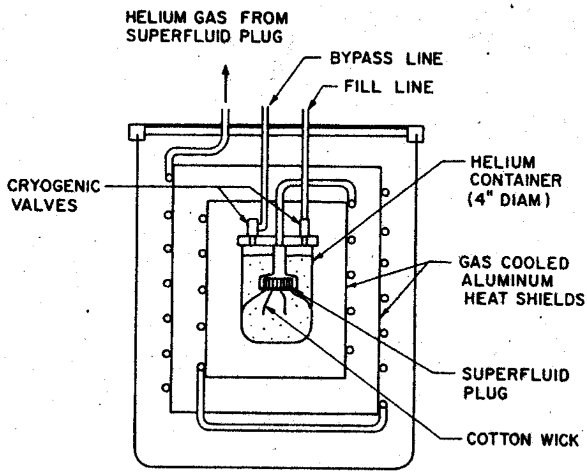

Fig. 1. Invertible dewar.

In order to test the plug, a dewar has been built which is designed to operate in any spatial orientation, including upside-down (see Fig. 1). If the refrigeration system is operable under negative-*g* conditions, there is good reason to believe that it can operate in zero-*g* as well. This dewar consists of a liquid-helium chamber with the plug inside. Two cryogenic valves, operated from above, are situated on top of the chamber for transfer of the liquid and by-passing the plug. Gas which leaves the plug is conducted through two aluminum heat shields before exiting at the top. The chamber and shields are wrapped with NRC superinsulation and placed inside an outer aluminum can which is subsequently evacuated to 10^{-6} torr.

To date, the dewar has been operated upright at 1.75°K and inverted at 2.28°K (above T_λ) for extended periods of time. A small modification must be made in one of the valves before the dewar can operate upside-down in the superfluid regime.

CONCLUSION

Using a superfluid plug promises to be an excellent method for containing liquid helium in space and provides a controlled flow of liquid below the λ point. By enlarging the plug to pass normal fluid as well, we have a system which is operable through a larger range of temperature with no chance of explosion. The use of a high thermal-conductivity plug should also be adaptable to the containment of other cryogenic fluids in a zero-*g* environment, provided adequate thermal equilibrium inside the dewar can be maintained.

NOTATION

A = total cross-sectional area of channels
A' = total cross-sectional area of metallic portion of plug
C = thermal conductance of metallic portion of plug
G = Gibbs potential
k = thermal conductivity
L = latent heat
$\dot{m}$ = mass flow rate
P = pressure
ΔP = pressure difference across plug
S = specific entropy