Bachelor's Thesis Engineering Technology 2021-2022

3 In 1 Glue Machine

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Specialization Electromechanical Engineering Technology

Situation

Company

Dagani engineering is a small SME located in Belgium that specializes in creating custom parts for cars and airplanes. One of those parts are wooden airplane propellors. These propellors are mainly used in older WWI aircrafts or for esthetic purposes.

General production method

1. Multiple planks of wood are stacked on top of each other.
2. Glue is applied in-between the planks.
3. Manual clamping of the plank stack while the glue hardens.
4. Rough CNC milling of the propellor shape.
5. Finish of the propellor by hand.

Problems

1. Inconsistent glue pattern due to manual application.
2. Using manual clamps makes it difficult to achieve even pressure and could create gaps in the glue layer. Which in turn creates weaknesses in the propellor.
3. Doing most of the steps by hand makes it labor-intensive.

Objective

The objective is to automate multiple steps to increase the efficiency of the production process. Therefore, the machine needs to able to do different tasks like stacking, gluing and clamping. While achieving a consistent glue layer that ensures the overall strength of the propellor.

Result

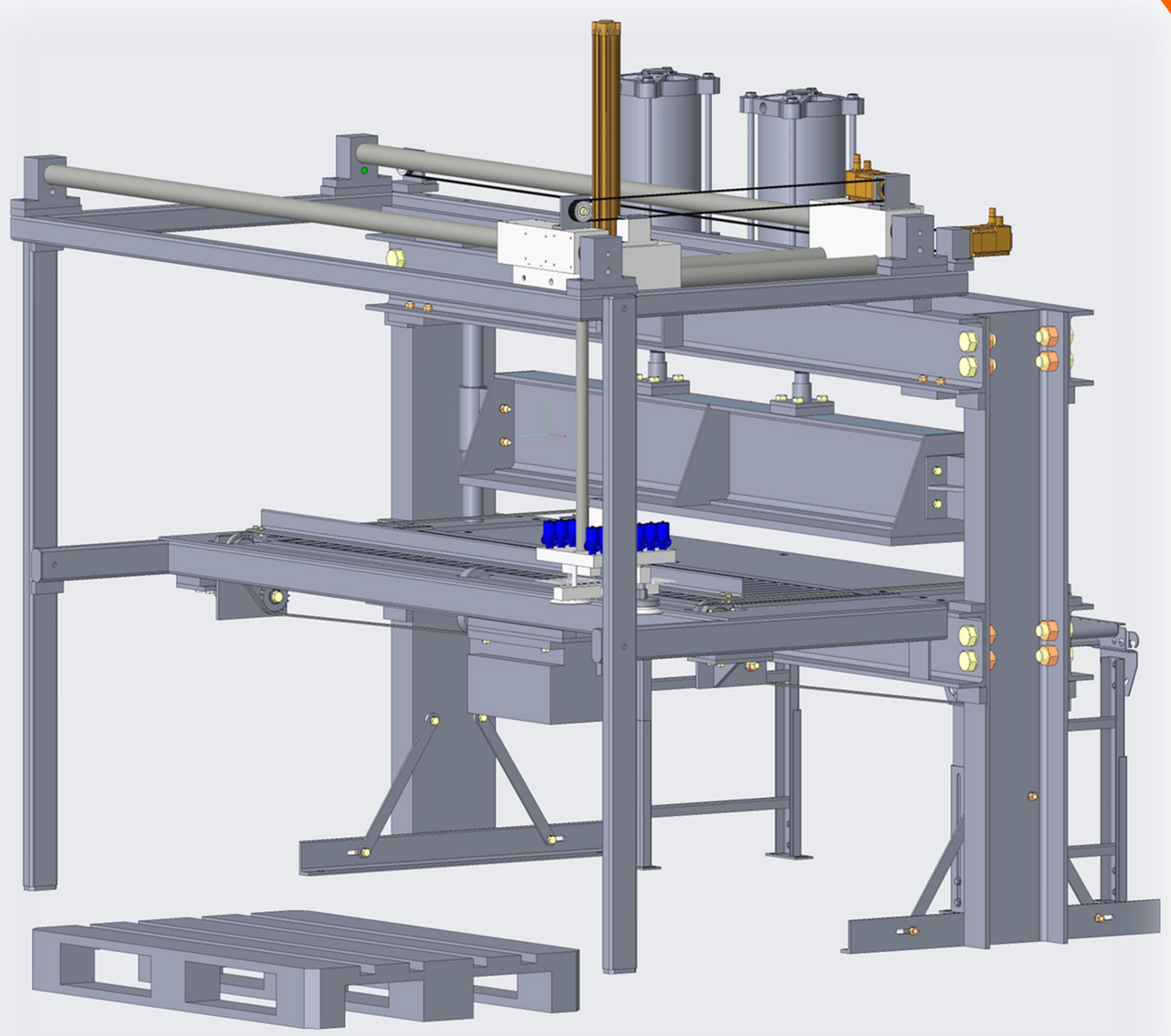

Figure 4: Complete 3 in 1 glue machine.

Functions

Stacking

The pick and place unit in figure 1 is used to stack planks, from 0,8 m to 1,8 m in length, on top of each other. The grabbing tool uses vacuum suction to grab planks with a weight up to 50 kg.

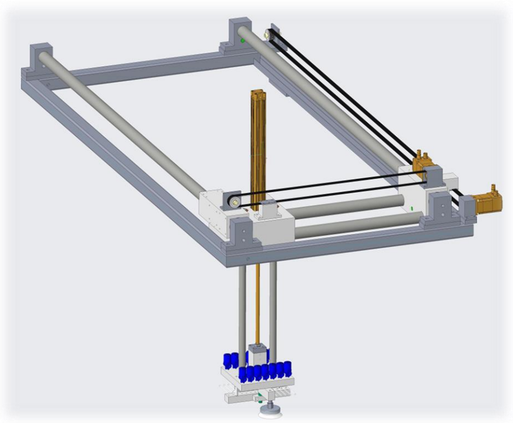

Figure 1: Custom pick and Place unit.

Glueing

The grabbing tool in figure 2 has a build in glue head with multiple glue channels. This makes it possible to apply glue to planks up to 0,3 m wide.

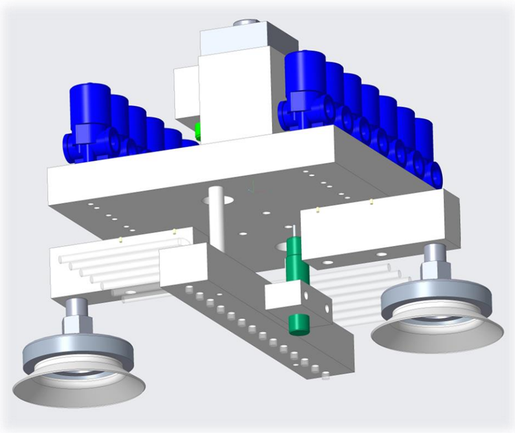

Figure 2: Grabbing tool with central glue head.

Clamping

Plank stacks are clamped using the pneumatic press in figure 3. The press has two 200 mm pneumatic cylinders that can be regulated to evenly apply up to 5 tons of pressure.

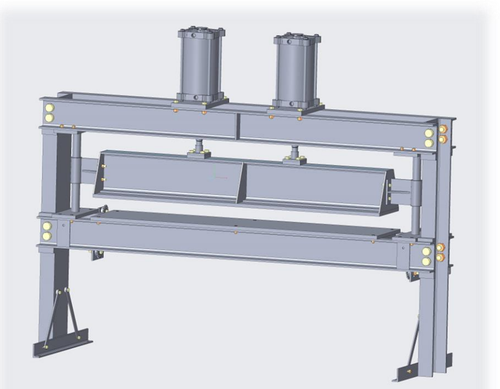

Figure 3: Custom 5 ton pneumatic press

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1. Marinus, B., M. Roger, and R.V.D. Braembussche, Aeroacoustic and Aerodynamic Optimization of Aircraft Propeller Blades, in 16th AIAA/CEAS Aeroacoustics Conference.
2. Pérez-Arribas, F. and R. Pérez-Fernández (2018). "A B-spline design model for propeller blades." Advances in Engineering Software 118: 35-44.

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