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(54) METHOD AND DEVICE FOR SEPARATING MATERIAL FLOWS

VERFAHREN UND VORRICHTUNG ZUR TRENNUNG VON MATERIALSTRÖMEN

PROCEDE ET APPAREIL DE SEPARATION DE FLUX DE MATIERES

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(56) References cited:
US-A- 4 435 196 US-A- 5 084 161
US-A- 5 308 384

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Description

Field of the invention

[0001] The invention relates to a method according to the preamble of the appended claim 1 for separating material flows from aqueous suspensions containing pulp fibers and other fine particles formed in a paper manufacturing process. The invention also relates to a device for implementing the aforementioned method according to the preamble of the appended claim 14.

Background of the invention

[0002] In manufacturing processes of paper and chemical pulp, the fiber-containing paper or chemical pulp used as the raw material is passed through a number of different process steps before the outcome of the final product. These steps include, for example, pulp processing, such as cleaning, bleaching and washing with various aqueous solutions. The effluents discharged from the processes often contain pulp fibers which are a valuable raw material for the process, for which reason the effluents are recycled back into the pulp. Furthermore, in a modern paper machine, the aim is to reduce the manufacturing costs e.g. by reducing the quantity of fresh water and effluents, wherein it is advantageous to recycle the effluents of the process as much as possible. The white water which has flown through the forming wire of the paper machine is also collected and re-used as dilution water in the manufacture of the papermaking pulp. The effluents obtained as a result of the above-described processes contain not only pulp fibers but also other impurities which are present or have been accumulated in the process cycle and which are disadvantageous for the process, such as chips, resinous colloids, other substances which soil the pipework, and gases, such as small air bubbles. It is common to these impurities that they are accumulated in the surface layer of the aqueous suspension either because they have a lighter specific weight than water or they can, in some way, adhere to a substance lighter than water, such as an air bubble, which lifts up the impurity to the surface layer of the suspension. The above-mentioned impurities are particularly problematic in the paper pulp to be supplied into the headbox of the paper machine, because they cause holes, spots and other defects in the paper web to be manufactured. Also, the dilution water to be used in the dilution headbox must be as impurity-free as possible. The dilution water is normally water discharged from the wire section of the paper machine, fresh water, or a mixture of these, and it must also be cleaned of the above-described impurities, because the dilution water is fed directly into the headbox where the consistency of the pulp to be fed onto the wire is controlled.

[0003] Resins and other light impurities or other substances adhering to a gas bubble as well as the gas bubbles are partly removed from the pulp suspension to be

fed into the headbox by means of a deaeration tank. The pulp suspension to be cleaned is sucked by negative pressure into the deaeration tank via jet tubes extending above the fluid level so that the suspension impinges on the top of the tank which causes breakdown of the gas bubbles in addition to boiling caused by the negative pressure. The gas thus removed from the suspension is sucked out of the tank via a gas outlet. The light impurities present in the suspension are separated onto the surface of the suspension and are removed from the tank along with the surface layer to be discharged separately back into the circulation, typically onto the suction side of a pump after the wire pit, from where they are returned to the inlet of the deaerator. The surface layer is separated as an overflow by means of a partition wall controlling the level of the suspension at the other end of the tank. The suspension to be introduced into the paper machine is discharged via an opening in the bottom of the tank, placed before the partition wall controlling the level. This kind of an arrangement is disclosed, for example, in FI patent 63613 (corresponding US patent 4,419,109) and US patent 5,308,384.

[0004] Also the dilution water used for diluting the paper pulp is processed in the deaeration tank in the above-described manner, as disclosed in FI patent 100950 (corresponding EP patent 958 433).

[0005] A problem in the arrangements of the above-mentioned publications is that the separation of the surface layer in the deaeration tank takes place after the removal of the suspension to be led into the paper machine, wherein some of the impurities contained in the surface will end up in the suspension.

[0006] US patent 6,491,744 presents another arrangement for removing gas from a pulp suspension. In this arrangement, the surface layer to be removed from the pulp suspension, i.e. the overflow, is discharged from the tank via a separate discharge pipe placed before the outlet of the purified pulp flow in the direction of the flow of the suspension.

[0007] All the above-mentioned arrangements of prior art also involve the problem of a short overflow sill in the overflow separation device, which has the result that all the impurity and foam particles present on the surface of the aqueous suspension cannot be eliminated in a sufficiently efficient way. Furthermore, the surface layer of the suspension removed as an overflow from the pulp suspension or the dilution water is returned to the circulation of the paper machine, which means that the impurities in the surface layer are accumulated in the circulation and cause an increasing number of problems in the process.

[0008] As explained above, the overflow contains light impurities and gases which resurface the mass suspension. When the overflow is discharged from the separation tank, the surface layer of the aqueous suspension is removed which contains not only the impurities on the surface but also a lot of the aqueous suspension itself which, in principle, can be fully utilized in the process. In

other words, only a small part of the overflow is really harmful for the process and the rest could be quite safely returned to circulation. US patent 5,084,161 discloses one solution for removing light impurities contained in the overflow. In this arrangement, the overflow removed from the deaeration tank is led via a pipework to an independent separation device, such as a separating cyclone or the like, in which the light impurities are separated from the overflow and the remaining cleaned water/pulp suspension is led into a wire pit. A disadvantage in this arrangement is that it requires supplementary investments in equipment.

[0009] The paper machine also contains a number of other tanks, basins and flumes for transporting or storing aqueous suspensions collected from various process steps and for deairing the suspensions, wherein light impurities in the suspensions are collected on their surface levels. As an example, we can mention a wire flume or an expanded white water flume, which belong to the short circulation in the paper machine. The expanded white water flume replaces the conventional wire pit and wire drains in the paper machine, and its function is to collect the white water discharged from the wire and possible other circulating waters in the paper machine and to deaerate the aqueous suspensions supplied into it and to return dilution water to the short circulation. At present, the suspension layer on the surface of the aqueous suspension is discharged from the white water flume in an overflow after the removal of the main flow.

Brief description of the invention

[0010] The purpose of the present invention is to provide a method for separating material flows from aqueous suspensions formed in the manufacturing process of paper or pulp and containing pulp fibers or other fine particles, by means of which method the above-mentioned problems can be avoided and the different material flows can be separated from each other separately from the main flow of the aqueous suspension in such a way that the material flows harmful for the paper or pulp manufacturing process can be discharged and the material flows useful for the process can be returned to the circulation. It is also an aim of the invention to provide a device implementing the aforementioned method.

[0011] To attain this purpose, the method according to the invention is primarily characterized in what will be presented in the characterizing part of the independent claim 1.

[0012] The device according to the invention, in turn, is primarily characterized in what will be presented in the characterizing part of the independent claim 14.

[0013] The other, dependent claims present some preferred embodiments of the invention.

[0014] The invention is based on the idea that the aqueous suspension containing pulp fibers or other fine particles is led into a separation tank in which the aqueous suspension is divided into a main flow and an over-

flow and from which tank the overflow is discharged in at least two different fractions. The division of the overflow into at least two different fractions is based on a surprising finding on the composition of the overflow. In prior art, a given layer thickness has been removed as an overflow from the surface of the aqueous suspension, without considering the fact that the overflow comprises at least two different layers: an upper layer containing lighter impurities and gases, as well as a lower overflow layer with no light impurities. When these two layers are separated from each other according to the invention, numerous advantages are achieved. The separation of the layers can take place either gradually, by first removing the whole overflow from the aqueous suspension and by separating the upper layer from the lower layer of the whole overflow, or by separating the different layers of the overflow substantially simultaneously from the main flow, *i.e.* substantially at the same point of the main flow at the same time. The simultaneous separation of the overflow layers can be effected directly from the flow of the aqueous suspension, in the middle of the same. In this way, the upper layer of the overflow, containing harmful impurities, can be easily removed, for example, for wastewater treatment or for purification. In addition to the fact that the lower layer of the overflow does not contain the above-mentioned light impurities, it does not contain heavier components of the pulp suspension which have been deposited in the main flow underneath it. Therefore, it can be led either to the overflow return point of prior art, *i.e.* the wire pit, or to another point in the paper manufacturing process where a cleaner aqueous suspension is needed, for example to the dilution or long circulation in the paper machine or directly to the dilution of the pulp. The separation of the overflow takes place either by means of overflow walls installed in the separation tank or by means of overflow discharge equipment installed in the flow of the aqueous suspension and dividing the overflow directly into at least two different fractions. The overflow walls or the equipment is installed in the separation tank substantially transversely against the direction of flow of the aqueous suspension so as to discharge the overflow efficiently across the whole separation tank. When separating the layers, the discharge equipment utilizes the weight differences of the different layers of the overflow, wherein the heavier lower layer is discharged from around the lighter upper layer of the overflow. The overflow layers are thus separated as successive layers from the main flow at substantially the same point of the main flow. The discharge of the overflow with the discharge equipment takes place in the middle of the aqueous suspension flow containing pulp fibers or other fine particles, before the discharge of the main flow of the aqueous suspension, wherein the space needed for separating the overflow and the main flow is reduced and the required separation tank can be made shorter than the devices of prior art, thereby providing savings in the material costs. When the discharge equipment is installed in the separation tank before the outlet passage

of the main flow and the impurities contained in the overflow are thus discharged before the discharge of the main flow, the advantage is also achieved that the main flow does not drain the impurities and is cleaner. Furthermore, the arrangement of the invention extends the overflow sill, wherein the upper layer of the overflow, containing impurities, is separated more efficiently from the aqueous suspension and thereby improves the purification of the aqueous suspension.

Brief description of the drawings

[0015] In the following, the invention will be described in more detail with reference to the appended drawings, in which

- Fig. 1 is a schematic block chart of the method for separating material flows according to the invention,
- Fig. 2 is a schematic side view of a separation tank belonging to the device according to the invention, in a cross section,
- Fig. 3 is a schematic side view of another separation tank belonging to the device according to the invention, in a cross section,
- Fig. 4a is a schematic side view of a third separation tank belonging to the device according to the invention, in a partial cross section,
- Fig. 4b shows the overflow discharge equipment outlet shown in Fig. 4a in a more detailed perspective view,
- Fig. 4c shows the overflow discharge equipment shown in Fig. 4a in a top view,
- Fig. 4d shows the separation tank of Fig. 4a seen from the end and in a partial cross-section,
- Fig. 4e shows other overflow discharge equipment in a perspective view,
- Fig. 4f shows the separation tank of Fig. 4a accommodating the overflow discharge equipment of Fig. 4e, seen from the end and in a cross-section,
- Fig. 4g shows third overflow discharge equipment seen from the end and in a cross-section,
- Fig. 5 is a schematic side view of a fourth separation tank belonging to the device according to the invention, in a partial cross section,
- Fig. 6a is a schematic side view of a fifth separation

tank belonging to the device according to the invention, in a partial cross section,

- Fig. 6b shows the overflow discharge equipment of Fig. 6a in a top view,
- Fig. 6c shows the separation tank of Fig. 6a seen from the end and in a partial cross-section,
- Fig. 6d shows the overflow discharge equipment of Fig. 6b in a perspective view,
- Fig. 6e shows other overflow discharge equipment of Fig. 6a in a perspective view,
- Fig. 6f shows the separation tank of Fig. 4a accommodating the overflow discharge equipment of Fig. 6e, seen from the end and in a cross-section,
- Fig. 7a is a schematic side view of one embodiment of the separation tank belonging to the device according to the invention, in a partial cross section, and
- Fig. 7b is a schematic side view of another embodiment of the separation tank belonging to the device according to the invention, in a partial cross section.

[0016] In Figs. 1 to 7b, the same numerals refer to corresponding parts and they will not be explained separately later on, unless required by the illustration of the subject matter.

Detailed description of the invention

[0017] In this description, the term main flow WS_{out} refers to a flow separated from an aqueous suspension containing pulp fibers or other fine particles in a separating process or device, from which flow the components harmful for the paper or pulp manufacturing process, present on the surface of the suspension, have been removed, and which flow is led to the next step in the paper or pulp manufacturing process. Furthermore, the term overflow refers to the suspension layer or layers removed from the surface of the aqueous suspension containing pulp fibers or other fine particles in a separation process or device, the layer(s) containing substances which are harmful for the paper or pulp manufacturing process, such as chips, resinous colloids and air bubbles and/or the above-mentioned aqueous suspension. Moreover, in this application, paper pulp also refers to the fiber pulp used in the manufacture of cardboard.

[0018] Figure 1 shows schematically, in the form of a block chart, the method for separating material flows according to the invention. The aqueous suspension WS_{in} entering the separation and containing pulp fibers and

other fine particles is led to a separation process 1 in which the main flow WS_{out} and the overflow are separated in an overflow separation process 2. In the overflow separation process, the upper layer OF_1 of the overflow, containing resinous colloids, air bubbles or other light impurities, is separated from the lower layer OF_2 of the overflow and is discharged from the process. The upper layer OF_1 of the overflow is lead either into wastewater treatment or for purification, wherein the impurities in the surface layer are removed by a suitable separation method, for example by microflotation, with a disk filter or another precipitation device, and is discharged as waste. The pure suspension remaining in the purification can be returned to a suitable point in the paper manufacturing process. The lower layer OF_2 of the overflow is recirculated into the process. The separation of the overflow from the flow of the aqueous suspension and the separation of the different layers of the overflow take place in the same separation process 1 of the aqueous suspension, and the different layers of the overflow are separated either gradually by means of overflow walls or by discharge equipment placed in the middle of the aqueous suspension flow, wherein the different layers of the overflow are separated substantially simultaneously within the separation process. Consequently, the invention makes it possible to separate different overflow layers from the aqueous suspension without discharge equipment apart from the process.

[0019] The aqueous suspensions formed in different process steps in the paper machine and their different layers separated in the separation tank have distinct functions. The separation processes are used to affect the way of providing the different layers of the suspensions for utilization. A significant factor is the recovery time of the flow in the separation tank, which varies in the separation processes of the aqueous suspensions in different process steps. The invention as well as the flow recovery time specific for each separation process make it possible to utilize the lower layer of the overflow in such points where cleaner aqueous suspensions are required in the paper machine.

[0020] The flow in the wire flume, the expanded white water flume and the forming or press section water tanks has a long flow recovery time of at least 5 to 15 seconds, even 60 seconds, so that the heavy material, such as filler particles, can deposit in the bottom part of the flow space. In the aqueous suspension, the following layers are thus formed: an impure air-containing upper overflow layer OF_1 , a cleaner lower overflow layer OF_2 , and a heavy material containing main flow WS_{out} on the bottom of the tank. The upper overflow layer OF_1 is removed and taken either to wastewater treatment or for purification, from which the resulting clean water is led to the deaeration tank of the paper machine or, in the case of a tank in the press section, to a disk filter. The lower overflow layer OF_2 is led to a dilution water circulation, and the main flow WS_{out} is returned to the short circulation of the paper machine.

[0021] In the deaeration tank of the pulp suspension, placed before the headbox, the flow recovery time is 15 seconds at a maximum, but it may vary from 5 to 15 seconds. The recovery time is used to control harmful consistency fluctuation in the deaeration tank: the flow recovery time of less than 15 seconds guarantees that the heavy material in the suspension cannot deposit on the bottom of the separation tank, which would cause consistency fluctuations. The upper overflow layer OF_1 is removed and possibly treated in a desired way to separate the impure material and to return the fibrous material to the pulp manufacture. The lower overflow layer OF_2 is returned to the deaeration tank. The main flow WS_{out} is homogeneous pulp which is supplied to the headbox of the paper machine.

[0022] In the white water deaeration tank, the consistency fluctuations do not present any problem, wherein the flow recovery time can be selected almost freely. A long recovery time guarantees that the heavy material can deposit in the main flow. The impure upper overflow layer OF_1 is discharged and possibly treated to remove impurities, and the clean water obtained as a result of the treatment is returned to the deaeration tank. The lower overflow layer OF_2 is returned to the dilution water circulation of the paper machine, and the main flow WS_{out} is led into the short circulation of the paper machine, more precisely to the pulp dilution.

[0023] Figure 2 is a schematic side view of a separation tank belonging to the device according to the invention, in a cross section. The separation tank shown in the figures is a deaeration tank known as such, intended for the removal of air contained in the pulp that is to be fed to the headbox and the dilution waters used for controlling the headbox of the paper machine. The deaeration tank 3 is supplied with an aqueous suspension WS_{in} containing pulp fibers and other fine particles via a duct 4 and jet tubes 5 connected to the same. A negative pressure prevails in the tank, and the gases released from the aqueous suspension are removed via the passage 6. On the lower surface of the tank, an outlet pipe 7 is provided, from which the fibrous, degassed main flow WS_{out} of the aqueous suspension is discharged in a way known as such into the headbox not shown in the figure. On the opposite side of the outlet pipe 7, seen from the duct, a first partition wall is installed, a so-called overflow wall 8, which is connected to the opposite long walls of the separation tank, substantially transversely to the flow direction of the aqueous suspension, and thereby extends over the width of the tank and makes the level of the aqueous suspension set, at the end of the tank on the side of the duct 4, substantially on the height level of the overflow wall 8. The level of the aqueous suspension may vary from 0 to 50 mm above the height of the overflow wall 8. The height of the overflow wall and the discharge rate of the main flow are adjusted so that the overflow is separated at a sufficient accuracy from the surface of the suspension. Between the overflow wall 8 and the end of the tank 3, another partition wall or overflow wall 9 is

installed, which is also connected to the opposite long walls of the separation tank, substantially transversely to the flow direction of the aqueous suspension, and which also extends over the width of the tank but is 5 to 200 mm, preferably 150 mm lower than the overflow wall 8 and thereby makes the level of the overflow run above the overflow wall 8 set substantially at the height level of the overflow wall 9. The overflow walls 8 and 9 can be folded in the longitudinal direction, for example accordion-folded walls, and they can also be placed diagonally across the width of the tank. It is essential that both of the overflow walls 8 and 9 extend over the width of the tank, wherein their overflow removing effect also extends over the width of the tank. A fluid space is left between the overflow wall 9 and the end wall of the tank, opposite to the duct 4. As presented above, the overflow walls divide the tank in three parts in the longitudinal direction of the tank. The separation of the different overflow fractions or layers takes place in steps, and the overflow is separated in two different fractions before they are removed from the separation tank. The whole overflow will first run over the overflow wall 8 and its surface level will be set at a height determined by the overflow wall 9. The layers of the overflow are separated between the overflow walls 8 and 9. The overflow left between the overflow walls 8 and 9 is the so-called lower, cleaner overflow layer OF_2 which can be discharged, for example, via a passage 10 to the dilution water circulation of the paper machine. The lighter, impure layer OF_1 , separated between the overflow walls 8 and 9 and floating on the surface of the overflow, runs over the overflow wall 9 and is removed via a passage 11 to waste treatment.

[0024] The flow of the pulp suspension in the separation tank is guided to avoid turbulence, because turbulence causes harmful mixing of the layers and migration of the surface layers to the bottom. Turbulence is prevented for example by using curved flow guides 8' and 9' shown in Fig. 2, along which the surface layer of the overflow moves to the next space. In Fig. 2, the flow guides 8' and 9' are placed at the upper edge of the corresponding overflow walls 8 and 9, behind the overflow walls in the flow direction of the aqueous suspension, and they extend over the whole length of said overflow walls. In this way, they provide an even flow of the overflow along the flow guides to the part following the overflow wall.

[0025] Figure 3 is a schematic side view of another separation tank belonging to the device according to the invention, in a cross section. The figure shows an expanded white water flume belonging to the short circulation of the paper machine, in which the pressure in the flume is the same as outside the flume and which is equipped with a lid to prevent the entry of litter into the white water. The passage 6 is used to guarantee the maintenance of a constant pressure in the expanded white water flume. When the invention is introduced in the expanded white water flume, the overflow of the white water or the water suspension can be discharged in two

fractions, and the lower, cleaner overflow layer can be discharged into a desired point in the process and the impure surface layer of the overflow can be removed to wastewater purification. In the embodiment of Fig. 3, the overflow walls 8 and 9 explained in connection with Fig. 2 are integrated in the expanded white water flume 23. Figure 3 also shows two flow guides 8a and 8b which, unlike the arrangement of Fig. 2, simultaneously guide the different overflow layers in the flow direction of the aqueous suspension, separate from each other, directly into different parts of the separation tank, defined by the overflow walls 8 and 9. The flow guide 8b is a curved plate-like means extending over the whole width of the separation tank and fixed at its both ends to the walls of the separation tank at such a height, in relation to the level of the aqueous suspension, that the upper, lighter and more impure layer OF_1 of the aqueous suspension runs directly into the part separated by the overflow wall 9, from which it is removed via a passage 11. The flow guide 8a is placed at the upper edge of the overflow wall 8, behind the overflow wall in the flow direction of the aqueous suspension, and it extends over the whole length of said overflow wall. Between the overflow wall 8 and the flow guide 8b, there is a slit through which the lower, cleaner overflow layer OF_2 runs directly along the flow guide 8a into a space defined by the overflow walls 8 and 9, from which it is discharged via a passage 10. On the lower surface of the expanded white water flume, there is an outlet pipe 7, from which the fibrous, degassed main flow WS_{out} of the aqueous suspension is discharged. Depending on the paper manufacturing process, the outlet pipe 7 can also be divided into several outlet passages. What is essential is that the outlet passage or passages 7 are placed between the overflow walls 8 and 9 and the inlet passage 12 of the aqueous suspension WS_{in} , but closer to the overflow wall 8 than the passage 12.

[0026] In the arrangement of Figs. 2 and 3, two overflow walls 8 and 9 are used for separating the overflow, wherein the combined overflow sill formed by them is twice as long as in the arrangements of prior art. This improves the separation of the overflow. The flow guides for the aqueous suspension and the flow guide method shown in Fig. 2 can naturally also be applied in the expanded white water flume of Fig. 3 and, correspondingly, the flow guide method and guides of Fig. 3 can be applied in the separation tank of Fig. 2.

[0027] Figure 4a is a schematic side view of a third separation tank belonging to the device according to the invention, in a partial cross section. The deaeration tank 3 is supplied with an aqueous suspension WS_{in} containing pulp fibers and other fine particles via a duct 4 and jet tubes 5 connected to the same. A negative pressure prevails in the tank, and the gases released from the aqueous suspension are removed via the passage 6. On the lower surface of the tank, an outlet passage or outlet pipe 7 is provided, from which the fibrous, degassed main flow WS_{out} of the aqueous suspension is discharged in

a way known as such into the headbox not shown in the figure. Above the duct 4, before the outlet pipe 7 for the main flow WS_{out} in the flow direction of the aqueous suspension, overflow discharge equipment 13 is installed to extend over the width of the tank 3. The overflow discharge equipment is thus installed in the middle of the flow of the aqueous suspension.

[0028] The overflow discharge equipment 13 can also be integrated in connection with the duct 4, even to the extent that they can be made of the same piece.

[0029] The discharge equipment 13 is installed substantially in the horizontal direction and transversely to the flow direction of the aqueous suspension so that its separating surfaces or overflow sills, separating the different layers of the overflow, are substantially at the level of the aqueous suspension in the separation tank 3. The level of the aqueous suspension may vary from 0 to 50 mm above the overflow sills. The discharge equipment 13 is shown in more detail in Fig. 4b. The discharge equipment consists of two longitudinal separation chutes installed within each other. The outermost chute 14, which in this example is a solid concave chute formed e.g. by bending a sheet, open at the top and at the ends, forms the outer jacket of the discharge equipment. The inner chute 15, which forms the inner jacket of the discharge equipment, is also solid, made e.g. by bending a sheet, and is also open both at the top and at both ends. The inner chute 15 is installed inside the outer chute so that an open space, so-called overflow space 16, is formed between it and the outer chute. The inner chute 15 is designed so that it comprises diagonally downwards extending side walls which extend about 1/3 lower than the total height of the inner chute. The side walls are connected by a launder-like lower part. The chutes 14 and 15 are installed, at their both ends, in the inner walls of the separation tank 3, over its cross-section, so that the upper edges of the chute 15 are substantially at the same level or slightly higher than the upper edges of the chute 14 and that a slit 17 is left between their upper edges. The operation of the discharge equipment will be described in the following with reference to Fig. 4c which shows the discharge equipment 13 in a top view and in which the separation of the different components of the aqueous suspension is illustrated with arrows. In the separation tank, the flow direction of the flowing aqueous suspension is parallel to arrow A, and the main flow WS_{out} is parallel to it, below the discharge equipment 13 and the duct 4 towards the outlet 7 (not shown in the figure), as shown with arrow B. The lower overflow layer OF_2 to be separated from the aqueous suspension flows through the slit 17, as shown with arrows C, into the overflow space 16, and the upper overflow layer OF_1 is separated from the surface of the overflow into the chute 15, as shown with arrows D. The different layers of the overflow are thus separated substantially simultaneously from the main flow. It should be noted that since the purpose of the separation tank 3 is to separate the light substances on the surface of the aqueous suspension, the

suspension must be allowed a recovery time so that the lighter components can resurface the suspension. This is implemented with the design and dimensions of the tank as well as with the placement of the outlet pipe 7 and the discharge equipment 13 in relation to each other. A flow towards the outlet pipe 7 also finds its way against the main flow direction A of the tank; in other words, the discharge equipment 13 discharges the overflow on both sides of the device, wherein the overflow sill is twice as long as in the arrangements of prior art. It should also be noted that the uppermost overflow layer OF_1 only forms a small part of the overflow, wherein most of the overflow consists of the lower overflow layer OF_2 which can thus be returned to the circulation.

[0030] The different overflow layers OF_1 and OF_2 are removed from the discharge equipment 13 separately from each other by means of outlet passages installed through the walls of the separation tank 3, illustrated in Fig. 4d which shows the separation tank 3 seen from the end. The lower overflow layer OF_2 is discharged from the overflow space 16 from both ends of the discharge equipment 13 via outlet passages 18 and is supplied to the papermaking process. The lighter upper overflow layer OF_1 is also discharged from both ends of the inner chute 15 of the discharge equipment 13 installed through the walls of the separation tank, via outlet passages 19, separately from the lower overflow layer. Figure 4d also shows a duct 4 for the aqueous suspension, placed underneath the discharge equipment 13, as well as a degassing passage 6. If desired, both of the overflow layers can be discharged at only one end of the discharge equipment, wherein only one set of outlets 18 and 19 is installed for this purpose in the walls of the separation tank.

[0031] The overflow discharge equipment 13 can also be implemented with the arrangement of Fig. 4e which shows other overflow discharge equipment 13 in a perspective view. This discharge equipment is placed in the separation tank in a way corresponding to the outlet of Fig. 4a. In the arrangement of Fig. 4e, the lower overflow layer OF_2 is led through the slit 17 formed between the outer chute 14 and the inner chute 15 into an overflow space 16. The side wall of the outer chute 14 extends at a distance from the wall of the inner chute 15, wherein the slit 17 is formed therebetween, underneath the wall of the inner chute 15. In relation to the level of the aqueous suspension, the upper edge of the side wall of the outer chute 14 is, at a maximum, 150 mm underneath the level of the aqueous suspension. Figure 4f illustrates the placement of the slit 17 in the discharge equipment, showing the separation tank seen from the end and in a cross-section, the overflow discharge equipment of Fig. 4e being placed in the tank. With respect to its function, the discharge equipment according to this embodiment is similar to the discharge equipment presented above; in other words, the main flow B of the aqueous suspension flows from below the discharge equipment, the lower overflow layer OF_2 flows through the slit 17 into the overflow space 16, as shown by arrow C, and the upper over-

flow layer OF_1 flows into the inner chute 15, as shown by arrow D. The removal of the different overflow layers from the discharge equipment takes place via different passages, separate from each other, as presented above.

[0032] Figure 4g shows third overflow discharge equipment whose structure corresponds, in other respects, to the discharge equipment of Figs. 4e and 4f, except for the fact that the upper edge of the inner chute 15 is designed to extend substantially horizontally onto the upper edge of the outer chute 14. The slit 17 is arranged between the upper edge of the inner chute 15 and the upper edge of the outer chute 14. The upper surface of the upper edge of the inner chute 15 guides the lighter overflow layer OF_1 into the chute 15, from which it can be removed. The lower overflow layer OF_2 is discharged via the slit 17 into the overflow space 16.

[0033] Figure 5 is a schematic side view of a fourth separation tank belonging to the device according to the invention. This separation tank 3 is an expanded white water flume. In this embodiment, the discharge equipment 13 shown in the figure can be replaced with any of the discharge equipment shown in Figs. 4b to 4g. The discharge equipment is connected in a way similar to that presented above, at its both ends to the opposite walls of the separation tank in such a way that the suspension flowing in the separation tank flows primarily transversely to the discharge equipment. The other details of the placement of the discharge equipment, its function and the removal of the different overflow layers from the discharge equipment, apart from each other, are quite identical to those presented in the embodiments of Figs. 4b to 4g, and they are thus not explained more closely.

[0034] Figure 6a is a schematic side view of a fifth separation tank belonging to the device according to the invention, in a cross section. The arrangement shown in the figure corresponds, with the exception of the discharge equipment 13, to the embodiment of Fig. 4a, and the function and the parts of the separation tank are thus not explained more closely than what is necessary in view of the operation of the discharge equipment. In this arrangement, the separation of the overflow is performed by at least two devices of discharge equipment 20 which are coupled at substantially the same height on the opposite long walls of the separation tank, opposite to each other, overlapping in the lateral direction of the tank 3. In other words, they are placed transversely to the flow direction of the aqueous suspension, wherein the effect of their overflow separation extends over the width of the separation tank. The level of the aqueous suspension is at substantially the same height as the upper edges of the discharge equipment. The level of the aqueous suspension may vary from 0 to 50 mm above the upper edges of discharge equipment. Figure 6b shows the overflow discharge equipment 20 in a top view, the separation of the different components of the aqueous suspension being illustrated with arrows. The flow direction of the aqueous suspension is parallel to arrow A, and the main flow

WS_{out} is parallel to it, below the outlets 20 and the duct 4 towards the outlet passage 7 (not shown in the figure), as shown with arrow B. The lower overflow layer OF_2 flows through the slits 17, as shown with arrows C, into the overflow space 16, and the upper overflow layer OF_1 is separated from the surface of the overflow into a separation space 22, as shown with arrows D. In other words, the lower overflow layer OF_2 is removed from around the upper overflow layer OF_1 . It can be seen that the different material layers flow from the surface of the aqueous suspension into the discharge equipment on both sides of the discharge equipment in the same way as presented in connection with Figs. 4b and 4c. The overflow sill has thus been made twice as long as in the arrangements of prior art. Figure 6b also shows the outlets 18 and 19 of the different overflow layers which have also been shown in Fig. 6c illustrating the separation tank of Fig. 6a seen from the end. The different overflow layers are discharged, in the same way as presented in Fig. 4d, via outlet passages connected to the walls of the separation tank 3. The outlet passage 19 conveys the upper overflow layer OF_1 to wastewater treatment, and the outlet passage 18 conveys the lower overflow layer OF_2 to be utilized in the paper machine.

[0035] Figure 6d shows, in a perspective view, overflow discharge equipment 20 according to Fig. 6b. The discharge equipment 20 has a wedge-like shape, and its outer jacket 21 consists of two triangular pieces connected to each other on one side and to the wall of the separation tank 3 on the other side to form a wedge-like separation space having a sharp tip and an open top. Within the separation tank, the above-mentioned sharp tip points at the longitudinal axis of the separation tank. Furthermore, the separation device comprises an elongated, trough-shaped separation space 22 for the upper overflow layer OF_1 which is open at the top and is connected at its one end to the wall of the tank and at its other end to the sharp tip formed by the jacket 21, inside the jacket 21 so that the upper edges of the walls of the separation space 22 and the upper edges of the jacket 21 are substantially at the same level. In this way, the separation space 22 also acts as an inner jacket for the outlet 20. It is essential that the area of the opening defined by the walls of the upper part of the jacket 21 and the walls of the separation tank 3 is larger than the trough-like separation space 22 so that a slit 17 is formed between the separation space 22 and the walls of the jacket 21, on both sides of the separation space 22, wherein the lower overflow layer OF_2 can run into the overflow space 16. The upper overflow layer OF_1 flows into the separation space 22, from which it is removed.

[0036] In this embodiment, it is also possible to apply the above-described implementation in which the slit 17 is formed in the side wall of the outer jacket of the discharge equipment 20 by making the side wall of the discharge equipment lower than that shown in the embodiment of Figs. 6b to 6d. Figure 6e shows such overflow discharge equipment 20 in a perspective view. In the ar-

rangement of Fig. 6e, the lower overflow layer OF_2 is led via slits 17 formed between the outer jacket 21 and the separation space 22 into the overflow space 16. Consequently, there are slits 17 on both sides of the discharge equipment 20. The side walls of the outer jacket 21 extend a distance from the wall of the separation space 22, wherein slits 17 are formed therebetween, underneath the wall of the separation space 22. The upper surface of the side wall of the outer jacket is, at a maximum, 150 mm underneath the level of the aqueous suspension. Figure 6f illustrates the placement of the slit 17 in the discharge equipment, showing the separation tank 3 in a view from the end and in a cross-section, the overflow discharge equipment 20 of Fig. 6e being placed in the tank. With respect to its function, the outlet according to this embodiment does not differ from the discharge equipment shown in Figs. 6b to 6d, and two such devices of discharge equipment are placed in the separation tank 3 in a way similar to that shown in Fig. 6a.

[0037] The overflow discharge equipment 20 according to Figs. 6b to 6f can naturally be also placed in a corresponding way in the expanded white water flume of Fig. 5a.

[0038] Particularly advantageous embodiments of the invention are those shown in Figs. 4a-4g, 5 and 6a-6f, in which the discharge equipment 13 is placed before the outlet passage 7 of the main flow WS_{out} , wherein the impurities on the surface of the suspension are removed before discharging the main flow, for which reason the main flow WS_{out} is particularly pure when discharged from the separation tank 3. In the embodiments of the invention according to Figs. 7a and 7b to be presented next, the overflow discharge equipment 13 is placed partly before the outlet passage 7 for the main flow WS_{out} .

[0039] Figure 7a shows schematically one embodiment of the separation tank 3 belonging to the device according to the invention, seen in a side view and in a partial cross-section, wherein the overflow discharge equipment 13 is placed partly before the outlet passage 7 for the main flow WS_{out} . The discharge equipment 13 is installed in the walls of the separation tank, in such a way in relation to the outlet passage for the main flow WS_{out} that the second edges of the outer chute 14 and the inner chute 15, substantially perpendicular to the flow, are placed outside the edge of the outlet passage 7 for the main flow (illustrated with a broken line in the figure) that the discharge equipment 13 is placed substantially partly above the outlet passage 7 for the main flow. The duct 4 which conveys the aqueous suspension WS_{in} to be purified, into the separation tank, is installed to extend through the bottom of the separation tank.

[0040] Figure 7b shows schematically another embodiment of a separation tank belonging to the device according to the invention, in a side view and in a partial cross-section, wherein the outlet passage 7 for the main flow WS_{out} is placed as an extension of the separation tank 3 in the lower part of the end of the separation tank. The overflow discharge equipment 13 is installed against

the end of the separation tank, on the side of the outlet passage 7 for the main flow, wherein the discharge equipment 13 is placed partly above the outlet passage 7 for the main flow. The duct 4 is installed in the same way as in the embodiment of Fig. 7a, that is, through the bottom of the separation tank.

[0041] For a person skilled in the art, it is naturally obvious that the method and apparatus according to the invention can also be applied in other tanks or transfer conduits used in papermaking, with a need to separate the different components of the aqueous suspension from each other. Such tanks and conduits include, for example, the wire drain, the white water channel, the wire pit, the forming section water tank, the suction boxes tank, the low box, and the tank for receiving water from the press section of the paper machine. Naturally, it is also obvious that even though some of the above embodying examples have presented the processing of the headbox stock by means of a deaeration tank, the method according to the invention can also be applied for the processing of dilution waters for the headbox.

[0042] Moreover, the invention is not intended to be limited to the above embodiments presented as an example, but the invention is intended to be applied widely within the scope of the inventive idea as defined in the appended claims. For example, the design of the discharge equipment 20 may be different from that presented, and its sharp end may be rounded, wherein the tip remains more easily free from impurities present in the aqueous suspension.

Claims

1. A method for separating material flows from aqueous suspensions containing pulp fibers or other fine particles formed in the manufacturing process of paper, cardboard or pulp, in which the aqueous suspension is led into a separation tank (3), in which the aqueous suspension is divided into a main flow and an overflow, **characterized in that** the overflow is discharged from the separation tank (3) in at least two different fractions (OF_1 , OF_2), which fractions (OF_1 , OF_2) are separated substantially simultaneously from the main flow (WS_{out}).
2. The method according to claim 1, **characterized in that** the overflow is removed directly from the flow of the aqueous suspension, from its middle, by using overflow discharge equipment (13, 20).
3. The method according to claim 1 or 2, **characterized in that** the overflow is removed from the separation tank (3) in the flow direction of the aqueous suspension substantially before the removal of the main flow (WS_{out}).
4. The method according to any of the claims 1 to 3,

characterized in that the overflow discharge equipment (13, 20) is used to remove the overflow from both sides of the discharge equipment (13, 20).

5. The method according to any of the claims 1 to 4, **characterized in that** the overflow discharge equipment is used to discharge the lower overflow layer (OF₂) from around the upper overflow layer (OF₁). 5
6. The method according to claim 1, **characterized in that** the overflow is divided into two different fractions (OF₁, OF₂) before their removal from the separation tank (3). 10
7. The method according to claim 1 or 6, **characterized in that** the overflow is removed from the separation tank (3) in the flow direction of the aqueous suspension after the removal of the main flow (WS_{out}). 15
8. The method according to any of the claims 1 to 7, **characterized in that** the overflow is removed from the surface of the aqueous suspension. 20
9. The method according to any of the claims 1 to 8, **characterized in that** the overflow discharge equipment (8, 9, 13, 20) is placed substantially transversely to the flow direction of the aqueous suspension in the separation tank (3). 25
10. The method according to any of the claims 1 to 9, **characterized in that** the upper overflow layer (OF₁) contains at least light impurities, such as chips, resinous colloids and gas bubbles. 30
11. The method according to any of the claims 1 to 10, **characterized in that** the upper overflow layer (OF₁) is led to wastewater treatment or to purification. 35
12. The method according to any of the claims 1 to 11, **characterized in that** the lower overflow layer (OF₂) is led into the papermaking process, particularly the dilution or long circulation of the paper machine or the dilution of the paper pulp. 40
13. The method according to any of the claims 1 to 12, **characterized in that** the separation tank (3) is one of the following: the deaeration tank, the expanded white water flume, the white water drain, the white water channel, the wire pit, the forming section water tank, the suction box tank, the low box, or the tank for receiving water from the press section of the paper machine. 45 50
14. A device for separating material flows from aqueous suspensions containing pulp fibers or other fine particles formed in the manufacturing process of paper, cardboard or pulp, which device comprises a sepa-

ration tank (3) for dividing the aqueous suspension into a main flow (WS_{out}) and an overflow, **characterized in that** the device comprises means (8, 9, 13, 20) for discharging the overflow from the separation tank (3) in at least two different fractions (OF₁, OF₂), which fractions (OF₁, OF₂) are separated substantially simultaneously from the main flow (WS_{out}).

15. The device according to claim 14, **characterized in that** the means (8, 9, 13, 20) for discharging the overflow are connected to the opposite long walls of the separation tank (3) substantially transversely to the flow direction of the aqueous suspension in such a way that the effect of the means (8, 9, 13, 20) to discharge the overflow extends over the width of the separation tank (3).
16. The device according to claim 14 or 15, **characterized in that** the means (13, 20) for discharging the overflow are fitted in the separation tank (3) substantially before the outlet passage (7) for the main flow (WS_{out}) in the flow direction of the aqueous suspension.
17. The device according to any of the claims 14 to 16, **characterized in that** the means (13, 20) for discharging the overflow are fitted in the middle of the flow of the aqueous suspension.
18. The device according to any of the claims 14 to 17, **characterized in that** the means (20) for discharging the overflow are connected to the opposite long walls of the separation tank (3), opposite to each other, overlapping in the lateral direction of the tank (3).
19. The device according to any of the claims 14 to 18, **characterized in that** the means (13, 20) for discharging the overflow comprise an outer jacket (14, 21) and an inner jacket (15, 22) which are fitted, in relation to each other, in such a way that an overflow space (16) is formed therebetween, and that the upper edges of the outer jacket and the inner jacket define a slit (17) for guiding the lower overflow layer (OF₂) into the overflow space (16).
20. The device according to any of the claims 14 to 19, **characterized in that** the means (13, 20) for discharging the overflow are fitted in the separation tank (3) in such a way that the surface of the aqueous suspension is substantially at the same height as the upper edges of the inner chute (15, 22) of the means (13, 20).
21. The device according to claim 14, **characterized in that** the means (8, 9) are fitted after the outlet passage (7) for the main flow in the flow direction of the aqueous suspension in the separation tank (3) in

such a way that the second means (8) is fitted closer to the outlet passage (7) for the main flow.

22. The device according to claim 14 or 21, **characterized in that** the means (8, 9) are different overflow walls fitted in the separation tank (3), of which the overflow wall (8) extends to the level of the aqueous suspension and the overflow wall (9) is substantially lower than the overflow wall (8).
23. The device according to any of the claims 14 to 22, **characterized in that** passages (10, 11, 18, 19) are connected to the separation tank (3) for discharging the upper overflow layer (OF₁) and the lower overflow layer (OF₂) separately.
24. The device according to any of the claims 14 to 23, **characterized in that** the means (8, 9, 13, 20) for discharging the overflow are fitted inside the separation tank (3).

Patentansprüche

1. Verfahren zur Trennung von Materialströmen von wässrigen Suspensionen, welche Zellstoffasern oder andere feine Partikel aufweisen, die bei dem Herstellungsprozess von Papier, Pappe oder Faserstoff gebildet werden, bei welchem die wässrige Suspension in einen Ausscheidungstank (3) geleitet wird, in welchem die wässrige Suspension in einen Hauptstrom und einen Überlauf geteilt wird, **dadurch gekennzeichnet, dass** der Überlauf von dem Ausscheidungstank (3) in wenigstens zwei unterschiedlichen Bruchteilen (OF₁, OF₂) abgeleitet wird, wobei die Bruchteile (OF₁, OF₂) im wesentlichen gleichzeitig von dem Hauptstrom (WS_{out}) getrennt werden.
2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** der Überlauf direkt von dem Strom der wässrigen Suspension entfernt wird, und zwar aus ihrer Mitte unter Verwendung einer Überlauf-Ableitungs-Einrichtung (13,20).
3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Überlauf von dem Ausscheidungstank (3) in der Strömungsrichtung der wässrigen Suspension im wesentlichen vor der Entfernung des Hauptstroms (WS_{out}) entfernt wird.
4. Verfahren nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Überlauf-Ableitungs-Einrichtung (13,20) verwendet wird, um den Überlauf von beiden Seiten der Ableitungs-Einrichtung (13,20) zu entfernen.
5. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die Überlauf-Ableitungs-Einrichtung verwendet wird, um die untere Überlaufschicht (OF₂) von um die obere Überlaufschicht (OF₁) herum abzuleiten.
6. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** der Überlauf vor ihrer Entfernung in den Ausscheidungstank (3) in zwei unterschiedliche Bruchteile (OF₁, OF₂) geteilt wird.
7. Verfahren nach Anspruch 1 oder 6, **dadurch gekennzeichnet, dass** der Überlauf von dem Ausscheidungstank (3) in der Strömungsrichtung der wässrigen Suspension nach der Entfernung des Hauptstroms (WS_{out}) entfernt wird.
8. Verfahren nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** der Überlauf von der Oberfläche der wässrigen Suspension entfernt wird.
9. Verfahren nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** die Überlauf-Ableitungs-Einrichtung (8,9,13,20) im wesentlichen schräg zu der Strömungsrichtung der wässrigen Suspension in dem Ausscheidungstank (3) angeordnet wird.
10. Verfahren nach einem der Ansprüche 1 bis 9, **dadurch gekennzeichnet, dass** die obere Überlaufschicht (OF₁) zumindest leichte Unreinheiten, wie zum Beispiel Grieß, harzige Kolloide und Gasblasen, aufweist.
11. Verfahren nach einem der Ansprüche 1 bis 10, **dadurch gekennzeichnet, dass** die obere Überlaufschicht (OF₁) zu einer Abwasserbehandlung oder -reinhaltung geleitet wird.
12. Verfahren nach einem der Ansprüche 1 bis 11, **dadurch gekennzeichnet, dass** die untere Überlaufschicht (OF₂) in den Papierherstellungsprozess eingeleitet wird, insbesondere in die Verdünnung oder den langen Kreislauf der Papiermaschine oder die Verdünnung des Papierfaserstoffs.
13. Verfahren nach einem der Ansprüche 1 bis 12, **dadurch gekennzeichnet, dass** der Ausscheidungstank (3) einer der folgenden ist: der Entlüftungstank, der expandierte Siebwasserkanal, der Siebwasserablauf, der Siebwasserkanal, die Siebgrube, der Blattbildungsbereichs-Wassertank, der Saugkastenbehälter, der Sammelbehälter für Rückwasser oder der Tank zum Aufnehmen von

Wasser von dem Pressenabschnitt der Papiermaschine.

14. Vorrichtung zur Trennung von Materialströmen von wässrigen Suspensionen, welche Zellstofffasern oder andere feine Partikel enthalten, die in den Herstellungsprozess von Papier, Pappe oder Faserstoff gebildet werden, wobei die Vorrichtung einen Ausscheidungstank (3) zum Teilen der wässrigen Lösung in einen Hauptstrom (WS_{out}) und einen Überlauf aufweist,
5
dadurch gekennzeichnet, dass
die Vorrichtung eine Einrichtung (8,9,13,20) zum Ableiten des Überlaufs von dem Ausscheidungstank (3) in wenigstens zwei unterschiedliche Bruchteile (OF1, OF2) aufweist, wobei die Bruchteile (OF1, OF2) im wesentlichen gleichzeitig von dem Hauptstrom (WS_{out}) geteilt werden. 10
15. Vorrichtung nach Anspruch 14,
dadurch gekennzeichnet, dass
die Einrichtung (8,9,13,20) zum Ableiten des Überlaufs mit den einander gegenüberliegenden, langen Wänden des Ausscheidungstanks (3) im wesentlichen schräg zu der Strömungsrichtung der wässrigen Suspension auf eine solche Art und Weise verbunden sind, dass die Wirkung der Einrichtung (8,9,13,20) zur Ableitung des Überlaufs sich über die Breite des Ausscheidungstanks (3) erstreckt. 15 20 25 30
16. Vorrichtung nach Anspruch 14 oder 15,
dadurch gekennzeichnet, dass
die Einrichtung (13,20) zum Ableiten des Überlaufs in den Ausscheidungstank (3) im wesentlichen vor den Auslassdurchgang (7) für den Hauptstrom (WS_{out}) in der Strömungsrichtung der wässrigen Suspension angeordnet ist. 35
17. Vorrichtung nach einem der Ansprüche 14 bis 16,
dadurch gekennzeichnet, dass
die Einrichtung (13,20) zum Ableiten des Überlaufs in der Mitte des Stroms der wässrigen Suspension angebracht ist. 40
18. Vorrichtung nach einem der Ansprüche 14 bis 17,
dadurch gekennzeichnet, dass
die Einrichtung (20) zum Ableiten des Überlaufs mit den einander gegenüberliegenden, langen Wänden des Ausscheidungstanks (3) einander gegenüberliegend und sich in der seitlichen Richtung des Tanks (3) überlappend verbunden sind. 45 50
19. Vorrichtung nach einem der Ansprüche 14 bis 18,
dadurch gekennzeichnet, dass
die Einrichtung (13,20) zum Ableiten des Überlaufs eine äußere Hülle (14,21) und eine innere Hülle (15,22) aufweist, welche im Bezug zueinander auf eine solche Art und Weise angebracht sind, dass ein 55

Überlaufraum (16) dazwischen gebildet ist, und dass die oberen Ränder der äußeren Hülle und der inneren Hülle einen Schlitz (17) zum Leiten der unteren Überlaufschicht (OF2) in den Überlaufraum (16) festlegen.

20. Vorrichtung nach einem der Ansprüche 14 bis 19,
dadurch gekennzeichnet, dass
die Einrichtung (13,20) zum Ableiten des Überlaufs in den Ausscheidungstank (3) auf eine solche Art und Weise angebracht ist, dass die Oberfläche der wässrigen Suspension im wesentlichen dieselbe Höhe aufweist wie die oberen Ränder der inneren Rinne (15,22) der Einrichtung (13,20).
21. Vorrichtung nach Anspruch 14,
dadurch gekennzeichnet, dass
die Einrichtung (8,9) nach dem Auslassdurchgang (7) für den Hauptstrom in der Strömungsrichtung der wässrigen Suspension in dem Ausscheidungstank (3) auf eine solche Art und Weise angebracht ist, dass die zweite Einrichtung (8) näher an dem Auslassdurchgang (7) für den Hauptstrom angebracht ist.
22. Vorrichtung nach einem der Ansprüche 14 bis 21,
dadurch gekennzeichnet, dass
die Einrichtung (8,9) unterschiedliche Überlaufwände aufweist, die in dem Ausscheidungstank (3) angebracht sind, von welchen die Überlaufwand (8) sich zu dem Niveau der wässrigen Suspension erstreckt und die Überlaufwand (9) im wesentlichen niedriger als die Überlaufwand (8) ist.
23. Vorrichtung nach einem der Ansprüche 14 bis 22,
dadurch gekennzeichnet, dass
Durchgänge (10,11,18,19) mit dem Ausscheidungstank (3) zum Ausscheiden der oberen Überlaufschicht (OF1) und der unteren Überlaufschicht (OF2) separat verbunden sind.
24. Vorrichtung nach einem der Ansprüche 14 bis 23,
dadurch gekennzeichnet, dass
die Einrichtung (8,9,13,20) zum Ableiten des Überlaufs innerhalb des Ausscheidungstanks (3) angebracht ist.

Revendications

1. Procédé pour séparer des flux de matériaux de suspensions aqueuses contenant des fibres de pâte et d'autres particules fines formées lors du processus de fabrication du papier, du carton ou de la pâte, dans lequel la suspension aqueuse est dirigée vers une cuve de séparation (3), dans lequel la suspension aqueuse est séparée en un flux principal et un flux de débordement, caractérisé en ce que ledit

- flux de débordement est évacué de la cuve de séparation (3) en au moins deux fractions (OF_1 , OF_2), lesdites fractions étant séparées sensiblement simultanément du flux principal (WS_{out}).
2. Procédé selon la revendication 1, **caractérisé en ce que** le flux de débordement est séparé directement du flux de la suspension aqueuse, à partir de son milieu, en utilisant un système d'évacuation de flux de débordement (13, 20). 5
 3. Procédé selon la revendication 1 ou 2, **caractérisé en ce que** le flux de débordement est évacué de la cuve de séparation (3) dans la direction du flux de la suspension aqueuse sensiblement avant l'évacuation du flux principal (WS_{out}). 10
 4. Procédé selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** le système d'évacuation de flux de débordement (13, 20) est utilisé pour séparer le flux de débordement à partir des deux côtés du système d'évacuation (13, 20). 15
 5. Procédé selon l'une quelconque des revendications 1 à 4 **caractérisé en ce que** le système d'évacuation de flux de débordement est utilisé pour évacuer la couche inférieure du flux de débordement (OF_2) en la séparant de la couche supérieure du flux de débordement (OF_1). 20
 6. Procédé selon la revendication 1, **caractérisé en ce que** le flux de débordement est divisé en deux fractions différentes (OF_1 , OF_2) avant leur évacuation de la cuve de séparation (3). 25
 7. Procédé selon la revendication 1 ou 6, **caractérisé en ce que** le flux de débordement est évacué de la cuve de séparation (3) dans la direction du flux de la suspension aqueuse après l'évacuation du flux principal (WS_{out}). 30
 8. Procédé selon l'une quelconque des revendications 1 à 7, **caractérisé en ce que** le flux de débordement est évacué de la surface de la suspension aqueuse. 35
 9. Procédé selon l'une quelconque des revendications 1 à 8 **caractérisé en ce que** le système d'évacuation de flux de débordement (8, 9, 13, 20) est placé sensiblement transversalement à la direction du flux de la suspension aqueuse dans la cuve de séparation (3). 40
 10. Procédé selon l'une quelconque des revendications 1 à 9, **caractérisé en ce que** la couche supérieure du flux de débordement (OF_1) contient au moins les impuretés légères comme les copeaux, les colloïdes résineux et les bulles de gaz. 45
 11. Procédé selon l'une quelconque des revendications 1 à 10, **caractérisé en ce que** la couche supérieure du flux de débordement (OF_1) est envoyée au traitement ou à la purification des eaux usées. 50
 12. Procédé selon l'une quelconque des revendications 1 à 11, **caractérisé en ce que** la couche inférieure du flux de débordement (OF_2) est envoyée dans le processus de fabrication du papier, en particulier vers la dilution ou la circulation longue de la machine à papier ou la dilution de la pâte à papier. 55
 13. Procédé selon l'une quelconque des revendications 1 à 12, **caractérisé en ce que** la cuve de séparation (3) est l'une des suivantes: la cuve de désaération, le glissoir élargi à eau vive, l'évacuation de l'eau vive, le canal d'eau vive, la fosse sous toile, la cuve à eau de la section de formage, la cuve du caisson d'aspiration, le caisson bas ou la cuve recevant l'eau de la section de presse de la machine à papier.
 14. Dispositif pour séparer des flux de matériaux de suspensions aqueuses contenant des fibres de pâte et d'autres particules fines formées lors du processus de fabrication du papier, du carton ou de la pâte, ledit dispositif comprenant une cuve de séparation (3) pour diviser la suspension aqueuse en un flux principal (WS_{out}) et un flux de débordement, **caractérisé en ce que** le dispositif comprend des moyens (8, 9, 13, 20) pour évacuer le flux de débordement de la cuve de séparation (3) en au moins deux fractions (OF_1 , OF_2), lesdites fractions étant séparées sensiblement simultanément à partir du flux principal (WS_{out}).
 15. Dispositif selon la revendication 14, **caractérisé en ce que** les moyens (8, 9, 13, 20) pour évacuer le flux de débordement sont reliés aux parois longues opposées de la cuve de séparation (3) sensiblement transversalement à la direction du flux de la suspension aqueuse de telle manière que l'effet des moyens (8, 9, 13, 20) pour évacuer le flux de débordement s'étende sur la largeur de la cuve de séparation (3).
 16. Dispositif selon la revendication 14 ou 15, **caractérisé en ce que** les moyens (13, 20) pour évacuer le flux de débordement sont installés dans la cuve de séparation (3) sensiblement avant le passage de sortie (7) pour le flux principal (WS_{out}) dans la direction du flux de la suspension aqueuse.
 17. Dispositif selon l'une quelconque des revendications 14 à 16 **caractérisé en ce que** les moyens (13, 20) pour évacuer le flux de débordement sont installés au milieu du flux de la suspension aqueuse.
 18. Dispositif selon l'une quelconque des revendications 14 à 17, **caractérisé en ce que** les moyens (20)

pour évacuer le flux de débordement sont reliés aux parois longues opposées de la cuve de séparation (3), face à face, en se recouvrant dans la direction latérale de la cuve (3).

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19. Dispositif selon l'une quelconque des revendications 14 à 18, **caractérisé en ce que** les moyens (13, 20) pour évacuer le flux de débordement comprennent une enveloppe extérieure (14, 21) et une enveloppe intérieure (15, 22) qui sont installées, l'une par rapport à l'autre, de façon à former un espace pour un flux de débordement (16) entre elles, et **en ce que** les bords supérieurs de l'enveloppe extérieure et de l'enveloppe intérieure définissent une fente (17) pour guider la couche supérieure du flux de débordement (OF₂) dans l'espace pour flux de débordement (16). 10
20. Dispositif selon l'une quelconque des revendications 14 à 19, **caractérisé en ce que** les moyens (13, 20) pour évacuer le flux de débordement sont installés dans la cuve de séparation (3) de façon à ce que la surface de la suspension aqueuse soit sensiblement à la même hauteur que les bords supérieurs de la glissière intérieure (15, 22) des moyens (13, 20). 15
21. Dispositif selon la revendication 14, **caractérisé en ce que** les moyens (8, 9) sont installés après le passage de sortie (7) pour le flux principal dans la direction du flux de la suspension aqueuse dans la cuve de séparation (3) de telle façon que le second moyen (8) est installé plus près du passage de sortie (7) du flux principal. 20
22. Dispositif selon la revendication 14 ou 21, **caractérisé en ce que** les moyens (8, 9) sont des cloisons de débordement différentes installées dans la cuve de séparation (3), la cloison de débordement (8) allant jusqu'au niveau de la suspension aqueuse alors que la cloison de débordement (9) est sensiblement plus basse que la cloison de débordement (8). 25
23. Dispositif selon l'une quelconque des revendications 14 à 22, **caractérisé en ce que** les passages (10, 11, 18, 19) sont reliés à la cuve de séparation (3) pour évacuer séparément la couche supérieure du flux de débordement (OF₁) et la couche inférieure du flux de débordement (OF₂). 30
24. Dispositif selon l'une quelconque des revendications 14 à 23, **caractérisé en ce que** les moyens (8, 9, 13, 20) pour évacuer le flux de débordement sont installés à l'intérieur de la cuve de séparation (3). 35

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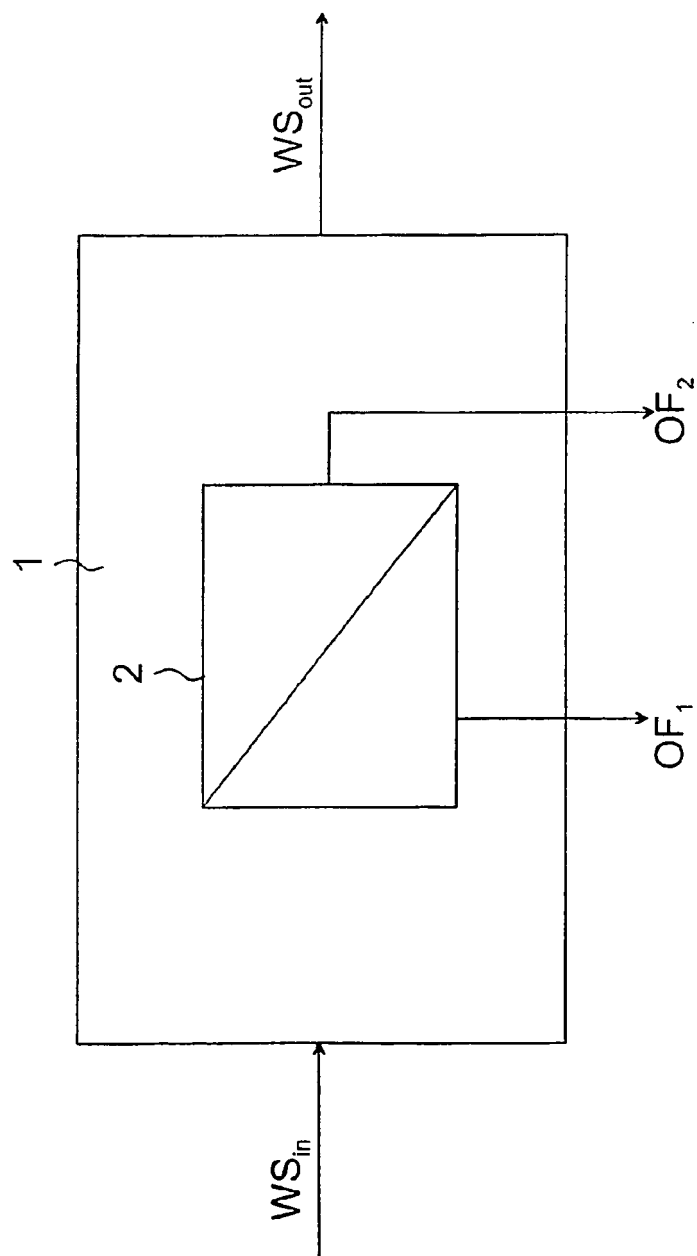


Fig. 1

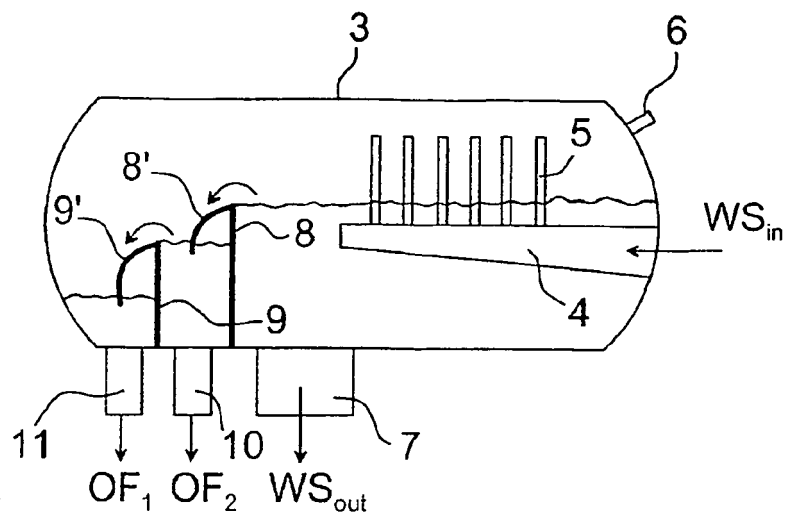


Fig. 2

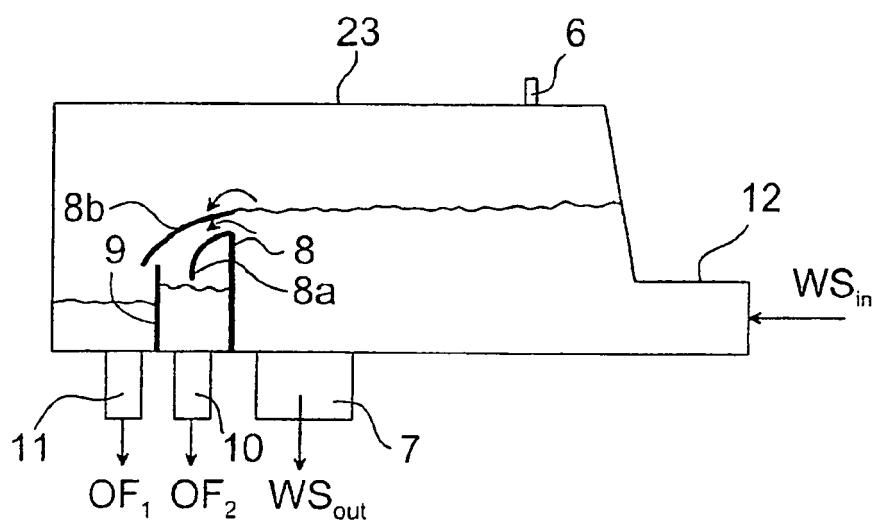


Fig. 3

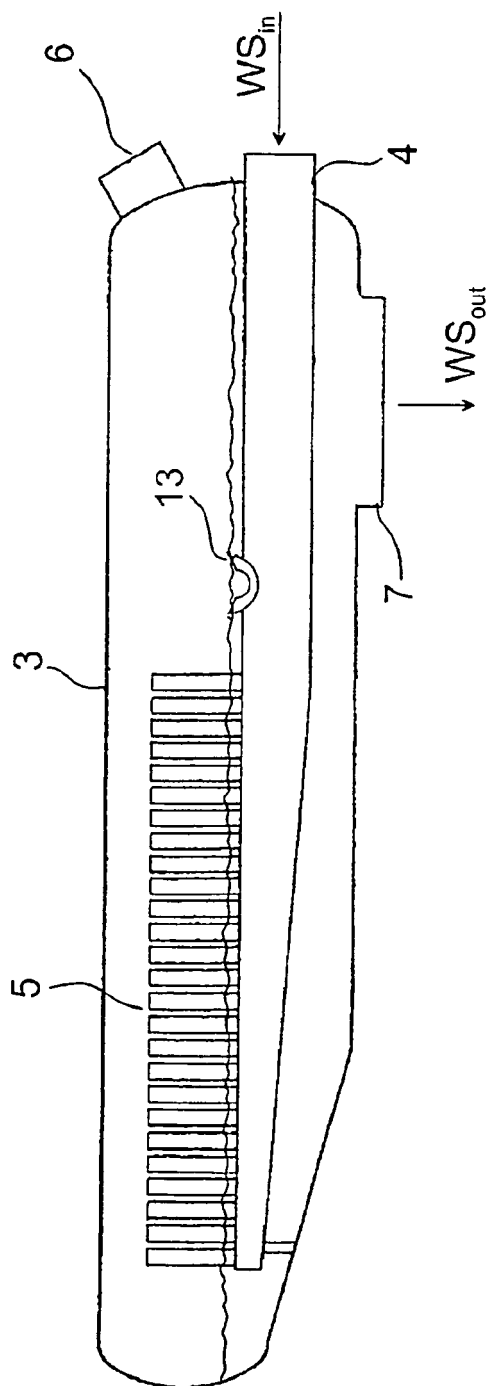


Fig. 4a

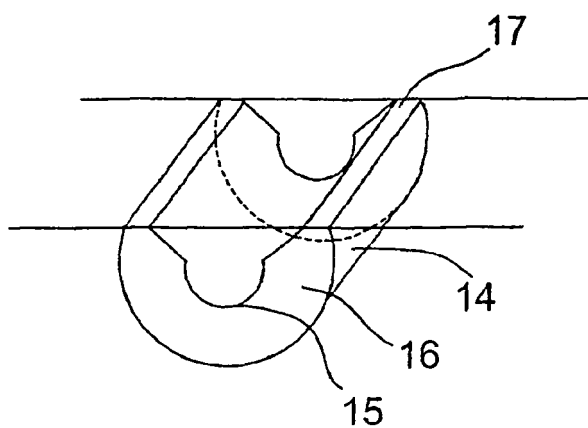


Fig. 4b

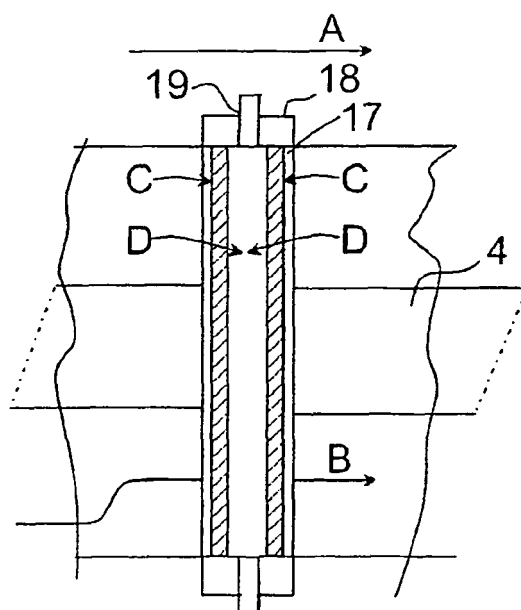


Fig. 4c

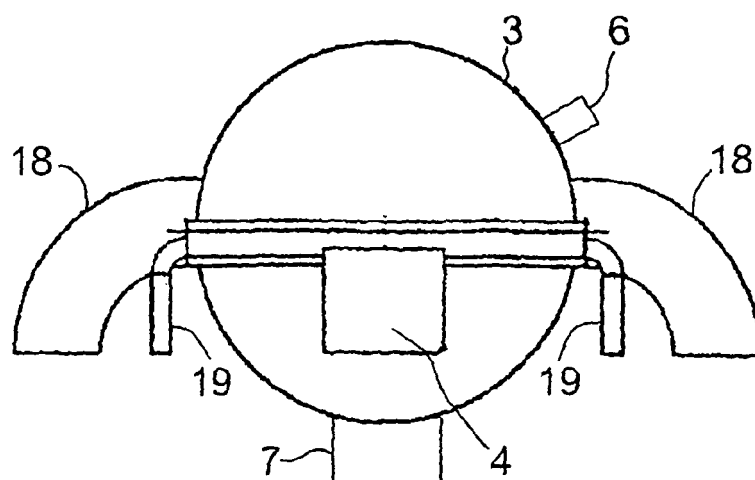


Fig. 4d

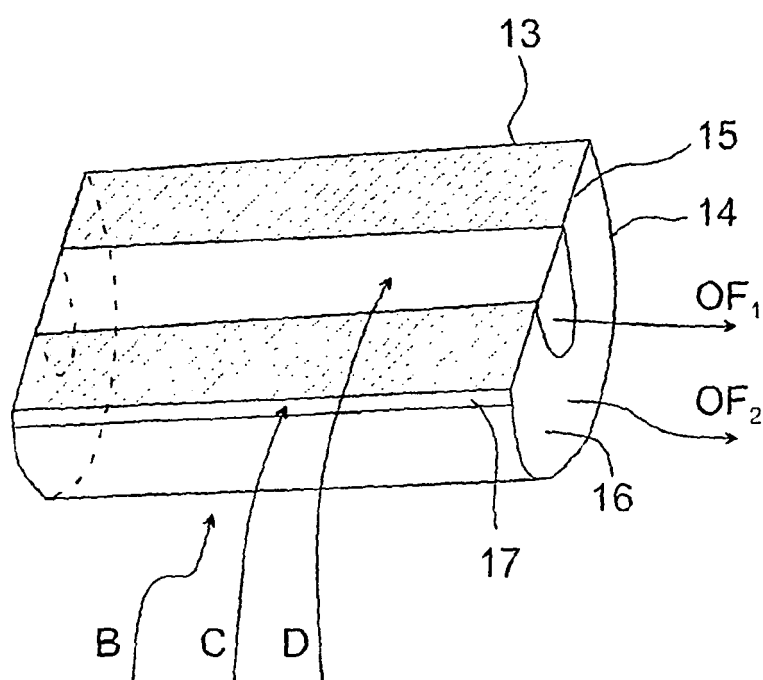


Fig. 4e

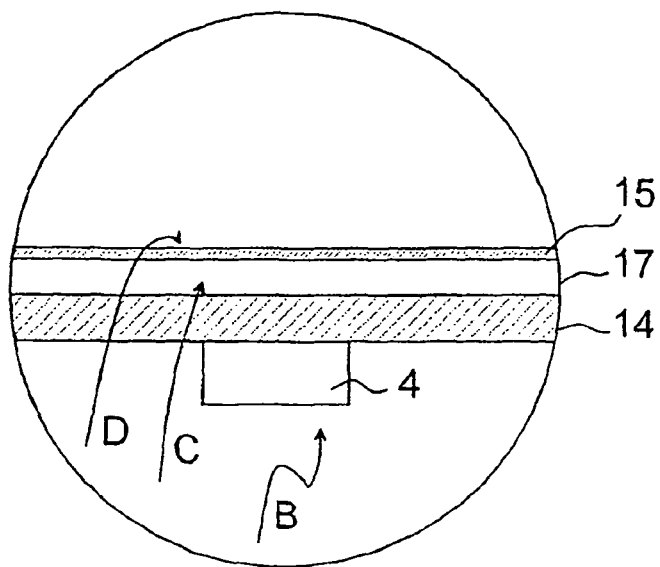


Fig. 4f

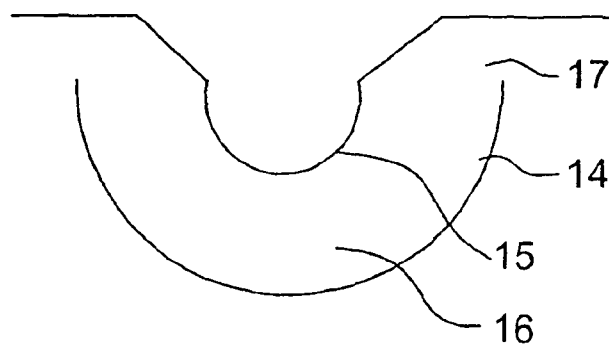


Fig. 4g

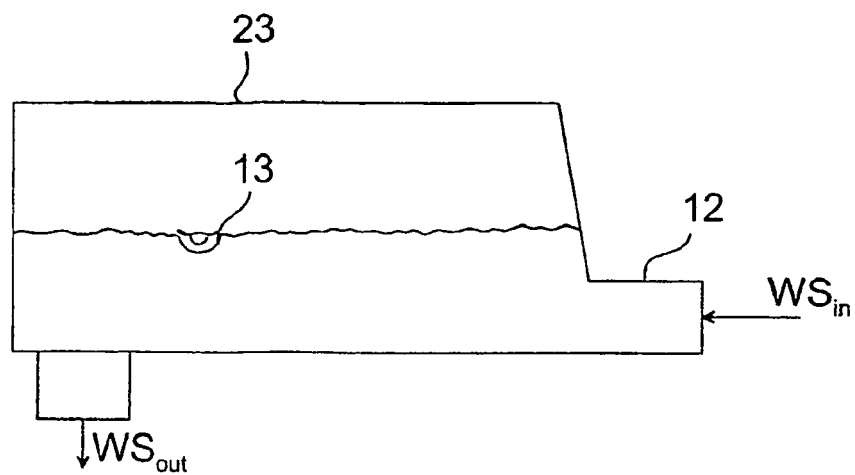


Fig. 5

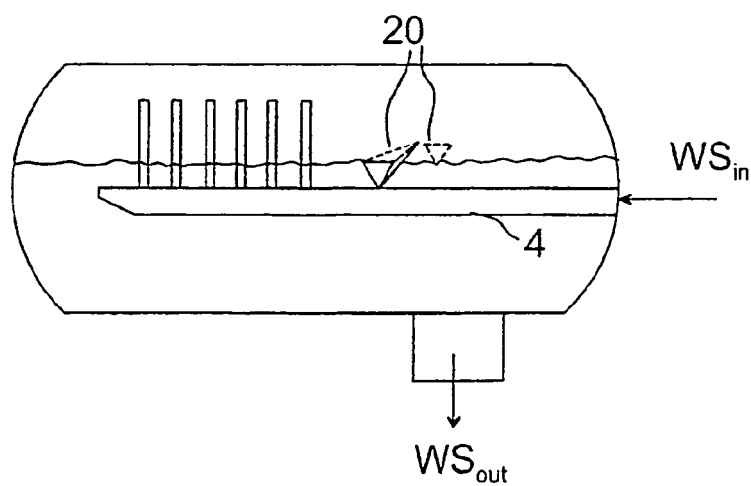


Fig. 6a

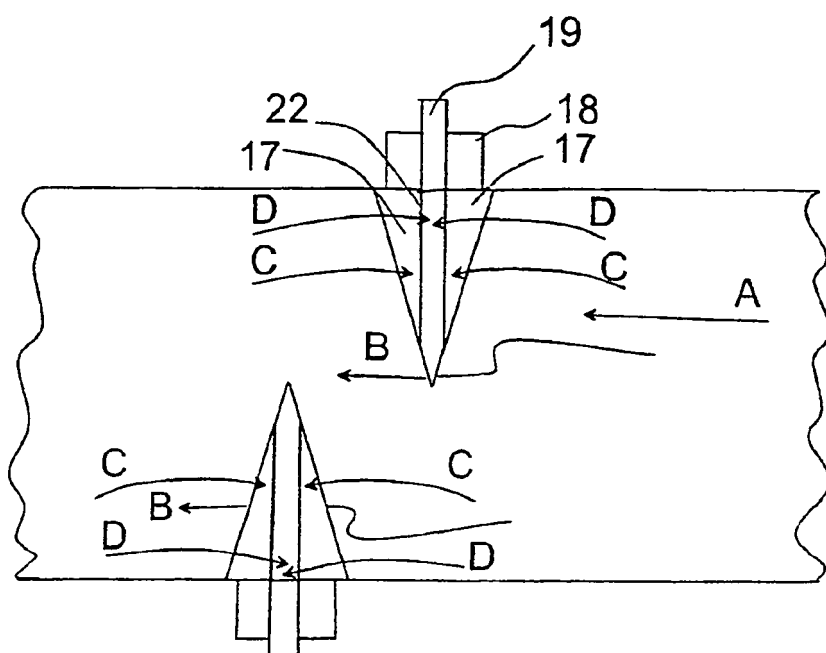


Fig. 6b

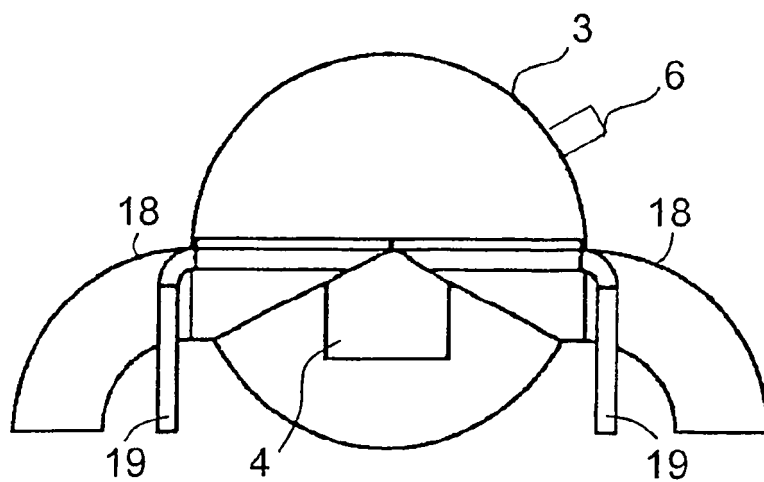


Fig. 6c

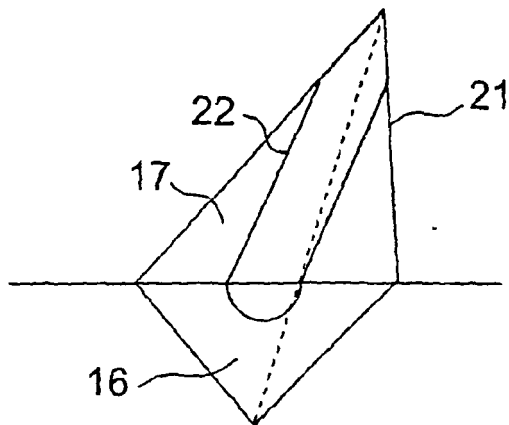


Fig. 6d

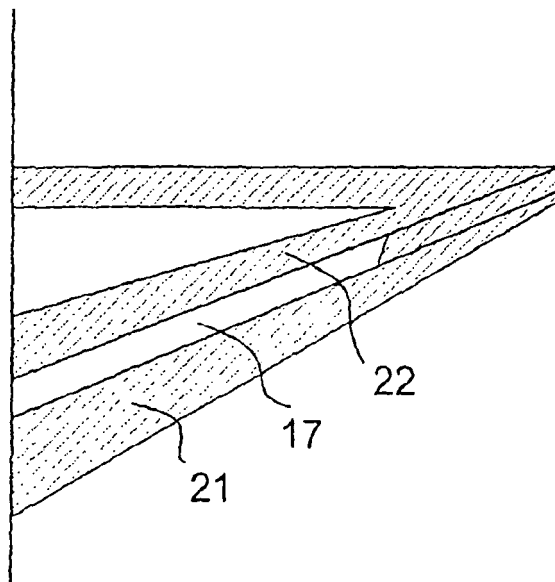


Fig. 6e

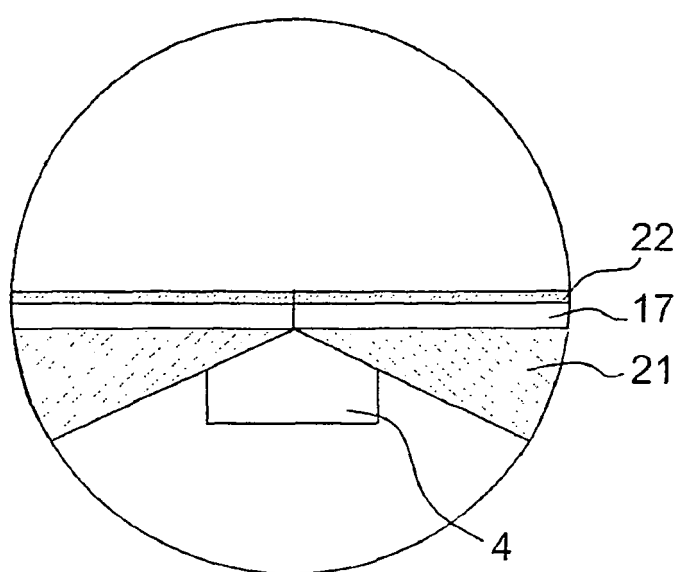


Fig. 6f

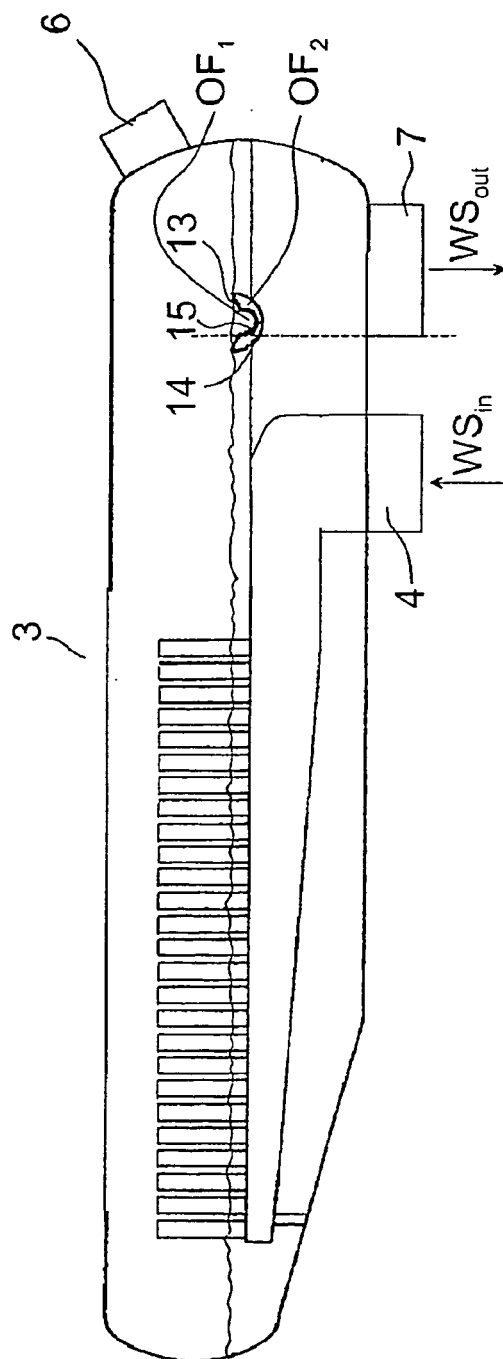


Fig. 7a

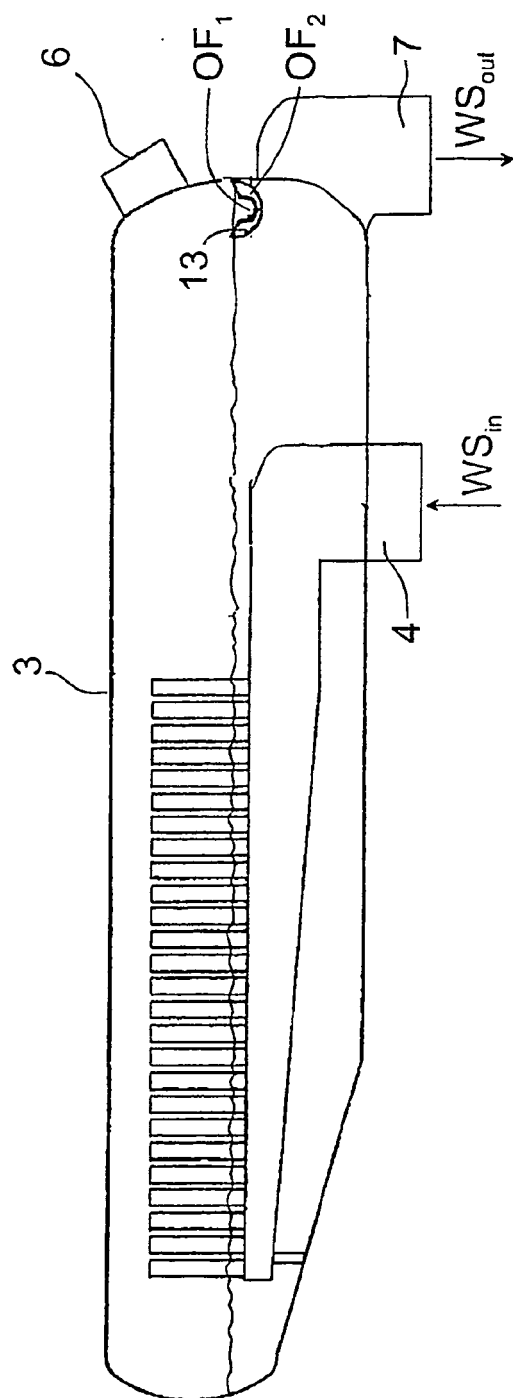


Fig. 7b

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- FI 63613 [0003]
- US 4419109 A [0003]
- US 5308384 A [0003]
- FI 100950 [0004]
- EP 958433 A [0004]
- US 6491744 B [0006]
- US 5084161 A [0008]