

New Harmonic Drive® SHF series and SHG series

Harmonic Drive Systems, Inc.

After a strain wave gearing, named Harmonic Drive® was invented in the US, this technique was introduced to Japan and bloomed into a robotic industry. Harmonic Drive® is a very unique gearing system which can obtain a large reduction ratio in one stage by using an elastic deformation of thin-walled gearing, and there is no backlash. After making some improvements, Harmonic Drive systems now commands an 80% share of the strain wave gearing marketing in Japan.

New Harmonic Drive, named SHF series was derived from SH series. Its hollow shaft structure achieved a silk hat-shaped strain wave gearing based on US-introduced cup-shaped wave gearing and originally designed by ourselves in Japan (Fig.1). In addition to our original tooth profile and stress-reduced design, SHF series has achieved short length in axial, high stiffness, robust and high accuracy hollow shaft structure. Thanks to the improvement of tooth profile, material, elliptical shape, surface treatment and so on, SHG series has achieved 30% higher load capacity compared to SHF series.

Since stress is gathered at the connecting point of the thin-walled section and diaphragm for silk hat-shape, it was thought that silk hat-shape could not be marketed when the technology was first introduced. In order to overcome this issue, higher strength compared to cup type was obtained by calculation for stress-reduced design by FEM and high accurate machining using NC lathe.

Therefore, hollow shaft structure enables industrial robots to be simplified since motor wirings for each joint can be passed through a gearing. Simultaneously, bending of motor wiring can be minimized and the lifetime can be extended. In some applications, a shaft and other devices can be passed so that many valuable usages can be achieved.

In addition, its series can fully realize the capability of strain wave gearing and compactness of robots. The efficient productivity has been achieved by unit type (Fig. 2) which contains an output bearing.

SHF series was marketed in 1995, and SHG was marketed in 2002. As well as these units have been used for wheel parts of Mars Rover (Fig. 3), many industrial robots and humanoid robots by using a hollow shaft structure.

The total sales for speed reducer in robotic industry in 2004 is 568,800 sets, including both domestic and overseas. (This information is based on “Fuji Keizai’s “Whole story of FA and robotic industry in 2005.”) A total share of SHF and SHG in 2004 is 8.4% of total sales in speed reducer in robotic industry.

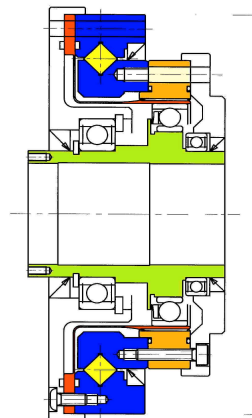


Fig. 2 structure

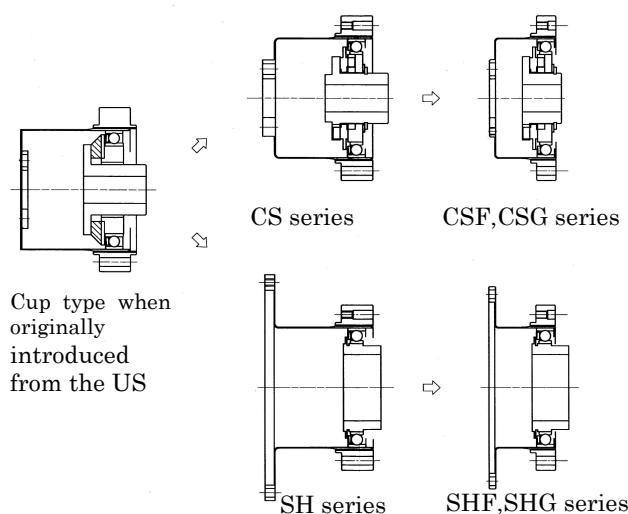


Fig. 1

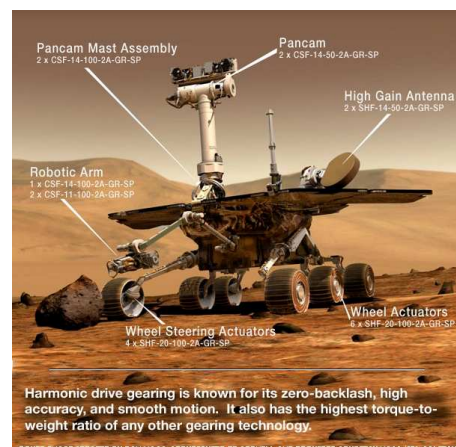


Fig. 3 Mars Rover