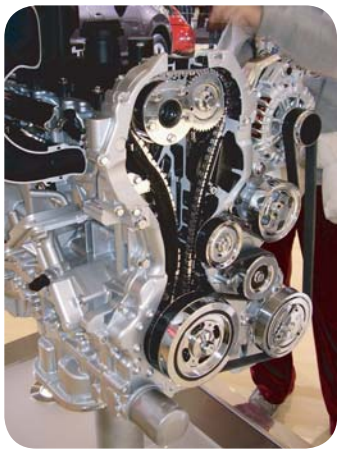
Technology

Continuously Variable Transmission (CVT)

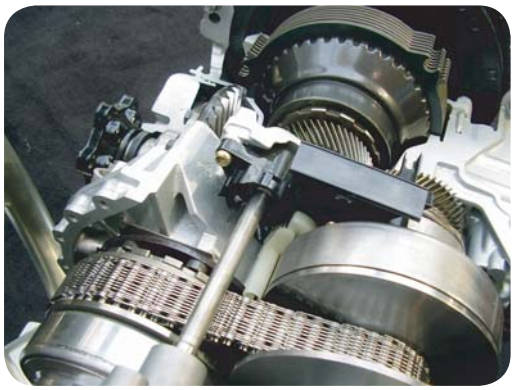
Article courtesy of Jim Kerr, SIAST Kelsey Campus, Automotive Technology

Continuously Variable Transmissions are not new. Leonardo da Vinci made a sketch of one in 1490, and several attempts were made to put them in automobiles at the start of the century, but it took until 1958 before DAF, a Netherlands car company built a CVT in any volume. The transmission was a simple rubber band and cone system but it could only be used behind low horsepower engines and was jerky at slow speeds.



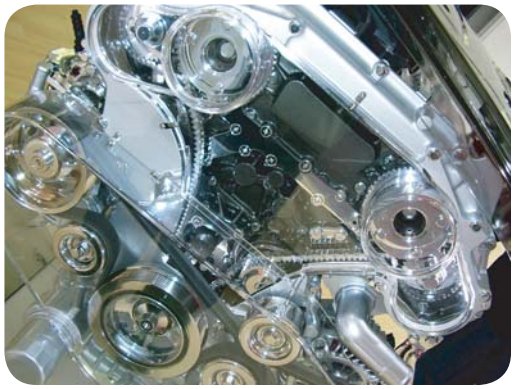
Today, CVTs are installed by several manufacturers. Simplistic in concept, modern CVTs are a marvel of materials and engineering technology. Snowmobiles use a rubber belt that transfers power between two variable width pulleys. Automotive CVTs today use a steel push belt running between two variable width pulleys, similar to a snowmobile.

The belt is made of a series of small plates held in position by a cable. When torque is applied to the belt as it comes off the drive pulley, the plates lock together so the belt acts as a solid link. As the belt starts to rotate around the driven pulley, there is no more torque on the belt and it becomes flexible again. Imagine trying to push a rope. Every time you push it, it turns into a stick, but pull on it and it becomes a rope again. Sounds like magic. The oil used in this CVT is part of that magic.



The best way to describe the oil is that it acts like it has "rubber molecules" that provides the grip between the belt and the pulleys. As pressure is applied to the oil, the "rubber molecules" compress, turning into a crystalline form that locks the belt and pulley together. Relax the pressure and the oil returns to its original state.

Now add a clutch and a simple planetary gearset, the same as used in automatic transmissions, to allow neutral and reverse. Some have a torque converter for smoother operation at very low speeds. Once underway, the torque converter locks up so the CVT belt and pulleys provide all the gear advantage.



An oil pump, a small valve body, speed sensors, and a control make up the rest of the CVT. Computer control systems provide the correct gear ratio for every driving application. Most CVTs allow manual selection of gear ratios so the CVT can be shifted like a manual transmission.

Steel belt CVTs can approach 97% efficiency, similar to manual transmissions. Conventional automatic transmissions typically have efficiency in the 80% range. The increased efficiency and always-correct gear ratio enables CVT equipped vehicles to achieve up to 10% better fuel economy, lower engine emissions, and faster acceleration compared to conventional automatics.

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