# Automating Primal Cutting of Lamb Carcasses

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## Introduction

Further processing of carcasses implies their reduction to cuts required either by the wholesale or the retail customer. The first stage of reduction is to a primal cut, a bulk component enabling better handling during further reduction or easier packaging where this is desired. Each carcass is unique in size and shape, presenting problems if the production of primal cuts is to be automated. A major problem is locating the carcass so that a machine can act to position saws and perform each cut quickly and reliably. At the same time the machine must maintain clearance between the cutting blades and the support mechanism for a specified range of meat cuts, which may include various trimming operations.

The cutting specification for this project was set by the New Zealand Meat Producers Board specification for lamb cuts and through consultation with industry. Allowance has been made for the machine to eventually perform the full range of cutting paths needed for a variety of primal cuts. Present indications are that a reduced range will suffice. The development to date is able to align, capture and perform up to three cross cuts (barrel cuts) on each carcass presented for processing. The cuts are made simultaneously by band saws automatically positioned to laser stripes set at the cut positions by the operator during the carcass loading procedure.

## Machine operation

The base machine at present consists of a carcass loading cradle, a carcass gripper system on a feed table and a set of saw blades, one fixed and two able to be positioned according to laser stripe markers set by the operator. The design anticipates the need to split individual barrel cuts (including splitting the legs), remove flaps to the 35 mm specification and square cut the shoulders if necessary.

The sequence of operation is as follows (see Figures 1 & 2).

A carcass is placed on the rails of the loading cradle and so that its crotch is up against the crotch pole. The operator sets each of the three laser stripes to the required cut positions on the carcass by independent manual action (other cut positioning sequences are possible). The operator commits the carcass to cutting, at which point all remaining operations become automatic. A shoulder clamp moves into position (on the shoulder/rack cut line) and clamps at this position. The cradle (with carcass) moves to position the leg/loin cutting path and the saws begin to move into position as the cradle with the clamped carcass moves into the machine proper. The gripper system then expands in a proportional manner until it fits the carcass size, the grippers move forward by air cylinder action, and the suction cups at each station (i.e. at the centre of each resulting primal cut) latch onto the carcass, swivelling to accommodate any surface irregularities. The cylinder rods and suction cup swivels of each gripper are then locked so that the carcass is held firmly in position while extra carcass supports under each cup station and a shoulder support mechanism move into place and lock (not shown in the figures). These extra supports bridge the centre line of the carcass to take pressure off the suction cups, so maintaining the positional integrity of each cut until it is handed over to subsequent processing.

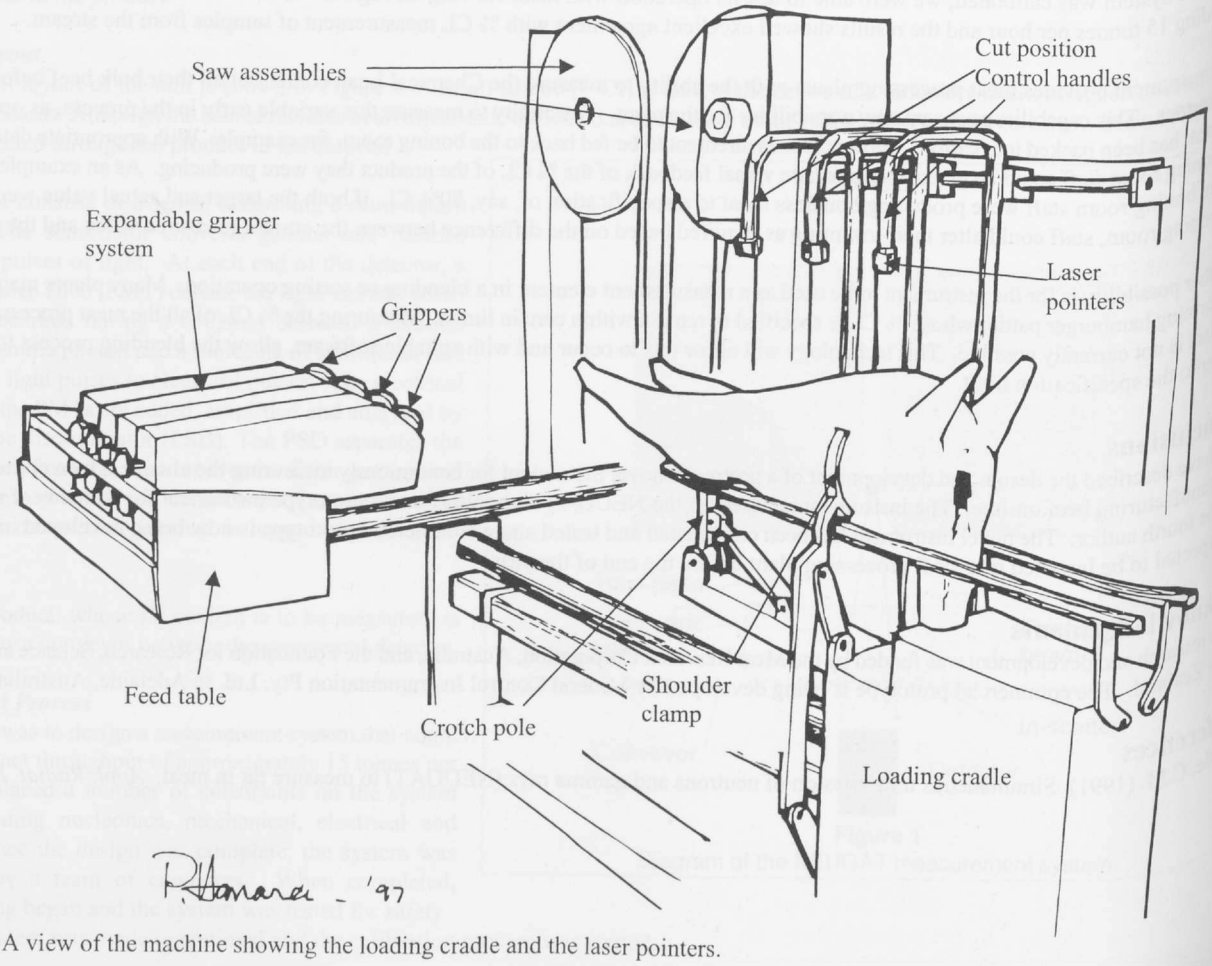


Figure 1. A view of the machine showing the loading cradle and the laser pointers.

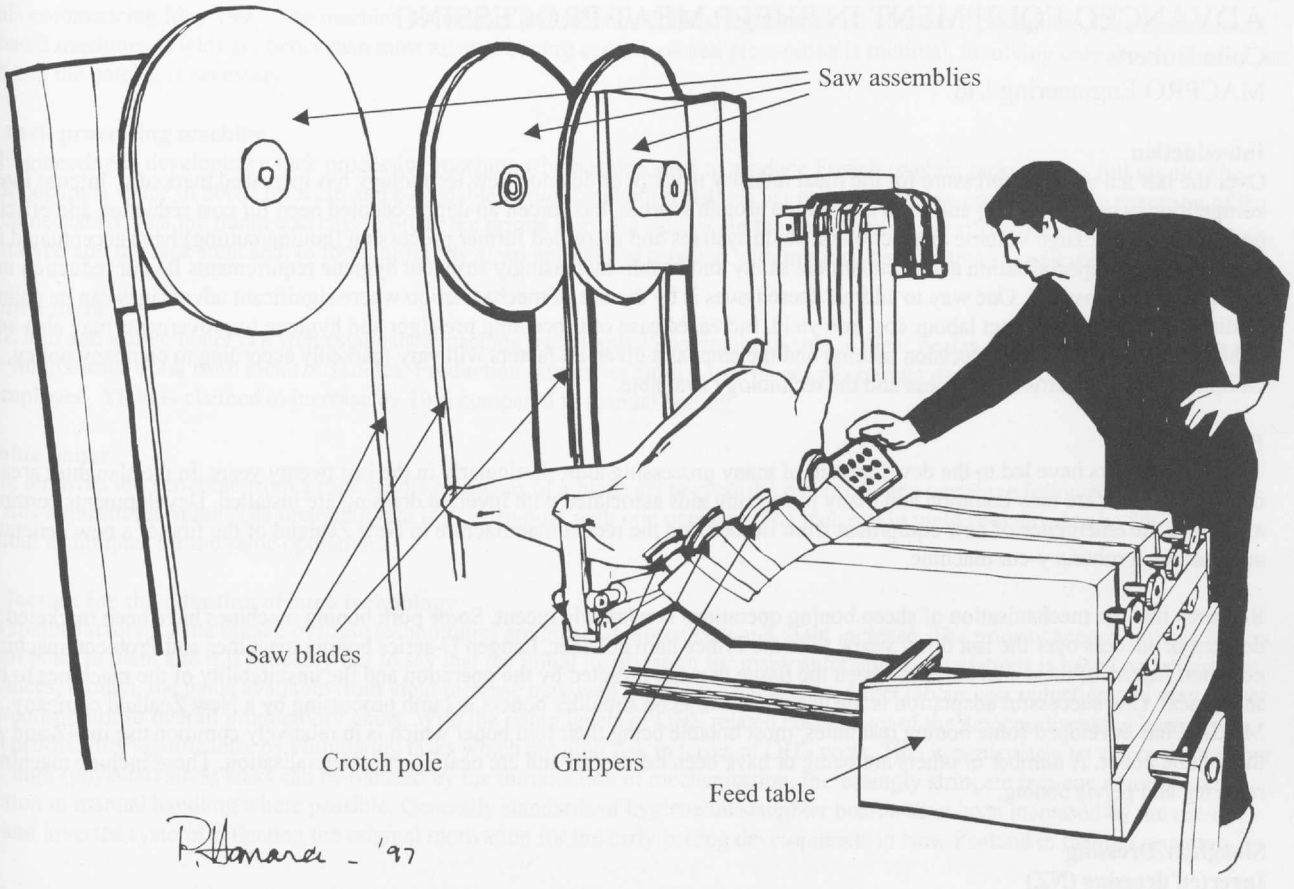


Figure 2. A view of the machine showing the grippers in place with the carcass ready for cutting.

If carcass splitting is required on the machine, then another set of suction grippers will latch onto the carcass from the other side and the supports will withdraw leaving the centre line exposed for the splitting blade traverse.

Once the gripper system has attached to the carcass, the shoulder clamp and crotch pole are lowered to completely release the carcass to the control of the grippers and supports before the cradle moves out of the machine in preparation for carcass cutting. The cradle is immediately made ready for the next loading operation. The feed table moves forward through the band saw blades to complete the cutting operation. Removing the vacuum from any or all of the suction cups will release the sawn meat cuts as required.

Provision has been allowed on the machine for extra modules, which would split selected meat cuts, remove flaps and square cut the shoulders if these operations are part of a cutting specification.

**Discussion**

This project is designed to allow fully automated cutting of lamb primals, should this be required. After the mechanics of the splitting, flap cutting and square cutting modules have been added to the machine, the major challenge remaining will be to automatically position the cuts according to measurements made from each carcass.

**Conclusions**

The development to date demonstrates that it is possible to adjust a suitable gripper system to the varying size and shape of individual carcasses so that carcasses and their components can be held in a known position throughout processing.

**Acknowledgements**

This project is being funded by the New Zealand Meat Research and Development Council.

The authors wish to acknowledge the contributions of colleagues at the Meat Industry Research Institute of New Zealand for their valuable input into this development.

**Intellectual property**

Encompassed within this project is intellectual property protected by New Zealand and International patents.