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THE USE OF INDIUM IN HIGH-VACUUM EQUIPMENT

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Publication Date

1955-05-23

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THE USE OF INDIUM IN
HIGH-VACUUM EQUIPMENT

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Radiation Laboratory
Berkeley, California

Contract No. W-7405-eng-48

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F. L. Reynolds

May 23, 1955

Printed for the U. S. Atomic Energy Commission

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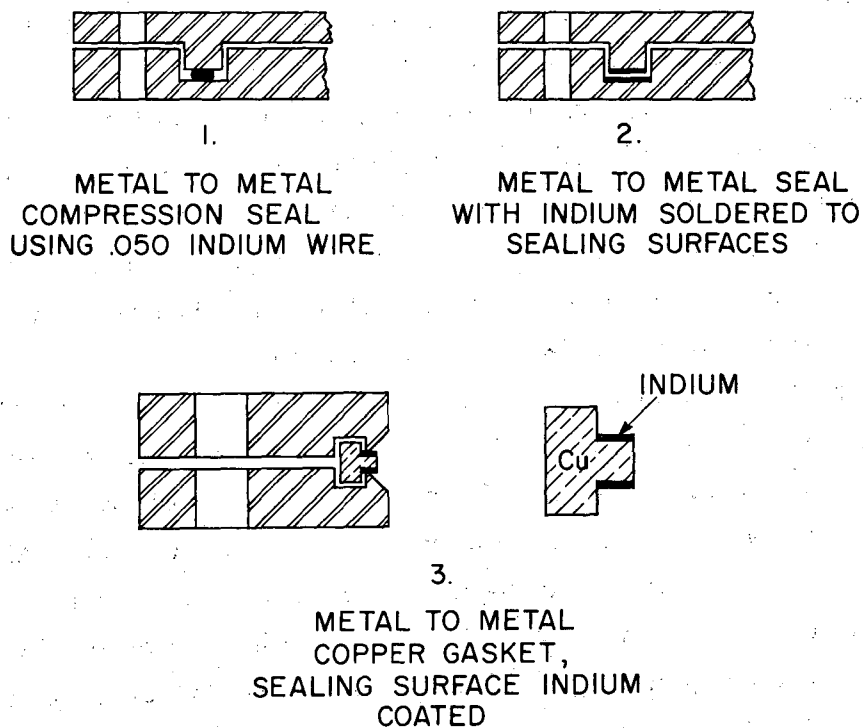
The use of organic materials in metal high-vacuum systems is often objectionable, particularly with instruments such as mass spectrometers where the presence of rubber, vacuum grease, and even teflon make themselves known by the many background hydrocarbon peaks that appear throughout the spectrum.

We have employed successfully for some time several ideas concerning the use of indium and indium-coated copper as suitable gasket material. In addition, we have developed a simple yet novel valve employing indium that does not use organic material as vacuum seal.

The sketches in Fig. 1 illustrate three methods in which indium may be used for gaskets. Method No. 1 involves a metal-to-metal seal using 0.050-inch-diameter wire. Provided the surfaces are machined to a fairly smooth finish we can make excellent vacuum seals by this method. Method No. 2 uses the same design of flange, but here the indium is soldered directly to the two surfaces and pressure-sealed. The third method involves the coating of indium onto a copper ring gasket, and employs a knife-edge structure for the metal-to-metal contact. All three methods allow for many resealing operations before the gasket has to be discarded.

The vacuum valve consists of a copper block, in which a groove is milled as shown in Fig. 2, and into which fits a cap, also of copper. Indium fills the groove and coats the sides of the cap, forming a seal. A small nichrome heater, adjusted to operate on 110 v ac, is incorporated into the lower milled section. Whenever the valve is to be opened or closed, the heater is turned on until the indium melts (it takes about two minutes to heat the indium to its melting point, 155°C) and the cap can be raised or lowered by action of the metal syphon bellows. This work was performed under the auspices of the U. S. Atomic Energy Commission.

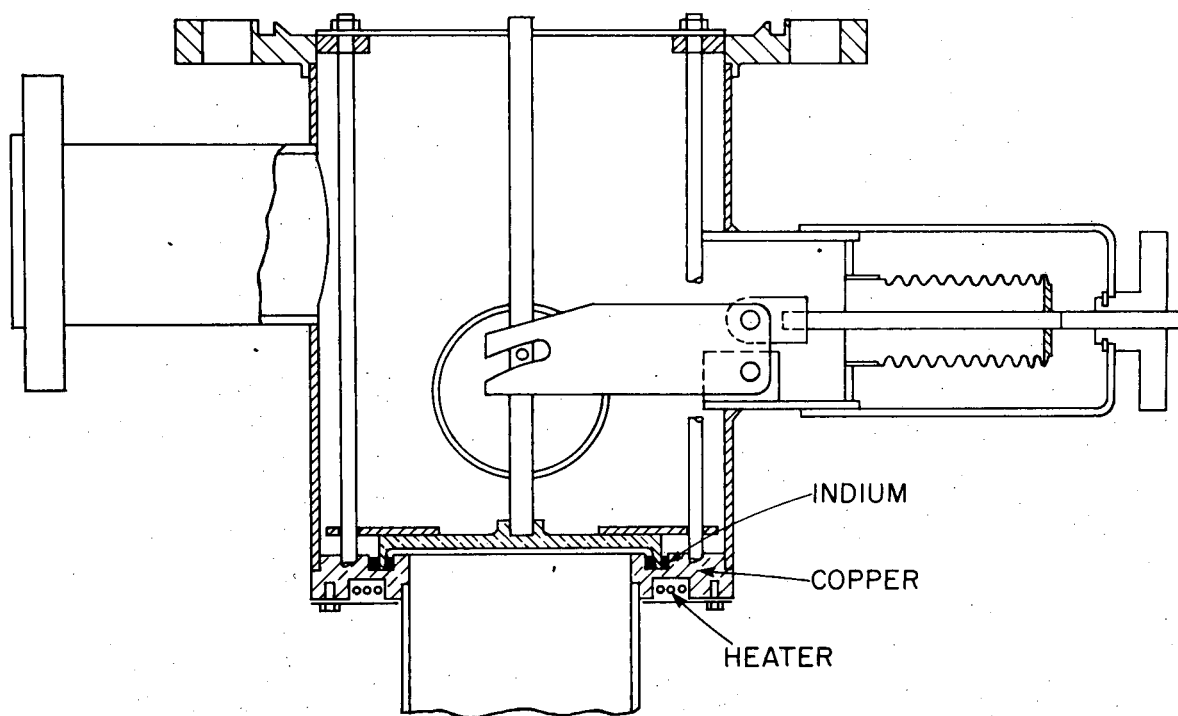
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INDIUM GASKET TECHNIQUES

MU-9413

Fig. 1. 1, 2, 3.



MU-9415

Fig. 2. Vacuum valve in which indium metal is used as gasket material.