

ROTARY BULK MATERIAL FEEDER

The invention relates to a rotary bulk material feeder having a housing in the cylindrical interior of which a cellular rotor with lateral disc members is rotatably mounted with a sealing arrangement provided between each of the lateral disc members and the housing.

A sealing arrangement between each lateral disc member of a rotor and the respective end cover portion of the housing is known which comprises a slip ring which resiliently presses from the cover side against the face of the respective lateral disc member which faces the cover. However, the slip ring is subject to unavoidable wear and tear which increases as the slip ring becomes pressed more heavily onto the end surface of the side plate. The necessary contact pressure has to be greater in proportion to the difference in pressure between the intake and outlet side of the feeder. Furthermore, it is difficult to make a long sealing gap, as viewed in the direction of flow, with a slip ring of this kind, which would be desirable since the sealing effect improves with the length (and narrowness) of the sealing gap. However, if the slip ring is widened accordingly, there is the risk that wear will become uneven as the width of the slip ring increases.

Patent Specification DE-A-3802924 discloses a rotary bulk material feeder having a housing in a cylindrical interior space of which a cellular rotor with lateral disc members is disposed, each of which disc members is provided on its outer end surface which faces a bearing cover of the housing with a metal ring which lies coaxial to the axis of the cellular rotor and an annular sealing arrangement which surrounds the metal ring and cooperates with an annular region of the outer end surface of the disc. The sealing arrangement is composed of a sealing ring of pliable material, which is affixed to a steel ring and by means of axially oriented adjustment elements which are provided in the bearing covers can be pressed against the machined end surface of the corresponding outer end surface of the disc. This sealing arrangement therefore corresponds to the previously described slip ring principle and thus also has the same disadvantages. The metal ring provided on the outer end surface of each lateral disc member of the cellular rotor does not cooperate together with the sealing arrangement but instead is a component of a labyrinth seal.

Patent Specification GB-A-2213880 discloses a bulk material feeder in which the sealing of the cellular rotor with respect to the housing is not effected by a sealing arrangement between each lateral disc member of the cellular rotor and the respective bearing cover, but instead by a slip ring of plastics material which is mounted to float with axial movement in a peripheral groove in the interior wall of the housing and fits onto a coaxial extended peripheral surface formed by a metal ring which is screwed onto the respective lateral disc.

According to the invention, there is provided a rotary bulk feeder having a housing in the cylindrical interior of which a cellular rotor with lateral disc members is rotatably mounted, each lateral disc member having an annular ring on its axially outer face with the ring coaxial with the axis of the rotor and projecting towards a respective bearing cover of the housing with a sealing arrangement provided between each lateral disc member and the housing and cooperating with an annular portion of the outer end face of the lateral disc member; in which at each end of the rotor each sealing arrangement includes a plastics filling ring which surrounds the external peripheral surface of the ring, the radially outer lateral surface of the filling ring is spaced from an adjacent cylindrical interior surface of the housing by a packed sealing gap and resilient means load the filling ring in both the axial direction and the radial direction.

A long flow path is created by the ring, which is preferably of metal, proposed by this solution and coaxial with the axis of the rotor, on the axial outer end surface of each lateral disc member and facing the adjacent bearing cover. The filling ring is arranged in this flow path, and is stationary opposite the metal ring, but because of a "floating" construction only small radial and axial contact pressure are required which are produced by the resilient mean. The filling ring is therefore free of forces to a large extent, and is thus subject to only slight wear. It is possible to have a very small sealing gap remaining between the outer peripheral surface of the filling ring and the corresponding cylindrical interior surface of the housing, this gap being needed for the filling ring which is a floating arrangement relative to the housing. It is sufficient if the width of the gap is equal to the thermal expansion (thus to the increase in diameter) of the lateral disc members when the highest operational

temperature occurs, plus the usual tolerances for compensating for non-circularity and for the rotor shaft possibly becoming deflected when there is a great difference in pressure between the inlet side and outlet side of the feeder. The sealing effect obtained can be very good because of the narrow sealing gap and the great length of the gap. At the same time, there need be none of the drawbacks of the previous sealing arrangements, namely a high degree of wear, heating up and thus expansion of the rotor lateral disc members merely because of the friction between them and the sealing arrangement, and high expenditure on controls for adjusting the contact force of the sealing arrangement.

The resilient means may comprise a resilient profile ring which projects beyond the surface of the filling ring facing the bearing cover, and is compressed to a small extent on the inner wall of the bearing cover and on the cylindrical interior surface of the housing.

The outer surface of the filling ring preferably has a step therein partly to accommodate the resilient profile ring in form locking manner. The filling ring and the profile ring may be secured together.

Preferably, the filling ring has a continuous slot at one location on its circumference.

Since metal and plastics material have very different heat expansion coefficients, it is advantageous if the circumference of the filling ring is interrupted in one place by a slot. Temperature expansions are therefore accommodated, and pressure concentrations cannot result.

The resilient means may comprise compression springs arranged between the bearing cover and the face of the filling ring facing the bearing cover, and at least one elastomer ring arranged between the cylindrical interior surface of the housing and the radially outer surface of the filling ring, the elastomer ring bearing on the filling ring in the radial direction. The elastomer ring is preferably partly accommodated in a peripheral groove in the filling ring.

The invention is diagrammatically illustrated by way of example in the accompanying drawings, in which:

Figure 1 shows a longitudinal section of a rotary bulk material feeder according to the invention;

Figure 2 shows the region II in Figure 1, on a larger scale,

showing a first embodiment of a sealing arrangement;

Figure 3 shows the region III in Figure 1, on a larger scale, showing a second embodiment of a sealing arrangement; and

Figure 4 shows the region IV in Figure 1, on a larger scale, showing a third embodiment of a sealing arrangement.

5 A conventionally designed rotary bulk material feeder comprises a housing 1, which has an intake 1a for loose bulk material at the top and an outlet 1b for loose bulk material at the bottom. There can be a difference in pressure in the range of a few bar (hectopascal), for example, between the intake and outlet sides. A cellular rotor is arranged in a cylindrical bore in the housing 1 and comprises a shaft 10 2, a plurality (e.g. 12) of radial vanes 3 and lateral disc members 4a and 4b. The shaft 2 is mounted in lateral housings 5a and 5b of the housing 1. Between each housing 5a or 5b and the respective lateral disc member 4a or 4b there is a sealing arrangement to prevent leakage 15 from the intake side to the outlet side (or vice versa) of the feeder, and a description will now be given of various embodiments of sealing arrangement, with reference to Figures 2 to 4.

The sealing arrangement shown in Figure 2 comprises a metal ring 20 6a, coaxial with the axis of the cellular rotor, which is welded onto the lateral disc member 4a and which ends at a slight spacing from the respective lateral housing 5a. Sitting loosely on the metal ring is a filling ring 7a made of a plastics material. When the cellular rotor is at a standstill, there is no difference in pressure between the intake and outlet sides thereof and, at ambient temperature, a small 25 sealing gap s remains between the outer peripheral surface of the filling ring 7a and a cylindrical inner surface 1c of the housing 1. On the end surface of the filling ring 7a facing the lateral housing 5a there is a step in the diameter, thus giving an approximately L-shaped 30 profile to the filling ring 7a. The step in the diameter is filled in by a profile ring 8a which has a rectangular cross-section and which is made of elastomer material, e.g. foam rubber. The resilient profile ring 8a is of a size such that it projects beyond the filling ring 7a both in the radial extent (in the direction of the inner surface 1c of 35 the housing 1) and also in the axial extent (in the direction of the lateral housing 5a), and the projecting portions thereof bear in a slightly compressed state firstly against the inner surface 1c of the

housing 1, and secondly against the inner wall of the lateral housing 5a. The forces exerted thereby on the filling ring 7a both in the radial and axial direction hold the filling ring 7a lightly on the outer peripheral surface of the metal ring 6a, on the one hand, and on the axially outer surface of the lateral disc member 4a, on the other hand. Although the entrainment forces produced therein by rotation of the cellular rotor, and exerted in a circumferential direction on the stationary filling ring 7a, are still small, it can be expedient for the filling ring 7a to be fitted with a device to guard against twisting, e.g. in the form of a peg (not shown) which is engaged in the lateral housing 5a and which extends into the filling ring 7a. In addition, it is to be recommended that the filling ring 7a be provided at one place on its circumference with a continuous slot, as indicated at 9a in Figure 1. In practice, the filling rings will be designed, however, so that the respective slots come to rest in a position in which they are rotated through 90° with respect to the illustration, because otherwise (in the outlet region in the embodiment shown in Figure 1) extra, undesirable gaps would occur.

The filling ring 7a and the elastomer ring 8a can be stuck together at least over a region thereof, so as to form together one integrated structural part.

If it is desired to have as little wear as possible on the filling ring 7a, then axial contact pressure of the filling ring 7a on the outer end surface of the lateral disc member 4a can be abandoned, but the sealing effect suffers somewhat. Since, in this case, the elastomer ring 8a does not need to extend beyond the filling ring 7 in the axial direction (or at least does not have to be fitted in a compressed state axially in that direction), the profile ring 8a can instead be arranged between the housing surface 1c and the filling ring 7a (as shown in Figure 2), thus between the filling ring 7a and the outer surface of the metal ring 6a (not shown).

A basic feature of the sealing arrangement according to Figure 2, and also in those shown in Figures 3 and 4, described hereinafter, is the "floating" arrangement of the filling ring 7a in relation to the housing 1 and the corresponding cover, the filling ring thus permitting thermal expansion of the lateral disc members 4a and 4b, deflection of the shaft 2 as a result of a high difference in pressure between the

intake and outlet sides of the housing and other influences acting in a similar way, without any additional (compulsive) forces arising thereby, promoting wear and tear. Instead, the gap s simply increases or decreases accordingly.

5 The second embodiment of the sealing arrangement shown in Figure 3 differs from that of Figure 2 merely in that the profile ring 8a is replaced by other spring means. These comprise firstly compression springs 8h arranged between the lateral housing 5h and the end of a filling ring 7h facing the lateral housing, and secondly two elastomer rings 8g which are accommodated with a part of their cross-section in parallel peripheral grooves in the outer surface of the filling ring 7a, and moreover reset against the inner surface 1c of the housing 1 with slight radial compression, so that the sealing gap s is interrupted by the elastomer rings. The elastomer rings 8g accordingly push the filling ring 7a against the outer peripheral surface of the metal ring 6h. The plastics material of the elastomer rings 8g is also resilient and resists wear very well, so that it is possible for the device provided to guard against twisting, mentioned in connection with Figure 2, to be omitted. When the cellular rotor rotates, the filling ring 7h and the elastomer rings 8g move, as the cellular rotor rotates, with varying degrees of slippage in relation to the rotational speed of the cellular rotor.

With the sealing arrangement illustrated in Figure 4, the lateral disc member 4h bears a metal ring 6c which is comparable to the metal rings 6a and 6b, but which is arranged on the outer periphery of the lateral disc member 4h. the sealing gap s remains between the outer surface of the metal ring 6c and the cylindrical inner surface 1c of the housing 1 (as in the embodiments of Figures 2 and 3). The inner periphery of the lateral housing 5h is at a diameter which is greater than the diameter of the cylindrical interior surface 1c of the housing 1. In this way, an annular surface 1d is created in a radial plane, against which a filling ring 7c rests, which is here illustrated as having two portions. In addition to the aspects of the filling rings 7a to 7h shown in Figures 2 and 3 respectively, of importance in the present embodiment is that the filling ring 7c comprises an elastically or plastically deformable sealing material. Particularly suitable materials have been shown to be sealing materials used as stuffing box

packing material. The filling ring 7c is acted upon in the axial direction by a metal profile ring 8e, onto the back of which compression springs 8d press and which also bear against the lateral housing 5h, provided for this purpose with receiving bores. The metal profile ring 8e does not, however, push onto the filling ring 7c in the axial extent only, but encloses it over the greatest part of its outer circumference. For this purpose, the metal profile ring 8e has on the inside thereof a step in the diameter, in which step the filling ring 7c is received in form-locking manner. Therefore, under the axial pressure of the metal profile ring 8e, the filling ring 7c is able to become deformed almost exclusively only in the direction towards the metal ring 6c. Depending on the sealing material selected, this deformation can be elastic or plastic. As a result of the deformation, the gap s is reduced at this location. Since the metal profile ring 8e and the filling ring 7c form a floating sealing arrangement, it is capable of following the unavoidable radial displacements of the metal ring 6c which are a result of the causes outlined, so that undesirable, high friction forces between the inner peripheral surface of the filling ring 7c and the outer surface of the metal ring 6c are avoided.



CLAIMS

1. A rotary bulk feeder having a housing in the cylindrical interior of which a cellular rotor with lateral disc members is rotatably mounted, each lateral disc member having an annular ring on its axially
5 outer face with the ring coaxial with the axis of the rotor and projecting towards a respective bearing cover of the housing with a sealing arrangement provided between each lateral disc member and the housing and cooperating with an annular portion of the outer end face of the lateral disc member; in which at each end of the rotor each
10 sealing arrangement includes a plastics filling ring which surrounds the external peripheral surface of the ring, the radially outer lateral surface of the filling ring is spaced from an adjacent cylindrical interior surface of the housing by a packed sealing gap and resilient means load the filling ring in both the axial direction and the radial
15 direction.
2. A rotary bulk feeder according to claim 1, wherein the coaxial ring is formed of metal.
- 20 3. A rotary bulk feeder according to claim 1 or claim 2, wherein the resilient means comprises a resilient profile ring which projects beyond the surface of the filling ring facing the bearing cover, and is compressed to a small extent on the inner wall of the bearing cover and on the cylindrical interior surface of the housing.
- 25 4. A rotary bulk feeder according to claim 3, wherein the outer surface of the filling ring has a step therein partly to accommodate the resilient profile ring in form-locking manner.
- 30 5. A rotary bulk feeder according to claim 3 or claim 4, wherein the resilient profile ring is an elastomer ring and the filling ring and the elastomer ring are secured together.
- 35 6. A rotary bulk feeder according to any one of claims 3 to 5, wherein the filling ring has a continuous slot at one location on its circumference.



7. A rotary bulk feeder according to claim 1 or claim 2, wherein the resilient means comprises compression springs arranged between the bearing cover and the face of the filling ring facing the bearing cover, and at least one elastomer ring arranged between the cylindrical interior surface of the housing and the radially outer surface of the filling ring, the elastomer ring bearing on the filling ring in the radial direction.
8. A rotary bulk feeder according to claim 7, wherein the elastomer ring is partly accommodated in a peripheral groove in the filling ring.
9. A rotary bulk feeder substantially as hereinbefore described and illustrated with reference to the accompanying drawings.