



Theo Hillers GmbH

Facts

Challenge

Design and construct an extremely light, functionally integrated gripper for the removal of sieves for the pharmaceutical industry.

Solution

Manufacture of a lightweight robotic hand with integrated air channels from polyamide using the EOSINT P 390.

Results

- Light: low weight through utilization of polyamide and integration of functions
- Increases quality: less wastage in the working process
- Uncomplicated: integrated construction with reduced complexity and shorter assembly time



The vacuum suckers of the polyamide robotic hand place the filter sieves gently and securely on the conveyor belt (courtesy of ASS Maschinenbau GmbH).

New Approaches in Automation Technology –
ASS Maschinenbau Additively Manufactured Robotic Hand
for Pharmaceutical Supplier Theo Hillers GmbH



Additive Manufacturing of Innovative Lightweight Robotic Hand for Existing Linear Handling System

Short profile

ASS Maschinenbau GmbH develops intelligent solutions to diverse assignments for the Automation and Robotic sectors. The product range includes grip components, robotic hands and automation systems, with a focus on the plastics injection moulding industry and automated CFC (carbon fibre composite) processing.

Theo Hillers GmbH has been internationally active in the area of plastics injection technology for more than 30 years. The company supplies customers globally from the automobile, electrical engineering, pharmaceuticals and medical technology sectors.

Further information

www.ass-automation.com
www.hillers.de

Extensive automation is an important factor in achieving success in the manufacturing sector. But what if a company requires a small series of custom-made components for its own production process? This was the challenge faced by ASS Maschinenbau GmbH from Overath/Germany and its customer Theo Hillers GmbH, based in Kall/Germany. One of the products that Theo Hillers manufactures is a sieve. It is produced using an injection moulding process for companies in the pharmaceutical sector. Robotic hands remove the finished components – specialized robotic hands, the fabrication of which is only possible through Additive Manufacturing. Production was trusted to the EOS system operated by ASS Maschinenbau.

Challenge

Theo Hillers GmbH was searching for a solution for the handling of sieves and their sprues (the waste piece on a casting left by the hole through which the mould was filled). The solution was to be docked on a sprue removal device, often known as a *sprue picker*. For a number of reasons, standardized automation technology had reached its limits. The problems included the continued utilization of the existing sprue picker, the number of small cavities in the tightest of spaces, increased quality requirements, limited space and a maximum weight of the robotic hand of about

500 g. In addition there was the need to reduce overall complexity. A new process was needed. ASS Maschinenbau GmbH took on the task.

With the previous solution the sprue picker extracted the sprue using a two-axle linear handling unit with an additional swivel axis, dropping the filter screens as free-drop parts on a conveyor belt. In the new manufacturing process it was possible to optimize the reliability of the process and to minimize wastage. This is because the filter screen is no longer dropped onto the conveyor belt: the clean removal

and setting down of the part on the belt were fundamental aims of the project.

There were two options when it came to designing a solution: either develop a new linear handling unit with an aluminium robotic hand for part removal, or design a solution based on the retention of the existing handling unit. Cost factors dictated that this was the preferred approach. The step towards a solution based on a new type of robotic hand required pioneering spirit and the courage of Theo Hillers GmbH: unlike with grippers made from aluminium-based modular systems, when it came to the lightweight polyamide construction of a robotic hand there was little practical experience to fall back on. This contrasts with other areas that do utilize components made from the material.

Solution

Known at ASS as *PA-Forming*, Additive Manufacturing offered the best solution because it



Lightweight and stable: the robotic hand, developed by ASS Maschinenbau GmbH, has been in daily use at Theo Hillers GmbH since early 2014 (courtesy of ASS Maschinenbau GmbH).

allowed for the continued use of the customer's existing system. The constructors were given maximum freedom of design – ideal for the construction of the robotic hand, with its complex geometries. As the products are extracted over a vacuum using suction, the engineers carried out corresponding tests prior to the actual construction of the gripper: the robotic hand needed to apply suction to eight or twelve cavities (depending on the application) over the generated vacuum. It also had to be able to stop. These tests revealed that the twelve-cavity robotic hand required four air circuits for every three articles, while the eight-cavity hand needed four air circuits for every two.

On the basis of the compiled results, air ducts were integrated in the CAD data. The internal air ducts offer the advantage that no additional weight is incurred for the air hoses and that the robotic hand is far tidier and thereby less complex; what's more, this means that maintenance times are reduced. To save further weight, the connections for the vacuum suction are also constructed directly in the robotic hands instead of, as previously, using adapters made of brass. This also makes changing the suckers a simple task. ASS Maschinenbau combined the

numbers of cavities, the air ducts, the connectors to the linear handling unit and the valves, such that the limits of weight and space were adhered to. They simultaneously ensured that the robotic hand was both stable and would remain free from fractures due to material fatigue.

Following the conclusion of the comprehensive planning phase, production took place in a single night in early 2014 – by means of Additive Manufacturing. The EOSINT P 390 system from manufacturer EOS was used. Once the CAD data had been transferred, the machine used its laser to construct the component, layer by layer, from plastic powder. Following the extraction and cleaning of excess polyamide, the vacuum suckers, connections for the air supply, the grip jaws and the necessary connection components were all fitted: the completed lightweight robotic hand was ready for use.

Results

For the first application, a lightweight robotic hand was produced from polyamide in the form of a star. The robotic hand has twelve vacuum suckers and a grip jaw. The suckers are there to ensure that the parts that were previously dropped are now placed cleanly on

the conveyor belt, while the grip jaws recover the sprue from the sieve. The air ducts for the vacuum suction and the grip jaws are internally integrated within the robotic hand, as is the adapter for the suction. With a diameter of almost 250 mm and a constructed height of approximately 110 mm the robotic hand, made from polyamide, weighs less than 400 g and, therefore, could be easily expanded to include the grip jaws for the sprue.

"Immediately following the deployment of the additively manufactured robotic hand, the errors in the sieve that arose from the way in which it was dropped, were eliminated", says Tobias Klinkhammer, Manager of Injection Moulding Production at Theo Hillers GmbH. "This solution, other than the conventional systems from aluminium profiles, has fulfilled both our expectations in terms of handling and our fundamental aim, which was the reduction of wastage."

The innovative robotic hands meet the stringent basic conditions relating to dimensions and weight. Production and commissioning took place smoothly and quickly for ASS Maschinenbau and its customer, Theo Hillers GmbH. With the innovatively produced,

extremely light and compact robotic hands, the pharmaceutical supplier was able to increase its process reliability and thereby more than compensate for the slightly higher costs of production. The new gripper system and its associated manufacturing process have met all of its targets – thereby playing an important role in maintaining the company's high level of competitiveness.

"The successful use of the lightweight robotic hand shows that when it comes to special requirements, special solutions are necessary and that these can be realized. With EOS and its innovative systems, we certainly have the right partner."

Reinhold Ziewers, Managing Director at ASS Maschinenbau GmbH

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Tobias Klinkhammer, Manager of Injection Moulding Production at Theo Hillers GmbH

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