An Introduction to Hydro-mechanical Transmissions

Fuel cost and the fuel saving characteristics of continuously variable transmissions (CVTs) have increased the pressure to provide CVT capability to larger and larger machines. Hydro-mechanical transmission architecture allows smaller hydraulic components to provide cost effective CVT functionality to larger machines. As a result the number of hydro-mechanical transmission in the market place is growing.

A hydro-mechanical transmission schematic is conceptually simple with two parallel power paths. The hydraulic path is made up of a pump and motor refered to here as a variator. The mechanical path is typically a shaft with maybe a gear or two. These paths are interconnected with ordinary mechanical transmission components such as gears, shafts, clutches and at least one planetary. There are a very large number of interconnection possibilities. In a given design it is the details of these interconnections that constitute the bulk of the intellectual property and the suitability to the target machine application.

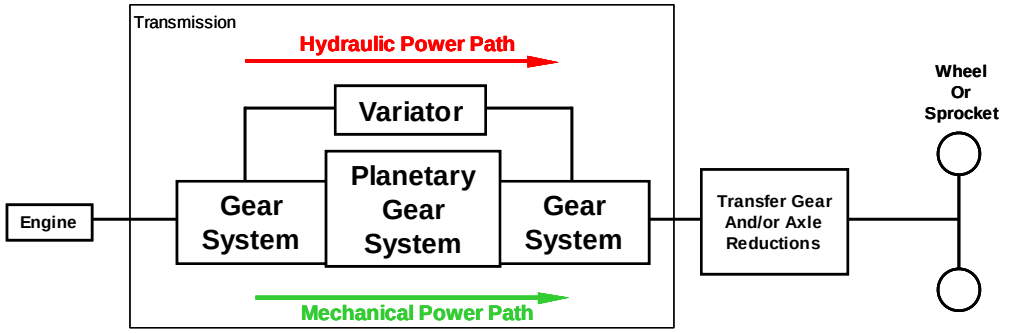

Figure 1 – General Parallel Path Transmission Schematic

Hydro-mechanical transmissions have been available in agricultural tractors for a long time. They are either standard or popular options.

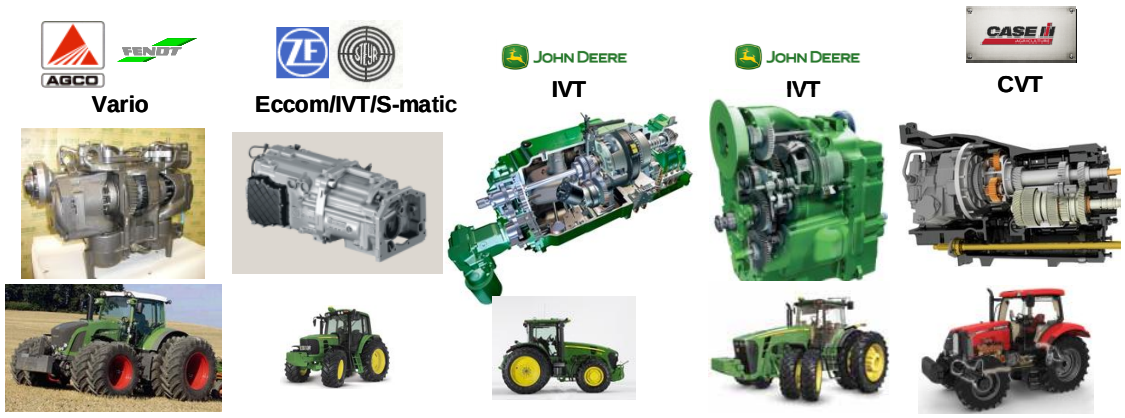

Figure 2 – Hydro-mechanical Transmission Examples – AG

Hydro-mechanical transmissions have not generally been available in earthmoving until now. The wheel loader segment is thought to benefit the most from a CVT and that is where the latest offerings can be found. The following examples have been announced and are available now or will be shortly.

Figure 3 – Hydro-mechanical Transmission Examples – Wheel Loader

Three things differentiate given designs. First is the construction of the variator pump and motor and their location. For example: variable displacement swashplate pump, fixed displacement bent axis motor, internally mounted. Second is the type of coupling. Common terms are input coupled, output coupled, and compound split. It generally describes whether or not the transmissions input or output shaft is directly connected through a gear ratio to one of the variator shafts. In the case of compound split neither variator shaft is directly connected. Third is number of ranges or modes. This is the number of different mechanical interconnections made between the mechanical and hydraulic paths by engaging and disengaging any clutches in the gear systems. Note that the type of coupling is not necessarily the same for each range or mode.

This material will not prepare the recipient to design a hydro-mechanical transmission. But it will enable them to begin to recognize them by the arrangement of their components and distinguish between different designs. This material is prepared exclusively from an off-road perspective.