

# MHLUME ROTA-TIPPER CANE OFF-LOADING SYSTEM

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## Abstract

Chopper harvested cane was first introduced at Mhlume in 1976. The Cameco Port-A-Box System was recommended because the off-loading equipment could be installed outside the existing gantry storage area. The system was designed for direct off-loading at the mill using 10-ton in-field tractor-trailer units only. During 1979, the increase in chopper harvesting operations necessitated the expansion of the off-loading facilities. Limitations of the existing system led to the development of the more compact Rota-Tipper which was installed in 1979 and has operated successfully for the past four seasons.

## Introduction

The Cameco Port-A-Box System operated as follows (refer to Figure 1), when the tractor-trailer unit was located by the road bumps:

1. Lifters — Lift bin off trailer.

- 2. Pusher — Pushes bin on to off-loading conveyor, hold bin while lifters retract, retract pusher, tractor-trailer unit can now move and re-position at (6).
- 3. Off-loading Conveyor — Motorised rollers transfer bin on to motorised dumping conveyor (4).
- 4. Dumping Conveyor — Centralises bin in dumper.
- 5. Dumper — Lifts bin and discharges contents into conveyor or table. Returns bin to conveyor.
- 6. On-Loading Conveyor — Motorised rollers receive empty bins from dumping conveyor.
- 7. Lifters — Raise bin off on-loading conveyor.
- 8. Pusher — Pushes bin on to trailer and holds while lifter retract — retract pusher.

The tractor-trailer unit can now return to the fields. The turn-around time for one bin (10 tons) was approximately 6 minutes.

All of the above motions were carried out individually by an operator from a control tower.

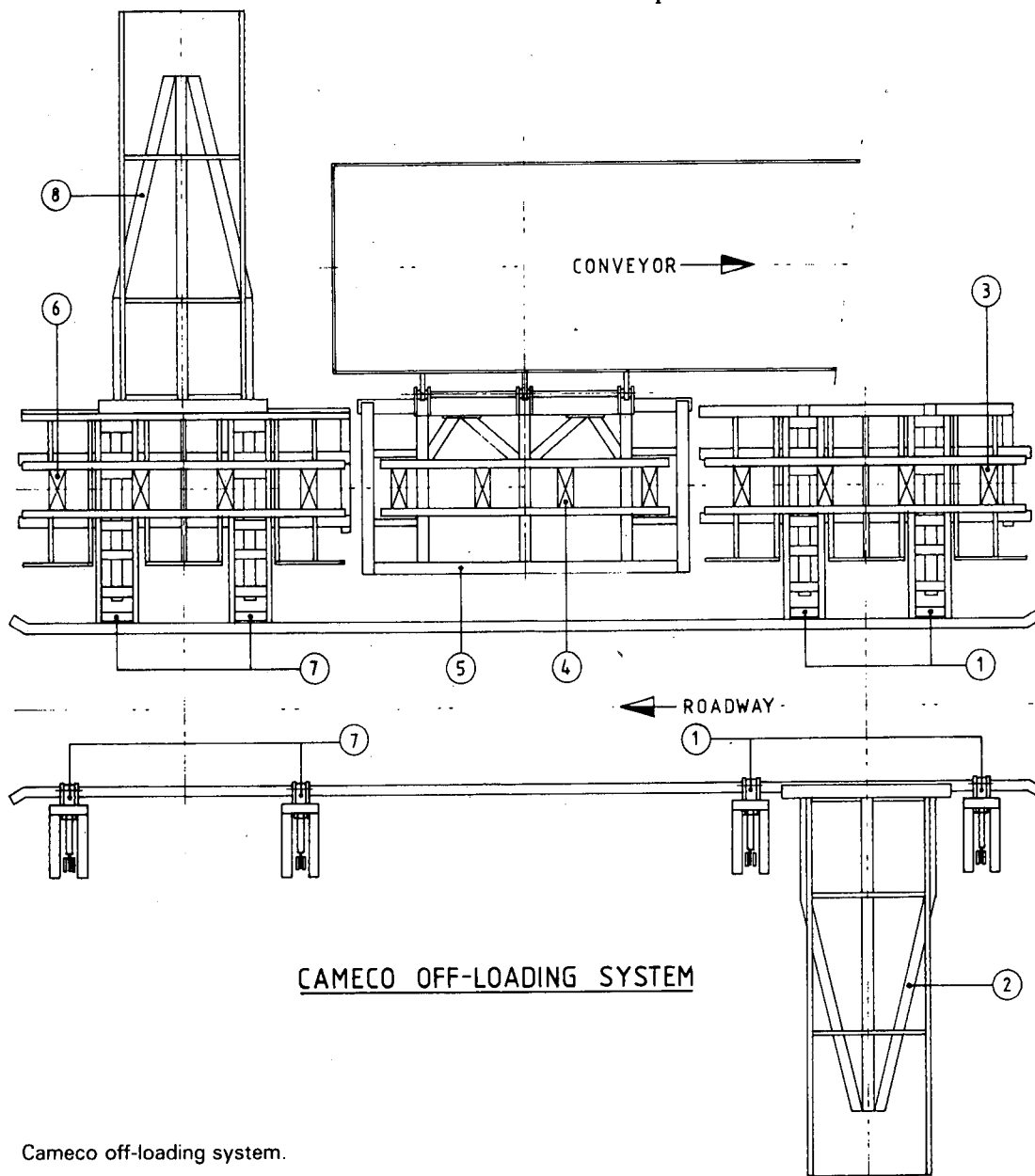


FIGURE 1 Cameco off-loading system.

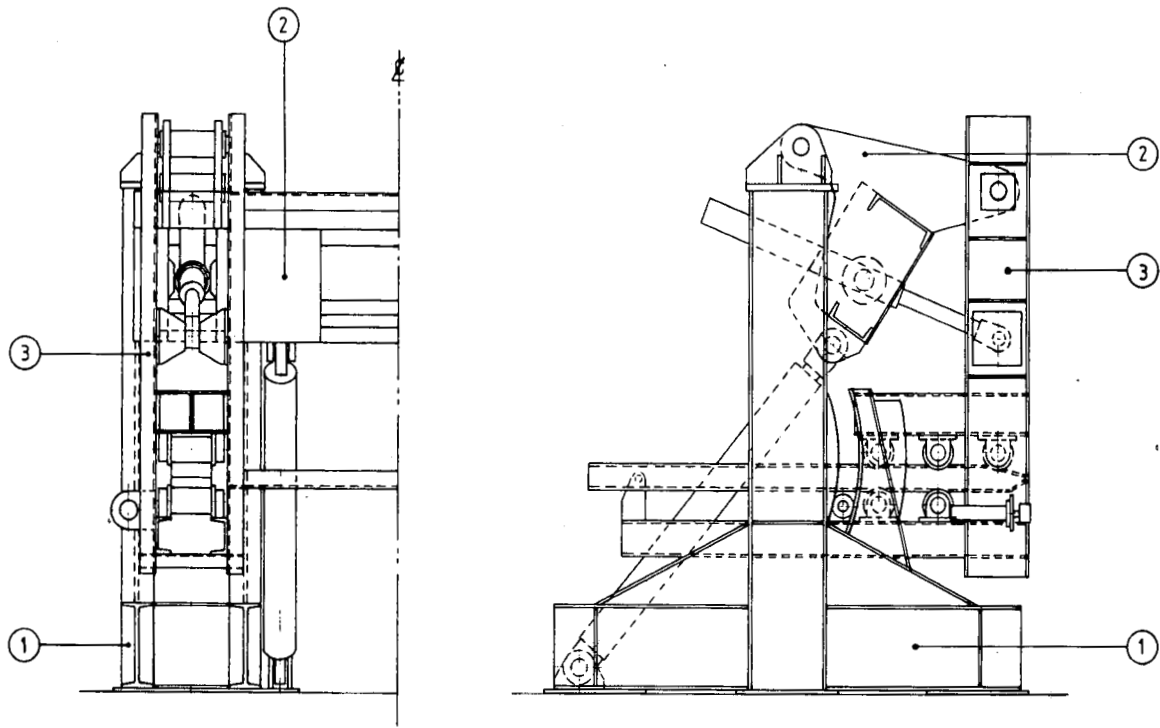


FIGURE 2 Mhlume Rota-Tipper — Front and side elevations.

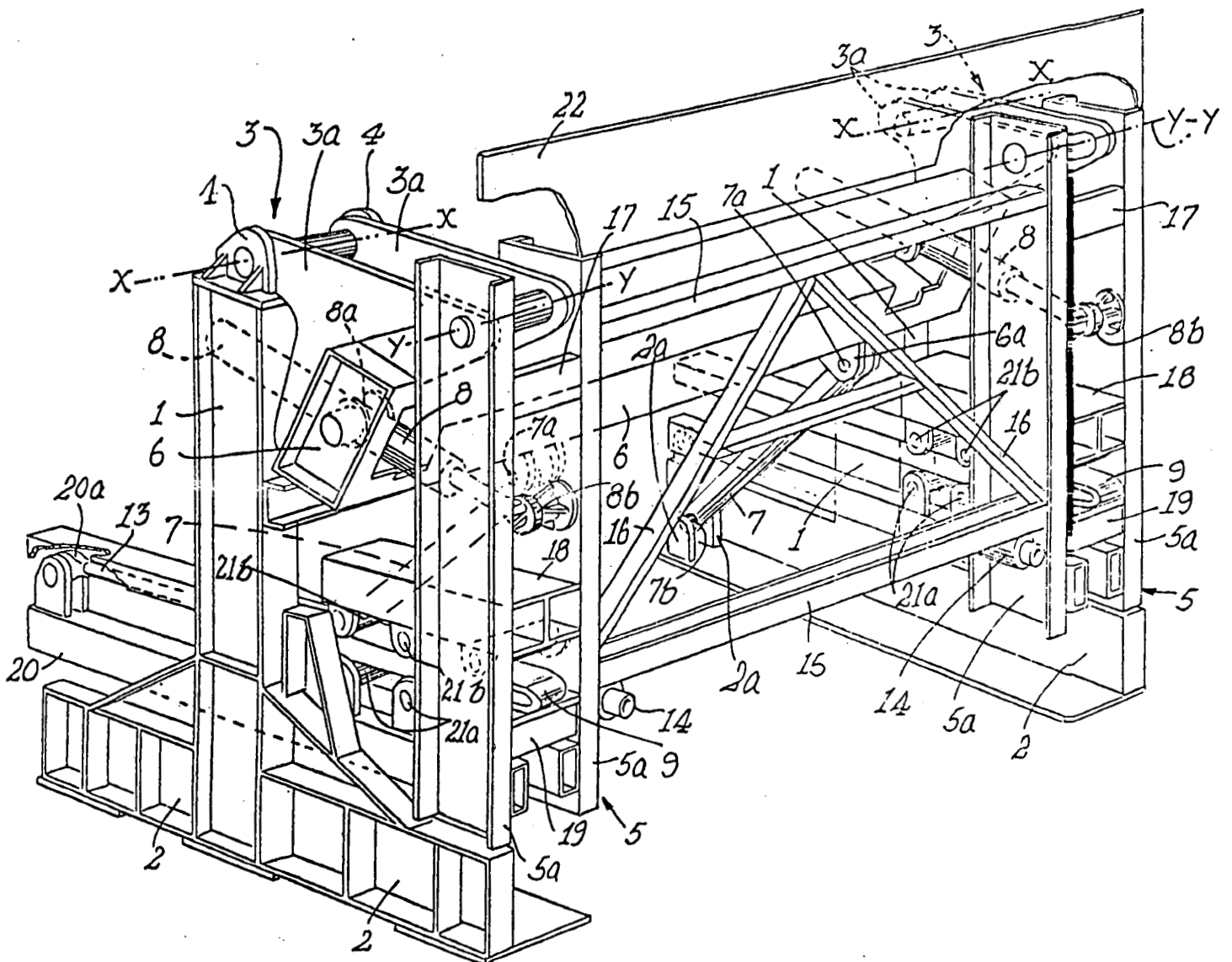


FIGURE 3 Diagrammatic arrangement of Rota-Tipper.

The need for a second off-loading station arose during Mhlume's Mill Expansion due to be completed in 1979. The increased capacity would be taken up with increased chopped cane operations.

The envisaged machine would have the following capabilities:

- (1) Be compatible with the existing system, therefore no expense would be necessary for haulage equipment modification.
- (2) Would cater for outgrowers who would prefer different sized containers due to soil compaction etc, and who only wish to handle their own containers.
- (3) Would adjust to off-load any type of vehicle from a low deck in-field unit to a high deck road transporter.
- (4) It could accept Simunye units should the need arise.

To duplicate the existing Cameco System would have meant encroaching upon the gantry-bundled cane storage area; in addition requirements 2 and 3 could not be met by a standard Cameco unit. An investigation was conducted in order to design a machine to meet all of the above requirements and, in addition, be sufficiently compact so as to avoid reducing the existing cane storage area.

From initial sketches, a model was constructed and all operations studied. This proved that the proposed concept was sound and the final design and manufacture were given approval.

### Construction

The unit was designed to lift 20 tons and is very compact. It consists of three main parts. (See Figures 2, 3 and 4).

#### 1. Main support frame (1)

The main support frame is securely bolted to the foundation block and accommodates the main pivot pins at the top, and a bottom clevis for the main lifting cylinders. It also incorporates guide channels which hold the tipping frame vertical during the first stage of operation.

#### 2. Lifting frame (2)

The lifting frame accommodates the secondary tipping cylinders and is so designed that during operation a vertical lift of 700 mm occurs before tipping commences. This action is carried out by the main cylinders.

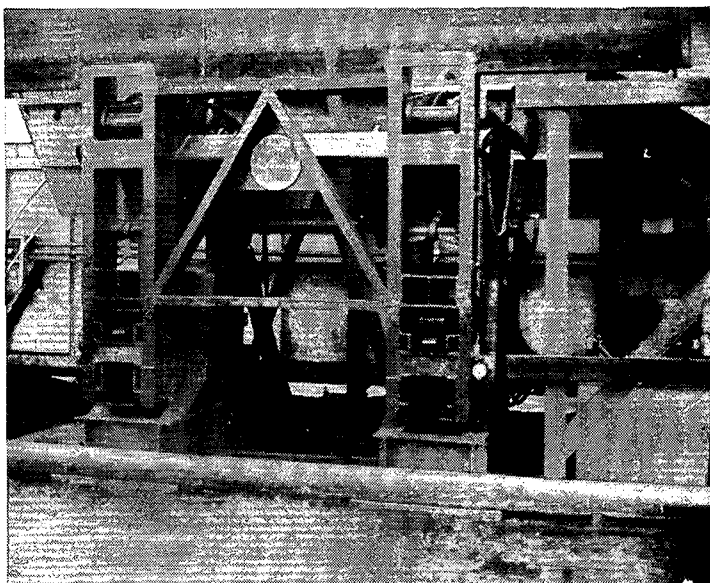


FIGURE 4 Front view of Rota-Tipper

#### 3. Tipping frame (3)

The tipping frame houses two parallel forks which engage the cane bin and are hydraulically operated. Mounted on the frame are two pusher rams of 150 mm stroke which locate the bin on to the trailer on the return cycle. The tipping frame is attached to the lifting frame by two pivot pins.

The machine is operated by a 48,5 kW hydraulic power pack. All control valves are mounted on the oil reservoir and the pumps are internal. Connection is made to the machine by 10 flexible hoses.

### Operation

The control panel was designed by Mhlume staff. It was envisaged that the unit would be operated by the truck driver and was designed as such, but was subsequently rejected by the haulage contractors. An operator now controls the machine.

When the truck is in position, the unit is raised or lowered by the operator to suit the bin slots. The control is switched to auto and the sequence start button depressed. The unit then engages the bin, lifts it vertically off the truck, empties the contents on to the feeder table and returns the bin vertically on to the trailer. The pusher rams locate the bin on the trailer stops and holds it there until the forks have retracted. The unit will then return to rest completing the cycle and an alarm is sounded informing the driver he can move off. The off-loading operation from when the truck is in position until it is ready to leave is completed in 1,5 minutes.

The most important feature of the unit operation is the fact that the bin is lifted vertically off the trailer and returned vertically. On lifting 12 to 13 tons off the trailer the bed height changes due to tyre and springs flexing, therefore the returning bin must be repositioned at a higher level.

### Commissioning

The first Rota-Tipper was installed and commissioned during the 1979 season and only two minor problems were encountered. Apart from these the machine operated so successfully that a second Rota-Tipper was installed in 1980 to replace the Cameco System.

- (1) The initial installation incorporated roadway guides and road bumps to ensure proper location of the bin units. Shortly after it was found that units from different estates varied in wheel base width, length and axle location which therefore made a standard location guide impossible. The outer guide and road bumps were removed leaving only the inner guide to prevent vehicles from hitting the machine. It was found that the drivers soon became competent in locating their trucks without the use of any guide whatsoever.
- (2) Due to the trailer hitch position on the in-field units it was found that the trailer when full rested at a slight angle. When the full bin was lifted from the trailer this angle increased, and on returning the empty bin, difficulty was found on retracting the forks. This was due to the limited clearance between the tipper forks and the bin slots. This was overcome by adjusting the hitch position on the trailers.

### Maintenance

Normal maintenance of the unit consists of regular greasing of fork rollers and pivot pins and weekly electrical check of control gear.

Average annual maintenance cost for the years 1981 and 1982 amounted to E3360/unit (E = Emalangenzi equal in value to SA Rand).

**TABLE 1**  
Tons of cane off-loaded

Year	Port-A-Box System	Rota-Tipper
1976	46 515	-
1977	59 061	-
1978	71 132	-
1979	175 913	87 956
1980	-	275 674
1981	-	334 179
1982	-	383 264
<b>TOTAL</b>	<b>352 621</b>	<b>1 081 073</b>

Maintenance costs on cane haulage units which had been averaging E38 100/annum were reduced to E26 230/annum with the introduction of the Rota-Tipper System. This reduction was due to a decrease in the damage incurred during the off-loading operation.

### Conclusion

Mhlume has at present two Rota-Tipper off-loading units in operation, one having operated for four seasons and the other for three. Table 1 lists the tonnage of cane off-loaded by both the Cameco Port-A-Box and the Rota-Tipper systems since the introduction of chopper harvesting at Mhlume.

The Rota-Tipper systems have off-loaded more than a million tons of cane since their installation and have proved to date, to be versatile and reliable.

### Acknowledgements

My thanks to the management of Mhlume (Swaziland) Sugar Company Limited for their financial support and confidence in this project and their permission to present this paper.

I also wish to thank my engineering staff for their assistance and co-operation which has contributed to the success of the Rota-Tipper, which is now patented in UK, Australia and USA.