Linear Cryogenic Pump

Summary
A reciprocating pump designed specifically to deliver cryogenic liquids is driven by a linear motor drive, which creates numerous advantages in total system economy, efficiency, control and product availability.

Overview
Air Products is offering for license a patent that relates to linear motor driven reciprocating pumps optimized specifically for pumping cryogenic or other near boiling liquids. Conventional reciprocating cryogenic pumps have evolved from standard water pumps with modifications in materials and thermal design for the demands of cryogenic service. Using a linear electric motor as the source of mechanical energy and beginning with a clean sheet in the design of the liquid end of the pump has resulted in a device that is born directly from the experience and demands of pumping near boiling liquids at cryogenic temperatures. Many novel features and capabilities flow from this unique design starting point. The Linear Cryogenic Pump (LCP) has no rotating parts. All parts move in pure linear motion which eliminates functional side loads, enhancing seal and bearing life, thus minimizing maintenance. Traditional pumps utilize a slider-crank or other rotary to linear mechanism, which increases pump complexity and limits hydraulic functional capabilities, particularly for near boiling fluids. The LCP uses a pressure energy storage feature instead of a conventional flywheel. Pressure energy storage allows the pump to operate at nearly constant motor loading regardless of speed. This allows for unique capabilities to regulate cryogenic flow over a wide range. The linear motor allows the piston motion to be programmed for slow suction velocities and rapid discharge velocities. This allows the pump to operate at very low suction pressures and NPSH values. Unlike conventional reciprocating designs, the LCP is completely hermetic, having no sliding seals which virtually eliminates leakage to the surroundings. This makes it especially attractive for cryogenic fluids that may be flammable, toxic or otherwise hazardous. The LCP design is also suitable for non-cryogenic fluids.

Benefits:

- Reduces cryogenic tank losses
- Delivers increased refrigeration
- Provides flow regulation from 0 to 100%
- Increases time between routine maintenance
- Prevents leakage of pumped fluid
- Minimizes NPSH requirements
- Minimizes pipeline vaporization problems
- Reduces cryogenic storage costs
- Reduces cryogenic piping costs
- Decreases mechanical complexity

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<td>Reciprocating Pumps with Linear Motor Drive</td>
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**Stages of Development:**
The Linear Cryogenic Pump is more than a licensed product concept. Two prototypes of the CP have been built and used for testing purposes by NASA and Florida State University.

**Also Offered:**
Technology transfer assistance may be provided with a license.

**Availability:**
All serious inquiries for license will be considered.

Bibliography reference and additional material:
Kottke, Bill – "Air Products Develops New 'Smart' Pump."

For more information on licensing this technology contact:

Robert J. Coraor, Ph.D.,
Manager, Technology Transfer
Telephone: 610-481-4744
Fax: 610-481-8971
E-mail: coraorrj@airproducts.com
Air Products and Chemicals Inc.
7201 Hamilton Boulevard
Allentown, PA 18195

tell me more
http://www.airproducts.com

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