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(54) A VACUUM FILTER FOR FILTERING URANIUM COMPOUNDS OF HIGH U-235 CONTENT

(71) We, NUKEM GMBH, a body corporate organised under the laws of Germany of 6450 Hanau 1, Germany; do hereby declare the invention, for which we 5 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 a vacuum filter 10 for filtering uranium compounds of high U-235 content.

More particularly, the present invention relates to a rotary disc filter, of stable geometry, by which precipitates of uranium 15 compounds of very high U-235 content may be filtered off, washed and carried safely away.

It is known that, in order to avoid critical accidents in the nuclear industry, 20 the reactions have to be carried out in vessels of stable geometry. For the acceptance of a processing apparatus by the supervising authority, consideration must be given to the problem of failures. In the 25 case of filters, the area beneath the surface of the filter has to be included as part of the geometry in the assessment of criticality, because the filter material may tear or break, in which case the highly 30 enriched uranium compound would also be present in the area below the surface of the filter. A rotary disc filter is described, for example, in DT-AS No. 1,767,549.

In the case of uranium compounds 35 having low U-235 enrichment levels, the safe layer thickness (that is, the amount of radioactive uranium which may be stored without risk of nuclear reaction) is so great that the area below the surface of the filter 40 may be incorporated into this layer thickness without the height of the vacuum filter above the filter cloth having to be excessively reduced. With high enrichment levels (in excess of 90% of U-235), however, 45 the safe layer thickness only amounts to

3.8 cm and, in the case of ammonium uranyl carbonate (AUC), which only contains about 50% of uranium, to only 4.0 cm. If, in the case of these minimal safe layer thicknesses, the height of the 50 space below the filter cloth also has to be taken into consideration, it is no longer possible to produce industrial filters because the layer thickness still available in that case above the filter cloth is too small to 55 accommodate the precipitation residue.

Accordingly, an object of the present invention is to provide a vacuum filter, more particularly a rotary disc filter, which is suitable for filtering uranium compounds 60 of high U-235 content on a commercial scale without danger of the safe layer thickness being exceeded in the event of destruction of the filter material.

The present invention provides a vacuum 65 filter, more especially a rotary disc filter, which comprises a filter housing, two filter cloths, one of which is located downstream of and below the other, optionally a scraping knife, and a perforated plate of 70 a material resistant to the filtrate arranged between the two filter cloths, the vacuum filter being adapted to have a vacuum applied beneath the lower filter cloth.

The thickness of the plate should amount 75 to at least 0.5 mm. Although in theory there are no upper limits to the thickness of the plate, in practice the thickness of the plate is from 0.5 to 50 mm. Although the constituent material of the plate is preferably a corrosion-resistant steel, it is also possible to use ceramics, glasses or other metallic materials which are resistant to the corrosive effect of the filtrate.

The "perforated plate" consists, for 85 example, of a slotted metal plate. It has proved to be particularly effective to use a perforated plate of corrosion-resistant steel having a perforation diameter of from 2 to 8 mm. The particular advantage of this 90

perforated plate with its numerous small perforations is that, in cases where scraping blades are used as the scraping knife in rotary disc filters, it does not provide the 5 blades with a contact surface in the event of tearing of the filter cloth which could result in destruction of the perforated plate.

By virtue of the filter according to the present invention, the highly enriched 10 uranium deposit is prevented from entering the empty space below the lower filter cloth rupturing or tearing. Thus, the nuclear risk which could arise if the upper filter cloth in the event of the upper filter cloth 15 was damaged is eliminated due to the presence of a second filter cloth (the safety filter), beneath the first one. Accordingly, no allowance has to be made for the empty space below the filter cloth so far as the 20 layer thickness is concerned, with the result that the entire safe layer thickness above the filter surface may be used.

The accompanying drawing represents 25 diagrammatically one illustrative embodiment 25 of a filter according to the present invention.

The vacuum filter consists of a filter housing 1 in which a filter cloth support 2 is secured. This support 2 may consist of 30 a sintered plate or of a perforated plate. A lower filter cloth 3 lies on this support, being separated by a perforated plate 4 from the upper filter cloth 5 on which the deposit accumulates.

35 In operation, a vacuum is applied beneath the lower filter cloth support 2. The filtered particles collect on the filter cloth 5 during filtration, while the liquid penetrates through both filter cloths 3 and 5, support 2 40 and plate 4, and drops into the vacuum vessel beneath the suction filter.

In the case of rotary disc filters, the 45 supervising authorities stipulate the provision of two safety devices operating independently of one another. According to the present invention, therefore, rotary disc filters of the type in question are preferably equipped with a switch which is connected to a scraping knife and which, in 50 the event of increased resistance of the knife, immediately switches off the disc drive and interrupts the flow of the solution which is about to be filtered. This increased resistance is attributable either to tearing 55 of the upper filter cloth or to rubbing of the scraping knife on the perforated plate.

The scraping knife holder is mounted, for example, on a mobile carriage which is held in its end position by a spring. The

resistance of the knife is measured by the 60 load of the spring. If the resistance of the knife increases beyond its normal level, for example because the scraping knife has entrained the upper filter cloth 5, the 65 scraping knife presses the carriage against the spring and, in doing so, operates a switch which stops the important functions of the filter and, in particular, immediately 70 switches off the disc drive and interrupts the flow of the solution which is about to be filtered.

This safety measure prevents uranium 75 sludges from breaking through the surface of the lower filter cloth. It is only the upper filter cloth which may be damaged, in which case the rotary disc is switched off. The lower filter cloth remains protected against damage by the slotted or perforated plate lying thereon.

#### WHAT WE CLAIM IS:

1. A vacuum filter, more especially a rotary disc filter, for filtering off uranium compounds of high U-235 content, which comprises a filter housing, two filter cloths, one of which is located downstream of and below the other, and a perforated plate of a material resistant to the filtrate arranged between the two filter cloths, the vacuum filter being adapted to have a vacuum applied beneath the lower filter cloth. 90

2. A filter as claimed in claim 1 also comprising a scraping knife.

3. A filter as claimed in claim 1 or claim 2 comprising a perforated plate having a thickness of at least 0.5 mm. 95

4. A filter as claimed in any of claims 1 to 3 comprising a perforated plate of corrosion-resistant steel having perforation diameters of from 2 to 8 mm.

5. A filter as claimed in any of claims 1 to 4 which is a rotary disc filter comprising a scraping knife provided with a switch which is adapted to switch off the disc drive and interrupt the flow of the solution about to be filtered in response to an increase in the resistance of the knife. 100

6. A vacuum filter as claimed in claim 1 substantially as herein described.

7. A vacuum filter as claimed in claim 1 substantially as herein described with particular reference to the accompanying drawing. 110

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COMPLETE SPECIFICATION

1 SHEET

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

