(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 787 091 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
08.10.2014 Bulletin 2014/41

(21) Application number: **12853778.4**

(22) Date of filing: **27.11.2012**

(51) Int Cl.:
C22B 1/16 *(2006.01)* ***F27B 21/08*** *(2006.01)*

(86) International application number:
PCT/KR2012/010109

(87) International publication number:
WO 2013/081350 (06.06.2013 Gazette 2013/23)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **28.11.2011 KR 20110124863**

(71) Applicant: **Posco**
Gyeongsangbuk-do 790-300 (KR)

(72) Inventors:
- **JEON, Sang-Jin**
Pohang-si
Kyungsangbook-do 790-360 (KR)
- **CHO, Myung-Ho**
Pohang-si
Kyungsangbook-do 790-360 (KR)
- **CHOI, Seung-Ho**
Pohang-si
Kyungsangbook-do 790-360 (KR)

(74) Representative: **Potter Clarkson LLP**
The Belgrave Centre
Talbot Street
Nottingham, NG1 5GG (GB)

(54) SEALING DEVICE OF DRIVING SECTION

(57) There is provided a sealing device for sealing a structure in which a driving part (shaft) is inserted. The sealing device includes: a structure mounting member mounted on a structure, the driving part being inserted into the structure mounting member; a driving part fixing member disposed on the structure mounting member for sealing the driving part inserted thereinto, the driving part being fixed to the driving part fixing member; and a rotation absorbing part provided between the driving part fixing member and the structure mounting member for not transmitting rotation through a relational structure. The sealing device may effectively seal a bin or hopper in which a driving shaft of a screw feeder is inserted while absorbing operational vibration (shaking) and suppressing abrasion by absorbing rotations of the driving shaft and maintaining sealing.

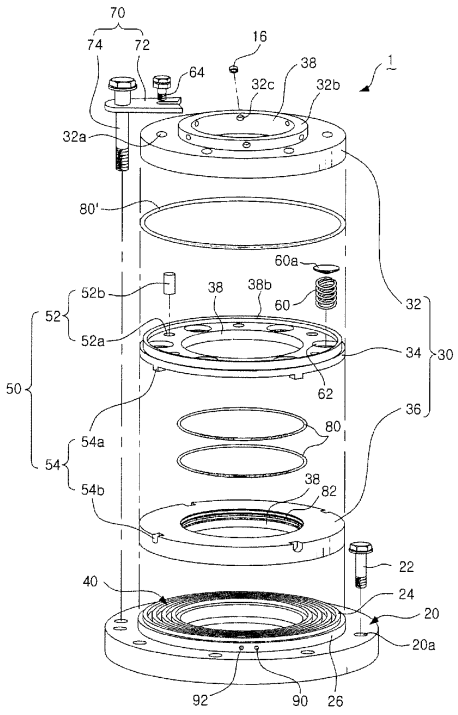

FIG. 5

EP 2 787 091 A1

Description

[Technical Field]

[0001] The present disclosure relates to a driving part sealing device for sealing a structure (container) into which a driving shaft is inserted, and more particularly, to a driving part sealing device for effectively sealing a structure (container) such as a bin or hopper into which a driving shaft of a screw feeder is inserted, while absorbing vibrations (shaking) of the driving shaft and suppressing abrasion thereof by absorbing rotations (rotational force) and providing sealing through an alternately arranged ring structure.

[Background Art]

[0002] Most ironworks use a blast furnace method to produce molten iron. In the blast furnace method, sintered iron ore is inserted into a blast furnace together with coke made of bituminous coal and is reduced to iron. However, the blast furnace method requires raw-material pretreatment equipment such as sintering equipment, incurring considerable equipment construction and maintenance costs. In addition, separate equipment is required for the treatment of contaminants.

[0003] Therefore, research has been conducted to develop processes for producing molten iron using steam coal as a fuel and reductant and fine iron ore accounting for 80% or more of the global output of iron ore as an iron source without pre-treating the fine iron ore, and many efforts have been made to put the processes to practical use and improve the efficiency of the processes.

[0004] For example, US Patent No. 5,534,046 discloses an apparatus for producing molten iron using steam coal and fine iron ore. In short, the apparatus includes: multistage fluidized reduction furnaces in which bubble fluidized beds are formed; and a melter-gasifier connected to the fluidized reduction furnaces. While fine iron ore and sub raw materials kept at room temperature are inserted into the first fluidized reduction furnace and transferred to the following fluidized reduction furnaces, a high-temperature reducing gas is supplied to the fluidized reduction furnaces from the melter-gasifier so as to heat, fire, and reduce the fine iron ore and sub raw materials, and then the reduced fine iron ore and sub raw materials are supplied to the melter-gasifier.

[0005] Here, the fine iron ore and sub raw materials reduced in the fluidized reduction furnace may be agglomerated into lumps before being supplied to the melter-gasifier to improve the air and liquid permeability of a coal layer of the melter-gasifier.

[0006] For example, US Patent No. 5,666,638 discloses an apparatus in which reduced fine iron ore and sub raw materials are agglomerated into lumps (briquettes) and then supplied to a melter-gasifier.

[0007] In detail, a screw feeder is disposed in a bin (or hopper) so that desired amounts of reduced iron ore and sub raw materials can be supplied from the bin to a lump iron ore manufacturing apparatus using the screw feeder, and a sealing structure is formed on a bin structure in which a driving shaft of the screw feeder is inserted for sealing of the inside of the bin and thus keeping the inside of the bin under high-pressure, high-temperature conditions.

[0008] In a molten iron producing apparatus including a lump iron ore manufacturing unit (not shown), a shaft of a screw feeder of a bin of the lump iron manufacturing unit may be sealed with a sealing member such as an O-ring. However, since the O-ring is a line-contact sealing member, sealing may not be stably maintained.

[0009] Particularly, when the shaft of the screw feeder is rotated by an external driving unit such as a motor, the sealing member may be considerably vibrated (shaken) and thus may be damaged and shortened in lifespan, thereby causing problems such as poor sealing, frequent replacement of the sealing member, and a low operational rate of the screw feeder.

[Disclosure]

[Technical Problem]

[0010] An aspect of the present disclosure may provide a driving part sealing device for effectively sealing a structure (container) such as a bin or hopper into which a driving shaft of a screw feeder is inserted, while absorbing vibrations (shaking) of the driving shaft and suppressing abrasion by absorbing rotations (rotational force) and providing sealing through an alternately arranged ring structure.

[Technical Solution]

[0011] According to an aspect of the present disclosure, a sealing device for a driving part may include: a structure mounting member mounted on a structure and receiving the driving part therein; a driving part fixing member disposed on the structure mounting member and fixed to the driving part for sealing the driving part inserted thereinto; and a rotation absorbing part provided between the driving part fixing member and the structure mounting member for absorbing rotations using a relational structure.

[0012] The structure mounting member may be a structure mounting ring coupled to the structure.

[0013] The driving part fixing member may include a plurality of driving part fixing rings assembled to transmit rotational force through a rotation transmitting part.

[0014] The rotation transmitting part may include at least one of: a first rotation transmitting part including a pin inserted into at least one pin hole formed in the driving part fixing rings; and a second rotation transmitting part including a protrusion inserted into at least one recess formed in the driving part fixing rings.

[0015] The first and second rotation transmitting parts

may be sequentially arranged on the driving part fixing rings.

[0016] The sealing device may further include a guide groove and a guide ring provided on the driving part fixing rings, or stepped portions formed on edge portions of the driving part fixing rings making contact with each other.

[0017] The rotation absorbing part may include rings arranged alternately on the driving part fixing member and the structure mounting member so as to absorb rotation of the driving part.

[0018] The rings of the rotation absorbing part may include at least one convex ring and at least one concave ring arranged at corresponding positions, and the convex ring and the concave ring may be correspondingly arranged on one of the driving part fixing rings of the driving part fixing member and the structure mounting ring adjacent to the driving part fixing ring.

[0019] The sealing device may further include a vibration absorbing part disposed between the driving part fixing rings to absorb vibrations or shaking when the driving part is rotated.

[0020] The vibration absorbing part may be a coil spring disposed in a hole formed in the driving part fixing rings, and the coil spring may be adjusted in elasticity by using a pressing bolt inserted into the driving part fixing rings.

[0021] The sealing device may further include a clamping part connected between the driving part fixing member and the structure mounting member or the structure for being used when the sealing device is installed on the structure.

[0022] The clamping part may include: a clamping bar horizontally fixed to an upper side of the driving part fixing member; and a clamping bolt inserted into the clamping bar and coupled to the clamping bar and the structure mounting member or the structure.

[0023] A fastener fixed to the driving part may be coupled to at least one of the driving part fixing rings of the driving part fixing member, and at least one sealing member may be provided on at least one of the structure mounting member and the driving part fixing member for sealing between the driving part and the sealing device.

[0024] The sealing device may further include at least one of a lubricant supply unit and a gas supply unit connected to the rotation absorbing part for suppressing abrasion or maintaining sealing.

[0025] The structure may be a bin or hopper including a screw feeder, and the driving part may be a driving shaft of the screw feeder.

[0026] Additional aspects will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the embodiments.

[Advantageous Effects]

[0027] According to embodiments of the present disclosure, the sealing device may effectively seal a structure to which a driving part such as a driving shaft is connected and may reduce abrasion of sealing components to increase the lifespan of the sealing device or the structure.

[0028] For example, the sealing device may be used in a container such as a bin or hopper including a screw feeder or a pressure-resistant structure in which a large amount of dust is generated at high temperature, so as to provide stable sealing between the container or structure and a screw feeder driving part (shaft) inserted into the container or structure.

[0029] In addition, the sealing device may absorb operational vibrations and suppress abrasion by absorbing rotations using an alternately arranged ring structure.

[0030] Therefore, the sealing device of the present disclosure may provide improved sealing and abrasion-suppressing effects.

[Description of Drawings]

[0031]

FIG. 1 is a view illustrating a molten iron producing apparatus including a lump iron ore manufacturing unit as an exemplary unit in which a driving part sealing device is installed according to an embodiment of the present disclosure.

FIG. 2 is a view illustrating a bin (hopper) including a screw feeder and disposed in the lump iron ore manufacturing unit shown in FIG. 1, the driving part sealing device of the embodiment of the present disclosure being installed on the screw feeder.

FIG. 3 is a view illustrating the driving part sealing device installed on the screw feeder of the bin according to the embodiment of the present disclosure.

FIG. 4 is a perspective view illustrating an assembled state of the driving part sealing device according to the embodiment of the present disclosure.

FIG. 5 is an exploded perspective view illustrating the driving part sealing device shown in FIG. 4 according to the embodiment of the present disclosure.

FIG. 6 is a cross-sectional view illustrating the driving part sealing device shown in FIG. 4 according to the embodiment of the present disclosure.

[Best Mode]

[0032] Hereinafter, embodiments of the present disclosure will be described with reference to the accompanying drawings.

[0033] FIGS. 1 to 3 are schematic views illustrating a molten iron producing apparatus 100 for producing molten iron using steam coal and fine iron ore. The molten iron producing apparatus 100 includes a lump iron ore manufacturing unit 130, and a driving part sealing device 1 (refer to portion A of FIG. 3) of the present disclosure is installed on a screw feeder 136 of a bin 138 of the lump iron ore manufacturing unit 130.

[0034] For example, as shown in FIG. 1, the molten iron producing apparatus 100 for producing molten iron using steam coal and fine iron ore may include a plurality of reducing furnaces 110, the lump iron ore manufacturing unit 130, a lump iron ore storage tank 150, and a melting furnace 170. The structure of the molten iron producing apparatus 100 is known in the related art.

[0035] As described above, iron reduced in the reducing furnaces 110 is agglomerated into lumps 130a (refer to FIG. 2) in the lump iron ore manufacturing unit 130 so as to improve gas permeability in the melting furnace 170.

[0036] As shown in FIGS. 2 and 3, the lump iron ore manufacturing unit 130 includes: a storage tank 132 into which fine iron ore reduced in the reducing furnaces 110 is transferred by a pressure difference; an agglomeration machine 134 configured to agglomerate fine iron ore into lumps 130a by pressing the fine iron ore; the bin 138 disposed above the agglomeration machine 134 and including the screw feeder 136 to uniformly feed fine iron ore to the agglomeration machine 134; and a crusher 140 configured to crush lumps 130a into desired sizes. In the lump iron ore manufacturing unit 130, iron ore lumps 130a are transferred from the agglomeration machine 134 to a conveyer 143 through a distributor 141 and a screen 142.

[0037] Referring to FIG. 1, fine iron ore is transferred by a high-pressure gas within a temperature range of 600°C to 700°C along the reducing furnaces 110, the lump iron ore manufacturing unit 130, the lump iron ore storage tank 150, and the melting furnace 170.

[0038] The lump iron ore storage tank 150 temporarily stores iron ore lumps and supplies the iron ore lumps to the melting furnace 170. In addition, the molten iron producing apparatus 100 may further include a dust collecting unit 190.

[0039] FIG. 3 illustrates the bin 138 and the agglomeration machine 134. The screw feeder 136 is disposed in the bin 138.

[0040] The driving part sealing device 1 is disposed in a structural part (for example, portion A in FIG. 3) of the bin 138 into which a driving shaft 136a of the screw feeder 136 is inserted. The driving part sealing device 1 will be described in detail with reference to FIGS. 4 to 6.

[0041] Since (fine) iron ore and steam coal are transferred in the molten iron producing apparatus 100 by a difference in gas pressure, the driving part sealing device 1 of the embodiment of the present disclosure is disposed in a portion of the bin 138 into which the driving shaft 136a of the screw feeder 136 is inserted, so as to provide sealing against high-pressure and high-temperature environments. Particularly, the driving part sealing device 1 may absorb vibrations or shaking (chattering) of the driving shaft 136a and may effectively absorb the rotations of the driving shaft 136a to reduce wearing.

[0042] The driving part sealing device 1 will now be described in more detail with reference to FIGS. 4 to 6 according to the embodiment of the present disclosure.

[0043] In the following description of the embodiment of the present disclosure given with reference to FIGS. 1 to 3, the driving part sealing device 1 is disposed on the driving shaft 136a of the screw feeder 136 installed in the bin 138 of the lump iron ore manufacturing unit 130 of the molten iron producing apparatus 100 so as to seal the bin 138. However, the driving part sealing device 1 of the embodiment of the present disclosure is not limited thereto.

[0044] For example, the driving part sealing device 1 may be used to seal a (airtight) container such as a bin or hopper into which a screw feeder is installed to uniformly discharge a stock such as powder or grain by using compressed air or gas.

[0045] The driving part sealing device 1 of the embodiment of the present embodiment is not limited as being disposed on a driving shaft of a screw feeder. For example, the driving part sealing device 1 of the embodiment of the present disclosure may be disposed on a structural part of an airtight container into which a driving unit (driving shaft) is inserted, so as to seal an internal gas or powder atmosphere of the container.

[0046] That is, it may be understood that the driving part sealing device 1 is used to seal a structure 10 in which a driving part 12 is disposed. In the following description, the structure 10 is the bin 138, and the driving part 12 is the driving shaft 136a of the screw feeder 136.

[0047] Referring to FIGS. 4 to 6, the driving part sealing device 1 of the embodiment of the present disclosure may include: a structure mounting member 20 through which the driving part 12 shaped like a rod or pipe may be inserted; a driving part fixing member 30 placed on the structure mounting member 20 to fix and seal the driving part 12 inserted thereinto; and a rotation absorbing part 40 disposed between the structure mounting member 20 and the driving part fixing member 30 to absorb the rotation of the driving part 12.

[0048] According to the embodiment of the present disclosure, the driving part fixing member 30 is fixed to the driving part 12 inserted into the structure 10 and is rotated together with the driving part 12 when the driving part 12 is rotated. The structure mounting member 20 is mounted on the structure 10, and the rotation absorbing part 40 is formed between the structure mounting member 20 and the driving part fixing member 30 to absorb the rotation of the driving part 12 and the driving part fixing member 30 while providing stable sealing. Particularly, the rotation absorbing part 40 has an alternating structure (described later in detail) for providing stable sealing while reducing abrasion.

[0049] According to the embodiment of the present disclosure, the structure mounting member 20 of the driving part sealing device 1 is detachably mounted on the structure 10 such as the bin 138 as shown in FIGS. 4 to 6. The structure mounting member 20 may be a mounting ring having a driving part opening 22 through which the driving part 12 is inserted.

[0050] In the following description, the structure mounting member 20 is taken as a structure mounting

ring.

[0051] The structure mounting ring 20 has a circular ring shape with the driving part opening 22, and the driving part 12 such as the driving shaft 136a of the screw feeder 136 is inserted into the opening 22 and a driving part opening 14 formed in the structure 10.

[0052] A plurality of bolt holes 20a are formed along the circumference of the structure mounting ring 20, and thus bolts 24 may be inserted into the bolt holes 20a and coupled to a bracket or base 10a of the structure 10 to detachably fix the structure mounting ring 20 to the structure 10.

[0053] As shown in FIGS. 4 to 6, the driving part fixing member 30 of the driving part sealing device 1 may include a plurality of driving part fixing rings by which rotational force can be transmitted through a rotation transmitting part 50 (described later).

[0054] In detail, for example, the driving part fixing member 30 may include first, second, and third fixing rings 32, 34, and 36 sequentially arranged in a downward direction along the driving part 12. The number of the first to third fixing rings 32, 34, and 36 may be varied.

[0055] In the embodiment shown in FIGS. 4 to 6, the driving part fixing member 30 includes the first to third fixing rings 32, 34, and 36. However, the third fixing ring 36 may not be used, or may be formed of a material different from a material used to form the structure mounting ring 20.

[0056] For example, the first and second fixing rings 32 and 34 may be provided to install a vibration absorbing part 60 (described later). In addition, the second and third fixing rings 34 and 36 may be provided as a single part.

[0057] If the third fixing ring 36 is formed of the same material as that used to form the structure mounting ring 20, when the driving part sealing device 1 of the embodiment is used in the bin 138 of the lump iron ore manufacturing unit 130 of the molten iron producing apparatus 100 shown in FIGS. 1 to 3, the third fixing ring 36 and the structure mounting ring 20 may be easily affected by a high temperature environment inside the bin 138 because the third fixing ring 36 and the structure mounting ring 20 have the same melting point. Therefore, the third fixing ring 36 may be formed of a material capable of easily dissipating heat such as copper, and the structure mounting ring 20 may be formed of a material different from the material of the third fixing ring 36. In this case, the second and third fixing rings 34 and 36 may be provided as individual parts.

[0058] That is, in the embodiment of the present disclosure, the driving part fixing member 30 may include the first and second fixing rings 32 and 34 in which the vibration absorbing part 60 is disposed, and may further include the third fixing ring 36 formed of a material different from a material of the structure mounting ring 20.

[0059] If the driving part fixing member 30 includes only the first and second fixing rings 32 and 34, the rotation transmitting part 50 (described later in more detail) may include a first rotation transmitting part 52, and if the driving part fixing member 30 includes all the first to third fixing rings 32, 34, and 36, the rotation transmitting part 50 may include first and second rotation transmitting parts 52 and 54.

[0060] In other words, the driving part fixing member 30 of the embodiment of the present disclosure may include only the first and second fixing rings 32 and 34 or all the first to third fixing rings 32, 34, and 36.

[0061] In the case in which the driving part sealing device 1 is used for the bin 138 of the molten iron producing apparatus 100 shown in FIGS. 1 to 3, the first to third fixing rings 32, 34, and 36 of the driving part fixing member 30 may include cooling structures for circulating a coolant.

[0062] The following description of the embodiment of the present disclosure will be given for the case in which the driving part fixing member 30 includes all the first to third fixing rings 32, 34, and 34.

[0063] The first to third fixing rings 32, 34, and 36 are brought into contact with each other and are fixed. For example, the first and second fixing rings 32 and 34 or the first to third fixing rings 32, 34, and 36 are brought into contact with each other and assembled as shown in FIG. 4. In this state, fasteners such as set bolts 16 are inserted into screw holes 32b formed at regular intervals in a ridge of the first fixing ring 32 and fixed to the driving part 12 such as the driving shaft 136a inserted into the first to third fixing rings 32, 34, and 36.

[0064] After the first fixing ring 32 is fixed to the driving part 12, the first to third fixing rings 32, 34, and 36 are sequentially brought into contact with each other and assembled, and the third fixing ring 36 is disposed on the structure mounting ring 20. This contact state (assembled state) of the structure mounting ring 20 and the first to third fixing rings (driving part fixing rings) 32, 34, and 36 may be maintained because the position of the driving part 12 such as the driving shaft 136a is fixed in the structure 10.

[0065] At this time, while inserting the driving part 12 into the structure 10, the structure mounting ring 20 and the fixing rings 32, 34, and 36 of the driving part sealing device 1 may be easily assembled and mounted on the structure 10 by using a clamping part 70 (to be described later).

[0066] As shown in FIGS. 4 to 6, in the embodiment of the present disclosure, the rotation transmitting part 50 may include the first rotation transmitting part 52, and the first rotation transmitting part 52 may include pins 52b inserted into pin holes 52a formed in the first and second fixing rings 32 and 34 of the driving part fixing member 30.

[0067] In addition, the rotation transmitting part 50 may include the second rotation transmitting part 54, and the second rotation transmitting part 54 may include protrusions 54a and recesses 54b formed at positions corresponding to those of the second and third fixing rings 34 and 36.

[0068] The number of the first and second rotation transmitting parts 52 and 54 may be varied according to

the number of the first to third fixing rings 32, 34, and 36. In other words, the rotation transmitting part 50 may include only one of the first and second rotation transmitting parts 52 and 54 or more rotation transmitting parts.

[0069] For example, if the driving part fixing member 30 includes only the first and second fixing rings 32 and 34, the rotation transmitting part 50 may include only one of the first and second rotation transmitting parts 52 and 54. In this case, if the vibration absorbing part 60 is considered, the rotation transmitting part 50 may only include the first rotation transmitting part 52 having a predetermined length.

[0070] Penetration openings 38 are formed in inner center portions of the first to third fixing rings 32, 34 and 36 so that the driving part 12 such as the driving shaft 136a may be inserted into the penetration openings 38.

[0071] In the embodiment of the present disclosure, if the driving part 12 to which the first fixing ring 32 is fixed using the set bolts 16 as shown in FIGS. 5 and 6 is rotated, the first fixing ring 32 is rotated together with the driving part 12. At this time, the rotation of the first fixing ring 32 is transmitted to the second fixing ring 34 because the second fixing ring 34 is connected to the first fixing ring 32 through the pins 52b.

[0072] In addition, the rotation of the second fixing ring 34 is also transmitted to the third fixing ring 36 because the protrusions 54a formed at regular intervals on the bottom side of the second fixing ring 34 are inserted into the recesses 54b formed on the topside of the third fixing ring 36 as shown in FIGS. 5 and 6.

[0073] Therefore, as shown in FIGS. 4 and 6, if the driving part 12 such as the driving shaft 136a of the screw feeder 136 is rotated, the rotation of the driving part 12 is sequentially transmitted to the first and second fixing rings 32 and 34 or the first to third fixing rings 34 and 36 of the driving part fixing member 30, and thus the driving part 12 and the driving part fixing member 30 may be rotated together.

[0074] In addition, a guide groove 38a may be formed in the bottom side of the first fixing ring 32, and a guide ring 38b may be formed on the topside of the second fixing ring 34. Alternatively, stepped portions may be formed on edge portions of the first and second fixing rings 32 and 34 (a stepped portion 33 of the second fixing ring 34 is shown in FIG. 5). In addition, a packing 80' may be disposed between peripheral portions of the first and second fixing rings 32 and 34 to block contaminants such as dust.

[0075] Sealing members 80 such as O-rings may be disposed in the penetration opening 38 of the third fixing ring 36, and O-ring grooves 82 may be formed in the third fixing ring 36 as shown in FIG. 5.

[0076] Owing to the packing 80' disposed between the first and second fixing rings 32 and 34, the sealing members 80 disposed between the third fixing ring 36 and the driving part 12, and surface contact between the second and third fixing rings 34 and 36, sealing may be stably maintained to hermetically keep the structure 10 without the leakage of high-pressure gas or dust from the inside of the structure 10.

[0077] In addition, sealing members 80 such as O-rings may be disposed between the structure mounting ring 20 and the base (or bracket) 10a welded to the structure 10.

[0078] As shown in FIGS. 4 to 6, in the driving part sealing device 1 of the embodiment of the present disclosure, the vibration absorbing part 60 may be disposed between at least the first and second fixing rings 32 and 34 of the first to third fixing rings 34 and 36 so as to absorb vibrations or shaking while the driving part 12 is rotated.

[0079] For example, the vibration absorbing part 60 may include a plurality of coil springs arranged along the circumference of the second fixing ring 34.

[0080] In addition, the vibration absorbing part 60 may include support plates 60a fixed to the topsides of the coil springs, and the elasticity of the coil springs may be adjusted by using pressing bolts 64 inserted into coupling holes 32c formed at regular intervals along the circumference of the first fixing ring 32.

[0081] That is, the elasticity of the coil springs may be adjusted by tightening or loosening the pressing bolts 64, so as to control vibration (shaking) absorbing ability of the first and second fixing rings 32 and 34.

[0082] For example, when the driving part 12 such as the driving shaft 136a of the screw feeder 136 installed in the bin 138 is rotated as shown in FIG. 3, fine iron ore may be discharged from the bin 138 by the rotation of the screw feeder 136, and while the fine iron ore is discharged, the driving shaft 136a may be vibrated (shaken). At this time, the coil springs of the vibration absorbing part 60 disposed between the first and second fixing rings 32 and 34 may absorb the vibrations. Therefore, problems of the related art such as vibration or sealing errors caused by vibration may be prevented. That is, the driving part sealing device 1 of the embodiment of the present disclosure may effectively prevent sealing errors caused by vibration of a driving shaft or may effectively protect a driving shaft or a structure.

[0083] As shown in FIGS. 4 and 5, the driving part sealing device 1 of the embodiment of the present disclosure may further include the clamping part 70. The clamping part 70 may be used to maintain the assembled state of the structure mounting ring 20 and the first to third fixing rings 34 and 36 of the driving part fixing member 30 when the driving part sealing device 1 is installed on the structure 10. In addition, since the clamping part 70 fixes the first fixing ring 32 to the driving part 12, the driving part sealing device 1 may be easily installed on the structure 10.

[0084] For example, the clamping part 70 may be coupled between the driving part fixing member 30 and the structure mounting ring 20 to be mounted on the structure 10 to maintain the assembled state of the driving part sealing device 1 until the first fixing ring 32 is fixed to the driving part 12.

[0085] The clamping part 70 may include: horizontally

extending clamping members (bars) 72 coupled to some of the pressing bolts 64 fixed to the first fixing ring 32; and clamping bolts 74 inserted into ends of the clamping members 72 and vertically coupled to the structure mounting ring 20 (or the structure 10).

[0086] The clamping bolts 74 inserted into the clamping members 72 may be screwed in the structure mounting ring 20, and the clamping members 72 may be fixed to the first fixing ring 32 by the pressing bolts 64. Therefore, the first to third fixing rings 34 and 36 may be clamped to the structure mounting ring 20 in a tightly contact (assembled) state.

[0087] After the driving part sealing device 1 is installed on the structure 10 (in this state, the driving part 12 protrudes from the structure 10 through the driving part sealing device 1, and the first fixing ring 32 is fixed to the driving part 12 using the set bolts 16), the clamping part 70 may be easily detached from the driving part sealing device 1 by separating the clamping members 72 after slightly loosening the pressing bolts 64 and unscrewing the clamping bolts 74.

[0088] Next, as shown in FIGS. 5 and 6, the rotation absorbing part 40 of the driving part sealing device 1 may include one or more convex rings 42 and one or more concave rings 44 that are alternately arranged at corresponding positions on the bottom side of the third fixing ring 36 of the driving part fixing member 30 and the topside of the structure mounting ring 20, so that the rotation of the third fixing ring 36 may not be transmitted to the structure mounting ring 20.

[0089] The convex rings 42 and the concave rings 44 may be rings and grooves in which the rings are insertable, and rotation may not be transmitted therebetween.

[0090] In the embodiment of the present disclosure, the terms "convex rings" and "concave rings" are used to denote alternately insertable structures. Referring to an actual structure shown in FIG. 6, rings are arranged at predetermined intervals on the bottom side of the third fixing ring 36 in one piece with the third fixing ring 36, and rings are arranged at predetermined intervals on a central projection 26 of the structure mounting ring 20 in one piece with the central projection 26.

[0091] Since the convex rings 42 formed on the bottom side of the third fixing ring 36 are separate from the concave rings 44 formed on the topside of the structure mounting member (ring) 20, rotation may not be transmitted therebetween. In addition, since the convex rings 42 and the concave rings 44 are sequentially arranged in radial directions with regard to the third fixing ring 36 and the structure mounting ring 20, sealing between the convex rings 42 and the concave rings 44 may be reliable.

[0092] As shown in FIGS. 5 and 6, the rotation absorbing part 40 may include at least one of a lubricant supply inlet 90 and a gas supply inlet 92 in the central projection 26 of the structure mounting ring 20 (the lubricant supply inlet 90 may be favored), so as to reduce friction between the convex rings 42 and the concave rings 44 and improve sealing.

[0093] Referring to FIG. 6, a lubricant such as grease may be supplied through the lubricant supply inlet 90 to an innermost region between the convex rings 42 and the concave rings 44, and then the lubricant be smoothly distributed to the outermost convex ring 42 and concave ring 44 by pressure.

[0094] In this way, the lubricant such as grease may be uniformly distributed between the convex rings 42 and the concave rings 44 of the rotation absorbing part 40, and thus the interface between the convex rings 42 and the concave rings 44 may be sealed. In addition, the convex rings 42 and the concave rings 44 may be worn or damaged less when the driving part 12 rotates.

[0095] In this way, the lubricant such as grease may block a gap between the convex rings 42 and the concave rings 44 of the rotation absorbing part 40 for sealing therebetween.

[0096] Along with this, inert gas such as nitrogen gas may be supplied through the gas supply inlet 92 to form a gas curtain layer for effectively preventing the leakage of gas or dust.

[0097] In addition, as shown in FIG. 6, when the structure mounting ring 20 of the embodiment of the present disclosure is mounted on the structure 10 (such as the bin 138) or the base 10a attached to an outer wall of the bin 138, the sealing members 80 may be disposed between the lowermost fixing ring of the driving part fixing member 30 (that is, the second or third fixing ring 34 or 36) and the structure 10 or the base 10a. In this way, a gap between metal plates may be sealed.

[Industrial Applicability]

[0098] An aspect of the present disclosure provides a driving part sealing device capable of absorbing vibration (shaking) and effectively sealing a structure such as a bin or hopper through which a driving shaft (of a screw feeder) is inserted. In addition, alternating ring structures additionally included in the driving part sealing device may prevent transmission of rotation and may provide improved sealing while reducing abrasion.

Claims

1. A sealing device for a driving part, the sealing device comprising:

   a structure mounting member mounted on a structure and receiving the driving part therein;
   a driving part fixing member disposed on the structure mounting member and fixed to the driving part for sealing the driving part inserted thereinto; and
   a rotation absorbing part provided between the driving part fixing member and the structure mounting member for absorbing rotation using a relational structure.

2. The sealing device of claim 1, wherein the structure mounting member is a structure mounting ring coupled to the structure.

3. The sealing device of claim 1, wherein the driving part fixing member comprises a plurality of driving part fixing rings assembled to transmit rotational force through a rotation transmitting part.

4. The sealing device of claim 3, wherein the rotation transmitting part comprises at least one of:

    a first rotation transmitting part comprising a pin inserted into at least one pin hole formed in the driving part fixing rings; and
    a second rotation transmitting part comprising a protrusion inserted into at least one recess formed in the driving part fixing rings.

5. The sealing device of claim 4, wherein the first and second rotation transmitting parts are sequentially arranged on the driving part fixing rings.

6. The sealing device of claim 3, further comprising a guide groove and a guide ring provided on the driving part fixing rings, or stepped portions formed on edge portions of the driving part fixing rings making contact with each other.

7. The sealing device of any one of claims 1 to 6, wherein the rotation absorbing part comprises rings arranged alternately on the driving part fixing member and the structure mounting member so as to absorb rotation of the driving part.

8. The sealing device of claim 7, wherein the rings of the rotation absorbing part comprise at least one convex ring and at least one concave ring arranged at corresponding positions, and
the convex ring and the concave ring are correspondingly arranged on one of the driving part fixing rings of the driving part fixing member and a structure mounting ring, the structure mounting ring being the structure mounting member and adjacent to the driving part fixing ring.

9. The sealing device of claim 3, further comprising a vibration absorbing part disposed between the driving part fixing rings to absorb vibrations or shaking when the driving part is rotated.

10. The sealing device of claim 9, wherein the vibration absorbing part is a coil spring disposed in a hole formed in the driving part fixing rings, and the coil spring is adjusted in elasticity by using a pressing bolt inserted into the driving part fixing rings.

11. The sealing device of any one of claims 1 to 6, further comprising a clamping part connected between the driving part fixing member and the structure mounting member or the structure for being used when the sealing device is installed on the structure.

12. The sealing device of claim 11, wherein the clamping part comprises:

    a clamping bar horizontally fixed to an upper side of the driving part fixing member; and
    a clamping bolt inserted into the clamping bar and coupled to the clamping bar and the structure mounting member or the structure.

13. The sealing device of any one of claims 1 to 6, wherein a fastener fixed to the driving part is coupled to at least one of the driving part fixing rings of the driving part fixing member, and
at least one sealing member is provided on at least one of the structure mounting member and the driving part fixing member for sealing between the driving part and the sealing device.

14. The sealing device of any one of claims 1 to 6, further comprising at least one of a lubricant supply unit and a gas supply unit connected to the rotation absorbing part for suppressing abrasion or maintaining sealing.

15. The sealing device of any one of claims 1 to 6, wherein the structure is a bin or hopper comprising a screw feeder, and
the driving part is a driving shaft of the screw feeder.

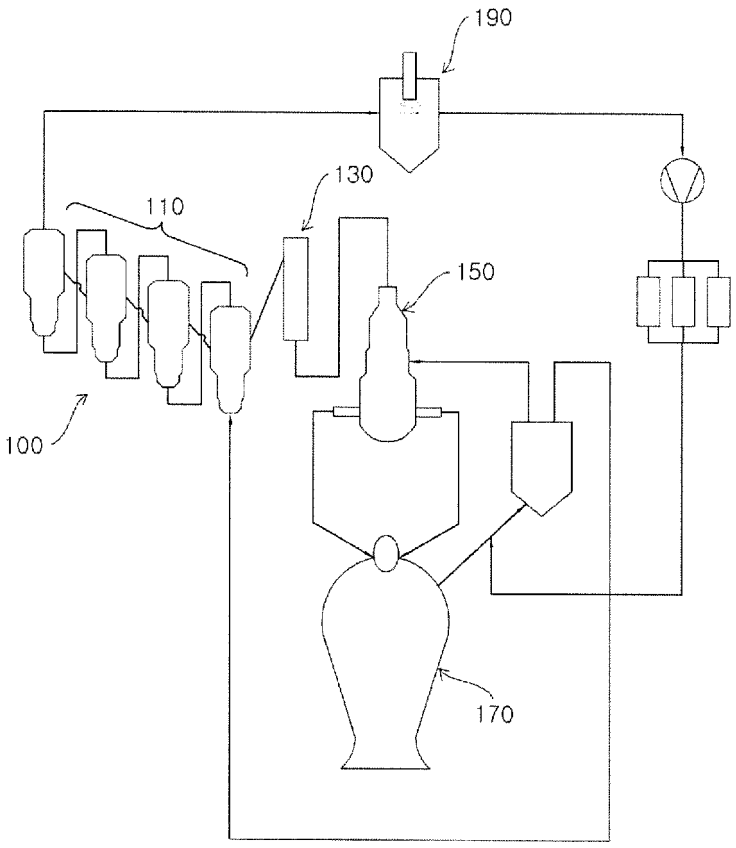

FIG. 1

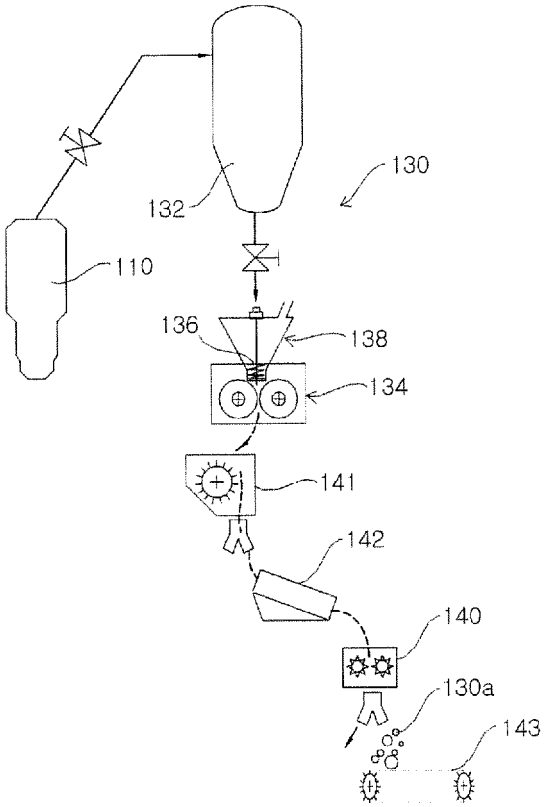

FIG. 2

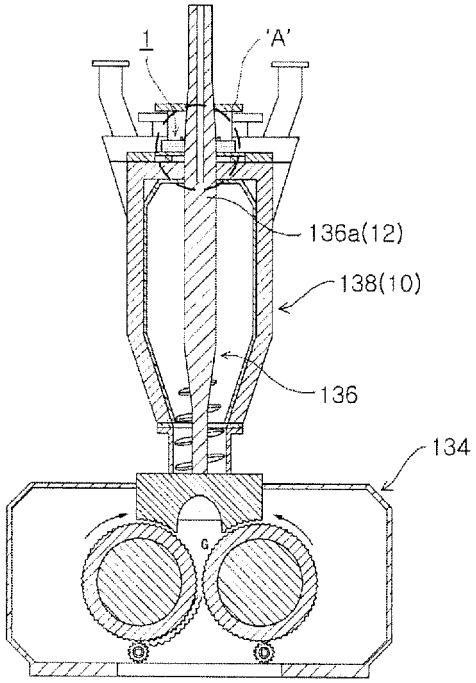

FIG. 3

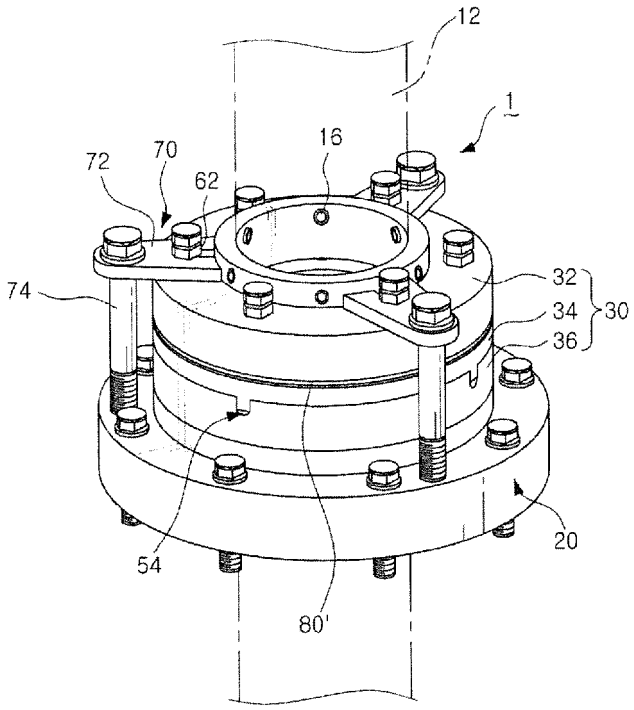

FIG. 4

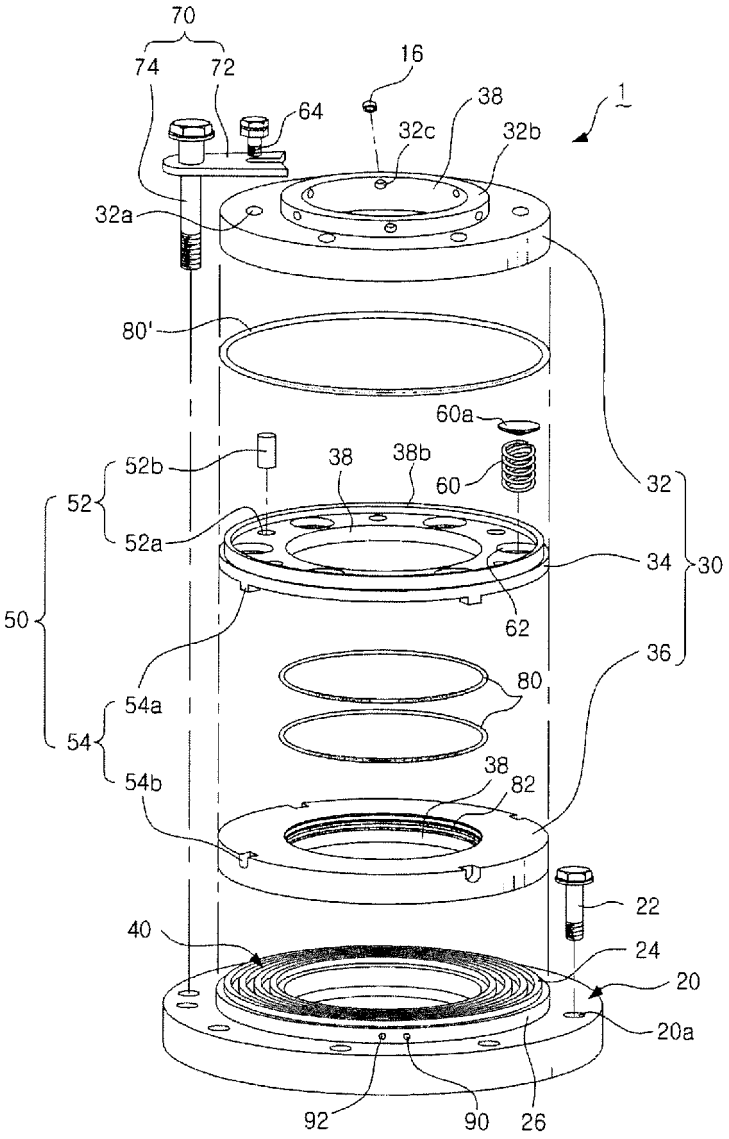
70
74
72
16
64
38
32c
32b
1
32a
80'
60a
52b
38
38b
60
32
52
52a
34
30
50
62
36
80
54a
54
54b
38
82
22
40
24
20
20a
92
90
26

FIG. 5

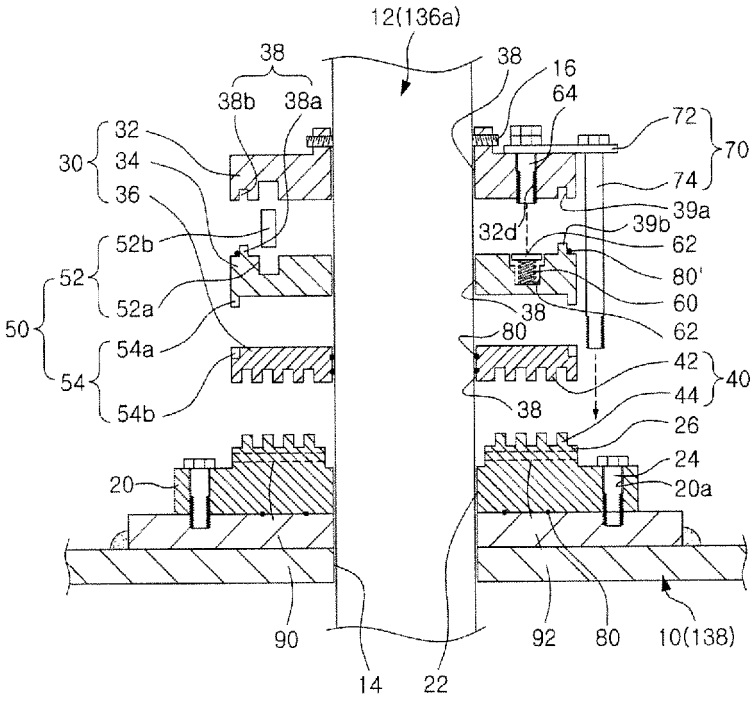
12(136a)
38
38b
38a
38
16
64
72
70
74
30
32
34
36
39a
39b
32d
62
52b
52
52a
80'
60
50
38
62
80
54a
42
40
54
54b
44
38
26
24
20
20a
90
92
80
10(138)
14
22

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2012/010109

A. CLASSIFICATION OF SUBJECT MATTER

C22B 1/16(2006.01)i, F27B 21/08(2006.01)i

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)

C22B 1/16; F16J 15/34; F16J 15/00; B63H 23/36; F16J 15/32; F16J 15/18; F04D 13/00; F16J 15/16; B65G 65/46; B65G 33/32

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models: IPC as above
Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: drive shaft, rotating shaft, sealing, sealing, sealing, stationary member, fixing ring, vibration, packing, packing, sealing, sealed, ring, shaft, rod, rotation, sealing

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-2001-0077089 A (SHIN WON CO.,LTD) 17 August 2001 See pages 2-3 and figure 2.	1-15
A	JP 2008-240837 A (KUBOTA CORP.) 09 October 2008 See abstract, claim 1 and figure 1.	1-15
A	JP 08-156888 A (KIIPAA KK.) 18 June 1996 See paragraphs [0008]-[0010] and figure 1.	1-15
A	JP 2003-227570 A (SUMITOMO HEAVY IND. LTD.) 15 August 2003 See abstract, paragraphs [0014]-[0020] and figure 1.	1-15
A	JP 08-104415 A (MITSUBISHI HEAVY IND., LTD.) 23 April 1996 See abstract, paragraphs [0002]-[0008] and figures 1-2.	1-15
A	KR 10-1044346 B1 (PARK, YEONG SEOB) 29 June 2011 See paragraphs [0028]-[0052] and figure 2.	1-15

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 FEBRUARY 2013 (26.02.2013)	**27 FEBRUARY 2013 (27.02.2013)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon, 189 Seonsa-ro, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2012/010109

Patent document cited in search report	Publication date	Patent family member	Publication date
KR 10-2001-0077089 A	17.08.2001	NONE	
JP 2008-240837 A	09.10.2008	NONE	
JP 08-156888 A	18.06.1996	NONE	
JP 2003-227570 A	15.08.2003	NONE	
JP 08-104415 A	23.04.1996	NONE	
KR 10-1044346 B1	29.06.2011	NONE	

Form PCT/ISA/210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 5534046 A **[0004]**
- US 5666638 A **[0006]**