Filament printer for fast 3D printing of plastic components

TLB
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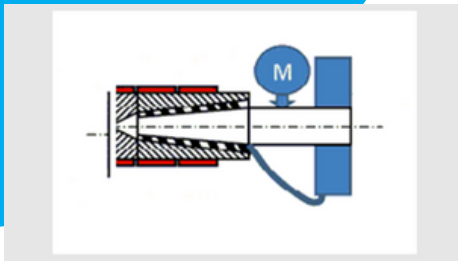
The present invention relates to an innovative method and the respective equipment for the additive manufacturing of plastic components with a significantly increased print speed compared to commercial 3D printers and 3D printing techniques.

- Higher, constant mass output for fast 3D printing
- Homogeneous warming supported by additional frictional heat within the screw
- No extra propulsion for the filament required
- Suitable for thermoplastic materials or filament types
- Ideal for large components
- Installation possible on robotic arms allowing for printing independent of location
- Maximum melting performance through a grooved plasticizing zone and a barrier screw and thus high energy efficiency



Fields of application

3D printing of large components or prototypes which can not be produced using conventional printers

Background

Additive manufacturing enables a tool-free production of plastic components, whereby any shape and a wide selection of printable plastics can be used. In addition, there are many different variants of 3D printing, which differ mainly in the use of the starting material, which can be liquid resin, powder or filaments.

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Development Status
TRL 4

Patent Situation
DE 102019106873 B4 pending

Reference ID
18/112TLB

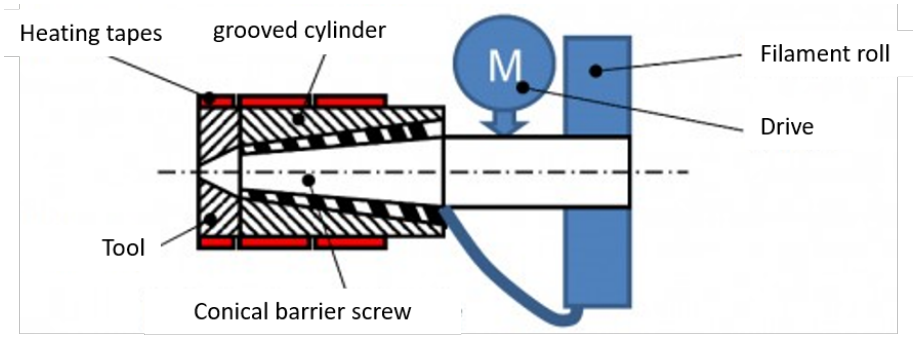
Service
Technologie-Lizenz-Büro GmbH has been entrusted with the exploitation of this technology and assists companies in obtaining licenses.

Problem

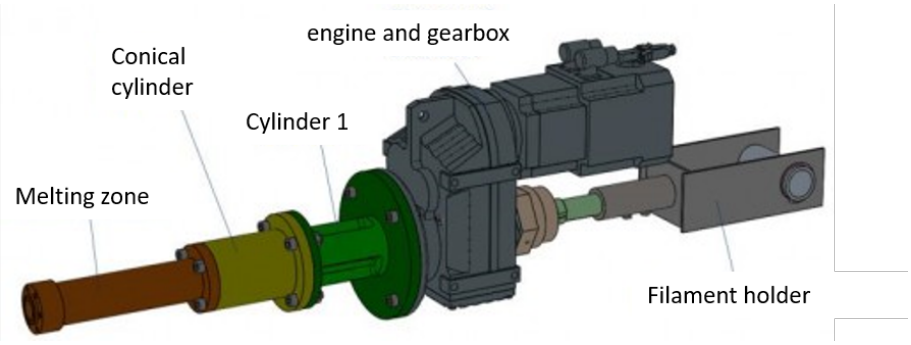
The standard use of 3D printing, especially FDM (Fused Deposition Modeling) and alike, in a production with larger quantities or in the manufacturing of large components is limited by the slow processing speed of the printing process and by the dimensions of the build space. Accordingly, 3D printing is still limited to smaller components and can be used with only with limitations in the production of larger components. In order to make 3D printing faster state-of-the-art technology does not have an extruder system which offers a sufficient mass throughput performance at maximum melting effectiveness.

Solution

Scientists at the University of Stuttgart have developed an innovative method as well as the equipment to overcome the limitations described above. As part of the invention, an innovative extruder with an output range of 0.5–5 kg/h was developed (compared to conventional output performances of filament extruders in FDM processes of around 10–100 g/h), which directly processes a thermoplastic filament through a revolving extruder screw without the filament being shredded. The propulsion of the unmelted filament is carried out solely through the revolution of the extruder screw. The filament then is melted in the hot end of the extruder, whereby melting is supported by the frictional heat generated within the screw. In this way, a homogeneous melting of the filament can be achieved immediately before positioning the strand. This enables very precise printing for use in a 3D printer. Furthermore, the high output performance of the extruder in comparison to known solutions enables very fast printing which involves significant time and cost reductions. A further benefit to the invented solution is the location-independent printing, so that the extruder can be installed on the arm of a robot or similar. The innovative filament printer is particularly suitable for large components and prototypes which are to be produced quickly and inexpensively.



Schematic structure of the filament extruder. [Image source: P. Thieleke, IKT, University of Stuttgart]



Isometric view of overall structure. [Image source: P. Thieleke, IKT, University of Stuttgart]

Publikationen und Verweise

P. Thieleke und C. Bonten, Entwicklung eines neuartigen Extruders zur Verarbeitung eines Filaments für den roboterbasierten 3D-Druck, 26. Stuttgarter Kunststoffkolloquium, 2019.

P. Thieleke und C. Bonten, Die andere Art von Filamentextruder: Neuartiger Extruder verarbeitet ein Filament und ist dadurch für die roboterbasierte additive Fertigung einsatzfähig, In: Kunststoffe 05/2019.