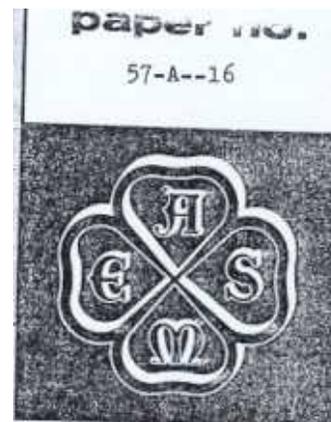


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THE AUTOMATIC LUMBER PLANING MILL

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The Automatic Lumber Planing Mill

By Peter Koch

It is probable that a truly automatic planing operation could be devised if some of the variables commonly present in mill-run lumber were eliminated and the remaining variables kept under close control. This paper will deal with the more general situation faced by most lumber manufacturing plants. In other words, it will be assumed that the incoming lumber has the ordinary degree of variability.

In order to make the discussion applicable to the operations of the majority of planing mills, it is assumed that the plant under consideration is a concentration yard. That is to say, rough green lumber is collected from a variety of sources and is subsequently dried, planed, and shipped. For the purposes of discussion, assume that a portion of the lumber is trucked into the concentration yard from a company owned sawmill and that the balance is brought in by truck from neighboring mills that do not have drying and planing facilities of their own.

BASIC CONSIDERATIONS

In a discussion of this sort, one must designate the species involved as requirements are considerably different with different woods (1)(2).¹ This paper has to do with the remanufacture of white pine and contemplates a facility having a drying and planing capacity in the range of 60,000 to 100,000 board feet of lumber per 8-hr shift. It is not the purpose of this paper to discuss the details of the machining processes involved as this subject is dealt with in some detail in the literature (3-6). However, as the capacity of most remanufacturing plants is dictated by the capacity of the planer and matcher, the plant could be described as being built around a planer and matcher having 8, 10, 12, or possibly 14 knives in each head.

Functions Involved in Remanufacture

It is assumed that the lumber is received at the concentration yard in solid piles, having been sorted previously only for thickness. In such an operation, 1-in-thick boards make up perhaps 90 per cent of the total volume handled.

This paper develops a flow plan for a pine lumber remanufacturing plant. Machines and layout are so arranged that 11 men can receive, kiln dry, plane, double-end trim, end-print, grade stamp, tally, sort, and put into dry storage 60-100 thousand board feet of lumber per shift.

Having in mind the general nature of the operation, one can then list the functions that must be performed in order to remanufacture the lumber:

- 1 Tally the incoming lumber for quantity and grade.
- 2 Stack the lumber on kiln sticks prior to drying.
- 3 Kiln dry virtually all the lumber (with provision for omitting the kiln-drying a step on a small portion of the total lumber.)
- 4 Break down the kiln loads and recover the sticks.
- 5 Plane the lumber (surfaced four sides or with more complex patterns.)
- 6 Trim the boards to exact commercial lengths.
- 7 Mark both ends of each board with an appropriate trade mark and apply an end coating.
- 8 Mark the face of each board with the appropriate grade mark.
- 9 Segregate the planed boards according to dimension and grade.
- 10 Tally the planed boards by dimension and grade.
- 11 Store the planed, dry lumber.
- 12 Make up orders and ship the lumber in quantities as ordered.
- 13 Tally the shipments as a basis for billings.

The functions outlined are not necessarily listed in the order of accomplishment in the manufacturing process. It is evident however that a certain order is mandatory for some functions; i.e., kiln stacking must precede kiln drying, kiln drying must precede planing, and planing must precede shipping.

¹ Numbers in parentheses refer to the Bibliography at the end of the paper.

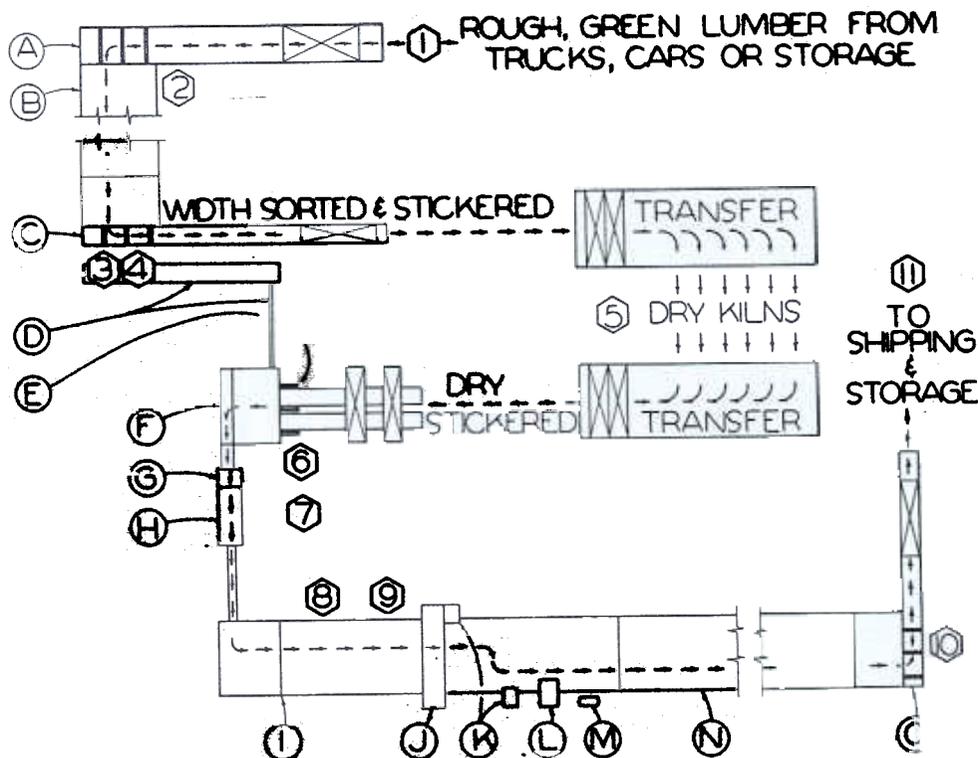


Fig. 1 Planing-mill flow chart

Machines

- A. Tilting elevator to break down incoming loads of rough, green, random width lumber. (See Figure 2).
- B. Multideck sorter to segregate various standard widths of lumber (See Figure 3).
- C. Package stacker to make four foot wide by four foot high stickered piles to be fork lifted into a full size kiln charge. The machine is also designed to solid pile in the event lumber is destined to be planed green. (See Figure 4).
- D. Stick return belt.
- E. Travelling apron deck conveyor feeding tilting unloader (See Figure 5).
- F. Feed table (See Figure 6).
- G. Pre-surfacer to minimize cup split (See Figure 6).
- H. Planer and matcher with double profiles (See Figure 6).
- I. Device to automatically load each board in front of a lug (See Figure 5).
- J. Selectively automatic random length trimmer (See Figures 7 and 8).
- K. End printers & waxers (See Figure 9).
- L. Grade marker (See Figures 7 & 10).
- M. Tally mechanism (See Figure 7).
- N. Multi-deck sorter to accommodate segregation by grade (See Figure 3).
- O. Stacker to build up solid piled packages of a single grade segregation (See Figure 11).

Manpower

1. Fork lift driver (unloads incoming trucks, moves rough lumber in green storage, brings rough lumber to the roll case serving the green sorter line, removes stickered loads from the package stacker, builds kiln loads from stickered packages and breaks down kiln loads into component dry packages).
2. Operator of tilting unloader (feeds green sorter).
3. Operator of package stacker (builds 48" x 48" stickered packages).
4. Same.
5. Dry kiln operator.
6. Feeder for planer and matcher.
7. Grinderman, saw filer, and set up man for planer production line.
8. Grader (manipulates controller that instructs trimmerman and feeds in-put signals controlling grade marker, tally machine, and sorter diversion).
9. Trimmer operator (manipulates controller that actuates selectively automatic random length trimmer, and feeds dimensional signals to tally and sorting devices).
10. Stacker operator (builds solid packages of planed lumber that has been segregated by grade in the dry sorter).
11. Straddle truck operator (services planer infeed and outfeed i.e., brings packages from kiln to planer infeed, moves blanked lumber to dry storage area, returns blanked lumber to planer for rerun and takes finished lumber to shipping dock.)

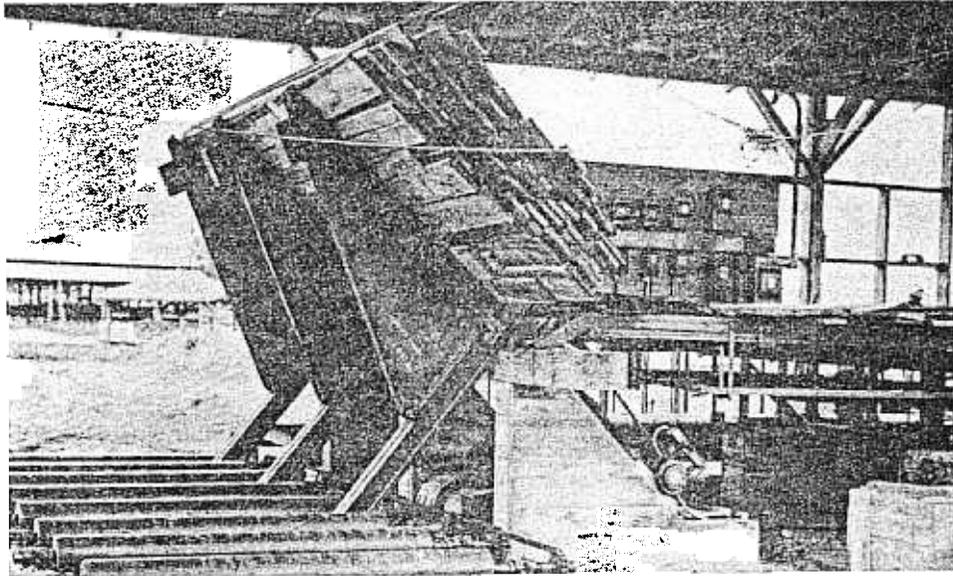


Fig.2 Large tilting unloader capable of handling an entire truck load of green lumber. Package may be rolled into place directly from bed of incoming truck or it may be placed by fork lift on infeeding roll case. Unloader feeds a short section of lugged chain leading to a multideck sorter, where lumber is sorted for width. Photo: Moore Dry Kiln Company

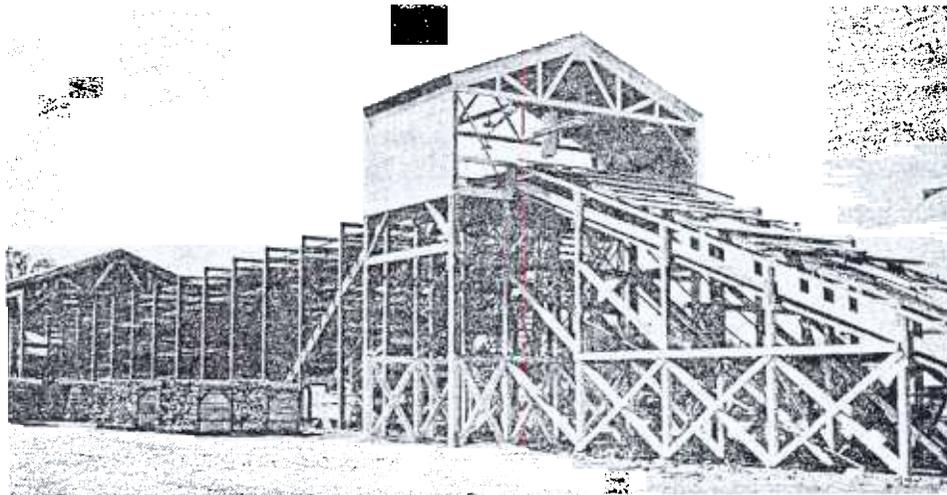


Fig.3 Lumber is sorted for width in this multideck sorter. As individual boards (each riding on a set of conveyor mounted lugs) descend past the decks, they are automatically shunted according to width into proper storage tray. As each tray in turn begins to fill with lumber, an adjustable apron or chain is used to bring lumber to stacker. In this view, stacker is in background at far end of sorter. Photo: Moore Dry Kiln Company

MECHANIZED PLANING MILL

After considerable process analysis, trial and error in the design of real and synthesized plants, and much observation of mills in operation,

it has been concluded that the following scheme has some merit, Fig. 1. The rough, green lumber is offloaded from incoming trucks (or transferred from green storage) onto a roll-case feeding a large tilting unloader, Fig. 2. A

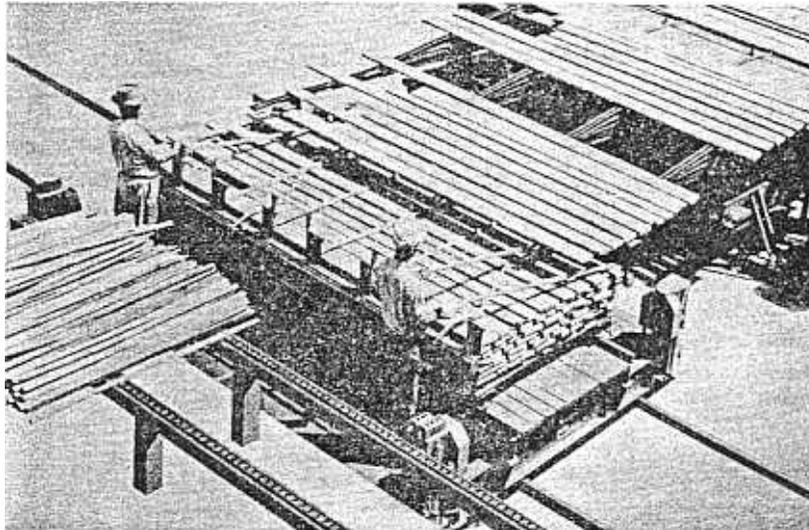


Fig.4 Automatic stacker that can build packages of lumber with or without kiln sticks. This stacker receives width-sorted, rough, green lumber from multideck sorter. From here packages are removed by fork lift and built into full kiln charge. Photo: Moore Dry Kiln Company

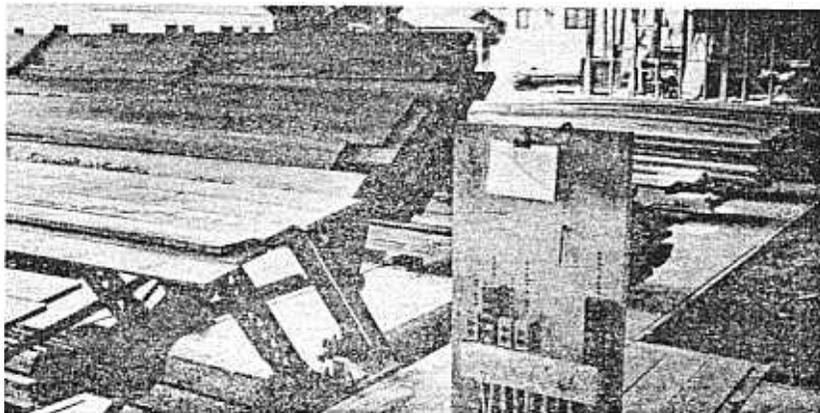


Fig.5 Traveling-apron deck conveyor and tilting unloader feeding planer and matcher. Note that kiln sticks drop into a conveyor which automatically returns them to package stacker. Photo: Stetson-Ross Machine Company, Inc.

single operator breaks the load down onto a short lugged conveyor chain which in turn feeds a multideck sorter. The conveyor is so arranged that each board is loaded behind a set of lugs, and as the boards descend past the horizontal apertures at the beginning of each storage level, they are measured automatically for width and shunted off onto the proper level, Fig. 3. Thus the load of random-width lumber is segregated into multilevel storage according to board width. As the first board enters a particular level it travels by gravity to stops at the extreme end of the sorter and subsequent boards

move down the length of the tray until they come to rest against preceding boards.

As soon as one level or tray becomes loaded with lumber, the stop can be lowered and the boards delivered onto a hinged, powered conveyor that in turn delivers the accumulation of lumber to a semi-automatic stacker, Fig. 4. This stacker is so designed that it can package stack lumber either with kiln sticks or solid piled without kiln sticks at the operator's option. For the situation under discussion, the finished packages might measure 4 ft wide by 4 ft high and perhaps 16 ft long. Each

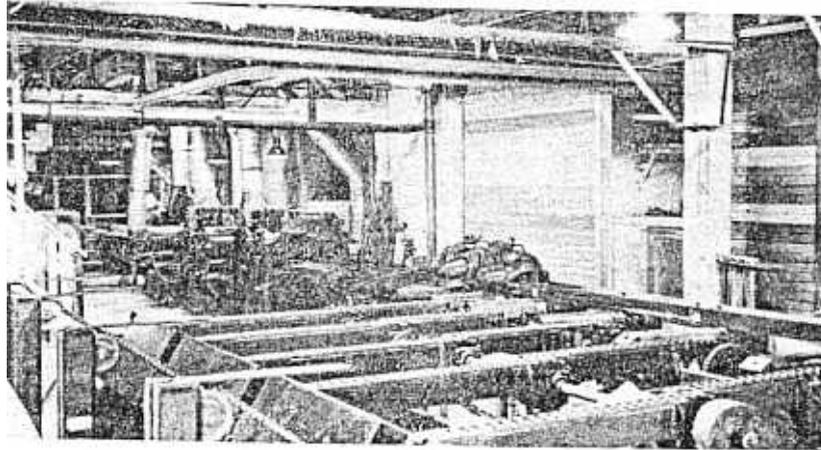


Fig.6 Transfer chains to automatic feeding table of planer and matcher are visible in foreground. Planer and matcher is equipped with double profiles and is preceded by a pre-surfacer. Purpose of presurfacer is to feed lumber gently through a preliminary surfacing operation, thereby removing some stock from horns and bulge of lumber that has been cupped in drying process. It has been found that this pre-surfacing greatly reduces losses due to cup-split lumber.
Photo: Stetson-Ross Machine Company, Inc.

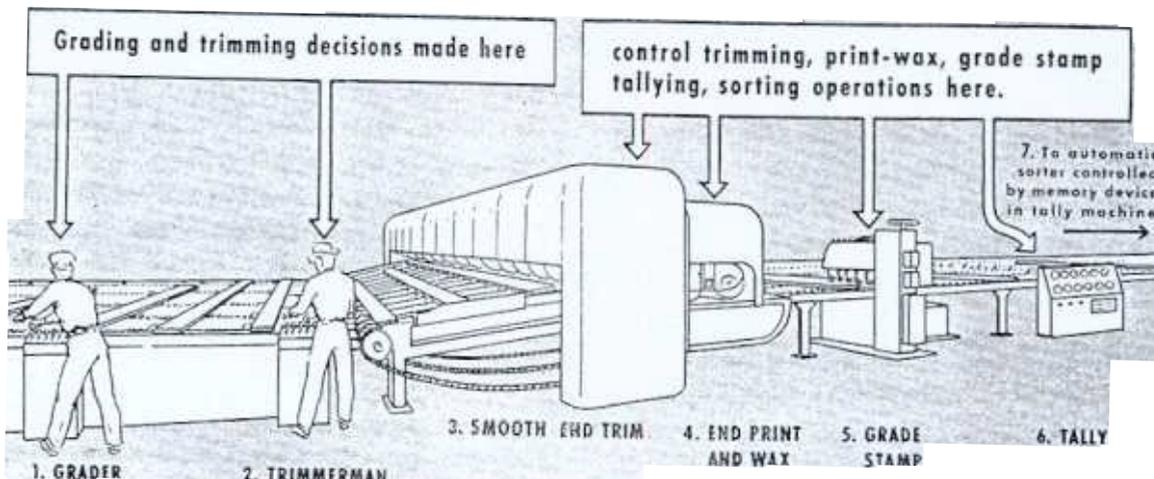


Fig.7 This layout of equipment behind planer and matcher performs in the following manner:

- (a) Actuation of grade button by grader is retained by memory device until board reaches grade marker.
- (b) Selective trimmer station synchronizes with time-delay unit so that trimmerman can make his selection while board is immediately in front of him.
- (c) Selective saw units of trimmer are controlled by memory device.
- (d) Double-end printing and waxing are accomplished by means of two staggered units with a roll case between to move stock endwise.
- (e) Grademarker is actuated according to input signal by grader.
- (f) Tally machine picks up length, width, and thickness input at this point, and combines these with grade input from grader's memory device to tally the boards as they pass.
- (g) From the tally machine, boards leave the lugged conveyor to enter multideck sorter from whence they are delivered to stacker.

Photo: Stetson-Ross Machine Company, Inc.

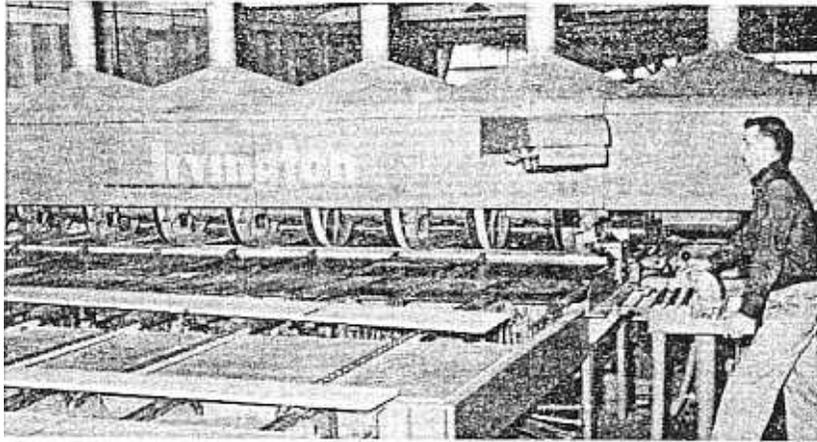


Fig.8 View of installation at Potlatch Forests, Inc., in Lewiston, Idaho. In this particular installation, trimmerman, rather than grader plays dominant roll. In foreground, boards are being loaded automatically onto lugged chain feeding random length trimmer. This installation has a two-level conveyor behind the trimmer and operator's console permits him to predetermine whether any particular board will go to either level after trimming, whether it will be end-printed and end-waxed or simply end-waxed. As some boards may require ripping as well as cross-cutting to obtain maximum grade, it is possible for operator to press a suitable button, and board will pass through trimmer untrimmed, unmarked, and unwaxed for delivery to appropriate level for later remanufacturing. Thus this transfer machine developed by the manufacturer is a very flexible system. Photo: Irvington Machine Works, Inc.

package would, of course, contain random length lumber of a single width and thickness.

The package then moves clear of the stacker via a powered roll case and is removed by a fork lift. Kiln loads may then be constructed by building the stickered packages into a suitable stack for kiln charging. Following discharge from the kiln, the charge is broken down into its component packages by means of a fork lift and these packages are then transported to the deck conveyor leading to the planer, Fig. 5. At this point, a single operator simultaneously breaks down the lumber package onto the planer feed table and returns the kiln sticks to a conveyor convenient to the stacker shown in Fig. 4.

The lumber is thus fed onto transfer chains which precede the automatic feeding table, Fig. 6. As illustrated, the feed table delivers boards in a steady flow to the planer and matcher. As the pressure exerted by the feed rolls and chip breaker of a conventional planer and matcher have a tendency to split lumber that has cupped during the drying process, a special blanking attachment precedes the planer proper. This presurfacers gently feeds

the board through a pair of top and bottom surfacing heads and removes excess lumber from the hump and horns of a cupped board before it enters the more severe feedworks of the planer and matcher proper. Thus the lumber emerging from the equipment shown in Fig. 6 is planed on all four sides and shows a minimum amount of damage from cup splits. The planer and matcher is equipped with top and bottom profile heads so that blanked lumber (or rough lumber) can be selected for grade and rerun through the machine to yield panelling patterns and other patterns of a similar nature that require profile heads.

The planed lumber is exhausted upon a short section of conveyor chain which terminates in a device that automatically loads each board in front of a set of lugs on a set of moving chains, Fig. 7. The grader studies each board as it passes before him and by actuating a switch controlling a memory device, he feeds a suitable impulse into the grade marker, the tally machine, and the multideck sorter depending upon the grade of the board. At the same time he instructs the trimmerman if defects are to be removed to upgrade the board. In the absence of such instruction, the trimmerman allows the

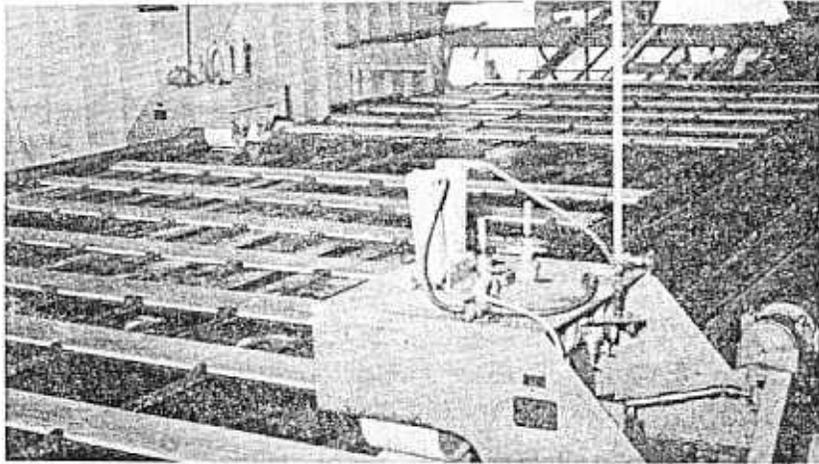


Fig.9 Another view of installation described in Fig. 8. On emerging from double-end trimmer, boards pass through these end-printing and end-waxing devices. Because boards are random length, they must be shifted endwise between machines. Instructions retained from previous switch actuation on part of operator determine whether any particular board will be passed without action, end-waxed only or end-waxed and end-printed. Multilevel sorter is visible in background. Photo: Irvington Machine Works, Inc.

board to pass through the trimmer which automatically cuts it to the longest possible commercial length (refer to Fig. 8).

On emerging from the trimmer, the ends of each board are automatically stamped with a suitable trade mark and waxed. Because the boards are random length it is necessary to accomplish this one end at a time as shown in Fig. 9. From the printers and waxers, the lugged conveyor carries the boards under the grade marker, Fig. 10, which summons the appropriate information from previous instructions from the grader, and stamps the face of each board with the proper grade mark.

From this point the board passes the tally device which measures the board length (a suitable multiplier having been entered manually into the machine to compensate for width and thickness) and combines these data with grade information previously received from the grader, Fig. 7. The device thus keeps a running tally according to grade. It will be observed that this is the first tally of the lumber, and thus payments to suppliers of green lumber would be based on tally at this point.

After leaving the tallying device the lumber, which is still on lugs, is diverted off the lugged conveyor and into a multideck sorter by means of the delayed instructions provided by the grader, Fig. 3.

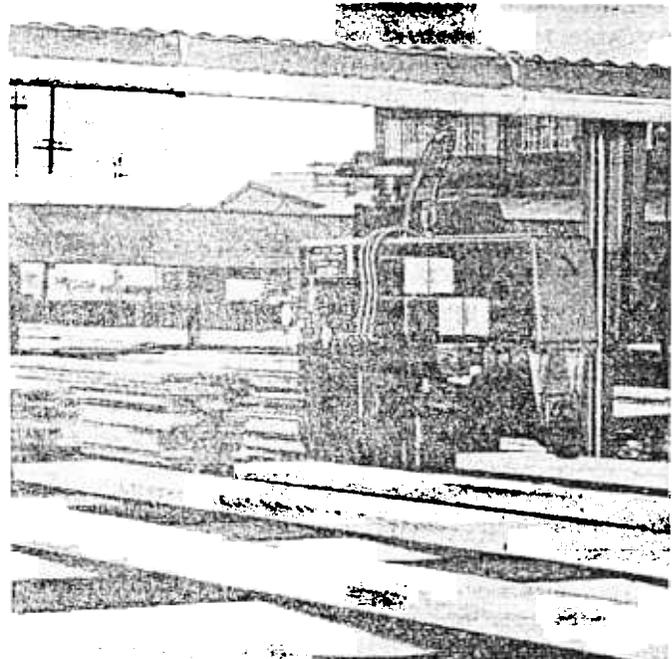


Fig.10 Automatic grademarker with air-operated printing units to stamp grade on face of each board. Photo: Stetson-Ross Machine Company, Inc.

As soon as a particular grade has been accumulated in sufficient quantity, the appropriate deck is emptied onto a conveyor

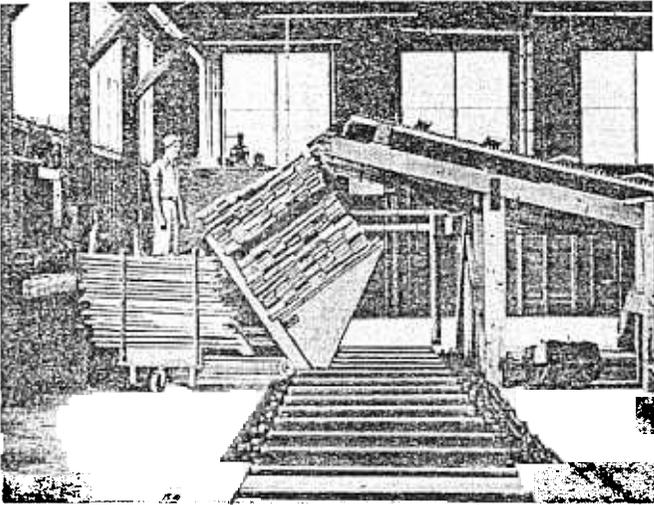


Fig.11 When a sufficient volume of a particular grade has accumulated on any deck of multilevel sorter, it is conveyed to package stacker prior to removal to dry storage. A tilting reloader is illustrated here. Horizontal stackers are also available. Photo: Stetson-Ross Machine Company, Inc.

feeding a reloading device, Fig. 11. After the sorted lumber has been stacked into a suitable package it is removed on a roll case for subsequent pick-up and transport to dry storage. Lumber to be rerun into selected patterns can be later picked out of dry storage with the knowledge that the pattern stock will be on grade after it is machined.

Fig. 12 illustrates a suggested shipping layout that would permit mixed order loading of either trucks or cars with a minimum of physical work. Because the system is conveyorized it could be expected to keep considerable pressure on the loaders.

Conclusion

In conclusion, a scheme has been outlined whereby a work force of only 11 men (not counting maintenance men, power-plant operators or watchmen) receives, dries, planes, double-end trims, end stamps, grade marks, tallies, sorts and puts into dry storage 60-100 thousand board feet of lumber per shift. It is estimated that another 7 men might be required to handle the shipping involved in such an operation.

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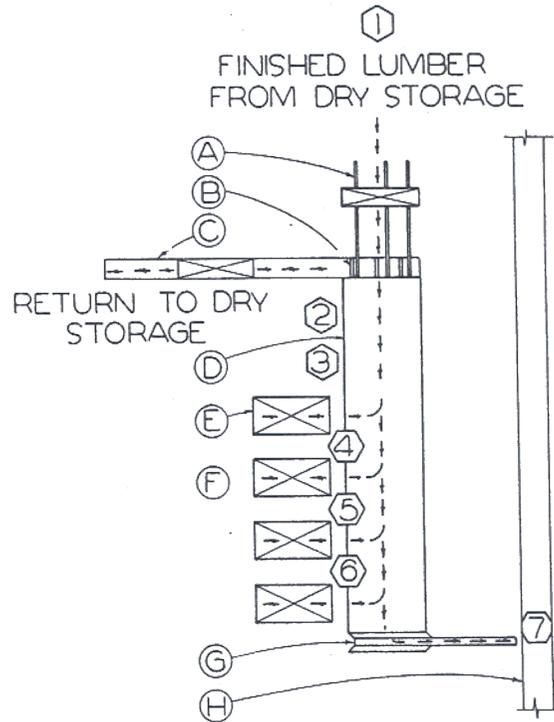


Fig.12 Layout of shipping area

Layout

- A. Fork lift serviced storage chain (side approach) for lumber packages being brought to the shipping area.
- B. Tilting elevator to break down incoming loads onto shipping conveyor.
- C. Fork lift serviced roll case to remove packages after the required amount of lumber has been removed to make up a particular order.
- D. Shipping conveyor.
- E. Elevator mounted roll cases on which to preload mixed orders for trucks.
- F. Truck loading apron.
- G. Inclined conveyor belt feeding directly into railroad car door.
- H. Railroad spur.

Manpower

1. Fork lift operator bringing finished lumber packages from dry storage on order (and returning the access to dry storage).
2. Operator of tilting unloader.
3. Tally out man.
4. Loading crew.
5. Loading crew.
6. Loading crew.
7. Loading crew.

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