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- (71) Applicant (for all designated States except US): **ALFA LAVAL CORPORATE AB** [SE/SE]; Box 73, S-221 00 Lund (SE).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): **KLINTENSTEDT, Kjell** [SE/SE]; Sjöängsvägen 16, S-132 34 Saltsjö-boo (SE).
- (74) Agent: **STRANDÉN, Lars-Erik**; Alfa Laval Corporate Ab, Hans Stahles väg, S-147 80 Tumba (SE).

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(54) Title: COMPRESSIBLE UNIT FOR A CENTRIFUGAL SEPARATOR

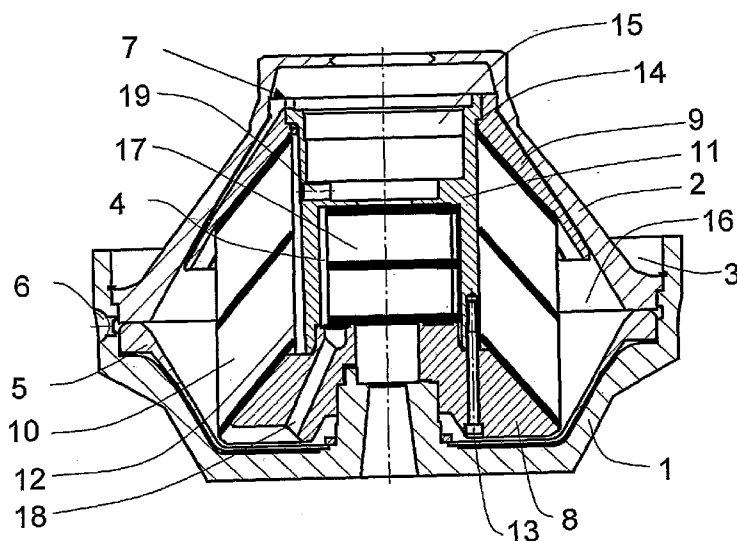


Fig. 1

(57) Abstract: The present invention relates to a compressible unit (7) comprising a plurality of separating discs (10) and adapted to being capable, in a compressed state, of being mounted in a rotor of a centrifugal separator and being taken out of the rotor, which rotor during operation with the unit mounted therein is rotatable about an axis of rotation, which unit comprises a support means (8), a pressure means (9), between which support and pressure means the separating discs (10) are disposed abutting against one another, a central control means (11) provided with guide surfaces (12) which abut against the separating discs (10) and control the latter's radial and polar position, and at least one compression means (13) adapted, during compression of the unit (7) in a compression direction, to pressing the support and pressure means (8, 9) towards one another in such a way that the separating discs (10) disposed between them are compressed. During the compression, the guide surfaces (12) of the central control means (11) allow relative

movement between the support and pressure means (8, 9) and the separating discs (10) disposed between them, and are of at least sufficient extent in the compression direction for the position-controlling abutment between the guide surfaces (12) and the separating discs (10) to be maintained throughout the relative movement during the compression.

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COMPRESSIBLE UNIT FOR A CENTRIFUGAL SEPARATOR

BACKGROUND TO THE INVENTION, AND STATE OF THE ART

5 The present invention relates to a compressible unit comprising a plurality of separating discs and adapted to being capable, in a compressed state, of being mounted in a rotor of a centrifugal separator and being taken out of the rotor, which during operation with the unit mounted therein is rotatable about an axis of rotation. This unit comprises a support means
10 and a pressure means, between which support and pressure means the separating discs are disposed abutting against one another. The unit further comprises a central control means provided with guide surfaces which abut against the separating discs and control the latter's radial and polar position, and at least one compression means adapted, during
15 compression of the unit in a compression direction, to pressing the support and pressure means towards one another in such a way that the separating discs disposed between them are compressed.

An example of a centrifugal separator with a unit of a similar kind is
20 referred to in SE 146 598, but the compression of the stacked separating discs is effected, after the insert has been moved down in the rotor body, by an expensive compression tool in a labour-intensive process.

US 5,637,217 and WO 2004/020105 refer to examples of centrifugal
25 separators provided with inserts of separating discs in the form of units which are held together and compressed by a plurality of rods or bolts through the disc set, thereby disturbing the flow through the disc set and hence the separation results. A large number of parts also have to be handled during assembly and disassembly, which are therefore labour-
30 intensive operations.

SUMMARY OF THE INVENTION

- The object of the present invention is to propose a compressible unit
5 which comprises a plurality of separating discs of the kind indicated
above and is easy to assemble and disassemble outside the rotor of the
centrifugal separator and easy to compress without any expensive
compression tools.
- 10 Another object is to propose a compressible unit which is easy to replace,
inspect and modify as the need arises.

- A further object is to propose a compressible unit which can be balanced
separately, making it easy to replace without having to rebalance the
15 rotor of the centrifugal separator.

- According to the present invention, these objects are achieved by the
guide surfaces of the central control means in a compressible unit which
comprises a plurality of separating discs of the kind indicated above being
20 so configured that during the compression they allow relative movement
between the support and pressure means and the separating discs
disposed between them, and being of at least sufficient extent in the
compression direction for the position-controlling abutment between the
guide surfaces and the separating discs to be maintained throughout the
25 relative movement during the compression.

- According to an embodiment of the invention, the compressible unit has
in the compression direction an extent which is reduced by at least five
percent during the compression.

According to another embodiment of the invention, the compressible unit has in the compression direction an extent which is reduced by at least ten percent during the compression.

- 5 According to a preferred embodiment of the invention, the unit is compressed in a compression direction which is parallel with the axis of rotation. In this context, the compression means is preferably disposed between at least one out of the support and pressure means and the control means, which latter in turn abuts against the other out of the
- 10 support and pressure means via axially facing pressure-transmitting contact surfaces in such a way that during compression the control means together with the other out of the support and pressure means and the separating discs disposed between the support and pressure means is pressed towards the first out of the support and pressure means.

15

According to a special embodiment of the invention, the unit also comprises an inlet chamber which is formed within the control means and which is provided a plurality of inlet discs for entraining during operation a liquid mixture of components which is to be separated.

20

According to another special embodiment of the invention, the unit also comprises an outlet chamber which is formed within the control means and which is connected to the radially outer region of the control means via at least one outlet passage disposed in the control means.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described below in more detail with reference to the attached drawings, in which

5

Fig. 1 depicts schematically a rotor of a centrifugal separator, which rotor is provided with a compressed unit in accordance with the present invention, in axial section, and

- 10 Fig. 2 depicts schematically an uncompressed unit in accordance with the present invention, in axial section, which is not mounted in a rotor of a centrifugal separator.

DETAILED DESCRIPTION OF VARIOUS EMBODIMENTS OF THE 15 INVENTION

The rotor depicted in Fig. 1 has a lower element 1 and an upper element 2 which are held together by a locking ring 3. As a depicted example of many possible rotors which might be provided with a compressible unit according to the present invention, it is adapted to being mounted on an unde-
20 depicted hollow drive shaft through which the liquid mixture of components which is to be separated is supplied to a central inlet chamber 4 in the rotor. The rotor depicted is provided with an axial tubular valve slide 5 adapted in a conventional manner to intermittently
25 opening and closing a passage, closed in the drawing, between the inside of the rotor and outlet apertures 6 disposed in the lower element of the rotor.

Centrally in the rotor, a compressible unit 7 according to the present
30 invention is disposed axially between the valve slide 5 and the upper

element 2. The compressible unit has a support means 8, a pressure means 9 and, disposed between them, a stack of a plurality of truncated conical separating discs 10 which have between them intermediate spaces in which the main separation takes place during operation. The unit 7 is provided centrally with a control means 11 itself provided with a number of guide surfaces 12 which abut against the separating discs 10 and control the latter's radial and polar position at the radially inner edge of the separating discs. A compression means 13 is disposed between at least one out of the support and pressure means and the control means 11. In the example depicted, the compression means 13 takes the form of a screw disposed between the support means 8 and the control means 11. The control means 11 itself abuts against the other out of the support and pressure means, which in the example depicted is the pressure means 9, via axially facing pressure-transmitting contact surfaces 14 in such a way that during compression the control means 11 together with said other out of the support and pressure means and the separating discs 10 disposed between the support and pressure means are pressed against said one out of the support and pressure means.

In the unit depicted by way of example, an inlet chamber 4 and an outlet chamber 15 are formed centrally within the control means. In the inlet chamber 4 a plurality of inlet discs 17 are adapted to entraining during operation a liquid mixture of components which is to be separated, and the inlet chamber 4 communicates with a separating chamber 16 via a number of distribution ducts 18. The outlet chamber 15 communicates with the separating chamber 16 via at least one outlet passage 19 disposed in the control means.

Since the unit depicted in Fig. 1 is mounted in the rotor, it is compressed. Fig. 2 depicts the same unit not mounted in a rotor and not compressed,

as indicated by the axial distance 20 between the support means 8 and the control means 11.

In the example depicted, the separating discs are conical and
5 compressed in a direction which is parallel with the axis of rotation, but it is also possible to apply the invention with conventional axial separating discs which are compressed in the circumferential direction.

Thanks to the present invention a compressible unit comprising a plurality
10 of separating discs is accomplished which is easy to assemble and disassemble outside the rotor of the centrifugal separator, easy to compress without any expensive compression tools and easy to replace, inspect and modify as the need arises.

15 A compressible unit according to the present invention can also be balanced separately, making it possible for it to be replaced without having to rebalance the rotor of the centrifugal separator.

CLAIMS

1. A compressible unit (7) comprising a plurality of separating discs (10) and adapted to being capable, in a compressed state, of being mounted
5 in a rotor of a centrifugal separator and being taken out of the rotor, which rotor during operation with the unit mounted therein is rotatable about an axis of rotation, which unit comprises
- a support means (8),
10 a pressure means (9),
- between which support and pressure means the separating discs (10) are disposed abutting against one another,
15 a central control means (11) provided with guide surfaces (12) which abut against the separating discs (10) and control the latter's radial and polar position, and
- 20 at least one compression means (13) adapted, during compression of the unit (7) in a compression direction, to pressing the support and pressure means (8, 9) towards one another in such a way that the separating discs (10) disposed between them are compressed,
- 25 c h a r a c t e r i s e d in that
- during the compression, the guide surfaces (12) of the central control means (11) allow relative movement between the support and pressure means (8, 9) and the separating discs (10) disposed between them, and
30 are of at least sufficient extent in the compression direction for the

position-controlling abutment between the guide surfaces (12) and the separating discs (10) to be maintained throughout the relative movement during the compression.

- 5 2. A compressible unit according to claim 1, characterised in that it has in the compression direction an extent which is reduced by at least five percent during the compression.
3. A compressible unit according to claim 1, characterised in that
10 it has in the compression direction an extent which is reduced by at least ten percent during the compression.
4. A compressible unit according to any one of the foregoing claims, characterised in that the compression direction is parallel with the
15 axis of rotation.
5. A compressible unit according to claim 4, characterised in that the compression means is disposed between at least one out of the support and pressure means (8, 9) and the control means (11), which
20 latter abuts against the other out of the support and pressure means (8, 9) via axially facing pressure-transmitting contact surfaces (14) in such a way that during the compression the control means (11) together with the other out of the support and control means (8, 9) and the separating discs (10) disposed between the support and pressure means (8, 9) is pressed
25 toward the first out of the support and pressure means (8, 9).
6. A compressible unit according to any one of the foregoing claims, characterised in that it also comprises an inlet chamber (4) which is formed within the control means (11) and which is provided with a

plurality of inlet discs (17) for entraining during operation a liquid mixture of components which is to be separated.

7. A compressible unit according to any one of the foregoing claims, c h
5 a r a c t e r i s e d in that it also comprises an outlet chamber (15) which is connected to the radially outer region of the control means (11) via at least one outlet passage (19) disposed in the control means (11).

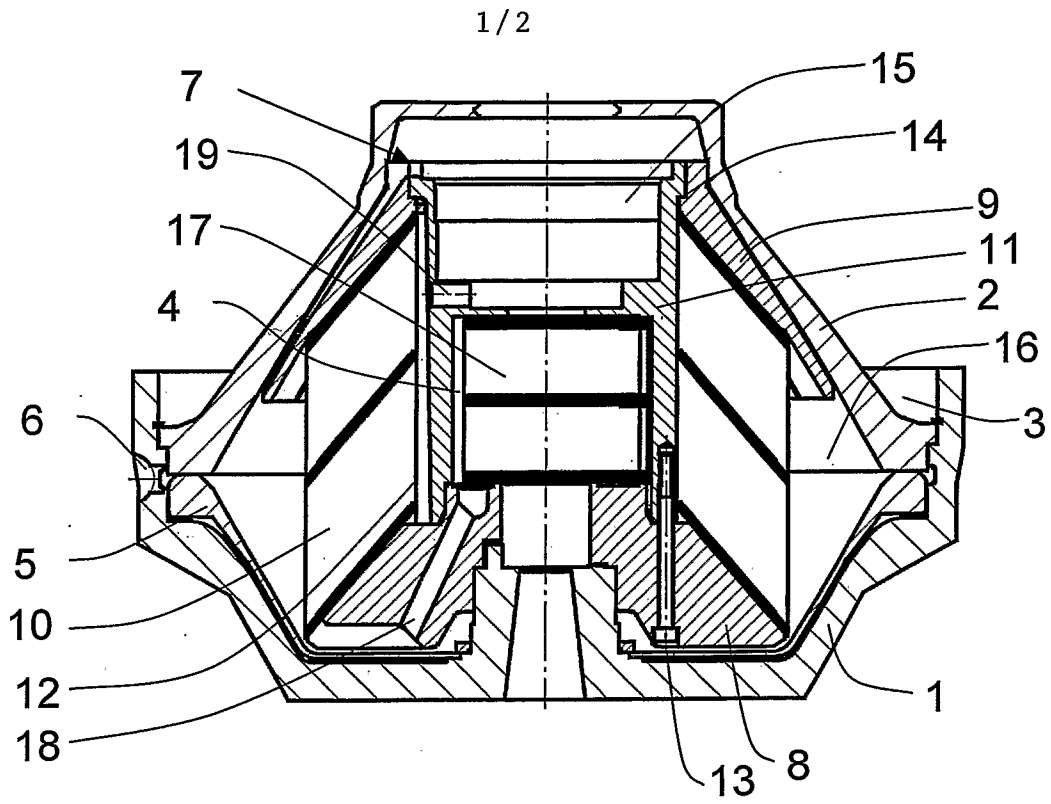


Fig. 1

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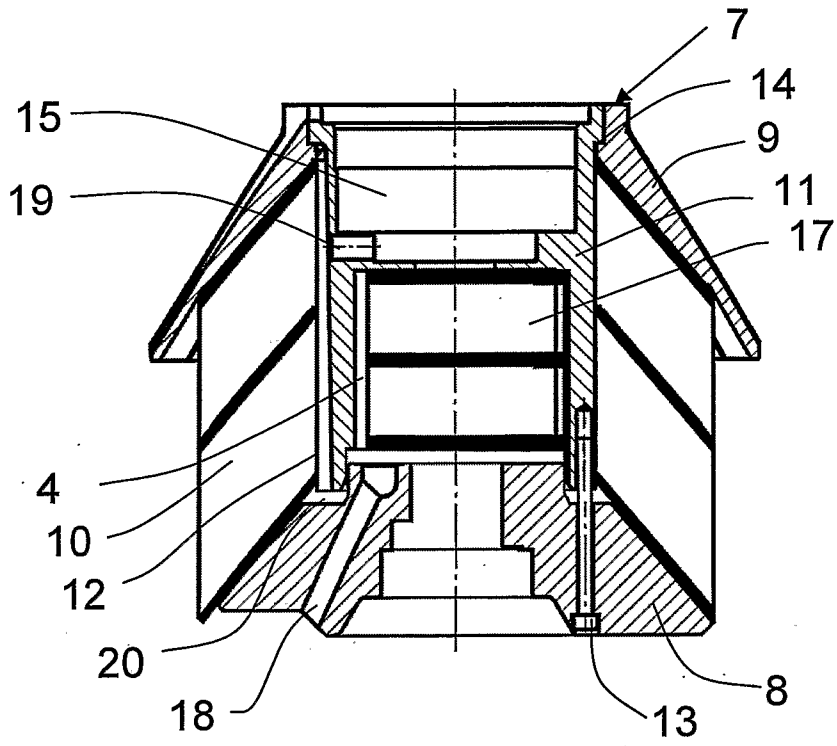


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2008/000169

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE 146598 C (AB SEPARATOR), 24 August 1954 (24.08.1954) --	1-7
A	US 5637217 A (P.K. HERMAN ET AL), 10 June 1997 (10.06.1997), abstract --	1-7
A	WO 2004020105 A2 (3NINE AB), 11 March 2004 (11.03.2004), abstract --	1-7
A	US 2725190 A (H.W.HEIN ET AL), 29 November 1955 (29.11.1955) --	1-7

Further documents are listed in the continuation of Box C.

See patent family annex.

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Date of the actual completion of the international search

3 June 2008

Date of mailing of the international search report

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Facsimile No. +46 8 666 02 86

Authorized officer

Fredrik Andersson /MRO
Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No. PCT/SE2008/000169
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5795477 A (P.K. HERMAN ET AL), 18 August 1998 (18.08.1998), abstract ----- -----	1-7

International patent classification (IPC)**B04B 1/08** (2006.01)**B04B 7/08** (2006.01)**Download your patent documents at www.prv.se**

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Use the application number as username.

The password is **VCBQEMDIJC**.

Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

26/01/2008

PCT/SE2008/000169

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