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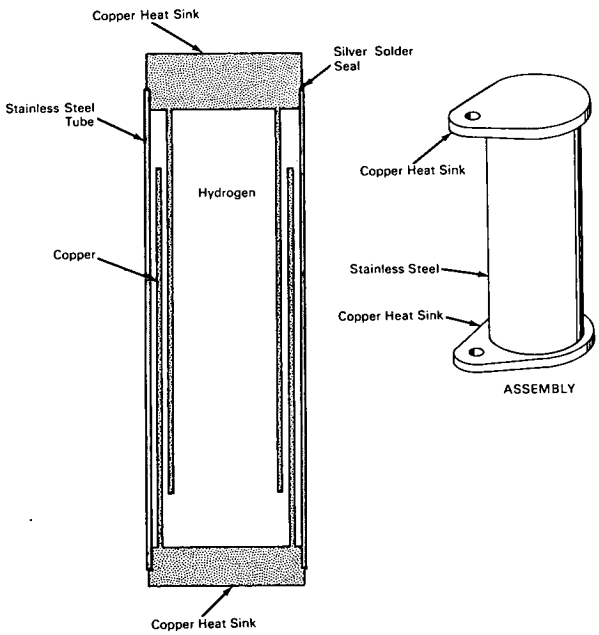
Brief 65-10068

NASA TECH BRIEF

Automatic Thermal Switch Accelerates Cooling-Down of Cryogenic System.



The problem: Providing an automatic switch that will accelerate the cooling of helium gas to below its inversion temperature (approximately 40°K) in the Joule-Thomson branch of a multistage helium liquefaction system and to 4°K in the final stage.

The solution: A hermetically sealed metal tube containing hydrogen gas under pressure. This device is a good thermal conductor at temperatures down to 10°K and a thermal insulator below this temperature.

How it's done: The switch employs a short stainless steel tube fitted with copper heat sinks at both ends. This assembly is pressurized with hydrogen and hermetically sealed with silver solder at the junction between the stainless steel tubing and the copper heat sinks.

The switch is a thermal conductor above 10°K, since at these temperatures heat can be transferred between the two copper sinks by conduction along the stainless steel tube and by convection through the hydrogen gas. Below this temperature, the hydrogen solidifies, leaving a hard vacuum in the tube, and the conductivity of the stainless steel is virtually zero. Therefore the switch becomes an excellent thermal insulator below 10°K. In operation in the helium liquefaction system, the thermal switch is connected between two stations where heat transfer must be effected to accelerate the cooling-down process.

(continued overleaf)

Note: Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Jet Propulsion Laboratory
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Reference: B65-10068

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

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(JPL-655)