

Separator Having Direct Drive

The invention relates to a separator having the features of the preamble of claim 1 and a method for its operation.

Such separators, which are also suitable for industrial use and can preferably be used in continuous operation, are known from the prior art, for example from DE 10 2017 113 649 A1.

Among the known systems, there are designs in which the drum, the drive spindle and the electric drive motor are rigidly connected to form a structural unit which is then elastically supported as a whole on a drive housing. Examples of such prior art are disclosed by GB 368 247, FR 1.287.551, DE 1 057 979 and DE 43 14 440 C1.

With regard to the prior art, WO 2004/089550 should also be mentioned, in which the drum, the drive spindle and the electric drive motor are also connected to form a structural unit, which can then be supported as a whole on a drive housing. A casing with an inner wall and an outer wall is placed around a housing or a machine frame. Between these walls, a space is formed in which a cooling fluid, e.g. water, can flow. In this way, the cooling fluid can cool the housing, which is substantially heated by the electric motor during operation of the centrifugal rotor. An element connected to the spindle is also provided to lubricate the bearings. This rotates with the spindle in the lubricating oil present in an oil chamber, so that some of the lubricating oil is converted into oil mist. The oil mist lubricates a lower bearing. The oil mist is further directed through channels to the inside of an upper bearing and to the suction side of a fan device. This results in lubrication of the upper bearing. The remaining oil mist is forced back down through a gap in the motor. This setup is complex and relatively complicated. In addition, the oil mist does not contribute to cooling the engine.

The cooling of the known drive devices still appears to be in need of improvement.

The invention has the object of improving the cooling of the drive device of the generic separator by simple means.

The invention solves this object by the subject matter of claim 1. It further solves this problem by the method of claim 16.

According to claim 1, a separator is provided comprising:

- a unit which rotates during operation and which has a drum and a drive spindle,
- a drive motor designed as an electric motor for rotating the drive spindle and having a stator and a rotor,

- wherein the rotor is arranged on the drive spindle and the stator is radially spaced apart from the rotor in a drive housing which does not rotate during operation,
- wherein the stator has at least one or multiple winding heads, and
- wherein at least one chamber is formed on at least one of the winding heads, in
5 which chamber a coolant film and/or bath is formed during operation, so that this winding head is cooled with coolant during operation or is cooled during operation.

According to this wording, one or more of the chambers may be formed on each of one or more winding heads.

10 In this way, one of the winding heads or, optionally, two winding heads are cooled in a simple manner, preferably directly in a coolant film or even bath that forms during operation on one or more outer surfaces. The coolant transports heat away from the winding heads.

Previously, the winding heads were surrounded by air. The thermal conductivity λ of air is 0.0262 W/mK. The thermal conductivity λ of lubricating oil can be, for example, 0.13
15 to 0.15 W/mK. Thus, the heat transfer to the surrounding medium is already considerably improved, e.g. by a factor of 5. In addition, the heat is dissipated more effectively by rotation or preferably circulation of the lubricating oil, whereas in the prior art the air surrounding the winding head was essentially stationary.

20 The coolant is a free-flowing coolant. Lubricating oil is used as the coolant, especially since this must be provided anyway for the lubrication of one or more bearings on the centrifuge. One advantage is that, due to the additional cooling of the winding heads, the motor can be loaded more heavily without the motor temperature rising above a permissible value. The cooling is more effective and the power density is therefore high.

25 It is therefore advantageous that the lubricating oil is used on the one hand for lubricating one or more bearings of the drive spindle and on the other hand for cooling the one or more winding heads.

The electric drive motor can be, for example, an asynchronous motor or a synchronous motor - e.g. a reluctance motor.

30 One advantage is that the existing lubricating oil, which is used to lubricate the rolling bearings, is now also used to cool the motor or the winding heads. Thus, the machine does not require any further aggregates and no further cooling medium such as water. The combination of direct heat dissipation from the motor stator - for example at cooling fins - and heat dissipation from the winding heads via lubricating oil flow to the cooling fins is thus particularly effective.

According to an advantageous but not mandatory design, the drive motor may preferably be located entirely between a neck bearing and a foot bearing.

According to an advantageous design, one winding head is an upper winding head and the other winding head is a lower winding head, and one or more chambers are formed on the upper winding head and/or on the lower winding head. If oil cooling chambers are formed on each of the two winding heads, both winding heads are cooled effectively and easily.

It is preferred that, for the purpose of effective cooling, the respective chamber on the respective winding head is formed as an annular chamber, which is formed at the top, outside and/or bottom of the respective winding head, so that correspondingly an upper, an outer and/or a lower surface of the respective winding head is covered by a lubricating oil film during operation and is well cooled.

It is useful if the respective chamber has an inlet and an outlet, wherein the outlet can also be designed as an overflow.

It may be provided that one or both chambers may each be completely filled with the oil bath during operation. Inlet and outlet are then designed accordingly and coordinated with the oil inflow so that one or both chambers are filled. In this way, particularly good cooling and lubrication can be achieved or realized in the area of the respective chamber(s).

In order to be able to form the one or more chambers, it is advantageous if an integral or multi-piece motor housing is formed in the drive housing, which holds the stator. The chambers can then be formed between the motor housing and the stator, and these elements can be provided as a pre-assembled unit that can be mounted to the drive housing.

According to a particularly preferred design, it may be provided that the drive housing and/or the motor housing has cooling fins. The drive housing and/or the motor housing has one or more cooling channels through which lubricating oil that has been drained from one or both chambers flows. By means of the cooling fins, the thermal energy of the lubricating oil is then dissipated to the environment. In this way, all or part of the heat absorbed by the lubricating oil in the chambers is released back into the environment by convection.

It may be provided that the respective chamber at the respective winding head has an I-, L- or U-shaped cross-section.

Next, in an advantageous design, it may be provided that the respective chamber is formed between elements and/or sections of the motor housing and the respective winding head.

It may be provided that the pre-assembled drive and rotary system unit has a closed lubrication system circuit.

Advantageously, according to one variant, it can be provided that the drive spindle is axially penetrated by a bore, with the drive spindle being immersed in a lubricating oil sump at the bottom of the drive housing, with lubricating oil being conveyed through the bore of the drive spindle into the region of a neck bearing and/or into the region of a feed line of the chamber at the upper winding head.

According to a further structurally advantageous design, it may be provided that lubricating oil draining from the first chamber at the upper winding head is conducted through cooling channels in the drive housing and/or in the motor housing into the second chamber at the lower winding head, from where it is conducted back into the lubricating oil sump.

The invention also provides a method for cooling a drive motor of a separator, comprising the following steps: Providing a separator - in particular according to one of the embodiments described above as being according to the invention - and filling and flowing lubricating oil through the one or more chambers during operation.

In order to provide a structurally compact and easily manageable separator, it is further advantageous if (preferably exclusively) air cooling is provided as the cooling system, which comprises cooling fins on the outer circumference of the drive housing.

Finally, it can be advantageously - but not necessarily - provided that the rotating system with the drum and the drive spindle is supported essentially axially via the foot bearing in the drive housing. However, other variants with support at the neck bearing can also be implemented in this respect.

Further advantageous designs are disclosed in the remaining subclaims.

The invention is described in more detail below by means of exemplary embodiments with reference to the drawings, wherein:

Fig. 1 shows a sectional view of a separator according to the invention shown in schematic form;

Fig. 2 shows a perspective view of a further separator according to the invention;

Figs. 3a, b show in a) a first upper detail enlargement from Fig. 1 and in b) a second lower detail enlargement from Fig. 1, in which a flow path for a coolant is shown with arrows and hatching in each case.

Fig. 1 shows a separator 1 that has a system that does not rotate or is stationary during operation and a system that rotates or is rotating relative to the stationary system during

operation. In this case, the rotating system and the stationary system each have a plurality of elements.

The rotating system of the separator comprises a drum 2 with a vertical axis of rotation D. This drum 2 is shown here only schematically. It can be designed in various ways.

5 Preferably, it is designed for continuous operation for continuous clarification and/or separation of a flowable product into one or two liquid phases and optionally a solid phase - in particular in an industrial process. For this purpose, its interior space is preferably provided with a separating disc stack of separating discs (not to be seen or shown here). The, preferably single or double, conical drum 2 is placed on the here
10 vertical upper end of a rotatable drive spindle 3. The drive spindle can be aligned vertically or, in operation, essentially vertically and have a vertical axis of rotation D.

The drum 2 can have an inlet and at least two outlets for the phases of the product or mixture of substances to be processed, which are separated in the centrifugal field.

The drive spindle 3 is rotatably supported by a bearing arrangement, which here
15 comprises a neck bearing 4 and a foot bearing 5. The neck bearing 4 is arranged in a bearing housing 6 - preferably radially elastically supported. An elastic element such as an elastic ring can be arranged in this case between the inner circumference of the bearing housing 6 and the outer circumference of the neck bearing 4 (not shown here). The bearing housing 6 does not rotate and is therefore part of the system that is
20 stationary during operation.

The bearing housing 6 can be mounted on an integral or multi-part motor housing 7, 8. The motor housing can consist of several sections. In particular, it can have a motor housing cover ring 7 which is placed on the lower motor housing 8.

The bearing housing 6, optionally the motor housing cover ring 7 and the motor housing
25 8 can each have an annular flange section 6a, 7a and 8a respectively on their outer circumference. These annular flange sections 6a, 7a, 8a can each lie axially stacked one above the other. They can be joined or are joined together - e.g. with axial screws not shown here - to form a module-like unit. Together they can form a ring flange section of a pre-assemblable and here also pre-assembled drive and rotary system unit.

30 A drive motor 10, which is an electric motor, is arranged in the integral or multi-part motor housing 8. Optionally, the foot bearing 5 can also be formed or arranged there. The drive motor 10 has a stator 20 and a rotor 21. The stator 20 is fixed here directly or indirectly in or on the drive housing 11. It does not rotate during operation. The rotor 21, on the other hand, can be connected to the drive spindle 3 in a rotationally fixed
35 manner.

The system with the bearing housing 6, optionally the motor housing cover ring 7 and

the integral or multi-piece motor housing 8, can form a pre-assembled drive and rotary system unit in the manner of a replaceable cassette which can be mounted as a whole. This pre-assembled drive and rotary system unit is also referred to hereinafter as the pre-assembled unit for short. This pre-assembled unit may also comprise the drum 2.

5 This structure is advantageous in this respect, but not necessarily to be implemented exactly in this way in order to realize the invention.

The motor housing 8 is inserted into a drive housing 11 and held there. This drive housing 11 can be designed in the form of an outer housing surrounding the motor housing 8. However, it can also be designed as a frame. The drive housing 11 can, for

10 example, be fastened to a base such as a hall floor or the like.

Cooling fins 12 can be formed on the outer circumference of the drive housing 11 in order to easily dissipate or radiate waste heat from the drive system into the ambient space.

The drive housing 11 has a ring flange 11a on its inner circumference. The pre-

15 assembled drive and rotary system unit can be attached to this ring flange 11a. Here, the outer ring flange section of the pre-assembled drive and rotary system unit can rest on the inner ring flange 11a of the drive housing 11 as shown, or in an alternative design hang below it.

The pre-assembled unit and its annular flange section are preferably fastened, in

20 particular screwed tight, to the annular flange 11a of the drive housing 11 by at least one or more fastening means, in particular one or more screw bolts (not shown here).

Furthermore, a hood 9 can be attached to the drive housing 11, which does not rotate during operation and encloses the drum 2.

On the one hand, an air cooling system can be used to cool the drive with the drive

25 motor 10, implemented by the cooling fins 12. This is advantageous and simple.

It is also proposed to use liquid cooling as a supplement or alternative. A corresponding liquid cooling system is designated below by the reference sign 100.

In this liquid cooling system 100, a lubricant circulation system is advantageously used for liquid cooling of the motor 10. It is particularly advantageous to use or at least also

30 use a lubricant circulation system for this purpose, which also serves to lubricate at least one of the bearings 4, 5 with lubricant.

According to a possible design according to the invention, the lubricant circulation system may be constructed as follows:

A lubricant supply line is used to supply the bearings 4, 5 with lubricant. This lubricant

supply line can be implemented in various ways. For example, the drive spindle 3 can have a bore 101 passing through it axially, with the drive spindle 3 being immersed in a lubricating oil sump 102 at the bottom of the drive housing 11 (the upper lubricant level of which is indicated by a dashed line). Lubricating oil is conveyed through the bore 101 of the drive spindle 3 in the manner of a suction pipe into the area below the neck bearing 4. The bore 101 in the drive spindle 3 thus serves here as the lubricant supply line. From the bore 101, the lubricating oil can be guided radially further radially outward in the rotating system through one or more radially extending transverse bores 103 until it emerges from the transverse bore 103 of the drive spindle 3 into a stationary annular space outside the drive spindle 3 (see also Fig. 3a).

The lubricating oil emerging from the drive spindle 3 meets stationary components located radially outside the drive spindle 3, in this case the motor housing cover ring 7 and/or the motor housing 8. The neck bearing 4 can be lubricated by a lubricating oil mist produced during operation.

A portion of the lubricating oil may further return downwardly into the lubricating oil sump 102 in a chamber extending concentrically with the drive spindle 3. The foot bearing 5 may be located in the lubricating oil sump and lubricated thereby. However, it may also be located above the lubricating oil sump and be lubricated as the lubricating oil returns to the lubricating oil sump.

According to the invention, in particular the cooling of the stator 20 fixed in the drive housing is optimized. The stator 20 has upper and lower winding heads 20a and 20b and a coil pack 20c. It is constructed as a kind of ring element, with the coil pack being located centrally between the upper and lower winding heads 20a, 20b.

At least one chamber K1, K2 is formed on the stator 20, in particular on the upper and/or on the lower winding head 20a, 20b, which fills with lubricating oil during operation so that at least part of the outer surface of the respective winding head 20a and/or 20b lies in a lubricating oil bath or is covered by a lubricating oil film during operation. The respective chamber K1 is configured to have an inlet and an outlet. The inlet and the outlet are designed such that the respective chamber K1 and/or K2 is preferably completely filled with lubricating oil during operation.

Advantageously, one of the chambers K1, K2 can be formed on both the upper winding head 20a and the lower winding head 20b.

The chambers K1 and/or K2 are preferably designed as annular chambers which extend radially on the outside and, optionally, at the top and/or bottom of and around the respective winding head 20a and/or 20b.

It may be provided that at least one drainage channel (which may branch into several

cooling channels) from at least one of the chambers K1, K2 is guided through the drive housing and/or the motor housing in the area of the cooling fins 12 in order to be able to radiate the heat absorbed by the lubricating oil from the respective chamber K1 and/or K2 from there via the cooling fins to the surroundings.

5 In this way, air cooling is used to particular advantage or combined with liquid cooling. In the exemplary embodiment shown, this is advantageously - but not necessarily - implemented as follows.

10 The motor housing cover ring 7 is located above the stator 20. The motor housing 8 (which is also preferably annular) is again arranged radially outside the stator 20. This can extend - in one or more parts - downward to the lubricating oil sump 102.

The motor housing cover ring 7 has an annular chamber 71 which is open towards the inside. This annular chamber 71 collects part of the lubricating oil emerging radially from the drive spindle 3. The motor housing cover ring 7 can also have an inlet channel 72 with which lubricating oil is fed from the annular chamber 71 into the chamber K1, which
15 is formed radially on the outside as an annular chamber between the winding head 20a and adjacent elements of the motor housing. Here, these are the elements motor housing cover ring 7 and motor housing 8.

The chamber K1 fills with lubricating oil during operation. The chamber K1 can be designed as an annular chamber. The chamber K1 can further have an I-shaped, L-shaped or preferably U-shaped cross-section. It is preferred if the chamber K1 is
20 designed in such a way (in particular with regard to the volume of the chamber K1 and with regard to the quantity of oil flowing through it) that the lubricating oil does not heat up by more or less than 20° K when flowing through the chamber K1 during operation. In this way, excessive heating in the areas around chamber K1 can be avoided very
25 well.

Fig. 3a illustrates how, in operation, chamber K1 is filled with lubricating oil passing through channel 72. This lubricating oil cools the upper winding head 20a on one, two or here even three of its sides. In particular, these are the top side, the bottom side and the radially outer side of the upper winding head 20a.

30 An outlet channel 73 can emerge from the chamber K1. This leads here (optionally first upwards and then) radially outwards into (or merges into) a cooling channel 74, which is guided through the drive housing and/or the motor housing, provided with one or more of the cooling fins 12, so that some or all of the heat absorbed by the lubricating oil in the chamber K1 at the upper winding head 20a can be re-radiated via one or more
35 cooling fins 12.

The cooling channel 74 in turn merges into an inlet channel 75 (here leading radially

inwards), which opens into the second chamber K2 on the lower winding head 20b.

Also, the lower winding head 20b is surrounded by lubricating oil in this chamber K2 radially outside and/or above and/or below on one, two or three sides of a chamber K2. The chamber K2 may also be configured as an annular chamber. Also the chamber K2
 5 can have an I-shaped, L-shaped or U-shaped cross-section.

Fig. 3b illustrates how, in operation, chamber K2 is filled with lubricating oil by lubricating oil passing through channel 75. This lubricating oil cools the lower winding head 20b on one, two or here even three of its sides. In particular, these are the upper side, the lower side and the radially outer side of the lower winding head 20b.

10 The chamber K2 between the lower winding head 20b and the motor housing 8 also fills with lubricating oil due to the fact that lubricating oil continues to be fed from the sump into the chamber K1 and provides cooling for the lower winding head 20b.

In this case, the lubricating oil can drain from the lower chamber K2 downward through another outlet channel 76 toward the lubricating oil sump 102, into which it eventually
 15 flows.

The design of chamber K2 - in particular the volume and flow rate of the lubricating oil during operation - should preferably be selected so that the lubricating oil does not heat up by more than or preferably less than 20° K when flowing through chamber K2. This is because with such a design, overheating in the area around this chamber K2 can be
 20 prevented particularly reliably.

In this way, it is provided that the lubricating oil flows past the stator 20 and in particular past one or both winding heads 20a, 20b in an additionally targeted manner in such a way that the lubricating oil actively cools one or preferably both of the winding heads 20a, 20b by a specific lubricant flow and film. In addition, the winding heads are cooled
 25 in such a way that there is preferably a kind of lubricating oil bath in the chambers K1, K2, the lubricating oil of which is, however, repeatedly replaced by lubricating oil flowing in.

The two winding heads 20a, 20b can have an approximately rectangular basic shape in cross-section. In this case, an inner side of the stator 20 can be spaced from the drive
 30 spindle 3 and the rotor 21 by an annular space. In this area, preferably no supplementary lubricant flow is realized, at least none that goes beyond the cooling effect exerted in this annular space by the lubricating oil flowing from the neck bearing to the foot bearing.

At the outer circumference, on the other hand, the upper and/or the lower winding head
 35 are enclosed by the drive housing or components on the drive housing in such a way

that they form one or more chambers K1, K2, in particular annular chambers, on one, two or preferably even three of its sides.

Here, the motor housing cover ring 7 arranged above the stator is designed in such a way that it conducts lubricating oil through the channel 72 into the first chamber K1, which surrounds the upper winding head on three sides here. This chamber K1 fills with lubricating oil during operation. As soon as it overflows, the overflowing lubricating oil flows through a further channel 74 in the direction of the further chamber K2, which surrounds the lower winding head 20b on one, two or three sides.

From this lower chamber K2, the outlet channel 76 finally leads back into the lubricating oil sump like a bore or channel.

In this way, the lubricating oil even passes directly by both winding heads 20a, 20b to cool them and is finally conveyed back to the lubricating oil sump 102.

It is thus provided that one or more channels and/or chambers K1, K2 are formed between the stator 20 and one or more adjacent components of the drive housing 11, which here include the motor housing cover ring 7 and the motor housing 8, which channels and/or chambers K1, K2 are completely or partially filled with lubricating oil during operation, wherein a flow of lubricating oil is also produced in order to actively cool the stator, in particular its one or both winding heads 20a, 20b, as directly as possible with lubricating oil by directly flowing over at least one surface region of the winding heads 20a, 20b.

The invention can be implemented in various ways. This has been advantageously done in Figs. 1, 3a and 3b. However, it is of course also possible to implement the invention in a different constructive manner in other constructive designs.

The lubricating oil flows into the annular chambers K1 and K2, or at least part of the lubricating oil flows out of the drive spindle 3 below the neck bearing.

Preferably, the lubricating oil is directed selectively over one or both of the winding heads 20a, 20b, and it may further preferably be provided that one or both of the winding heads 20a, 20b are partially immersed in a lubricating oil bath during operation. The overflow can be designed such that the lubricating oil level in the upper chamber K1 always completely surrounds the upper winding head 20a. The submergence helps to dissipate heat generated by ohmic losses in the upper winding head 20a. The overflowing lubricating oil can then, or while flowing through, be directed through one or more cooling channels 74 in the drive housing and/or the motor housing, thus easily dissipating heat to the environment via the cooling fins 12 of the drive housing 11.

The cooled lubricating oil then flows into a similar chamber K2, which surrounds the

lower winding head 20b. The outlet from this can again be designed so that the lubricating oil level in the container always completely surrounds the winding head. This can be achieved, for example, by a suitable orifice in the outlet of the container or by a suitable cross-section of the outlet channel 76.

- 5 In this way, the two winding heads 20a, 20b of the integrated motor are actively cooled by the returning lubricating oil. On the one hand, part of the heat dissipated by the winding heads is absorbed and conducted away by the flowing lubricating oil, and on the other hand, part of the heat dissipated by the winding heads is conducted to the surrounding separator housing by the lubricating oil standing in the chambers around
- 10 the winding heads. For this purpose, the chambers around the winding head should be filled with lubricating oil.

List of reference signs

	1	Separator
	2	Drum
	3	Drive spindle
5	4	Neck bearing
	5	Foot bearing
	6	Bearing housing
	6a	Annular flange section
	7	Motor housing cover ring
10	7a	Annular flange section
	71	Annular chamber
	72	Inlet channel
	73	Outlet channel
	74	Cooling channel
15	75	Inlet channel
	76	Outlet channel
	8	Motor housing
	8a	Ring flange section
	9	Hood
20		
	10	Drive motor
	11	Drive housing
	11a	Ring flange
	12	Cooling fin
25		
	20	Stator
	20a	Winding head
	20b	Winding head
	20c	Coil pack
30	21	Rotor
	100	Liquid cooling system
	101	Bore
	102	Oil sump
35	103	Transverse bores
	K1, K2	Chambers
	D	Axis of rotation

CLAIMS

1. Separator (1), comprising:
 - a. a unit which rotates during operation and which has a drum (2) and a drive spindle (3)
 - 5 b. a drive motor (10) designed as an electric motor for rotating the drive spindle and having a stator (20) and a rotor (21),
 - c. wherein the rotor (21) is arranged on the drive spindle (3) and the stator (20) is radially spaced apart from the rotor (21) in a drive housing (11) which does not rotate during operation,
 - 10 d. wherein the stator has at least one or multiple winding heads (20a, 20b), characterized in that
 - e. at least one chamber (K1, K2) is formed on at least one of the winding heads (20a, 20b), in which chamber (K1, K2) a coolant film or a coolant bath is formed during operation, so that this winding head (20a, 20b) is cooled with
15 coolant during operation,
 - f. wherein the coolant in the respective chamber (K1, K2) is a lubricating oil and wherein the lubricating oil is used on the one hand for lubricating one or more bearings (4, 5) of the drive spindle and on the other hand for cooling the one or the multiple winding heads (20a, 20b).
- 20 2. Separator according to claim 1, characterized in that the one winding head is an upper winding head (20a) and the other winding head is a lower winding head (20b), and in that at least one of the chambers (K1, K2) is formed on the upper and/or on the lower winding head (20a, 20b).
- 25 3. Separator according to one of the preceding claims, characterized in that the respective chamber (K1, K2) on the respective winding head (20a, 20b) is formed as an annular chamber which is formed at the top, the outside and/or the bottom of the respective winding head (20a, 20b) so that correspondingly an upper, an outer and/or a lower surface of the respective winding head is partially or completely covered by a lubricating oil film during operation.
- 30 4. Separator according to one of the preceding claims, characterized in that the respective chamber (K1, K2) has an inlet and an outlet.
5. Separator according to one of the preceding claims, characterized in that one or

both chambers (K1, K2) is/are completely filled in each case with the oil bath during operation.

6. Separator according to one of the preceding claims, characterized in that one or more cooling channels (74) are formed in the drive housing (11).
- 5 7. Separator according to one of the preceding claims, characterized in that the drive housing (11) has cooling fins (12) and in that one or more of the cooling channels (74) have lubricating oil flowing through them, which has been discharged from one or both chambers (K1, K2), in order to dissipate thermal energy of the lubricating oil to the environment via the cooling fins (12).
- 10 8. Separator according to one of the preceding claims, characterized in that the at least one or more chambers (K1, K2) is/are each designed such that the lubricating oil does not heat up by more or less than 20°K when flowing through the respective chamber (K1, K2) during operation.
- 15 9. Separator according to one of the preceding claims, characterized in that the respective chamber (K1, K2) is formed between elements and/or sections of the motor housing (7, 8) and the respective winding head (20a, 20b).
- 20 10. Separator according to one of the preceding claims, characterized in that the drive spindle (3) is axially penetrated by a bore (101), wherein the drive spindle (3) is immersed in a lubricating oil sump (102) at the bottom of the drive housing (11), wherein lubricating oil is conveyed through the bore (101) of the drive spindle (3) into the region of a neck bearing and/or into the region of a feed line of the chamber (K1) at the upper winding head (20a).
- 25 11. Separator according to claim 10, characterized in that lubricating oil draining from the first chamber (K1) at the upper winding head (20a) is directed through the cooling channels (74) into the second chamber (K2) at the lower winding head (20b), from where it is directed back into the lubricating oil sump (102).
12. Separator according to one of the preceding claims, characterized in that the, preferably single or double, conical drum (2) is placed on the upper end of a rotatable drive spindle (3).
- 30 13. Separator according to one of the preceding claims, characterized in that a separating disc stack of separating discs is arranged in the drum (2).
14. Separator according to one of the preceding claims, characterized in that the pre-assembled drive and rotary system unit (100) comprises a closed lubrication system circuit.

15. Separator according to one of the preceding claims, characterized in that the drive motor is located between a neck bearing (4) and a foot bearing (5).
16. Method for cooling a drive motor (20) of a separator (1) according to one or more of the preceding claims, comprising the following steps:
- 5 A) providing a separator according to one of the preceding claims; and
- B) flow of lubricating oil through one or more chambers (K1, K2) during operation.
17. Method according to claim 16, characterized in that lubricating oil flows through the at least one or more chambers (K1, K2) in such a way that the lubricating oil heats up by less than 20°K when flowing through the respective chamber (K1, K2).
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18. Method according to claim 16 or 17, characterized in that one or more of the chambers (K1, K2) is/are completely filled in each case with an oil bath during operation.