Sheetmetal 101: Clecos

RAINBOW Aviation Services™

Cleco is the trade-name originated from Cleveland Pneumatic Tool Company. The cleco is a temporary fastener primarily used in the construction of sheet metal components. Even though the cleco was a relatively simple tool made up of only a handful of components, (Figure: 1) it revolutionized the sheet-metal aircraft manufacturing process. If you are going to be building a sheet metal aircraft, you undoubtedly will become intimately familiar with the use of the cleco. It is common practice, that during construction, we assemble components of the aircraft and hold them temporarily in place with cleco's as we proceed with the drilling process. After we have laid out and drilled all of the holes in a component, we will need to remove all the cleco's and disassemble the structure so that we may de-burr each of the holes and remove any chips remaining from the drilling process from between the sheet-metal surfaces. Because the dimensions of a structure change with contamination between sheets of metal, it is not uncommon to assemble and disassemble a structure many times before we begin the process of permanently riveting the components together. This is where the cleco really shines. This ingenious tool allows us to assemble and disassemble a structure very quickly. Using a pair of cleco pliers, which grips the body under the manufactured lip, and allows us to actuate the plunger pushing the lock fingers

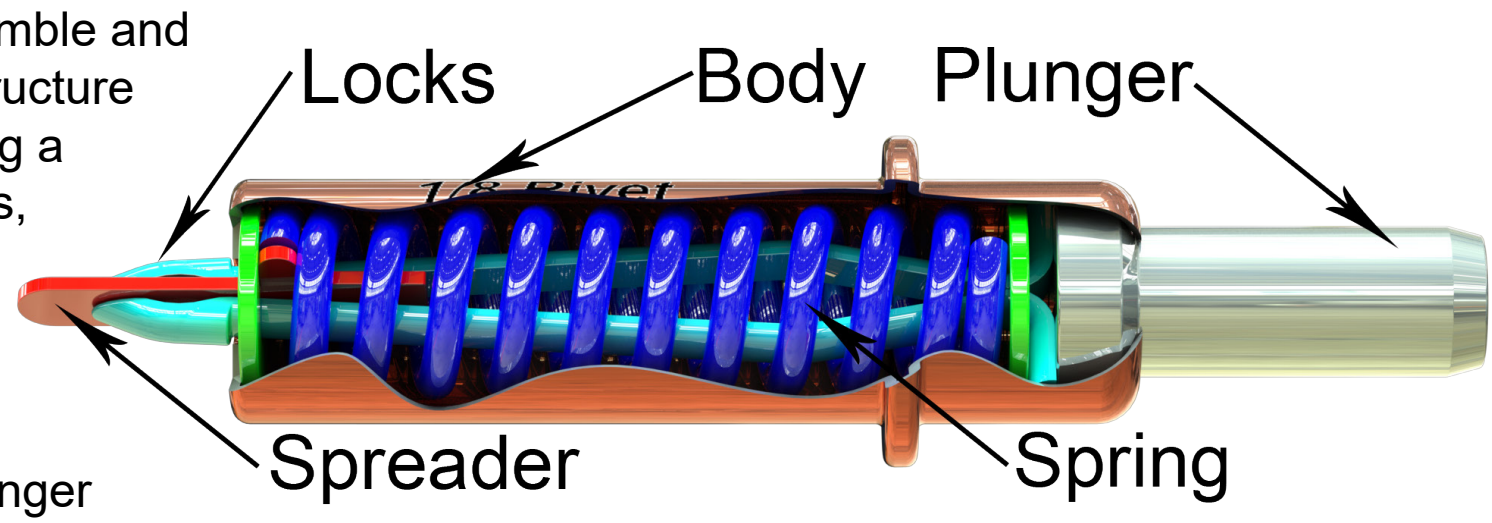

Figure: 1 Components of a Cleco

beyond the spreader bar. this allows the lock fingers to collapse upon themselves making the overall diameter less than the diameter of the rivet hole. This in turn allows us to push the cleco through all of the different layers of sheet-metal. Once the cleco is fully engaged, releasing the cleco pliers allows the fingers to retract and simultaneously be spread out by the “spreader bar” now making the overall diameter of the locks larger than the rivet hole. (Figure: 2) the locks are now under spring pressure holding the individual pieces of sheet metal together .Under normal circumstances,a cleco every 3 to 4 rivet holes may be sufficient. In cases where the sheet-metal consists of multiple layers, and perhaps thicker material, it may be necessary for cleco’s in nearly every hole drilled. As the structures get larger and more complex it may be necessary to bring out the “big guns”. When we are facing difficulties in pulling all of the different pieces of sheet-metal together tightly we revert to the use of what we call “draw” cleco’s. (Figure: 3) These cleco’s are much more heavy duty, and rather than using a spring to pull the locks against the sheet-metal, they use a wing nut which can be drawn down with much more force. Often, we are working with casting or machined components that are also attached to sheet-metal structures. The total thickness of material which may be trying to hold together may exceed the capability of a standard cleco. For those special cases we can employ the use of an extra long pull type cleco. The primary drawback to the wing-nut type cleco, is that they are typically quite time-consuming to install and remove compared to their spring-loaded brothers. As a result, they normally only get pulled out of the toolbox when the spring type cleco’s just won’t get the job done.

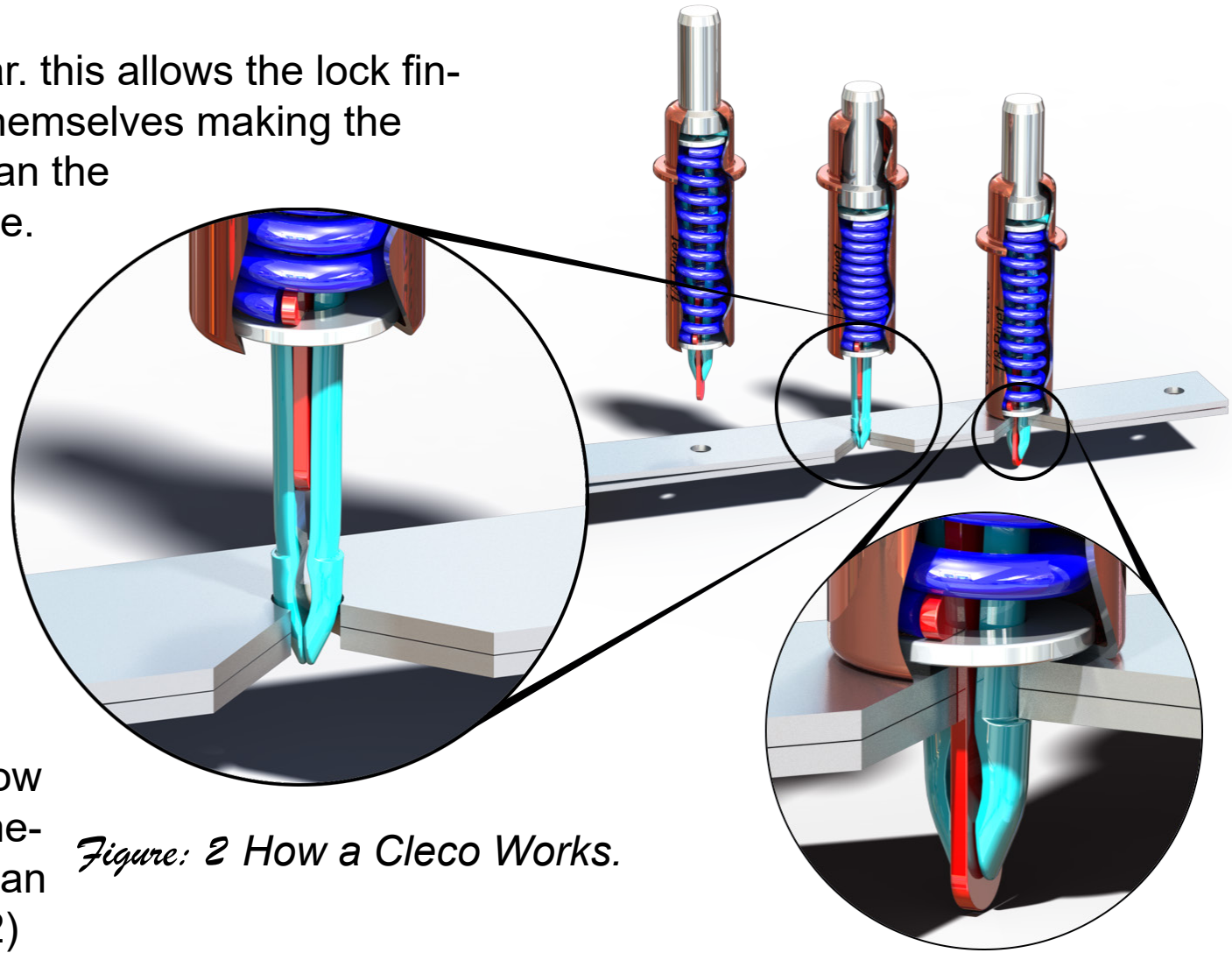

Figure: 2 How a Cleco Works.

When working on sheet-metal projects, we use a variety of different size rivets depending on the type of structure involved. Although the 1/8 inch rivet is probably the most common, we would say that there are four primary sizes used in the majority of aircraft applications. As a result, there are cleco’s for each one of the rivet sizes used. Conveniently, the cleco’s are color-coded for fast identifi-

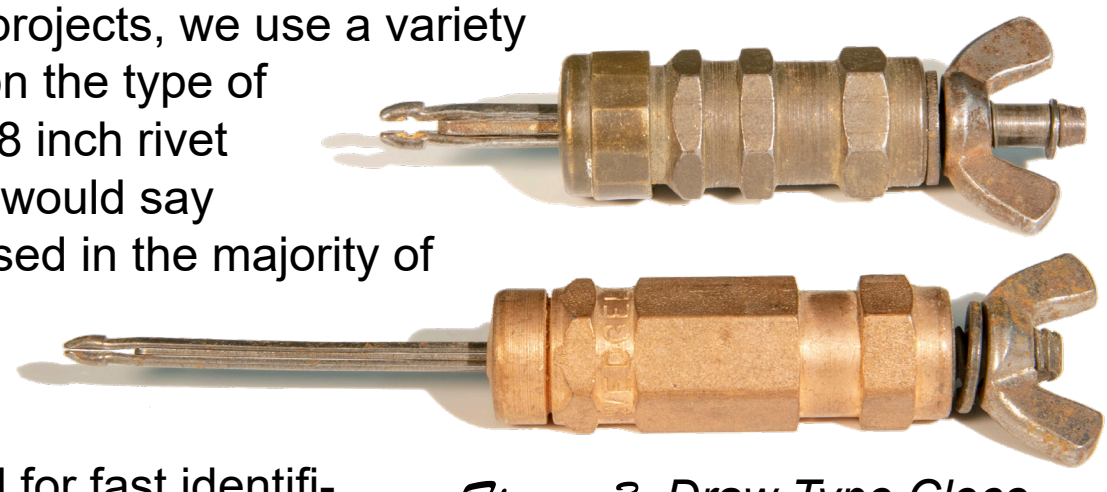

Figure: 3 Draw Type Cleco

cation. (Figure: 4) During a typical repair or construction project, you may end up with several different rivet and cleco sizes, all within the same subassembly. As the cleco's come in and out of the structure it's very common that they get mixed up. But having them color-coded makes it very convenient. And easy to sort out at the end of a project. It is normal during a construction process to drill all of the holes to the actual fractional rivet size. For example using a 3/32 drill bit to drill for a 3/32 rivet. This allows us to assemble the structure and have slight movement as we proceed with clecoing the structure together. It's not uncommon that during the assembly process there is some movement within the structure creating a slight offset in the rivet holes. As a result, using the fractional size drill bit initially allows us to return later to "ream" the holes to their final dimension after the structure is solidly in place with cleco's. This results in rivet holes with much better alignment, which is the cornerstone to a well-built aluminum structure. The corresponding final drill bit size can be found on the body of the cleco's in the graphic depicting color coding. These final drill bit sizes are only a few thousandths of an inch larger than the fractional rivet size. And you will need the corresponding numbered drill bit if you want to avoid frustration. It's nearly impossible to fit an aluminum rivet into the fractional drill bit hole size. They hang up and get stuck, both trying to install, and trying to remove if they won't insert all the way. The cleco's are designed to work with both the fractional drill bit as well as the number drill bit. If you find that the cleco does not grab the sheet-metal during installation, this is a sign that the rivet hole has been "hogged" out. If the cleco pops out of the hole, it is generally an indication that an oversized rivet may be necessary.

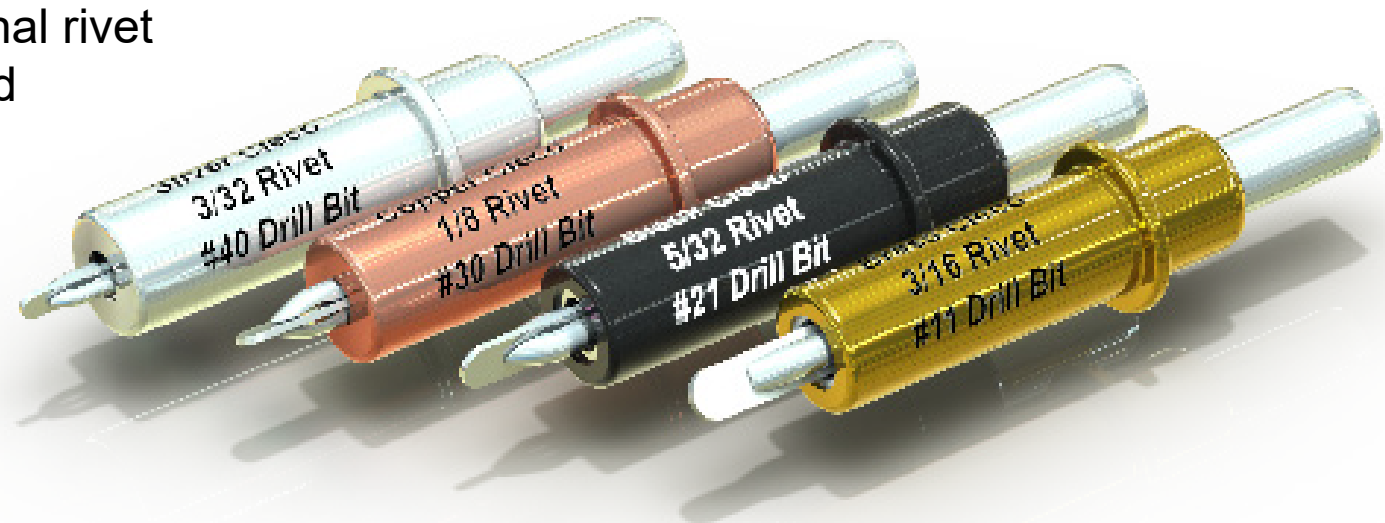

Figure: 4 Color Coded Cleco's

As you can see, there's a cleco for just about every sheet-metal project you could think of. And even if you're not working on a sheet-metal project today, one of the more useful cleco's used on a day-to-day basis for all kinds of projects, is the cleco clamp. (Figure: 5). It's kind of like a spring-loaded "C" clamp. It's small enough that it can be used in some fairly tight quarters and strong enough that we find it useful for a myriad of different holding tasks. When we use it for sheet-metal, its primary use is for holding the pieces of material together while you're making the first couple of holes to install a regular cleco. And unlike regular cleco's where you will probably need several hundred to build

Figure: 5 Cleco Clamp

a sheet-metal airplane, having only a handful of these around will usually find their way into many day-to-day projects.

Figure: 6 Cleco Pliers

Last but not least, cleco pliers. Over the years the cleco plier design has settled into a “one design fits all” style. But looking in our toolbox we found quite a selection of different styles of cleco pliers.(Figure: 6) Surprisingly, we find that the angle available from each of the different style of pliers provides the ability to install and remove cleco’s in other than traditional external applications. When doing complex repairs we are often reaching for a different pair to reach into areas where the traditional pliers just don’t seem to fit. These different designs are a collection from a lifetime of doing sheet-metal work. Keep your eyes peeled, every once in a while you’ll see one of the weird pair show up on eBay.

Although we consider sheet-metal construction an “art”, it is an art worthy of mastering. And to this day, it is still the most popular construction method when it comes to the experimental aircraft builder. And for the sheer enjoyment of building, aluminum sheet-metal is by far our favorite construction medium.