

Fully automatic pre-assembly of radiator collectors

Baue Boersma, Rens Remans

Specialization Electromechanical Engineering Technology : design and production

Situation

In the manufacturing proces of radiators, pre-assembled collectors are used. Until now, these collectors have been assembled by hand. This is not only a time-consuming process, but also a lost labor force. The aim of this bachelor thesis is to automate this pre-assembly process.

Requirements

- The main goal of this machine is to reduce labor costs.
- The entire machine must operate fully automatically. This may only be checked and operated by an operator.
- The machine must deliver at least 200 assembled pieces per hour.
- It must be able to assemble six different types of collectors.

Stages

1. The first phase is the orientation phase. Here, the collectors are laid one after the other in the same direction. After this step, they are moved linearly with a conveyor belt.
2. Secondly, the collectors are placed in a tensioning plate by means of a gripper. These are placed consecutively alone or in pairs. The plate lies on a timing belt, which can be positioned with precision under the ring placer.
3. In the last phase, tin rings are supplied through the reservoir and stamped into the collector by the ring placer.

1: Pre-orientation

- The collectors arrive in cardboard boxes and are placed in the sorter by the operator.
- The sorter consists of 2 conveyor belts that are placed next to each other, with different speeds. Therefore, the discharge speed is always greater than the supply speed.
- The collectors are oriented by shear plates. If they are lying correctly, they are caught by a rail. If not, they repeat the whole process again.

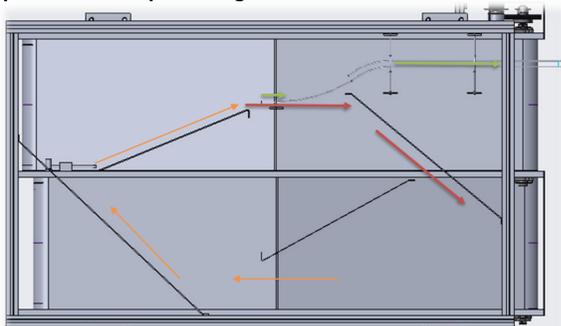


Fig 1: Sorter

2: Plate loading

- A step driven conveyer belt drives the collectors to a gripper.
- By using a vision system that recognises the orientation of the collectors, the pneumatic gripper can rotate to the matching orientation.

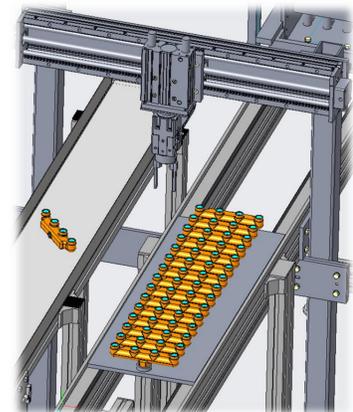


Fig 2: Gripper assembly

3: Adding the tin ring

- A fully loaded tension plate gets locked the same way as during phase two underneath the assembler. The holes on top of the collectors are now perfectly aligned with the module holes in the assembler.

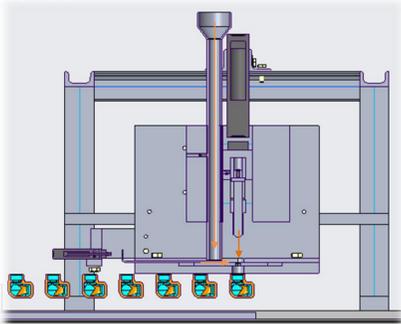


Fig 4: Ring assembler

- Tin rings are buffered in the long tube (fig 4). A pneumatic pushrod places them under the mandrel/pusher.
- The mandrel falls in the ring to centre the ring, secondly a pusher presses the ring through the sliders. The mandrel reaches the collector first. The ring will be guided by the mandrel to the correct position and the pusher will press it until the desired depth is reached.

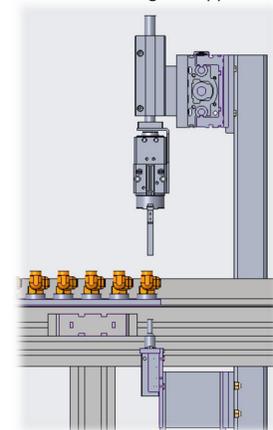


Fig 3: Positioning from the gripper

- The gripper rotates the collector to the default orientation and places it on a tension plate. This plate is locked in place by two pins underneath. These pins are connected to pneumatic cylinders. These Cylinders retract whenever a collector is placed on the plate and expand to lock in the next position.

Detail views

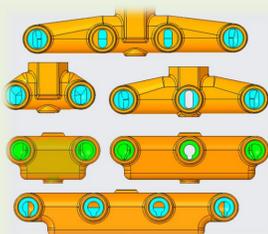


Fig 5: Six types of collectors

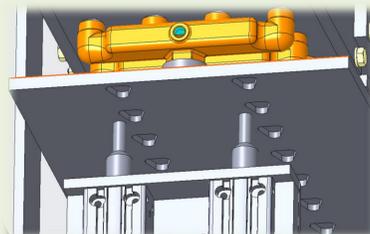


Fig 6: Positioning system

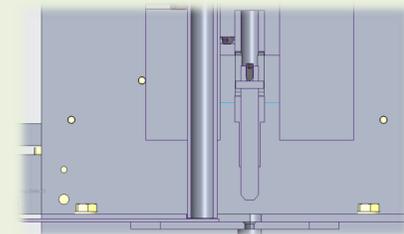


Fig 7: Detailed cross section assembler

Supervisors / cosupervisors: Karel Kellens, Michael Daenen, John Bijmens