NASA TECH BRIEF

Manned Spacecraft Center

High Pressure Liquid Gas Pump

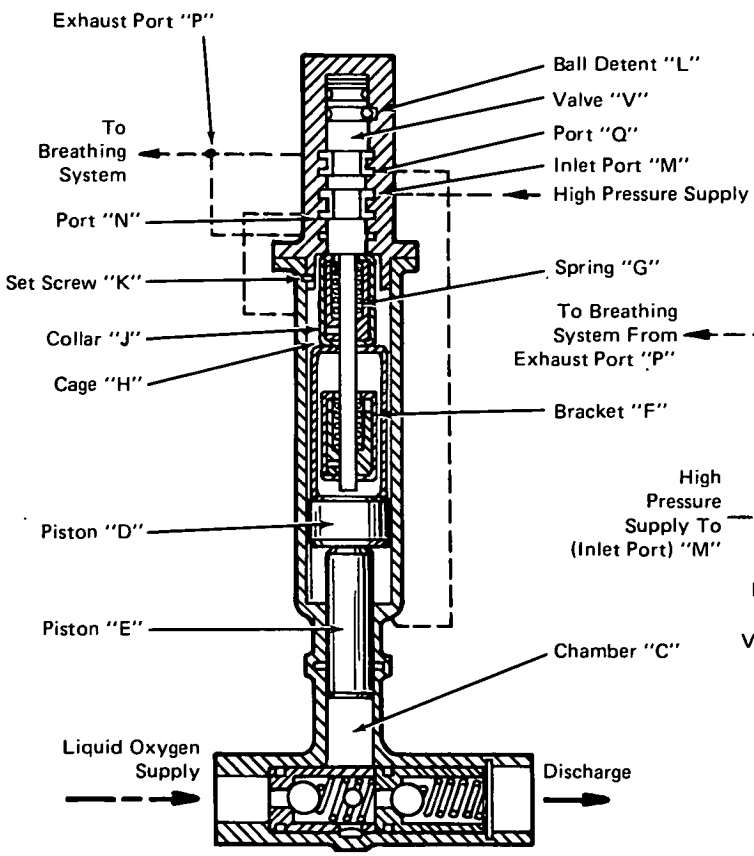

Figure 1. Cryo Pump With Mechanical Valve Shift

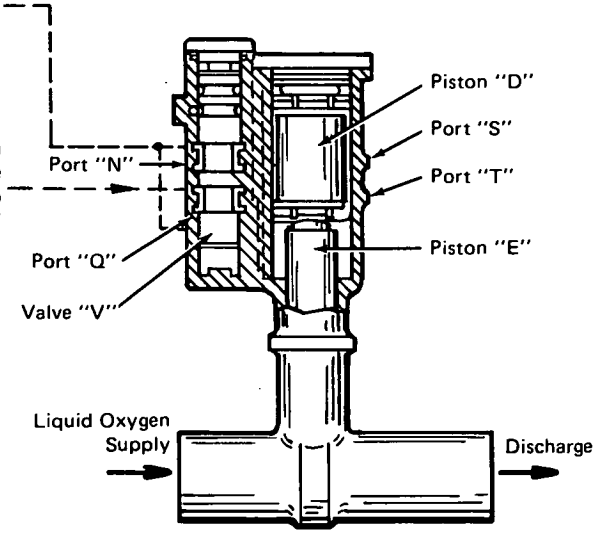

Figure 2. Cryo Pump With Pneumatic Valve Shift

The problem:

High pressure gas generators are usually fed by piston pumps which tap the liquid gas from the low pressure storage. Such pumps must be compact and be capable of withstanding a cryogenic environment.

The solution:

Two different pumps have been designed: one with a mechanical valve shift and the other with a pneumatic shift. Both designs are suitable for cryogenic fluids in the pressure range of hundreds to a few thousand atmospheres.

How it's done:

Figure 1 shows the pump with a mechanical valve shifter. As shown, piston D has just completed an upward stroke. Near the end of the upward stroke, bracket F, which is a part of piston D, has moved cage H upward compressing spring G until cage H engages collar J. This collar is attached to the stem of valve V, and has driven

(continued overleaf)

valve V upward causing ball detent L to move to the right until it reaches the land between the upper and lower detent grooves. At this point spring G snaps the valve upward until detent L drops into the lower detent groove where it is shown. In this position, valve V connects ports M and N together and directs high pressure gas to the upper side of piston D thus forcing it downward. At the moment that valve V shifts, it also connects port Q to port P, allowing the gas below piston D to exhaust. While piston D is rising, the check valve below and to the left of chamber C is being held open by the differential pressure across it, and chamber C is being filled with liquified gas. Now this liquid is trapped so that, as piston D descends, piston E produces a high pressure in chamber C which opens the check valve on the right and forces the liquid into the discharge line.

In the gas operated valve shift design, shown in Figure 2, a liquified gas pump in which valve V is shifted by gas pressure (which is applied to one end or the other of valve V by piston D) and uncovers either port S or T. This pump is shown at the end of the upward stroke and with port T uncovered but before valve V has been forced down. That portion of this pump not shown in cross section B is identical to that of the lower portion of Figure 1.

Note:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
Manned Spacecraft Center
Code JM7
Houston, Texas 77058
Reference: B72-10590

Patent status:

NASA has decided not to apply for a patent.

Source: Richard L. Acres of
Service Technology Corp.
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(MSC-14087)