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(54) Title: SEALED SPROCKET FOR A CONVEYOR SYSTEM

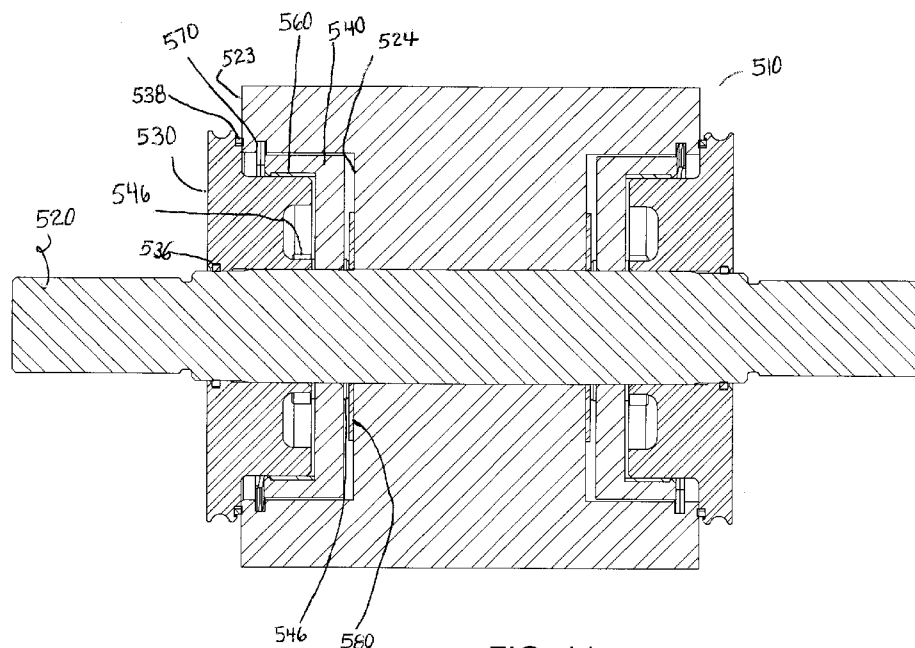


FIG. 11

(57) Abstract: A sealed sprocket for a conveyor belt comprises a sprocket mounted on a drive shaft and a seal system sealing an interface between the sprocket and the drive shaft. The seal system comprises a seal cap housing ring seals for sealing interfaces between the sprocket and seal cap and between the seal cap and drive shaft.

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

- *with international search report (Art. 21(3))*

SEALED SPROCKET FOR A CONVEYOR SYSTEM

BACKGROUND

The invention relates generally to sprockets for an endless conveyor belt system.

5 More particularly, the invention relates to sealed sprockets for preventing dirt, bacteria and—or other contamination from entering a bore hole of a sprocket.

Sprockets are used to drive endless power-transmission and conveyor belts and chains. Each sprocket is mounted on a shaft received by a bore hole extending axially through the sprocket. A gearbox or a belt-driven pulley mounted to an end of the shaft
10 makes the shaft a driveshaft. The interface between a sprocket and a shaft provides opportunity for dirt, debris and—or liquid to leak into the bore, compromising hygiene and providing a niche point for bacteria and a potential source of contamination.

SUMMARY

15 One version of a sprocket embodying features of the invention comprises a sprocket mounted on a drive shaft and a seal system sealing an interface between the sprocket and the drive shaft. The seal system comprises a seal cap housing ring seals for sealing interfaces between the sprocket and seal cap and between the seal cap and drive shaft.

According to one aspect, an assembly in a conveyor system, comprises a sprocket
20 having peripheral teeth for engaging a conveyor belt and a central bore hole for receiving a shaft, a shaft inserted in the central bore hole and a sealing device for sealing the interface between the sprocket and shaft.

According to another aspect, a seal for a sprocket comprises an end seal cap configured to receive a shaft and interface with a sprocket end face, a first annular seal
25 compressively seated in a groove for sealing an interface between the sprocket and the annular seal cap and a second annular seal compressively seated in a groove for sealing an interface between the annular seal cap and the shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a sealed sprocket according to an embodiment of the invention;

FIG. 2 is a cross-sectional view of the sprocket of FIG. 1 through line A-A;

5 FIG. 3 is a side view of a sealed sprocket according to another embodiment of the invention;

FIG. 4 is a cross-sectional view of the sprocket of FIG. 3 through line A-A;

FIG. 5 is a side view of a sealed sprocket according to another embodiment of the invention;

10 FIG. 6 is a cross-sectional view of the sprocket of FIG. 5 through line A-A;

FIG. 7 is a front view of a sealed sprocket according to another embodiment of the invention

FIG. 8 is a side view of the sprocket of FIG. 7;

FIG. 9 is a cross-sectional view of the sprocket of FIG. 8 through line A-A;

15 FIG. 10 is an exploded view of a sealed sprocket according to another embodiment of the invention;

FIG. 11 is a cross-sectional view of the sealed sprocket of FIG. 10 when assembled;

FIG. 12 is an exploded view of a sealed sprocket according to another embodiment of the invention; and

20 FIG. 13 is a cross-sectional view of the sealed sprocket of FIG. 12 when assembled.

DETAILED DESCRIPTION

A sprocket or roller for driving or otherwise engaging a conveyor belt comprises a seal for preventing bacteria, dirt, liquid and—or other contamination from entering the bore
25 hole of the sprocket. The invention will be described below relative to certain illustrative embodiments, though the invention is not limited to the illustrative embodiments.

FIGS. 1 and 2 show a sealed sprocket 10 according to an embodiment of the invention. The illustrative sprocket 10 is a full width sprocket, spanning the width of a corresponding conveyor belt, but the invention is not so limited. The sprocket comprises a
30 cylindrical body having peripheral teeth (not shown) for engaging drive elements, such as drive teeth, on a conveyor belt, and a central bore hole 12 extending along the central axis.

The cylindrical body may be formed of any suitable plastic or other material. The central bore hole 12 is designed to receive a drive shaft 20 for driving the sprocket 10. The drive shaft 20 may be knurled, though the invention is not so limited. A seal system 30 seals the interface between the sprocket and shaft at one or both ends of the bore hole 12.

5 The seal system 30 comprises an annular seal cap 32 formed of stainless steel, PEEK or another suitable material. The seal cap 32 is seated in an annular groove in a first end face 22 of the sprocket 20. The illustrative seal cap 32 is flush with the end face 22, though the invention is not so limited. The seal system 30 further comprises a tolerance ring 34 between the shaft and the seal cap, spaced from the first end face 22. The tolerance ring 34 is seated in
10 a groove on either the outer surface of the shaft (as shown) or a groove formed in an inner surface of the seal cap 32.

 The seal system 30 further includes seal rings, shown as a radially inner o-ring 38 and a radially outer o-ring 36. The seal rings are not limited to o-rings, and can alternatively comprise gaskets, lip seals, adhesives or any other suitable type of seal. The radially inner o-
15 ring 38 is compressively seated in a groove in an inner surface of the seal cap 32 and seals an interface between the seal cap 32 and shaft 20. The radially outer o-ring 36 is compressively seated in a groove in an outer surface of the seal cap 32 to seal between the sprocket 10 and the seal cap 32. Alternatively, the radially outer o-ring 36 may be seated in a groove in the sprocket, and-or the radially inner o-ring 38 may be seated in a groove in the radially outer
20 surface of the shaft 20.

 FIG. 2 also shows another embodiment of a seal system 130 formed at a second end face 24 of the sprocket for sealing between the shaft 20 and sprocket 10. The seal system 130 includes a seal cap, shown as a seal sleeve 132, overlaying the shaft at an interface between the shaft 10 and sprocket 20 and extending into and from the second end face 24 of the
25 sprocket. The radially inner surface of the sprocket includes a groove for seating the seal sleeve 132, which may be formed of stainless steel, PEEK or another suitable material. A tolerance ring 134 is seated in a groove on either the outer surface of the shaft (as shown) or a groove formed in an inner surface of the seal cap 132, at an end of the seal sleeve that is distal from the second end face 24. The seal sleeve 132 is configured to seat two seal rings,
30 shown as o-rings 136, 138. The first o-ring 136 is compressively seated in a groove in the radially outer surface of the seal sleeve 132 and is axially inwards in the second end face 24

(within the body of the sprocket 20). The second o-ring is 138 compressively seated in either a groove on the outer surface of the shaft or the inner surface of the seal sleeve to seal between the seal sleeve and shaft, though the invention is not so limited.

FIGS. 3 and 4 show another embodiment of a sealed sprocket 210 including a seal system 230 for providing a hygienic interface between a shaft 220 and the sprocket body. The seal system 230 comprises an external seal cap 232 adjacent a first end face 222 of the sprocket. The external seal cap 232 comprises an annular element having an axially inner face 234 designed to seat a first o-ring 238, or other suitable seal ring, and a radially inner face 233 designed to seat a second o-ring 236, or other suitable seal ring. The first o-ring 238 seals an interface between the first end face 222 and seal cap 232 and the second o-ring seals an interface between the end cap and shaft 220. The o-rings can be seated in grooves formed in either the seal cap or the end face 222 or the shaft 220. The illustrative external seal cap 232 has an angled front face 235, but the invention is not so limited. The seal system 230 also includes a tolerance ring 237 between the radially inner surface of the seal cap and the shaft, which can be seated in a groove in either the shaft or seal cap 232.

FIGS. 5 and 6 show another embodiment of a sealed sprocket 310 including a seal system 330 for providing a hygienic interface between a shaft 320 and the sprocket body. The seal system 330 comprises an annular seal cap 332 extending from and into the first end face 322 of the sprocket. Fasteners 240, illustrated as bolts, extend axially through the seal cap 332 and into the end face 322 to secure the seal cap 332 to the sprocket. A first o-ring 338 seals an interface between the first end face 322 of the sprocket and seal cap 332 and a second o-ring 336 seals an interface between the end cap 332 and shaft 320. Other suitable types of seal rings can be used in place of o-rings.

A seal cap in a seal system for a sprocket can alternatively be inserted with a slight press fit without fasteners or tolerance rings.

FIGS. 7—9 show another embodiment of a sealed sprocket 410 including an internal seal system for sealing the interface between the sprocket body and shaft 420, which may be knurled. In the embodiment of FIGS. 7—9, the shaft 420 includes a first peripheral groove for seating a first o-ring 438, sealing an interface between a radially inner surface of the sprocket 410 and the shaft at a first end of the sprocket. The shaft 420 may have a reduced size at the first end. The bore hole 412 at the first end of the sprocket may be chamfered. The

shaft 420 includes a step 421 at a second end in which is formed another peripheral groove for seating a second o-ring 436, and the sprocket bore is widened in this end to accommodate the step 421. The step 421 prevents damage to the o-ring 436 during insertion of the shaft into the sprocket. The second end of the bore hole 412 is enlarged to

5 accommodate the step 421, and may also be chamfered.

FIGS. 10 and 11 show another embodiment of a sealed sprocket 510 including a seal system for sealing the interface between the sprocket body and shaft 520, which may be knurled. The end faces 523 of the sprocket body includes recesses 522 forming a cavity for receiving the seal system. The seal system includes an end seal cap 530 that includes a

10 flanged portion that is larger than the recess 522 in the end face 523 of the sprocket 510 and an annular portion that is received in the recess 522. An inner o-ring 536 seals the interface between the shaft 520 and the inner surface of the seal cap 330. An outer o-ring 538 seals the interface between the flange of the end seal cap 530 and the end face 523 of the sprocket body. A tolerance ring 560 holds the end seal cap 530 in place. An inner tolerance ring

15 holder 540 is inserted and contained in the cavity 522 for positioning the tolerance ring 560. The inner tolerance ring holder 540 comprises a flat, annular back wall 541 having a central opening 542 for receiving the shaft 520 and a plurality of fastener openings 543 surrounding the central opening 542. An annular lip 544 extends from the peripheral edges of the back wall 541 forming a seat for the end seal cap. When assembled, the tolerance ring 560 is

20 sandwiched between the inner surface of the annular lip 544 and the outer surface of the annular portion of the end seal cap 530.

A clip ring 570 positions and retains the tolerance ring holder 540 within the cavity 522. A tensioner pretensions the tolerance ring holder against the clip ring 570 to ensure proper placement of the tolerance ring 560. In the illustrative embodiment, the tensioner

25 comprises fasteners, shown as bolts 546, extending through the openings 543 in the holder to a shim 580, shown as a metal ring. The shim 580 is sandwiched between the bottom wall 524 of the cavity 522 and the back surface of the holder back wall 541. Any suitable means for positioning the tolerance ring holder 540 tightly against the clip ring 570 may be used. The tolerance ring 560, once properly positioned and inserted, holds the tolerance ring holder

30 540 and end seal cap 530 in sealed position.

In one embodiment, the inner cavity 522 in the sprocket end face may be filled with dye or another substance to detect failure of the o-rings 536, 538 or another malfunction.

FIGS. 12 and 13 show another embodiment of a sealed sprocket 610. The sealed sprocket includes a seal system comprising a flat annular end cap 630 having a central opening 631 for receiving a portion of the shaft 620 and a groove 632 extending around the inner surface of the central opening for receiving an o-ring 638 to seal the end cap against the shaft 630. The flat annular end cap is larger than the opening 622 in the end face of the sprocket. The flat annular end cap 630 can be sealed against the sprocket face 623 by welding or another suitable means.

In one embodiment, the inner cavity 622 in the sprocket end face may be filled with dye or another substance to detect failure of the o-ring 638 or weld, or another malfunction.

The seal systems described above prevent contamination from migrating into the interior of a sprocket.

Although the invention has been described in reference to a version of a sprocket, other versions are possible. For example, the seal system can be used with any roller, idler sprocket or component in a conveying system.

What is claimed is:

1. An assembly in a conveyor system, comprising:
a sprocket having peripheral teeth for engaging a conveyor belt and a central bore
hole for receiving a shaft;
5 a shaft inserted in the central bore hole; and
a sealing device for sealing the interface between the sprocket and shaft.
2. The assembly of claim 1, wherein the sealing device comprises an annular element
interfacing with a first end face of the sprocket, a first annular seal sealing an interface
10 between the sprocket and the annular element and a second annular seal sealing an interface
between the sprocket and the shaft.
3. The assembly of claim 2, further comprising a tolerance ring between the shaft and
the annular element.
15
4. The assembly of claim 2, further comprising fasteners for coupling the annular
element to the sprocket.
5. The assembly of claim 1, wherein the sealing device comprises a first annular seal
20 compressively seated in a groove in a peripheral surface of the shaft.
6. The assembly of claim 5, wherein the sealing device comprises a second annular seal
compressively seated in a groove in a stepped up portion on the peripheral surface of the
shaft.
25
7. The assembly of claim 1, wherein the sealing device comprises:
a tolerance ring holder positioned in a cavity formed in an end face of the sprocket,
an end seal cap including a first o-ring for sealing against the shaft and a second o-
ring for sealing against the end face of the sprocket, the end seal cap seated in an opening in
30 the tolerance ring holder; and

a tolerance ring sandwiched between an inner surface of the tolerance ring holder and an outer surface of the end seal cap for holding the end seal cap in place.

8. The assembly of claim 7, further comprising a clip ring for holding the tolerance ring holder in position within the cavity.

9. The assembly of claim 8, further comprising a tensioner for biasing the tolerance ring holder against the clip ring.

10. The assembly of claim 1, wherein the sealing device comprises:
an annular end cap having a central opening for receiving the shaft, the annular end cap welded to an end face of the sprocket; and
an o-ring mounted in a groove of the central opening for sealing against the shaft.

11. A seal for a sprocket, comprising:
an end seal cap configured to receive a shaft and interface with a sprocket end face;
a first annular seal compressively seated in a groove for sealing an interface between the sprocket and the annular seal cap; and
a second annular seal compressively seated in a groove for sealing an interface between the annular seal cap and the shaft.

12. The seal of claim 11, further comprising a tolerance ring between the shaft and the annular cap.

13. The seal of claim 11, wherein the annular seal cap is formed of stainless steel or PEEK.

14. The seal of claim 11, further comprising:
a tolerance ring holder seated in a cavity in the sprocket end face, wherein a portion of the end seal cap is seated in an opening in the tolerance ring holder, and
a tolerance ring sandwiched between the tolerance ring holder and the end seal cap.

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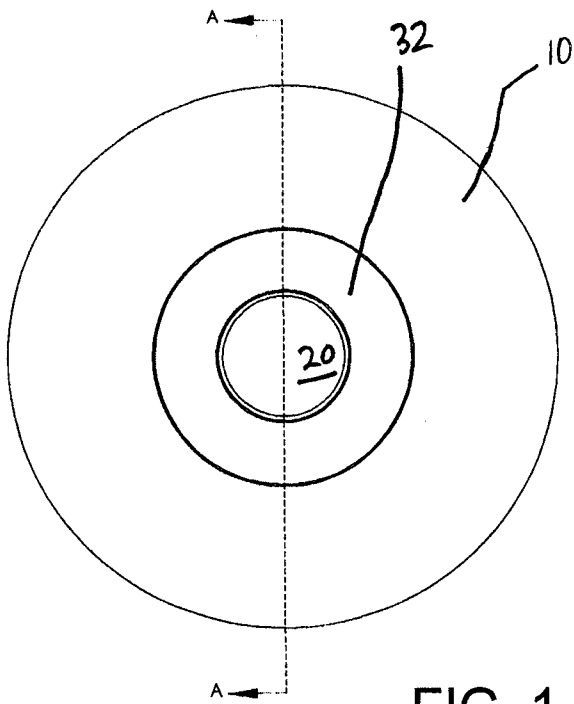


FIG. 1

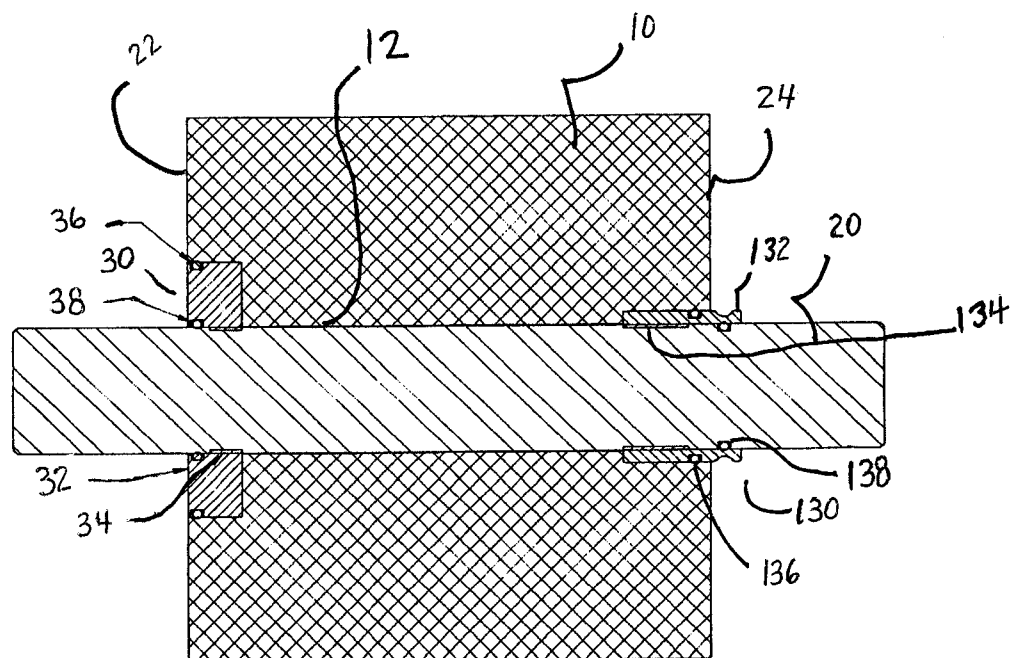


FIG. 2

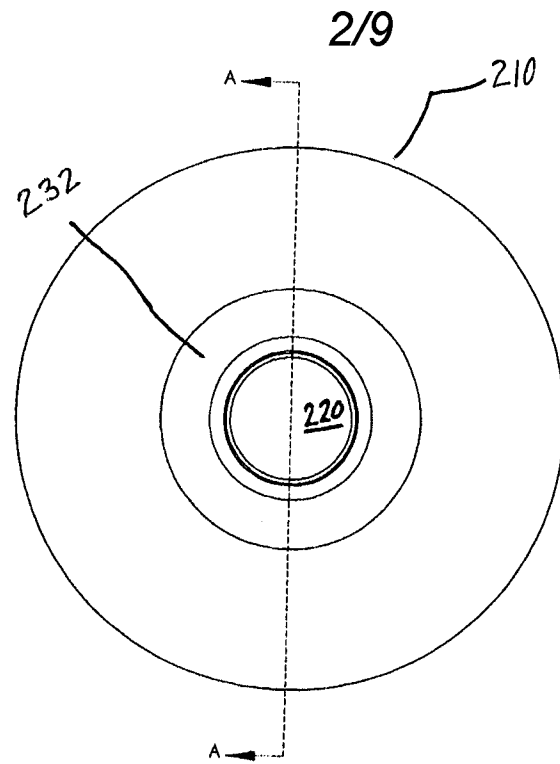


FIG. 3

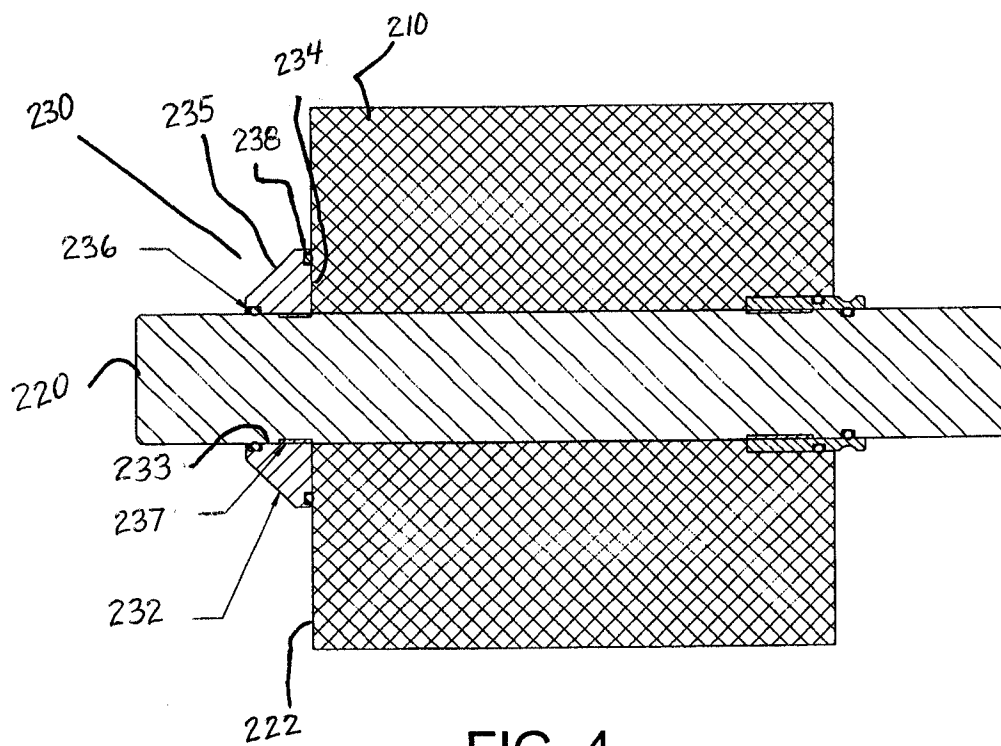


FIG. 4

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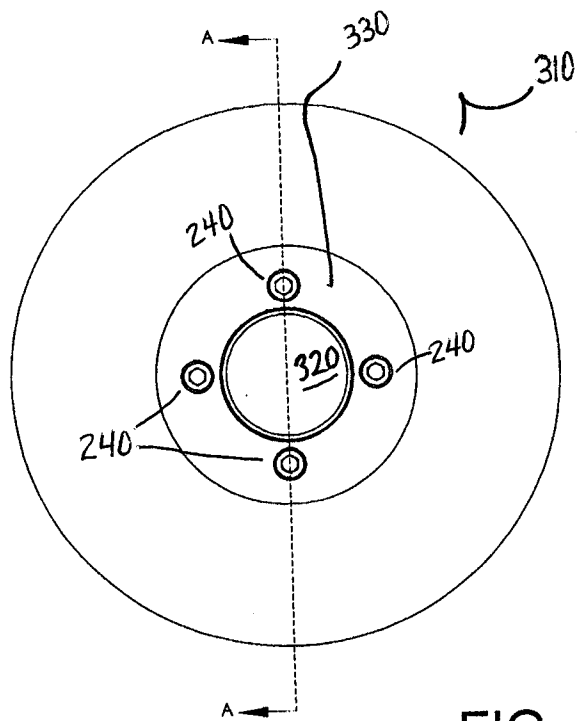


FIG. 5

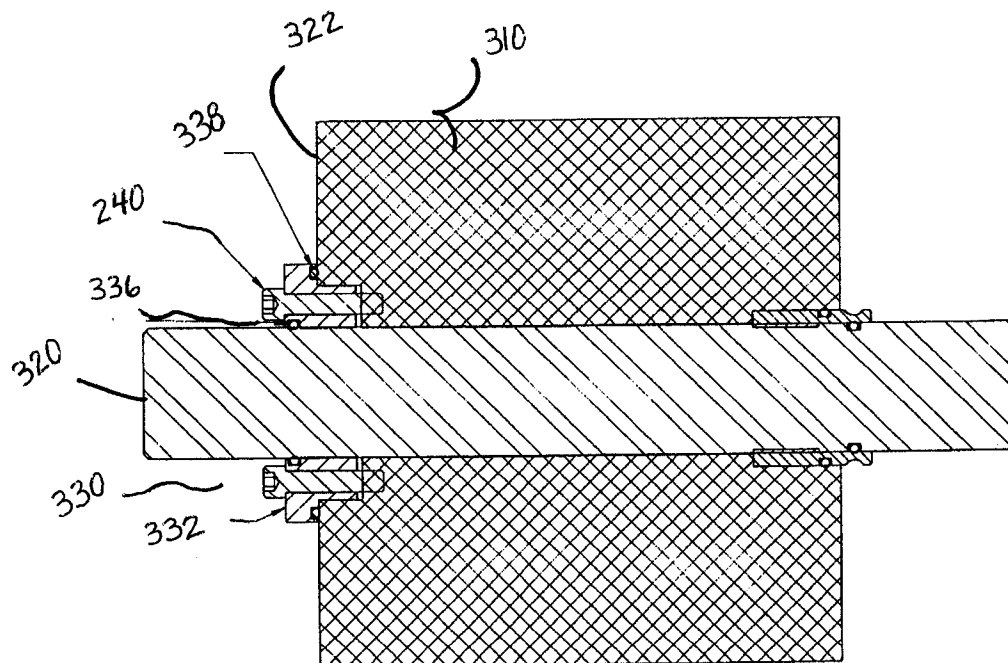


FIG. 6

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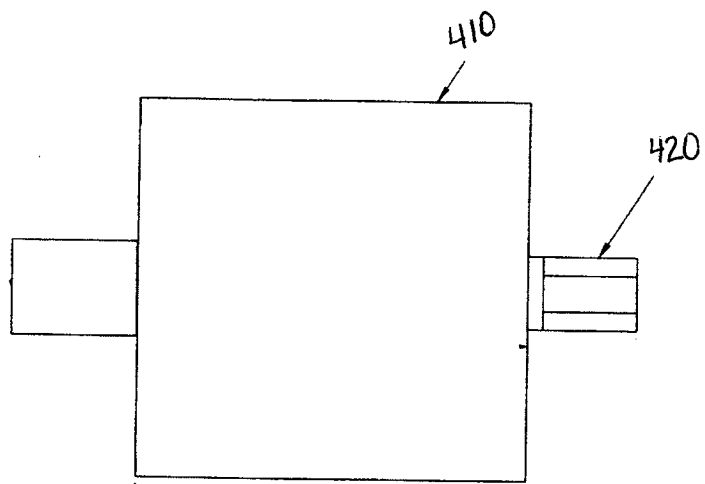


FIG. 7

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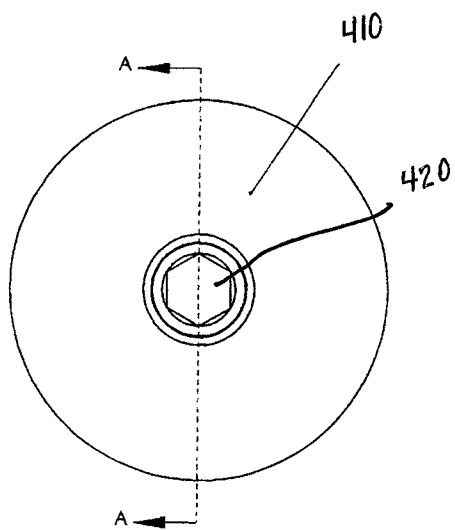


FIG. 8

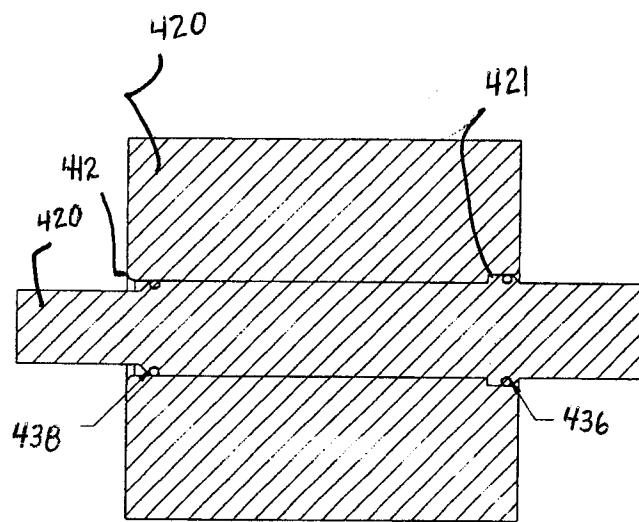


FIG. 9

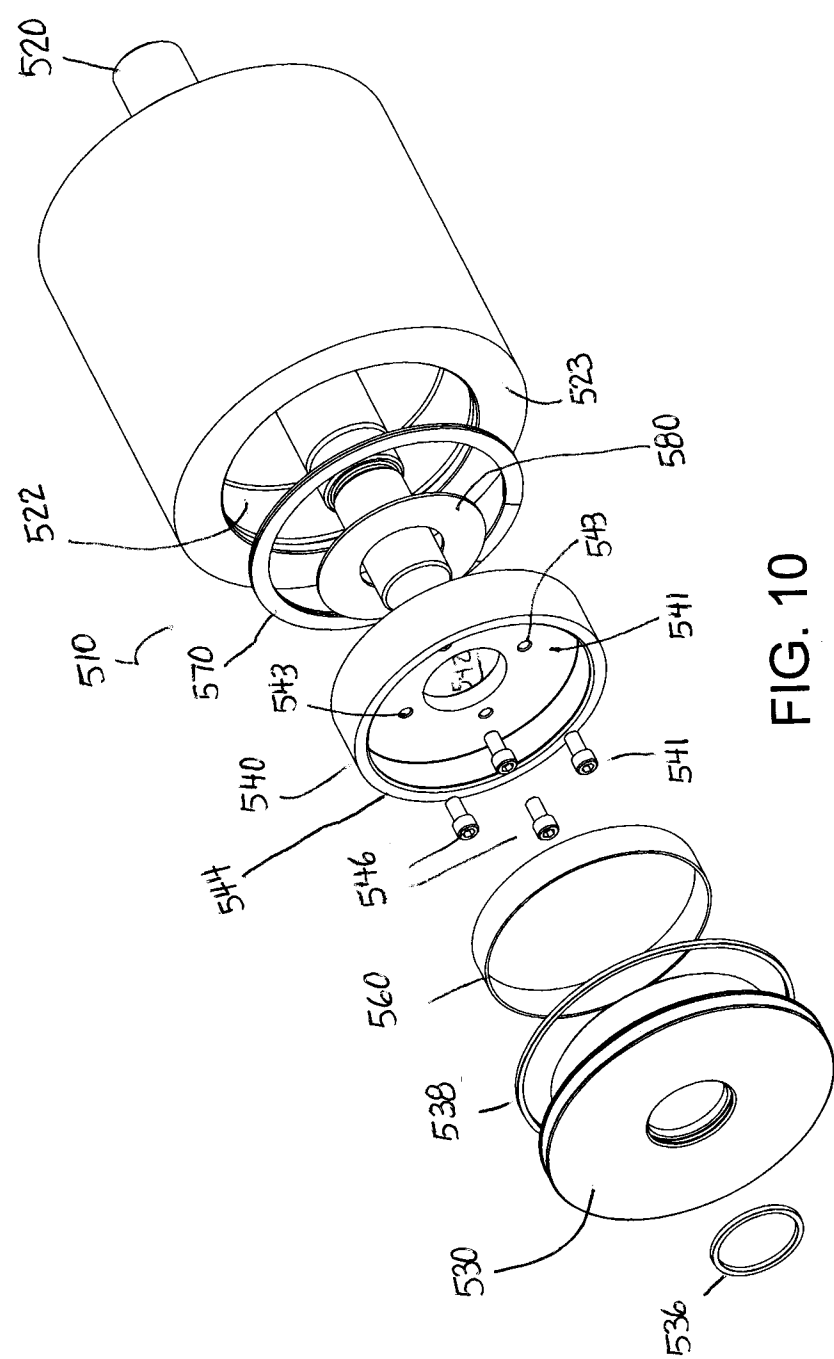


FIG. 10

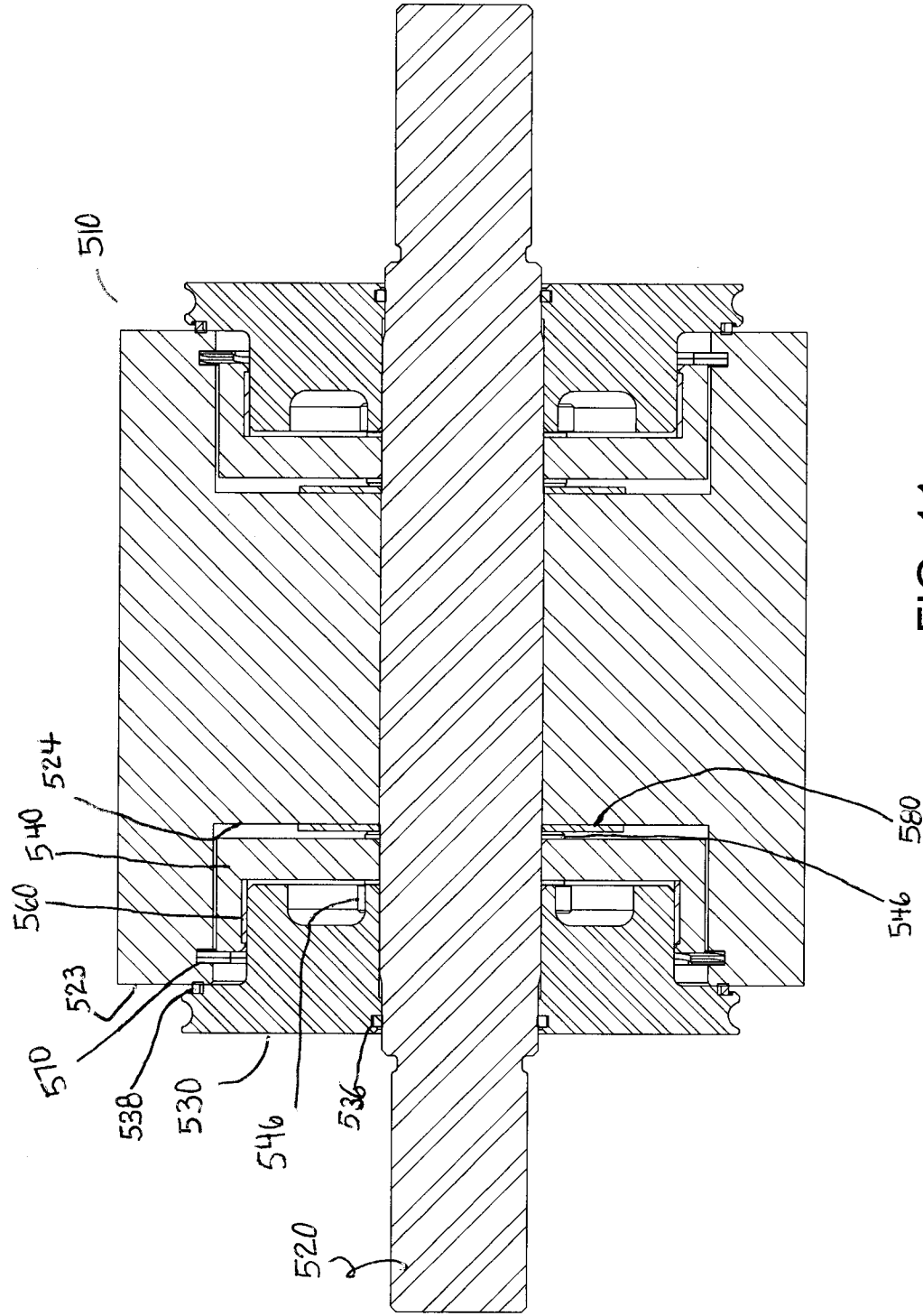


FIG. 11

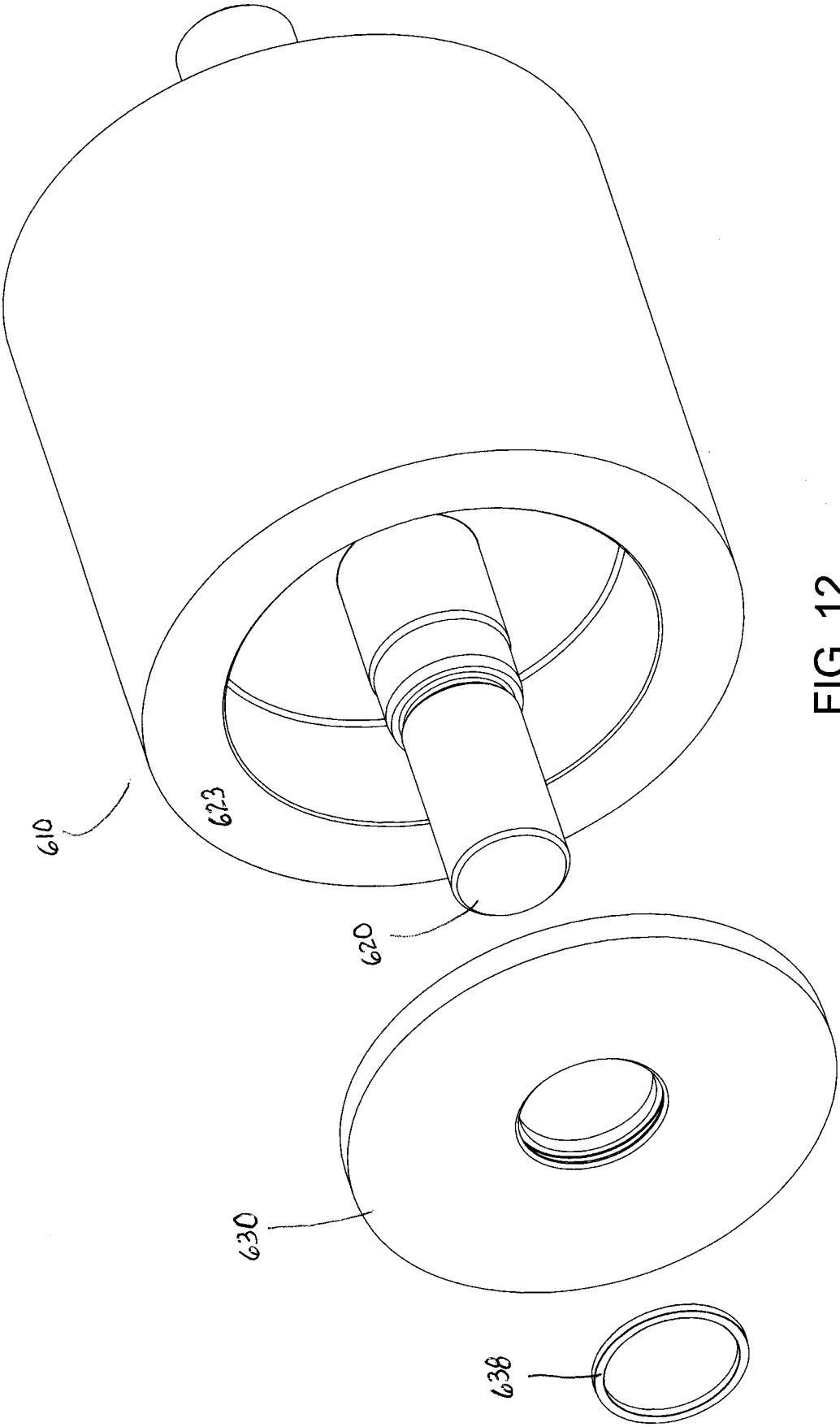


FIG. 12

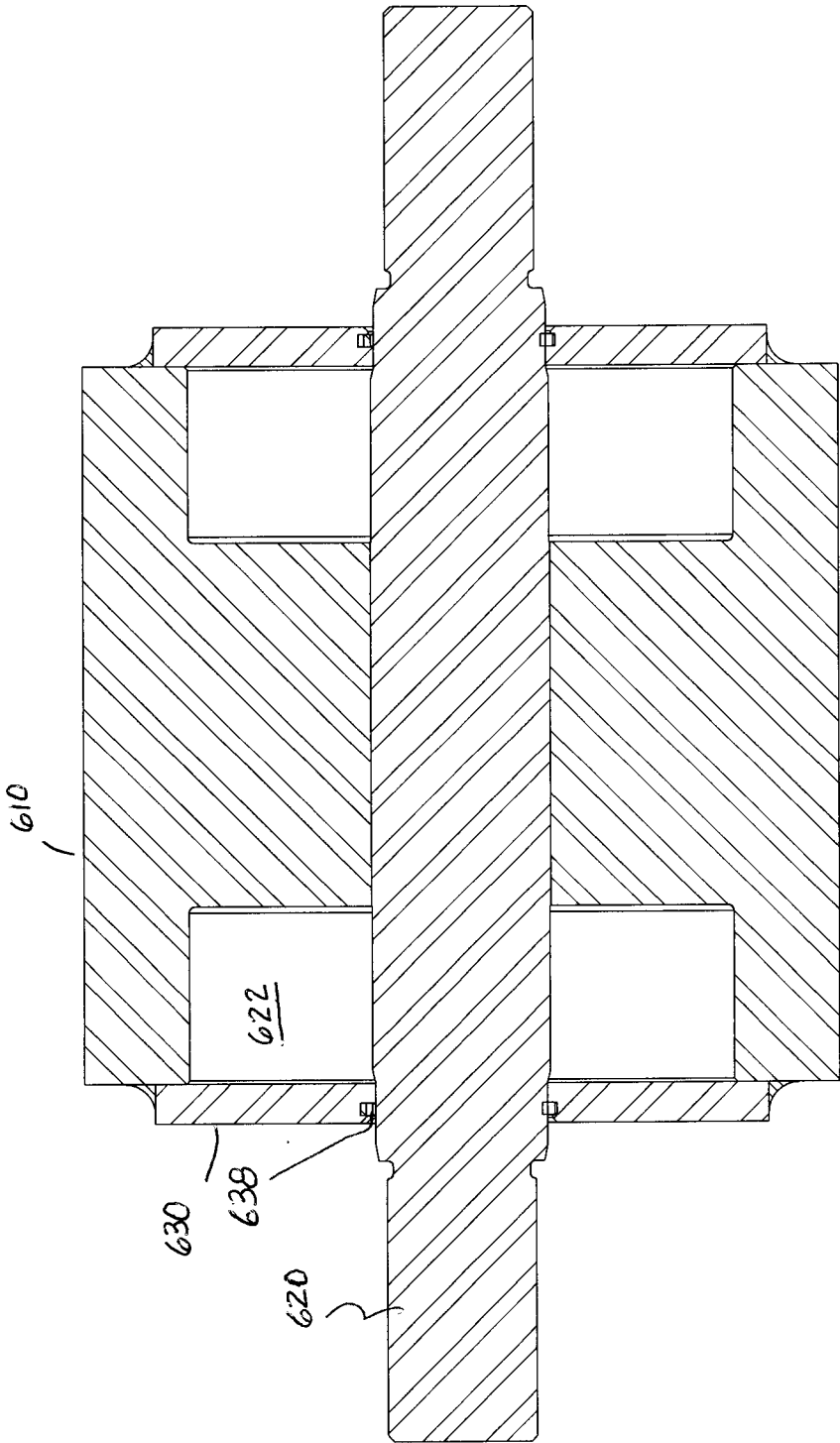


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/036243**A. CLASSIFICATION OF SUBJECT MATTER****B65G 23/04(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)

B65G 23/04; A10D 45/02; B62D 55/092; B62D 55/15; B65G 17/16; B65G 23/06; B65G 23/23; B65G 39/02; B65G 45/00; E01H 1/04

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

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & keywords: sprocket, conveyor, belt, teeth, seal, shaft, tolerance ring, end cap, o-ring

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4143757 A (WALLENFANG, JEROME A.) 13 March 1979	1
Y	See column 3, line 10 - column 4, line 52 and figures 1-4.	2-14
Y	US 2015-0360872 A1 (WOLTERS et al.) 17 December 2015 See paragraphs [0161]-[0168] and figures 40-43.	2-4, 7-14
Y	JP 06-080230 A (T & T K.K.) 22 March 1994 See paragraph [0025] and figures 1-2.	5-6
A	CN 204355183 U (ZOOMLION HEAVY MACHINERY CO., LTD.) 27 May 2015 See claims 1-4 and figure 1.	1-14
A	EP 0922809 A1 (DULEVO INTERNATIONAL S.P.A.) 16 June 1999 See paragraphs [0033]-[0045] and figures 1-5.	1-14



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"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

27 September 2018 (27.09.2018)

Date of mailing of the international search report

27 September 2018 (27.09.2018)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2018/036243

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