WATER INJECTION INTO A STEAM SPRAY SYSTEM

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INTRODUCTION

1. The steam used to humidify the air in dry kilns for wood is frequently superheated because of a reduction of steam pressure anywhere between the boiler and the steam spray line in the dry kiln. It is therefore futile to adopt a very high humidity during the conditioning treatment, because it cannot be attained in practice. In the system under consideration the boiler pressure of 165 psig is reduced to 100 to 130 psig. At 100 psig the steam is 338 F and tends to raise the dry bulb temperature too much when a high wet bulb temperature is desired.

2. In a few lumber drying installations cold water has been introduced into steam spray lines to cool and moisten the steam. In one method the water goes through copper tubing fitted with a handoperated

valve situated before the junction of the tube and the steam line. The valve is opened prior to conditioning, but the water then runs continuously into the steam pipe, whether or not steam is demanded by the kiln control instrument. In another method the cold water is not introduced into the steam line, but goes through a spray nozzle directly into the air. Sometimes automatic water control has been used, but the natural salts in the water tend to solidify and plug the spray orifices. In both methods it is difficult to control the rate of flow.

PURPOSE

In order to assure steam of uniform temperature and moisture for drying pencil slats, another method is required. It should introduce the water into the steam spray line only when steam is required by the kiln control instrument. Furthermore, the rate of flow of the water as well as of the steam should be predetermined and not readily adjustable.

DESCRIPTION OF APPARATUS

A kiln with the new system has a microswitch actuated by the steam spray control valve. The microswitch opens and closes the one-half inch solenoid valve in the water line. The water line has a one-sixteenth inch diameter orifice and pressure of 50 lb/in^2. The one-inch steam spray line has a one-quarter inch orifice and a pressure of 100 lb/in^2. Each orifice is centred in a disk of one-eighth inch thick stainless steel pressed into a short section of extra heavy one-inch diameter pipe having a milled shoulder near one end. The water and the steam reach a mixing chamber made of two bell reducers and one 2 x 6 inch pipe nipple. A thermometer well and a zero to thirty lb. pressure guage are fitted into this chamber. The well is filled with oil dampened graphite into which a thermometer, 100 to 400 F, can be inserted. Thus the characteristics of the wet steam can be known.

RESULTS

1. The wet steam is 233 F at 7 psig, decreased from the dry steam at 338 F and 100 psig. The volume of steam, conversely, has increased to 18.4 $ft.^3$ from 3.9 $ft.^3$ per pound.
2. A relative humidity of 79% at 180 F is quickly reached.
3. The corresponding 11.3% Equilibrium Moisture Content of wood conditions the product quickly and saves 10% drying time.
4. The boiler make-up water is reduced by 20 percent and the boiler water chemicals by 30%.

CONCLUSIONS

1. The method quickly produces a high humidity and reduces conditioning time.
2. Steam consumption is reduced, thus lessening the need for softened make-up water, for boiler water chemicals, and for fuel.