

CONVENTION
AUSTRALIA 601744

Patents Act

APPLICATION FOR A STANDARD PATENT

✓We Eagle Industry Co. Ltd.

of 6-15, Shibakoen 2-chome,
Minato-ku,
Tokyo,
JAPAN.

LODGED AT SUB-OFFICE
10 JUN 1987
Melbourne

hereby apply for the grant of a standard patent for an invention
entitled:

MECHANICAL SEAL FOR A SLURRY PUMP

which is described in the accompanying complete specification.

APPLICATION ACCEPTED AND AMENDMENTS

ALLOWED 10.7.90

Details of basic application

Number of basic application: 9937/1987

Convention country in which
basic application was filed: JAPAN

Date of basic application : 28 January 1987

Address for Service:

PHILLIPS ORMONDE & FITZPATRICK
Patent and Trade Mark Attorneys
367 Collins Street
Melbourne 3000 AUSTRALIA

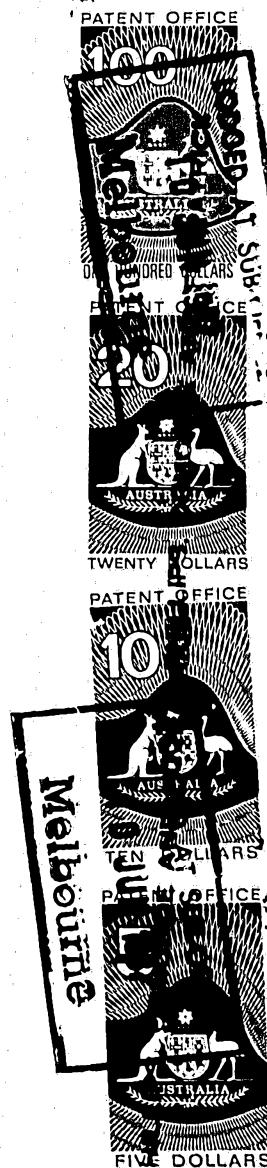
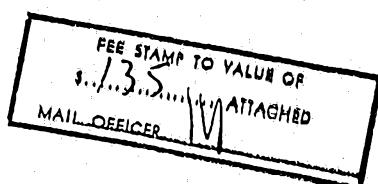
Dated: 25 May 1987

PHILLIPS ORMONDE & FITZPATRICK
Attorneys for:
Eagle Industry Co. Ltd.,

By:

David B Fitzpatrick

Our Ref : 56396
POF Code: 3342/66191



6012q/1

AUSTRALIA
Patents Act
DECLARATION FOR A PATENT APPLICATION

▼ INSTRUCTIONS

(a) Insert "Convention" if applicable
(b) Insert FULL name(s) of applicant(s)

In support of the ⁽¹⁾ Convention application made by
(b)

EAGLE INDUSTRY CO., LTD.

(c) Insert "of addition" if applicable
(d) Insert TITLE of invention

(hereinafter called "applicant(s) for a patent ^(c) for an invention entitled ^(d)

MECHANICAL SEAL FOR A SLURRY PUMP

(e) Insert FULL name(s) AND address(es) of declarant(s)
(See headnote*)

I/~~We~~ ^(e) Kazushiro TSURUTA, President of Eagle Industry Co., Ltd.
of 6-15, Shibakoen 2-chome, Minato-ku, Tokyo

do solemnly and sincerely declare as follows:

1. ~~I am the applicant(s)~~
(or, in the case of an application by a body corporate)
1. I am/~~We are~~ authorized to make this declaration on behalf of the applicant(s).
2. ~~I am the actual inventor(s) of the invention.~~
(or, where the applicant(s) is/are not the actual inventor(s))
2. ^(f) Yoichi OGATA, of c/o Saitama Factory of Eagle Industry Co., Ltd.
1500, Oaza Kitayanagi, Sakado-shi, Saitama-ken, Japan

(f) Insert FULL name(s) AND address(es) of actual inventor(s)

(g) Recite how applicant(s) derive(s) title from actual inventor(s)
(See headnote**)

(g) is/~~are~~ the actual inventor(s) of the invention and the facts upon which the applicant(s) is/~~are~~ entitled to make the application are as follows:

Applicant is the assignee of the invention from the actual inventor.

(Note: Paragraphs 3 and 4 apply only to Convention applications)

3. The basic application(s) for patent or similar protection on which the application is based is/~~are~~ identified by country, filing date, and basic applicant(s) as follows:

(h)

Japan, January 28, 1987,

Eagle Industry Co., Ltd.

4. The basic application(s) referred to in paragraph 3 hereof was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

(k) Insert PLACE of signing

Declared at ^(k) Tokyo

(l) Insert DATE of signing

Dated ^(l) April 20, 1987

(m) Signature(s) of declarant(s)

(m) K. Tsuruta

Kazushiro Tsuruta

Note: No legalization or other witness required

To: The Commissioner of Patents

(12) PATENT ABRIDGMENT (11) Document No. AU-B-74090/87
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 601744

(54) Title
MECHANICAL SEAL FOR A SLURRY PUMP

International Patent Classification(s)
(51) F04D 029/12 F16J 015/34

(21) Application No. : 74090/87 (22) Application Date : 10.06.87

(30) Priority Data

(31) Number (32) Date (33) Country
62-9937 28.01.87 JP JAPAN

(43) Publication Date : 04.08.88

(44) Publication Date of Accepted Application : 20.09.90

(71) Applicant(s)
EAGLE INDUSTRY CO. LTD.

(72) Inventor(s)
YOICHI OGATA

(74) Attorney or Agent
PHILLIPS ORMONDE & FITZPATRICK, 367 Collins Street, MELBOURNE VIC 3000

(15) Prior Art Documents
AU 522385 45526/79 F16J 15/36
AU 541043 73107/81 F16J 15/34

(67) Claim

1. A mechanical seal device for a slurry pump having an impeller rotatable, within a housing on a drive shaft; the seal device being of annular form and adapted to be received on the shaft, to provide a seal between the shaft and housing, with a first one of axially opposed ends of the seal device nearer to the impeller and downstream from its other end with respect to slurry flow under the action of the impeller; the seal device having axially opposed seal rings of which one ring nearer to the other end of said device is non-rotatable and the other ring nearer the first end is rotatable; the seal device further including, between the one end thereof and the other ring, a seal cover connectable to the shaft and by which the other ring is rotatable, an annular projection extending axially from the cover towards the other end of the device, and a rubber seal member fitted radially within the projection around said other ring; said projection and seal member at the axial ends thereof nearer to the other end of the

(11) AU-B-74090/87
(10) 601744

-2-

device together defining a frusto-conical surface which tapers outwardly and away from the other end of the device such that, in use of said device, circulation of slurry to said impeller substantially without accumulation of slurry between said projection and seal member is facilitated.

AUSTRALIA

Patents Act

601744

COMPLETE SPECIFICATION
(ORIGINAL)

Class Int. Class

Application Number:
Lodged:

Complete Specification Lodged:
Accepted:
Published:

Priority

Related Art:

This document contains the
amendments made under
Section 49 and is correct for
printing

APPLICANT'S REFERENCE: U-8702

Name(s) of Applicant(s):

Eagle Industry Co. Ltd.

Address(es) of Applicant(s):

6-15, Shibakoen 2-chome,
Minato-ku,
TOKYO,
JAPAN.

Address for Service is:

PHILLIPS ORMONDE & FITZPATRICK
Patent and Trade Mark Attorneys
367 Collins Street
Melbourne 3000 AUSTRALIA

Complete Specification for the invention entitled:

MECHANICAL SEAL FOR A SLURRY PUMP

Our Ref : 56396

POF Code: 1342/66191

The following statement is a full description of this invention, including
the best method of performing it known to applicant(s):

The present invention relates to an improvement in a mechanical seal used for a shaft seal part of a slurry pump adapted to pump liquids containing a large amount of slurries.

(Prior Art)

One example of the slurry pump of this kind has been heretofore known, in which as shown in FIG. 2, an impeller 3 is mounted on the extreme end of a shaft 2 extending from a drive source such as a motor 1, and the impeller 3 is rotated and actuated to pump a slurry liquid containing a large amount of particulate solids such as bauxite or powdery coal. A mechanical seal 11 which functions as a shaft seal device is provided in the boundary between a space 4 on the side of the impeller 3 and a space 5 on the side of the motor 1 so as to prevent said slurry liquid from flowing towards the motor 1.

The mechanical seal generally indicated at 11 has as shown in FIG. 3, a non-rotational seal ring 12 airtightly carried on the side of a pump housing 6 and a rotational seal ring 13 carried on said shaft 2, both the seal rings 12 and 13 being axially opposed to prevent the passage of the slurry liquid S present on the outside diameter side with said opposed portion directed towards the inside diameter.

The rotational seal ring 13 is embraced by a holder 14 so that the former may be formed integral therewith. On the other hand, a seal cover 16 is fitted in the outer periphery

of the shaft 2 through a sleeve 15. This seal cover 16 is provided with an axially projecting annular projection 16a on the outside diameter edge on one axial end, a rubber spring 17 is fitted into the inside diameter side of said annular projection 16a, and said ~~holder~~^{holder} 14 is fitted into said rubber spring 17. The holder 14 has a notch 14a formed at the rear end thereof so as to engage a pin 18 projected on the seal cover 16, and is rotated following the shaft 2. The rubber spring 17 is provided, as its name imparts, to back up the holder 14 to bias the rotational seal ring 13 against the non-rotational seal ring 12.

The non-rotational seal ring 12 is likewise embraced by the holder 19. A flange indicated at 20 is mounted on a pump housing, and a rubber spring 21 is interposed between the flange 20 and the holder 19. The holder 19 is stopped by means of a pin 22.

(Problem intended to be solved by the invention)

In the above-described mechanical seal, the annular projection 16a projected on the forward end of the seal cover 16 is set so as to satisfy the relation of $L > \ell_1$, where L is the projected length and ℓ_1 is the length of the surface in abutment with the rubber spring 17; the annular projection 16a being axially projected from the rubber spring 17 by the length ℓ_2 ($= L - \ell_1$); and an annular space 23 in the form of a depression is formed in the inside diameter side.

With this arrangement, when the slurry liquid S is pumped as the pump operates and a part thereof moves around the mechanical seal 11, a part of the slurry contained in the slurry liquid S is accumulated on an annular space 23. The slurry liquid S flows rightwards as viewed in the drawing, impinges upon the tapered surface 6a of the pump housing 6, circulates counterclockwise and leaves the slurry in the annular space 23. The thus left slurry is jumped and rolled within the space 23, and is urged particularly against the annular projection 16a to wear the inside diameter surface of the projection 16a. The present invention has its object to prevent such a wear.

~~(Means used to solve the problem)~~

~~A mechanical seal in the form of an internal flow~~

type mechanical seal according to the present invention comprises an axially projecting annular projection formed in the end of a seal cover fitted into a shaft of a slurry pump, a rubber spring fitted on the side of the inside diameter of said annular projection, a seal ring on the rotational side rotating following the shaft, said seal ring being fitted into said rubber spring, and the forward end of the seal ring on the rotational side opposed to a seal ring on the non-rotational side being projected axially from the forward end of said annular projection, characterized in that the approximately whole surface of the inside diameter surface of said



Summary of the Invention

According to the present invention, there is provided a mechanical seal device for a slurry pump having an impeller rotatable, within a housing on a drive shaft; the seal device being of annular form and adapted to be received on the shaft, to provide a seal between the shaft and housing, with a first one of axially opposed ends of the seal device nearer to the impeller and downstream from its other end with respect to slurry flow under the action 10 of the impeller; the seal device having axially opposed seal rings of which one ring nearer to the other end of said device is non-rotatable and the other ring nearer the first end is rotatable; the seal device further including, between the one end thereof and the other ring, a seal cover connectable to the shaft and by which the other ring is rotatable, an annular projection extending axially from the cover towards the other end of the device, and a rubber seal member fitted radially within the projection around said other ring; said projection and seal member at 20 the axial ends thereof nearer to the other end of the device together defining a frusto-conical surface which tapers outwardly and away from the other end of the device such that, in use of said device, circulation of slurry to said impeller substantially without accumulation of slurry between said projection and seal member is facilitated.

30

39



-4a-

AB

annular projection is formed into a surface in abutment with respect to said rubber spring to define the projecting length thereof, and tapered surfaces are formed on the extreme end of said annular projection as needed so as to facilitate the circulation of a slurry liquid as a liquid to be sealed.

— (Operation) —

10

That is, the mechanical seal according to the present invention is designed to eliminate the aforesaid annular space so as not to create the accumulation of slurries contained in slurry liquids flowing into the outer periphery of the mechanical seal, and more specifically, the projected length of the annular projection is reduced to a the extent of $L = \ell_1$. Thereby all the slurries contained in the liquids ride on the whirling current to flow away, and the inner periperal portion of the annular projection will not be worn.

— (Embodiment) —

20

First, the mechanical seal of the present invention shown in FIG. 1 is compared with the prior art shown in FIG. 3. In the mechanical seal according to the present invention, an ~~annular~~ ^{annular} projection 16a projected on the forward end of a seal cover 16 is shortened ~~until~~ ^{until} the approximately whole surface of the inside diameter surface thereof forms a surface in abutment with respect to a rubber spring 17, and a convergent tapered surface 16b is formed in the extreme end of the annular projection 16a. In contrast to the tapered surface 16b, a

continuous tapered surface 17a is also formed in the edge of the rubber spring 17.

The slurry liquid flown in from the rightward whirls very smoothly as shown and carries away the slurry by its own force.

(Effects of the Invention)

As described above, in the mechanical seal for the slurry pump according to the present invention, the projected length of the annular projection is defined to eliminate the annular space which is an obstacle of the whirling of the slurry liquid, thereby restraining the accumulation of slurry to prevent a wear of said projected portion. A suitable tapered surface is formed at the extreme end of the projection to make the flow of slurry smoother.

4. BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a half sectional view showing the mounted state of a mechanical seal according to the embodiment of the present invention; FIG. 2 is a sectional view of essential parts showing one example of a slurry pump; and FIG. 3 is a half sectional view showing one example of a mechanical seal of prior art.

(1) motor, (2) shaft, (3) impeller, (4) (5) spaces, (6) pump housing, (11) mechanical seal, (12) non-rotational seal ring, (13) rotational seal ring, (14) (19) holders,

(15) sleeve, (16) seal cover, (16a) annular projection,
(6a)(16b)(17a) tapered surfaces, (17)(21) rubber springs,
(18)(22) pins, (20) flange, and (S) slurry liquid.

The claims defining the invention are as follows:

1. A mechanical seal device for a slurry pump having an impeller rotatable, within a housing on a drive shaft; the seal device being of annular form and adapted to be received on the shaft, to provide a seal between the shaft and housing, with a first one of axially opposed ends of the seal device nearer to the impeller and downstream from its other end with respect to slurry flow under the action of the impeller; the seal device having axially opposed seal rings of which one ring nearer to the other end of said device is non-rotatable and the other ring nearer the first end is rotatable; the seal device further including, between the one end thereof and the other ring, a seal cover connectable to the shaft and by which the other ring is rotatable, an annular projection extending axially from the cover towards the other end of the device, and a rubber seal member fitted radially within the projection around said other ring; said projection and seal member at the axial ends thereof nearer to the other end of the device together defining a frusto-conical surface which tapers outwardly and away from the other end of the device such that, in use of said device, circulation of slurry to said impeller substantially without accumulation of slurry between said projection and seal member is facilitated.
2. A mechanical seal according to claim 1, substantially as herein before described with reference to the accompanying drawings.

30

DATED: 27 JUNE, 1990

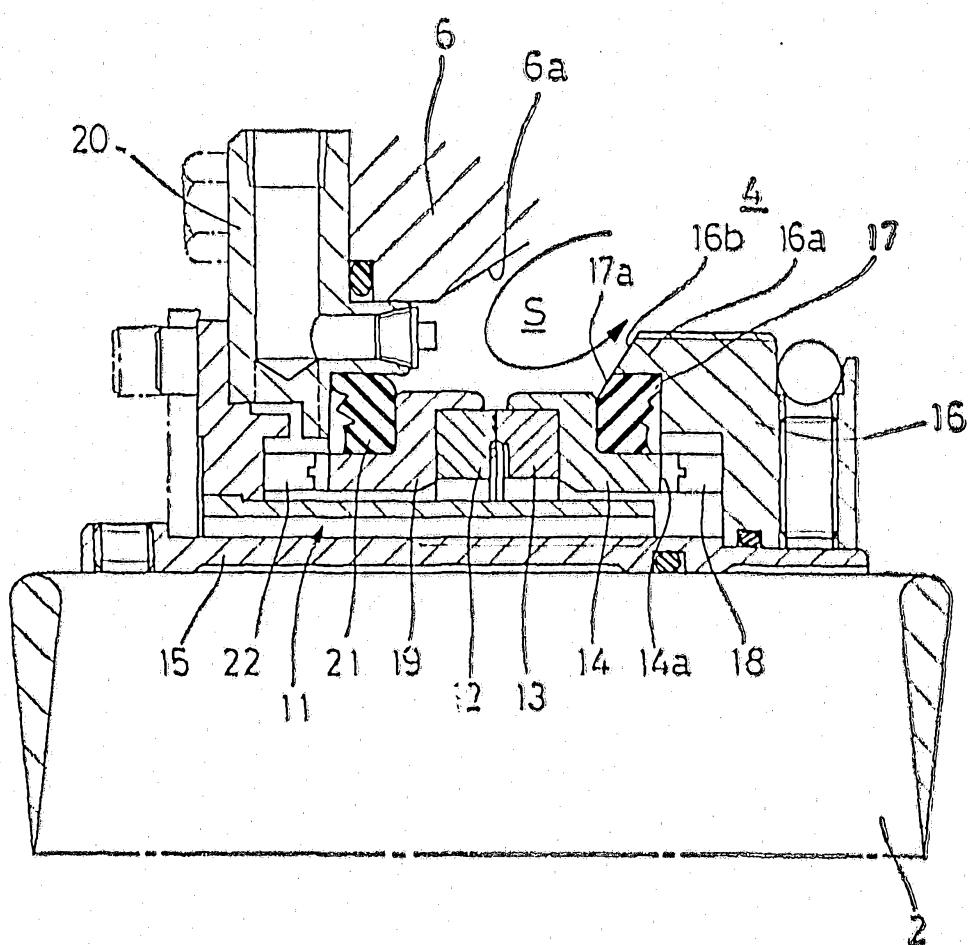
PHILLIPS ORMONDE & FITZPATRICK
Attorneys For:
EAGLE INDUSTRY CO. LTD.

15382



74-090/87

FIG. 1



74 090/87

FIG. 2

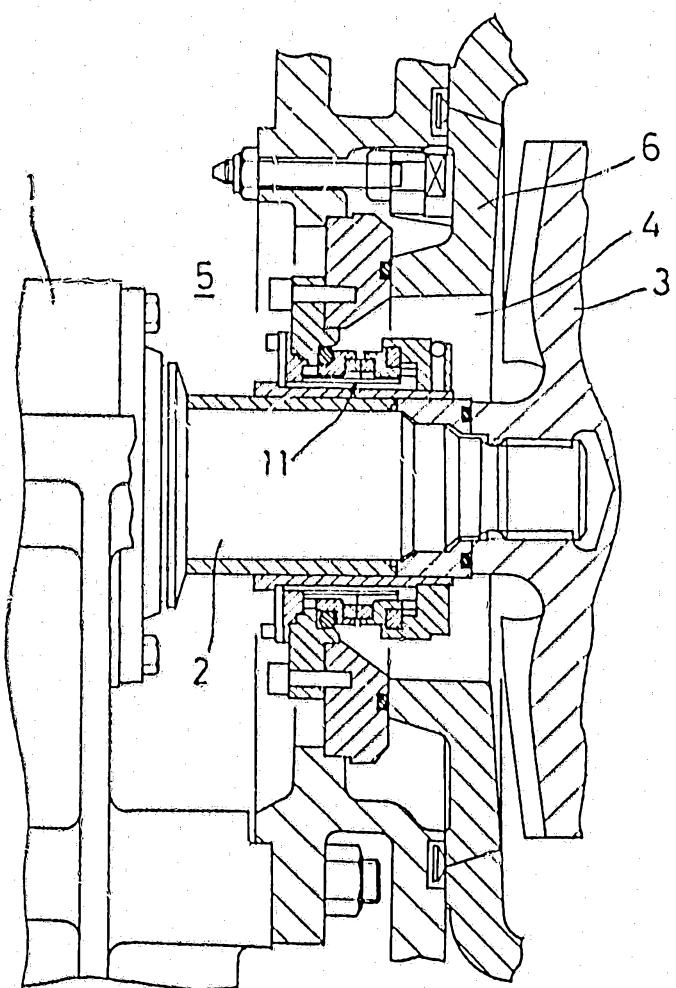


FIG. 3

