A Bubble Canopy For Your Homebuilt

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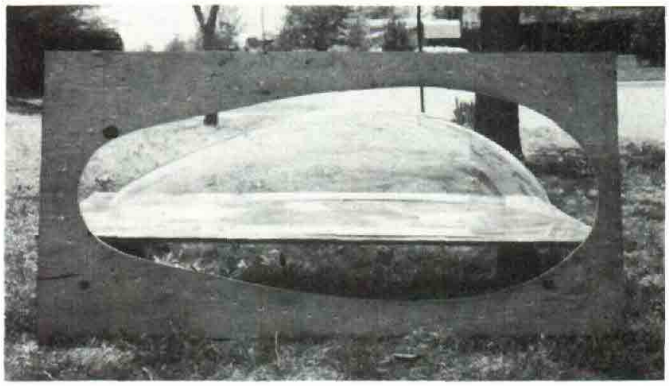
HAVE YOU ever stopped and admired the beautiful blown bubble canopies of some of the outstanding homebuilts seen at Rockford and then, like me, thought . . . "I wish I was rich and could afford one of those?" Or, maybe you have admired that absolutely clear and distortion-free greenhouse on top of a P-51 and wondered why someone couldn't come up with one like it that would fit onto your little jewel, and at a price you could afford.

I have been thinking for years that a teardrop-shaped bubble is just exactly what I needed to cap off my little "Fifinella", but no one ever advertises them for sale and you surely can't find one in the surplus houses, so I have done without. It was beginning to look as though the only way I would ever get one was to build it myself, and I didn't know the first thing about working with plastics.

To start the ball rolling, I visited a local sign company that makes raised-letter plastic signs, thinking that these people would know all there is to know about blowing plastics, and perhaps they do. If so, they are guarding their trade secrets carefully. They explained that they couldn't be a party to my attempting anything so foolish. However, they would be glad to blow one for me if I would provide the form board and about $60.00. No guarantee, of course, but they would be willing to try!

Help From California EAAer

Well, I did without a canopy while I tried to find a solution to the problem. I talked to everyone I could find who had ever worked around plastics and found that no two of them agreed on how to go about free-blowing. I also read everything I could find on the subject, but this consisted primarily of reports on how skilled technicians are able to produce parts using thousands of dollars worth of equipment. No help from this quarter, either.



It was not until I finally wrote to Ken Linn of 40836—15th St., W., Palmdale, Calif., who had installed a beautiful bubble on his 65 hp Lycoming powered Taylor "Monoplane", and received a letter of detailed instructions, that I finally worked up the courage to tackle this project. Actually, Linn deserves the credit for this report since, for the most part, I am just passing along his instructions. If you have been fighting the canopy problem, too, then read on. It isn't that rough, after all.

The equipment for building the form simply consists of two pieces of ¾ in. plywood of the appropriate size. The base board is a solid piece of plywood with one hole drilled near the center and a fitting screwed to the bottom of it for the air line. Since a little pressure will be needed, this should be a flange fitting screwed to the board rather than just threading a pipe into the wood. A small neoprene baffle, or even cardboard, should then be tacked over the top of the hole to deflect the inrushing air.

Large Oven Is Needed

Over this base board goes the sheet of plexiglas with a neoprene or rubber gasket seal, then a second sheet of ¾ in. plywood over the glass with a hole in it of the desired shape to form the canopy. These are then all bolted together with a row of bolts about 1 in. apart all around the cutout. Tighten these down good to compress the gasket and make it air tight, and you are ready for the oven.

A little more than passing consideration should be given to the cutout in the form board, however, as when the hot plastic is formed and thins out, the wider parts of the canopy will rise out of proportion to the narrower part at the rear. The pictures show the shape of the cutout used to produce the canopy shown and should be sufficient to warn the reader that the cutout should not be too narrow at the rear.

The only problem left now is to get hold of an oven that will be big enough to take your form. I had already tried unsuccessfully to make friends with the fellows who run the local pizza parlor, but they thought I was crazy and were not about to have anyone baking plexiglas in their oven, so it looked like I was going to have to build my own.

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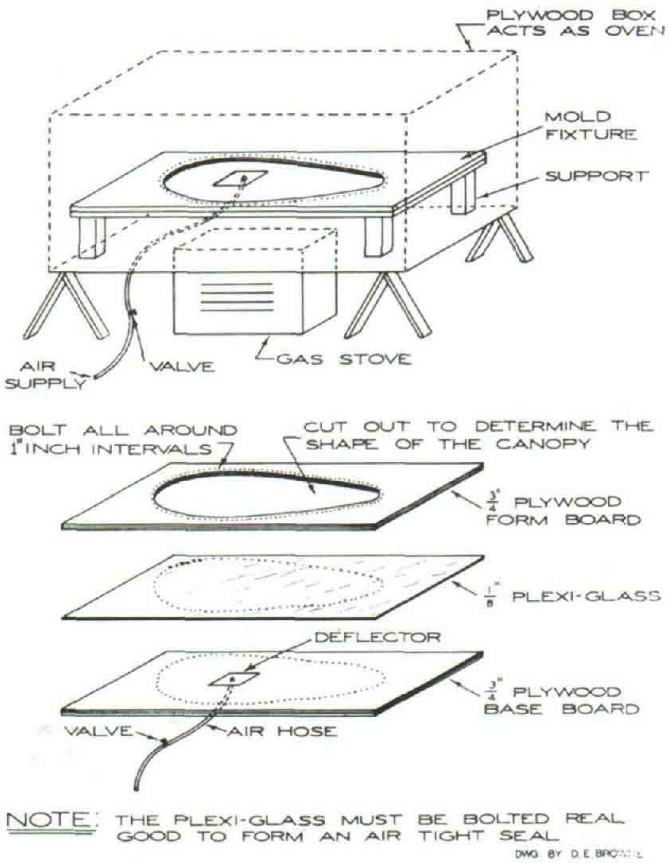


DESIGN OF TAIL SPRINGS . . .

(Continued from preceding page)

find that this is not excessive. When mounted on the airplane, it looks perfectly right.

Once you understand the following formula, you should have no trouble with the calculations:

$$I/C = \frac{\text{Bending moment}}{\text{Yield strength}}$$

At the small diameter, this gives us . . .

$$I/C = \frac{1{,}665}{165{,}000}$$

$$I/C = .0100$$

At the large end, this becomes . . .

$$I/C = \frac{8{,}736}{165{,}000}$$

$$I/C = .0529$$

Now, all that you have to do is to run down a Section Moduli chart until you reach the one nearest yours on the high side and read across to the correct diameter, and there you have it!

In our case, I/C of .0100 is 15/32 in. dia., and I/C of .0529 is 53/64 in. dia.

So, if you start with a piece of ⅞ in. by 27 in. 6150 and turn to the dimensions given, it will all fit nicely into a 1 in. by .058 in. by 8 in. socket welded into the aft end of the fuselage.

The spring can be installed at a slight downward angle to give room under the rudder. If you care to run a

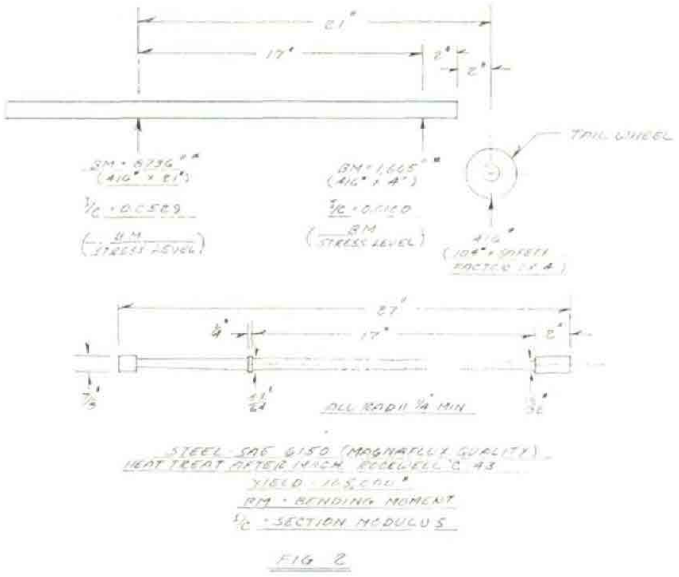


FIG 2

deflection problem, you will find that this spring will deflect about 4 in. under full load. Also, the actual yield comes closer to 180,000 psi which is an additional safety factor.

Direct steering should be given some thought as it really works, especially on short-coupled airplanes.

These springs have been fitted to all three Daphnes built to date, the Vidervol VS-1 and one or two other aircraft.

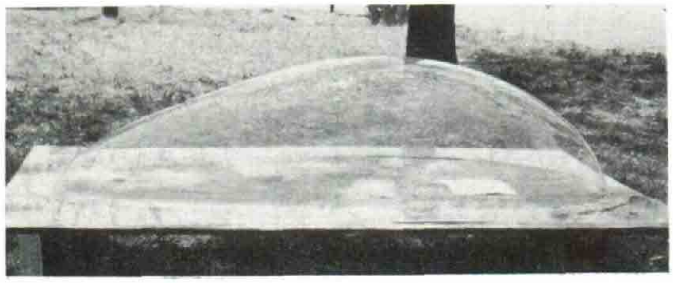
BUBBLE CANOPY . . .

(Continued from page 8)

Decide to Build My Own Oven

Ken Linn indicated that he had done just that. He used a plywood shipping crate that was about 3 ft. by 3 ft. by 6 ft., and lined it inside with glass insulation. He cut a hole in the bottom side to fit over the gas stove he used for heating his garage, and that was his oven. I wasn't able to find such a box locally and so decided to build one out of ½ in. gypsum wallboard which, I assumed, would work just as well and would only cost three or four dollars but, fortunately, John Berwick from Alon Aircraft Co. stepped up at this point and offered the use of their oven.

However, since the operation can be performed at home, let me quote from Linn's letter: "After the glass was bolted between the form and an air line attached, it went into the box, leaving enough room at the top for the canopy to rise (12-15 in.). I made a small window in the box to watch the glass and heat, and brought the temperature up to 280 deg. F., then opened the air valve and the canopy began to rise. When the glass reached the height I wanted, I held it with the air valve and opened the door to let it cool."



I would suggest that to be sure that the glass is hot enough to form, a small scrap piece be placed in the oven supported by one end. When this test piece is hot enough to hang limp, then the canopy should be ready to form.

Margin for Error in Plexiglas

If your oven is not large enough to form the part in it, it can be removed and placed on the bench since the glass will remain pliable for a couple of minutes.

Another bonus you get for free is that if something goes wrong and you don't like the part you end up with, just put it back in the oven. The glass will go back to a flat sheet and you can start over.

I used Plexiglas Grade G Unshrunk. This is the least expensive grade available, and a ⅛ in. sheet, 2 ft. by 4 ft. cost me less than $8.00. The finished canopy is as free from distortion as could be hoped for, so I see no need for the better grades of glass. The part should be tempered at 110-140 deg. F., for 8 hours after forming, which can probably be done in the attic of your home on any sunny day.

Besides the price of the glass, my canopy cost me $3.00 for plywood and $1.00 for nuts and bolts.

So, go ahead! I got my canopy on the first try!