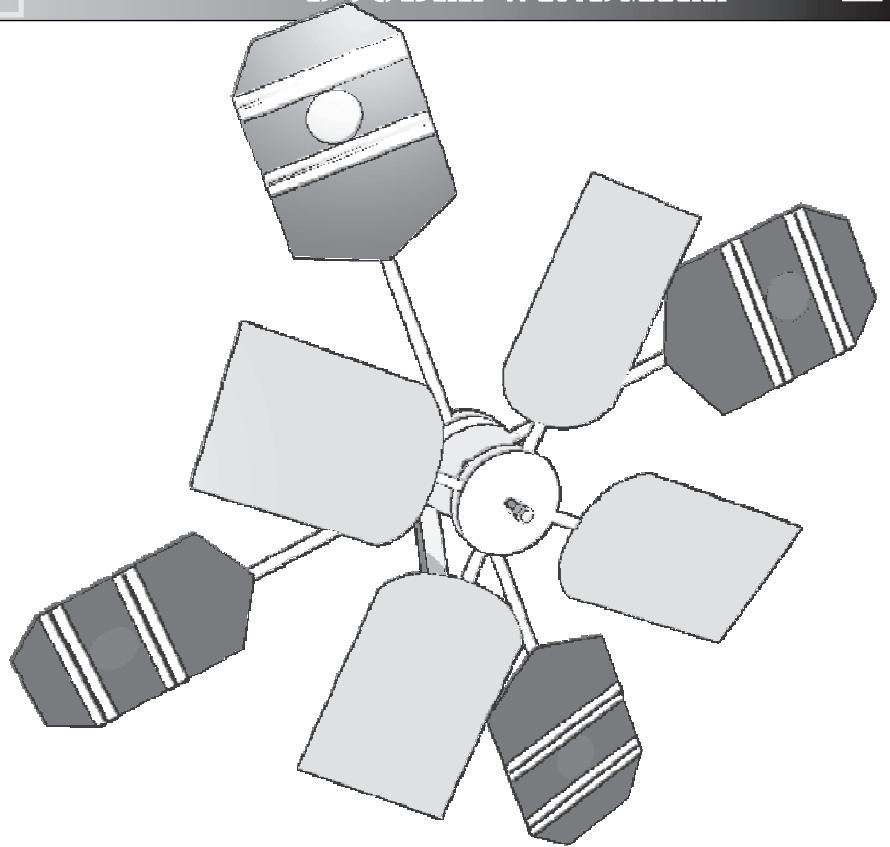


This double, contra-rotating windmill is easy to make and exciting to watch. Designed for use indoors or, if there's a very light breeze, outdoors.

MATERIALS

- 3 Jumbo artstraws
- 4 card discs - about 50mm dia.
- short length of dowel or paper stick
- assorted coloured card (copy card)
- short length of plastic straw



- Before beginning you will need to enlarge the holes in the discs. The dowel should be a loose fit in the holes (use a pencil point).
- Cut one artstraw into 4 equal parts. Glue the 4 pieces to form a cross on one of the discs. Do not let any of the pieces of artstraw cover the hole. Glue the second disc (a) to sandwich the straws. You could use a wheel jig (see wheels page) to line up the holes.
- Cut 4 sails from thin card about 6 x 8cm. Keep the shape very simple but decorate if you wish.

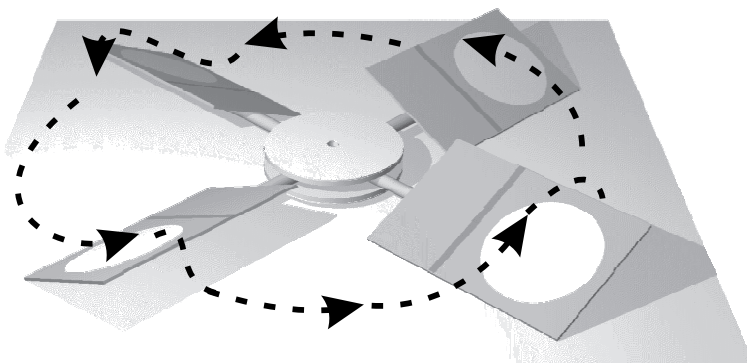
■ **FITTING THE SAILS** - Make a mark on each straw about 1 to 2cm from the disc. Place the assembly on a flat surface and run a bead of glue along the top of each straw from the mark to the end of each straw. Place each card sail onto the glue then tilt the sail over until one edge rests on the surface. They must all tilt the same way. *Imagine some little mannikin is running round the structure. He runs up each 'ramp' and jumps off the other side. He should never need to change direction or 'climb' up onto the ramp.* If you find you have a sail sloping the wrong way then change the tilt while the glue is still wet. *You will realise that our 'little man' can run round clockwise or anti-clockwise - it doesn't matter which, but if he runs clockwise so will the finished windmill.*

■ Put the first windmill to one side and make another. This time start by cutting 2 artstraws in half. This will make the second windmill twice the diameter of the first, otherwise the process is the same, BUT . . . this time you want to make the windmill rotate the opposite way to the first one. When you add the sails the 'little man' must run round in the opposite direction. The sails must slope the other way.

■ When both windmills are finished assemble them on a length of dowel (or paper stick). The order should be as illustrated below. 1. card or PVC stopper, 2. small windmill with sails pointing to the front, 3. spacer - short length of straw about 5cm long (preferably plastic), 4. large windmill, again face the sails to the front, straws behind, 5. second stopper. If you wish you can add some form of handle, but that's not necessary.

■ When you walk forward holding the windmill facing the direction of travel the two sections should go round in opposite directions. If they don't go round something is probably too tight. Check that the holes are big enough and that the stoppers are not gripping the windmills - everything should be loose.

Once you have made one successfully you might like to try more interesting and ambitious designs. It is possible to make **asymmetric** windmills - as long as they **balance**. Add weights (extra card or modelling clay) to the back to make them balance. Experiment!



The little man travels around - running up each ramp and then jumping down.

