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Editorial

Editorial Note on Fluid Coupling

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EDITORIAL

A fluid coupling, also known as a hydraulic coupling, is a hydrodynamic or 'hydrokinetic' device that is used to transmit rotating mechanical power. It has been used as an alternative to a mechanical clutch in automobile transmissions. It is also widely used in marine and industrial machine drives, where variable speed operation and controlled start-up of the power transmission system without shock loading are critical. The fluid coupling was invented by Hermann Föttinger, the chief designer at the AG Vulcan Works in Stettin. His 1905 patents covered both fluid couplings and torque converters. Dr. Gustav Bauer of Vulcan-Werke worked with English engineer Harold Sinclair of Hydraulic Coupling Patents Limited to adapt the Föttinger coupling to vehicle transmission in an attempt to alleviate the lurching Sinclair had experienced while riding on London buses in the 1920s. Following Sinclair's discussions with the London General Omnibus Company in October 1926, as well as trials on an Associated Daimler bus chassis, Daimler's Percy Martin decided to apply the principle.

A fluid coupling is made up of three parts, plus the hydraulic fluid:

- The fluid and turbines are contained in the housing, also known as the shell (which must have an oil-tight seal around the drive shafts).
- There are two turbines (fan-like components):

One connected to the input shaft is known as the pump or impeller, and the other is known as the primary wheel input turbine.

The other, which is connected to the output shaft, is referred to as the turbine, output turbine, secondary wheel, or runner.

The hydraulic fluid is directed by the 'pump,' whose shape forces the flow in the direction of the 'output turbine' (or driven torus[a]). Any difference in the angular velocities of the 'input stage' and 'output stage' results in a net force on the 'output turbine,' causing a torque and causing it to rotate in the same direction as the pump.

The step-circuit coupling, formerly known as the "STC coupling" by the Fluidrive Engineering Company, is a modification to the simple fluid coupling.

When the output shaft is stalled, some of the oil gravitates to the STC coupling's reservoir, but not all of it. This reduces "drag" on the input shaft, resulting in lower idling fuel consumption and a decrease in the vehicle's tendency to "creep." When the output shaft begins to rotate, centrifugal force forces the oil out of the reservoir and back into the coupling's main body, restoring normal power transmission. Low-viscosity fluids are preferred because a fluid coupling operates kinetically. Multi-grade motor oils or automatic transmission fluids are commonly used. The amount of torque that can be transmitted at a given input speed increases as the fluid density increases.

However, hydraulic fluids, like other fluids, undergo viscosity changes as temperature changes. This causes a change in transmission performance, so where unwanted performance/efficiency changes must be kept to a minimum, a high viscosity index motor oil or automatic transmission fluid should be used. Fluid couplings were used in a wide range of early semi-automatic and automatic transmissions. The hydrodynamic torque converter has been used in automotive applications since the late 1940s, replacing the fluid coupling. In automotive applications, the pump is typically connected to the engine's flywheel—in fact, the enclosure of the coupling may be part of the flywheel itself, and thus is turned by the engine's crankshaft. The turbine is linked to the transmission's input shaft. As the engine speed increases while the transmission is in gear, torque is transferred from the engine to the input shaft by fluid motion, propelling the vehicle. In this regard, t's behaviour is instructive. The most prominent use of fluid couplings in aeronautical applications was in the DB 601, DB 603, and DB 605 engines, where it was used as a barometrically controlled hydraulic clutch for the centrifugal compressor, and in the Wright turbo-compound reciprocating engine, where three power recovery turbines extracted approximately 20% of the energy or about 500 horsepower (370 kW) from the engine. Fluid couplings are relatively easy to manufacture. The turbines, for example, can be aluminium castings or steel stampings, and the housing can also be a casting or stamped or forged steel.

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