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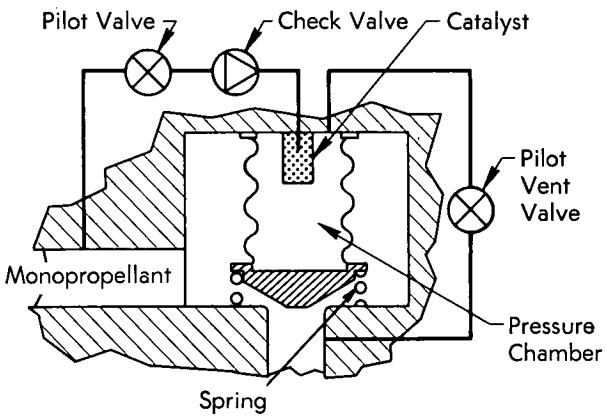
NASA TECH BRIEF

Ames Research Center

Propellant-Powered Actuator for Gas Generators

Monopropellant gas generators operating with hydrazine have been developed for use as spacecraft rocket engines and for spacecraft propellant pressurization systems. Generally, a gas generator is controlled by valves that are actuated by squib-powered



devices. However, tests of systems which can be actuated by the gases formed from the catalytic decomposition of monopropellants have shown that small quantities of fuel are capable of producing high pressures, thus providing large actuation forces. Moreover, the measured work output of a monopropellant actuator compares very favorably with the output of squib-type actuators. Hence, it was considered desirable to investigate the use of propellants for powering actuators.

The diagram indicates one way in which a monopropellant chemical actuator can be used for operation of a monopropellant control valve that is normally open. Initially there is flow of monopropellant through the valve; when turn-off is desired, a pilot valve is pulsed, allowing a predetermined amount of monopropellant to flow through it via a check valve; the monopropellant then flows into a catalyst bed where it is decomposed into hot gases. The pressure of the resulting hot gases acts against the piston or bellows head of the actuator to close the valve. When the monopropellant flow control valve is to be opened, the pilot vent valve is used to vent the pressure in the actuator; the vented gas may be directed back into the line or overboard. Positive opening or closing of a valve may be obtained by using a second actuator device.

Three-way pilot valves may be used to replace the separate pilot valves. The advantage of using separate valves is that they need to be opened only momentarily for valve actuation. Actuation can thus be effected at reduced power requirements without use of latching solenoid-type valves.

A bipropellant actuator has been designed that is similar to the monopropellant unit except that both fuel and oxidizer must be injected into the pressure chamber. The bipropellant actuation concept may also be applied to other spacecraft actuation functions requiring high force levels. The use of gases from propellant combustion for actuation are similar to the use of squibs for actuating explosive valves, except that actuation of propellant systems can be repetitive.

Note:

Requests for further information may be directed to:

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(continued overleaf)

Patent status:

No patent action is contemplated by NASA.

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