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Description

The invention relates to a seal assembly comprising a first seal element which rests on a machine element so as to seal by way of a radial pre-load and a second seal element which is disposed so as to be concentric with the first seal element and causes the radial contact pressure of the first seal element on the second machine element, wherein the first seal element and the second seal element are received in a housing bore.

Prior art

Such seal assemblies are known from general mechanical engineering and are used, for example, as a rod seal or piston seal for sealing translationally moved machine elements. The first seal element rests on the machine element, wherein a radial contact pressure of the first seal element on the machine element is generated by a second seal element which is arranged on the outer peripheral side on the first machine element and causes a radial contact pressure of the first seal element on the machine element. The first seal element frequently consists of a polymer material with a relatively low elasticity, while the second seal element frequently consists of an elastomeric material. For example, it is known to use an O-ring as the second seal element.

US 2,804,325 discloses a radial shaft sealing ring with a sealing lip which is bulged outwardly in the direction of a space to be sealed, for arranging between a machine element and a housing. The sealing lip is provided with a casing on the side facing the machine element.

US 2009/001671 A1 discloses a seal assembly with a two-part seal element, according to the preamble of Claim 1, which rests on a machine element so as to seal by way of a radial pre-load. The seal assembly comprises a dynamically acting seal element with a sinusoidal path of a sealing lip, when viewed in the peripheral direction.

DE 26 45 327 A1 discloses an annular composite seal. The composite seal comprises an outer annular sleeve and a core arranged in the sleeve. JP S62858 U discloses a groove ring.

5 So that such a seal assembly is securely fixed, a groove-shaped receiving space for the seal assembly is frequently provided in the housing.

10 In the seal assemblies known from the prior art it is a drawback that the housing bore, or the groove-shaped receiving space, is in contact with the medium to be sealed and that a dead space, in which medium to be sealed remains, can be produced. Thus such seal assemblies are not suitable for use in food technology.

15 The same problem is also produced when using known radial shaft sealing rings for rotational applications. For example, in these applications an annular dead space is produced between the supporting ring and sealing lip. Moreover, such radial shaft sealing rings are only suitable to a limited extent when
20 pressurized.

Description of the invention

The object of the invention is to provide a seal assembly which
25 is suitable for use in food technology by a good sealing action.

This object is achieved by the features of Claim 1. The dependent claims refer to advantageous embodiments.

30 To achieve this object, the seal assembly comprises a first seal element which rests on a machine element so as to seal by way of a radial pre-load and a second seal element which is disposed so as to be concentric with the first seal element and causes the radial contact pressure of the first seal element on the
35 first machine element, wherein the first seal element and the second seal element are received in a housing bore, wherein the first seal element and the second seal element seal the gap resulting between the housing bore and the machine element,

wherein the first seal element and the second seal element are designed to be planar along a radial plane and are co-aligned at least on the end side that faces the space to be sealed and thus form a surface which is planar and without a dead space.

5

The first seal element and the second seal element are arranged such that they can be received by a housing bore. It is not necessary to provide a groove-shaped receiving space in the housing. The gap which is produced between the housing bore and the machine element is filled by the first seal element and the second seal element such that no medium to be sealed can penetrate into the gap between the housing bore and machine element. In this regard, the seal assembly according to the invention is suitable, in particular, for use in food technology.

15

The first seal element and/or the second seal element can be designed substantially cylindrically. In cooperation with a cylindrically designed housing bore, this results in the advantage that after being mounted in the housing bore the first seal element and the second seal element fill the housing bore such that no medium to be sealed can penetrate into the housing bore. In particular, it is advantageous that a dead space, in which medium to be sealed can remain, is not produced.

25

The end sides of the first seal element and the second seal element that face the space to be sealed are preferably designed to be annular. This results in a planar, flat surface formed by the first seal element and the second seal element relative to the space to be sealed, with the medium to be sealed. In this embodiment, no dead spaces, in which medium to be sealed can remain, are produced. The housing bore is sealed by the first seal element and the second seal element such no medium to be sealed can penetrate therein.

35

A seal assembly designed in such a manner is suitable, in particular, for clean-in-place cleaning (CIP cleaning). In CIP cleaning, the components of a food technology system, such as

for example the seal assembly, can be cleaned in situ - without dismantling. The seal assembly according to the invention is particularly suitable for such CIP cleaning, since no cleaning agent or product residue can remain in dead spaces such as gaps
5 or grooves.

A further improvement, in particular from a hygiene perspective, results when the housing bore of the housing is aligned with the end sides of the seal elements.

10 The first seal element can be formed from a polymer material. A particularly suitable polymer material is PTFE or a PTFE compound with fillers. PTFE has a particularly low friction and is resistant relative to most media to be sealed, in particular
15 most media to be sealed from the field of food technology. Moreover, PTFE is resistant relative to the cleaning agent used in CIP cleaning.

20 The second seal element can be formed from an elastomeric material. The second seal element produces a uniform contact pressure of the first seal element on the machine element. An advantageous elastomeric material for use in food technology is fluorinated rubber. Comparable with PTFE, fluorinated rubber is resistant relative to most media and can also be used over a
25 wide temperature range.

The first seal element can be connected to the second seal element in a form-fitting manner. To this end, the first seal element and the second seal element can have a form-fitting
30 geometry. To this end, the first seal element can have, for example, a peripheral, rectangular or saw tooth-shaped elevation and the second seal element has on the internal peripheral side a recess which is congruent with the elevation of the first seal element. The first seal element and the second seal element are
35 latched together after mounting, so that they cannot be inadvertently released from one another. Such an embodiment is advantageous, in particular, when translationally moved machine elements are designed to be sealed.

The first seal element can be provided with a return conveyor structure on the internal peripheral side, i.e. with the surface facing the machine element. The return conveyor structure is preferably designed such that medium is conveyed back in the direction of the space to be sealed. The return conveyor geometry can be incorporated, for example, into the first seal element in the form of a helical groove geometry.

Preferably, the return conveyor geometry is closed by an encircling bead relative to the space to be sealed. The encircling bead results in a static seal so that it is possible to prevent media from flowing out of the space to be sealed, in particular at a standstill.

The first seal element can be at least in portions supported on the housing bore. This is advantageous, in particular, when a higher pressure prevails on the side of the medium to be sealed, which could lead to the first seal element shearing off from the second seal element.

A protective lip, which protrudes from the second seal element in the radial and axial direction and which at least in portions covers the first seal element, can be formed from the second seal element. The protective lip protrudes in the direction of the surrounding side.

The second seal element can be bevelled on the outer peripheral side. The second seal element is preferably conically bevelled. This results in an annular compensation space with a triangular cross section between the housing and second seal element. The space is not connected to the media space so that it does not result in a dead space with the medium to be sealed. Thermal expansion and swelling of the seal elements caused by the action of media can be compensated by the compensation space. As a result, it is possible to ensure a uniform radial contact pressure of the first seal element on the machine element to be sealed. In order to empty the compensation space in the case of

the penetration of media - for example due to a temporary leakage at the dynamic sealing point - the compensation space can be connected via a channel to the surroundings.

5 Brief description of the drawing

Several embodiments of the seal assembly according to the invention are explained in more detail hereinafter with reference to the figures. In each case schematically:

10

Fig. 1 shows a seal assembly with a return conveyor structure;

Fig. 2 shows a seal assembly with a protective lip;

15 Fig. 3 shows a seal assembly with a form-fitting connection between the first seal element and second seal element;

Fig. 4 shows a seal assembly in the form of a rod seal.

Embodiment of the invention

20 The figures show a seal assembly 1 comprising a first seal element 2 and a second seal element 4. The first seal element 2 rests on a machine element 3 so as to seal by way of a radial pre-load. The second seal element 4 rests on the first seal element 2 on the outer peripheral side, wherein the second seal
25 element 4 is arranged concentrically to the first seal element 2 and causes the radial contact pressure of the first seal element 2 on the machine element 3.

Figure 1 shows a seal assembly 1 in which the end side 7 of the
30 first seal element 2 and the second seal element 4 facing the space 10 to be sealed are designed to be annular, so that the seal elements 2, 4 are designed to be planar in a radial plane and are co-aligned. This shape results in a flat and particularly small and closed surface of the seal assembly 1 which faces the
35 space 10 to be sealed. The surface is planar and without dead spaces. As a result, the seal assembly 1 can be cleaned in a particularly simple manner, a minimal media contact surface is

produced and the seal assembly 1 can be cleaned by means of CIP cleaning.

In the present case, the seal elements 2, 4 are also aligned on the end side facing the surrounding side 9.

The first seal element 2 is formed from a polymer material, in this case from PTFE, and the second seal element 4 is formed from an elastomeric material, in this case a fluorinated rubber.

The second seal element 4 rests on the first seal element 2 by way of a radial pre-load. Moreover, the first seal element 2 is connected to the second seal element 4 in a form-fitting manner. To this end, the first seal element 2 has a radially outwardly protruding rectangular projection 12 on the outer peripheral side. The second seal element 4 has a recess 13 in the form of a rectangular groove which is congruent with the projection 12. After being mounted, the projection 12 latches in the recess 13 so that the first seal element 2 and the second seal element 4 are captively connected together.

The first seal element 2 is provided on the inner peripheral side with a return conveyor structure 8 on the side facing the machine element 3. The return conveyor structure 8 is designed to be helical in the present case. A spiral groove is incorporated in the first seal element 2 in order to form the return conveyor structure 8. The return conveyor structure 8 is designed such that medium is conveyed in the direction of the space 10 to be sealed. A seal assembly 1 provided in such a manner with a return conveyor structure 8 is suitable, in particular, for sealing rotationally moved machine elements 3.

The return conveyor structure 8 in the direction of the space 10 to be sealed is closed by an encircling bead 11. This results in a static seal.

The second seal element 4 has on the outer peripheral side a peripheral recess 19 which is triangular in cross section. This

results in a compensation space between the housing 17 and the second seal element 4. Volumetric changes of the seal elements 2, 4 can be compensated by the compensation space.

5 Figure 2 shows a seal assembly 1. In the present embodiment, a protective lip 14 is formed from the second seal element 4. The protective lip 14 protrudes in the direction of the surrounding side 9 and at least partially covers the first seal element 2.

10 The first seal element 2 has a trapezoidal recess 15 on the side facing the machine element 3. Sealing lips which rest on the machine element 3 by way of a defined radial pre-load are formed on the two end sides of the first seal element 2. A seal assembly 1 designed in such a manner is suitable, in particular, for
15 sealing translationally moved machine elements 3.

The protective lip 14 can be designed such that it comes to rest on the machine element 3. The protective lip 14 prevents soiling and the like from being able to penetrate into the gap between
20 the first seal element 2 and machine element 3.

Figure 3 shows a seal assembly 1 in which the first seal element 2 is connected to the second seal element 4 in a form-fitting manner. In the present embodiment, the projection 12 and the
25 recess 13 are designed to be saw tooth-shaped. The first seal element 2 has a trapezoidal recess 15 on the side facing the machine element 3, so that sealing lips which rest on the machine element 3 by way of a radial pre-load are produced in the region of the two end sides of the first seal element 2.

30

Figure 4 shows a seal assembly 1 which is designed as a rod seal and serves for sealing translationally moved machine elements 3. The first seal element 2 has a lip seal 16 protruding in the direction of the space 10 to be sealed. Moreover, a groove-shaped receiving space 18, in which the first seal element 2 and
35 the second seal element 4 are received, is provided in the housing 17.

The second seal element 4 has on the outer peripheral side a triangular further recess 19 so that the second seal element 4 can extend into the region of the further recess 19 due to the effect of high temperatures or swelling.

Patentkrav

1. Tætningsarrangement (1), omfattende et første tætningselement (2) og et andet tætningselement (4), et hus (17) med en husboring (5) samt et maskinelement (3), hvor det første tætningselement (2) og det andet tætningselement (4) er optaget i husboringen (5), hvor det første tætningselement (2) og det andet tætningselement (4) tætner den spalte (6), der fremkommer mellem husboring (5) og maskinelement (3), hvor det første tætningselement (2) med radial forspænding ligger tætnende an mod maskinelementet (3), og hvor det andet tætningselement (4) er anbragt koncentrisk med det første tætningselement (2) og bevirker den radiale tilpresning af det første tætningselement (2) mod maskinelementet (3), kendetegnet ved, at det første tætningselement (2) og det andet tætningselement (4) i det mindste på den mod det rum (10), der skal tættes, vendte frontside (7) langs et radiale plan er udformet plant og flugter med hinanden.
2. Tætningsarrangement ifølge krav 1, kendetegnet ved, at de mod det rum (10), der skal tættes, vendte frontsider (7) af det første tætningselement (2) og det andet tætningselement (4) er udformet cirkulært ringformet.
3. Tætningsarrangement ifølge krav 1 eller 2, kendetegnet ved, at det første tætningselement (2) er udformet af polymert materiale.
4. Tætningsarrangement ifølge et af kravene 1 til 3, kendetegnet ved, at det andet tætningselement (4) er udformet af elastomert materiale.
5. Tætningsarrangement ifølge et af kravene 1 til 4, kendetegnet ved, at det første tætningselement (2) er forbundet formssluttende med det andet tætningselement (4).
6. Tætningsarrangement ifølge et af kravene 1 til 5, kendetegnet ved, at det første tætningselement (2) er

forsynet med en returtransportstruktur (8).

7. Tætningsarrangement ifølge krav 6, kendetegnet ved,
at returtransportstrukturen (8) transporterer medium i retning
5 mod det rum (10), der skal tættes.

8. Tætningsarrangement ifølge krav 6 eller 7, kendetegnet ved,
at returtransportstrukturen (8) i retning mod det rum (10), der
skal tættes, er lukket ved hjælp af en omløbende vulst (11).
10

9. Tætningsarrangement ifølge et af kravene 1 til
8, kendetegnet ved, at det første tætningselement (2) i det
mindste afsnitvist er understøttet i aksial retning mod
husboringen (5).
15

10. Tætningsarrangement ifølge et af kravene 1 til
9, kendetegnet ved, at huset (17) og det andet tætningselement
(4) begrænser et udligningsrum.

20 11. Anvendelse af tætningsarrangementet (1) ifølge et af de
foregående krav til tætning af maskinelementer i
levnedsmiddeltekniske anlæg.

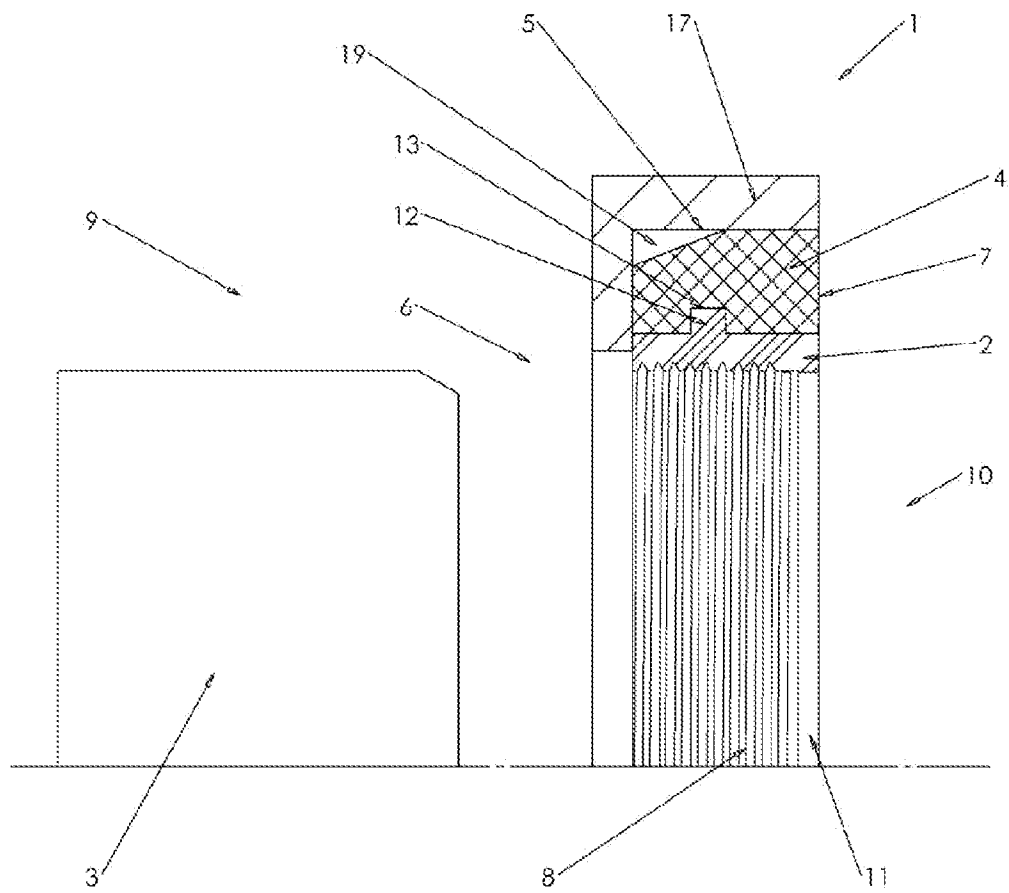


Fig. 1

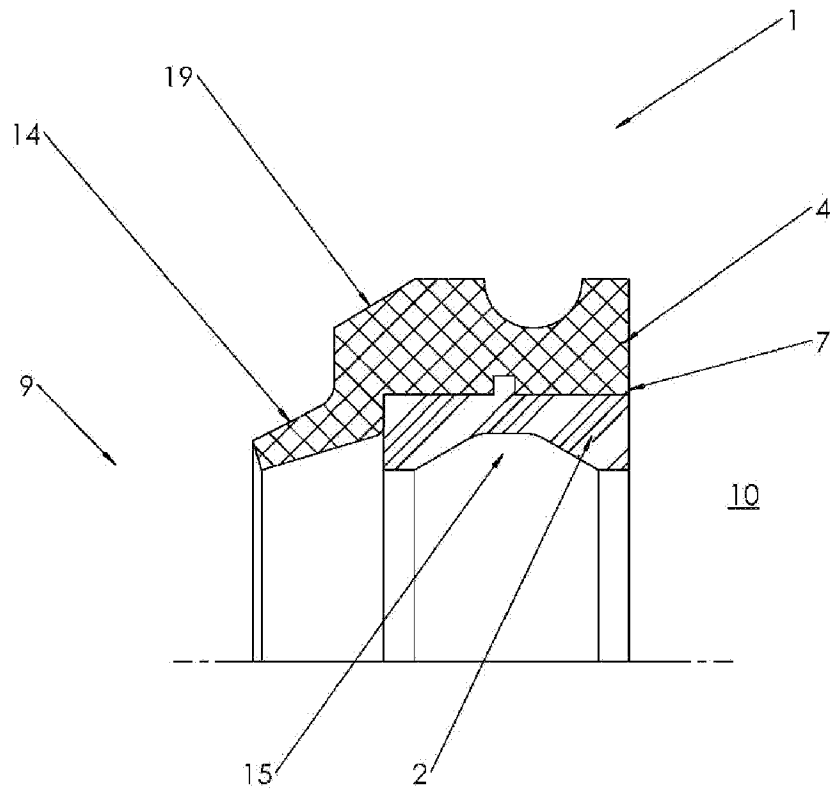


Fig. 2

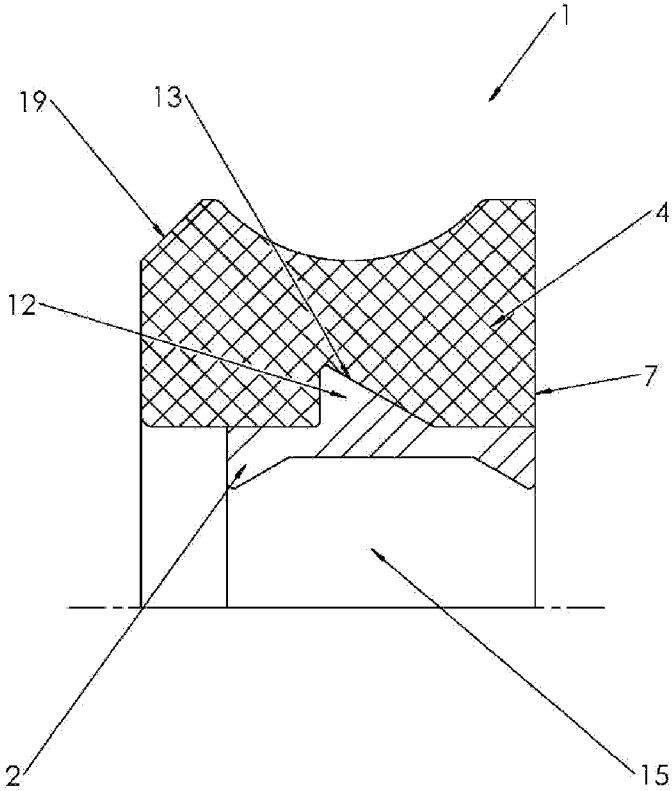
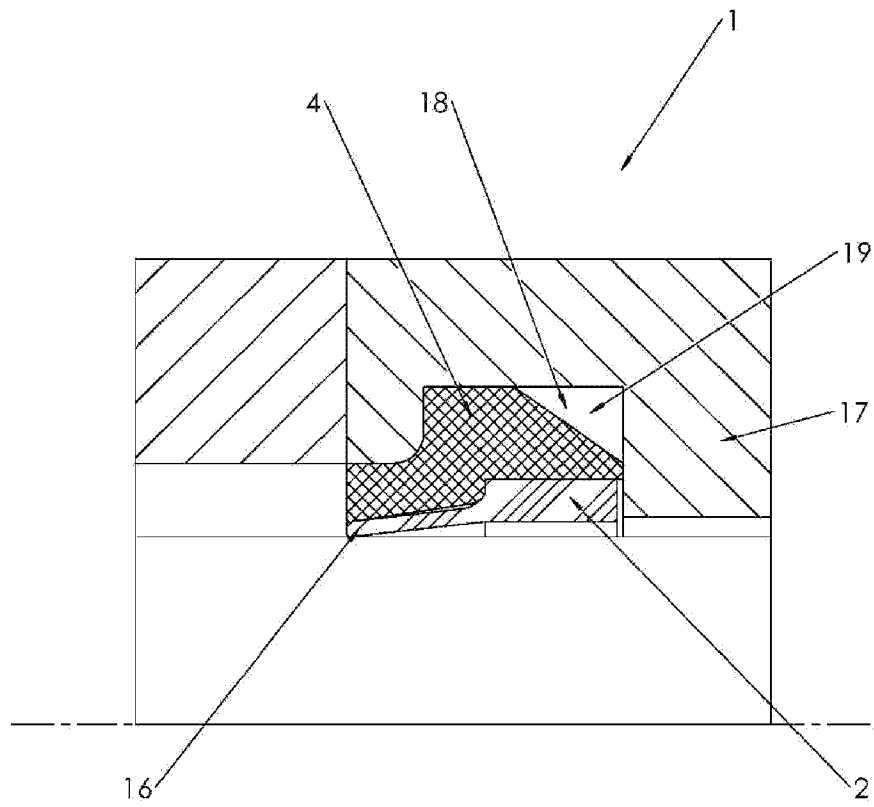


Fig. 3

**Fig. 4**