

A DETACHABLE ROTARY VALVE AND A FEEDING DEVICE

Technical Field

[0001] Embodiments of the present application relate to the technical field of dairy, food and pharmaceutical, in particular to a detachable rotary valve with special rotor support as a feeding device.

Background of the Invention

[0002] In dairy, food, pharmaceutical and other industries, various materials need to be fed or conveyed using pneumatic conveying system in the production process. Usually, a rotary valve with slide rails is used on the factory production line to replace manual work to transfer the materials from bottom of silos, cyclones, dust collectors, weigh hoppers etc. During this process, the valve needs to be opened or closed frequently for cleaning after every batch depending on the hygiene level in demand.

[0003] Most rotary valves due to their improper design especially the bigger sizes like 300mm and above, frequent opening and closing of the valve will cause scratches on the internal bore. Once scratches are formed, there is a risk of disqualification in the inspection process of the rotary valve and the valves are no longer within USDA and EHEDG Specifications. In addition, without proper support, during the cleaning process, when the rotor is pulled out from the non-drive side, it will tilt downward at the far end, resulting in scoring marks on the housing damaging it. This phenomenon is unacceptable in the food, dairy or pharmaceutical industry.

Summary of the Invention

[0004] It is necessary to provide a detachable rotary valve with special rotor support to solve the problem of bore damage in the rotary valve in the existing technology.

[0005] In order to solve the above technical problems, an embodiment according to the application, discloses a detachable rotary valve. The detachable rotary valve includes a housing; a non-drive side cover being in detachable connection with the housing; a drive side cover fixed on the drive side of the housing; a rotor assembly accommodated in the housing for transferring product; wherein a special support for supporting the rotor assembly is arranged on the non-

drive side cover, such that a downward tilt of the rotor assembly, when it is pulled out along with the diagonal slide rails on non-drive side with the non- drive side cover, is minimized to avoid rotor tip rubbing the housing..

[0006] In this embodiment, the rotor assembly is tapered shape and the housing has a corresponding tapered hole for accommodating the rotor assembly, such that the rotor assembly does not touch the tapered hole when the rotor assembly is pulled out from the housing.

[0007] In this embodiment, the diameter on non-drive side of the rotor assembly is bigger than the diameter on the drive side of the rotor assembly.

[0008] In this embodiment, the rotor support includes a set of bearings and shaft seals; wherein the bearings and the shaft seals are arranged along the axis of rotation of the rotor assembly.

[0009] In this embodiment, the non-drive side cover includes a first space for containing the bearings and a second space for containing the shaft seals.

[0010] In this embodiment, a pair of bearings are contained in the first space for supporting the rotor assembly and a bearing spacer arranged between the pair of bearings.

[0011] In this embodiment, the rotor assembly includes rotor shaft and a set of blades; wherein the rotor shaft is in detachable connection with the non-drive side cover.

[0012] In this embodiment, the detachable rotary valve further includes a tee bolt configured to lock the rotor shaft with the non- drive side end cover.

[0013] In this embodiment, the non- drive side cover and the drive side end cover are fixed on the housing by a set of fixing bolts.

[0014] At least one advantage of the detachable rotary valve according to the application is that the wider rotor support can provide a stronger support to avoid the downward tilt of the rotor assembly and the rotor and hole designed in taper structure can help to prevent the rotor from touching the hole, when the rotor assembly is pulled out along with diagonal slide rails on non- drive side with the non- drive side cover.

Brief Description of the Drawings

[0015] In order to describe the specific embodiments of the present application or the technical

solutions in the prior art more clearly, the accompanying drawings required for describing the specific embodiments or the prior art will be briefly introduced below. In all the accompanying drawings, similar elements or parts are generally marked with similar numerals. In the accompanying drawings, all the elements or parts are not necessarily drawn according to an actual proportion.

[0016] Fig. 1 is a schematic diagram of a rotor support with diagonal slide rails detachable rotary valve according to the embodiment of the application, showing the front view of the rotor support with diagonal slide rails of detachable rotary valve;

[0017] Fig. 2 is a schematic diagram of a rotor support with diagonal slide rails detachable rotary valve according to the embodiment of the application, showing a top view of the rotor support with diagonal slide rails detachable rotary valve;

[0018] Fig. 3 is a schematic diagram of the housing.

[0019] Fig. 4 is a schematic diagram of special support on non-drive side, which is used to support the rotor assembly.

[0020] Fig. 5 is a schematic diagram of the non-drive side cover, tee bolt and the special support on the non-drive side.

[0021] Fig. 6 is a schematic diagram of the rotor assembly.

[0022] Fig. 7 is a schematic diagram of the complete assembly of valve with non- drive side end cover with rotor in withdrawn condition.

[0023] Fig. 8 is a schematic diagram of complete assembly in the withdrawn condition without rotor.

[0024] Fig. 9 is a schematic diagram of the discharge process of the product.

[0025] Description of reference marks:

[0026] 10. Diagonal slide rails; 20. Non–drive side cover; 21. Bearings; 2011. The pairs of bearings set; 2012. Bearing spacer; 2013. Dummy Shaft on non-drive side; 22. shaft seals; 30. Housing; 31. Tapered hole; 40. Drive side cover; 50. Tee bolt; 60. End cover bolts; 70. Motor with gearbox assembly; 80. Rotor assembly; 801. rotor shaft; 8011. Non–drive side of the rotor shaft; 8012. Drive side of the rotor shaft; 802. Rotor blades.

Detailed Description of the Embodiments

[0027] For facilitating understanding the present disclosure, the present disclosure will be described below in more detail with reference to the accompanying drawings and the specific embodiments. It needs to be noted that when one element is stated as “fixed to” another element, the element may be directly located on another element, or one or more centered elements may exist therebetween. When one element is stated as “connected to” another element, the element may be directly connected to another element, or one or more centered elements may exist therebetween. Terms “vertical”, “horizontal”, “left”, “right” and similar expressions used in the present description are merely for the purpose of description.

[0028] Unless defined otherwise, all technical and scientific terms used in the present description have the same meaning as commonly understood by the ordinary skill in the art to which this technology belongs. In the present description, the terms used in the description of the present application are merely for the purpose of describing specific embodiments, rather than to limit the present application. The term “and/or” used in the present description includes any or all of combinations of one or more listed relevant items.

[0029] As shown in FIG. 1 and FIG. 2, the detachable rotary valve according to an embodiment of the present application includes: a diagonal slide rail (10), non-drive side cover 20, housing 30, drive side cover 40, tee bolt assembly 50, fixing bolts 60 motor with gearbox assembly 70 and rotor assembly 80.

[0030] The non–drive side cover 20 and the drive side cover 40 are on either side of the housing 30 and respectively detachable and fixable by the fixing bolts 60. The housing 30 is hollow and it is provided to accommodate the rotor assembly 80. Specifically, as shown in FIG.3, the hole for accommodating the rotor assembly 80 is labeled as 31.

[0031] The tee bolt 50 is configured to lock the rotor assembly 80 with the non-drive side cover 20. As shown in FIG.7 and 8, the non-drive side cover 20 can be pulled out with or without the rotor assembly 80, such that the inner surface of the non- drive side cover 20 can be easy for cleaning.

[0032] Since the rotor assembly 80 is resting on bearings on either side, it is straight and parallel to the ground in the assembled condition. When the rotor assembly 80 and non-drive side cover 20 are together pulled out of the housing 30 after undoing the fixing bolts 60, the rotor assembly 80 would by nature tilt downwards on the unsupported end. Because of this, the

bottom portion of the rotor would rest on the housing 30 resulting in scoring marks. This is not good for the rotary valve when it is used in product transfer, especial in food, dairy and pharmaceutical industries.

[0033] In this application, we have avoided or rather minimized the tilt to the extent with special support on non- drive side cover and providing the tapered rotor and tapered hole.

[0034] As shown in FIG. 4, the special support is described in detail. The special rotor support includes a plurality of bearings 21 and shaft seals 22. Correspondingly, the non-drive side cover 20 is provided with a first space and a second space.

[0035] The bearings 21 and the shaft seals 22 are respectively contained in the first space and the second space and arranged along the axis of rotation of the rotor assembly 80. The distance between the bearings 21 and the shaft seals 22 can be set according to the actual need.

[0036] Accordingly, the special rotor support consisted by the bearings and the shaft seals is wider than traditional support and the wider support can provide stronger support force to prevent or minimize the downward tilt of the rotor assembly in pulled out condition, in order to avoid rotor tip rubbing the housing.

[0037] Specifically, as shown in FIG. 5, a pair of bearings 2011 are mounted in the first space for supporting the rotor assembly and a bearing spacer 2012 arranged between the pair of bearings 2011. The non–drive side cover 20 sits on the housing 30 with spigot location to have concentricity to the housing bore in the assembled condition. The dummy shaft 2013 assembles in the bearings 2011, such that the rotor blades 802 can be rotated in the pulled-out condition.

[0038] As shown in FIG. 6, the rotor assembly 80 is described in detail. The rotor assembly 80 includes rotor shaft 801 and a plurality of rotor blades 802.

[0039] The rotating valve blades 802 are in tapered shape, which is also can be called “tapered rotor”. In other words, a diameter on non- drive side of the rotor assembly is bigger than the diameter on the drive side of the rotor assembly. Correspondingly, the hole 31 provide in the housing also is in tapered shape, which is also can be called “tapered hole”. As such, the contact between the rotor assembly 80 and the housing 30 can be avoided.

[0040] The specific number of fixing bolts can be set according to size of rotary valve, which is not specifically limited here. For example, the detachable fixed connection between the non-drive side cover 20 and the housing 30 on one side and drive side cover 40 to housing 30 on

the other side can be realized by 8 detachable bolts 60 or more according to the size evenly arranged along the circumferential direction of the housings.

[0041] As shown in FIG.7 and FIG.8, during the cleaning process, the non-drive side cover 20 and the rotor assembly 80 can be pulled out along with the diagonal slide rails 10 on non-drive side. A pair of slide rails 10 are distributed diagonally to form the diagonal slide rails 10 forming the rigid support for the rotor and end cover and the housing 30 is supporting the diagonal slide rails 10 when the non-drive side cover 20 is pulled out along with the rotor assembly 80.

[0042] The tapered bore housing 30 may has inlet opening to receive the bulk solids like sugar, cocoa powder, dairy powder, etc and outlet opening to discharge out at the bottom. As shown in FIG.9, the rotor assembly 80 transfers the received bulk solids through the inlet of the tapered bore housing 30 into the discharge side by virtue of its rotation. Rotor assembly 80 is rotatably connected to the motor assembly 70.

[0043] As described as above, the diagonal slide rails 10 allows the operator to pull out the rotor assembly 80 from the non-drive side during the cleaning process and the special support with suitable width provides a strong support to minimize the downward tilt of the rotor assembly which is pulled out from the housing. Meanwhile, during the cleaning of the rotor assembly 80, the rotor blades 801 can be rotated because of the special support.

[0044] The above descriptions are not intended to limit the patent scope of the present application, but merely used as embodiments thereof. All equivalent structure or equivalent process transformations made according to the contents of the description and the accompanying drawings in the present application, no matter whether they are directly or indirectly used in other related technical fields, should fall within the patent protection scope of the present application in a similar way.

CLAIMS

1. A detachable rotary valve, characterized by comprising:
a housing (30) with a non-drive side and a drive side;
a non-drive side cover (20) being in detachable connection with the housing (30);
a drive side cover (40) fixed on the drive side of the housing (30);
a rotor assembly (80) accommodated in the housing (30) for product transfer.
wherein a special support for supporting the rotor assembly is arranged on the non-drive side cover (20), such that a downward tilt of the rotor assembly (80) is minimized, when it is pulled out along with diagonal slide rails (10) on non-drive side with the non-drive side cover (20),.
2. The detachable rotary valve according to claim 1, characterized in that the rotor assembly (80) is in tapered shape and the housing (30) has a corresponding tapered hole for accommodating the rotor assembly (80), such that the rotor assembly (80) does not touch the tapered hole when the rotor assembly (80) is pulled out from the housing (30).
3. The detachable rotary valve according to claim 2, characterized in that a diameter on non-drive side of the rotor assembly (80) is bigger than the diameter on the drive side of the rotor assembly (80).
4. The detachable rotary valve according to claim 1, characterized in that the support comprises a plurality of bearings (21) and shaft seals (22);
wherein the bearings (21) and the shaft seals (22) are arranged along the axis of rotation of the rotor assembly (80).
5. The detachable rotary valve according to claim 4, characterized in that the non-drive side cover (20) comprises a first space for containing the bearings (21) and a second space for containing the shaft seals (22).
6. The detachable rotary valve according to claim 5, characterized in that a pair of bearings (2011) are contained in the first space for supporting the rotor assembly (80) and a bearing spacer (2012) arranged between the pair of bearings (2011).
7. The detachable rotary valve according to claim 1, characterized in that the rotor assembly

(80) comprises rotor shaft (801) and a plurality of blades (802);
wherein a non-drive side of the rotor shaft (801) is in detachable connection with the non-drive side cover (20).

8. The detachable rotary valve according to claim 1, characterized in that the detachable rotary valve further comprises a tee bolt (50) configured to lock the rotor assembly (80) with the non-drive side end cover (20).
9. The detachable rotary valve according to claim 7, characterized in that the non-drive side cover (20) and the drive side cover (40) are fixed on the housing (30) by a set of fixing bolts (60).
10. A feeding device, characterized by comprising the detachable rotary valve according to any one of claims 1-9.