

TECHNICAL NOTE 18/97



Forest Research
An agency of the Forestry Commission

TECHNICAL DEVELOPMENT BRANCH

REIPAL PUSHER FORESTRY JACK

Summary

The Reipal Pusher Forestry Jack III (RPJ) is a mechanical device that can assist in the take down of a tree with an unfavourable lean or imbalance.

When in position it applies a lateral force to a leaning tree to ensure that it will fall in the intended direction.

RPJ jacks (3 models) have been designed to ease the take down of trees with or without the use of high lift wedges and a sledge hammer.

The RPJ III has a mechanical advantage of 1:30, ie a force of 10 kg applied to the cranking handle, transfers a force of 300 kg to the tree.

The cost of the tool is from c £300 to c £ 400 depending on the model ordered.

Introduction

RPJ jacks have been developed to assist take down of standing trees with unfavourable lean or imbalance due to branch configuration. They were first introduced to the forest industry at the Elmia forestry show in 1993.

Technical Development Branch (TDB) has evaluated the RPJ III as part of a continuous review of Felling Aid Tools.

Description

The RPJ III consists of 3 telescopic sections (Plate 1).

The **bottom section** is 1 200 mm long and constructed from 2 mm thick box steel. There is a 6 mm thick by 120 mm square base plate at the bottom with 2 corners 'turned in' to act as anchors.

Attached to this bottom section is a hand operated, ratchet controlled, winch.

Plate 1

Reipal Pusher Forestry Jack III



An adjustable nylon carrying strap is attached to a welded lug, at each end of the section, by spring clips.

The **middle section** is constructed from 2 mm thick steel tube, 45 mm in diameter and 1200 mm long. The top 30 mm has been strengthened by a 2.5 mm by 45 mm sleeve. Four 11 mm holes have been drilled for a locking pin.

A 10 mm diameter locking pin with securing clip is located at the top with a short retaining chain fitted to the clip.

At the bottom of the tube there is a pulley wheel, supported on an axle. The ends of the axle are welded to the pipe.

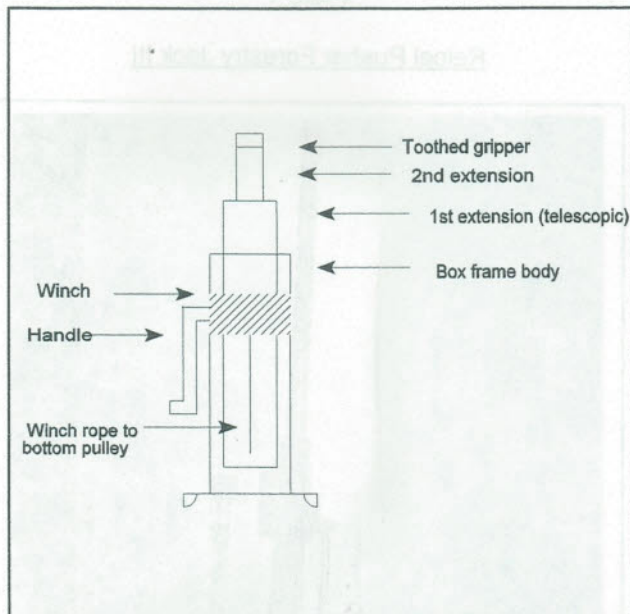
The **top section** is tubular, 1 160 mm by 2 mm. The top 600 mm has been strengthened by a 20 mm by 35 mm sleeve. Welded into the top is a 5 mm toothed plate set at a 35° angle.

Two 11 mm holes have been drilled through the tube, one 150 mm from the top and the other half way down. Both holes have been strengthened by 2.5 mm steel sleeves spot welded into place.

The 3 pieces slot into each other to make up the telescopic design of the RPJ. The middle section is held in place by the rope attachment system. Only the top section can be pulled completely out by hand (Figure 1).

Figure 1

Telescopic Action



Winch Mechanism

The winch mechanism is attached to the bottom section of the jack.

The handle is fitted onto a threaded shaft that has a 10 toothed ratchet. The ratchet has a steel washer each side and fibre washers inserted between the ratchet and steel washers.

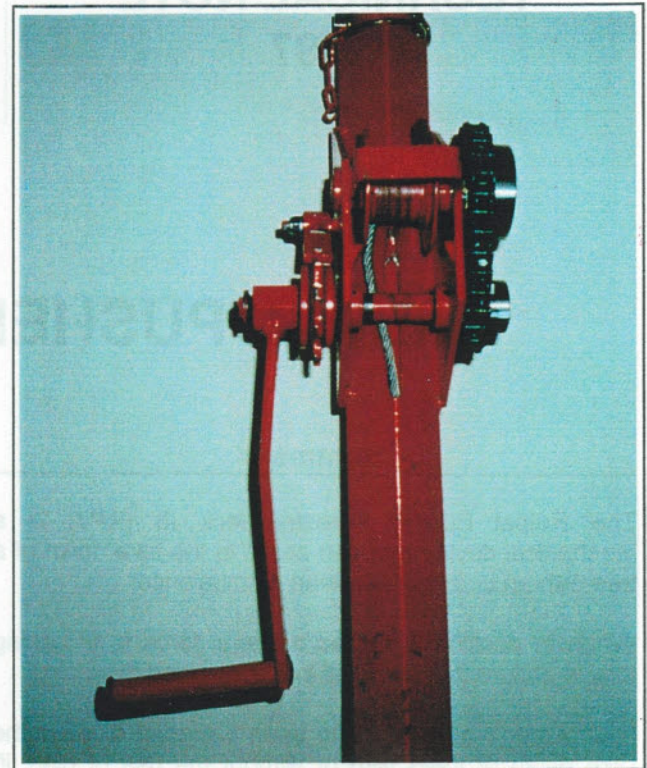
A small spring loaded pawl is attached to the plate to prevent the ratchet rotating anti-clockwise.

The handle turns the bottom shaft on the winch. The winch drum is linked to the drive shaft by a motorcycle type chain and toothed sprocket on each shaft. The turning ratio of the sprockets is 1.5 to 1.0.

The 2.20 m long winch rope is made of 6 mm 8 strand wire core construction. It is secured to the side plate of the winch drum by a U-bolt. The rope end is fitted with a swaged aluminium ferrule to prevent it slipping through the U-bolt (Plate 2).

Plate 2

Winch Mechanism



A shaped cross member forms a guard over the drum to prevent the wire rope from unravelling off the drum.

The wire rope is fed around the back of the drum and inserted into the main box section. The rope is inserted through the middle section at the bottom pulley and returns out of the main box section on the opposite side to the winch mechanism.

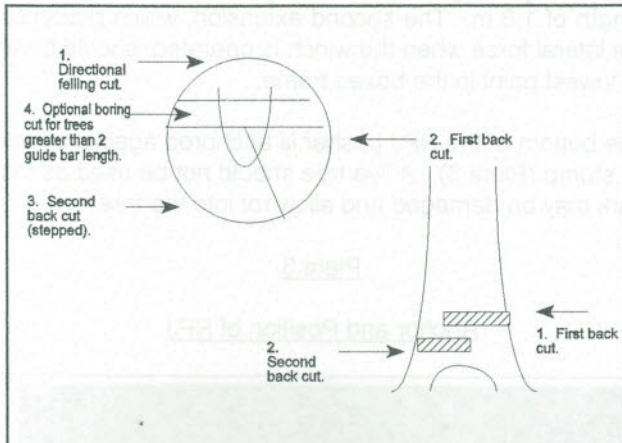
The wire is looped and another swaged aluminium ferrule holds the end in place.

The loop is placed around a pin on the outside of the box frame and held in place by 2 washers and a split pin.

Three models of pusher are produced (Table 1). Only the RPJ Pusher III was available for evaluation.

Figure 3

Rear View of Felling Cut



The saw is removed from the cut and winching commenced to push the tree over (Plate 4).

Plate 4

Pushing Tree Over



When the tree starts to fall the operator must move away from the tree, out of the danger zone, leaving the RPJ pusher to fall along with the tree.

When the tree is on the ground in a stable position, the RPJ is retrieved and the winch unwound by turning the handle in an anti-clockwise direction. This releases the pressure of the fibre washer on the ratchet and allows the wire drum to revolve and release the wire rope on the drum. The telescopic section of the RPJ can then be pushed in by hand.

Additional care must be taken on trees that have large buttresses and are greater than 2 guide bar lengths in

diameter. The feller must be precise in the preparation of the debutting and felling cuts. The final felling cuts should either meet, or overlap to ensure that no part of the trunk has been left uncut apart from the hinge.

It is essential that no central core is left uncut as this can result in the operator applying an unnecessary force on the RPJ. If the core cannot be broken by normal operation then further debutting and felling cuts must be made.

Trial Information

The RPJ III, the largest model in the range, was used when felling trees on the outside edge of a forest compartment and volume sample trees within a forest block.

Four Sitka spruce trees were felled for demonstration purposes to instruct the chainsaw operators on the working method. Another 3 trees were felled by TDB staff to test the RPJ to its limit (Table 2).

Table 2

Tree Details

Tree (No)	Lean (%)	dbh (cm)	Length (m)	Mid diam (cm)	Volume (m³)
1	6	47	21	28	1.29
2	4	34	21	24	0.95
3	5	41	17	25	0.83
4	8	35	22	26	1.16
5	7	33	21	24	0.95
6	6	37	22	26	1.16
7	7	66	22	42	3.04

The RPJ had no problem in pushing over the trees, tree No 7 was specifically chosen to put it under extreme load.

Operational Safety

'Take down' using the RPJ is safer than the conventional hammer and high lift wedge method. This is due to the RPJ pushing the tree instead of lifting.

The high lift wedge system, using 2 or 3, wedges lifts the tree as they are hammered into the rear felling cut. The wedges may break the hinge and cause the tree to become unstable and fall in the wrong direction.

The RPJ applies a **lateral** force to the trunk and pushes the tree over using the uncut strip of the butt as a hinge. The force applied to the trunk **does not create the lifting motion** which can cause the hinge to rip or break.

The RPJ is **less strenuous** for the operator to use than the high lift wedge system.

Recent RPJ models have a crank handle that is designed to bend in the event of overloading.

The rope should be checked to ensure it meets Health and Safety requirements¹.

The tree size relating to these load limits is not known.

Maintenance

The drum spindle should be regularly lubricated through the hole provided. On the RPJ III model, it is also necessary to lubricate the chain and second spindle. Periodic greasing of the hand lever fixing threads is required.

The wire rope that raises and lowers the extension pipe should be inspected for signs of wear. All wire ropes benefit from regular lubrication, with clean oil, to reduce wear and tear.

Replacement of the wire rope is straight forward. Damaged rope must be replaced and should **never** be spliced.

The RPJ should be lubricated before storing for any period and checked prior to use after storage.

Operators Comments

A good piece of equipment, simple to set up and operate. The bottom anchor plate could have been larger and if the opposite corners are turned inwards this would help to stabilise the plate against a billet of wood. With corners on the same edge turned in the billet slipped out from under the plate.

The turning handle was too short and only 1 hand could fit on it. When extra pressure was required, it was difficult to apply the second hand without semi-crushing the fingers of the bottom hand. However, this aspect of design helps prevent overloading.

Turning the handle to move the pawl onto the next tooth on the ratchet was difficult when the RPJ was under extreme load. The operating mechanism of the turning handle could have been designed on the same principle as a 'Lugall' winch².

Walking on previously felled ground with the RPJ was difficult. The RPJ slipped down the operators back and dragged on branches and stumps.

The supporting strap would be more comfortable if made wider and padded. Relocating the lugs that hold the carrying strap would raise the RPJ when being carried.

¹ Provisional Use of Work Equipment Regulations (1992).

² Lugall winch is manufactured and Patent applied for by: Lug All Co, Haverford, Pennsylvania, USA.

Conclusions

A good piece of equipment designed to make take down of trees easier and less strenuous on the operator.

Assembly of the RPJ is straight forward and the working method simple.

The RPJ can assist the operator to take down a tree that has an unfavourable lean, safely and with less effort.

There are RPJ models suitable for use with a range of tree sizes.

The RPJ can be used in most tree felling situations, by the professional tree surgeon, or the highly productive chainsaw operator.

Recommendations

The winch rope should be tested to ensure it meets specified Health and Safety requirements.

The RPJ should not be used on trees which have a load greater than the manufacturer's recommendations:

- 1.5 Tonne for Pusher I.
- 1.8 Tonne for Pusher II.
- 2.0 Tonne for Pusher III.

Great care should be taken to ensure accurate debutting and felling cuts are made and particularly on trees with a butt diameter greater than 2 guide bar lengths.

There should always be 1 full coil of rope around the winch drum before the RPJ is operated.

The supporting strap of the RPJ should be made wider and have adjustable padding fitted.

The welded lugs at the top and bottom should be moved closer together to raise the height of the strap which would lift the RPJ base clear of the ground when being carried.

The winch handle should be lengthened to enable 2 hands to be used when turning it.

A marker line should be painted on the side plate of the winch mechanism to indicate a 45° angle. This will give guidance to the operator when setting up the RPJ.

The manufacturer should investigate modification of the handle ratchet mechanism.

Maintenance should be carried out as specified in the manufacturer's instructions.

Acknowledgements

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