Boxes and Cooperage

DRY KILNS FOR COOPERAGE STOCK.

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The dry kiln has been, and probably still is, one of the most troublesome factors arising from the development of the timber industry. In the earlier days, before power machinery for the working up of timber products came into general use, dry kilns were unheard of. Air drying, or seasoning, was then relied upon solely to furnish the craftsman with dry stock from which to work up his product. Even after machinery had made rapid and startling strides on its way to perfection, the dry kiln remained practically an unknown quantity, but gradually, as the industry developed and demand for dry stock increased, the necessity of some more rapid and positive method of seasoning became apparent and the subject of artificial drying began to receive the serious attention of the more progressive and energetic members of the craft.

The first efforts in the way of artificial drying were confined to the aiding or hastening nature in the seasoning process by exposing the lumber, or timber, to the direct heat from fires built in pits, over which the lumber was piled or hacked in a way to expose it to the heat rays of the fire below. This, of course, was a primitive, hazardous and very unsatisfactory method, to say the least, but it marked the first step in the evolution of the present dry kiln and in that particular only is it deserving of mention.

In addition to marking the first step in artificial drying, it illustrated also, in the simplest manner possible, the underlying principle governing all drying problems, viz., the application of heat to evaporate or volatilize the water contained in the material with sufficient air in circulation to carry away in suspension the vapor thus liberated. It matters not what type of kiln is used, source or application of heating medium, this underlying principle remains the same and must be the first thing considered in the design or selection of the equipment necessary for producing the two required elements—heat and circulation.

Although this principle constitutes the basis of all drying problems and must, therefore, be continually carried in mind in the consideration of them, it is equally necessary to have a comprehensive understanding of the characteristics of the material to be dried and its action during the drying process. All failures in the past, in the drying of timber products, can be directly attributed to either the kiln designer's ignorance of these things, or his failure to carry them fully in mind in the consideration of his problems.

Wood has characteristics very much different than those of other materials, and what little knowledge we have of it and its properties has been taken from the accumulated records of experience. The reason for this imperfect knowledge lies in the fact that wood is not a homogeneous material, like the metals, but a complicated structure, and so variable that one stick will behave widely different from another stick, although it may have been cut from the same tree. The great variety of woods often make the mere distinction of the kind or species of the tree most difficult. It is not uncommon to find men of long experience disagree as to the kind of tree a certain piece of timber was cut from, and, in some cases, there is even a wide difference in the appearance and evidently the structure of timber cut from the same tree.

It is not the intent of this paper to go into a discussion of the characteristics and properties of wood, except as they affect the drying problem, and it must also be perfectly obvious, considering the limited time allowed for this paper, that even this phase of the problem can be handled only in a general way.

The rapidity with which water can be evaporated, that is, the rate of drying, depends on the size and shape of the piece and on the structure of the wood. Thin stock can be dried much faster than thick, under the same conditions of temperature and humidity. Pine can be dried, as a general thing, in about one-third of the time that would be required for oak of the same thickness, although the former contains the more water of the two. While it is true that a higher temperature can be carried in the kiln for drying pine and similar woods, this does not altogether account for the difference in drying time, as experience has taught us that even when both woods are dried in the same kiln, under the same conditions, pine will still dry much faster, proving thereby that the structure of the wood itself affects the drying.

The aim of all kiln designers is to dry in the shortest possible time, without injury to the stock. Experience has demonstrated that high temperatures are very effective in evaporating water, regardless of the degree of humidity. A fresh piece of sap wood will lose weight in boiling water and can also be dried to quite an extent in steam. This proves conclusively that a high degree of humidity does not have the detrimental effect on drying that is commonly attributed to it. In fact, a proper degree of space humidity, especially in the loading and receiving end of a kiln, is just as necessary to good results in drying as getting the proper temperature. Experiments have also demonstrated that injury to stock in the way of checking, warping and hollow-horning always develops immediately after the stock is taken into the kiln, due to the degree of humidity being too low.

The receiving end of a kiln should always be kept moist, where the stock has not been steamed before being put into the kiln. The reason for this is simple enough. When the air is too dry it tends to dry the outside of the board first and in so doing shrinks and closes up the pores. As the stock is moved down the kiln, it absorbs a continually increasing amount of heat, which tends to drive off the moisture still present in the center of the board. The pores on the outside having been closed up, there is no exit for the vapor or steam that is being rapidly formed in the center of the board. It must find its way out some way and in doing so, sets up strains, which result either in checking, warping or hollow-horning. If the humidity had been kept higher, the outside of the board would not have dried so quickly, and the pores would have remained open for the exit of moisture from the interior of the board, and this trouble would have been avoided.

Where the humidity is kept at a high point in the receiving end of the kiln, we also find that higher temperatures can be safely carried and in that way the drying process hastened with comparative safety. While thin stock, such as cooper-