

Fully jacketed screw centrifuge

The invention relates to a solid bowl screw centrifuge according to the preamble of claim 1.

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Solid bowl screw centrifuges are known in the most diverse possible versions, thus, for example, from DE 43 20 265 A1 and WO 2004/058409 A1.

10 DE 42 38 568 A1 illustrates in fig. 1 that and how dirt can accumulate in a solids capture chamber when a solid bowl screw centrifuge is in operation. This necessitates repeated cleaning of the solids capture chamber in order to avoid operating impairments caused
15 by blockages or even damage to the rotating system.

To solve this problem, it is known from US 3,399,828 to form at the solids discharge of a solid bowl screw centrifuge, at its tapering end, a solids capture
20 chamber in which is arranged, tension-mounted, an elastic air-impermeable diaphragm covering an air duct which is closed off, air-tight, with respect to the surroundings and with respect to the actual solids capture chamber. By the action of compressed air,
25 pressure fluctuations can be generated at the diaphragm which set the latter in oscillation, thus serving to release dirt from the walls of the capture chamber, here the diaphragm.

30 Although the problem of dirt is reduced in this way, the problem still appears to be the relatively high outlay in terms of apparatus and structure for generating pressure fluctuations at the elastic diaphragm. Furthermore, it is relatively difficult to
35 change the diaphragms, since the diaphragms repeatedly have to be mounted, pressure-tight, in the solids capture chamber.

Embodiments of the invention seek to eliminate this
40 problem.

According to an aspect, there is provided a solid bowl screw centrifuge which has the following: a rotatable drum with an axis of rotation oriented, in particular, horizontally; a rotatable screw arranged in the drum;
5 at least one discharge port, oriented at an angle to the axis of rotation of the solid bowl screw centrifuge, for the discharge of solids from the drum in the bowl of the drum, with the at least one discharge port being assigned a solids capture chamber
10 which partially surrounds the drum rotating during operation and which does not rotate during operation, with at least one hose segment not circumferentially closed in cross section being arranged in the capture chamber, wherein, the hose segment is composed of an
15 elastomeric material and designed as an elastomeric element, in the capture chamber no pressure gradient can be generated by the action of compressed air and the elastomeric element is not arranged in the capture chamber in such a way as to be pressure-tight, the non-circumferentially closed hose segment is arranged
20 virtually in the form of a ring in the solids capture chamber, so that said hose segment surrounds the drum in the region of the solids discharge port virtually completely, with the exception of an outlet port into a diversion or a capture container, and the non-circumferentially closed region of the hose segment is
25 C-shaped, U-shaped or Ω -shaped in cross section.

Advantageously, in spite of dispensing with a chamber
30 which is closed by an elastomer and in which a pressure gradient can be generated by the action of compressed air, movements in the elastomeric element in the solids capture chamber are sufficiently generated, solely by the impact of the solid, in order to release dirt. The
35 number of cleanings of the solids capture chamber can consequently be reduced, compared with solids capture chambers without an elastomeric element. Moreover, maintenance work is simplified as compared with

solutions with a pressure chamber in which a pressure gradient can be generated, since the elastomer no longer has to be arranged so as to be pressure-tight. Moreover, as compared with such solutions, there is no
5 need for the means required for generating the pressure gradient (for example, a controllable pump).

A further advantage is the noise reduction achieved, since the impingement momentum of the solids is
10 effectively decoupled vibrationally from the stand or the noise-radiating surface of the centrifuge, and since the hose segment implements a dual-shell structure which has a noise-insulating effect. This is also advantageous especially in the case of harder and
15 coarse solids and when there is a high discharge of solids for a unit time (or high solids performance).

Advantageous refinements will be gathered from the subclaims.
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The invention is explained in more detail below by means of exemplary embodiments, with reference to the drawing in which:

- fig. 1 shows a section through part of a solid bowl screw centrifuge with a known solids capture chamber;
- 5 fig. 2 shows a section though a solids capture chamber configured according to the invention for a solid bowl screw centrifuge particularly of the type of
- 10 fig. 1;
- fig. 3 shows a section through a solids capture chamber of the solid bowl screw centrifuge of fig. 1 in the dirty state;
- 15 and
- fig. 4 and 5 show sections through further solids capture chambers configured according to the invention, in each case for a solid
- 20 bowl screw centrifuge particularly of the type of fig. 1.

Fig. 1 shows a solid bowl screw centrifuge with a non-rotatable housing 1 (or a hood-like cover), in which is

25 arranged a rotatable drum 3 which has a horizontal axis of rotation D. Furthermore, a screw 5 preferably rotatable at a differential rotational speed with respect to the drum 3 is arranged in said drum 3.

30 The drum 3 and the screw 5 have in each case an essentially cylindrical portion 3a, 5a and a tapering portion 3b, 5b adjoining the latter. The screw blade 7 surrounds both the cylindrical region and the tapering region of the screw body 9.

35 Furthermore, the drum 3 also has a further cylindrical portion 3c which adjoins the conically tapering portion

3b and which defines a co-rotating solids discharge chamber 11.

5 An axially extending centric inflow pipe 13 serves for feeding the centrifugable material via a distributor 9 into the centrifuging space 15 between the screw 5 and the drum 3.

10 If, for example, a sludgy pulp is conducted into the centrifuge, solid particles settle on the drum wall. A liquid phase is formed further inward.

The mounted screw 5 (bearing 17a) rotates at a somewhat lower or higher speed than the rotatably mounted drum 3
15 (bearing 17b) and conveys the ejected solids toward the conical portion 3b and, furthermore, to the cylindrical solids discharge chamber 11 adjoining the screw in the axial direction and located in the second cylindrical region 3c of the drum 3, said solids discharge chamber
20 being provided in turn with at least one solids discharge port 19 which here leads out of the drum 3 radially outward. This outlet port may also be oriented at an angle to the radial, for example in order to achieve an energy-saving repulse effect in the
25 circumferential direction (not illustrated here).

By contrast, the liquid flows to the larger drum diameter at the rear end of the cylindrical portion of the drum 3 and is diverted there at overflow ports 21,
30 here with an adjustable weir 23.

The solids 5 emerging from the solids discharge port 19 of the rotating drum 3 collect in a solids capture chamber 25 which surrounds the solids discharge chamber
35 annularly and of which the cross section, here of the rectangular type, can be seen in fig. 1 and 3. This cross section is preferably provided, but is not mandatory. A diverting pipe may exit preferably

vertically downward (not illustrated here) from the solids capture chamber or a capture container may be provided in order further to divert or to capture the sludgy solids which have emerged.

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Fig. 3 illustrates that, when the solids bowl screw centrifuge is in operation, accretions 27 may form in the solids capture chamber 25 and therefore the latter has to be cleaned repeatedly.

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In order to reduce the number of cleaning operations, there is provision according to fig. 2 for arranging in the solids capture chamber of a solid bowl screw centrifuge (for example, but not necessarily, of the type of fig. 1) a hose segment 29 which has a non-planary cross section and is preferably not circumferentially closed in cross section on the circumference (see fig. 3). This hose segment 29 is preferably arranged virtually in the form of a ring in the solids capture chamber, so that said hose segment surrounds the drum in the region of the solids discharge port 19 virtually completely, preferably with the exception of an outlet port into a diversion or a capture container (not illustrated here).

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The cross section, in the section perpendicular to the chamber, is preferably non-planar, but preferably C-shaped, U-shaped or Ω -shaped, the open side of the C, of the U or of the Ω facing the solids discharge port 19. The non-circumferentially closed region 35 of the hose segment 29 therefore faces the discharge port 19. The two open margins of the hose segment may be fastened to small webs 31, 33. The margins are oriented parallel to one another here.

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During operation, solids are thrown through the discharge port or discharge ports 19 into the solids capture chamber 25 where they impinge onto the inside,

facing the discharge port or discharge ports 19, of the hose segment 29. As a result, (essentially oscillation-like) movements M are excited in the hose segment 29 moveable elastically per se, which movements prevent
5 the accretion of solids or contribute to releasing accreting solids from the hose segment again.

The number of cleanings can be reduced in this way. Moreover, it is easy to change the hose segment 29,
10 since the chamber or the space 37 "behind" the hose segment 29 does not have to be or is not designed to be pressure-tight.

As can be seen in fig. 2, the hose segment 29 may bear
15 directly, in a region preferably spaced apart from the fastening regions (here at the webs 30, 31) in the solids capture chamber 25, here in a region on the outside, facing away from the discharge port 19, of the hose segment, against an inside 38 of a wall 39 of the
20 solids discharge chamber 11 (u-shaped in section here and formed from walls oriented at right angles to one another). As a result, during operation, pronounced movements (arrows M) occur particularly in the region of the corner zones. This is advantageous because these
25 are also the regions where deposits are preferentially formed.

As can be seen in fig. 4 however, the hose segment 29 may also be arranged so as to be spaced apart (gap G)
30 from the inside 38 of the walls of the solids discharge chamber 11 completely (apart from the direct or indirect connection to the walls of the solids discharge chamber via the webs 30, 31). This is advantageous particularly in terms of the generation of
35 noise which is reduced here once again, as compared with fig. 2. Moreover, any point of the hose segment can move freely in order thereby to prevent an

accretion of the solids and/or release existing accretions again.

5 The hose segment is preferably composed entirely (fig. 2, fig. 4) of an elastomer (for example a rubber material) or is formed as a composite part which is composed partially of an elastomer (see fig. 5) and partially of a non-elastomeric material such as a metal, for example steel or the like.

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According to the advantageous example of fig. 5, the base limb 40 of the hose-shaped segment is composed of metal (or of a coated metal or the like) and the side limbs 41, 42 of the u-shaped hose segment are composed
15 of the moveable elastomer.

The limbs 41, 42 are consequently moveable and the base limb 40 is per se immovable. This variant is especially stable and durable since the rigid portion or limb
20 constitutes wear protection. The number of necessary cleaning operations is nevertheless markedly reduced, since, upon the impingement of solids, the base limb 40 is also co-moved via the limbs 41, 42. Moreover, the material can slide off the metal limb especially
25 effectively.

List of reference symbols

Housing	1
Drum	3
Screw	5
Cylindrical portions	3a, 3c, 5a
Tapering portions	3b, 5b
Screw blade	7
Screw body	9
Solids discharge chamber	11
Inflow pipe	13
Centrifuging space	15
Bearing	17a, b
Discharge port	19
Overflow ports	21
Weir	23
Solids capture chamber	25
Accretions	27
Hose segment	29
Webs	31, 33
Region	35
Space	37
Inside	38
Wall	39
Base limb	40
Limbs	41, 42
Axis of rotation	D
Movements	M
Solids	S
Gap	G

Claims

1. A solid bowl screw centrifuge which has the following:

- 5
- a rotatable drum with an axis of rotation oriented, in particular, horizontally,
 - a rotatable screw arranged in the drum,
 - at least one discharge port, oriented at an
- 10
- angle to the axis of rotation of the solid bowl screw centrifuge, for the discharge of solids from the drum in the bowl of the drum,
 - with the at least one discharge port being assigned a solids capture chamber which
- 15
- partially surrounds the drum rotating during operation and which does not rotate during operation,
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- with at least one hose segment not
- 20
- circumferentially closed in cross section being arranged in the capture chamber,
- wherein
- the hose segment is composed of an elastomeric material and designed as an elastomeric
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- element,
 - in the capture chamber no pressure gradient can be generated by the action of compressed air and the elastomeric element is not arranged in the capture chamber in such a way as to be
- 30
- pressure-tight,
 - the non-circumferentially closed hose segment is arranged virtually in the form of a ring in the solids capture chamber, so that said hose segment surrounds the drum in the region of the
- 35
- solids discharge port virtually completely, with the exception of an outlet port into a diversion or a capture container, and

- the non-circumferentially closed region of the hose segment is C-shaped, U-shaped or Ω -shaped in cross section.

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2. The solid bowl screw centrifuge as claimed in claim 1, wherein the hose segment is in such a way designed and arranged in the solids discharge chamber that it is excited to oscillatory movements upon the
10 impingement of solids.

- 5 3. The solid bowl screw centrifuge as claimed in
 claims 1 or 2, wherein the region of the hose segment
 which is not circumferentially closed in cross section
 faces the discharge port.
- 10 4. The solid bowl screw centrifuge as claimed in one
 of the preceding claims, wherein the hose segment
 bears, spaced apart from regions of direct or indirect
 fastening in the solids discharge chamber, in at least
 one region, on its outside facing away from the
15 discharge port, against an inside of a wall of the
 solids discharge chamber.
5. The solid bowl screw centrifuge as claimed in one
 of the preceding claims, wherein the hose segment has a
20 spacing with respect to all the insides of the solids
 discharge chamber, except in regions of direct or
 indirect fastening in the solids discharge chamber.
6. The solid bowl screw centrifuge as claimed in one
25 of the preceding claims, wherein the hose segment is
 composed completely of an elastomeric material.

7. The solid bowl screw centrifuge as claimed in one of the preceding claims, wherein the hose segment is designed as a hybrid part which is composed partially of an elastomeric material and partially of a rigid material.

8. The solid bowl screw centrifuge as claimed in one of the preceding claims, wherein a space not closed off so as to be pressure-tight is formed between the hose segment and the solids discharge chamber.