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(73) Patenthaver: **KSB SE & Co. KGaA, Johann-Klein-Straße 9, 67227 Frankenthal, Tyskland**

(72) Opfinder: **PENSLER, Thomas, Friedensstrasse 7b, 06179 Teutschenthal, Tyskland**
WIESNER, Hermann, Siedlerstrasse 13, 91275 Auerbach, Tyskland
CHRISTIANS, Tim, Bartolfelder Strasse ,31, 37431 Bad Lauterberg, Tyskland

(74) Fuldmægtig i Danmark: **AWA Denmark A/S, Strandgade 56, 1401 København K, Danmark**

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Description

The invention relates to an arrangement for the shaft sealing of a centrifugal pump unit.

A shaft seal is a seal which seals a centrifugal pump at the feed-through of the rotating pump shaft from the fixed pump casing so that the leakage loss is reduced to a certain degree and any wear of the sealing surfaces becomes as low as possible.

The invention relates to a shaft seal comprising sliding ring-counter ring pairings. Such sliding ring seals have a sealing gap which stands at a right angle to the shaft axis. Shaft seals of this type are also referred to as axial or hydrodynamic sliding ring seals.

The spring-loaded ring of the sliding ring-counter ring pairing is referred to as sliding ring. The sliding ring is axially moveable.

Different arrangements of sliding ring seals are distinguished. In the back to back embodiment, a sealing medium is fed into the space between the two sliding ring seals which in the pressure lies above the pressure level of the delivery medium of the centrifugal pump to be sealed. The sealing pressure well ensures that no pressure leakage enters the atmosphere.

In the case of a tandem seal, the space between the seals is frequently purged by a pressureless quenching liquid.

From EP 2 687 715 A1 an underwater turbine generator is known which comprises two sliding ring units which are positioned in tandem arrangement relative to one another.

DE 100 17 668 A1 discloses an aerodynamic sealing system with contactlessly operating sealing bodies having a tandem arrangement.

In DE 199 28 141 A1, sealing arrangements are described. A version shows sliding ring seals in tandem arrangement.

Double seals are employed among other things in waste water pumps. The pump is sealed through two sliding ring seals which are lubricated with a liquid from a well. Spring elements, which are placed in the dynamic (rotating) part of the sealing arrangement generate the required pressure force between sliding ring and counter ring. Because of the shaft overhang brought about by the structure, instances of high shaft bending occur in dirty water pumps, which with sliding ring seals of a conventional type have a negative effect on the service lives and the sealing. Furthermore, the assembly of the sliding ring seals required with conventional double seals is elaborate. In particular during repair work, sliding surfaces that are exposed cause problems.

The object of the invention is to create an arrangement for the shaft sealing of a centrifugal pump unit which has a high reliability and a long lifespan. In addition, the arrangement is to be characterized by a compact design. In addition, it should ensure a simple assembly and be easily accessible for maintenance operations. Furthermore, the arrangement for the shaft sealing is to be characterized by preferably low production costs.

According to the invention, this object is solved through a double seal module that can be slid into the centrifugal pump and a well arranged in the centrifugal pump unit, wherein the double seal module comprises a first sliding ring-counter ring pairing and a second sliding ring-counter ring pairing, the pairings are positioned in tandem arrangement relative to one another and each pairing is assigned a spring element for generating a pressure force between sliding ring and counter ring, the spring elements are arranged in stationary components and a space between the sliding ring-counter ring pairings is purged with a liquid from the well.

In contrast with conventional seals in tandem arrangement, a double seal module with two stationary sliding ring seals is employed in the arrangement according to the invention. Here, the spring elements are arranged in stationary components of the

sliding ring sealing system. These components do not perform any rotary movement. Thus, the spring elements stand still and do not cause any additional vibrations. Through the stationary arrangement, influences of the shaft bending on the service life and sealing effect of the sliding ring seal are minimized. The combination according to the invention of a module, a tandem arrangement and a stationary embodiment of the two sliding ring seals makes possible a simple and cost-effective assembly of the module. The double seal module according to the invention can be easily installed by sliding the unit into the suitably prepared centrifugal pump without the sliding surfaces being at risk.

Through the use according to the invention of two stationary sliding ring seals in tandem arrangement, the tolerance of the seal relative to instances of shaft bending and thus the reliability of the pump sealing is increased in contrast with known solutions with dynamic sliding ring seals in tandem arrangement. In contrast with known solutions with sealing cartridges with face to face arrangements of stationary sliding ring seals, the sealing function of the motor-side sliding ring seal of the double seal module is still provided even during a failure of the pump-side sliding ring seal with the tandem arrangement selected according to the invention.

The spring elements can be embodied in different designs. Accordingly, group springs as concentrically arranged spring packages can be employed for example. Furthermore, the use of metal bellows or wavy springs as spring elements is conceivable. A bellows produced from an elastomer can also be employed as spring element.

The double seal module according to the invention is lubricated with a liquid from a well. In a particularly favourable embodiment of the invention, the walls of the well are formed by housing parts of the centrifugal pump unit. Here it proves to be particularly favourable when the walls of the well are formed by a pressure cover and a bearing carrier or the centrifugal pump unit.

In contrast with conventional sliding ring sealing cartridges in tandem arrangement, the well for the liquid, in the case of the sliding ring sealing module according to the invention, is created only in combination with surrounding components of the

centrifugal pump. In contrast with conventional cartridges for the shaft sealing, the liquid chamber is thus not an integral part of the module per se. This makes possible a compact design and a simple assembly of the module.

With the module according to the invention, a sufficiently large space as well as formed through the housing parts of the pump, which in contrast with conventional cartridges does not require any additional connections for the external supply with a liquid.

Preferentially, the well is arranged in the centrifugal pump unit. In contrast with conventional sliding ring sealing cartridges, no additional components for the well of the liquid are thus required with the arrangement according to the invention. By contrast, liquid containers with a corresponding apparatus are required in conventional systems. The design according to the invention renders both an external well container and also an external supply with lubricating or sealing means dispensable. The liquid well for lubricating the two sliding ring seals is completely integrated in the centrifugal pump unit.

Preferentially, the module forms a bottom of the well. Jointly with the housing parts of the centrifugal pump unit, which form the walls, a space for the well of the liquid is thereby created which is completely integrated in the centrifugal pump. This offers substantial advantages in particular also for assembly reasons since the double seal module, by sliding the unit into the suitably prepared centrifugal pump, can be easily installed without the sliding surfaces being at risk. Thus, in contrast with known tandem seals with liquid well, a simple assembly of the module in one operation is possible with the embodiment chosen according to the invention. In contrast with conventional cartridge seals, the sliding surfaces are not exposed at any time of the assembly and are thus optimally protected. This ensures a reliable operation and a long lifespan.

Preferentially, the module is arranged between housing parts of the centrifugal pump unit. Particularly suited is an arrangement of the module between the pressure cover and the bearing carrier of the centrifugal pump unit. It proves to be favourable when a

housing part of the module establishes a connection between the two housing parts of the centrifugal pump unit.

Preferentially, at least one spring element is arranged in a stationary housing part of the module. It proves to be particularly favourable when the housing part of the module comprises receptacles in which the spring elements are arranged. The receptacles can be for example recesses in the form of a groove.

In an advantageous version of the invention, the housing part of the module comprises passages for lubricating the sliding ring seals. The passages establish a connection between the sliding ring seals and the well in which the liquid for purging the sliding ring seals is located.

In a version of the invention, the module comprises a shaft sleeve in which a rotating counter ring is arranged. Here it proves to be favourable when the shaft sleeve comprises a receptacle in which a counter ring is arranged.

Preferentially, the module comprises a carrier ring for a counter ring. This carrier ring is rotating and is in direct or indirect connection with the shaft. In a version of the invention, the carrier ring is arranged on a shaft sleeve. The shaft sleeve is slid onto the shaft up to a stop and rotates with the shaft. Here, the carrier ring is non-rotatably connected to the shaft sleeve and likewise rotates.

In a particularly favourable version of the invention, the module comprises a cover part. A leakage of too large a quantity of purging liquid is prevented by the cover part. In combination with further auxiliary seals such as for example O-rings, the cover part of the module ensures a minimization of the leakage of purging liquid.

Further features and advantages of the invention are obtained from the description of an exemplary embodiment by way of a drawing and from the drawing itself.

The only figure shows an axial section of an arrangement for the shaft sealing of a centrifugal pump unit.

The centrifugal pump unit comprises a shaft 1 on which an impeller 2 is arranged, of which in the figure merely a part region is visible. The impeller 2 is surrounded by a space 3 in which the delivery liquid is located. Through the arrangement according to the invention a leakage of delivery liquid from the space 3 is prevented.

The arrangement comprises a module 4 with a first sliding ring-counter ring pairing 5 and a second sliding ring-counter ring pairing 6. Each pairing 5, 6 comprises a rotating counter ring 7, 8 each and a stationary sliding ring 9, 10. The sliding real seals are positioned in tandem arrangement relative to one another. This results in the following construction from the pump side to the motor side: first rotating counter ring 7, first stationary sliding ring 9, second rotating counter ring 8, second stationary sliding ring 10.

The arrangement comprises spring elements 11, 12. According to the invention, the spring elements 11, 12 are arranged in stationary components.

The module 4 comprises a housing part 13. The housing part 13 is provided with receptacles in which the spring elements 11, 12 are arranged. In the exemplary embodiment, the receptacles are embodied as bores. The housing part 13 of the module 4 is stationary and does not rotate. Thus, the spring elements 11, 12 are also stationary and likewise do not rotate.

The first spring element 11 exerts a pressure force on the sliding ring 9. The sliding ring 9 is stationary and axially moveable. An intermediate ring 14 transmits the force of the first spring element 11 to the first sliding ring 9. The first stationary sliding ring 9 is pressed against the first rotating counter ring 7. The intermediate ring 14 comprises a pin which is not shown. By way of this, the sliding ring 9 is secured against co-rotating. The intermediate ring 14 serves as anti-rotation device of the sliding ring 9.

A second intermediate ring 15 transmits the force of the second spring element 12 onto the second stationary sliding ring 10 and presses the second sliding ring 10 against the

second rotating counter ring 8. The intermediate ring 15 comprises a pin which is not shown. By way of this, the sliding ring 10 is secured against co-rotating. The intermediate ring 15 serves as anti-rotation device of the sliding ring 10.

The first rotating counter ring 7 is arranged in a receptacle of a shaft sleeve 16. The second rotating counter ring 8 is arranged in a receptacle of a carrier ring 17. The carrier ring 17 is non-rotatably connected to the shaft sleeve 16. Upon a rotation of the shaft 1, both the shaft sleeve 16 and also the carrier ring 17 with the counter ring 8 arranged therein rotate.

The module 4 comprises a cover part 18. The cover part 18 projects into the housing part 13 of the module 4 at least in part. The cover part 18 has a groove in which an O-ring 19 is arranged, which lies against the first stationary sliding ring 9. The representation additionally comprises multiple O-rings which serve as auxiliary seals, wherein merely the O-ring 19 is exemplarily marked with a number.

The arrangement for the shafting sealing comprises a first housing part 20 and a second housing part 21. The first housing part 20 of the centrifugal pump unit is a pressure cover. The second housing part 21 of the centrifugal pump unit is a bearing carrier.

In the arrangement according to the invention, the two housing parts 20, 21 form the walls of a well 22 in which liquid for lubricating the sliding ring-counter ring pairings 5, 6 is arranged. The housing part 13 of the module 4 comprises passages for purging the sliding ring-counter ring pairings 5, 6 with liquid from the well 22.

P A T E N T K R A V

1. Anordning med en akseltætning og en centrifugalpumpeenhed k e n d e t e g n e t ved et dobbelttætningsmodul (4), som kan skubbes ind i centrifugalpumpeenheden, og et rum (22) anordnet i centrifugalpumpeenheden, hvor dobbelttætningsmodulet (4) har en første glidering-modring parring (5) og en anden glidering-modring parring (6), og parringerne (5, 6) er positioneret i tandemanordning med hinanden, og hver parring (5, 6) er tilordnet et fjederelement (11, 12) til generering af en kontakttrykkraft mellem glidering (9, 10) og modring (7, 8), og fjederelementerne (11, 12) er anordnet i stationære komponenter, og et mellemrum mellem glidering-modring parringerne (5, 6) gennemskylles med en væske fra rummet (22).

2. Anordning ifølge krav 1, k e n d e t e g n e t ved, at vægge af rummet (22) er dannet af husdele (20, 21) af centrifugalpumpeenheden, især af et tryklåg og/eller en lejebærer.

3. Anordning ifølge et hvilket som helst af kravene 1 eller 2, k e n d e t e g n e t ved, at modulet (4) danner en bund af rummet (22).

4. Anordning ifølge et hvilket som helst af kravene 1 til 3, k e n d e t e g n e t ved, at modulet (4) er anordnet mellem husdele (20, 21) af centrifugalpumpenheden, især mellem et tryklåg og en lejebærer.

5. Anordning ifølge et hvilket som helst af kravene 1 til 4, k e n d e t e g n e t ved, at en husdel (13) af modulet (4) skaber en forbindelse mellem husdelene (20, 21) af centrifugalpumpen.

6. Anordning ifølge et hvilket som helst af kravene 1 til 5, k e n d e t e g n e t ved, at mindst ét fjederelement (12) er anordnet i en husdel (13) af modulet (4).

7. Anordning ifølge et hvilket som helst af kravene 1 til 6, k e n d e t e g n e t ved, at der er i en husdel (13) af modulet (4) er anordnet kanaler til smøring af glidering-modring parringerne (5, 6) med væske fra rummet (22).

8. Anordning ifølge et hvilket som helst af kravene 1 til 7, k e n d e t e g n e t ved, at modulet (4) omfatter et akselhylster (16), som har en modtagelsesindretning til en roterende modring (7).

9. Anordning ifølge et hvilket som helst af kravene 1 til 8, k e n d e t e g n e t ved, at modulet (4) har en bærering (17) til modtagelse af en roterende modring (8).

10. Anordning ifølge et hvilket som helst af kravene 1 til 9, k e n d e t e g n e t ved, at modulet (4) har en lågdel (18).

Fig.