A Means Of Obtaining Proper Gluing Pressure

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Figures 1, 2, 3, 4 by H. A. Scott
Figures 5, 6, 7, 8 by Manuel Fernandez

While building an EAA Design Competition airplane, the LAMINAIR Mk1, my partner in construction, Lyle Nelson, devised an excellent means of producing a good laminated spar which I deemed worthy of reiterating. The formula for success is to apply adequate force on sufficient back-up material so as to distribute the proper pressure uniformly.

A common way to apply such forces is by utilizing "C" clamps. The method to be illustrated is based on the

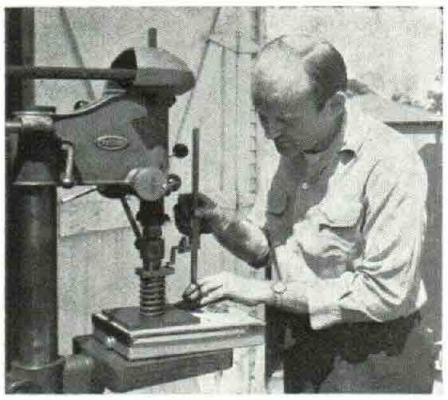


Fig. 1

skillful employment of this device. As for back-up material, straight lengths of channel iron, boiler plate, "I" beams, etc. can be used. These items can be obtained from a salvage or junk yard at reasonable prices considering they will be used to make the most critical piece of structure in the airplane. Wood does not provide the necessary back-up rigidity to produce a good uniformly thin glue line on an extensive part such as a wing spar.

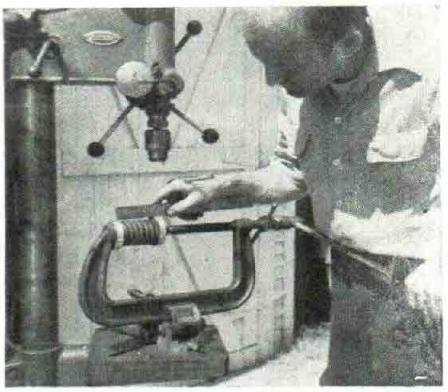


Fig. 3

The glue pressure for Sitka Spruce per ANC-19a is 125 psi (± 25 psi), this multiplied by the glue surface area (length x width) produces the total force required. The force imposed by each "C" clamp will then determine their spacing.

Nelson found the force a "C" clamp can supply by the following procedure:

1. Mount a strong spring (any strong spring will do) on a regular bathroom scale, with metal plates under and on the spring. These protect the scale and provide a pad to apply a crushing force. Take the tare from the scale by adjusting it to read zero pounds. Measure the distance to the top of the spring from some convenient base as illustrated in Fig. 1. Now through some means of applying force, such as a drill press, stop at fifty pounds and again measure the distance, this subtracted from the previous dimension yields the spring deflection under a fifty pound load. Plot the points on a graph such as Fig. 2, the load versus deflection data just found and repeat this process of

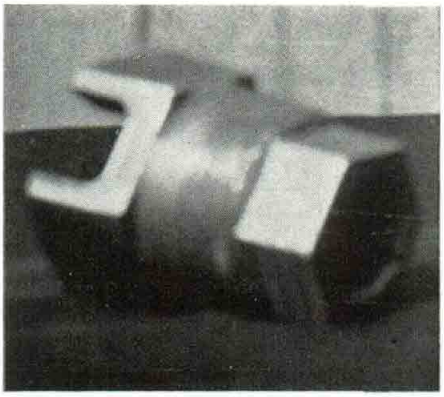
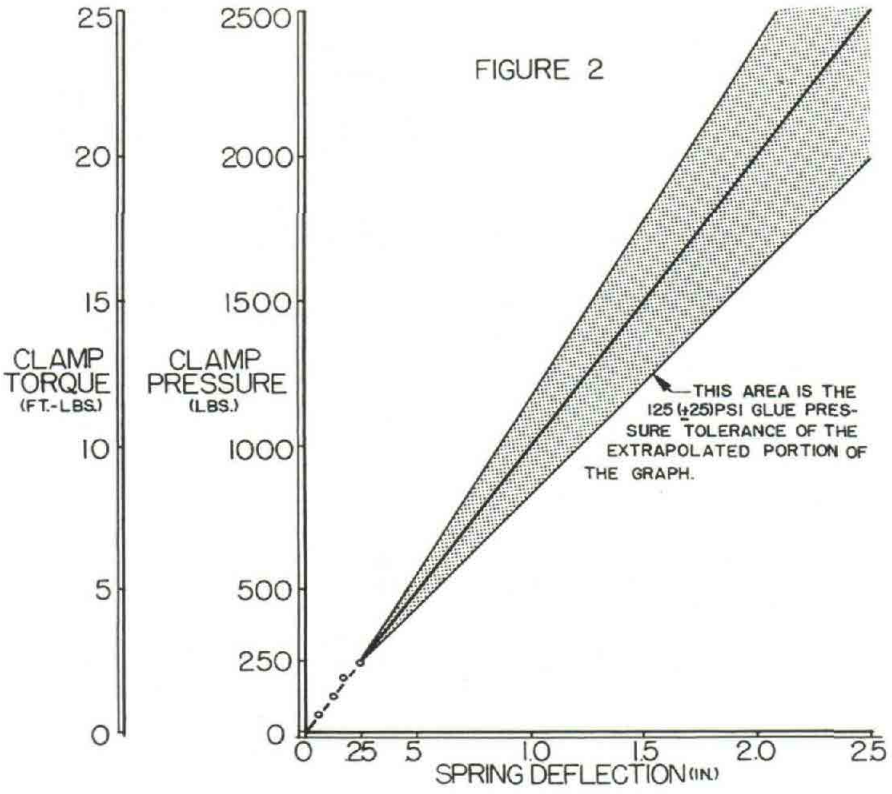


Fig. 4

50 pound increments to the capacity of the scale. Caution, do not depress the spring past half maximum as a rule of thumb to maintain accuracy.

2. Having calibrated the spring we shall now use it to determine the amount of force that can be exerted for a given torque by the "C" clamps. Be sure all the clamps are uniformly cleaned and oiled. Utilizing a torque wrench compress the spring to each known deflection and note the torque requirements as shown



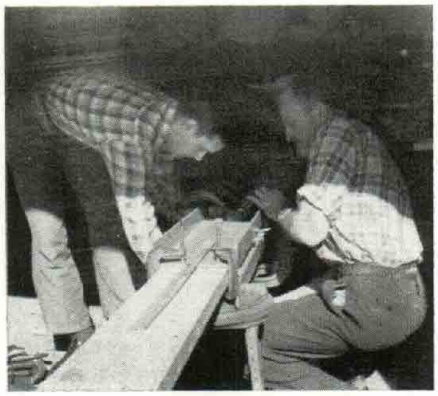


Fig. 5

in Fig. 3. Record the torque data on your graph, Fig. 2. It is now possible to extrapolate the plotted data by a linear ratio to approach the clamp capabilities. For example, to determine the torque requirements to apply a 2,000 pound clamp force multiply the torque necessary to obtain a 200 pound load by 10. The extrapolation assumption is considered valid because of the large tolerances involved. This process should be followed for several of each size clamp. Fig. 4 depicts an adapter that will fit into a standard socket for torque wrench utilization and is able to slide over the clamp screw and provide for torque application thru slots mounting over the screw handle.

3. Knowing the glue area of your laminate it is now possible to arithmetically determine the clamp spacing. To illustrate, let us say we will use the same size clamps throughout at a 2500 pound load each and our glue area is a spar 6 in. by 120 in. or 720 sq. in. This surface multiplied by the gluing pressure of 125 lbs. per sq. in. produces a total compressive load of 90000 lbs. That divided by the 2500 lbs. per clamp results in 36 clamps required. Also this brings to light the necessity of friends and tool rentals if you

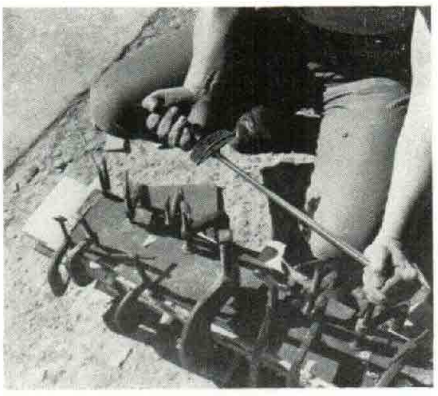


Fig. 6

News From Canada

We have received an interesting report from Chris Falconar of Edmonton, Alberta, telling about what our friends north of the border are doing. Since the country's Department of Transport established rules to permit the building and flying of amateur aircraft, dozens of enthusiasts in Edmonton, Calgary and other Canadian cities have started projects. Due to the head start gained by French builders and the many excellent designs which have resulted, all-wood craft from French designs are the most popular. Many Canadians feel that modern advances in wood preservatives, durable glues and weather resistant finishes might very well make all-wood airplanes outlast steel-tube-and-fabric jobs.

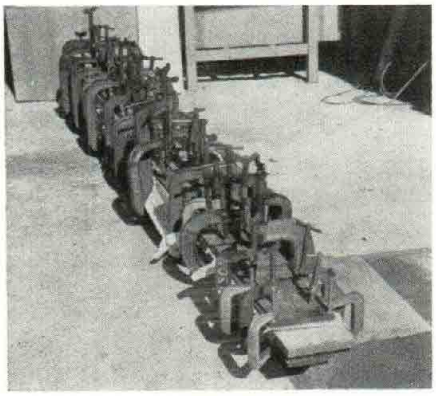


Fig. 7

possess the normal few "C" clamps. Divide the laminate length, 120 in., by the number of clamps and solve the spacing which in this case is 3.33 inches. Figure 5 demonstrates clamp spacing, Figure 6 torquing the "C" clamps, and Figure 7 a

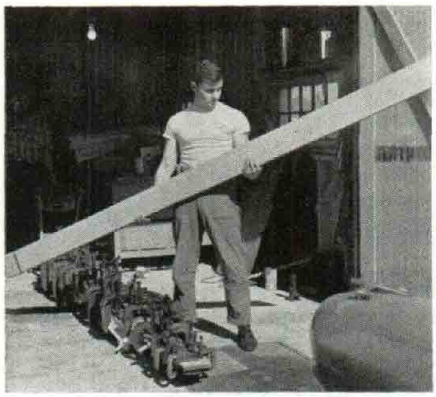


Fig. 8

clamped laminate. Figure 8 has the author with a specimen in hand standing next to another in the making.

It should be remembered that man has not been able to get any more out of anything than he has put into it and therefore the work involved in obtaining a superior glue joint is justified by the airworthiness and good workmanship of the resulting lamination.

In Edmonton, EAA Chapter 30 has about 30 active members, and meetings are held at the Municipal Airport every second Monday of the month at 8 p.m. All other Monday nights are "Workshop Nights" during which members work on the Heath Parasol and Super RA-14 which comprise the group's projects. Individual projects include two Jodel D9's, four Jodel D11's, a Turbulent, a Mignet HM290, a Tempete, two Pietenpols and several others just getting started.

A Baby Ace has been flying at Wetaskiwin, Alberta, since last fall and a Wayne WR-1 is being built. At Calgary, three Turbulents are under construction, one of which might be called a "Super Turbulent" because it is to have a Continental 65 instead of a Volkswagen engine. Jaromir Vesely is building an original design. In Winnipeg, Stan McLeod and Al Bartlett are organizing a chapter among thirty-odd enthusiasts. McLeod is progressing well with a Turbulent, using the living room for a workshop. Chalk up one more understanding wife! Bill Thompson is at work on a Jodel D11 and shows the results of his years of experience.

A few years ago Stan Green of the Provincial Institute of Technology and Art produced one of the most beautiful Bleriot replicas imaginable. This airplane subsequently experienced some very interesting exploits. It was shipped to France and flown across the English Channel by Edmonton pilot Jean de la Bruyere. On returning to North America, it was used in the film "Lafayette Escadrille". Stan Green's latest creation is a World War I Sopwith "Pup" fighter. It is almost complete and should fly this summer. It is so authentic that even a LeRhone rotary engine will be installed.