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(71) Applicant: **Tetra Laval Holdings & Finance S.A.**
1009 Pully (CH)

(72) Inventor: **Yong, Hoong Wai**
08-1115 Singapore (SG)

(74) Representative: **Tetra Pak - Patent Attorneys SE**
AB Tetra Pak
Patent Department
Ruben Rausings gata
221 86 Lund (SE)

(54) A CENTRIFUGAL SEPARATOR

(57) A centrifugal separator (100) for liquid food (RP) is disclosed, comprising a centrifuge bowl (101), discs (109) in a first set of discs (110) defining interspaces (112) in between the disks (109), the interspaces (112) extending from a periphery (107) of the disc stack (108) to an axial center portion (113) and limiting the liquid food (RP) to flow between the periphery (107) and the center portion (113) of the disc stack (108), discs (109) in a second set of discs (111) defining interspaces (112') and comprising distribution openings (114) located between the periphery (107) and the center portion (113) of the disc stack (108) for distributing a flow of the liquid food (RP) where the light phase (LP) flows from the distribution openings (114) towards a center channel (115) at the center portion (113) and the heavy phase (HP) flows from the distribution openings (114) towards the periphery (107).

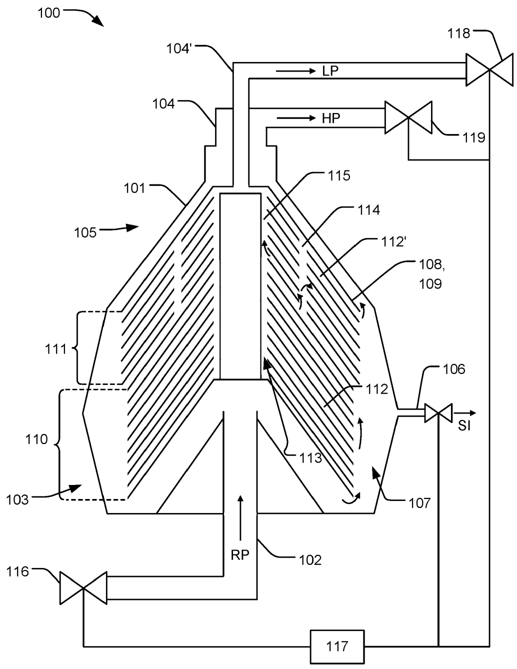

Fig. 1

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Description

Technical Field

[0001] The invention relates to a centrifugal separator for separating liquid food into a light phase, a heavy phase, and an ejection phase that comprises solid impurities, and to a method of separating liquid food.

Background

[0002] Separators for separating liquid food into different phases of varying density under the influence of a centrifugal force are called centrifugal separators. The liquid food is introduced in a rotating disc stack of the centrifugal separator. Under the influence of the centrifugal force heavier sediment and lighter particles in the liquid food begin to settle radially outwards respectively inwards in the separation channels according to their density. Heavier solid impurities collect in a sediment space at the periphery of the separator, and are intermittently ejected as an ejection phase from an ejection port at the periphery.

[0003] Separators are typically utilized for separating raw milk into skimmilk and cream. A problem with previous separators is that the efficiency is reduced for the separation of liquid food other than milk. For example, sub-optimal separation of liquid food containing an increased ratio of fine particles and/or high-density particles may result in a cloudy appearance in an otherwise clear liquid phase of the food product. This may affect the perceived quality of the liquid food product. Furthermore, the lowered performance may also lead to increased product losses.

Summary

[0004] It is an object of the invention to at least partly overcome one or more limitations of the prior art. In particular, it is an object to provide an improved centrifugal separator with increased performance for separating liquid food, in particular liquid food containing an increased ratio of fine particles and/or high-density particles compared to milk.

[0005] In a first aspect of the invention, this is achieved by a centrifugal separator for separating liquid food into a light phase, a heavy phase, and an ejection phase that comprises solid impurities, the separator comprising a centrifuge bowl, an inlet for the liquid food at a bottom portion of the centrifuge bowl and outlets for the heavy phase and the light phase at a top portion of the centrifuge bowl, an ejection port arranged at a periphery of the centrifuge bowl to eject the ejection phase from the centrifuge bowl, a disc stack of conical discs arranged inside the centrifuge bowl, the disc stack comprising a first set of discs arranged in the bottom portion, and a second set of discs arranged in the top portion, wherein the liquid food passes the first set of discs before passing the second set of discs when received through the inlet. The discs in the first set of discs define interspaces in between the disks, the interspaces extending from the periphery of the disc stack to an axial center portion of the disc stack and limiting the liquid food to flow between the periphery and the center portion of the disc stack. The discs in the second set of discs define interspaces in between the disks and comprise distribution openings that are located between the periphery and the center portion of the disc stack for distributing a flow of the liquid food where the light phase flows from the distribution openings towards a center channel at the center portion and the heavy phase flows from the distribution openings towards the periphery.

[0006] In another aspect of the invention, this is achieved by a method for separating liquid food into a light phase, a heavy phase and an ejection phase that comprises solid impurities in a separator, the method comprises distributing a flow of the liquid food through a first set of discs in a disc stack arranged in the separator so that the liquid food is limited to flow between a periphery and a center portion of the disc stack, and distributing a flow of the liquid food through a second set of discs in the disc stack so that the light phase flows from distribution openings, located between the periphery and the center portion, towards a center channel at the center portion, and the heavy phase flows from the distribution openings towards the periphery.

[0007] Having a first set of discs to limit the liquid food to flow between a periphery and a center portion of the disc stack, and a second set of discs comprising distribution openings for distributing a flow of the light phase from the distribution openings towards a center channel and a flow of the heavy phase from the distribution openings towards the periphery, provides for improved separation performance for liquid food containing particles of reduced size or increased density while minimizing product losses.

[0008] Still other objectives, features, aspects and advantages of the invention will appear from the following detailed description as well as from the drawings.

Drawings

[0009] Embodiments of the invention will now be described, by way of example, with reference to the accompanying schematic drawings.

> Fig. 1 is a cross-sectional side view of a centrifugal separator for separating liquid food into a light phase, a heavy phase, and an ejection phase that comprises solid impurities;
>
> Fig. 2 is a diagram showing a time interval for the ejection of an ejection phase in relation to the timing of changes in flow through an inlet valve and a first outlet valve; and
>
> Figs. 3a-c are flowcharts of methods for separating liquid food into a light phase, a heavy phase and an

ejection phase.

Detailed Description

[0010] Embodiments of the invention will now be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all, embodiments of the invention are shown. The invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein.

[0011] Fig. 1 is a schematic illustration of a centrifugal separator 100 for separating liquid food (RP) into a light phase (LP), a heavy phase (HP), and an ejection phase (SI) that comprises solid impurities (SI). The separator 100 comprises a centrifuge bowl 101, and an inlet 102 for the liquid food (RP) at a bottom portion 103 of the centrifuge bowl 101. The separator 100 comprises outlets 104, 104', for the heavy phase (HP) and the light phase (LP) at a top portion 105 of the centrifuge bowl 101. An ejection port 106 is arranged at a periphery 107 of the centrifuge bowl 101 to eject the ejection phase (SI) from the centrifuge bowl 101. The ejection port 106 may be configured to open for a short period of time, and with a predefined frequency so that the impurities collected at the periphery 107, i.e. at the sediment space, are regularly emptied from the centrifuge bowl 101. The separator 100 comprises a disc stack 108 of conical discs 109 arranged inside the centrifuge bowl 101. The disc stack 108 comprises a first set of discs 110 arranged in the bottom portion 103, and a second set of discs 111 arranged in the top portion 105. The liquid food (RP) passes the first set of discs 110 before passing the second set of discs 111 when received through the inlet 102.

[0012] The discs 109 in the first set of discs 110 define interspaces 112 in between the disks 109. The interspaces 112 extend from the periphery 107 of the disc stack 108 to an axial center portion 113 of the disc stack 108 and limit the liquid food (RP) to flow between the periphery 107 and the center portion 113 of the disc stack 108. The discs 109 in the second set of discs 111 define interspaces 112' in between the disks 109 and comprise distribution openings 114 that are located between the periphery 107 and the center portion 113 of the disc stack 108. The distribution openings 114 distribute a flow of the liquid food (RP) so that the light phase (LP) flows from the distribution openings 114 towards a center channel 115 at the center portion 113 and the heavy phase (HP) flows from the distribution openings 114 towards the periphery 107. The light phase (LP) flows from the center channel 115 to the outlet 104' for the light phase (LP), and the heavy phase (HP) flows from the periphery 107 to the outlet 104 for the heavy phase (HP).

[0013] Having a first set of discs 110 to limit the liquid food (RP) to flow between the periphery 107 and the center portion 113 of the disc stack 108 provides for maximizing the radial distance along which the liquid food (RP) flows, which allows for an efficient separation of solid impurities (SI). The liquid food (RP) flows radially inwards through the interspaces 112 towards the center portion 113, and on the way through the disc stack 108 the solid impurities (SI) are separated and thrown back along the undersides of the discs 109 to the periphery 107 where they are collected and subsequently ejected through the ejection port 106. As the liquid food (RP) passes along the full radial width of the discs 109, the time of passage also allows very small particles to be separated. This is particularly advantageous in case the liquid food contains an increased ratio of fine particles, which may be the case for e.g. coconut water. While the first set of discs 110 provides for an efficient separation of small solid impurities (SI), the second set of discs 111 provides for a separation of the heavy phase (HP) and the light phase (LP) via the distribution of flow through the distribution openings 114 as described above. For example, fat particles of lower density flows radially inwards from the distribution openings 114, as opposed to the heavy phase (HP), and the fat can be extracted through the outlet for the light phase (104'). The separator 100 thus provides for an optimized removal of solid impurities (SI) of reduced size as well as efficient separation of the light phase (LP) and the heavy phase (HP) in a single compact disc stack 108. The amount of fine solid impurities (SI) and any portion of the light phase (LP), e. g. fat, in the separated heavy phase (HP) can thus be minimized. Providing such pure extraction of the heavy phase (HP) may be particularly advantageous in case the liquid food is coconut water. Any cloudiness caused by fine solid impurities and/or solid impurities of high density, such as fibres or coconut meat etc, or the coconut fat, may thus be minimized. The purity of the separated coconut water, i.e. the heavy phase (HP), may thus be increased. This also provides for an increased perceived quality from the consumer perspective. Such improved separation efficiency and food quality may thus be provided by a single separator 100. This provides for minimizing cost and resources as well as a more compact and less complex production line.

[0014] The number of discs 109 in the first set of discs 110 may be higher than the number of discs 109 in the second set of discs 111. This provides for a further increase separation performance of solid impurities (SI) in the liquid food (RP).

[0015] The separator 100 may comprise an inlet valve 116 that is arranged at the inlet 102 to reduce the flow of liquid food (RF) through the inlet 102 when the ejection phase (SI) is ejected through the ejection port 106. Reducing the flow of liquid food (RF) through the inlet 102 provides for reducing turbulence in the separator 100 as the ejection phase (SI) is ejected through the ejection port 106. The reduced turbulence of the flow of liquid food (RP) in the separator 100 provides for minimizing loss of liquid food (RP) other than the solid impurities (SI) through the ejection port 106. The reduced losses allows for increasing the efficiency of the separator 100. The flow of liquid food (RF) through the inlet 102 may be reduced or completely stopped when the ejection phase

(SI) is ejected through the ejection port 106. Completely stopping the flow of liquid food (RF) through the inlet 102 may provide for reducing the aforementioned turbulence further.

[0016] The inlet valve 116 may be connected to a controller 117 configured to control the flow of liquid food (RF) through the inlet 102, as schematically shown in Fig. 1.

[0017] The inlet valve 116 may be arranged to reduce the flow of liquid food (RF) through the inlet 102 for a defined first time interval (Δt_1). The first time interval (Δt_1) may start at a predetermined first time (t_s) before the ejection phase (SI) is ejected through the ejection port 106. Fig. 2 is a diagram showing the first time interval (Δt_1) in relation to the time interval, from t_1 to t_2, during which the ejection phase (SI) is ejected through the ejection port 106. Starting the first time interval (Δt_1) at a predetermined first time (t_s) before the ejection phase (SI) is ejected through the ejection port 106 provides for further reducing any turbulence of the liquid food (RP) in the separator 100.

[0018] The first time interval (Δt_1) may end at a predetermined second time (t_e) after the ejection phase (SI) is ejected through the ejection port 106, as schematically illustrated in Fig. 2. This further provides for avoiding flushing out liquid food (RP) through the ejection port 106 as the ejection phase (SI) is ejected.

[0019] The separator 100 may comprise a first outlet valve 118 that is arranged at the outlet 104' for the light phase (LP) to increase the flow of the light phase (LP) through the outlet 104' for the light phase (LP) when the ejection phase (SI) is ejected through the ejection port 106. Increasing the flow of the light phase (LP) provides for reducing any backflow of the light phase (LP) as the ejection phase (SI) is ejected. I.e. the replacement of a certain volume of liquid which is ejected through the ejection port 106 may create a flow towards the ejection port 106. Increasing the flow of the light phase (LP) allows for compensating the backflow, which otherwise may risk mixing of the light phase (LP) and the heavy phase (HP). Avoiding such mixing provides for a more efficient separation. For example, in the case the liquid food is coconut water, the risk of having the coconut cream in the light phase (LP) mixing with the clear coconut water of the heavy phase (HP) is reduced. Any "cloudiness" of the extracted coconut water, caused by the coconut cream may thus be avoided to attain a pure high quality product.

[0020] The first outlet valve 118 may be connected to a controller 117 configured to control the flow of liquid food (RF) through the first outlet valve 118, as schematically shown in Fig. 1.

[0021] The first outlet valve 118 may be arranged to increase the flow of the light phase (LP) through the outlet 104' for the light phase (LP) for a defined second time interval (Δt_2). The second time interval (Δt_2) may start at a predetermined first time (t'_s) before the ejection phase (SI) is ejected through the ejection port (106), as schematically illustrated in Fig. 2. This provides for further avoiding the aforementioned backflow and mixing of the light phase (LP) and the heavy phase (HP).

[0022] The second time interval (Δt_2) may further end at a predetermined second time (t'_e) after the ejection phase (SI) is ejected through the ejection port 106.

[0023] In one example, the first outlet valve 118 increases the flow of the light phase (LP) through the outlet 104' for the light phase (LP) while the inlet valve 116 reduces the flow of liquid food (RF) through the inlet 102 when the ejection phase (SI) is ejected. I.e. the first time interval (Δt_1) overlaps with the second time interval (Δt_2) during a duration between t_1 and t_2, as schematically illustrated in Fig. 2. It should however be understood that any of the inlet valve 116 and the first outlet valve 118 may be independently controlled to vary the flow as described above to provide for the mentioned advantageous benefits.

[0024] In one example, the first time interval (Δt_1) is equal to the second time interval (Δt_2). Hence, the flow of the light phase (LP) through the outlet 104' for the light phase (LP) is increased during the same time interval as the flow of the liquid food (RF) through the inlet 102 is reduced. This may provide for a particularly efficient separation. It is however conceivable that in some examples the predetermined first times (t_s, t'_s) are equal, and that the predetermined second times (t_e, t'_e) are different, and vice versa, depending on the particular application while providing for the above mentioned advantageous benefits.

[0025] The predetermined first time (t_s) of the first time interval (Δt_1) may be in the range of 1 to 4 seconds before the ejection phase (SI) is ejected through the ejection port 106. Alternatively or in addition, the predetermined second time (t'_s) of the second time interval (Δt_2) may be in the range of 1 to 4 seconds before the ejection phase (SI) is ejected through the ejection port 106. A range of 1 to 4 seconds may provide for a particularly efficient separation with reduced risk of mixing the light phase (LP) and the heavy phase (HP) as well as minimized product losses.

[0026] The predetermined second time (t_e) of the first time interval (Δt_1) may be in the range of 1 to 6 seconds after the ejection phase (SI) is ejected through the ejection port 106. Alternatively or in addition, the predetermined second time (t'_e) of the second time interval (Δt_2) may be in the range of 1 to 6 seconds after the ejection phase (SI) is ejected through the ejection port 106. A range of 1 to 6 seconds may provide for a particularly high separation performance and minimized product losses.

[0027] The separator 100 may comprise a second outlet valve 119 that is arranged at the outlet 104 for the heavy phase (HP) to reduce the flow of the heavy phase (HP) through the outlet 104 for the heavy phase (HP) when the ejection phase (SI) is ejected through the ejection port 106. The extraction of the heavy phase (HP) may thus be reduced or avoided during the ejection of the solid impurities (SI). Any undesired turbulence or backflow as described above may thus not affect the heavy phase (HP) and the extraction thereof may be resumed as the ejection is completed. The flow of the heavy phase (HP) through the second outlet valve 119 may be reduced or completely stopped when the ejection phase (SI) is ejected through the ejection port 106. Completely stopping the flow may be particularly advantageous in attaining a high separation performance. The second outlet valve 119 may be connected to a controller 117 configured to control the flow of liquid food (RF) through the second outlet valve 119, as schematically shown in Fig. 1.

[0028] Fig. 3a illustrates a flow chart of a method 200 for separating liquid food (RP) into a light phase (LP), a heavy phase (HP) and an ejection phase (SI) that comprises solid impurities (SI) in a separator 100. The method 200 comprises distributing 201 a flow of the liquid food (RP) through a first set of discs 110 in a disc stack 108 arranged in the separator 100 so that the liquid food (RP) is limited to flow between a periphery 107 and a center portion 113 of the disc stack 108. The method 200 further comprises distributing 202 a flow of the liquid food (RP) through a second set of discs 111 in the disc stack 108 so that the light phase (LP) flows from distribution openings 114, located between the periphery 107 and the center portion 113, towards a center channel 115 at the center portion 113, and the heavy phase (HP) flows from the distribution openings 114 towards the periphery 107. The method 200 thus allows for an efficient separation of liquid food (RP) containing an increased ratio of fine particles, which may be the case of e.g. coconut water, as described above in relation to the separator 100 and Figs. 1 - 2.

[0029] Fig. 3b illustrates another flow chart of a method 200. The method 200 may comprise reducing 203 the flow of the liquid food (RP) into the separator 100 while ejecting 204 the ejection phase (SI) from the separator 100. Turbulence in the separator 100 may thus be reduced, as described above.

[0030] Fig. 3c illustrates another flow chart of a method 200. The method 200 may comprise increasing 203' the flow of the light phase (LP) through an outlet 104' for the light phase (LP) while ejecting 204 the ejection phase (SI) from the separator 100. Backflow of the light phase (LP) may thus be reduced, providing for a improved separation and product quality, as described above.

[0031] Fig. 3d illustrates another flow chart of a method 200. The method 200 may comprise reducing 203" the flow of the heavy phase (HP) through an outlet 104 for the heavy phase (HP) while ejecting 204 the ejection phase (SI) from the separator 100. This further provides for an efficient separation of the heavy phase (HP), as described above.

[0032] As mentioned, the liquid food (RP) may be coconut water. It is conceivable that the liquid food (RP) may comprise other food where separation of a light phase (LP), a heavy phase (HP), and solid impurities (IS) is desirable.

[0033] The method 200 may be carried out with a temperature of the liquid food (RP) in the range 4 - 15°C. This provides for facilitated separation of small solid impurities (SI) since the particles may form larger aggregates more easily in this temperature range. Hence, in case of separating coconut water, the coconut water may have a temperature in the range 4 - 15°C.

[0034] From the description above follows that, although various embodiments of the invention have been described and shown, the invention is not restricted thereto, but may also be embodied in other ways within the scope of the subject-matter defined in the following claims.

Claims

1. A centrifugal separator (100) for separating liquid food (RP) into a light phase (LP), a heavy phase (HP), and an ejection phase (SI) that comprises solid impurities (SI), the separator (100) comprising
   a centrifuge bowl (101),
   an inlet (102) for the liquid food (RP) at a bottom portion (103) of the centrifuge bowl (101) and outlets (104, 104') for the heavy phase (HP) and the light phase (LP) at a top portion (105) of the centrifuge bowl (101),
   an ejection port (106) arranged at a periphery (107) of the centrifuge bowl (101) to eject the ejection phase (SI) from the centrifuge bowl (101),
   a disc stack (108) of conical discs (109) arranged inside the centrifuge bowl (101), the disc stack (108) comprising a first set of discs (110) arranged in the bottom portion (103), and a second set of discs (111) arranged in the top portion (105),
   wherein the liquid food (RP) passes the first set of discs (110) before passing the second set of discs (111) when received through the inlet (102), **characterized in that**
   discs (109) in the first set of discs (110) define interspaces (112) in between the disks (109), the interspaces (112) extending from the periphery (107) of the disc stack (108) to an axial center portion (113) of the disc stack (108) and limiting the liquid food (RP) to flow between the periphery (107) and the center portion (113) of the disc stack (108), and **in that**
   discs (109) in the second set of discs (111) define interspaces (112') in between the disks (109) and comprise distribution openings (114) that are located between the periphery (107) and the center portion (113) of the disc stack (108) for distributing a flow of the liquid food (RP) where the light phase (LP) flows from the distribution openings (114) towards a center channel (115) at the center portion (113) and the heavy phase (HP) flows from the distribution openings (114) towards the periphery (107).

2. A separator according to claim 1, wherein the number of discs (109) in the first set of discs (110) is higher than the number of discs (109) in the second set of discs (111).

3. A separator according to claim 1 or 2, comprising an inlet valve (116) that is arranged at the inlet (102) to reduce the flow of liquid food (RF) through the inlet (102) when the ejection phase (SI) is ejected through the ejection port (106).

4. A separator according to claim 3, wherein the inlet valve (116) is arranged to reduce the flow of liquid food (RF) through the inlet (102) for a defined first time interval (Δt_1), wherein the first time interval (Δt_1) starts at a predetermined first time (t_s) before the ejection phase (SI) is ejected through the ejection port (106).

5. A separator according to claim 4, wherein the first time interval (Δt_1) ends at a predetermined second time (t_e) after the ejection phase (SI) is ejected through the ejection port (106).

6. A separator according to any of claims 1 - 5, comprising
a first outlet valve (118) that is arranged at the outlet (104') for the light phase (LP) to increase the flow of the light phase (LP) through the outlet (104') for the light phase (LP) when the ejection phase (SI) is ejected through the ejection port (106).

7. A separator according to claim 6, wherein the first outlet valve (118) is arranged to increase the flow of the light phase (LP) through the outlet (104') for the light phase (LP) for a defined second time interval (Δt_2), wherein the second time interval (Δt_2) starts at a predetermined first time (t'_s) before the ejection phase (SI) is ejected through the ejection port (106).

8. A separator according to claim 7, wherein the second time interval (Δt_2) ends at a predetermined second time (t'_e) after the ejection phase (SI) is ejected through the ejection port (106).

9. A separator according to claim 4 and 7, wherein the first time interval (Δt_1) is equal to the second time interval (Δt_2).

10. A separator according to claim 4 and 7, wherein the predetermined first time t_s and/or t'_s is in the range of 1 to 4 seconds before the ejection phase (SI) is ejected through the ejection port (106).

11. A separator according to claim 5 and 8, wherein the predetermined second time t_e and/or t'_e is in the range of 1 to 6 seconds after the ejection phase (SI) is ejected through the ejection port (106).

12. A separator according to any of claims 1 - 11, comprising a second outlet valve (119) that is arranged at the outlet (104) for the heavy phase (HP) to reduce the flow of the heavy phase (HP) through the outlet (104) for the heavy phase (HP) when the ejection phase (SI) is ejected through the ejection port (106).

13. A method (200) for separating liquid food (RP) into a light phase (LP), a heavy phase (HP) and an ejection phase (SI) that comprises solid impurities (SI) in a separator (100), the method comprises
distributing (201) a flow of the liquid food (RP) through a first set of discs (110) in a disc stack (108) arranged in the separator (100) so that the liquid food (RP) is limited to flow between a periphery (107) and a center portion (113) of the disc stack (108), and
distributing (202) a flow of the liquid food (RP) through a second set of discs (111) in the disc stack (108) so that the light phase (LP) flows from distribution openings (114), located between the periphery (107) and the center portion (113), towards a center channel (115) at the center portion (113), and the heavy phase (HP) flows from the distribution openings (114) towards the periphery (107).

14. A method according to claim 13, comprising
reducing (203) the flow of the liquid food (RP) into the separator (100) while ejecting (204) the ejection phase (SI) from the separator (100).

15. A method according to claim 13 or 14, comprising
increasing (203') the flow of the light phase (LP) through an outlet (104') for the light phase (LP) while ejecting (204) the ejection phase (SI) from the separator (100).

16. A method according to any of claims 13 - 15, comprising
reducing (203") the flow of the heavy phase (HP) through an outlet (104) for the heavy phase (HP) while ejecting (204) the ejection phase (SI) from the separator (100).

17. A method according to any of claims 13 - 16, wherein the liquid food (RP) is coconut water.

18. A method according to any one of claims 13 - 17, wherein the temperature of the liquid food (RP) is in the range 4 - 15°C.

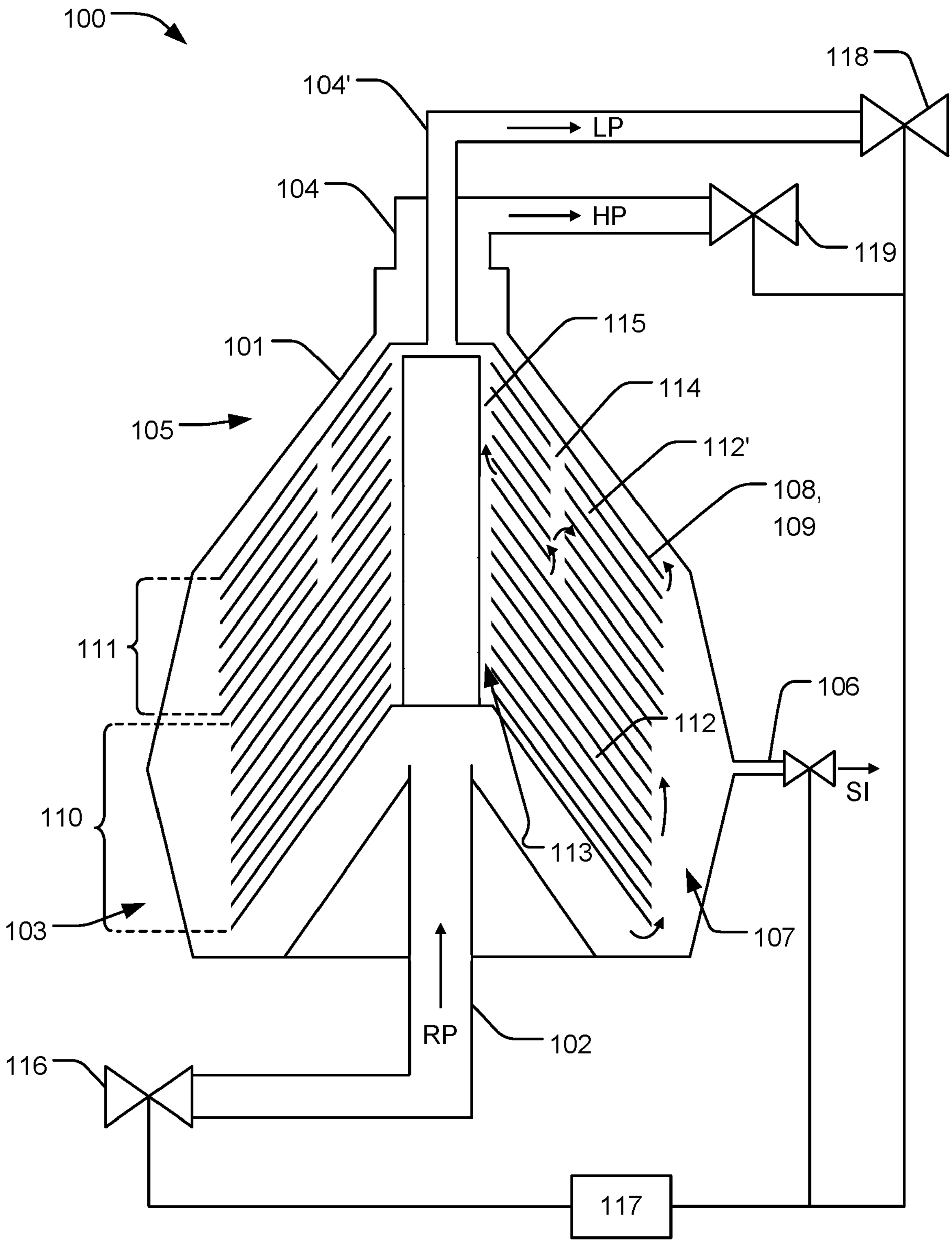
100
104'
LP
118
104
HP
119
115
101
114
105
112'
108,
109
111
106
112
110
SI
113
103
107
RP
102
116
117

Fig. 1

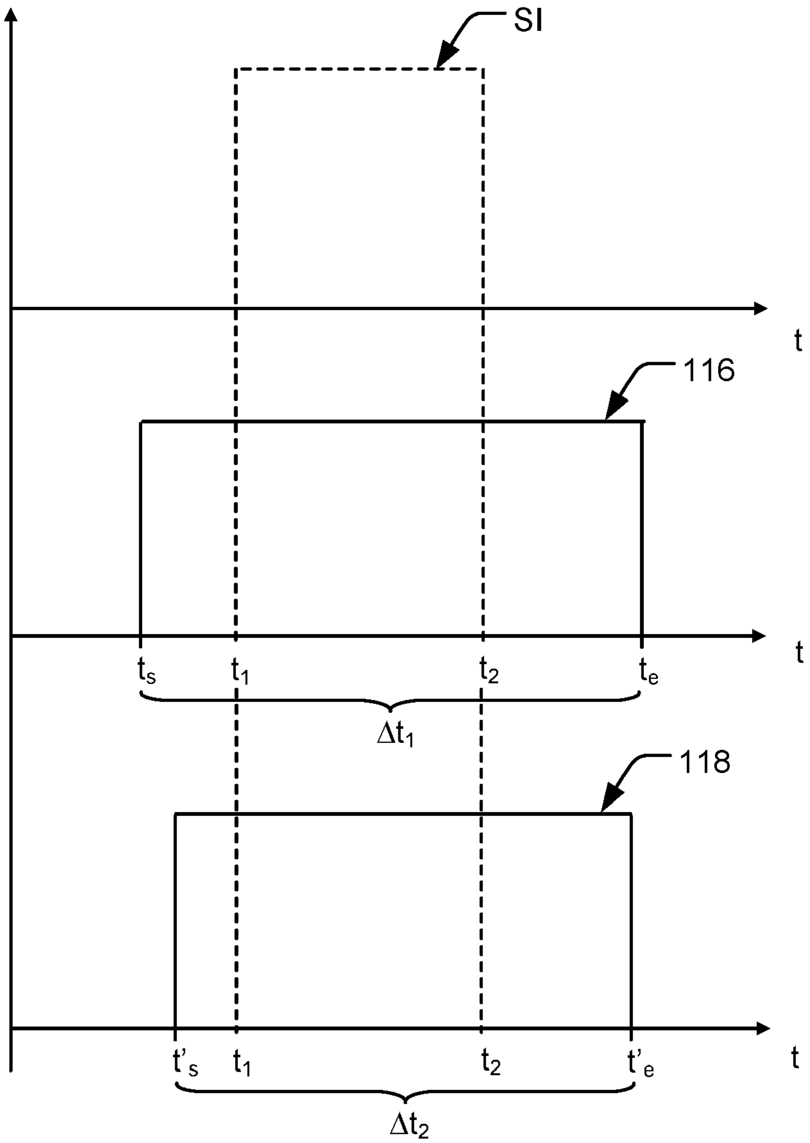

Fig. 2

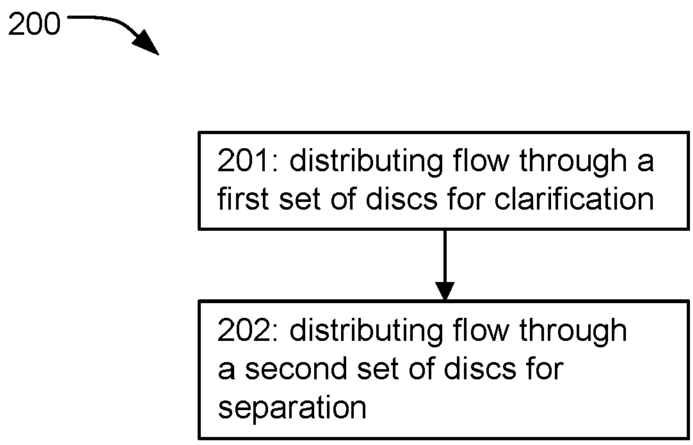
200
201: distributing flow through a first set of discs for clarification
202: distributing flow through a second set of discs for separation

Fig. 3a

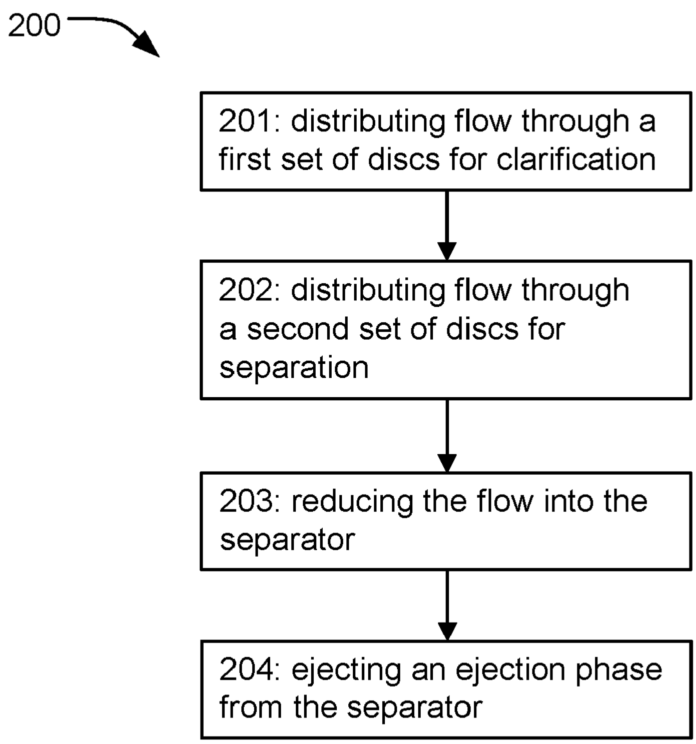
200
201: distributing flow through a first set of discs for clarification
202: distributing flow through a second set of discs for separation
203: reducing the flow into the separator
204: ejecting an ejection phase from the separator

Fig. 3b

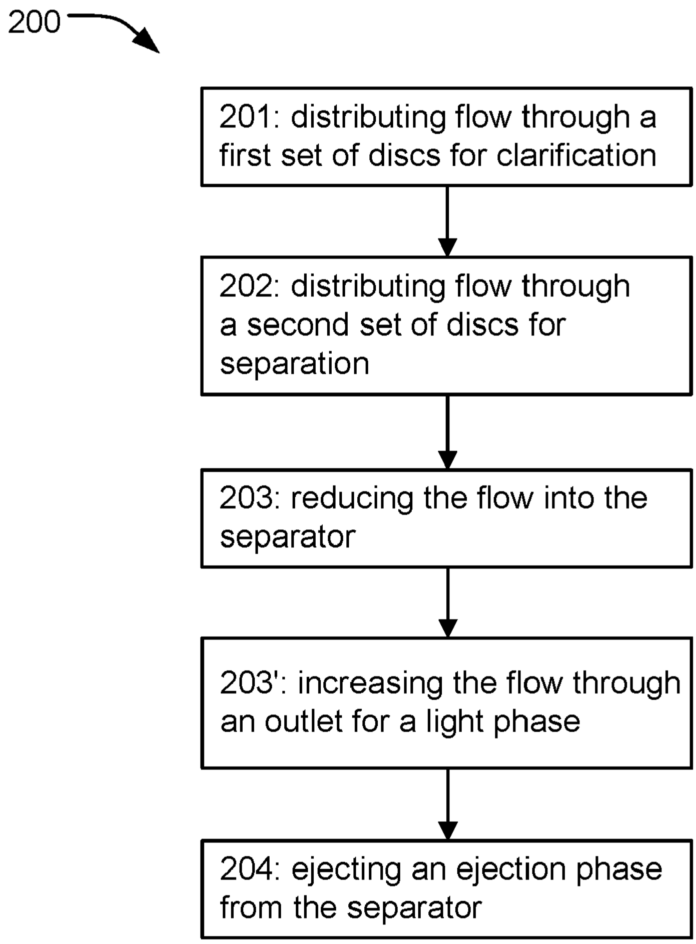
200
201: distributing flow through a first set of discs for clarification
202: distributing flow through a second set of discs for separation
203: reducing the flow into the separator
203': increasing the flow through an outlet for a light phase
204: ejecting an ejection phase from the separator

Fig. 3c

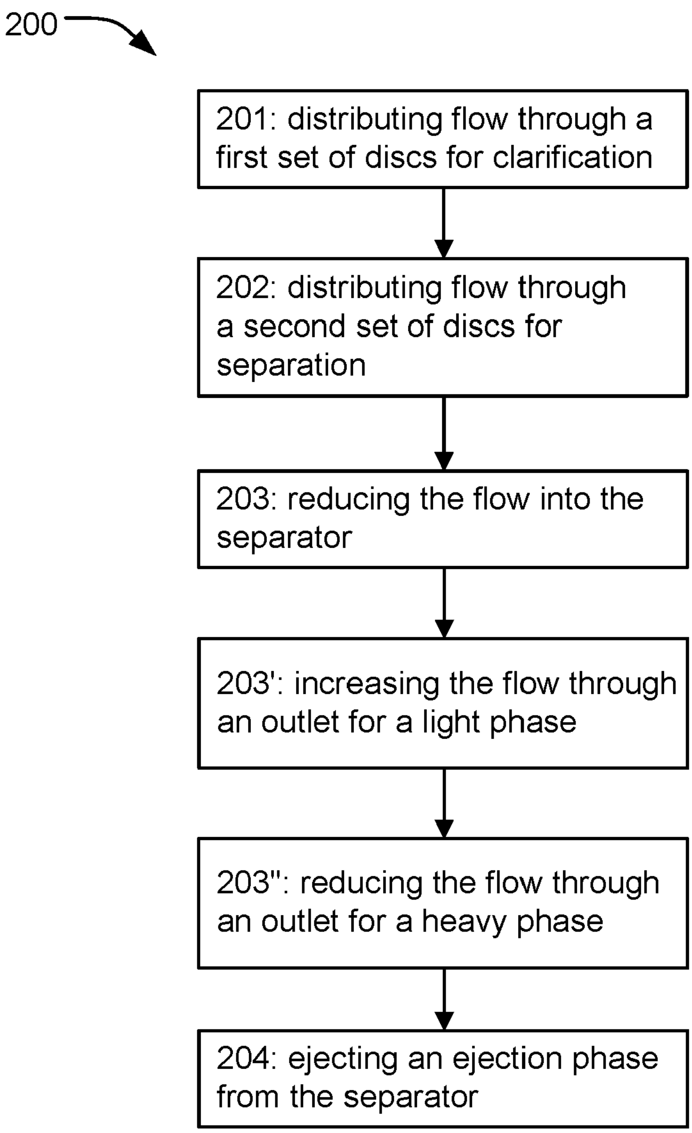
200
201: distributing flow through a first set of discs for clarification
202: distributing flow through a second set of discs for separation
203: reducing the flow into the separator
203': increasing the flow through an outlet for a light phase
203'': reducing the flow through an outlet for a heavy phase
204: ejecting an ejection phase from the separator

Fig. 3d

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EUROPEAN SEARCH REPORT

Application Number
EP 19 21 4930

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 2 500 100 A (STREZYNSKI GEORGE J) 7 March 1950 (1950-03-07) * column 2, line 10 - column 4, line 3; figure *	1,2,13, 17,18 3-6,12, 14,16	INV. B04B1/08 B04B1/14 B04B11/04 B04B7/14
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The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
Munich	2 April 2020	Leitner, Josef

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X : particularly relevant if taken alone
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