Bachelor's Thesis Engineering Technology

2022-2023

Automation of assembly line for the clutch of hybrid CVT transmission

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Electromechanical Engineering Technology

? GOAL

- Project for **transmission manufacturer Punch Powertrain** in Sint-Truiden.
- Part of the development of the new generation of **Continuously Variable Transmissions (CVTs).**
- This project consists of **designing a production line** that manufactures a subassembly of the new generation of hybrid propulsion systems. This will be done starting from several components (see Fig. 1). The task consists of **aligning 6 separator plates and 5 friction plates** to then fit this **assembly into the housing**. The subassembly is eventually delivered to the final transmission production line. The process consists of three main steps: **supply, assembly + finishing and output.**

Figure 1: Components of the subassembly

DESIGN PROCESS

Requirements

- Machine build-in space is maximum 2 m x 2 m x 3.6 m (LxWxH).
- Using electric or pneumatic drive.
  ➔ 380 V (L1, L2, L3, N), current unlimited
  ➔ Compressed air.
- A buffer should be provided for at least 2940 separator plates and 2548 friction plates.
- Using standard profiles: BOSCH Rexroth Strut profiles.
- Consideration of ergonomic working height for the operator according to ISO 6385.
- The process achieves a branch time of 60 seconds or less.
- Operating time: 5 days out of 7, 3 shifts per day of 8 hours (full-time).

Function block diagram

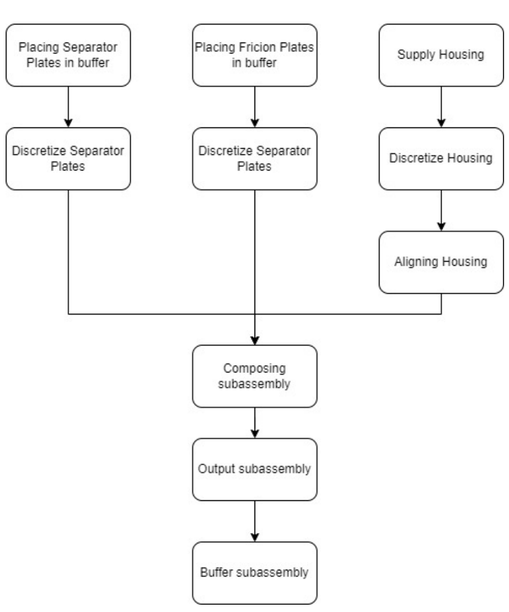


Figure 2: Function block diagram

Morphological overview

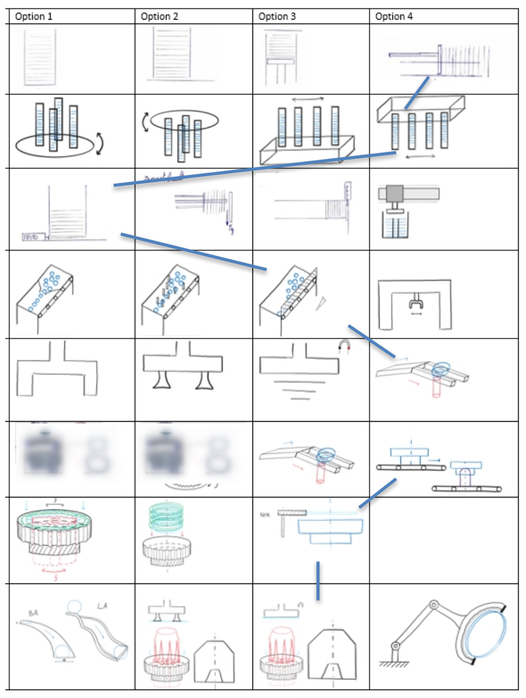


Figure 3: Morphological overview

General overview of the production line

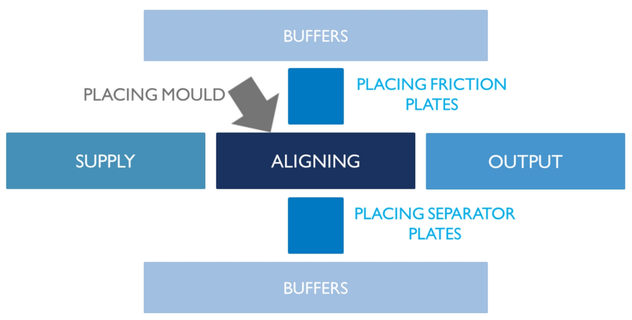
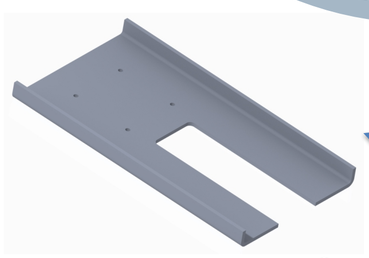


Figure 4: General overview

According to method of Den Kroonenberg

RESULT



Supply
After the conveyor, a sheet-metal plate is provided for the feed with a slot and a non-slip part at the end of the plate. The taper of the provided mould placed on the linear guide will engage in the hole at the bottom of the clutch housing. The mould moving on the linear guide will thus pull the housing over the non-slip part to the next process step.

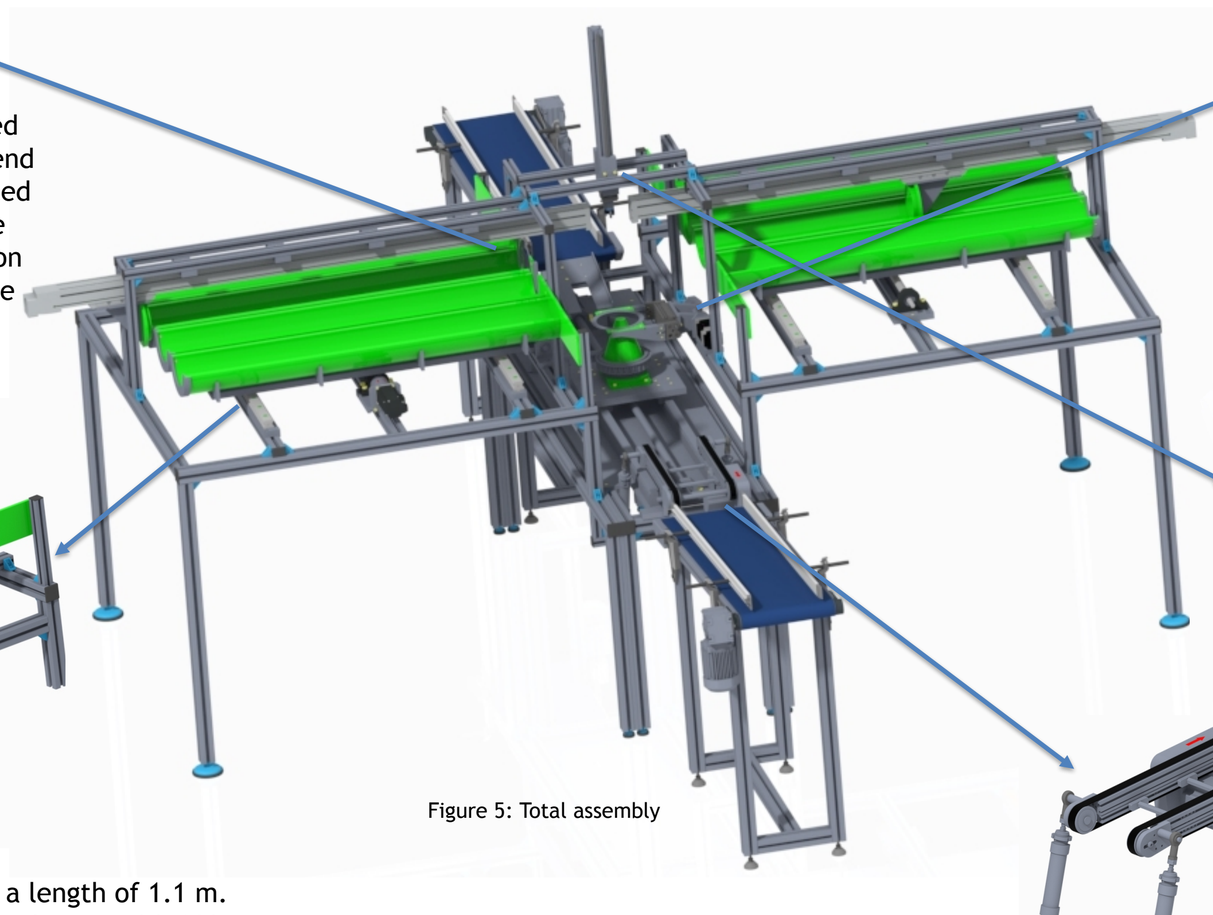
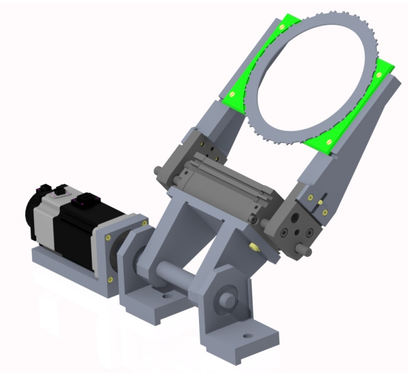
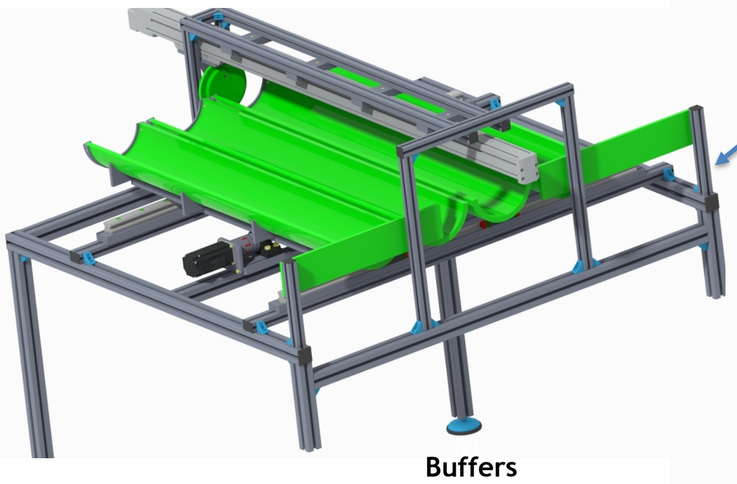


Figure 5: Total assembly



Clamping mechanism
The linear guide above the buffers pushes one plate into the clamping mechanism every stroke. The compressed air-driven cylinder will grip the plate and, after the servomotor is turned 90°, release the clutch plate again.



Buffers
The entire system consists of 8 buffer tubes with a length of 1.1 m. These tubes can store more than 3,000 separator plates and 2,600 friction plates. The buffers can be emptied by equipped linear guides.

Cylinder for mould
This cylinder will place the second mould inside the casing. The plates will fall over this mould for proper alignment inside the casing. After all the plates have been placed, this mould will be removed again so the whole thing can go to the output.

Output
The discharge consists of a linear guide consisting of two thin belts. This guide is pushed up by two cylinders so that the assembly is lifted out of the mould and can thus be transported to the discharge conveyor.

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