

A DEFLECTING SEPARATOR WITH A DISPLACEMENT MEMBER

The invention relates to a deflecting separator in particular, but not exclusively, for separating unwanted matter from pneumatically conveyed bulk or granular material such as grain.

Previously proposed deflecting separators of this kind are particularly suited for removing dusty particles and impurities from granulated loose material. After passage through the separator, the residual dust content can be 30 ppm or less.

A large part of the dust which is separated in the separator will have occurred as a result of the preceding pneumatic transportation, by parts rubbing off from the granular material. However, with certain loose materials, pneumatic transportation not only causes dust-like abrasion, but also gives rise to so-called "angel's hair", which are thread-like or film-like additions. It is true that this "angel's hair" has a considerably slower sinking rate than the granular material owing to its large surface area in relation to its mass. Therefore, in theory it ought to have a good separating capacity when subjected to separating techniques. However, in actual fact this is not the case. The reason for the relatively bad separation rate compared to dust is presumably the large surface area of the "angel's hair", which, at least if a thread of this kind in the separation zone forms a certain angle with the direction of flow, makes it very probable that the thread will be met by subsequent grains from the granular material, and be entrained downwards.

According to the invention, there is provided a deflecting separator comprising a first, fixed pipe section, through which loose material to be separated can be passed generally vertically downwardly, the first pipe section enclosing generally concentrically a displacement member with a conical tip at its upper end which forms a first annular space with the first pipe section;

a plurality of evenly distributed longitudinally extending ribs on the periphery of the displacement member to give the displacement member a star-shaped profile in cross-section, the ribs having a height in the radial extent which is approximately equal to half the internal width of the first annular space and the end faces of the ribs which face the flow of entering loose material being sloped in the direction

of flow;

a second pipe section which encloses the lower end of the first pipe section and forms a second annular space with the first pipe section, the second pipe section extending beyond the bottom end of the first pipe section to the upper end of a container provided to receive separated heavier loose material and having an intake opening for a separating gas which passes through the second annular space entraining lightweight particles of the loose material and discharges through a discharge opening provided in the region of the upper end of the second pipe section.

In such a deflecting separator firstly, "angel's hair" which is disposed in the flow between the ribs forming the star-shaped profile of the displacement member is directed for the most part at least, parallel to the direction of flow, and thus presents to the following grains of the granular material only a small working surface. Secondly, the ret of the "angel's hair" in the flow is displaced into the peripheral region of the first annular space, so that the path which is to be covered in the radial extent up to the second annular space is considerably shortened and accordingly the probability of the "angel's hair" being met on this path by subsequent grains is greatly reduced.

Conveniently, the base lines of the ribs are at a spacing on the periphery of the displacement member which is approximately equal to the difference between the radii of the first pipe section and the displacement member.

It is preferable that the ribs are in length approximately between 10 and 15 times the difference between the radii of the first pipe section and the displacement member, and extend approximately as far as the lower orifice of the first annular space.

In a preferred embodiment, the internal clearance which remains between the free front edges of the ribs and the inner wall of the first pipe section is approximately between 3 and 4 times the maximum grain diameter of the loose material which is to be separated.

In a particularly preferred embodiment, the end faces of the ribs, facing the entering flow of loose material, slope parallel to the conical tip of the displacement member.

The invention is diagrammatically illustrated by way of example

in the accompanying drawings, wherein:

Figure 1 is a perspective view, partly broken away, of a deflecting separator according to the invention; and

Figure 2 shows a part of the deflecting separators of Figure 1,
5 on a larger scale, likewise in perspective.

Pneumatically conveyed loose material passes into the separator shown in Figure 1 via a funnel 1 which makes a transition into a pipe section 2. The pipe section contains a displacement member 3 with a conical tip 3a. The periphery of the displacement member 3 is provided
10 with a plurality of axially extending ribs 4, the front faces 4a of which slope in the direction of flow, parallel to the conical tip 3a of the displacement member 3. The ribs 4 can, for example, be made of welded on strips of sheet metal.

The loose material/air-flow which enters the pipe section 2 at
15 the top thereof increases in speed, as a result of the displacement member 3, in a first annular space 5 which is delimited by the displacement member 3 and by the pipe section 2. The pipe section 2 terminates at its lower end within a second pipe section 6 which concentrically encloses the first pipe section 2, forming a second
20 annular space 7. The second pipe section 6 opens out towards the lid 8a of a container 8. The container 8 is used to accommodate the separated loose material, and it has a connection piece 9 for the supply of separating air. The upwardly flowing separating air has a braking effect on lightweight components of the flow of loose material
25 issuing from the bottom end of the first pipe section 2, and conveys it to a connection piece 10 which is provided close to the upper end of the second pipe section 6 which is closed upwardly by a lid 6a.

The lightweight components removed from the loose material in this way not only include dust, but also so-called "angel's hair" which
30 preferably collects in the region, near the periphery, of the first annular space 5, as a result of the ribs 4 and the sloping front faces 4a thereof. Therefore, the path which has to be covered in the radial extent to the entrance to the second annular space 7 is short compared with the length of the separation zone which starts at the bottom
35 orifice of the pipe section 2. "Angel's hair" which arrives at the channels delimited by the ribs 4 is, on the other hand, directed in the direction of flow, so that the probability of its being met by



subsequent particles of loose material of larger volume, and of its being entrained through the separation zone as far as the container 8, is relatively small.

5 Experiments with ribs 4 which were ca. 30 mm apart in the peripheral extent, and which in height were approximately equal to half the internal width of the first annular space 5, gave an improvement in the rate of separation of "angel's hair", compared with using a state of the art separator, by a factor of 4, with an unchanged high separation degree for dust-like particles of the loose material.

10 Moreover, optimum results are obtained if the arrangement of ribs is as follows:

- the spacing of the ribs in the peripheral extent should not be less than the difference between the radii of the pipe section 2, on the one hand, and of the displacement member 3, on the other hand.
- 15 - the length of the ribs should be approximately 10 to 15 times the difference between the afore-mentioned radii, so that a stable flow (which is as laminar as possible) can be produced.
- the height of the ribs in the radial extent is dependent on the maximum grain diameter of the granular material which is to be separated, and is to be selected in such a way that the internal clearance remaining up to the inner wall of the pipe section 2 is 20 3 to 4 times the grain diameter, so that the grains of the granular material are prevented from blocking this gap.

CLAIMS

1. A deflecting separator comprising a first, fixed pipe section, through which loose material to be separated can be passed generally vertically downwardly, the first pipe section enclosing generally concentrically a displacement member with a conical tip at its upper end which forms a first annular space with the first pipe section;

a plurality of evenly distributed longitudinally extending ribs on the periphery of the displacement member to give the displacement member a star-shaped profile in cross-section, the ribs having a height in the radial extent which is approximately equal to half the internal width of the first annular space and the end faces of the ribs which face the flow of entering loose material being sloped in the direction of flow;

a second pipe section which encloses the lower end of the first pipe section and forms a second annular space with the first pipe section, the second pipe section extending beyond the bottom end of the first pipe section to the upper end of a container provided to receive separated heavier loose material and having an intake opening for a separating gas which passes through the second annular space entraining lightweight particles of the loose material and discharges through a discharge opening provided in the region of the upper end of the second pipe section.

2. A deflecting separator according to claim 1, wherein the base lines of the ribs are at a spacing on the periphery of the displacement member which is approximately equal to the difference between the radii of the first pipe section and the displacement member.

3. A deflecting separator according to claim 1 or claim 2, wherein the ribs are in length approximately between 10 and 15 times the difference between the radii of the first pipe section and the displacement member, and extend approximately as far as the lower orifice of the first annular space.

4. A deflecting separator according to any one of the preceding claims, wherein the internal clearance which remains between the free



front edges of the ribs and the inner wall of the first pipe section is chosen to be approximately between 3 and 4 times the maximum grain diameter of the loose material which is to be separated.

- 5 5. A deflecting separator according to any one of the preceding claims, wherein the end faces of the ribs, facing the entering flow of loose material, slope parallel to the conical tip of the displacement member.
- 10 6. A deflecting separator substantially as hereinbefore described and illustrated with reference to the accompanying drawings.
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