NASA TECH BRIEF

Lewis Research Center

Poppet Valve Tester

A poppet valve tester has been designed and built to investigate fundamental factors affecting the cyclic life and sealing performance of valve seats and poppets. The tester provides for varying the impact loading of the poppet against the seat and the rate of cycling, and controls the amount and type of relative motion between the sealing faces of the seat and poppet. The relative motion between the seat and poppet can be varied in three modes.

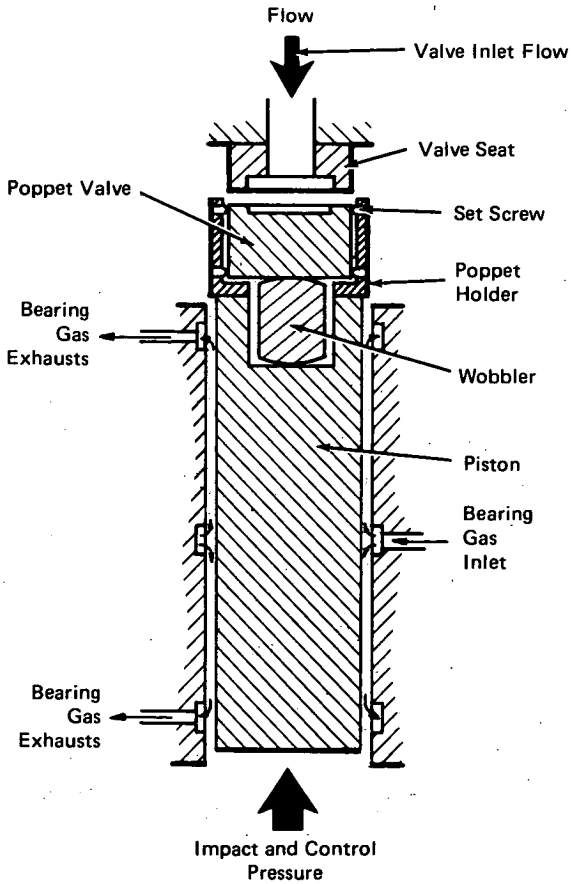

Figure 1

A cross-section of the tester is shown in Figure 1. A central piston riding on a gas bearing film provides axial movement in a near-frictionless manner. At one end of the piston, a valve poppet is mounted in close proximity to a valve seat, and at the other end of the piston, pneumatic pressure is applied to drive the poppet into contact with the seat with controlled impact. The valve poppet is carried in a poppet holder on the end of the piston. The design of the poppet holder allows for one of three modes of interface motion between the poppet and the seat.

In the clamped mode, shown in Figure 1, the poppet is positioned by the poppet holder set screws so that the poppet face is parallel with the seat face. No relative interfacial motion is produced between the poppet and the seat on closing. All wear is the result of the impact forces.

In the clamshell mode, shown in Figure 2, only the poppet-holder set-screws nearest the seat/poppet interface are in contact with the poppet. A spring provides a small cocking force to the poppet causing the poppet/wobbler combination to roll, with the center of rotation being at the plane of the poppet-holder set-screws nearest to the seat-poppet interface. When pressure is applied to the piston, the poppet first contacts the seat at the side opposite the spring and then rotates into full contact with the seat interface in a clamshell action. If the plane of the set screws exactly matched the plane of the poppet interface, true clamshell motion would occur with no interfacial sliding; however, the set-screw plane is slightly below the poppet interface so that a small sliding interfacial motion results.

In the scrubbing mode, shown in Figure 3, a much larger amount of sliding motion is produced between the seat and poppet faces as they close. In this mode, the poppet-holder set-screws farthest from the poppet interface contact the poppet, forcing the poppet/wobbler combination to roll with the center of rotation at the

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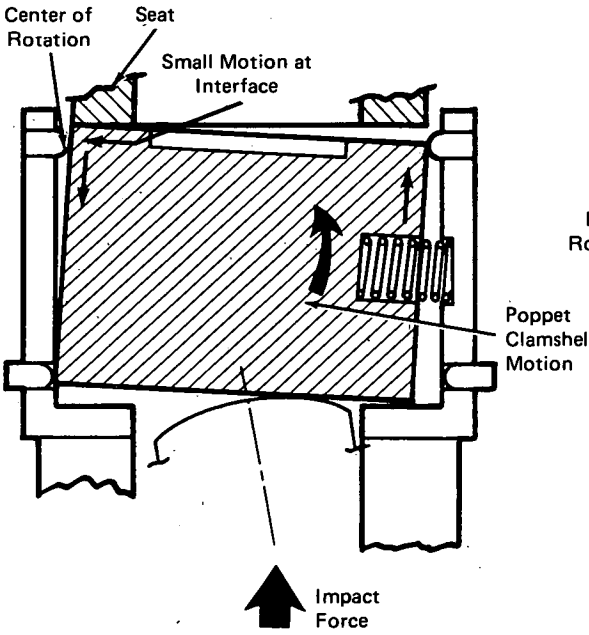

Figure 2

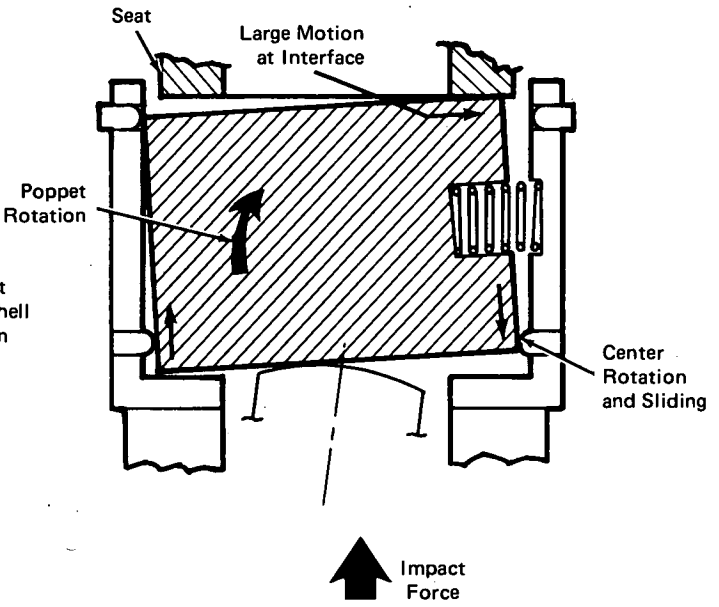

Figure 3

plane of the set screws farthest from the poppet interface. The spring again provides a small cocking force to the poppet. When pressure is applied to the piston, the poppet contacts the seat on one side first, and then rotates and slides into full contact.

Notes:

1. The following documentation may be obtained from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $18.75
   (or microfiche $1.45)
   Reference: NASA CR-120976 (N73-24516), High Performance Space Shuttle Auxiliary Propellant Valve Program
2. Technical questions may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B73-10415

Patent status:

NASA has decided not to apply for a patent.

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