

A centrifugal separator

The present invention relates to a centrifugal separator, especially a decanter centrifuge, for separating two phases of liquid of different density, comprising a rotating body rotating in use in a direction of rotation around a preferably horizontal axis of rotation, said axis of rotation extending in a longitudinal direction of said rotating body, a radial direction extending perpendicular to the longitudinal direction; said rotating body comprising a bowl, said bowl comprising a base provided at a rear longitudinal end of said bowl, said base defining a first rear longitudinal area of the centrifugal separator rear of said base, at least two outlet passages extending through said base, said outlet passages communicating with respective weir edges at respective levels, said weir edges defining in use a level of liquid in the bowl and a level of an interface between the two phases of liquid in the bowl, a first of said outlet passages extending axially to a first outlet opening discharging in use liquid from the rotating body in said first rear longitudinal area, and a second of said outlet passages comprises a conduit extending to a second outlet opening discharging in use liquid from the rotating body in a second rear longitudinal area rear of said first rear longitudinal area, said second outlet opening being positioned to have a distal edge relative to the axis of rotation placed at a level not above the level of the weir edge communicating with said second outlet opening.

FR-A- 2 120 537 discloses a centrifuge of this art.

EP-A-1 480 754 discloses an centrifugal separator in which the base comprises an inner annular space receiving in use a light phase of liquid that has passed the weir of the first outlet passage, from which annular space the liquid, in one embodiment (Fig. 2), is conveyed by a skimming disc to a central duct provided around an inflow pipe of the centrifugal separator. In another embodiment (Fig. 3) the inner annular space is connected with a passage extending radially an outlet opening discharging the liquid from the rotating body. In both embodiments the second outlet passage comprises a weir at an internal side of the base

and the second outlet passage extends in a diverging manner relative to the axis of rotation to an outlet opening in the external side of the base, where an adjustable throttle device is provided for controlling the run-off quantity of a heavy phase of liquid.

5 WO-A-2009/127212, enclosed herein by reference, discloses a centrifugal separator having a base with two outlet passages for a light and a heavy phase of liquid, respectively, whereby one outlet passage extends axially through the base whereas the other outlet passage extends, via an outlet chamber inside the base, radially out of the base to
10 nozzle directing the out-flowing liquid in a direction opposite the direction of rotation.

It is an object of the present invention to provide a centrifugal separator of the art mentioned by way of introduction, in which both the heavy and the light phase is discharged from the rotating body at a relatively small radius or distance from the axis of rotation in order to reduce the energy consumption of the centrifugal separator.
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It should be understood that the expression "level" refers to the radial distance from the axis of rotation, and by analogy to the field of gravity of earth "up" refers to a direction towards the axis of rotation and "down" refers to an opposite direction.
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According to the invention a shaft part of the rotating body extends coaxially with the axis of rotation from the base, said shaft part carrying a flange, and said conduit extends from the base and through the flange to said second outlet opening, the flange separating said first and said second rear longitudinal area. The flange facilitates preventing re-mixing of the two phases after discharge from the respective outlet openings, and the flange may assist supporting the conduit.
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Further according to the invention the centrifugal separator comprises a casing housing the rotating body, said casing comprising a proximal compartment for receiving a liquid discharged from the rotating body through the first outlet opening, and a distal compartment for receiving liquid discharged from the rotating body through the second outlet opening, said compartments being separated by a partition. Thus the proximal compartment extends the first rear longitudinal area and the
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distal compartment extends the second rear longitudinal area. Hereby prevention of re-mixing of the two liquid phases is facilitated. The casing including the partition is divided in at least two parts comprising a lid, whereby the above mentioned flange is surrounded by an annular sealing and the partition engages the annular sealing, at least when the lid is in a closed position. Hereby prevention of re-mixing of the two liquid phases is further facilitated.

In an embodiment said distal edge constitutes said weir edge communicating with said second outlet opening.

10 In an embodiment the annular sealing comprises an inner annular sealing member in sliding engagement with the flange and an outer flexible member providing for a non sliding engagement with the partition when the lid is in a closed position.

In another embodiment the annular sealing comprises two semicircular parts attached to either of the two parts of the partition, the semicircular parts being preferably securely mounted to the respective parts of the partition, to form an annular sealing when the two parts of the casing and thus the two parts of the partition are brought together by bringing the lid into its closed position.

20 Preferably an outlet housing is placed in the second rear longitudinal area, said outlet housing constituting part of said conduit, said outlet housing being rotatable around an adjustment axis, and said outlet housing comprising a side wall offset from the adjustment axis, the second outlet opening being placed in said side wall. In a practical embodiment the conduit with the outlet housing is part of an outlet element having a connecting piece rotatably connected to the base. In a further practical embodiment the outlet member is tubular and has a tube axis coaxial with the adjustment axis. Preferably the adjustment axis is parallel with the axis of rotation. By providing an outlet opening in a side wall of such rotatable outlet housing is obtained that the liquid discharged by said outlet opening may be discharged in a direction opposite the direction of rotation thereby recovering energy from the discharged liquid. Further, when the distal edge of the outlet opening provides the weir edge of the outlet passage in question, rotating the outlet housing will

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adjust the level of the weir edge.

Generally for cases where a sealing between a rotating member such as a flange, e.g. of a rotating body comprising a bowl of the centrifuge, especially a decanter centrifuge, and a sectioned partition, especially of a casing, is required, according to the present invention an annular sealing comprises an inner annular sealing member in sliding engagement with the flange and an outer flexible member providing for a non sliding engagement with the partition when the sections thereof are brought together e.g. by bringing a lid carrying a section of the partition into a closed position.

It is also possible according to the invention, that at least one of the weir edges extend in a plane, which is parallel with the base.

In the following the invention will be described in more detail by way of examples of embodiments with reference to the schematic drawing, in which

Fig. 1 shows a longitudinal section of a rotating body of a prior art decanter centrifuge,

Fig. 2 shows an outlet of a prior art decanter centrifuge,

Fig. 3 shows a section along line III-III in Fig. 2,

Fig. 4 shows a prior art decanter centrifuge with an open lid,

Fig. 5 shows a partial longitudinal section of an embodiment of an outlet arrangement usable with the present invention,

Fig. 6 shows a section along line VI-VI in Fig. 5,

Fig. 7 shows a partial longitudinal section of a rotating body according to the present invention showing a first outlet,

Fig. 8 shows a partial longitudinal section of the rotating body of Fig. 7 showing a second outlet,

Fig. 9 shows a partial perspective view of the rotating body in Figs. 7 and 8,

Figs 10a shows an end view, as indicated by line Xa-Xa in Fig. 10b, of the base of a decanter centrifuge in a second embodiment

Fig. 10b shows a section along line Xb-Xb in Fig. 10a,

Fig. 10c shows a section along line Xc-Xc in Fig. 10a,

Fig. 11 shows a section corresponding to Fig. 10b of a variant of

the embodiment shown in Figs. 10a-10c,

Fig. 12 shows, similar to Fig. 8, a partial longitudinal section of a rotating body and partitions of a casing, and

Fig. 13 is a plan view of a sealing member.

5 A rotating body 1 of a prior art centrifugal separator or decanter centrifuge schematically shown in fig. 1 comprises a bowl 2 and a screw conveyor 3 which are mounted on a shaft 4 such that they in use can be brought to rotate around a horizontal axis 5 of rotation, the axis 5 of rotation extending in a longitudinal direction of the bowl 2. Further, the rotating body 1 has a radial direction 5a extending perpendicular to the longitudinal direction.

For the sake of simplicity directions "up" and "down" are used herein as referring to a radial direction towards the axis 5 of rotation and away from the axis 5 of rotation, respectively.

15 The bowl 2 comprises a base plate 6 provided at one longitudinal end of the bowl 2, which base plate 6 has an internal side 7 and an external side 8. The base plate 6 is provided with a number of liquid phase outlet passages 9 having external openings in the external side 8 of the base plate. Furthermore the bowl 2 is at an end opposite to the base plate 6 provided with solid phase discharge openings 10.

The screw conveyor 3 comprises inlet openings 11 for feeding a feed e.g. slurry to the rotating body 1, the slurry comprising a light or liquid phase 12 and a heavy or solid phase 13. During rotation of the rotating body 1 as previously described, separation of the liquid phase 12 and solid phase 13 phases is obtained. The liquid phase 12 is discharged through the outlet passages 9 in the base plate 6, while the screw conveyor 3 transports the solid phase 13 towards the solid phase discharge openings 10 through which the solid phase 13 is eventually discharged.

25 With reference to fig. 2 the external opening of each liquid phase outlet passage 9 may according to the prior art be partly covered by a weir plate 14. The weir plate 14 determines the level 15 of liquid (cf. fig. 3) in the bowl which substantially cannot exceed the overflow edge 17 of the weir plate, because the area 16 of the opening above the weir plate 14 from a practical view of the liquid is unlimited. The weir

plate 14 is securely fixed to the base plate 6 by fastening means (not shown) in the form of e.g. bolts protruding through holes 18 in a peripheral part 19 of a supporting device 21. In the fixed state the peripheral part 19 covers at least part of the rim 20 of external opening of the liquid phase outlet passage 9, and the supporting device 21 partly covers the weir plate 14 to a level indicated by 22 on fig. 2.

Fig. 3 shows a cross section through the liquid phase outlet opening 9 along the line III-III in fig. 2, indicating the level 15 of liquid, which substantially coincides with the overflow edge 17 of the weir plate 14.

Fig. 4 shows for illustration a prior art decanter centrifuge comprising a rotating body 30 mounted in a casing 31 comprising a lower part 32 and a lid 33 hinged to the lower part 32 by means of hinges 34. The lid is shown in an open position. The casing comprises several partitions, which are sectioned whereby upper semicircular sections 35 of the partitions are attached to the lid 33 to cooperate with lower sections 36 of the partitions in the lower part 32 of the casing when the lid is brought into a closed position. These partitions divide the space between inner walls of the casing 31 and the rotating body 30 into compartments 37, some of which are used for collecting respective phases of the feed separated inside the rotating body 30. Thus a heavy phase compartment 37a collects a heavy solid phase and a light phase compartment 37b collects a light liquid phase.

Fig. 5 and 6 illustrates part of a rotating body 40 comprising a bowl 41, a base plate or base 42, and a shaft part 43 connected to the base 42. The rotating body has a horizontal axis of rotation 45. So far the rotating body 40 may be similar to the rotating bodies 1 and 30 shown in Figs. 1 and 4 respectively. However, to illustrate an outlet arrangement usable with the present invention, a liquid phase outlet passage 47 extending through the base 42 accommodates a circular connecting piece 49 of a tubular outlet element 51 with a blind end 53. The tubular outlet element 51 thus extends the outlet passage 47.

The blind end 53 provides an outlet housing 55 with a circular cylindrical side wall 57. The outlet element 51 has an axis extending in

parallel to the axis of rotation 45 and constituting an adjustment axis 59 as it will be explained in more detail below. In operation the rotating body 40 is rotating in a direction of rotation 61 as indicated in Fig. 6. The side wall 57 of the outlet housing 55 comprises an outlet opening 63
5 with a weir edge 65 and an opposite edge 67 both of which extend along a respective generator of the cylinder surface of the cylindrical side wall 57. The weir edge 65 and the opposite edge 67 extend between them an angle α , which preferably is in the range 30° to 75° , more preferably 45° to 60° .

10 In the embodiment shown the connecting piece 49 is substantially cylindrical like the outlet housing 55 apart from a groove accommodating an O-ring seal 69. Another O-ring seal 71 is accommodated in a recess surrounding the outlet passage 47. The outlet element 51 comprises a circumferential collar 73, which is partly accommodated in an
15 other recess surrounding the outlet passage 47. Being circular the connecting piece 49, and therewith the rest of the outlet element 51, is rotatable around the adjustment axis 59.

A screw 75 with a washer 77 is provided beside the outlet element 51 so that tightening the screw 75 urges the washer 77 against the
20 collar 73 thereby clamping the same, whereby rotation of the outlet element 51 is prevented, the screw 75 and the washer 77 constituting an embodiment of a fastener.

Further a scale 79 is provided on the surface of the base 42 beside the recess accommodating the collar 73, and on the collar a mark
25 81 is provided giving an indication of the angular position of the outlet element 51, the scale 79 and the mark 81 together constituting an embodiment of an indicator.

Though only one outlet passage 47 is shown in Figs. 5 and 6 it should be understood that a plurality of outlet passages may be present
30 and evenly distributed around the axis of rotation as it is normal for such centrifugal separators.

The outlet housing 55 works as follows:

In use the bowl 41 rotates in the direction 61 causing a feed inside the bowl 41 to separate in a heavy solid phase (not shown) and a

light liquid phase having a surface at a level 83, which is slightly above the level of the weir edge 65 thereby providing a pressure head driving the liquid phase out of the bowl through the outlet element 51 and the outlet opening 63. The outlet opening 63 should be so large that during
5 normal use of the centrifugal separator it does not run full, but a free space or an air vent between the free surface of the flowing liquid and the opposite edge 67 will be present.

The outlet element 55 is put in an angular position by rotating it around the adjustment axis 59 to bring the weir edge 65 to a desired
10 level corresponding to a desired level 83 of the liquid inside the bowl. If the latter level need to be adjusted the level of the weir edge 65 is adjusted correspondingly by rotating the outlet element 55 around the adjustment axis 59. Due to the circular movement of the adjustment raising the weir edge 65 will at a given point entail that the opposite edge 67
15 is lowered to a position close to or below the level of the weir edge 65 and at that point liquid will flow over the opposite edge 67 which is not intended. Thus there is a limit to the range within which the level of the weir edge can be adjusted. The larger the angle α is, the smaller is the range within which the level of the weir edge can be adjusted while obtaining the intended function. However the smaller the angle α is the
20 smaller is also the size of the outlet opening 63. These are factors the skilled person will take into consideration when deciding the size of the angle α .

When adjusting the angular position of the outlet element 51
25 care is taken that the outlet opening 63, as shown in Fig. 6, is facing rearwards relative to the direction of rotation 61 in order to discharge the liquid phase in an opposite direction relative to the direction of rotation 61 whereby energy is recovered from the discharged liquid.

For adjustment of the angular position of the outlet element 51
30 the screw 75 is un-tightened to release the collar 73 from the clamping action of the washer 77. The outlet element is turned around the adjustment axis using the scale 79 and mark 81 to control the angle of adjustment, and the screw is tightened again to prevent unintended rotation of the outlet element 51.

Figs. 7 to 9 show a part of an embodiment of a rotating body 101 according to the invention. The parts not shown may be similar to corresponding parts of the embodiments shown in Figs. 1 to 6. However the present embodiment is adapted for separating feeds wherein a liquid
5 phase comprises a mixture of two liquid phases of different density. Thus elements the inside the bowl (not shown) may be similar to the elements inside the embodiments of a bowl disclosed in WO 2009/127212, which is incorporated herein by reference. The rotating body 101 has an axis of rotation 102 and comprises a base 103, which is connected with a shaft
10 part 105, which carries a flange 107, and a coaxial shield 109 is provided. The base 103 and the flange 107 define between them a first rear longitudinal area 111 of the centrifugal separator, and the flange 107 and the shield 109 define between them a second rear longitudinal area 113 of the centrifugal separator. By definition the first rear longitudinal
15 area 111 is rear of the base 103, and the second rear longitudinal area 113 is rear of the first rear longitudinal area 111.

Partitions of a casing, which is not shown in detail, but which corresponds to the casing shown in Fig 4, are indicated in Figs. 8 and 9 by their upper sections 35a, 35b and 35c. Upper section 35a and the
20 flange 107 defines together with upper section 35b a proximal compartment in the first rear longitudinal area 111, and upper section 35a and the flange 107 defines together with upper section 35c and the shield 109 a distal compartment in the second rear longitudinal area 113.

Being adapted for feeds comprising two liquid phases the base
25 103 comprises two outlet passages provided at different angular positions relative to the axis of rotation 102.

Thus Fig. 7 shows a first outlet passage 115 with a recess 117 accommodating a connecting piece 119 of a first circular cylindrical outlet element 121 extending the first outlet passage. A blind end of the
30 outlet element 121 is formed as a connecting piece 123 accommodated in an opening 125 in the flange 107. Thus the outlet element 121 is held by the base 103 and the flange 107. O-ring seals 127 are provided in respective grooves in the connecting pieces 119 and 123. The part of the outlet element 121 between the connecting pieces 119 and 123 consti-

tutes a circular cylindrical side wall of an outlet housing 126 with a first outlet opening 128 having a first weir edge 129 and an opposite edge 131. The first outlet housing 126 is rotatable around an adjustment axis 133 as the connecting pieces 119 and 123 are circular. In an inner surface of the base a recess 135 is provided at the outlet passage 115. The recess 135 accommodates a channel member 137 with a through passage 139 opening into the outlet passage 115 thereby extending the latter.

Thus in use the outlet housing 126 with its weir edge 129 works similar to the outlet housing 55 described with reference to Figs. 5 and 6, the weir edge 129 defining a level 141 of liquid inside the bowl. Thus, in use the light phase of the liquid from the bowl will be discharged from the first outlet opening 128 into the proximal compartment in the first rear longitudinal area 111.

It should however be noted that the orientation of the outlet opening 128 indicates that the direction of rotation of the rotating body in this embodiment is opposite to the direction of rotation of the rotating body of the embodiment shown in Figs. 5 and 6.

Fig. 8 shows a second outlet passage 145 with a recess 147 accommodating a connecting piece 149 of a second circular cylindrical outlet element 151 extending the second outlet passage. A blind end of the outlet element 151 is formed as a second outlet housing 154 with a circular cylindrical side wall 156, which comprises a second outlet opening 158 with a distal edge 160 distal from the axis of rotation 102 and an opposite edge 161 proximal the axis of rotation 102 both of which edges extend along a respective generator of the cylinder surface of the cylindrical side wall 156. In the present embodiment the distal edge 160 constitutes a second weir edge 159. The outlet element 151 is provided with an intermediate connecting piece 153 accommodated in an opening 155 with a recessed shoulder in the flange 107. Thus the outlet element 151 is held by the base 103 and the flange 107. O-ring seals 157 are provided in respective grooves in the connecting pieces 149 and 153. The part of the outlet element 151 between the connecting pieces 149 and 153 constitutes a tubular conduit 162. The second outlet housing 154 is

rotatable around an adjustment axis 163 as the connecting pieces 149 and 153 are circular. In an inner surface of the base a recess 165 is provided at the second outlet passage 145. The recess 165 accommodates a second channel member 167 with a passage 169 extending the second outlet passage 145 to a lower level in the bowl, where a heavy liquid phase is present. Thus the second channel member 167 shields in use the second outlet passage 145 from the light liquid phase in the bowl.

In use the second outlet housing 154 with its weir edge 159 works similar to the outlet housing 55 described with reference to Figs. 5 and 6 and similar to the outlet housing 126 described with reference to Fig. 7. However the weir edge 159 is not defining the level 141 of liquid inside the bowl, but is together with the first weir edge 129 defining the level 171 of an interface between given light and heavy liquid phases in the bowl. The skilled person will understand that the actual level 171 of said interface also depends on the rate between the densities of the light and the heavy phase. Thus, in use the heavy phase of the liquid from the bowl will be discharged from the second outlet opening 158 into the distal compartment in the second rear longitudinal area 113.

Being in the present embodiment parts of a unitary element the second outlet housing 154 and the tubular conduit 162 constitute an elongate outlet housing having a first axial length and the second outlet opening 158 extends a second axial length, which is less than half the first axial length. Thereby the second outlet opening 158 is placed remote from the base 103. This provides for discharging one of the liquid phases in the second rear longitudinal area 113 next to the first rear longitudinal area 111, while discharging said liquid phase at a level close to the level of the liquid inside the bowl, which assists minimizing loss of energy. Discharging the liquid in a direction opposite the direction of rotation assists minimizing further the loss of energy or entails recovery of energy from the rotating body of liquid in the bowl.

For adjustment of the levels 141 and 171 the first and the second outlet elements 121 and 151 are rotated around their respective adjustment axis 133 and 163 using indicators not shown to control the rotation and un-tightening fasteners not shown to allow the rotation. This

is similar to the adjustment described with reference to the embodiment shown in Figs. 5 and 6.

While in the embodiment shown in and discussed with reference to Figs. 7 to 9, the light phase is discharged into the proximal compartment and the heavy phase is discharged into the distal compartment, this could be changed by interchanging the channel members 137 and 167 and by corresponding readjustment of the levels of the first and the second weir edge 129 and 159, whereby the heavy phase is discharged into the proximal compartment and the light phase is discharged into the distal compartment.

In order to prevent re-mixing of the two liquid phases after discharge from the respective outlet openings 128 and 158 a seal is provided between the flange 107 and a partition of the casing cooperating therewith. Figs. 8 and 9 show an upper section 35a of said partition, which comprises a foot portion 173. The flange 107 carries an inner annular sealing member 175 mounted by means of an annular holding element 177 attached to the flange 107. The annular sealing member 175 is in sliding engagement with the flange 107 and it is preferably made of a relative hard plastics material. The annular sealing member 175 has a groove accommodating an outer flexible member in the form of an O-ring seal 179. When the lid of the casing is in its closed position, as indicated in Figs. 8 and 9 by the position of the upper section 35a of the partition, the foot portion 173 press against the O-ring seal 179 and prevents rotation of the annular sealing member 175 while the sliding engagement of the annular sealing member 175 with the flange 107 allows the rotating body 101 to rotate. This sealing construction may also be used between other partitions and corresponding parts of the rotating body.

It should be noted that while the preferred embodiment shown in Figs. 7 to 9 utilises the outlet arrangement shown in Figs. 5 and 6, it is within the scope of the present invention to omit the first and /or the second outlet housing 126 and 156 and instead e.g. provide weirs like the weir shown in Figs. 2 and 3 to discharge one liquid phase from the first outlet passage 115 directly into the proximal compartment over the

weir edge 17 and/or to discharge the other liquid phase from the tubular conduit 162 directly into the distal compartment e.g. over the weir edge 17.

Thus Figs. 10a, 10b and 10c illustrates an embodiment with a
5 rotating body 201 having an axis of rotation 202 and comprising a base 203. A shaft part 205 is connected to the base 203 and carries a flange 207. A first outlet passage 215 extends through the base 203 to a first outlet opening 228, at which a first weir plate 229a with a first weir edge 229 is provided. At an inner surface of the base a shielding channel
10 member 267 extends the first outlet passage 215 to a level in the bowl below an interface 271 between light and heavy liquid phase. Thus the shielding channel member 267 shields in use the first outlet passage 215 from the light liquid phase in the bowl of the rotating body 201. Thus, in use the heavy phase of the liquid in the bowl will be discharged from the
15 first outlet opening 228 into a proximal compartment in a first rear longitudinal area 211.

Fig. 10b shows a second outlet passage 245 with a recess 247 accommodating a connecting piece of an outlet element 251 extending through the flange 207 and providing a tubular conduit 262 extending
20 the second outlet passage 245 to a second outlet opening 258 delimited by a second weir plate 259a with a second weir edge 259, which constitutes a distal edge 260 of the second outlet opening 258. The second weir edge 259 defines a level 241 of liquid inside the bowl. Thus, in use the light phase of the liquid from the bowl will be discharged from the
25 second outlet opening 258 into a distal compartment in a second rear longitudinal area 213.

In this embodiment the weir plates 229a and 259a, and thus the weir edges 229 and 259, extends parallel to the base 203 and the flange 207, respectively, and further in this embodiment the base 203 and the
30 flange 207 both extends in respective planes perpendicular to the axis of rotation 202.

Fig. 11 is a view corresponding to Fig. 10b of a variant of the embodiment shown in Figs. 10a, 10b, and 10c. Thus identical elements are referred to by identical reference numerals. In the embodiment of

Fig. 11 the weir plate comprising the weir edge communicating with the second outlet passage 245 has been removed from the second outlet opening 258. Instead a second weir plate 359a with a second weir edge 359 is provided to restrict the entrance of the second outlet passage 245 at the inner surface of the base. The second weir edge 359 defines the level 241 of liquid inside the bowl of the rotating body 201. In this case the lower part of the second outlet opening 258 constitutes the distal edge 360 of said second outlet opening. Thereby the distal edge 360 is placed at a level below the level of the weir edge 359 allowing liquid that has passed the weir edge 359 to flow freely to the second outlet opening 258 and out therefrom into the distal compartment in the second rear longitudinal area 213, without a level of liquid flowing in the tubular conduit 262 extending above the weir edge 359, which would ruin the function of said weir edge 359 as a means for controlling the level 241 of liquid inside the bowl.

It should be noted that it e.g. would be possible to mix the above embodiments whereby one of the outlets of the embodiments of Figs 10 and 11 would be provided with an outlet housing as described in relation to Figs. 5 to 8.

Figs. 12 and 13 illustrate another embodiment of an annular seal between a flange attached to a rotating body and a partition. Elements that are or might be similar to elements shown in Fig. 8 are given the same reference numerals as used in Fig. 8.

Thus Fig. 12 shows a part of a rotating body comprising a base 103, a shaft part 105, an axis of rotation 102, a shield 109, a second circular outlet element 151 with a second outlet opening 158. The shaft part 105 carries a flange 107a, the second circular outlet element 151 extending through the flange 107a. Fig. 12 further shows upper sections 35a', 35b and 35c of partitions of a casing. It should be understood that the upper sections 35a', 35b and 35c are attached to a lid of the casing as shown in Fig. 4. The partition represented by the upper section 35a' and the flange 107a separate together the first rear longitudinal area 111 and the second rear longitudinal area 113.

The upper section 35a' has a foot portion 173a, which has a suf-

ficient size to receive screws 401 (only one of which is shown) for mounting a semicircular sealing element 175a. Fig. 13 is a plan view of the semicircular sealing element 175a showing its shape at least in a mounted position. It should be understood that a similar semicircular
5 sealing element 175a is mounted on a lower section corresponding to the upper section 35a' of the partition, said lower section being mounted in a lower part of the casing opposite the upper section 35a', which as mentioned is mounted in the lid of the casing.

The skilled parson will appreciate that in the embodiment of
10 Figs. 12 and 13 when the rotating body is mounted in the casing as shown in Fig. 4 and the lid is closed the two semicircular sealing elements 175a will form a sectioned annular sealing, which is in sliding engagement with a circumferential surface of the flange 107a to perform a function similar to the function of the annular sealing member 175
15 shown in Fig. 8.

P A T E N T C L A I M S

1. A centrifugal separator for separating two phases of liquid of different density, comprising
- a rotating body (101; 201) rotating in use in a direction of rotation around an axis of rotation (102; 202), said axis of rotation extending in a longitudinal direction of said rotating body,
 - a radial direction extending perpendicular to the longitudinal direction;
 - said rotating body (101; 201) comprising a bowl,
 - said bowl comprising a base (103; 203) provided at a rear longitudinal end of said bowl, said base facing a first rear longitudinal area (111; 211) of the centrifugal separator rear of said base,
 - at least two outlet passages (115,139, 145,169; 215, 245) extending through said base (103; 203), said outlet passages communicating with respective weir edges (129, 159; 229, 259; 359) at respective levels, said weir edges (129, 159; 229, 259; 359) defining in use a level (141; 241) of liquid in the bowl and a level (171; 271) of an interface between the two phases of liquid in the bowl, a first of said outlet passages (115, 139; 215) extending axially to a first outlet opening (128; 228) discharging in use liquid from the rotating body in said first rear longitudinal area (111; 211), and a second of said outlet passages (145,169; 245) comprising a conduit (162; 262) extending to a second outlet opening (158; 258) discharging in use liquid from the rotating body in a second rear longitudinal area (113; 213) rear of said first rear longitudinal area (111; 211), said second outlet opening (158; 258) being positioned to have a distal edge (160; 260; 360) relative to the axis of rotation (102; 202) placed at a level not above the level of the weir edge (159; 259; 359) communicating with said second outlet opening (158; 258),
 - a shaft part (105; 205) of the rotating body (101; 201) extending coaxially with the axis of rotation (102; 202) from the base (103; 203), said shaft part carrying a flange (107; 207), and said conduit (162; 262) extends from the base (103; 203) and through the flange (107; 207) to said second outlet opening (158; 258), the flange separat-

ing said first and said second rear longitudinal area (111 and 113; 211 and 213),

a casing (31) housing the rotating body (101), said casing comprising a proximal compartment for receiving a liquid discharged
5 from the rotating body through the first outlet opening (128), and a distal compartment for receiving liquid discharged from the rotating body through the second outlet opening (158), said compartments being separated by a partition (35a),

wherein the casing including the partition is divided in at least
10 two parts comprising a lid (33), the flange (107) is surrounded by an annular sealing (175, 179) and the partition (35a) engages the annular sealing, at least when the lid is in a closed position.

2. A centrifugal separator according to claim 1, c h a r a c t e r -
i z e d in that said distal edge (160; 260) constitutes said weir edge
15 (159; 259) communicating with said second outlet opening (158; 258).

3. A centrifugal separator according to claim 1 or 2, c h a r a c -
t e r i z e d in that the annular sealing comprises an inner annular seal-
ing member (175) in sliding engagement with the flange (107) and an
outer flexible member (179) providing for a non sliding engagement with
20 the partition (35a) when the lid is in the closed position.

4. A centrifugal separator according to claim 1 or 2, c h a r a c -
t e r i z e d in that the annular sealing comprises two semicircular
parts (175a) attached to either of the two parts (35a', 36) of the parti-
tion to form the annular sealing when the two parts of the casing and
25 thus the two parts of the partition are brought together by bringing the
lid into its closed position.

5. A centrifugal separator according to claim 4, c h a r a c t e r -
i z e d in that the semicircular parts are securely mounted to the re-
spective parts of the partition.

30 6. A centrifugal separator according to any of the preceding
claims, c h a r a c t e r i z e d by an outlet housing (154) placed in the
second rear longitudinal area (113), said outlet housing constituting part
of said conduit, said outlet housing being rotatable around an adjust-
ment axis (163), and said outlet housing comprising a side wall (156)

offset from the adjustment axis, the second outlet opening (158) being placed in said side wall.

7. A centrifugal separator according to claim 6, c h a r a c t e r -
i z e d in that the conduit with the outlet housing is part of an outlet
5 element (151) having a connecting piece (149) rotatably connected to
the base (103).

8. A centrifugal separator according to claim 7, c h a r a c t e r -
i z e d in that the outlet member is tubular and has a tube axis coaxial
with the adjustment axis.

10 9. A centrifugal separator according to any of claims 6 to 8,
c h a r a c t e r i z e d in that the adjustment axis is parallel with the
axis of rotation.

10. A centrifugal separator according to any one of claims 1 to
5, characterized in that at least one of the weir edges (229, 259) extend
15 in a plane, which is parallel with the base (203).