



**ENSTA
BRETAGNE**



SELF-ADAPTING MAGNETIC WHEELS

PATENT NO. FR 3 110 111 / WO2021233804

RobotMag: Penstock inspection robot fitted with self-adapting magnetic wheels, built for EDF.

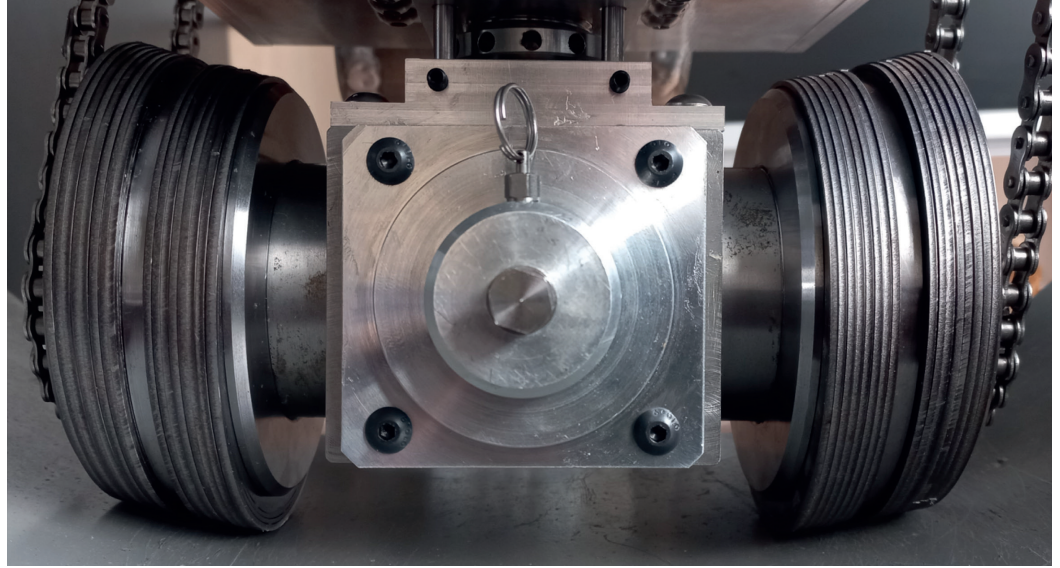


OBJECTIVES

Allow a magnetic carrier to adhere strongly to a curved metal wall.

CONSTRAINTS

The metal walls are curved and have sufficient magnetic permeability to conduct a magnetic field. This is generated by on-board permanent magnets and runs through standard steel cylindrical wheels. As the materials involved are not very deformable, the contact area between the curved wall and the cylindrical wheels is necessarily very small. This induces a magnetic saturation phenomenon on contact, which limits the magnetic field's transmission. The result of these constraints is a weak attractive force between a standard magnetic wheel and a curved metal wall.

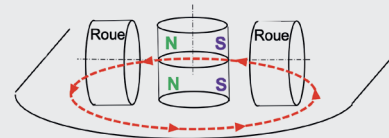


SOLUTION

Break the wheel down into deformable, mobile discs. This solution allows the metal wheel to deform in order to increase the contact area between the wheel and the curved wall. The conduction of the magnetic flux is ensured and induces high attraction forces.

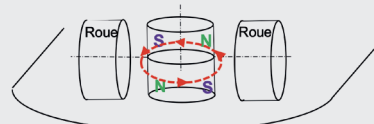
Enabled position

The magnetic flux passes through the surface and allows the magnetization.



Disabled position: inversion of polarities

The magnetic flux loops between the two magnets and no longer passes through the metal surface.



This makes it possible to safely operate a magnetic carrier on curved, steeply inclined, vertical or overhanging walls.

APPLICATION

Underwater robot



PROTOTYPE'S CHARACTERISTICS

- Robot with an umbilical connector or Wi-Fi control
- Immersion depth up to 10 m
- Bending radius of the rolling surface up to 500 mm
- Magnetic field generator with permanent magnets that can be disabled through manual rotation
- Total pulling force up to 300 kg
- High payload

USES

The robot performs various operations under ship hulls, or along submerged or emerged metal structures: observations, cleaning, painting, welding, measurements, etc. The movement of the underwater robot, as for «RobotMag», EDF's inspection robot, is ensured by self-adapting wheels.

Photo credits: ©ENSTA Bretagne

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PATENTS

The self-adapting magnetic wheel is protected by a patent No. FR 3 110 111 / WO2021233804

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