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Aid Tools for Timber Harvesting

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AID TOOLS FOR TIMBER HARVESTING

by D J Howard and F W Hayes

Forestry Commission

1. Introduction

A wide range of aid tools is available for use in felling, thinning and timber handling operations. Most of the tools available in the United Kingdom have been evaluated by the Work Study Branch of the Forestry Commission and recommendations are made on their suitability for use in this country.

The various aid tools are grouped according to function. Within each group the advantages and disadvantages of the various types available are discussed and the recommended choice is described with an assessment of its usefulness. Information on working methods is found in the Appendices.

Many of the aid tools described can be of great assistance to the chainsaw operator when used correctly. While benefits may not be directly quantifiable in increased output, a trained operator equipped with correct felling aids is less likely to adopt unsafe and arduous working methods. Although the techniques involved in the use of some tools may be self evident it must be emphasised that the more sophisticated, such as winches and the felling cushion, require correct operator training and practice if they are to be used successfully.

This publication although up-to-date at the time of writing (mid-1982) will not remain so. New tools will be developed and improvements will be made to those currently available. Frequent critical appraisal of the contents of the various trade catalogues is strongly recommended to all interested in the subject of aid tools for harvesting operators.

A summary of a range of operations and the recommended harvesting aid tools is given in Table 1.

2. Breaking bars

The breaking bar is the single most useful hand aid tool for directional take-down. It is basically a lever which is inserted into the felling cut allowing the tree to be pushed over in the required direction. A skilled operator may also use his breaking bar as a wedge to hold open a partially completed felling cut thereby preventing the chainsaw bar from being trapped if the tree leans back. Working methods are described in Appendix I.

The conventional all steel breaking bar is robust and has a mechanical advantage of approximately 13:1. Thus, assuming the average man can exert a force of 100 kg on the bar he will effectively be applying a lifting force of 1,300 kg to the tree. This type of bar usually incorporates a cant hook to facilitate turning of lodged trees and as an aid to turning for complete snedding. The rugged nature of the all steel bar also allows it to be used as a makeshift hammer for the insertion of felling wedges.

Bars with light alloy or tubular steel handles are also available and although they have a distinct weight advantage they are not as robust as the all steel bars and are prone to damage if misused. These bars do not normally have an integral cant hook but may have the facility for attaching a pulp hook for turning. Experience has shown that this is not a satisfactory arrangement as the pulp hook tends to open out if used for anything other than light turning and may become dangerous to use.

There are several variations of breaking bars designed to increase the mechanical advantage. These include redesigned lifting

Table 1 Summary of recommended aid tools

Operation	*Recommended aid tools issued to each feller*	*Recommended aid tools which should be available to each feller*	
Early thinning: selective or systematic	Billnäs 19340 breaking bar/canthook. Kawi turning strap, short version. 2 Fiskars 19000 pulp hooks in pouches on a logger's belt. Small felling wedge.		Winch for very difficult take-down.
Later thinnings	Small felling cushion (or Husqvarna double lever breaking bar for average tree volume of 0.4 m^3 or less). Kawi turning strap. 2 Fiskars 19000 pulp hooks in pouches on a logger's belt. Small felling wedge.		
Clear-felling: up to 0.4 m^3 average tree volume	Small felling cushion or Husqvarna double lever breaking bar. 2 Fiskars 19000 pulp hooks in pouches on a logger's belt. Small felling wedge.		Up to 0.5 m^3 tree volume: Lugall 5 CL.
Clear-felling: up to 0.8 m^3 average tree volume	Small felling cushion. Breaking bar (Billnäs 19340 if trees are to be turned otherwise Husqvarna double lever bar). 2 Fiskars 19000 pulp hooks in pouches on a logger's belt. Small felling wedge.	High-lift wedges and sledge hammer.	
Clear-felling: greater than 0.8 m^3 average tree volume	Large *and* small felling cushion. Breaking bar (Billnäs 19340 if trees are to be turned otherwise Husqvarna double lever bar). 2 Fiskars 19000 pulp hooks in pouches on a logger's belt. Small felling wedge.		Over 0.5 m^3 tree volume: Lugall 25 CL.

plates, pump action toothed wedges and an ingenious double lever mechanism made by Husqvarna. None of these incorporate a cant hook. In clear fellings and large thinnings the turning facility offered by a combined breaking bar/cant hook becomes less important. It may be more advantageous to have the increased leverage offered by a tool such as the double lever breaking bar, with a separate aid tool for turning if required.

A number of breaking bars have been evaluated both in trials and long term operational use. Two bars have shown up well in the trials and are recommended.

1. The Billnäs 19340 breaking bar/cant hook

This is recommended for use in situations where trees have to be turned during take-down, or for complete snedding of large poles which cannot be turned by hand.

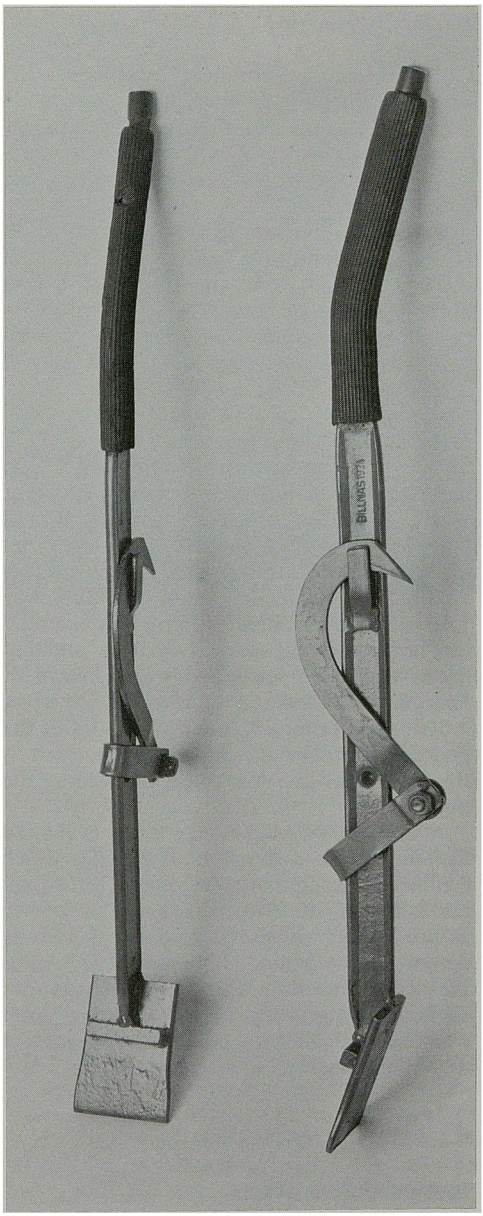


Plate 1. Billnäs 19340 breaking bar/cant hook.
(*ED 1191*)

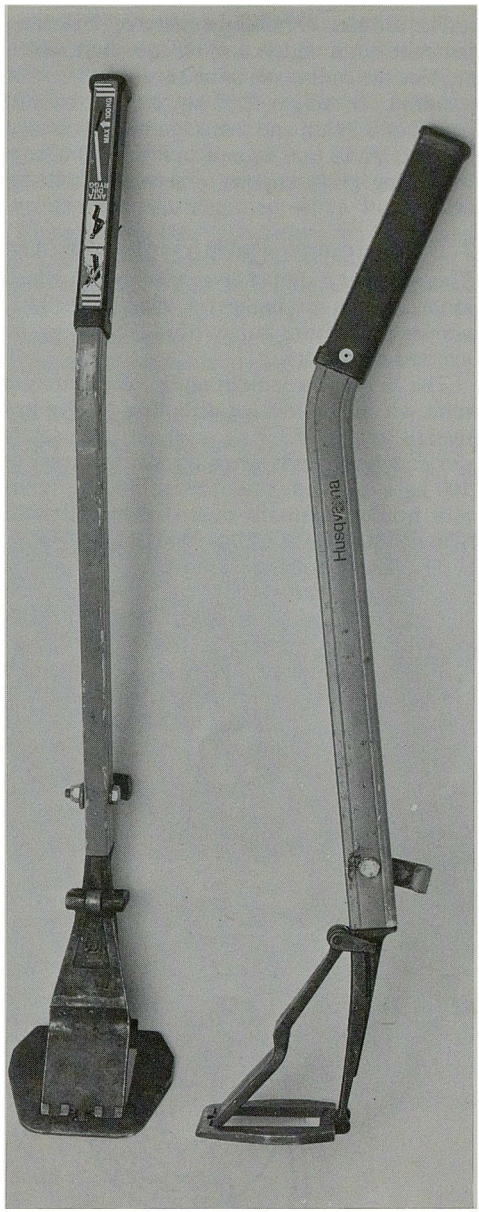


Plate 2. Husqvarna double lever breaking bar.
(*ED 1190*)

The Billnäs 19340 is an all steel breaking bar/cant hook with a lug on the shaft which enables the cant hook to be secured when not required. It weighs 2.52 kg, has an overall length of 0.79 m, and a mechanical advantage of 13:1. A 12 mm square bar welded across the lifting plate enables a second lift to be made.

2. The Husqvarna double lever breaking bar

This features a simple lever mechanism which increases the mechanical advantage to 30:1, allowing a lifting force of 3,000 kg to be exerted on the tree.

The bar has a handle made of aluminium tube which, besides contributing to the low overall weight of 1.7 kg, also acts as a safety device which bends when a force in excess of 100 kg is applied, thus preventing the operator from accidentally over-straining himself. The overall length of this bar is 0.8 m.

The Husqvarna breaking bar does have a lug to which a pulp hook can be attached for light turning although this is not recommended for the reasons stated at p.3.

A disadvantage of this bar is that it cannot be used as a makeshift hammer for inserting felling wedges as it will be damaged if used in this way.

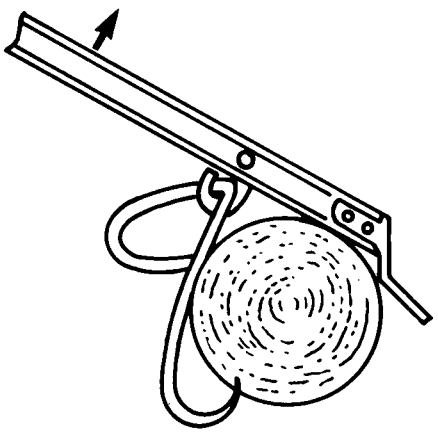


Figure 1. Pulp hook used as a cant hook.

3. Pulp hooks

One of the most useful hand tools associated with felling is the pulp hook or lifting hook. It is used for turning and moving poles or pieces during snedding, hand extraction, and stacking. It may also be used as an aid to take-down of small trees.

The most important feature of a pulp hook is its ability to grip the log securely, although weight, strength, and the thickness of the hook must also be considered. The thickness of the hook should be such that it can be inserted into a chainsaw cut to hold open a felling cut or to drag a piece of pulp.

A pulp hook may be attached to certain breaking bars to serve as a cant hook for light turning only, as shown in Figure 1. If a pulp hook is used in this way for anything other than light turning the point will be opened out, and although it may still grip a log under light pressure, it will slip when greater force is applied, possibly leading to injury of the user.

In order to obtain a safe grip it is essential that hooks are kept sharp at all times, and that hooks that have opened out are discarded. Sharpening of hooks should be done by using a file on the outer edge and both sides of the point. The inner edge must never be filed as this will have the same effect as opening the hook.

A number of pulp hooks were evaulated including some with extended handles which can be used as light breaking bars. Of the pulp hooks tested, the Fiskars 19000 (also known as the Billnäs 19000 and various other trade names) is recommended because at 283 grammes it is lighter than other similar hooks, but no less strong, with a very effective point profile ensuring a good grip of the log, even at an oblique angle.

4. Felling wedges

(i) Small felling wedges

Small felling wedges made from nylon or light metal alloy are available in lengths from 100 to 130 mm. Neither nylon nor alloy wedges

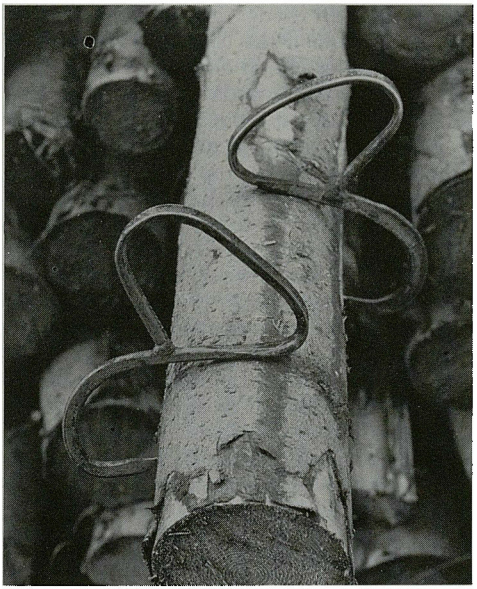


Plate 3. Fiskars 19000 pulp hook. (*ED 1193*)

will normally damage a saw chain if they come into contact with it, although both may blunt it. Small wedges have a lifting height of 20 mm. The nylon ones weigh approximately 75 grammes and the light metal ones 150 grammes. A small wedge may be carried in a pouch on the logger's belt or in a pocket.

The most common use of a small felling wedge is to prevent the tree leaning back whilst the main cut is made, either to prevent the guide bar and chain being trapped or as an aid to subsequent take-down. In the latter case take-down may be accomplished following completion of the main cut by tapping the wedge further into the cut, or by inserting a breaking bar into the open cut adjacent to the wedge and levering the tree over in the normal manner. Wedges can also be used to help free a saw jammed whilst crosscutting or to free jammed breaking bars. They may be hammered into saw cuts using a conventional breaking bar or other improvised hammer.

Small felling wedges are light, convenient to carry, versatile and cheap. They are an essential accompaniment to conventional breaking bars. There is no great difference in efficiency between nylon and alloy wedges. Occasionally nylon wedges bounce back out of the saw cut when they are being hammered, particularly when the sapwood is frozen. They are brittle at low temperatures and have occasionally disintegrated when hammered. There is more friction between the light metal wedge and the sawn wood, so bouncing out is less frequent. The light metal wedge can, however, be broken during hammering if its head is not struck squarely. On balance the light metal wedge is preferred.

(ii) Intermediate wedges

Prior to the introduction of chainsaws, steel wedges of 150 to 300 mm length with up to

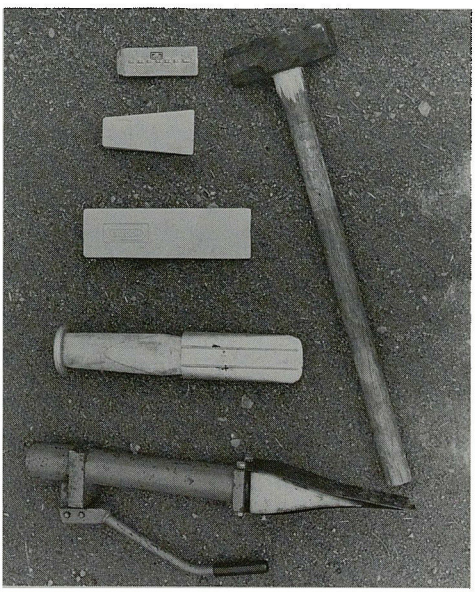


Plate 4. Felling wedges. (*ED 1192*)
Top to bottom:
Small alloy felling wedge
Small plastic felling wedge
Intermediate plastic wedge 25 cm in length
High lift wedge
Hydraulic wedge

40 mm lift were the main felling aid for large trees. Steel felling wedges have now been largely superseded by high lift alloy wedges. However, in some of the hardwood areas of southern England the robust steel wedge with its more gradual taper is considered all important when almost every tree may have to be wedged.

Although steel wedges are extremely robust they are relatively heavy and present a serious hazard to the saw chain, which will be seriously damaged should it come into contact with the wedge. Consequently the use of steel wedges is only recommended in exceptional circumstances as indicated above.

Plastic wedges of up to 250 mm in length and 40 mm in lifting height are widely available. They have been developed for use with chainsaws to minimise damage to the chain should it hit a wedge as cutting takes place. Although they are tough, plastic wedges tend to be brittle particularly at low temperatures. The intermediate sizes have a greater length in proportion to their lifting height, and are less likely to bounce out of a cut than is the plastic small felling wedge. In relation to other tools they are very cheap, and their introduction could lead to cost savings in situations where there is high consumption of high lift wedges.

Intermediate felling wedges of light alloys were previously available in similar dimensions to those of plastic. Currently, the major suppliers of forestry tools stock only plastic wedges. If light metal intermediate felling wedges return to the market, they may be used as an alternative to plastic ones.

(iii) The high lift wedge

The high lift wedge is made of light alloy with a replaceable wooden insert. The insert is strengthened by a light alloy ring at the end which is hammered. The lifting height is 75 mm when the wedge is fully driven home. The wedge is 385 mm in overall length and 1 kg in weight. To drive in a high lift wedge effectively a sledge hammer is necessary. The hammer should have a 2–3 kg head (5–7 lbs) and a shaft of no less than 0.6 m (24″) in length.

The high lift wedge is used to fell trees which are beyond the capacity of a conventional breaking bar. It is an extremely effective tool for this purpose. Hammering a high lift wedge to take down a large tree, or a tree with a heavy lean, demands a very high expenditure of energy, and it is not exceptional for the wedging of a large tree to take a feller 10 minutes. There is a strong temptation for the feller to reduce the effort demanded in wedging by leaving a weak hinge, with consequent loss of control, or to fell the tree in a direction which may be less favourable for extraction.

High lift wedges are relatively expensive and soon worn out. It is undesirable that the use of high lift wedges should be anything but an occasional last resort. Their current scale of use could be significantly reduced by the intelligent use of other aid tools.

(iv) The Swedfeller hydraulic felling wedge

The hydraulic felling wedge is a compact tool incorporating a powerful wedging device fitted to the end of a horizontal hydraulic cylinder. The cylinder is operated by a manual pump which together with the fluid reservoir and valve assembly forms an integral part of the tool. In operation a pair of spring steel jaws are inserted in the felling cut at the point where an ordinary felling wedge would be placed. The operation of the pump forces a high lift nylon wedge between the spring steel jaws with a lifting effect equivalent to a force of 12,000 kg. After use the wedge is reset by holding up the pump handle for a few seconds.

During trials the hydraulic felling wedge was used successfully on the largest clear fellings, including trees of over 3 cubic metres, and on mature trees which were required to be felled against their natural lean.

Unfortunately, the wedge's hydraulic system is extremely sensitive to contamination and prone to air leaks if treated roughly. The procedure for bleeding air out of the system is a specialist operation. When unskilled personnel have attempted to make adjustments in the field the result has been to make the tool

completely unserviceable. Used with care the hydraulic wedge is an excellent heavy-duty felling aid, but potential users must understand the ease with which it can be seriously damaged.

5. The Nordfeller felling cushion

The felling cushion was developed in Sweden and utilises the power of the chainsaw to inflate a bag which is inserted into the felling cut, substituting engine power for muscle in the take-down of trees.

At present the Husqvarna 444 and 162 and the Jonsereds 451 and 452 models may be fitted with felling cushions. Normally cushion attachments are only supplied with new saws but in some instances it is possible to obtain conversion kits for older saws.

The felling cushion consists of a rubber bag encased in a strong cover of woven glass-fibre with a reinforcing frame of spring steel wire to provide rigidity. When in use a pipe leading into the cushion is connected by a quick release coupling to a valve block bolted to the starter housing of the chainsaw. The valve block controls gas pressure piped from a non-return valve in the cylinder head. The cushion is inflated by the manual depression of a spring-loaded control knob whilst the throttle is open. When the knob is released it returns to a neutral position which holds the pressure even when the saw engine is stopped. After the tree has fallen the knob is pulled out to release pressure, the pipe is uncoupled from the valve block and the cushion is returned to a pouch carried on the logger's belt.

At present there are two sizes of felling cushion. The smaller is for use with both lightweight and medium weight chainsaws with engine capacities in the 40–70 cc range,

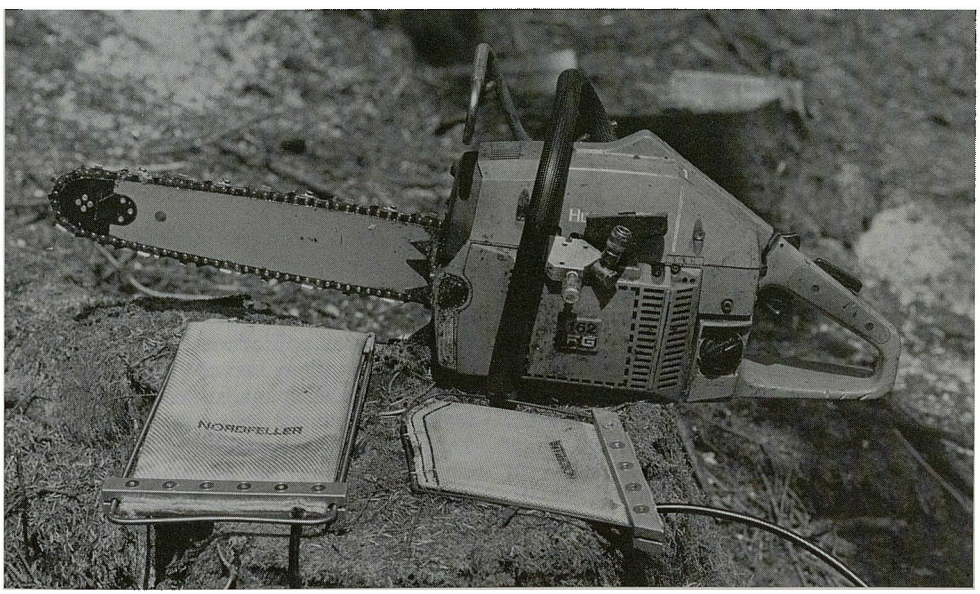


Plate 5. Husqvarna 162FG with large and small felling cushion. (*ED 1204*)

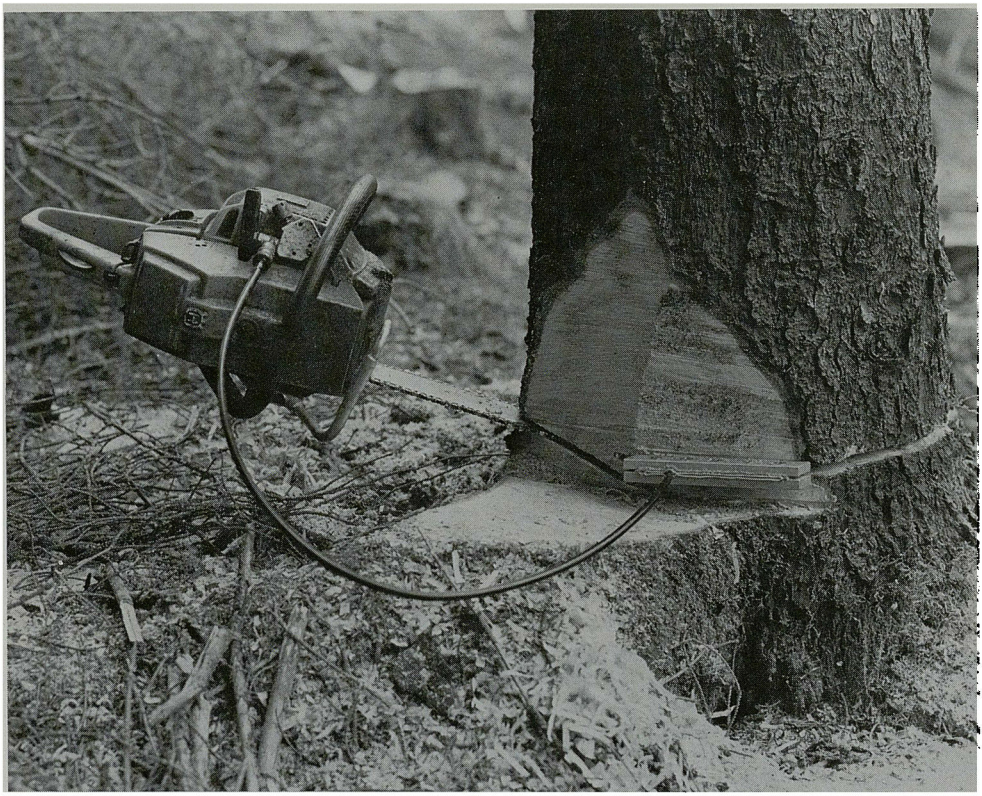


Plate 6. Felling cushion in use – note final diagonal cut. (*ED1205*)

the larger for use with medium weight saws with engine capacities from 60–70 cc only. The lifting force which can be exerted by a cushion is in approximate proportion to the surface area of cushion held in the felling cut. The maximum lifting force obtainable from the small cushion is 3,000 kg and from the larger cushion 8,000 kg. It is not recommended that a large cushion be used with a smaller saw because of the relatively slower speed of inflation.

The point at which the small cushion becomes inadequate and the larger size is required depends on a number of factors of which tree volume is the only one easily quantified. The lean of a tree, the weight and distribution of its crown, and the direction of felling, all play their part. The largest trees felled during studies have been 2.5 m^3 using the small cushion and 5.5 m^3 using the large cushion. As an approximate guide, the small felling cushion may be used with a very high degree of success in open thinning and in clear felling of up to 0.8 m^3 *average* tree volume. This size of crop is within the capabilities of chainsaws such as the Jonsereds 451 and the Husqvarna 444 both fitted with 13″ guide bars. If the Husqvarna 162 or other saw of suitable engine capacity is used with the larger felling cushion then the small one should be supplied as well. The two cushions overlap in the range of individual tree size from approximately 0.7

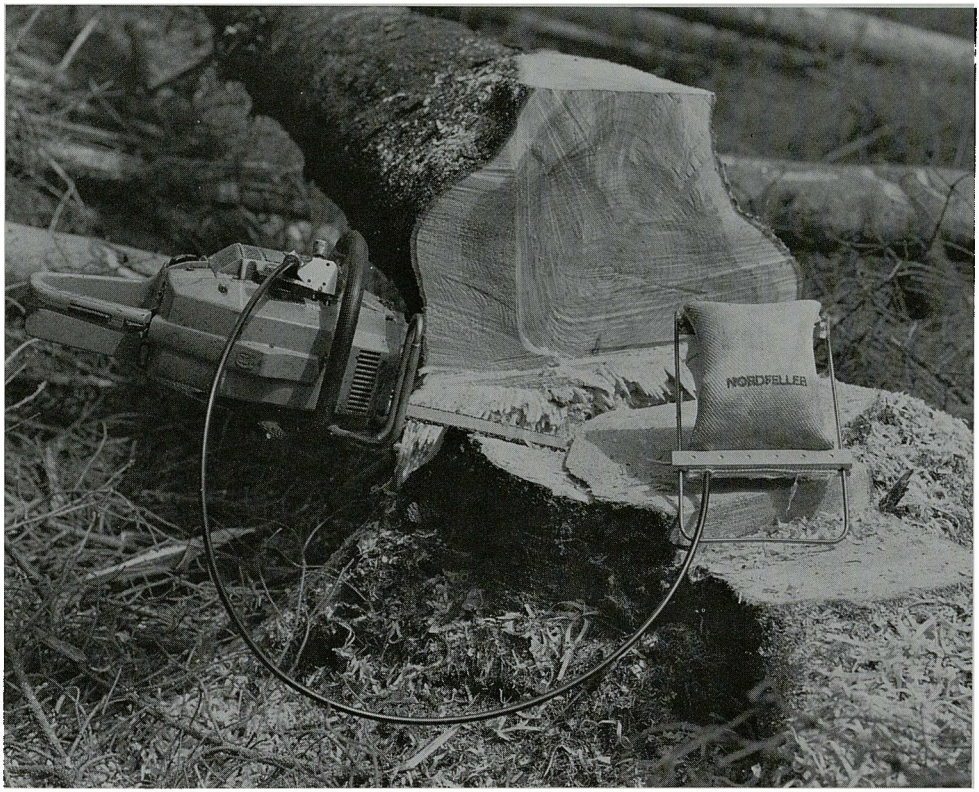


Plate 7. The stump after felling showing inflated cushion. (*ED 1206*)

$m^3 - 1.5\ m^3$ and the smaller size is simply more convenient for the smaller trees. As yet there is no belt carried pouch for the large cushion.

The felling cushion is one of the more sophisticated aid tools. There is no proper substitute for instruction in the correct working method by an expert, prior to using it for the first time. Anyone intending to use this tool should take full advantage of any instruction offered by the manufacturer or suitable training organisation. Also important in this respect is the need to fully understand and to follow the recommended maintenance procedures if unnecessay breakdowns are to be avoided. The correct working technique with felling cushions is shown in Appendix II.

6. Turning devices

Turning devices are used mainly for the take-down of hung-up trees. Although the breaking bar/cant hook is the most useful tool for this purpose it does have limited leverage, and other tools must be used when the breaking bar/cant hook is not sufficient for the job. Several such tools are described below.

(i) The turning hook

This is a cant hook attached to a ring through which a pole may be inserted for leverage.

The hook is similar in profile to that used on the breaking bar/cant hook but has the capacity to grip trees of greater diameter. This is

Plate 8. The turning hook. (*ED 1199*)

because of the presence of two joints in the 380 mm long assembly. These joints also allow a good grip to be taken on smaller diameter stems. The inner diameter of the ring through which the pole lever is inserted is 78 mm. The pole used is of slightly less diameter than this at its smaller end and is normally 1·5–2 m in length. If a longer pole is used to provide additional leverage for a badly hung-up tree the pole may be broken where it passes through the ring if too great a force is exerted. Subject only to this limitation the turning hook is a handy and effective tool.

(ii) The Sooline cant hook

A tool which is still occasionally used is the large Sooline cant hook. This tool has a 1.07 m long wooden handle and a steel foot to grip the tree. The rigid hook is 310 mm long and consequently is unsuitable for trees of less than 20 cm in diameter. It weighs 3.06 kg. It is used for the take-down of hung-up trees beyond the capacity of the breaking bar/cant hook. However, because of its weight and bulk, which make it awkward to carry, it is at a great disadvantage when compared with other readily available and equally effective turning aids.

(iii) The Kawi turning strap

This a length of polyester tape, 47 mm in width, with a loop formed at one end. To the

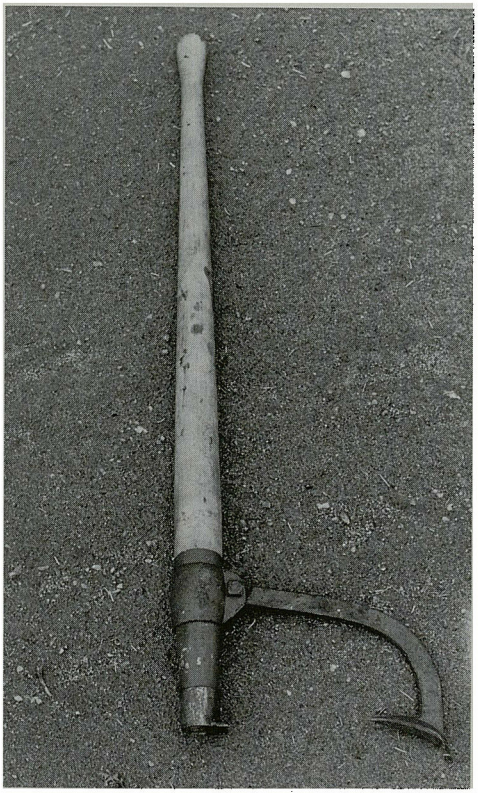


Plate 9. The Sooline cant hook. (*ED 1198*)

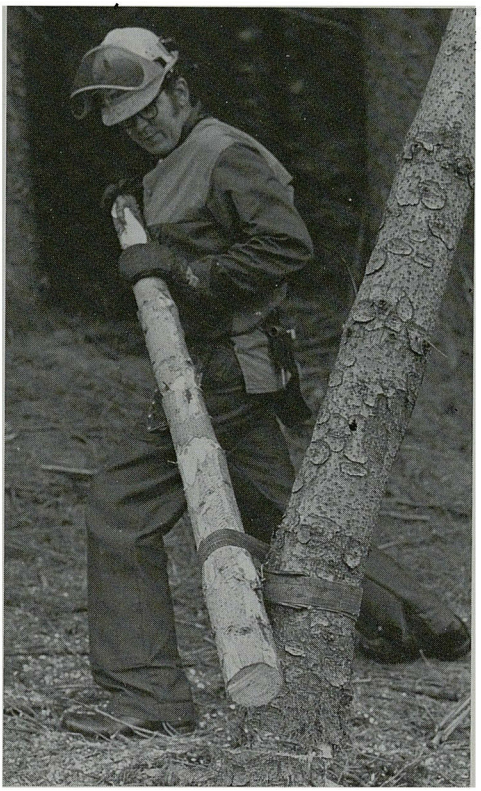


Plate 10. The Kawi turning strap. (*ED 1200*)

other end is fixed a light steel hook carrying two short spikes. With the spikes facing into the bark the strap is laid over the hook and leverage is obtained by using a pole placed through the loop. The entire device is prevented from slipping round the tree by the spikes penetrating the stem and being held very securely in position by the broad tape which lies on top of them. The strap is available in lengths of 1.88 m and 1.10 m both with a 300 mm loop which allows a large pole to be used if necessary. The shorter length should prove adequate for the range of trees normally encountered in thinnings. The strap weighs approximately 0.3 kg and may be carried on the logger's belt or in the drawstring bag in which it is supplied.

The extremely light weight and ease of use of the strap make it a feasible alternative turning aid to the breaking bar/cant hook. In some cases its use will allow the feller to be equipped with a better directional felling aid such as the double lever breaking bar which, as discussed previously, is of limited use in turning hung-up trees. Also it will be a very badly hung-up tree, of any size, that cannot be taken down with the strap. Overall it is the best turning aid and therefore the one recommended for use whenever frequent turning beyond the capacity of the breaking bar/cant hook is required.

The concept of the turning strap is not new.

Versions in steel cable and polypropylene rope have been available for some time. These types are, however, not as effective as the strap because the round section rope tends to slip off the gripping device.

It is possible to turn trees successfully using a simple polypropylene rope loop. Whilst this is not as consistently effective as straps with hooking devices it is preferable to the use of various unsafe practices which are observed on occasions.

7. Aid tools for the take-down of hung-up trees

Before the widespread introduction of systematic thinning, it was common practice in early selective thinnings to take down the tree by pulling the butt. First thinnings of Sitka spruce in particular were unlikely to fall naturally.

(i) Long-handled felling tongs

These were introduced to enable the butt to be pulled in a safe and methodical manner. When trees being pulled down with the tongs became lodged or hung-up the cant hook was used to turn them, either to complete the take-down or as a preliminary to further pulling. The tongs remain the most effective tool for take-down by pulling the butt for trees averaging up to approximately 0.1 m^3 in volume. However, even using long-handled tongs, pulling down any but the smallest trees is an extremely tiring job. It is therefore ergonomically undesirable that men be required to take down more than the occasional tree by this technique. When marking trees for removal in a selective thinning thought must be given to take-down problems which may result from marking decisions. Failure to do so will increase the proportion of butt-first take-downs.

In systematic first thinnings most trees can normally be taken down using the breaking bar/cant hook or other turning aid, and the percentage of trees that need to be pulled by the butt is low. Under these circumstances there is an understandable reluctance on the part of the feller to carry the tongs, which are heavy and awkward. For the occasional butt which does need to be pulled there are several other satisfactory aids used to varying extents.

(ii) The Kawi turning strap

This strap makes an excellent improvised pulling aid. The strap will grip the butt securely, and a breaking bar or short length of wood may be placed through the loop to provide a comfortable handle. Turning cables, rope slings, and even a length of chainsaw starter cord can be used in a similar manner. There is a danger, however, that starter cord or material of similar strength may break if it has been damaged by fraying, and should not therefore be used regularly. Polypropylene rope of 10 mm diameter or greater is a more satisfactory material for the purpose.

Small hand tools used for stacking, such as tongs or pulp hooks, may be used occasionally to pull the butts of very small trees, but care is needed to ensure a good grip and safe positioning of the feet. When using these tools the tree should be pulled in a series of shorter moves than when using long-handled tongs. It must be emphasised that *occasionally* is the key word as far as the use of small hand tools in this way is concerned. Their availablility on site is no substitute for one of the more suitable tools such as tongs, tape or polypropylene rope.

If the tree is too heavy to be pulled, or if it becomes lodged in the canopy after it has been pulled, the feller may use a lever from the side. The action is to lever slightly upwards as well as in the required direction. A small diameter pulp billet 2–3 m long makes a convenient lever.

A more sophisticated method for larger trees which have resisted turning is to bore a groove in the base of the tree into which a smooth pole is inserted. When the remains of the hinge or holding wood is cut away the tree may be easily levered along this improvised rail. This technique is very quick if the feller is skilled in its application, and can save a lot of

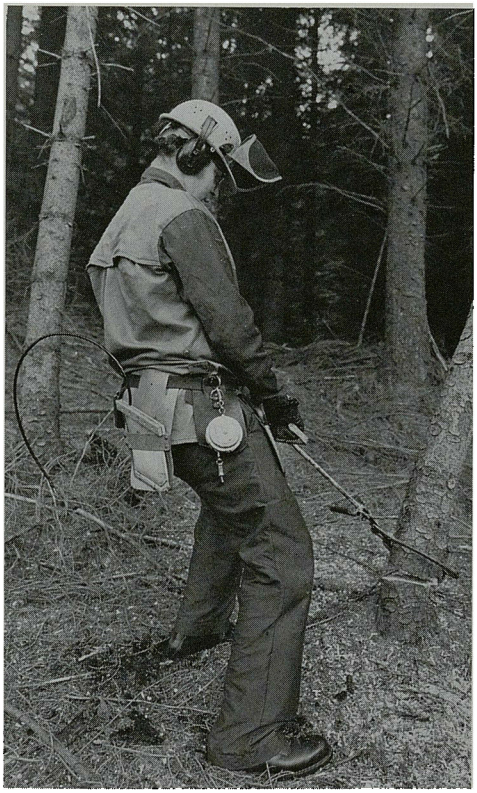


Plate 11. Long handled felling tongs. (*ED 1201*)

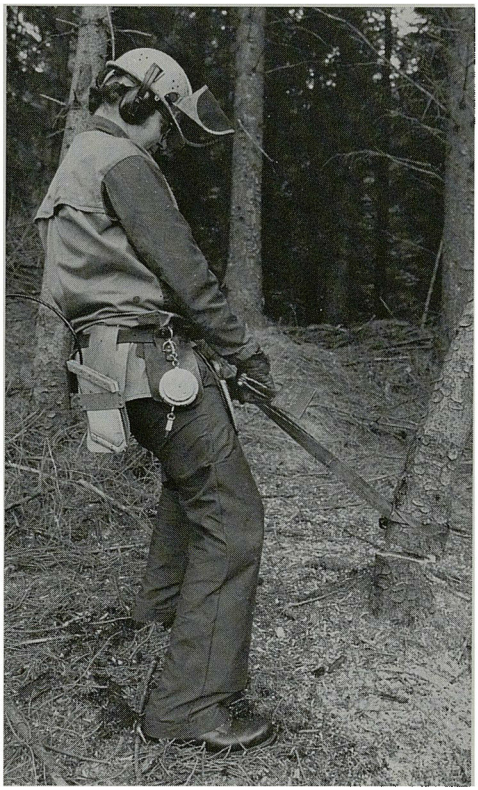


Plate 12. Kawi turning strap used to pull butt. (*ED 1207*)

time and effort if its need is anticipated early in the take-down. No matter what method is used for moving trees by the butt the following points should always be observed:

a. Before movement commences the route should be examined and any obstructions noted to avoid tripping.
b. It should be ensured that the tool has a firm grip on the tree; tongs and hooks should be given a preliminary tug, ropes should be tight.
c. The feet should be carefully positioned so that the butt will not fall onto them as it comes off the stump.
d. Pulling should be done with the back and arms straight and the knees bent in order to use the powerful muscles of the thighs.

8. Hand winches

When all other attempts to take down a hung-up tree have failed, the only other hand aid available is a hand operated winch. In broad terms for take-down work, a winch of at least 500 kg maximum stated pulling capacity is required in situations where the average tree size is less than 0.5 m^3. Where the

average tree size exceeds 0.5 m^3 a winch with a maximum stated pulling capacity of at least 1,000 kg is required.

Safety considerations

Statutory safety regulations relating to rope strength apply to lifting where there must be a safety factor of at least 5:1. For pulling, a safety factor of at least 3:1 is generally quoted.

Most hand winches incorporate an overload protection system which generally takes the form of sheer pins or a bending handle. The loading at which the system fails is the actual maximum possible pull. Although the relationship between actual maximum and stated maximum varies from winch to winch the actual is always greater than the stated, and within the safety factor of the rope. For this reason it is essential that only the correct handle and/or sheer pins are used, together with the types of rope recommended by the winch manufacturers.

Winch accessories such as strops, extra rope, shackles, hooks, pulleys, etc., must all be of adequate capacity for the winch concerned, and together with the winch itself should be subjected to regular inspection and maintenance.

Although not directly concerned with takedown, it should be noted that under no circumstances should a winch of less than 1,000 kg stated pulling capacity be used for holding back root plates of windthrown trees.

Winch types

Hand winches fall into two main categories:

a. *Continuous feed winches* where the rope is continuously fed through the body of the winch by the action of the handle. There is no restriction on the length of rope which can be winched in. Control of the operation is very precise and the mechanics of applying and releasing tension are simple.
b. *Drum type winches* which operate on a ratchet and pawl system and hence are less precise in operation than continuous feed winches. The rope is wound on to a drum as the machine is operated, and the reach can be extended by the use of additional ropes. However, the length of rope which can be winched in is governed by the capacity of the drum. A drum winch with its rope forms a compact unit which is generally lighter than a continuous feed winch of equal pulling capacity.

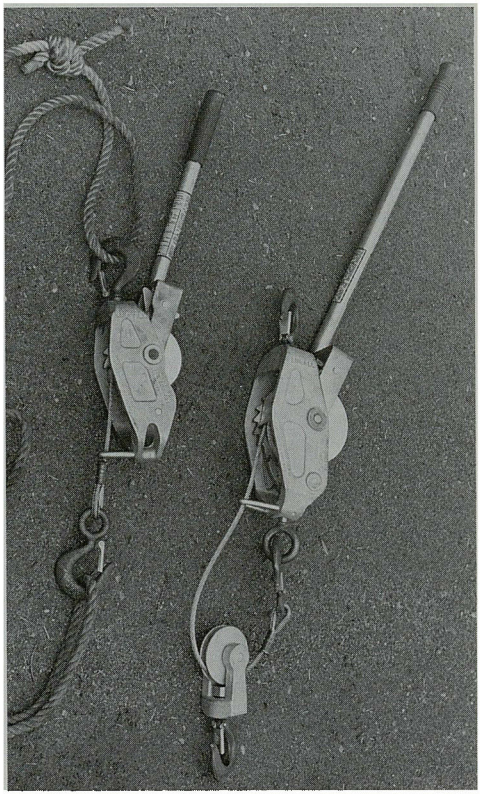


Plate 13.
Left: Lugall 5CL.
Right: Lugall 25 CL – double rigged.
(*ED 1202*)

In a forest situation, weight and compactness are important factors as far as the operator is concerned, thus giving drum winches a distinct advantage over their continuous feed counterparts.

Following extensive field trials of a number of winches available in the United Kingdom,

two Lugall drum winches proved satisfactory and are recommended for use:

(i) **The Lugall 5CL** is a lightweight drum winch with a maximum stated pulling capacity of 500 kg. It is fitted with a bending safety handle which fails at approximately 750 kg. At a weight of 3.3 kg, complete with 4.9 m of aircraft section steel rope, the 5CL is approximately 1 kg lighter than equivalent continuous feed winches.

A disadvantage of the Lugall 5CL, as with all drum winches, is the restriction on rope length. The reach can be extended by the use of additional rope, but extension ropes must be at least equal in strength to the main rope.

(ii) **The Lugall 25CL** is a high capacity drum winch with a stated maximum pull of 1,000 kg. It is fitted with a bending safety handle which fails at approximately 1,500 kg. With a weight of 7 kg, complete with 6.7 m of aircraft section steel rope, the 25CL is 4–5 kg lighter than equivalent continuous feed winches.

By means of a pulley and hook arrangement which can be attached to the frame of the winch there is a facility for double rigging. Although this will double the pulling capacity of the 25CL it effectively halves the length of the rope. Double rigged the Lugall 25CL should prove capable of dealing with most forest take-down situations.

9. Timber handling aid tools

Timber handling aids, when used correctly, can be of great benefit to all fellers. Properly maintained these tools will in most cases provide a more secure grip than gloved hands. This is particularly true in wet conditions which so often prevail, where the use of handling aids will also help to keep chainsaw gloves dry. Handling aids, whilst of benefit in any felling system, are essential for manual shortwood working.

Training in the use of timber handling tools is essential if the greatest benefit is to be obtained from them, and if they are to be used safely. Most possess sharp points for gripping the timber, and injuries will occur if the correct techniques are not used. With some, pulp hooks are a notable example, full working dexterity may come only after several days practice. Thus prospective users should not be discouraged if they appear awkward to handle at first.

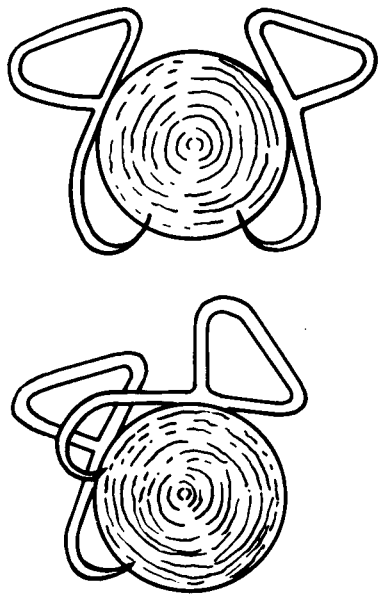


Figure 2. The use of pulp hooks for dragging/lifting and turning.

(i) Pulp hooks

As an aid to handling timber, pulp hooks are most effective when used as a pair. When pivoting, dragging or lifting logs they exert a firm and positive grip when applied in opposition, as shown in Figure 2.

When turning or rolling logs the hooks allow constant control to be maintained if their positions are staggered. Only one hook is re-positioned at a time but the turning force is applied to both simultaneously. In bench

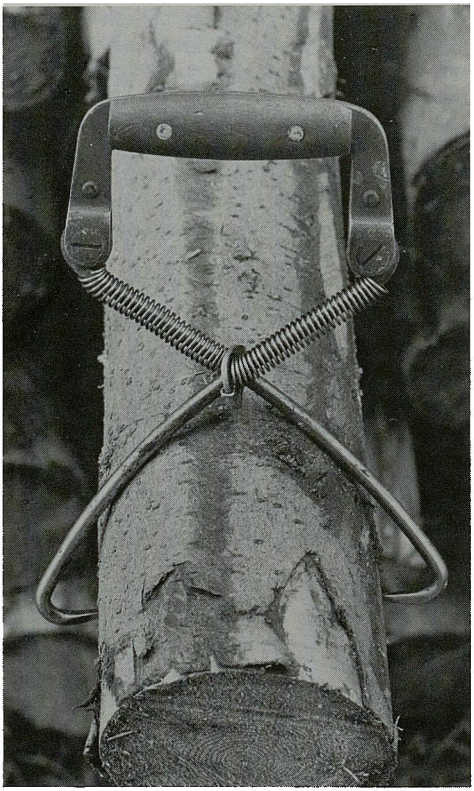


Plate 14. Spring loaded hand tongs. (*ED 1194*)

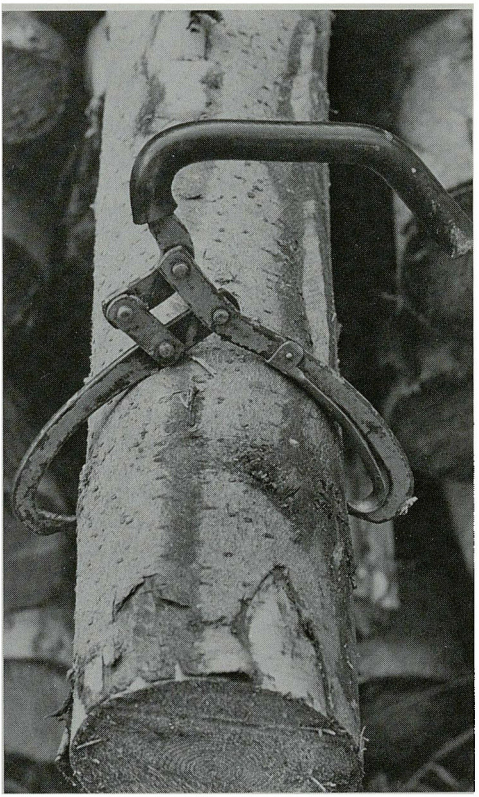


Plate 15. EIA rolling tongs. (*ED 1195*)

felling systems, where pivoting and rolling are the normal methods of timber movement, two pulp hooks are by far the most effective aids. When logs have to be dragged or lifted the use of two pulp hooks enables a worker to adopt a natural position with his arms spaced comfortably apart.

(ii) Spring loaded hand tongs

These have been the most common timber handling aid in Britain to date. They are used principally for stacking pulpwood, not only in shortwood operations but also during crosscutting and manual stacking at roadside. They are satisfactory for dragging and lifting pulp billets. However, use of one pair of tongs alone, held in one hand, for dragging or lifting larger material should be avoided, owing to the bad posture and consequent strain on the spine which such use encourages.

(iii) Other hand tongs

A wide variety of pulpwood tongs is available most of which operate through a parallel linkage. An example is the **EIA rolling tongs** weighing 450 grammes, which has been found satisfactory for a range of shortwood operations and for stacking at roadside. The name of rolling tongs is given to this tool because of a modification, the extra hand grip, which allows the tongs to be used as a pulp hook. This feature allows the tongs to be used for

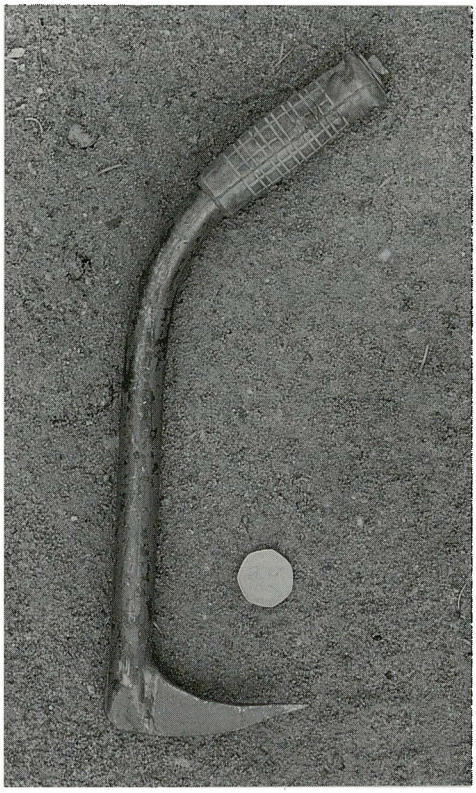


Plate 16. Picaroon. (*ED 1196*)

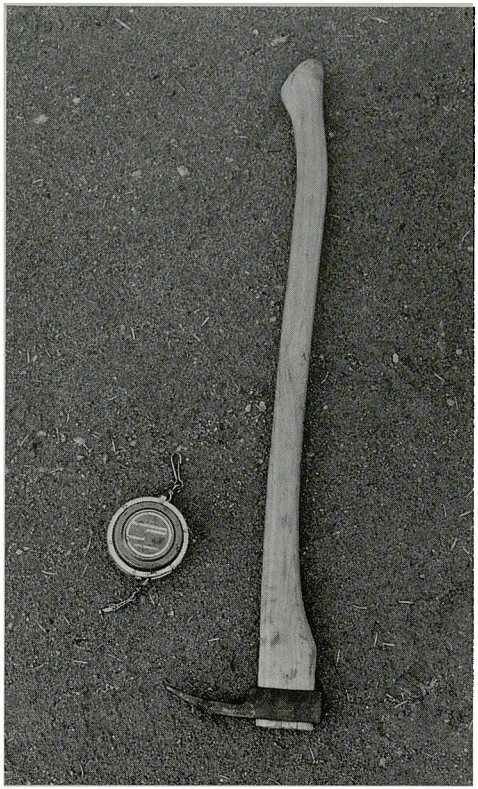


Plate 17. Hammer type pulp hook. (*ED 1197*)

turning and rolling logs. It is a very versatile tool suitable for shortwood working if individual fellers have a strong preference for tongs rather than pulp hooks. They may of course be used as one half of a "pair" in conjunction with a Fiskars 19000 pulp hook.

(iv) Other timber handling aid tools

All aids described so far in this publication have been those normally used at or near the felling site. However, there are two tools worthy of mention, use of which is largely confined to roadside conversion and stacking sites. They are the **picaroon** and the **hammer type pulp hook.** The former is of assistance in dragging long pulp billets and short sawlogs. The latter is suitable for stacking short pulpwood when typically two men, each with a hammer type hook, do this job. Both are tools which have proved their worth over many years.

10. Acknowledgements

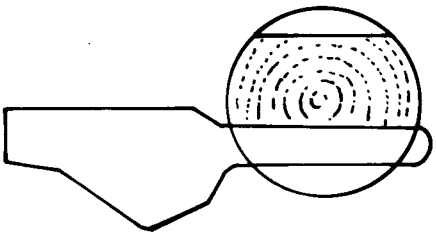
The Work Study Branch of the Forestry Commission acknowledges with gratitude the assistance given by the tool manufacturers and suppliers in supplying the tools, and the numerous foresters and staff in the Conservancies for providing facilities for the trials.

APPENDIX I: WORKING METHODS WITH BREAKING BARS

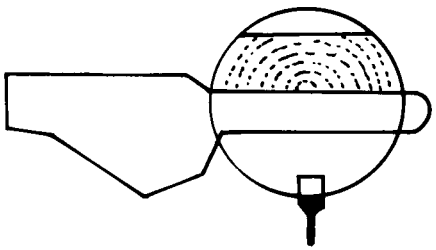
A. Conventional breaking bars

Method I:

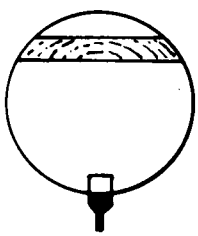
1. Lay in.
2. Commence main cut.



3. Insert breaking bar behind guide bar.

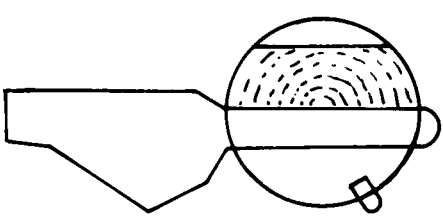


4. Complete main cut leaving an adequate hinge.
5. Lever over the tree using the breaking bar.

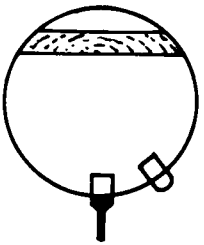


Method II:

1. Lay in.
2. Commence main cut.
3. Insert small felling wedge instead of breaking bar.



4. Complete main cut leaving adequate hinge.



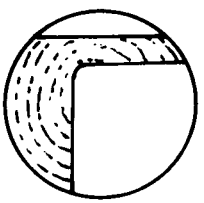
Either

5. Insert breaking bar adjacent to the wedge and opposite to the desired line of fall.
6. Lever over the tree using the breaking bar.

or

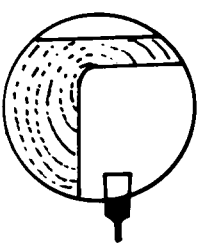
7. Drive in the wedge using the breaking bar as a hammer.
8. Lever with breaking bar if required in addition to driving in the wedge.

Method III:
Trees too small to insert breaking bar or wedge whilst the guide bar is in the cut.

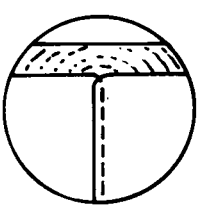


1. Lay in.
2. Saw away two-thirds of the main cut.

3. Remove the saw and insert the breaking bar.



4. Complete the main cut at an angle so that the guide bar tip passes beneath the first stage of the main cut, leaving an adequate hinge.
5. Lever over with the breaking bar in the usual way.



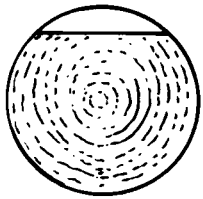
B. Husqvarna double lever breaking bar

Methods I or III above.

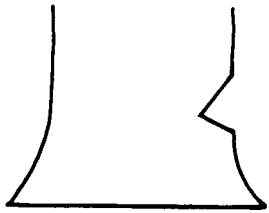
APPENDIX II: WORKING METHODS WITH FELLING CUSHION

Nordfeller felling cushion

1. Lay in the usual way.

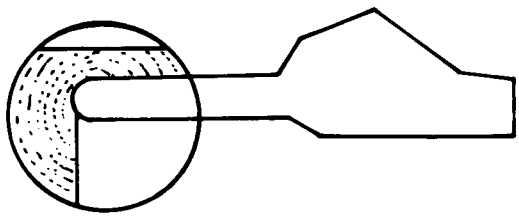


2. Ensure that the top and bottom cuts meet.

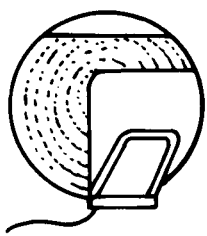


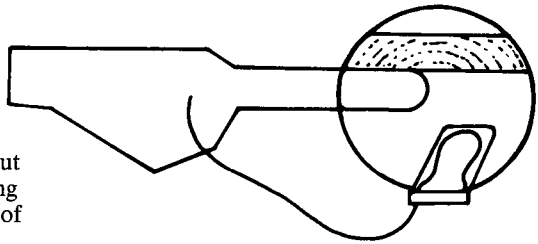
The felling cut is made in two stages

3. Saw away two-thirds of the main cut and remove the saw.

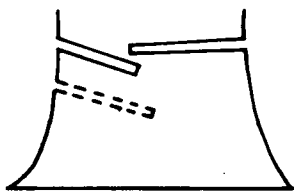


4. Leave a slightly thicker hinge than normal. Clear chips from the cut with pulling chain.
5. Insert the felling cushion in the cut with the pipe nearest the uncut wood. Connect the pipe to the valve block on the saw.
6. Open the throttle and depress the control knob briefly. (This initial pressure in the cushion prevents the tree from leaning back when cutting is continued).





7. Complete the second stage of the main cut diagonally, at the same time fully inflating the cushion during the last 5–10 seconds of cutting. (Do not cut through the hinge).



8. If the cushion is not fully inflated when the hinge is reached a second diagonal cut may be made (dotted line). (Full pressure is reached only when cutting).

9. Move diagonally backwards away from the falling tree taking the saw and attached cushion.
10. Using the right hand deflate, uncouple, and stow away the cushion.

Deflation may be carried out as the operator moves away but *moving away from the falling tree must be the first consideration.*

The cushion should be deflated to release the pressure before the pipe is uncoupled.

APPENDIX III: WORKING METHODS WITH DRUM TYPE HAND WINCHES

N.B. The different methods described are necessary because of the danger of a lodged tree skidding downhill out of control as take-down is achieved on a steep slope. This danger obviously depends on factors other than just the angle of the slope (e.g. ground conditions, tree size, etc.). The figure of 35 per cent is therefore given as a general guide. The butt of the tree may be either on the stump (with or without the hinge cut) or on the ground.

Method A: Take-down route uphill or on ground with a slope of less than 35 per cent

1. If the butt is still on the stump ensure that the stump cut is level or downward sloping in the direction of take-down.
2. If hinge is uncut, use the tip of the chainsaw bar to cut up to 80 per cent of the hinge on the side liable to pinch. Cut the remainder of the hinge with a series of 'V' cuts from either side.
3. Clear the take-down route of obstructions.
4. Select a suitable anchor tree (or stump) roughly in the take-down line. If a tree is chosen it should be as near as is practical in order to obtain the maximum lift on the lodged tree.
5. Position strop around the anchor. If the anchor is a nearby tree, the strop should be fitted as high as is practical – again, to obtain maximum lift.
6. Position strop around lodged tree as low as possible, and attach hook on winch rope to thimble eye on strop.
7. Spool off rope from drum, with the release catch held open, as the winch is taken to the anchor.
8. Position hook on winch through thimble eye on strop.
9. Operate winch until tree falls or new anchor is required.

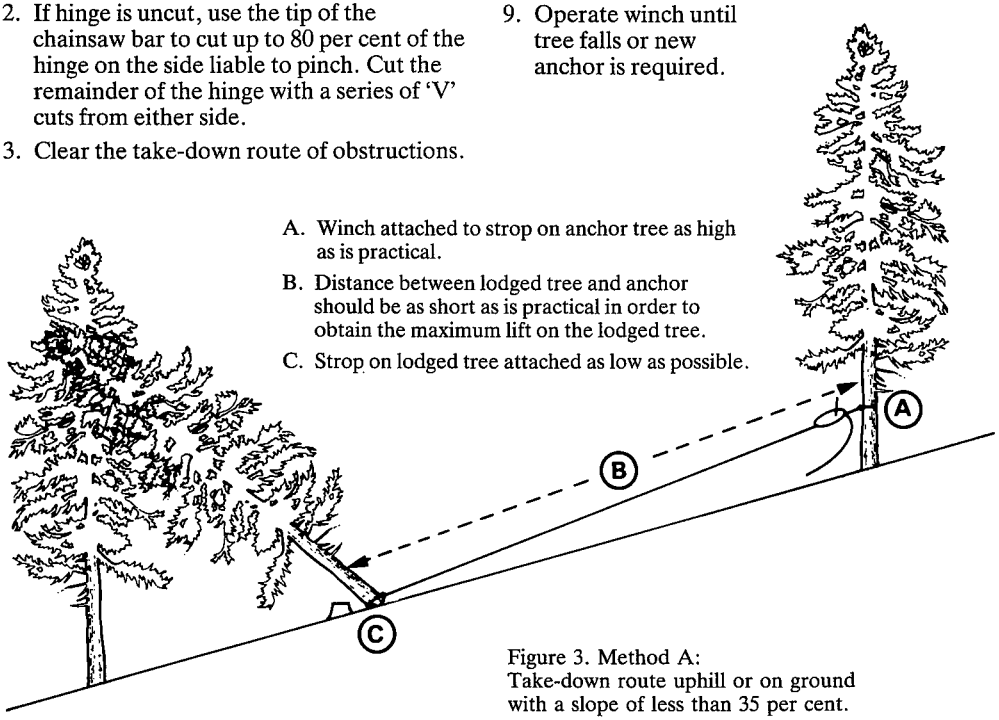


Figure 3. Method A:
Take-down route uphill or on ground with a slope of less than 35 per cent.

Method B: Take-down route downhill on a slope of more than 35 per cent (see *N.B.* p.24)

1. If the butt is still on the stump ensure that the stump cut is level or downward sloping in the direction of take-down.
2. If hinge is uncut, use the tip of the chainsaw bar to cut up to 80 per cent of the hinge on the side liable to pinch. Cut the remainder of the hinge with a series of 'V' cuts from either side.
3. Clear the take-down route of obstructions.
4. Select two suitable anchors, the first roughly in the take-down line and the second to the side well outside the take-down line. The first anchor should be far enough from the lodged tree so as to allow take-down to be achieved without need to rehitch (this could be a hazardous operation on a steep slope). This may mean an additional rope is required which should be of sufficient length to pass from the lodged tree to beyond the snatch block on the first anchor (additional rope, hooks, etc., to be of suitable strength).
5. Position strop around the first anchor and attach snatch block by a shackle through the thimble eye of the strop (both snatch block and shackle to be of suitable strength).
6. Position strop around butt of lodged tree as low as possible and attach hook on winch rope (or additional rope) to thimble eye on strop.)
7. Spool off rope from drum with the release catch held open, and feed rope over snatch block pulley as the winch is taken to the second anchor. Where an additional rope is necessary feed this over snatch block pulley, attach to hook on winch rope, and spool off as before to second anchor.
8. Position hook on winch through thimble eye on strop.
9. Operate winch until tree falls or new anchor(s) is required.

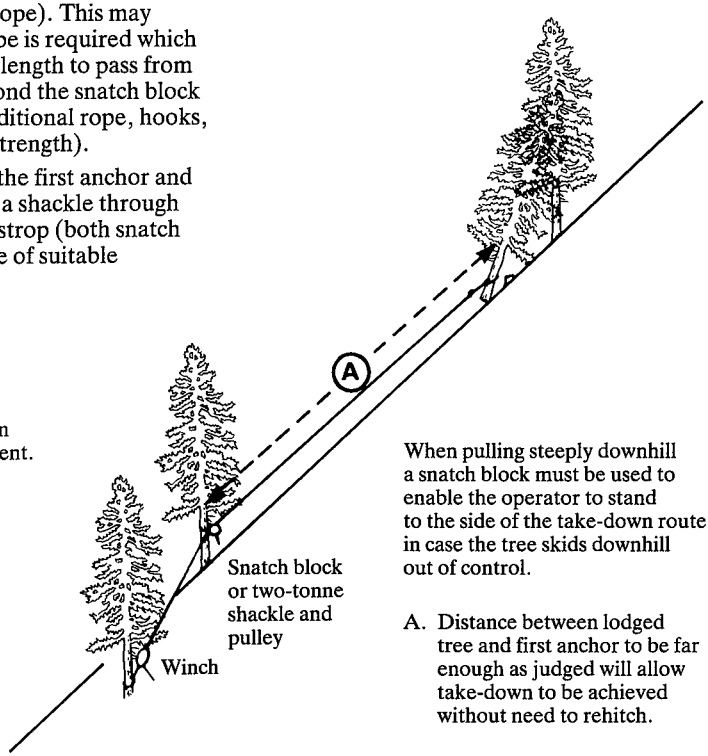


Figure 4. Method B: Take-down route downhill on a slope of more than 35 per cent.

When pulling steeply downhill a snatch block must be used to enable the operator to stand to the side of the take-down route in case the tree skids downhill out of control.

A. Distance between lodged tree and first anchor to be far enough as judged will allow take-down to be achieved without need to rehitch.

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