from that time no other propeller has been used on the machine, except when the Paragon was laid up for repairs. The officers say they get about the same results with both propellers, but it is noticeable that the Paragon is the only one they use.

In 1911 we made for the Roberts Motor Co. two propellers, which were exactly alike in every particular,

except that one had a blade about 50 per cent wider than the other. Upon test, they reported no practical difference in speed. The thrust was not taken.

The blade of a propeller must not be considered as an oar or paddle pushing backward against the air. It does not move broadside, but edgewise through the air, and its angle of attack is very fine. We must consider the air as flowing across the blade from leading to trailing edge, just as it flows across an aeroplane wing, except that the angle of incidence of the blade is very much less. The business of the blade is to so affect the air flowing over that the stream of air will leave the blade at a slight angle from the direction in which the air approaches the blade. The blade has to be wide enough to cause this change in the direction of the air flowing over it, without breaking the air into turbulent eddies, whirlpools, etc., and without dragging any dead air along with the blade as it moves. If the blade is wide enough to produce this change of direction of flow, it can do no more than this after it has been made wider; neither will it consume any more power for a given amount of change in the flow of the air, except that there will be a very slight increase of skin friction, due to the added surface, but this is too small a matter to make any practical difference. It is probable that nearly all propeller blades are wider than they need to be in order to produce the same amount of change in the direction of flow of the air as it leaves the blade. The average propeller could be cut down considerably in width without affecting appreciably the speed at which it turns; but if the width is so far reduced that the air flowing over it cannot form in smooth, even lines, but surges around both edges of the blade, its efficiency will be enormously reduced and probably as much or even more power will be required to turn it at a given speed. The aim in propeller design is to secure ample width to insure a smooth flow of air over the face and back of the blade, under the expected condition of power, speed and slip. Any greater width than this may do no serious harm within reasonable limits, but encumbers the machine with unnecessary wood and a little more skin friction in the blade.

Spencer Heath.

THE WIDTH OF BLADES

Speaking of the width of propeller blades, it may be of interest to know how narrow they have been made in some recent foreign designs. An 8 ft. 10 in. propeller, developed in the Royal aircraft factory of Great Britain for use on Renault motors, with heavy biplanes, has the following width: 4-ft. diameter, 6 1-8 in.; 6-ft. diameter, 6 3-16 in.; 8-ft. diameter 3 15-16 in. Two of these propellers were furnished with the Renault-driven navy boat D-2, and there was a great deal of favorable talk about them among the officers, as these propellers were supposed to embody the best results of very extensive experiments at the Royal aircraft factory, both in the laboratory and on the field. The two propellers are set at right angles to each other on the same shaft, so the combination approximates a four-bladed propeller. After this propeller was used a short time, we furnished an 8½-ft. three-bladed Paragon, and