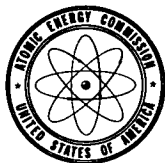


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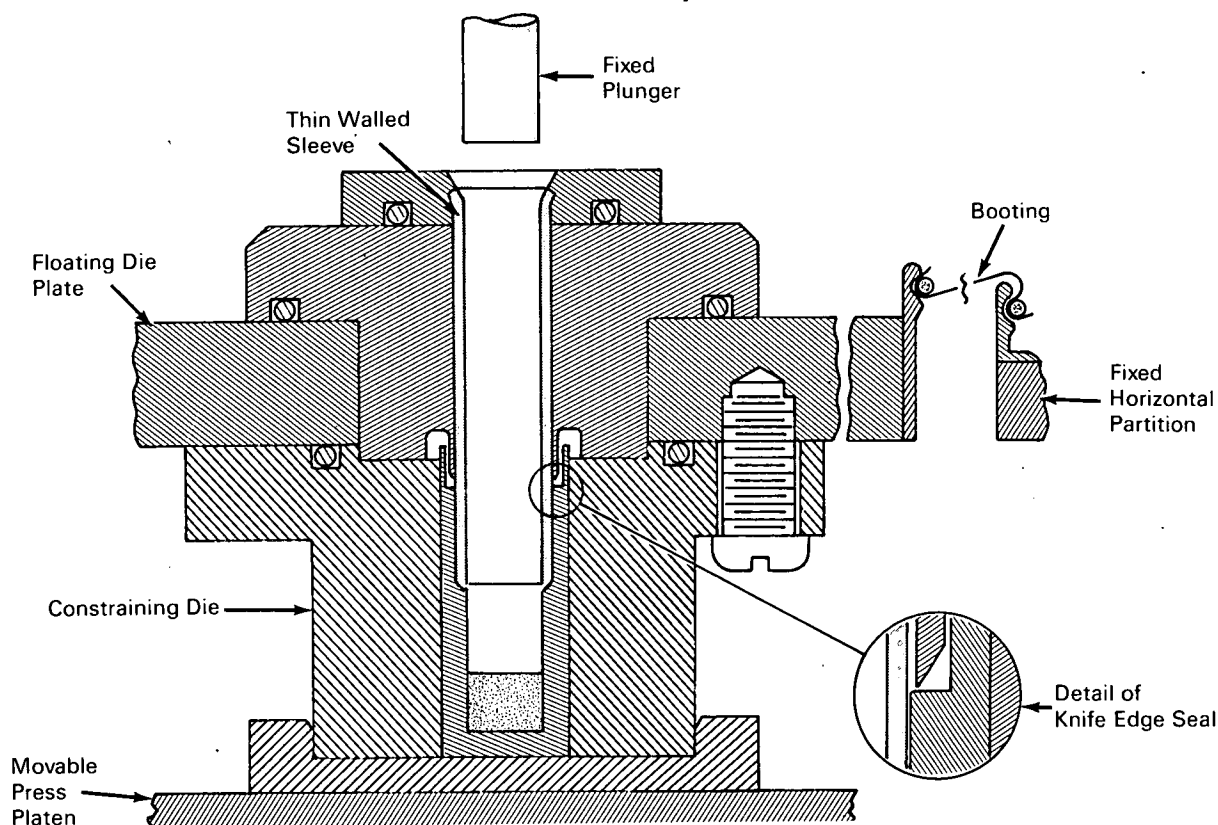


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Apparatus for Fabrication of Americium-Beryllium Neutron Sources Prevents Capsule Contamination



The problem:

To build an apparatus to fill a capsule with a mixture of americium and beryllium radioactive powders, to compact the mixture within the capsule, to seal weld the capsule opening, and to test the sealed capsule for leaks. This all must be done without contaminating the exterior surface of the capsule. Previously, there was no apparatus available capable of doing this job.

The solution:

A standard gloved enclosure modified by the addition of a special horizontal partition, a vortex mixer, a metallurgical specimen mounting press, a remote controlled welder, a closed glass test vessel, and proper radiation shielding.

How it's done:

An existing large gloved clean-air enclosure is modified by installing a clear, horizontal partition with a

(continued overleaf)

circular hole in its middle and adding another entrance lock to give access to both chambers. In effect, two separate gloved enclosures are created, one on top of the other. A metallurgical specimen mounting press is installed in the bottom chamber such that it extends up through the hole in the partition. The press has a movable platen above which its capsule dies are mounted on a floating support plate that is booted to the partition. This isolates the upper chamber, where the powders are mixed and loaded, from the lower chamber where the empty capsule is inserted and the filled capsule welded and leak tested. A ping-pong type ball check valve mounted in the partition allows the clean air pumped into the lower chamber to pass to the upper chamber where the air is exhausted.

The mixing of the americium and beryllium powders is done on a vortex mixer mounted on one side of the upper chamber. Because of the radioactivity, long tongs are used to hold the powder containers during mixing. Extensive radiation shielding is also used to protect the operators.

The Am-Be powders are mixed until the neutron output, measured by a counter in the upper compartment, levels off at a maximum. Then, a recently cleaned and deoxidized capsule body is loaded from the bottom chamber into the constraining die of the press. The movable platen is moved up to firmly hold the capsule in the constraining die.

The mixed powders are then poured into the open end of the capsule from the upper chamber in three fractions, each of which is compressed in turn by the ram force of the press plunger. The powder is prevented from contaminating the exterior of the capsule by a knife-edge seal made on the weld cap seat of the capsule. A thin-walled stainless steel sleeve, which is slipped into the upper part of the die passage before the powder mixture is poured and which overlaps the knife-edge seal joint, protects the inner surface of the die from contamination.

A short aluminum seal plug supported on the clean plunger rod is passed into the upper chamber just

prior to use and care is used to avoid contamination during handling. When the ramming is complete, the thin-walled stainless steel sleeve is removed and the seal plug pressed into place on top of the compacted powder. The movable platen is then lowered and the press plug-sealed capsule is forced out of the constraining die into the lower chamber.

A weld cap is pressed into place on the seal plug, and the final seal weld is made with a remote-controlled welder mounted in the lower chamber. After cooling, the welded capsule is submerged in high grade kerosene which is stored in the closed glass vessel also mounted in the lower chamber. With a vacuum pumped above the liquid surface, a bubble stream in the liquid indicates a leaky weld.

Notes:

1. Additional details are contained in: *Proceedings of the Conference on Remote Systems Technology*, ANS, November 1964, p. 273-278.
2. Inquiries concerning this innovation may be directed to:

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Patent status:

Inquiries about obtaining rights for commercial use of this innovation may be made to:

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