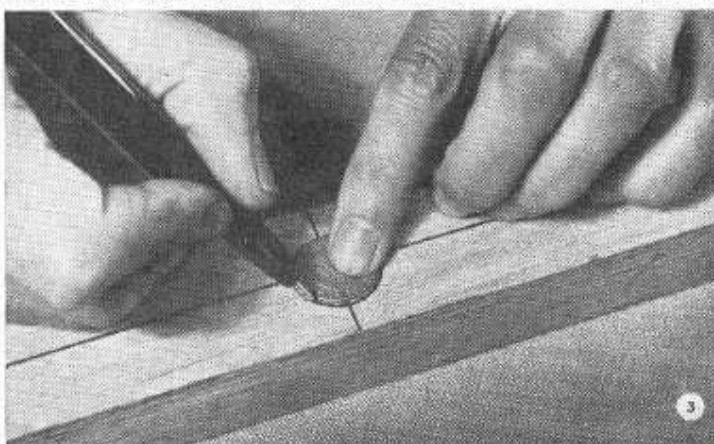
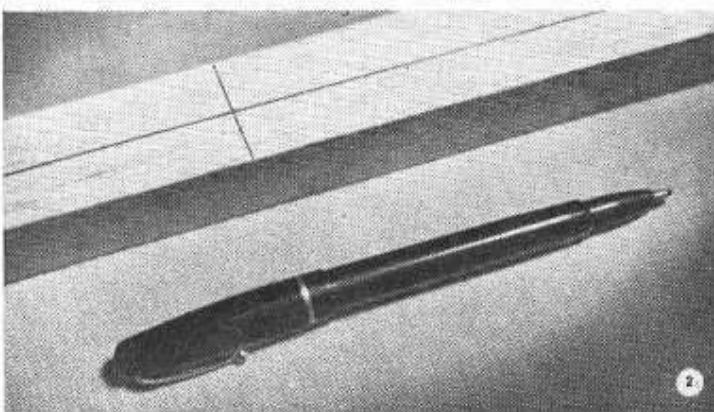
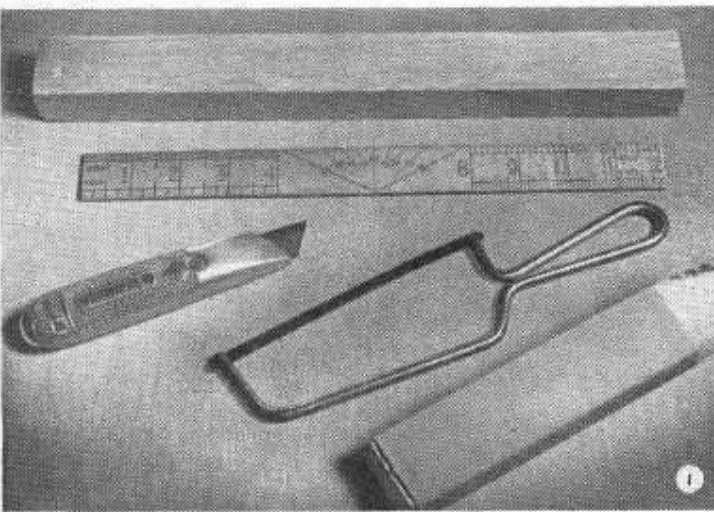


Carving a



THE quickest way of learning how to make something is to watch someone actually making it, and this certainly applies to the rather complicated job of carving a propeller for a rubber model. Since an actual demonstration is not possible in a magazine, we are going to have the next best thing—plenty of photographs taken during the various stages of the work.

There is a great deal of difficult theory behind the designing of a propeller, some people favouring one system, some another. The performance will vary considerably according to the width of the blades and

Follow these stages

Fig. 1 : Shows some of the things you will need ; a piece of medium balsa, $1\frac{1}{2} \times 1$ in. and 13 ins. long, a ruler and miniature hacksaw, balsa knife (preferably with a narrower blade than the one illustrated here), and a block of wood round which to wrap sandpaper—rough grade to start with, smooth to finish off.

Fig. 2 : The first stage in marking out the balsa block, for which a roll ball pen is very useful. Lay the block down with its wide ($1\frac{1}{2}$ in.) face uppermost, and draw two guide lines, one down the middle lengthwise and the other across.

Fig. 3 : Later on, when the block has to be sawn and sliced about, there is a danger of cutting too far or too deeply near the hub. If you lay a sixpence over the intersection of the two guide lines and scribe round it, this will provide a good safety margin, inside which you must not saw or cut until the final stages of the job. An error here will mean weakness at the point where the propeller must be strongest.

Fig. 4 : The next job is to drill a hole of $\frac{1}{8}$ in. diameter right through the centre of the block. Take great care to see that the drill is held quite vertically while this is done.

Fig. 5 : Marking out the face of the block. Measure and mark all the points carefully before drawing in the lines. The actual measurements, are, of course, exactly the same for both blades of the propeller. As long as you are careful with the saw, and leave a slight margin for error as will be described later on, there is no need to mark out both sides of the block in this way.

ESPECIALLY for the BEGINNER PART XXI

BY REV. F. CALLON

balsa propeller

their pitch—the angle at which they are set in relation to the propeller shaft, the varying shape and area of the blade cross section, etc. But beginners should not bother their heads too much about theory—a case of learning to fly before you can talk—and so this article is intended to show you the way to carve a propeller, not how to design one. The propeller described is just an average sort of design, and will be suitable for models of 24 in. to 36 in. wingspan, needing from 4 to 8 strands of $\frac{1}{4} \times 1/24$ rubber strip according to the size and weight of the model.

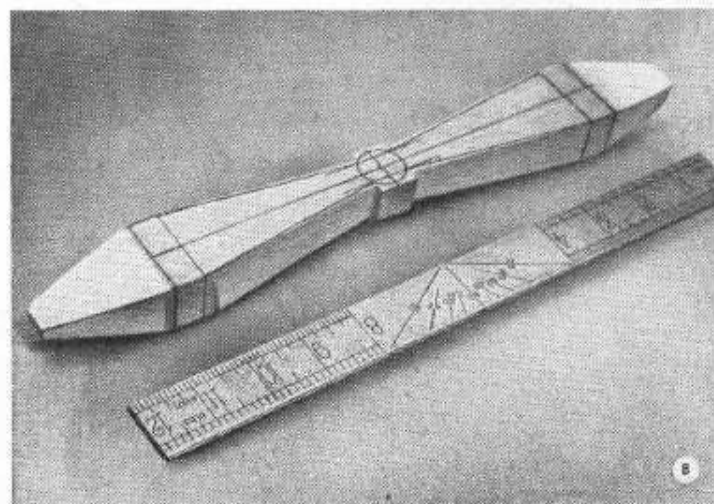
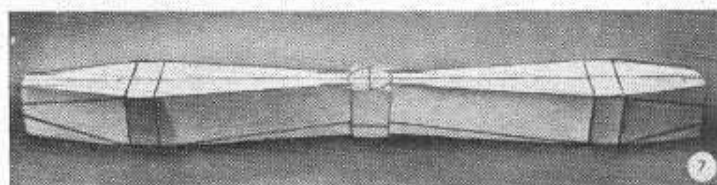
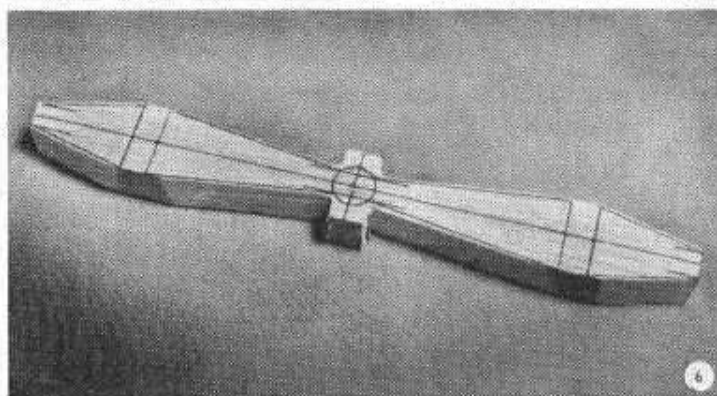
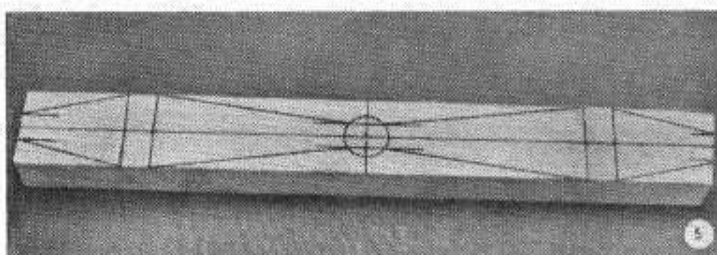
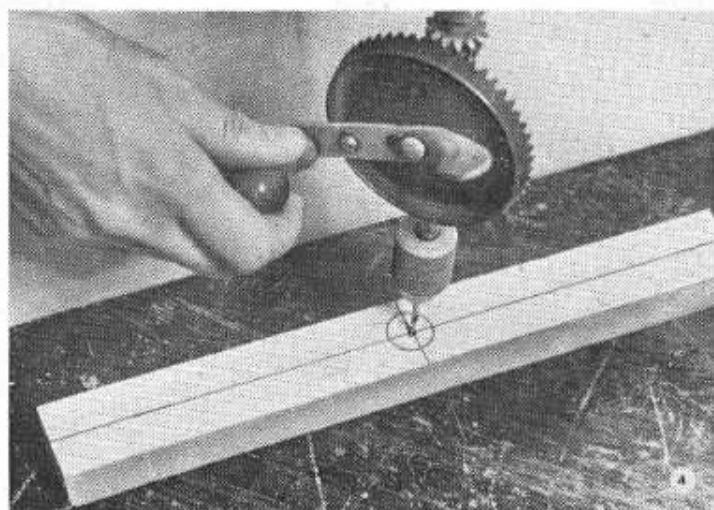
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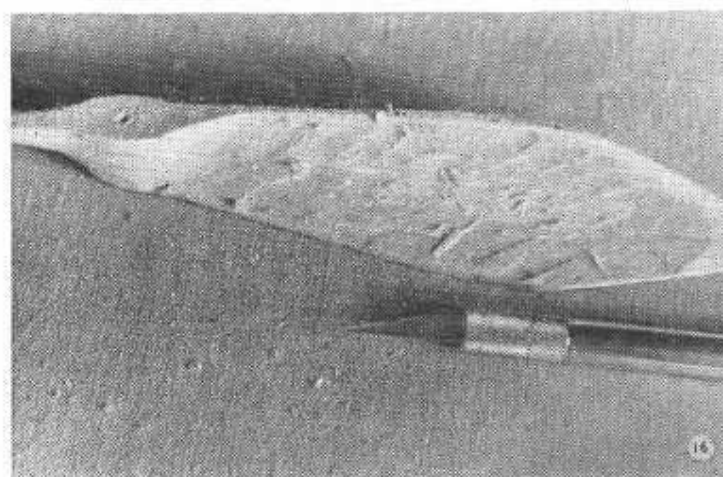
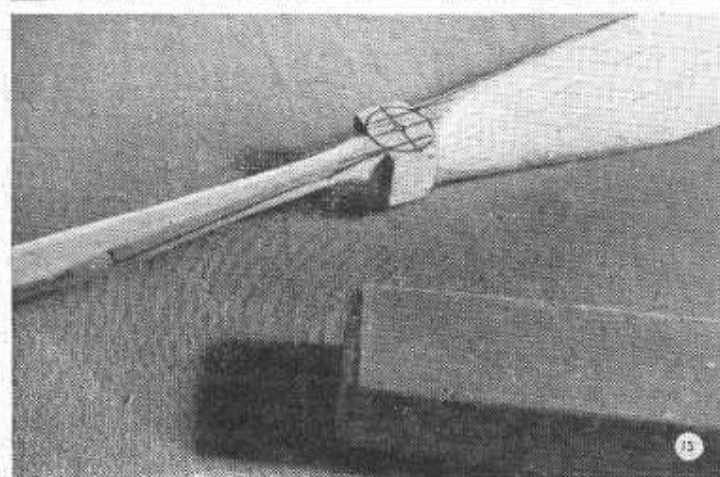
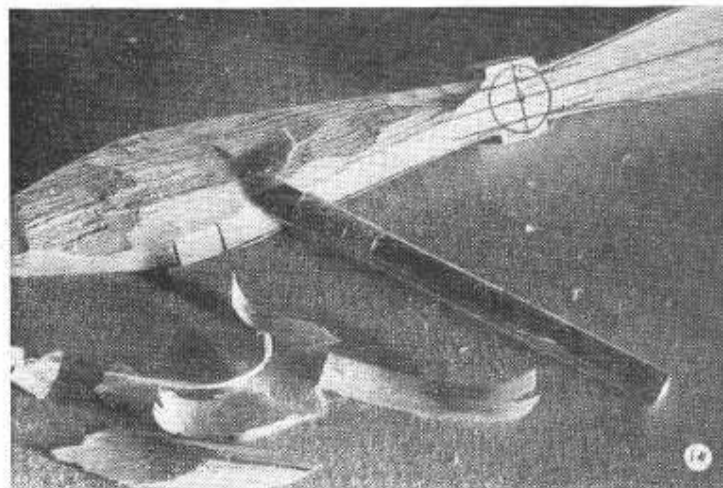
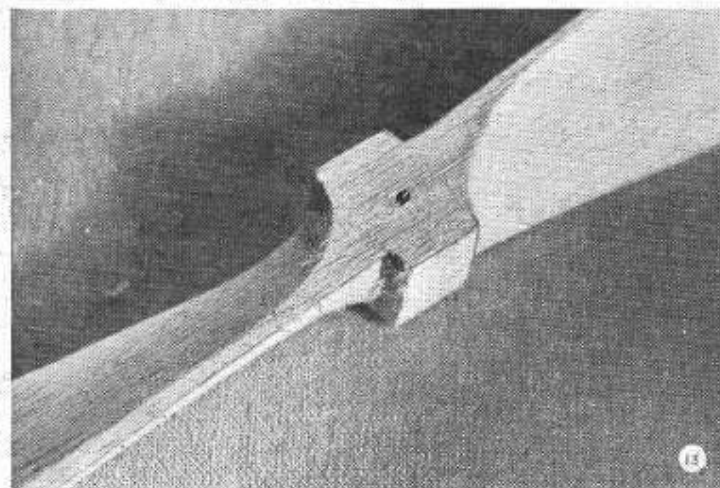
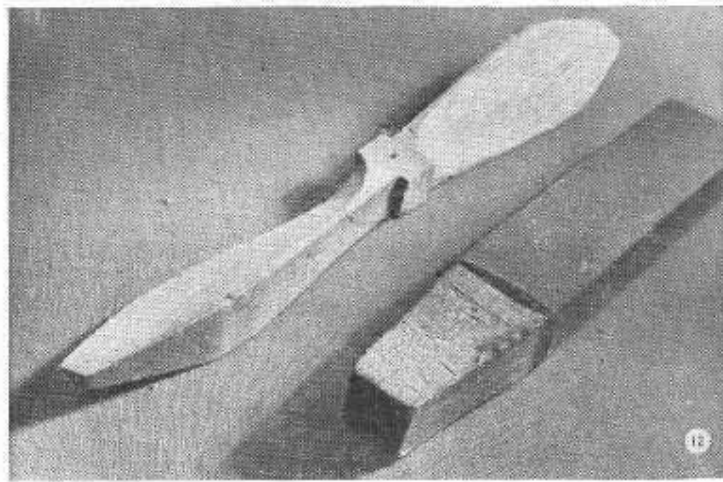
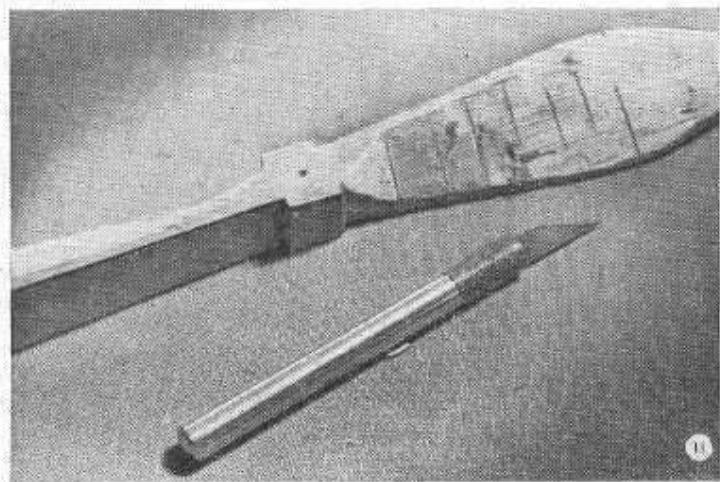
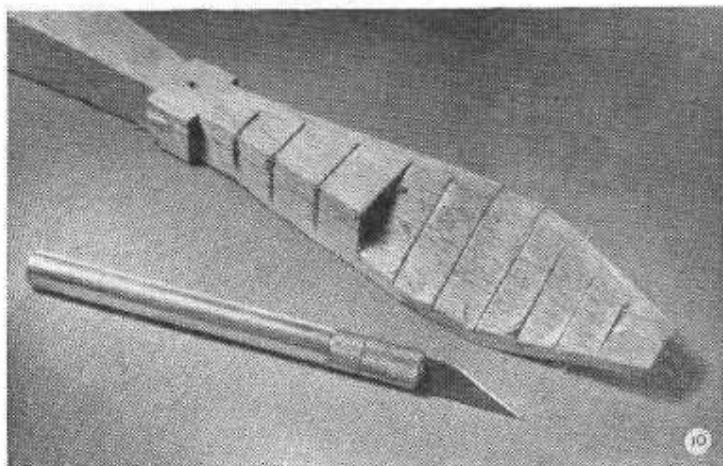
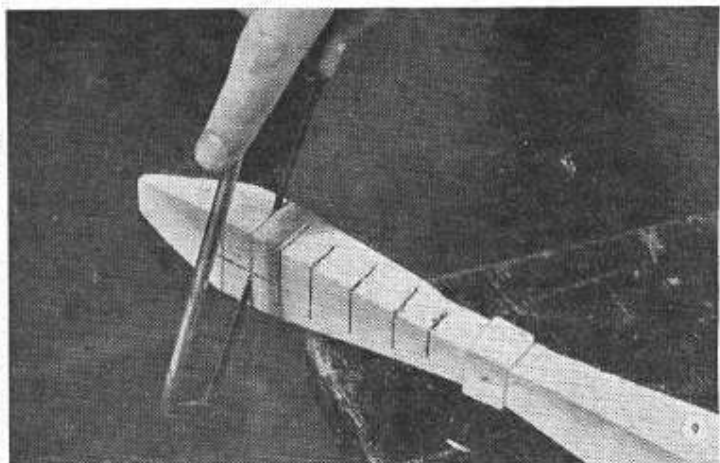
Fig. 6 : We are now ready to start "roughing out" the block, and for this a hacksaw is needed. You may find it simpler to remove the hacksaw blade from its frame and use it by itself. Cut vertically down through the block just outside the slanting side lines and up to but not into the safety circle. Then make two cuts into each side of the block at the centre, at right-angles to the length of the block, to meet the ends of the four slanting cuts just outside the circle, and thus cutting away four triangular blocks of surplus wood. The excess jutting out at each side of the centre may be trimmed off roughly in a straight line—a sort of tangent to the safety circle as can be seen in Fig. 8.

It is important to make the slanting cuts just outside the guiding lines, for then it does not matter so much if they are not quite vertical all the way along, and this can be put right with a rough grade of sandpaper on your sanding block before going any further.

Fig. 7 : The side of the block is now marked out according to the measurements required.

Fig. 8 : This photograph shows the block completely roughed out and ready for carving. It has been cut through from side to side along the guide lines marked out in Fig. 7, and finally "squared up" with the sanding block. Once the block has been roughed out in this way, the rest of the job is quite automatic, since the correct curve and pitch will be given to the propeller merely by carving across from the top forward corner down to the lower rear corner all the way along from the hub to the tip of the blade.





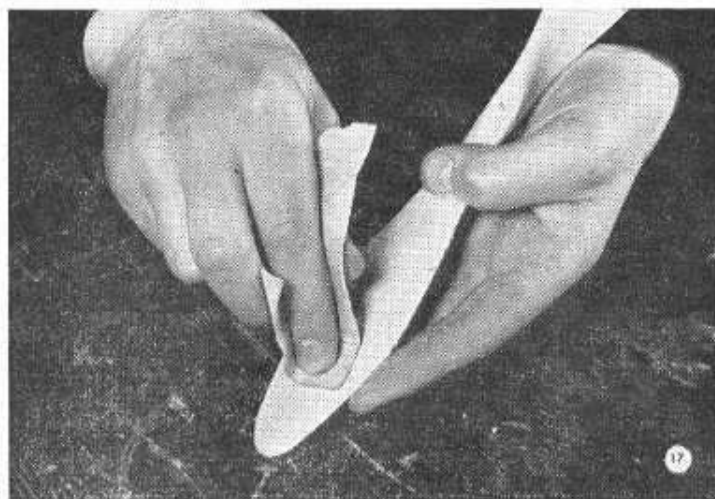


Fig. 9 : Our first job is to carve the rear face of the propeller quite flat diagonally from corner to corner all the way along, and it is just as well to give a little thought to the matter of which way the diagonal goes before you start cutting; otherwise there is a fifty-fifty chance of ending up with a "backwards way" propeller! It is risky to start gashing away with a balsa knife at this stage, for the blade naturally follows the grain of the wood when dug in deeply and it may easily split part of the leading or trailing edge right off. Fig. 9 shows how to prevent this possibility, by making a series of saw cuts every inch or so across the rear face of each blade, reaching to within about $\frac{1}{8}$ in. of the corners of the block.

Fig. 10 : A knife is now used to split off the sections one at a time across the block.

Fig. 11 : The same is done to the rear face of the other half of the propeller, and a knife used to make a rough job of carving the two rear faces flat from corner to corner all the way along.

Fig. 12 : A rough grade of sandpaper is now used to clean up this twisting flat surface.

Fig. 13 : A close-up of the rear centre section, showing how the rear faces of the blades are roughly shouldered in to the (at present) rectangular hub.

Fig. 14 : The front of the blade is now carved to a slightly rounded or convex surface—something like the top of a wing aerofoil.

Fig. 15 : This in its turn is roughly smoothed over with the sanding block, so that the blades are about $\frac{1}{4}$ in. thick all the way along $\frac{1}{2}$ in. back from the leading edge, and taper down very slightly on either side.

Fig. 16 : The ideal cross section of the propeller blade should be rather like that of an undercambered aerofoil section—hollow underneath with a blunt, rounded leading edge and a tapered trailing edge. The first step towards this result is made by scooping out the rear faces of the blades a little. A knife which has a curved blade is ideal for this. At the same time the rectangular central boss can be carved and sanded until it becomes little more than an elliptical bulge in the middle of the propeller.

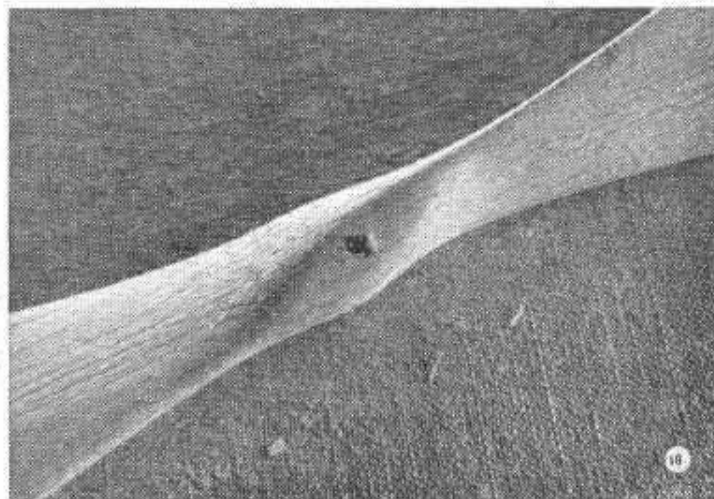
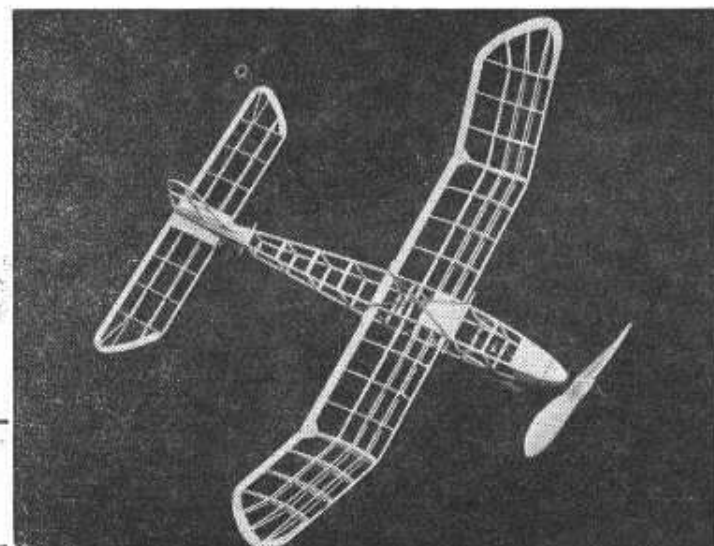


Fig. 17 : The slightly hollow surface of the rear faces of the blades is now smoothed out with the help of a piece of sandpaper wrapped round the finger. The leading and trailing edges are sanded to a smooth curve outline, the former with a rounded cross section, the latter tapering away to $\frac{1}{16}$ in. thickness.

Fig. 18 : This shows what the hub should look like. The roots of the blades on either side of the hub should also be thinned down as shown, but not so much as to weaken them.

Now turn back to the heading photo of this article to see the final product. A 13 in. hand carved propeller, ready for the insertion of a brass bush for the propeller shaft and an extra bit of sanding to obtain the correct balance. If a free-wheel device is to be used which necessitates a small screw or brass tube being inserted into the hub at one side of the bush, this unit should be put in place on the lighter side of the propeller, and balancing should not be attempted until this has been done. All that remains then is to give the entire unit several coats of dope, and sand it with smooth paper after each successive coat has dried. A final coat of banana oil will give a high gloss waterproof finish.

Some modellers prefer to give their propellers a covering of tissue before applying the dope, and there is no doubt that this saves several coats of dope. Care is needed in the selection of a lightweight tissue for this purpose, otherwise the weight will be more than we want.



Study of the Rev. Callon's Especially for the Beginner articles enabled Janet Imrie of West London to build this excellent Keil-Kraft Senator without assistance from any male friends. A creditable effort which emphasises the value of 'Beginner' articles.