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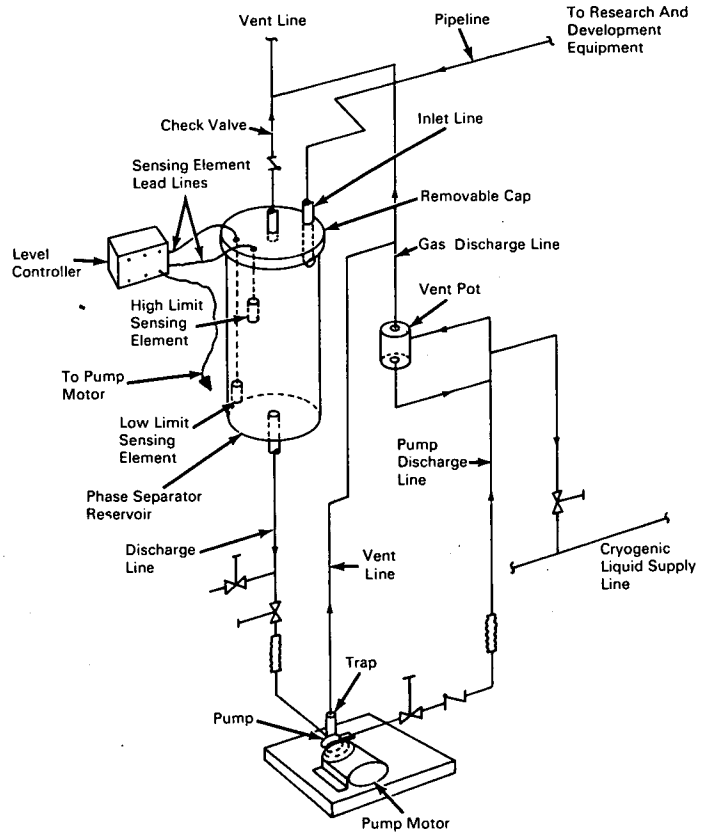
NASA TECH BRIEF

Concept for Cryogenic Liquid Reclamation System



The problem:

A system is needed for salvaging liquid nitrogen that is presently being treated as waste because there is no known system that operates on an intermittent or demand basis for salvaging cryogenic liquids. Available closed loop systems do not provide the stop-start capabilities required. The liquid nitrogen not consumed during experiments in space environment laboratories is usually dumped on the ground causing visibility problems in the immediate vicinity. A successful reclamation system would eliminate the visibility problem and result in obvious cost savings.

The solution:

A concept for a cryogenic liquid reclamation system that may be used as an add-on unit to the nitrogen system of environmental test laboratories to salvage liquid nitrogen presently being treated as waste.

(continued overleaf)

How it's done:

The cryogenic cooling agent is forced through the pipeline by the pressure maintained within the research and development equipment, which would have to be at least higher than atmospheric as the reservoir is vented to atmosphere. The reservoir also serves as a phase separator since the fluid discharge from the R & D equipment is in both a liquid and gaseous state. The reservoir is a specially made dewar flask constructed of two high quality cylindrical shells separated by an ultrahigh thermal insulating vacuum. The cap, which is removably attached to the reservoir, has openings for the inlet line, the vent line, and sensing element lead lines. The vent line, which vents gas to the atmosphere, has a check valve to prevent reverse flow.

Within the reservoir there are two sensing elements: (1) the high limit sensing element and (2) the low limit sensing element. The sensing elements are connected to a level controller by the lead lines. An opening in the bottom of the reservoir provides a point of connection for a discharge line, which is connected to a pump. The difference in elevation between the reservoir and the pump must be sufficient to provide a net positive suction head of pump which will be determined by the type of cryogenic liquid being salvaged and pump design.

The motor is electrically connected to the level controller so that the pump may be started and stopped by the level controller as a function of the amount of liquid in the reservoir. A vent line which is connected to the trap vents the gas that may have boiled off from the cryogenic liquid contained in the discharge line. Electrical resistance heater tape is wrapped around the bearings of the pump to avoid bearing freeze-up. The resistance tape is on only during the times the pump is not running, since during the times of operation sufficient heat is generated in the pump motor to prevent bearing freeze-up.

The pump discharge line is connected to the cryogenic liquid supply line so that salvaged cryogenic liquid may be fed back through the R & D equipment or in the event there is insufficient demand for the cryogenic liquid being pumped, the liquid may be forced back into the cryogenic liquid supply tank. The cryogenic liquid reclamation system is insulated to minimize heat gain from external sources.

Notes:

1. It may be possible to use this reclamation system on most cryogenic liquids that will not cause explosions and where the purity of the liquid is not of critical importance.
2. The system may be installed indoors or outdoors provided the gas boiled off from the cryogenic liquid is vented to the outside.
3. This development is in the conceptual stage only, and as of date of publication of this Tech Brief, neither a model nor prototype has been constructed.
4. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   NASA Pasadena Office
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: B67-10420

Patent status:

Inquiries about obtaining rights for commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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