Industrial Design
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A universal solution for door handle springs.

Development of a sprig system that the company Themans can integrate in their current product line.

The research question of this bachelor's assignment is: "In which way can a system, small enough to fit in a 28.5mm backplate, return a door handle to his neutral position for more than 200.000 cycles?". The company Themans is interested in the answer to this question. Themans is a company located in Deventer, Netherlands that designs, produces and sells door hardware for OEMs and project developers, amongst others.

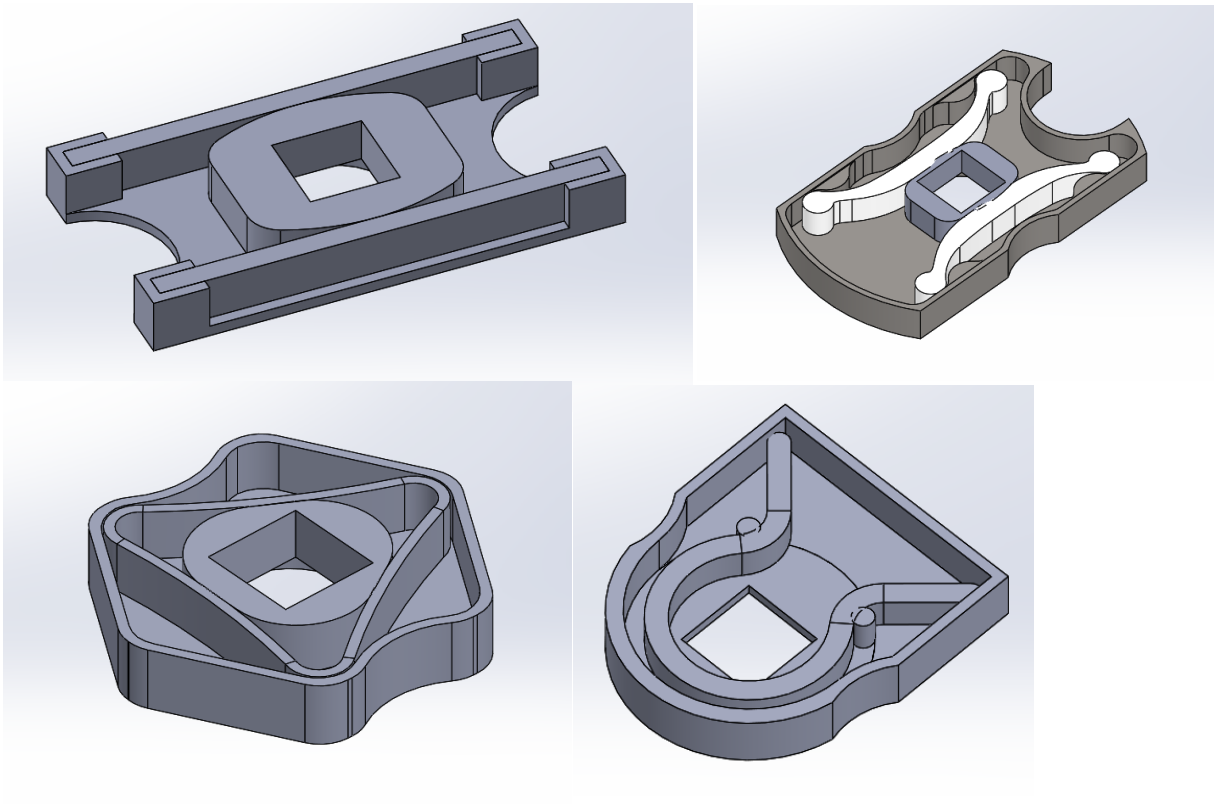
An important product group for Themans is door fittings. Door fitting consists of two backplates and, most of the time, two door handles. When untouched, door handles are usually in their neutral position. This is achieved by springs in the locking mechanisms, and sometimes by springs in the door fittings themselves. These additional springs relieve the locking mechanism, making it last longer.

The goal of this project was to develop an alternative to current spring systems. This alternative should be able to replace all current systems and consider the various ways the backplates are mounted, to be future proof. This universal solution offers advantages for Themans since that means they can reduce the number of products in stock. Another goal is durability, by regulations the system should survive 200.000 cycles, but customers have often asked for more, even twice that amount (Lieshout et al., 2019).

Process

This assignment is a continuation of previous years. In the past students have tried to solve this problem and delivered a good base to start this analysis. Their reports contained a couple of concepts that had been tested. Furthermore, a study was done into the products currently on the market. These two sources gave a good impression of what works and what does not in the market of door fittings. The analysis results in a requirement list.

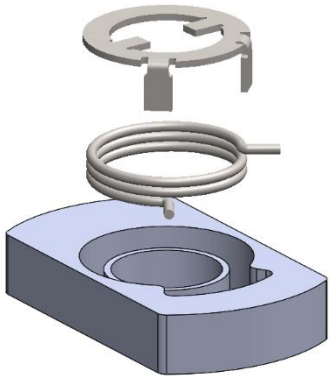
The result of the analysis were four concepts, worked out in SolidWorks, displayed below.



The four concepts; leave spring (top left) polymer spring (top right) triangle (bottom left) harp (bottom right)

These concepts were tested against four requirements that were deemed most important to allow for further development.

- Does the system allow for the handle move up and down?
- Does the system allow for the handle to be used on both doors that turn left and those that turn right, **without** tools?
- Does the system allow for the handle to be used on both doors that turn left and those that turn right, **with** tools?
- Can the system fit in all Themans' backplates?



The concept that was expected to do all that the best, was the concept ‘harp’ and that concept was developed further. Since plastic used as a spring turned out to be not desirable due to size constraints, it was decided to use a metal torsion spring. This spring was developed in such a way to maximise durability, for example by adding a coil to keep stress levels low. The housing was optimized to be milled out of aluminium or stainless steel. This assembly was tested in a 3D printed prototype to prove it is possible.

Through testing, it was proven that this spring survives the number of cycles required by regulations. The other parts also performed well. Now the system could be implemented in a prototype that was closer to reality, with a backplate milled from stainless steel. In that test, the springs survived twice the number of cycles needed, while still being intact afterwards.

Conclusion

With a small change to the actuator, this system could be implemented across all products sold by Themans that use a spring system and therefore is an answer to the research question. This offers them a cost-effective way to cut in the number of different parts in stock, as well as product types. Instead of 2 handles that cannot be interchanged, it can be replaced by one product. This allows the customer to order with ease and decide later if the door has its hinges left or right. And since it can perform its function for a longer time, the customer gets a more valuable product, while also being more sustainable.