

NEWS AND VIEWS OF THIS KILN DRYING BUSINESS

AUG 21 1952

The Problem: How can black walnut gunstock blanks be kiln dried without honeycombing?

The Answer:
by JOHN M. McMILLEN, Tech-
nologist

U. S. Forest Products Laboratory
Madison, Wisconsin

There are two keys to the prevention of honeycombing in gunstock blanks: (1) good end coating; and, (2) temperature control. Most honeycombing in walnut gunstock blanks starts as end checking. The end checks penetrate into the blanks and open up into honeycomb checks when kiln temperatures are raised too rapidly.

End Coating

A hot-dip, pitch-asphalt end coating developed by the Forest Products Laboratory and widely used by the gunstock industry will prevent end checks. The composition of this end coating, by weight, is:

- 60 parts of 213 degree F. coal-tar pitch
- 25 parts of 155 degree F. coal-tar pitch
- 15 parts of 210-220 degree F. asphalt

This coating can be applied by dipping, but the use of a roller device described in the U. S. Forest Products Laboratory Report No. R1435 is preferable. Plain asphalt of the 210-220 degree F. type also has been used successfully by some plants. The higher melting pitches used alone are too brittle. They chip during rough handling and leave some ends poorly protected. Lower melting pitches run off in the kiln.

Kiln Temperatures

Kiln operators who have had little or no experience with gunstocks or who do not have definite knowledge that their kilns maintain uniform temperatures throughout, with no "hot spots", should not exceed the dry-bulb temperature given in Table 1.

This is schedule T3-D4, from U. S. Forest Products Laboratory Report No. D1791, "Schedules for the Kiln Drying of Wood." By using this schedule, an operator can be reasonably sure that the dry-bulb temperature will not be excessive before the cores of the blanks are dried below the Rept. No. D1769-13

Table 1.—Beginners' schedule
for walnut gunstocks

Moisture Content		Temperature		Relative Humidity	
From :	To :	Dry-bulb	Wet-bulb		
% :	% :	°F. :	°F. :	%	
Initial :	50 :	110 :	103 :	78	
50 :	40 :	110 :	100 :	70	
40 :	35 :	110 :	95 :	57	
35 :	30 :	110 :	85 :	36	
30 :	25 :	120 :	80 :	17	
25 :	20 :	130 :	80 :	10	
20 :	15 :	140 :	90 :	14	
15 :	7 :	160 :	110 :	21	
Equalize		160 :	131 :	44	
Condition		160 :	150 :	77	
36 to 48 hours					

danger point of honeycombing. This schedule, when used in a modern kiln with forced-air circulation at 200 to 300 feet per minute, should dry black walnut gunstock blanks, 2½ inches thick, in approximately 65 days.

Kiln Check-up

Since excessive kiln temperatures may be disastrous, a kiln check-up should be made before each charge of gunstock blanks is dried. Fans, coils, traps, automatic coil and spray valves, and hand shut-off valves should be examined. Booster coils between the loads in multiple-track kilns should be shut off when drying gunstocks, unless it has been found by temperature checks that they do not produce excessive temperatures. The recorder-controller should be calibrated so that the temperatures set and recorded are the same as the actual temperatures at the instrument bulbs in the kiln. During a test run on some non-critical material before attempting to dry gunstocks, entering air temperatures should be observed in different parts of the kiln to see how close they are to the actual temperature at the instrument bulbs. When considerable differences are found, measures should be taken to correct the faulty conditions and eliminate the differences, if possible. If the differences cannot be eliminated, the dry-bulb temperature should be underset on the instrument enough to compensate for the exces-

sive temperature in the hottest zone. If undersetting of the dry-bulb temperature is necessary, cold zones of the kiln should be watched for formation of mold. If mold occurs, the wet-bulb depression can be increased 1° or 2°, or, if necessary to restore circulation, a brief high-temperature, steam-sterilization treatment can be used. Undersetting of the dry-bulb temperature should be continued with each new temperature step, unless additional temperature checks show this is no longer necessary.

Stacking and Sampling

To insure uniform drying, gunstock blanks should be stacked on stickers, with air movement parallel to the stickers. If it is necessary to place the sticker in another way, at least 1 inch of space should be left between blanks. Where the air circulation is not good, the blanks will dry more slowly and be subject to honeycombing when the temperature is raised on the basis of faster-drying samples.

The drying of gunstock blanks is a precision job. It requires the use of the best kiln-sample procedure. Beginners should use at least 12 samples, representing both the driest and the wettest material in the load. Sample pockets should be not closer than 2 feet from the ends of the loads. Samples should be placed in loads throughout the length of the kiln, making sure that some samples are located in both the hottest and coldest zones. The pockets should be numbered, so that each sample can be returned to its own pocket after weighing. Changes in kiln conditions should be based on the average moisture content of the three wettest samples.

When the moisture content of the three wettest samples is down to 15 percent, sections should be cut from six blanks for intermediate moisture content determination. Moisture content corrections can be applied to all of the other samples. The driest sample should be dried to 6 percent before starting equalization. The wettest sample should be dried to 8 percent before starting conditioning.

Equalization brings the moisture

December 1951

Gunstock Blanks

content of individual blanks within a

narrow range. This step may not be necessary if the moisture content of the blanks is nearly uniform at the start, and the operating conditions throughout the kiln are uniform. The conditioning treatment relieves case-hardening stresses. It is not necessary to steam the blanks during the drying, and prolonged steaming before the blanks are dry may promote honeycombing.

The final average moisture content, moisture content of the blanks of the shells and cores, and extent of case-hardening relief should be determined by cutting sections from all samples after conditioning is completed.

An accelerated kiln schedule and other detailed suggestions for speeding-up the drying of gunstock blanks are described in U. S. Forest Products Laboratory Report No. R1433. Considerable experience should be attained drying gunstocks, however,

before attempting to use this schedule. As an approach to a speed-up, schedule T5-D4 from U. S. Forest Products Laboratory Report No. D1791 is suggested. By following this schedule, drying time should be reduced to approximately 55 days. Use of the fully accelerated schedule should reduce drying time to 45 to 50 days.

If it is necessary to dry gunstock blanks in a natural-circulation kiln or a kiln with very slow air circulation, the wet-bulb depressions can be increased 2° to 4° during the first two steps of the kiln schedule.

If drying lags in any type of kiln and contract requirements necessitate speeding-up drying, such action should consist of lowering the relative humidity a little faster than called for in the T5-D4 schedule. No attempt should be made to gain time by raising temperatures above those shown in Report No. R1433.