

Simplified, high-precision laser-micro-drilling using trepanning optics with micro-structured mirrors

Background

Today, geometries inside a component no longer have to follow the cylindrical geometry of a mechanical drill. It has long been possible to produce precisely shaped cavities of complex shapes by removing the material at specific points using laser energy - even at hard-to-reach spots.

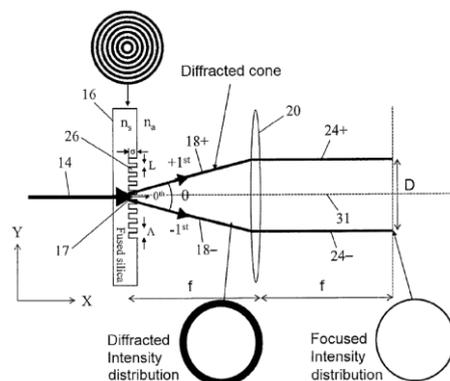
Problem

In conventional trepanning systems, several elements (wedge plates, or cylindrical lenses) rotate, which makes the installation itself as well as the setup and calibration of such a system complex and time consuming. Therefore, there is high potential for optimization in terms of efficiency and user-friendliness.

Solution

The concept of grating-based trepanning optics directs the laser focus in the desired direction solely by rotating a diffraction grating. The gratings can be designed to be operated in reflection or in transmission. Nevertheless, the working principle is the same. This setup enables the efficient production of holes by a much more robust and cost-effective trepanning system. The concept also offers greater flexibility in terms of the range of hole sizes. Furthermore, it requires components that are easy to manufacture (a diffraction grating with low aspect ratio).

The special advantage lies in the robustness as well as in the simplified setup and operation of the system. It can also be designed in different configurations.



Exemplary configuration with transmissive trepanning optics supplemented by circular diffraction grating. The size of the drilled hole can be adjusted via the diffraction angle [University of Stuttgart].

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Patent Situation

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Service

Technologie-Lizenz-Büro GmbH manages inventions until they are marketable and offers companies opportunities for license and collaboration agreements.

Vorteile

- simple, robust construction - only one rotating component
- simplified setup and operation - easy to align
- low-cost production of the components by means of well-established lithography and etching processes
- highly precise, time and cost efficient

Application

This trepanning concept developed at the Institut für Strahlwerkzeuge (University of Stuttgart) now allows for a significantly simplified design of such a laser drilling system. In combination with custom-designed grating mirrors, also developed by the same team, a new trepanning optics system can be realized. It can produce negatively conical and complex geometries of high precision without post-processing; at the same time, setup and operation become easier.