CV joints - the next step

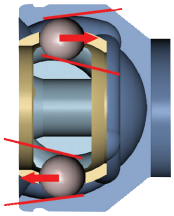
Constant Velocity (CV) joints are essential components of the drivetrain. They transmit tremendous torque from the differential to the wheels, while allowing steering movements and spring deflection. Erwin den Hoed, an independent journalist for Dutch automotive magazine, *Auto en Motortechniek*, explains the ruggedness and advantages of CV joint designs and introduces the next step in CV Joint evolution.

More than 50 years ago, a breakthrough came with the launch of the Austin Mini and the front-wheel drive. Since then, the front-wheel drive principle has not only been implemented in compact class vehicles, but has also been used in luxury class cars. Today, about 64% of all cars world-wide are fitted with front-wheel drive, and about 13% with four-wheel drive. The technological advances achieved in CV joints have made an essential contribution to this development. Without them, the front-wheel drive, as we now know it, would not have been possible.

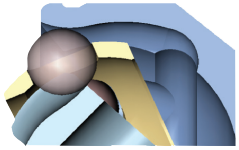
The main requirements for modern driveshafts and CV joints are:

- Reliable transmission of engine torque at constant velocity, and under acceleration.
- Angles of up to 50° to allow steering and suspension movement.
- Driveshaft plunges of up to 50 mm at the output of the differential, to allow suspension movements
- Maximum vibration decoupling between the engine-transmission assembly and the wheel suspension, thus maintaining the comfort of vehicle occupants.
- A long, trouble-free service life

The main requirements for a CV joint as far as the driver is concerned, is that they are durable and reliable. They will function without fail or bother. As a mechanic, you need to rely on the manufacturer to provide a well made and durable CV joint that was carefully designed and rigorously tested. Relying on a budget or generic brand could easily end up as false economy, in the event of a premature failure of the replacement part. Installing a quality part from a trusted manufacturer will bring peace of mind to you and your customer.

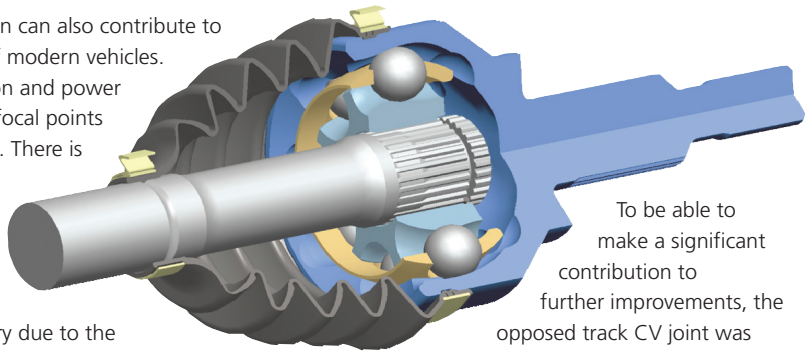


Opposed sets of tracks



S-shaped tracks

Driveshaft design can also contribute to the efficiency of modern vehicles. Weight reduction and power density are the focal points of development. There is also a trend towards greater applied operating angles, necessary due to the increase in spring travel in all-wheel/4 wheel drive and sport utility vehicles. The efficiency of the driveshaft and the maximum allowed operating temperature, are becoming increasingly important in this respect.



This article is concerned mainly with the outboard fixed CV joint. The basic Rzeppa design that dominates these joints (named after its inventor Alfred Rzeppa) goes back to the early 1930s. The original design has proven itself in as many as 100 million vehicles since then. Over the years, fine adjustments to the design, improvements to materials, heat treatment and lubricants and the optimisation of production processes have led to continuing advances in the technology. Alfred Rzeppa originally proposed a clutch element with constant velocity properties, consisting of inner race, outer race, cage and balls as coupling links between tracks. Another significant development came in 1972, when a new longitudinal track form (UF) was introduced (i.e. a straight track segment), which allowed the maximum angle to be increased. Since the market launch in 1972, the UF version of the CV joint has been the basic benchmark for future developments.

To be able to make a significant contribution to further improvements, the opposed track CV joint was developed as the alternative to the Rzeppa joint. The resulting Countertrack joint can be considered a significant technological advancement compared to the Rzeppa joint. The power density has been increased by more than 15%, while at the same time friction losses have been reduced by more than 30%. For the same installation space, the rated torque of the Countertrack is about 25% higher than that of the Rzeppa joint, which corresponds approximately to a doubling of the life of the joint in the vehicle. For special applications with high installation angles and therefore high temperature loads, rated torque can be increased by 40% compared with the modern Rzeppa joint.

Complex considerations arose in the development of the new design: track shape and profile, fatigue and contact wear on the balls, number of balls, materials and heat treatments, lubrication, etc. An interesting note is that there is a fine balancing act between the number, size and spacing of the balls and the overall strength and longevity of the CV joint. Today, the largest market share belongs to the design with six balls, which is the one originally proposed by Rzeppa. The end result of the design of the Countertrack is a CV joint that is more efficient and has a longer service life for all vehicles on the road.

In extensive validation tests, the Countertrack CV joint showed outstanding performance in direct comparison with the traditional Rzeppa joint, and especially in comparison with the UF joint. Expect to see more of this new design as push for efficiency and lower emissions continues.