AUSTRALIA

Patents Act

APPLICATION FOR A PATENT

We \(\text{of} \) SANDVIK AB and AKTIEBOLAGET SKF,

48130372

Pack, S-811 01 Sandviken, Sweden; and Hornsgatan 1, S-415 50 Goteborg, Sweden, respectively.

hereby apply for the grant of a Patent for an invention entitled

"ROTARY DRILL BIT WITH SEVERAL ROTARY CUTTERS"

which is described in the accompanying \(\text{of} \) complete specification.

(Note: The following paragraph applies \(\text{of} \) only to Convention applications)

This application is a Convention application based on the basic application(s) for a patent or similar protection identified \(\text{of} \) number, country, and filing date as follows:

G 78 28 401.2 Germany 23rd September, 1978.

Address for Service: PHILLIPS ORMONDE AND FITZPATRICK
Patent and Trade Mark Attorneys
367 Collins Street
Melbourne, Australia 3000

Dated \(\text{of} \) 23rd July, 1979.

PHILLIPS ORMONDE AND FITZPATRICK,
Attorneys for:
SANDVIK AB and AKTIEBOLAGET SKF.

The novelty relates to a rotary drill bit with several rotary cutters each of which is rotably supported.
In support of the (6) convention application made by

SANDVIK AB AND AKTIEBOLAGET SKF,

(4918679)

(hereinafter called "applicant(s) for a patent")

for an invention entitled (6)

ROTARY DRILL BIT WITH SEVERAL ROTARY CUTTERS

Yours sincerely,

Leonnart Taquist, Manager of Sandvik AB of

Pack, S-811 01 Sandviken, Sweden, and Åke P. #, Manager

of Aktiebolaget SKF, of Hornsgatan 1, S-415 50 Göteborg, Sweden,

do solemnly and sincerely declare as follows:

1. I/us/we are the applicant(s).

(2) We are authorized to make this declaration on behalf of the applicant(s). (or, in the case of an application by a body corporate)

2. I/us/we are the actual inventor(s) of the invention.

(2) Armin Olschewski, Stösselstrasse 8, D-8720 Schweinfurt;

Manfred Brandenstein, Tränkasse 57, D-8781 Eussenheim; Lothar

Walter, Harald-Hamburger-Straße 18, D-8720 Schweinfurt and

Heinrich Kunkel, Wilhelm-Leibl-Weg 16, D-8720 Schweinfurt, all of

the Federal Republic of Germany; and, (completed on reverse side)

are the actual inventor(s) of the invention and the facts upon which the applicant(s)

are entitled to make the application are as follows:

"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:

West Germany; 23 September, 1978; by Sandvik GmbH and

SKF Kugellagerfabriken GmbH.

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

Declared at (6) Sandviken

Dated (6) 820976

SANDVIK AKTIEBOLAG

Leonnart Taquist

PHILLIPS ORMONDE & FITZPATRICK

Patent and Trade Mark Attorneys

367 Collins Street

Melbourne, Australia

The present invention aims at providing a rotary drill bit of the kind specified in the first paragraph...
Claim 1. Rotary drill bit with several rotary cutters, each of which is rotably supported on at least one radial roller bearing and one axial roller bearing with conical rolling elements on a trunion formed integrally with the drill bit body, characterized in that one of the two raceways of each axial roller bearing with conical rolling elements is plane and extends at right angles to the axis of rotation of the rotary cutter and the associated other raceway is conical and formed with a guiding shoulder radially guiding the outward facing end of the conical rolling elements.
Application Number:
Lodged:

Complete Specification Lodged:
Accepted:
Published:

Priority:

Related Art:

APPLICANT’S REF.: TFA/vh.hb DT 78 032 AU.

Name(s) of Applicant(s):
SANDVIK AB and AKTIEBOLAGET SKF.

Address(es) or Applicant(s):
Fack, S-811 01 Sandviken, Sweden; and,
Hornsgatan 1, S-415 50 Goteborg, Sweden,
respectively.

Actual Inventor(s):
ARMIN OLSCHIEWSKI; MANFRED BRANDENSTEIN;
LOTHER WALTER; DR. HEINRICH KUNKEL; and,
GOSTA NORLANDER.

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Complete Specification for the invention entitled:
"ROTARY DRILL BIT WITH SEVERAL ROTARY CUTTERS"

The following statement is a full description of this invention, including the best method of performing it known to applicant(s):
The novelty relates to a rotary drill bit with several rotary cutters each of which is rotably supported at least one radial roller bearing and one axial roller bearing with conical rolling elements on a trunion formed integrally with the drill bit body.

A rotary drill bit of this kind is known, each of the rotary cutters of which is supported in two radial roller bearings with cylindrical rolling elements and an intermediate axial roller bearing with conical rolling elements. These conical elements run between two raceways formed in the trunion and the rotary cutter and are comparatively difficult to fabricate with the exact taper and alignment. Moreover, the prior art rotary drill bit has the drawback that a radial play in the radial bearings (caused, for instance, by wear in the raceways) results in a mutual displacement of the two raceways of the axial roller bearing with conical rolling elements when the rotary cutter rotated. This displacement may cause a harmful jamming of the conical rolling elements between the conical raceways and thus a premature failure of the axial roller bearing, with conical rolling elements. To this must be added that, from the beginning, a very small radial play must be set in the radial bearings, so that the bearing elements have to be machined with close tolerances, adversely affecting the economy of production.

The novelty mentioned in Claim 1 aims at providing a rotary drill bit of the kind specified in the first paragraph above with rotary cutter bearings in which there may exist or develop a fair amount of radial play without impairing the functional efficiency of the axial roller bearing with conical rolling elements. Moreover, it must be possible to manufacture the rotary drill bit economically.

What the novel arrangement achieves is that the plane raceway of the axial roller bearing with conical rolling elements may move slightly in relation to the associated conical raceway in response to the radial play of the radial bearings, without the conical rolling elements in the axial roller bearing jamming. Therefore, comparatively wide production tolerances may be acceptable for the bearing elements, thus simplifying their manufacture from an economic...
The present invention aims at providing a rotary drill bit of the kind specified in the first paragraph above with rotary cutter bearings in which there may exist or develop a fair amount of radial play without impairing the functional efficiency of the axial roller bearing with conical rolling elements. Moreover, it must be possible to manufacture the rotary drill bit economically.

According to the invention there is provided a rotary drill bit with several rotary cutters, each of which is rotatably supported on at least one radial roller bearing and one axial roller bearing with conical rolling elements on a trunion formed integrally with the drill bit body, characterized in that one of the two raceways of each axial roller bearing with conical rolling elements is plane and extends at right angles to the axis of rotation of the rotary cutter and the associated other raceway is conical and formed with a guiding shoulder radially guiding the outward facing end of the conical rolling elements.

What the novel arrangement achieves is that the plane raceway of the axial roller bearing with conical rolling elements may move slightly in relation to the associated conical raceway in response to the radial play of the radial bearings, without the conical rolling elements in the axial roller bearing jamming. Therefore, comparatively wide production tolerances may be acceptable for the bearing elements, thus simplifying their manufacture from an economic point of view. The wearing of the elements of the radial roller bearings of a rotary cutter and the resulting increase of the radial play are readily admissible. Moreover the axial roller bearings with conical rolling elements can be economically manufactured, because each of them has a plane raceway which is easy to make.

An alternative embodiments, either the plane raceway or the conical raceway of the conical rolling elements is directly formed in the trunion or in the rotary cutter. These embodiments provide a comparatively strudy and compact rotary drill bit requiring little structural space, since no additional raceways for the axial roller bearing with conical rolling elements need be provided between
rotary cutter and trunion.

The axial roller bearing with conical rolling elements may be formed without a bearing cage. This has the advant-
point of view. The wearing of the elements of the radial roller bearings of a rotary cutter and the resulting increase of the radial play are readily admissible. Moreover the axial roller bearings with conical rolling elements can be economically manufactured, because each of them has a plane raceway which is easy to make.

Advantageous developments of the novelty are described in the subclaims.

The embodiments according to Claims 2 and 3 provide a comparatively sturdy and compact rotary drill bit requiring little structural space, since no additional raceways for the axial roller bearing with conical rolling elements need be provided between rotary cutter and trunion.

The embodiment according to claim 4 has the advantage that the space available between the plane raceway and the conical raceway of each axial roller bearing with conical rolling elements is completely filled with conical rollers so that a comparatively higher supporting capacity of the axial roller bearing with conical rolling elements is ensured. At the same time, said axial roller bearing can be economically produced without provision of a bearing cage. The rolling elements of the roller bearing contact and guide each other in operation.

The novel rotary drill bit according to the invention is explained in greater detail in the following description of two embodiments illustrated in the drawings:

Fig. 1 shows a longitudinal section through the rotary cutter of a rotary drill bit.

Fig. 2 shows a longitudinal section through the rotary cutter of a modified rotary drill bit.

In Fig. 1 the numeral 1 denotes one of the trunions of the drill bit body 2 on which the respective rotary cutter 3 is rotably supported by means of a radial roller bearing with cylindrical rolling elements 4 adjacent to the drill bit body 2 and a radial roller bearing with cylindrical rolling elements 5 located farther away. Between the two radial roller bearings with cylindrical rolling elements 4 and 5 there is arranged an axial roller bearing with conical rolling elements 6, said conical rolling elements 7 running between the plane raceway 8 of the trunion 1 and the conically...
formed raceway 9 of the rotary cutter 3. The plane raceway 8 is at right angles to the axis of rotation 10 of the rotary cutter 3 and the axis of rotation of the conical rolling elements 7 converge at the point of intersection 11 of the axis of rotation 10 with the plane of the raceway 8. The conically formed raceway 9 has a guiding shoulder 12 which radially guides and holds in place the outward facing end of the conical rolling elements 7. The plane raceway 8 is directly formed in the trunion 1 and the conical raceway 9 is directly formed in the rotary cutter 3, so that the rotary drill bit has an advantageously compact shape with comparatively few construction elements.

Moreover, the axial roller bearing with conical rolling elements 6 is formed without a bearing cage, so that the conical rolling elements 7 contact and guide each other along their peripheral surface. Even if play should occur in the roller bearings with cylindrical elements 4 and 5 owing to wear, no jamming of the conical rolling elements 7 is caused in the axial roller bearing with conical rolling elements 6, because relative radial movements between the plane raceway 8 and the conical raceway 9 are possible without hindrance.

When mounting the rotary cutter 3 on the trunion 1, the annular seal 13 is first slid on said trunion and the cylindrical rolling elements of the radial roller bearings 4 and 5 inserted in their respective raceways on the trunion 1. Then the conical raceway 9 of the rotary cutter 3 is filled with conical rolling elements 7. The rotary cutter 3 with the complement of conical rolling elements 7 is axially pushed on the trunion 1 until the conical rolling elements 7 bear against the plane raceway 8. Finally the annular seal 12 is fixed in the bore of the rotary cutter 3, e.g. by welding, so that the rotary cutter 3 is secured against being drawn off the trunion 1.

In order to lubricate the roller bearings with cylindrical rolling elements 4, 5 as well as the axial roller bearing with conical rolling elements 6, the bearing space between the rotary cutter 3 and the trunion 1 can be filled with a suitable lubricant, e.g. lubricating grease.

Fig. 2 shows the rotary cutter 3 of a modified
rotary drill bit which is rotably supported in two roller bearings with cylindrical rolling elements 4 and 5 and an axial roller bearing with conical rolling elements 6 on the trunion 1 of the drill bit body 2, just like the rotary cutter shown in Fig. 1. However, here the plane raceway 14 is formed in the rotary cutter 3 and the conical (tapered) raceway 15 with the guiding shoulder 16 is formed in the trunion 1. Again, the axial roller bearing with conical rolling elements 6 can perform small relative radial movements between the raceways 14 and 15 without causing any damage.

In the present case, a piston ring 17 is inserted in the bore of the annular seal 13. Said piston ring glides on the trunion 1 and thus seals the bearing space between the rotary cutter 3 and the trunion 1 against ingress of foreign matter from the outside.
The claims defining the invention are as follows:

1. Rotary drill bit with several rotary cutters, each of which is rotably supported at least one radial roller bearing and one axial roller bearing with conical rolling elements on a trunion formed integrally with the drill bit body, characterized in that one of the two raceways of each axial roller bearing with conical rolling elements is plane and extends at right angles to the axis of rotation of the rotary cutter and the associated other raceway is conical and formed with a guiding shoulder radially guiding the outward facing end of the conical rolling elements.

2. Rotary drill bit according to Claim 1, characterized in that the plane raceway of the axial roller bearing with conical rolling elements is directly formed in the trunion or in the rotary cutter.

3. Rotary drill bit according to Claim 1 or 2, characterized in that the conical raceway of the axial roller bearing with conical rolling elements is directly formed in the trunion or in the rotary cutter.

4. Rotary drill bit according to one of the foregoing claims, characterized in that the axial roller bearing with conical rolling elements is formed without bearing cage.

DATED: 13th July, 1979

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5. A rotary drill bit substantially as herein described with reference to Figure 1 or 2 of the accompanying drawings.

Dated: 31 August, 1982

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[Signature]
DRAWINGS