UNIVERSITY OF MINNESOTA
Driven to Discover℠

Hybrid Micro-Electromechanical Systems Fluidic Control Valve

IP Status: Issued US Patent; **Application #:** 15/399,150

Piezoelectric Flow Control Valve Exploits Micro-Electromechanical Systems (MEMS) Technology

Piezoelectric flow control valves offer revolutionary savings in actuation power, as they require near zero power to hold the actuator in any static position from fully closed to fully open. Nevertheless, few piezoelectric valves have made it to market due to challenges in manufacturing them. An innovative design for proportional flow control valves overcomes those challenges. Its three basic constituents are an actuator (which consists of a piezoelectric stack, or piezostack), a seal plate (which is attached to the bottom face of the piezostack assembly), and an orifice plate. The valve operates by expanding or contracting the piezostack to move the bottom face of the seal plate closer to or farther from the orifice plate. When the bottom face of the seal plate contacts the top face of the orifice plate, the valve is fully closed. While the valve is initially being designed for pneumatic applications, it may be adaptable to low pressure hydraulic applications also. The low power requirements and small size of the valves make them ideally suited for human-assist applications.

Array of Small Orifices Offers Advantages

Conventional valves control flow by metering the passage of a fluid through a single, large orifice. This device uses a unique array of small orifices, fabricated using MEMS-based micro-machining processes, instead of a single large orifice. This design greatly reduces the deflection of the metering element (seal plate) required to fully open the valve while still yielding macro-scale flow rates. Therefore, the seal plate can be directly moved with a simple piezostack actuator, eliminating the need to augment the piezostack with a mechanical motion amplifier. Piezostack use also means fast response and high-resolution control. Some piezoelectric valves utilize piezobender-style actuators. The response characteristics of valves using piezobender actuators typically change as a function of operating pressure. Because this valve uses a piezostack, the response of these valves do not change due to changes in operating pressure.

BENEFITS AND FEATURES:

- Extremely low power consumption
- Highly linear control regardless of operating pressure
- High resolution control
- Fast response / high bandwidth
- Near zero heat generation
- Design is scalable and can be modified to accommodate a number of hydraulic and pneumatic needs
- Compact packaging
- Silent operation
- Low cost

Technology ID
20160222

Category
Engineering & Physical Sciences/Design Specifications
Engineering & Physical Sciences/Instrumentation, Sensors & Controls

Learn more

APPLICATIONS:

- Pneumatics and/or hydraulics
- Medical devices
- Manufacturing
- Industrial motion control
- Microfabrication tools
- HVAC control systems
- Refrigeration
- Pneumatic tools
- Precision fluidics
- Vacuum systems
- Mass flow controllers
- Air compressors
- Air brakes
- Air suspension systems
- Dental drills
- Pneumatic tube transport systems
- Pipe organs

Phase of Development - Concept demonstration prototype successfully tested, design revisions for alpha prototype currently under development.

Researchers

Thomas Richard Chase, PhD
Professor, Mechanical Engineering
External Link (www.me.umn.edu)

Licensing Terms

MN-IP Try and Buy
Center for Compact and Efficient Fluid Power (CCEFP) Try and Buy – Available to CCEFP member companies

Try

- Trial period is up to 12 months
- Trial fee is $0; In place of Try fee, a business plan for the Try period is required
- No US patent fees during Try period[1]

Buy

- In place of a conversion fee, a post-Try period business plan is required[2]
- First $1M cumulative sales are royalty-free
- Sublicense freely
- Royalty rate: 2% of Net Sales
- Patent(s) expenses paid by licensee
- Qualified startups: 5% of equity of startup is allocated to University at formation[3]
- Transfer fee for transferring license to a third party - $25,000

Please contact us for detailed term sheet for a Try & Buy agreement as well as guidelines for Try[1] and post-Try period[2] business plans as well as qualified startups[3]

Explore other available products at Technology Commercialization