

**"TUNABLE" DEVICE FOR VIBRATION ABSORPTION**

Main Technological Area —> Mechanics

Keyword —> resonant damper | tuned mass damper | vibration absorber

The purpose of this device is to dampen vibrations generated by the rotor and transmitted to the rotor hub and then to the helicopter. Like all resonant mass absorbers, the effectiveness of the device is high only at the resonance frequency, while it is very low or negligible outside a very narrow band centered on this frequency. The device has minimal damping to maximize its effectiveness at the tuning frequency.

**TECHNICAL FEATURES**

Current devices of this category, for helicopter rotor applications, consist of a mass fixed to the free end of a cantilever rod perpendicular to the plane of the rotor, the other end of which is bound to the rotor hub and rotated with it. The system acts as an inverted pendulum that uses the flexural stiffness of the rod to erase vibrations in the rotor plane. The system is very simple and effective, however its main limitation is its inability to cope with variable revolutions.

An alternative approach proposed consists of a tunable system, which combines a relative simplicity, the lack of moving parts (thus maintaining a monolithic design that guarantees low damping) and an intrinsic ability to cope with variable revolutions.

This is achieved through a modified design whereby the mass support rod may be subject to compression/tension, thus altering its fundamental frequency and effectively allowing for adjustment of the resonance frequency. Compressive loads tend to de-stabilize the rod and thus reduce its resonance frequency while the voltage has a stabilizing effect and increases its resonance frequency (effect well known in stringed musical instruments). The effect is achieved, for example, by means of a cable through the inside of the instrument. of the support rod which is energized by an actuator when the frequency is to be changed.

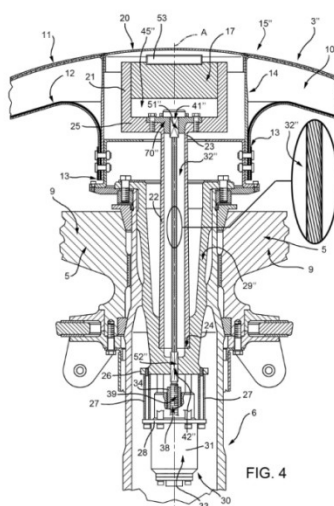


Figure 1 - Technical drawing of the solution



### INNOVATION/BENEFITS

- Ability to adapt to variable frequencies (variable revolutions)
- Simplicity
- Effectiveness thanks to the absence of vibrating moving parts, which maintains a low damping of the system.

### AREAS OF USE

- Rotary / fixed wing aircraft
- Land Vehicles
- Naval Application
- Damping in ground turbo-generation plants

### PATENT INFORMATION

**Priority Date** – 2016/02/22

**Priority Number** - EPO EP3208192A1

**IPC Codes** – B64C27/00 – F16F15/02

#### Active Worldwide Extensions

EPO – EP3208192B1; Filing Date 2016/02/22; Grant Date 2018/04/11

Italy – France – Germany – United Kingdom

USA – US10882609B2; Filing Date 2017/02/22; Grant Date 2021/01/05

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#### Leonardo internal code

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