

Magnetic Rotating Halbach Gearbox

Reference No: B80105

CHALLENGE

Magnetic gearboxes are common alternatives to their mechanical equivalents in certain technical applications. Wherever the use of lubricants is limited (e.g. in the food or pharmaceutical industries) or corrosive environments require encapsulation of mechanical gears (e.g. drills or stirrers and pumps in the chemical industry), magnetic gears are widely used. However, magnetic gears have some disadvantages. The proposed "Halbach Gearbox" addresses the problem of low torque density and poor power ratio at higher speeds (due to ferromagnetic losses) of existing magnetic gears.

INNOVATION

The new gearbox is based on the idea of integrating permanent magnets into the planetary gears of a planetary gearbox in such a way that the individual permanent magnets rotate in a fixed angular relationship to each other. The arrangement of the magnets in case of the "Halbach Gearbox" demonstrator corresponds to a $k=1$ configuration of a circular Halbach array¹. Typical for such a Halbach configuration are very strong magnetic field gradients. These enable the magnetic bearing of an output shaft in the center of the planetary gear. In addition, the gradients rotate by rotation of the planetary gear, so that an output shaft, which is driven by the strong gradient fields, also rotates and high torque can be transmitted (without a mechanical sun gear).



Fig. 1 - 3: CAD model and 3D-printed, working demonstrator of the "Halbach Gearbox".

COMMERCIAL OPPORTUNITIES

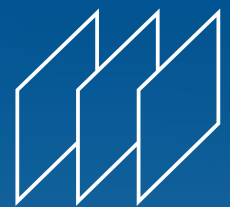
- High torque gearbox for pumps, stirrers, power tools, transportation, etc...
- Fully encapsulated construction possible.
- Contactless, low wear power transmission.
- Inherent overload protection through mechanical separation of input and output side.
- All Parts 3D-printable (no high precision required).

DEVELOPMENT STATUS

3D-printed demonstrator.

REFERENCES:

1 https://en.wikipedia.org/wiki/Halbach_array



BayPAT



Technology from
JULIUS-
MAXIMILIANS-
UNIVERSITÄT
WÜRZBURG

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Contact:

Thomas Hummel
+49 (0) 89 5480177-39
thummel@baypat.de

**Bayerische
Patentallianz GmbH**
Prinzregentenstr. 52
80538 München
www.baypat.de