

DECANTER CENTRIFUGE

The invention relates to a decanter centrifuge comprising a scroll conveyor rotatable around a preferably horizontal axis of rotation mounted substantially concentrically within a rotating bowl, the hub including an inside surface and an outside surface, at least one passageway between the inside surface and the outside surface of the scroll conveyor and a feed pipe in the center of the scroll hub. The invention also relates to a feed chamber for a decanter centrifuge.

Such systems are known e.g. from US 5,403,486. Here a number of extensions form a multispray nozzle. This patent presents a rotating wash feed compartment to improve cake washing and an acceleration system of the feed by using U-shaped channels extending from the inside to the outside surface of a conveyor hub. The U-shaped channel communicates with an inwardly extending L-shaped baffle which opposes the Coriolis force. This design creates sudden feed acceleration by breaking particles or flocs and product accumulation behind baffles by reducing its effect quickly. The U-shaped channels extending to the outside of the conveyor has disadvantages in that the feed slurry is discharged in the pool in the form of concentrated jets which results in a remixing of already separated solids. As these channels are not filled full with liquid the air circulation is not well controlled because these kind of channels work as a fan by putting air under pressure. These systems are very complex and also tend to clog when a more sticky suspension is fed in. US 2014/0005024 discloses a new feed chamber provided with a proximal cross wall, distal cross wall and wear resistance members which are extend on the all inner surface of the feed chamber. US 3,568,920 presents a dismountable insert concerning a feed chamber for wear resistance. The raw materials are fed into the machine through a rotating feed pipe in a bushing feed chamber. The scroll is provided with an inner rotor fixed with bolts on the outside of scroll conveyor. It is possible to disassembly the inner rotor in order to change the bushing inserts. This scroll is complex to manufacture, the rotating feed pipe is difficult to seal and the nozzles of the feed chamber are not extended inside and outside of the feed chamber.

DE 40 41 868 shows a centrifuge with an insert for all the inside surface of the feed chamber made in one part for wear resistance. This cannot be replaced and this after this insert is worn the whole centrifuge scroll has to be dismantled and refurbished.

US 5,380,266 shows a feed accelerator system with vanes inside a conical feed chamber is presented. This system improves the efficiency of the feed chamber by accelerating the product inside the feed chamber at the rotational speed of the scroll before to discharge in the pool of the centrifuge. Another accelerating system inside the feed chamber is presented in the patent US 5,401,423.

A traditional decanter is running at high speed and the feeding of the machine is operating at zero rotational speed of the product. One of the difficulties is to bring the feed at the bowl speed with high efficiency, low shear rate (smooth acceleration to avoid breaking of particles or flocs) and without having important wear. During operation of a centrifuge wear may occur inside of the feed chamber and at the discharge ports. It is often necessary to carry out a cut of the scroll, a new welding and new balancing. Standard feed chambers are made for high hydraulic efficiency or wear protection or easy maintenance but not all these futures in the same time.

To avoid the disadvantages of the state of the art the invention is characterized in a number of nozzles provided extending from the inside of the scroll hub to the outside whereby on the inside surface of the scroll conveyor and between the nozzles around the circumference there are provided accelerator inserts. These inserts ensure a good and gradual acceleration of feed into the inlet nozzles and in addition provide an effective protection of the feed chamber wall. This arrangement with nozzles and accelerator inserts offers the possibility to effect repairs of the scroll directly on site in a short time. The invention presents a new feed chamber for the scroll with high efficiency, smooth product acceleration, wear protection and easy maintenance. With such system it can be ensured that the wear is distributed over all inlet nozzles even.

An advantageous embodiment of the invention is characterized by the nozzles fixed on the hub of the scroll conveyor with bolts. So they may be easily dismantled and also exchanged if necessary, e.g. when they are worn.

According to the invention the accelerator inserts may have a wave shaped form, may be made from polyurethane or may have a smooth surface.

The invention is now described with reference to the accompanied drawings, where
Fig. 1 shows a decanter centrifuge according to the invention,

Fig. 2 shows a detail of Fig. 1 with the feed chamber according to the invention,

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

5 Fig. 4 shows an alternative embodiment of the invention analogue to Fig. 3 and

Fig. 5 shows an accelerator insert according to the invention.

Fig. 1 shows a decanter centrifuge according to the invention with a bowl 1 with a
high rotational speed for optimum phase separation, a scroll 2 for sludge conveyance
10 and compacting, an axial feed 3, a feed chamber 4, mixture outlet 5, an outlet 6 for
clear liquid phase and an outlet 7 for the recovery of the solid phase.

Fig. 2 shows a detail of the decanter centrifuge according to the invention. A number
of accelerator inserts 16 is arranged inside the feed chamber 4 between nozzles 10,
end wall 12 and accelerating cone 13, which is connected to the axial feed 3 and to
15 an opening of the circular feed chamber 4. This results in a new feed chamber 4 for
the scroll 2 with high efficiency, smooth product acceleration, wear protection and
easy maintenance.

The cross section of the nozzles 10 can be rectangular, oval or round or have any
other shape. The outside extension of the nozzles is made up to pond level 9 in order
20 to avoid discharge of the product in the pool 9a as a splash and to avoid air flow
through the nozzles 10. This will avoid product re-suspension in the pool 9a in the
region of the feed chamber 4 and air under pressure inside the machine, especially
for the decanter centrifuges operating at high pond level (close to the scroll hub or
submerged scroll conditions). The inner surface 11 of the nozzles 10 is protected
25 with ceramics, tungsten carbide or any other wear resistant protection. The fixation of
the nozzles is made with bolts 17, on the hub 8 of the scroll 2. The accelerator
inserts 16 are made in polyurethane, stainless steel with wear resistant protection on
inner surface or any wear resistant material. The sizes of these accelerator inserts 16
are such that it is possible to install them through the opening of scroll 2 before

mounting the nozzles 10. The fixation of such accelerator inserts 16 is made in circumferential direction by the extension inside of two consecutive nozzles 10 inside the feed chamber 4 and axially by end wall 12 and fixation ring 15. This arrangement with nozzles 10 and accelerator inserts 16 offers the possibility to effect repairs of the scroll 2 directly on site in a short time.

The inside extension of the nozzles 10 is made up to the level of the accelerator inserts 16 in order to avoid high shear or stagnation flows inside the feed chamber 4.

Fig. 3 shows a cross section along line III-III in Fig. 2 through a feed chamber according to the invention. In this feed chamber there are arranged a number of accelerator inserts 16 which are held in place by the extensions of the nozzles 10 into the feed chamber. On the outside of the feed chamber the nozzles are fixed with bolts 17 to allow an easy and quick mounting and releasing for maintenance without dismantling the whole scroll 2. In the embodiment of Fig. 3 the nozzles 10 and accelerator inserts 16 are arranged symmetrically.

Fig. 4 shows another arrangement of accelerator inserts 16. Here the inserts have a non-symmetrical smooth surface. They are still arranged and fixed between the nozzles 10. To allow this, the nozzles 10 have a form where they extend into the feed chamber at different lengths corresponding to the accelerator inserts. This can be achieved more easily with a cross section of the nozzle 10 which is rectangular.

Fig. 5 shows a detailed shape of an accelerator insert 16, where a progressive smooth surface 22 of a smooth vane 22a is made in order to avoid high shear of the product. The surface 19 is in contact with the fixation ring 15 and the surface 20 is in contact with the inner extension of the nozzles. Further the surface 21 is in contact with end wall 12 of the feed chamber 4.

The invention is not limited to the embodiments of the drawings but seen in the scope of the claims. Especially the form of the accelerator inserts can be different from the ones shown and the material of the accelerator inserts and nozzles can be different from the ones presented.

Claims

1. A decanter centrifuge comprising a scroll conveyor rotatable around a preferably horizontal axis of rotation mounted substantially concentrically within a rotating bowl (1), the scroll conveyor (2) comprising a hub (8) and at least one helical winding, the hub (8) including an inside surface and an outside surface, at least one passageway between the inside surface and the outside surface of the scroll conveyor and a feed pipe (3) in the center of the scroll hub (8), characterized in a number of nozzles (10) provided extending from the inside of the feed chamber (4) to the outside and wherein on the inside surface of the scroll hub (8) and between the nozzles (10) around the circumference there are provided accelerator inserts (16).
2. A decanter centrifuge according to claim 1, wherein the nozzles (10) are fixed on the hub (8) of the scroll conveyor with bolts (17).
3. A decanter centrifuge according to any of claims 1 to 2, wherein the nozzles (10) are exchangeable.
4. A decanter centrifuge according to claim 1, wherein the accelerator inserts (16) are exchangeable.
5. A decanter centrifuge according to claim 1, wherein the accelerator inserts (16) have a wave shaped form or other smoothed surface.
6. A decanter centrifuge according to claim 1, wherein the accelerator inserts (16) are made from polyurethane, stainless steel with wear resistant protection on inner surface or any wear resistant material.
7. A feed chamber for a decanter centrifuge comprising a scroll conveyor rotatable around a preferably horizontal axis of rotation mounted substantially concentrically within a rotating bowl (1), the scroll conveyor comprising a hub (8) and at least one helical winding, the hub (8) including an inside surface and an outside surface, at least one passageway between the inside surface and the outside surface of the scroll conveyor, a feed pipe (3) in the center of the scroll hub (8), characterized in a number of nozzles (10) provided extending from the inside of the feed chamber (4) to the outside wherein on the inside surface of the scroll hub (8) and between the nozzles (10) around the circumference there are provided accelerator inserts (16).

8. A feed chamber according to claim 7, wherein the nozzles (10) are fixed on the hub (8) of the scroll conveyor with bolts (17).
9. A feed chamber according to any of claims 7 to 8, wherein the nozzles (10) are exchangeable.
- 5 10. A feed chamber according to claim 7, wherein the accelerator inserts (16) are exchangeable.
11. A feed chamber according to claim 7, wherein the accelerator inserts (16) have a wave shaped form or other smoothed surface.
- 10 12. A feed chamber according to claim 7, wherein the accelerator inserts (16) are made from polyurethane, stainless steel with wear resistant protection on inner surface or any wear resistant material.