



# High Speed 3-Way Valve for Switch-Mode Hydraulic Circuits (20150315, Dr. James Van de Ven)

**IP Status:** Issued US Patent; **Application #:** 15/289,461

## New Valve Design for Switch-Mode Hydraulic Circuits

A high-speed three-way crank-slider valve can be used in switch-mode hydraulic circuits. Its unique drive mechanism features two valve spools axially driven by crank-slider mechanisms. By phase shifting the two crank links, which are on a common crankshaft, the duty cycle of the valve is adjusted. The two spools split and re-combine flow such that two switching cycles occur per revolution of the crankshaft, achieving peak spool velocities at mid-stroke that result in short valve transition times and reduced viscous friction losses. The valve is compact and inexpensive to build and can be used in a wide variety of fluid power applications, from robotics to industrial to renewable energy.

## Minimizes Energy Loss

Unlike electrically actuated valves, the spools of this valve are directly coupled to a crankshaft; therefore, during deceleration the kinetic energy of the valve spool is stored as rotating kinetic energy in the shaft. This deceleration energy, used to accelerate the valve in the opposite direction. As the kinetic energy of decelerating the valve is captured and re-used, the energy loss is minimized, which eliminates the trade-off between high switching speed and energy losses observed in conventional valves.

## BENEFITS AND FEATURES:

- Reduces energy losses (leakage, friction, throttling, and actuation forces)
- Fast switching frequency (>100 Hz)
- Fast valve transition (<5% of the switching period)
- Compact

## APPLICATIONS:

- Fluid power/hydraulics
- Robotics
- Industrial applications
- Renewable energy

**Phase of Development** - Prototype being tested. Operational prototype used in extensive lab testing.

## Licensing Terms

## Technology ID

20150315

## Category

Engineering & Physical  
Sciences/Sustainable Technology  
Engineering & Physical  
Sciences/Transportation

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### Researchers

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[External Link](http://www.me.umn.edu) (www.me.umn.edu)

### Publications

[Design of a Crank-Slider Spool Valve for Switch-Mode Circuits with Experimental Validation](#)

*University of Minnesota Experts @ Minnesota*, Jun 1, 2018, 10.1115/1.4038537

[Crank-Slider Spool Valve for Switch-Mode Circuits](#)

*ASME/BATH 2015 Symposium on Fluid Power & Motion Control*, October 12-14, 2015,

FPMC2015-9606