# TWIST WELD CABLE END TREATMENT

## What is twist welding?

BY CAROL AND BRIAN CARPENTER

Figure 1

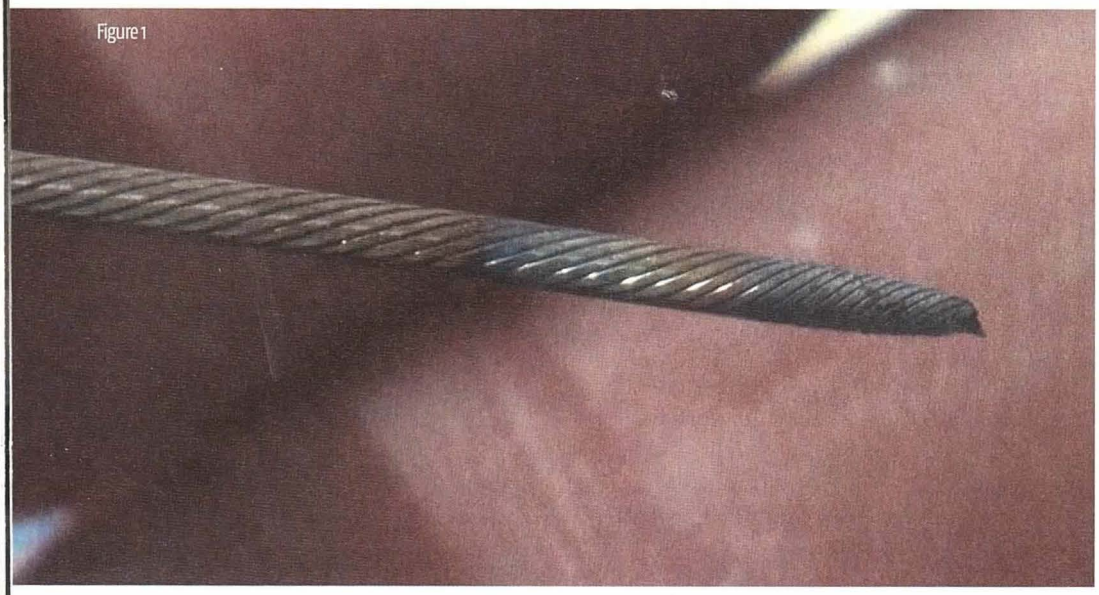

Figure 2

**TWIST WELDING IS A PROCESS** for treat end of a cable to prevent it from un ing. The idea was originally shared us by one of our students. He had b the cable industry for nearly 30 yea had a more basic version of our tec nique, but didn't have a name for it We coined the term twist welding while developing and refining the technique. (Figure 1)

We have been using the twist w method on everything from aircraf trol cables to bicycle shifters. One universal problem when cutting ar is what to do with the cable end th been cut off. Many times the cable environment where it is either bei manipulated or removed and reins on a regular basis for maintenance poses, which generally results in t individual wires, within the end o cable, becoming untwisted and fra The frayed cable end shown in Fig presents a problem. If you pull the through the hole, it may not be po to gather up all the individual wir tightly enough to actually reinsert them. (Figure 3)

One method for handling it is t weld the end of the cable to preve from becoming frayed in the first The twist weld method is extreme effective, and we have yet to see c treated in this manner become un

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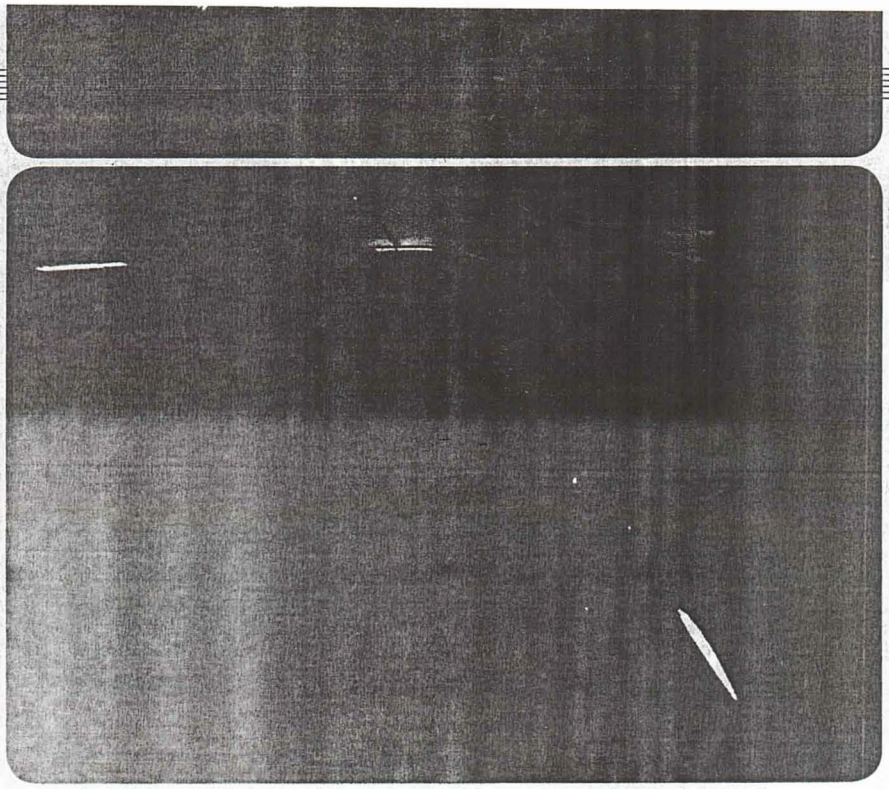


*Subtle details such as flush-mounted wingtips show a builder is serious about making his project "right," but may add a significant number of hours to your overall build process.*

# Perfection, Completion, and Common Sense

'Good enough' is never good enough, but 'perfect' maybe more than you have time for

BY BUDD DAVISSON

**CAN YOU THINK OF ANYTHING** that takes longer to bring into the world than an amateur-built airplane? The natural character of the homebuilding process can be agonizingly slow, but there's one thing that can bring it down to a tree sloth crawl: an uncompromising search for absolute perfection. While we all like to see our hands creating a perfect flying machine, the truth is that perfection is the enemy of completion.

Before you head to the Internet to launch a scalding comment at me about striving for perfection in all things aeronautical, read on first. Then toast my toes, if you want. I can take it.

Right up front I should say that there are those builders to whom there is no such thing as perfection because no matter how perfect something they do appears to the rest of us, they aren't satisfied with it. So, perfection to them is unobtainable and a forever-goal. However, they are psychologically addicted to perfection, so they have no choice but to strive for it. I'm not talking to them. I'm talking to the rest of us.

Incidentally, when walking around fly-ins these days, it's easy to become intimidated by the insane quality of many homebuilt aircraft. There are so many absolutely gleaming jewels on the flightline that we have the urge to drag our own airplane back into the hangar because it looks so crude by comparison. This may not be logical, but it's certainly understandable.

The truth is if you have an aircraft you've built tied down on the flightline, I don't care how fancy or plain Jane it may be, it is a monumental testament to your abilities as a craftsman and your ability to see a project through to the end. Very few people worldwide can say that they've built an airplane. Therefore, any home-brewed airplane says something wildly positive about the builder, and all builders should be proud of the accomplishment.

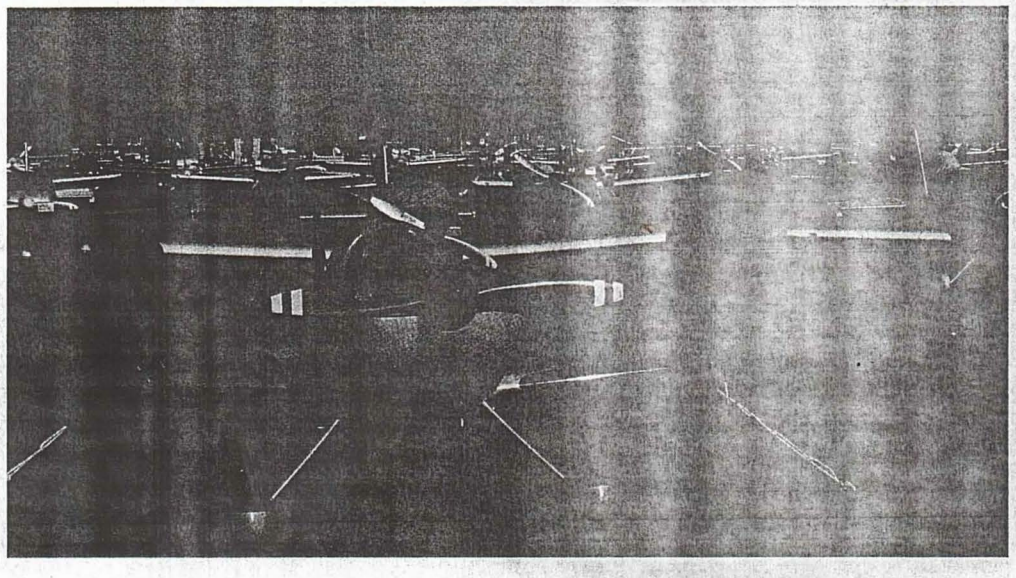
As for perfection, there is a good argument for striving for it in an airplane because the opposite of perfection is imperfection. This connotes something that is flawed or just "good enough," and the last



PHOTOGRAPHY BY **BRIAN CARROLL**

thing we want to fly is a flawed airplane. But that's not what we're talking about here. It is a given that in the structural and system aspects of an airplane, perfection is what we're striving for. We're not just seeking functionality; we're looking for long-term reliability. Peace of mind and safety is borne of structural/systemic perfection. However, once you've fashioned a structurally sound airplane that functions perfectly, from that point on it becomes necessary that we arrive at a definition of perfection and look at its effect on building an airplane.

I'm positive there has been no study that quantifies the number of hours seeking perfection adds to building time. However, I can think of a half-dozen airplanes I know well that took three times longer to finish than others of the exact same type even though the builders had the same life situations and the aircraft were similarly equipped. The difference is in the degree of perfection.



In cases like the aforementioned aircraft, you can line them up side by side and, assuming there's no wildly exotic paintwork involved, from 20 feet you can't tell them apart. However, study them closely, and you'll see the differences in the tiny details. A majority of those fine details yield nothing in terms of safety or reliability and are visible only to the really knowledgeable observer, yet they add significantly to the build time.

An airplane can be loaded with big and small time-intensive details, but they may be something as subtle as cleverly attached wingtips: They don't lap over the outboard skins but are flush to the wing's surface. This is an almost unnoticed detail but shows that the builder is really serious about making things "right." What doesn't show is that to flush-mount those wingtips, he may have had to manufacture his own wingtips, assuming it's a kit airplane, because most wingtips lap over the skin. This means that the tips that are readily available are the wrong dimensions. To butt into the tip rib, the tip itself needs to be proportionately reduced in size. If fiberglass, that means making the right-sized plug, then pulling a female mold off that, then laying up the tip. And the tips probably won't exchange right for left, so the process has to be done twice. Then, when you have a properly sized wingtip, you have to figure out how to attach it, which leads to designing attach points that are below skin level to screw to (flush screws, naturally!).

How much time will something like flush-mounting the wingtips add to the total? Who knows? Seventy-five hours? One hundred hours? If you're an average builder getting 10-15 hours a week in the shop, you're looking at several months just to flush-mount the wingtips. Probably more.

Quite often the image of the perfect airplane also includes increased complexity in the form of an exotic instrument panel, wild interior, and even wilder paint job. Besides often adding weight (they don't have to add weight

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being expens

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plumbing an advanced

with remote compass senso

gauge senders, strobes, etc. can a

dreds of hours. Will you actually use

stuff? You have to ask yourself how much

this you're doing for use, how much is bei

done for personal satisfaction, and how much is there just to wow the fly-in crow

Then you have to decide how much time

will add and whether the payback is wort

Basically, when looking at these kinds concepts, you have to ask yourself why you're building the airplane in the first pl

**I can think of a half-dozen airplanes I know well that took three times longer to finish tha others of the exact same type even though the builders had the same life situations and the aircraft were similarly equipped**

The best reason for building is simply because you like building (don't ever buil just because you want to fly; in that case, i unlikely the airplane will be finished). On of the major motivations behind building building's sake is that we love the problen solving aspect of it. So taking more time t flush-mount wingtips is a process that is i own reward. We don't care if it takes too long. We're busy creating something, and that process satisfies an inner need. If you that kind of builder, which many are, the worse day of your life will be when the pr ect is completely finished. The feeling of "Now what?" can be overwhelming. This i why there are so many serial builders and many low-time, freshly built homebuilts f sale. The feeling of creation is what these

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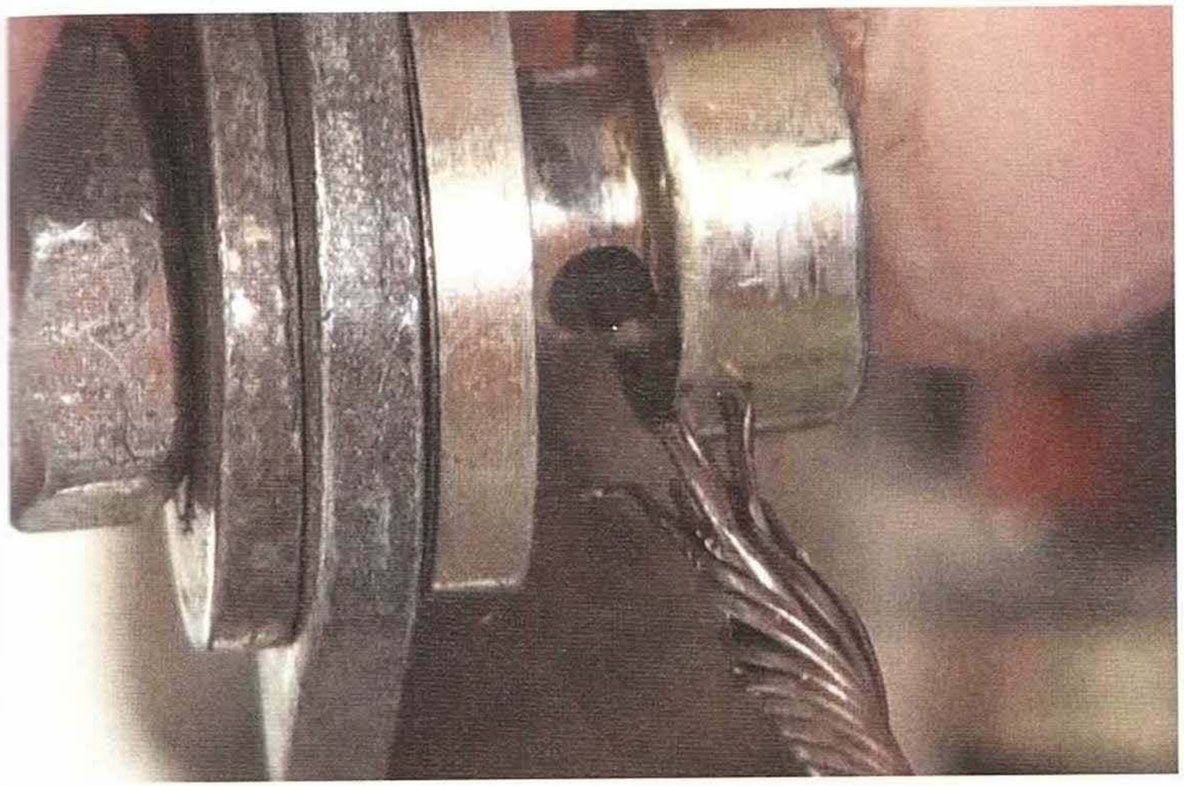


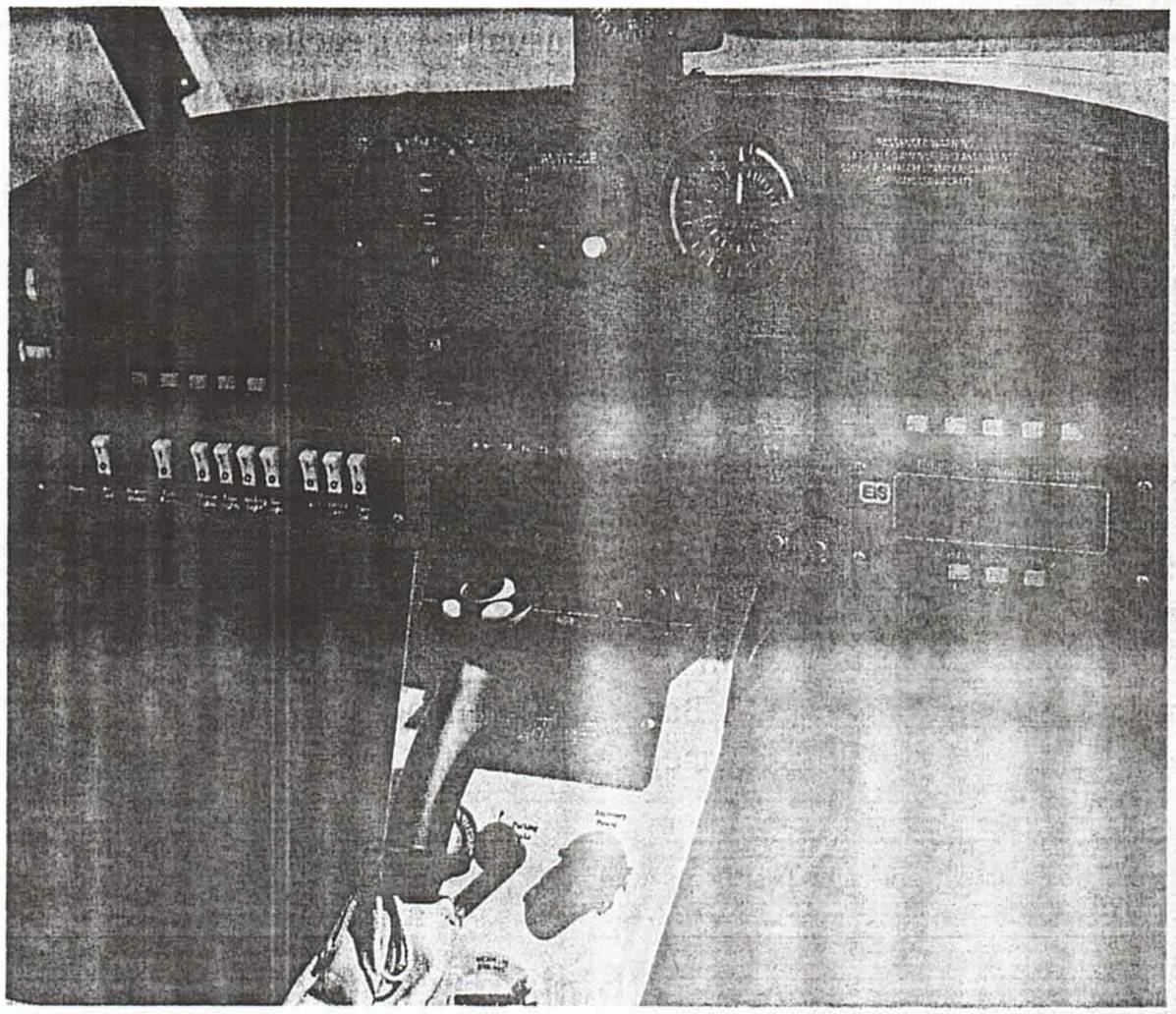
Figure 3

Figure 4

**HOW TO TWIST WELD**

The process is simple and can be done with hand tools normally found in most toolboxes. All that is required is a slow-turning, variable speed cordless drill, a propane torch, and a vise or a pair of pliers. (Figure 4)

Insert the freshly cut or damaged end of the cable into the cordless drill chuck and tighten the chuck onto the cable. Hold the other end of the cable 2 to 4 inches away from the drill chuck using either a vise or a pair of pliers. With a propane torch on low heat, apply the flame to the cable. Once the cable begins to turn an



*Wiring a basic VFR panel can be a weekend project; adding all the bells and whistles to complete an advanced IFR panel can add hundreds of hours. Will you actually use all of that stuff?*

kinds of builders live for. Even though they aren't eaten alive by the perfection bug, they still crave the feeling of accomplishment and satisfaction that comes from doing something a little better than the next guy. Or a little better than they did it last time. There is, however, a trade-off between the urge to build and the urge to fly.

It's important before starting an aircraft project that we recognize exactly how much the actual flying of the aircraft weighs into our decision to build. Then we have to put our urge to fly against how much time we're willing to put into making it perfect and analyze the trade-offs. Since the perfection-quest can easily double the building time of an airplane, it can push that all-important first flight off many years. Is it worth that much?

To look at it in another way: By the time you've finished building the perfect family airplane, will your kids have grown up and moved away? While you're perfecting that super speedster, have the years nibbled away at your medical to where the airplane is airworthy but you're not? When working out the perfection versus completion equation, remember that the clock is ticking on all of us. *EAA*

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**Budd Davisson** is an aeronautical engineer, has flown 300 different types, and has published four books and more than 4,000 articles. He is editor-in-chief of *Flight Journal* magazine and a flight instructor primarily in Pitts/tailwheel aircraft. Visit him at *www.AirBum.com*.

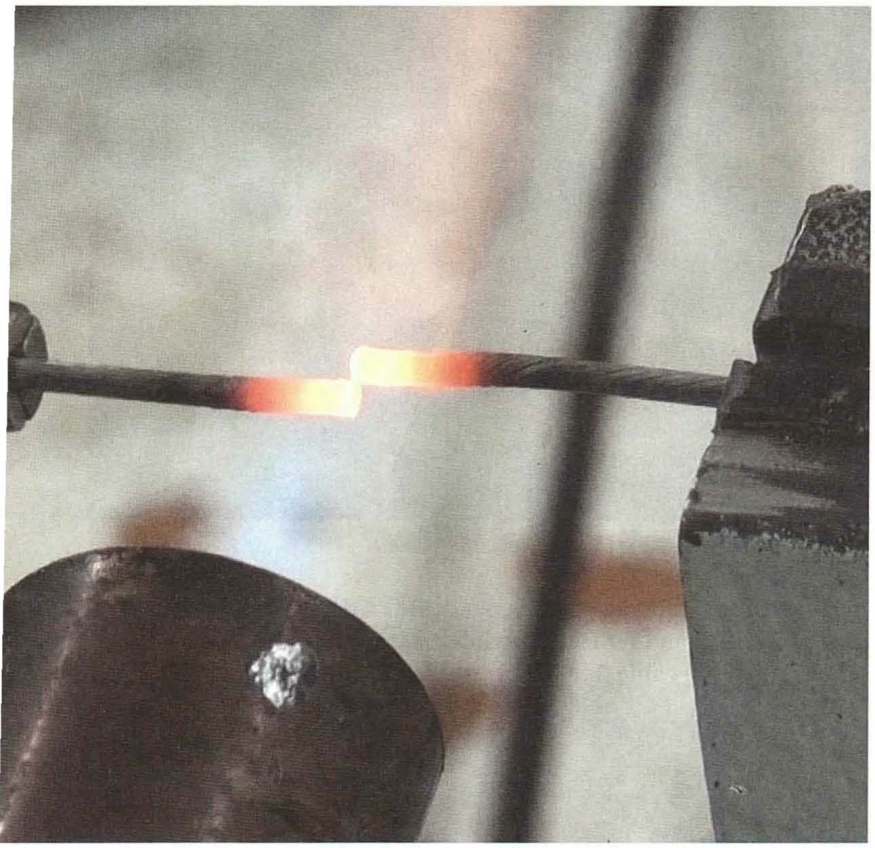


Figure 5

Figure 6

Figure 7

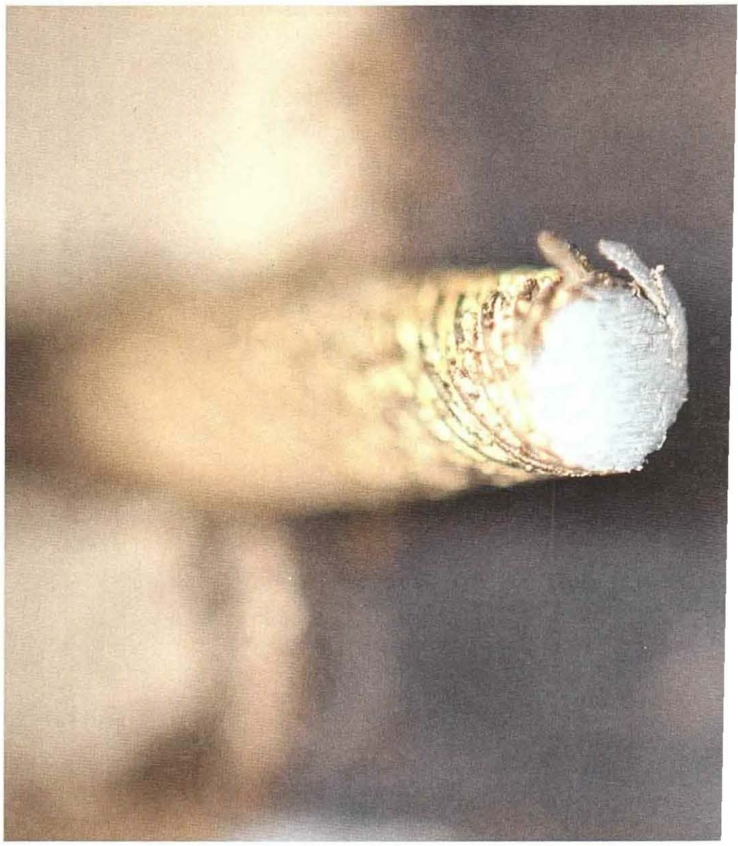


Figure 8



PHOTOGRAPHY BY CAROL AND BRIAN CAF

orange color, it is time to start spinning the cable at a very low speed. Continue to twist the cable while simultaneously heating. As the cable is twisted, it will fuse the cable wires together forming a solid single wire. Continue twisting until there is enough stress built up to separate the cable into two pieces. (Figure 5)

**REFINING THE PROCESS**

There are a couple of points that will really improve the outcome of the process:

1. Use a cordless drill that turns at a very low speed. Say, somewhere in the neighborhood of 20 to 100 rpm.

2. During the turning process, apply a few pounds of tension on the cable by pulling the cordless drill. (Figure 6) It will do two things: First, it will help maintain a nice straight end after the cable separates. Second, it will help to narrow the diameter of the cable during the twisting process. The narrowing will make it much simpler to insert the cable end into a hole, such as the throttle arm on a Bing carburetor. (Figure 7)

As you can see in Figure 8, if we take the cable end, where we have applied the twist weld method, and sand down the cross section, we can reveal the fused nature of each individual wire. The cable wire strands are literally welded together. (Figure 8)

**POINTS OF INTEREST**

Keep in mind that this process is affecting the structural integrity of the cable, but only in the area where we have applied that heat to the cable. This simply means that you should leave enough additional cable beyond the twist weld area for the actual attachment.

Another factor to take into consideration, beyond the structural integrity, is the increased susceptibility to corrosion. An example of this is where we have burned off the

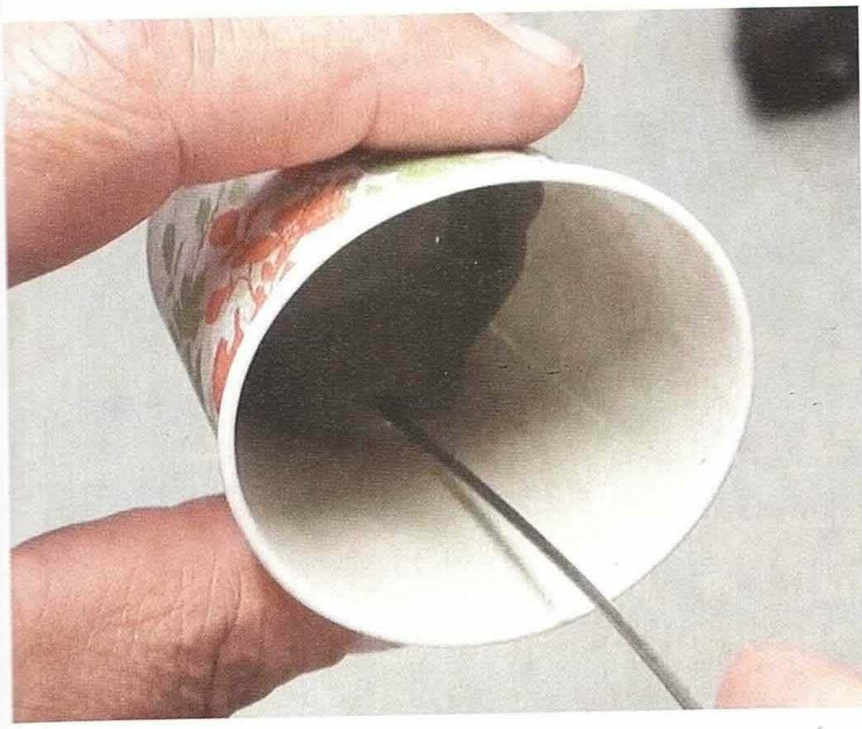


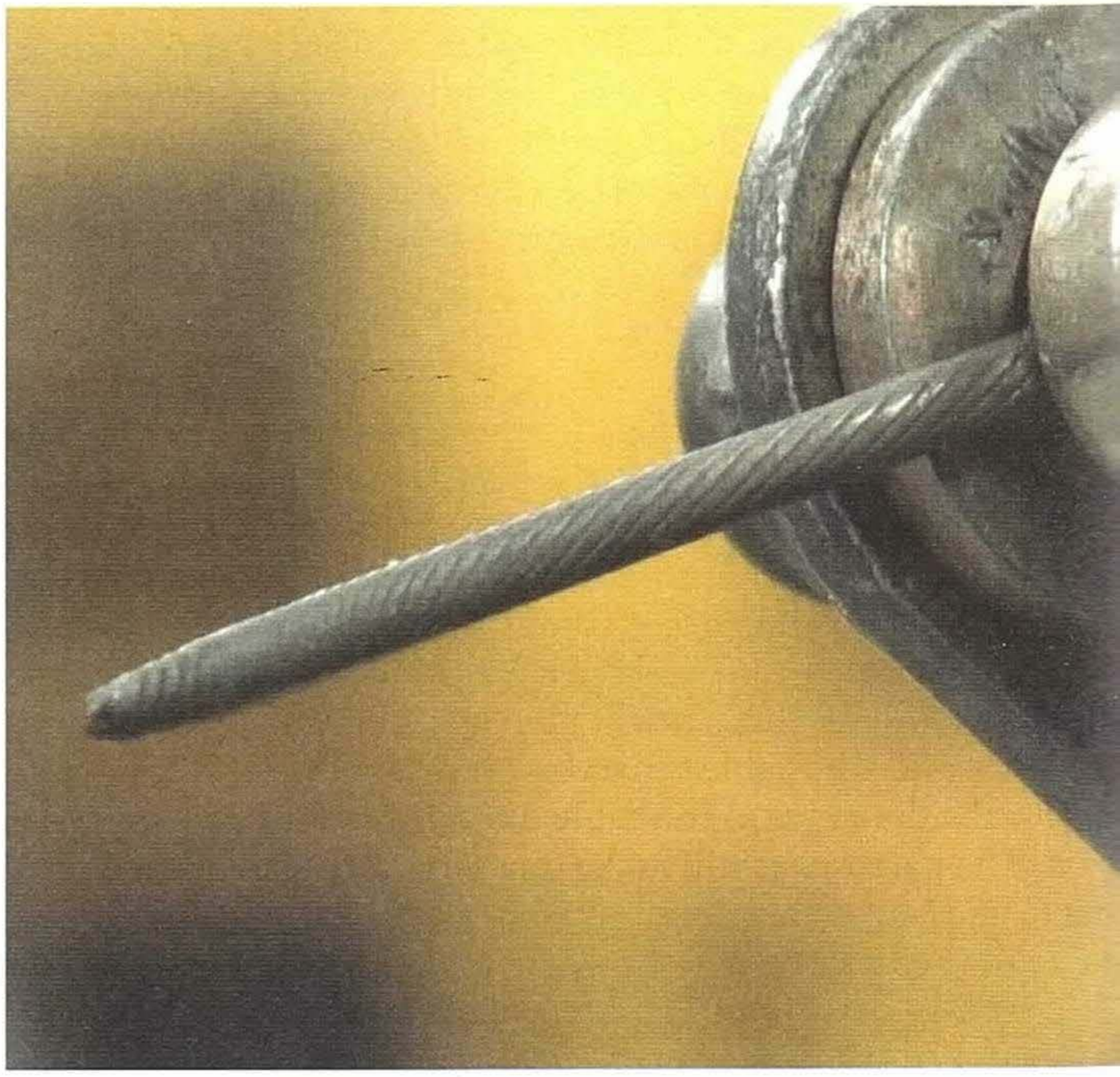
Figure 9

galvanizing on a steel cable. This will make the steel more susceptible to corrosion.

One way to deal with the potential corrosion problem is to simply dip the twist-welded end of the cable into a container of paint or primer. An etching primer from a spray can is thin enough that it will soak into the cable strands when the cable is dipped into the primer.

Spray a small amount of primer into a paper cup, insert the cable, and let it soak for about 10 seconds. (Figure 9) Allow the cable to absorb as much of the paint as possible. Remove the cable from the primer and hang it vertically, allowing the excess primer to drip off the end of the cable. It will keep the thickness of the paint on the cable end thin enough that it won't increase the cable diameter and interfere with the ability to insert the cable into a small diameter hole. (Figure 10)

Once you have used the twist weld method you will become a convert. The method works well, looks great, and is quick and easy to accomplish. You will find yourself looking for opportunities to use it on your own aircraft. It's certainly a trick you'll enjoy sharing with your friends. *EAA*



**Carol and Brian Carpenter**, EAA 678959 and 299858, owners of Rainbow Aviation Services, have co-authored two aviation books and team teach the Light Sport Repairman Workshops. Brian is a CFII, DAR, A&P/IA, and the designer of the EMG-6 (an electric