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(54) Title: DEVICE FOR CONTINUOUS ANNULAR CHROMATOGRAPHY

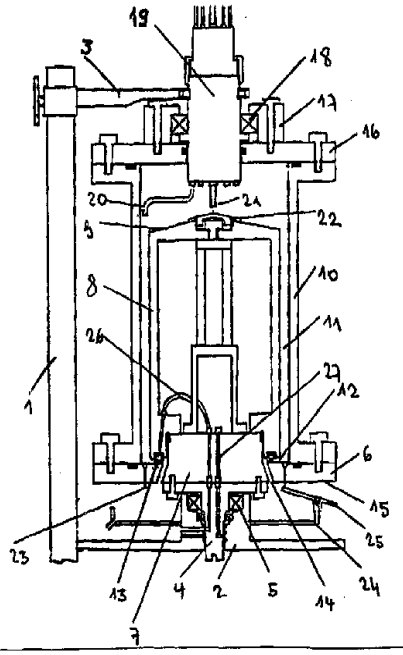
(54) Bezeichnung: VORRICHTUNG ZUR KONTINUIERLICHEN ANNULAREN CHROMATOGRAPHIE

(57) Abstract

The invention relates to a device for continuous annular chromatography, comprising a particle bed in the form of a cylinder casing, and at least one feed point for the liquid stock material. The particle bed and feed point move in relation to one another. The invention is characterized in that at least one opening (12, 32) giving access to the particle bed is provided at the lower end of the particle bed chamber, especially for conveying the bed material.

(57) Zusammenfassung

Vorgeschlagen wird eine Vorrichtung zur kontinuierlichen annularen Chromatographie, bei der eine Relativbewegung zwischen einem Teilchenbett in Form eines Zylindermantels und mindestens einer Aufgabestelle für flüssiges Beschickungsmaterial vorgesehen ist, mit dem Kennzeichen, daß am unteren Ende des Teilchenbettraums (11) mindestens eine Zugangsöffnung (12, 32) zum Teilchenbett, insbesondere zur Bettmaterialabfuhr, vorgesehen ist.



A Device for Continuous Annular Chromatography

The invention relates to a device for continuous annular chromatography in which there is provided a relative movement between a particle bed in the form of a cylinder casing and at least one feed location for liquid stock material.

With column chromatography a standing cylinder with particle-like material is filled and above is supplied with a component mixture which is to be separated. Subsequently from above one continuously elutes with a solvent – with this the components on account of their varying affinity to particle material are separated proportionally to the flow speed of the solvent (eluent) and leave the column after one another.

One differentiates between the use of a uniform solvent (isocratic operation) and the use of several different solvents (step and gradient operation). With the step operation, the solvent is changed without transition, with the gradient operation the component part of the individual solvents in a solvent mixture is changed over time.

With this elution chromatography the components are simply washed through the column; if one on the other hand uses in the eluent a so-called displacer. i.e. a component part which has a higher affinity to the particle material than all previously charged components and therefore displaces these, one talks of displacement chromatography in which with respect to elution chromatography upgraded fractions are obtained, but not all of the individual components is obtainable in pure form (always also mixtures are obtained).

In order to be able to continuously chromatograph, annular chromatography has been developed with which a relative movement between a particle bed in the form of a standing cylinder casing, and, arranged on its head, at least one feed location for liquid stock material is provided for, the individual components in spiral paths run through the particle material and along the lower cylinder casing circumference simultaneously exit at various circumferential regions. It may e.g. be applied as HPLC, elution or displacement chromatography and above all is operated isocratically.

With this one differentiates between embodiment forms where the particle bed with respect to the feed rotates, and those in which the feed with respect to the

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particle bed rotates. As an example for a literature reference concerning an embodiment form in which the bed rotates, US 5,045,209 of Westinghouse Electric Corp. is mentioned, which describes the chromatograph extraction of scandium and yttrium. As an example for a literature reference concerning an embodiment form with a stationary particle bed, US 4,149,436 of Union Oil Company of California is mentioned, which describes displacement chromatography for all purposes.

The invention relates to a further development of all known devices for annular chromatography and amongst other things achieves the object of being able to renew the particle bed without dismantling the device.

This invention provides in one form a device according to claim 1, characterised in that the access opening 12; 32 is an annular opening.

In an alternative form the invention provides a method for discharging a particulate bed material from an annular space of an annular chromatographic device as defined in claim 1 or 2, comprising unsealing the access opening 12, 32 by either collapsing the seal 13 by application of reduced pressure or by lifting the cylindrical body 8, and discharging the bed material via said opening 12, 32, optionally by flushing.

For this purpose the device according to the invention above all is characterised in that on the lower end of the particle bed space there is provided at least one access opening to the particle bed, in particular for bed material discharge.

Via this access opening the bed material can be emptied downwards, preferably rinsed out with fluid; and the device can be newly charged from above. Via the access opening one may also counter-rinse with a pressure medium, e.g. with pressurised air the bed may be loosened. The emptying as well as the new charging of the device with bed material is effected with a relative movement of the particle bed space and a feed location for new particle bed material, which may be simply provided as a tube next to the feed location for liquid stock material.

The access opening is preferably an annular opening and in particular is closed and opened in that the volume of a hollow seal is changed via its inner space. Advantageously the access opening is formed in that a hollow seal is collapsed by applying a vacuum.

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It has also been conceived for forming and closing the access opening to provide a wall of the particle bed space displaceable at least in sections.

In the following the invention is described in more detail by way of two embodiment examples with reference to the drawing in which Fig. 1 and Fig. 2 in each case are schematic lateral views in section which show a device for the annular chromatography with a stationary feed head and a rotating particle bed. With this construction, components corresponding to one another have the same reference numerals.

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On a base 1 there is arranged a fixed support platform 2 and a displaceable carrying arm 3. The support platform 2 is penetrated by a rotor table 4 which is driven from below and which via a tapered roller bearing 5 is supported on the support platform 2 and on which a base plate 6 is bolted, said plate comprising a central raised part 7 onto which a cylindrical hollow body 8 with a cone roof 9 is placed. Concentric to the hollow body 8 a cylinder casing 10 is bolted from above onto the base plate 6, wherein between the hollow body 8 and the cylinder casing 10 there remains a vertical annular space 11 and between the lower edge of the hollow body 8 and the upper side of the base plate 6 there remains a horizontal gap 12 which inwardly extends up to the central raised part 7 and in which an annular hollow seal 13 is arranged. In the base plate there are provided passage bores 14 which connect the horizontal gap 12 to the lower side 15 of the base plate 6.

The cylinder casing 10 carries a lid 16 and this a bearing sleeve 17 with a tapered roller bearing 18 which is centrally supported on a stationary feeder unit 19 held by carrying arm 3, so that all components placed on the rotor table 4 in operation are rotated with respect to the support platform 2 and the feeder unit 19.

The vertical annular space 11 is filled with particle-like bed material which in the usual manner is e.g. a gel material, an ion exchange material or likewise and, as indicated at 20, can be supplied via the feeder unit 19. Likewise here liquid stock material is supplied as well as centrally at 21, an eluent which via a distributor plate 22 and the cone roof 9 flows away to the bed material in space 11. On the floor of the material bed the base plate 6 is penetrated by a removal connection piece 23 distributed over a circular circumference and the support platform 2 carries a collection tub 24 for accommodating collector vessels which are not shown. A lateral leading away tube is indicated at 25.

If the bed material is to be changed the hollow seal 13 is collapsed via the vacuum conduit 26, by which means the horizontal gap 12 opens towards to the bores 14 and the bed material is rinsed into the collector tub 24. At 27 an aeration or pressurised air conduit is indicated with which the hollow seal 13 may be expanded during operation of the installation.

The device shown in Fig. 2 in contrast to that of Fig. 1 does not comprise a

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sealing changeable in its volume for opening and closing the annular gap, rather the whole body 8 is lifted from the base plate 6 via a hydraulic or pneumatic cylinder piston unit 28, 29 which is supported on the central part 7 of the base plate via a foot 30. With this the lower annular edge 31 of the hollow body 8 is lifted out of a corresponding annular groove 32 in the base plate 6, in which it is sealingly seated in the idle condition. In the base of the annular groove 32 there are arranged the passage bores 14. Otherwise the embodiment forms according to Fig. 1 and 2 and their operation are identical.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A device for continuous annular chromatography comprising a stationary feeder unit 19 and a rotatable particle bed space 11 formed by a cylindrical body 8 and a cylindrical casing 10 arranged concentrically around said cylindrical body 8 for receiving a particulate bed material, characterised in that at the lower end of the particle bed space 11 there is provided at least one access opening 12, 32 to the particle bed suitable for removal of the bed material, wherein said particle bed space 11 is sealed against said access opening 12, 32 by a lower end of said cylindrical body 8 in combination with a seal 13.

2. A device according to claim 1, characterised in that the access opening 12, 32 is an annular opening.

3. A device according to claim 1 or 2, characterised in that the seal is a hollow seal 13 that is collapsible by way of applying reduced pressure or expandable using compressed air.

4. A device according to claim 1 or 2, characterised in that the cylindrical body 8 is displaceable by lifting.

5. A method for discharging a particulate bed material from an annular space of an annular chromatographic device as defined in claim 1 or 2, comprising unsealing the access opening 12, 32 by either collapsing the seal 13 by application of reduced pressure or by lifting the cylindrical body 8, and discharging the bed material via said opening 12, 32, optionally by flushing.

6. The method of claim 5, wherein during discharge of the bed material the particle bed space 11 is moved relative to a feed location for new particle bed material.

7. A device for continuous annular chromatography substantially as hereinbefore described with reference to Figure 1 or Figure 2.

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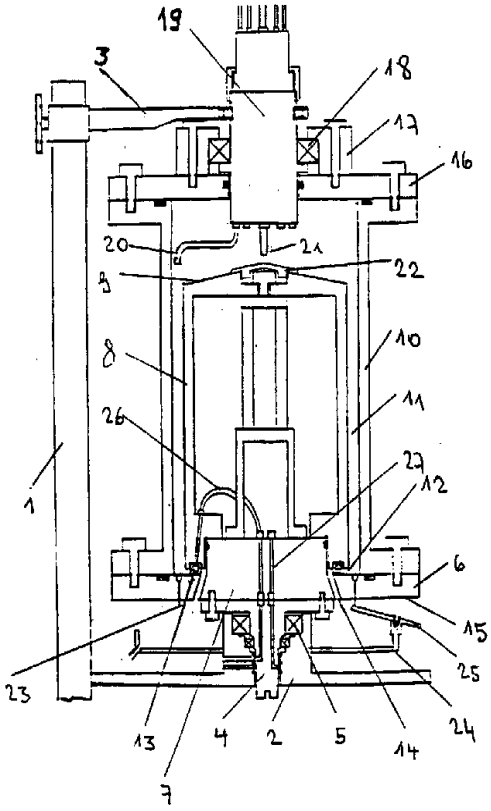

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Fig.1

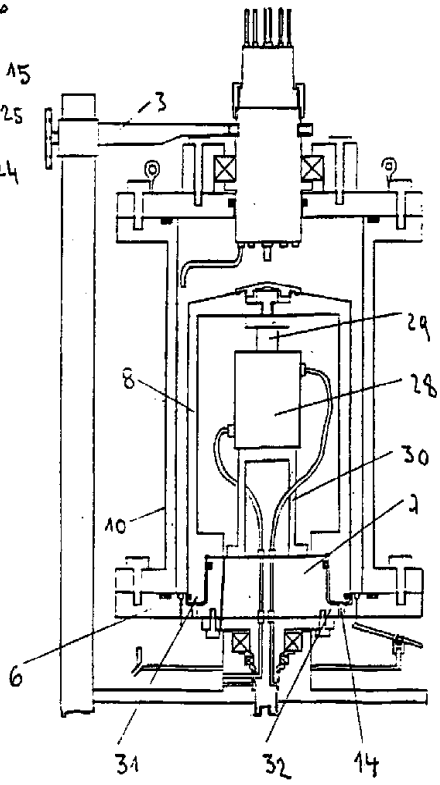

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Fig.2