AUTOMATIC MOISTURE DETECTION ON A LUMBER DRY SORTING CHAIN

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INTRODUCTION

Laucks Laboratories have been active in western industry for almost fifty years, and have specialized in the field of wood technology--particularly adhesives--for the past thirty years. In view of this background, it was not unusual that, with the advent of the "electronic age," Laucks Laboratories should investigate the application of electronics to some of the technical problems that had been long encountered in the plywood and lumber industries of the West. Among the various possibilities, the idea of checking and controlling moisture, electronically, seemed particularly intriguing.

An investigation of existing developments in this field led us to the Plywood Research Foundation (the technical arm of the Douglas Fir Plywood Association), which had been working with an electronic device for continuously checking the moisture content in veneer. Because of our close contacts with the Douglas Fir Plywood Association in the past, we were thus placed in a favorable position and ultimately awarded a contract for the further development and promotion of their original equipment. Renamed the Laucks SENTRY, some 100 units have since been installed in plywood plants throughout the United States and Canada. SENTRY equipment for the lumber industry is, therefore, an outgrowth of this early work in veneer, and while the actual application is considerably more complex, the basic principles remain unchanged.

OPERATING PRINCIPLES OF THE SENTRY

For those of you who are not familiar with our equipment, I shall briefly review the principles by which it operates. As you know, most cellulose and protein materials such as wood, paper, cotton, wool, etc., contain certain electrical properties which vary greatly with the moisture content of the material; therefore, to measure moisture content, we simply utilize these properties and their variations. This is true of handmeters as well, many of which do an excellent job in the work for which they are designed. However, since the SENTRY is a continuous machine, we must incorporate a few additional circuits in order to obtain the high degree of sensitivity, stability, and automation necessary to a continuous operation.

Basically, our lumber model depends upon the capacitance property of wood, for only with this property can we eliminate the necessity for direct pressure contact of the electrode--a feature which would obviously rule out a continuous operation and also produce marks and holes in the board. However, to this basic principle we have added further refinements and modifications in order to cover large areas, (thus off-setting any error than might be caused by density variations within a given section) and to give us the high degree of penetration necessary to measure a wet spot on the underside of an eight-quarter board--our maximum claim! Perhaps this last feature can best be explained through the use of a drawing (slide of electrode field).

The basic components of a SENTRY system for lumber consists of (1) the electronic control unit or console, (2) the marker controller, (3) the sensing element or electrode, and (4) the automatic markers, the latter being arranged to designate any boards which fall below one given moisture level or exceed another--thus giving a "three-way sort".

Of these four components, and certainly insofar as you lumber producers are concerned, the electrode arrangement is perhaps the most vital....and, for us, the most complex. There is no particular problem in arranging an electrode for finished lumber, particularly where it moves in a continuous, "endo" chain, but such an arrangement would have little value in an operation where the principle objective is to stop the board before the expense of sawing and surfacing is incurred. Furthermore, we would have quite a problem in converting you to an "endo" operation. Visualize, if you will, a kiln car load of four-quarter by six being unstacked at a rate of forty feet per minute. To move this at right angles to the direction of unstacking, a belt would have to travel fast enough to off-bear each board before the following board could land on top of it. Thus, mathematically, our belt would have to move 80 (the number of boards) times 20 (the length of each board), or 1600 feet per minute. At this rate, you'd have no shipping problem. Just point the belt in the direction of your customer and let the lumber fly.

Seriously, however, a lumber producer finds it far more convenient to scan the board as it passes sideways, and consequently our first efforts were directed toward an electrode arrangement which would cover an entire sideways board. It is no longer a company secret that the idea was impractical. The cost was even worse. So, our next step was to determine just how much of the board had to be covered, and after considerable research it was found that a 12- to 14-inch segment could give us a fair picture of the entire board--at least enough to assure a 95% accuracy and come within all grading requirements. So that is essentially what we are doing today--providing a check, or statistical account, for the kiln superintendant, comparable to the results that could otherwise be achieved only by three men working 'round the clock with hand meters.

ADVANTAGES TO THE KILN OPERATOR

We believe that this last point cannot be too strongly emphasized, particularly when we consider its various phases:

a. Wet lumber can be marked and excluded before it is furfaced, rather than after, and can be salvaged through re-drying or diversion to another use.

b. Over-drying, often practiced as a safe-guard against the above, becomes a thing of the past.

c. A constant and complete record of seasoning can be kept by the kiln superintendant.

d. Failures in drying equipment can be spotted instantly. Our system permits crib-to-crib, or even tier-to-tier, checking. Any areas showing a pattern of moisture variation (from average) should be investigated for faulty design or maintenance.

e. The two-level marking system affords a segregation of lumber into three categories, to be finished or processed accordingly. Boards are marked with a green dye if they fall below, say, 7%, or with a red dye if the exceed, say, 12%, and pin-pointing of dryer schedules is promptly assured. Perhaps this latter point can best be illustrated by the following slide (Curve #2).

I should mention that our experience with lumber has been limited, at least in comparison with the knowledge that we have gained in the veneer field, and part of this is due to the fact that we have been unable to obtain complete records. However, we can draw a fairly good conclusion from the following curve (Curve #3) taken from a Douglas fir veneer operation and showing the relation of moisture content versus length of time in dryer. The point to bear in mind is that, by this curve, it is apparent that 60% more time is required to bring veneer from 8% moisture content down to 1%.

While we cannot draw a direct comparison with your operation (because of such factors as case hardening, collapse and equilization processes) we feel that the potential is quite obvious. We do know that, in at least one instance, kiln schedules were speeded by 50%.

POTENTIAL SAVINGS TO MANAGEMENT

The foregoing section has been aimed primarily at the kiln operator. We shall now point out a few factors directly tied to management. Let us assume that a mill dries 100,000 feet of lumber per day, and that of this amount 20,000 feet are shop and select material. If, say, 20% or 4,000 feet of this latter material is cupped by over-drying, and subsequently roller-split in the planing operation, it is quite probable that the total loss resulting from splitting, down-grading and volume could amount to $50,00 per thousand or $200.00 per day. Now then, since it is almost certain that a mill experiencing this degree of fall-down could shorten its drying schedules, let us continue our assumption, install adequate moisture control, and take one day off kiln time. If we use a drying cost of $1.00 per 1000, our 100,000-foot mill could then enjoy a further saving of $100 per day. We thus show an initial saving of $200. per day, followed by a secondary saving of $100, or a total of $300. per day--roughly $75,000. per year. We always like to insert examples like this. Our salesmen tell us it cushions the shock!

We believe these are important considerations, regardless of the size of your operation. Shop and selects are not the only fields for savings. Even in common grades, the price differential is around $25.00 between grades. If over-drying pushes your entire production downward, you're losing big money. Even if you're not over-drying, much can be accomplished by directing your production into its most useful category. For example, average dry material of, say 12% moisture or less might be routed to pattern, where we understand there is little chance of fall-down due to split. Material between 12 and 16% might be finished four sides. The balance, which would be negligible, could then be re-dried. The point is, every mill has potential savings which have not been fully exploited. If, by the proper use of modern control machinery you can gradually incorporate these savings into your production, reduce your costs and gain customer approval--you're well on the road to a highly profitable operation.