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WEYERHAEUSER LIMBER-PROCESSOR

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INTRODUCTION

In the early 1980's, it became evident that the harvesting methods for Western second growth Douglas fir plantations were going to require rethinking in order to keep costs in line.

The issue of adopting new harvesting techniques was brought to a head when a large tract of second growth Douglas fir reached harvesting age in the Chehalis, Washington area. The options considered were :

(1) Build intermediate off-highway roads and a central yard for cutting, sorting, and reloading on to rail.

(2) Build an extended off-highway haul road to connect to existing sort yards.

(3) Manually fell and cut to length in the woods, yard smaller pieces, sort at the landing, and truck directly to customer.

(4) Develop an effective method of roadside processing so that trees could be felled and yarded whole, then merchandised and highway hauled.

The economics of roadside processing appeared to be very attractive. If a roadside processor could be mounted on a hydraulic loader, it would allow a single piece of equipment to access logs under towers or swing yarders, or stockpiles produced by grapple yarders or skidders. In addition, it would permit some degree of sorting while processing, facilitate the stacking of processed logs and improve loading efficiency from presorted log stockpiles.

A thorough review of North American equipment resulted in the conclusion that a shovel-mounted processor did not exist that could delimb, measure, and cut to length Western second growth Douglas fir. During a trip to Europe in 1983, a boom-mounted processor was discovered. Similar to the Steyr KP40, the Stenab S60, developed by the Austrian Bundesforste, had the capability of delimbing, measuring, and cutting to length up to 56 cm diameter trees. In addition, it had a programmable length facility.

The fifth production unit of the S60 was purchased in co-operation with Steyr-Daimler-Puch and delivered to Weyerhaeuser operations near Chehalis, Washington in December of 1983.

STENAB S60 FIELD TRIALS

The Austrian S60 was mounted on an FMC Linkbelt 5400. Several changes were made to the S60 during its initial four month field trials, including :

(1) A stroke limiter on the main saw was coupled to the stem diameter at the cut point. This was necessary because we were cutting longer lengths than the Austrians. As the log is cut through the longer length tips the processor and any saw blade extending through the diameter is prone to damage against the cut log end.

(2) Saw guides were installed to limit the deflection of the large circular saw blade. This became necessary when early fatigue cracks developed in the saw blade around the hub.

(3) The feed-chain spikes were modified, because the original geometry penetrated the stem excessively, resulting in potential wood degrade.

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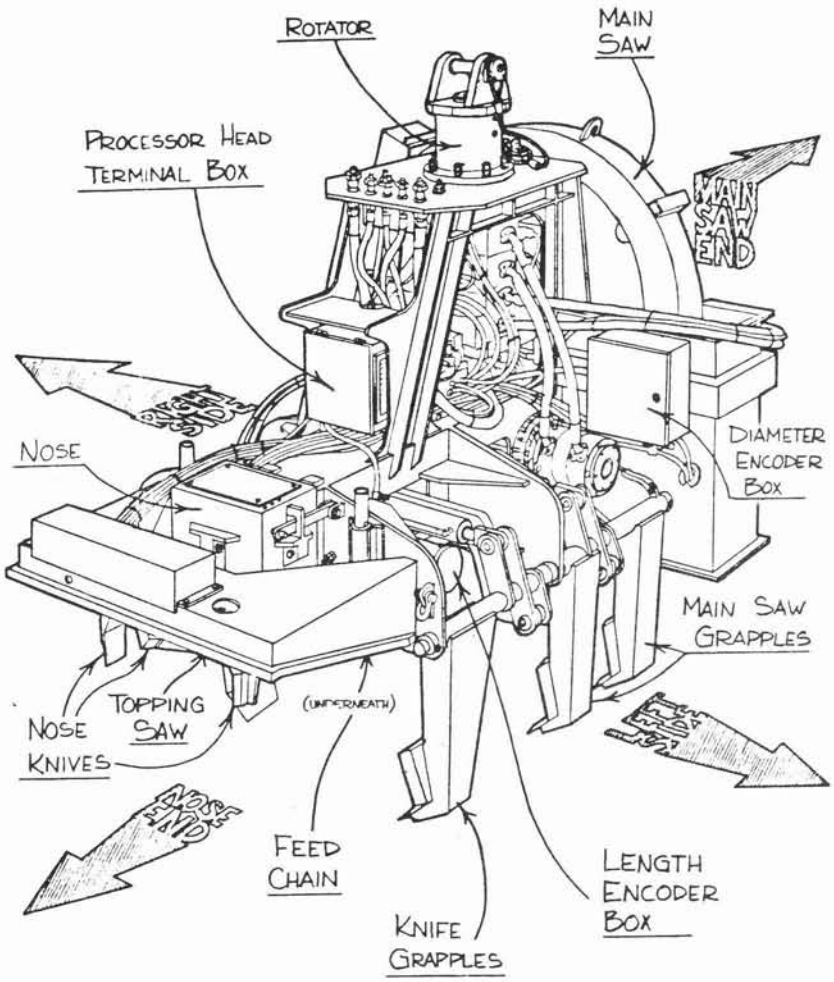

Figure 1 - Weyerhaeuser Limber-Processor

(4) A log diameter indicator was installed to provide this important information to the operator. Two schemes were tried. The one which proved most successful was a large analog gauge mounted on the processor.

WEYERHAEUSER LIMBER-PROCESSOR

Because the initial trials proved successful, it was decided to proceed with the design and construction of two additional Limber-Processors, incorporating the modifications made to the Austrian S60.

In designing the Weyerhaeuser Limber-Processor (see Figure 1) essentially no conceptual changes were made to the Austrian version. We incorporated all the modifications made to the S60 during the field trials plus a number of other significant design improvements, including :

(1) Grappling and feeding capacity was increased to 76 cm and a three - point main saw grapple was designed to hold the log more securely.

(2) The electronic controls were redesigned from the ground up, using readily available programmable controller technology.

(3) The saw guides and scabbard were designed to move with the saw disc.

(4) A digital readout of log diameter was provided for the operator.

(5) Pre-programmed diameter (as well as length) feed stops were included.

(6) A topping chainsaw was added with its own automatic lubrication system.

(7) Automatic lubrication was provided for the log feed-chain belt.

(8) Diagnostic lights were installed on the processor head electrical circuits and solenoid valves to reduce the time required for fault analysis.

(9) Maintenance access was improved all around.

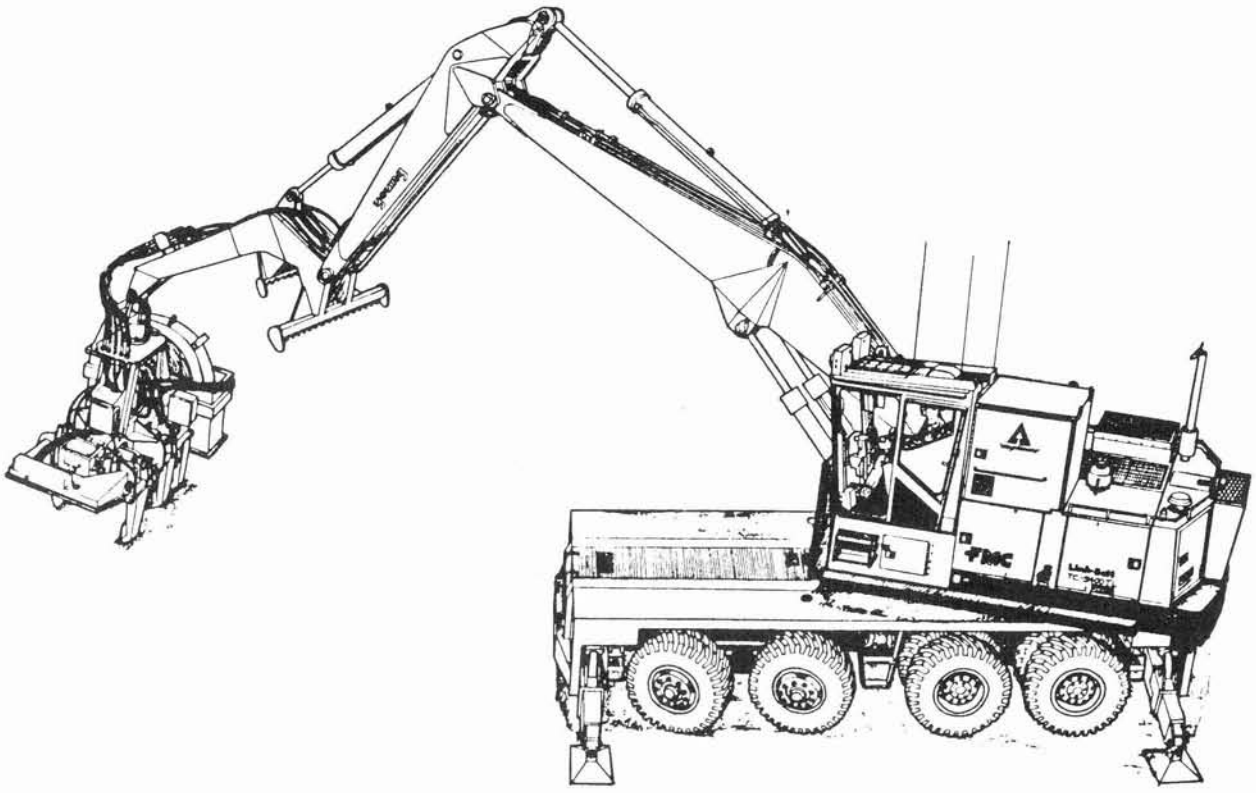

Figure 2 - Weyerhaeuser Limber-Processor on FMC/ Linkbelt 5400 loader

FIELD TRIALS OF THE WEYERHAEUSER LIMBER-PROCESSOR

The Limber-Processors, mounted on Linkbelt 5400 loaders (Figure 2) have been operated in a variety of different applications, including the processing of roadside stockpiles from grapple skidder and grapple yarder operations, processing under highlead towers, and processing in log yards where trees are delivered tree-length.

Roadside processing of trees averaging about 1.83 m^3, in situations where there is adequate room for stacking the merchanised logs, has resulted in productivities of approximately 680 m^3 per 8 hour shift.

When operating under highlead towers, where productivity is limited by the yarder 510 m^3 per shift have been processed.

Merchandising in log yards, Limber-Processor productivity has been measured at 1.5 trees/min. for 145 m^3/productive machine hour. One operator has claimed a maximum daily production of 1060 m^3 on an 8 hour shift.

An evaluation has recently been completed by Jim Ewart of FERIC (Forest Engineering Research Institute of Canada) which will be published later this year.

COSTS

The Weyerhaueser Limber-Processors have been operating approximately one year. At this time, insufficient data exists from which to make reliable estimates of future availability, utilisation and the costs of repair and maintenance.

It is estimated that the installed cost of a commercially available Limber-Processor will be approximately US$150,000 plus carrier.

BENEFITS

This machine offers several benefits. First, it allows the yarding of tree-length versus log - length wood. The savings here are a function of the costs of cutting to length as well as the improvement in yarding productivity due to larger piece size.

Secondly, roadside processing also decreases loading and hauling costs because of its sorting capability.

Thirdly, the greatest benefit is from log value recovery. The operator of the limber-processor has several advantages over the manual faller in the woods. He has a very good view of the defects and sweep over the entire stem, accurate length and diameter information available to him after

any yarding breakage and he is able to make high quality cuts with accurate length measurements as well as doing an excellent limbing job. In the Pacific Northwest, where export logs have the highest value, we have seen a substantial increase in the market value from a stand of timber.

Fourthly, from the management aspect, still other benefits are operator training and the shortened response time to merchandising changes required by the market. Because of the productivity of this system, there are fewer operators to train. Merchandising consistency is improved because fewer people are required to do it, and making changes to improve cutting to length is easier. Since the results of merchandising changes can be fed back to the operator almost immediately, recovery can be improved much more quickly. It is literally possible to change the log specifications one day and have the resulting product mix delivered to the customer the following day.

MARKETING PLANS

We are currently negotiating with Steyr-Daimler-Puch to utilise the Weyerhaueser design in manufacturing limber-processors for sale in North America. Technical specifications are given in Figure 3.

TECHNICAL DATA	STEYR KP40	WEYERHAEUSER S60
Length	1900 mm	2970 mm
Width	1150 mm	1930 mm
Height	1180 mm	2160 mm
Weight with rotator	810 kg	4000 kg
Max. delimbing diameter	40 cm	60 cm
Max. cutting diameter	35 cm	58 cm
Circular saw dia.	900 mm	1400 mm
Max. rotation of circular saw	1900 rpm	1400 rpm
Log feeding rate	1.5 m/sec	1.1 or 1.9 m/sec
Log feeding force	12-25000 N	102,000 N
Feed stop programmes	7 lengths	5 lengths, 3 dia.
Length measuring accuracy	± 2 cm at 4 m ± 0.5% above 4 m	± 3 cm at 12.5 m -
Cutting time	1.2 s (35 cm dia)	0.5 sec (58 cm dia)
Topping saw max. cut dia.	-	46 cm
Max. feed diameter	-	76 cm

Figure 3 - Steyr KP40 and Weyerhaeuser S60 specifications

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