

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN TRAPS FOR SUBLIMABLE MATERIAL

(71) We, BRITISH NUCLEAR FUELS LIMITED, of Risley, Warrington, Cheshire, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to cold traps, and in particular to that kind of cold trap employed for the purification of gaseous uranium hexafluoride by condensation and sublimation. Such cold traps have regenerative heat exchange means whereby the flow of the medium from which impurities are to be removed by cold trapping, is directed in two opposed flow paths separated by a barrier forming a common boundary between the flow paths. External cooling means serve to produce in the first flow path the conditions for impurities to be changed in phase from that of the medium so as to allow separation to be effected, and in passage along the second flow path the medium is partially reheated by heat transfer from the medium in the first flow path through the said barrier forming the common boundary between the two flow paths, which is economic of the heating means needed to return the medium to the condition at entry. Such a cold trap is referred to hereafter as 'of the hereinbefore specified kind'.

A problem of criticality can arise where a cold trap of the said kind requires to be used with uranium hexafluoride of an enrichment significantly above that normally employed and for which the cold trap was designed dimension-wise. To have to provide specially designed additional cold traps for possibly only occasional arising of the need to operate with more highly enriched feed than normal, would be expensive and also inconvenient in having to duplicate and switch pipework.

According to the invention, a cold trap of the hereinbefore specified kind has disposed

within it neutron absorbing material protected against contact with the uranium hexafluoride. The neutron absorbing material may be incorporated in the cold trap in a manner which permits its removal when not required.

An advantage of the invention is that a cold trap of dimensions suitable for dealing with uranium hexafluoride of normal enrichment can be adapted to deal with a quantity of material of greater enrichment when required by the expedients referred to in the last paragraph. When that quantity has been processed, the absorber can be removed and stored and the cold trap restored to the condition for dealing with material of normal enrichment. Alternatively, it can be employed with the absorber still in position, but it will be appreciated that this reduces the capacity of the cold trap to some extent.

A constructional example of an embodiment of the invention will now be described. Reference is made to the disclosure of our co-pending application No. 33604/77 (Serial No. 1577843) in which is shown and described a cold trap having a container consisting of a tube whose axis is vertical and having an upper cylindrical portion and a lower portion which tapers in the downward direction, the tube being jacketted and contained in a lagged casing through which the jacket connections protrude, together with an inlet/outlet for the product gas, uranium hexafluoride, and a gas impurity/vacuum draw-off pipe. The sole Figure of the drawing accompanying the Provisional Specification (which is a side view in medial section) shows a portion only, namely the container without jacketting and casing, of a similar kind of cold trap, and where possible, similar reference numerals have been employed in the said sole Figure for parts similar to parts of the cold trap illustrated in the drawings of the said co-pending application. It is not consi-

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dered necessary that the remaining portions should be illustrated for an understanding of the present invention and its embodiment.

5 Referring to the drawing, this illustrates the container of a cold trap of the said kind, the container consisting of a tube 1 disposed with its axis vertical and having a lower portion 2 which is tapered in the downward direction and an upper cylindrical portion 3 having a branch inlet/outlet 4 for the process gas, uranium hexafluoride, and a flange 9 for mounting purposes welded to it. The tapered portion 2 is closed at its lower end by an end 8 welded thereto, and four fins 10 at right angles to one another are mounted above the end 8. A gas impurity/vacuum draw-off pipe 7 disposed within the tube 1 extends to nearly the bottom thereof. Most of the tube 7 is jacketted by a tube 6 of larger diameter than tube 7 and concentric therewith; the tube 6 extends from the top of tube 7 downwardly to approximately four-fifths of the length of the tube 7 where it terminates in an end 11 welded sealingly to tube 7. The upper end of jacket tube 6 has a flange 12 welded to it, and the flange 12 is adapted to be bolted to an upper end closure 5 consisting of an apertured plate welded to the tube 1 but to allow penetration through its aperture of the tube 7 and jacket tube 6 with clearance. A pair of sealing 'O' rings 13 are interposed between the flange 12 and end 5. A flanged union 14 for connection to a gas draw-off line (not shown) is welded to a closure ring 15 which is welded to the tubes 6 and 7 to seal off the annular space between those tubes. This space is filled by a suitable neutron absorber 16, for example boron carbide powder mixed with graphite powder, tamped down to completely fill the said space before the closure ring 15 is secured in its sealing position.

The provision of the neutron absorbing material in the manner described ensures the overcoming of any criticality problem when the cold trap is operated with material of higher enrichment than normal, for example 4-5% enrichment compared with 2-3% normal enrichment. The particular manner of incorporating the neutron absorbing material also ensures minimum interference with and minimum reduction of, the space within the cold trap in which the uranium hexafluoride is condensed and sublimed.

WHAT WE CLAIM IS:-

- 55 1. A cold trap of the hereinbefore specified kind, having disposed within it neutron absorbing material protected against contact with the uranium hexafluoride.
- 60 2. A cold trap according to claim 1, wherein the neutron absorbing material is incorporated in the cold trap so as to be removable therefrom.
- 65 3. A cold trap, substantially as hereinbefore described with reference to the drawing

accompanying the Provisional Specification.

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PROVISIONAL SPECIFICATION

1 SHEET

*This drawing is a reproduction of
the Original on a reduced scale*

