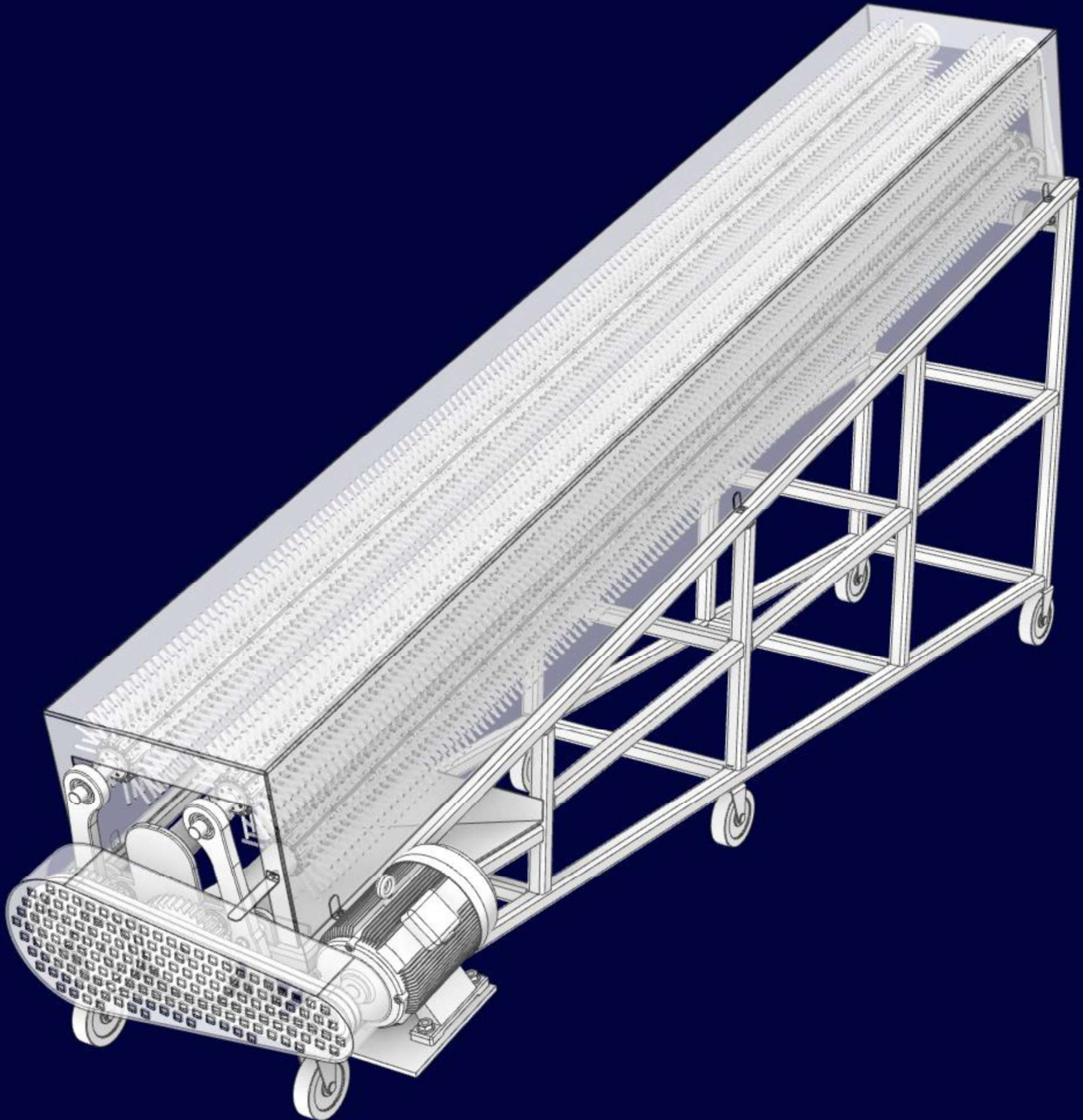


Cassava Peeling Machine

Dr Marcelo Precoppe



Construction guide delivered to **INTERMECH ENGINEERING LIMITED**, in fulfilment of the project *Prototype development of an innovative cassava peeling machine*, funded by GRE Innovation Fund.

May 2022



**UNIVERSITY OF
GREENWICH**

Introduction

Cassava is a tropical root with strategic importance to sub-Saharan Africa, as it is the main source of calories for a large proportion of its population. Cassava has a short shelf life and for human consumption needs to be processed into flour within 48 hours after harvest. For this reason, cassava processing plays a key role in extending its shelf life. Peeling is the very first step in cassava processing. The cassava peel is composed of two layers, an outer corky layer called the periderm, and underneath that, a layer called the cortex. For all cassava products other than starch, both layers need to be removed and are mostly done manually with a knife. That is because the machines available for cassava peeling are not able to completely remove the peel without wasting useful parts of the root. Peeling machines' performance is evaluated based on the peel retention and material losses. Peel retention is the percentage weight of the peel that remains attached to the roots after the peeling process. Material losses are the percentage weight of the useful part removed non-intentionally during the peeling process. Available cassava peeling machines use an abrasive surface and that causes either high peel retention or high material losses. This document provides guidelines for the construction of innovative cassava peeling machine; one that uses rotating brushes instead, delivering minimum peel retention and minimum material losses.

Equipment Overview

The equipment is composed of a frame that supports four rollers and a driving system powered by an electric motor. The frame sits on casters and the drive system rotates the two lower rollers. The rollers contain bristles and are enclosed in a metallic cover. Figure 1 provides an overview of the equipment.

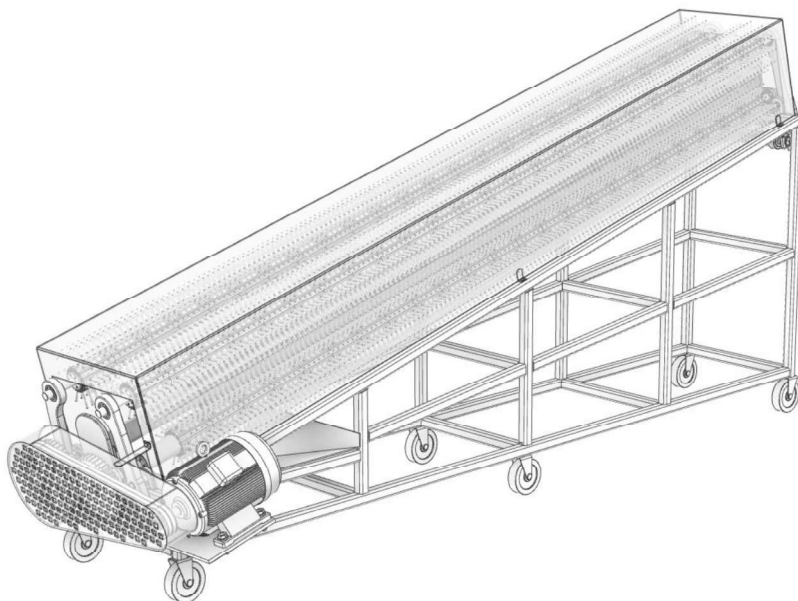


Figure 1. Equipment overview.

Equipment components

Frame

The frame is built with mild steel square hollow section, 20 mm by 20 mm and with walls 3 mm thick. On its lower right side, support for the motor is built using an 8 mm mild steel plate. The frame is placed on a set of 6 casters. Figure 2 shows the frame on top of the casters.

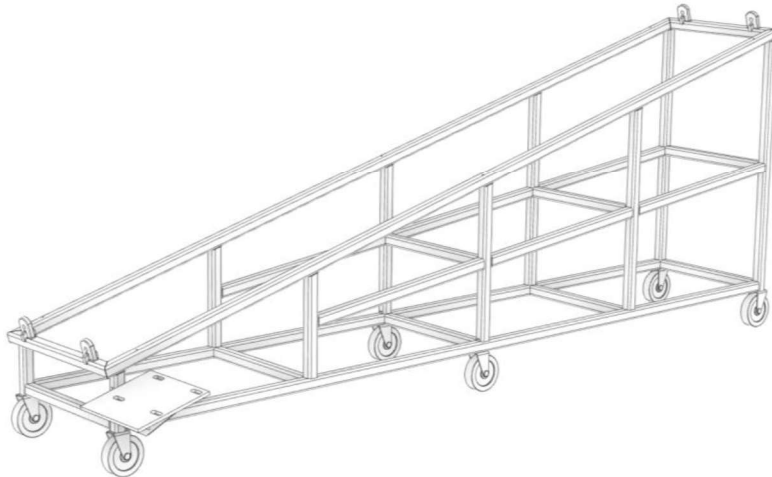


Figure 2: Frame, on top of casters, supports the equipment components.

Drive system

The drive system uses belts and pulleys in conjunction with spur gears, enclosed under a safety guard (Figure 3). The belt and pulleys transmit the motor power, torque, and speed to spur gears, which, in its turn, makes the rollers spin. The system is powered by a 3 hp electric motor.

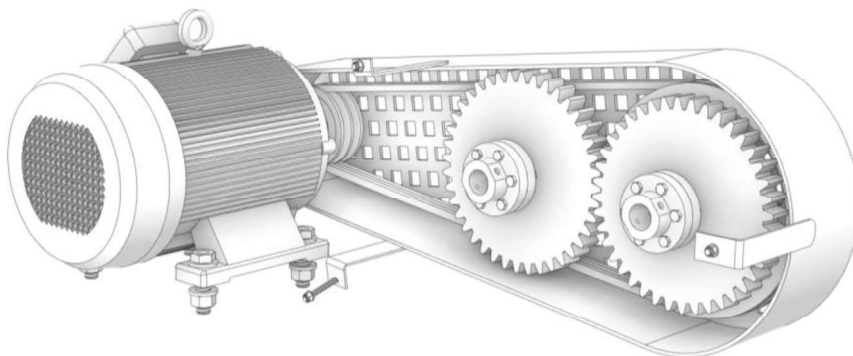


Figure 3: Belt and pulley plus gears transmit power from the motor to the rollers.

Rollers

To peel the roots, the equipment uses 4 rollers with brushes as shown in Figure 4. The two lower rollers are connected to the spur gears and rotate at approximately 450 revolutions per minute. The rollers are composed of a rod in the centre, with bristles around it. The lower rollers are connected to the spur gears by couplings and at these rollers, the bristles do not extend to their entire length (Figure 5).

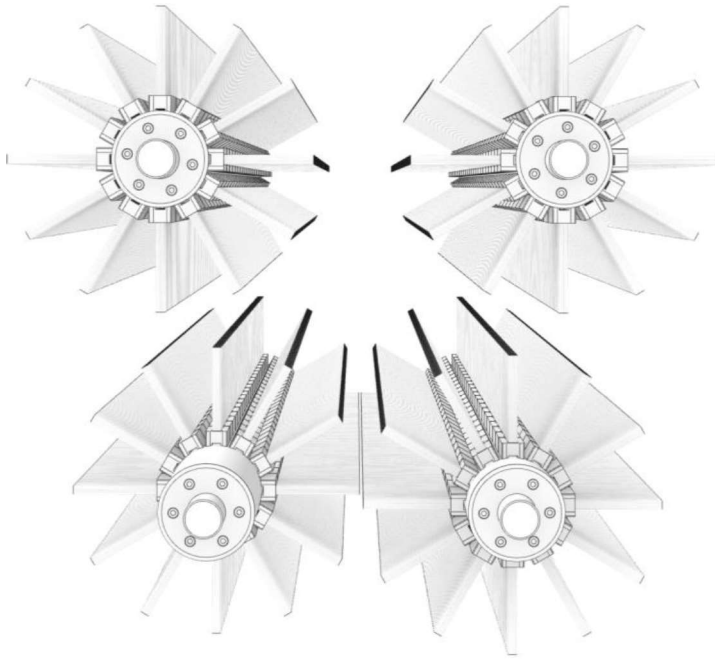


Figure 4. Rollers with brushes rotate at high speed, peeling the roots.

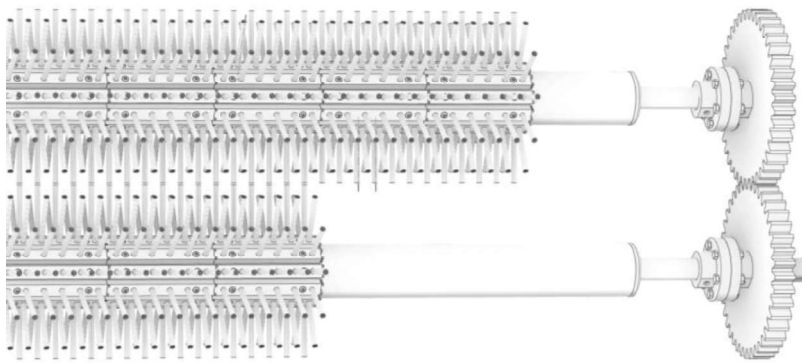


Figure 5. Lower rollers, coupled to the gears, do not have bristles on their ends.

Lower roller holders

The lower rollers are held by brackets, attached to the frame. Ball bearings are used to reduce rotational friction (Figure 6). The bracket at the back of the equipment has a hole on it, that is used to introduce the roots (Figure 7).

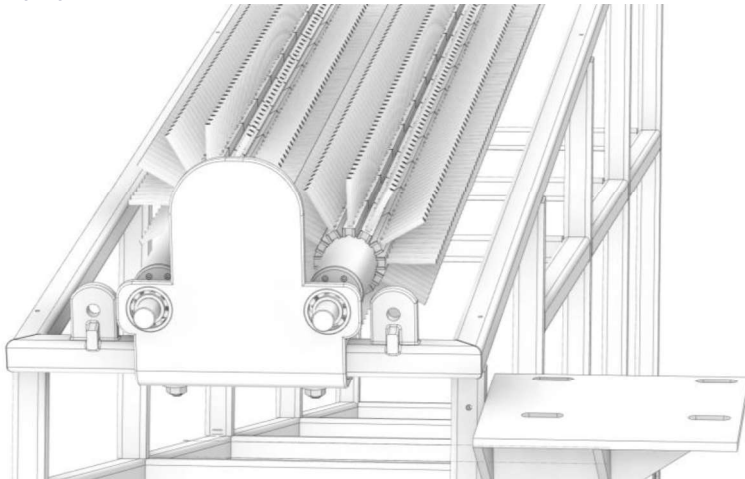


Figure 6. Bracket that holds the lower rollers, located at the front of the machine.

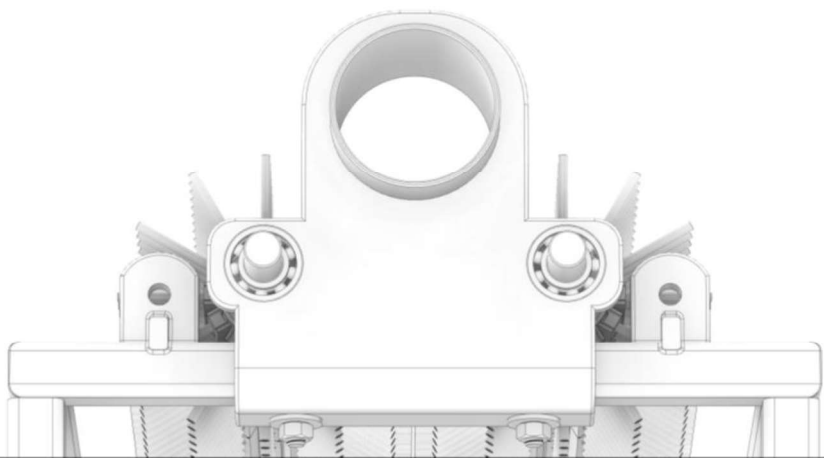


Figure 7. Bracket that holds lower rollers, located at the back of the machine.

Upper roller holders

The upper rollers are held by spring-loaded cantilever arms. Ball bearings allow it to rotate freely, and the spring load cantilever allows the distance from the rollers to change, accommodating the varied sizes and shapes of the roots (Figure 8).

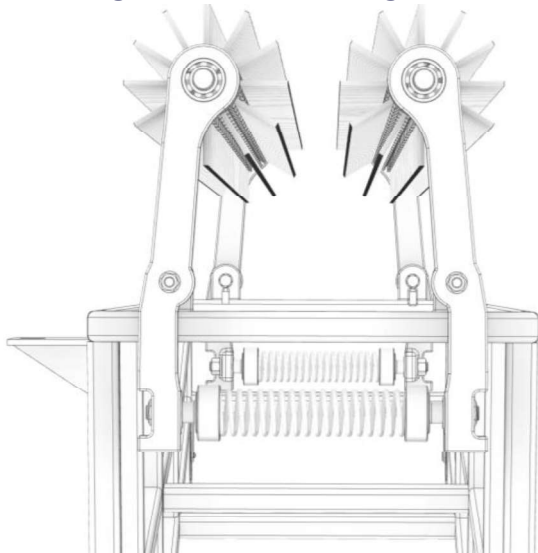


Figure 8. Upper rollers rotate freely and are held by spring-loaded cantilever arms.

Cover

A removable cover, placed on the top of the frame, shields the rollers (Figure 9).

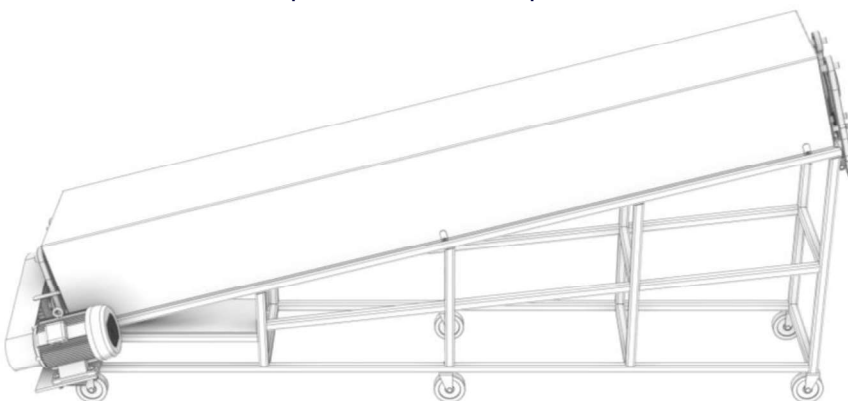


Figure 9. Removable cover shields the rollers.

Outlet

An inclined stainless-steel plate guides the roots out of the equipment (Figure 10).

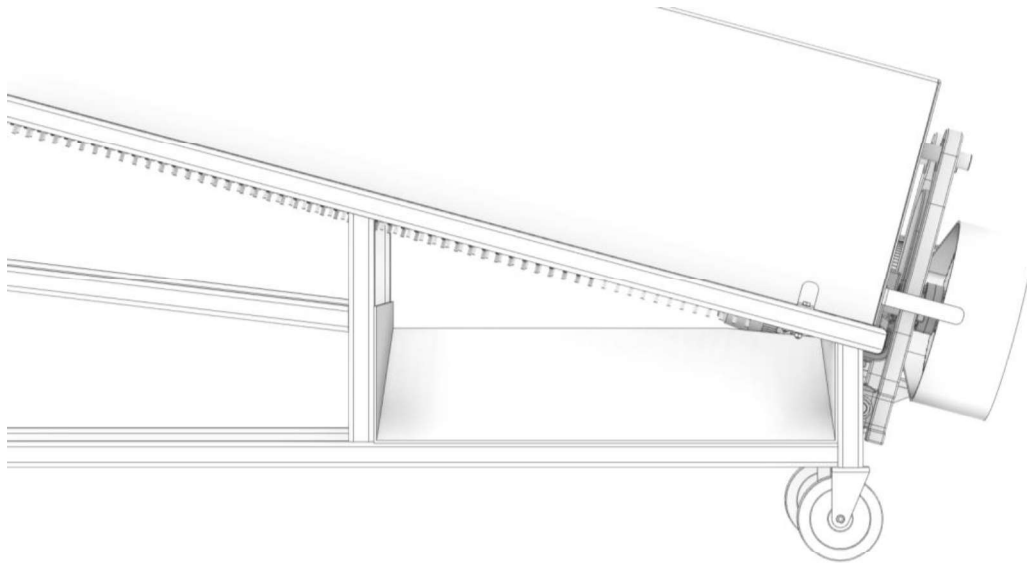


Figure 10. Peeled roots are guided out of the equipment by an inclined plate.

Equipment Operation

The roots are introduced, manually, one by one at the equipment feeding point. The brushes, rotating at high speed remove the peel from the root. The peels fall under the equipment and the roots move forward by gravity until it falls on an inclined plate and leaves the equipment (Figure 11).

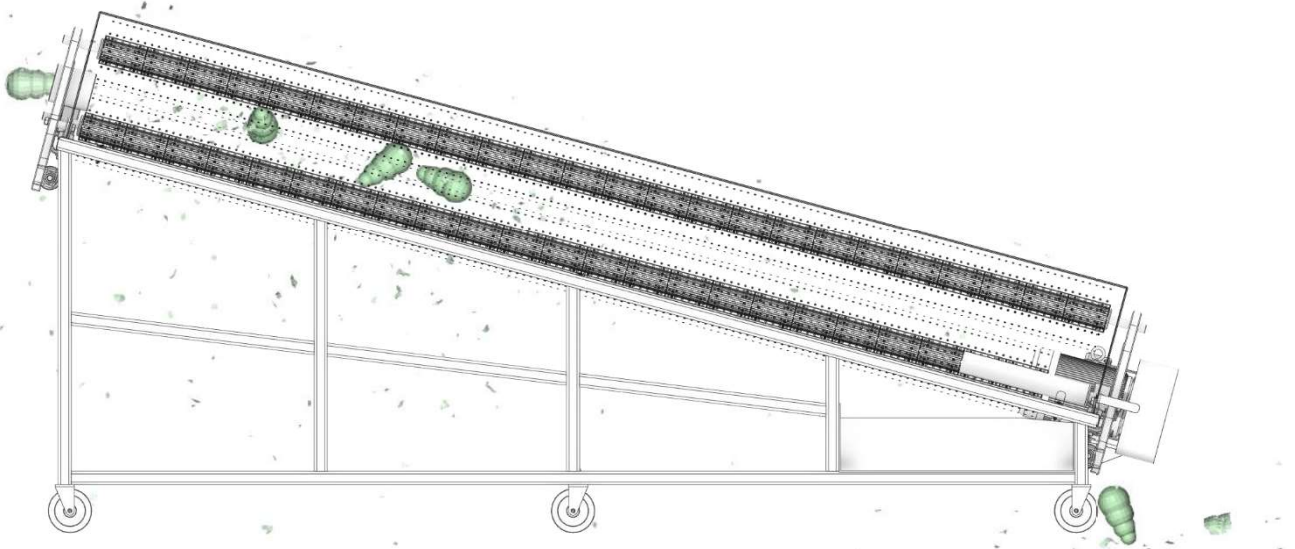


Figure 11. Operation of the peeler machine, tested using Discrete Element Method.

Equipment Dimensions

Dimensions of the equipment and the 3D CAD model can be visualized or downloaded from <https://a360.co/3kru86Y> (password protected).

Introduction

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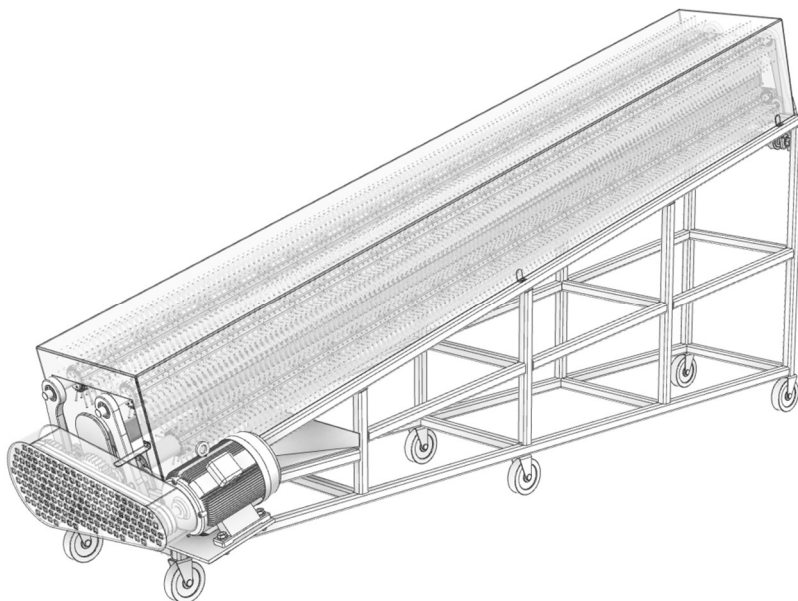


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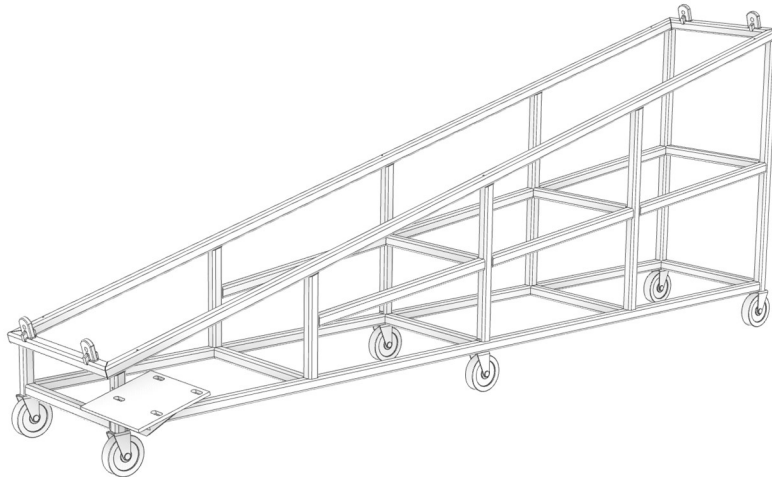


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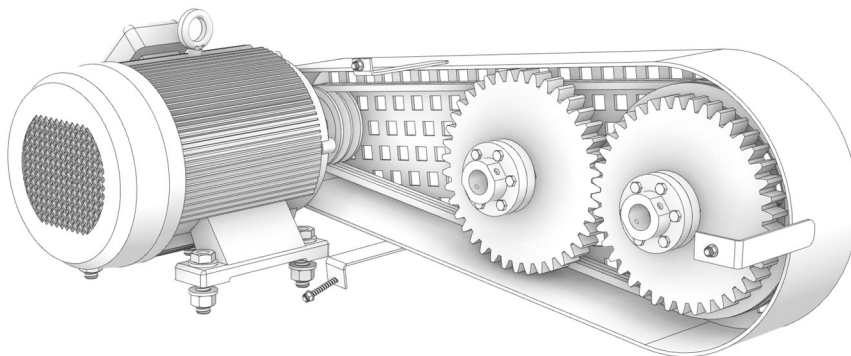


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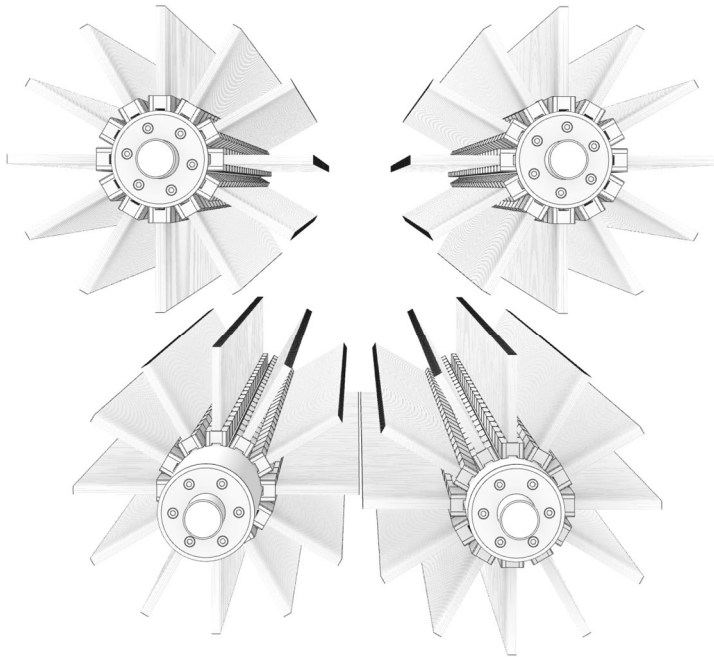


Figure 4. Rollers with brushes rotate at high speed, peeling the roots.

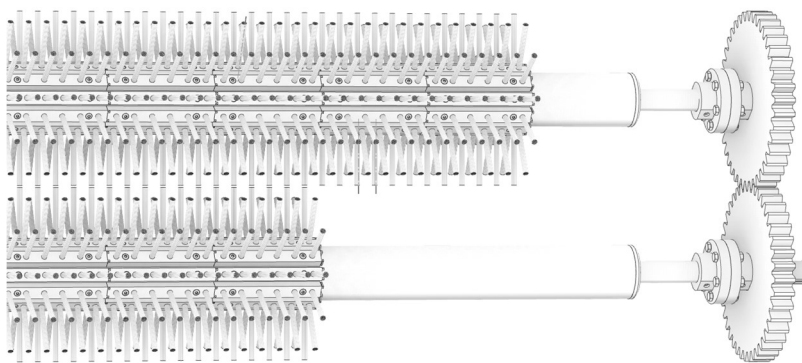


Figure 5. Lower rollers, coupled to the gears, do not have bristles on their ends.

Lower roller holders

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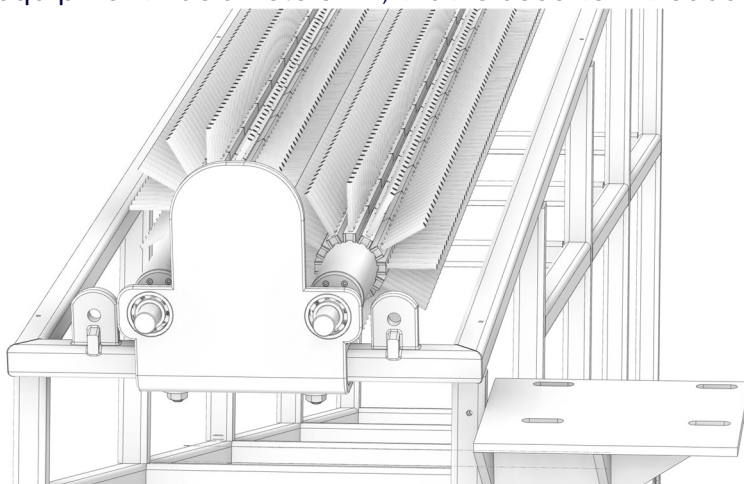


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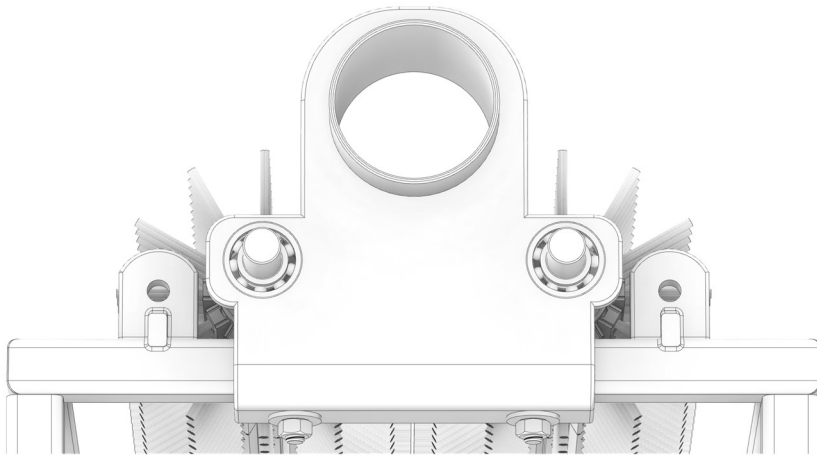


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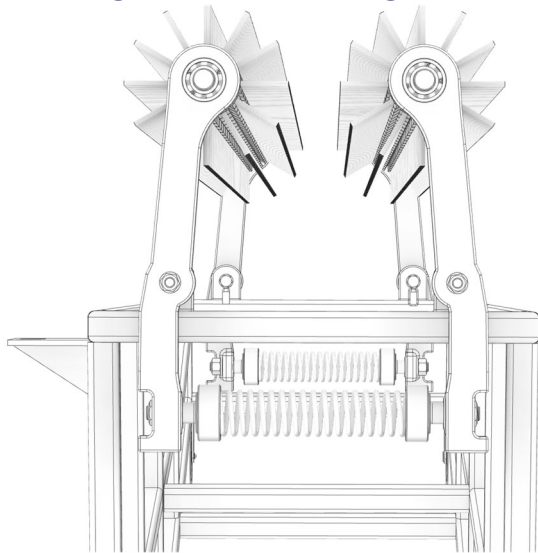


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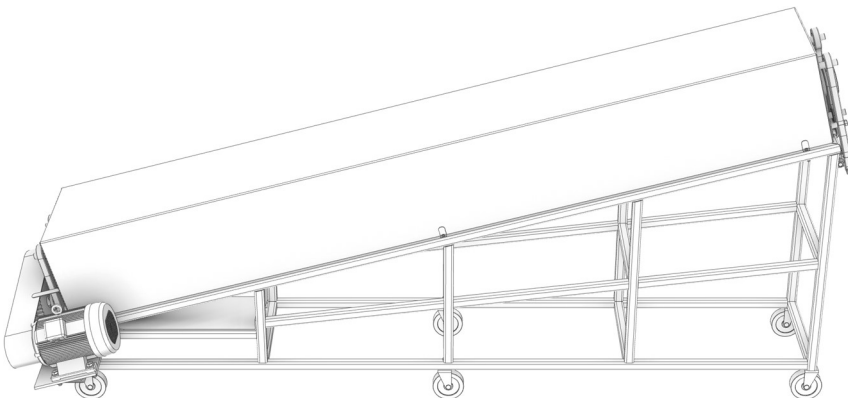


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Outlet

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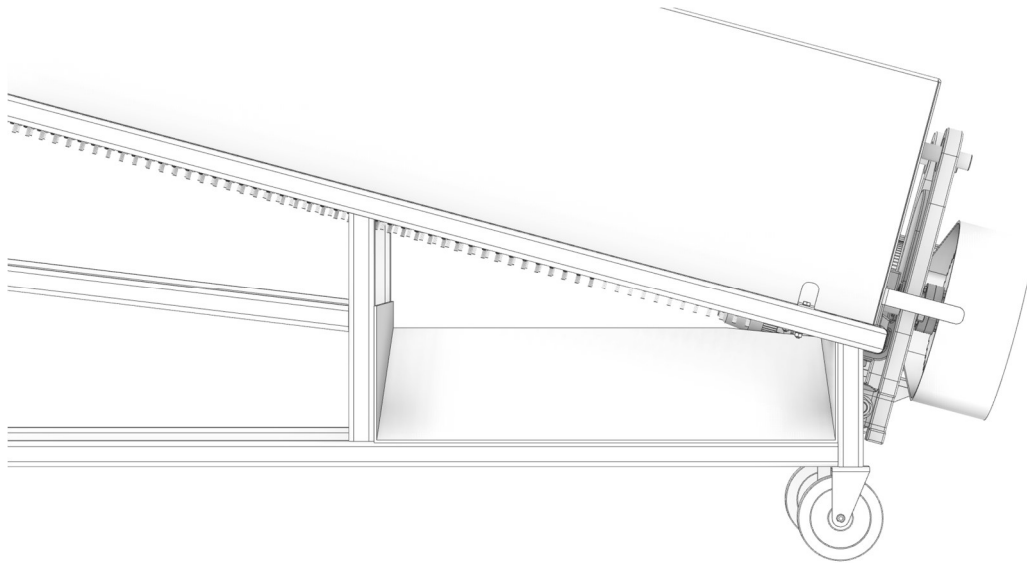


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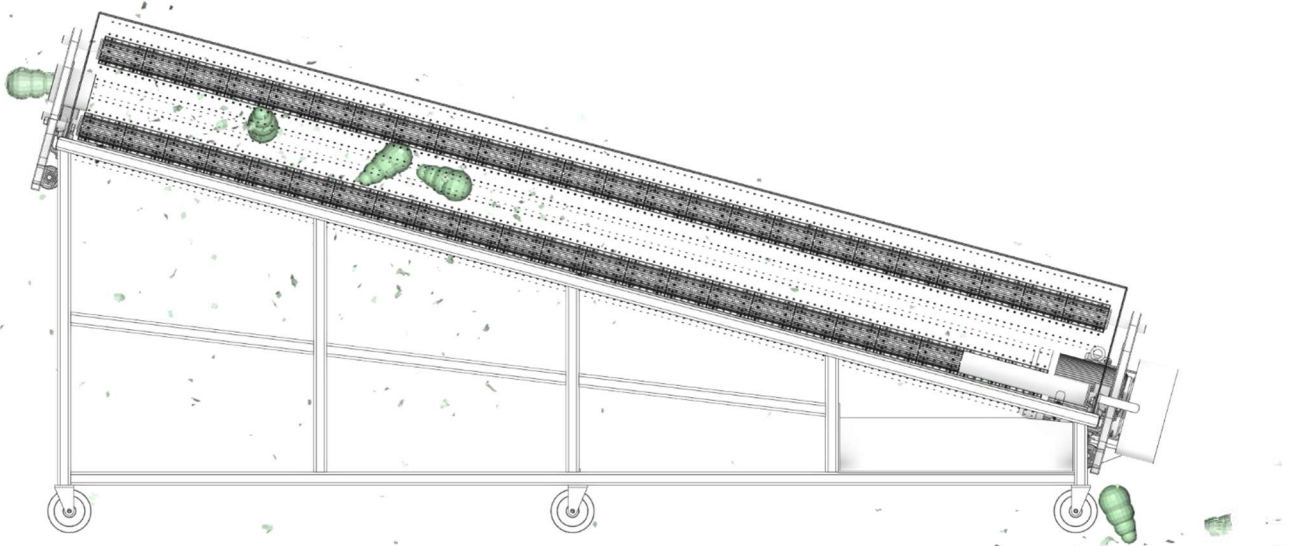


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