# TECHNICAL NOTES

FOREST PRODUCTS LABORATORY

U. S. FOREST SERVICE

MADISON, WISCONSIN



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## WARPING OF AIRCRAFT PROPELLERS

One of the greatest troubles experienced with airplane propellers during the war was caused by the warping and twisting of the blades near the tips, and a large percentage of the propellers received at the front were rejected on this account.

In order to determine the causes and to develop methods of preventing this trouble, a number of experimental propellers were manufactured for the War and Navy Departments by the Forest Products Laboratory of the U. S. Forest Service at Madison, Wisconsin.

The propellers were made of Central American and African mahogany using carefully selected stock uniform in density and moisture content, and were stored under uniform atmospheric conditions for 30 days between the roughing out and final carving operations. After the standard finish, consisting of five coats of spar varnish, had been applied, they were again stored under the same conditions for observation as to warping and twisting.

These propellers were made up and handled much more carefully than the commercial product, and every possible effort made to produce perfect results. After exposure to a very damp or humid atmosphere for three or four months, it was found that every propeller had warped or twisted or otherwise changed shape to an extent that made them unacceptable for use. They had all absorbed about five per cent of moisture through the five coats of spar varnish, and this moisture caused all the trouble. The treatments to which these propellers were exposed, namely, being manufactured in a relatively dry condition and later exposed to moist atmosphere, is very similar to that which is normally received by propellers made in the United States and shipped to France. Frequently propellers are made in a relatively moist climate and shipped to a drier one, and trouble from change of shape due to drying out is almost sure to result.

There is only one way in which trouble from change of shape due to changes in moisture may be obviated, and that is to prevent these moisture changes. The experiments just outlined show that it is impossible even under ideal manufacturing conditions to produce propellers which will not warp or twist with changes in moisture.

These changes may be prevented either by applying a moisture-proof coating or by keeping the propellers under uniform atmospheric conditions throughout their life. At present, the aluminum leaf coating developed by the Forest Products Laboratory is the only practicable moisture-proof coating which has been successfully applied to propellers. It is not possible to keep propellers under absolutely uniform atmospheric conditions during manufacture and service, but these conditions can be approached by making up the propellers at the moisture content which they will normally reach in service. Propellers made up this way and coated with aluminum leaf have the best possible chance of giving high efficiency and long service.