

Hot air balloons

Peter Carter

Hot air balloons are very simple flying machines, and have been floating around since 1783. The balloons described here are the result of some development, with the aim to make them easy to build and reliable. I suggest you build and fly a couple of the smaller ones before trying a larger one.

It's possible to make smaller balloons than these, but their performance is very limited, and they are much more prone to catching fire. You can scale things up and make larger ones. If you do that, make sure that the horizontal circumference is greater than the vertical: the other way about and the balloon will be unstable.

Materials

- Brown paper for patterns
- Jewellers tissue (white, or coloured wrapping tissue)
- PVA glue
- Cane or split bamboo
- Wire, 1.5 mm
- Cotton wool
- Tape (masking or cellulose)
- Methylated spirits

You may find suitable tissue at a newsagent or stationer's. If you want lots, go to an art materials supplier.

Equipment

- Pencil
- Ruler
- Protractor
- Scissors
- Felt pens
- Pliers
- Some form of fire extinguisher: garden hose, bucket, etc.

Construction

Draw the pattern full size on to the brown paper, which should be folded along the centreline so that both sides are symmetrical. Take care with the angle at the top. Cut out the pattern. (If you plan on making many balloons, as for a class project, make the pattern on something more solid: hardboard, or perhaps Coreflute®.)

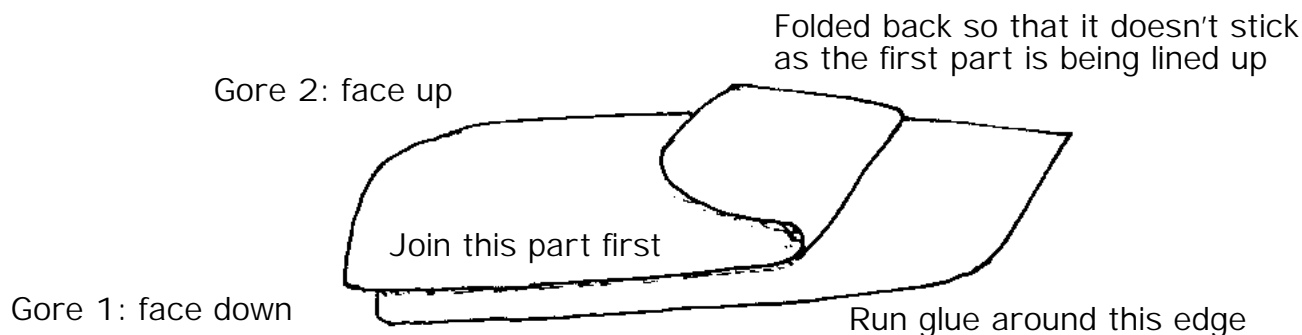
If the size of the tissue you have is different from what is shown here, adjust the pattern to fit.

Make the gore blanks. For the smaller balloon, take eight sheets and stick along long edges to make four, 68 by 85 cm. For the larger, 16 sheets stuck along short edges to make eight, 135 by 43.

Overlap the sheets about a centimetre, and use as little glue as possible. The glue line should be no wider than 2mm: too much is heavy and tends to make a mess.

When the glue is dry enough so that the blanks do not stick to each other, put them exactly on top of each other, with the pattern on top. Cut carefully around the pattern or mark the blanks for cutting without the pattern in place.

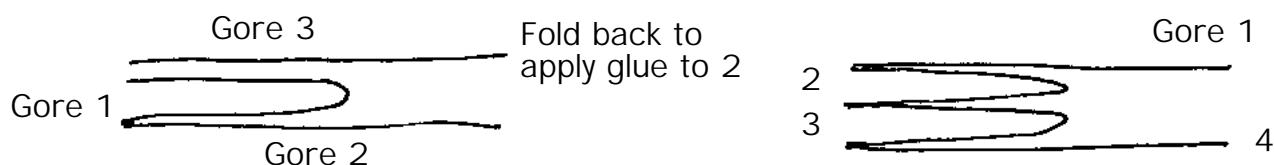
If you want to decorate the balloon, do so at this stage with the felt pens.



Assembly

Take the first gore and place it face down on the table. Run a thin line of glue around the nearer edge.

Fix the second gore, face up, to the first, beginning at the top end.



Turn the whole assembly over, and fold back the free edge of the upper gore.

Run glue along the edge of the lower gore, and attach the third.

Continue the turning over, folding back, adding the next process until all four or eight are together. Then make the final seam. A second pair of hands may be useful.

Check that all seams and the apex are sealed. Set it aside to dry.

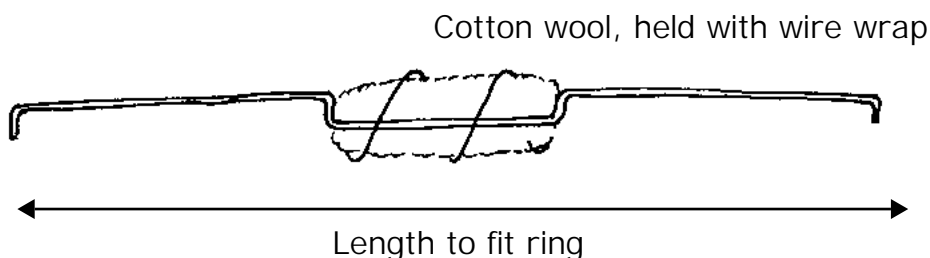
Base ring

The easiest way to make the ring is with cane or split bamboo. For the smaller balloon 120cm of 4mm cane, for the larger 160cm of 6mm, including some overlap. Use tape to hold the ends together, and if you are using bamboo take particular care because it can spring and do you some damage.

Check that the ring fits, and glue it in place.

Burner

Bend the wire to the shape shown in the diagram. Hook it over the base ring, and hold it in place with tape. For the smaller balloon, the cotton wool should be about 10 cm square, 20 cm by 10 cm for the larger. Wrap it around the support, then wrap another piece of wire, preferably thinner, around it to hold it in place.



Flying

A word of warning: in flying these balloons you are playing with fire. Fly only in very calm conditions (cold frosty mornings are best), and observe all fire restrictions (this is a winter activity, not summer). Have something ready to put out any fires that may occur: the garden hose, a bucket of water, knapsack spray or whatever.

Two or three helpers are needed to hold the balloon upright and inflated so that flames do not touch the paper. The best position for holding is the horizontal seam.

Saturate the cotton wool with methylated spirits and light it.

The balloon will heat up and expand, and after a few moments the helpers can let go. Hold the balloon by the base ring until it is lifting: if it falls it will almost certainly catch fire. If necessary walk the balloon with any drift until it rises.

The balloon may dribble a bit of burning meths at first, so make sure you're not directly underneath.

The smaller balloon can fly for up to 10 minutes, the larger for 20 or more, and travel a surprising distance in that time. If you can recover it, well and good, but if it is torn or scorched don't fly it again.

