

## **A REVIEW ON CONSTANT VELOCITY JOINT**

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### **Abstract**

A coupling (joint) is mechanical device used to connect two shafts together at their ends for the function of transmission of power. The basic function of joints is to join two parts of rotating elements while permitting some degree of misalignment or end movement or both. with constant velocity (CV) coupling which offers features like minimizing side loads, higher misalignment capabilities, more operating speeds, improved efficiency of transmission and many more. Constant Velocity (CV) joints allow a drive shaft to transmit power through a variable angle, at constant rotational speed, without an significant increase in friction or play. Constant velocity (CV) joints are mechanical power transmission components that provide rotational power at various angles. They provide the same output velocity in relation to the input velocity, independent of the angle they are operated at. In this paper the research work of various researchers related to manufacturing, measurement and analysis of components of constant velocity joints is reviewed. Also some various types of Constant Velocity (CV) joints are also discussed.

### **Introduction**

The fundamental capacity of a force transmission joint is to transmit torque from an info shaft to a yield shaft at a given shaft speed and, where important to contain shaft misalignment. In the 16th century GerolamoCardano invented the universal joint, one of the earliest means of transmitting power between two angled shafts. Early front wheel drive systems used universal joints, where a cross-shaped metal pivot sits between two forked carriers. They are simple to make and can be extremely strong and are still used to provide a flexible coupling in some propshafts, where there is not very much movement. As front wheel drive systems became more popular, the shortcomings of universal joints in front axles became more and more apparent. However, when operated at extreme angles they become notch and difficult to turn. The universal joint failed to maintain constant velocity during rotation was recognized by Robert Hooke in the 17th century, who proposed the first constant velocity joint, consisting of two Cardan joints offset by 90 degrees, so as to terminate out the velocity variations. Many different types of constant-velocity joints have been invented since then.

Constant-velocity (CV) joints are essential components in your car's drive shaft system. CV joints allow a drive shaft to transmit power through a variable angle, at constant rotational speed, without an significant increase in friction or play. All front-wheel drive cars have CV joints on both ends of the drive shafts. The outer CV joints connect the drive shafts to the wheels, while Inner CV joints connect the drive shafts to the transmission. In front-wheel drive cars, CV joints deliver the torque to the front wheels through turns. Constant Velocity (CV) joints are an integral part of modern vehicles, considerably disturbing steering, suspension, and vehicle vibration comfort levels. Each driveshaft comprises of two types of CV joints, namely fixed and plunging types coupled using a shaft.

### **Literature Review**

**Tae-Wan Ku, Lee-Ho Kim, Beom-Soo Kang[1].**This paper presents an alternative method to produce the outer race of CV (constant velocity) joints with six inner ball grooves. Multi-stage cold forging process is presented to replace multi stage warm forging process. The multi stage cold forging process is simplified and redesigned as one operation to produce the forged outer race and the backward extrusions of the traditional

process. The sizing and necking are also combined into a single sizing-necking process. A 3-dimensional finite element simulation on each sequence is performed to ensure the appropriateness of the suggested process with respect to deformation behavior. Also the experimental investigations are carried out using SCr420H as the initial billet material. This process simplification ensures that the total number of operations for the multi-stage cold forging process can be reduced. The proposed multi-stage cold forging process reduced the volume of the initial billet by about 7% with the same specifications of the outward appearance. The required operation time is reduced by 81% in the comparison with the traditional warm forging process. The proposed process simplification and its application to the multi-stage cold forging replaces the traditional multi-stage warm forging can be practically applied to the manufacturing process for the forged component with the complicated 3-dimensional configuration, including the outer race of the CV joint.

**K.S. Park, B.J. Kim, Y.H. Moon[2].** This paper gives the ball groove measurement system for measurement the dimensions of the six ball grooves in the outer race of Constant Velocity (CV) joints. The outer race of a constant velocity (CV) joint is an important load-supporting automotive component that transmits torque between the transmission and the driven wheel. The outer race is difficult to be forged and the required dimensional tolerances are very tight because its shape is very complicated. A quick and precise measurement is required for these forged products to guarantee the dimensional accuracy of a forged outer race and to decrease the time for inspection. A ball groove measurement system that uses the mechanical linear displacement sensor and lab view software has been developed and implemented in an industrial production line. The newly developed system is suitable to achieve high measurement accuracy with a simple operational sequence. The measured dimensional profiles of developed system also show excellent conformity with those from a Zeiss 3D measurement scanner. The system provides objective and reliable results including cause of the CV joint defect. Also, useful for redesigning a mold by checking the dimension tolerance of the CV joint ball groove. The proposed system can assurance the dimension correctness of the final product, since the 3D measuring method to provide more accurate result of the surface of ball grooves is used.

**Chul-Hee Lee, AndreasA.Polycarpou[3].** This paper gives a phenomenological CV joint friction model was formed to show the contact perform of tripod CV joints by utilizing an instrumented CV joint grinding mechanical assembly with tripod-sort joint gatherings. Examinations were going to under different working states of CV joint articulation angles, oil, oscillatory speeds and torque. The trial information and physical parameters were utilized to construct up a material science based phenomenological CV joint element grinding model. It was establish that the proposed friction model catches the trial information well, and the model was utilized to predict the external produced axial force, which is the essential main source of power that causes vehicle vibration issues.

**Jian Mao, Yuanxin Luo, Jun Liu[4].** This research paper gives an idea for transmitting rotary movement from the gearbox output shaft to the wheels with a consistent speed a car drive shaft is utilized as a part of a front drive transmission vehicle. This paper shows the kinematic model of ball joint and tripod joint with consideration of clearance and proposes a disentangled dynamic model of the drive shaft. The recreation of the dynamic model is known by the purposeful information. Also, the rough wear of the ball sort joint is tried on the experimental setup with attention of full stacking. The outcomes express that the development of the movement will be influenced by the clearance when the stacking alters its course. The movement will be stable because of the damping. From the experiments it can be initiate that the abrasive wear of ball joint to a great extent relies on upon the relative sliding speed. This will most likely manipulate the dynamic performance and the impact power, which will similarly cause the other type of failures.

## Types Of Cv Joint

### 1. Tracta joints

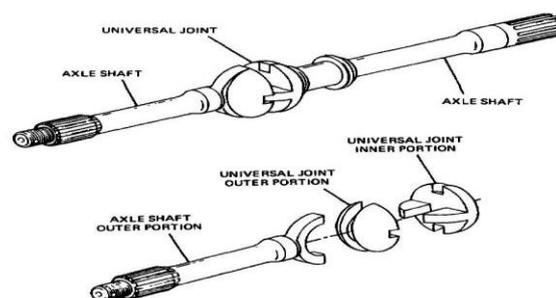


Fig. 1-Tracta Joint

The Tracta joint works on the principle of the double tongue and groove joint. It consists of only four individual parts includes the two forks (a.k.a. yokes, one driving and one driven) and the two semi-spherical sliding pieces which interlock in a floating connection. Each yoke jaw engages a circular groove formed on the intermediate members. By a swivel tongue and grooved joint both intermediate members are joined together in turn. The driving intermediate member accelerates and decelerates during each revolution, when the input and output shafts are inclined at some working angle to each other. Since the central tongue and groove joint are a quarter of a revolution out of phase with the yoke jaws, the consequent speed fluctuation of the driven intermediate and output jaw members exactly counteracts and neutralizes the speed difference of the input half member. Thus the output speed change is equal to that of the input drive, providing constant velocity rotary motion.

## 2. Rzeppa joints

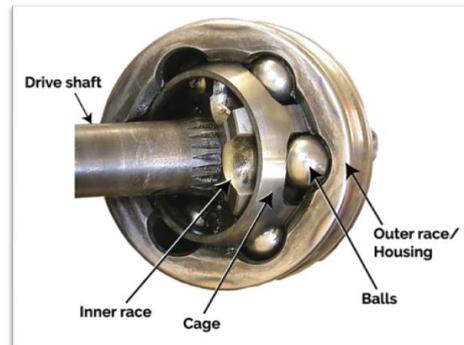


Fig. 2-Rzeppa Joint

A Rzeppa joint consists of a spherical inner shell with 6 grooves in it and a similar persistent outer shell. Each groove guides one ball. The input shaft fitted in the centre of a large, steel, star-shaped gear that nest inside a circular cage. The cage is spherical but with ends open, and it has six openings in the region of the perimeter. The cage and gear fit into a grooved cup that has a splined and threaded shaft attached to it. Six large steel balls sit inside the cup grooves and fit into the cage openings, nestled in the grooves of the star gear. The output shaft on the cup then runs through the wheel bearing and is secured by the axle nut. This joint can contain the large changes of angle when the front wheels are turned by the steering system; typical Rzeppa joints permit 45°–48° of articulation, while some can give 54°. At the outboard end of the driveshaft a slightly dissimilar unit is used. The end of the driveshaft is splined and fits into the outer joint. It is held in place by a circlip.

## 3. Tripod joints

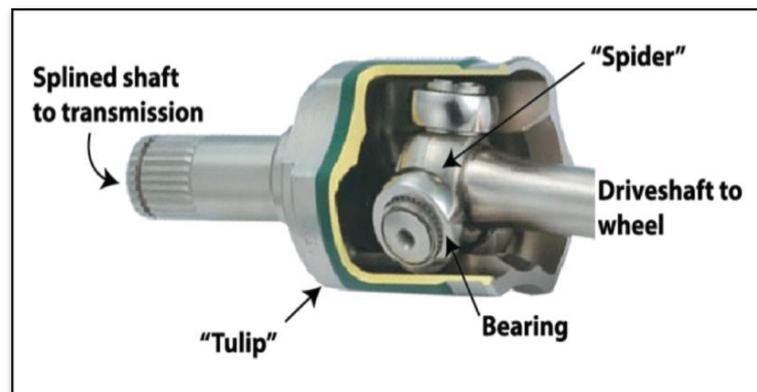


Fig.3-Tripod Joint

The tripod joints are used at the inboard end of car drive shafts. This joint has a three-pointed yoke attached to the shaft, which has barrel-shaped roller bearings on the ends. These fit into a cup with three similar grooves, attached to the differential. Since there is only considerable movement in one axis, this simple arrangement works well. These also permit an axial plunge movement of the shaft, so that engine rocking and other effects do not preload the bearings. A typical Tripod joint has 26 degrees of angular articulation and up to 50 mm of plunge travel. The tripod joint tends to be lower in cost and more efficient but does not have as much angular range as many of the other types of joint. Due to this it is typically used in rear wheel drive vehicle configurations where the essential range of motion is lower.

#### **4 Double Cardan**

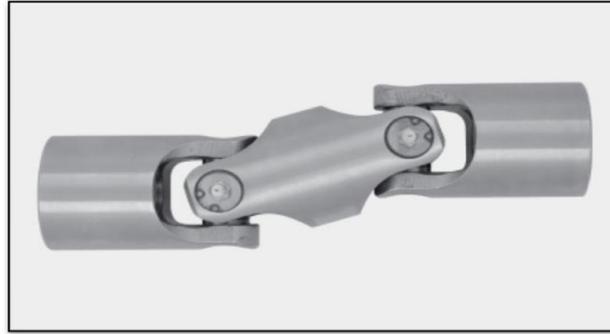


Fig.4-Double Cardan

Double Cardan joints are analogous to double Cardan shafts, except that the length of the intermediate shaft is reduced leaving only the yokes; this effectively allows the two Hooke's joints to be mounted back to back. Double Cardan Joints remove the need to correctly phase the universal joints at the ends of the intermediate shaft, which eases covering of the intermediate shafts around the other components in the engine bay of the car. They are typically used in steering columns. For maintaining equal angles between the driven and driving shafts for true constant velocity rotation a centering element is required in Double cardan joints. This centering device requires additional torque to accelerate the internals of the joint. Therefore it produce some additional vibration at higher speeds.

#### **CONCLUSION**

The Constant velocity Joints are one of the most important components of front wheel drive axles. These joint transmits power at constant rotational speed through a variable angle. The current paper addresses the state-of-the-art research accomplished towards understanding manufacturing processes and dimensions measurement system for constant velocity joint components. Various types of constant velocity joints are useful for various applications. There is need to design constant velocity joint which lowers production cost, space requirement and simply technology of manufacture as compared to present CV joints in market.

#### **REFERENCES**

- [1] Tae-Wan Ku , Lee-Ho Kim , Beom-Soo Kang , Multi-stage cold forging and experimental investigation for the outer race of constant velocity joints, *Materials and Design* 49 (2013) 368–385.
- [2] K.S. Park , B.J. Kim, Y.H. Moon, Development of a ball groove measuring system for forged outer race constant velocity (CV) joints, *Journal of Materials Processing Technology* 191 (2007) 145–148.
- [3] Chul-Hee Lee 1, AndreasA.Polycarpou, A phenomenological friction model of tripod constant velocity (CV) joints, *Tribology International* 43 (2010) 844–858.
- [4] Jian Mao,1 Yuanxin Luo,2 and Jun Liu3, Research Article Dynamics Performance and Abrasive Wear of the Automotive Drive Shaft, Hindawi Publishing Corporation *Advances in Mechanical Engineering* Volume 2014, Article ID 713824, 9 pages.