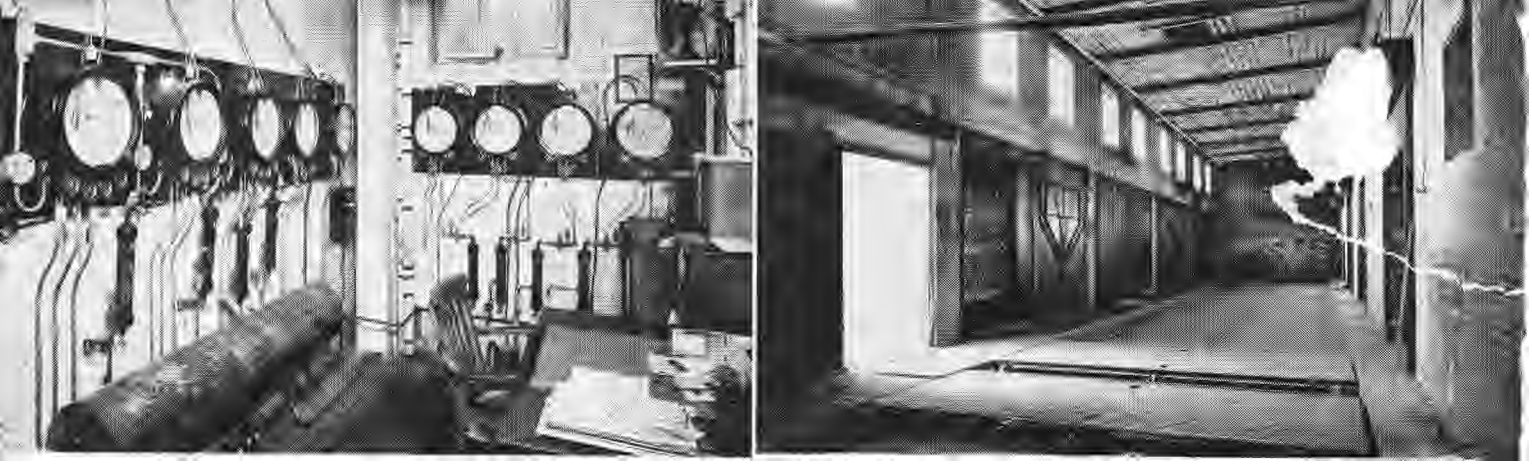

DRY KILN OPERATION

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Economical and efficient kiln operations require proper kiln lay-out. The kiln should lie in the straight-line flow of lumber from the green chain, or point of supply, to the shipping out point. Such operations also require labor-saving machinery like stacking and unsticking equipment, lumber lifts and switching or transfer cars. For economy, lumber should not be moved or handled by hand more than absolutely necessary.

Proper kiln lay-out and labor-saving machinery also contribute to the effectiveness of kiln schedules. No one factor influences kiln degrade in lumber as much as the schedules by which it is dried. In commercial practice, drying schedules are built up to meet certain use requirements. Such schedules will therefore vary from plant to plant. For example, No. 3 B common oak need not be dried so carefully as the higher-grade oak stock lumber or as beer-barrel staves Kiln schedules may be obtained from various agencies, but in the final analysis the kiln operator must modify his schedules in accordance with his local problems and the standard of drying that his company requires.

Use of Samples

The initial moisture content and drying characteristics of a charge of lumber vary from board to board, whether the lumber arrives green from the saw or in varying degrees of air seasoning. In'working up schedules, the kiln operator should use as many as possible in order to obtain a good understanding of an average cross section of the material with which he is working. As soon as he has developed his schedule to his satisfaction, the number of samples can be decreased in accordance with his experience with the lumber and with the demands other kiln responsibilities make upon his time.

A kiln operator renders maximum service when he is on the alert for the solution of manufacturing problems. He should feel that it is his responsibility to study problems that, when solved, will improve his drying technique. Such questions as the following illustrate typical problems.

Does it pay to condition a certain item of lumber`?

2. Is uniformity of moisture in the lumber as it moves through the plant up to standard ? What can be done to improve it ?
3. Is there a particular sticker spacing in a kiln truck that best controls the warp in a given item of lumber ?
4. What are the most expedient methods for handling the lumber from the kiln to the swing saw ?

An experimental approach to these and similar problems will readily occur to the operator. The general research technique that underlies them all is to have everything the same in two or more groups of boards except the variable that one wishes to investigate. To compare the grade or to compare respective yields of the test lots of lumber, the amount of lumber in each test lot should be as large as circumstances will allow, with probably 5,000 board feet as the smallest amount of material that will give reasonably reliable results.

An operator cannot do his best work unless the kiln can be relied upon to maintain uniform drying conditions. In a compartment kiln it is not enough to maintain the desired schedule in the region of the recorder bulbs ; the entering air conditions through the length of the kiln must be uniform. If this re-

Left: A battery of Foxboro humidity controllers in the kiln superintendent's office. Center: Good housekeeping is a prime requisite of optimum dry kiln operation. Right: One of the operator's main jobs is to see that there is a cushion of lumber stacked on kiln cars in front of the kilns to insure enough material to keep the kilns operating at full capacity.

quirement is not met, one or more things can happen. The lumber in one section of the kiln may check and honeycomb, while in another the lumber may mold. The drying time may be prolonged. The moisture uniformity may fall below par.

Lumber Saving by Proper Stacking

Warping in some species cannot be entirely controlled. The only means so far devised for minimizing it is to employ the very best piling methods. In piling 4/4 gum on a kiln car it may be desirable to have sticker spacing of no more than **1** foot. Commonly, in piling hardwood lumber a 24-inch sticker space is used, but this spacing is not close enough to control the warping of certain items of lumber

Box piling can be used to avoid overhanging ends resulting from piling random lengths on a kiln car; however, unless the proper technique is thoroughly understood and carried out box piling will encourage warp. An alternate method used by some lumbermen involves separation of each length **of lumber on a** kiln car by a solid floor of stiff 2-inch planks. The resultant voids between cars are then curtained off to reduce the tendency of the air to short circuit.

Steam

If air-dried lumber is steamed in a saturated atmosphere at any time during the run, old air seasoning checks reopen when the lumber is subsequently dried. Initial, periodic, or final steaming treatment at relative humidities in excess of 90 percent is harmful to lumber that has previously been surface checked.

Hour by hour a heated kilnshould heat by radiation. To minimize the steam required, it is necessary to use the most severe drying schedule the lumber will stand without degrade. Consideration also should be given to the possible need for additional heat insulation on the roof of the kiln. Infiltration of cold air around the doors and through cracks and crevices in the kiln structure shOuld be reduced to a minimum. These precautions not only have a direct beneficial effect upon steam consumption, but also assist in bringing about more uniform temperatures in the kiln.

Use of Moisture from Wood for Humidification--The difference betweelower dry and wet bulb tempera tures is a rough measure of the amount of heat available for evaporating moisture from lumber. For example, assume that a wet-bulb temperature of 160°F. can be maintained by the moisture leaving the wood and by the venting of the kiln while a dry-bulb temperature of 180°F. is also maintained within the **kiln.** Then if a smaller loWer wet-bulb depression is not needed to prevent surface checks, or, in other words, if a 20°F. wet-bulb depression is not excessive, the moisture from the wood is sufficient to maintain the desired relative humidity. If, however, the dry-bulb temperature is raised to 200°F., the steam spray would have to be put in operation to raise the wet-bulb temperature to 180°F. With the same wet-bulb depression, in this range of temperatures, no appreciable increase in drying will be effected ; hence, the steam required to raise the wet-bulb temperature from 160° to 180°F. would be wasted.

Many wet-bulb control systems open and close the vents automatically. When the dampers on the vents remain closed all the time, and the wet-bulb temperatures coast above their desired temperature, it would be wasteful of steam to vent the kiln so much that additional vapor is required from the steam spray maintain the desired wet-bulb temperature.

Excessive Venting—One of the fundamental rules is to vent the kiln no more than is necessary to prevent the relaticoils. dity from becoming greater than that desired. Air that is vented has to be replaced by cold air that in turn must be heated to the desired dry-bulb temperature and at the same time be huniidified so that it has the proper wet-bulb temperature. 'Evidently, therefore, excessive venting wastes steam spray and also puts an additional burden on the steam coils'.

Preliminary Steaming—Steaming at 100 percent relative humidity usually serves no useful purpose and is often detrimental. The process requires much steam, and while the kiln atmosphere is saturated the lumber cannot dry ; hence, the period the lumber must remain in the kiln is prolonged.

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Steam for Humidification—When it is necessary to control the humidity with the steam sprays, the dampers on the vents should reforin closed most of the time. For best results, the steam pressure should be adjusted so that the kiln is calling for steam about 80 percent of the time. If, when the thermostat calls for steam spray, a large amount of steam is immediately released into the kiln, the wet-bulb temperature will rise above the set point. ' The result of such operation is cyclic wet-bulb temperature action and a higher average wet-bulb temperature than called for by the schedule. Naturally, the drying time will be prolonged, and the quantity of steam required to dry the charge will be increased.

Unnecessary Radiation—The uniformity of temperature in a dry kiln is a "must" if the kiln is to operate efficiently. In operating long kilns, particularly at low temperatures, experience has shown that at a given steam pressure the use of the smallest amount of radiation that will maintain the desired temperature is more conducive to temperature uniformity than a larger amount of radiation.

Routine inspection reduces mishaps that interfere with the easy flow of lumber through the kiln. It is not easy to take care of a kiln wreck or to grese a hot bearing during the kiln run. Time, effort, and worry is saved when everything about the kiln is in working order, the tracks in line, the trucks greased, the water boxes clean and well supplied with suitable water, all wet-bulb wicks clean and fresh, etc.

While the final criterion of a kiln operator's work is his ability to dry lumber in the fastest time consistent with degrade, there is no better measure of his efficiency than how he keeps house. Housekeeping includes not only neatness of equipment and records, but systematic planning and execution of the job. As the lumber is loaded, sample slots should be built into the load ; suitable sample boards be laid out by the stacker ; and saws, scales, ovens, etc., be conveniently located so as to avoid confusion and reduce work involved in preparing and placing samples.

One of the kiln operator's functions is to time the loadings and unloadings so that the kilns will be drying lumber all the time. In this sense he is literally a traffic manager. Even at best, a certain amount of kiln capacity will be lost because of unforeseen delays and mishaps. Yet it is surprising how much can be done to increase kiln turnover by careful planning. At one plant where careful records were kept for a 6-month period, it was found that only 87 percent of the lumber that could have been dried passed through the kilns This means that 13 percent of the kiln capacity was lost. At another plant, by improving the drying schedules and doing a better job

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of keeping the kilns full, it was possible to free 20 percent of the kiln capacity for the drying of items that previously had gone to the yard. Fortunately, in this case the quality of drying was improved while the kiln turn-over was increased.

Kiln capacity will be saved by drying lumber as much as possible before it goes into the kilns. A cushion of lumber stacked on kiln cars in front of kilns will provide a prekiln drying period and also insure enough material with which to load a kiln as soon as it is pulled.

Collecting and Saving Records

Complete records of each kiln charge will go a long way toward protecting the dry-kiln department and the management from complaints. The records should show the performance of the kiln and the moisture and stress conditions of the lumber involved. A complete library of kiln-run records, schedules, drying rate, kiln performance, steam pressures, and other pertinent information, can be consulted and reanalyzed at any time. Information of this kind is necessary to improve drying schedules and to understand better the drying characteristics of various items of wood obtained from different localities at various degrees of seasoning. Analysis of the records may bring out a peculiarity of a specific kiln and may indicate whether or not it is working properly.