

SPECIFICATION

Separation device

- 5 The invention relates to a device for separating from a liquid, components suspended therein.

Such a separating device is known from NL-A 70 01 713 and 25 70 04 494. The

- 10 advantage of cross-flow separation described therein is that the separated components are allowed to flow off more or less in the shadow of the corrugations and out of contact with the liquid flow, and, in contrast to the generally used longitudinal flow separation, is not
15 influenced by the liquid flowing in the same or opposite sense, so that less remixing by turbulences will take place. The separation effect can, therefore, be better in cross-flow separation than in longitudinal flow separation,
20 provided that care is taken to prevent components flowing off at the extremeities of the corrugated plates being taken up again by the liquid flow, and, therefore, in the above-mentioned known device transverse guiding
25 partitions are used which will suppress short-circuit flows of the liquid past the plate assembly.

- This known device has, however, some disadvantages. Manufacturing such a device is rather complex, since, with the exception of the supply and discharge chambers for the liquid, also collecting ducts for the separated components should communicate with the basin,
35 which makes the structure of the basin more complex, and, moreover, reduces the useful space for the plates with equal external outline dimensions. The oblique orientation of the plates transversely to the liquid flow leads,
40 moreover, to lozenge-shaped cross-sections of the plate assembly, and, thus, to an unfavourable space utilisation of the basin, or requires complex oblique basin constructions.

- According to the present invention there is provided a device for separating from a liquid components suspended therein, comprising an assembly of substantially parallel, corrugated, plates arranged in a basin at an angle to the horizontal plane, between which plates separation passages are defined, which plates are provided with mutually parallel corrugations having generatrices which include an angle of less than 90° with the line of maximum inclination of the plates, two opposite
55 transverse walls of the basin, joining the oblique lateral edges of the plates, providing communication with a liquid supply and discharge chamber respectively, the shape and dimensions of the walls substantially corresponding to the overall cross-section of the plate assembly parallel to the walls, which chambers are connected to a liquid supply and discharge duct respectively, all this in such a manner that the liquid flow between
65 these chambers extends substantially

transversely to the corrugations of the plates, the lowest or highest end edges respectively of these plates joining collecting passages for heavy or light components respectively, which

- 70 components are collected in the lowest or highest parts respectively of the plate corrugations and move along these parts towards the end in question, at which end of the corrugated plates baffles are provided which are
75 directed towards a collecting chamber for the component in question, which baffles are adapted substantially to prevent liquid flow past the plate assembly, the corrugated plates extending up to the lateral walls in question of the basin, and contact the lateral walls of the basin chamber in which the plates are arranged, at their lower edges with the corrugation crests, and at their upper edges with the corrugation troughs, a spacing existing between the corrugation troughs and crests respectively and the lateral wall in question, and, thus, forming a discharge passage for the separated component flowing off at that end and the guide baffles being mounted
90 against the lateral wall in question, and being aligned with a series of superposed corrugation troughs or crests respectively.

- With the construction set forth in the immediately preceding paragraph no separate discharge ducts for the separated components are required so that no useful space is lost. If the discharge passages are still insufficiently large, the corrugated plates can be additionally cut away at those portions which do not
100 contact the wall in question.

- Although the plates can now be supported in a simple manner at support points on the transverse walls or guides partitions, mounting such plates separately is objectionable,
105 and removing such plates for cleaning purposes would then become time-consuming. The possibility of removing the plates is very important since the plates cannot be cleaned in the basin, as end portions of the corrugations are not or hardly accessible.

- It is, therefore, preferred to divide the plate assemblies into sub-assemblies each comprising a plurality of interconnected plates of equal length kept at the correct distance by distance pieces, which sub-assemblies have a substantially parallelogram-shaped cross-section in a plane through superposed corrugation axes, which subassemblies can be stacked one upon the other, and, more specifically, sub-assemblies with a triangular or trapezoidal cross-section consisting of plates of different sizes can be placed in the unfilled lower and upper corners. Such sub-assemblies can be easily transported and put in place,
125 and removing them for cleaning purposes is simple too. The number of plates in such a sub-assembly is, in principle, not limited; but is determined by practical considerations, such as, for instance, the desired weight, the
130 inclination in respect of the height of the

basin, and so on.

It has appeared to be advantageous to interconnect a plurality of plates by means of rods with the interposition of tube sections surrounding these rods and acting as distance pieces, which bars are directed substantially perpendicularly to the plates. At least at one end the rods can be adapted to act as a distance piece with respect to an adjacent sub-assembly, said ends either engaging a portion of an adjacent plate, or fitting in or on a terminal portion of a bar of this adjacent sub-assembly if both rods are mutually aligned.

If the basin is divided into two or more chambers by means of partitions extending in the flow direction, a said plate assembly can be arranged in each chamber without requiring special provisions for discharging the separated components.

The invention will now be described by way of example, with the accompanying diagrammatic drawing, in which:

Figure 1 is a plan view of a device according to the invention;

Figure 2 is a cross-section on line II-II of Fig. 1;

Figure 3 is a fragmentary section, to an enlarged scale, of a terminal part of a plate assembly of the device;

Figure 4 is a plan view of a part of Fig. 3; and

Figure 5 is a corresponding fragmentary section of other parts of the device including distance pieces.

In Figs. 1 and 2 a cross-flow separator according to the invention is shown in a highly simplified manner. For simplicity's sake it is assumed, for the moment, that the device is designed for separating sedimentating components, although floating components can also be separated.

In a basin 1 with a rectangular cross-section mutually parallel corrugated plates 2 are arranged at an inclination; in the embodiment shown the plates lie in two groups one at each side of a median wall 3, the plates of one group having an opposite inclination to those of the other. Moreover, the ends of the basin 1, a supply chamber 4 and a discharge chamber 5 are provided, each communication with respective supply and discharge ducts (not shown) for the liquid to be treated. Under the plate assembly, a collecting funnel is provided 6 for separated sediment.

In Fig. 3 a fragmentary section of lower end portions of some of the corrugated plates 2 and the adjacent lateral wall 7 of the basin 1 is shown, and Fig. 4 shows the corresponding top plan thereof. The corrugated plates 2 comprise alternating corrugation crests 8 and troughs 9, the plates at the lower ends bearing with their corrugation crests against the wall 7. As a consequence of the corrugated configuration the corresponding ends of the

troughs will, then, be spaced from the wall 7, so that passages 10 are defined, and the separated sediment can fall through these passages, and will, finally, arrive in the funnel 6.

In order to prevent the liquid flow which is transversely directed with respect of the corrugations from entraining the sediment sliding downwards through the passages 10, baffles 11 are mounted on the wall 7 in at least a part of the passages 10. These baffles assist in keeping the liquid flow away from the passages 10, so that the sediment discharge can take place substantially without impediment. Moreover, these baffles will have a guiding effect on the sediment flow, and the latter may tend to follow along these baffles.

At the opposite ends of the plates at the median wall 3, the situation is opposite. There the ends of the corrugation troughs bear against the wall, and the crests are spaced therefrom, so that, again, passages 10 are defined. If components are present in the liquid having a lower specific gravity than the liquid, these will migrate towards the upper ends of the corrugation crests, from which they can float towards the liquid surface through passages 10. Also in these passages 10 baffles 11 can be arranged for keeping the liquid flow away from these passages. In the upper part of the basin 1 a suitable discharge means for floating components will be provided, e.g. an overflow gutter or the like, which has not been shown since such discharge means are generally known.

Although it is possible to arrange the plates 2 one-by-one in the basin 1, supporting them, for instance, at their ends on supports mounted on walls 3 and/or 7, so that the baffles 11 also serve as supports, this will generally be too cumbersome, especially since the plates must be removable from the basin for cleaning. Therefore, another manner of supporting the plates is preferred.

In Fig. 2 thicker lines indicate the manner in which a plate assembly can be subdivided into, on the one hand, a plurality of sub-assemblies 12 with a substantially parallelogram-shaped outline, and, on the other hand, smaller sub-assemblies 13 with a trapezoidal cross-section at the corners. The number of plates shown is, for the sake of clarity smaller than in practice. The corners can be closed off by a blanking page 14, since, there, the plate length would become too small. In this manner substantially the whole cross-section of the basin 1. can be effectively used. In the sub-assemblies the plates 2, which are in the assemblies 12 all of the same length, are interconnected, so that these sub-assemblies can each be moved into or out of the basin as a unit.

For interconnecting the plates as a sub-assembly rods are used, which, as follows from Fig. 3, are fixed at their ends by means

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of nuts 16 or the like, and which rods are surrounded by tube sections 17 acting as distance pieces between the successive plates. These rods 15 extend perpendicularly to the plates. The number of plates thus interconnected depends on the allowable length of the unsupported free end portion 18, and, thus, also on the inclination of the plates.

- 5 Successive sub-assemblies are supported on one another in the manner shown in Fig. 5. The end of a rod 15 can be constructed as a support foot 19, which, as shown, bears on a corrugation crest of an overlying plate or on a corrugation trough of an underlying plate, which foot can also be mounted as shown, on a tub section 17' fitting over an end portion of a rod 15. If the rods of adjacent sub-assemblies are mutually aligned, it is possible, as shown in the right-hand side of Fig. 5, to arrange a supporting sleeve 17'' between the rod ends in question.

- Only at the lower end of the basin 1 additional supporting means for supporting the plate assembly should be provided, e.g. a plurality of bars spanning this lower end. The number of rods 15 in the longitudinal direction of the corrugations can be small, since the plates have a high stiffness in that direction.

- 10 If the passages 10 are not wide enough for discharging the flow of separated components, the plates 2 can be cut away e.g. as shown in Fig. 4 at 21 (broken lines). This will be useful, in particular, in those plates which are nearer to the collecting space for the component in question.

- Sometimes it can be advisable to provide additional baffles which, for instance, can be aligned with the vertical baffles 11, and which are either situated at the upper side of the plates 2, and, then, extend above the liquid surface and below the floating layer present there, so as to protect the latter against disturbance by the liquid flow, or below the plates 2, and, then, extending into the sediment layer in the funnel 6, also with the aim of arresting the liquid flow. In particular corresponding apertures delimiting the liquid flow can be provided at the inflow and outflow ends. Furthermore it is possible to connect such transverse baffles and parts of the baffles 11 with the sub-assembly in question.

- It will be clear that the device can be constructed with only one or with more than two plate chambers, and that the plates of adjacent chambers can also have the same inclination, in contrast to the inclinations in Fig. 2 where they are oppositely directed.

60 CLAIMS

1. A device for separating from a liquid components suspended therein, comprising an assembly of substantially parallel, corrugated, plates arranged in a basin at an angle to the horizontal plane, between which plates separation passages are defined, which plates are provided with mutually parallel corrugations having generatrices which include an angle of less than 90° with the line of maximum

- 70 inclination of the plates, two opposite transverse walls of the basin, joining the oblique lateral edges of the plates, providing communication with a liquid supply and discharge chamber respectively, the shape and dimensions of the walls substantially corresponding to the overall cross-section of the plate assembly parallel to the walls, which chambers are connected to a liquid supply and discharge duct respectively, all this in such a manner that the liquid flow between these chambers extends substantially transversely to the corrugations of the plates, the lowest or highest end edges respectively of these plates joining collecting passages for heavy or light components respectively, which components are collected in the lowest or highest parts respectively of the plate corrugations and move along these parts towards the end in question, at which end of the corrugated plates baffles are provided which are directed towards a collecting chamber for the component in question, which baffles are adapted substantially to prevent liquid flow past the plate assembly, the corrugated plates extending up to the lateral walls of the basin chamber in which the plates are arranged, at their lower edges with the corrugation crests, and at their upper edges with the corrugation troughs, a spacing existing between the corrugation troughs and crests respectively and the lateral wall in question, and, thus, forming a discharge passage for the separated component flowing off at that end and the guide baffles being mounted against the lateral wall in question, and being aligned with a series of superposed corrugation troughs or crests respectively.

2. A device according to claim 1 wherein the baffles extend into the said discharge passages.

3. A device according to claim 1 or 2, wherein the corrugation parts of a plate not contacting the wall in question are additionally cut away for increasing the passage in question.

4. A device according any one of claims 1 to 3, wherein the plate assembly consists of sub-assemblies, each comprising a plurality of interconnected plates of substantially the same length kept at the correct spacing by means of distance pieces, which sub-assemblies have a substantially parallelogram-shaped outline in a plane through corresponding generatrices of superposed plates.

5. A device according to claim 4, wherein, in corners of each assembly, sub-assemblies are placed comprising plates of different sizes and having a substantially triangular or trapezoidal cross-section.

6. A device according to claim 4 or 5,



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It will be clear that the device can be constructed with only one or with more than two plate chambers, and that the plates of adjacent chambers can also have the same inclination, in contrast to the inclinations in Fig. 2 where they are oppositely directed.

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70 inclination of the plates, two opposite transverse walls of the basin, joining the oblique lateral edges of the plates, providing communication with a liquid supply and discharge chamber respectively, the shape and dimensions of the walls substantially corresponding to the overall cross-section of the plate assembly parallel to the walls, which chambers are connected to a liquid supply and discharge duct respectively, all this in such a manner that the liquid flow between these chambers extends substantially transversely to the corrugations of the plates, the lowest or highest end edges respectively of these plates joining collecting passages for heavy or light components respectively, which components are collected in the lowest or highest parts respectively of the plate corrugations and move along these parts towards the end in question, at which end of the corrugated plates baffles are provided which are directed towards a collecting chamber for the component in question, which baffles are adapted substantially to prevent liquid flow past the plate assembly, the corrugated plates extending up to the lateral walls of the basin chamber in which the plates are arranged, at their lower edges with the corrugation crests, and at their upper edges with the corrugation troughs, a spacing existing between the corrugation troughs and crests respectively and the lateral wall in question, and, thus, forming a discharge passage for the separated component flowing off at that end and the guide baffles being mounted against the lateral wall in question, and being aligned with a series of superposed corrugation troughs or crests respectively.

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6. A device according to claim 4 or 5,



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wherein each plate assembly comprises plates inter-connected by means of rods with the interposition of tube sections surrounding these rods and acting as distance pieces,
5 which rods extend substantially perpendicularly to the plates.

7. A device according to claim 6, wherein the rods at least at one end, are shaped as a distance piece for an adjacent sub-assembly,
10 which distance piece engages either a portion of a plate of this adjacent sub-assembly, or terminal piece of a said rod aligned therewith.

8. A device according to any one of claims 1 to 7, wherein the basin is subdivided
15 by means of at least one longitudinal partition into chambers, in each of which chambers a said plate assembly is accommodated.

9. A separation device substantially as hereinbefore described with reference to the
20 accompanying drawings.

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