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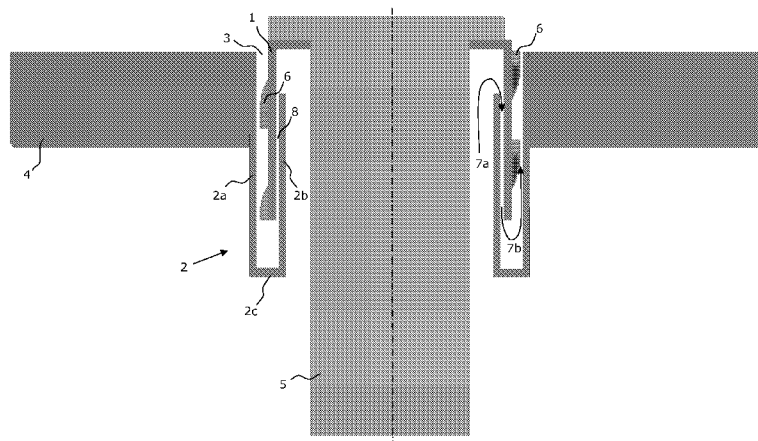
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(54) Title: REX MILL ROLLER-SET SHAFT SEALING

Fig. 1



(57) Abstract: A description is provided of a seal for preventing harmful material passing through a gap (3) between two machine elements (4,5) with said seal comprising two sealing parts (1,2) where at least one of the sealing parts (1) is fixed to one of the machine elements (5) and being configured for rotational operation together with said machine element (5) and where at least one of the machine elements (5) is configured for a movement back and forth in its axial direction relative to the other machine element (4). The seal is characterised in that the sealing part (1) being configured for rotational operation is provided with at least one helical thread (6) and in that one of the sealing parts (2) forms a casing (2a,2b,2c) around a portion of the other sealing part (1) and in that at least a portion of the helical thread (6) is located inside the casing (2a,2b,2c). In this way material (e.g. harmful dust) is restricted from passing through the gap between the two machine elements regardless of the fact that both machine elements perform a rotational and translatory movement relative to each other. The rotating sealing part with the helical thread ensures that most of the material coming into contact with the seal will be thrown away from the gap even when a significant relative axial displacement between the machine elements takes place.



Description

Title of Invention: REX Mill Roller-Set Shaft Sealing

- [1] The invention relates to a seal for preventing harmful material from passing through a gap between two machine elements with said seal comprising two sealing parts where at least one of the sealing parts is fixed to one of the machine elements and being configured for rotational operation together with said machine element and where at least one of the machine elements is configured for a movement back and forth in its axial direction relative to the other machine element.
- [2] Seals for preventing harmful material from passing through a gap between two machine elements are well known. Such seals, e.g. for sealing an annular gap between two rotating machine elements, will normally also be capable of absorbing minor axial displacements caused by vibration. But if both rotation of the machine elements relative to each other as well as a significant axial displacement between the machine elements are intended to occur during operation this known kind of seal will break. The known design of seals for sealing an annular gap between two rotating machine elements does not allow a significant relative axial displacement between the machine elements.
- [3] It is an objective of the present invention to provide a seal capable of sealing a gap between two relatively rotating machine elements which also carry out a significant translatory movement relative to each other.
- [4] This is obtained by a seal mentioned in the introduction, and being characterized in that that the sealing part being configured for rotational operation is provided with at least one helical thread and in that one of the sealing parts forms a casing around a portion of the other sealing part and in that at least a portion of the helical thread is located inside the casing.
- [5] In this way material (e.g. harmful dust) is restricted from passing through the gap between the two machine elements regardless of the fact that the machine elements perform a rotational and translatory movement relative to each other. The rotating sealing part with the helical thread ensures that most of the material coming into contact with the seal will be thrown away from the gap even when a significant relative axial displacement between the machine elements takes place.
- [6] The seal may in principle be used for sealing a gap between any two relatively rotating machine elements with or without axial displacement between the machine elements. Both machine elements may rotate in similar or opposite directions or only one machine element may rotate. The seal may e.g. be used in a roller mill for sealing an annular gap between a grinding table and a rotatable and axially movable vertical shaft located in the central part of the grinding table. The gap between the grinding

table and the shaft needs sealing to prevent harmful material from entering the delicate machine components below the grinding table. The vertical shaft is moved back and forth in its axial direction when the rollers connected to the shaft need to be adjusted relative to the grinding table. During the axial movement the sealing part connected to the shaft will be exposed to varying extents. When the shaft is moved up more of the seal is exposed but due to the helical thread most of the material coming into contact with the seal will be thrown away. However, some material may pass through the two sealing parts, being deposited at the bottom of the casing formed by one of the sealing parts. In a seal without a helical thread this would make it impossible to move the shaft back since the deposited material would prevent the movement. But the helical thread excavates the deposited material which, due to the centrifugal force and the geometry of the casing, will be present at the outer circumference of the inside of the casing.

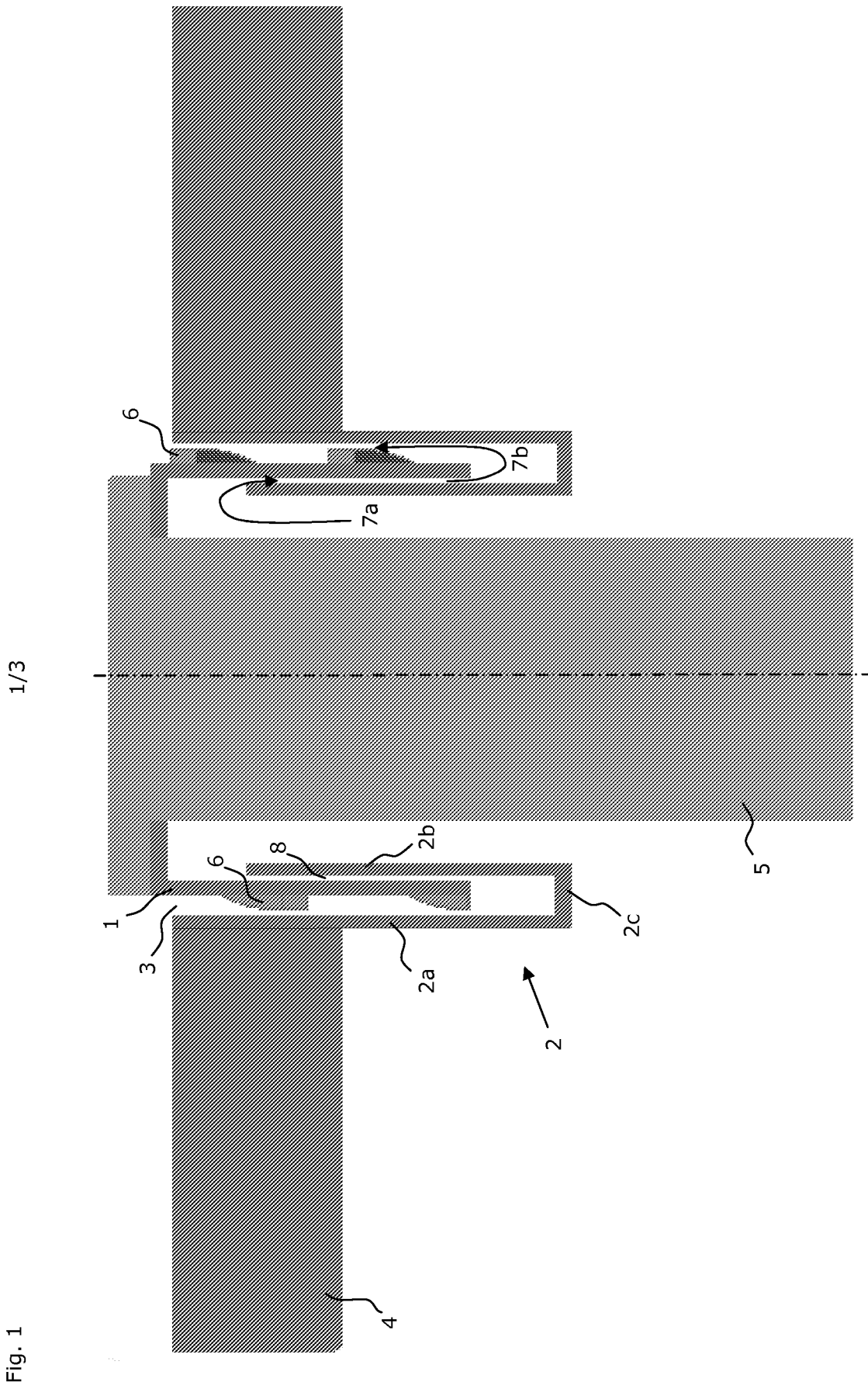
- [7] It is preferred that sealing air is introduced between the two sealing parts to prevent material, which not is thrown away by the helical thread, from passing through the gap between the sealing parts. Only a small constant flow of sealing air is needed since the helical thread will ensure that most of the material coming into contact with the seal is physically removed. If some material, despite the sealing air, passes between the two sealing parts and drop into the bottom of the sealing part forming a casing, the helical thread will excavate and remove the material from the seal.
- [8] It is preferred that the surface of the sealing parts, whereon the helical thread is provided, is substantially cylindrical.
- [9] In a preferred embodiment the sealing part is provided with a plurality of helical threads each covering a part of the cylindrical surface of the sealing part and overlapping each other in the axial direction of the sealing part. In principle the pitch of the helical thread may have any conceivable sizes as long as the thread performs the desired operation for the seal.
- [10] The invention will now be explained in greater detail with reference to the drawing, being diagrammatical, and where
- [11] Fig. 1 shows a cross-section of an embodiment of a seal between to machine elements and,
- [12] Fig. 2a and 2b show cross-sections of the seal in two different positions.
- [13] Fig. 1 shows a seal for sealing an annular gap 3 between a grinding table 4 and a rotatable vertical shaft 5 rotating relative to each other. The seal prevents material on the upper side of the grinding table 4 from passing through to the delicate machine parts below the grinding table 4. The seal comprises two sealing parts 1,2 where the first sealing part 1, which is provided with a helical thread 6, is fixed to and rotates with the vertical shaft 5. Besides the rotational movement the vertical shaft 5 is capable of performing a movement, relative to the grinding table 4, in its axial direction. The

second sealing part 2, which is fixed to the grinding table 4, forms a casing 2a, 2b, 2c around a portion of the first sealing part 1. Since the helical thread 6 provided on the first sealing part 1 does not engage with the second sealing part 2, the sealing parts 1,2 can move freely relative to each other in their axial direction. When the vertical shaft 5 is moved up, the helical thread 6 ensures that the part of the seal which then becomes exposed is not obstructed by removing the material coming into contact with the helical thread 6. Sealing air 7a introduced between the first sealing part 1 and the second sealing part 2b prevents material from passing up through the gap 8 and the sealing air 7b also minimizes the amount of material passing down through the gap 3 between the helical thread 6 and the second sealing part 2a. If some material passes the helical thread 6 and is deposited at the bottom of the casing 2c the material will be excavated by the helical thread 6, when the vertical shaft 5 is moved down (or the grinding table 4 is moved up) and the helical thread 6 gets into contact with the material.

- [14] Fig. 2a and Fig. 2b show the seal in two different positions. In Fig. 2a the seal is in the bottom position, which means that the first sealing part 1 with the helical thread 6 is at the bottom 2c of the second sealing part 2. In Fig. 2b the sealing parts 1,2 are moved relative to each other. If some material during operation is deposited in the bottom 2c of the second sealing part 2 this material will be excavated by means of the helical thread 6 when the first sealing part 1, with the helical thread 6, returns to the position shown in Fig. 2a. The material will be present at the outer circumference of the inside of the casing 2a, 2b, 2c due to the inclined bottom 2c of the second sealing part 2 and also due to the centrifugal force if the second sealing part 2 rotates.

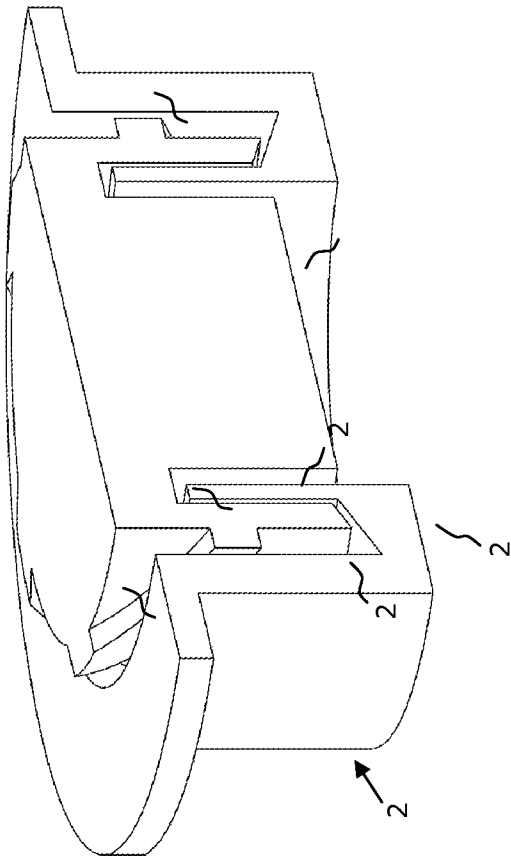
Claims

- [Claim 1] 1. A seal for preventing harmful material from passing through a gap (3) between two machine elements (4,5) with said seal comprising two sealing parts (1,2) where at least one of the sealing parts (1) is fixed to one of the machine elements (5) and being configured for rotational operation together with said machine element (5) and where at least one of the machine elements (5) is configured for a movement back and forth relative to the other machine element (4) **characterised in** that the sealing part (1) being configured for rotational operation is provided with at least one helical thread (6) and in that one of the sealing parts (2) forms a casing (2a,2b,2c) around a portion of the other sealing part (1) and in that at least a portion of the helical thread (6) is located inside the casing (2a,2b,2c).
- [Claim 2] 2. A seal according to claim 1 **characterized in** that the surface of the sealing part (1), whereon the helical thread (6) is provided, is substantially cylindrical.
- [Claim 3] 3. A seal according to any preceding claim **characterized in** that one of the sealing parts (1) is provided with a plurality of helical threads (6) each covering a part of the cylindrical surface of the sealing part (1).
- [Claim 4] 4. A seal according to claim 3 **characterized in** that the helical threads (6) overlap each other in the axial direction of the sealing part (1).
- [Claim 5] 5. A seal according to any preceding claim **characterized in** that sealing air (7a) is introduced between the two sealing parts (1,2).



2/3

Fig. 2a



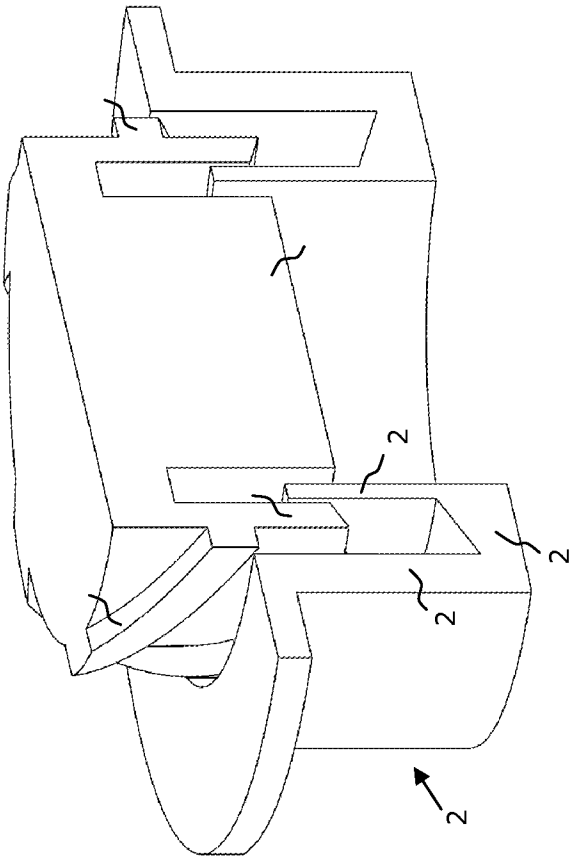


Fig. 2b

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER INV. F16J15/16 F16J15/40 F16J15/54 F16J15/44 F16J15/56 B02C15/00 F16J15/447 ADD. According to International Patent Classification (IPC) or to both national classification and IPC																	
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) F16J B02C Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal																	
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Category*</th> <th style="width: 70%;">Citation of document, with indication, where appropriate, of the relevant passages</th> <th style="width: 20%;">Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top;">X</td> <td>JP 2002 022032 A (MEIDENSHA ELECTRIC MFG CO LTD) 23 January 2002 (2002-01-23) * abstract; figures 1-19 -----</td> <td style="text-align: center; vertical-align: top;">1-5</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">X</td> <td>EP 0 049 719 A1 (CRANE HOUDAILLE JOHN INC [US]) 21 April 1982 (1982-04-21) page 4, line 24 - page 2, line 37; figures 1-3 -----</td> <td style="text-align: center; vertical-align: top;">1-4</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">X</td> <td>GB 1 489 136 A (POLYGRAPH LEIPZIG) 19 October 1977 (1977-10-19) page 1, line 77 - page 2, line 70; figures 1-3 -----</td> <td style="text-align: center; vertical-align: top;">1-5</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>SU 1 093 851 A1 (BUYANOVSKIY VLADIMIR N) 23 May 1984 (1984-05-23) the whole document -----</td> <td style="text-align: center; vertical-align: top;">1-5</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	JP 2002 022032 A (MEIDENSHA ELECTRIC MFG CO LTD) 23 January 2002 (2002-01-23) * abstract; figures 1-19 -----	1-5	X	EP 0 049 719 A1 (CRANE HOUDAILLE JOHN INC [US]) 21 April 1982 (1982-04-21) page 4, line 24 - page 2, line 37; figures 1-3 -----	1-4	X	GB 1 489 136 A (POLYGRAPH LEIPZIG) 19 October 1977 (1977-10-19) page 1, line 77 - page 2, line 70; figures 1-3 -----	1-5	A	SU 1 093 851 A1 (BUYANOVSKIY VLADIMIR N) 23 May 1984 (1984-05-23) the whole document -----	1-5
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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