

A fresh wind for the cement industry

Wikov, a Czech based company, has recently launched a new series of epicyclic Orbi-fleX branded gearboxes. The product features a flexible pin and overload stop technology to minimise failure rates and increase savings in operating expenditure.

Planetary gearboxes play an ever more important role in the global gearbox market, in which they are experiencing the most rapid growth. Despite the often conservative approach to the technical upgrades in many industrial sectors, planetary gears are well established and are becoming a standard drive. For many applications they definitely represent the future of the gearbox market. Aside from their well-known benefits, such as their small size and high power density, some types of planetary gearbox provide end-users with extra features that offer additional value.

Wikov has long been aware of this indisputable potential and recently brought to the market a brand new series of 22 ready-to-deliver designs for planetary gearboxes with flexible pin technology. Their application is not just limited to cement, as they find use in mining, wind power and other applications where longer lifetimes and limited downtime are prerequisites for successful daily operation. The technology of the flexible pin applied in Wikov's planetary gearboxes enables a 40-50% reduction of the gearbox weight in comparison with conventional gearboxes of the same power and shock load resistance, as well as extended gear and bearing lifetimes.

We use flexibility, rather than fight it

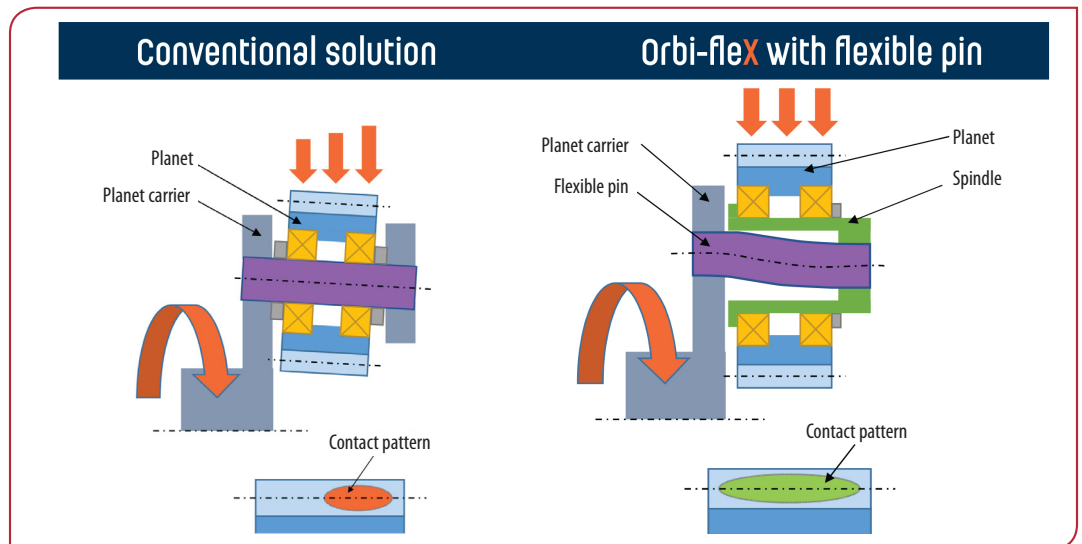
This all sounds impressive, but how did this technology come to be at Wikov? To answer this, a deeper look into history of the flexible pin is required.

Flexible pin was invented over 50 years ago by British engineer Ray Hicks, who started working with gears in 1954. Ray founded Compact Orbital Gears in 1964, when he patented his own epicyclic gear system that used compound cantilever flexible planet spindles known as flexible pins. The pins enable the planets to float and thus ensure perfect alignment. This reduces the stresses and makes the construction of smaller, lighter and more reliable planetary gearboxes possible.

The 'Hicks Flexible Pin' was successfully applied to a wide variety of industrial and aerospace gearboxes, ranging up to 48,000hp and with speeds up to 100,000rpm. To date, over 2000 such gearboxes have been made and installed worldwide.

Ray is a long-term friend and associate of Dr Frank Cunliffe. The two founded Orbital2 in 2002 to design and license the manufacture of flexible pin epicyclic gearboxes for the renewable energy industry, specifically wind power applications. Two years later, Orbital2 was acquired by Mr Wichterle, the owner of the Czech holding company Wikov. He financed this unique technology into the wind energy market. Since then, Orbital2 has deployed gearboxes for 1.5-7MW wind turbines around the world under the Wikov brand, with some 1.5-2MW Asian projects deployed through licensed manufacturers.

This is how Wikov came to be the only owner of the original flexible pin technology and explains how it developed the technology further. The



Right - Figure 1: A comparison of conventional and flexible-pin planetary gearboxes and their behaviour during a shock load.



Above: An Orbi-flex with flexible-pin integrated into a bevel-helical planetary gearbox for a bucket wheel drive.

developments since acquiring Orbital2 have added further value and bring a top-quality solution to the market.

Flexible pin with overload stop

A flexible pin with patented overload stop was introduced to the market by Wikov in 2005. The overload stop protects the flexible pin against possible mechanical damage that could happen when the driveline experiences high peak loads. This could happen in wind turbine applications, where very extreme shock loads may occur in some cases.

Figure 1 shows a comparison of conventional (left) and flexible-pin (right) planetary gearboxes and their behaviour during a shock load. The structure of the conventional solution, when it experiences higher than nominal loads, tends to deform and thus forces planets to tilt from ideal positions. This causes unequal loading of planet bearings and worsens the gear mesh contact pattern. Preventing such phenomena usually means adding more stiffness through more material but movement cannot be completely stopped. However, with the flexible pin solution, the planet is released to move in a controlled manner and stays parallel. Perfect bearing load distribution and contact patterns are assured.

“The Overload Stop helps to keep the stress in the flexible-pin during the peak load situations within acceptable material limits by increasing the stiffness of the system. This reduces the deflection of the flexible pin while still keeping the parallel motion of the planet wheel and perfect load distribution across the facewidth of the gear,” explains Vilem Rosko, Engineering Manager of Orbital2. This is in stark contrast with conventional planetary gearboxes, in which the system deflections are not compensated for in any way and the gears experience high edge contact stresses that lead to the premature teeth failure.

Right: Orbi-flex planetary gearboxes driving a roller press in a cement plant.



Overload Stop installations in wind turbine gearboxes provided very strong evidence of the effectiveness of this solution. A gearbox opened after 10 years of operation in a wind turbine uncovered the condition of the key components such as gears and bearings. They appeared to be untouched.

However, this achievement took some years as Wikov ‘mined’ the experience from the rapidly expanding wind power sector. “Over the course of time, Wikov became the leader in the flexible pin technology,” says Jan Vosatka, Technical Director at Wikov Industry.

“However, after the dramatic decline of the wind turbine sector in around 2012, we decided to apply flexible pin technology to other industrial applications, where we felt flexible pin can be beneficial for gearbox durability and lifetime.”

The development of the flexible pin technology has included continuous, intensive research and development into increased capacity and reduced complexity and costs for the gearbox. This has made the technology suitable for the cement and mining sectors under a new product range, the Orbi-flex.

Orbi-flex planetary gears with flexible pin have been installed in cement roller presses, as drives for the bucket wheel and track drive for the excavators used in open pit mines and mobile shredders in the wood processing sector. These dynamic applications are prone to shock loads that can have a significant impact on the lifetime of the gears and bearings. A conventional gearbox suffers from overloads and its internal components become damaged or worn out, which soon reduces their efficiency, increases maintenance costs and/or exposes the end-user to replacement costs. All of these issues are eliminated with the Orbi-flex, a solution that has already proven itself in harsh real-world operations. 