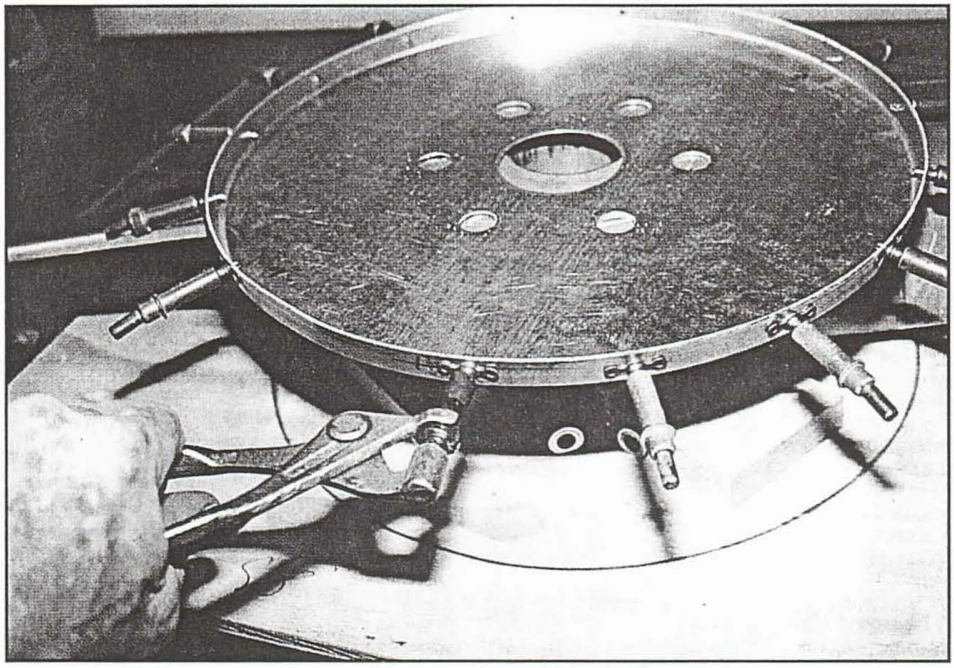
ANCHOR NUTS . . . WHY? WHERE? HOW?



Here anchor nuts are clamped to the outside edge of a propeller bulkhead with 1/8" Clecos in preparation for drilling the rivet attachment holes. After the holes are drilled the anchor nuts will be transferred to the inside flange edge and riveted.

More than 15 years ago I wrote a chapter titled "Where and How to Install Nut Plates" for my book "The Sportplane Builder," (it's the blue one). Since that time I have learned a few more things about installing anchor nuts.

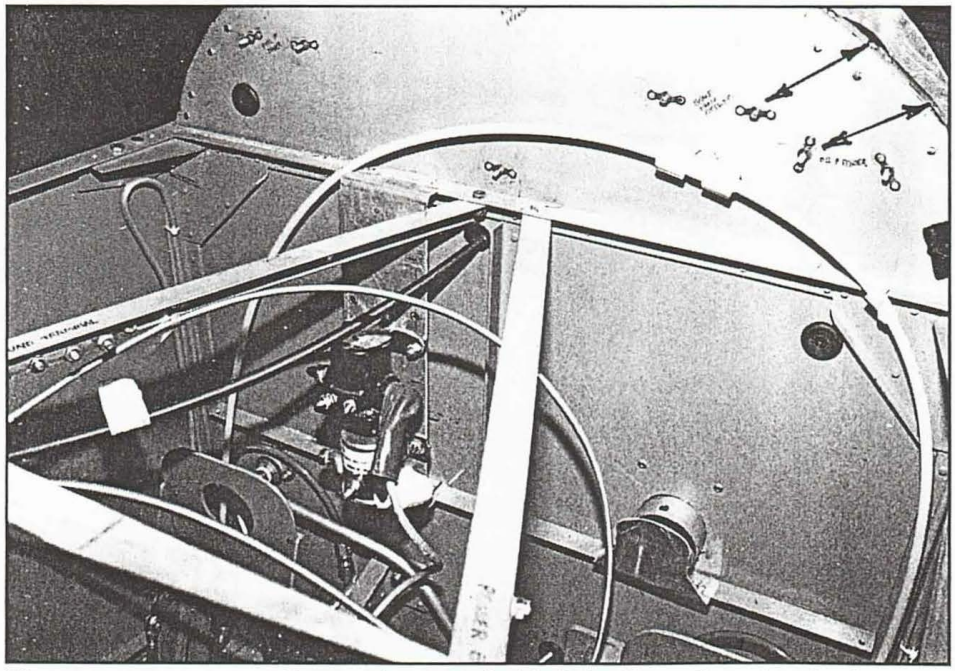
For some reason I like to call them nut plates. Be that as it may, I still don't like those pesky little things but, boy, are they important!

As the name implies, anchor nuts are captive nuts you can attach permanently to the blind side (backside usually) of an assembly. Often this is a removable accessory, component part, or cover, of some sort.

These anchor nuts, or nut plates, as they are often called, are usually installed where access to a regular hex nut with a wrench would be difficult, if not impossible.

With anchor nuts installed, it becomes possible to insert and torque your machine screws or bolts from one side.

Anchor nuts eliminate the need for groping around under an assembly in an attempt to install an ordinary hex nut.



These accessory mounting anchor nuts behind the firewall are too far from the edge making it impossible to set the rivets with a rivet squeezer. Instead, a rivet gun had to be used.

Where Do You Use Them?

You will find that anchor nuts are just about the only way you can make some installations. The most frequently affected problem locations are the following:

1. Inspection access covers and hatches.
2. Cowling attachment.
3. Installation of accessories on the firewall.
4. The installation of antennas.
5. Propeller spinner/bulkhead installation.
6. The attachment of wing root fairings.
7. Instrument panel installation.

If you think about it you will realize that the applications listed have this in common. Each is, for all practical purposes, a so-called "blind installation." That is, the part generally has to be secured with little or no access to the opposite side for installing and torquing ordinary nuts.

Substituting anchor nuts in these locations, therefore, not only makes the installation possible, they will also permit you to remove the part later for replacement or maintenance.

Keep this thought in mind. During the construction of your airplane you will enjoy much easier access to everything than will be possible later after the airplane is finished.

For example, after you complete your airplane, you will find it impossible to remove an accessory like the voltage regulator, gascolator, or air/oil separator from the firewall, single-handedly, if the unit was in-

stalled with ordinary hex nuts.

Obviously, without the aid of a second person inside the airplane manipulating a wrench on the opposite side, such a simple task is almost impossible.

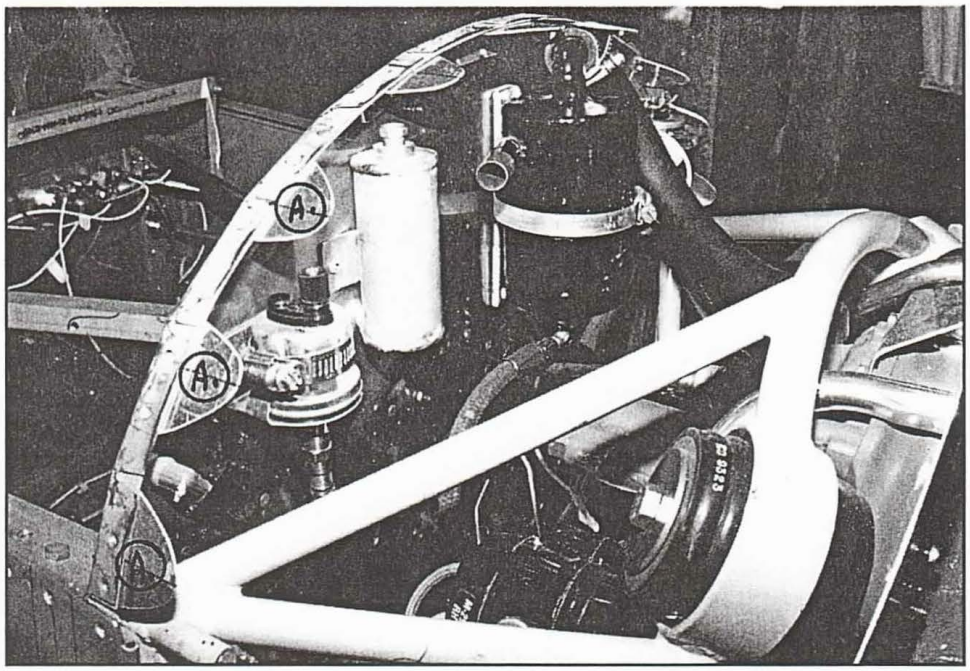
But, even if you have somebody to help, what do you do if you have a big fuselage fuel tank up front? You may still lack wrench access to the firewall unless the tank is removed first!

Of course, you would have missed all that fun had you anticipated the need and installed the accessory with anchor nuts.

The same problem can confront you should you have to remove an antenna. It would be simple enough to accomplish the task single-handedly if anchor nuts are installed . . . if not, you will need somebody outside the airplane with a back-up wrench.

In short, consider installing anchor nuts anywhere you find it impossible, or impractical, to install standard aircraft hex nuts.

Naturally, quite a bit of extra work (and cost) is involved in installing-anchor nuts, so it is not likely you will consider installing them just for the fun of it . . . not without a good reason.



These firewall mounted accessories are all mounted with the aid of anchor nuts to make them removable without access to the backside of the firewall. The rear portion of the cowling will be secured with machine screws. Note the installation of tabs (A) for mounting the anchor nuts.

Selecting the Right Kind of Anchor Nut

This is no big problem because almost any type of anchor nut (nut plate) you can get will most likely be suitable for the job. Assuming, of course, it is the correct size for the bolt or machine screw you intend to install.

Incidentally, many a builder has, on occasion, installed a wrong size anchor nut, simply because he failed to check it before installing it. That always means more unnecessary work as they have to be drilled out and replaced.

Here are a few thoughts you can mull over. It is not at all unusual for the typical all-metal homebuilt to have more than two or three hundred anchor nuts installed.

Two of the most commonly used anchor nut varieties include:

1. The two lug nylon insert locking type (AN366F).
2. The two lug all-metal anchor nut (K1000).

Other less frequently used types include the all-metal floating anchor nuts, one lug nuts, corner nuts, and even miniature nuts for limited space installations.

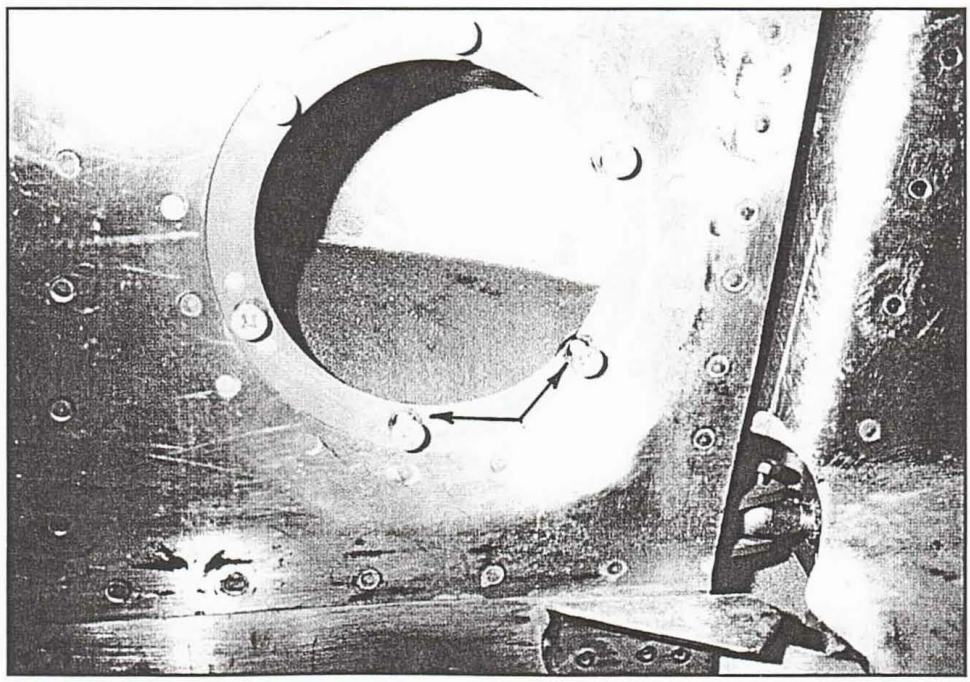
NOTE: Check your homebuilt supplier catalogs for the options and sizes they normally carry. Don't be confused by the specification numbers (AN, MS, NA, etc.). Look at the illustrations and select the bolt/screw size you need accordingly.

Cost is very definitely a factor to consider when selecting the type of anchor nuts you will use.

For example, according to one of my catalogs, I can see why the all-metal K1000 two lug anchor nut is so popular. For one thing, it is quite inexpensive (about 17 cents each). Besides that, it is very light, is lubricated lightly with a dry lubricant, has a self-locking capability, and can tolerate temperatures as high as 450 degrees F.

In contrast, the listed, nylon locking insert anchor nut (AN366F) is a heavier, bulkier, anchor nut that can only tolerate a maximum of 250 degrees F. And, in spite of these shortcomings, retails between $1.10 and $2.98 each. (In 1994, more than ever before, it pays to shop around.)

My little RV-3 has over 345 anchor nuts installed as of this date. Guess which variety of anchor nuts I am using? It is the 17 cent variety, of course. If I had to install the expen-



This aft fuselage access is essential for installing and connecting the elevator control mechanism. Anchor nuts make this possible. Note how the builder has temporarily installed the correct size screws to keep from misplacing them.

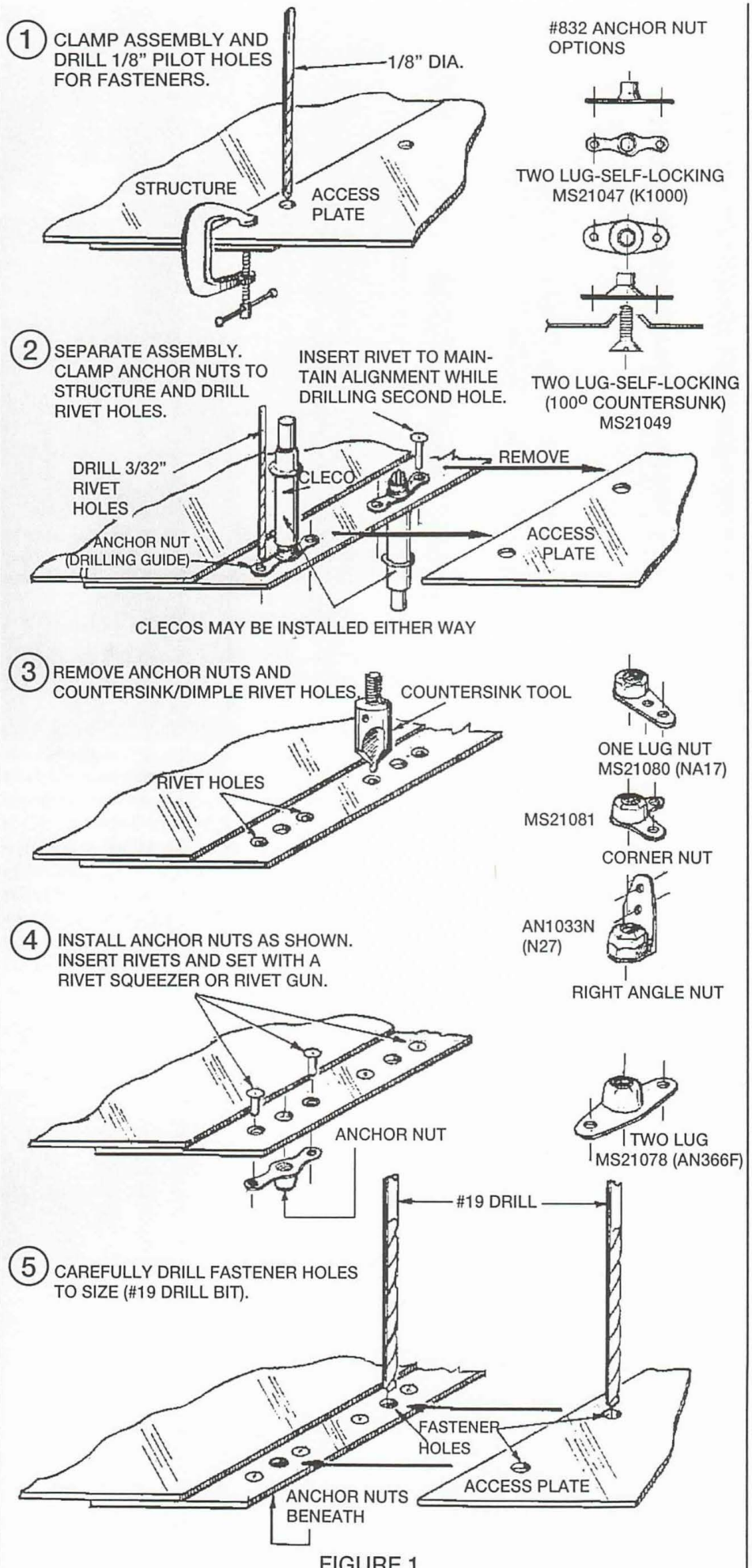


FIGURE 1
ANCHOR NUT INSTALLATION PROCEDURE (FOR #832 NUTS)

sive AN500F elastic-insert type, I would have had to obtain a bank loan by now.

Incidentally, I know you won't be able to resist the temptation to figure out how much 345 of the higher priced nylon locking insert anchor nuts would have cost me, so, go ahead . . . the numbers will shake you up.

Sometimes the space remaining for installation of an anchor nut is so limited that neither a standard two lug anchor nut or a miniature anchor nut will fit. Often a corner nut or a one lug anchor nut has to be substituted in these locations.

In other locations it may be necessary to install a right-angle nut, but these are rare exceptions.

Anchor nuts are also made with a floating captive nut which supposedly allows easier alignment on assembly. I find these to be conducive to sloppy workmanship and, therefore, merit little consideration for use in the average homebuilt. Besides, they are more expensive and more difficult to rivet in place.

Tips For Installing Anchor Nuts

Although anchor nuts are most frequently used to attach access plates, fairings and the like, they can also be used in structural applications with bolts.

Normal belief has it that the only way to attach anchor nuts is by riveting them to aluminum surfaces. This is not so.

You can also rivet these nut plates to plywood surfaces and fiberglass components. For that matter, anchor nuts may even be tack welded to steel parts.

On wood surfaces, anchor nuts are secured with nails or screws as well as by riveting. It all depends on the thickness of the surface material. In either case, it would be prudent to add a dab of epoxy adhesive between the nut plate and the wood surface.

The minimum acceptable diameter for aircraft structural bolts is 3/16" (AN3 bolts).

It is well to mention that larger anchor nuts are available and they are suitable for use in highly stressed locations.

The only noticeable difference in the anchor nuts used with larger bolts (3/8" dia. [AN6] and up) is that they are secured with larger rivets (1/8" rivets instead of the smaller 3/32" rivets) to better resist the higher torque limits imposed by such bolts during installation.

The most popular size anchor nut is the one that takes 832 machine

screws. This size is used almost everywhere you would need to install an anchor nut.

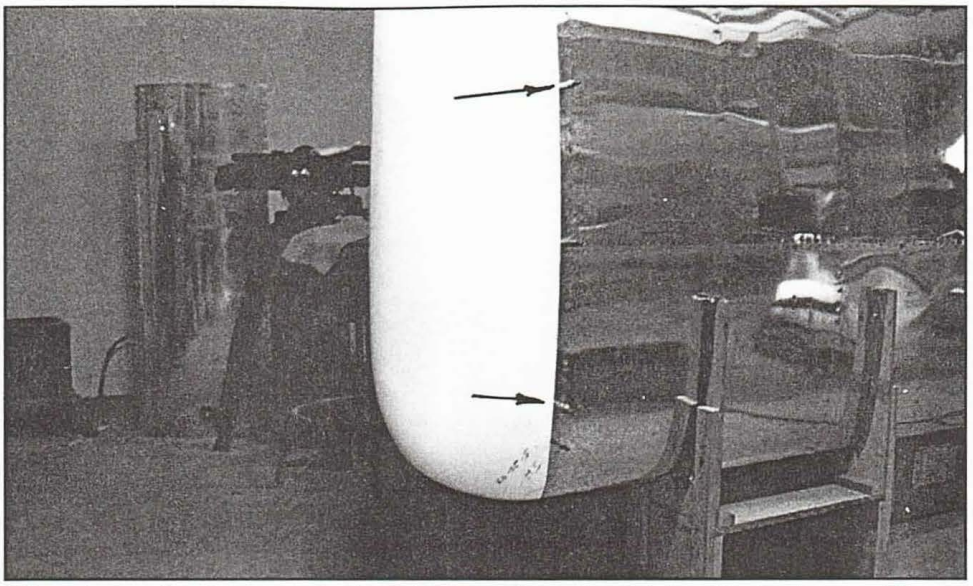
Fortunately, this is also the easiest of the anchor nuts to install. The reason being that a 1/8" Cleco can be used to temporarily clamp it in place while you drill the 3/32" attachment rivet holes.

Here is the basic procedure I use to install the 832 anchor nuts (see Figure 1).

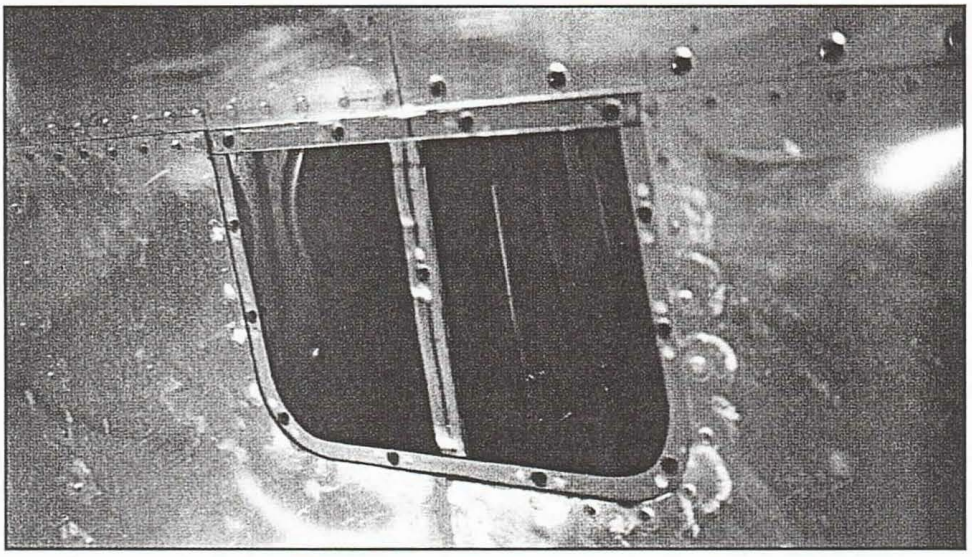
1. Clamp the two parts together and drill a 1/8" alignment hole through both of them where the attaching screw/bolt is to be installed.
2. Separate the two parts and set the top piece aside.
3. Place an anchor nut over the drilled hole in the bottom part and clamp it with a 1/8" Cleco. This will accurately align the nut plate with the drilled alignment hole.
4. Drill a 3/32" rivet hole through one of the anchor nut lugs.
5. Caution, don't ignore this step! Insert a 3/32" rivet in the hole you just drilled to prevent the anchor nut from twisting out of alignment while you drill the second hole through the opposite lug.
6. Remove the anchor nut and countersink the two 3/32" rivet holes.
7. Reinstall the anchor nut in its correct location (underneath now) holding it in position with a 1/8" Cleco or Cleco shoulder clamp. If Clecos won't reach, install a short temporary screw to hold the anchor nut in place.
8. Insert a flush head 3/32" rivet in each lug hole and set it . . . preferably with a rivet squeezer. Of course, if you must - use a rivet gun where a rivet squeezer won't reach - but it will be a trickier operation.
9. Remove the Cleco clamp and redrill the original 1/8" alignment hole to its correct diameter for the 832 screw with a #19 drill bit. Be extremely careful because the drill bit will tend to hog in and ruin the threads in the already installed anchor nut.

Also, don't forget to enlarge the 1/8" fastener hole in the removable access plate, if applicable, with a #19 drill.

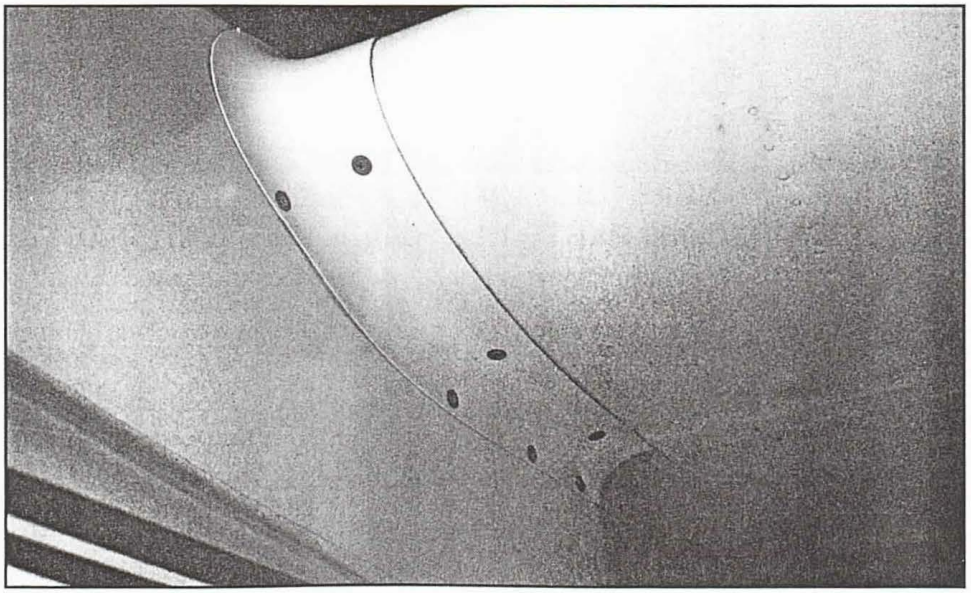
10. If the installation machine screw is to be a flush head type, you will have to dimple, or countersink, the surface skin. Dimpling the bottom metal part of the assembly after an anchor nut is installed is, naturally, impossible. However, when the metal is thick enough countersinking should present no problem. Naturally, with thinner material, the



Fiberglass wing tips may be installed easily and quickly with rivets, or with nut plates and screws to make them removable. However, wing tips rarely ever have to be removed so the extra work and cost is seldom justified. A little extra slack in the wing tip light wires works just as well.



Installation and inspection access must be provided wherever there are control connections. Here access to the aileron bell crank and push-pull tubes is made possible with the help anchor nuts. This opening in the bottom of the wing is large enough to get both hands in while manipulating wrenches.



The temptation is great with some builders to paint over the attachment screws. This, however, proves to be a mistake as the fasteners soon chip and look bad. Installation of new stainless steel screws after painting is completed is the way to go.

surface skin can only be dimpled as countersinking would unduly enlarge the drilled installation holes.

Making Difficult Installations

Gravity will be working against you when you have to insert the rivets from the bottom and attempt to keep them from falling out. At the same time, you will be trying to press down on the anchor nut as you grope for the rivet squeezer . . . a difficult feat at best.

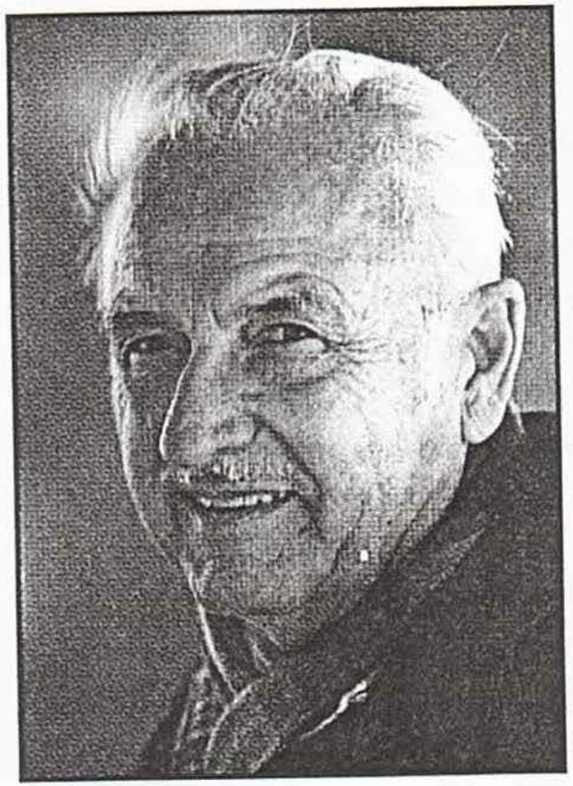
You will find that two hands are insufficient without resorting to a trick or two.

You can eliminate the need for a third hand by using bits of masking tape to hold the rivets in place. This is the same technique used to hold the rivets in place for other back riveting jobs.

However, when an anchor nut must be positioned from underneath while you insert the rivets from the top, masking tape can help but is not as effective. You may have to insert a temporary screw in the fastener hole if a shoulder Cleco won't reach. Of course, a 1/8" Cleco will work with an 832 anchor nut. However, its bulkiness may make it difficult to set the rivets with a rivet squeezer. In that case try inserting the Cleco from the opposite side or insert a 3/32" Cleco in one of the rivet holes. At any rate, think your problem through . . . there is usually a way to get the job done.

After the anchor nuts have been installed some builders run a tap into each nut plate to be sure the screw will go in easily during assembly. This practice, however, is not at all wise where the self-locking feature of the anchor nuts is important.

Installing anchor nuts, initially, is sometimes difficult and always time consuming. Nevertheless, the effort is worth it because they will always be there to simplify your future maintenance and inspection work.



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BOOKS BY TONY

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