

Center Differential of the New Audi Quattro with Cylkro Face Gear Technology

An enormous breakthrough for the multiple-power Cylkro face gear transmission in the field of automotive applications was the introduction at the Geneva Autosalon earlier this year of the new Audi Quattro RS 5 with a self-locking crown gear differential in the Quattro drive train, which regulates the power distribution between the front and rear axles.

Two Cylkro face gears with different tooth geometries, resulting in a 40:60% torque split, are built into this lightweight differential (4.8 kg). ASSAG was given the responsibility of developing the tooth geometry of the face gears and pinions that are used in the heart of the Quattro drivetrain. Finally the successful cooperation resulted in a common patent applica-

tion and ASSAG granted a license for serial production of the Cylkro face gears. Using the Cylkro face gear technology, Audi could realize a weight reduction of 2 kg compared to the conventional differential. Furthermore, the package of plates of the differential could be considerably reduced.

How it works. The Cylkro face gear with the largest number of teeth (Fig. 8, left side) is connected with the cardan shaft to the rear axle. The second face gear takes care of the power take-off to the front axle. In between the face gears, four planetary pinions are equally spaced at 90° in a planet carrier that is driven by the outgoing axis of the S-tronic 7-speed gearbox with double clutch.

The self-locking crown gear center differential attains a high efficiency ratio. This standard rear-biased configuration ensures sporty handling of

the vehicle. In the basic situation, there is no difference in rotational speeds of the face gears and the planet carrier. If one of the axles starts to spin, for example, while it is on ice or snow, the self-locking face gear center differential will immediately engage. By a package of plates, the differential can widely vary the torque distribution between the front and rear axles. Up to 70% of the drive force can be fed to the front, and as much as 85% toward the tail-end (Fig. 9).

ASSAG could realize this wide variation by exactly locating and tolerating the contact patterns between the pinions and face gears. These contact patterns have been pre-defined by ASSAG within specified limitations. This leads to certain axial forces on the face gears and on the package of plates, finally resulting in a variation of the torque distribution in such a way that ASSAG could fulfill all Audi specifications.

In the crown gear differential, the gears are mounted without backlash. The result is a homogeneous conversion of the torque distribution without any delay. In conjunction with intelligent software in the braking system, the Quattro system assigns optimal torque to every driven wheel. Interventions of the ESP system will be reduced to a minimum. This increases the drivability of the Audi RS 5 in every situation. (After the release of the RS 5, Audi will equip future Quattro series with the face gear differential.)

Catalog products. The earlier mentioned Danaher's gear range was the instigator for ASSAG to look at its own standard range of catalog Cylkro face gear sets. This way, Cylkro face gear sets would also become available as a standard program allowing short delivery times and competitive prices. The program covers torques from 0.7 to 518 Nm, ratios up to 1:10. More information on the standard program is available in the Cylkro catalog or download the free trial online at nitropdf.com/professional

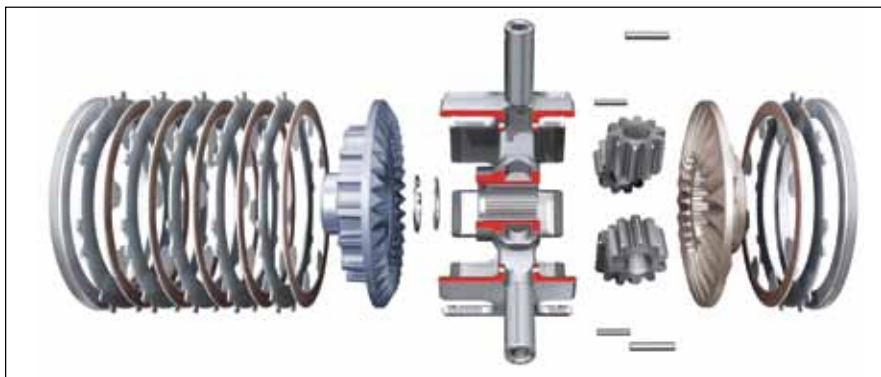


Figure 8—Detail of the Audi Quattro RS 5 center differential.



Figure 9—Embedded face gear center differential.