INDIGENOUS SUBSTITUTES FOR "LIGNUM VITAE" FOR MAKING STERN BEARINGS FOR FISHING BOATS

M. VELU & T. K. SIVADAS

Central Institute of Fisheries Technology (Craft & Gear Wing) Cochin-5.

Difficulties are very often encountered in selecting proper material for making stern bearings for fishing boats. Conventional materials such as white metal, bronze etc. wear out too fast also causing considerable wear to the propeller shaft. Lignumvitae, a natural wood commonly used for this purpose, is not available on a commercial scale in our country. Results of trials carried out to find out suitable substitutes for lignum-vitae from among indigenous timbers are presented in this paper.

INTRODUCTION

Selection of proper material for stern bearings for fishing boats presents certain special problems because of the peculiar operating conditions, to which these bearings are subjected. The bearings are lubricated by water, which is often full of suspended material like fine sand, as the boats operate mostly in shallow waters. Stern bearings made of conventional materials like white metal, bronze etc are found to wear out rapidly and cause considerable wear to the propeller shaft. Lignum-vitae(*Guaiacum officianale* Linn.) a natural wood, is widely used for this purpose but this timber is not grown in India on a commercial scale.

Systematic investigations were therefore undertaken to evaluate the wearing qualities of certain Indian timbers which were suggested as probable substitutes* for lignum-vitae.

METHODS AND MATERIALS

Laboratory trials: Specimens of the following timbers were prepared and subjected to both laboratory and field trials.

1. *Guaiacum officinale* — lignum-vitae: Control.
2. *Acacia chundra* — red cutch
3. *Mimusops littoralis* — Andaman bullet-wood,
4. *Hardwickia binata* — anjan

Laboratory trials were conducted in a

* Probable substitutes were suggested by the Forest Research Institute, Dehra Dun.

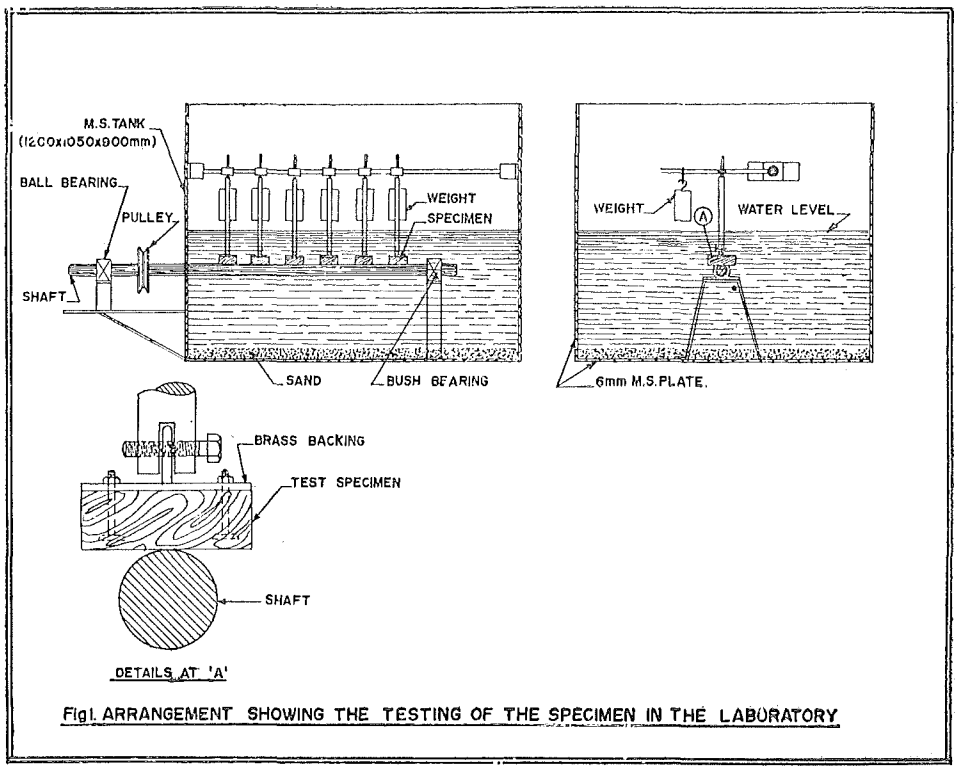

Fig1. ARRANGEMENT SHOWING THE TESTING OF THE SPECIMEN IN THE LABORATORY

tank of size 120 × 105 × 90 cm in which the specimens were subjected to wearing by loading them with weights suspended on a lever as shown in the Figure 1.

The shaft was driven at 500 rpm, which is approximately the propeller shaft speed in fishing boats. Seawater was filled in tank so that the level was 50 mm above the specimen to be tested. One litre of fine sand was admixed in the sea water to simulate as far as possible, the actual working conditions. The specimens were taken out after 250 hours of running and maximum depth of wearing was taken as a measure of the wearing quality of the wood.

Field Trials: In order to confirm the results of the laboratory trials, the timbers were subjected to field trials. Stern bearings made of these species were fitted to boats and their performance under actual working conditions was observed. After about 500 hours of working the bearings were taken out and the extent of wearing determined on the basis of the difference between the initial and final internal diameters after drying them to original moisture content, under shade.

TABLE I MAXIMUM DEPTH OF WEARING OF SPECIMEN IN THE LABORATORY TRIALS.

Specimen	Maximum depth of wearing in mm.			
	First trial	Second trial	Third trial	Fourth trial
1. *Guaiacum officianale* — lignum-vitae *Control*	8.3	3.1	6.2	6.1
2. *Mimusops littoralis* — Andaman bullet wood	5.7	4.0	5.8	7.2
3. *Hardwickia binata* — anjan	4.4	3.4	4 2	8.2
4. *Acacia chundra* — red cutch	6.0	2.7	8.6	7.5

TABLE II: WEARING CAUSED ON THE BEARINGS UNDER FIELD TRIALS.

Sl. No.	Species of bearing material	Size of boat (Length over-all in meters)	No of hours the boat worked	Rated RPM of the propeller shaft	Material of propeller shaft	Inner diameter of bearing before the trials (mm)	Inner diameter of bearing after the trials (mm)	Inner diameter of bearing along the diameter during actual working (mm)	Wear on the bearing along the diameter calculated for 500 hrs of running (mm)	Wearing caused on to the propeller shaft	Resistance to sea water
1.	*Mimusops littoralis*	9.12 (30′)	461	400	Bronze	58.58	59.55	0.97	1.05	***	Good
2.	,,	9.76 (32′)	558	750	-do-	51.80	52.85	1.05	0.94	***	
3.	*Hardwickia binata*	9.76	481	750	-do-	51.62	51.96	0.34	0.35	****	Good
4.	,,	9.12	520	400	-do-	58.42	59.58	1.16	1.12	****	
5.	*Acacia chundra*	9.76	480	750	-do-	49.02	50.10	1.08	1.13	**	Good
6.	,,	9.12	472	400	-do-	58.49	59.41	0.92	0.98	**	
7.	*Guaiacum officianale*	9.12	522	400	-do-	58.25	59.27	1.02	0.98	*	V.Good
8.	,,	9.76	420	750	-do-	51.54	52.50	0.96	1.14	*	

* Very little wearing

**** Wearing a little above allowable limits.

, * Wearing within the allowable limits.

For practical reasons all these bearings could not be made of uniform size and the time interval between fixing the bearings and taking them out for inspection also could not be kept constant.

Results and discussion

The results of the trials are presented in tables I & II.

Analysis of the results of the laboratory trials showed that all the indigenous timbers tested have wearing properties which compare favourably with those of lignum-vitae. All the timbers are more or less affected to the same extent. These results were also confirmed in the field trials.

Though the laboratory trials indicated that these timbers possess wearing qualities almost equal to those of lignum-vitae, field trials clearly showed the latter is superior to these timbers as it causes too little wear on the propeller shaft compared to that caused by the indigenous timbers. It is, however, beyond the scope of the present investigations to go into the basic properties which contribute towards better wearing qualities. The diagonal and oblique arrangement of successive fibre layers, silky texture, self lubricating properties, resistance to salt water and great compression strength (CSIR 1956) besides the presence of a waxy resin in the timber appear to be the contributory factors for its superior wearing qualities.

The undermentioned indigenous timbers which were subjected to the trials can however be recommended for use as stern bearings in fishing boats in the following order.

1. *Mimusops littoralis* — Andaman bullet wood.
2. *Acacia chundra* — Red cutch.
3. *Hardwickia binata* — anjan.

Clearance to be allowed in the finished bearings.

It is necessary to provide correct amount of clearance between the propeller shaft and the bearing as also between the bearing and the stern tube. Too much clearance between the bearing and the stern tube will cause the bearing to work loose in the stern tube with the resultant vibration of the propeller shaft. Insufficient clearance between the propeller shaft and bearing will make the bearing too tight on the shaft when it absorbs water and swells. Experiments were therefore carried out to determine the clearances to be allowed. It was concluded that the bearings with an initial moisture content of 12—20%, which is normally the moisture content of air dried timbers should be machined as a "push fit" in the stern tube and a free "sliding fit" on the propeller shaft.

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