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NASA TECH BRIEF

Novel Valve for Reciprocating Compressors: Concept

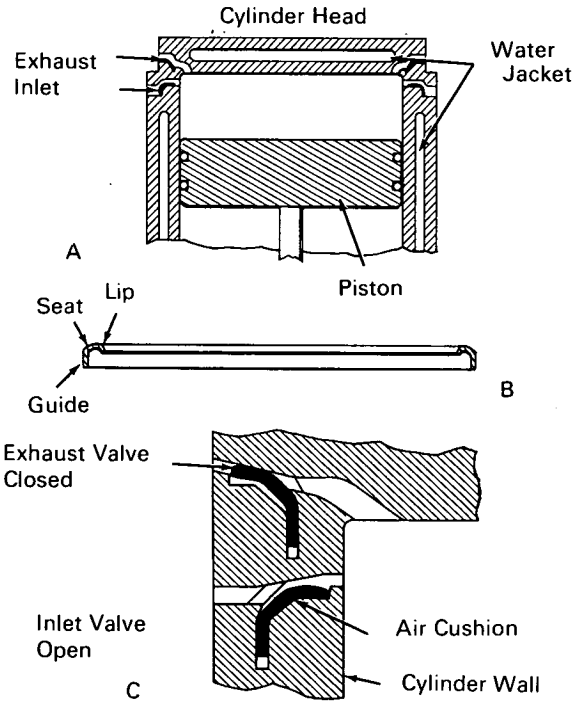

Figure 1. (A) Location of the valves in a compressor. (B) Vertical midsection of an inlet valve. (C) Inlet and exhaust valves during initiation of the induction

The problem:

Design of an improved automatic valve for the inlets and exhausts of reciprocating compressors, and possibly for the inlets of internal-combustion engines.

The solution:

A thin ring valve is proposed that encircles the cylinder and operates on the Bernoulli principle.

How it's done:

The valve is a thin ring, generally curved in section, that, fitted in a groove around the wall (the inlet or exhaust aperture), encircles the top of the wall of the cylinder (Figure 1A). The inner edge of the inlet valve (and the outer edge of the exhaust valve) is curved into a lip (Figure 1B). The outer edge of the inlet valve (and the inner edge of the exhaust valve) is straight in section and parallel with the line of the cylinder wall; it fits in a guide groove in the wall (Figure 1C). The valve seats approximately in the middle of its convex side—roughly at 45° from the line of the wall. The ring pocket of gas, below the opened valve, serves to cushion its vertical movement.

As the piston leaves the cylinder head, the lower pressure inside the cylinder opens the inlet valve. When the piston has half-completed its downward stroke its velocity—and the velocity of the inrushing gas—are at maximum; the gas's velocity over the valve's lip lowers the pressure there and so tends to close the valve during the latter half of the piston's downward travel. During the piston's compression stroke, the exhaust valve acts similarly.

The behavior (and timing) of the valve is governed largely by the relation of its designed weight to the gas's calculable velocity. Because the valve encircles the cylinder its lift may be very small relative to its effective aperture; its smooth contours should make it more than 90% efficient, and stresses generated by its small movement should be negligible. The cylinder head is left free of complications.

The same valve might be used for the inlet of an internal-combustion engine, possibly with these modifications: the valve might be cooled by injection of cold air into the gas pocket below it; it might be

(continued overleaf)

partially shielded during the combustion by a raised periphery of the piston head; auxiliary devices might help to regulate the timing. The peripheral nature of the valve should promote cooling of the cylinder walls. The whole area of the cylinder head would be available for exhaust valves and spark plug.

Notes:

1. Designers of compressors or internal-combustion engines may be interested.
2. This development is in a conceptual stage only; at the time of this publication no model or prototype exists.
3. Requests for further information may be directed to:

   Technology Utilization Officer
   Manned Spacecraft Center, Code BM7
   Houston, Texas 77058
   Reference: B70-10160

Patent status:

No patent action is contemplated by NASA.

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