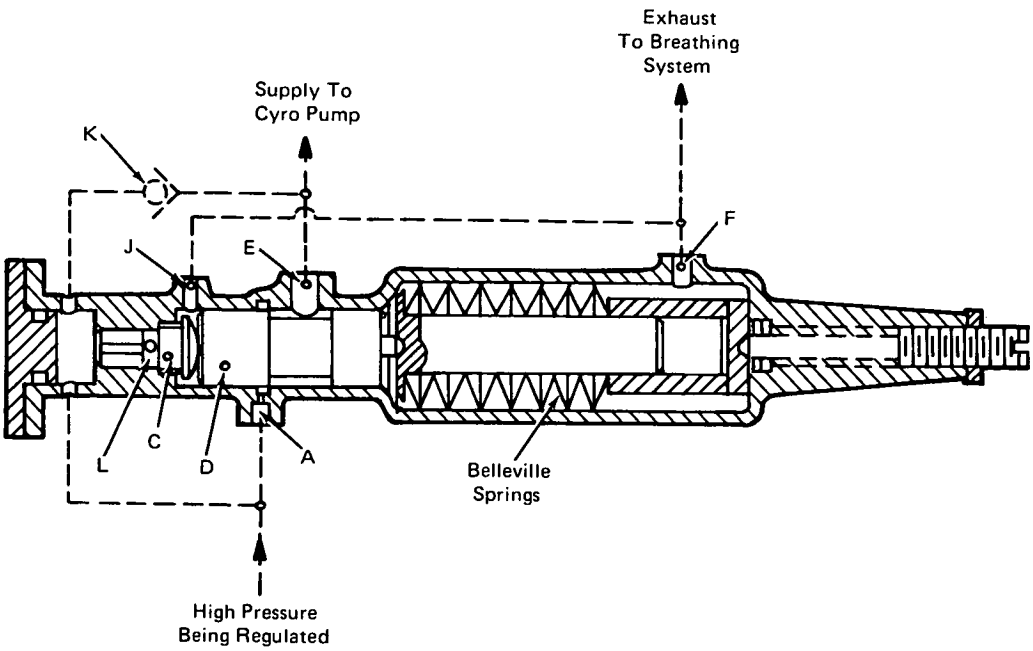
NASA TECH BRIEF

Manned Spacecraft Center

Combination Pressure Regulator And Safety Valve: A Concept



The problem:

A lightweight device is needed to regulate high pressure liquified gas to a high pressure vapor generator using liquid oxygen from the liquid oxygen supply systems in spacecraft. Another associated application is to supply "feed" water to flash boilers.

The solution:

The regulator valve controls a boiler feed pump which forces liquid into an evaporator or flash boiler at the proper rate to maintain the pressure in a system at some preset level.

How it's done:

The system concept is to regulate the pressure of the vapor by diverting a small amount of the vapor at a modulated rate to operate a feed pump, modulating valve, or other device which in turn adds liquid to a flash boiler. The regulator behaves as a feedback control which regulates the rate of liquid injected into the flash boiler to maintain the system pressure at the desired level. The arrangement shown in the illustration makes use of the basic concept. Vapor leaving port E is used to control the rate of pumping liquid into a flash boiler by increasing or decreasing the speed of the pump. Adjustment is accomplished by loosening locknut G and turning screw H.

The position of plunger C and valve D is determined by the pressure in chamber B and the load on the Belleville springs. Their position, in turn, determines whether or not port A is connected to port E. If the pressure in chamber B is very low, port A will be wide open. As the pressure in chamber B approaches the desired preset level, port A modulates toward a closed position. When the desired regulated pressure slightly exceeds the preset pressure level, port A closes completely and no gas passes port E, and the feed pump stops.

(continued overleaf)

If the consumption of high pressure gas is halted suddenly, a minute amount of liquid may remain in the system. As this evaporates, the pressure in chamber B may tend to rise above the preset level. Such a rise in pressure will move plunger C and valve D to the right. Port A remains closed, but Port L opens to connect chamber B to exhaust port J via the holes in plunger C. As gas is bled from chamber B and the pressure in this area drops, the Belleville springs move the valve D and plunger C to the left, again closing port L. Valve D can never cover either ports E or J.

There are conditions which can cause excess pressure in chamber B with port A closed. For example, when using low boiling temperature liquids a rise in temperature of trapped liquid between port E and the feed pump will cause the pressure to rise and check valve K to open. This excess pressure is bled off as described above.

Port F remains open at all times and prevents pressure fluctuations in the Belleville spring housing which would influence the regulated pressure in the supply to the pump.

The device can be modified for use in automotive or similar power plants where variable pressure is required. This can be accomplished by replacing screw H and locknut G by a plunger from a multiposition device similar to an automobile accelerator, or a programmed cam for automatic cycle pressure requirements, or any other positioning device which will produce the proper time-pressure relationahip required.

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: B72-10446

Patent status:

No patent action is contemplated by NASA.

Source: R. L. Acres of
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