

THE MECHANICAL HIGH PRUNER

by F.A. Colyer

INTRODUCTION:

Pruning in forestry terms is the removal of limbs from a tree to encourage that tree to produce a straight, knot-free mill log. This is why, in plantation forestry, pruning programmes are carried out at various stages in a tree's development. The removal of the lower limbs is no real problem with manual shears serving as a useful means of branch removal. Pruning a plantation tree to 4.0 metres and 6.0 metres has been a very labour intensive and costly operation. Manual hand saws attached to long aluminium poles have been used.

Nowadays, with the trend to use labour saving mechanical aids, a hydraulic powered mechanical high pruner has been developed to such an extent that it now provides a more than adequate substitute for the primitive hand saw.

The idea of using a mechanical high pruner, like the one now in use, was promoted after viewing and testing similar machinery used in orchards. With a few innovations and a slight change in design the original orchard pruner has been developed to suit a plantation pruning silvicultural operation.

Originally two "makes" or types of pruners were viewed and tested. Both were basically similar in design and method of operation, however parts were not generally interchangeable.

- 1) The Limb Lopper - was the cheaper of the two "makes". It however tended to be slower in field operation and rather heavy in design.
- 2) The Fairmont - this is a dearer priced machine. When compared to the Limb Lopper it was found to be a better design, had a distinct weight advantage and was superior in performance in field working conditions.

As a result of these comparisons it was obvious to choose the Fairmont type and innovate on its design and construction to suit plantation type pruning.

Description: The pruner or lance as it is called, consists of a handpiece which is simply an encased cylinder with an operating trigger (see diagrams 1 and 2) and an extension which projects beyond the handpiece which is made of a metal or fibre-glass pipe containing a shaft which reciprocates and operates the shears at the end.

The hydraulic pressures needed to operate the shears comes from a power unit attached to the three point linkage of a Massey Ferguson tractor. The power unit consists of a seal tank or reservoir (160 litres in capacity). Inside the tank is a hydraulic pump which has a capacity

of 55 litres of hydraulic oil per minute. Power to drive the pump comes from the power take off connection on the tractor. The operating power take off is 1400 r.p.m. The hydraulic pump, pumps oil through the high pressure hydraulic red hose at a pressure of 1500 - 1800 psi, into the operating handpiece, which when triggered operates the lance shears.

Mounted on top of the tank is an oil cooling radiator. The hydraulic oil is pumped through the radiator and cooled by a fan powered by a small 12 volt electric motor. Oil can be pumped through the radiator at a rate of 100 litres per minute.

The need to cool the hydraulic oil is due to an excessive heat development (38°C air temperature) during the summer months, which is in turn transferred to the handpiece.

Also mounted on the top of the tank are the hydraulic pressure hose couplings and a spring attachment. This spring attachment is a means of supporting and lifting the hoses off the ground. Under working conditions these hoses tend to catch in the scrub and fallen limbs.

PRUNER SPECIFICATIONS:

Length Overall: Lance used in 4.0m pruning - 2.25m long.
Lance used in 6.0m pruning - 3.4m long.
Weight: Lance used in 4.0m pruning - 4.5kg.
Lance used in 6.0m pruning - 5.5kg.
Cutting Capacity: 70mm
Oil Flow Recommended Range: 20-25 litres per minute.
Recommended Operating Pressure: 1,800 to 2,000 psi.
Maximum Recommended Operating Pressure: 2,000 psi.
Maximum Recommended Back Pressure: 150 psi.
Outer Tube and Pull Rod: Fibre glass or aluminium
(recommended aluminium).
Shear Blade and Hook: Heat treated tool steel.
Hydraulic Hose: 6 meters long.

MAINTENANCE AND SHARPENING OF BLADES: The blades are stone sharpened regularly or as required by the operators. The actual sharpening angle and bevel is illustrated in diagram 3. After each sharpening and before the commencement of work the hose couplings should be checked for leaks, all moving parts associated with the pruning lance be oiled, especially between the cutting blade and the hook. Daily the tractor should receive a check also.

CAPABILITIES: The mechanical pruner is capable of cutting a limb off a tree of up to 70mm in diameter. Using several cuts it will cut slightly larger limbs. It is however very undesirable to attempt to cut a limb over 70mm in diameter as a lot of strain is put on the blade and hook. Many blades have been damaged beyond sharpening repair and other parts associated with the blade and hook have been damaged or broken purely through attempting to cut off oversized limbs. The operators do carry spare parts for the unit should these breakdowns occur.

Oversized limbs present no real problem as many limbs in plantations where the pruner operates, do not reach these diameter sizes. Only break

and edge trees will tend to have oversized limbs. Silvicultural prescriptions now tell us not to prune these trees for that very reason.

METHOD OF OPERATION: Access is vital. The tractor must be small enough to fit between the rows. Usually a M.F. 35 or 65 is an ideal sized tractor. The two pruners walk between the rows of trees in the plantation and "work" four rows at a time. As they go along selecting and pruning the desired trees the tractor driver tries to keep the tractor close enough to the pruners so that the hoses don't become fully extended.

PRODUCTION: The mechanical high pruner, with three trained operators is capable of pruning 3 hectares at a rate of 250 stems or trees per hectare in an eight hour working day. This production rate is slightly higher with the shorter lances. Factors such as weather and breakdown affect the production rate. A well maintained unit and regular sharpening of blades will also affect production.

COSTS: Apart from the initial outlay for the machinery, operation costs are mainly kept to wages and tractor running costs. Breakdown and lances can contribute to costs as the lance, blades and hooks are fairly expensive to replace. The whole lance being approximately \$520.00 to replace, blades \$35.00 each and the hooks \$25.00 each. The frequency of breakdowns has now been minimised due to better design and more experienced operators.

SAFETY: The Forests Department places a great emphasis on safety and some mention should be made. The obvious hazard of falling limbs is part and parcel with the job. Generally the limbs are small and are no real hazard to the operators. It is necessary to wear a hard hat and eye protection at all times. When pruning the tractor driver is sheltered from falling limbs by a cab mounted on the tractor. Other hazards such as scrub fatigue and weather are subject to terrain, weather and mental attitude to the job. Mechanically, the machine is not hazardous and will not be if it is respected by its operators.

SUMMARY: The mechanical high pruner now has had many hours of testing and working. Results show that it has proven to be a more than adequate substitute for the handsaw and has a quite valuable place in plantation silviculture. With even more greater understanding of the machines capabilities and innovations in design and silvicultural planning, the mechanical high pruner will serve as a great use in future years.

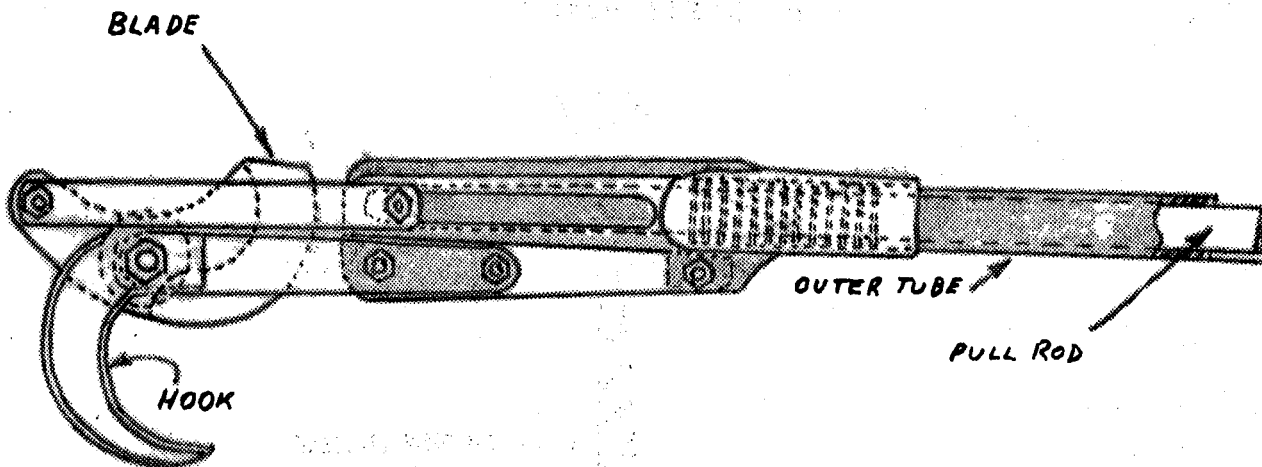


DIAGRAM 1 CUTTING END.

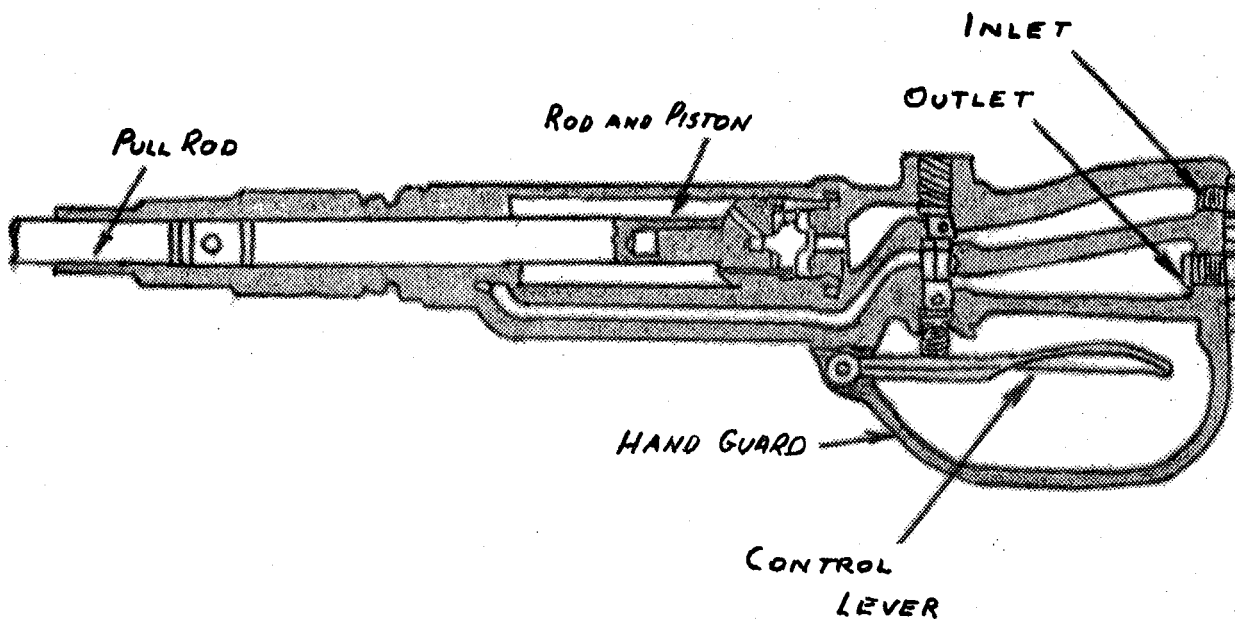


DIAGRAM 2. HAND PIECE

mechanical high pruner;

SHARPENED EDGE
OF SHEAR BLADE

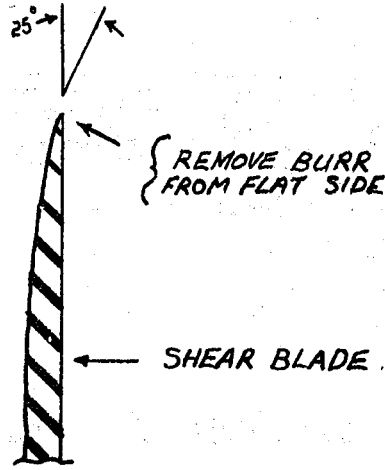


DIAGRAM 3