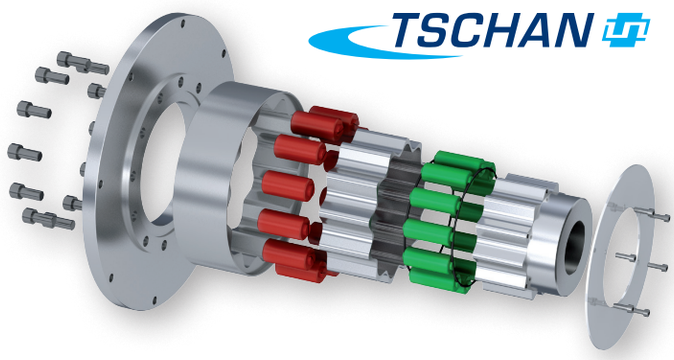
Elastic buffers ordered in series make TSCHAN® TNR adjustable

RINGFEDER POWER TRANSMISSION presents new kind of non-shiftable shaft coupling



Elastic buffers ordered in series make TSCHAN® TNR „adjustable“. This simply requires a smart combination of available elastomers.

The **TSCHAN® TNR** is a new model for highly elastic couplings made by RINGFEDER POWER TRANSMISSION. Unlike commonly used torsionally elastic shaft couplings, the TNR is adjustable and therefore allows for a smoother start-up of power transmissions. It also optimises torsional vibration during operation.

If it is mounted between the combustion engine and the transfer box, for example, this novel, non-shiftable coupling is not just ideal for mobile construction machines such as excavators, cranes, hauliers, and wheel loaders, but it's also perfectly suited for power generation wherever combustion engines such as emergency power units or mobile generator are used.

Coupling stiffness defines lowest possible natural frequency

When internal combustion engines are employed, as is frequently the case with Diesel engines, the power train is subject to dynamic stimuli. These manifest in torsional-vibration behaviour and are caused periodically as gas and mass forces are excited. The actual dynamic behaviour of the power train can be plotted mathematically by joining mass moments of inertia, damping and rigidity. It is, however, the stiffness and the mass moments of inertia of the entire power train that determine at which frequencies, i.e. rotations, the disruptions occur. The position of the lowest natural frequency is defined by the distribution of the mass moments of inertia of the rotating components and the smallest rigidity; it thus depends significantly on what kind of coupling is being used. When the excitation frequency and the natural frequency coincide, resonance is inevitable. By adjusting the mass moments of inertia and the rigidity of the coupling, both can be moved from service speed into the non-critical range.

A well-known example of the afore-mentioned behaviour is the flywheel in diesel engines. Thanks to the additional mass moments of inertia, it homogenises the torque curve. However, since the dimensions of flywheels are made with the fuel consumption and operating characteristics in mind, i.e. they are designed for the combustion process, it would be unwise to try to do anything at the vibration points on the drive side by using an additional mass moment of inertia. In practice, elastic couplings with a relatively low stiffness have stood their ground as the “problem solvers”.

Consistent out dimensions

This is where the new TSCHAN® TNR by RINGFEDER POWER TRANSMISSION comes in. Due to its low stiffness, the shaft coupling influences the above-mentioned vibration points the most. What was special about developing this new concept was the fact that the key figures of the coupling can now be adjusted on a larger scale and with little effort, while the out dimensions remain the same. The coupling becomes “adjustable” because the elastic buffers are separated one from another and, as a result, are ordered in series. This simply requires a smart combination of available elastomers on one inner and one outer buffer plane. Thus, the rigidity can be easily optimized for each power train.

Frequently, there is a very limited range of mechanical transmission elements available for the various coupling types and sizes. In addition, they are often fixed on a hub. In the past, it was therefore necessary to make compromises as far as the torsional vibration behaviour was concerned. Now, however, with the TSCHAN TNR, the characteristics of the couplings can easily be adjusted.

One brilliant idea

“While I was working in the research and development department at RINGFEDER POWER TRANSMISSION, I always had the challenge of having to find the right coupling for the right power transmission that would match the torsional-vibration behaviour of

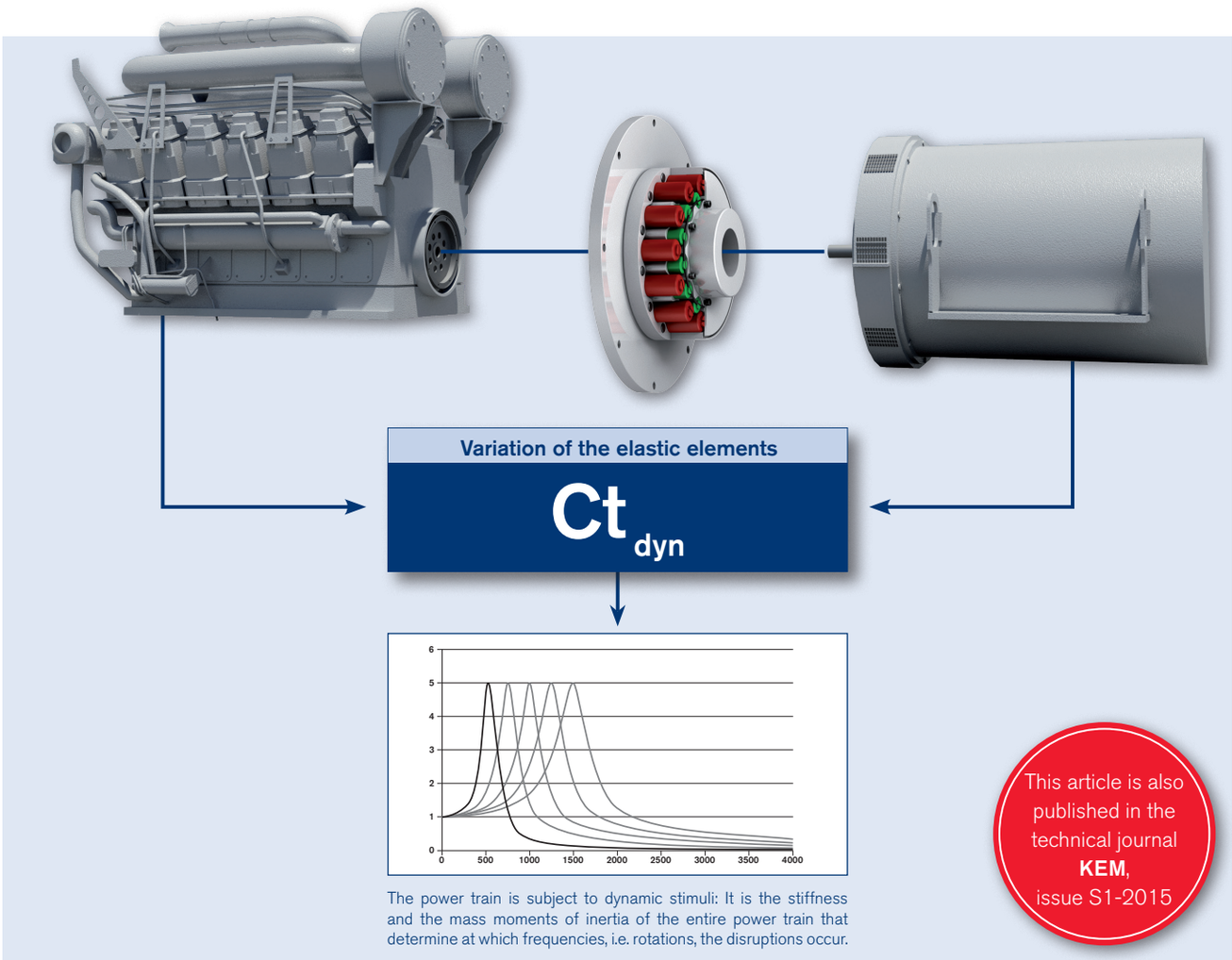
a given plant", says engineer Simon Graf, talking about the development of the TNR. "Often, we have had to compromise and ended up with a more complex design," says product manager Norbert Telaar. This observation gave birth to the idea of developing couplings, the rigidity of which could be adjusted within a wide range. "Arranging elastic elements in series and utilizing the resulting variability was the decisive factor", says Graf.

When the rubber meets the road

To begin with, the engineers at RINGFEDER POWER TRANSMISSION studied the challenge of adjusting power trains. Based on their observations, they then developed a concept and the first prototypes, which were put to the test on their own dynamic test bench. Deeply impressed by the results, the upper management did approve the continuation of the research and development despite the rather high costs. Detailed models and simulations were made and further tests carried out on a special test bench at the University of Bayreuth. After that stage in the design process, the mathematical correlation between the various levels had to be plotted along with the elastomers that were being used. Additional tests had to show that the calculations had been correct. "Today," says Norbert Telaar, "we are able to include different elastomers for known material key figures, and can thus guarantee that we will come up with an applicable solution quickly."

Background/Authors

The TNR is the latest brainchild under the TSCHAN label. The company, which is based in Neunkirchen, has been part of the RINGFEDER POWER TRANSMISSION GMBH since 2014 as their 4th trademark. Norbert Telaar, head of the production management for the entire product range, and engineer Simon Graf were responsible for developing this new kind of highly elastic couplings. Telaar (55) studied general mechanical engineering at the University of Duisburg, where he majored in vibration technology. He joined what was then the TSCHAN GMBH back in 1998, having passed through some other companies. Simon Graf (30) holds a Master in Mechanical Engineering.



The power train is subject to dynamic stimuli: It is the stiffness and the mass moments of inertia of the entire power train that determine at which frequencies, i.e. rotations, the disruptions occur.

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