# An Instrument for Measuring the Pitch and Blade Thickness of Mineral Screw Propellers

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**A simple and accurate instrument has been designed and fabricated to measure the pitch and blade thickness at various points of a marine screw propeller for arriving at a correct shape and for proper balancing of the propeller. The instrument can be utilized by pattern makers, finishing shops, boat yards, etc. With the existing instruments this measurement is very difficult and cumbersome.**

MEASUREMENT of the pitch and blade thickness at various points of a marine screw propeller[1] is absolutely essential during designing and machining in order to get the correct shape of the propeller blade or after repairing in order to get proper propeller balancing. This is quite difficult, particularly in case of smaller ones, due to the intricate shape of the propeller. A simple mechanical instrument which has been designed and fabricated at the Central Institute of Fisheries Technology, Cochin, can conveniently be used for this purpose by pattern makers, foundries, finishing shops, boat yards, repair shops, research institutions, etc.

## Description of the instrument

The instrument (Fig. 1) consists of an angle-iron tripod (1) and to its top is welded a short stem, carrying a thick horizontal metal disc (2), on which the propeller can rest. A fully threaded spindle (3) is screwed into the disc perpendicular to it. Two identical horizontal graduated arms (4), are fixed to the stud on suitable collars and the arms can freely rotate either independently or together about the centre of the stud. They are kept parallel by means of a threaded spacer rod (10) working through a welded eye (9) at each free end of the horizontal arms. The distance between the horizontal arms can be varied and can be fixed at any vertical distance depending upon the length of the propeller boss (15) by tightening the nuts in the spacer rod. Vertical scales (7) are inserted on each of the identical sleeves (5) provided in each arm (4) and can freely slide along the horizontal scale and can be fixed at any position by means of thumb screws (6) (not shown). The lower vertical scale (pointed tips) is graduated from top to bottom and the upper scale is graduated from bottom to top and the scale can be moved up and down by means of rack and pinion arrangement (7a) and can be fixed in any vertical position by means of thumb screws (8).

The upper horizontal arm carries a pointer (12) which moves along the circular scale (11) marked in degrees on the disc (which can be screwed along the vertical spindle), and can be made to rest on the upper side of the propeller boss. The tripod has three levelling screws (13) and a circular spirit level (14) for levelling the instrument.

## Procedure

The instrument base and the horizontal arms are levelled and the spacer-rod nuts tightened to fix the arms rigid and parallel. A piece of wood is taken and shaped so that the taper of this piece conforms to that of the bore of the propeller boss. A longitudinal hole is then drilled in the wooden piece through the centre. The

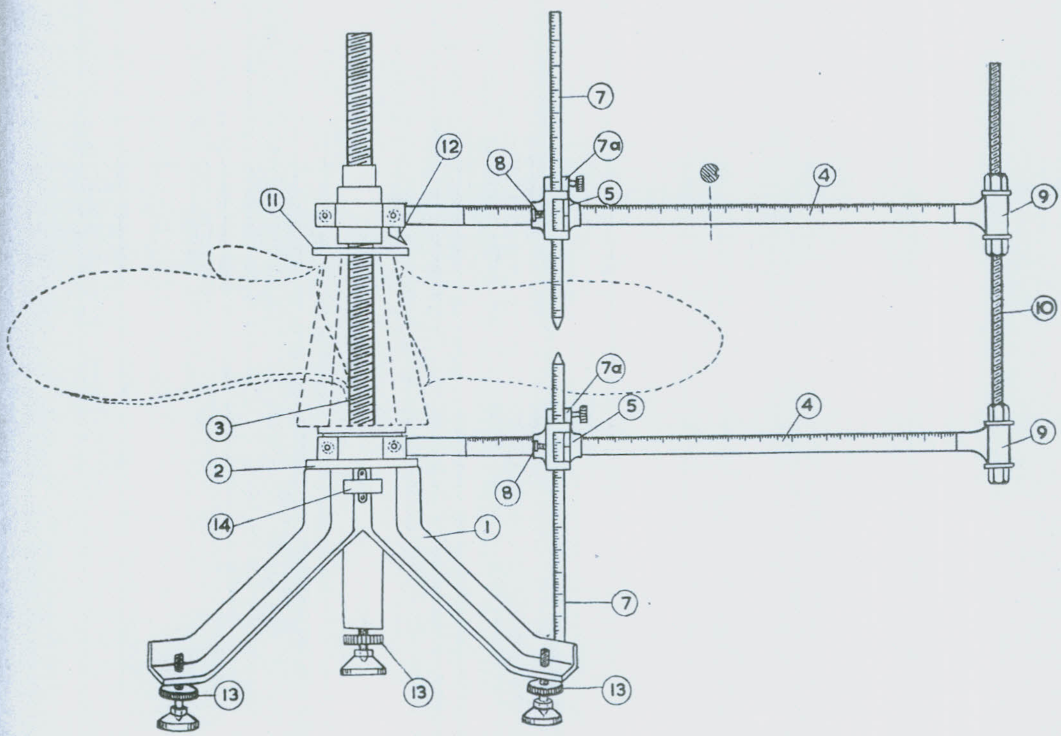


FIG. 1 — INSTRUMENT FOR MEASURING PITCH AND BLADE THICKNESS OF SCREW PROPELLERS

diameter of the hole must be such that the wooden block will fit as a close fit on to the spindle. Then this piece is inserted into the boss of the propeller and the combined propeller and fitting block is inserted on the spindle. Then the other parts of the instrument are assembled.

*Measurement of propeller pitch* — For this purpose, the sleeve of the upper horizontal scale is moved to the radius at which the pitch is to be measured, and fixed by tightening the thumb screw (the lower scales are not used when measuring pitch). The upper vertical scale is then moved and adjusted until it touches the end of the trailing edge on the upper side of the propeller (Fig. 2) and the upper vertical scale reading $h_1$ is noted. The horizontal arm is swung towards the leading edge without altering the position of the sleeve, and the vertical scale is dropped until it comes in contact with top of the propeller. The vertical scale reading $h_2$ and the circular scale reading are noted.

Knowing the vertical scale readings $h_1$ and $h_2$ and the circular scale readings $\theta_1$ and $\theta_2$ respectively in the two positions of the arm, the pitch at radius R (Fig. 2b) is calculated from the equation

$$\text{Pitch} = \frac{h_1 \sim h_2}{\theta_1 \sim \theta_2} \times 360$$

($\theta_1$ and $\theta_2$ are measured in degrees)

This can be repeated and the pitch at any other radius can be measured.

*Measurement of blade thickness* — The instrument is assembled and adjusted as previously. But both the vertical scales are used in this case. The sleeves are fixed at the radius at which the blade

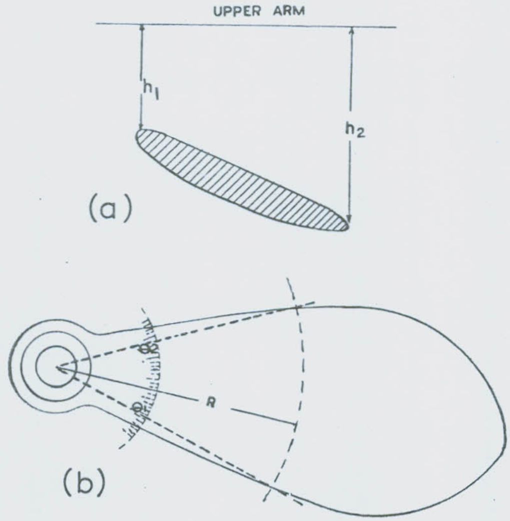


FIG. 2 — MEASURING PITCH OF THE SCREW [a, setting of the vertical scale; b, pitch at radius R]

thickness is to be taken. The angle subtended by the edges of the propeller at the particular radius is measured and divided into convenient number of equal parts (say 10) of $\phi°$ each.

The arms are swung so that the upper vertical scale just touches the end of the leading edge fixed on the vertical scale (Fig. 3). The upper vertical scale reading $h(U_0)$ is noted. The arms are moved away from the propeller blade and without disturbing the upper scale the tip of the lower vertical scale is brought in contact with that of the upper and the lower vertical scale reading $h(L_0)$ is noted. This represents the initial setting as shown in Fig. 3a. The arms are moved through $\phi°$ from the initial position and the upper vertical scale is dropped until it comes in contact with the upper side of the propeller blade. The vertical scale reading $h(U_1)$ is noted. Without disturbing anything else, the lower vertical scale is moved until it touches the lower side of the propeller blade. (The lower vertical scale will exactly be below the upper as they have already been adjusted to be so.) The reading of the lower vertical scale $h(L_1)$ is noted. By successively swinging the arm through an angle $\phi°$, the process is repeated for all the points.

Taking a horizontal plane passing through the leading edge at the particular radius as reference plane, H(U) and H(L) will give the ordinates of the upper and lower profiles of the blade respectively at the various points and thus the shape of the section can be plotted as shown in Fig. 3b. The blade thickness at any point across the section can then be read out directly from this plot.

*Accuracy* — It is possible to get a fair degree of accuracy (±5 per cent) in measurements depending upon the accuracy with which the various parts of the instrument are machined and assembled. The main source of error in this instrument is due to the offset of the vertical scale from the horizontal scale. This error is more pronounced at smaller radii (5 in. and below) where due allowance must be given for the offset of the vertical scale. However, the effect of the error at larger radii (more than 5 in.) is negligible.

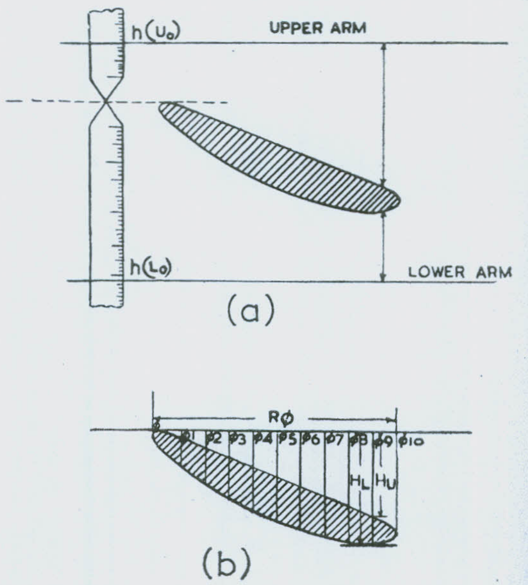


FIG. 3 — MEASURING BLADE THICKNESS OF THE PROPELLERS [a, initial setting of the vertical scales; b, plot of the section of the propeller blade]

The instrument is easy to manufacture, maintain and repair. The same instrument can be used for measuring both pitch and blade thickness. Once the instrument is adjusted and set any number of readnigs can be taken quickly. No further adjustment is necessary.

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**Reference**

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# Processing of Groundnut for the Removal of Red Skins and Hearts

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**Utilization of groundnut meal for edible flour or protein preparation necessitates the removal of red skins and germs from groundnuts as their presence in the meal adversely affects its acceptability. Hence, investigations were undertaken to study the comparative efficiency of deskinning and degerming groundnut kernels using five different equipments including one pilot plant which was designed and fabricated at the Gil Technological Research Institute. Of these equipments, two, namely the pilot plant and rubber-sleeved smooth rolls, gave satisfactory performance, the extent of removal of the skins being 90-98 per cent and germs, 60-87 per cent. Not only superior quality cake but also colourless oil with low free fatty acid content has been obtained.**

GROUNDNUT kernel contains 3 per cent of testa or red skins and 2 per cent of germ or heart on an average[1]. The skins contain tannins, leuco-anthocyanins and phlobaphene[2] and the hearts saponins[3]. These minute constituents of minor parts of groundnut kernels have assumed much significance because of increased utilization of groundnut meal for preparation of edible flour or protein. The acceptability of edible groundnut flour or protein is reduced on account of the presence of skins and hearts. Two groundnut flour manufacturers in India have installed deskinning equipment among others supplied by a reputed US firm for the production of groundnut flour. A pilot plant designed and fabricated at the Institute and some other standard machines available in the country were tried in order to see if it gave performance similar to the imported equipments. The trials carried out with this pilot plant as also with four other equipments on deskinning and degerming groundnut kernels, and the results and conclusions are presented in this paper.