NASA TECH BRIEF

Pilot-Booster Control Valve

A novel, two-stage, pressure-sensing control valve (pilot and booster) has been designed for servo-control of a 10-in. main tank valve regulating the pressure of liquid oxygen in the tank and serving also to vent the tank during filling.

The first (sensing) stage of the pilot valve senses tank pressure exceeding the preset value, opens, and allows pressure to enter the booster stage. The booster stage opens and allows pressure to enter the power bellows. With two stages in the pilot valve, small motions in the sensing stage cause large motions in the booster stage, which allows flow into the power bellows to actuate it. As the tank's pressure increases, the pilot-valve stages continue to open until the pressure decreases or remains within the control band of the valve.

A novelty in the pilot-booster control valve is the use of a negative-rate Belleville spring in the pilot to cancel the positive spring rates of bellows and coil springs. This rate-cancellation feature makes the pilot more sensitive to pressure. The combined-spring rate is nonlinear, so that sensitivity to vibration is reduced. Use of several high-rate spring elements in the system results in a higher natural frequency than would be yielded by one low-rate element.

The greater sensitivity to pressure and greater resistance to vibration may be applicable in high- and transient-pressure systems.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Code A&TS-TU
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Patent status:

No patent action is contemplated by NASA.

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