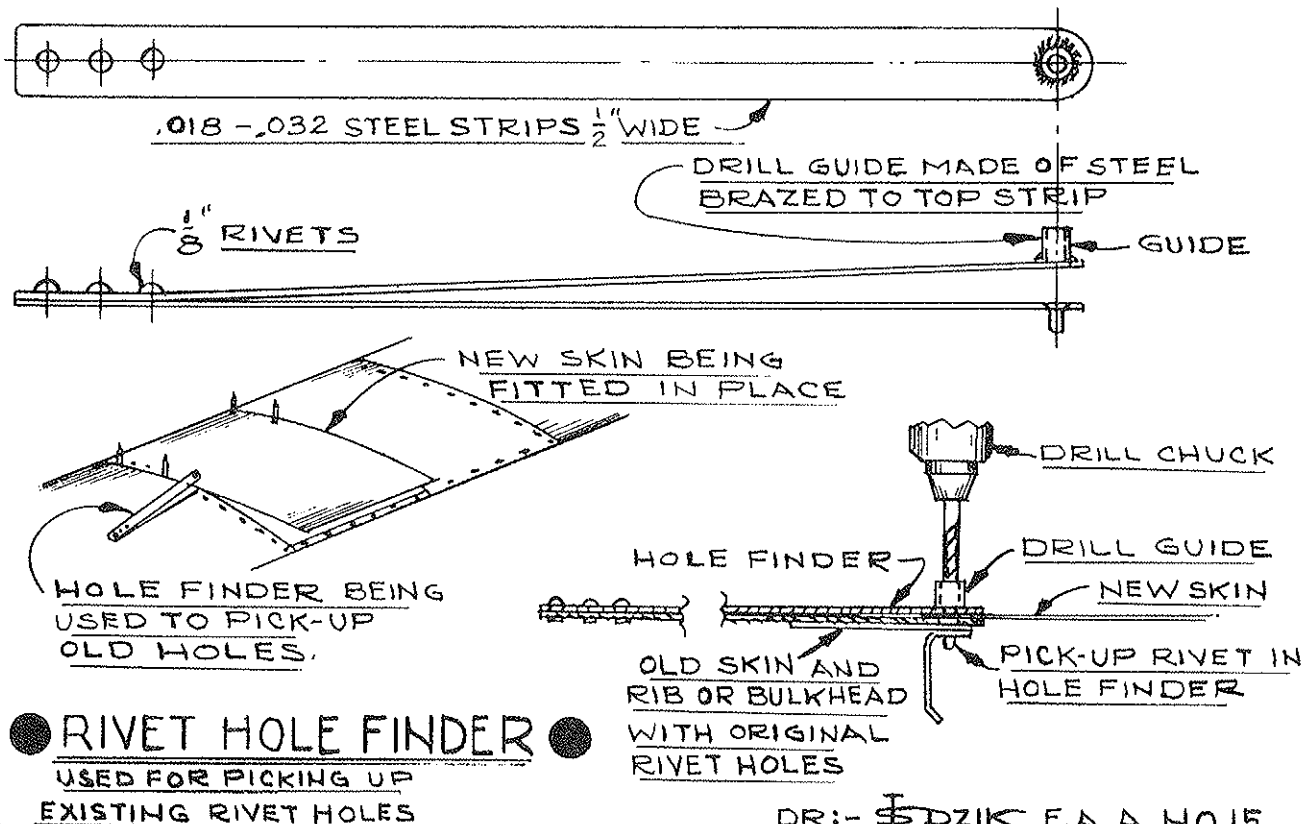
working factory uses these by the hundreds in the manufacture of slab doors, and reports wonderful results. I think you will agree that the possibilities of such a simple gadget are almost unlimited.

RIVET HOLE FINDER

By Fred W. Luddeke

P. O. Box 36, Chickasaw, Ala.

The hole finder idea is really very simple, but I have not seen it mentioned previously, so here it is: I have been using this type for over 20 years and have found it to be the most foolproof one that can be used in almost any location except where there is a very tight radius. Even then it can be used by using a smaller size drill bit and pulling the hole to the lower side of the drill guide. Practice will teach you how to do this. Wider strips should be used if the length is to exceed 14 inches as they tend to lose proper alignment when made too long and too thin.



PRESSURE GLUING METHOD

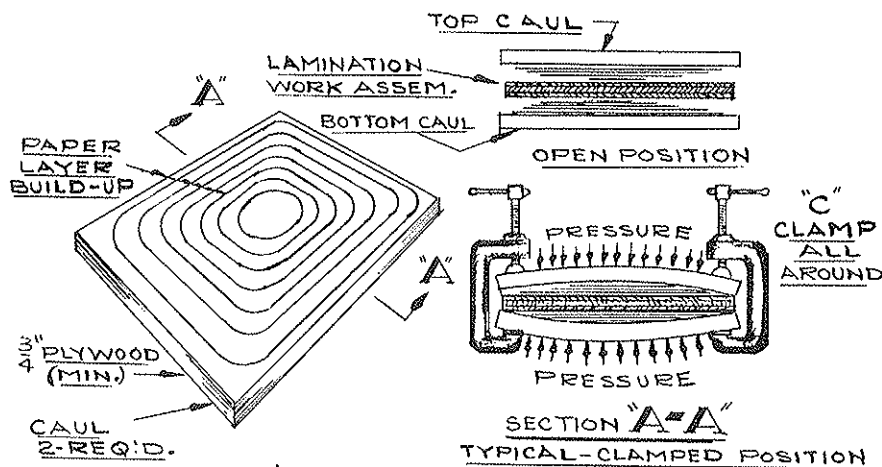
By L. J. Weishaar, EAA 9250
1924 N. 6th St., Springfield, Ill.

Here's a trick which may not be original but is, as far as I'm concerned, my own brainstorm.

The problem: Obtaining glue pressure over large, flat areas which are inaccessible to C-clamps. In my case it was the solid-core, ply-covered front fuselage bulkhead on the "Turbulent."

The solution: Cut top and bottom caul boards from a suitably heavy plywood (the area to be covered determines the stiffness required). For each caul, cut a piece of newspaper to the same shape but slightly smaller in all dimensions. On top of these, fit pieces of newspaper cut to yet smaller dimensions but still roughly the same shape. Continue building this paper "contour model" toward the center of the area with pieces of paper of decreasing sizes. As you work toward the center, the corners should be more and more rounded so that if, for instance, you start with a rectangle, the smallest center piece would be an oval. The whole thing looks like a symmetrical high pressure area on a weather map. Fasten the paper hill to the caul with an "X" of masking tape.

With the sandwich to be glued assembled between the paper-covered cauls, mount C-clamps around the peri-



METHOD FOR

LARGE AREA PRESSURE GLUING DR. J. DZIK EAA 15

phery of the cauls, tighten securely and there you are!

Before the actual gluing is attempted, the pressure developed should be tested by "feel" by assembling the cauls face-to-face and noting the clamp pressures required to close the edge gaps. If it doesn't seem to be sufficient, either make the contour lines closer together or double the thickness of each contour.

I bored a few lightening holes in the solid core and, by gluing one side at a time, was able to note by the glue squeeze-out on the first side that a good joint was obtained over the whole area.

ASH WOOD AND VOLKSWAGEN CARBURETORS

By Capt. William E. Brown, EAA 10669
R. D. 4, Athens, Ohio

If some of the members have had difficulty, as I have had, in locating ash lumber of aircraft quality, this knowledge might be of help. Most wood specialty houses stock baseball bat blanks, 2½ in. by 2½ in. by 38 in., of very high quality ash. The Craftsman Wood Service Co. of 2725 S. Mary St. in Chicago, 8, Ill., has them for \$1.25 each.

Secondly, this information from the "Volkswagen Handbook" published by HOT ROD magazine may be of

interest: "The VW Solex carb, when run without an air cleaner, gives an extremely lean mixture. It is necessary to increase the main jet size about two sizes larger to correct this." This might save some burned valves on some of the conversions using the Solex carb. The J. C. Whitney Co. sells an adjustable air-metering jet for the Solex which could be used to enrich the mixture without changing the main jet.

For The Birds

By Milt Colden, EAA 1855
Clintonville, Wis.

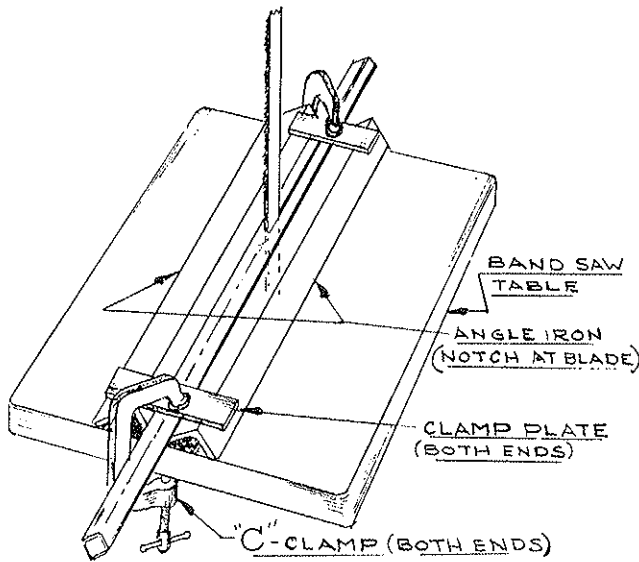
I have a tip that is a prize winner, but will not win me a prize as it is not a construction tip. However, it must be published as it is a cure-all for one of the aircraft owner's worst problems, namely, Birds and Bird-Dirt. The idea is so simple that one just couldn't think of it and the idea was given to me by an old German lady who used it in her garden. Take an old piece of fur from a coat collar or anything like it and tack it around the top and two sides of a piece of 2x2 about 8 in. long, leaving about 6 in. hanging from the end of it to resemble a tail. Put

one or more of these in the top area of your hangar and you will never again have Bird trouble. About three years ago a doctor friend of mine with a nice new Comanche had Bird trouble so I mentioned this to him and he tried it out with two such "Cats" nailed to his rafters. Not a bird dropping since. Two months ago I did the same with two such "Cats" and I haven't had a dropping since on my Cyclops. So if you owners are having trouble just give it a try. I have also been informed by the old gal that a stuffed owl will give the same effect.

TRAILING EDGE MATERIAL MANUFACTURE

By J. E. Riley, EAA 7118

1 Mills Crescent, Saskatoon, Saskatchewan, Canada



TRAILING EDGE MATERIAL
(MANUFACTURE)

DR: J. DZIK EAA NO. 15

For anyone having difficulty locating trailing edge material for control surfaces as used in the "Tailwind", the following suggestion may prove helpful:

First, purchase 4130 steel square tubing of the required gauge and size to conform to the width of the trailing edge required. In the case of the "Tailwind", I used $\frac{3}{8}$ in. by .035 in. Next, rip the tubing diagonally. (Use a band saw or rip saw) thus giving two trailing edges from the one lineal measure. Now dress the edges (either by grinding or filing) to the desired width; $\frac{1}{2}$ in. for the "Tailwind." Using a brake or jig in a vise, bend the one side over to the required angle. There is no danger of a crack forming because the tubing already contains the correct bending radius.

WELDING TABLE FROM BARBECUE

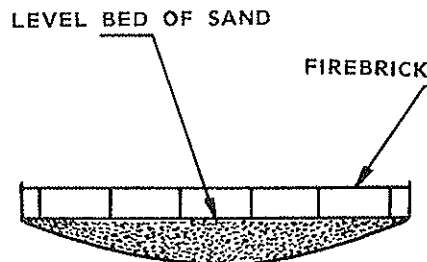
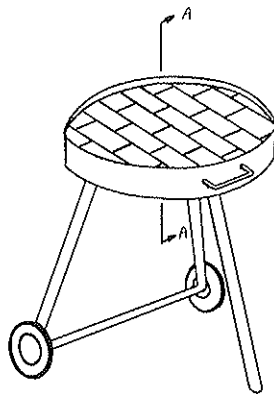
By Chet Klier

1014 Prosperity Ave., St. Paul, Minn.

This handy and economical welding table can easily be constructed from an ordinary home barbecue. Moist sand is placed in the fire pan and then spread to give an even, smooth surface. The firebrick are then placed on top of the sand bed and fitted into place. The bricks are easily shaped with hammer and chisel to fit the round edges of the fire pan. (All bricks should be numbered so

that they can be easily replaced after the barbecue has been repossessed for outdoor cooking).

A brazier hood will provide a wind screen and spark shield while welding small fittings. Hot pieces can be placed on the top of the hood to cool after welding. Drawings show detail of the welding table.



SECTION A-A

SAFETY ALERT U.S. General Aviation

CARBURETOR ICE

Vaporization of fuel in the carburetor will lower the carburetor air temperature as much as 60 deg. F. With moisture in the air, ice will form in the carburetor when the temperature reaches the freezing range. This condition could result in a critical loss of power.

An outside air temperature range of 40 deg. F. to 60 deg. F. is most conducive to carburetor ice; however, it can occur at temperatures as high as 90 deg. F. Conditions are more critical when operating at reduced throttle settings. Float type carburetors are more prone to icing

than the pressure type. The temperature range and the degree of icing depend upon the carburetor design and installation.

REMEMBER

Be aware of the possibility of icing under varying operating conditions and use the recommended procedures for safe operation.

CIVIL AERONAUTICS BOARD

Cut Metal With A Band Saw

Hands ache from using a hack saw to make the many cuts involved in making sheet steel aircraft fittings? Then send \$1.00 to Rockwell Manufacturing Co., Pittsburgh 8, Pa., for a copy of their booklet, "Getting the Most Out of Your Band Saw and Scroll Saw." It contains a rather detailed chapter on the subject of using common home workshop wood-cutting type band saws to cut sheet metal stock and tubing quickly and neatly. Special metal-cutting blades are readily available from hard-

ware supply houses to do the work, and they cost only a trifle more than common wood cutting blades. Soft grades of aluminum can even be cut with sharp wood-cutting blades. It is possible to bolt together several sheets of metal and saw out a number of identical fittings at once. By all means, get this publication if you are doing much work with sheet steel, tubing and aluminum. •

HANDLING SMALL NAILS

By Henry C. Foster, EAA 10200
Box 34, Wexford, Pa.

Here is a tip that is particularly helpful in the building of wooden wing ribs or any other construction which requires the use of one-quarter or three-eighths inch long aircraft nails. Any craftsman who has worked with extremely short nails encounters the problem of holding the nail upright prior to the first blow of the hammer. It is virtually impossible to hold an 18, 19 or 20 gauge nail one-quarter inch long with the fingers without these fingers taking the brunt of the hammer blow intended for the nail. It has been common practice to use a pair of long-nosed pliers to pick up the nail and hold it in place for the initial blow of the hammer. An alternate method, quicker and easier than the use of pliers, is the use of a small magnetic screw driver generally available in any hardware store. This type of screw driver with a magnetic tip enables the craftsman to pick up the nail and hold it in place for hammering. With just a little practice it is possible to make considerably better time than any other method that might be used to hold the extremely small nails used in substantial quantities in the construction of wooden aircraft components. •

BEFORE YOU CUT THAT TUBING

By Clyde W. Evers, EAA 6624
R. 1, Box 153-A, Sheridan, Oreg.

While building the cabane vees for my "Baby Ace", I made a mistake which made it necessary to make a splice. Of course, I then realized how to avoid doing it again.

My motto now is . . . "Cut up something cheap!" By using a dowel stick or old broom handle of the same size as the tubing, you can get the bevels right on those compound angles without ruining costly tubing. •

ZINC-CHROMATE TIP

By Alan Zingelmann, EAA 1256
3555 Madrid Dr., Westerville, Ohio

In warm weather, zinc-chromate primer that has been reduced with thinner will soon turn to a jelly-like consistency that cannot be re-mixed. Should you find yourself with an unused quantity of reduced chromate on hand, you may store it for several months in a screw top container (instant coffee jar, etc.) in your refrigerator. Although chromate and thinner will separate, a brisk shaking will make it ready for use. •

ROSETTE WELDS

By Robert A. White, EAA 10484
609 N. Lindberg, Griffith, Ind.

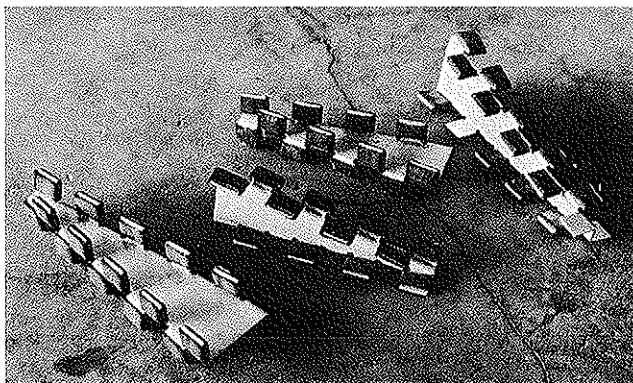
There are a number of things that the more experienced builders take for granted, which the amateur has to find out the hard way. Some of the things just aren't in the books, if you have the books.

For instance . . . I found that my drawings called for rosette welds on tubes with zero clearance between the two tubes. It is very hard to get the inner tube hot enough to weld without burning the outer tube. I also found that if a hole is drilled in the inner tube about half the diameter of the outer tube, the heat will penetrate the inner tube more readily and is a simple matter to fill. I might say that where there is no clearance between the tubes, CAM-18 states that the rosette is not necessary at all, depending upon the type of joint. •

AILERON LOCKS

By Raymond L. Shambley, EAA 10195
225 Viking Rd., Charleston, W. Va.

To make these simple and inexpensive aileron locks, a piece of sheet metal is marked to fit the aileron slot in the wing. Mark off a 1½ in. margin on the top and bottom, then mark off these lines in one inch increments. Drill or punch a ¼ in. hole at each one inch mark.



Cut from the edge to each hole, so that a series of tongues will result. Bend each tongue 90 degrees, alternating to the right and the left. Slip a piece of sponge rubber tubing on each tongue to protect the wing. This lock slips into place easily, and the sponge rubber tubing keeps it in place. The locks depicted in the picture were made for a Schweizer I-26 sailplane. •

APPLYING ALUMINUM LEADING EDGE

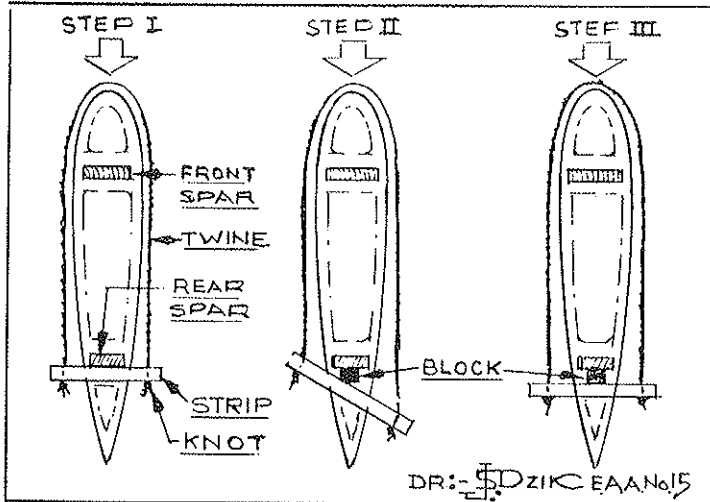
By Charles T. Vogel song, EAA 10199
R. 3, Dillsburg, Pa.

I have seen many hints on applying leading edge aluminum. I had the job to do on my "Flut-R-Bug" and felt that there must be a simpler way without special jigs, clamps, tools, etc. I found that all that is needed are some pieces of hardwood strips, $\frac{3}{4}$ in. by 2 in. by 8 in., and a supply of used baler twine that any farmer will give to you for free, and some scrap blocks. You will need as many strips and pieces of twine as ribs over which the leading edge is placed. Slots are sawed in the

is hard, some may wish to pre-shape it between two pieces of 2 by 4's, using a piece of pipe as a press between the 2 by 4's. The aluminum is placed over the rib ends and can be tacked, if desired, along one of the edges to hold it in the proper position. Make a knot in one end of the piece of baler twine and slip it into one of the slots of the strips. Place the twine about $\frac{1}{4}$ in. on either side of the rib. (This will allow clearance for nailing into the ribs).

The slotted strip is placed behind the rear spar, the twine is run over the aluminum and back through the slot in the other end of the strip. A second knot is placed in the twine after it passes through the second slot. I placed a piece of $\frac{1}{4}$ in. scrap plywood between the strip and the spar to prevent damage. Now by slanting the strip in reference to the spar, a block can be placed between it and the spar. The necessary leverage for tightening is obtained by straightening the strip. Different thicknesses of blocks will give correct tightness. (You obtain terrific pressure in this manner!).

This will snug the aluminum right up to the rib. One of these jigs is used at each rib. The complete leading edge can be positioned to satisfaction before any permanent nailing is done. The illustration shows the steps for tightening. The twine will slide easily on the aluminum but will not mar it if it is the hard kind. A wider strap can be placed under the twine if it is feared it will crease the aluminum. The main advantage is that the leading edge can be strapped into its exact position before using a nail. Readjustment of the strings can be made to work out any irregularities before nailing. After the leading edge is nailed, just release the strips, slip the knots out of their slots, and you are ready for the next piece of aluminum. Results were perfect for my installation; expenses for equipment exactly nothing!



strips about $1\frac{1}{2}$ in. deep on each end, just wide enough to slip the twine into, and not so wide as to let a knot in the twine through. The distance between the slots should be about the same as the maximum thickness of the rib over which the leading edge fastens. If the aluminum

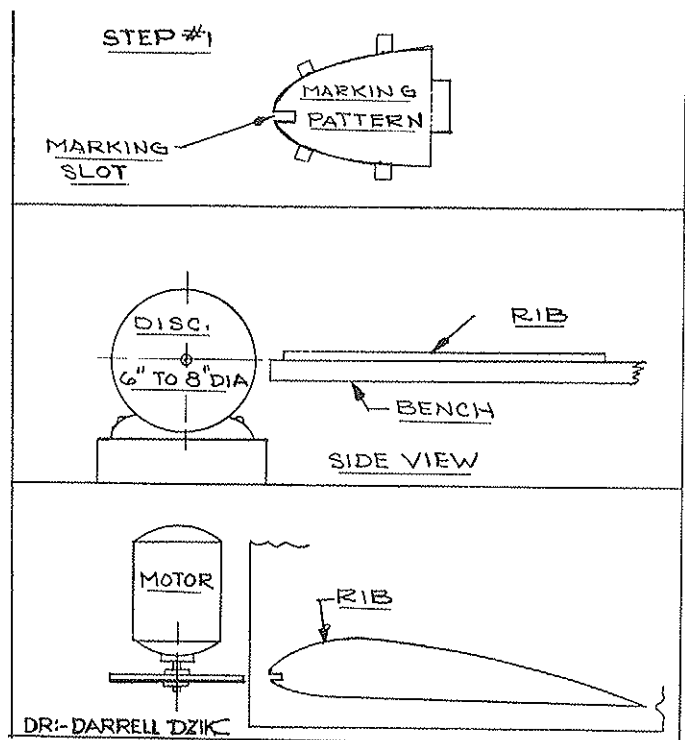
RIB NOSE SECTION SLOTS

By Don Simons, EAA 9191
163 New York Ave., Youngstown, Ohio

To cut neat slots in the nose section of a rib, make a metal pattern from any suitable material (aluminum, terneplate, tin, etc.), to slip over the front of the rib. Bend the tabs down to get the correct position, and provide a slot to allow marking the intended slot to be cut out.

After marking the ribs to show the intended cut-out, make a disc from plywood of the correct thickness. We used a disc about 6 in. in diameter. Glue medium-grade sandpaper to the edge of the disc and mount it on any $\frac{1}{4}$ hp motor. Clamp the motor firmly at the end of a bench, so that the ribs can be pushed straight into the revolving disc.

We had to change sandpaper three times to finish two sets of "Miniplane" ribs. The total time spent making the marking pattern, disc and set-up to do the job . . . 30 minutes. Spoilage . . . zero!



Winter Air Vent Covers

By Edward B. Price, EAA 21541

19 Orton Rd., West Caldwell, N.J.

When installing the new windshield on my 1946 Taylorcraft BC-12D which I had just repainted and reassembled, I also installed "snap-vents" for ventilation. Now that cold weather is here, I find that too much cold air for the cabin heat to overtake comes in, so I found an answer which I would like to pass along.

The "snap-vent" is removed from the 2 in. diameter hole and a small plastic disposable beaker, manufactured by Econo-Lab, is pushed into the hole until it is tight. The excess on the inside is removed with a sharp knife

or razor blade. Approximately 1 in. of height was about right. The beakers are tapered and will fit any size near the 2 in. diameter hole in which the "snap-vent" is installed.

These plastic beakers are cheap. I also use one on the fuel tank to keep rain out when the ship is tied down. There is more drag from the plug than there is from the vent, and it can be easily removed when the vent is required. •

DECIDING COLOR SCHEME AND TRIM

By Alan Zingelmann, EAA 1256

3555 Madrid Dr., Westerville, Ohio

Undecided on the color scheme and trim for your airplane? An economical method that will let you experiment with many ideas is to mark the fuselage, etc. with contrasting colored tape (1/4 in. by 1 in. strips of black tape on silver dope, 3 to 6 in. apart) to provide a scaled reference. Then take a "Brownie" photograph to include the full length, from a position at right angles to the center of the object, (this will minimize scale distortion). Be sure to fill your negative with only the structure that is part of the problem. Take this to the drug store or photo shop and ask for an 8 in. by 10 in. **matte finish** enlargement; then you have a scaled view that may be drawn upon with pencil, ink, etc. When your art satisfies, you may take the full scale dimensions of your color scheme directly from the reference marks the tape provides on the photograph. An 8 in. by 10 in. photograph of a "Cub" size fuselage will enable you to read one inch increments with dividers. Picture quality is not very important; if the scale marks and outline of major details show, you will have good results for a cost of \$2.00 or \$3.00.

A time saving method for penciling in locations for registration numbers, trim stripes, etc., is to select a horizontal reference that you wish your numbers, etc., to be parallel and at right angles to. Then support your structure so that the datum you have selected (stringer, longeron, skin joint) is made level. A parallel horizontal line can be drawn through any point measured from this datum, using a carpenter's 24 in. level.

A vertical line can be drawn through any point measured horizontally, using the level to plumb the line through the point. Mild skin curvatures, and stringer and longeron projections will not detract greatly from the accuracy of this method. •

SANDING TOOL

By Hal Sanders, EAA 1109

4555 Finley Ave., Los Angeles, Calif.

For a high speed sanding disc, if a sanding disc is not on hand for your table saw:

1. Take an old saw blade of appropriate size for your table saw and grind off the teeth.
2. Trace the disc pattern on different grits of sand paper and cut out the circles and center hole.
3. Commercial adhesives made for the purpose are used to glue the sand paper to the ground down saw, using different grits on each side, according to personal requirements.
4. Saw blade is then conventionally mounted, resulting

in a high-speed sanding disc. The fence can be used as a guide for straight sanding if not too much material is to be removed. •

TAPPING AND THREADING TIP

By Charles C. Putnam, EAA 2859

2659 Carleton Ave., Los Angeles, Calif.

The following is a method of tapping and threading hard or soft aluminum:

1. Use a sharp tap or die, preferably one that has not been used on steel.
2. Apply "Hinds" industrial compound, or a mixture of honey and almond hand cream to the tap or die and the piece of work. Flood both for best results.
3. Turn the tap or die in one direction only. Do not back off intermittently as with steel.
4. When threading, clean the flutes of the die often and apply more hand cream. When tapping, remove the tap as soon as the drag increases slightly more than normal, and clean the tap and hole and apply more hand cream. If the tap loads up too much, it damages the threads. I usually remove the tap two or three times while tapping the average depth hole.

I have used other types of hand cream with good results, but Hinds seemed to do the best work. I have also tried several different cutting oils and lubricants, but none of them worked as well as any of the hand creams. I believe that the reason hand cream works so well is because of the lanolin or glycerine content, or both. •

BRAZING AND WELDING TIP

By Eugene W. Slade, EAA 768

111 Siesta Lane, Marietta, Ga.

While repairing a Go-Kart for a friend, I removed some old brazing in preparation for welding. Some of the braze remained even after filing, and caused the welds to crack down the center upon cooling.

It is suggested that brazing only be used where you are absolutely sure that welding will never be required, as the base metal may have to be cut out and replaced to obtain a high-strength joint.

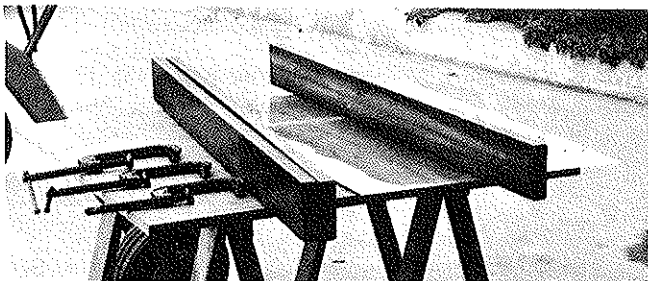
Check all welding rods which you buy . . . a new brazing rod is on the market which looks like copper-coated weld rod. If even a small amount of brazing rod were to get into an important joint, it would surely fail at a later time due to the weakened weld. It is suggested that two pieces of scrap be brazed just to test this out. Then remove most of the braze, and weld the joint, paying particular attention to the way that the weld acts during welding. After welding, clamp one end in a vise, and you can break off the other piece with a hammer! •

Bending Aluminum Sheet

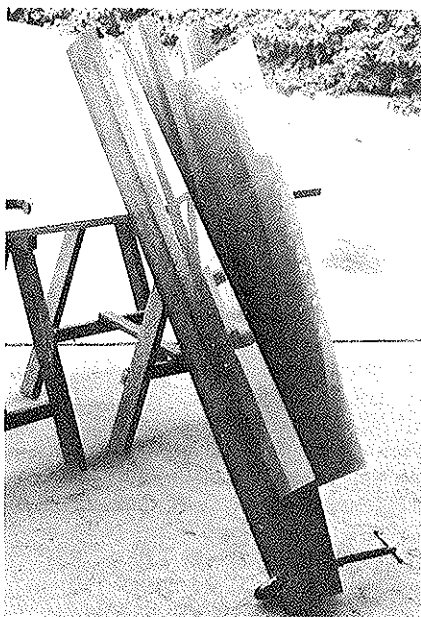
By Rim Kaminskas, EAA 3476
482 Patrician Way, Monrovia, Calif.

Bending sheet aluminum for a leading edge of a wing always presents a problem. An easy way to accomplish this is illustrated here. Picture No. 1 shows all that is required . . . three boards and three clamps. Bend the aluminum sheet between the three boards as shown in picture No. 2. Then clamp it as shown in pictures No. 3 and No. 4. Remove the clamps and you will have a perfectly formed leading edge as shown in picture No. 5.

The radius of the bend may be controlled by the thickness of the board in the middle.

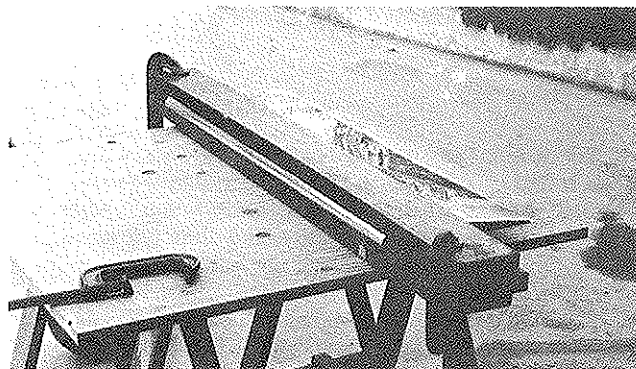


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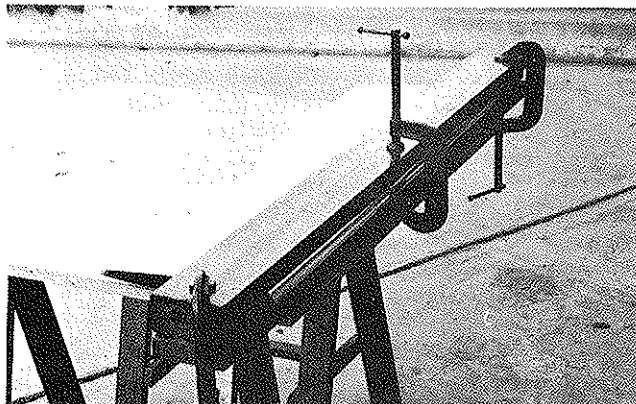


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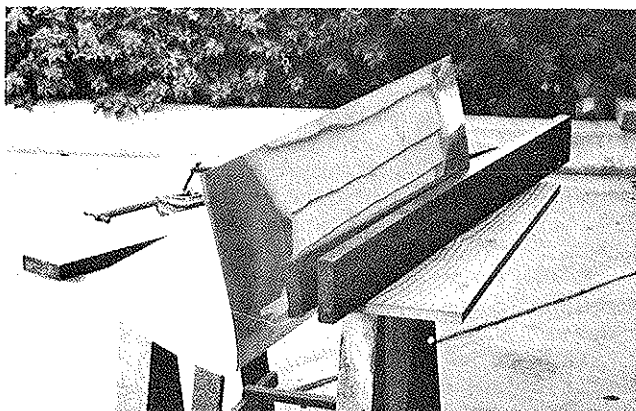
All that is needed are three boards and three clamps.



3



4



5

SPRAY "TENT" IN GARAGE

By David Mason, EAA 8828

I HAVE a suggestion for members who may have a problem of where to do their spraying of dope or enamel. I made a "tent" inside my garage of .040 polyethylene sheet, available at most builders' supply stores. Stringing some inexpensive clothes line cable across the garage about a foot below the ceiling, I hung the plastic film over it. Clothes pins hold the film and the end pieces in place.

The polyethylene costs about \$15-\$20 for a 100 foot roll, 25 to 30 feet wide. This "tent" keeps the overspray from getting on other items stored in the garage, and is easily removed when the painting is finished. Being nearly clear, the plastic allows light in from ceiling fixtures or windows, and extra lighting is not necessary. •

SAFETY ALERT U.S. GENERAL AVIATION

FUEL EXHAUSTION

Each year there are over 100 accidents as a result of fuel exhaustion. Ten percent of these are fatal. These accidents could have been prevented by proper pre-flight preparation and en route planning.

REMEMBER

CHECK YOUR FUEL SUPPLY PRIOR TO DEPARTURE, MONITOR THE RATE OF FUEL CONSUMPTION IN FLIGHT, AND PLAN TO ARRIVE AT YOUR DESTINATION WITH AN ADEQUATE FUEL RESERVE.

CIVIL AERONAUTICS BOARD

A Sturdy Wing Stand

By Bill Ware, Jr., EAA 3328

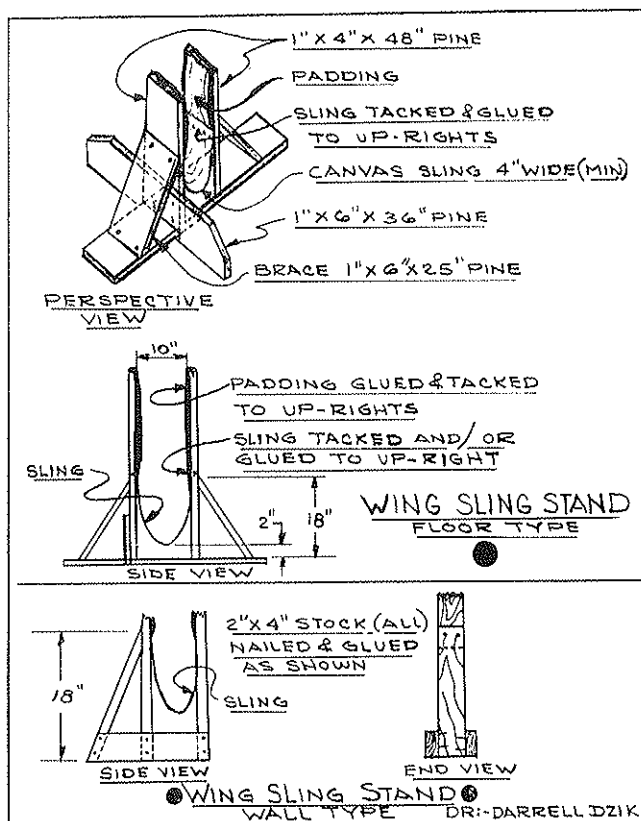
422 Wesson St., El Dorado, Ark.

While the idea presented here certainly is not original, these wing stands will be found to be very stable, protect the wings, and can be used for different wings regardless of variation in airfoil. There's no telling how many hangars and shops use similar wing sling stands.

Each stand consists of two uprights at least 3 ft. high. A length of upholsterer's webbing or a length of heavy canvas strap is tacked to both uprights so as to form a sling. The strap is installed so as not to touch the stand's base. It will adjust automatically to the contours of the wings leading edge . . . again, regardless of what airfoil is used! The uprights are padded in any way possible . . . flattened fire hose, strips of old carpets or rugs, folded rags, etc.

The sling stand sketches contain arbitrary dimensions which can be varied to accommodate whatever scrap lumber is available. The builder may use nails, screws and glue as he sees fit. Materials for the sling straps and padding are left to the discretion and ingenuity of the builder.

Furniture-type caster wheels may be installed on the floor model "wing sling stand", making it possible to move both wing and stands across the hangar floor without removing the wing from the stands. •



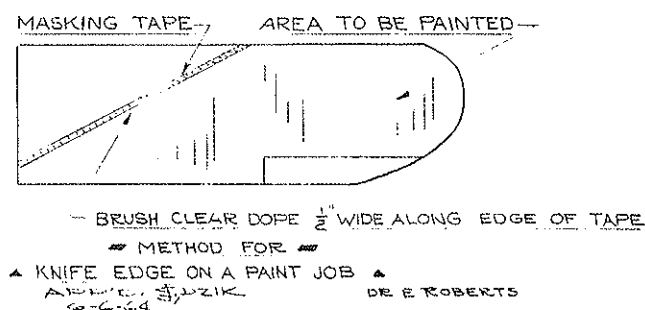
Knife Edging of a Paint Job

By Harrison P. Whittaker, EAA 1089

1243 Poplar Ave., SW., Canton, Ohio

To get that "knife edge" on a paint job when masking between two or more colors, brush a coat of clear dope along the edge of the masking tape before applying the color coat.

When the masking tape is removed, a "knife edge" will result between the two color areas. •



The Versatile Abrasive Wheel

By Dr. Earl T. Johnson, EAA 16252

P. O. Box 367, Glendale, Oreg.

In the course of several construction kinks encountered in the building of my Jodel D-11, I have found that the grit abrasive wheel has many uses. It is particularly effective for beveling leading and trailing edges of spars, finishing rough cut spars or cap strips and as a general all-around replacement for a disc sander.

Since it has no kerf, an abrasive wheel may be much more accurately set with relatively little effort. It will

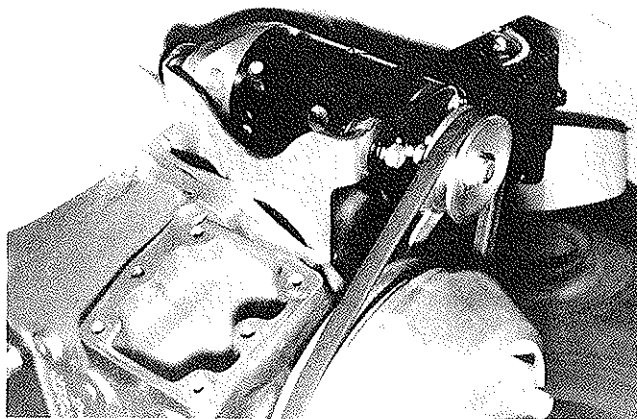
produce a finished cut with one pass, will rip or cross saw like a blade and can be used in many other ways that a blade cannot. Called a "Karbo Grit Abrasive Wheel", it can be purchased from Sears and Roebuck in various sizes for about \$6.00. I have not noticed mine wearing out, although I suppose that it eventually will.

However, so far it has given plenty of use with no maintenance.

A Lightweight Generator And Battery For A Lycoming Engine

By R. W. Riter, EAA 12838
Sky Harbor Airport, Northbrook, Ill.

THE LIGHTEST-WEIGHT generator and battery which I could find that could be used on the O-290-G was an Auto-lite GJG-4001M-6M generator that, I believe, was used on a Johnson outboard, and two 6-volt batteries from motorcycles. These batteries measured 1¾ in. by 4¾ in. by 5 in., and weighed about 4¼ lbs. each.



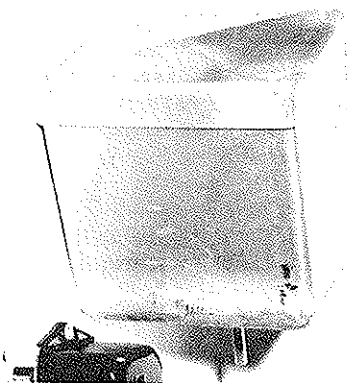
These fit into my aluminum battery box which has inside dimensions of 3½ in. by 4¾ in. by 5 in.

The generator was used and in need of repair so, for \$10.00, I took it home and investigated. It is a small compact unit, well constructed with ball bearings on both ends and made for high rpm. Rotation has to be

changed, and the big job is to remove the brush brackets and turn them around so that the brush angle is correct with respect to the direction of rotation. Other than that, it will work.

I drilled two ¾ in. holes in the housing for blast cooling. I made a new commutator end bracket from aluminum, incorporating a mounting arm. The drive-end bracket is a bolt-on steel type with the mounting arm and provision for the adjustable arm. The bracket that bolts to the engine was made from steel and a 2½ in. aluminum pulley was used.

The engine drive pulley was made from an old starter gear-pulley combination with the gear and excess aluminum cut off on the lathe. However, this could be left on if a starter was to be used at any time.



The regulator is a 12V, 10 Amp. Auto-lite VBO-4201C-2. This set-up, giving up to 10 amps output, is adequate for a small radio, lights, etc., and would probably be all right for a starter if a large battery, solenoid and wiring were used.

Repairing Fabric Covered Aircraft

By Orville Lippert, EAA 9159
9595 N.E. County Line Rd., Riverdale, Mich.

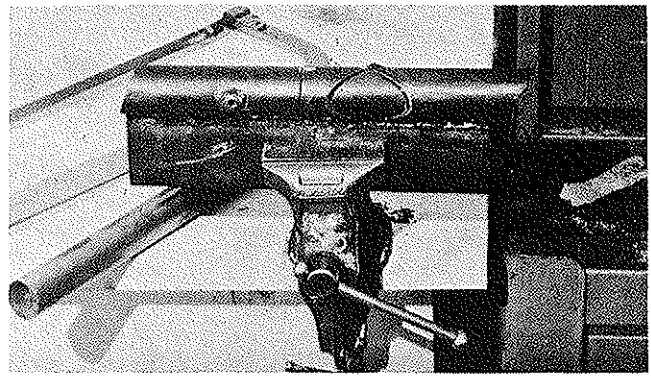
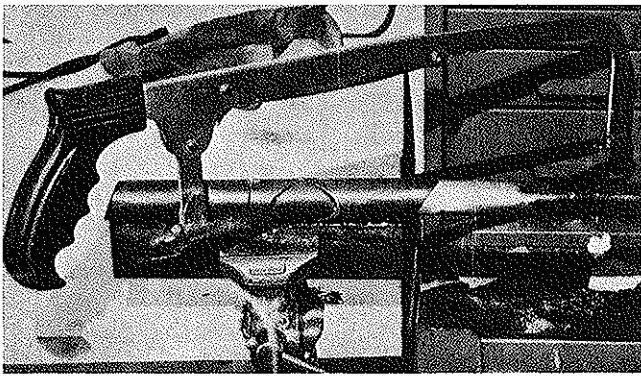
I WILL TRY to cover a few points on the repairing of fabric covered aircraft.

We will assume, to start off with, that your one-and-only has been the recipient of a beautiful enamel paint job. Excellent weather protection, good looking, glossy with about one-half the work necessary to get a similar effect with dope, to say nothing of the ease of matching cowlings and metal parts to the fabric both in color and gloss. Anyway, to your utter horror, a patch has become necessary due to some other clod borrowing the little jewel and dragging a wing tip into the frozen tundra. "Benevolent Joe", the friendly AP, can't get the machine into his heated hangar, and you would like to fly it again before spring.

So the first step is to either get the bird into an unheated "T" hangar, or put on your "long Johns" and scrape the snow and ice off, and get to work. First, determine the size. I have found that on small patches (not to be misconstrued as to mean several panels), a temporary repair can be effected on enameled fabric even in sub-zero weather by the following method:

Obtain some old doped fabric from someone who has recovered a panel. Preferably this should be a silver doped finish, although color dope is satisfactory. Either nitrate or CAB dope is OK. Maybe CAB would be a little more desirable, but not a great deal. Cut a pinked patch from this old material, allowing about a one-inch overlap around the damaged area. Dip this patch in acetone and apply immediately over the damaged area. On a doped surface apply face up, and the acetone remaining in the cloth side of the patch will be enough to weld the patch to the hide. On an enameled surface, probably you will have to place the doped face of the patch to the wing surface. Smooth down around the edges until the acetone dries in about a minute. You are then ready to fly. As soon as you care to, you can shoot your color back on.

I have made satisfactory emergency repairs in 10 below zero weather with this method. But remember, this would have to be classed as a temporary repair, and permanent repairs should be made as soon as possible in accordance with CAM 18.

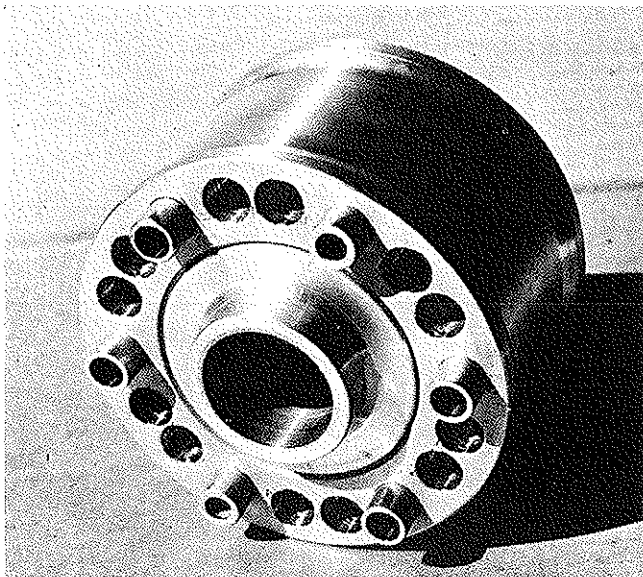
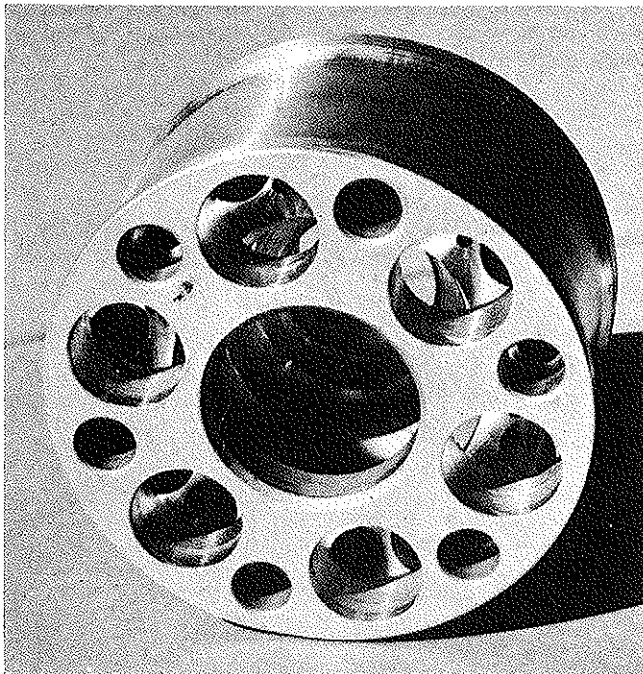


Tube-Cutting Jig

By Andrew H. Harness, EAA 12899
2805 SW. 55th, Oklahoma City, Okla.

A very practical tool cutting jig can be made from a piece of scrap tubing with an inside dimension big enough to swallow the largest tube that might be cut. Weld the

tube to a plate edge for securing in a vise as well as to hold the jig together after the miter slots are cut. •



INEXPENSIVE PROPELLER HUB EXTENSION

By Russell W. Riter, EAA 12838
Sky Harbor Airport, Northbrook, Ill.

Here is a simple and inexpensive way to get a propeller extension if you don't need over 3½ in.

I purchased a junked propeller for \$2.00, sawed off both blades, and got my money back when I sold the blades for scrap. This propeller fitted the Lycoming O-290 engines.

The outer disc was then finished in the lathe, and I drilled 1¼ in. holes about 1 in. deep between the bolt holes on the back side. On the front side, I drilled two equal-spaced ⅝ in. holes through to the 1¼ in. holes. These holes are to make it as light as possible. The mounting-bolt holes were reamed to a straight bore since they were compressed and out-of-round from previous torquing of the propeller bolts.

A counterboring tool with a pilot to fit the reamed bolt holes was made, as well as a cutter to fit the bushings that were pressed into the holes. The bushings are ⅝ in. O.D. and ⅝ in. I.D. by 1 5/16 in. long. Cessna p/n 0442129-1 will work or they can be turned and plated.

A front-centering bushing was turned from a piece of aluminum and shrunk in. The outside diameter of the part that sticks out is the same as the crankshaft. Since I didn't have a piece of aluminum, I sawed off the end from a scrap Hartzell blade and turned it to fit.

This type of extension is a little heavier than a spool type, but there should be no worries about strength or failure.

If less than 3½ in. is needed, cut off what you do not need while the outside diameter is being turned, but be sure to keep both faces parallel or the propeller will not run true. •

Sailplane Panel Vibrator

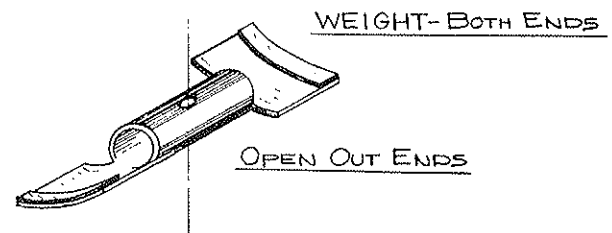
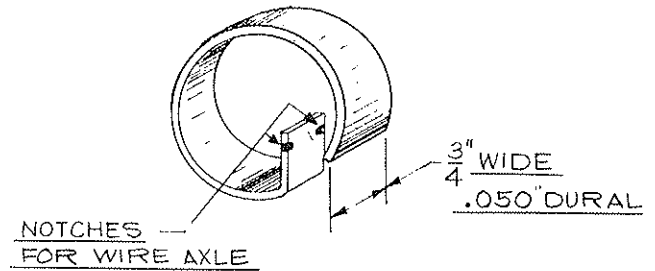
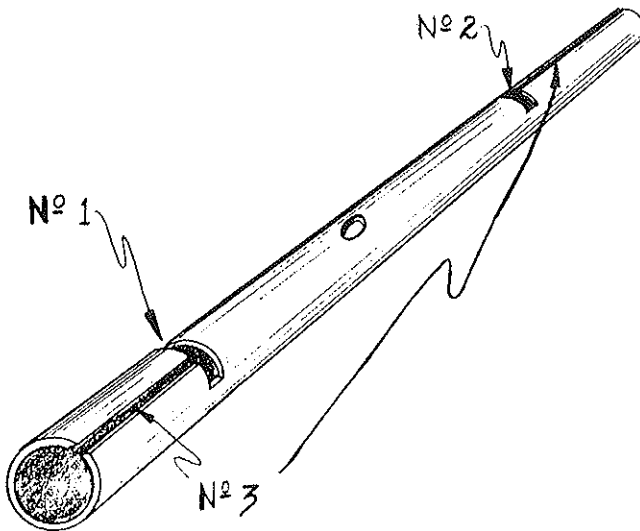
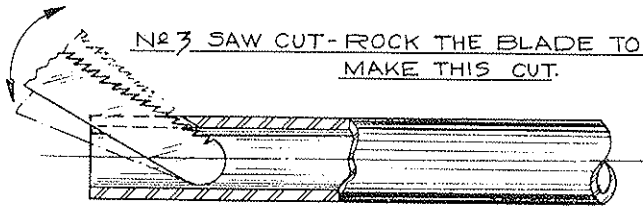
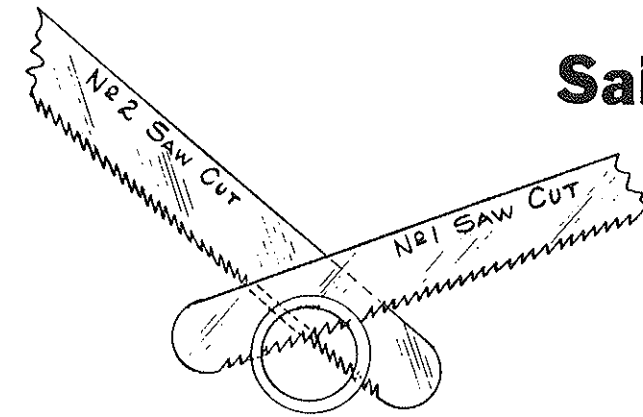
By Stephen du Pont
Buck Hill Farm, Southbury, Conn.

A PANEL vibrator for a sailplane was wanted for use during a Photo Panel recorded test of sailplane performance.

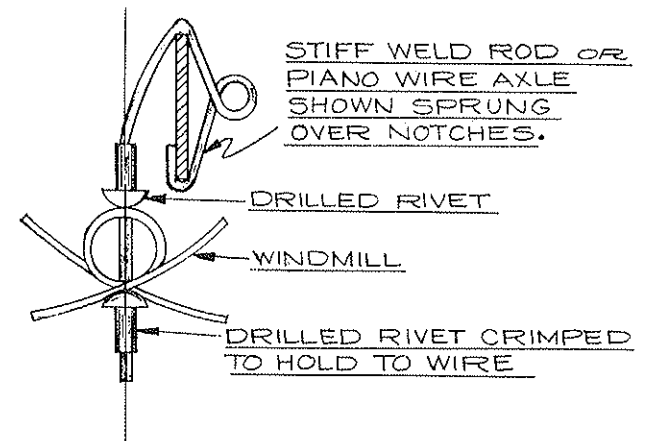
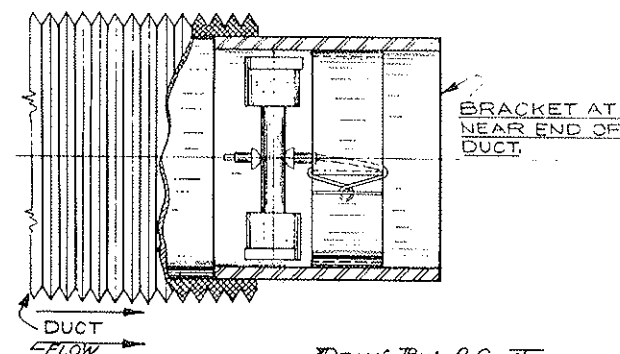
An out of balance propeller or rather windmill in the ventilator tube was suggested by Bill Welch, and was made as follows:

A short piece of aluminum tubing, $\frac{1}{4}$ inch diameter, short enough to go across the duct without hitting was formed into a two-bladed windmill as shown.

Then a piece of dural scrap stock was wrapped into a hoop as shown. The windmill was mounted by a wire (welding rod) axle secured to the dural coil as shown. A piece of dural $\frac{1}{16}$ inch wide and as long as the chord of the blade was attached to the end of one blade with contact cement to provide the out of balance. This device was forced into the near end of the ventilator duct and it shakes as bad as an engine with three AC spark plugs and one you name it. •



FINISHED WINDMILL



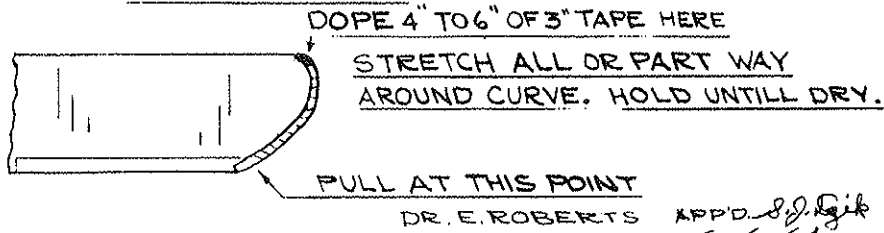
TAPING WING-TIP BOWS

By James E. Bell, EAA 3786
6 Sheldon Dr., Spencerport, N.Y.

Applying 3 in. tapes on wing-tip bows and tail surfaces can be quite a problem. Some builders cut wedges from the tape to go around the edge, which works all right, but here is a tip that was taught to me by "Squeek" Hepler.

Make a lengthwise fold in the 3 in. tape and crease it. Dope about 4 to 6 in. of it on at the beginning of

TAPING WING TIP BOWS



the curve and allow the dope to dry. Then dope the rest, or even a part of the curve if it is large. A good, even pull on the tape will allow the tape

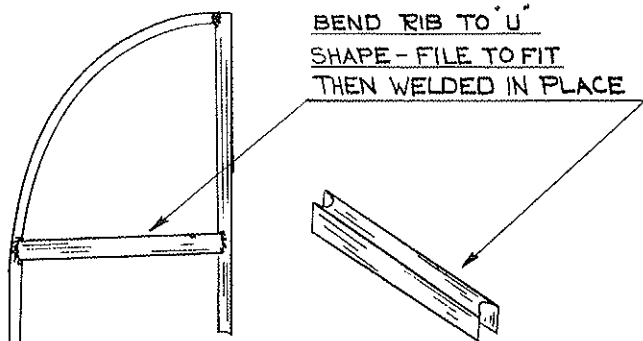
to fit the curve perfectly and make a much neater finished product. The crease which was made in the tape allows for a good center guide.

RIB CONSTRUCTION FOR RUDDER OR FIN

By Henry E. Winslow, EAA 595
Mira Loma Circle Apts., Unit 14A
1600 W. 5th St., Oxnard, Calif.

A strong rib construction for rudder or fin is made from 4130 sheet stock. It is first bent into "U" shape, then filed to fit and welded in place.

This type of construction has the advantage of forming the proper contour when two different sizes of tubing are used at the tail post and leading or trailing edge.



METHOD FOR
RIB CONSTRUCTION
APP'D. *EDZIK* DR. E. ROBERTS
G-6-64

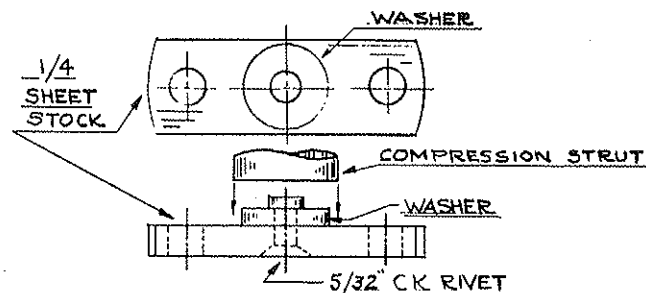
Also position-light wires may be routed through it without weakening the structure materially, as would be the case of a rib made of round tubing.

CUTTING DRAIN GROMMET HOLES

By Robert G. Harmon, EAA 1254
2980 NW. 173rd Terr., Opa Locka, Fla.

For cutting the fabric from drain grommet holes, I have found that a 1/4 in. auger bit is just the thing! I purchased one for \$1.00, and then used a whetstone to put a good sharp edge on the cutting surfaces. By putting a tap handle on it and using very light pressure, it will cut a very clean hole in no time, and by continuing right-hand rotation after the cut is made, the fabric slug will stay on the bit when withdrawn.

It also worked very well to cut the 1/4 in. drain holes through the plywood on my "Cougar" wings. I would advise trying out this method first on a scrap piece in order to determine how light the pressure should be to prevent the back surface of the plywood from splintering.



STRUT FITTINGS
APP'D. *EDZIK* DR. E. ROBERTS
G-6-64

STRUT FITTINGS

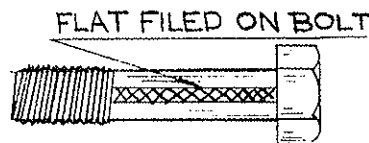
By Alfred E. Griffin
2567 Eveleth Ave., Hayward, Calif.

The machined aluminum compression strut fittings on the "Miniplane" wings can be made easier and faster by cutting up 1/4 in. sheet and fastening an aluminum washer to the fitting with a 5/32 in. countersunk rivet.

ALIGNING BOLT FOR WELDING

By John Singer, EAA 3782
P. O. Box 131, Beaver Falls, Pa.

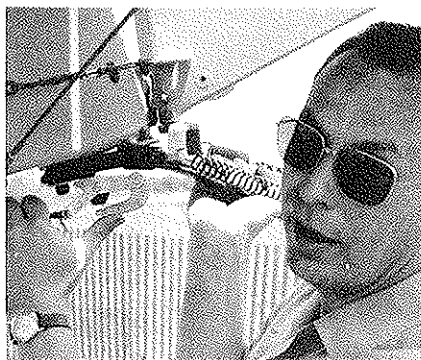
I'm sure that there isn't one homebuilder who has not experienced difficulty in getting a bolt out of a fitting or hinge where it was necessary to use a bolt to hold the parts in alignment while welding . . . that is, unless he was building an all-wood airplane. To make the



CLEAN OFF ALL CADMIUM
OR USE STANDARD IRON BOLT.

WELDING BOLT
APP'D. *EDZIK* DR. E. ROBERTS
G-6-64

job easy, be sure to clean off all of the cadmium and file several flat spots on the bolt. Then, after welding, the bolt can be easily removed.



GROUND HANDLING SAFETY

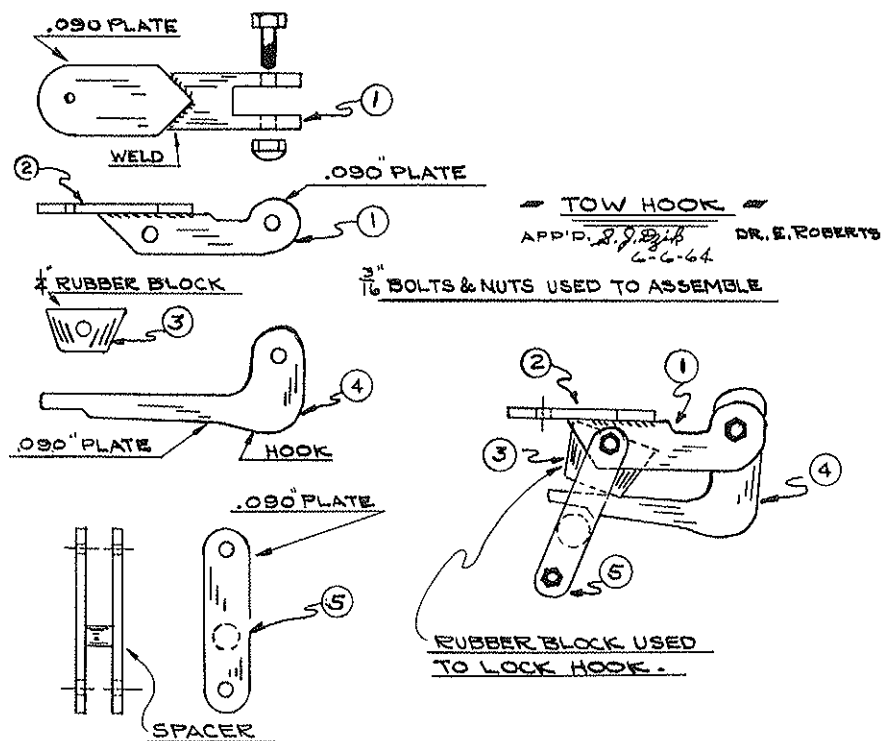
By Arlo Schroeder, EAA 4902

114 SW. 6th, Newton, Kans.

Have the wheel chocks disappeared from your airport? Who knows what happened to them. Then how do you start an airplane that has no parking brake?

Arlo Schroeder is shown checking the installation of a glider tow-hook on the tailwheel spring bolt of Bob Stephens' "Special."

The purpose of the hook is to secure the tail of the airplane during engine-starting operations. This eliminates the chase and possible solo flight of an airplane by itself when there is no one to man the controls



while the engine is being started by hand. When the pilot is ready to taxi the airplane, the hook is released from the cockpit.

The hook can be homebuilt by the individual or it can be purchased from the Schweizer Aircraft Corporation.

OUTER RIB JIGS

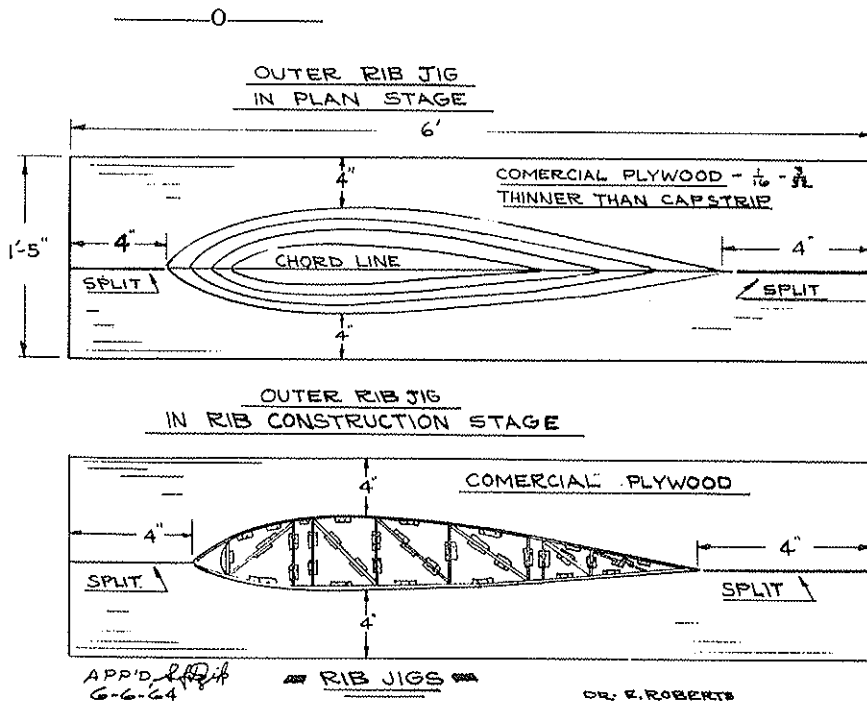
By A. J. Meuse, EAA 5374

RCAF Station

Lamacoza, Quebec, CANADA

This suggestion can save countless hours in making ribs for a tapered wing.

Take a piece of commercial plywood approximately 1/16 to 3/32 in. thinner than the capstrip size being used, of sufficient length and width to accommodate the largest rib plan plus 4 in. on all four sides. Next, draw the chord line on the plywood, using the largest rib plan for reference. Then reproduce all the rib outlines on the plywood, using the chord lines as reference. Then take the smallest rib outline and cut out the center. Put the plywood with the rib outline over the corresponding rib plan or template, placing wax paper between them. When the plan is smoothed out, nail the jig down and then you are ready to place the inner support blocks (cross-member supports) and



construct your ribs. When they are finished, take the plywood jig and cut

out the next size and do the same as the first. Simple, isn't it?

TEMPORARY METAL-TURNING LATHE

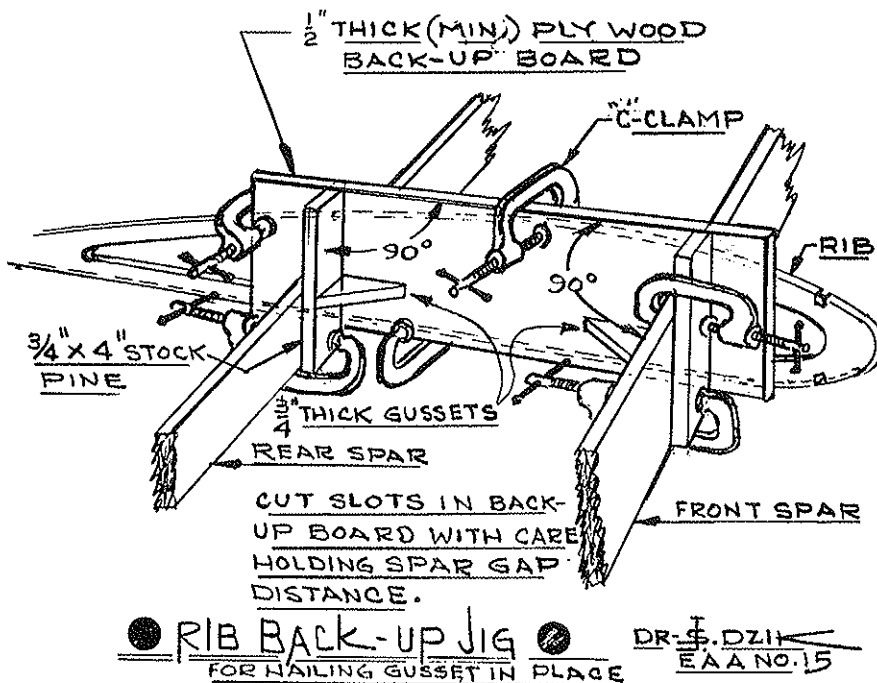
By Graydon L. Sharpe, EAA 3784

R. 2, Augusta, Maine

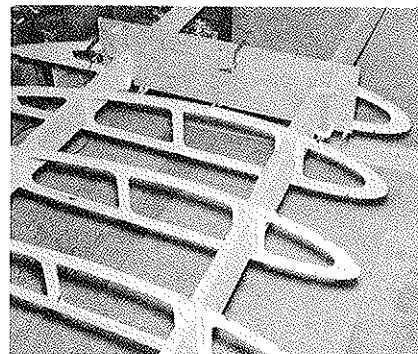
For the person who has a drill press but no metal-turning lathe, and who wants to square the ends of small bushings, the bushing can be chucked in the drill press,

turn it on, and bring the bushing down onto a flat mill file that has been secured to the table. The file will need

(Continued on bottom of next page)



By George L. Stout, EAA 9700
3007 Coomer Rd.
Newfane, N.Y.



day, the jig would be moved up to the next rib for the same operation, then going back to finish the opposite side of the previous rib.

It may seem like a slow process, but many homebuilders can't afford to go too fast, so a little progress each day keeps the enthusiasm alive much better than long waiting periods in between.

IN BUILDING the wings for my Stits "Flut-R-Bug", I found that cutting a piece of $\frac{1}{2}$ in. plywood to fit over the spars at the required rib spacing helped a great deal when installing the ribs.

By clamping the plywood jig to the spars, and then clamping the rib to the plywood jig, the rib is held snug and straight, with good backing for gluing and tacking the $\frac{1}{4}$ in. round gussets on one side. The next

Landing Gear Material

Responding to the many inquiries received in connection with the type of material used in the spring landing gears, we asked Steve Wittman for his advice in this matter, and he replied as follows:

"The desirable steel for the Wittman spring landing

gear is SAE 6150, but it is not easy to find. A steel that is satisfactory and readily available is 4140. Both should be heat-treated 400 to 425 Brinnell. We purchase our steel from . . . High Alloy Steel Co., 5100 W. 73rd Street, Chicago 38, Ill."

HELPFUL HINTS . . .

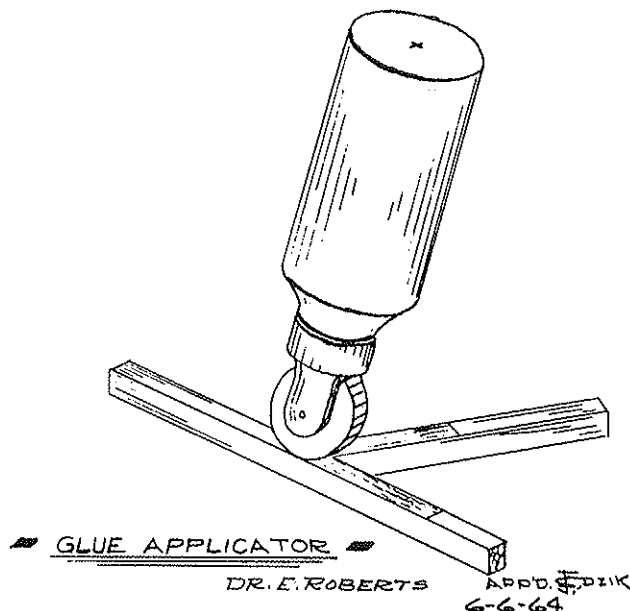
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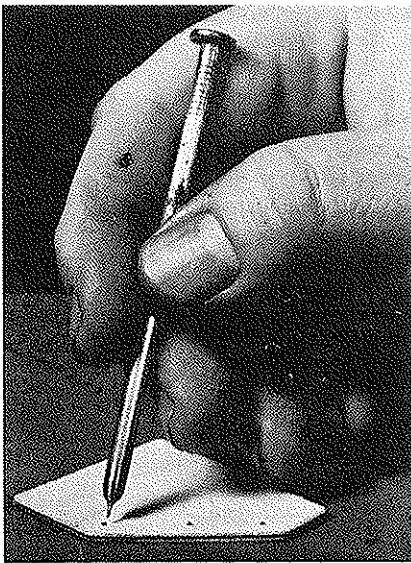
frequent cleaning while the work is in progress. Bushings can also be reduced in diameter by holding the file against the surface while it is chucked in the press or a hand electric drill.

GLUE APPLICATOR

By Dale Johnson, EAA 4258
3704 Cambridge, Midland, Mich.

When building wood ribs, a very efficient and effective glue applicator can be had by purchasing a paint striper as shown. They can be purchased from Sears and Roebuck Co. Mix your glue and roll it on. Just the right amount can be applied to both cap strips and gussets. When done with the ribs, the tool can later be used for that fine job of pin striping when painting your completed ship.





NAIL POSITIONING TOOL

By Mel Sutter, EAA 14377

524 W. Market St., Akron, Ohio

One of the most tedious steps in building wing ribs is the nailing of the small $\frac{1}{4}$ in., 20 gauge nails into the gussets, and the method will help to subtract many hours from the job of building the wings.

A large house nail or spike was ground down to the shape as shown in the picture. Using no other tools,

small holes are pressed into the thin plywood with the large nail.

This step is followed by placing the small aircraft nails into the holes with the fingers only. This last step can be delegated to some other member of the family, even the children, because the positioning of the nails has been pre-determined. •

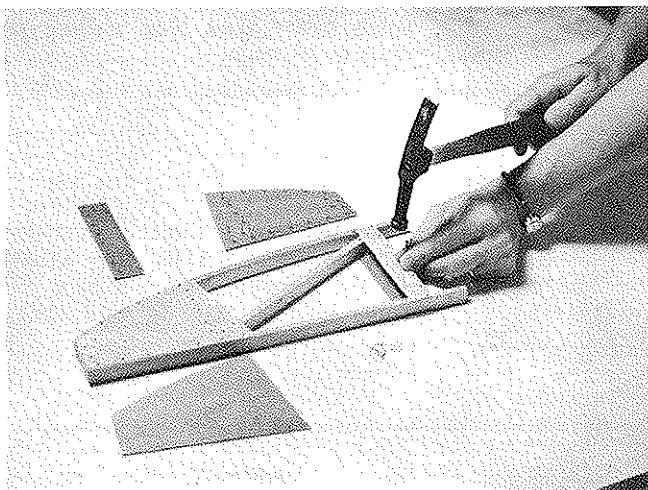
NAILING WING RIB GUSSETS

By William C. Kilburn, EAA 14168

Plantation Circle, Asheboro, N.C.

In getting nails started in wing gussets prior to mixing glue, here is a method that will not only eliminate some of the frustration of trying to handle the small nails with half-glued fingers, but will also insure ending up with a more accurate job of nailing:

STEP 1. Make one rib, using any method, and after the glue dries, pull the nails and locate exactly where the nails should have been located. Mark each spot.



STEP 2. At each spot that was marked, drill a hole just large enough to let the heads of your aircraft nails pass clear through. This completes the jig. To use it, put a gusset on the work bench and put the jig on top of it, with the gusset properly located where it will go. Drop a nail into each hole. Use a nail set or a common nail with the point filed off to reach into each hole and lightly drive the aircraft nail into the gusset. After all the gussets are pre-nailed for one side of a rib, turn the nailing jig over and nail a set of gussets for the other side.

The picture shows the process of pre-nailing gussets for a "Cougar" false rib. Shown are both pre-nailed gussets for one side of a rib, and the jig being used to pre-nail a gusset for the other side. What appears to be nails on the jig are actually the drilled holes. •

OPENING HOLES IN METAL FITTINGS

By Graydon L. Sharpe, EAA 3784

R. 2, Augusta, Maine

To enlarge a hole in a steel or aluminum fitting that does not require close-tolerance fit (such as a fitting

through which a tube passes and is welded around the perimeter), one easy way to do this is to chuck the tang of an appropriate size rat-tail file in a carpenter's brace. Inserting the small end of the file into the existing hole, rotate the brace counter-clockwise with pressure inward on the file. Because the file teeth pattern on the file is helicoid like a screw, if turned clockwise it would tend to screw into the work and would take too much of a bite. By turning counter-clockwise, the amount of cutting can be easily controlled by the amount of pressure held inward on the file and with no grabbing. •

NON-SLIP SCREWDRIVER

By Graydon L. Sharpe, EAA 3784

R. 2, Augusta, Maine

Sometimes in the removal of tightly installed or corroded Phillips-head screws, the screwdriver tends to slip up and out of the screw slots, rounding off the shoulders and thus making it easier to slip on each succeeding try. Instead, try this! When first going at the job, apply a tiny bit of fine valve-lapping compound on the tip of the screwdriver for each screw. This fine abrasive much increases the friction between the screwdriver and the slots, and more energy can then be applied toward torque and less to trying to hold the screwdriver down into the slots. No word should be needed on clean-up of the abrasive after use. •

SABRE SAW VERSATILE FOR HOMEBUILDERS

By Edward J. Gumell, EAA 7038

5641 Willow Terrace Dr., Bethel Park, Pa.

I think most of us in this homebuilding of aircraft have at one time or another run into a situation where we have need of metalworking tools of some kind — lathes, band saws, etc. Metal fittings of 4130 from .065 up can be worked by hand only with difficulty if at all. A little gimmick that has worked extremely well for me is the use of a heavy duty sabre saw as a very portable and versatile band saw.

When I bought my Craftsman heavy duty sabre saw a few years back, included in the kit were the usual woodworking blades and one very fine-toothed metal blade which I tried on some .090 and promptly forgot because it burned up. A little later, however, I needed the use of a metal band saw but had no access to one and had to improvise, which is when I tried the method I now do almost all my cutting with on gauges from .065 up to .250 in mild steel.

I had some standard 10 in. Griffin high-speed hacksaw blades (I think any good blade would do as well)

snapped one off to a 3 in. length, ground the top back edge for three-quarters of an inch to fit my saw holder. In my particular case, about a quarter inch was left to go in the holder. This will probably vary with the saw, but it should work in most cases. The first blade I used was an 18 tooth which works well in heavier material, and I have since used up to a 24 tooth for lighter metals.

The use is the same as though wood were being cut, except that the sheet should be well clamped on a heavy board to minimize up and down vibration. The speed of cutting will be faster than that of a table band saw, but will have to be found out through experimentation. One thing to remember, don't force the cut! You will find that after a certain temperature is reached the blade will move very easily. Another thing, wear safety glasses of some kind; the blade is moving up and down around 3,000 strokes per minute and is cutting on the up stroke and throws out small steel chips quite forcibly.

Radii can be cut down to one-half inch by grinding the blade to a smaller width. The usual width is one-half inch, so I took time and made a set in graduations of 1/16th down to a quarter which has taken care of all my needs so far. Another thing that helps on long straight cuts is to use a guide and a little cutting oil or grease along the line of cut. Aluminum, brass and cast iron have all been cut this way, remembering the softer the metal, the coarser-toothed the blade that can usually be used. Because the blade is moving at such a terrific speed, the edges of the piece being cut rarely have to be touched except for possible rounding-off. •

RIB STITCHING

By Noel M. Walker, Jr., EAA 5150
Tazewell, Va.

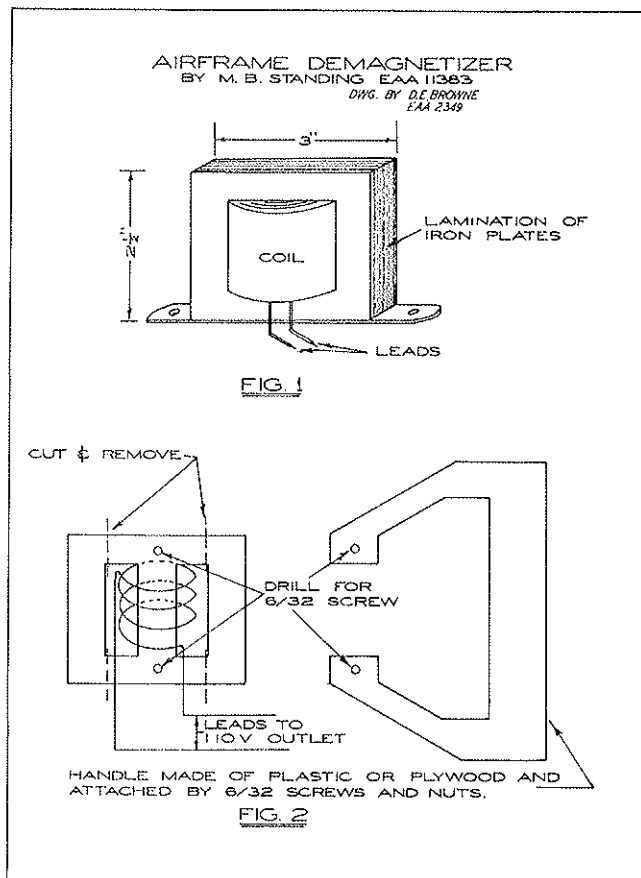
Except for the extra walking around, I find that doing rib stitching alone is as easy as doing it with two men. In fact, I use this same procedure when I have help, as it saves a great amount of time in trying to hit the mark on the other side.

First, I stand the wing on its leading edge in a simple rack, and then mark the chalk lines. Then I take my needle and punch the holes for the needle on both sides of the wing, either all or as many ribs as I expect to sew at the time. Then I place a light on each side of the wing and by looking through one of the needle holes above the hole in which I am inserting the needle, I can see the light shining through the opposite hole and can also see the needle. It is easy to aim the needle through the opposite hole and saves punching those accidental holes and the guesswork involved in finding the right spot. I believe that this saves about half the time on a two-man job, and it is surprising how much of a wing you can reach from one side. •

Airframe Demagnetizer

By M. B. Standing, EAA 11383
135 Sheridan Way
Woodside, Calif.

WHEN INSTALLING the compass in my Stits "Sky-coupe", I found so much residual magnetism in the cabin area, as a result of welding the 4130 airframe, that the compass would point only in a single direction. An expenditure of 90 cents for a surplus TV choke provided



material from which to construct a simple demagnetizer.

Fig. 1 shows the external appearance of the choke before alterations. Fig. 2 is a schematic drawing of the general shape of the laminated iron core and the copper coil that is wound around the central core. The electrical resistance (DC) of the coil measured 100 ohms. This would give a flow of about 0.8 amps when connected to a house circuit.

To convert the choke for demagnetizing work, it is necessary to remove a portion of both outside cores. First, however, drill through the plates and install two brass machine screws to keep the core laminations from separating. Cut the outside cores at the location shown and discard the outside pieces of laminated cores. The shape of the remaining core will now be that of the letter H with the coil around the center section. File any sharp corners. Connect the leads to a suitable length of electric wire and a standard electrical plug. Add a wooden handle if you wish.

To use the demagnetizer, move it slowly back and forth along the desired section of airframe while it is connected to the 60 cycle/110 volt house circuit. Position the unit so that the airframe tubing acts to complete the magnetic flux path emanating from one end of the H. Do not turn off the current while the unit is against the airframe. To do so will result in the airframe being strongly magnetized at that point.

I suggest that all welded clusters and connections be tested for magnetism before applying any final cover. This can be done by bringing a compass close to the weld and noting any strong deflection of the needle. Believe me, it would pay to demagnetize the bare airframe before covering than not to do it and run the chance of having to do it after the fabric and paint is on. •

BOX SPAR CLAMP

By Stanley W. Wilkin
EAA 10764

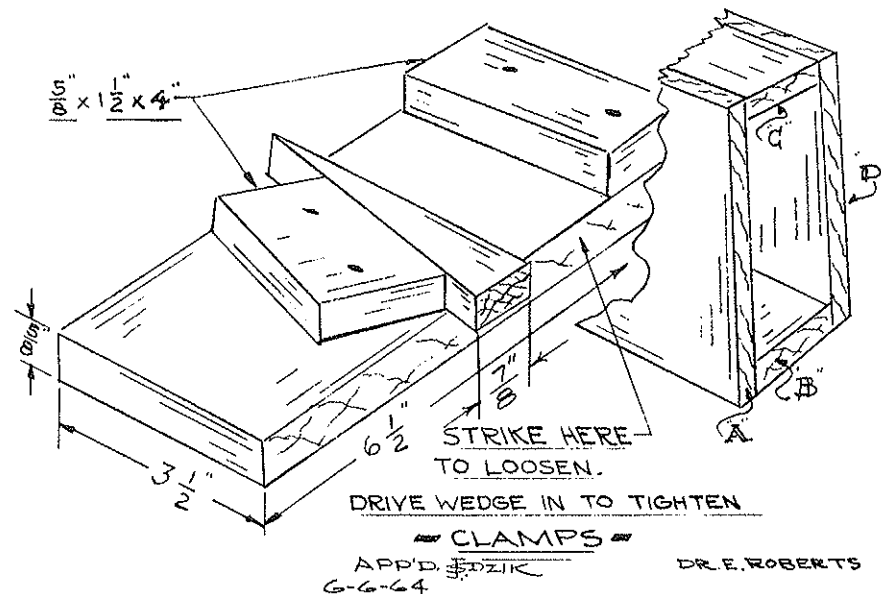
184 Islington Ave., N.
Islington, Ontario, CANADA

This very simple clamp is an idea that I came up with to help me make an extra dollar to carry on with the building of my aircraft.

My chums asked me if I would build a box spar for a mast for their sailboat. The construction of the mast was very similar to a box spar of an aircraft wing.

I took on the job to build this 32 foot spar, but in the back of my mind, the thing that I did not know was how I was going to clamp it simply and not lose my shirt in labor for jiggling.

I hit on this idea for a clamp and made 120 of them from $\frac{5}{8}$ in. packing box lumber planed on one side. This was obtained free from my place of employment. The time required to make the clamps was only eight hours. I used two $1\frac{1}{2}$ in. long nails in each block and no glue to make



the clamp. As the spar was tapered, this made the clamps easy to adjust by moving the block behind the wedge to the right width for the spar and driving in the nails.

The clamp can be made to fit any width of spar just by cutting the base

block to suit. I used a base block that was $6\frac{1}{2}$ in. long. I glued A, B and C first with the filler blocks in place, and then glued D.

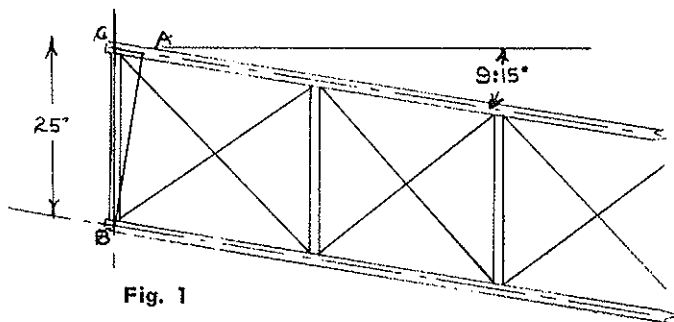
I hope that this idea will be of some help to some of the EAA members who are short on clamps. •

TRAMMELING A SWEEPBACK WING

By
and

Ellis S. Barrett
EAA 15787
E. Surry Rd., Keene, N.H.

G. D. Wilson
EAA 11422
Fitzwilliam, N.H.

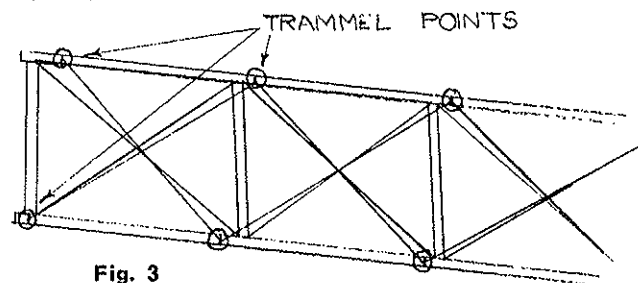
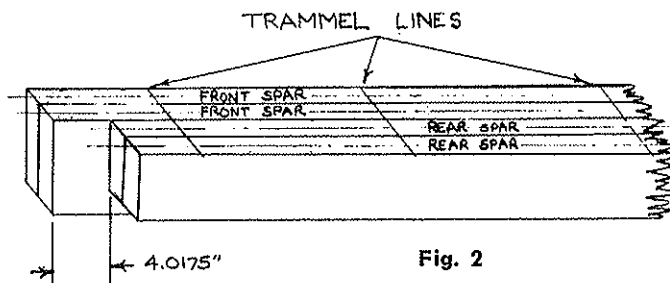


The problem of how to trammel a pair of sweptback wings with precision has undoubtedly been solved before. However, outlined here is our method which is simple and very accurate. It can be done with a trammel bar, a scale, and a minimum of skull work.

We solved the problem for the upper wings of a PJ-260. However, the method can be easily adapted to any wing.

Let us assume that the wing has $9\frac{1}{4}$ deg. of sweepback and the spars are 25 in. on centers (measured parallel with the ribs).

If you draw a line perpendicular to and intersecting the center line of the rear spar at a compression tube or rib location, use the center line of the compression tube or rib, and the center line of the front spar, you form right triangle ABC. (Fig. 1). Angle CAB equals 90 deg., angle CBA equals $9\frac{1}{4}$ deg. This can be proved geometrically. Line CB equals 25 in.



Using basic trigonometry, you determine the length of line CA.

$$\text{Sine of } 9\frac{1}{4} \text{ deg.} = \frac{CA}{25}$$

$$.1809 = \frac{CA}{25}$$

$$4.0175 \text{ in.} = CA$$

Now take both pairs of spars and clamp them to-

gether with the front and rear spar butts displaced by 4.0175 in. (Fig. 2). With a square, scribe several trammel lines across the spars preferably in the vicinity of the compression tubes.

When you assemble the wings, use these trammel lines and trammel as if the wings had no sweepback. (Fig. 3). Lo and behold! The wing has $9\frac{1}{4}$ deg. sweepback.

Trammeling at other than compression tube locations presented no problems. Both wings have a predetermined amount of sweepback. There are no eyeball measurements and no jigs required. But, perhaps more important, both wings have exactly the same sweepback.

CARBURETOR AIR SCREEN COVER AND CONTROL LOCK

By Rollin C. Caler, EAA 11984
1113 New Mexico St., Boulder City, Nev.

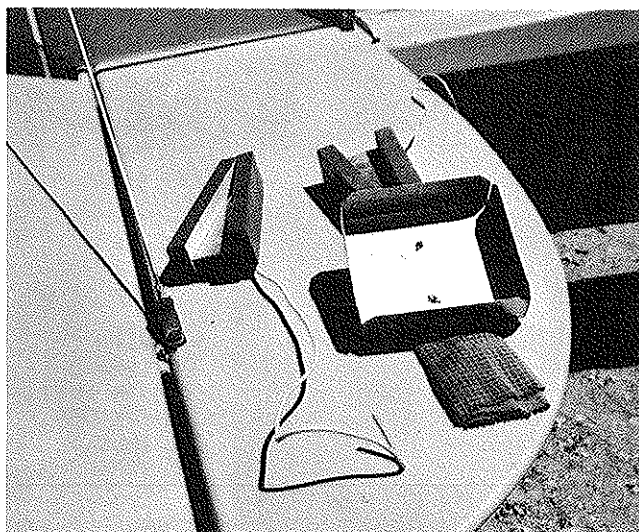
PROTECTION OF the carburetor air screen from blowing dust and sand while the aircraft is tied down at the airport can be quickly accomplished with the use of a simple slip-on type cover made of .021 in. galvanized iron obtained at the local builders' supply or hardware store.

The two dimensions of the screen are first marked on the flat sheet, then about $1\frac{1}{2}$ in. added outside and parallel to the inner lines. A 90 deg. cut with sheet metal shears is made at each corner to allow bending to a box shape. The remaining sharp ends should be cut round to prevent injury. The sides are formed over a block of wood using a mallet. In bending, the inner line should be "saved" which will give a slightly oversize effect. The bend should then be bent in more than 90 deg. to recover the original dimensions then bent out to give a smooth spring-like slide-on surface. The outside face can be

painted red as well as to attach a red cloth streamer as a reminder to remove the cover before starting the engine.

Tailor-made gust locks for ailerons are easily made by more use of this galvanized iron and $\frac{3}{4}$ in. scrap wood. A sheet of this metal is placed between the aileron and the adjacent wing rib and about 6 in. long pieces of $\frac{3}{4}$ by $\frac{3}{4}$ in. are placed above and below the rib to give the outer outline of the lock. After marking, the sheet should be cut slightly undersize to prevent unnecessary sharp edges. The assembly is then nailed together using nails long enough to go through both sides and clinched. The nails go through the metal quite easily. I used three nails on top and three on the bottom.

The outer surfaces should be painted red to be easily seen and removed during the pre-flight inspection. The inner surfaces should remain unpainted to prevent discoloring the aircraft surfaces. The forward edge of the metal should be filed smooth to prevent damage to the aircraft fabric. Attachment to the wing depends on what



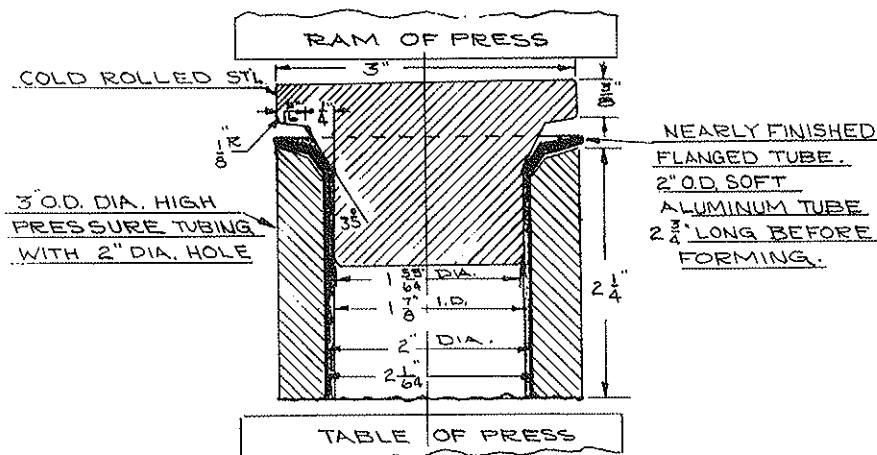
struts, etc. are present. On my Corben "Baby Ace," I found a spare piece of vinyl-coated No. 12 solid electrical wire made a quick and durable attachment to the rear strut.

TUBE FLANGING TOOL

By Hilton McNeal
EAA 5902

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Ft. Myers, Fla.

In the past, it was a slow, tedious process to make a flanged tube for joining 2 in. flexible tube to a flat surface such as the vent for cabin heat. I took two 3-in. dia. chunks of steel and machined them, as shown in the sketch, for a male and female die. This tool enabled me to easily form a finished flanged tubing nipple in a very short time by putting a $2\frac{3}{4}$ in. blank length of 2 in. soft aluminum tubing in the female die and then pressing the male die down on the top to make the flare. Release the press, tap lightly, and the blank



TIP ON MAKING A FLANGED TUBE
APP'D. J. DZIK
6-6-64 DR. E. ROBERTS

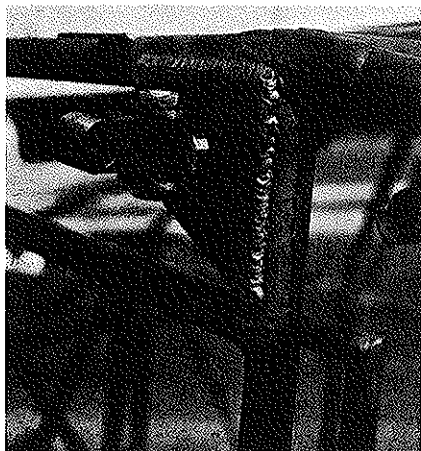
comes out perfectly flared and ready to use by drilling the mounting holes. This sure beats the old hand forming,

welding, or riveting two or three pieces to form this part, and takes only a fraction of the time.

"COUGAR" FOLDING-WING DETAILS

By Marvin D. Becker, EAA 3238
11571 Palmwood Dr., Garden Grove, Calif.

FOLDING-WINGS is not a new idea and there have been many methods of accomplishing this feature in past designs. The method used on my "Cougar" has worked fine for me, but perhaps you can improve a few features to suit your needs.

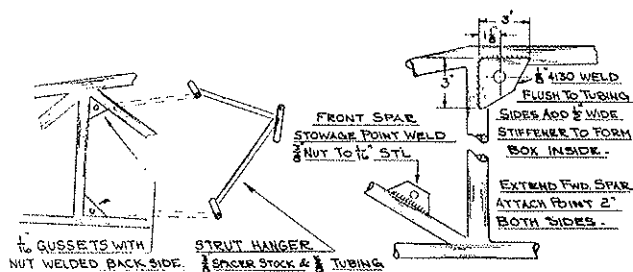
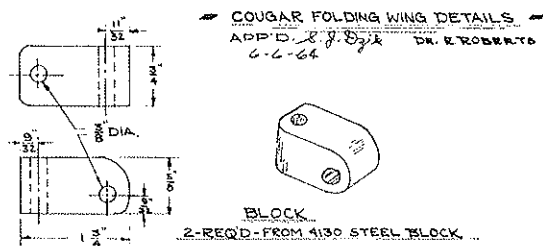
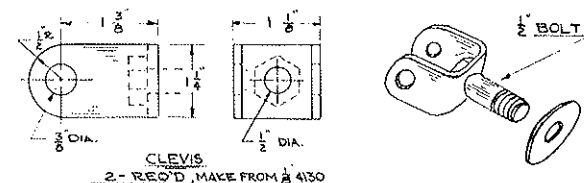
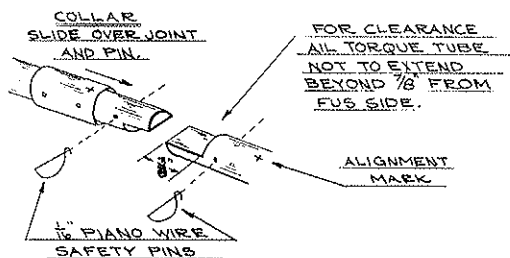
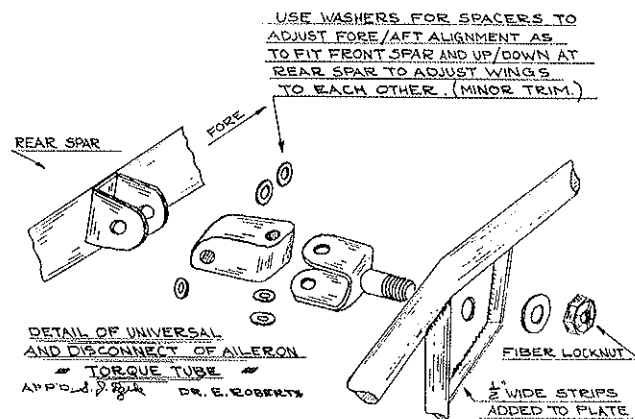


Close-up
view of a
universal.

There have been many inquiries about the details on this folding-wing which prompted me to present the material here.

Very little extra weight penalty is added with the full universal at the rear spar, the front spar-attach point which is beefed up and extended 2 in., and the nuts welded to gussets for wing stowage.

Setting the ship up for flight takes 20 to 30 minutes depending on how many questions I answer for the group that gathers. The front-spar and lift strut are completely removed for folding. The struts are stowed in the cockpit. A set of tail lights with stop and turn signals is slipped on the prop blades for travel to and from the airport and the "Cougar" is pulled on its gear backwards, by a "bolt-on fuselage" tow-bar made from large streamline tubing.



I have logged about 1,000 miles of trailer operation since the first flight on September 12, 1961 without any problems. She fits very well in my garage, the highest point is 6 ft. 6 in. at the aileron with the wings folded. See the May, 1961 issue of *SPORT AVIATION* for more pictures and construction details on the "Cougar."

CRIMPING TOOL

By Russell W. Riter
Sky Harbor Airport

EAA 12838
Northbrook, Ill.

I have formed a lot of ribs and bulkheads over plywood using 2024T3 up to .063 but, as anyone who has formed them knows, when a curve is

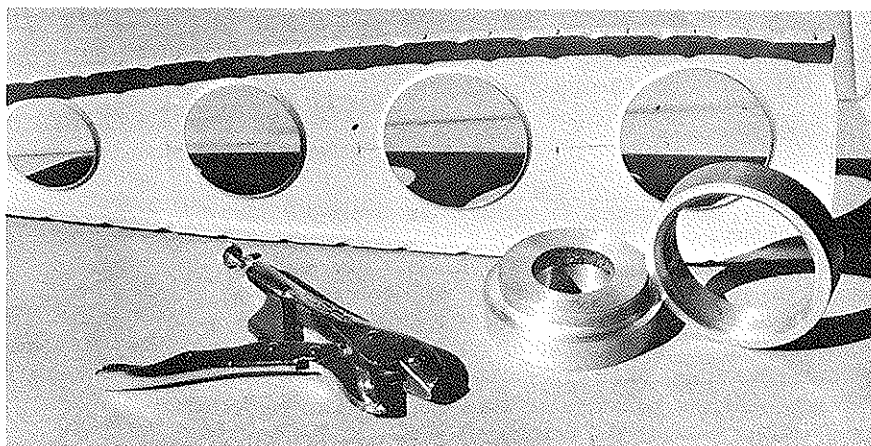
formed while bending the 90 deg. flange, the main material takes a curve when it usually should be flat and straight. The flange can be drilled

and cut out between rivet positions, however, I have made a tool that makes a little crimp between rivet positions and straightens the rib. A

couple of pieces of angle iron were cut and the edges were all rounded and smoothed. They were then brazed to a pair of vise-grip pliers.

After forming and trimming the flanges, mark the rivet spacing and then crimp between the rivet spacing just enough to straighten the rib.

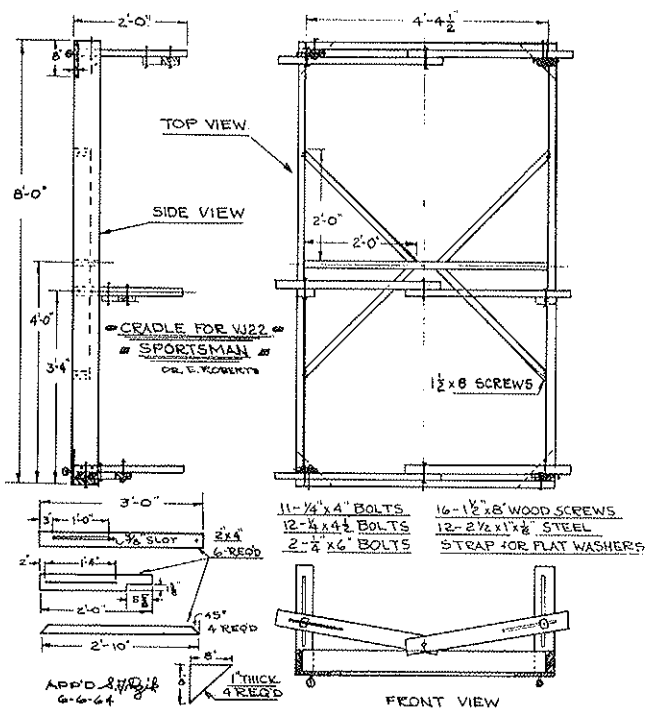
Also shown in the picture is one size of lightening hole flange die. I made a set from 1 in. to 3¾ in., by ¼ in. increments. Simply lay out the holes, saw out with a hole saw, smooth the edges and press the flange with a vise or a press. They look as professional as a factory job. •



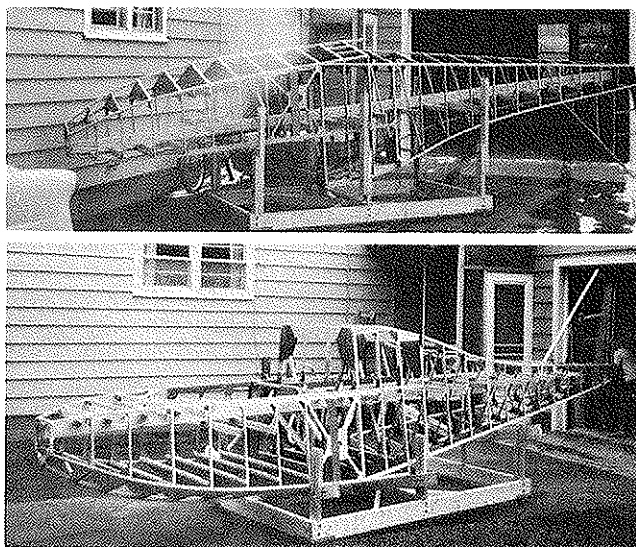
SPORTSMAN'S CRADLE

By Kenneth C. Walton, EAA 12488

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This simple and inexpensive cradle will greatly simplify the problem of handling and moving the fuselage-hull of a Volmer VJ-22 "Sportsman" during its construction. There is no reason why the cradle could not also be adapted to original design amphibian. •



LIFTING TEMPLATES FROM FULL-SCALE PRINTS

By Daniel D. Dwyer, EAA 11545

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IF YOU HAVE A set of prints that show wing fittings or other such small metal parts full scale, take a piece of clear celluloid or acetate (technically referred to as cellulose-acetate sheeting), place the transparent material over the parts shown on the print and tack it to the print with four small pieces of masking tape wherever it is convenient. This material is transparent and a lot like

plexiglas, but should only be about .015 thick. It can be purchased from an office supply dealer if no other convenient source is available.

Trace the outline of the part on the transparent material with a sharp knife, razor blade, utility knife or, better yet, an Exacto knife. This is a tool common to model builders for cutting balsa, shaped and handled like a pencil, with interchangeable cutting edges on the end.

It isn't necessary to cut too deep into the celluloid material. Anyone can draw the line with the cutting tool without any danger of cutting the print. Use a straight-edge to follow the straight lines, and washers or coins to guide around the radii. Locate the holes with a scribe. Lift the celluloid from the print and bend along the lines, and it will break along these lines very easily. It helps to use tweezers or pliers to break around the contours or radii. Knock off any burrs with sandpaper before using the pattern to scribe the flat stock. Your print will not be marked or damaged in any way.

Simple Construction Of Fiberglas Wing Tips

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WHEN I GOT around to making the wings for my Stits Skycoupe, I decided that I wanted something different in the way of wing tip design. Ray had designed the tips to use a single $\frac{1}{2}$ in. tube bow supported by the outermost rib and the two spar ends. The fabric stretches tight from the last rib to the bow a la Airnocker. I wanted something more fancy.

I figured the best way to start was to place some small riblets between the regular wing rib and the bow. These were cut from $\frac{1}{8}$ in. plywood to the contour I wanted. These are shown in Fig. 1.

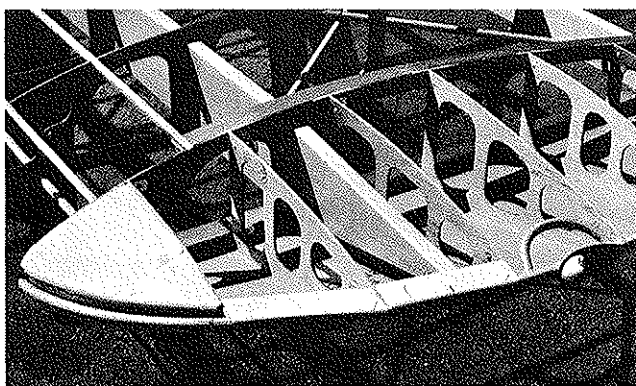


FIG. 1

To get a rounded effect at the bow I next cemented pieces of polystyrene foam between the riblets and at the leading edge of the wing. These are also shown in Fig. 1.

My plan was to next cover each side of the tip with one layer of fibreglas — after sanding the polystyrene to the right shape. This was a good idea up until I put the resin on the glass cloth and tried to stretch it over the riblets. If the cloth was on the top of the wing, I got nothing but hills and valleys! When I turned the wing on edge or upside-down to get rid of the saw-tooth effect, the cloth would fall on the floor! Obviously, a supporting media was needed.

In looking around for something to use, I spotted the $\frac{1}{8}$ in. corrugated cardboard that Mr. Reynolds had shipped my sheet aluminum in. Just the thing — cut strips and glue these between the riblets. The result is shown in Fig. 2.

But I wasn't out of the woods yet! The top surface for the first half of the chord was composed of too many flat segments with breaks in the curvature at the riblet

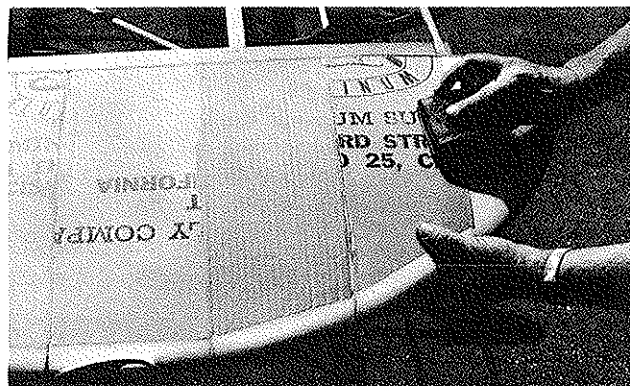


FIG. 2

locations. Solution was to glue more styrofoam to the flat spots and then sand to a smooth shape. This was then covered with one layer of 7 oz. glass cloth, using the usual polyester boat resin. You can see the finished product in Fig. 3.



FIG. 3

I had originally thought to remove the cardboard after the fibreglas had set up. However, it adds so much rigidity to the tip with so little additional weight that I'm going to leave it in the wing.

One word of caution is in order. There are two types of styrofoam. One type dissolves when contacted with Ambroid glue, lacquer thinner, polyester resin, etc. It will, however, stand polyvinylacetate glues (Elmer's, Wilhold, etc.). The second type, which I obtained from the local airplane hobby shop, was not affected by the organic materials. •

SAFETY ALERT U.S. GENERAL AVIATION MISUSE OF BRAKES

Misuse or excessive use of light aircraft brakes will reduce their reliability and service life.

To maintain effectiveness and reliability, it is suggested that you:

1. Permit aircraft speed to be reduced aerodynamically before using brakes.

2. Taxi in a manner requiring minimum brake use. Do not "drag" brakes at any time.
3. Do not use brakes while there is lift on the wings.
4. Apply brakes smoothly with an increase in pressure as necessary for maximum effectiveness.
5. Exercise caution during touch-and-go landing as brakes may become over-heated.

REMEMBER
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Reprint 1977