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RSI (Shop Note)

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INFLATABLE GASKET FOR THE 72-INCH BUBBLE CHAMBER

Luther R. Lucas and H. Paul Hernandez

April 1959

Printed for the U. S. Atomic Energy Commission

INFLATABLE GASKET FOR THE 72-INCH BUBBLE CHAMBER*

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A satisfactory glass-to-metal seal at liquid hydrogen temperatures has been developed for the large oval-shaped optical window of the 72-inch liquid hydrogen bubble chamber (Fig. 1). Indium wire is held in contact with the chamber glass by an inflatable stainless steel member capable of 160 mils useful deflection.

During cooldown to liquid hydrogen temperatures, the stainless steel chamber shrinks about 3/16 in. more than the glass, causing a relative translation between the contacting surfaces. To avoid opening leaks, the gasket is not sealed until the cooldown is nearly completed.[1] Only a nominal inflation pressure (~40 psi) is used during the cooldown, enough to keep the assembled parts in position without mashing the indium. At about 77° K, after most of the relative shrinkage has occurred, the inflation pressure is increased to between 400 and 600 psi, mashing the indium and making the seal.

Indium wire is used instead of lead because lead cannot be easily mashed at 77° K. We have also found that 99.999%-pure indium gives a better seal than the 99.9% pure, since it is softer. We have experienced no difficulty

* Work done under the auspices of the U. S. Atomic Energy Commission.

with indium sticking to the glass, possibly because the gasket is not precoured in a vacuum and because the compression between the indium and glass is made at low temperature.

With a double row of indium wires as used on the seal, the bearing stress on the glass is only 800 psi at an inflation pressure of 400 psi. Since the BSC-517/645 glass should be able to withstand a compressive stress on the order of 10,000 psi for this gasket geometry, an adequate margin of safety should exist.[2]

Because a multiplicity of seals with pumpouts between each seal is used, it is not necessary that each seal be tight to a helium leak detector, as long as the vacuum pumps can handle the leaks. In practice we have found that after an initial period of chamber pulsing the seal improves. A vacuum in the range of 10^{-5} to 10^{-6} mm Hg can be held above the glass, with a liquid pressure below the glass varying from 95 to 30 psi. Pressures in the indium pumpouts vary from 10μ to 1000μ, and the pumpout pressure at the edge of the glass is about 50μ.

During the current liquid hydrogen operation the chamber has been cycled from room temperature to low absolute temperatures (27°K) three times with the same set of gaskets.

REFERENCES

1. Jack Franck, Optical Windows and Scale for Hydrogen Bubble Chamber, UCID-71, March 20, 1956.
2. Determined from tests using 10-in. bubble chamber windows. (Reference photographs BC-114, BC-115, and BC-116 are available from the Technical Information Division, Lawrence Radiation Laboratory, Berkeley.)
3. Luther R. Lucas and H. Paul Hernandez, Inflatable Gasket for the 72-Inch Bubble Chamber, UCRL-8526 Rev., April 1959.

LEGEND

Fig. 1 (a) The 72-in. bubble chamber, showing the inflatable gasket in position; (b) cross section of the inflatable gasket and related parts of the chamber rim and glass.

Table I

Dimensions and characteristics of the inflatable gasket	
maximum accommodation	160 mils
load to compress gasket 180 mils	31.3 lb/lin-in.
maximum test inflation pressure (at 77° K)	800 psi
inflation gas	helium (reactor grade)
dimensions:	
inflation-tube radius (R)	0.375 in.
inflation-tube thickness (d)	19 mils
materials:	
inflation tube	type-305 stainless steel
gasket block	type-304 stainless steel
diameter of indium wire	0.150 in.

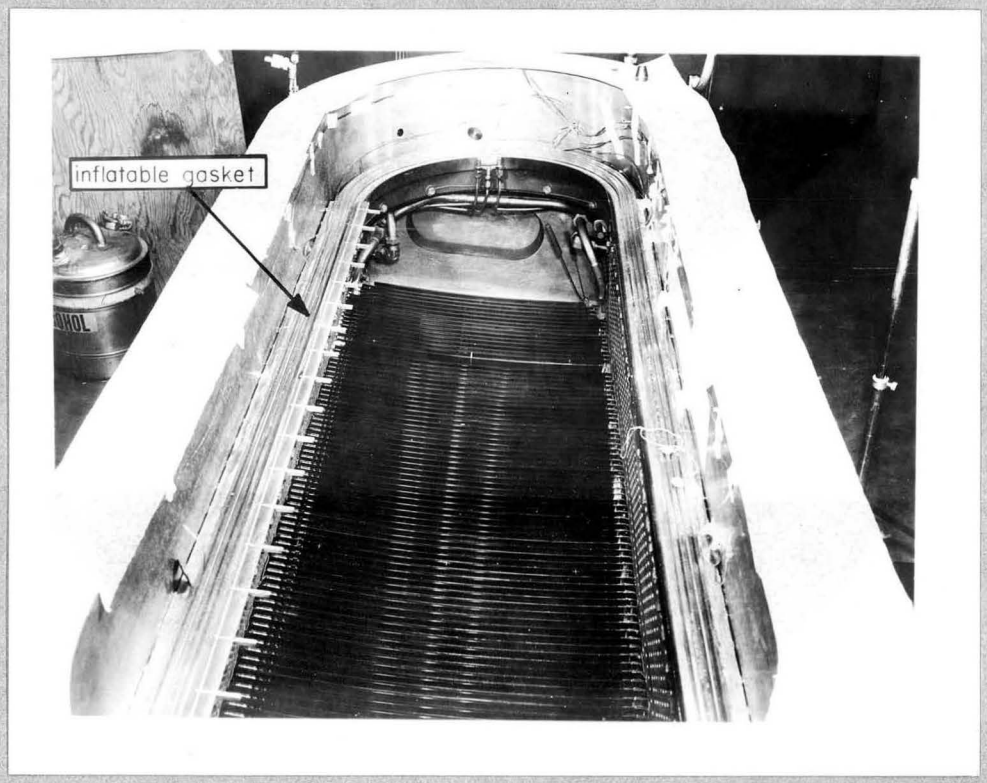
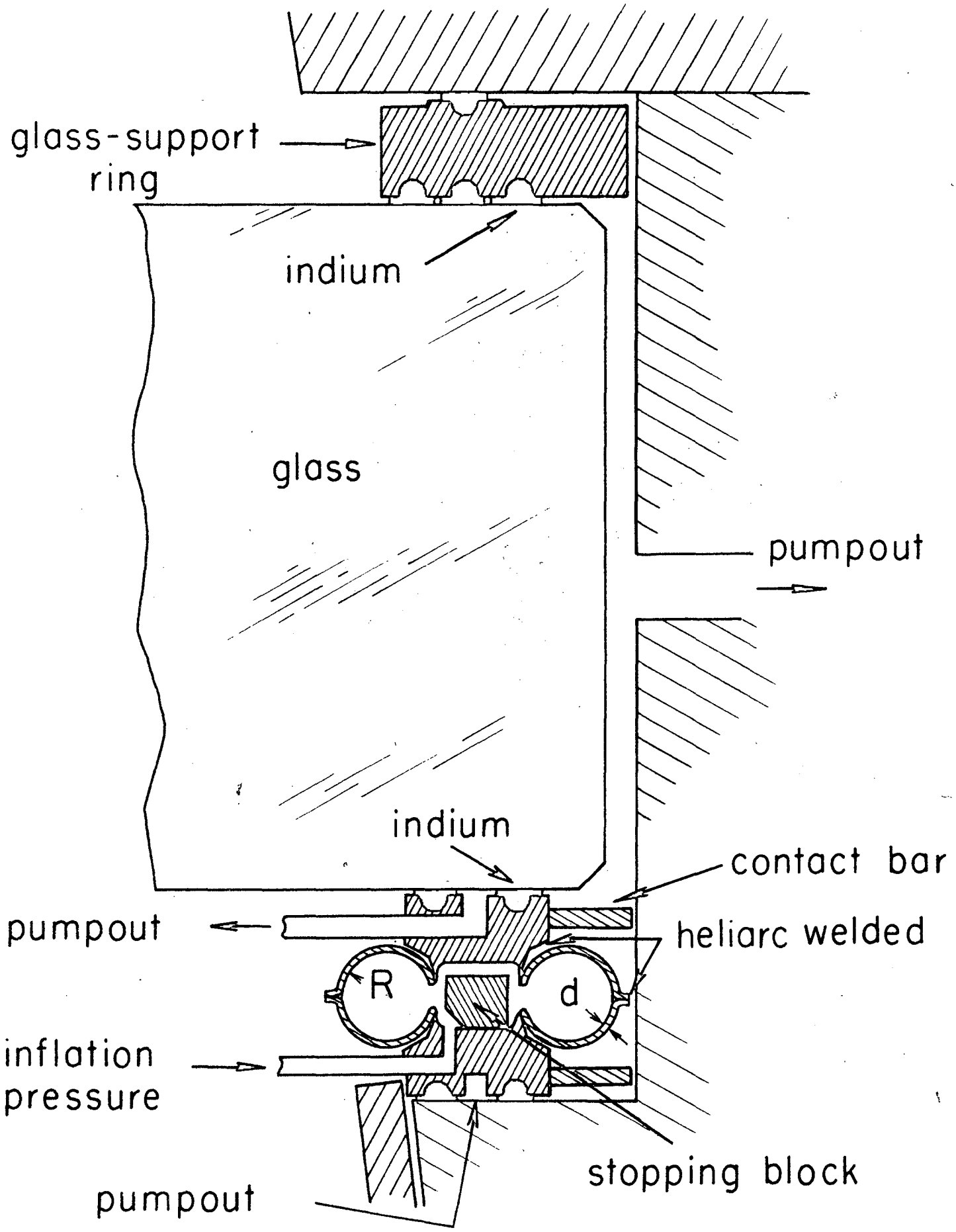


Fig. 1a



Figure

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