

LAUCKS
Sentry PRODUCTS

4441 Stuart Building
Seattle 1, Washington
MAin 4153

CONTINUOUS AUTOMATIC DETECTION OF
MOISTURE CONTENT AND SORTING OF LUMBER

Several months ago, we accepted an invitation from your secretary, Mr. Harvey Smith, to present a paper on continuous moisture detection and sorting of lumber. This was done, however, with some misgiving, for at that time we had not accumulated enough data on our development to give a comprehensive report. The same condition exists - perhaps to a lesser degree - today, and for this reason we hope you will consider this paper in the nature of a "progress report" rather than final text on moisture detection!

History of Development

The idea of an automatic moisture detector originated at the Plywood Research Foundation, the technical "brain" of the Douglas Fir Plywood Association. This Tacoma organization recognized the great need for some method of controlling moisture in veneer, and accordingly assigned one of their top research men, Mr. James Dallas, to the task. Some two years later, Mr. Dallas brought forth an electronic device with exceptional promise, and it was at this point that our company stepped into the picture. Having no facilities for manufacturing or selling the instrument, the Research Foundation granted a license to Laucks Laboratories of Seattle, with the idea that our laboratory would continue the development of the instrument and explore its new and different applications. Since named the "Laucks SENTRY Continuous Moisture Detector", the instrument has been successfully installed in a number of plywood and furniture plants.

Need for SENTRY

The need for an automatic measure of moisture in various materials is apparent to all who are very familiar with industrial processes. Moisture is a big problem in a number of industries - food products, for example, are critically effected by moisture. The milling of wheat flour requires that the moisture content of the berry be within exacting limits; otherwise difficulty is encountered in separating the bran. Other examples might be the



CONTINUOUS MOISTURE DETECTOR

Manufactured by Instrument Division



Laucks Laboratories, Inc.

Continuous Automatic Detection of
Moisture Content and Sorting of Lumber
By John E. Hefferline
Laucks SENTRY Products
Seattle, Wn.
Page 2.

pressing of oil from soybean, cottonseed, copra, etc. All of these processes are greatly effected by moisture.

In the chemical industry, we find moisture problems in the manufacture of synthetic rubber, certain resins, and photographic films - - to cite only a few.

The pulp and paper industry faces a moisture problem. A number of its processes require a rigid control in order that the finished product meet acceptable standards.

These are only a few examples, all of which we hope to explore as time permits. In the meantime, however, we are directing our efforts toward wood and wood products - - and this, of course, is in your field. For that matter, you gentlemen are probably more familiar with moisture problems in wood than we, so again I must remind you that this is only a "progress report".

How the SENTRY Works

There are a number of moisture detectors on the market, and probably several hundred of them are being used every day. Like every other device, some are good and some are not so good, and while the good ones will do a satisfactory job of "spot checking", even they have shortcomings. For the most part, none are automatic.

To solve the problem of automatic detection, the Plywood Research Foundation had to incorporate a number of unusual features into the SENTRY. Several of these features, especially the ones concerning electronic circuits, are in the patent office now, and consequently we are not at liberty to describe them. However, we can say that the operation of the SENTRY depends upon the conductance and capacitance of the materials under test. Since moisture has a marked effect upon these properties, its presence can be detected and measured.

The most distinctive feature of the SENTRY is the electrode system, and its ability to scan large areas of material. This scanning can be done with a minimum loss in sensitivity. While the electrode system is not completely fool-proof, we can say that in a practical sense all disturbing influences have been eliminated.

The response of the SENTRY is almost a straight line function between 4% and 20% moisture. Its response is proportional to the quantity or mass of water in the field of the electrodes. Thus a change in the volume of wood will give a different response at a given moisture content. For this reason, we have had to take into account the variation in length, width, and thickness of wood entering the field of the electrode.

From a practical standpoint, these variations can be handled by preliminary sorting or by a special electrode which "averages" the wood flowing into the field. Another method is to predetermine an allowable variation. Generally speaking, the SENTRY is set at a predetermined value, above which it will automatically mark or set off a signalling device. This setting is based on the average dimension of the wood passing into the electrode's field. If the material is flowing end to end, we need only consider the width and thickness. If it is flowing sideways, the thickness and length are the key dimensions. If the product of either set of dimensions varies by, say 10% over the setting on the SENTRY, then you can expect a 10% variation in the accuracy of the SENTRY. Thus, when installing an instrument on the production line, it is necessary for us to determine what degree of accuracy is required to meet the standards of the job. In some instances, a variation of 2% from actual value is permissible; in others, a much closer tolerance is required. In any event, we are generally able to meet the requirements. We have tested most of the western wood species, and find that although differences do occur, they are quite often negligible. The same may be said about density, which within a given specie has given us no difficulty.

Methods of Installation

In the plywood industry, our installations have been made on the dry belts, close to the exit end of the dryers, where the grading and sorting is already being done. The electrodes of the SENTRY are installed flush with the table carrying the belts, and at right angles to the belts, so that the veneer passes over the electrodes. The electrodes vary from eight to twelve feet in length, depending on the job, and are approximately three inches in width. The long length of the electrodes affords a complete scanning of the veneer as it is carried along on the belts. A hold-down arrangement is also provided so that the veneer is kept in close contact with the electrodes.

The SENTRY unit, often referred to as the "brain" of the equipment, is adjustable to any desired maximum moisture level. If the moisture content of the wood exceeds the maximum level, the resulting signal activates a small auxiliary marking device.

This sequence of operations may be outlined as follows: Veneer leaves the dryer and is discharged upon the dry belt. It then passes into the field of the electrode. This field is a narrow band about one inch in width, running the entire length of the electrode. As the veneer passes into this field it is scanned over its full length, in one inch increments, until the whole sheet has passed the electrode. The electrode picks up the signal caused by moisture and transmits to the electronic circuit of the SENTRY. Here, if the signal exceeds the reject level previously set up in the instrument, a series of relays close, which in turn close the circuit to the marking device. The marked pieces of veneer may

then be removed by the off-bearers stationed along the belt.

This same system may be used to sort lumber which may exceed a desired moisture content. In the case of lumber, it is generally more practical to scan the material as it passes end to end over the electrode system; however, there may be cases where this type of arrangement presents problems in plant design. Accordingly, we are designing an electrode which we hope will be effective on lumber passing sideways over the electrodes. Although this will necessitate an electrode not less than twenty feet in length, we are optimistic that such a device can be built.

Present Scope

To date, we have made twelve installations in plywood plants, three in furniture, and one in a large lumber manufacturing plant. In each case, the interest has been more than gratifying, and the results far above our expectations.

Our original objective in the plywood industry was to minimize the failures at the hot presses, the failures being caused by excess moisture in the veneer. Unfortunately, there was little information obtainable on maximum permissible moisture, and a great deal of our data had to be compiled on the spot. We now know that permissible moisture varies with (1) veneer thickness, (2) plywood construction, (3) pressing conditions, and (4) glue formulation.

The SENTRY provides a tool by which the manufacturer can determine his best standards and then maintain them. In most cases, the manufacturer finds that he can use a higher average moisture content than before, and that over-drying is no longer necessary to eliminate "blow" at the press. Thus the entire production is accelerated, sometimes as high as 20%.

In the furniture manufacturing plants the problems we have encountered have been the detection of excessive moisture in order to control dimensional stability, and to obtain a more satisfactory material for subsequent glueing. In these installations the SENTRY has completely eliminated rejects due to excessive moisture. These rejects in one instance amounted to 15% of production.

Our experience in the lumber field is not as extensive as that of plywood and furniture. However, in the one installation that is now in operation, the SENTRY is placed on a Yates planner, where 100,000 to 200,000 board feet of lumber per day is subjected to a 100% inspection with respect to moisture. The stock varies in thickness from 3/4" to 8/4" and in width from 2" to 12".

It is our belief that the SENTRY can be adapted as a tool to inspect kiln dryer production. This would be a 100% inspection and stock could be supplied to customers or to remanufacturing operations with assurance that every piece is within the specified

Continuous Automatic Detection of
Moisture Content and Sorting of Lumber
By John E. Hefferline
Laucks SENTRY Products
Seattle 1, Washington
Page 5.

moisture content.

It has been suggested that it may be advantageous to bracket the green stock by means of the SENTRY before loading into the kiln. There may be merit to the idea. We plan to make some tests along these lines in the near future.

Conclusion

In conclusion it should be stated that this development has progressed rapidly. Accordingly we have not been able to gather sufficient data to answer many questions. However, we believe our experience in plywood and furniture has served to show that the continuous, automatic detection of moisture in wood is practical and useful.

John E. Hefferline
Laucks SENTRY Products
4441 Stuart Building
Seattle 1, Washington