

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371		Attorney Docket No. SMC 13979WOUS
		U.S. Application No. (if known, see 37 CFR 1.5)
International Application No. PCT/EP2013/062861	International Filing Date 20 06 2013	Priority Date Claimed 02 08 2012
Title of Invention GYRATORY CRUSHER MAIN SHAFT SLEEVE		
First Named Inventor ABERG		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information. 1. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). NOTE: The express request under 35 U.S.C. 371(f) will not be effective unless the requirements under 35 U.S.C. 371(c)(1), (2), and (4) for payment of the basic national fee, copy of the International Application and English translation thereof (if required), and the oath or declaration of the inventor(s) have been received. 2. ☒ A copy of the International Application (35 U.S.C. 371(c)(2)) is attached hereto (not required if the International Application was previously communicated by the International Bureau or was filed in the United States Receiving Office (RO/US)). 3. An English language translation of the International Application (35 U.S.C. 371(c)(2)) a. ☐ is attached hereto. b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4). 4. An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) a. ☒ is attached. b. ☐ was previously filed in the international phase under PCT Rule 4.17(iv). Items 5 to 8 below concern amendments made in the international phase. <u>PCT Article 19 and 34 amendments</u> 5. ☐ Amendments to the claims under PCT Article 19 are attached (not required if communicated by the International Bureau) (35 U.S.C. 371(c)(3)). 6. ☐ English translation of the PCT Article 19 amendment is attached (35 U.S.C. 371(c)(3)). 7. ☐ English translation of annexes (Article 19 and/or 34 amendments only) of the International Preliminary Examination Report is attached (35 U.S.C. 371(c)(5)). <u>Cancellation of amendments made in the international phase</u> 8a. ☐ Do not enter the amendment made in the international phase under PCT Article 19. 8b. ☐ Do not enter the amendment made in the international phase under PCT Article 34. NOTE: A proper amendment made in English under Article 19 or 34 will be entered in the U.S. national phase application absent a clear instruction from applicant not to enter the amendment(s). The following items 9 to 17 concern a document(s) or information included. 9. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 10. ☒ A preliminary amendment. 11. ☒ An Application Data Sheet under 37 CFR 1.76. 12. ☐ A substitute specification. NOTE: A substitute specification cannot include claims. See 37 CFR 1.125(b). 13. ☐ A power of attorney and/or change of address letter. 14. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.3 and 37 CFR 1.821-1.825. 15. ☐ Assignment papers (<i>cover sheet and document(s)</i>). Name of Assignee: _____ 16. ☐ 37 CFR 3.73(c) Statement (<i>when there is an Assignee</i>). _____		

This collection of information is required by 37 CFR 1.414 and 1.491-1.492. The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 15 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

U.S. APPLN. No. (if known – see 37 CFR 1.5)	INTERNATIONAL APPLICATION No. PCT/EP2013/062861	ATTORNEY DOCKET No. SMC 13979WOUS
17. ☒ Other items or information: (a) PCT/ISA/210 (b) PCT/IB/308		
The following fees have been submitted.		CALCULATIONS PTO USE ONLY
18. ☒ Basic national fee (37 CFR 1.492(a)) \$280		\$ 280
19. ☒ Examination fee (37 CFR 1.492(c)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) \$0 All other situations \$720		\$ 720
20. ☒ Search fee (37 CFR 1.492(b)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) \$0 Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority \$120 International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB \$480 All other situations \$600		\$ 480
TOTAL OF 18, 19, and 20 =		\$
☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) in an electronic medium or computer program listing in an electronic medium) (37 CFR 1.492(j)). Fee for each additional 50 sheets of paper or fraction thereof \$400		
Total Sheets	Extra Sheets	RATE
- 100 =	/ 50 =	x \$400
Surcharge of \$140.00 for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h)).		\$
CLAIMS	NUMBER FILED	RATE
Total claims	- 20 =	x \$80
Independent claims	- 3 =	x \$420
MULTIPLE DEPENDENT CLAIM(S) (if applicable)		+ \$780
Processing fee of \$140.00 for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)).		\$
TOTAL OF ABOVE CALCULATIONS =		\$ 1480
☐ Applicant asserts small entity status. See 37 CFR 1.27. Fees above are reduced by 1/2.		
☐ Applicant certifies micro entity status. See 37 CFR 1.29. Fees above are reduced by 3/4. Applicant must attach form PTO/SB/15A or B or equivalent.		
TOTAL NATIONAL FEE =		\$ 1480
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property.		\$
TOTAL FEES ENCLOSED =		\$
		Amount to be refunded:
		\$
		Amount to be charged:
		\$

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

- a. ☐ A check in the amount of \$ _____ to cover the above fees is enclosed.
- b. ☒ Please charge my Deposit Account No. 50-5792 in the amount of \$ 1480 to cover the above fees.
- c. ☐ The Director is hereby authorized to charge additional fees which may be required, or credit any overpayment, to Deposit Account No. _____ as follows:
- i. ☐ any required fee.
- ii. ☐ any required fee except for excess claims fees required under 37 CFR 1.492(d) and (e) and multiple dependent claim fee required under 37 CFR 1.492(f).
- d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038. The PTO-2038 should only be mailed or faxed to the USPTO. However, when paying the basic national fee, the PTO-2038 may NOT be faxed to the USPTO.

ADVISORY: If filing by EFS-Web, do **NOT** attach the PTO-2038 form as a PDF along with your EFS-Web submission. Please be advised that this is **not** recommended and by doing so your **credit card information may be displayed via PAIR**. To protect your information, it is recommended to pay fees online by using the electronic payment method.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

- ☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013, and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: A U.S. national stage application may not claim priority to the international application of which it is the national phase. The filing date of a U.S. national stage application is the international filing date. See 35 U.S.C. 363.

Correspondence Address

- ☒ The address associated with Customer Number: 78686 **OR** ☐ Correspondence address below

Name					
Address					
City		State		Zip Code	
Country				Telephone	
Email					

Signature	/Corinne Gorski/	Date	01-30-2015
Name (Print/Type)	Corinne Gorski	Registration No. (Attorney/Agent)	34339

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SMC 13979 WOUS
		Application Number	
Title of Invention	GYRATORY CRUSHER MAIN SHAFT SLEEVE		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
--

Inventor Information:

Inventor 1					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Niklas		ABERG		
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service					
City	Sodra Sandby	Country of Residence i	SE		
Mailing Address of Inventor:					
Address 1	Skatteberga 1396				
Address 2	S-247 92				
City	Sodra Sandby	State/Province			
Postal Code		Country i	SE		
Inventor 2					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Bengt-Arne		ERIKSSON		
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service					
City	Svedala	Country of Residence i	SE		
Mailing Address of Inventor:					
Address 1	Sveagatan 4				
Address 2	S-233 33				
City	Svedala	State/Province			
Postal Code		Country i	SE		
Inventor 3					Remove
Legal Name					

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SMC 13979 WOUS
		Application Number	
Title of Invention	GYRATORY CRUSHER MAIN SHAFT SLEEVE		

Prefix	Given Name	Middle Name	Family Name	Suffix
	Fredrik		ROS DAHL	
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service				
City	Sandviken	Country of Residence i	SE	

Mailing Address of Inventor:				
Address 1	c/o Sandvik Intellectual Property AB			
Address 2	S-811 81			
City	Sandviken	State/Province		
Postal Code		Country i	SE	
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button. Add				

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).			
☐ An Address is being provided for the correspondence information of this application.			
Customer Number	78686		
Email Address		Add Email	Remove Email

Application Information:

Title of the Invention	GYRATORY CRUSHER MAIN SHAFT SLEEVE		
Attorney Docket Number	SMC 13979 WOUS	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)		Suggested Figure for Publication (if any)	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐ Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SMC 13979 WOUS
		Application Number	
Title of Invention	GYRATORY CRUSHER MAIN SHAFT SLEEVE		

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	78686		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	a 371 of international	PCT/EP2013/062861	2013-06-20
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) ⁱthe information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Remove			
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ^j (if applicable)
12179089.3	EP	2012-08-02	
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SMC 13979 WOUS
		Application Number	
Title of Invention	GYRATORY CRUSHER MAIN SHAFT SLEEVE		

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐	This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
--------------------------	--

Authorization to Permit Access:

☒	Authorization to Permit Access to the Instant Application by the Participating Offices
If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application. In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application. In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.		
Applicant 1		Remove
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.		
		Clear
☒ Assignee	☐ Legal Representative under 35 U.S.C. 117	☐ Joint Inventor
☐ Person to whom the inventor is obligated to assign.	☐ Person who shows sufficient proprietary interest	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SMC 13979 WOUS
		Application Number	
Title of Invention	GYRATORY CRUSHER MAIN SHAFT SLEEVE		

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor :	

If the Applicant is an Organization check here. ☒

Organization Name	SANDVIK INTELLECTUAL PROPERTY AB
-------------------	----------------------------------

Mailing Address Information:

Address 1	SE-811 81		
Address 2			
City	Sandviken	State/Province	
Country i	SE	Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.

Add

Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Assignee 1				
Complete this section only if non-applicant assignee information is desired to be included on the patent application publication in accordance with 37 CFR 1.215(b). Do not include in this section an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest), as the patent application publication will include the name of the applicant(s).				
				Remove
If the Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SMC 13979 WOUS
		Application Number	
Title of Invention	GYRATORY CRUSHER MAIN SHAFT SLEEVE		

Mailing Address Information:			
Address 1			
Address 2			
City		State/Province	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			
Additional Assignee Data may be generated within this form by selecting the Add button. Add			

Signature:

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications					
Signature	/Corinne Gorski/			Date (YYYY-MM-DD)	2015-01-30
First Name	Corinne	Last Name	Gorski	Registration Number	34339
Additional Signature may be generated within this form by selecting the Add button. Add					

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



(51) International Patent Classification:
B02C 2/06 (2006.01)

(21) International Application Number:
PCT/EP2013/062861

(22) International Filing Date:
20 June 2013 (20.06.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12179089.3 2 August 2012 (02.08.2012) EP

(71) Applicant: **SANDVIK INTELLECTUAL PROPERTY AB** [SE/SE]; S-811 81 Sandviken (SE).

(72) Inventors: **ÄBERG, Niklas**; Skatteberga 1396, S-247 92 Södra Sandby (SE). **ERIKSSON, Bengt-Arne**; Sveagatan 4, S-233 33 Svedala (SE). **ROSDAHL, Fredrik**; Sandvik Intellectual Property AB, S-811 81 Sandviken (SE).

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,

HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) Title: GYRATORY CRUSHER MAIN SHAFT SLEEVE

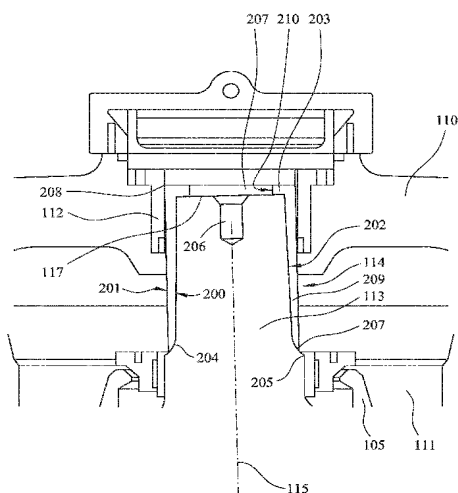


FIG. 2

(57) Abstract: A gyratory crusher main shaft sleeve for friction fitting over an uppermost end of a crusher main shaft. The sleeve comprises an elongate axial wall for positioning in contact with an outward facing surface of the main shaft. The axial wall comprises a thickness that decreases in a direction from a second upper end to a first lower end wherein the internal facing surface of the sleeve extends transverse to a longitudinal axis of the sleeve so as to taper inwardly towards the axis in a direction from the first to the second end.

5

Gyratory Crusher Main Shaft Sleeve

10

15

Field of invention

The present invention relates to a gyratory crusher main shaft sleeve for positioning at an uppermost end of a crusher main shaft and in particular, although not exclusively, to a sleeve having a tapered wall thickness.

Background art

Gyratory crushers are used for crushing ore, mineral and rock material to smaller sizes. Typically, the crusher comprises a crushing head mounted upon an elongate main shaft. A first crushing shell is mounted on the crushing head and a second crushing shell is mounted on a frame such that the first and second crushing shells define together a crushing gap through which the material to be crushed is passed. A driving device is arranged to rotate an eccentric assembly about the lower portion of the shaft so as to cause the crushing head to perform a gyratory pendulum movement and crush the material introduced in the crushing gap.

-2-

US 2009/0008489 discloses a hydraulically adjustable cone crusher in which an axial bearing assembly comprises a hydraulic adjustment cylinder for adjusting the setting of the crusher. US 4,919,349 discloses a gyratory crusher having a dual seal arrangement that utilises forced air and a gasket arrangement to block contaminants entering the crusher.

- 5 SU 897280 describes a cone crusher that has a step cup bearing to absorb and transmit the crushing force of the crusher head.

The gyratory pendulum movement of the crushing head is supported by a lower bearing assembly positioned below the crushing head and a top bearing into which an upper end of the main shaft is journalled. Typically, the main shaft upper end is protected against wear by a sleeve. Commonly, the protective sleeve comprises a cylindrical geometry and is held at the main shaft via an interference or friction fit. This arrangement however requires the sleeve to be heated to increase its diameter to enable mounting and possible disassembly at the main shaft.

15

Example protective sleeves are disclosed in US 1,592,313; US 1,748,102; RU 718160 and RU 940837.

However, a number of problems exist with conventional protective sleeves. In particular, if the time taken to friction fit the heated sleeve onto the main shaft end is too great it is not uncommon for the sleeve to cool and shrink before it is forced onto the shaft to the correct and final position. Additionally, disassembly is often problematic as the sleeve is required to be cut before it can be removed. On large crushers, protective sleeves have a substantial wall thickness and this cutting operation can be time and labour intensive with the added risk of potential damage to the shaft. What is required is a main shaft sleeve that addresses the above problem.

25

Summary of the Invention

It is an object of the present invention to provide a sleeve for a main shaft of a gyratory crusher that enables convenient attachment and detachment at the shaft so as to be quickly and conveniently assembled and disassembled.

30

-3-

The objective is achieved by providing a sleeve having an internal facing surface that tapers inwardly in the axial direction towards a longitudinal axis of the sleeve from a first (lower) end to a second (upper) end. The present sleeve arrangement is configured for secure mounting in position via an interference or friction fit arrangement in direct contact
5 with a tapered end region of the main shaft. In particular, a conical shape profile of the internal facing surface of the sleeve is capable of sliding over a corresponding conical shaped main shaft end region without risk of the sleeve seizing prematurely at the shaft before reaching its fully mated position. As with existing devices, the present sleeve may be heated to increase its diameter immediately prior to assembly. Similarly, to facilitate
10 disassembly, heat may be applied to the sleeve together with mechanical agitation.

According to a first aspect of the present invention there is provided a gyratory crusher main shaft sleeve for friction fitting over an uppermost end of a crusher main shaft, the sleeve comprising: an elongate axial wall extending around a longitudinal axis of the
15 sleeve, the wall having an internal facing surface for positioning in contact with an outward facing surface of the main shaft, and an external facing surface relative to the longitudinal axis, the wall extending between the internal and external facing surfaces; the wall having a first end for positioning at a lower region of the main shaft and a second end for positioning at an upper region of the main shaft relative to the lower region; wherein a
20 thickness of the wall at a region between the first and second ends decreases in a direction from the second end to the first end; characterised in that: in the axial direction the internal facing surface at said region extends transverse to the longitudinal axis so as to taper inwardly towards the axis in the direction from the first to the second end.

25 Preferably, the region over which the thickness of the wall decreases extends substantially the full axial length of the sleeve.

Preferably, the sleeve further comprises a radial wall extending perpendicular or transverse to the axial wall, the radial wall positioned at or towards the second end and extending
30 inwardly towards the longitudinal axis. Optionally, the radial wall comprises a through bore positioned at the longitudinal axis of the sleeve.

-4-

Preferably, a cross sectional shape profile of the external facing surface is substantially circular. Preferably, a cross sectional shape profile of the internal facing surface is substantially circular. Preferably, a shape profile of the external facing surface defines a section of a cylinder in the axial direction. Preferably, a shape profile of the internal facing surface defines a section of a cone in the axial direction.

Optionally, the sleeve comprises at least one groove indented in the internal facing surface. Additionally, the groove may extend in a circumferential direction around a region of the internal facing surface. Optionally, the groove extends in a direction axially along the internal facing surface. Optionally, the sleeve may further comprise at least one bore provided through the wall to allow the passage of a fluid to the internal facing surface. Accordingly, the bore is capable of allowing a lubricating fluid to be introduced through the body of the sleeve so as to flood the region between the internal facing surface of the sleeve and the external facing surface of the main shaft at the region of the sleeve. Where the sleeve comprises a groove at the internal facing surface, the lubricating fluid is capable of flowing within the groove both circumferentially and axially to fully lubricate the sleeve and main shaft interface.

Optionally, at a region of the first end, the internal facing surface is curved radially outward relative to the longitudinal axis in a direction towards the external facing surface such that the wall thickness decreases to zero at the curved region.

According to a second aspect of the present invention there is provided a gyratory crusher main shaft comprising: a shaft body having a first end for positioning at a lower region of the crusher and a second end for positioning at an upper region of the crusher relative to the first end; characterised in that: a thickness of the shaft body is tapered in the axial direction of the main shaft at a region of the second end so as to decrease in cross sectional area; and the main shaft further comprises a sleeve as detailed herein friction fitted over the tapered region at the second end of the main shaft.

30

According to a third aspect of the present invention there is provided a gyratory crusher comprising a main shaft and a sleeve as described herein.

Brief description of drawings

A specific implementation of the present invention will now be described by way example only and with reference to the following drawings in which:

5

Figure 1 is a cross-sectional side view of a gyratory crusher having a main shaft supported at its upper end by a top bearing set and having a protective sleeve mounted about the upper end of the main shaft according to a specific implementation of the present invention;

10

Figure 2 is a magnified view of the upper region of the crusher of figure 1.

Detailed description of preferred embodiment of the invention

Referring to figure 1, a crusher comprises a frame 100 having an upper frame 101 and a lower frame 102. A crushing head 103 is mounted upon an elongate shaft 107. A first crushing shell 105 is fixably mounted on crushing head 103 and a second crushing shell 106 is fixably mounted at top frame 101. A crushing zone 104 is formed between the opposed crushing shells 105, 106. A discharge zone 109 is positioned immediately below crushing zone 104 and is defined, in part, by lower frame 102.

20

Upper frame 101 is further divided into a topshell 111, mounted upon lower frame 102 (alternatively termed a bottom shell), and a spider that extends from topshell 111 and represents an upper portion of the crusher. The spider comprises two diametrically opposed arms 110 that extend radially outward from a central cap positioned on a longitudinal axis 115 extending through frame 100 and the gyratory crusher generally. Arms 110 are attached to an upper region of topshell 111 via an intermediate annular flange that is centred around longitudinal axis 115. Typically, arms 110 and topshell 111 form a unitary structure and are formed integrally.

A drive (not shown) is coupled to main shaft 107 via a drive shaft 108 and suitable gearing 116 so as to rotate shaft 107 eccentrically about longitudinal axis 115 and to cause crushing head 103 to perform a gyratory pendulum movement and crush material

-6-

introduced into crushing gap 104. An upper end region of a shaft 113 comprises an axial taper to define an upper conical section. The cone 113 tapers inwardly in the bottom to top direction away from head 103. A very uppermost end 117 of shaft 107 is maintained in an axially rotatable position by a top bearing assembly 112. Similarly, a bottom end 118 of
5 shaft 107 is supported by a bottom bearing assembly 119.

To avoid excessive wear of the upper conical portion 113, a substantially cylindrical wear sleeve 114 is mounted over and about shaft region 113. Sleeve 114 is held in position at region 113 by an interference of friction fit and is provided in close touching contact over
10 the axial length of sleeve 114. Accordingly, sleeve 114 is positioned intermediate between bearing assembly 112 and region 113 to absorb the radial and axial loading forces resultant from the crushing action of the gyratory pendulum movement.

With reference to figure 2, sleeve 114 comprises an external facing surface 201 and an
15 internal facing surface 200, the orientation of faces 201, 200 being relative to the longitudinal axis 115 extending through shaft region 113 and sleeve 114. Internal facing surface 200 is secured in direct contact against an external facing surface 202 of conical region 113. Accordingly, internal facing surface 200 tapers inwardly towards longitudinal axis 115 from a first end 207 and a second end 208, where the first end 207 is positioned
20 below second end 208 within the crusher during normal use. A cross sectional shape profile of internal facing surface 200 and external facing surface 201 is circular substantially the length of sleeve 114 between first and second ends 207, 208. However, external facing surface 201 is aligned substantially parallel with axis 115 such that sleeve 114 when viewed externally comprises a substantially cylindrical geometry. According to
25 this configuration, the annular axial wall 209 of sleeve 114 that is defined between apposed surfaces 200, 201 comprises a thickness that tapers and reduces in a direction from second upper end 208 to first lower end 207. As will be appreciated, to enable sleeve 114 to fit in close shrink-fit contact with conical end portion 113, the taper angle of inner surface 200 is substantially equal to the taper angle of the external facing surface 202 of shaft region 113
30 relative to axis 115.

-7-

At first end 207, a thickness of walls 209 decrease sharply as internal facing surface 200 curves outwardly 204 forwards external facing surface 201. This curved or sharp annular edge region 204 is configured to fit in close contact against a shoulder region 205 of shaft 107 that curves radially outward at a region immediately above crushing shell 105 and head 103.

Uppermost end 117 of shaft 107 is retained in position by a mounting pin 206, aligned at axis 115, that extends axially downward from a mounting boss 207. Boss 207 and pin 206 are positioned coaxially with shaft end 113 and sleeve 114.

A radial wall 203 extends perpendicular to axial wall 209 and is orientated inwardly towards axis 115 at second end 208. A bore 210 is provided through radial wall 203 of a diameter sufficient to accommodate boss 207 such that wall 203 extends around boss 207 from axial wall 209. Accordingly, sleeve 114 is fully mated in position over conical shaft region 113 when radial wall 203 is seated against shaft end 117. In this configuration, axial wall 209 is positioned intermediate between top bearing 112 and shaft region 113.

According to the specific implementation, the axial wall 209 comprises a thickness that decreases from second end 208 to first end 207 uniformly over the entire length of sleeve 114 with the exception of curved end region 204.

Claims

1. A gyratory crusher main shaft sleeve (114) for friction fitting over an uppermost end (113) of a crusher main shaft (107), the sleeve (114) comprising:
 - 5 an elongate axial wall (209) extending around a longitudinal axis (115) of the sleeve (114), the wall (209) having an internal facing surface (200) for positioning in contact with an outward facing surface (202) of the main shaft (107), and an external facing surface (201) relative to the longitudinal axis (115), the wall (209) extending between the internal (200) and external (201) facing surfaces;
 - 10 the wall (209) having a first end (207) for positioning at a lower region (205) of the main shaft (107) and a second end (208) for positioning at an upper region (117) of the main shaft (107) relative to the lower region (205);
wherein a thickness of the wall (209) at a region between the first (207) and second (208) ends decreases in a direction from the second end (208) to the first end (207);
 - 15 characterised in that:
in the axial direction the internal facing surface (200) at said region extends transverse to the longitudinal axis (115) so as to taper inwardly towards the axis (115) in the direction from the first (207) to the second (208) end.
- 20 2. The sleeve as claimed in claim 1 wherein the region over which the thickness of the wall (209) decreases extends substantially the full axial length of the sleeve (114).
3. The sleeve as claimed in any preceding claim further comprising a radial wall (203) extending perpendicular or transverse to the axial wall (209), the radial wall (203)
 - 25 positioned at or towards the second end (208) and extending inwardly towards the longitudinal axis (115).
4. The sleeve as claimed in claim 3 wherein the radial wall (203) comprises a through bore (210) positioned at the longitudinal axis (115) of the sleeve (114).
- 30 5. The sleeve as claimed in any preceding claim wherein a cross sectional shape profile of the external facing surface (201) is substantially circular.

6. The sleeve as claimed in any preceding claim wherein a cross sectional shape profile of the internal facing surface (200) is substantially circular.

5 7. The sleeve as claimed in any preceding claim wherein a shape profile of the external facing surface (201) defines a section of a cylinder in the axial direction.

8. The sleeve as claimed in any preceding claim wherein a shape profile of the internal facing surface (200) defines a section of a cone in the axial direction.

10

9. The sleeve as claimed in any preceding claim further comprising at least one groove indented in the internal facing surface (200).

10. The sleeve as claimed in claim 9 wherein the groove extends in a circumferential
15 direction around a region of the internal facing surface (200).

11. The sleeve as claimed in claim 9 or 10 wherein the groove extends in a direction axially along the internal facing surface (200).

20 12. The sleeve as claimed in any preceding claim further comprising at least one bore provided through the wall (209) to allow the passage of a fluid to the internal facing surface (200).

13. The sleeve as claimed in any preceding claim wherein at a region of the first end
25 (207), the internal facing surface (200) is curved radially outward (204) relative to the longitudinal axis (115) in a direction towards the external facing surface (201) such that the wall thickness decreases to zero at the curved region (204).

14. A gyratory crusher main shaft comprising:
30 a shaft body (107) having a first end (118) for positioning at a lower region of the crusher and a second end (117) for positioning at an upper region of the crusher relative to the first end (118);

-10-

characterised in that:

a thickness of the shaft body (107) is tapered in the axial direction of the main shaft at a region (113) of the second end (117) so as to decrease in cross sectional area; and

the main shaft further comprises a sleeve (114) as claimed in any preceding claim
5 friction fitted over the tapered region (113) at the second end (117) of the main shaft.

15. A gyratory crusher comprising a main shaft (107) and a sleeve (114) as claimed in claim 14.

-1/2-

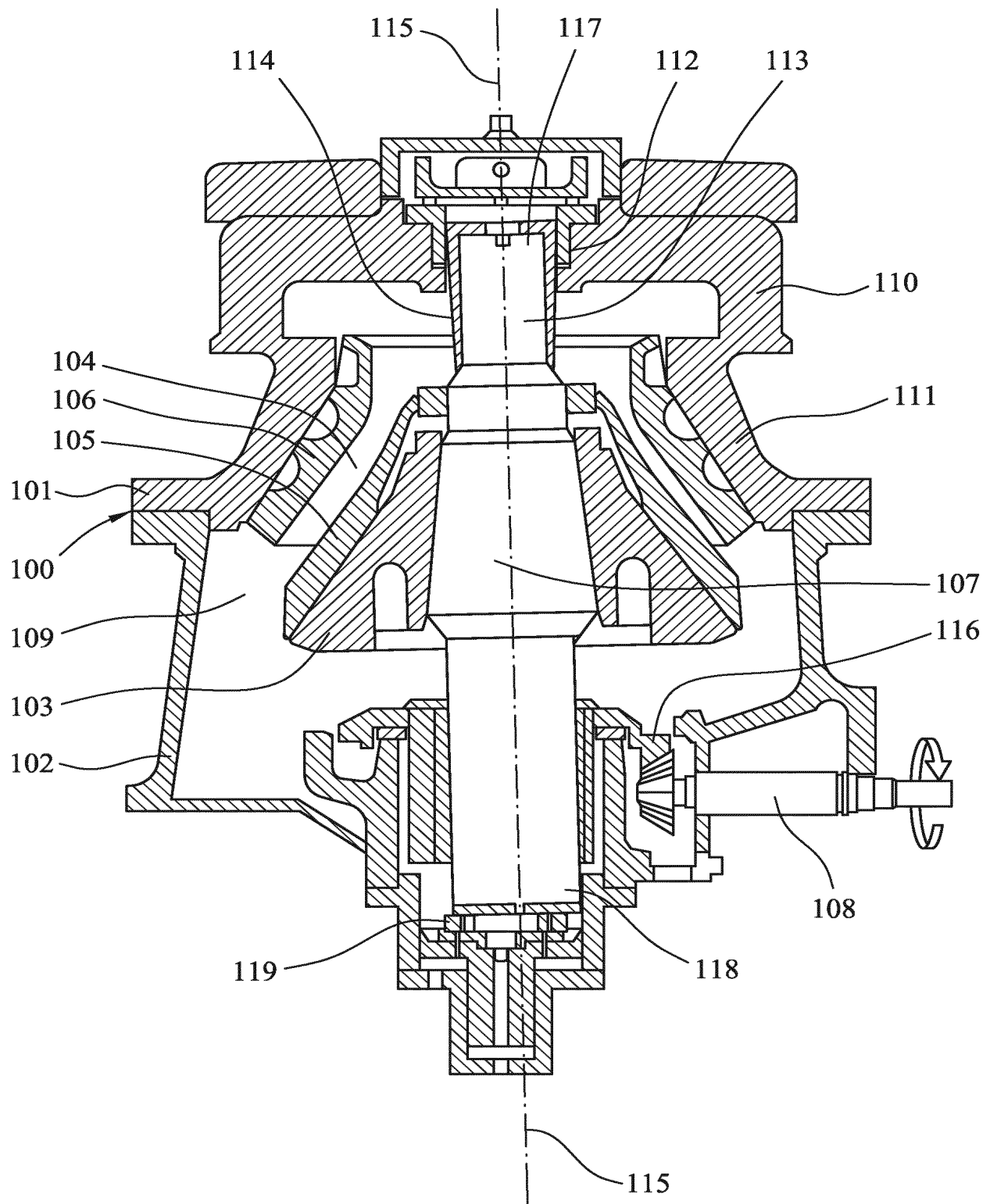


FIG. 1

-2/2-

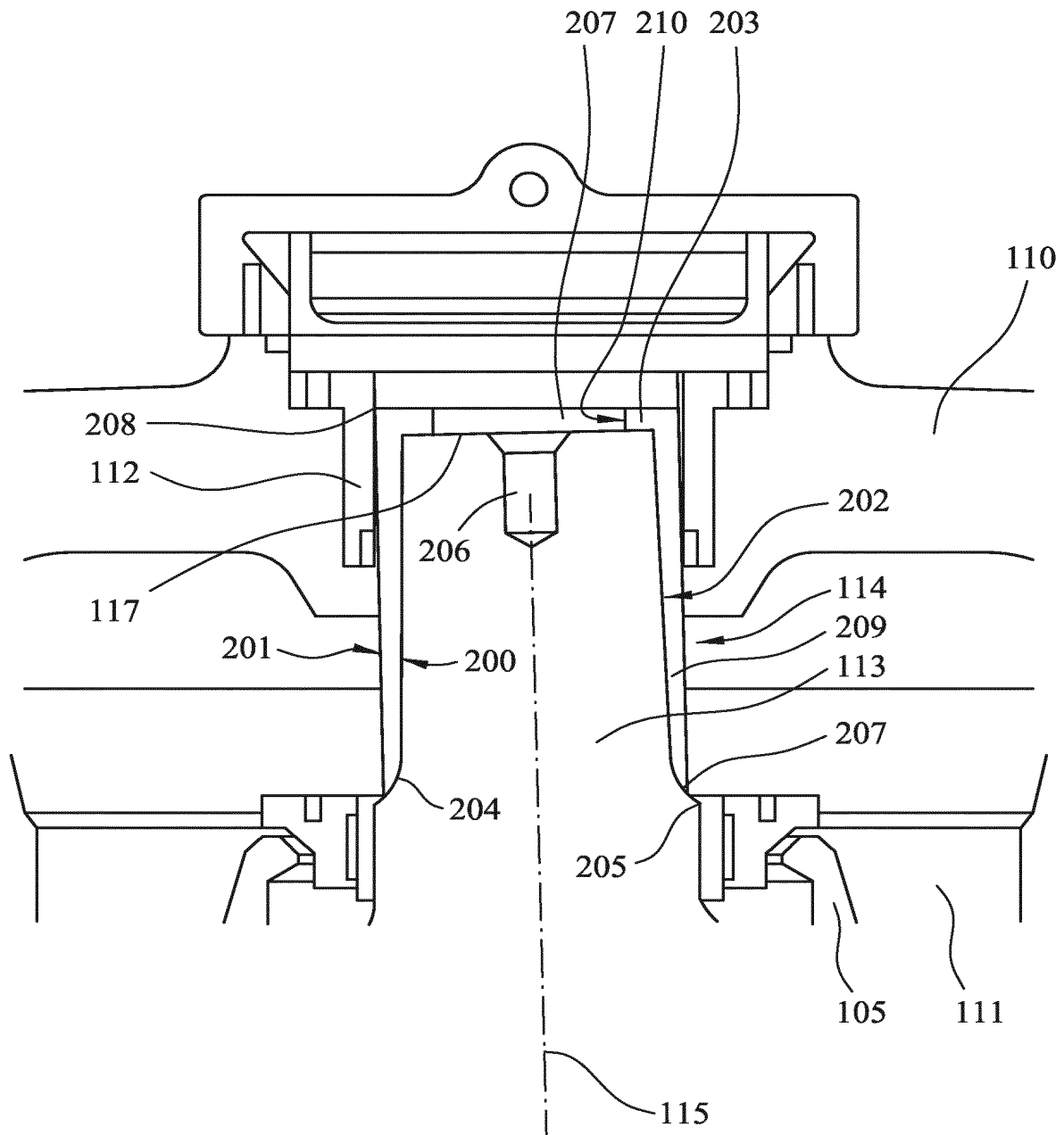


FIG. 2



From the INTERNATIONAL BUREAU

PCT

SECOND AND SUPPLEMENTARY NOTICE
INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION (TO DESIGNATED OFFICES
WHICH APPLY THE 30 MONTH TIME
LIMIT UNDER ARTICLE 22(1))

(PCT Rule 47.1(c))

To:

SANDVIK INTELLECTUAL PROPERTY AB
S-811 81 Sandviken
SUÈDE

Date of mailing (day/month/year)

04 December 2014 (04.12.2014)

Applicant's or agent's file reference

PE 13979WO

IMPORTANT NOTICE

International application No.

PCT/EP2013/062861

International filing date (day/month/year)

20 June 2013 (20.06.2013)

Priority date (day/month/year)

02 August 2012 (02.08.2012)

Applicant

SANDVIK INTELLECTUAL PROPERTY AB

- ATTENTION:** For any designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002 (30 months from the priority date), **does not apply**, please see Form PCT/IB/308(First Notice) issued previously.
- Notice is hereby given that the following designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002, **does apply**, has/have requested that the communication of the international application, as provided for in Article 20, be effected under Rule 93bis.1. The International Bureau has effected that communication on the date indicated below:
06 February 2014 (06.02.2014)

AZ, BY, CN, EP, HU, KG, KP, KR, MD, MK, MZ, NA, NG, PG, RU, SY, TM

In accordance with Rule 47.1(c-bis)(i), those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

- The following designated Offices, for which the time limit under Article 22(1), as in force from 1 April 2002, **does apply**, have not requested, as at the time of mailing of the present notice, that the communication of the international application be effected under Rule 93bis.1 :

AE, AG, AL, AM, AO, AP, AT, AU, BA, BB, BG, BH, BN, BR, BW, BZ, CA, CH, CL, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EA, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, ID, IL, IN, IS, JP, KE, KN, KZ, LA, LC, LK, LR, LS, LT, LY, MA, ME, MG, MN, MW, MX, MY, NI, NO, NZ, OA, OM, PA, PE, PH, PL, PT, QA, RO, RS, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, TH, TJ, TN, TR, TT, UA, US, UZ, VC, VN, ZA, ZM, ZW

In accordance with Rule 47.1(c-bis)(ii), those Offices accept the present notice as conclusive evidence that the Contracting State for which that Office acts as a designated Office does not require the furnishing, under Article 22, by the applicant of a copy of the international application.

4. TIME LIMITS for entry into the national phase

For the designated or elected Office(s) listed above, the applicable time limit for entering the national phase will, **subject to what is said in the following paragraph**, be **30 MONTHS** from the priority date.

In practice, **time limits other than the 30-month time limit** will continue to apply, for various periods of time, in respect of certain of the designated or elected Office(s) listed above. For **regular updates on the applicable time limits** (30 or 31 months, or other time limit), Office by Office, refer to the *PCT Gazette*, the *PCT Newsletter* and the *PCT Applicant's Guide*, Volume II, National Chapters, all available from WIPO's Internet site, at <http://www.wipo.int/pct/en/index.html>.

It is the applicant's **sole responsibility** to monitor all these time limits.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Authorized officer

Agnès Wittmann-Regis

Facsimile No. +41 22 338 82 70

e-mail: pt06.pct@wipo.int



(51) International Patent Classification:
B02C 2/06 (2006.01)

(21) International Application Number:
PCT/EP2013/062861

(22) International Filing Date:
20 June 2013 (20.06.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12179089.3 2 August 2012 (02.08.2012) EP

(71) Applicant: **SANDVIK INTELLECTUAL PROPERTY AB** [SE/SE]; S-811 81 Sandviken (SE).

(72) Inventors: **ÅBERG, Niklas**; Skatteberga 1396, S-247 92 Södra Sandby (SE). **ERIKSSON, Bengt-Arne**; Sveagatan 4, S-233 33 Svedala (SE). **ROSDAHL, Fredrik**; Sandvik Intellectual Property AB, S-811 81 Sandviken (SE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR,

KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

Published:

— with international search report (Art. 21(3))
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(88) Date of publication of the international search report:

7 August 2014

(54) Title: GYRATORY CRUSHER MAIN SHAFT SLEEVE

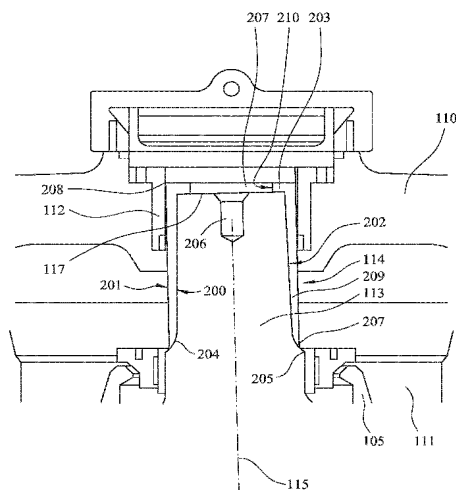


FIG. 2

(57) Abstract: A gyratory crusher main shaft sleeve (114) for friction fitting over an uppermost end (113) of a crusher main shaft (107). The sleeve comprises an elongate axial wall (209) for positioning in contact with an outward facing surface (202) of the main shaft. The axial wall comprises a thickness that decreases in a direction from a second upper end (208) to a first lower end (207) wherein the internal facing surface (200) of the sleeve extends transverse to a longitudinal axis (115) of the sleeve so as to taper inwardly towards the axis in a direction from the first to the second end.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2013/062861

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2013/062861

A. CLASSIFICATION OF SUBJECT MATTER

INV. B02C2/06
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B02C F16C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 1 402 255 A (SANBORN EUGENE L) 3 January 1922 (1922-01-03)	1,2,5-8, 14,15
Y	page 1, lines 80-103; figure -----	3,4,9-13
X	GB 1 031 679 A (FRANCA GHIAZZA) 2 June 1966 (1966-06-02)	1,2,5-8, 14,15
Y	page 1, lines 65-85 page 3, lines 60-91; figures -----	3,4,9-13
Y	DE 681 942 C (KRUPP FRIED GRUSONWERK AG) 4 October 1939 (1939-10-04)	3,4
A	page 1, lines 22-28; figure -----	1,14,15
Y	DE 103 46 475 B3 (EUROCOPTER DEUTSCHLAND [DE]) 10 March 2005 (2005-03-10) paragraph [0012]; figure 1 -----	3
	-/--	

☒ 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

16 June 2014

Date of mailing of the international search report

25/06/2014

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Flodström, Benny

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2013/062861

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	DE 371 447 C (SMITH ENGINEERING WORKS) 15 March 1923 (1923-03-15) page 3, lines 8-46; figures -----	9,10,12 1,2,5-8, 14,15
Y A	US 2002/088885 A1 (VAN MULLEM ALBERT J [US] ET AL) 11 July 2002 (2002-07-11) paragraphs [0023] - [0025]; figures -----	9,11,12 1,2,5-8, 10,13-15
Y A	US 5 934 583 A (JEAN CHENG-SHU [TW]) 10 August 1999 (1999-08-10) column 2, lines 28-54; figure 3 -----	9,10,12 1,3,5-7, 14,15
Y A	US 4 027 825 A (COXHILL MAJOR) 7 June 1977 (1977-06-07) column 2, lines 17-55; figure 1 -----	13 1,3,5-8, 14,15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/062861

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 1402255	A	03-01-1922	NONE	
GB 1031679	A	02-06-1966	DE 1482401 A1 GB 1031679 A	27-11-1969 02-06-1966
DE 681942	C	04-10-1939	NONE	
DE 10346475	B3	10-03-2005	NONE	
DE 371447	C	15-03-1923	NONE	
US 2002088885	A1	11-07-2002	NONE	
US 5934583	A	10-08-1999	GB 2334905 A US 5934583 A	08-09-1999 10-08-1999
US 4027825	A	07-06-1977	NONE	

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-8, 14, 15

A sleeve comprising potential special technical features relating to a radial wall (203) extending perpendicular or transverse to the axial wall (209), the radial wall (203) positioned at or towards the second end (208) and extending inwardly towards the longitudinal axis (115).

2. claims: 9-12

A sleeve comprising potential special technical features relating to at least one groove indented in the internal facing surface (200) and/or to at least one bore provided through the wall (209).

3. claim: 13

A sleeve comprising potential special technical features relating to, at a region of the first end (207), the internal facing surface (200) being curved radially outward (204) relative to the longitudinal axis (115) in a direction towards the external facing surface (201) such that the wall thickness decreases to zero at the curved region (204).

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of
Invention

GYRATORY CRUSHER MAIN SHAFT SLEEVE

As the below named inventor, I hereby declare that:

This declaration is directed to: ☒ The attached application, or
☐ United States application or PCT international application number _____
 filed on _____

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: ERIKSSON, Bengt-Arne Date (Optional) 2015-01-23

Signature: Bengt-Arne Eriksson

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SE/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	
	)	
Niklas ABERG	)	Group Art Unit: Unassigned
	)	
Application No.	)	
NEW National Stage of	)	
PCT Application No. PCT/EP2013/062861	)	Examiner: Unassigned
Filed: June 20, 2013	)	
	)	
Filed: January 30, 2015	)	
	)	
For: GYRATORY CRUSHER MAIN	)	
SHAFT SLEEVE	)	

MAIL STOP PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

PRELIMINARY AMENDMENT

Sir:

Prior to examination of the above-identified application, please amend the application as follows:

Amendments to the Claims begin on page 2 of this paper.

Amendments to the Abstract begin on page 6 of this paper.

Amendments to the Specification begin on page 7 of this paper.

Remarks begin on page 8 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Please amend the claims as follows:

1. (Currently Amended) A gyratory crusher main shaft sleeve (114) for friction fitting over an uppermost end (113) of a crusher main shaft (107), the sleeve (114) comprising:

an elongate axial wall (209) extending around a longitudinal axis (115) of the sleeve (114), the wall (209) having an internal facing surface (200) for positioning in contact with an outward facing surface (202) of the main shaft (107), and an external facing surface (201) relative to the longitudinal axis (115), the wall (209) extending between the internal (200) and external (201) facing surfaces;

the wall (209) having a first end (207) for positioning at a lower region (205) of the main shaft (107) and a second end (208) for positioning at an upper region (117) of the main shaft (107) relative to the lower region (205); wherein a thickness of the wall (209) at a region between the first (207) and second (208) ends decreases in a direction from the second end (208) to the first end (207); ~~characterised in that,~~ in the axial direction the internal facing surface (200) at said region ~~extends~~ extending transverse to the longitudinal axis (115) so as to taper inwardly towards the axis (115) in the direction from the first (207) to the second (208) end.

2. (Currently Amended) The sleeve as claimed in claim 1, wherein the region over which the thickness of the wall (209) decreases extends substantially the full axial length of the sleeve (114).

3. (Currently Amended) The sleeve as claimed in ~~any preceding~~ claim 1, further comprising a radial wall (203) extending perpendicular or transverse to the axial wall (209), the radial wall (203) positioned at or towards the second end (208) and extending inwardly towards the longitudinal axis (115).

4. (Currently Amended) The sleeve as claimed in claim 3, wherein the radial wall ~~(203)~~ ~~comprises~~ includes a through bore ~~(210)~~ positioned at the longitudinal axis ~~(115)~~ of the sleeve ~~(114)~~.

5. (Currently Amended) The sleeve as claimed in ~~any preceding~~ claim 1, wherein a cross-sectional shape profile of the external facing surface ~~(201)~~ is substantially circular.

6. (Currently Amended) The sleeve as claimed in ~~any preceding~~ claim 1, wherein a cross-sectional shape profile of the internal facing surface ~~(200)~~ is substantially circular.

7. (Currently Amended) The sleeve as claimed in ~~any preceding~~ claim 1, wherein a shape profile of the external facing surface ~~(201)~~ defines a section of a cylinder in the axial direction.

8. (Currently Amended) The sleeve as claimed in ~~any preceding~~ claim 1, wherein a shape profile of the internal facing surface ~~(200)~~ defines a section of a cone in the axial direction.

9. (Currently Amended) The sleeve as claimed in ~~any preceding~~ claim 1, further comprising at least one groove indented in the internal facing surface ~~(200)~~.

10. (Currently Amended) The sleeve as claimed in claim 9, wherein the groove extends in a circumferential direction around a region of the internal facing surface ~~(200)~~.

11. (Currently Amended) The sleeve as claimed in claim 9 ~~or 10~~, wherein the groove extends in a direction axially along the internal facing surface ~~(200)~~.

12. (Currently Amended) The sleeve as claimed in ~~any preceding~~ claim 1, further comprising at least one bore provided through the wall ~~(209)~~ to allow the passage of a fluid to the internal facing surface ~~(200)~~.

13. (Currently Amended) The sleeve as claimed in ~~any preceding~~ claim 1, wherein at a region of the first end (207), the internal facing surface (200) is curved radially outward (204) relative to the longitudinal axis (115) in a direction towards the external facing surface (201) such that the wall thickness decreases to zero at the curved region (204).

14. (Currently Amended) A gyratory crusher main shaft comprising:
a shaft body (107) having a first end (118) for positioning at a lower region of the crusher and a second end (117) for positioning at an upper region of the crusher relative to the first end (118); ~~characterised in that:~~ a thickness of the shaft body (107) is being tapered in ~~the~~ an axial direction of the main shaft at a region (113) of the second end (117) so as to decrease in cross-sectional area; and

~~the main shaft further comprises a sleeve (114) as claimed in any preceding claim~~ friction fitted over the tapered region (113) at the second end (117) of the main shaft, the sleeve including an elongate axial wall extending around a longitudinal axis of the sleeve, the wall having an internal facing surface for positioning in contact with an outward facing surface of the main shaft, and an external facing surface relative to the longitudinal axis, the wall extending between the internal and external facing surfaces, the wall having a first end for positioning at a lower region of the main shaft and a second end for positioning at an upper region of the main shaft relative to the lower region, wherein a thickness of the wall at a region between the first and second ends decreases in a direction from the second end to the first end, in the axial direction the internal facing surface at said region extending transverse to the longitudinal axis so as to taper inwardly towards the axis in the direction from the first to the second end.

15. (Currently Amended) A gyratory crusher comprising:
a main shaft (107) including a shaft body having a first end for positioning at a lower region of the crusher and a second end for positioning at an upper region of the crusher relative to the first end, a thickness of the shaft body being tapered in an axial direction of the main shaft at a region of the second end so as to decrease in cross-sectional area; and

a sleeve (114) as claimed in claim 14 fitted over the tapered region at the second end of the main shaft, the sleeve including an elongate axial wall extending around a longitudinal axis

of the sleeve, the wall having an internal facing surface for positioning in contact with an outward facing surface of the main shaft, and an external facing surface relative to the longitudinal axis, the wall extending between the internal and external facing surfaces, the wall having a first end for positioning at a lower region of the main shaft and a second end for positioning at an upper region of the main shaft relative to the lower region, wherein a thickness of the wall at a region between the first and second ends decreases in a direction from the second end to the first end, in the axial direction the internal facing surface at said region extending transverse to the longitudinal axis so as to taper inwardly towards the axis in the direction from the first to the second end.

Amendments to the Abstract

Please delete the Abstract in its entirety and replace it with the following:

Abstract

A gyratory crusher main shaft sleeve friction fit over an uppermost end of a crusher main shaft. The sleeve includes an elongate axial wall for being positioned in contact with an outward facing surface of the main shaft. The axial wall has a thickness that decreases in a direction from a second upper end to a first lower end, wherein the internal facing surface of the sleeve extends transverse to a longitudinal axis of the sleeve so as to taper inwardly towards the axis in a direction from the first to the second end.

Amendments to the Specification

Please amend the specification as follows:

On page 1 after the Title, please insert the following:

Related Application Data

This application is a §371 National Stage Application of PCT International Application No. PCT/EP2013/062861 filed June 20, 2013 claiming priority of EP Application No. 12179089.3, filed August 2, 2012.

REMARKS

Claims 1-15 have been amended. A new Abstract has been submitted. The specification has been amended to include Related Application Data. Accordingly, claims 1-15 are currently pending.

Applicants have amended the claims to remove multiple dependencies and improve form. Applicants hereby assert that no new matter has been added.

Respectfully submitted,

/Corinne Gorski/

Corinne Gorski
Registration No. 34,339

January 30, 2015

Sandvik/Diamond Innovations, Inc.
6325 Huntley Road
Worthington, OH 43085
Tel. 614-438-2834

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		
	First Named Inventor	ABERG	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	SMC 13979WOUS	

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5934583	A	1999-08-10	JEAN CHENG-SHU	
	2	4027825	A	1977-06-07	COXHILL MAJOR	
	3	1402255		1922-01-03	SANBORN	

If you wish to add additional U.S. Patent citation information please click the Add button.

Add

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020088885	A1	2002-07-11	VAN MULLEM ALBERT ET AL	

If you wish to add additional U.S. Published Application citation information please click the Add button.

Add

FOREIGN PATENT DOCUMENTS								Remove
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	10346475	DE	B3	2005-03-10	EUROCOPTER DEUTSCHLAND		☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number			
	Filing Date			
	First Named Inventor	ABERG		
	Art Unit			
	Examiner Name			
	Attorney Docket Number	SMC 13979WOUS		

	2	371447	DE	C	1923-03-15	SMITH ENGINEERING		☒
	3	1031679	GB		1966-06-02	GHIAZZA		☐
	4	681942	DE	C	1939-10-04	MEISTER		☒

If you wish to add additional Foreign Patent Document citation information please click the Add button **Add**

NON-PATENT LITERATURE DOCUMENTS				Remove
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵	
	1		☐	

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	
First Named Inventor	ABERG
Art Unit	
Examiner Name	
Attorney Docket Number	SMC 13979WOUS

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

- ☐ See attached certification statement.
- ☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.
- ☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Corinne Gorski/	Date (YYYY-MM-DD)	2015-01-30
Name/Print	Corinne Gorski	Registration Number	34339

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

DE371447

Abstract

Cone crusher, whose crushing cone is mounted for adjustment to the fixed shell on an adjustable eccentric sleeve drive shaft. The means for adjusting the crushing cone is between the crushing cone and a support ring that rotates together with the crushing cone, but from the eccentric, the crushing cone bearing sleeve by a downwardly directed sleeve-like projection of the cone body, is separated.

DEUTSCHES REICH



AUSGEGEBEN
AM 15. MÄRZ 1923

REICHSPATENTAMT
PATENTSCHRIFT

— № 371447 —

KLASSE 50c GRUPPE 3
(S 55242 III/50c)

Smith Engineering Works in Milwaukee, Wisconsin, V. St. A.

Kegelbrecher, dessen Brechkegel zwecks Einstellung zum festen Mantel auf einer exzentrischen Hülse der Antriebswelle verstellbar gelagert ist.

Smith Engineering Works in Milwaukee, Wisconsin, V. St. A.

Kegelbrecher, dessen Brechkegel zwecks Einstellung zum festen Mantel auf einer exzentrischen Hülse der Antriebswelle verstellbar gelagert ist.

Patentiert im Deutschen Reiche vom 7. Januar 1921 ab.

Für diese Anmeldung ist gemäß dem Unionsvertrage vom 2. Juni 1911 die Priorität auf Grund der Anmeldung in den Vereinigten Staaten von Amerika vom 14. November 1917 beansprucht.

Die Erfindung betrifft Zerkleinerungsmaschinen mit kreisender Bewegung der arbeitenden Teile, insbesondere sogenannte Kegelbrecher, und zwar die Nachstellung des Brechkegels im Rumpf der Maschine.

Nachstellvorrichtungen für den Brechkegel sind bekannt. Neu ist daher nur die besondere Anordnung der Nachstellvorrichtung. Diese Anordnung bildet den Gegenstand der Erfindung. Nach der Erfindung sind die Teile zum Einstellen des Brechkegels zwischen diesen und einen Stützring gelegt, der mit dem Brechkegel zusammen umläuft, aber von der exzentrischen, den Brechkegel tragenden Hülse durch eine Verlängerung des Kegelkörpers getrennt ist. Auf diese Weise werden die Einstellteile von irgendwelchen Nebenbeanspruchungen frei gehalten.

Um zu verhüten, daß Staub und feste Teile in die den Antrieb des Brechkegels einschließende Ölkammer gelangen, ist der Stützring für die Einstellvorrichtung durch einen Tragring mit dichtender Oberfläche unterstützt, der seinerseits wiederum dicht an der Ölkammer anliegt. Ferner ist zu diesem Zweck die Verlängerung des Brechkegels, die durch den die Einstellvorrichtung tragenden Stützring hindurchgeht, gegen diesen sorgfältig abgedichtet und die Verlängerung bis in die Ölkammer hindurchgeführt.

Auf der Zeichnung ist der Gegenstand der Erfindung in einer beispielsweise Ausführungsform durch eine zum Teil schematisch gehaltene Schnittansicht dargestellt. Der Rumpf A ruht auf einem Bodenteil A^1 und besitzt eine innere Auskleidung oder Futter A^2 . Das Ganze ist auf einem Fundament A^3 angeordnet. Der Teil A^4 bildet mit dem Bodenteil A^1 ein Stück und trägt die senkrechte Welle A^5 , die oben in dem Teil A^6 gelagert ist, der mit dem Zuführtrichter A^7 ein

Stück bildet. Dieser gewissermaßen einen Dekkel bildende Trichter A^7 ist mit dem Rumpfe A durch Bolzen A^8 verbunden.

Auf der die antreibende Riemscheibe B^1 tragenden Welle B ist ein Kegelrad B^2 aufgekeilt, das in der Öltasche B^3 mit dem Kegelrad B^4 auf dem exzentrischen Mantel B^5 in Eingriff steht, der seinerseits drehbeweglich auf der feststehenden Welle A^5 angeordnet ist und mit seinem unteren Ende auf dem Drucklager B^6 ruht. Der Arbeitskopf C läuft auf dem exzentrischen Mantel B^5 und kann sich um diesen Mantel drehen. Er ruht einstellbar auf dem Ring C^1 , wobei die Schrauben C^2 dienen. Der Ring C^1 seinerseits ruht gleitbeweglich auf einem Lagering C^3 mit einem Dichtungsringe oder Abdichtungsringe C^4 . Auch besitzt der Ring C^3 schräg gerichtete, Öl und Staub abnehmende Kanten, wie in der Zeichnung dargestellt ist. Der Ring C^3 wiederum ruht auf dem Teil A^4 und bildet mit dem Ring C^4 und dem vom Arbeitskopf abwärts vorspringenden zylindrischen Fortsatz C^5 den oberen Abschluß einer Ölkammer für die arbeitenden Teile. Die Lagerplatte C^3 wird durch Stifte C^6 gegen jede Drehbewegung auf dem Teil A^4 und den Wänden der Ölkammer gesichert. C^7 ist ein harter Mahlmantel aus Mangan oder ähnlichem dauerhaftem Stoffe, der ausgewechselt werden kann. Er kann mit Riefen oder Rinnen versehen sein; ist er auf dem Arbeitskopf abnehmbar angeordnet, so wird er darauf durch einen Bolzen C^8 in Stellung gehalten, der in Ohre C^9 des Mantels greift und durch Muttern C^{10} angezogen wird. Unter gewissen Umständen könnte der Mantel mit dem Arbeitskopf aus einem Stück bestehen und in der Weise erzeugt sein, daß man lediglich die äußere Umfläche des Arbeitskopfes durch Ab-

schrecken härtet. Für Maschinen, die stark in Anspruch genommen werden, ist indessen ein Manganmantel vorzuziehen, da er leicht erneuert werden kann. Wird der Manganmantel fortgelassen, so erhält der Arbeitskopf die Umform, die er so zusammen mit dem Mantel besitzt.

Das Hauptölrohr führt von einer nicht dargestellten Ölpumpe durch einen Arm des sternförmigen Teils A^6 in einen Kanal D^1 , welcher in eine ringförmige Schmierrinne am oberen Ende der Welle ausmündet. Ein radialer Kanal D^3 steht an einem Ende mit den Nuten D^2 , am anderen Ende mit dem mittleren Kanal D^4 in Verbindung, welcher seinerseits durch einen radialen Kanal D^5 mit einer Ringnut D^6 im mittleren Teile der Welle verbunden ist. Das durch diese Kanäle getriebene Öl gelangt schließlich in die Nut D^6 und bewegt sich auf und nieder an der Welle unter Ölung des Lagers des exzentrischen Teiles auf der Welle. D^7 ist ein durch das Exzenter gehender und ständig mit der Nut D^6 in Verbindung bleibender Kanal, durch den das Lager zwischen der Exzenterhülse und dem Arbeitskopf ständig unter Öl gehalten wird. Das auf der Innenseite der Exzenterhülse aufsteigende Schmiermittel geht über das obere Ende und abwärts zur Kammer D^8 , die zwischen dem Dichtungsring D^9 und dem oberen Ende des Arbeitskopfes vorgesehen ist. Dieser Dichtungsring D^9 liegt auf einer Dichtungsfläche D^{10} am oberen Ende des Arbeitskopfes und bildet hier einen öldichten Verband. Durch die Schrauben D^{11} , die einen festen Sitz des Dichtungsringes auf dem oberen Ende des Kopfes gewährleisten, wird auf diesen Dichtungsring ein Druck ausgeübt, um die Öldichtheit des Verbandes zu erhöhen. Das auf der Außenseite und der Innenseite des exzentrischen Mantels niederfließende Öl gelangt schließlich in die Ölkammer am Boden des Mantels. Das Öl auf der Innenseite des Mantels tritt aus und schmiert das Drucklager, welches den exzentrischen Mantel trägt. Alles Öl dient mit dazu, das Kegelgetriebe und Zahnrad zu schmieren und läuft dann durch das Rohr D^{12} in den Behälter D^{13} ab.

Die Lager E , E^1 , in welchem die Antriebswelle B ruht, werden durch einen Ölkanal E^2 mit Schmiermittel versehen, welcher von dem in die Kammer E^3 zwischen den Lagern ausmündenden Rohre D^3 abzweigt. Das Öl arbeitet dann auf zwei Wegen, ein Teil in der Ölkammer B^3 am Fuße des exzentrischen Mantels und ein Teil in der Kammer E^5 , wo das Kegelrad E^6 auf der Welle B das Kegelrad E^7 einer Pumpenwelle E^8 antreibt, so daß der Pumpenantrieb ständig in gehöriger Schmierung gehalten wird.

Von da kehrt das Öl durch das Rohr E^9 zum Rohr D^{12} und weiter zum Behälter zurück.

Die Wirkungsweise der neuen Einrichtung ist folgende:

Das zu zerkleinernde Gut wird durch den Zuführtrichter von oben eingeführt und wird im Arbeitsrumpfe infolge der Drehbewegung des Arbeitskopfes zerkleinert.

Bei der fortschreitenden Zerkleinerung fallen die Teile von hinreichender Kleinheit durch die Öffnung zwischen dem Arbeitskopf und der Rumpfwandung aus. Diese ringförmige Öffnung kann trotz der Abnutzung des Arbeitskopfes und der Gegenwandung ständig in gleichmäßiger Bemessung gehalten werden, indem der Arbeitsmantel mittels der zu dem Zwecke vorgesehenen Einstellmuttern angehoben wird. Ebenso kann diese Einstellvorrichtung auch dazu dienen, um für verschiedene Zwecke oder verschiedene Stoffe die Größe der Ablauföffnung zu ändern. Soll das Gut feiner zerkleinert werden, so wird auch die Öffnung enger eingestellt, und soll es gröber ausfallen, so wird die Öffnung entsprechend größer gehalten, in jedem Falle fällt das zerkleinerte Gut durch die Öffnung aus, sobald es eine dazu genügende Feinheit der Zerkleinerung erreicht hat.

PATENT-ANSPRÜCHE:

1. Kegelbrecher, dessen Brechkegel zwecks Einstellung zum festen Mantel auf einer exzentrischen Hülse der Antriebswelle verstellbar gelagert ist, dadurch gekennzeichnet, daß die Mittel zum Einstellen des Brechkegels zwischen diesem und einem Stützring (C^1) liegen, der mit dem Brechkegel zusammen umläuft, aber von der exzentrischen, den Brechkegel tragenden Hülse durch einen abwärts gerichteten hülsenartigen Ansatz (C^5) des Kegelkörpers getrennt ist.

2. Kegelbrecher nach Anspruch 1, bei dem die Teile zum Antrieb des Brechkegels in einer geschlossenen Ölkammer liegen, dadurch gekennzeichnet, daß die Ölkammer nach oben hin durch den Stützring (C^1) und einen Tragrings (C^3), auf dem der Stützring gleitend gelagert ist, abgeschlossen ist.

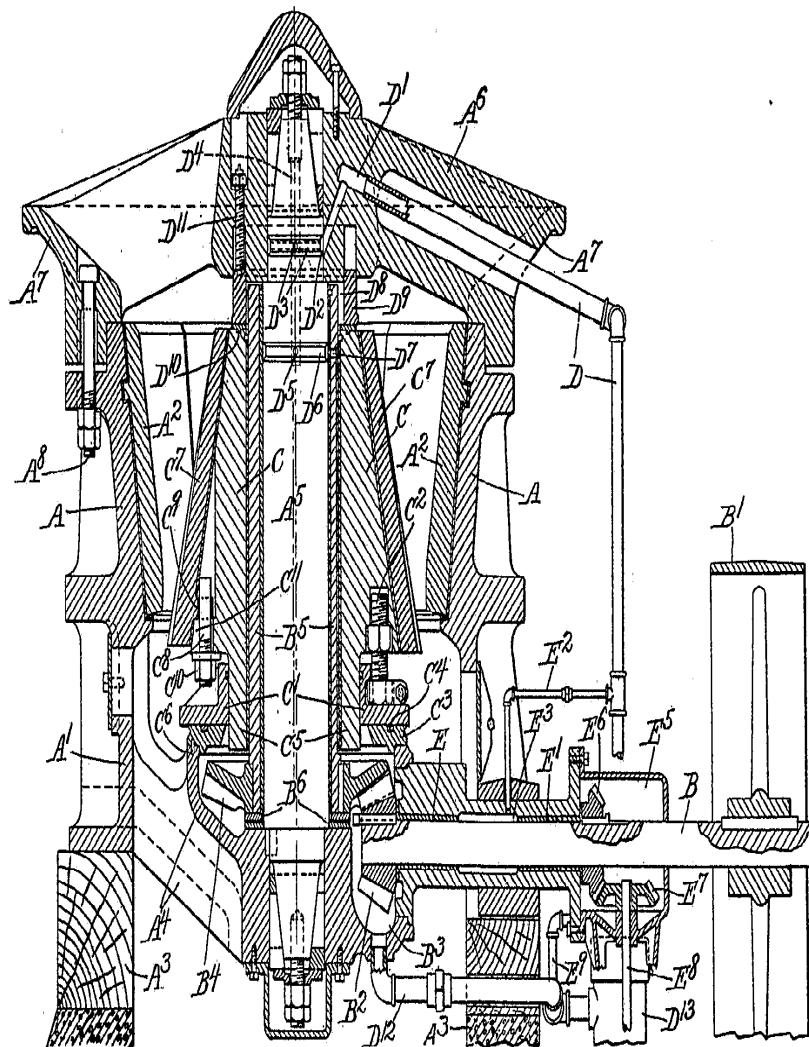
3. Kegelbrecher nach Anspruch 1 und 2, dadurch gekennzeichnet, daß der abwärts gerichtete hülsenartige Ansatz (C^5) des Brechkegels dicht in den Stützring eingesetzt ist und in diesem gleiten kann.

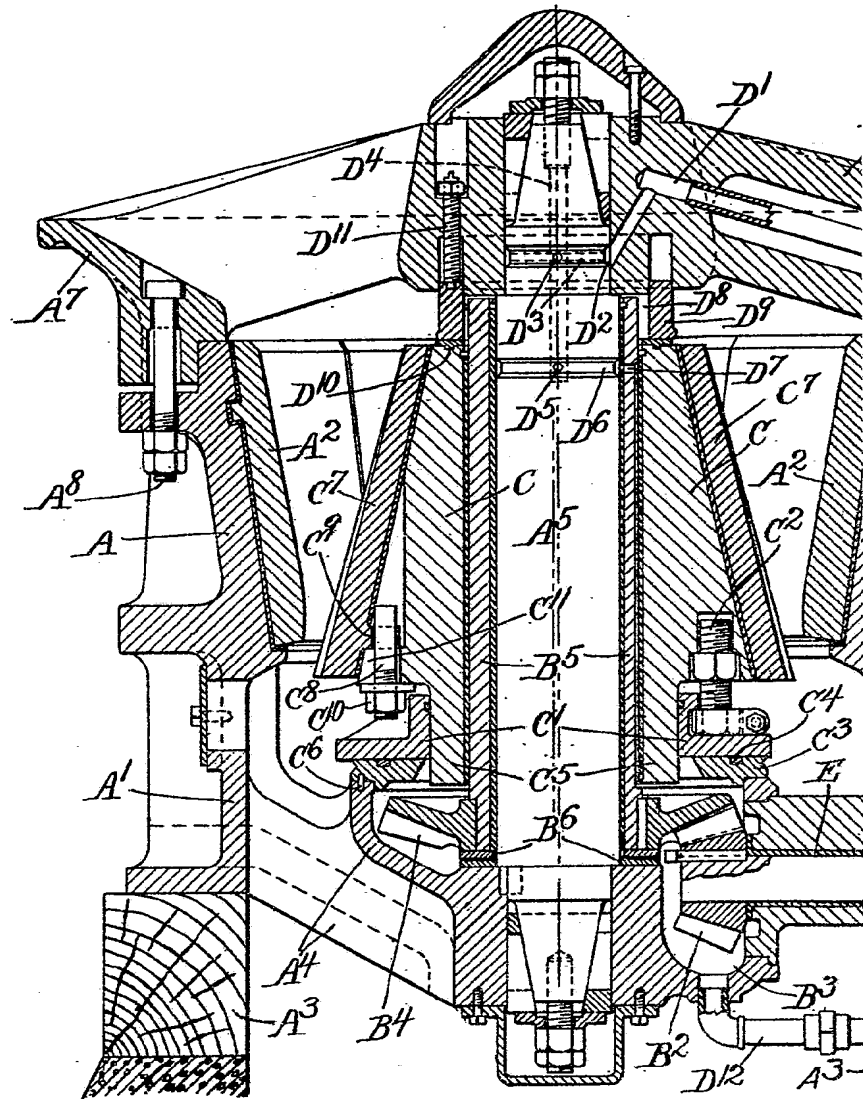
4. Kegelbrecher nach Anspruch 1 und 2, dadurch gekennzeichnet, daß das untere Ende der exzentrischen Hülse in die Ölkammer hineinreicht, die die Teile zum Antrieb des Brechkegels enthält.

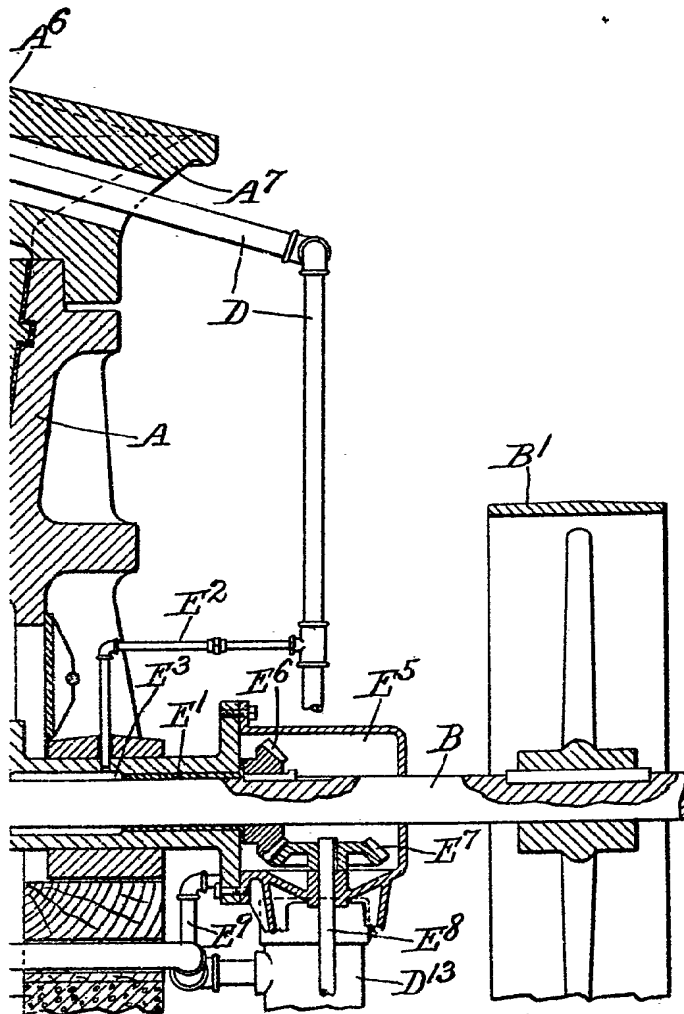
Hierzu 1 Blatt Zeichnungen.

Zu der Patentschrift 371447
Kl. 50c Gr. 3

Zu der Patentschrift 371447
Kl. 50c Gr. 3







DE681942

Abstract

Cone crusher with orbital pendulum moving crushing cone and a stationary crushing outer shell, where the inner wall is provided with ribs. Surrounding the crushing cone stationary the crushing outer shell, at least in height and the thickness, is in one piece, serving as a carrier of the crusher head and at the same time as housing shell.

DEUTSCHES REICH



AUSGEGEBEN AM
4. OKTOBER 1939

REICHSPATENTAMT
PATENTSCHRIFT

Nr 681 942

KLASSE **50 c** GRUPPE 2⁰¹

K 148182 III/50 c



Karl Meister in Magdeburg-Hopfengarten



ist als Erfinder genannt worden.

Fried. Krupp Grusonwerk Akt.-Ges. in Magdeburg-Buckau

Kegelbrecher

Patentiert im Deutschen Reiche vom 10. Oktober 1937 ab

Patenterteilung bekanntgemacht am 14. September 1939

Gemäß § 2 Abs. 2 der Verordnung vom 28. April 1938 ist die Erklärung abgegeben worden,
daß sich der Schutz auf das Land Österreich erstrecken soll

Fried. Krupp Grusonwerk Akt.-Ges. in Magdeburg-Buckau

Kegelbrecher

Patentiert im Deutschen Reiche vom 10. Oktober 1937 ab

Patenterteilung bekanntgemacht am 14. September 1939

Gemäß § 2 Abs. 2 der Verordnung vom 28. April 1938 ist die Erklärung abgegeben worden, daß sich der Schutz auf das Land Österreich erstrecken soll

Die Erfindung betrifft einen Kegelbrecher mit pendelnd kreisend bewegtem Brechkegel und festem Kegelmantel. Die Erfindung besteht darin, daß das die Verzahnung tragende Futter des feststehenden Brechmantels zugleich als Gehäuse dient. Dadurch wird das bisher übliche das Futter umgebende besondere Gehäuse entbehrlich, wodurch die Bauart des Brechers vereinfacht und verbilligt wird. Weitere Merkmale der Erfindung sind in der Beschreibung enthalten.

Es ist bei einem Rundbrecher vorgeschlagen worden, den Brechmantel aus Stäben herzustellen oder zu lochen. Beim Erfindungsgegenstand handelt es sich um einen Kegelbrecher, bei dem das den Brechkegel umgebende ortsfeste, mit Rippen versehene Brechfutter zugleich als Gehäusemantel dient.

Auf der Zeichnung ist ein Ausführungsbeispiel des Erfindungsgegenstandes im Schnitt dargestellt.

Der Brechkegel 1 wird von der Welle 2 getragen. Die Welle 2 hängt oben an einem Kopflager 3, das in einer Ausnehmung 4 einer Büchse 5 ruht. Die Ausnehmung 4 erweitert sich allmählich vom Boden 6 der Büchse 5 nach oben, damit das Kopflager 3 eine kreisend pendelnde Bewegung ausführen kann. Die den Brechkegel 1 tragende Welle ruht unten in einem mit einer exzentrischen Ausnehmung 7 versehenen Festlager 8. Dieses trägt ein Zahnrad 9, in das ein auf der Antriebswelle 10 sitzendes Zahnrad 11 eingreift. Durch Drehen des Festlagers 8 wird die Welle 2 und mit ihr der Brechkegel 1 in bekannter Weise in eine kreisend pendelnde Bewegung versetzt. Das zugleich als Mantelgehäuse dienende Futter 12 hat eine gewölbte Arbeitsfläche 13, die von der waagerechten Mittelebene aus nach dem Aufgange und nach dem Austragende hin gleichmäßig, d. h. symmetrisch verläuft. Das Futter 12 ist am oberen und am unteren Ende mit einer schräg verlaufenden Ringfläche 14 bzw. 15 versehen. Die untere schräge Ringfläche 15 ruht auf einer entsprechend verlaufenden Ringfläche 16 des Traggestells 18. Gegen die obere

schräge Ringfläche 14 des Futters 12 legt sich eine entsprechende Schrägfläche 19 des mit der Büchse 5 durch Arme 20 verbundenen ringförmigen Kopfes 21 des Brechers. Der Ring 21 ist durch Schraubenbolzen 22 mit dem Traggestell 18 verbunden. Nach Lösen der Muttern 23 kann dann der Ring 21 vom Traggestell 18 abgenommen werden. Nach Abnutzung der den unteren Teil des Brechraumes 24 begrenzenden Wandung x des Brechmantels kann dieser dann ausgebaut und so wieder eingesetzt werden, daß die vorher den oberen Teil des Brechraumes begrenzende Wandung x' des Mantels nunmehr die Wandung des unteren Teiles des Brechraumes bildet.

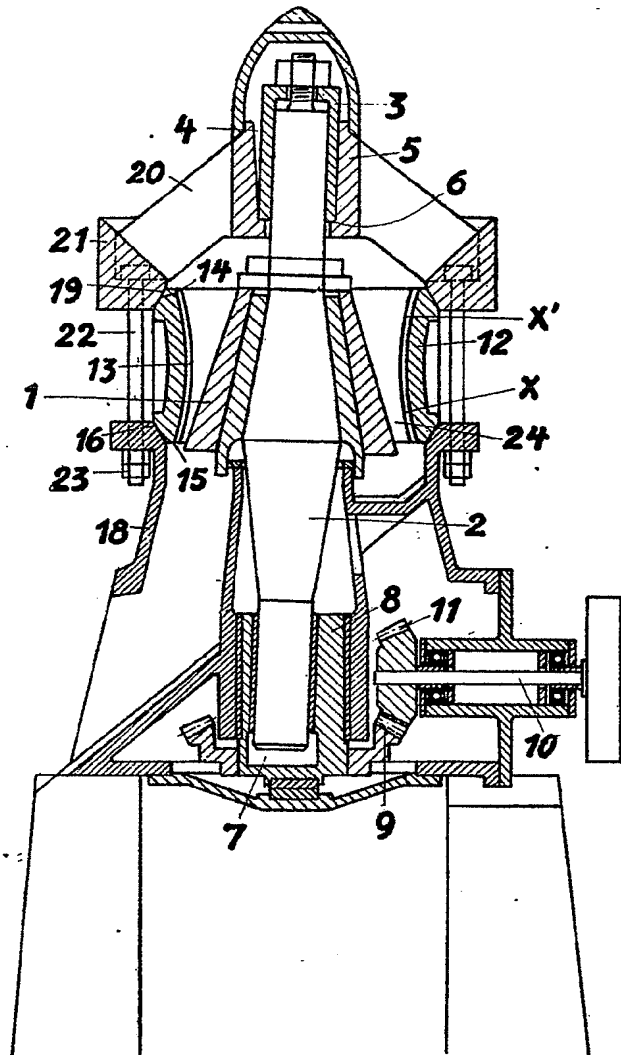
Die Lagerung des Futters kann auch eine andere sein. So könnte das Futter mit Ringflanschen versehen sein, die auf dem Traggestell aufrufen bzw. dem Ring 21 als Lagerung dienen.

PATENTANSPRÜCHE:

1. Kegelbrecher mit kreisend pendelnd bewegtem Brechkegel und ortsfestem Brechfutter, dessen Innenwandung mit Rippen versehen ist, dadurch gekennzeichnet, daß das den Brechkegel umgebende ortsfeste Brechfutter mindestens in der Höhe und der Dicke einstückig ist und als Träger des Brecherkopfes und zugleich als Gehäusemantel dient.

2. Kegelbrecher nach Anspruch 1, dadurch gekennzeichnet, daß das Futter (12) an seinem oberen und unteren Rande eine steilschräg verlaufende Ringfläche (14, 15) hat, von denen die untere Ringfläche (15) auf einer entsprechenden Schrägfläche (16) des Brechergehäuses (18) ruht, während auf der oberen Ringfläche (14) des Futters (12) der ringförmige, abnehmbare Kopf (21) des Brechers ruht, und daß der ringförmige Kopf (21) des Brechers in bekannter Weise durch Schraubenbolzen (22) mit dem Traggestell (18) des Futters (12) verbunden ist.

Hierzu 1 Blatt Zeichnungen



1.031.679



PATENT SPECIFICATION

DRAWINGS ATTACHED

1.031.679

Date of Application and filing Complete Specification: April 14, 1964.

No. 15368/64.

Application made in Italy (No. 25856) on Dec. 12, 1963.

Complete Specification Published: June 2, 1966.

© Crown Copyright 1966.

Index at acceptance:—B2 A13; F2 A(6D, 6E2, 7D2, 20, 33, 35B1, 35B2, 47); F2 H12A

Int. Cl.:—B 02 c F 06 b, c, n

COMPLETE SPECIFICATION

Improved Gyratory Crushing Machine

- I, FRANCA GHIAZZA, of 19 Via Bruciati, Albissola, Savona, Italy; an Italian national do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- This invention relates to an improved gyratory crushing machine.
- Gyratory crushing machines, see Fig. 1, are constituted in general by an outer crushing ring 1 of manganese steel or other hard and tough material, inside which a crusher 2 formed by a cone roll is mounted for gyratory motion, the crusher exercising considerable pressure against the ring, against which it crushes material 3, which finds itself between the ring and the crusher, also of hard and tough material. The shaft 4 of the crusher is stationary relative to its slides and its geometrical axis has an approximately conical motion of revolution around the vertical axis of the machine with vertex in top.
- With said motion of revolution the crusher crushes the material rolling on it. For the working and in order to obtain variation in the fineness of the crushed material, it is necessary to regulate the crusher and this is obtained by lifting or lowering the shaft and the crusher or otherwise varying the approach between the crusher and the outer ring. In the motion of revolution the thrust S of the crushed material, applied to the crusher and therefore to the shaft, is skew and not orthogonal with regard to the axis of the shaft and gives rise to one radial component, one axial component and to one resisting torque. To the two component forces the upper and lower bearings of the shaft react, while the torque is balanced by the motor drive.
- To avoid however the well known operating inconveniences of the aforementioned mounted structures the improvements in question refer first to a realization of an upper bearing for the shaft, secondly to a particular disposition of the driving gear, thirdly to a locking mechanical device.
- The invention will be further described by way of example with reference to the accompanying drawings, in which:—
- Fig. 1 is a vertical section of a gyratory crushing machine;
- Fig. 2 is a section of an upper bearing of the shaft of a gyratory machine supplied with the improvements according to the invention;
- Fig. 3 is a section of a gyratory crushing machine according to the invention;
- Fig. 4 is a section, corresponding to Fig. 3, of a modified gyratory crushing machine according to the invention;
- Fig. 5 is a section of an upper bearing showing a locking system; and
- Fig. 6 is a section corresponding to Fig. 5, showing a modified locking system.
- In Fig. 2, the upper end 5 of a main shaft has a steel ring 6 secured to it and supported by an inner rim of a bushing 7. Between 6 and 7 there is a radially determined free play. The bushing 7 is secured in a collar 8 having two different external diameters and slidable in a cylindrical cavity of a sleeve 9 secured to or forming part of the upper frame of the machine. Such a cavity also has two different diameters, providing a sliding coupling between 8 and 9 and an annular chamber 10 between them. In said chamber under pressure oil is introduced, urging the collar 8 upwardly. Between the jointing together surfaces of 8 and 9, seals 11, 12 are arranged. There is also a hand or motor oil pump 13 with a delivery pipe 14. On the delivery pipe is arranged in shunt the manometer 15 and a hydropneumatic battery 16 the working of which is well known. There are besides opportune stopcocks and also the oil reservoir 17.
- The hereinafter described bearing allows the radial reaction of the sleeve 9, which reacts through 7—8 against the ring 6. The axial component of the downward thrust is balanced by the resultant underpressure oil thrust, which

acts on the annular surface of the collar 8 secured to the bushing 7, which with its rim supports and transmits the thrust to the ring 6 secured to the shaft. The performance of said arrangement is such that, either at standstill of the crushing machine or during its working, it is possible to introduce or to take away oil from the annular chamber 10 thus changing its volume; it is therefore possible to lift or to lower all the parts 8—7—6—5 and therefore to change the crushing fineness. Performance of the above described arrangement is again the following: when the vertical downward thrust increases suddenly for extraneous bodies of abnormal hardness and toughness (e.g. metallic bodies and other) and therefore the oil pressure in the annular chamber reaches a higher value to that prefixed in the battery calibration, the oil flows from the annular chamber 10 and goes into the battery. So the shaft and the crusher are lowered and a larger opening of passage for the material is obtained spontaneously and therefore the extraneous bodies are eliminated at the outlet from the crushing chamber. At the cessation of the cause the battery sends back the oil to the chamber 10 in equal volume, returning to the initial position the collar 8 and therefore the shaft and the crusher. The lower bearings are in general formed in such a manner as to give rise to the revolving motion of the shaft by means of a bushing rotating with an eccentric hole, in which hole the lower end of the shaft is received. Given the considerable pressure and the important forces in motion it is necessary to obtain a good lubrication. In general it is supplied with opposite centrelines outside the machine, with pumps, filters and safety agents, etc.

The present specification refers to the realization of a self-lubricating control system.

In Fig. 3 a bushing 18 with an eccentric hole is secured to a flange or disc 19 to which a pulley flywheel 20 is connected, below which there is an oil pan; the bushing 18 is rotatable in a sleeve 22 forming part of the frame of the machine. To the sleeve 22 a lower ring 23 is secured; the pulley 20 with opposite ribs has an inner ring 24, by which it is supported on ring 23 by bronze rings or the like thrust bearings 25. Said thrust support sustains therefore all the weight of the whole rotating, viz.: flywheel, oil pan, disc 19, bushing 18 and oil itself. Between the rotating disc 19 and the lower ring 23 there is arranged an oil seal 26; in the ring 23 some radial holes are provided, terminating in the inside hollow space contained between 19 and 23 and the seal 26. In the disc 19 radially arranged tubes 27 are secured, bent in and communicating with the said hollow space. In the lower part of the bushing 18 holes 28 are provided disposed obliquely in a radial direction for taking the oil between the cylindrical surfaces of the members 18 and 22. The oil pan 21 is

equipped externally with cooling and ventilation fins 29 and in order to increase the effect of cooling it is formed as a centrifugal radial ventilator. All the inside cavities contained in the pulley 20 and in the pan 21 are full of oil up to a determined level $l-l$ which is shown in Fig. 3 when the machine is stationary; when the machine is functioning the oil, because of the centrifugal force, assumes from the more outside strata an overpressure in regard to the atmospheric pressure. The oil passes along the holes 28 into the hollow space at the inside of the seal 26, where it will have the same overpressure, dp , and therefore crosses the disk or diaphragm 19 by means of the rotating tubes 27 in which the overpressure increases from dp to $2 dp$ at the exit; therefore in the more outside strata of the oil in the rotating pan one will have an overpressure of $2 dp$; while in the central part of the pan, because of the centrifugal action of the mass of the oil which fills the pan, the overpressure will be only dp . Such an overpressure causes the oil to rise in lubrication channels provided between the bushing 18 and the shaft and externally through the holes 28 between the bushing 18 and the sleeve 22. At the upper end of the bushing the oil passes through holes 30 in the sleeve 22 and from this it goes down in the inside of the pulley 20. At the top between the shaft of the machine and the frame 22 is arranged a cover hose of elastic material 31 secured to the shaft. The cover is mounted at its lower end on a bearing 32 and also forms an inside lip to better ensure that oil dispersion does not happen. The so described system is characterized by the fact that the whole rotating pulley and pan form the oil tank and a centrifugal effect is employed in order to obtain the oil circulation; with this aim, the disc 19 separates the tank into two different chambers and besides there is the stationary ring 23 with radial holes functioning as a diaphragm or diffuser, for which said tank functions as a centrifugal pump with two impellers.

It is necessary to bear in mind that the tubes 27 only serve for the delivery of still warm oil, coming from the upper chamber towards the outside of the pane 21 and thus to increase the cooling effect, so that the oil rising from the centre of the pan finds itself at a reduced temperature. By way of greater explanation of the working it is observed that, if the radial holes in the immovable ring 23, and the seal 26, were omitted, then an overpressure dp at the centre of the pan could not be realized and therefore the oil would not rise to lubricate the upper part of the revolving sleeve. The above described arrangement has therefore a general task to assure the forced and spontaneous oil circulation, and, given the presence of a considerable oil volume to have all the parts to be lubricated in the oil bath; also, when the machine is stationary,

to have a spontaneous overpressure that assures intense oil circulation, and to conduct the oil towards the rotating containing surfaces so that there is a good contact and an efficacious cooling.

Other arrangements can be provided to reach the same aim, as for instance, the arrangement of Fig. 4. A bushing 33 with an eccentric hole extends down to an oil pan 34 to which it is secured, as also is a pulley 35. A frame sleeve 36 has a flange 37 on which the pulley flywheel 35 is supported by means of a ring 38 and bearing 39, the flange 37 being extended downwards by a cylinder 37¹. It is possible to provide, between the inside flange 37 and the rotating outside parts 34—35, impellers and diaphragms as in a centrifugal pump, for instance conduits 40—41 secured to the cylinder 37¹ and rotating conduits 42 secured to the oil pan 34. The conduit 41 is positioned so as to introduce the oil under pressure into holes 43 in the cylinder 37¹. Between the rotating bushing and stationary cylinder 37¹ a seal 44 is arranged, placed below holes 45 provided in the movable bushing 33 with the function of locking of the oil circulation and obtaining a constant pressure equal to 2 dp. The oil rises between the surfaces of the sleeve 36 and the bushing 33, and the bushing 33 and the shaft, and re-enters, through holes in the sleeve 36, the inside cavity of the pulley, and passes to the bottom through vertical channels, then continuing through conduits 40—42.

The upper ring may be secured to the shaft in different ways, for example as shown in Fig. 5 or 6. It is indispensable that no free play occurs between the shaft and the ring; free play would rapidly damage the parts and, in conjunction with the fixing, the ring must be able to support the axial component of the crushing effort. The fixing is generally obtained by a conical coupling between shaft and ring, which are locked together by means of screws, nuts or the like safety agents against loosening. The arrangement according to the invention consists in a mechanical agent, in which the axial pressure necessary for the ring to lock to the shaft of the gyratory crusher by means of conical surfaces, is subdivided between different pressing agents with the interarrangement of springs, so that the total effort is subdivided making locking more easy and efficient; in addition the springs provide the predetermined pressure required for locking, being of a strength previously calculated to assure said locking force.

A realization of such a device can be the following:—

In Fig. 5 a shaft 46 is locked to a ring 47 by conical coupling surfaces. The shaft terminates in a threaded stem 48, to which a threaded nut 49 is screwed. Between ring 47 and nut 49 there is a washer 50. In the nut 49 six or eight or more threaded holes are

provided, leading into holes 52 of larger diameter. The washer 50 has holes with a distribution corresponding to that of those in the nut 49. Said holes have two diameters, viz. they each form a cylindrical chamber 53 and a smaller bypass hole 54. The chambers 53 house cylinders 55 each having an axial stem in a hole 54 and compression springs 56 are carried on the stems. In order to lock the ring 47 on the shaft 46 the washer 50 is placed, with the cylinders 55 and springs 56 in the chambers 53, over the stem 48, and the ring 49 is screwed down on the washer 50. Screws 57 engaged in threaded holes 51 in the nut 49 press on the cylinders 55 and compress the springs locking them against the washer 50. Any loosening during the working, for instance a settling of the ring 47 over the shaft 46 or the movement of a screw 57, will be accompanied by compensatory expansion of the springs 56. To avoid loosening of the nut 49 normal safety means are arranged, for instance the shaft terminates in a square boss 58 on which a plate 59 is engaged, the plate having slots locating the screws 57, thus preventing rotation of the nut 49 on the shaft 46.

Locking of the ring on the shaft can also be realized as illustrated in Fig. 6, where the locking effort rather than being divided between different springs is condensed in one only. The nut 49 presses directly through a washer 49¹ on the spring 56 on the upper surface of the ring 47, which contacts conically shaft 46. Complementarily known safety means 58 and 59 may be provided for the nut 49. Particularly the spring strengths are calculated so that the springs have a predetermined expansion force for guaranteeing, in case of loosening of the nut 49, an axial force sufficient to resist the axial thrust due to the crusher's effort and keep the two conical surfaces together.

WHAT I CLAIM IS:—

1. A gyratory crushing machine having a main shaft guided by a ring reacting radially to eccentric rotation of the shaft during crushing, the reaction being obtained by means of hydraulic pressure against an annular rim of a slidable piston sleeve secured to the ring, in which a hydropneumatic battery is connected in a conduit for providing oil to the piston, the battery acting as a safety device for axially moving the shaft when required by the material being crushed.

2. A gyratory crushing machine as claimed in claim 1, in which the hydropneumatic battery is adapted to be operative for pumping oil so as to change the volume bounded by the piston sleeve and thus move the shaft and an associated crusher relative to a crusher ring whilst the machine is working, the vertex of the cone of revolution of the shaft, in consequence of the adjustment or of the activation of the safety device, sliding along the vertical axis of the machine and thus changing the

angle of the shaft at the vertex of the cone of revolution during motion.

3. A gyratory crushing machine as claimed in claim 1 or 2, having a driving pulley secured to an oil pan forming an oil sump sufficiently deep that the lower end of the shaft and its associated bearings may be immersed in oil when the machine is stationary, the oil sump being separated into two parts by means including an oil seal and having oil circulation channels arranged to operate as a centrifugal pump upon rotation of the pulley, sump and shaft, providing an overpressure necessary for lubrication of the surfaces to be lubricated and for oil circulation.

4. A gyratory crushing machine as claimed in claim 1 or 2 in which the ring is mounted on the shaft with conical co-operating surfaces and is secured to the shaft by resilient means exercising a predetermined axial thrust sufficient to balance the axial thrust of the crusher and to maintain the ring on the shaft.

5. A gyratory crushing machine as claimed in claim 4 in which the resilient means comprise compression springs for urging a washer against the ring and pretensioned by screws carried in a nut screwable on the shaft.

6. A gyratory crushing machine as claimed in claim 1, arranged and adapted for operation substantially as described with reference to and as illustrated in Fig. 2 of the accompanying drawings.

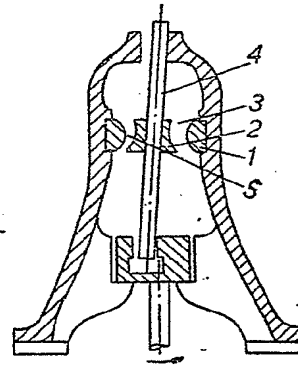
7. A gyratory crushing machine as claimed in claim 1, constructed and adapted for operation substantially as described with reference to and as illustrated in Fig. 3 or 4 of the accompanying drawings.

8. A gyratory crushing machine as claimed in claim 1 in which the shaft and ring are locked together substantially as described with reference to and as illustrated in Fig. 5 or 6 of the accompanying drawings.

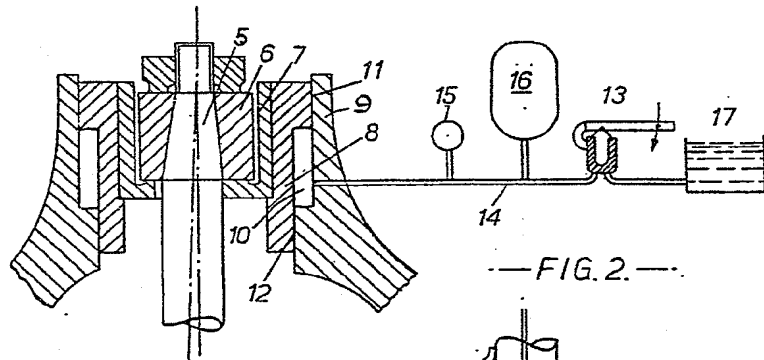
GEORGE HAM & PARTNERS.

Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press (Leamington) Ltd.—1966. Published by The Patent Office, 25 Southampton Buildings, London, W.C.2, from which copies may be obtained

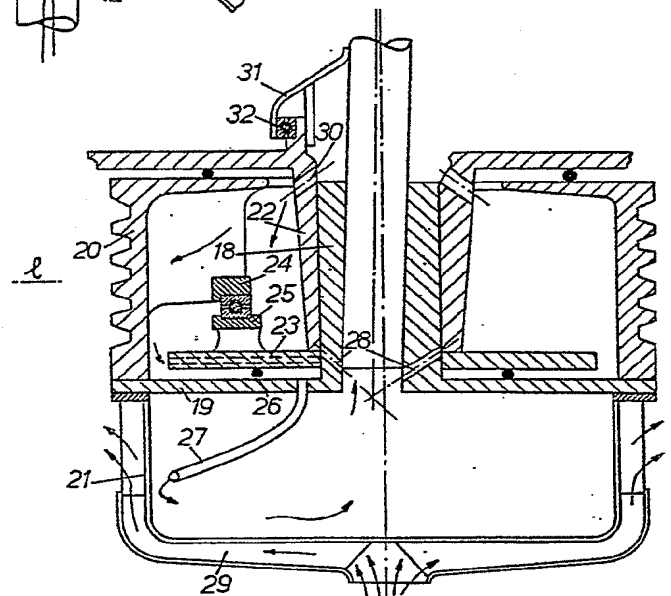
—FIG. 1.—



—FIG. 2.—



—FIG. 3.—



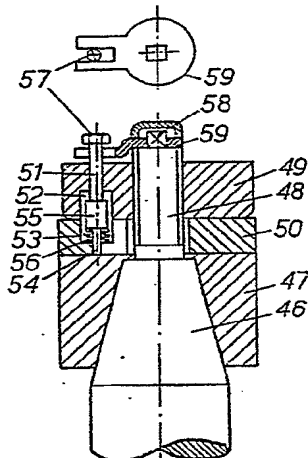
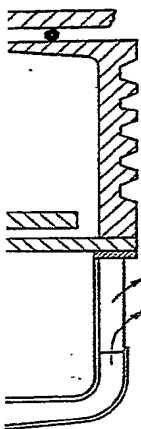
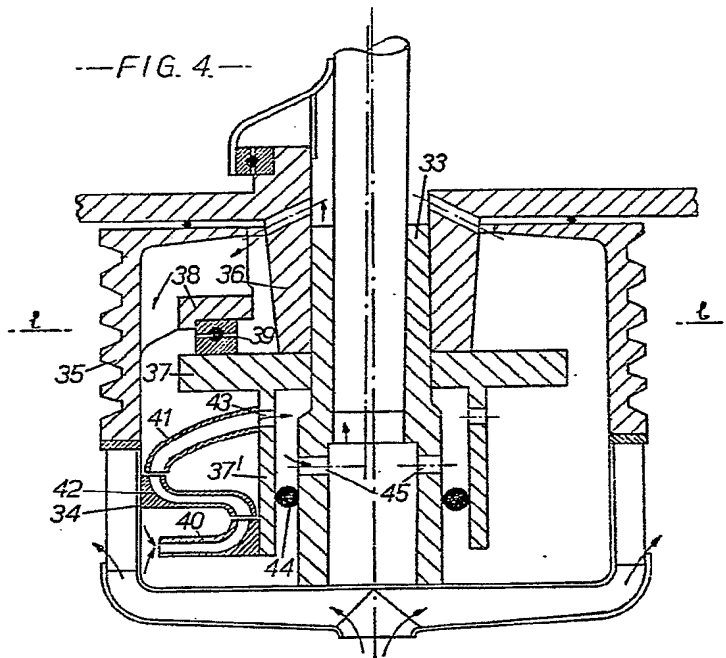
1031679

COMPLETE SPECIFICATION

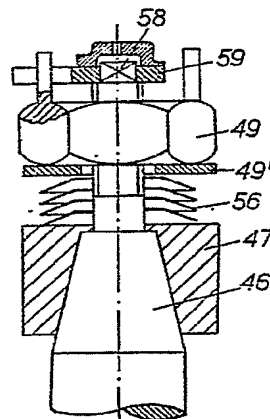
2 SHEETS

This drawing is a reproduction of
the Original on a reduced scale
Sheets 1 & 2

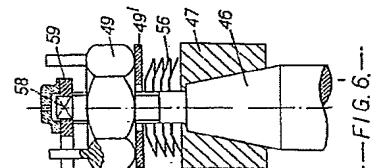
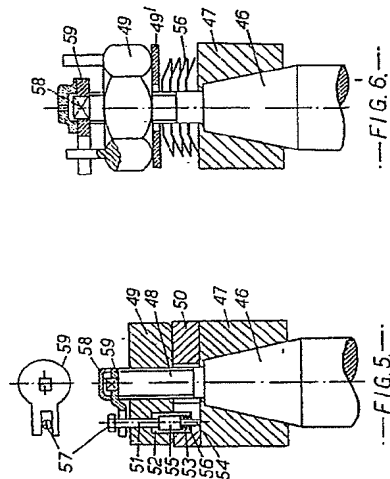
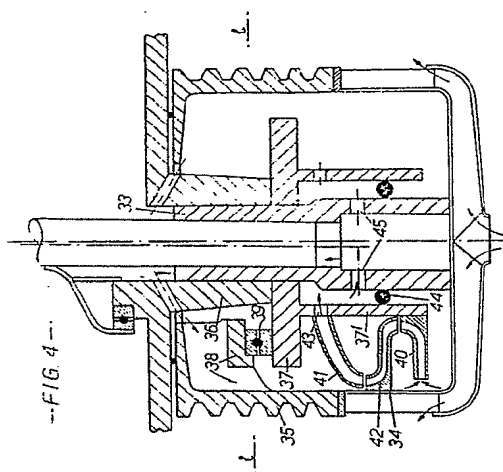
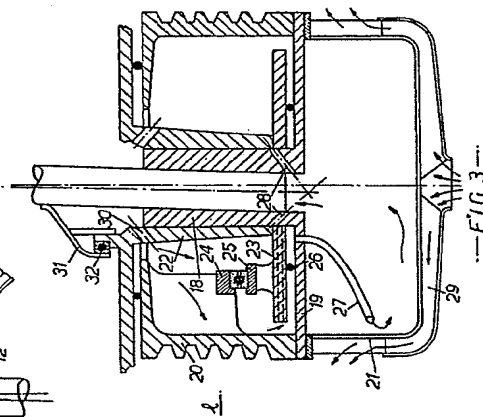
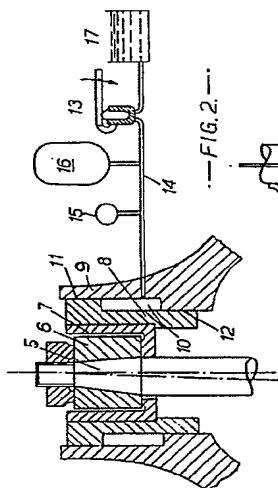
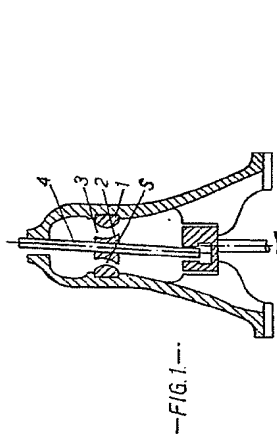
—FIG. 4.—



—FIG. 5.—



—FIG. 6.—



Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)**

Title of Invention	GYRATORY CRUSHER MAIN SHAFT SLEEVE
-----------------------	------------------------------------

As the below named inventor, I hereby declare that:

This declaration is directed to: ☒ The attached application, or
☐ United States application or PCT international application number _____
filed on: _____

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001
by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: ROSDAHL, Fredrik Date (Optional): 2015-01-30
Signature: *Fredrik Rosdahl*

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form.
Use an additional PTO/SB/AIA01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 216(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



Espacenet

Bibliographic data: DE10346475 (B3) — 2005-03-10

Bearing fitting for components subject to high centrifugal force has bearing bolt with an asymmetric convex endface on side pointing in direction of centrifugal force

Inventor(s): KLOEPPEL VALENTIN [DE]; SAHLSTORFER HERMANN [DE] ± (KLOEPPEL, VALENTIN, ; SAHLSTORFER, HERMANN)

Applicant(s): EUROCOPTER DEUTSCHLAND [DE] ± (EUROCOPTER DEUTSCHLAND GMBH)

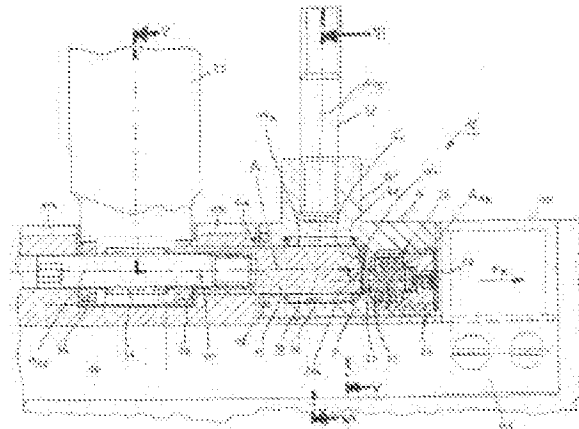
Classification: - **international:** B64C27/615; F16C17/08; F16C17/10; F16C21/00; F16C27/08; F16C33/10; (IPC1-7): B64C11/04; B64C27/32; F16C17/08; F16C23/10; F16C27/08; F16C33/10; F16C33/66
- **cooperative:** B64C27/615; F16C17/08; F16C17/10; F16C21/005; F16C27/08; F16C33/103; B64C2027/7272; B64C2027/7294; Y02T50/34

Application number: DE2003146475 20031002

Priority number(s): DE2003146475 20031002

Abstract of DE10346475 (B3)

The bearing fitting includes a bearing bolt (16), which has an asymmetric convex endface (16a) on the side pointing in the direction of the centrifugal force (FR) and facing the bottom (4c) of the pot element (4), of a convexity defining an eccentric resting point (P) on the bearing axis (A) which follows a circular path about the bearing axis when the bolt rotates.





(19)
Bundesrepublik Deutschland
Deutsches Patent- und Markenamt

(10) **DE 103 46 475 B3** 2005.03.10

(12)

Patentschrift

(21) Aktenzeichen: **103 46 475.1**
(22) Anmeldetag: **02.10.2003**
(43) Offenlegungstag: –
(45) Veröffentlichungstag
der Patenterteilung: **10.03.2005**

(51) Int Cl.⁷: **F16C 33/66**
F16C 33/10, B64C 27/32, B64C 11/04,
F16C 17/08, F16C 27/08, F16C 23/10

Innerhalb von 3 Monaten nach Veröffentlichung der Erteilung kann Einspruch erhoben werden.

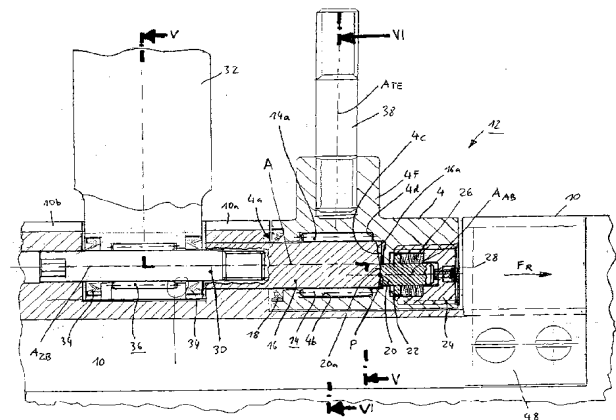
(71) Patentinhaber:
**Eurocopter Deutschland GmbH, 86609
Donauwörth, DE**

(72) Erfinder:
**Klöppel, Valentin, Dr., 81827 München, DE;
Sahlstorfer, Hermann, 81737 München, DE**

(56) Für die Beurteilung der Patentfähigkeit in Betracht
gezogene Druckschriften:
DE 196 22 130 A1
DE 84 30 909 U1
FR 12 02 022
GB 21 99 551 A
US 52 77 499 A
US 44 66 773
EP 10 83 123 A1
JP 09-1 70 622 A
JP 04-2 77 315 A

(54) Bezeichnung: **Lageranordnung für ein hochgradig fliehkraftbelastetes Bauteil, Rotorblatt sowie Drehflügelflugzeug mit einer derartigen Lageranordnung**

(57) Zusammenfassung: Lageranordnung für ein hochgradig fliehkraftbelastetes Bauteil (6, 10), umfassend ein Lager (14), welches eine Lagerachse (A) besitzt, die sich in Fliehkrafttrichtung (F_R) erstreckt; einen sich parallel zur Lagerachse (A) in dem Lager (14) erstreckenden Lagerbolzen (16) und ein Topfelement (4), in dem der Lagerbolzen (16) zusammen mit dem Lager (14) gelagert ist, wobei das Topfelement (4) den Lagerbolzen (16) und das Lager (14) umgreift und die Topföffnung (4a) des Topfelementes (4) entgegen der Fliehkrafttrichtung (F_R) angeordnet ist. Rotorblatt (6) mit einer schwenkbaren Rotorblattklappe (10) und einem Rotorblatt-Klappenlager (12) mit mindestens einer solchen Lageranordnung, wobei die Topföffnung (4a) in Richtung zu einem Rotorkopf-Anschlussbereich des Rotorblattes (6) weist und entgegen der in einem laufenden Betrieb des Rotorblattes (6) auftretenden Fliehkrafttrichtung (F_R) angeordnet ist. Drehflügelflugzeug, umfassend ein solches Rotorblatt (6) mit einer solchen Lageranordnung.



Beschreibung**TECHNISCHES GEBIET**

[0001] Die vorliegende Erfindung betrifft eine Lageranordnung für ein hochgradig fliehkraftbelastetes Bauteil gemäß dem Oberbegriff des Anspruchs 1 oder 2, sowie ein Rotorblatt und ein Drehflügelflugzeug, insbesondere ein Hubschrauber, mit einer derartigen Lageranordnung.

Stand der Technik

[0002] Eine Lageranordnung für ein hochgradig fliehkraftbelastetes Bauteil, nämlich ein Kreuzgelenk, gemäß dem Oberbegriff des Anspruchs 1 oder 2 ist aus der DE 84 30 909 U1 bekannt.

[0003] Die GB 2 199 551 A offenbart eine Lageranordnung für ein hochgradig fliehkraftbelastetes Bauteil in einem Rotorkopf eines Hubschraubers, umfassend ein Lager, welches eine Lagerachse besitzt, die sich im Wesentlichen in Fliehkraftrichtung erstreckt; ein sich parallel zur Lagerachse in dem Lager erstreckendes lagerbolzenartiges hohles Teil; und ein Topfelement, in dem das lagerbolzenartige Teil zusammen mit einer Teflon®-beschichteten selbstschmierenden Lagerbuchse gelagert ist, wobei das Topfelement das lagerbolzenartige Teil und die Teflon®-beschichtete Lagerbuchse umgreift und die Topföffnung des Topfelementes entgegen der Fliehkraftrichtung angeordnet ist.

[0004] In hochgradig fliehkraftbelasteten Bauteilen, die über beweglich gelagerte Elemente verfügen, sind Lager und Lageranordnung enormen Belastungen ausgesetzt. Ein Beispiel für ein hochgradig fliehkraftbelastetes Bauteil ist ein mit einer schwenkbaren Klappe versehenes Rotorblatt eines Drehflügelflugzeugs, insbesondere eines Hubschraubers. Derartige Klappen werden z.B. zur Reduktion von Lärm und Vibrationen sowie für ein bestimmtes Steuerverhalten des Rotorblattes eingesetzt. Üblicherweise ist die Klappe an einem Hinterkantenbereich des Rotorblattes angebracht. Im laufenden Rotorbetrieb sind die Klappe und ihre Lagerung Fliehkräften von bis zu 1000 g und mehr ausgesetzt. Unter diesen Bedingungen muss die Klappe hochfrequente schwellende oder oszillierende Schwenkbewegungen ausführen. Die Lageranordnung und die einzelnen Lager der Klappe, die in der Regel mit einem Schmiermittel versehen werden, sind hierbei hohen Reibungskräften unterworfen.

[0005] Konstruktiv bedingt ist es bei der Lagerung einer Rotorblattklappe auch oftmals erforderlich, die Lageranordnung oder einzelne Elemente davon mit einer nicht unerheblichen Vorspannung einzubauen. Insbesondere Klappenantriebsselemente, bei denen es sich zumeist um Zügelemente handelt, werden in

der Regel einer Vorspannung unterworfen, und sie leiten hohe Kräfte in die Lageranordnung ein. Dies führt zu hohen Lagerradialkräften und elastischen Verformungen, die wiederum Klappenwinkelverluste nach sich ziehen. Im Rotorbetrieb werden durch Luft- und Trägheitskräfte überdies Biege- und Torsionsverformungen am Rotorblatt und der Klappe hervorgerufen. Aus diesen Trägheits- und Luftkräften resultieren unerwünschte Zwangskräfte sowie Maßdifferenzen zwischen der Klappe und dem Rotorblatt. Bei den genannten Maßdifferenzen handelt es sich primär um Winkelabweichungen und Längenänderungen. Aufgrund dieser Einflüsse wird die Beweglichkeit der Klappenlagerung und damit die Klappenbewegung erschwert und kann unter ungünstigen Umständen sogar blockiert werden. Ein Rotorblattprofil verfügt außerdem nur über eine geringe Dicke, so dass handelsübliche Axiallager für eine Abstützung der auf die Klappe wirkenden Fliehkräfte keine Anwendung finden können.

[0006] Bei hochgradig fliehkraftbelasteten Bauteilen, wie z.B. der zuvor erwähnten Klappenlagerung eines Rotorblattes, hat es sich ferner gezeigt, dass infolge der sehr hohen Beanspruchung Schmiermittelabrisse oder Schmiermittelverluste auftreten. Dies führt zu einem nachteiligen Erhitzen der betreffenden Lagerelemente und zu einem erhöhten Verschleiß. Die Lebensdauer bzw. Betriebsdauer bis zu einer erforderlichen Wartung oder einem Austausch der Lageranordnung wird folglich reduziert. Da ein Rotorblatt bzw. dessen Klappe sicherheitsrelevante Bauteile sind, kommt einer Lageranordnung in diesen Komponenten besondere Bedeutung zu, und es werden sehr hohe Anforderungen an die Sicherheit und Zuverlässigkeit gestellt.

[0007] Lageranordnungen sollten darüber hinaus einen einfachen und problemlosen Ein- und Ausbau des gelagerten Bauteils sowie einzelner Lagerelemente zu Wartungs- oder Austauschzwecken ermöglichen. Überdies müssen Lageranordnungen oftmals auch diverse anwendungsspezifische Zusatzanforderungen erfüllen. Bei der besagten Rotorblatt-Klappenlagerung beispielweise ist zur Vermeidung einer aerodynamischen Widerstandserhöhung eine möglichst geringe Bauhöhe bzw. eine sehr kompakte Bauweise der Lageranordnung gefordert. Zudem sollte diese leicht und hochfest ausgestaltet sein. Auch aus diesen Gründen kommt der Lageranordnung und der damit erzielbaren schwenkbaren Anbindung eines Bauelementes besondere Bedeutung zu.

Aufgabenstellung**DARSTELLUNG DER ERFINDUNG**

[0008] Der Erfindung liegt die Aufgabe beziehungsweise das technische Problem zugrunde, eine kom-

pakte Lageranordnung für ein hochgradig fliehkraftbelastetes Bauteil zu schaffen, welche unter sehr hohen Fliehkraftbelastungen von bis zu 1000 g und mehr eine dauerhafte und zuverlässige Schmierung gewährleistet sowie eine sichere Betätigung eines gelagerten Bauelementes bei Fliehkrafteinwirkung ermöglicht. Ferner soll ein Rotorblatt sowie ein Drehflügelflugzeug mit einer solchen Lageranordnung bereit gestellt werden.

[0009] Diese Aufgabe wird gemäß einem ersten Aspekt gelöst durch eine erfindungsgemäße Lageranordnung mit den Merkmalen des Anspruchs 1.

[0010] Diese Lageranordnung für ein hochgradig fliehkraftbelastetes Bauteil umfasst: wenigstens ein Lager, welches eine Lagerachse besitzt, die sich im Wesentlichen in Fliehkraftrichtung (oder einem geringen Winkel dazu) erstreckt; mindestens einen sich parallel zur Lagerachse in dem Lager erstreckenden Lagerbolzen; und ein Topfelement, in dem der Lagerbolzen zusammen mit dem Lager gelagert ist, wobei das Topfelement den Lagerbolzen und das Lager umgreift und die Topföffnung des Topfelementes entgegen der Fliehkraftrichtung angeordnet ist.

[0011] Als Lager kann grundsätzlich sowohl ein Gleit- als auch ein Wälzlager sowie eine Kombination daraus Anwendung finden. Auch Flächen oder Teile des Topfelementes selbst können das Lager für den Lagerbolzen bilden. Unter einem Lagerbolzen ist im Sinne der Erfindung jeder geeignete Achs- oder Wellenkörper zu verstehen. Die Kontur des Lagerbolzens kann hierbei einfach zylindrisch geformt sein oder auch komplexere Formen annehmen. Es ist auch möglich, den Lagerbolzen zum Zwecke der Gewichtsreduzierung als Hohlkörper auszugestalten. Das Topfelement kann grundsätzlich ein- oder mehrteilig ausgebildet sein. Das Topfelement umgreift den Lagerbolzen zumindest im Bereich des Lagers, vorzugsweise jedoch über im Wesentlichen die gesamte Länge oder einen wesentlichen Teil der Gesamtlänge des Lagerbolzens bzw. des Lagers.

[0012] Das Topfelement ermöglicht eine einfache steckbare Montage und eine leichte Demontierbarkeit des Lagerbolzens und des Lagers und folglich eine simple Wartung der Lageranordnung. Darüber hinaus verhindert das Topfelement auf vorteilhafte Art und Weise ein Entweichen von Schmiermittel aus der Lageranordnung bzw. einen Schmiermittelabriss. Dieser vorteilhafte Effekt wird selbst unter extrem hohen Fliehkrafteinwirkungen von bis zu 1000 g und mehr und einem damit verbundenen extrem hohen Schmiermitteldruck erreicht. Ein nachteiligen Erhitzen der in der Lageranordnung verwendeten Lagerelemente, eine erhöhte Reibung sowie ein erhöhter Verschleiß sind somit wirkungsvoll vermeidbar. Ferner kann die Lebensdauer bzw. Betriebsdauer bis zu einer erforderlichen Wartung oder einem Austausch

der Lageranordnung erhöht werden. Dies ist besonders bei sicherheitsrelevanten Bauteilen von Vorteil, bei denen hinsichtlich der Lageranordnung eine hohe Anforderungen an die Sicherheit und Zuverlässigkeit gestellt wird.

[0013] Darüber hinaus kann das Topfelement bei relativ geringem konstruktiven Aufwand weitere Zusatzfunktionen innerhalb der Lageranordnung sowie derjenigen Komponente übernehmen, in welche die Lageranordnung selbst eingebaut ist; dies wird aus der nachstehenden Erläuterung eines bevorzugten Ausführungsbeispiels noch deutlicher werden. Insgesamt kann die erfindungsgemäße Lageranordnung recht leicht, hochfest, haltbar und in einer kompakten, platzsparenden Bauweise ausgestaltet werden. Die erfindungsgemäße Lageranordnung eignet sich insbesondere für eine Klappenlagerung eines Rotorblattes eines Drehflügelflugzeugs, wie nachfolgend noch näher erläutert werden wird. In diesem Zusammenhang trägt die erfindungsgemäße Lageranordnung zu einer sicheren und zuverlässigen Funktion der Rotorblatt-Klappe bei und kann dank ihrer geringen Bauhöhe auch eine unerwünschte aerodynamische Widerstandserhöhung am Rotorblatt vermeiden.

[0014] Weitere bevorzugte und vorteilhafte Ausgestaltungsmerkmale der erfindungsgemäßen Lageranordnung sind Gegenstand der Unteransprüche 3 bis 9.

[0015] Die der Erfindung zugrunde liegende Aufgabe wird gemäß einem zweiten Aspekt gelöst durch ein erfindungsgemäßes Rotorblatt mit den Merkmalen des Anspruchs 10.

[0016] Dieses Rotorblatt, insbesondere für ein Drehflügelflugzeug, umfasst: mindestens eine in einen Rotorblatt-Profilkörper integrierte Rotorblattklappe; und mindestens ein mit wenigstens einer Lageranordnung nach einem der Ansprüche 1 bis 9 versehenes Rotorblatt-Klappenlager, an dem die Rotorblattklappe um eine sich in Spannweitenrichtung des Rotorblatts erstreckende Klappenachse schwenkbar angeordnet ist; wobei die Klappenachse der Lagerachse der Lageranordnung entspricht und die Topföffnung des Topfelementes der Lageranordnung in Richtung zu einem Rotorkopf-Anschlussbereich des Rotorblattes weist und entgegen der in einem laufenden Betrieb des Rotorblattes auftretenden Fliehkraftrichtung angeordnet ist.

[0017] Mit dem erfindungsgemäßen Rotorblatt sind im Wesentlichen die gleichen Vorteile zu erzielen, wie sie bereits oben in Zusammenhang mit der erfindungsgemäßen Lageranordnung erläutert wurden. Darüber hinaus gestattet das erfindungsgemäße Rotorblatt trotz seiner geringen Dicke und den damit verbundenen sehr beengten räumlichen Verhältnissen für Lager und Lagerelemente eine reibungsarme

Aufnahme der Klappenfliehkräfte, eine Verbesserung der Rotorblatt-Klappenfunktion und eine Steigerung der Zuverlässigkeit und Sicherheit des Rotorblattes. Überdies ist eine Reduzierung der Wartungsintervalle des Blattes und des Drehflügelflugzeugs erzielbar, welches mit einem solchen Rotorblatt ausgestattet ist.

[0018] Die der Erfindung zugrunde liegende Aufgabe wird gemäß einem dritten Aspekt gelöst durch ein erfindungsgemäßes Drehflügelflugzeug mit den Merkmalen des Anspruchs 15. Mit dem erfindungsgemäßen Drehflügelflugzeug sind die gleichen Vorteile erreichbar, wie sie im Zusammenhang mit dem erfindungsgemäßen Rotorblatt erläutert wurden.

Ausführungsbeispiel

[0019] Bevorzugte Ausführungsbeispiele der Erfindung mit zusätzlichen Ausgestaltungsdetails und weiteren Vorteilen sind nachfolgend unter Bezugnahme auf die beigefügten Zeichnungen näher beschrieben und erläutert.

KURZE BESCHREIBUNG DER ZEICHNUNGEN

[0020] Es zeigt:

[0021] Fig. 1 einen schematischen Längsschnitt durch eine erfindungsgemäße Lageranordnung gemäß einer ersten Ausführungsform;

[0022] Fig. 2 eine schematische, teilweise geschnittene Draufsicht auf ein erfindungsgemäßes Rotorblatt mit einer erfindungsgemäßen Lageranordnung gemäß einer zweiten Ausführungsform;

[0023] Fig. 3 eine vergrößerte Ansicht des Bereiches X in Fig. 2;

[0024] Fig. 4 eine schematische Seitenansicht eines Wälzkörpers eines innerhalb der Lageranordnung von Fig. 2 und 3 verwendeten Wälzlagers;

[0025] Fig. 5 eine schematische Schnittansicht entlang der Linie V-V in Fig. 3; und

[0026] Fig. 6 eine schematische, vergrößerte Schnittansicht entlang der Linie VI-VI in Fig. 3;

DARSTELLUNG VON BEVORZUGTEN AUSFÜHRUNGSBEISPIELEN

[0027] In der nachfolgenden Beschreibung und in den Figuren werden zur Vermeidung von Wiederholungen gleiche Bauteile und Komponenten auch mit gleichen Bezugszeichen gekennzeichnet, sofern keine weitere Differenzierung erforderlich ist.

[0028] In der Fig. 1 ist ein schematischer Längs-

schnitt einer ersten Ausführungsform einer erfindungsgemäßen Lageranordnung für ein hochgradig fliehkraftbelastetes Bauteil gezeigt. Die auf das Bauteil und die Lageranordnung wirkende Fliehkraft bzw. die Fliehkraftrichtung ist in der Zeichnung durch einen Pfeil F_R angedeutet. Die Lageranordnung umfasst ein Lager, welches eine Lagerachse A besitzt, die sich im Wesentlichen in Fliehkraftrichtung F_R oder im Wesentlichen parallel zu dieser erstreckt. Parallel zur Lagerachse A verläuft ein zylindrischer Lagerbolzen 2 in dem Lager. Die Lageranordnung umfasst ferner ein Topfelement 4, in dem der Lagerbolzen 2 zusammen mit dem Lager gelagert ist. Das Topfelement 4 umgreift den Lagerbolzen 2 und das Lager. Die Topföffnung 4a des Topfelementes 4 ist entgegen der Fliehkraftrichtung F_R angeordnet. Im vorliegenden Beispiel, welches die einfachste Form der erfindungsgemäßen Lageranordnung darstellt, bildet die radiale Innenumfangsfläche 4b des Topfelementes 4 selbst ein Gleitlager für den Lagerbolzen 2. Generell kann für den Lagerbolzen 2 jedoch auch ein separates Lager, z.B. in Form eines (oder auch mehrerer) Wälzlagers vorgesehen sein, welches dann innerhalb des Topfelementes 4 angeordnet ist. Das Topfelement 4 bzw. das Lager ist mit einem geeigneten Schmiermittel, z.B. einem Schmierfett, versehen.

[0029] Wie in der Fig. 1 des Weiteren zu erkennen ist, besitzt der Lagerbolzen 2 an seiner in Fliehkraftrichtung F_R weisenden, dem Boden 4c des Topfelementes 4 zugewandten Seite eine fliehkraftabstützende asymmetrische konvexe bzw. ballige Stirnfläche 2a. Diese asymmetrische konvexe Stirnfläche 2a stützt sich am Boden 4c ab und nimmt die Fliehkräfte auf. Die Konvexität der Stirnfläche 2a definiert einen bezogen auf die Lagerachse A exzentrischen Auflagepunkt P (oder ggf. auch eine exzentrische Auflagelinie), der bei einer Drehung des Lagerbolzens 2 im Lager bzw. relativ zum Topfelement 4 eine Kreisbahn um die Lagerachse A beschreibt. Der axiale Auflagepunkt P ist also aus der axialen Mitte des Lagerbolzens 2 heraus versetzt. Der Begriff „Konvexität“ umfasst im Sinne der Erfindung eine Krümmung in einer oder mehreren Ebenen, also insbesondere eine dreidimensionale Krümmung, welche zu einer Balligen, asymmetrischen Form bzw. Kontur der Stirnfläche 2a führt. Ferner fallen unter die Konvexität auch mehrere konvex gekrümmte oder schräggestellte Einzelflächen, die an der Stirnfläche 2a des Lagerbolzens 2 ausgebildet oder angeordnet sind.

[0030] Infolge der asymmetrischen Form der Stirnfläche 2a und der exzentrischen Anordnung des Auflagepunktes P beschreibt dieser bei einer Drehung des Lagerbolzens 2 um die Achse A eine Kreisbahn auf dem Boden 4c. In dem Topfelement 4 befindliches Schmiermittel, das durch die Fliehkrafteinwirkung insbesondere in den Bereich des Bodens 4c gedrückt ist, wird deshalb bei schwellenden oder oszillierenden Schwenkbewegungen des Lagerbolzens 2

verdrängt. Dadurch entsteht ein Zwangsschmierungeffekt, der in Verbindung mit dem Topfelement **4**, dessen positive Eigenschaften bereits weiter oben erläutert wurden, zu einer reduzierten Reibung und einer dauerhaften und zuverlässigen Schmierung beiträgt. Dies ist insbesondere unter hohen axialen Belastungen und bei kleinen, hochfrequenten Schwenkbewegungen von Vorteil.

[0031] In der **Fig. 2** ist eine schematische, teilweise geschnittene Draufsicht auf ein erfindungsgemäßes Hubschrauber-Rotorblatt **6** mit einer erfindungsgemäßen Lageranordnung gemäß einer zweiten Ausführungsform dargestellt. **Fig. 3** zeigt eine vergrößerte Ansicht des Bereiches X in **Fig. 2**.

[0032] Das Rotorblatt **6** umfasst mindestens eine in einen Rotorblatt-Profilkörper **8** integrierte Rotorblattklappe **10**, nachfolgend kurz Klappe **10** genannt. Diese Klappe **10** ist in einem Rotorblatt-Klappenlager **12** gelagert, welches mit einer erfindungsgemäßen Lageranordnung versehen ist, auf die nachfolgend noch näher eingegangen wird. An dem Rotorblatt-Klappenlager **12** ist die Klappe **10** um eine sich in Spannweiten- bzw. Längsrichtung des Rotorblatts **6** erstreckende Klappenachse A schwenkbar angeordnet.

[0033] Wie in **Fig. 2** erkennbar, ist das Rotorblatt **6** bzw. die Klappe **10** in diesem Beispiel mit zwei in Spannweitenrichtung voneinander beabstandeten, im Wesentlichen gleichartigen Lageranordnungen ausgestattet. Diese befinden sich jeweils an einem zu einer Rotorblattspitze (nicht gezeigt) bzw. zu einem Rotorkopf-Anschlussbereich (nicht gezeigt) weisenden Endbereich der Klappe **10**. Die gemeinsame Lagerachse A dieser zwei Lageranordnungen entspricht der Klappenachse A. Für die nachfolgende Beschreibung wird der Einfachheit halber nur auf eine dieser Lageranordnungen Bezug genommen werden, da die andere, wie bereits erwähnt, gleichartig ausgestaltet und ausgerichtet ist.

[0034] Wie am deutlichsten aus der **Fig. 3** hervorgeht, besitzt die Lageranordnung wiederum ein Topfelement **4**, welches auf eine nachfolgend noch genauer beschriebene Art und Weise mit dem Rotorblatt-Profilkörper **8** verbunden ist. In dem Topfelement **4** ist ein Nadellager **14** und ein darin gelagerter Klappenlagerbolzen **16** angeordnet. Der Klappenlagerbolzen **16** und das Nadellager **14** definieren die Lagerachse A. Das Topfelement **4** umgreift den in der Zeichnung rechten Endbereich des Klappenlagerbolzens **16** und das gesamte Nadellager **14**. An der linken Seite ragt der Klappenlagerbolzen **16** durch ein Dichtungselement **18** hindurch aus dem Topfelement **4** heraus. Wie die Zeichnung zeigt, weist die Topföffnung **4a** des Topfelementes **4** in Richtung zu dem Rotorkopf-Anschlussbereich des Rotorblattes **6** (d.h. zur linken Seite der **Fig. 2** und **3**).

[0035] Die Topföffnung **4a** ist also entgegen der in einem laufenden Betrieb des Rotorblattes **6** auftretenden Fliehkraftrichtung F_R angeordnet. Ähnlich wie der Lagerbolzen **2** von **Fig. 1** verfügt der Klappenlagerbolzen **16** an seiner dem Boden **4c** des Topfelementes **4** zugewandten Seite über eine fliehkraftabstützende asymmetrische konvexe Stirnfläche **16a** mit einem exzentrisch angeordneten Auflagepunkt P. Bei der Ausführungsform nach **Fig. 2** und **3** bildet eine radiale Innenumfangsfläche **4b** des Topfelementes **4** eine äußere Lagerschale für die zylindrischen Wälzkörper **14a** des Nadellagers **14**. Daraus resultiert eine kompaktere Bauweise der Lageranordnung bzw. eine niedrigere Bauhöhe.

[0036] Wie aus der **Fig. 4** erkennbar ist, die eine schematische Seitenansicht des Wälzkörpers **14a** zeigt, besitzt ein Wälzkörper **14a** an seiner in Fliehkraftrichtung F_R weisenden Seite (ähnlich wie bei dem Lagerbolzen **2** gemäß **Fig. 1** und dem Klappenlagerbolzen **16**) eine fliehkraftabstützende asymmetrische konvexe Stirnfläche **14b**. Diese Stirnfläche **14b** stützt sich an einer Stirnfläche **4d** eines stufenförmigen Absatzes des Topfelementes **4** ab, die entgegen der Fliehkraftrichtung F_R weist (siehe **Fig. 3**). Die asymmetrische Konvexität der Stirnfläche **14b** ist so ausgestaltet, dass sie einen bezogen auf die jeweilige Wälz- oder Drehachse A_W des jeweiligen Wälzkörpers **14a** exzentrischen axialen Auflagepunkt P_{WK} (oder auch eine exzentrische Auflagelinie) definiert, der bei einer Drehung des betreffenden Wälzkörpers **14a** relativ zur Stirnfläche **4d** eine Kreisbahn um die Wälz- oder Drehachse A_W beschreibt.

[0037] Der dadurch erzielbare positive Effekt ist im Wesentlichen der gleiche, wie er weiter oben im Zusammenhang mit dem Lagerbolzen **2** von **Fig. 1** beschrieben wurde. Darüber hinaus ist folgendes anzumerken: Obwohl Nadellager üblicherweise nicht zur Aufnahme hoher axialer Kräfte ausgelegt sind, kann das Nadellager **14** zuverlässig in einem sehr starken Fliehkraftfeld arbeiten, weil aufgrund der dargelegten Lösung die Schmierung und die Gleiteigenschaften der nadelartigen Wälzkörper **14a** verbessert und Reibkorrosion (Pitting) sowie der Verschleiß zwischen Nadel-Stirnflächen und kontaktierenden lateralen Gleitflächen des Topfelementes **4** erheblich reduziert wird.

[0038] Wie insbesondere aus der **Fig. 3** deutlicher hervorgeht, stützt sich der Klappenlagerbolzen **16** mit seiner fliehkraftabstützenden asymmetrischen konvexen Stirnfläche **16a** axial gegen eine in der **Fig. 3** linke Stirnfläche **20a** eines stiftartigen Auflagerelements **20** ab, welches im Boden **4c** des Topfelementes **4** angeordnet ist. Es entsteht eine Punkt-Auflage. Dieses stiftartige Auflagerelement wird nachfolgend als Auflagerbolzen **20** bezeichnet. Der Auflagerbolzen **20** ist in einer in der **Fig. 3** auf der rechten Seite des Topfelementes **4** eingezeichneten Ausnehmung

22 angeordnet, die in eine Öffnung **4e** im Boden **4c** mündet. Die Ausnehmung **22** selbst ist in einem Einsatz **24** ausgeformt, welcher in eine Aussparung in der rechten Seite des Topfelementes **4** eingefügt und dort gesichert ist.

[0039] Die Ausnehmung **22** ist bis auf die Öffnung **4e** gegenüber der Außenseite des Topfelementes **4** verschlossen bzw. abgedichtet, so dass auch unter hoher Fliehkrafteinwirkung kein Schmiermittel aus dem Topfelement **4** bzw. dem Einsatz **24** entweichen kann. Die dem Klappenlagerbolzen **16** zugeordnete Stirnfläche **20a** des Auflagerbolzens **20** ist in dieser Ausführungsform plan. Sie kann je nach Anwendungsfall jedoch ebenfalls konvex oder sogar konkav sein, vorausgesetzt, der Radius der Konkavität ist größer als der Radius der konvexen Stirnfläche des Auflagerbolzens **20**.

[0040] Wie die **Fig. 3** weiter zeigt, sind die Lagerachse A des Klappenlagerbolzens und die Achse A_{AB} des Auflagerbolzens **20** parallel und seitlich versetzt zueinander angeordnet. Der seitliche Versatz ist in diesem Ausführungsbeispiel so gewählt, dass bei einer Neutralstellung des drehbaren Klappenlagerbolzens **16** bzw. der schwenkbaren Klappe **10** der an der asymmetrischen konvexen Stirnfläche **16a** des Klappenlagerbolzens **16** befindliche Auflagepunkt P genau auf der Achse A_{AB} des Auflagerbolzens **20** liegt.

[0041] Der Auflagerbolzen **20** ist des Weiteren in einer zur Lagerachse A im Wesentlichen parallelen Richtung gegen eine Vorspannkraft eines Vorspannelementes **26** (z.B. eine Spiral- oder Tellerfeder), welche den Auflagerbolzen **20** gegen die Stirnfläche **16a** des Klappenlagerbolzens **16** drückt, axial verschiebbar bzw. längsverschiebbar. Auf diese Weise ist eine Minimierung von Zwangskräften sowie eine Abfederung bei einer Biegung des Rotorblattes **6** und einer unsymmetrischen Belastung beider Achsen A, A_{AB} realisierbar. Die Vorspannkraft des Vorspannelementes **26** ist vorzugsweise einstellbar, was bei geeigneter Abdichtung zum Beispiel durch eine mit der rechten Bodenfläche des Auflagerbolzens **20** korrespondierende Stellschraube **28** oder eine andere geeignete Stelleinrichtung erfolgen kann. Da auch die zweite Lageranordnung der Klappe **10** entsprechend ausgestattet ist, kann somit eine zusätzliche Fliehkraftlagerung der Klappe **10** durch zwei axial gefederte Auflagerbolzen **20** erreicht werden. Infolge der Topfstruktur des Topfelementes **4** ist hierbei auch der jeweilige Auflagerbolzen **20** stets ausreichend mit Schmiermittel versehen.

[0042] Auf der in der **Fig. 3** linken Seite des Topfelementes **4** ist der Klappenlagerbolzen **16** in einem rechten Klappenrahmenbereich **10a** mit einem rechten Ende eines Lagerzapfens **30** eines Klappenbetätigungselementes **32** (hier: ein Zugband) verbunden. Die Verbindung ist in diesem Beispiel als Schraubver-

bindung ausgeführt. Es sind jedoch auch andere geeignete Verbindungsformen, wie z.B. Pressverbindungen, Schweißverbindungen, eine einstückige Ausgestaltung der beiden Teile, usw. denkbar. Ein linkes Ende des Lagerzapfens **30** ist in einem linken Klappenrahmenbereich **10b** fixiert und besitzt einen Innensechskant oder dergleichen zur Betätigung der Schraubverbindung.

[0043] Über den Lagerzapfen **30** greift das Zugband **32** zur Übertragung einer Stellbewegung an der Klappe **10** an. Das Zugband **32** ist mit Hilfe eines mit zwei lateralen Dichtungselementen **34** abgedichteten weiteren Nadellagers **36** um eine Achse A_{ZB} , welche die Längsachse des Lagerzapfens **30** darstellt, um den Lagerzapfen **30** schwenkbar gelagert. Die Wälzkörper dieses Nadellagers **36** können für eine verbesserte Fliehkraftabstützung in analoger Weise zu den oben beschriebenen Wälzkörper **14a** des Nadellagers **14** ausgestaltet, ausgerichtet und gegen eine Stirnfläche eines in einem klappenseitigen Auge des Zugbands **32** vorgesehenen stufenförmigen Absatzes abgestützt sein. Zur Vermeidung übermäßiger elastischer Verformungen durch die Zugkraft des Zugbandes **32** sollte dessen Angriffspunkt in Klappenlängsrichtung möglichst nahe an dem Klappenlager **12** liegen.

[0044] Der Klappenlagerbolzen **16** und der Lagerzapfen **30** des Zugbandes **32** verlaufen im Wesentlichen parallel zueinander und durchdringen sich an ihrem Verbindungsbereich mit einem seitlichen Versatz V gegenseitig. Die Durchdringung erfolgt hier mittels der zuvor erwähnten Schraubverbindung.

[0045] Wie in der **Fig. 5** erkennbar, die eine schematische Schnittansicht entlang der Linie V-V in **Fig. 3** zeigt, ist der seitliche Versatz V bei diesem Ausführungsbeispiel in Höhenrichtung bzw. in Profildickenrichtung des Rotorblattes **6** bzw. der Klappe **10** vorgesehen. Der Klappenlagerbolzen **16** und der Lagerzapfen **30** bilden damit gewissermaßen eine Achskörpereinheit aus, die jedoch über zwei unterschiedliche, voneinander beabstandete Lagerachsen für zwei unterschiedliche Elemente verfügt, nämlich die Achse A_{ZB} für das Zugband **32** und die Schwenkachse A für die Klappe **10** selbst. In einer Neutralstellung der Klappe **10** und bei einer Betrachtung derselben in einer Draufsicht (siehe **Fig. 3**) fluchten die Achsen A und A_{ZB} . Bei einer Schwenkbewegung der Klappe **10** wird gleichzeitig auch der Lagerzapfen **30** um die Achse A bzw. relativ zu dieser geschwenkt. Dadurch ergibt sich nicht nur eine relativ flache und aerodynamisch günstige Bauweise, sondern auch ein relativ großer Hebelarm zur Übertragung eines bei einer gegebenen Stellkraft möglichst großen Schwenkmomentes auf die Klappe **10**.

[0046] Es ist an dieser Stelle nochmals anzumerken, dass auch die zweite Lageranordnung der Klap-

pe **10**, d.h. die in der **Fig. 2** auf der linken Seite eingezeichnete Lageranordnung, analog zu der zuvor beschriebenen ausgestaltet ist und über gleiche Achsen A und A_{ZB} verfügt, so dass eine blockierungsfreie Klappenbewegung und -betätigung möglich ist. Der einzige wesentliche Unterschied zwischen den beiden Lageranordnungen ist, dass bei der einen das Zugband **32** an einem oberen und bei der anderen an einem unteren Bereich des Rotorblattprofils bzw. Profilkörpers angeordnet ist und damit ober- bzw. unterhalb der Achse A angreift. Dies ist in der **Fig. 5** angedeutet. Auf diese Weise ist es möglich, für eine gegenläufige Klappenstellbewegung (auf und ab) immer nur eines der beiden Zugbänder **32** der Klappe **10** auf Zug zu beanspruchen. Diese Klappenbetätigungselemente können somit flacher bzw. dünner und leichter ausgestaltet werden.

[0047] Unter Bezugnahme auf die **Fig. 3** sowie die **Fig. 6**, die eine schematische, vergrößerte Schnittansicht entlang der Linie VI-VI in **Fig. 3** zeigt, wird nun die Befestigung der Klappe **10** am Rotorblatt-Profilkörper **8** erläutert werden. Diese Befestigung erfolgt über das Topfelement **4** der jeweiligen Lageranordnung. Das Topfelement **4** ist hierbei mit einem Seitenbereich bzw. einem seitlichen Ansatz **4f** in oder an einem Hinterkantenbereich des Rotorblatt-Profilkörpers **8** fixiert. Wie besonders aus **Fig. 6** hervorgeht, ist der Ansatz **4f** in eine Aussparung **8a** eingefügt, die in dem Hinterkantenbereich des Rotorblatt-Profilkörpers **8** geformt ist. Diese Aussparung **8a** mündet über eine in einer hinteren Wandung **8b** vorgesehene Durchgangsöffnung **8c** hinweg in einem Hohlraum **8d** des Rotorblatt-Profilkörpers B. Dieser Hohlraum **8d** ist beispielsweise über einen verschließbaren Deckel an der Ober- und/oder Unterseite des Rotorblatt-Profilkörpers **8** zugänglich. Mit Hilfe eines vom Ansatz **4f** ausgehenden Befestigungsbolzens **38**, der sich in Profiltiefenrichtung des Rotorblattes **6** durch die Durchgangsöffnung **8c** hindurch erstreckt, ist das Topfelement **4** am Rotorblatt-Profilkörper **8** verschraubt. Damit ist die Klappe **10** beweglich am Rotorblatt-Profilkörper **8** gesichert.

[0048] Wie **Fig. 5** des Weiteren verdeutlicht, ist das Topfelement **4** elastisch in dem Hinterkantenbereich des Rotorblatt-Profilkörpers **8** befestigt, was vorzugsweise mit Hilfe von geeigneten elastischen Elementen erfolgt. Im vorliegenden Fall ist der Befestigungsbolzen **38** mittels Unterlegscheiben **40** und einer Hülse **42**, die aus einem Elastomerwerkstoff hergestellt sind, elastisch gelagert. Auf Seiten des Hohlraums **8d** ist der Befestigungsbolzen **38** zusätzlich durch eine Buchse **44** hindurch geführt, die an ihren Rändern mit Elastomerpuffern **46** oder dergleichen versehen ist, die sich elastisch an Seitenwänden des Hohlraums **8d** abstützen.

[0049] Darüber hinaus ist das Topfelement **4** – und damit die Klappe **10** an ihren Endbereichen – in einer

im Wesentlichen senkrecht zur Klappenachse A und annähernd in Profiltiefenrichtung des Rotorblattes **6** verlaufenden Achse A_{TE} geringfügig schwenkbar gelagert. Diese geringfügige Schwenkbarkeit wird in dem gegebenen Ausführungsbeispiel durch den elastisch gelagerten Befestigungsbolzen **38** gewährleistet, dessen Längsachse hier die Schwenkachse A_{TE} für das Topfelement **4** bildet. Die Schwenkbarkeit des Topfelementes **4** kann grundsätzlich jedoch auch durch andere geeignete Schwenklager oder drehelastische Lagerelemente, die eine entsprechende Biegung oder Verformung zulassen, erzielt werden. Auf die zuvor beschriebene Art und Weise wird im Rotorbetrieb eine übermäßige elastische Verformung der Klappe **10** sowie ein Blockieren oder Verkleben der Klappe **10** bei einer unterschiedlichen Biegung bzw. Verformung von Rotorblatt **6** und Klappe **10** vermieden. Und aus Winkeldifferenzen zwischen diesen Komponenten entstehende Zwangsmomente werden minimiert.

[0050] In diesem Zusammenhang ist anzumerken, dass bei dem erfindungsgemäßen Rotorblatt **6**, welches mit den oben beschriebenen Lageranordnungen ausgestattet ist, die Klappe **10** selbst möglichst biege- und verwindungssteif ausgeführt werden sollte. Dies kann zum Beispiel mit Hilfe einer Klappe erreicht werden, die im Wesentlichen aus einem Kohlenfaser-Verbundwerkstoff hergestellt ist.

[0051] Die Lageranordnungen der Klappe **10** können mit lösbaren Deckeln **48**, welche mit der Außenkontur des Rotorblattprofils fluchten, abgedeckt bzw. für Montage- und Demontagezwecke zugänglich gemacht werden (siehe **Fig. 2** und **3**) Erfindungsgemäß ist vorzugsweise ein Drehflügelflugzeug, insbesondere ein Hubschrauber, mit mindestens einem erfindungsgemäßen Rotorblatt **6** mit mindestens einer erfindungsgemäßen Lageranordnung der zuvor beschriebenen Art versehen.

[0052] Die Erfindung ist nicht auf die obigen Ausführungsbeispiele, die lediglich der allgemeinen Erläuterung des Kerngedankens der Erfindung dienen, beschränkt. Im Rahmen des Schutzzumfangs kann die erfindungsgemäße Lösung vielmehr auch andere als die oben konkret beschriebenen Ausgestaltungsformen annehmen. Insbesondere kann das Topfelement in Abhängigkeit der jeweiligen Form des gewählten Lagers und des Lagerbolzens sowie in Abhängigkeit der jeweiligen spezifischen Anwendungsform auch eine andere, komplexere Form als in den Ausführungsbeispielen annehmen. Das Topfelement kann in diesem Zusammenhang des Weiteren über andere oder zusätzliche Befestigungsabschnitte als den beschriebenen Ansatz **4f** verfügen. Zudem kann die fliehkraftabstützende asymmetrische konvexe Stirnfläche des Lagerbolzens und/oder der Wälzkörper und/oder des stiftartigen Auflagerelementes/Auflagerbolzens mit mindestens einem nanostrukturier-

ten Festschmierstoff versehen sein. Auf diese Weise lässt sich eine Schmierwirkung verbessern und Fretting vermeiden.

[0053] Ferner ist es denkbar, die fliehkraftabstützende Stirnfläche des (Klappen-)Lagerbolzens plan auszuführen und statt dessen die diesem Bolzen zugewandte bzw. zugeordnete Stirnfläche des Auflagerbolzens bzw. des stiftartigen Auflagerelementes asymmetrisch konvex auszubilden und mit einem exzentrischen Auflagepunkt zu versehen. Auch eine Kombination aus entsprechenden asymmetrischen konvexen Stirnflächen von (Klappen-)Lagerbolzen und Auflagerbolzen ist grundsätzlich realisierbar. Die fliehkraftabstützende asymmetrische konvexe Stirnfläche der Wälzkörper des im Rahmen der erfindungsgemäßen Lageranordnung verwendeten Wälzlagers kann in analoger Ausführung auch bei anderen Wälzlagerarten als den beschriebenen Nadellagern Anwendung finden, so z.B. auch bei Wälzlagern mit zylinderförmigen, tonnenförmigen oder kegelrollenförmigen Wälzkörpern. Ferner ist es möglich, das erfindungsgemäße Rotorblatt nicht nur mit einer, sondern mit mehreren Klappen zu versehen, die auch an der Vorderkante des Rotorblattprofils angeordnet sein können.

[0054] Bezugszeichen in den Ansprüchen, der Beschreibung und den Zeichnungen dienen lediglich dem besseren Verständnis der Erfindung und sollen den Schutzzumfang nicht einschränken.

Bezugszeichenliste

2	Lagerbolzen
2a	Asymmetrische konvexe fliehkraftabstützende Stirnfläche von 2
4	Topfelement
4a	Topföffnung von 4
4b	Innenumfangsfläche von 4
4c	Boden von 4
4d	Stirnfläche an stufenförmigem Absatz von 4
4e	Öffnung in 4c
4f	Seitlicher Ansatz von 4
6	Rotorblatt
8	Rotorblatt-Profilkörper
8a	Aussparung in 8
8b	Hintere Wandung von 8
8c	Durchgangsöffnung in 8b
8d	Hohlraum in 8
10	Rotorblattklappe
10a	Rechter Klappenrahmenbereich
10b	Linker Klappenrahmenbereich
12	Rotorblatt-Klappenlager
14	Nadellager
14a	Wälzkörper von 14
14b	Asymmetrische konvexe fliehkraftabstützende Stirnfläche von 14
16	Klappenlagerbolzen

16a	Asymmetrische konvexe fliehkraftabstützende Stirnfläche von 16
18	Dichtungselement
20	Stiftartiges Auflagerelement/Auflagerbolzen
20a	Stirnfläche von 20
22	Ausnehmung
24	Einsatz
26	Vorspannelement
28	Stellschraube
30	Lagerzapfen für 32
32	Zugband
34	Dichtungselemente
36	Nadellager
38	Befestigungsbolzen
40	Elastische Unterlegscheiben
42	Elastische Hülse
44	Buchse
46	Elastomerpuffer
48	Deckel
A	Lagerachse/Klappenachse
A_{AB}	Achse von 20
A_w	Wälz- oder Drehachse
A_{ZB}	Achse von 30 , 32
A_{TE}	Schwenkachse von 4
F_R	Fliehkraft/Fliehkraftrichtung
P	Axialer Auflagepunkt von 2 bzw. 16
P_{wk}	Axialer Auflagepunkt von 14a
V	Versatz von 16 und 30
X	Einzelheit aus Fig. 2

Patentansprüche

1. Lageranordnung für ein hochgradig fliehkraftbelastetes Bauteil (**6**, **10**), umfassend
 – wenigstens ein Lager (**14**), welches eine Lagerachse (A) besitzt, die sich im Wesentlichen in Fliehkraftrichtung (F_R) erstreckt;
 – mindestens einen sich parallel zur Lagerachse (A) in dem Lager (**14**) erstreckenden Lagerbolzen (**2**, **16**); und
 – ein Topfelement (**4**), in dem der Lagerbolzen (**2**, **16**) zusammen mit dem Lager (**14**) gelagert ist, wobei das Topfelement (**4**) den Lagerbolzen (**2**, **16**) und das Lager (**14**) umgreift und die Topföffnung (**4a**) des Topfelementes (**4**) entgegen der Fliehkraftrichtung (F_R) angeordnet ist,
dadurch gekennzeichnet, dass
 der Lagerbolzen (**2**, **16**) an seiner in Fliehkraftrichtung (F_R) weisenden, dem Boden (**4c**) des Topfelementes (**4**) zugewandten Seite eine fliehkraftabstützende asymmetrische konvexe Stirnfläche (**2a**, **16a**) besitzt, deren Konvexität einen bezogen auf die Lagerachse (A) exzentrischen Auflagepunkt (P) oder eine exzentrische Auflagelinie definiert, der (P) bzw. die bei einer Drehung des Lagerbolzens (**2**, **16**) relativ zum Topfelement (**4**) eine Kreisbahn um die Lagerachse (A) beschreibt.

2. Lageranordnung für ein hochgradig fliehkraftbelastetes Bauteil (**6**, **10**), umfassend

– wenigstens ein Lager (14), welches eine Lagerachse (A) besitzt, die sich im Wesentlichen in Fliehkrafttrichtung (F_R) erstreckt;

– mindestens einen sich parallel zur Lagerachse (A) in dem Lager (14) erstreckenden Lagerbolzen (2, 16); und

– ein Topfelement (4), in dem der Lagerbolzen (2, 16) zusammen mit dem Lager (14) gelagert ist, wobei das Topfelement (4) den Lagerbolzen (2, 16) und das Lager (14) umgreift und die Topföffnung (4a) des Topfelementes (4) entgegen der Fliehkrafttrichtung (F_R) angeordnet ist,

dadurch gekennzeichnet, dass

das Lager (14, 36) einen oder mehrere Wälzkörper (14a) aufweist, die an ihrer in Fliehkrafttrichtung (F_R) weisenden Seite eine fliehkraftabstützende asymmetrische konvexe Stirnfläche (14b) besitzen, die sich an einer entgegen der Fliehkrafttrichtung (F_R) weisenden Stirnfläche (4d) des Topfelementes (4) abstützt und

deren Konvexität einen bezogen auf die jeweilige Wälz- oder Drehachse (A_W) des jeweiligen Wälzkörpers (14a) exzentrischen Auflagepunkt (P_{WK}) oder eine exzentrische Auflagelinie definiert, der (P) bzw. die bei einer Drehung des betreffenden Wälzkörpers (14a) relativ zur Stirnfläche (14b) des Topfelementes (4) eine Kreisbahn um die Wälz- oder Drehachse (P_{WK}) beschreibt.

3. Lageranordnung nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass eine radiale Innenfläche (4b) des Topfelementes (4) eine äußere Lageschale für die Wälzkörper (14a) bildet.

4. Lageranordnung nach einem oder mehreren der vorhergenannten Ansprüche, dadurch gekennzeichnet, dass sich der Lagerbolzen (16) mit seiner fliehkraftabstützenden asymmetrischen konvexen Stirnfläche (16a) axial gegen eine Stirnfläche (20a) eines im Boden (4c) des Topfelementes (4) angeordneten stiftartigen Auflagerelementes (20) abstützt.

5. Lageranordnung nach einem oder mehreren der vorhergenannten Ansprüche, dadurch gekennzeichnet, dass das stiftartige Auflagerelement (20) in einer zur Lagerachse (A) im Wesentlichen parallelen Richtung gegen eine Vorspannkraft eines Vorspannelementes (26), welches das stiftartige Auflagerelement (20) gegen die Stirnfläche (16a) des Lagerbolzens (16) drückt, axial verschiebbar ist.

6. Lageranordnung nach einem oder mehreren der vorhergenannten Ansprüche, dadurch gekennzeichnet, dass die Vorspannkraft des Vorspannelementes (26) einstellbar (28) ist.

7. Lageranordnung nach einem oder mehreren der vorhergenannten Ansprüche, dadurch gekennzeichnet, dass die Lagerachse (A) des Lagerbolzens (16) und die Achse (A_{AB}) des stiftartigen Auflagerele-

mentes (20) parallel zueinander versetzt angeordnet sind.

8. Lageranordnung nach einem oder mehreren der vorhergenannten Ansprüche, dadurch gekennzeichnet, dass die dem Lagerbolzen (16) zugewandte Stirnfläche des stiftartigen Auflagerelementes (20) konvex ausgebildet ist.

9. Lageranordnung nach einem oder mehreren der vorhergenannten Ansprüche, dadurch gekennzeichnet, dass die fliehkraftabstützende asymmetrische konvexe Stirnfläche (2a, 16a; 14b) des Lagerbolzens (2, 16) und/oder der Wälzkörper (14a) und/oder des stiftartigen Auflagerelementes (20) mit mindestens einem nanostrukturierten Festschmierstoff versehen ist.

10. Rotorblatt (6), insbesondere für ein Drehflügelflugzeug, umfassend

– mindestens eine in einen Rotorblatt-Profilkörper (8) integrierte Rotorblattklappe (10); und

– mindestens ein mit wenigstens einer Lageranordnung nach einem der Ansprüche 1 bis 10 versehenes Rotorblatt-Klappenlager (12),

an dem die Rotorblattklappe (10) um eine sich in Spannweitenrichtung des Rotorblatts (6) erstreckende Klappenachse (A) schwenkbar angeordnet ist, wobei die Klappenachse (A) der Lagerachse (A) der Lageranordnung entspricht und die Topföffnung (4a) des Topfelementes (4) der Lageranordnung in Richtung zu einem Rotorkopf-Anschlussbereich des Rotorblattes (6) weist und entgegen der in einem laufenden Betrieb des Rotorblattes (6) auftretenden Fliehkrafttrichtung (FR) angeordnet ist.

11. Rotorblatt (6) nach Anspruch 10, dadurch gekennzeichnet, dass das Topfelement (4) mit einem Seitenbereich (4f) in einem Hinterkantenbereich (8a) des Rotorblatt-Profilkörpers (8) befestigt ist.

12. Rotorblatt (6) nach Anspruch 10 oder 11, dadurch gekennzeichnet, dass das Topfelement (4) elastisch (40, 42, 44, 46) in dem Hinterkantenbereich des Rotorblatt-Profilkörpers (8) befestigt (38) ist.

13. Rotorblatt (6) nach einem oder mehreren der Ansprüche 10 bis 12, dadurch gekennzeichnet, dass das Topfelement (4) um eine im Wesentlichen senkrecht zur Klappenachse (A) und im Wesentlichen in Profiltiefenrichtung des Rotorblattes (6) verlaufende Achse (A_{TE}) geringfügig schwenkbar gelagert ist.

14. Rotorblatt (6) nach einem oder mehreren der Ansprüche 10 bis 12, dadurch gekennzeichnet, dass dieses mindestens ein an der Rotorblattklappe (10) angreifendes Klappenbetätigungselement (32) besitzt, welches an einem an der Rotorblattklappe (10) angreifenden Lagerzapfen (30) schwenkbar gelagert ist, und

der Lagerbolzen (16) des Rotorblatt-Klappenlagers (12) und der Lagerzapfen (30) des Klappenbetätigungselementes (32) im Wesentlichen parallel zueinander verlaufen und sich mit einem seitlichen Versatz (V) gegenseitig durchdringen.

15. Drehflügelflugzeug, insbesondere Hubschrauber, umfassend mindestens ein Rotorblatt nach einem der Ansprüche 10 bis 14 mit mindestens einer Lageranordnung nach einem der Ansprüche 1 bis 9.

Es folgen 5 Blatt Zeichnungen

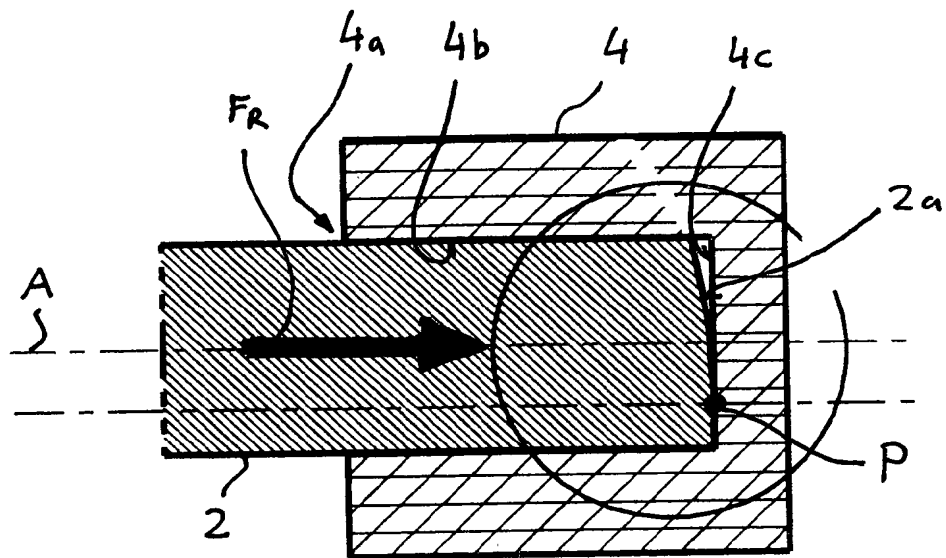


Fig. 1

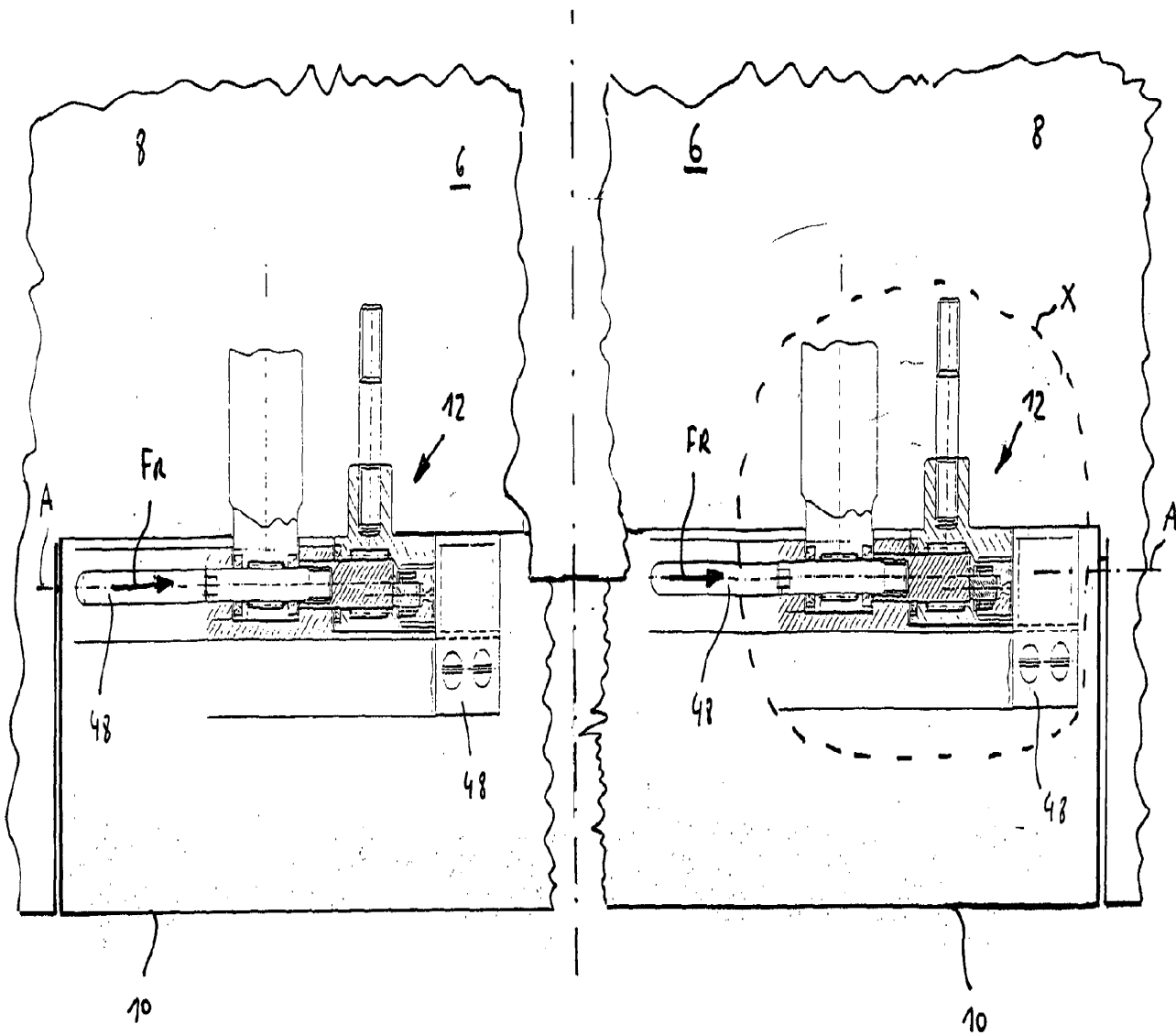
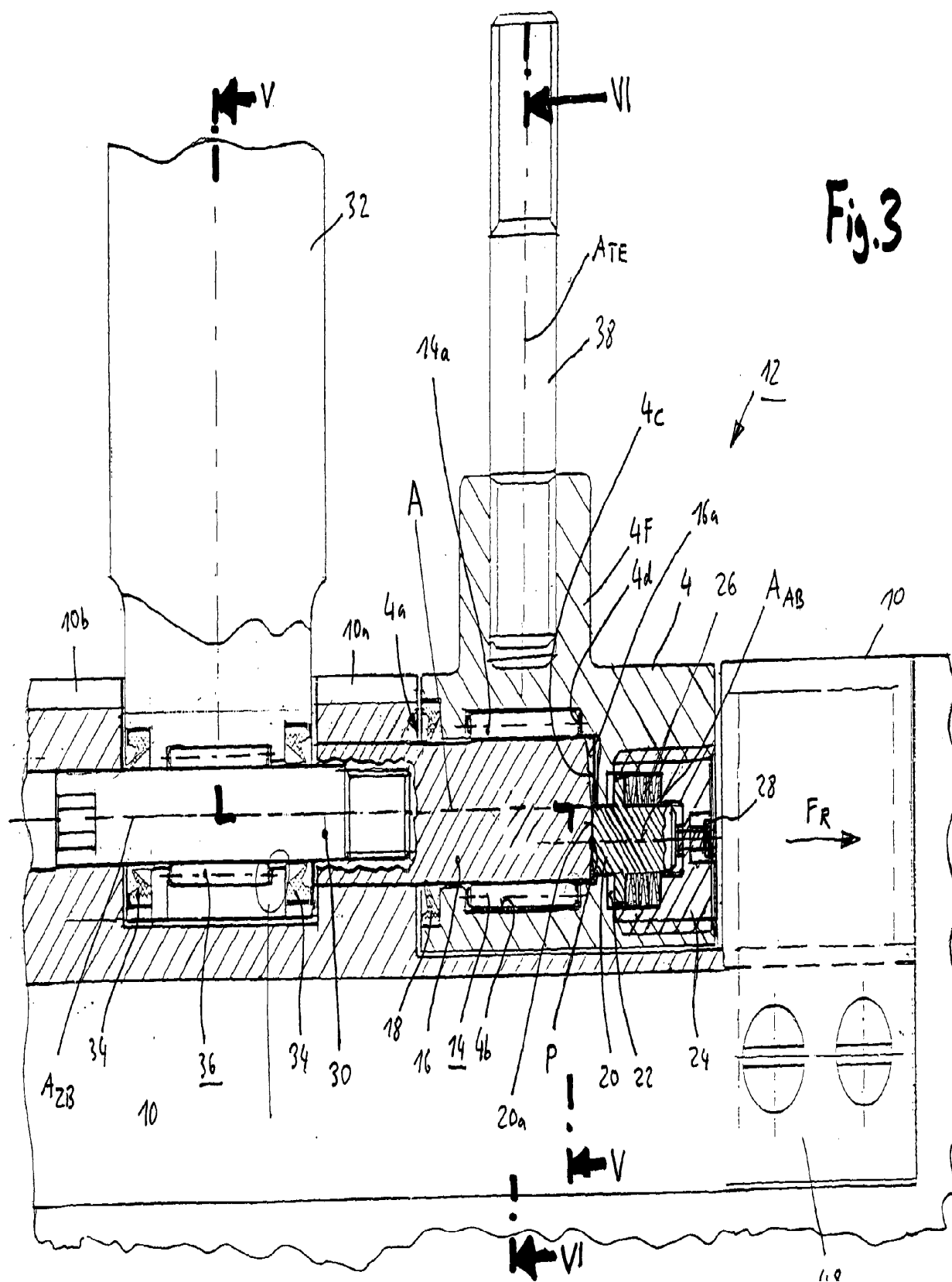
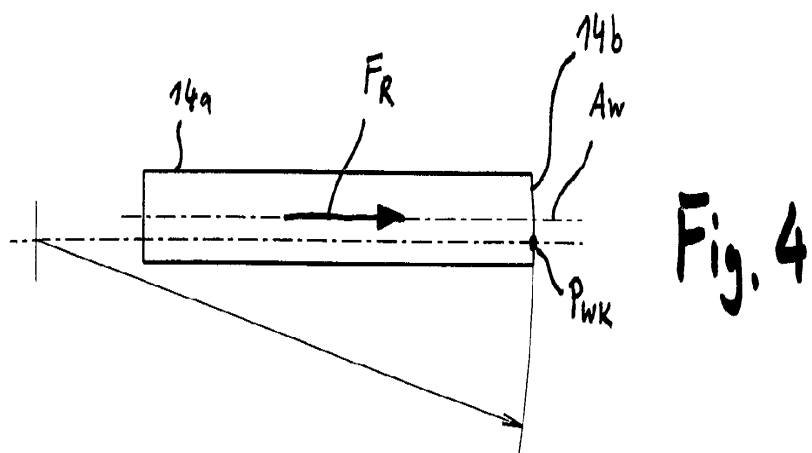
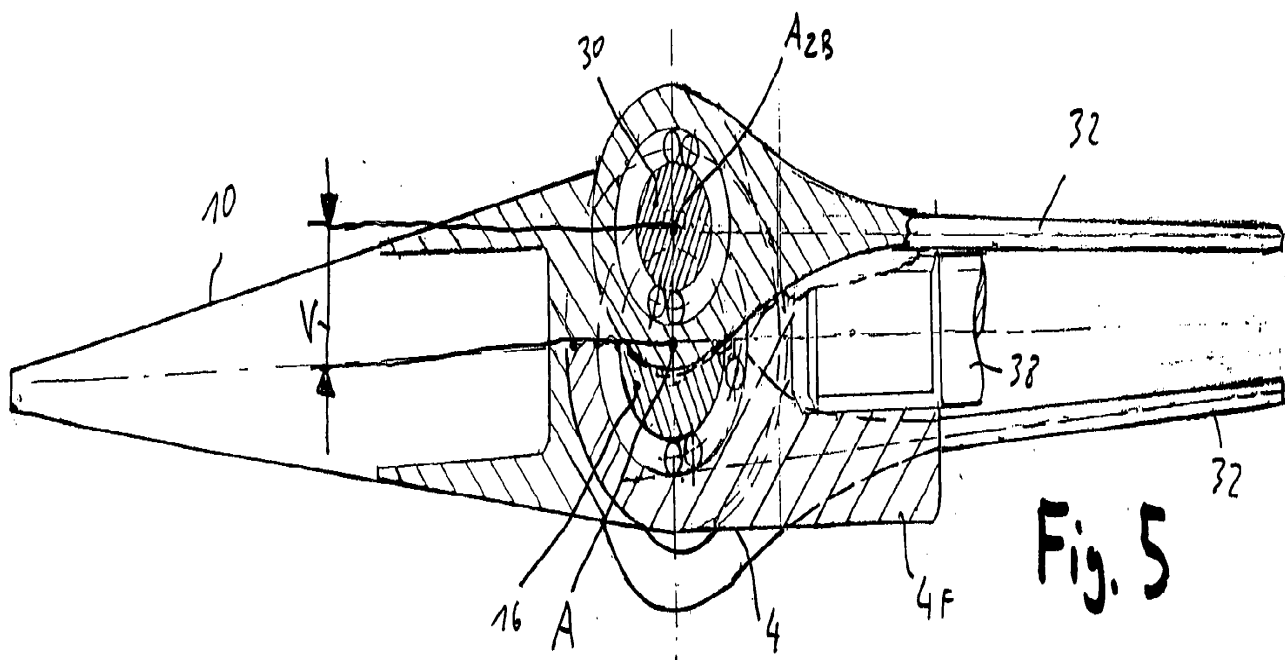
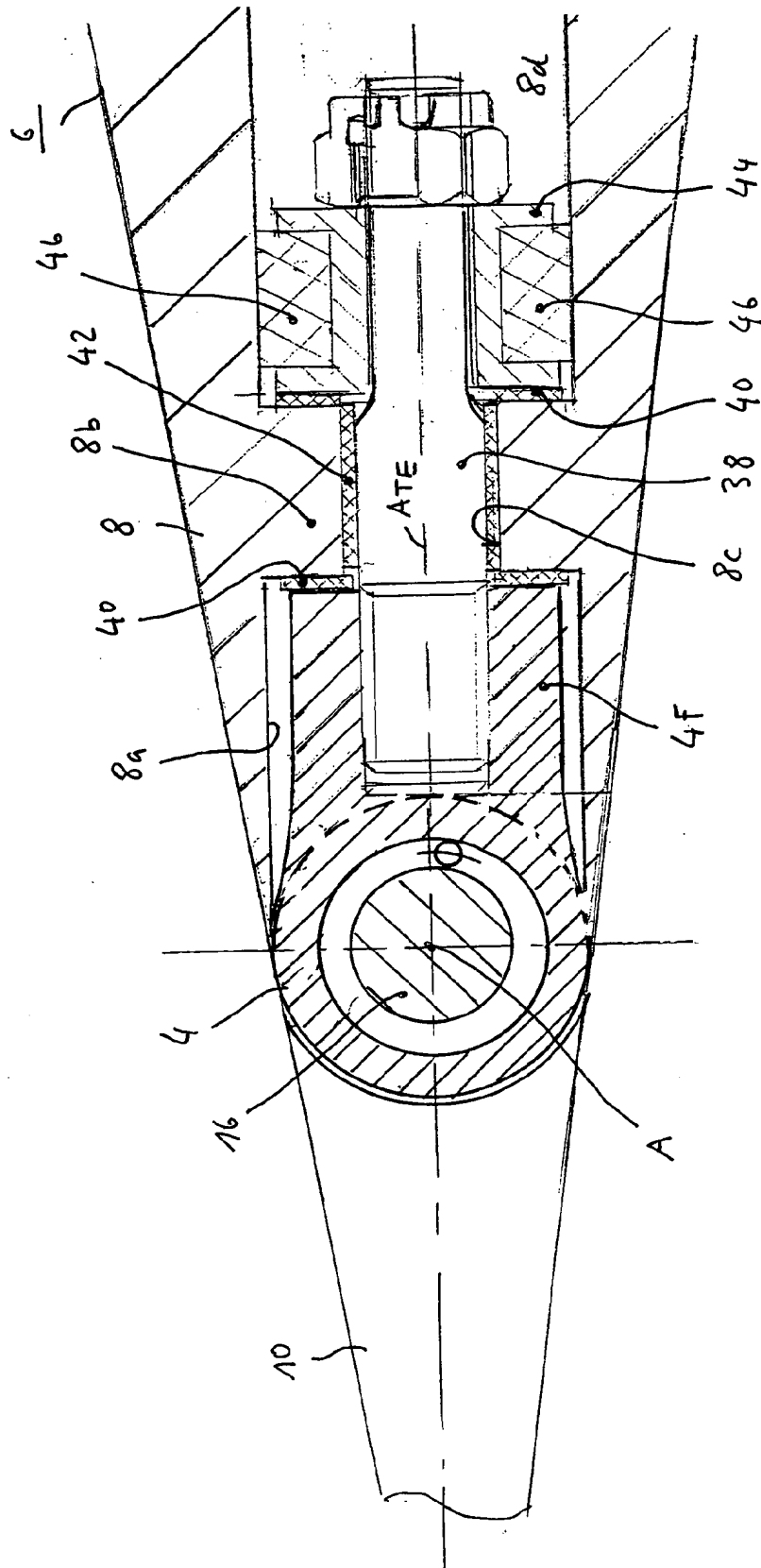


Fig.2

Fig.3







Fi. 6

Electronic Patent Application Fee Transmittal

Application Number:

Filing Date:

Title of Invention:

GYRATORY CRUSHER MAIN SHAFT SLEEVE

First Named Inventor/Applicant Name:

NIKLAS ABERG

Filer:

Corinne R. Gorski

Attorney Docket Number:

SMC 13979WOUS

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
National Stage Fee	1631	1	280	280
Natl Stage Search Fee - Report provided	1642	1	480	480
National Stage Exam - all other cases	1633	1	720	720

Pages:

Claims:

Miscellaneous-Filing:

Petition:

Patent-Appeals-and-Interference:

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1480

Electronic Acknowledgement Receipt

EFS ID:	21354932
Application Number:	14418535
International Application Number:	PCT/EP2013/062861
Confirmation Number:	2984
Title of Invention:	GYRATORY CRUSHER MAIN SHAFT SLEEVE
First Named Inventor/Applicant Name:	NIKLAS ABERG
Customer Number:	78686
Filer:	Corinne R. Gorski
Filer Authorized By:	
Attorney Docket Number:	SMC 13979WOUS
Receipt Date:	30-JAN-2015
Filing Date:	
Time Stamp:	12:05:51
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 1480
RAM confirmation Number	10039
Deposit Account	505792
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	13979WOUStransmittal.pdf	219763	no	4
			c1ae373b3086f1f8d8769988f7e22c6f8a4e d03f		
Warnings:					
Information:					
2	Application Data Sheet	13979WOUSADS.pdf	1503489	no	7
			d0390f4eb60939c4f7e249012af79eb2fb22 ddb7		
Warnings:					
Information:					
3	Documents submitted with 371 Applications	WO2014019765.pdf	611413	no	13
			6796af0aaa7810ac5c869764e5789b2568fd a565		
Warnings:					
Information:					
4	Documents submitted with 371 Applications	PCTIB308.pdf	62069	no	1
			6c4442297a97224418acbc0d56167e7dcf4 1f266		
Warnings:					
Information:					
5	Documents submitted with 371 Applications	PCTISA210.pdf	205572	no	6
			01f8c3c0f895f56e51798927335661f3c5d13 334		
Warnings:					
Information:					
6	Oath or Declaration filed	13979ErikssonOathSigned.pdf	1164923	no	2
			2fcfb619722679c2df7802f4535655b3eb3ff eb0		
Warnings:					
Information:					
7	Preliminary Amendment	SMC13979WOUSPreliminaryA mendment.pdf	137912	no	8
			7659bb0515307ed0069c14ef096ef49d6c3 b8f16		
Warnings:					
Information:					

8	Information Disclosure Statement (IDS) Form (SB08)	13979WOUSIDS.pdf	612444	no	4
			40851dc163644028a51cbd9bb8a4fd2a03034ff		
Warnings:					
Information:					
9	Foreign Reference	DE371447C.pdf	421209	no	7
			ff8de802209523a458caa4242b44c9c66a831a6f		
Warnings:					
Information:					
10	Foreign Reference	DE681942.pdf	205300	no	5
			3a6fc27630ea8ff298a366ce6cb4a5a64956121b		
Warnings:					
Information:					
11	Foreign Reference	GB1031679.pdf	470376	no	8
			369bc907ad9f5b5948fd99297a0ec0de177d7a69		
Warnings:					
Information:					
12	Oath or Declaration filed	13979RosdahlOath.pdf	783608	no	2
			9b7b16af09a18c5cd2a109834c99fb265db6f015		
Warnings:					
Information:					
13	Foreign Reference	DE10346475.pdf	1202349	no	16
			b8bc0b8cb141bb3e309780687df401418ace31cf		
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
14	Fee Worksheet (SB06)	fee-info.pdf	35386	no	2
			2959ee5d3f95527464ed2a8b69b0ef78d6108daa		
Warnings:					
Information:					
Total Files Size (in bytes):			7635813		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PCT

Print Out (Original in Electronic Form)

VIII-2-1	Declaration: Entitlement to apply for and be granted a patent Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent (Rules 4.17(ii) and 51bis.1(a)(ii)), in a case where the declaration under Rule 4.17(iv) is not appropriate: Name (LAST, First)	In relation to this international application SANDVIK INTELLECTUAL PROPERTY AB is entitled to apply for and be granted a patent by virtue of the following:
VIII-2-1(i v)		an assignment from ERIKSSON, Bengt-Arne to SANDVIK INTELLECTUAL PROPERTY AB, dated 15 August 2012 (15.08.2012)
VIII-2-1(i v)		an assignment from Rosdahl, Fredrik to SANDVIK INTELLECTUAL PROPERTY AB, dated 05 September 2012 (05.09.2012)
VIII-2-1(i v)		an assignment from ÅBERG, Niklas to SANDVIK INTELLECTUAL PROPERTY AB, dated 06 September 2012 (06.09.2012)

Bescheinigung

Die angehefteten
Unterlagen stimmen mit der
als ursprünglich eingereicht
geltenden Fassung der auf
dem nächsten Blatt
bezeichneten europäischen
Patentanmeldung überein.

Certificate

The attached documents are
exact copies of the text in
which the European patent
application described on the
following page is deemed to
have been filed.

Attestation

Les documents joints à la
présente attestation sont
conformes au texte,
considéré comme
initialement déposé, de la
demande de brevet
européen qui est spécifiée à
la page suivante.

Patentanmeldung Nr.

Patent application No.

Demande de brevet n°

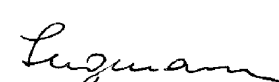
12179089.3 / EP12179089

The organization code and number of your priority application, to be used for filing abroad under the Paris Convention, is EP12179089.

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

 
U. Ingmann

Anmeldung Nr:
Application no.: 12179089.3
Demande no. :

Anmeldetag:
Date of filing: 02.08.12
Date de dépôt :

Anmelder / Applicant(s) / Demandeur(s):

Sandvik Intellectual Property AB
811 81 Sandviken/SE

Bezeichnung der Erfindung / Title of the invention / Titre de l'invention:

(Falls die Bezeichnung der Erfindung nicht angegeben ist, oder falls die Anmeldung in einer Nicht-Amtssprache des EPA eingereicht wurde, siehe Beschreibung bezüglich ursprünglicher Bezeichnung.

If no title is shown, or if the application has been filed in a non-EPO language, please refer to the description for the original title.

Si aucun titre n'est indiqué, ou si la demande a été déposée dans une langue autre qu'une langue officielle de l'OEB, se référer à la description pour le titre original.)

Gyratory crusher main shaft sleeve

In Anspruch genommene Priorität(en) / Priority(Priorities) claimed / Priorité(s) revendiquée(s)

Staat/Tag/Aktenzeichen / State/Date/File no. / Pays/Date/Numéro de dépôt:

Am Anmeldetag benannte Vertragsstaaten / Contracting States designated at date of filing / Etats contractants désignées lors du dépôt:

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

5

Gyratory Crusher Main Shaft Sleeve

10

15

Field of invention

The present invention relates to a gyratory crusher main shaft sleeve for positioning at an uppermost end of a crusher main shaft and in particular, although not exclusively, to a sleeve having a tapered wall thickness.

20

Background art

Gyratory crushers are used for crushing ore, mineral and rock material to smaller sizes. Typically, the crusher comprises a crushing head mounted upon an elongate main shaft. A first crushing shell is mounted on the crushing head and a second crushing shell is mounted on a frame such that the first and second crushing shells define together a crushing gap through which the material to be crushed is passed. A driving device is arranged to rotate an eccentric assembly about the lower portion of the shaft so as to cause the crushing head to perform a gyratory pendulum movement and crush the material introduced in the crushing gap.

25
30

US 2009/0008489 discloses a hydraulically adjustable cone crusher in which an axial bearing assembly comprises a hydraulic adjustment cylinder for adjusting the setting of the crusher. US 4,919,349 discloses a gyratory crusher having a dual seal arrangement that utilises forced air and a gasket arrangement to block contaminants entering the crusher.

- 5 SU 897280 describes a cone crusher that has a step cup bearing to absorb and transmit the crushing force of the crusher head.

The gyratory pendulum movement of the crushing head is supported by a lower bearing assembly positioned below the crushing head and a top bearing into which an upper end of
10 the main shaft is journalled. Typically, the main shaft upper end is protected against wear by a sleeve. Commonly, the protective sleeve comprises a cylindrical geometry and is held at the main shaft via an interference or friction fit. This arrangement however requires the sleeve to be heated to increase its diameter to enable mounting and possible disassembly at the main shaft.

15

Example protective sleeves are disclosed in US 1,592,313; US 1,748,102; RU 718160 and RU 940837.

However, a number of problems exist with conventional protective sleeves. In particular,
20 if the time taken to friction fit the heated sleeve onto the main shaft end is too great it is not uncommon for the sleeve to cool and shrink before it is forced onto the shaft to the correct and final position. Additionally, disassembly is often problematic as the sleeve is required to be cut before it can be removed. On large crushers, protective sleeves have a substantial wall thickness and this cutting operation can be time and labour intensive with the added
25 risk of potential damage to the shaft. What is required is a main shaft sleeve that addresses the above problem.

Summary of the Invention

It is an object of the present invention to provide a sleeve for a main shaft of a gyratory
30 crusher that enables convenient attachment and detachment at the shaft so as to be quickly and conveniently assembled and disassembled.

The objective is achieved by providing a sleeve having an internal facing surface that tapers inwardly in the axial direction towards a longitudinal axis of the sleeve from a first (lower) end to a second (upper) end. The present sleeve arrangement is configured for secure mounting in position via an interference or friction fit arrangement in direct contact with a tapered end region of the main shaft. In particular, a conical shape profile of the internal facing surface of the sleeve is capable of sliding over a corresponding conical shaped main shaft end region without risk of the sleeve seizing prematurely at the shaft before reaching its fully matted position. As with existing devices, the present sleeve may be heated to increase its diameter immediately prior to assembly. Similarly, to facilitate disassembly, heat may be applied to the sleeve together with mechanical agitation.

According to a first aspect of the present invention there is provided a gyratory crusher main shaft sleeve for friction fitting over an uppermost end of a crusher main shaft, the sleeve comprising: an elongate axial wall extending around a longitudinal axis of the sleeve, the wall having an internal facing surface for positioning in contact with an outward facing surface of the main shaft, and an external facing surface relative to the longitudinal axis, the wall extending between the internal and external facing surfaces; the wall having a first end for positioning at a lower region of the main shaft and a second end for positioning at an upper region of the main shaft relative to the lower region; wherein a thickness of the wall at a region between the first and second ends decreases in a direction from the second end to the first end; characterised in that: in the axial direction the internal facing surface at said region extends transverse to the longitudinal axis so as to taper inwardly towards the axis in the direction from the first to the second end.

Preferably, the region over which the thickness of the wall decreases extends substantially the full axial length of the sleeve.

Preferably, the sleeve further comprises a radial wall extending perpendicular or transverse to the axial wall, the radial wall positioned at or towards the second end and extending inwardly towards the longitudinal axis. Optionally, the radial wall comprises a through bore positioned at the longitudinal axis of the sleeve.

Preferably, a cross sectional shape profile of the external facing surface is substantially circular. Preferably, a cross sectional shape profile of the internal facing surface is substantially circular. Preferably, a shape profile of the external facing surface defines a section of a cylinder in the axial direction. Preferably, a shape profile of the internal facing surface defines a section of a cone in the axial direction.

Optionally, the sleeve comprises at least one groove indented in the internal facing surface. Additionally, the groove may extend in a circumferential direction around a region of the internal facing surface. Optionally, the groove extends in a direction axially along the internal facing surface. Optionally, the sleeve may further comprise at least one bore provided through the wall to allow the passage of a fluid to the internal facing surface. Accordingly, the bore is capable of allowing a lubricating fluid to be introduced through the body of the sleeve so as to flood the region between the internal facing surface of the sleeve and the external facing surface of the main shaft at the region of the sleeve. Where the sleeve comprises a groove at the internal facing surface, the lubricating fluid is capable of flowing within the groove both circumferentially and axially to fully lubricate the sleeve and main shaft interface.

Optionally, at a region of the first end, the internal facing surface is curved radially outward relative to the longitudinal axis in a direction towards the external facing surface such that the wall thickness decreases to zero at the curved region.

According to a second aspect of the present invention there is provided a gyratory crusher main shaft comprising: a shaft body having a first end for positioning at a lower region of the crusher and a second end for positioning at an upper region of the crusher relative to the first end; characterised in that: a thickness of the shaft body is tapered in the axial direction of the main shaft at a region of the second end so as to decrease in cross sectional area; and the main shaft further comprises a sleeve as detailed herein friction fitted over the tapered region at the second end of the main shaft.

According to a third aspect of the present invention there is provided a gyratory crusher comprising a main shaft and a sleeve as described herein.

Brief description of drawings

A specific implementation of the present invention will now be described by way example only and with reference to the following drawings in which:

5

Figure 1 is a cross-sectional side view of a gyratory crusher having a main shaft supported at its upper end by a top bearing set and having a protective sleeve mounted about the upper end of the main shaft according to a specific implementation of the present invention;

10

Figure 2 is a magnified view of the upper region of the crusher of figure 1.

Detailed description of preferred embodiment of the invention

Referring to figure 1, a crusher comprises a frame 100 having an upper frame 101 and a lower frame 102. A crushing head 103 is mounted upon an elongate shaft 107. A first crushing shell 105 is fixably mounted on crushing head 103 and a second crushing shell 106 is fixably mounted at top frame 101. A crushing zone 104 is formed between the opposed crushing shells 105, 106. A discharge zone 109 is positioned immediately below crushing zone 104 and is defined, in part, by lower frame 102.

20

Upper frame 101 is further divided into a topshell 111, mounted upon lower frame 102 (alternatively termed a bottom shell), and a spider that extends from topshell 111 and represents an upper portion of the crusher. The spider comprises two diametrically opposed arms 110 that extend radially outward from a central cap positioned on a longitudinal axis 115 extending through frame 100 and the gyratory crusher generally. Arms 110 are attached to an upper region of topshell 111 via an intermediate annular flange that is centred around longitudinal axis 115. Typically, arms 110 and topshell 111 form a unitary structure and are formed integrally.

25

30 A drive (not shown) is coupled to main shaft 107 via a drive shaft 108 and suitable gearing 116 so as to rotate shaft 107 eccentrically about longitudinal axis 115 and to cause crushing head 103 to perform a gyratory pendulum movement and crush material

introduced into crushing gap 104. An upper end region of a shaft 113 comprises an axial taper to define an upper conical section. The cone 113 tapers inwardly in the bottom to top direction away from head 103. A very uppermost end 117 of shaft 107 is maintained in an axially rotatable position by a top bearing assembly 112. Similarly, a bottom end 118 of shaft 107 is supported by a bottom bearing assembly 119.

To avoid excessive wear of the upper conical portion 113, a substantially cylindrical wear sleeve 114 is mounted over and about shaft region 113. Sleeve 114 is held in position at region 113 by an interference of friction fit and is provided in close touching contact over the axial length of sleeve 114. Accordingly, sleeve 114 is positioned intermediate between bearing assembly 112 and region 113 to absorb the radial and axial loading forces resultant from the crushing action of the gyratory pendulum movement.

With reference to figure 2, sleeve 114 comprises an external facing surface 201 and an internal facing surface 200, the orientation of faces 201, 200 being relative to the longitudinal axis 115 extending through shaft region 113 and sleeve 114. Internal facing surface 200 is secured in direct contact against an external facing surface 202 of conical region 113. Accordingly, internal facing surface 200 tapers inwardly towards longitudinal axis 115 from a first end 207 and a second end 208, where the first end 207 is positioned below second end 208 within the crusher during normal use. A cross sectional shape profile of internal facing surface 200 and external facing surface 201 is circular substantially the length of sleeve 114 between first and second ends 207, 208. However, external facing surface 201 is aligned substantially parallel with axis 115 such that sleeve 114 when viewed externally comprises a substantially cylindrical geometry. According to this configuration, the annular axial wall 209 of sleeve 114 that is defined between apposed surfaces 200, 201 comprises a thickness that tapers and reduces in a direction from second upper end 208 to first lower end 207. As will be appreciated, to enable sleeve 114 to fit in close shrink-fit contact with conical end portion 113, the taper angle of inner surface 200 is substantially equal to the taper angle of the external facing surface 202 of shaft region 113 relative to axis 115.

At first end 207, a thickness of walls 209 decrease sharply as internal facing surface 200 curves outwardly 204 towards external facing surface 201. This curved or sharp annular edge region 204 is configured to fit in close contact against a shoulder region 205 of shaft 107 that curves radially outward at a region immediately above crushing shell 105 and head 103.

Uppermost end 117 of shaft 107 is retained in position by a mounting pin 206, aligned at axis 115, that extends axially downward from a mounting boss 207. Boss 207 and pin 206 are positioned coaxially with shaft end 113 and sleeve 114.

10

A radial wall 203 extends perpendicular to axial wall 209 and is orientated inwardly towards axis 115 at second end 208. A bore 210 is provided through radial wall 203 of a diameter sufficient to accommodate boss 207 such that wall 203 extends around boss 207 from axial wall 209. Accordingly, sleeve 114 is fully mated in position over conical shaft region 113 when radial wall 203 is seated against shaft end 117. In this configuration, axial wall 209 is positioned intermediate between top bearing 112 and shaft region 113.

15

According to the specific implementation, the axial wall 209 comprises a thickness that decreases from second end 208 to first end 207 uniformly over the entire length of sleeve 114 with the exception of curved end region 204.

20

Claims

1. A gyratory crusher main shaft sleeve (114) for friction fitting over an uppermost end (113) of a crusher main shaft (107), the sleeve (114) comprising:

5 an elongate axial wall (209) extending around a longitudinal axis (115) of the sleeve (114), the wall (209) having an internal facing surface (200) for positioning in contact with an outward facing surface (202) of the main shaft (107), and an external facing surface (201) relative to the longitudinal axis (115), the wall (209) extending between the internal (200) and external (201) facing surfaces;

10 the wall (209) having a first end (207) for positioning at a lower region (205) of the main shaft (107) and a second end (208) for positioning at an upper region (117) of the main shaft (107) relative to the lower region (205);

wherein a thickness of the wall (209) at a region between the first (207) and second (208) ends decreases in a direction from the second end (208) to the first end (207);

15 characterised in that:

in the axial direction the internal facing surface (200) at said region extends transverse to the longitudinal axis (115) so as to taper inwardly towards the axis (115) in the direction from the first (207) to the second (208) end.

20 2. The sleeve as claimed in claim 1 wherein the region over which the thickness of the wall (209) decreases extends substantially the full axial length of the sleeve (114).

3. The sleeve as claimed in any preceding claim further comprising a radial wall (203) extending perpendicular or transverse to the axial wall (209), the radial wall (203) positioned at or towards the second end (208) and extending inwardly towards the longitudinal axis (115).

4. The sleeve as claimed in claim 3 wherein the radial wall (203) comprises a through bore (210) positioned at the longitudinal axis (115) of the sleeve (114).

30 5. The sleeve as claimed in any preceding claim wherein a cross sectional shape profile of the external facing surface (201) is substantially circular.

6. The sleeve as claimed in any preceding claim wherein a cross sectional shape profile of the internal facing surface (200) is substantially circular.

5 7. The sleeve as claimed in any preceding claim wherein a shape profile of the external facing surface (201) defines a section of a cylinder in the axial direction.

8. The sleeve as claimed in any preceding claim wherein a shape profile of the internal facing surface (200) defines a section of a cone in the axial direction.

10

9. The sleeve as claimed in any preceding claim further comprising at least one groove indented in the internal facing surface (200).

10. The sleeve as claimed in claim 9 wherein the groove extends in a circumferential
15 direction around a region of the internal facing surface (200).

11. The sleeve as claimed in claim 9 or 10 wherein the groove extends in a direction axially along the internal facing surface (200).

20 12. The sleeve as claimed in any preceding claim further comprising at least one bore provided through the wall (209) to allow the passage of a fluid to the internal facing surface (200).

13. The sleeve as claimed in any preceding claim wherein at a region of the first end
25 (207), the internal facing surface (200) is curved radially outward (204) relative to the longitudinal axis (115) in a direction towards the external facing surface (201) such that the wall thickness decreases to zero at the curved region (204).

14. A gyratory crusher main shaft comprising:
30 a shaft body (107) having a first end (118) for positioning at a lower region of the crusher and a second end (117) for positioning at an upper region of the crusher relative to the first end (118);

characterised in that:

a thickness of the shaft body (107) is tapered in the axial direction of the main shaft at a region (113) of the second end (117) so as to decrease in cross sectional area; and

the main shaft further comprises a sleeve (114) as claimed in any preceding claim
5 friction fitted over the tapered region (113) at the second end (117) of the main shaft.

15. A gyratory crusher comprising a main shaft (107) and a sleeve (114) as claimed in claim 14.

Abstract:

A gyratory crusher main shaft sleeve for friction fitting over an uppermost end of a crusher main shaft. The sleeve comprises an elongate axial wall for positioning in contact with an outward facing surface of the main shaft. The axial wall comprises a thickness that decreases in a direction from a second upper end to a first lower end wherein the internal facing surface of the sleeve extends transverse to a longitudinal axis of the sleeve so as to taper inwardly towards the axis in a direction from the first to the second end.

10

Figure 2

15

-1/2-

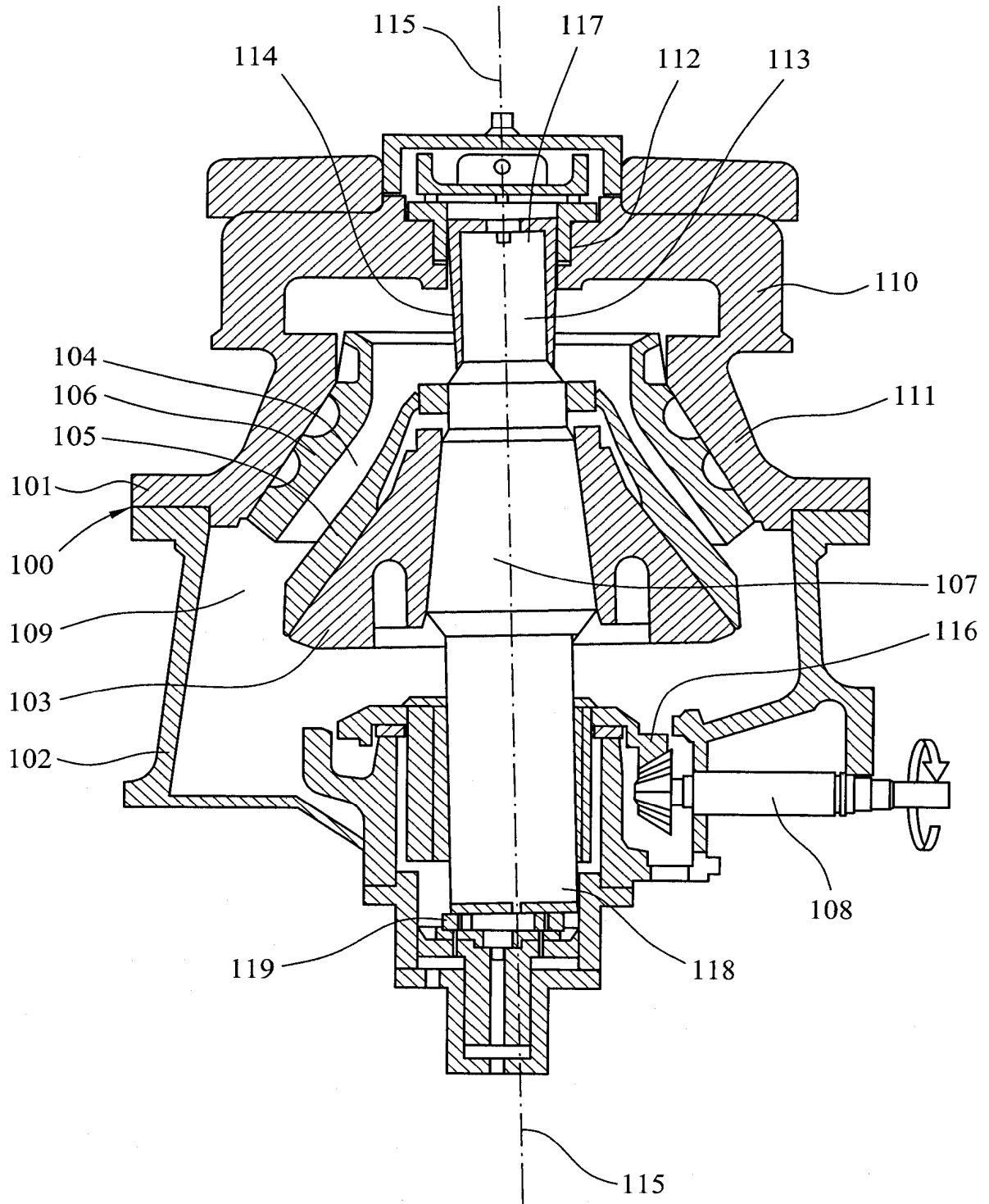


FIG. 1

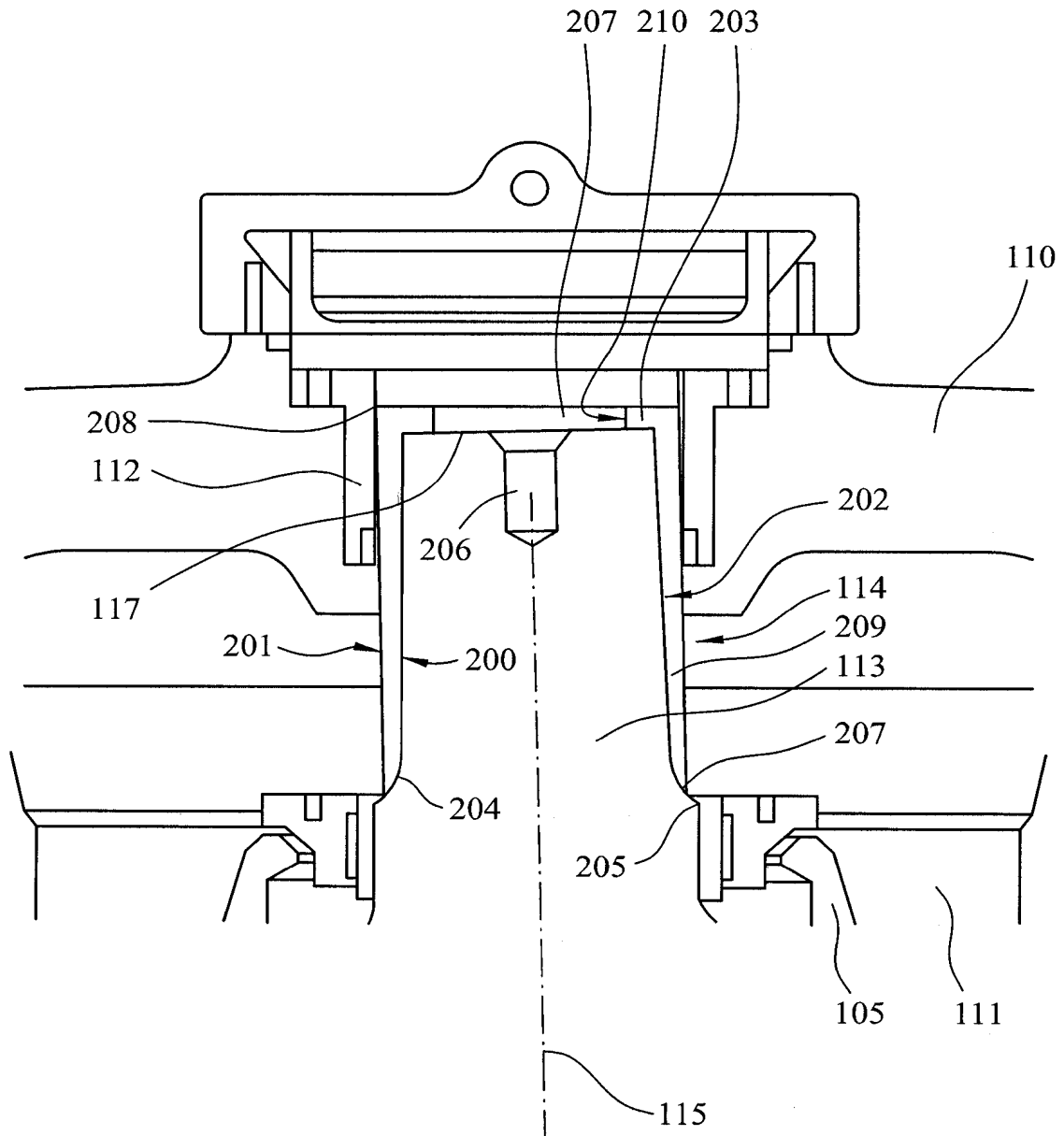


FIG. 2

DOCUMENT MADE AVAILABLE UNDER THE PATENT COOPERATION TREATY (PCT)

International application number:	PCT/EP2013/062861
International filing date:	20 June 2013 (20.06.2013)
Document type:	Certified copy of priority document
Document details:	Country/Office: EP
	Number: 12179089.3
	Filing date: 02 August 2012 (02.08.2012)
Date of receipt at the International Bureau:	04 July 2013 (04.07.2013)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-bis)

PCT REQUEST

Print Out (Original in Electronic Form)

0	For receiving Office use only	
0-1	International Application No.	PCT/EP2013/062861
0-2	International Filing Date	20 JUN 2013 (20.06.2013)
0-3	Name of receiving Office and "PCT International Application"	RO/EP
0-4	Form PCT/RO/101 PCT Request	
0-4-1	Prepared Using	PCT Online Filing Version 3.5.000.235 MT/FOP 20020701/0.20.5.20
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	European Patent Office (EPO) (RO/EP)
0-7	Applicant's or agent's file reference	PE 13979WO
I	Title of Invention	Gyratory Crusher Main Shaft Sleeve
II	Applicant	
II-1	This person is	Applicant only
II-2	Applicant for	All designated States
II-4	Name	SANDVIK INTELLECTUAL PROPERTY AB
II-5	Address	. . SE-811 81 SANDVIKEN Sweden
II-6	State of nationality	SE
II-7	State of residence	SE
II-8	Telephone No.	+ 46 26 260000
II-9	Facsimile No.	+ 46 26 261089
III-1	Applicant and/or inventor	
III-1-1	This person is	Inventor only
III-1-3	Inventor for	
III-1-4	Name (LAST, First)	ÅBERG, Niklas
III-1-5	Address	Skatteberga 1396 247 92 Södra Sandby Sweden

PCT REQUEST

Print Out (Original in Electronic Form)

III-2	Applicant and/or inventor	
III-2-1	This person is	Inventor only
III-2-3	Inventor for	
III-2-4	Name (LAST, First)	ERIKSSON, Bengt-Arne
III-2-5	Address	Sveagatan 4 233 33 Svedala Sweden
III-3	Applicant and/or inventor	
III-3-1	This person is	Inventor only
III-3-3	Inventor for	
III-3-4	Name (LAST, First)	ROSDAHL, Fredrik
III-3-5	Address	Sandvik Intellectual Property AB 811 81 Sandviken Sweden
V	DESIGNATIONS	
V-1	The filing of this request constitutes under Rule 4.9(a), the designation of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.	
VI-1	Priority claim of earlier regional application	
VI-1-1	Filing date	02 August 2012 (02.08.2012)
VI-1-2	Number	12179089.3
VI-1-3	Regional Office	EP
VI-2	Priority document request	
	The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1
VI-3	Incorporation by reference :	
	where an element of the international application referred to in Article 11(1)(iii)(d) or (e) or a part of the description, claims or drawings referred to in Rule 20.5(a) is not otherwise contained in this international application but is completely contained in an earlier application whose priority is claimed on the date on which one or more elements referred to in Article 11(1)(iii) were first received by the receiving Office, that element or part is, subject to confirmation under Rule 20.6, incorporated by reference in this international application for the purposes of Rule 20.6.	
VII-1	International Searching Authority Chosen	European Patent Office (EPO) (ISA/EP)

PCT REQUEST

Print Out (Original in Electronic Form)

VIII	Declarations	Number of declarations	
VIII-1	Declaration as to the identity of the inventor	—	
VIII-2	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	1	
VIII-3	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	—	
VIII-4	Declaration of inventorship (only for the purposes of the designation of the United States of America)	—	
VIII-5	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	—	

PCT REQUEST

Print Out (Original in Electronic Form)

VIII-2-1	Declaration: Entitlement to apply for and be granted a patent Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent (Rules 4.17(ii) and 51bis.1(a)(ii)), in a case where the declaration under Rule 4.17(iv) is not appropriate: Name (LAST, First)	In relation to this international application SANDVIK INTELLECTUAL PROPERTY AB is entitled to apply for and be granted a patent by virtue of the following:
VIII-2-1(i v)		an assignment from ERIKSSON, Bengt-Arne to SANDVIK INTELLECTUAL PROPERTY AB, dated 15 August 2012 (15.08.2012)
VIII-2-1(i v)		an assignment from Rosdahl, Fredrik to SANDVIK INTELLECTUAL PROPERTY AB, dated 05 September 2012 (05.09.2012)
VIII-2-1(i v)		an assignment from ÅBERG, Niklas to SANDVIK INTELLECTUAL PROPERTY AB, dated 06 September 2012 (06.09.2012)

PCT REQUEST

Print Out (Original in Electronic Form)

IX	Check list	Number of sheets	Electronic file(s) attached
IX-1	Request (including declaration sheets)	5	✓
IX-2	Description	7	✓
IX-3	Claims	3	✓
IX-4	Abstract	1	✓
IX-5	Drawings	2	✓
IX-7	TOTAL	18	
	Accompanying Items	Paper document(s) attached	Electronic file(s) attached
IX-8	Fee calculation sheet	—	✓
IX-18	PCT-SAFE physical media	—	—
IX-20	Figure of the drawings which should accompany the abstract	2	
IX-21	Language of filing of the international application	English	
X-1	Signature of applicant, agent or common representative	(PKCS7 Digital Signature)	
X-1-1	Name	SANDVIK INTELLECTUAL PROPERTY AB	
X-1-2	Name of signatory	SE, Sandvik Intellectual Property AB, P. Engлёn 31869	
X-1-3	Capacity (if such capacity is not obvious from reading the request)	(Applicant)	

FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	20 JUN 2013 (20.06.2013)
10-2	Drawings:	✓
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/EP
10-6	Transmittal of search copy delayed until search fee is paid	

FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	
-------------	---	--



(51) International Patent Classification:
B02C 2/06 (2006.01)

(21) International Application Number:
PCT/EP2013/062861

(22) International Filing Date:
20 June 2013 (20.06.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12179089.3 2 August 2012 (02.08.2012) EP

(71) Applicant: **SANDVIK INTELLECTUAL PROPERTY AB** [SE/SE]; S-811 81 Sandviken (SE).

(72) Inventors: **ÄBERG, Niklas**; Skatteberga 1396, S-247 92 Södra Sandby (SE). **ERIKSSON, Bengt-Arne**; Sveagatan 4, S-233 33 Svedala (SE). **ROSDAHL, Fredrik**; Sandvik Intellectual Property AB, S-811 81 Sandviken (SE).

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,

HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) Title: **GYRATORY CRUSHER MAIN SHAFT SLEEVE**

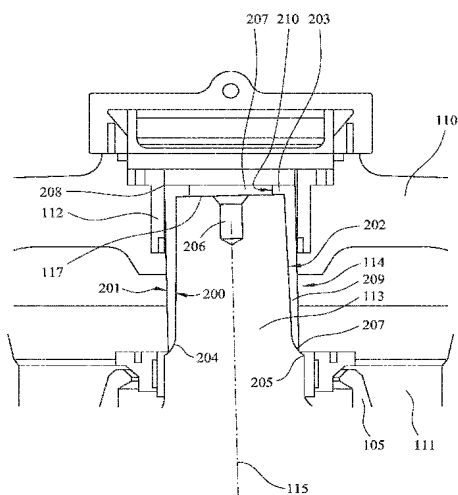


FIG. 2

(57) Abstract: A gyratory crusher main shaft sleeve for friction fitting over an uppermost end of a crusher main shaft. The sleeve comprises an elongate axial wall for positioning in contact with an outward facing surface of the main shaft. The axial wall comprises a thickness that decreases in a direction from a second upper end to a first lower end wherein the internal facing surface of the sleeve extends transverse to a longitudinal axis of the sleeve so as to taper inwardly towards the axis in a direction from the first to the second end.

5

Gyratory Crusher Main Shaft Sleeve

10

15

Field of invention

The present invention relates to a gyratory crusher main shaft sleeve for positioning at an uppermost end of a crusher main shaft and in particular, although not exclusively, to a sleeve having a tapered wall thickness.

Background art

Gyratory crushers are used for crushing ore, mineral and rock material to smaller sizes. Typically, the crusher comprises a crushing head mounted upon an elongate main shaft. A first crushing shell is mounted on the crushing head and a second crushing shell is mounted on a frame such that the first and second crushing shells define together a crushing gap through which the material to be crushed is passed. A driving device is arranged to rotate an eccentric assembly about the lower portion of the shaft so as to cause the crushing head to perform a gyratory pendulum movement and crush the material introduced in the crushing gap.

-2-

US 2009/0008489 discloses a hydraulically adjustable cone crusher in which an axial bearing assembly comprises a hydraulic adjustment cylinder for adjusting the setting of the crusher. US 4,919,349 discloses a gyratory crusher having a dual seal arrangement that utilises forced air and a gasket arrangement to block contaminants entering the crusher.

- 5 SU 897280 describes a cone crusher that has a step cup bearing to absorb and transmit the crushing force of the crusher head.

The gyratory pendulum movement of the crushing head is supported by a lower bearing assembly positioned below the crushing head and a top bearing into which an upper end of
10 the main shaft is journalled. Typically, the main shaft upper end is protected against wear by a sleeve. Commonly, the protective sleeve comprises a cylindrical geometry and is held at the main shaft via an interference or friction fit. This arrangement however requires the sleeve to be heated to increase its diameter to enable mounting and possible disassembly at the main shaft.

15

Example protective sleeves are disclosed in US 1,592,313; US 1,748,102; RU 718160 and RU 940837.

However, a number of problems exist with conventional protective sleeves. In particular,
20 if the time taken to friction fit the heated sleeve onto the main shaft end is too great it is not uncommon for the sleeve to cool and shrink before it is forced onto the shaft to the correct and final position. Additionally, disassembly is often problematic as the sleeve is required to be cut before it can be removed. On large crushers, protective sleeves have a substantial wall thickness and this cutting operation can be time and labour intensive with the added
25 risk of potential damage to the shaft. What is required is a main shaft sleeve that addresses the above problem.

Summary of the Invention

It is an object of the present invention to provide a sleeve for a main shaft of a gyratory
30 crusher that enables convenient attachment and detachment at the shaft so as to be quickly and conveniently assembled and disassembled.

-3-

The objective is achieved by providing a sleeve having an internal facing surface that tapers inwardly in the axial direction towards a longitudinal axis of the sleeve from a first (lower) end to a second (upper) end. The present sleeve arrangement is configured for secure mounting in position via an interference or friction fit arrangement in direct contact
5 with a tapered end region of the main shaft. In particular, a conical shape profile of the internal facing surface of the sleeve is capable of sliding over a corresponding conical shaped main shaft end region without risk of the sleeve seizing prematurely at the shaft before reaching its fully mated position. As with existing devices, the present sleeve may be heated to increase its diameter immediately prior to assembly. Similarly, to facilitate
10 disassembly, heat may be applied to the sleeve together with mechanical agitation.

According to a first aspect of the present invention there is provided a gyratory crusher main shaft sleeve for friction fitting over an uppermost end of a crusher main shaft, the sleeve comprising: an elongate axial wall extending around a longitudinal axis of the
15 sleeve, the wall having an internal facing surface for positioning in contact with an outward facing surface of the main shaft, and an external facing surface relative to the longitudinal axis, the wall extending between the internal and external facing surfaces; the wall having a first end for positioning at a lower region of the main shaft and a second end for positioning at an upper region of the main shaft relative to the lower region; wherein a
20 thickness of the wall at a region between the first and second ends decreases in a direction from the second end to the first end; characterised in that: in the axial direction the internal facing surface at said region extends transverse to the longitudinal axis so as to taper inwardly towards the axis in the direction from the first to the second end.

25 Preferably, the region over which the thickness of the wall decreases extends substantially the full axial length of the sleeve.

Preferably, the sleeve further comprises a radial wall extending perpendicular or transverse to the axial wall, the radial wall positioned at or towards the second end and extending
30 inwardly towards the longitudinal axis. Optionally, the radial wall comprises a through bore positioned at the longitudinal axis of the sleeve.

-4-

Preferably, a cross sectional shape profile of the external facing surface is substantially circular. Preferably, a cross sectional shape profile of the internal facing surface is substantially circular. Preferably, a shape profile of the external facing surface defines a section of a cylinder in the axial direction. Preferably, a shape profile of the internal facing surface defines a section of a cone in the axial direction.

Optionally, the sleeve comprises at least one groove indented in the internal facing surface. Additionally, the groove may extend in a circumferential direction around a region of the internal facing surface. Optionally, the groove extends in a direction axially along the internal facing surface. Optionally, the sleeve may further comprise at least one bore provided through the wall to allow the passage of a fluid to the internal facing surface. Accordingly, the bore is capable of allowing a lubricating fluid to be introduced through the body of the sleeve so as to flood the region between the internal facing surface of the sleeve and the external facing surface of the main shaft at the region of the sleeve. Where the sleeve comprises a groove at the internal facing surface, the lubricating fluid is capable of flowing within the groove both circumferentially and axially to fully lubricate the sleeve and main shaft interface.

Optionally, at a region of the first end, the internal facing surface is curved radially outward relative to the longitudinal axis in a direction towards the external facing surface such that the wall thickness decreases to zero at the curved region.

According to a second aspect of the present invention there is provided a gyratory crusher main shaft comprising: a shaft body having a first end for positioning at a lower region of the crusher and a second end for positioning at an upper region of the crusher relative to the first end; characterised in that: a thickness of the shaft body is tapered in the axial direction of the main shaft at a region of the second end so as to decrease in cross sectional area; and the main shaft further comprises a sleeve as detailed herein friction fitted over the tapered region at the second end of the main shaft.

30

According to a third aspect of the present invention there is provided a gyratory crusher comprising a main shaft and a sleeve as described herein.

Brief description of drawings

A specific implementation of the present invention will now be described by way example only and with reference to the following drawings in which:

5

Figure 1 is a cross-sectional side view of a gyratory crusher having a main shaft supported at its upper end by a top bearing set and having a protective sleeve mounted about the upper end of the main shaft according to a specific implementation of the present invention;

10

Figure 2 is a magnified view of the upper region of the crusher of figure 1.

Detailed description of preferred embodiment of the invention

Referring to figure 1, a crusher comprises a frame 100 having an upper frame 101 and a lower frame 102. A crushing head 103 is mounted upon an elongate shaft 107. A first crushing shell 105 is fixably mounted on crushing head 103 and a second crushing shell 106 is fixably mounted at top frame 101. A crushing zone 104 is formed between the opposed crushing shells 105, 106. A discharge zone 109 is positioned immediately below crushing zone 104 and is defined, in part, by lower frame 102.

20

Upper frame 101 is further divided into a topshell 111, mounted upon lower frame 102 (alternatively termed a bottom shell), and a spider that extends from topshell 111 and represents an upper portion of the crusher. The spider comprises two diametrically opposed arms 110 that extend radially outward from a central cap positioned on a longitudinal axis 115 extending through frame 100 and the gyratory crusher generally. Arms 110 are attached to an upper region of topshell 111 via an intermediate annular flange that is centred around longitudinal axis 115. Typically, arms 110 and topshell 111 form a unitary structure and are formed integrally.

A drive (not shown) is coupled to main shaft 107 via a drive shaft 108 and suitable gearing 116 so as to rotate shaft 107 eccentrically about longitudinal axis 115 and to cause crushing head 103 to perform a gyratory pendulum movement and crush material

-6-

introduced into crushing gap 104. An upper end region of a shaft 113 comprises an axial taper to define an upper conical section. The cone 113 tapers inwardly in the bottom to top direction away from head 103. A very uppermost end 117 of shaft 107 is maintained in an axially rotatable position by a top bearing assembly 112. Similarly, a bottom end 118 of
5 shaft 107 is supported by a bottom bearing assembly 119.

To avoid excessive wear of the upper conical portion 113, a substantially cylindrical wear sleeve 114 is mounted over and about shaft region 113. Sleeve 114 is held in position at region 113 by an interference of friction fit and is provided in close touching contact over
10 the axial length of sleeve 114. Accordingly, sleeve 114 is positioned intermediate between bearing assembly 112 and region 113 to absorb the radial and axial loading forces resultant from the crushing action of the gyratory pendulum movement.

With reference to figure 2, sleeve 114 comprises an external facing surface 201 and an
15 internal facing surface 200, the orientation of faces 201, 200 being relative to the longitudinal axis 115 extending through shaft region 113 and sleeve 114. Internal facing surface 200 is secured in direct contact against an external facing surface 202 of conical region 113. Accordingly, internal facing surface 200 tapers inwardly towards longitudinal axis 115 from a first end 207 and a second end 208, where the first end 207 is positioned
20 below second end 208 within the crusher during normal use. A cross sectional shape profile of internal facing surface 200 and external facing surface 201 is circular substantially the length of sleeve 114 between first and second ends 207, 208. However, external facing surface 201 is aligned substantially parallel with axis 115 such that sleeve 114 when viewed externally comprises a substantially cylindrical geometry. According to
25 this configuration, the annular axial wall 209 of sleeve 114 that is defined between apposed surfaces 200, 201 comprises a thickness that tapers and reduces in a direction from second upper end 208 to first lower end 207. As will be appreciated, to enable sleeve 114 to fit in close shrink-fit contact with conical end portion 113, the taper angle of inner surface 200 is substantially equal to the taper angle of the external facing surface 202 of shaft region 113
30 relative to axis 115.

-7-

At first end 207, a thickness of walls 209 decrease sharply as internal facing surface 200 curves outwardly 204 forwards external facing surface 201. This curved or sharp annular edge region 204 is configured to fit in close contact against a shoulder region 205 of shaft 107 that curves radially outward at a region immediately above crushing shell 105 and head 103.

Uppermost end 117 of shaft 107 is retained in position by a mounting pin 206, aligned at axis 115, that extends axially downward from a mounting boss 207. Boss 207 and pin 206 are positioned coaxially with shaft end 113 and sleeve 114.

A radial wall 203 extends perpendicular to axial wall 209 and is orientated inwardly towards axis 115 at second end 208. A bore 210 is provided through radial wall 203 of a diameter sufficient to accommodate boss 207 such that wall 203 extends around boss 207 from axial wall 209. Accordingly, sleeve 114 is fully mated in position over conical shaft region 113 when radial wall 203 is seated against shaft end 117. In this configuration, axial wall 209 is positioned intermediate between top bearing 112 and shaft region 113.

According to the specific implementation, the axial wall 209 comprises a thickness that decreases from second end 208 to first end 207 uniformly over the entire length of sleeve 114 with the exception of curved end region 204.

Claims

1. A gyratory crusher main shaft sleeve (114) for friction fitting over an uppermost end (113) of a crusher main shaft (107), the sleeve (114) comprising:
 - 5 an elongate axial wall (209) extending around a longitudinal axis (115) of the sleeve (114), the wall (209) having an internal facing surface (200) for positioning in contact with an outward facing surface (202) of the main shaft (107), and an external facing surface (201) relative to the longitudinal axis (115), the wall (209) extending between the internal (200) and external (201) facing surfaces;
 - 10 the wall (209) having a first end (207) for positioning at a lower region (205) of the main shaft (107) and a second end (208) for positioning at an upper region (117) of the main shaft (107) relative to the lower region (205);
wherein a thickness of the wall (209) at a region between the first (207) and second (208) ends decreases in a direction from the second end (208) to the first end (207);
 - 15 characterised in that:
in the axial direction the internal facing surface (200) at said region extends transverse to the longitudinal axis (115) so as to taper inwardly towards the axis (115) in the direction from the first (207) to the second (208) end.
- 20 2. The sleeve as claimed in claim 1 wherein the region over which the thickness of the wall (209) decreases extends substantially the full axial length of the sleeve (114).
3. The sleeve as claimed in any preceding claim further comprising a radial wall (203) extending perpendicular or transverse to the axial wall (209), the radial wall (203)
 - 25 positioned at or towards the second end (208) and extending inwardly towards the longitudinal axis (115).
4. The sleeve as claimed in claim 3 wherein the radial wall (203) comprises a through bore (210) positioned at the longitudinal axis (115) of the sleeve (114).
- 30 5. The sleeve as claimed in any preceding claim wherein a cross sectional shape profile of the external facing surface (201) is substantially circular.

6. The sleeve as claimed in any preceding claim wherein a cross sectional shape profile of the internal facing surface (200) is substantially circular.

5 7. The sleeve as claimed in any preceding claim wherein a shape profile of the external facing surface (201) defines a section of a cylinder in the axial direction.

8. The sleeve as claimed in any preceding claim wherein a shape profile of the internal facing surface (200) defines a section of a cone in the axial direction.

10

9. The sleeve as claimed in any preceding claim further comprising at least one groove indented in the internal facing surface (200).

10. The sleeve as claimed in claim 9 wherein the groove extends in a circumferential
15 direction around a region of the internal facing surface (200).

11. The sleeve as claimed in claim 9 or 10 wherein the groove extends in a direction axially along the internal facing surface (200).

20 12. The sleeve as claimed in any preceding claim further comprising at least one bore provided through the wall (209) to allow the passage of a fluid to the internal facing surface (200).

13. The sleeve as claimed in any preceding claim wherein at a region of the first end
25 (207), the internal facing surface (200) is curved radially outward (204) relative to the longitudinal axis (115) in a direction towards the external facing surface (201) such that the wall thickness decreases to zero at the curved region (204).

14. A gyratory crusher main shaft comprising:
30 a shaft body (107) having a first end (118) for positioning at a lower region of the crusher and a second end (117) for positioning at an upper region of the crusher relative to the first end (118);

-10-

characterised in that:

a thickness of the shaft body (107) is tapered in the axial direction of the main shaft at a region (113) of the second end (117) so as to decrease in cross sectional area; and

the main shaft further comprises a sleeve (114) as claimed in any preceding claim
5 friction fitted over the tapered region (113) at the second end (117) of the main shaft.

15. A gyratory crusher comprising a main shaft (107) and a sleeve (114) as claimed in claim 14.

-1/2-

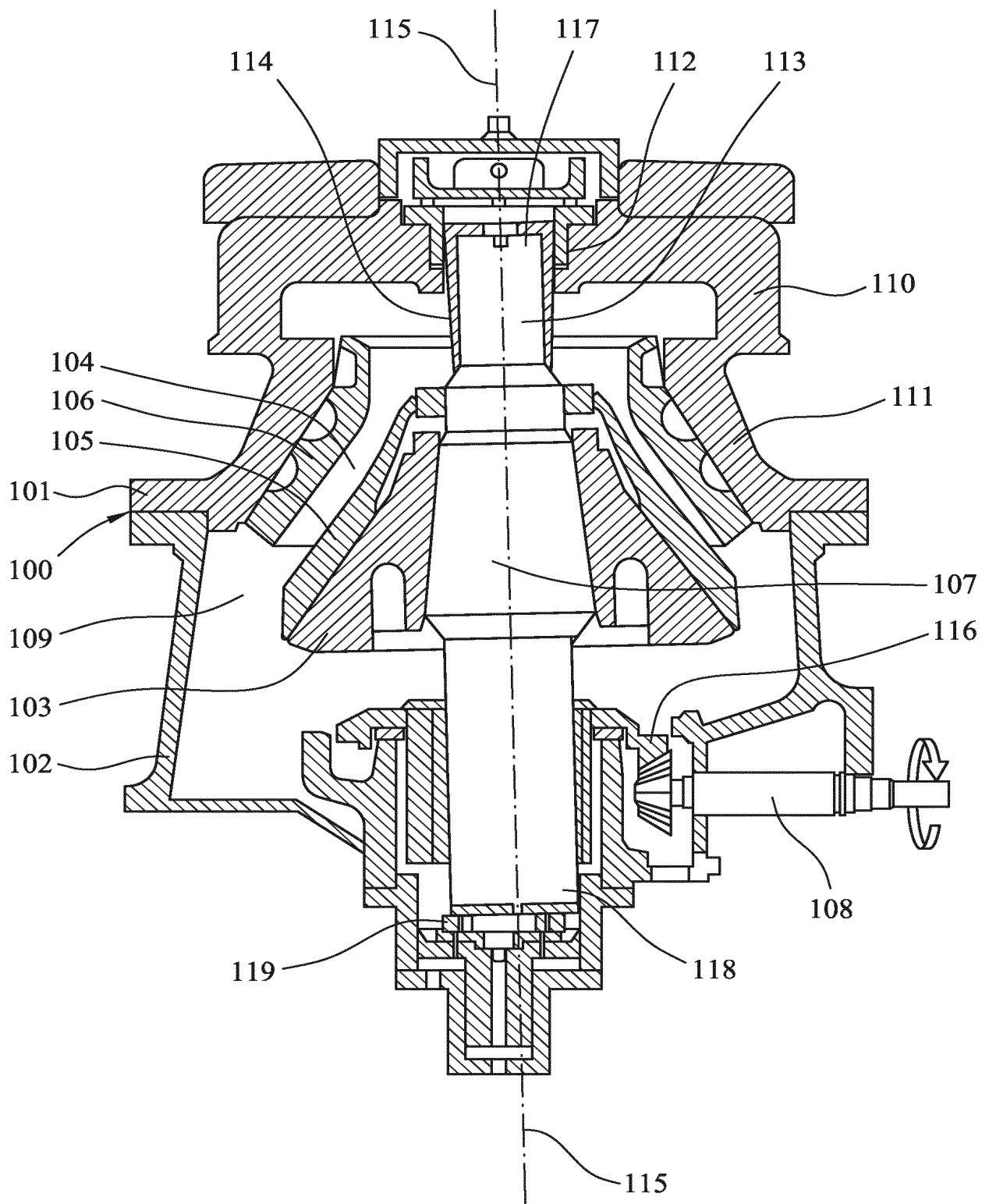


FIG. 1

-2/2-

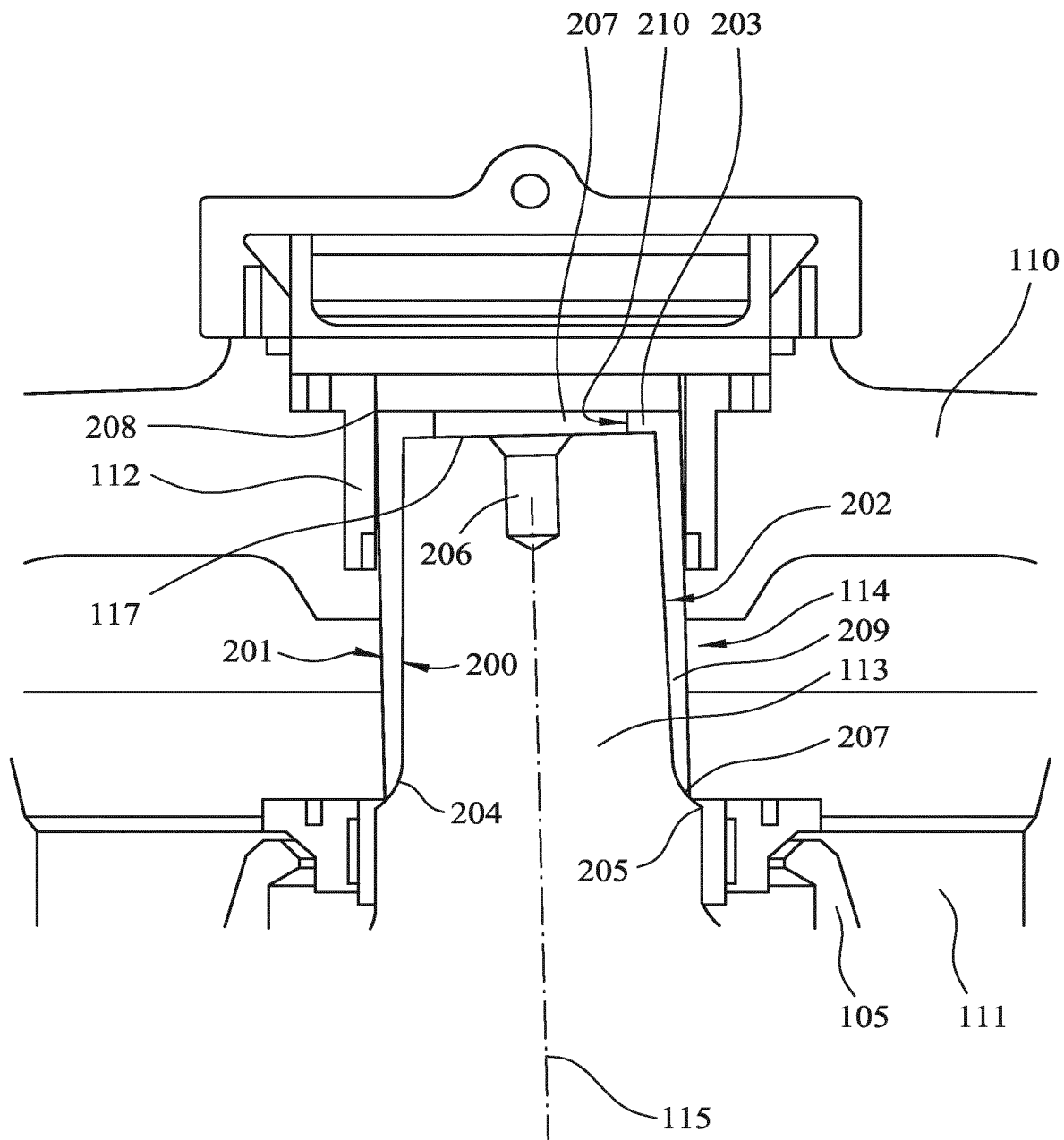


FIG. 2



(51) International Patent Classification:
B02C 2/06 (2006.01)

(21) International Application Number:
PCT/EP2013/062861

(22) International Filing Date:
20 June 2013 (20.06.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12179089.3 2 August 2012 (02.08.2012) EP

(71) Applicant: **SANDVIK INTELLECTUAL PROPERTY AB** [SE/SE]; S-811 81 Sandviken (SE).

(72) Inventors: **ÄBERG, Niklas**; Skatteberga 1396, S-247 92 Södra Sandby (SE). **ERIKSSON, Bengt-Arne**; Sveagatan 4, S-233 33 Svedala (SE). **ROSDAHL, Fredrik**; Sandvik Intellectual Property AB, S-811 81 Sandviken (SE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR,

KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

Published:

— with international search report (Art. 21(3))
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(88) Date of publication of the international search report:
7 August 2014

(54) Title: GYRATORY CRUSHER MAIN SHAFT SLEEVE

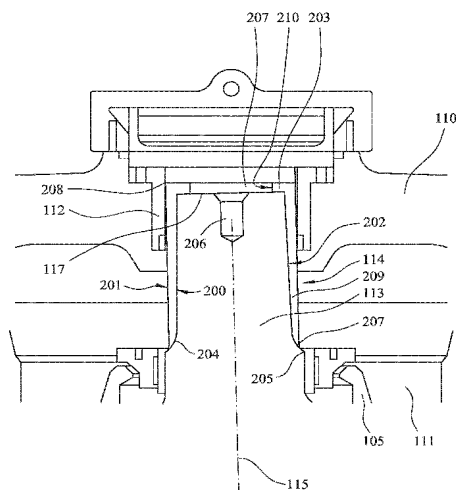


FIG. 2

(57) Abstract: A gyratory crusher main shaft sleeve (114) for friction fitting over an uppermost end (113) of a crusher main shaft (107). The sleeve comprises an elongate axial wall (209) for positioning in contact with an outward facing surface (202) of the main shaft. The axial wall comprises a thickness that decreases in a direction from a second upper end (208) to a first lower end (207) wherein the internal facing surface (200) of the sleeve extends transverse to a longitudinal axis (115) of the sleeve so as to taper inwardly towards the axis in a direction from the first to the second end.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/418,535	Filing Date 01/30/2015	☐ To be Mailed
---	---	----------------------------------	---------------------------------------

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

(Column 1)

(Column 2)

FOR	NUMBER FILED	NUMBER EXTRA		RATE (\$)	FEE (\$)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		X \$ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		X \$ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED – PART II

(Column 1)

(Column 2)

(Column 3)

	01/30/2015	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)	ADDITIONAL FEE (\$)
AMENDMENT	Total (37 CFR 1.16(i))	* 15	Minus	** 20	= 0		X \$80 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0		X \$420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
	TOTAL ADD'L FEE							0

(Column 1)

(Column 2)

(Column 3)

		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)	ADDITIONAL FEE (\$)
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=		X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		X \$ =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
	TOTAL ADD'L FEE							

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LDRC
/PAMELA ROGERS/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Substitute for Form PTO-1360
(For use with Form PTO/SB/06)

Applicant(s) **Niklas ABERG**

CLAIMS	AS FILED		AFTER FIRST AMENDMENT		AFTER SECOND AMENDMENT	
	Indep	Depend	Indep	Depend	Indep	Depend

	**		**		**	
	Indep	Depend	Indep	Depend	Indep	Depend

1	1		1			
2		1		1		
3		1		1		
4		1		1		
5		1		1		
6		1		1		
7		1		1		
8		1		1		
9		1		1		
10		1		1		
11		2		1		
12		2		1		
13		2		1		
14	1		1			
15		1	1			
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
Total Indep	2		3		0	
Total Depend	16	←	12	←	0	←
Total Claims	18		15		0	

51						
52						
53						
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						
85						
86						
87						
88						
89						
90						
91						
92						
93						
94						
95						
96						
97						
98						
99						
100						

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
14/418,535

APPLICATION AS FILED - PART I

(Column 1)		(Column 2)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	480
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(j))	15	minus 20 = *			OR	x 80 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 = *				x 420 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
			TOTAL			TOTAL	1480

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NUMBER NO.	FIRST NAMED INVENTOR	ATTY. DOCKET NO.
14/418,535	Niklas Aberg	SMC 13979 WOUS

78686
Sandvik/Diamond Innovations
6325 Huntley Road
Worthington, OH 43085

INTERNATIONAL APPLICATION NO.	
PCT/EP2013/062861	
I.A. FILING DATE	PRIORITY DATE
06/20/2013	08/02/2012

CONFIRMATION NO. 2984
371 FORMALITIES LETTER



Date Mailed: 03/20/2015

Notification of Insufficiency Under 37 CFR 1.492 and/or 1.495 (DO/EO/US)

The following items have been submitted by the applicant or the International Bureau to the United States Patent and Trademark Office as a Designated / Elected Office (37 CFR 1.495).

- Priority Document
- Copy of the International Application filed on 01/30/2015
- Copy of the International Search Report filed on 01/30/2015
- Preliminary Amendments filed on 01/30/2015
- Information Disclosure Statements filed on 01/30/2015
- Inventor's Oath or Declaration filed on 01/30/2015
- U.S. Basic National Fees filed on 01/30/2015
- Priority Documents filed on 01/30/2015
- Authorization to Permit Access filed on 01/30/2015
- Application Data Sheet (37 CFR 1.76) filed on 01/30/2015

The following items **MUST** be furnished within the period set forth below:

- To avoid abandonment, a surcharge (for late submission of search fee, examination fee or inventor's oath or declaration) as set forth in 37 CFR 1.492(h) of \$140 for an undiscounted entity, must be submitted with the missing items identified in this letter.

SUMMARY OF FEES DUE:

Total additional fees required for this application is **\$140** for an Undiscounted Entity:

- **\$140** Surcharge.

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.495(c).

- Properly executed inventor's oath or declaration for the following inventor(s) has not been submitted: **Niklas Aberg**

ALL OF THE ITEMS SET FORTH ABOVE MUST BE SUBMITTED WITHIN TWO (2) MONTHS FROM THE DATE OF THIS NOTICE. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.

<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

VONDA M WALLACE

Telephone: (571) 272-3734



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
14/418,535	01/30/2015		1480	SMC 13979 WOUS	15	3

CONFIRMATION NO. 2984

78686
Sandvik/Diamond Innovations
6325 Huntley Road
Worthington, OH 43085

FILING RECEIPT



Date Mailed: 03/20/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Niklas Aberg, Sodra Sandby, SWEDEN;
Bengt-Arne Eriksson, Svedala, SWEDEN;
Fredrik Rosdahl, Sandviken, SWEDEN;

Applicant(s)

SANDVIK INTELLECTUAL PROPERTY AB, Sandviken, SWEDEN

Power of Attorney: The patent practitioners associated with Customer Number 78686

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/EP2013/062861 06/20/2013

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)
EUROPEAN PATENT OFFICE (EPO) 12179089.3 08/02/2012

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 03/17/2015

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/418,535**

Projected Publication Date: 371 Supplemental Fees Missing

Non-Publication Request: No

Early Publication Request: No

Title

GYRATORY CRUSHER MAIN SHAFT SLEEVE

Preliminary Class**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No****PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER**Title 35, United States Code, Section 184****Title 37, Code of Federal Regulations, 5.11 & 5.15****GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where

the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of
Invention

GYRATORY CRUSHER MAIN SHAFT SLEEVE

As the below named inventor, I hereby declare that:

This declaration
is directed to:



The attached application, or



United States application or PCT international application number _____

filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: ABERG, Niklas

Date (Optional): 2015-02-18

Signature: Niklas Aberg

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	14418535			
Filing Date:	30-Jan-2015			
Title of Invention:	GYRATORY CRUSHER MAIN SHAFT SLEEVE			
First Named Inventor/Applicant Name:	Niklas Aberg			
Filer:	Corinne R. Gorski			
Attorney Docket Number:	SMC 13979 WOUS			
Filed as Large Entity				
Filing Fees for U.S. National Stage under 35 USC 371				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Oath/Decl > 30 Mos From 371 commencement	1617	1	140	140
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				140

Electronic Acknowledgement Receipt

EFS ID:	21881882
Application Number:	14418535
International Application Number:	
Confirmation Number:	2984
Title of Invention:	GYRATORY CRUSHER MAIN SHAFT SLEEVE
First Named Inventor/Applicant Name:	Niklas Aberg
Customer Number:	78686
Filer:	Corinne R. Gorski
Filer Authorized By:	
Attorney Docket Number:	SMC 13979 WOUS
Receipt Date:	26-MAR-2015
Filing Date:	30-JAN-2015
Time Stamp:	10:11:20
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 140
RAM confirmation Number	16499
Deposit Account	505792
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	13979WOUSignedOathNiklasA berg.pdf	57030	no	2
			4c26994d8298c7bea02dcc002627ae98265 2e8d3		
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30662	no	2
			7761100e971ec50fd22062ac752d4a9b0bb e66db		
Warnings:					
Information:					
Total Files Size (in bytes):			87692		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NUMBER NO.	FIRST NAMED INVENTOR	ATTY. DOCKET NO.
14/418,535	Niklas Aberg	SMC 13979 WOUS

78686
Sandvik/Diamond Innovations
6325 Huntley Road
Worthington, OH 43085

INTERNATIONAL APPLICATION NO.	
PCT/EP2013/062861	
I.A. FILING DATE	PRIORITY DATE
06/20/2013	08/02/2012

CONFIRMATION NO. 2984
371 ACCEPTANCE LETTER



Date Mailed: 04/16/2015

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office, in its capacity as a Designated / Elected Office (37 CFR 1.495), has ACCEPTED the above identified international application for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above. A Filing Receipt will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE "FILING DATE or 371(c) DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1) and (c)(2) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN BELOW.** The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363)

01/30/2015
DATE OF RECEIPT OF 35 U.S.C.
371(c)(1) and (c)(2) REQUIREMENTS

The following items have been received:

- Copy of the International Application filed on 01/30/2015
- Copy of the International Search Report filed on 01/30/2015
- Preliminary Amendments filed on 01/30/2015
- Information Disclosure Statements filed on 01/30/2015
- Inventor's Oath or Declaration filed on 03/26/2015
- U.S. Basic National Fees filed on 01/30/2015
- Priority Documents filed on 01/30/2015
- Authorization to Permit Access filed on 01/30/2015
- Application Data Sheet (37 CFR 1.76) filed on 01/30/2015

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

VONDA M WALLACE

Telephone: (571) 272-3734



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
14/418,535	01/30/2015	3725	1620	SMC 13979 WOUS	15	3

CONFIRMATION NO. 2984

78686
Sandvik/Diamond Innovations
6325 Huntley Road
Worthington, OH 43085

UPDATED FILING RECEIPT



Date Mailed: 04/16/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Niklas Aberg, Sodra Sandby, SWEDEN;
Bengt-Arne Eriksson, Svedala, SWEDEN;
Fredrik Rosdahl, Sandviken, SWEDEN;

Applicant(s)

SANDVIK INTELLECTUAL PROPERTY AB, Sandviken, SWEDEN

Power of Attorney: The patent practitioners associated with Customer Number 78686

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/EP2013/062861 06/20/2013

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)
EUROPEAN PATENT OFFICE (EPO) 12179089.3 08/02/2012

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 03/17/2015

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/418,535**

Projected Publication Date: 07/23/2015

Non-Publication Request: No

Early Publication Request: No

Title

GYRATORY CRUSHER MAIN SHAFT SLEEVE

Preliminary Class

241

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No**PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
14/418,535

APPLICATION AS FILED - PART I

(Column 1)		(Column 2)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	480
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(j))	15	minus 20 = *			OR	x 80 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 = *				x 420 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
			TOTAL			TOTAL	1480

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of
Invention

GYRATORY CRUSHER MAIN SHAFT SLEEVE

As the below named inventor, I hereby declare that:

This declaration
is directed to:



The attached application, or



United States application or PCT international application number _____

filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: ABERG, Niklas

Date (Optional): 2015-02-18

Signature: Niklas Aberg

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	14418535			
Filing Date:	30-Jan-2015			
Title of Invention:	GYRATORY CRUSHER MAIN SHAFT SLEEVE			
First Named Inventor/Applicant Name:	Niklas Aberg			
Filer:	Corinne R. Gorski			
Attorney Docket Number:	SMC 13979 WOUS			
Filed as Large Entity				
Filing Fees for U.S. National Stage under 35 USC 371				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Oath/Decl > 30 Mos From 371 commencement	1617	1	140	140
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				140

Electronic Acknowledgement Receipt

EFS ID:	22103235
Application Number:	14418535
International Application Number:	
Confirmation Number:	2984
Title of Invention:	GYRATORY CRUSHER MAIN SHAFT SLEEVE
First Named Inventor/Applicant Name:	Niklas Aberg
Customer Number:	78686
Filer:	Corinne R. Gorski
Filer Authorized By:	
Attorney Docket Number:	SMC 13979 WOUS
Receipt Date:	20-APR-2015
Filing Date:	30-JAN-2015
Time Stamp:	09:36:20
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	13979WOUSSignedOathNiklas Aberg.pdf	57030 4c26994d8298c7bea02dcc002627ae982652e8d3	no	2

Warnings:

The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30662	no	2
			c1ce6415979eaf8e716f29b8158452433fe09248		

Warnings:

Information:

Total Files Size (in bytes):			87692
------------------------------	--	--	-------

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronic Patent Application Fee Transmittal

Application Number:	14418535			
Filing Date:	30-Jan-2015			
Title of Invention:	GYRATORY CRUSHER MAIN SHAFT SLEEVE			
First Named Inventor/Applicant Name:	Niklas Aberg			
Filer:	Corinne R. Gorski			
Attorney Docket Number:	SMC 13979 WOUS			
Filed as Large Entity				
Filing Fees for U.S. National Stage under 35 USC 371				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Oath/Decl > 30 Mos From 371 commencement	1617	1	140	140
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				140

Electronic Acknowledgement Receipt

EFS ID:	22103276
Application Number:	14418535
International Application Number:	
Confirmation Number:	2984
Title of Invention:	GYRATORY CRUSHER MAIN SHAFT SLEEVE
First Named Inventor/Applicant Name:	Niklas Aberg
Customer Number:	78686
Filer:	Corinne R. Gorski
Filer Authorized By:	
Attorney Docket Number:	SMC 13979 WOUS
Receipt Date:	20-APR-2015
Filing Date:	30-JAN-2015
Time Stamp:	09:40:05
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Fee Worksheet (SB06)	fee-info.pdf	30662 160a2560a50104d60f4b8882bfa0a1489b97a46	no	2

Warnings:

Information:

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/418,535	01/30/2015	Niklas Aberg	SMC 13979 WO/US

CONFIRMATION NO. 2984

PUBLICATION NOTICE



OC000000076451543

78686
Sandvik/Diamond Innovations
6325 Huntley Road
Worthington, OH 43085

Title:GYRATORY CRUSHER MAIN SHAFT SLEEVE

Publication No.US-2015-0202630-A1

Publication Date:07/23/2015

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14418535
	Filing Date		2015-01-30
	First Named Inventor	ABERG	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		SMC 13979WOUS

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	4065064	A	1977-12-27	JAMES	

If you wish to add additional U.S. Patent citation information please click the Add button.

Add

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button.

Add

FOREIGN PATENT DOCUMENTS								Remove
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	203678427	CN	U	2014-07-02	ABERG ET AL		×
	2	2212448	CN	Y	1995-11-15	SHAO		☒
	3	101947476	CN	A	2011-01-19	CHEN		☒

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		14418535
Filing Date		2015-01-30
First Named Inventor	ABERG	
Art Unit		
Examiner Name		
Attorney Docket Number	SMC 13979WOUS	

4	421864	SE	B	1982-02-28	IVANOV ET AL	☒
---	--------	----	---	------------	--------------	-------------------------------------

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1		

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	
--------------------	--	-----------------	--

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	14418535
Filing Date	2015-01-30
First Named Inventor	ABERG
Art Unit	
Examiner Name	
Attorney Docket Number	SMC 13979WOUS

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Corinne Gorski/	Date (YYYY-MM-DD)	2016-09-16
Name/Print	Corinne Gorski	Registration Number	34339

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



Espacenet

Bibliographic data: SE421864 (B) — 1982-02-08

Arrangement for fastening a wear reinforcement on the crushing cone in a crusher

Inventor(s): IVANOV N A; IVANOV B G; ZAROGATSKY L P; MITROFANOV E S;
CHERKASSKY V A ± (N A * IVANOV, ; B G * IVANOV, ; L P *
ZAROGATSKY, ; E S * MITROFANOV, ; V A * CHERKASSKY)

Applicant(s): VNI I PI MEKH I OBRABOTKI POLE [SU] ± (* VSESOJUZNY
NAUCHNO-ISSLEDOVATELSKY I PROEKTNY INSTITUT, ;
MEKHANICHESKO I OBRABOTKI POLEZNYKH ISKOPAEMYKH)

Classification: - international: B02C2/04; (IPC1-7): B02C2/04
- cooperative: B02C2/005; B02C2/04 more

Application number: SE19790003139 19790409

Priority number(s): SE19790003139 19790409

Also published as: SE7903139 (L)

Abstract of SE421864 (B)

The present invention pertains to smaller and medium- sized conical crushers and especially arrangements for fastening a wear reinforcement to the crushing cone of a crusher. The invention comprises an arrangement for fastening of a wear reinforcement to the crushing cone in a crusher, which has an outer cone 2 and a crushing cone 4 mounted therein on a spherical support 3, wherein the cones are jacketed with wear reinforcements 1, 5, and it comprises a pressure sleeve 7 and a screw 10 provided with a flange 11 and placed in the central region of the crushing cone 4. The pressure sleeve is arranged beneath the upper end surface 6 of the wear reinforcement 5 and is provided with projecting pieces 8. The flange 11 is provided with threaded holes 12 and grooves 14 to accommodate the projecting pieces 8 of the pressure sleeve 7.; The pressure sleeve 7 is arranged under the flange 11 with a clearance 15 in between, the clearance being established with spacing bolts 13 placed in the threaded holes 12 of the flange 11 and screwed into the pressure sleeve 7 as far as a stop, as far as it goes. The present invention can be used with greatest advantage in the construction and mining industries.

SVERIGE

(12) UTLÄGGNINGSSKRIFT

[BI] (21)

7903139-9

(19) SE

(51) Internationell klass³

B 02 C 2/04



PATENTVERKET

(44) Ansökan utlagd och utläggningsskriften publicerad 82-02-08

(41) Ansökan allmänt tillgänglig 80-10-10

(22) Patentansökan inkom 79-04-09

(24) Löpdag

(62) Stamansökans nummer

(86) Internationell ingivningsdag

(86) Ingivningsdag för ansökan om europeiskt patent

(30) Prioritetsuppgifter

(11) Publiceringsnummer

421 864

Ansökan inkommen som:

☒ svensk patentansökan☐ fullföljd internationell patentansökan med nummer☐ omvandlad europeisk patentansökan med nummer

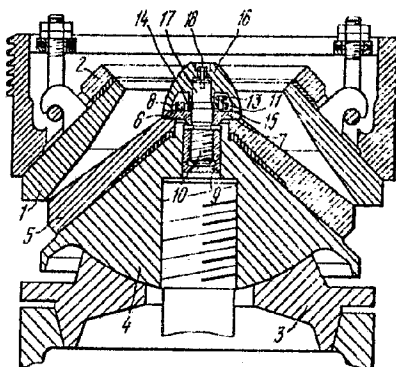
(71) Sökande: VSESOJUZNY NAUCHNO-ISSLEDOVATELSKY I PROEKTYN INSTITUT MEKHANICHESKOI OBRABOTKI POLEZNYKH ISKOPAEMYKH, LENINGRAD, SU

(72) Uppfinnare: N A Ivanov, B G Ivanov, L P Zarogatsky, E S Mitrofanov och V A Cherkassky, Leningrad

(74) Ombud: Hjärne

(54) Benämning

Anordning för infästning av en slitarmering till krosskonen i en kross



(57) Sammandrag:

Föreliggande uppfinning hänför sig till mindre och medelstora konkrossar och särskilt till anordningar för att infästa en slitarmering till krosskonen på en kross.

Uppfinningen omfattar en anordning för infästning av en slitarmering till krosskonen i en kross, som uppvisar en yttre kon (2) och en krosskon (4) monterad däri på ett sfäriskt stöd (3), varvid konerna är klädda med slitarmeringar (1), (5), och omfattar en tryckhylsan (7) och en skruv (10) försedd med en fläns (11) och placerad i krosskonens (4) centrala område. Tryckhylsan är anordnad under den övre ändytan (6) på slitarmeringen (5) och är försedd med utskjutande delar (8). Flänsen (11) är försedd med gångade hål (12) och spår (14) för att upptaga de utskjutande delarna (8) på tryckhylsan (7). Tryckhylsan (7) är anordnad under flänsen (11) med ett spel (13) därmed, där spelet fixeras med distansbultar (15) placerade i flänsens (11) gångade hål (12) och skruvade in i tryckhylsan (7) till ett stopp (så långt det går).

Föreliggande uppfinning kan med största fördel användas i bygg- och gruvindustrierna.

(56) Anförda publikationer:
Sovjet 507 356 (B02C 2/04)
Tyskland 451 454 (50 c:2/01)

Föreliggande uppfinning avser mindre och mellanstora krossar och särskilt anordningar för att infästa en slitarmering till krosskonen i en kross.

Föreliggande uppfinning kan användas med största fördel inom byggnads- och gruvindustrierna.

De mindre och mellanstora konkrossarna som nu är i användning omfattar en yttre kon och en krosskon anordnad däri, varvid en krosskammare bildas mellan dem. Krosskonen är monterad på ett sfäriskt stöd och fäst liksom även den yttre konen till krossens stativ. Drivningen av krosskonen sker med obalans eller excentriskt. Både på den yttre konen och krosskonen finns slitarmeringar monterade utformade som demonterbara koniska mantlar, som är kopior av resp. kon. Beroende på avsevärda slagbelastningar, som uppträder i krosskammaren, är det en anordning för infästning av en slitarmering till krosskonen som är en av de mest kritiska enheterna i en kross.

Inom tekniken är en anordning för infästning av en slitarmering till krosskonen på en kross känd, som uppvisar en slitarmeringsbeklädd yttre kon och en slitarmeringsbeklädd krosskon monterad i densamma på ett sfäriskt stöd (jfr USSR Author's Certificate No 410 808, Int. cl. B02c 2/04). Anordningen omfattar tryckhylsa anordnad på övre änden av slitarmeringen och formad som en skyddande kåpa försedd med sidoöppningar och som skyddar en mutter från förstöring som är anordnad under hylsan. Muttern, som är försedd med sidoöppningar, är skruvad på ett gängat fast skaft till konen, vars ändyta är försedd med ett diametralt spår. Tryckhylsan och muttern är låsta mot skaftet på konen med en konisk tapp inpassad i skaftets spår och i sidoöppningarna på muttern och hylsan.

Vid montering av slitarmeringen på konen skruvas muttern på sitt skaft till ett förutbestämt läge med avseende på slitarmeringens ändyta till dess att öppningar i muttern sammanfaller med det diametrala spåret på konens skaft. Tryckhylsan är även monterad så att dess öppningar ligger i linje med öppningarna på muttern och med spåret i konens

skaft. Den låsande koniska tappen drives genom de i linje liggande öppningarna på tryckhylsan, muttern och spåret i skaftet. Läget av muttern i höjddled förutbestäms för att säkerställa en presspassning för slitarmeringen efter det tappen drivits in och för att bringa mutterns öppningar i linje med spåret i konens skaft.

Då man byter ut den slitna slitarmeringen utföres operationerna i omvänd ordning.

På grund av kravet att låsa muttern endast i ett förutbestämt läge med avseende på spåret i konens skaft är det emellertid omöjligt att åstadkomma en jämn och tillräcklig presspassning från början för slitarmeringen. Allt eftersom slitarmeringen blir utsliten försämras pressen, vilket resulterar i förstöring av passytan på konen och därmed fungerar den inte som den skall.

Dessutom är anordningen invecklad till sin konstruktion.

Inom tekniken är en anordning för infästning av en slitarmering till krosskonen på en kross känd, som uppvisar en slitarmerad beklädd yttre kon och en slitarmerad beklädd krosskon monterad däri på ett sfäriskt stöd (jfr USSR Author's Certificate No 304 975, Int. cl. B02c 2/04). Även denna anordning omfattar en tryckhylsa anordnad på den övre ändytan av slitarmeringen och formad som en kåpa för att skydda en mutter anordnad därunder mot förstöring, varvid muttern är försedd med öppningar och skruvad på det gängade konskaftet. Tryckhylsan och muttern är låsta mot varandra med en konisk tapp. Anordningen skiljer sig från den ovannämnda anordningen genom att den ej har något diametralt spår på konskaftets ändyta. I detta fall låser den koniska tappen ej tryckhylsan och muttern mot konen, utan låser tryckhylsan endast mot muttern. Detta möjliggör självåtdragning av slitarmeringen då dess passning löses upp.

Montering och demontering av anordningen utföres på samma sätt som vid den först nämnda anordningen.

Förslitningen av slitarmeringen resulterar i en minskad styvhet i dess skal, varigenom presspassningen löses till dess att den är helt eliminerad.

Vid drift får krosskonens lösta slitarmering en viss radiell förskjut-

ning i förhållande till konen. Denna förskjutning passerar i följd omkring periferin på slitarmeringens passyta.

Med en sådan förskjutning kommer slitarmeringen i långsam rotation i förhållande till konen och med ökande friktionskraft medför den tryckhylsan som står i kontakt med slitarmeringens ändyta och även genom tappen roteras muttern som under åtdragning utövar genom samma tapp och tryckhylsan en ny kraftverkan på slitarmeringen så att den bringas att täta ordentligt med presspassning. Självåtdragningen sker regelbundet under slitarmeringens förslitning, vilket eliminerar störning av passytan på konkroppen.

Beroende på kravet för exakt upplinjering av öppningarna i muttern och tryckhylsan för att mottaga tappen misslyckas emellertid anordningen med att åstadkomma en önskad presspassning för slitarmeringen.

Under det att man demonterar anordningen måste tappens slås ut för att eliminera pressen i gängförbindningen. Detta hindras av friktionskraften i tappläget som ökas mångfaldigt jämfört med det som erhöles vid monteringen, beroende på elastisk eller plastisk deformation av tappens. Allt detta leder till att det ej går att åstadkomma en demonterbar förbindelse.

Känt inom tekniken är även en anordning för att infästa en slitarmering till krosskonen på en tröghetskross, som är försedd med en slitarmerad yttre kon och en slitarmerad krosskon inuti densamma på ett sfäriskt stöd (jfr USSR Author's Certificate No 507 356 Int. cl. B02c 2/04). Anordningen omfattar en tryckhylsa anordnad på slitarmeringens övre ändyta och en skruv placerad i en gängad öppning upptagen i konens centrala area, vilken skruv är försedd med en central öppning och en fläns försedd med gängade öppningar för att upptaga bultarna och med ett spår för att upptaga en utskjutande del av tryckhylsan. Tryckhylsan är bultad till flänsen på skruven och är utrustad med en skyddande kåpa fästad därpå.

Då man monterar anordningen skruvas skruven med tryckhylsan in i den gängade öppningen på konen och vid kontakt mellan hylsan och slitarmeringens ändyta dras den åt med en kraft tillräcklig för att säkerställa en tillräcklig press mellan slitarmeringen och konens passyta. Den skyddande kåpan fästes sedan på hylsan.

Denna anordning medger en pålitlig initiell presspassning för slitarmeringen. Samtidigt arbetar anordningen ifråga med en minskad åtdragning av slitarmeringen.

Det är inte nödvändigt med en slagbehandling på skruven för att utbyta den slitna slitarmeringen. Pressen i gängen på skruven frigöres genom att skruva upp bultarna som förbinder den med hylsan. Då man gjort detta kan skruven lätt avlägsnas för hand.

Eftersom emellertid de tillåtna dragpåkänningarna är lägre än tryckpåkänningarna är det nödvändigt att öka bultarnas diameter avsevärt, då man tar i betraktande hållfasthetsförhållandena under dragpåkänning. Ökning av bultarnas diameter är begränsad genom anordningens totala dimensioner, vilket resulterar i en otillförlitlig drift av anordningen.

Dessutom resulterar en o-parallellitet mellan slitarmeringens ändyta och flänsplanet i att anordningens delar ofta utsättes för deformationer, då man fäster slitarmeringen och då den är självåtdragande, vilket hindrar demonteringen av anordningen och i särskilda fall gör den inoperativ.

Vidare lider anordningen av en invecklad konstruktion.

Huvudändamålet med föreliggande uppfinning är att åstadkomma en anordning för infästning av en slitarmering till krosskonen, där tryckhylsan och dess koppling till skruven är så utförda att öka pålitligheten i slitarmeringens infästning.

Med hänsyn till detta huvudändamål föreslås en anordning för infästning av en slitarmering till krosskonen i en kross, som uppvisar en yttre kon och en krosskon monterad inuti denna på ett sfäriskt stöd, varvid konerna är beklädda med slitarmeringar, omfattande en tryckhylsa anordnad på den övre ändytan av slitarmeringen och försedd med utskjutande delar och en skruv placerad i ett gängat hål upptagen i krosskonens centrala område, varvid skruven är försedd med en fläns, vilken är försedd med gängade hål för att upptaga distansbultar och spår för att upptaga de utskjutande delarna på tryckhylsan, där enligt uppfinningen tryckhylsan är monterad under flänsen för att åstadkomma ett spel däremellan, varvid spelet fixeras medelst distansbultarna som skruvas mot tryckhylsan upp till ett stopp (så långt det går)

Fördelen med den föreslagna anordningen ligger i att tryckhylsan är självinriktande mot slitarmeringens ändyta genom distansbultarna om dess felaktiga inriktning med avseende på skruvens fläns uppträder. Distansbultarna säkerställer därmed en jämn och enhetlig presspassning mellan slitarmeringen och konen. Det är även till fördel att spelet mellan tryckhylsan och skruvens fläns möjliggör att då man byter ter ut slitarmeringen eliminera pressen i skruvens gängor genom att skruva upp distansbultarna genom en liten vridning.

Föreliggande uppfinning kommer nu att beskrivas i en föredragen utföringsform med hänvisning till de bifogade ritningarna där

fig. 1 är en längdsektion av driftenheten hos en konkross där anordningen för infästning av en slitarmering till krosskonen är utförd enligt uppfinningen,

fig. 2 är en fragmentarisk vy av en anordning för infästning av en slitarmering till krosskonen i en kross enligt uppfinningen och

fig. 3 visar slutligen en planvy av anordningen för infästning av en slitarmering till krosskonen där den skyddande kåpan är avlägsnad, enligt uppfinningen.

Med hänvisning till fig. 1 uppvisar anordningen för infästning av en slitarmering till krosskonen på en kross en slitarmering 1, som täcker en yttre kon 2, inuti vilken på ett sfäriskt stöd 3 en krosskon 4 är anordnad beklädd med en slitarmering 5. På den övre ändytan 6 av slitarmeringen 5 (fig. 1, 2) finns en tryckhylsa 7 anordnad för sedd med utskjutande delar 8. I ett gängat hål 9 i den centrala delen av konen 4 är en skruv 10 med en fläns 11 placerad. Flänsen 11 är för sedd med gängade hål 12, i vilka distansbultar 13 är iskruvade (fig. 3). I flänsen 11 finns vidare spår 14 svarande mot de utstående delarna 8 på tryckhylsan 7. Tryckhylsan 7 (fig. 2) är anordnad under flänsen 11 med ett spel 15 däremellan.

Monterad på den övre änden av tryckhylsan 7 finns en skyddande kåpa 16 anordnad koaxiellt med ett huvud 17 till skruven 10. Den skyddande kåpan 16 är fästad med en bult 18 försänkt i ett hål 19.

Anordningen för infästning av en slitarmering till krosskonen enligt föreliggande uppfinning fungerar enligt följande. Vid installationen av slitarmeringen 5 på krosskonen 4 placeras tryckhylsan 7 på den öv-

re ändytan av slitarmeringen. Därefter skruvas skruven 10 in i det gängade hålet 9 till dess att de utskjutande delarna 8 på tryckhylsan 7 kommer in i spåren 14 på flänsen 11. Distansbultarna 13 skruvas sedan ned i de gängade hålen 12 på flänsen 11 mot stoppet vid övre ändytan på tryckhylsan 7, varvid spelet 15 anordnas mellan flänsen 14 på skruven 10 och tryckhylsan 7. Spelet beror på den elastiska deformationen hos slitarmeringen 5 och spelet i den gängade förbindelsen mellan skruven 10 och öppningen 9.

Under drift kommer slitarmeringen 5 på krosskonen 4 att lossna något och därmed får den en lätt radiell förskjutning i förhållande till konen 4. Denna förskjutning förflyttar sig i följd omkring periferin på passytan till slitarmeringen 5. Slitarmeringen 5 kommer därmed i långsam rotation med avseende på konen 4 och med friktionskraft medför den tryckhylsan 7, som i sin tur vrider skruven 10 medelst de utskjutande delarna 8 monterade i springorna 14 på flänsen 11, så att den sålunda skruvas in i det gängade hålet 9. Skruven 10 verkar genom bultarna 13 på tryckhylsan 7 och vidare på slitarmeringen 5, som är självåtdragande mot passytan på konen 4. Självåtdragningen förnyas varje gång slitarmeringen 5 lossnar och därigenom åstadkommes pålitlig passning mot konen 4.

För att utbyta den slitna slitarmeringen 5 skruvas bulten 18 upp, den skyddande kåpan 16 avlägsnas och distansbultarna 13 lossas, varigenom pressen i gängen till skruven 10 elimineras och skruven går nedåt så långt som spelet 15 medger, de övre ytorna av gängorna på skruven frigöres därefter från de nedre ytorna på gängorna i den gängade öppningen 9. Pressen elimineras sålunda och skruven 10 kan lätt avlägsnas, varefter tryckhylsan avtages och den slitna slitarmeringen 5 demonteras.

Enligt föreliggande uppfinning föreslås en anordning för infästning av en slitarmering till krosskonen, som erbjuder:

- en ökad pålitlighet för slitarmeringens infästning
- en minskad arbetsinsats då man infäster och byter ut slitarmeringen
- en förenklad konstruktion på anordningen.

Ehuru föreliggande uppfinning här visats i viss utföringsform är den ej begränsad därtill. Det ligger inom uppfinningens ram att någon annan konstruktion kan användas i enlighet med principen för en kross.

Patentkrav

Anordning för infästning av en slitarmering till krosskonen i en kross, som uppvisar en yttre kon (2) och en krosskon (4) monterad inuti denna på ett sfäriskt stöd (3), varvid konerna är beklädda med slitarmeringar (1, 5), omfattande en tryckhylsa (7) anordnad på den övre ändytan (6) av krosskonens slitarmering (5) och försedd med utskjutande delar (8) och en skruv (10) placerad i ett gängat hål (9) upptaget i krosskonens (4) centrala område, varvid skruven är försedd med en fläns (11), vilken är försedd med gängade hål (12) för att upptaga distansbultar (13) och spår (14) för att upptaga de utskjutande delarna (8) på tryckhylsan (7), k ä n n e t e c k - n a d av att tryckhylsan (7) är monterad under flänsen (11) med ett spel (15) däremellan, varvid spelet fixeras av distansbultarna (13), som skruvas mot tryckhylsan (7) upp till ett stopp (så långt det går).

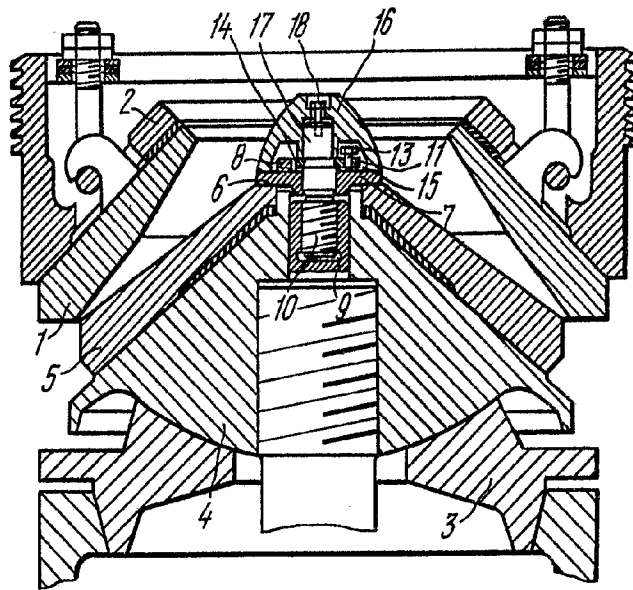


FIG. 1

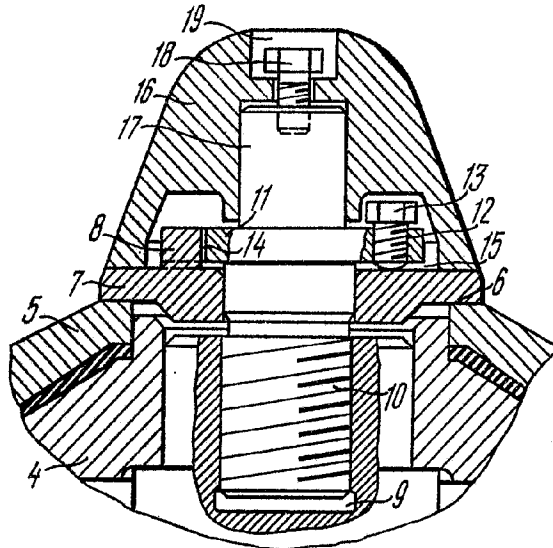


FIG. 2

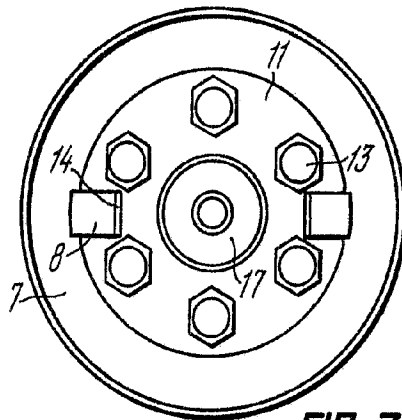


FIG. 3

Sammandrag

Föreliggande uppfinning hänför sig till mindre och medelstora konkrossar och särskilt till anordningar för att infästa en slitarmering till krosskonen på en kross.

Uppfinningen omfattar en anordning för infästning av en slitarmering till krosskonen i en kross, som uppvisar en yttre kon (2) och en krosskon (4) monterad däri på ett sfäriskt stöd (3), varvid konerna är klädda med slitarmeringar (1), (5), och omfattar en tryckhylsa (7) och en skruv (10) försedd med en fläns (11) och placerad i krosskonens (4) centrala område. Tryckhylsan är anordnad under den övre ändytan (6) på slitarmeringen (5) och är försedd med utskjutande delar (8). Flänsen (11) är försedd med gängade hål (12) och spår (14) för att upptaga de utskjutande delarna (8) på tryckhylsan (7). Tryckhylsan (7) är anordnad under flänsen (11) med ett spel (15) däremellan, där spelet fixeras med distansbultar (13) placerade i flänsens (11) gängade hål (12) och skruvade in i tryckhylsan (7) till ett stopp (så långt det går).

Föreliggande uppfinning kan med största fördel användas i byggnads- och gruvindustrierna.



Espacenet

Bibliographic data: CN203678427 (U) — 2014-07-02

Rotary crusher, main shaft of rotary crusher and sleeve of main shaft

Inventor(s): NIKLAS ABERG; BENGT-ARNE ERIKSSON; FREDRIK ROSDAHL
 ± (NIKLAS ABERG, ; BENGT-ARNE ERIKSSON, ; FREDRIK
 ROSDAHL)

Applicant(s): SANDVIK INTELLECTUAL PROPERTY ± (SANDVIK
 INTELLECTUAL PROPERTY AB)

Classification: - **international:** B02C2/00; F16C3/02
 - **cooperative:** B02C2/005; B02C2/06

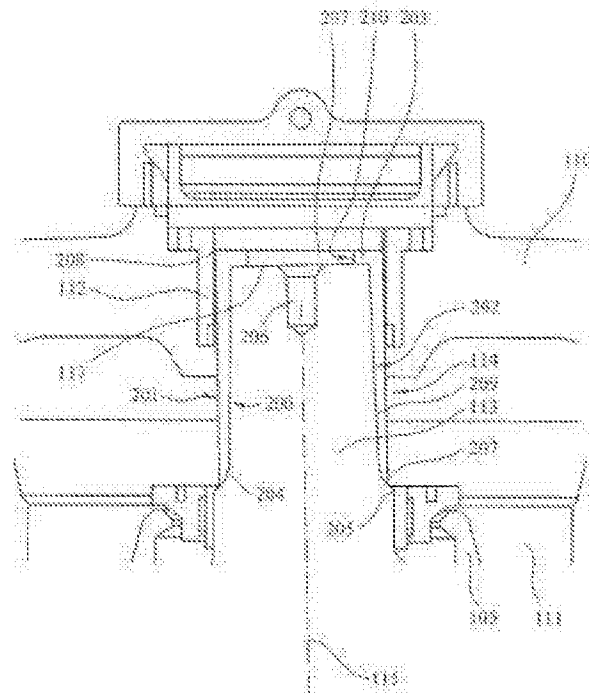
Application number: CN20132565999U 20130802

Priority number (s): EP20120179089 20120802

Also published as: EP2692444 (A1) US2015202630 (A1) WO2014019765 (A2)
WO2014019765 (A3) CN104602819 (A) more

Abstract of CN203678427 (U)

The utility model relates to a rotary crusher, a main shaft of the rotary crusher and a sleeve of the main shaft. The sleeve is in friction fit with the uppermost end of the main shaft. The sleeve comprises a stretched axial wall which is in surface contact with the outer surface of the main shaft. The axial wall has a thickness which is reduced from a second upper end to a first lower end, and the inner surface of the sleeve transversely extends along the longitudinal axis of the sleeve, so that the orientation axis in the direction from the first end to the second end is retracted inwards. The main shaft comprises a shaft body, wherein the shaft body is provided with a first end which is located in a lower part area of the crusher and a second end which corresponds to the first end and is located in an upper part area of the crusher; in a second end area, the thickness of the shaft body is gradually reduced in the axial direction of the main shaft, so that the cross sectional area is reduced; the main shaft also comprises the sleeve, and the sleeve is in the friction fit with the reduced area of the second end of the main shaft. The rotary crusher comprises the main shaft and the sleeve.





(12) 实用新型专利

(10) 授权公告号 CN 203678427 U

(45) 授权公告日 2014. 07. 02

(21) 申请号 201320565999. 5

F16C 3/02(2006. 01)

(22) 申请日 2013. 08. 02

(ESM) 同样的发明创造已同日申请发明专利

(30) 优先权数据

12179089. 3 2012. 08. 02 EP

(73) 专利权人 山特维克知识产权股份有限公司

地址 瑞典桑德维肯

(72) 发明人 尼克拉斯·阿伯格

本特-阿恩·埃里克松

弗雷德里克·罗斯达尔

(74) 专利代理机构 中原信达知识产权代理有限

责任公司 11219

代理人 蔡石蒙 车文

(51) Int. Cl.

B02C 2/00(2006. 01)

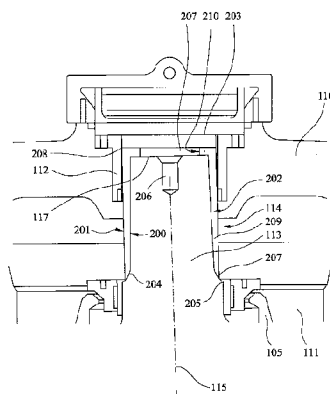
权利要求书2页 说明书4页 附图2页

(54) 实用新型名称

回转式破碎机、回转式破碎机主轴及其套筒

(57) 摘要

本实用新型涉及一种回转式破碎机、回转式破碎机主轴及其套筒,该套筒用于摩擦配合在破碎机主轴的最上端上。套筒包括定位成与主轴的向外面向表面接触的伸长的轴向壁。轴向壁包括在从第二上端向第一下端的方向上减小的厚度,其中套筒的朝内面向表面横向于套筒的纵向轴线延伸,以便在从第一端向第二端的方向上朝向轴线向内渐缩。破碎机主轴包括轴体,轴体具有定位在破碎机的下部区域处的第一端以及相对于第一端定位在破碎机的上部区域处的第二端,其中,在第二端的区域中,轴体的厚度在主轴的轴向方向上渐缩,以便在横截面面积上减少;主轴还包括套筒,套筒摩擦配合在位于主轴的第二端处的渐缩区域上。回转式破碎机所述主轴和套筒。



1. 一种回转式破碎机主轴的套筒(114),所述套筒用于摩擦配合在破碎机主轴(107)的最上端(113)上,所述套筒(114)包括:

伸长的轴向壁(209),所述轴向壁(209)绕所述套筒(114)的纵向轴线(115)延伸,且所述轴向壁(209)具有定位成与所述主轴(107)的向外面向表面(202)接触的朝内面向表面(200)和相对于所述纵向轴线(115)的朝外面向表面(201),所述轴向壁(209)在所述朝内面向表面(200)和所述朝外面向表面(201)之间延伸,

所述轴向壁(209)具有定位在所述主轴(107)的下部区域(205)处的第一端(207),以及定位在所述主轴(107)的与所述下部区域(205)相对的上部区域(117)处的第二端(208),

其中,所述轴向壁(209)在所述第一端(207)和所述第二端(208)之间的区域上的厚度在从所述第二端(208)到所述第一端(207)的方向上减少,

其特征在于:

在轴向方向上,在所述区域上的所述朝内面向表面(200)横向于所述纵向轴线(115)延伸,以便在从所述第一端(207)到所述第二端(208)的方向上向内朝向所述纵向轴线(115)渐缩。

2. 根据权利要求1所述的套筒,其特征在于,所述轴向壁(209)的厚度减少所遍及的区域延伸所述套筒(114)的大致整个轴向长度。

3. 根据前述任一权利要求的套筒,其特征在于,还包括垂直或横向于所述轴向壁(209)延伸的径向壁(203),所述径向壁(203)定位成处于所述第二端(208)处或朝向所述第二端(208),并向内朝向所述纵向轴线(115)延伸。

4. 根据权利要求3所述的套筒,其特征在于,所述径向壁(203)包括定位在所述套筒(114)的纵向轴线(115)处的通孔(210)。

5. 根据权利要求1或2所述的套筒,其特征在于,所述朝外面向表面(201)的横截面形状轮廓为大致圆形。

6. 根据权利要求1或2所述的套筒,其特征在于,所述朝内面向表面(200)的横截面形状轮廓为大致圆形。

7. 根据权利要求1或2所述的套筒,其特征在于,所述朝外面向表面(201)的形状轮廓在轴向方向上限定柱体的一部分。

8. 根据权利要求1或2所述的套筒,其特征在于,所述朝内面向表面(200)的形状轮廓在轴向方向上限定锥体的一部分。

9. 根据权利要求1或2所述的套筒,其特征在于,还包括在所述朝内面向表面(200)中凹进的至少一个凹槽。

10. 根据权利要求9所述的套筒,其特征在于,所述凹槽围绕所述朝内面向表面(200)的区域在周向方向上延伸。

11. 根据权利要求9所述的套筒,其特征在于,所述凹槽沿着所述朝内面向表面(200)在轴向方向上延伸。

12. 根据权利要求1或2所述的套筒,其特征在于,还包括至少一个孔,所述至少一个孔被设置成穿过所述轴向壁(209),以允许流体通过到达所述朝内面向表面(200)。

13. 根据权利要求1或2所述的套筒,其特征在于,在所述第一端(207)的区域,所述朝

内面向表面(200)相对于所述纵向轴线(115)在朝向所述朝外面向表面(201)的方向上径向向外弯曲(204),使壁厚在弯曲区域(204)处减少至零。

14. 一种回转式破碎机主轴,包括:

轴体(107),所述轴体(107)具有定位在破碎机的下部区域处的第一端(118)以及相对于所述第一端(118)定位在破碎机的上部区域处的第二端(117),

其特征在于:

在所述第二端(117)的区域(113)中,所述轴体(107)的厚度在所述主轴的轴向方向上渐缩,以便在横截面积上减少;并且

所述主轴还包括如前述任一权利要求所述的套筒(114),所述套筒(114)摩擦配合在位于所述第二端(117)处的渐缩区域(113)上。

15. 一种回转式破碎机,其特征在于,包括如权利要求14所述的主轴。

回转式破碎机、回转式破碎机主轴及其套筒

技术领域

[0001] 本实用新型涉及一种回转式破碎机、回转式破碎机主轴及其套筒，该套筒被定位在破碎机主轴的最上端，并且具体地但不排它地涉及一种具有渐缩壁厚的套筒。

背景技术

[0002] 回转式破碎机用于将矿石、矿物以及岩石材料破碎成较小的尺寸。通常，破碎机包括安装在伸长的主轴上的破碎头。第一破碎壳安装在破碎头上，且第二破碎壳安装在框架上，从而第一和第二破碎壳一起限定破碎间隙，将被破碎的材料通过该破碎间隙。驱动装置被布置用以使偏心组件绕轴的下部旋转，以使破碎头执行回转摆动运动并破碎被导入破碎间隙中的材料。

[0003] US2009/0008489 公开了一种液压可调圆锥破碎机，其中轴向轴承组件包括用于调整破碎机的设置的调整液压缸。US4,919,349 公开了一种具有双重密封结构的回转式破碎机，其利用加压空气和垫片结构来阻止污染物进入破碎机。SU897280 描述了一种圆锥破碎机，其具有止推盖轴承(step cup bearing)，用以吸收和传递破碎头的破碎力。

[0004] 破碎头的回转摆动运动由定位在破碎头下方的下部轴承组件以及对主轴的上端进行止推轴承支撑的上轴承支承。通常，主轴上端由套筒保护以免磨损。一般来说，保护套筒包括筒状几何构造，且经由过盈或摩擦配合而保持在主轴上。然而，这样的结构要求套筒被加热以增大其直径，以便能够安装到主轴上或可从主轴拆卸。

[0005] 在 US1,592,313、US1,748,102、RU718160 以及 RU940837 中公开了保护套筒的示例。

[0006] 然而，常规的保护套筒存在问题。具体而言，如果把加热后的套筒摩擦配合到主轴端部所花的时间过长，则在迫使套筒安装到轴上到达正确的最终位置之前，套筒就冷却且收缩并非是不常见的。另外，拆卸经常也存在问题，这是因为在能够移除套筒之前需要切割套筒。在大的破碎机上，保护套筒具有坚固的壁厚，这种切割操作能够花费大量时间和劳力，且增加了可能损伤轴的风险。要求一种能解决上述问题的主轴套筒。

发明内容

[0007] 本实用新型的一个目的是提供一种用于回转式破碎机主轴的套筒，该套筒允许方便地在轴上连接和分离，以便迅速且便利地组装和拆卸。

[0008] 该目的通过提供一种套筒而完成，该套筒具有朝内面向表面，该朝内面向表面在轴向方向上从第一(下)端到第二(上)端朝向套筒的纵向轴线向内渐缩。本套筒结构构造通过与其与主轴的减缩端部区域直接接触的过盈或摩擦配合结构而固定安装到位。具体而言，套筒的朝内面向表面的锥形轮廓能够滑过相应的锥形主轴端部区域，而不会有套筒在到达其完全配合位置前过早地卡在轴上的风险。在与现有装置一起使用时，本套筒可以在刚好将组装之前被加热，以增大其直径。类似地，为了方便拆卸，热可以被施加到套筒，同时伴随以机械振荡。

[0009] 根据本实用新型的第一方面,提供一种回转式破碎机主轴的套筒,该套筒用于摩擦配合在破碎机主轴的最上端上,该套筒包括:伸长的轴向壁,该轴向壁绕套筒的纵向轴线延伸,所述壁具有定位成与主轴的向外面向表面接触的朝内面向表面和相对于纵向轴线的朝外面向表面,所述壁在朝内面向表面和朝外面向表面之间延伸;所述壁具有定位在主轴的下部区域处的第一端以及定位在主轴的与下部区域相对的上部区域处的第二端;其中,壁在第一端与第二端之间的区域上的厚度在从第二端向第一端的方向上减少;其特征在于:在轴向方向上,在所述区域中的朝内面向表面横向于纵向轴线延伸,以便在从第一端到第二端的方向上朝向轴线向内渐缩。

[0010] 优选地,壁的厚度减少所遍及的区域延伸套筒的大致整个轴向长度。

[0011] 优选地,套筒还包括垂直或横向于轴向壁延伸的径向壁,径向壁定位在第二端处或朝向第二端定位,并朝向纵向轴线向内延伸。可选地,径向壁包括定位在套筒的纵向轴线处的通孔。

[0012] 优选地,朝外面向表面的横截面形状轮廓为大致圆形。优选地,朝内面向表面的横截面形状轮廓为大致圆形。优选地,朝外面向表面的形状轮廓在轴向方向上限定柱体的一部分。优选地,朝内面向表面的形状轮廓在轴向方向上限定锥体的一部分。

[0013] 可选地,套筒包括至少一个凹槽,该至少一个凹槽在朝内面向表面中凹进。此外,该凹槽可以围绕朝内面向表面的区域在周向方向上延伸。可选地,该凹槽沿着朝内面向表面在轴向方向上延伸。可选地,套筒可进一步包括至少一个孔,该至少一个孔被设置成穿过壁,以允许流体穿过到达朝内面向表面。相应地,孔能够允许润滑液通过套筒的主体被导入,以便在套筒的区域处浸润处在套筒的朝内面向表面与主轴的朝外面向表面之间的区域。在套筒包括有位于朝内面向表面的凹槽时,润滑流体能够在凹槽内周向地且轴向地流动,从而完全地润滑套筒和主轴的交界面。

[0014] 可选地,在第一端的区域中,朝内面向表面相对于纵向轴线在朝向朝外面向表面的方向上径向地向外弯曲,以使壁厚在弯曲区域处减少至零。

[0015] 根据本实用新型的第二方面,提供一种回转式破碎机的主轴,包括:轴体,所述轴体具有定位于破碎机的下部区域的第一端以及相对于第一端定位于破碎机的上部区域的第二端;其特征在于:在第二端的区域中,轴体的厚度在主轴的轴向方向上渐缩,以便在截面面积上减小;并且主轴还包括本文详细描述套筒,该套筒摩擦配合在位于主轴的第二端处的渐缩区域上。

[0016] 根据本实用新型的第三方面,提供一种包括本文所述的主轴和套筒的回转式破碎机。

附图说明

[0017] 下面,将参考附图仅举例说明本实用新型的具体实施方式,其中:

[0018] 图1是根据本实用新型的具体实施方式的回转式破碎机的剖面侧视图,该回转式破碎机具有在其上端处由上轴承装置支承的主轴且具有围绕主轴的上端安装的保护套筒;

[0019] 图2是图1的破碎机的上部区域的放大图。

具体实施方式

[0020] 参照图 1,破碎机包括框架 100,框架 100 具有上框架 101 和下框架 102。破碎头 103 安装到伸长的轴 107 上。第一破碎壳 105 可固定地安装在破碎头 103 上,第二破碎壳 106 可固定地安装在上框架 101 上。破碎区 104 形成在相对的破碎壳 105、106 之间。排出区 109 定位在破碎区 104 的正下方,且由下框架 102 部分地限定。

[0021] 上框架 101 进一步划分为顶壳 111 和十字架(spider),顶壳 111 安装在下框架 102 (替代性地称为底壳)上,十字架从顶壳体 111 延伸并且表示破碎机的上部。十字架包括两个沿直径方向相对的臂 110,所述臂 110 从中央盖向外径向地延伸,该中央盖定位在纵向轴线 115 上,纵向轴线 115 大体上延伸通过框架 100 和回转式破碎机。臂 110 通过绕纵向轴线 115 定中心的中间环形凸缘而安装到顶壳 111 的上部区域。通常,臂 110 和顶壳 111 形成单一结构并且被一体地形成。

[0022] 驱动器(未示出)经由驱动轴 108 和适当的齿轮 116 而联接到主轴 107,以便使轴 107 绕纵向轴线 115 偏心地旋转,并且使破碎头 103 执行回转摆动运动并破碎被导入破碎间隙 104 中的材料。轴 113 的上端区域包括轴向锥度,以限定上部锥形部分。锥体 113 在底部到顶部的方向上背离头部 103 向内渐缩。轴 107 的最上端 117 通过顶部轴承组件 112 而保持在轴向可旋转的位置。类似地,轴 107 的下端 118 由底部轴承组件 119 支承。

[0023] 为了避免上部锥形部分 113 过度磨损,大致柱形的磨损套筒 114 安装在轴区域 113 之上并且围绕轴区域 113。套筒 114 通过摩擦配合的过盈而在区域 113 处被保持到位,并且套筒 114 被设置成在套筒 114 的整个轴向长度上紧密触碰接触。相应地,套筒 114 被定位在轴承组件 112 和区域 113 之间,以吸收因回转摆动运动的破碎动作所导致的径向加载力和轴向加载力。

[0024] 参照图 2,套筒 114 包括朝外面向表面 201 和朝内面向表面 200,面 201、200 的定向参照的是延伸通过轴区域 113 和套筒 114 的纵向轴线 115。朝内面向表面 200 被以直接接触的方式固定抵靠锥形区域 113 的朝外面向表面 202。相应地,朝内面向表面 200 从第一端 207 到第二端 208 朝向纵向轴线 115 向内渐缩,其中在正常使用期间,第一端 207 在破碎机中被定位在第二端 208 下方。套筒 114 在第一端 207 和第二端 208 之间的长度上,朝内面向表面 200 和朝外面向表面 201 的横截面形状轮廓为大致圆形。然而,朝外面向表面 201 被布置成大致平行于轴线 115,从而在从外面观察时,套筒 114 包括大致柱形的几何形状。根据该构造,套筒 114 的被限定在相对的表面 200、201 之间的环形轴向壁 209 包括这样的厚度,即:该厚度在从第二上端 208 到第一下端 207 的方向上渐缩并且减小。可以理解的是,为了允许套筒 114 配合成与锥形端部 113 紧密收缩配合接触,内表面 200 的锥角大致等于轴区域 113 的朝外面向表面 202 相对于轴线 115 的锥角。

[0025] 在第一端 207 处,随着朝内面向表面 200 朝向朝外面向表面 201 向外弯曲 204,壁 209 的厚度急剧地减小。该弯曲或尖锐的环形边缘区域 204 构造成紧密接触轴 107 的台肩区域 205,该台肩区域 205 在破碎壳 105 和破碎头 103 的正上方的区域上径向地向外弯曲。

[0026] 轴 107 的最上端 117 通过安装销 206 而保持到位,安装销 206 与轴线 115 对准并且从安装凸起部 207 轴向地向下延伸。凸起部 207 和销 206 与轴端 113 和套筒 114 同轴地定位。

[0027] 径向壁 203 垂直于轴向壁 209 延伸并在第二端 208 处朝向轴线 115 向内定向。设

置穿过径向壁 203 的孔 210, 孔 210 具有足以容纳凸起部 207 的直径, 以使壁 203 从轴向壁 209 围绕凸起部 207 延伸。相应地, 当径向壁 203 被安置成抵靠轴端 117 时, 套筒 114 在整个锥形轴区域 113 上完全地配合到位。在该构造中, 轴向壁 209 定位在上部轴承 112 和轴区域 113 中间。

[0028] 根据具体实施方式, 轴向壁 209 包括这样的厚度, 即: 该厚度从第二端 208 到第一端 207 在套筒 114 的除弯曲的端部区域 204 之外的整个长度上均匀地减少。

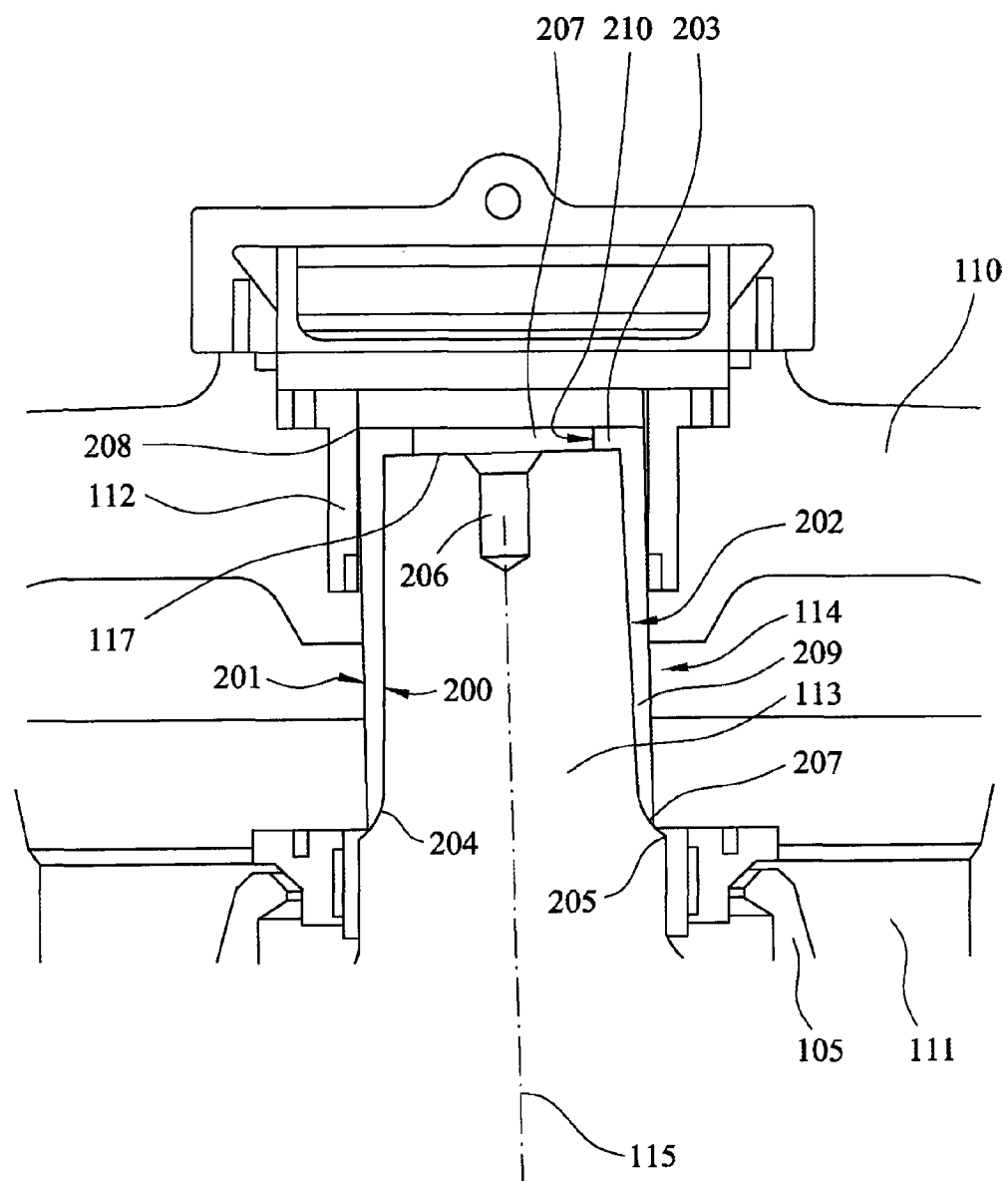


图 2

**Espacenet****Bibliographic data: CN101947476 (A) — 2011-01-19**

Eccentric sleeve mechanism for cone crusher**Inventor(s):** LIBO CHEN ± (CHEN LIBO)**Applicant(s):** CHEN LIHUA ± (CHEN LIHUA, ; CHANGXING CHANGHONG
ROADS AND BRIDGES MINING MACHINERY EQUIPMENT CO)**Classification:** - **international:** **B02C2/04**
- **cooperative:****Application
number:** CN20101288390 20100916**Priority number
(s):** CN20101288390 20100916**Also published
as:** CN101947476 (B)**Abstract of CN101947476 (A)**

The invention discloses an eccentric sleeve mechanism for a cone crusher. The eccentric sleeve mechanism comprises a central sleeve arranged on a frame, wherein an eccentric sleeve is arranged inside the central sleeve; a bearing assembly is arranged between the eccentric sleeve and the central sleeve; an eccentric bushing is arranged inside the eccentric sleeve; a moving cone spindle of the cone crusher passes through the eccentric bushing to be pressed on a supporting seat; a bearing III is arranged between the eccentric bushing and the moving cone spindle; a gear which is in engaged transmission with a bevel gear on a transmission spindle of the cone crusher is arranged at the lower end of the eccentric bushing; and a spherical supporting group is arranged between the lower end of the moving cone spindle and the supporting seat.; Due to the adoption of a three-rolling bearing structure, the eccentric sleeve mechanism for the cone crusher has the advantages of reducing the friction coefficient between the eccentric sleeve and the central sleeve and between the eccentric sleeve and the moving cone spindle, improving the rotating speed of the eccentric sleeve, improving the crushing efficiency and yield of the cone crusher, prolonging the service life of the machine, reducing the using cost of equipment, and guaranteeing sufficient lubrication of the rolling bearings by adopting a mode of simultaneously lubricating up and down by a lubricating channel I and a lubricating channel II.



(12) 发明专利申请

(10) 申请公布号 CN 101947476 A

(43) 申请公布日 2011.01.19

(21) 申请号 201010288390.9

(22) 申请日 2010.09.16

(71) 申请人 陈利华

地址 313103 浙江省长兴县和平镇工业园区

(72) 发明人 陈立波

(74) 专利代理机构 杭州华鼎知识产权代理事务
所(普通合伙) 33217

代理人 胡根良

(51) Int. Cl.

B02C 2/04(2006.01)

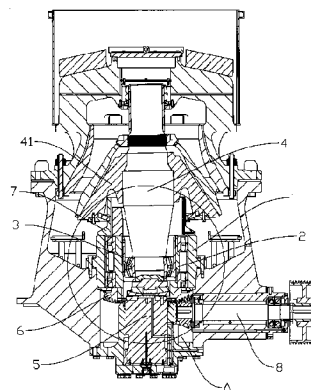
权利要求书 1 页 说明书 3 页 附图 3 页

(54) 发明名称

一种圆锥破碎机用偏心套机构

(57) 摘要

本发明公开了一种圆锥破碎机用偏心套机构,包括设在机架上的中心套筒,中心套筒中设有偏心套,偏心套与中心套筒之间均设有轴承组件,在偏心套中设有偏心衬套,圆锥破碎机的动锥主轴穿过偏心衬套压在支承座上,所述偏心衬套与动锥主轴之间设有轴承 III,偏心套的下端设有与圆锥破碎机传动主轴上锥齿轮啮合传动的齿轮,在动锥主轴的下端与支承座之间设有球面支承组。本发明采用三滚动轴承结构,减小偏心套与中心套筒以及偏心套与动锥主轴之间的摩擦系数,提高偏心套的转速,提供圆锥破碎机破碎效率和产量,并且提高了机器的使用寿命,降低了设备使用成本;采用滑润通道 I 和滑润通道 II 上下同时润滑的方式确保了滚动轴承的充分润滑。



1. 一种圆锥破碎机用偏心套机构,其特征在于:包括设在机架上的中心套筒(1),中心套筒中设有偏心套(2),偏心套与中心套筒之间设有轴承组件 I,在偏心套中设有偏心衬套(3),圆锥破碎机的动锥主轴(4)穿过偏心衬套压在支承座(5)上,所述偏心衬套与动锥主轴之间设有轴承组件 II,偏心套的下端设有与圆锥破碎机传动主轴(8)上锥齿轮(81)啮合传动的齿轮(6),在动锥主轴的下端与支承座之间设有球面支承组。

2. 根据权利要求1所述的一种圆锥破碎机用偏心套机构,其特征在于:所述轴承组件 I 包括设在偏心套外侧面上端的轴承 I(21)和设在偏心套外侧面上端的轴承 II(22),偏心套外侧面上设有定位轴承 I 内圈下端和轴承 II 内圈上端的环形凸起(23),在中心套筒中设有定位轴承 I 外圈下端和轴承 II 外圈上端的间隔环(24),在中心套筒上方设有定位轴承 I 上端的连接筒(7),轴承 II 内圈下端通过齿轮定位,在偏心套下端面上设有定位轴承 II 外圈下端的轴承挡圈(25)。

3. 根据权利要求2所述的一种圆锥破碎机用偏心套机构,其特征在于:所述轴承挡圈通过螺钉(26)固定在偏心套下端面上。

4. 根据权利要求2所述的一种圆锥破碎机用偏心套机构,其特征在于:所述连接筒定位在圆锥破碎机的动锥体(41)上,在连接筒中设有润滑通道 I(71)。

5. 根据权利要求1所述的一种圆锥破碎机用偏心套机构,其特征在于:所述轴承组件 II 包括安装在动锥主轴上的轴承 III(42),动锥主轴上设有定位轴承 III 上端的台阶(43),在动锥主轴下端的轴头上设有定位轴承 III 下端的轴套(44),轴套抵在球面轴承组上。

6. 根据权利要求1或5所述的一种圆锥破碎机用偏心套机构,其特征在于:所述球面支承组包括与动锥主轴下端的轴头连接的连接块(51),设在连接块上的球面支承上片(52)和设在支承座上的球面支承下片(53),以及设在球面支承上片和球面支承下片之间的球面支承中片(54),在球面支承上片的下表面设有外凸球面 I(521),在球面支承下片的上表面设有外凸球面 II(531),在球面支承中片的上表面设有与外凸球面 I 配合的内凹球面 I(541),在球面支承中片的下表面设有与外凸球面 II 配合的内凹球面 II(542)。

7. 根据权利要求5所述的一种圆锥破碎机用偏心套机构,其特征在于:所述轴承 III 与动锥主轴锥面配合。

8. 根据权利要求1所述的一种圆锥破碎机用偏心套机构,其特征在于:所述偏心衬套与偏心套间隙配合。

9. 根据权利要求1或2所述的一种圆锥破碎机用偏心套机构,其特征在于:所述中心套筒外侧壁上水平设有安装耳(11),安装耳上设有安装孔(12),中心套筒通过螺栓(13)穿过安装孔固定在机架上。

10. 根据权利要求1或2所述的一种圆锥破碎机用偏心套机构,其特征在于:所述支承座上设有润滑通道 II(55)。

一种圆锥破碎机用偏心套机构

技术领域

[0001] 本发明涉及圆锥破碎机的组成部件,特别是一种圆锥破碎机用偏心套机构。

背景技术

[0002] 偏心套机构是圆锥破碎机的关键组件之一,其主要作用是驱动动锥体旋转摆动,并对动锥体起支撑作用。目前,国内圆锥破碎机的偏心套机构一般都采用铜质偏心套的结构形式,偏心套与动锥主轴以及机架中心套间是滑动的运动形式。因此,偏心铜套与机架上的中心套筒以及动锥体主轴之间的转动转速受到限制,转速难以提高,降低了圆锥破碎机工作效率和生产能力;滑动摩擦的摩擦系数远大于滚动摩擦的摩擦系数,因而偏心套与机架上的中心套筒以及偏心铜套与动锥主轴之间的磨损大,降低了机器的使用寿命,增加了机器的使用成本。

发明内容

[0003] 本发明所要解决的问题就是提供一种结构新颖、独特的圆锥破碎机用偏心套机构,运转平稳,提高偏心套的转速,从而提高圆锥破碎机的破碎效率和产量,还提高了机器的使用寿命,降低了设备使用成本。

[0004] 为了解决上述技术问题,本发明采用如下技术方案:一种圆锥破碎机用偏心套机构,其特征在于:包括设在机架上的中心套筒,中心套筒中设有偏心套,偏心套与中心套筒之间设有轴承组件 I,在偏心套中设有偏心衬套,圆锥破碎机的动锥主轴穿过偏心衬套压在支承座上,所述偏心衬套与动锥主轴之间设有轴承组件 II,偏心套的下端设有与圆锥破碎机传动主轴上锥齿轮啮合传动的齿轮,在动锥主轴的下端与支承座之间设有球面支承组。

[0005] 进一步的,所述轴承组件 I 包括设在偏心套外侧面上端的轴承 I 和设在偏心套外侧面上端的轴承 II,偏心套外侧面上设有定位轴承 I 内圈下端和轴承 I 内圈上端的环形凸起,在中心套筒中设有定位轴承 I 外圈下端和轴承 II 外圈上端的间隔环,在中心套筒上方设有定位轴承 I 上端的连接筒,轴承 II 内圈下端通过齿轮定位,在偏心套下端面上设有定位轴承 II 外圈下端的轴承挡圈。

[0006] 进一步的,所述轴承挡圈通过螺钉固定在偏心套下端面上。

[0007] 进一步的,所述连接筒定位在圆锥破碎机的动锥体上,在连接筒中设有润滑通道 I。

[0008] 进一步的,所述轴承组件 II 包括安装在动锥主轴上的轴承 III,动锥主轴上设有定位轴承 III 上端的台阶,在动锥主轴下端的轴头上设有定位轴承 III 下端的轴套,轴套抵在球面轴承组上。

[0009] 进一步的,所述球面支承组包括与动锥主轴下端的轴头连接的连接块,设在连接块上的球面支承上片和设在支承座上的球面支承下片,以及设在球面支承上片和球面支承下片之间的球面支承中片,在球面支承上片的下表面设有外凸球面 I,在球面支承下片的上

表面设有外凸球面 II,在球面支承中片的上表面设有与外凸球面 I 配合的内凹球面 I,在球面支承中片的下表面设有与外凸球面 II 配合的内凹球面 II。

[0010] 进一步的,所述轴承 III 与动锥主轴锥面配合。

[0011] 进一步的,所述偏心衬套与偏心套间隙配合。

[0012] 进一步的,所述中心套筒外侧壁上水平设有安装耳,安装耳上设有安装孔,中心套筒通过螺栓穿过安装孔固定在机架上。

[0013] 进一步的,所述支承座上设有润滑通道 II。

[0014] 采用上述技术方案后,本发明具有如下优点:采用三滚动轴承结构,减小偏心套与机架上的中心套筒以及减小偏心套与动锥主轴之间的摩擦系数,提高偏心套的转速,提供圆锥破碎机破碎效率和产量,并且提高了机器的使用寿命,降低了设备使用成本;采用润滑通道 I 和润滑通道 II 上下同时润滑的方式确保了滚动轴承的充分润滑。

附图说明

[0015] 下面结合附图对本发明作进一步说明:

[0016] 图 1 为本发明一种实施例的结构示意图;

[0017] 图 2 为图 1 中 A 处放大图;

[0018] 图 3 为球面支承组的结构示意图。

具体实施方式

[0019] 如图 1、2 和 3 所示本发明一种实施例的结构示意图,一种圆锥破碎机用偏心套机构,包括设在机架上的中心套筒 1,中心套筒外侧壁上水平设有安装耳 11,安装耳上设有安装孔 12,中心套筒通过螺栓 13 穿过安装孔固定在机架上,中心套筒中设有偏心套 2,偏心套与中心套筒之间均设有轴承组件 I,在偏心套中设有偏心衬套 3,圆锥破碎机的动锥主轴 4 穿过偏心衬套压在支承座 5 上,支承座上设有润滑通道 II55,偏心衬套与动锥主轴之间设有轴承组件 II,偏心套的下端设有与圆锥破碎机传动主轴 8 上锥齿轮 81 啮合传动的齿轮 6,在动锥主轴的下端与支承座之间设有球面支承组。

[0020] 所述轴承组件 I 包括设在偏心套外侧面上端的轴承 I21 和设在偏心套外侧面下端的轴承 II22,偏心套外侧面上设有定位轴承 I 内圈下端和轴承 II 内圈上端的环形凸起 23,在中心套筒中设有定位轴承 I 外圈下端和轴承 II 外圈上端的间隔环 24,在中心套筒上方设有定位轴承 I 上端的连接筒 7,轴承 II 内圈下端通过齿轮定位,在偏心套下端面上设有定位轴承 II 外圈下端的轴承挡圈 25,轴承挡圈通过螺钉 26 固定在偏心套下端面上,连接筒固定在圆锥破碎机的动锥体 41 上,连接筒中设有润滑通道 I71。所述轴承组件 II 包括安装在动锥主轴上的轴承 III42,动锥主轴上设有定位轴承 III 上端的台阶 43,在动锥主轴下端的轴头上设有定位轴承 III 下端的轴套 44,轴套抵在球面轴承组上。

[0021] 所述球面支承组包括与动锥主轴下端的轴头连接的连接块 51,设在连接块上的球面支承上片 52 和设在支承座上的球面支承下片 53,以及设在球面支承上片和球面支承下片之间的球面支承中片 54,在球面支承上片的下表面设有外凸球面 I521,在球面支承下片的上表面设有外凸球面 II531,在球面支承中片的上表面设有与外凸球面 I 配合的内凹球面 I541,在球面支承中片的下表面设有与外凸球面 II 配合的内凹球面 II542。将支承组中

三个组成片中相互配合的端面加工成球面结构形式,球面结构具有自动对中作用,并且加强润滑,减少了球面支承片之间的摩擦阻力,提高了使用寿命。

[0022] 上述实施例中,偏心衬套与偏心套间隙配合,轴承 111 与动锥主轴锥面配合。

[0023] 本发明采用三滚动轴承结构,减小偏心套与机架上的中心套筒以及减小偏心套与动锥主轴之间的摩擦系数,提高偏心套的转速,提供圆锥破碎机破碎效率和产量,并且提高了机器的使用寿命,降低了设备使用成本;采用润滑通道 I 和润滑通道 II 上下同时润滑的方式确保了滚动轴承的充分润滑,如图 2 中虚线 I 和虚线 II 分别示意了润滑通道 I 和润滑通道 II 中润滑油流向。

[0024] 除上述优选实施例外,本发明还有其他的实施方式,本领域技术人员可以根据本发明作出各种改变和变形,只要不脱离本发明的精神,均应属于本发明所附权利要求所定义的范围。

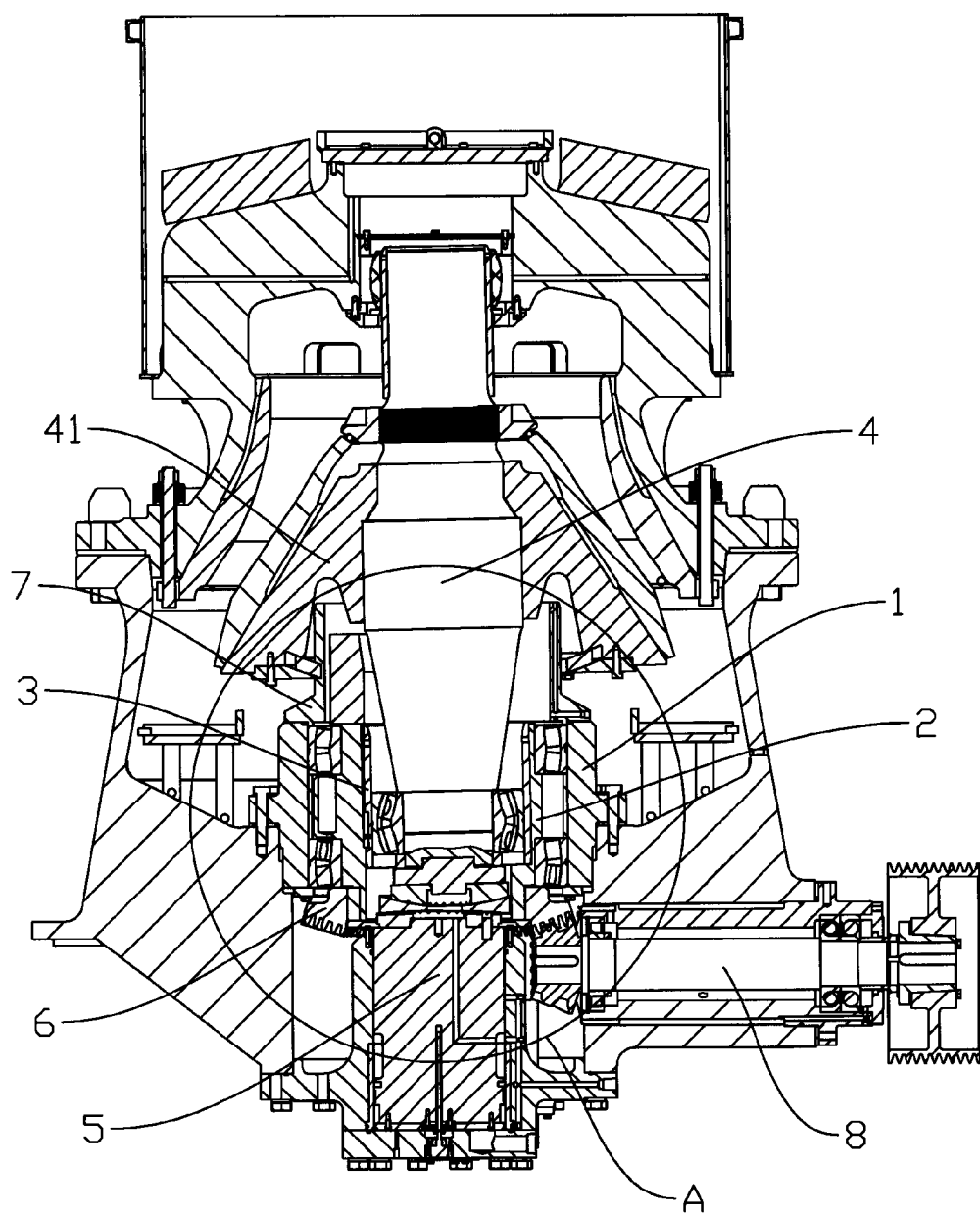


图 1

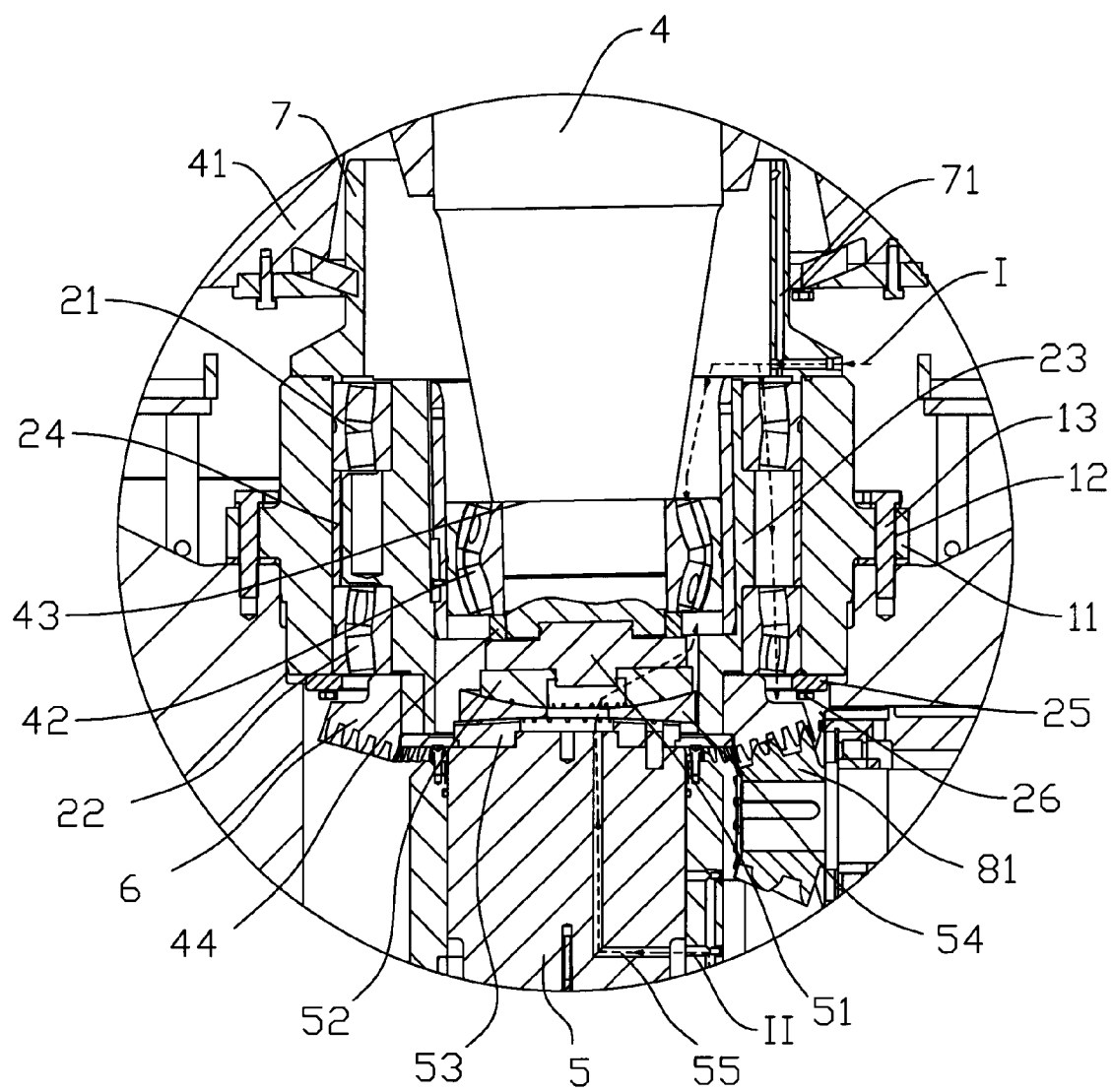


图 2

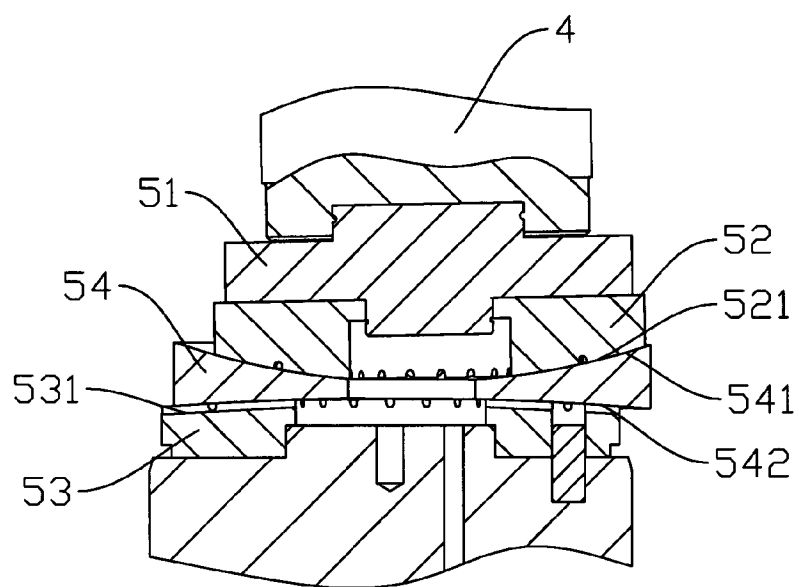


图 3

**Espacenet****Bibliographic data: CN2212448 (Y) — 1995-11-15**

Screw propelling type cone crusher

Inventor(s): RENFA SHAO [CN] ± (SHAO RENFA)
Applicant(s): SHAO RENFA [CN] ± (SHAO RENFA)
Classification: - **international:** *B02C2/06*; (IPC1-7): B02C2/06
- **cooperative:**
Application number: CN1994248443U 19941222
Priority number(s): CN1994248443U 19941222

Abstract of CN2212448 (Y)

The utility model relates to a screw propelling type cone crusher, which is used for crushing raw materials in the industries, such as the manufacture of building materials, the chemical industry, the metallurgy, the coal, the mining, etc. The utility model is characterized in that the screw propelling type cone crusher is composed of a fixed cone, a moving cone lining board with a screw, a spiral pressing cover, a moving cone, an eccentric shaft, a transmission system, etc. When the raw materials are crushed, the screw propelling type cone crusher can propel the raw materials through making use of the screw. Accordingly, the blocking phenomenon can not be generated; the condition is particularly favorable to crush the raw materials with higher crushing water content and greater viscosity, and the raw materials can be combined with the stirring function and the mixing function. Meanwhile, the internal part of the transmission system adopts a rolling bearing, and accordingly, the screw propelling type cone crusher has simple structure.



[12] 实用新型专利说明书

[21] ZL 专利号 94248443.6

[51]Int.Cl⁶

B02C 2/06

[45]授权公告日 1995 年 11 月 15 日

[22]申请日 94.12.22 [24]颁证日 95.10.15

[73]专利权人 邵仁发

地址 710003陕西省西安市北大街131号

[72]设计人 邵仁发

[21]申请号 94248443.6

[74]专利代理机构 西安市专利事务所

代理人 钟淑云 郭寅生

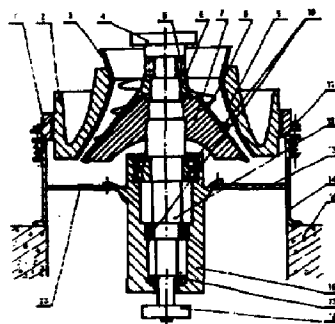
说明书页数:

附图页数:

[54]实用新型名称 螺旋推进式圆锥破碎机

[57]摘要

本实用新型涉及的是属于建材、化工、冶金、煤炭、矿山等行业破碎原料的螺旋推进式圆锥破碎机。它的结构特点在于螺旋推进式圆锥破碎机由定锥、带螺旋的动锥衬板、螺旋压盖、动锥、偏心轴和传动系统等组成。该机在破碎原料时,利用螺旋对原料进行推进,因此不会出现堵塞现象,这对于破碎含水率较高或粘性较大的原料特别有利,还对原料兼有搅拌和混合的功能。同时,传动系统中采用了滚动轴承,因而结构简单。



(BJ)第 1452 号

权 利 要 求 书

1、一种螺旋推进式圆锥破碎机，包括固定于机架上的定锥(2)和装配在偏心轴(12)上的动锥(7)，其特征在于：动锥(7)外表面上安装带有叶片的动锥螺旋衬板(8)，与固定在定锥(2)内表面上的定锥衬板(9)作偏心螺旋推进破碎配合，安装于偏心轴(12)上的动锥(7)、螺旋压盖(6)、锁紧螺帽(5)通过调心滚子轴承(10)和推力轴承(17)座落在轴承套筒(16)上。

2、根据权利要求1所述的螺旋推进式圆锥破碎机，其特征在于：螺旋压盖(6)与动锥螺旋衬板(8)上设有单线或多线的连续螺旋叶面。

3、根据权利要求1所述的螺旋推进式圆锥破碎机，其特征在于：还可以在偏心轴(12)中部装配大圆锥齿轮(19)，传动轴架(22)内通过滚动轴承装配传动轴(21)，传动轴(21)的一端装配皮带轮(18)，另端固定有小圆锥齿轮(20)与大圆锥齿轮(19)啮合。

螺旋推进式圆锥破碎机

本实用新型涉及的是应用旋回破碎机或圆锥破碎机的破碎和粉碎，具体地说是一种螺旋推进式圆锥破碎机。

目前使用的圆锥破碎机都由动锥与定锥构成，当作旋摆运动的动锥周期地靠近或离开定锥表面时，使进入破碎腔里的原料不断地受挤压和弯曲作用而破碎，被破碎了的原料靠自身重量从两锥体底部排出，但是，若遇原料含水率较高或粘性较大，则容易出现堵塞现象，降低了生产率。

本实用新型的目的在于避免上述现有技术中的不足之处，而提供一种具有强制输送原料，不会出现堵塞现象，并兼有对原料进行搅拌混合作用的螺旋推进式圆锥破碎机。

本实用新型的目的可以通过以下措施来达到：

一种螺旋推进式圆锥破碎机，包括固定于机架上的定锥2和装配在偏心轴12上的动锥7，其特熟之处在于，动锥7外表面上安装带有叶片的动锥螺旋衬板8，与固定在定锥2内表面上的定锥衬板9作偏心螺旋推进破碎配合，安装于偏心轴12上的动锥7、螺旋压盖6、锁紧螺帽5通过调心滚子轴承10和推力轴承17座落在轴承套筒16上。

本实用新型的螺旋压盖6可与动锥螺旋衬板8上设有单线或多线的连续螺旋叶面。

本实用新型还可以在偏心轴12中部装配大圆锥齿轮19，传动轴架22内通过滚动轴承装配传动轴21，传动轴21的一端装配皮带轮18，另端固定有小圆锥齿轮20与大圆锥齿轮19啮合。

附图与附图说明：

图1为本实用新型剖面结构示意图。

图2为本实用新型另一种传动结构局部剖面结构示意图。

图中：1- 支承套，2- 定锥，3- 漏斗，4- 分料盘，5 - 锁紧螺帽，6- 螺旋压盖，7- 动锥，8- 动锥螺旋衬板，9- 定锥衬板，10- 调心滚子轴承，11- 弹簧保护装置，12- 偏心轴，13- 支撑板，14- 机架，15- 基础，16- 偏心轴轴承套筒，17- 推力轴承，18- 皮带轮，19- 大圆锥齿轮，20- 小圆锥齿轮，21- 传动轴，22- 传动轴架，23- 卸料孔。

本实用新型下面将结合附图实施例作进一步详述：

如附图1所示，螺旋推进式圆锥破碎机中定锥2为铸铁或铸钢铸成通过螺纹与支承套1连接，并经弹簧保护装置11与机架14 连接，坐落在混凝土结构的基础15上。动锥7也为铸铁或铸钢材质，用键与偏心轴12连接，动锥螺旋衬板8由铸造而成， 由螺栓与动锥7固定。螺旋压盖6用键与偏心轴12连接，对动锥螺旋衬板8 起压紧作用。锁紧螺帽5对螺旋压盖6和动锥7起锁紧作用， 使其不致产生轴向窜动。分料盘4 用螺栓与偏心轴12固定，动锥7、 动锥螺旋衬板8、螺旋压盖6及偏心轴12等均由底部的偏心轴轴承套筒16，调心滚子轴承10和推力轴承17支撑，由调心滚子轴承10和推力轴承17的组合来承受破碎载荷。偏心轴轴承套筒16由螺栓固定于支撑板13上，与机架14 焊为一体的支撑板13 上开有卸料孔23，弹簧保护装置11通过长螺杆和弹簧把支承套1与机架14 连在一起。

如附图1所示传动系统也可用附图2来代替，偏心轴12中部用

键与大圆锥齿轮19装配，小圆锥齿轮20也是用键与传动轴21连接，固定的小圆锥齿轮20与大圆锥齿轮19啮合，传动轴架22一边用螺栓与偏心轴轴承筒16连接，另一边用螺栓固定于基础15上。传动轴21后固定皮带轮18。

本实用新型的工作过程为：

当电动机通过皮带带动皮带轮18旋转时，偏心轴12旋转，动锥7随偏心轴12一起作偏心运动。需破碎的原料先落到分料盘4上，再经旋转的分料盘4均匀落到漏斗3内，进入定锥衬板9与动锥螺旋衬板8之间的破碎腔。当作偏心运动的动锥7的一边靠近定锥2时，原料处于被挤压和破碎状态，借助于螺旋压盖6和动锥螺旋衬板8对原料的螺旋推进，被破碎了的原料将很容易通过两锥体的底部卸料孔23排出，而不会出现原料在破碎腔内的堵塞现象，同时还起到搅拌和混合作用。

机架周围的弹簧保护装置11是保护破碎机不受破坏的保险装置。当破碎机掉入非破碎物时，由于破碎力急增，弹簧受迫压缩，此时支承套1和定锥2一起向上抬起，动锥7和定锥2之间距离加大，从而使掉入的非破碎物经动锥和定锥底部的排料口排出，然后支承套1和定锥2又借助弹簧的张力恢复原位。

调整定锥2与动锥7之间的距离即调整排料口的尺寸是借助于定锥2与支承套1间的锯齿形螺纹升、降定锥衬板9来实现的。为了使在破碎过程中锯齿螺纹间不产生上下或圆周方向的相对运动，在支承套1和定锥2间用螺栓固定锁紧止动装置。

本实用新型与现有技术相比具有以下优点：

1、由于在动锥表面增设了螺旋叶面强制输送原料，因而不

会出现堵塞现象，有利于破碎含水率较高或粘性较大物料的粉碎，同时具有搅拌和混合原料的功能。

2、本实用新型的传动系统中均采用了滚动轴承，因而结构简单，便于推广。

说明书附图

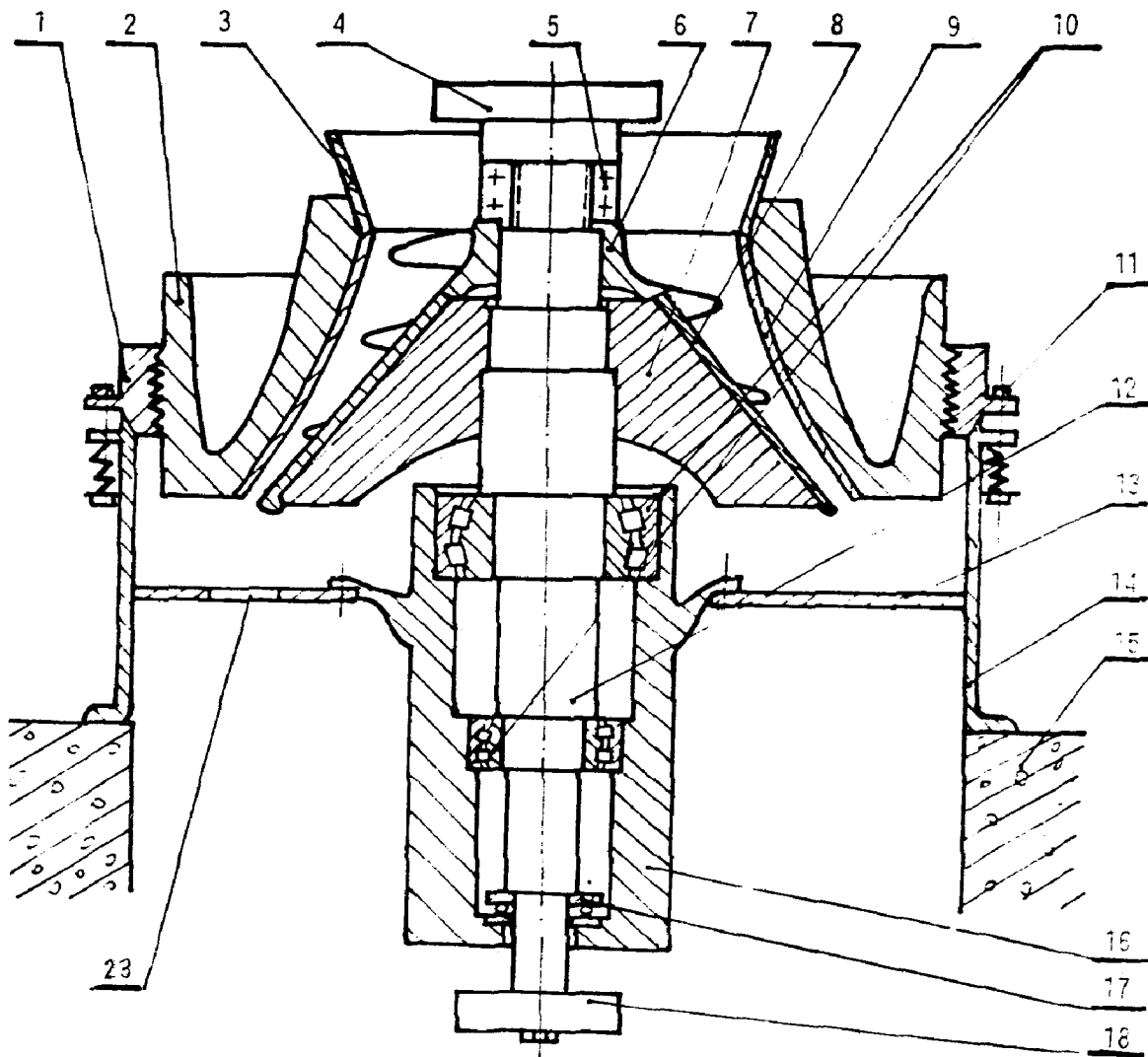


图 1

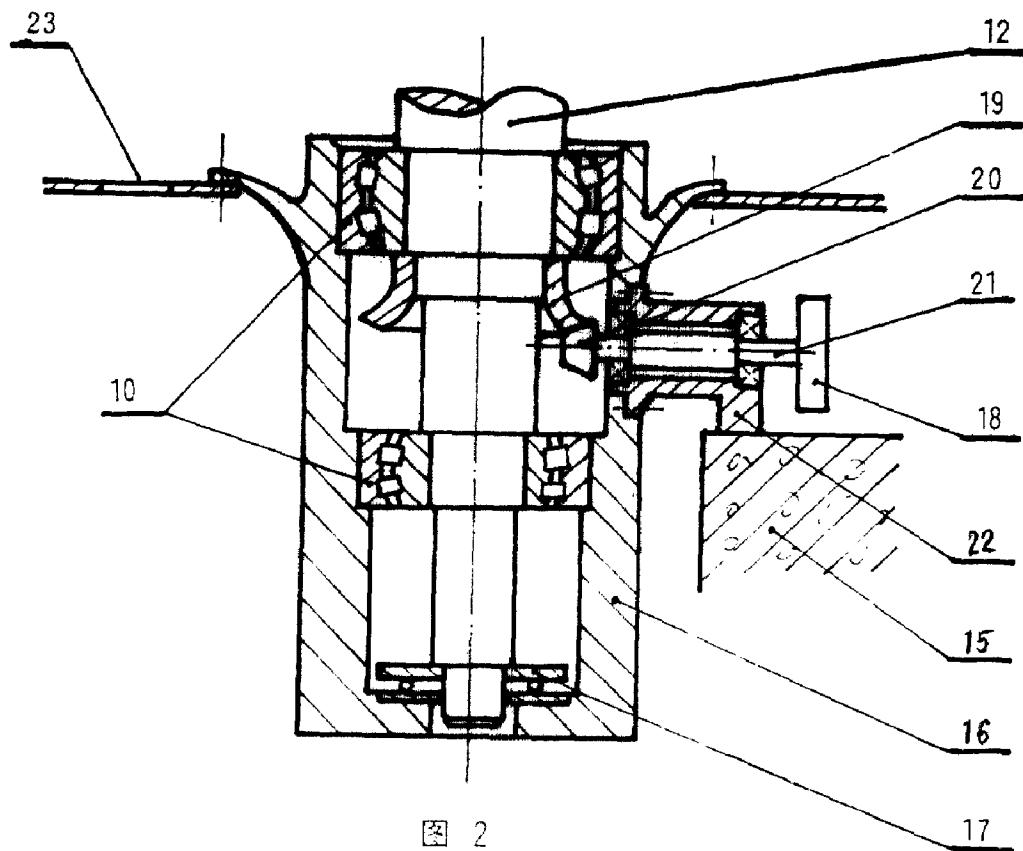


图 2

Electronic Acknowledgement Receipt

EFS ID:	26948090
Application Number:	14418535
International Application Number:	
Confirmation Number:	2984
Title of Invention:	GYRATORY CRUSHER MAIN SHAFT SLEEVE
First Named Inventor/Applicant Name:	Niklas Aberg
Customer Number:	78686
Filer:	Corinne R. Gorski
Filer Authorized By:	
Attorney Docket Number:	SMC 13979 WOUS
Receipt Date:	16-SEP-2016
Filing Date:	30-JAN-2015
Time Stamp:	13:01:53
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	13979WOUSIDS2.pdf	626526	no	4
			de43f7fdc5d02bb8a942a5f03998b6db1c7d0732		

Warnings:

Information:					
2	Foreign Reference	SE421864.pdf	952478	no	13
			4d84a4b78a70008d230296b80a0ad30840710e14		
Warnings:					
Information:					
3	Foreign Reference	CN203678427.pdf	888344	no	11
			35524b94d6db24f3bac25c5eae8390cbc654259d		
Warnings:					
Information:					
4	Foreign Reference	CN101947476.pdf	747633	no	10
			fdefcba02cd07a83290734cb054fde317558f15d		
Warnings:					
Information:					
5	Foreign Reference	CN2212448.pdf	599653	no	9
			237496b50b3382a3ccd4366c4b728dod70a184ee		
Warnings:					
Information:					
Total Files Size (in bytes):			3814634		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/418,535	01/30/2015	Niklas Aberg	SMC 13979 WOUS	2984

78686 7590 04/19/2017
Sandvik/Diamond Innovations
6325 Huntley Road
Worthington, OH 43085

EXAMINER

FRANCIS, FAYE

ART UNIT	PAPER NUMBER
----------	--------------

3725

NOTIFICATION DATE	DELIVERY MODE
-------------------	---------------

04/19/2017

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

corinne.gorski@sandvik.com
patents@sandvik.com
ken.ripple@sandvik.com

Office Action Summary	Application No. 14/418,535	Applicant(s) ABERG ET AL.	
	Examiner FAYE FRANCIS	Art Unit 3725	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 1/30/15.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

- 5) ☒ Claim(s) 1-15 is/are pending in the application.
5a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 6) ☐ Claim(s) _____ is/are allowed.
- 7) ☒ Claim(s) 1-15 is/are rejected.
- 8) ☐ Claim(s) _____ is/are objected to.
- 9) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☒ The drawing(s) filed on 1/30/15 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☒ All b) ☐ Some** c) ☐ None of the:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date attached.
- 3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 4) ☐ Other: _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Drawings

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the subject matter of claims 9-11 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

3. The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-15 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

The recitation of “A gyratory crusher main shaft sleeve” in the preamble of claim 1, renders the claim indefinite, since the body of the claim does not provide any positive limitation to a crusher or a main shaft. This is especially confusing since in the last paragraph, it appears that the applicant is defining the orientation of the sleeve by positioning it in a certain to upper and lower regions of the main shaft when no shaft has been positively claimed. Also, how is “gyratory crusher main shaft sleeve” different from a sleeve/cover per se? Note also claims 14 and 15 with similar regard.

Several expressions recited in the claims lack sufficient antecedent bases. **For example only**, the phrase “the sleeve” in line 2 and “the wall” in line 4 of claim 1 lacks proper antecedent basis. In another example only, the phrase “the crusher” in line 2, “the main shaft” in line 5 and “the wall” in line 9 of claim 14 also lacks proper antecedent basis. In yet another example only, the phrase “the groove” in line 1 of claims 10-11 lacks proper antecedent basis. In a fourth example only, note the expression “the wall”

Art Unit: 3725

in claim 15. These expressions make it difficult to determine what is or not in the claims. Accordingly the applicant is requested to review all of the claims for the purpose of making corrections wherever appropriate but not specifically pointed to, in order to provide appropriate antecedents and to ensure consistency in the numbers of specific elements recited in the claims.

In this office action the examiner take the positions that all the claims are directed to a gyratory crusher having a main shaft and a shaft sleeve.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claim(s) 1-8 and 9-11 is/are rejected as best understood under pre-AIA 35 U.S.C. 102b as being anticipated by Coxhill (4,037,800).

The claims are interpreted as best understood by the examiner. The claims are interpreted as requiring a gyratory crusher 10, a main shaft 33 and a sleeve 36 having first and second end with a decreasing thickness between the first and second ends. Coxhill is considered to clearly show a device having the structural elements of the claims that can be understood.

7. Claim(s) 1-8 and 9-11 is/are rejected as best understood under pre-AIA 35 U.S.C. 102b as being anticipated by Sanborn (1,402,255).

The claims are interpreted as best understood by the examiner. The claims are interpreted as requiring a gyratory crusher, a main shaft 15 and a sleeve/bushing 16 having first and second end with a decreasing thickness between the first and second ends. Sanborn is considered to clearly show a device having the structural elements of the claims that can be understood (page 1 lines 80-103).

Claim Rejections - 35 USC § 103

8. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

10. Claims 9-11 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over either Coxhill or Sanborn in view of Gunnarsson et al.

Art Unit: 3725

Either Coxhill or Sanborn discloses most of the elements of these claims but for the groove.

Gunnarsson et al is cited to show desirability, in the relevant art, to provide a gyratory crusher with ducts 50 and groove 52 in order to lead the lubricating oil to the crusher. It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the device of either Coxhill or Sanborn with the groove as taught by Gunnarsson et al for lubricating the crusher shaft.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to FAYE FRANCIS whose telephone number is (571)272-4423. The examiner can normally be reached on M-F 8:30-5:00.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shelley Self can be reached on 571-272-4524. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 3725

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Faye Francis/
Primary Examiner
Art Unit 3725

FF

Notice of References Cited	Application/Control No. 14/418,535		Applicant(s)/Patent Under Reexamination ABERG ET AL.	
	Examiner FAYE FRANCIS		Art Unit 3725	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-3,539,119 A	11-1970	COOK EUGENE B	B02C2/047	241/215
*	B	US-3,813,047 A	05-1974	Torrence; James D.	B02C2/06	241/211
*	C	US-4,037,800 A	07-1977	Coxhill; Major	B02C2/06	241/213
*	D	US-4,060,205 A	11-1977	Pollak; Robert J.	B02C2/047	138/26
*	E	US-5,152,468 A	10-1992	Virtamo; Jussi	B02C2/06	241/213
*	F	US-5,820,045 A	10-1998	Karra; Vijia Kumar	B02C2/00	241/207
*	G	US-6,446,892 B1	09-2002	Fasoli; Ralph	B02C2/04	241/207
*	H	US-2011/0006143 A1	01-2011	Gunnarsson; Johan	B02C2/04	241/215
*	I	US-8,646,713 B2	02-2014	Belotserkovskiy; Konstantin	B02C2/042	241/207
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Doc code: IDS

PTO/SB/08a (01-10)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14418535	
	Filing Date		2015-01-30	
	First Named Inventor	ABERG		
	Art Unit			
	Examiner Name			
	Attorney Docket Number		SMC 13979WOUS	

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/F.F/	1	4065064	A	1977-12-27	JAMES	

If you wish to add additional U.S. Patent citation information please click the Add button.

Add

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button.

Add

FOREIGN PATENT DOCUMENTS								Remove
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T ⁵
/F.F/	1	203678427	CN	U	2014-07-02	ABERG ET AL		×
/F.F/	2	2212448	CN	Y	1995-11-15	SHAO		☒
/F.F/	3	101947476	CN	A	2011-01-19	CHEN		☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	14418535
Filing Date	2015-01-30
First Named Inventor	ABERG
Art Unit	
Examiner Name	
Attorney Docket Number	SMC 13979WOUS

/F.F/	4	421864	SE	B	1982-02-28	VANOV ET AL	☒
-------	---	--------	----	---	------------	-------------	-------------------------------------

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1		

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature	/FAYE FRANCIS/	Date Considered	04/12/2017
--------------------	----------------	-----------------	------------

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	14418535		
Filing Date	2015-01-30		
First Named Inventor	ABERG		
Art Unit			
Examiner Name			
Attorney Docket Number	SMC 13979WOUS		

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Corinne Gorski/	Date (YYYY-MM-DD)	2016-09-16
Name/Print	Corinne Gorski	Registration Number	34339

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Doc code: IDS

PTO/SB/08a (01-10)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number			
	Filing Date			
	First Named Inventor	ABERG		
	Art Unit			
	Examiner Name			
	Attorney Docket Number	SMC 13979WOUS		

U.S.PATENTS						Remove		
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear		
/F.F/	1	5934583	A	1999-08-10	JEAN CHENG-SHU			
/F.F/	2	4027825	A	1977-06-07	COXHILL MAJOR			
/F.F/	3	1402255		1922-01-03	SANBORN			
If you wish to add additional U.S. Patent citation information please click the Add button.						Add		
U.S.PATENT APPLICATION PUBLICATIONS						Remove		
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear		
/F.F/	1	20020088885	A1	2002-07-11	VAN MULLEM ALBERT ET AL			
If you wish to add additional U.S. Published Application citation information please click the Add button.						Add		
FOREIGN PATENT DOCUMENTS						Remove		
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ² i	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	10346475	DE	B3	2005-03-10	EUROCOPTER DEUTSCHLAND		☒

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		
Filing Date		
First Named Inventor	ABERG	
Art Unit		
Examiner Name		
Attorney Docket Number	SMC 13979WOUS	

/F.F/	2	371447	DE	C	1923-03-15	SMITH ENGINEERING	☒
/F.F/	3	1031679	GB		1966-06-02	GHIАЗZA	☐
/F.F/	4	681942	DE	C	1939-10-04	MEISTER	☒

If you wish to add additional Foreign Patent Document citation information please click the Add button **Add**

NON-PATENT LITERATURE DOCUMENTS
Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

EXAMINER SIGNATURE

Examiner Signature	/FAYE FRANCIS/	Date Considered	04/12/2017
--------------------	----------------	-----------------	------------

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)

Application Number		
Filing Date		
First Named Inventor	ABERG	
Art Unit		
Examiner Name		
Attorney Docket Number	SMC 13979WOUS	

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

- ☐ See attached certification statement.
- ☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.
- ☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Corinne Gorski/	Date (YYYY-MM-DD)	2015-01-30
Name/Print	Corinne Gorski	Registration Number	34339

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L3	0	("1402255").URPN.	USPAT	OR	OFF	2017/04/13 13:35
L4	0	("1402255").URPN.	USPAT; USOCR	OR	OFF	2017/04/13 13:36
L5	1	("1402255").PN.	USOCR	OR	OFF	2017/04/13 13:36
L6	15	("2787424" "2833486" "3133707" "3140834" "3539119").PN. OR ("4027825").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/13 13:49
L7	406	(241/215).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/13 14:03
L8	28	L7 and (bushing near5 shaft)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/13 14:03
L9	74	L7 and (sleeve near5 shaft)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/13 14:59
S1	7	((("ABERG") near3 ("Niklas"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/12 10:39
S2	51	((("ERIKSSON") near3 ("Bengt-Arne"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/12 10:39
S3	1	((("ROSDAHL") near3 ("Fredrik"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/12 10:39
S4	1036	B02C2/005.cpc.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2017/04/12 10:42
S5	1164	B02C2/06.cpc.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2017/04/12 10:42
S6	5	("4065064" "5934583" "1402255" "4027825" "2002008885").PN.	US-PGPUB; USPAT	OR	OFF	2017/04/12 10:49
S7	321	B02C2/00.cpc.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2017/04/12 10:51
S8	206	(241/209).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/12 10:51
S9	59	(241/210).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/12 10:51
S11	585	(241/207).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	2017/04/12 10:52

			JPO; DERWENT; IBM_TDB			
S12	120	(241/213).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/12 16:39
S13	406	(241/215).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/12 16:40
S14	118	S13 and sleeve	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/12 16:41

4/ 13/ 2017 6:14:13 PM
C:\ Users\ ffrancis\ Documents\ EAST\ Workspaces\ 14418535.wsp

Search Notes 	Application/Control No. 14418535	Applicant(s)/Patent Under Reexamination ABERG ET AL.
	Examiner FAYE FRANCIS	Art Unit 3725

CPC- SEARCHED		
Symbol	Date	Examiner
B02C2/005, 06, 00	4/13/2017	

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
241	215, 209	4/13/2017	FF

SEARCH NOTES		
Search Notes	Date	Examiner
B02C2/005, 06, 00	4/13/2017	

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

--	--

<i>Index of Claims</i> 	Application/Control No. 14418535	Applicant(s)/Patent Under Reexamination ABERG ET AL.
	Examiner FAYE FRANCIS	Art Unit 3725

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant		☐ CPA		☐ T.D.		☐ R.1.47			
CLAIM		DATE							
Final	Original	04/14/2017							
	1	✓							
	2	✓							
	3	✓							
	4	✓							
	5	✓							
	6	✓							
	7	✓							
	8	✓							
	9	✓							
	10	✓							
	11	✓							
	12	✓							
	13	✓							
	14	✓							
	15	✓							

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	
	)	Confirmation No.: 2984
Niklas ABERG	)	
	)	
Application No.: 14/418535	)	Examiner: Faye Francis
	)	
Filed: January 30, 2015	)	
	)	
For: GYRATORY CRUSHER MAIN	)	Group Art Unit: 3725
SHAFT SLEEVE	)	

United States Patent & Trademark Office
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

AMENDMENT

Sir:

In response to the Office Action mailed April 19, 2017 in connection with the above-identified application, the period for response having been extended by one (1) month, please amend the application as follows:

Amendments to the Claims begin on page 2 of this paper.

Remarks begin on page 6 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Please amend the claims as follows:

1. (Cancelled).
2. (Cancelled).
3. (Cancelled).
4. (Cancelled).
5. (Cancelled).
6. (Cancelled).
7. (Cancelled).
8. (Cancelled).
9. (Cancelled).
10. (Cancelled).
11. (Cancelled).
12. (Cancelled).
13. (Cancelled).

14. (Currently Amended) A ~~gyratory crusher~~ main shaft associated with a gyratory crusher, the shaft comprising:

a shaft body having a first end ~~for positioning~~ arranged to be positioned at a lower region of ~~the a~~ crusher and a second end ~~for positioning~~ arranged to be positioned at an upper region of ~~the a~~ crusher relative to the first end, a thickness of the shaft body being tapered in an axial direction of the main shaft at a tapered region of the second end so as to decrease in cross-sectional area; and

a sleeve friction fitted over the tapered region at the second end of the main shaft, the sleeve including an elongate axial wall extending around a longitudinal axis of the sleeve, the axial wall having an internal facing surface for positioning in contact with an outward facing surface of the main shaft, and an external facing surface relative to the longitudinal axis, the axial wall extending between the internal and external facing surfaces, the axial wall having a first end for positioning at a lower region of the main shaft and a second end for positioning at an upper region of the main shaft relative to the lower region, wherein a thickness of the axial wall at a region between the first and second ends decreases in a direction from the second end to the first end, in the axial direction the internal facing surface at said region between the first and second ends extending transverse to the longitudinal axis so as to taper inwardly towards the longitudinal axis in the direction from the first to the second end.

15. (Currently Amended) A gyratory crusher comprising:

a main shaft including a shaft body having a first end for positioning at a lower region of the crusher and a second end for positioning at an upper region of the crusher relative to the first end, a thickness of the shaft body being tapered in an axial direction of the main shaft at a region of the second end so as to decrease in cross-sectional area; and

a sleeve fitted over the tapered region at the second end of the main shaft, the sleeve including an elongate axial wall extending around a longitudinal axis of the sleeve, the axial wall having an internal facing surface for positioning in contact with an outward facing surface of the main shaft, and an external facing surface relative to the longitudinal axis, the axial wall extending between the internal and external facing surfaces, the axial wall having a first end for

positioning at a lower region of the main shaft and a second end for positioning at an upper region of the main shaft relative to the lower region, wherein a thickness of the axial wall at a region between the first and second ends decreases in a direction from the second end to the first end, in the axial direction the internal facing surface at said region between the first and second ends extending transverse to the longitudinal axis so as to taper inwardly towards the longitudinal axis in the direction from the first to the second end.

16. (New) The shaft as claimed in claim 14, wherein the region over which the thickness of the axial wall decreases extends substantially the full axial length of the sleeve.

17. (New) The shaft as claimed in claim 14, further comprising a radial wall extending perpendicular or transverse to the axial wall, the radial wall being positioned at or towards the second end and extending inwardly towards the longitudinal axis.

18. (New) The shaft as claimed in claim 17, wherein the radial wall includes a through bore positioned at the longitudinal axis of the sleeve.

19. (New) The shaft as claimed in claim 14, wherein a cross-sectional shape profile of the external facing surface is substantially circular.

20. (New) The shaft as claimed in claim 14, wherein a cross-sectional shape profile of the internal facing surface is substantially circular.

21. (New) The shaft as claimed in claim 14, wherein a shape profile of the external facing surface defines a section of a cylinder in the axial direction.

22. (New) The shaft as claimed in claim 14, wherein a shape profile of the internal facing surface defines a section of a cone in the axial direction.

23. (New) The shaft as claimed in claim 14, further comprising at least one bore provided through the axial wall to allow the passage of a fluid to the internal facing surface.

24. (New) The shaft as claimed in claim 14, wherein at a curved region of the first end, the internal facing surface is curved radially outward relative to the longitudinal axis in a direction towards the external facing surface such that the axial wall thickness decreases to zero at the curved region.

REMARKS

Claims 14 and 15 have been amended. Claims 1-13 have been cancelled. New claims 16-24 have been submitted. Accordingly, claims 14-24 are currently pending.

The drawings have been objected to for not showing claimed features. As claims 9-11 have been cancelled, such objection shall not be addressed further.

Claims 1-15 have been rejected under 35 USC 112(b), second paragraph. Applicant respectfully submits that the amendments to the claims fully address the Examiner's objections.

Claims 1-8 and 9-11 have been rejected under 35 USC 102b as being anticipated by US 4,037,800 to Coxhill.

As claims 1-11 have been cancelled. Applicant respectfully submits that the above rejection is moot.

Claims 1-11 have been rejected under 35 USC 102b as being anticipated by US 1,402,255.

As claims 1-11 have been cancelled. Applicant respectfully submits that the above rejection is moot.

Claims 9-11 have been rejected under 35 USC 103(a) as being unpatentable over Coxhill or Sandborn in view of Gunnarsson.

As claims 9-11 have been cancelled. Applicant respectfully submits that the above rejection is moot.

Applicant notes that no prior art rejections have been applied against independent claims 14 and 15. The subject matter of cancelled claims 2-8, 12 and 13 now appears in newly submitted claims 16-24, which depend from amended claim 14.

Accordingly, Applicant respectfully submits that the claims are allowable over the cited prior art.

Given the above, Applicant respectfully submits that the application is in condition for allowance. A prompt passage to issuance is therefore earnestly solicited.

Respectfully submitted,

/Corinne Gorski/

Corinne Gorski
Registration No. 34,339

Sandvik/Diamond Innovations, Inc.
6325 Huntley Road
Worthington, OH 43085
Tel. 703-505-4761

Electronic Patent Application Fee Transmittal

Application Number:	14418535			
Filing Date:	30-Jan-2015			
Title of Invention:	GYRATORY CRUSHER MAIN SHAFT SLEEVE			
First Named Inventor/Applicant Name:	Niklas Aberg			
Filer:	Corinne R. Gorski			
Attorney Docket Number:	SMC 13979 WOUS			
Filed as Large Entity				
Filing Fees for U.S. National Stage under 35 USC 371				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 1 month with \$0 paid	1251	1	200	200
Miscellaneous:				
Total in USD (\$)				200

Electronic Acknowledgement Receipt

EFS ID:	30130443
Application Number:	14418535
International Application Number:	
Confirmation Number:	2984
Title of Invention:	GYRATORY CRUSHER MAIN SHAFT SLEEVE
First Named Inventor/Applicant Name:	Niklas Aberg
Customer Number:	78686
Filer:	Corinne R. Gorski
Filer Authorized By:	
Attorney Docket Number:	SMC 13979 WOUS
Receipt Date:	21-AUG-2017
Filing Date:	30-JAN-2015
Time Stamp:	10:16:33
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$200
RAM confirmation Number	082117INTEFSW00011034505792
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

--

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	SMC13979WOUSAmendment.pdf	29559	no	7
			838ec69c7edece20e762bd52a6c6f969cc701343		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30788	no	2
			072a740ccc7679f1a958d71618a65c15b01d1d5f		

Warnings:

Information:

Total Files Size (in bytes):			60347
------------------------------	--	--	-------

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 14/418,535		Filing Date 01/30/2015		☐ To be Mailed		
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO											
APPLICATION AS FILED – PART I											
(Column 1)			(Column 2)								
FOR		NUMBER FILED		NUMBER EXTRA		RATE (\$)		FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A		N/A		N/A					
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))		N/A		N/A		N/A					
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A		N/A		N/A					
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 =		*		X \$ =					
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =		*		X \$ =					
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))											
* If the difference in column 1 is less than zero, enter "0" in column 2.								TOTAL			
APPLICATION AS AMENDED – PART II											
(Column 1)			(Column 2)			(Column 3)					
AMENDMENT	08/21/2017		CLAIMS REMAINING AFTER AMENDMENT			HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA			
	Total (37 CFR 1.16(i))		* 11		Minus	** 20		= 0			
	Independent (37 CFR 1.16(h))		* 2		Minus	*** 3		= 0			
	☐ Application Size Fee (37 CFR 1.16(s))										
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
								TOTAL ADD'L FEE		0	
(Column 1)			(Column 2)			(Column 3)					
AMENDMENT			CLAIMS REMAINING AFTER AMENDMENT			HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA			
	Total (37 CFR 1.16(i))		*		Minus	**		=			
	Independent (37 CFR 1.16(h))		*		Minus	***		=			
	☐ Application Size Fee (37 CFR 1.16(s))										
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
								TOTAL ADD'L FEE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.											

LIE
SHEILA D. CHAPMAN

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

78686 7590 09/13/2017
Sandvik/Diamond Innovations
6325 Huntley Road
Worthington, OH 43085

EXAMINER

FRANCIS, FAYE

ART UNIT

PAPER NUMBER

3725

DATE MAILED: 09/13/2017

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

14/418,535

01/30/2015

Niklas Aberg

SMC 13979 WOUS

2984

TITLE OF INVENTION: GYRATORY CRUSHER MAIN SHAFT SLEEVE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	12/13/2017

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax **(571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

78686 7590 09/13/2017
Sandvik/Diamond Innovations
6325 Huntley Road
Worthington, OH 43085

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/418,535	01/30/2015	Niklas Aberg	SMC 13979 WOUS	2984

TITLE OF INVENTION: GYRATORY CRUSHER MAIN SHAFT SLEEVE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	12/13/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
FRANCIS, FAYE	3725	241-207000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached. ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.	2. For printing on the patent front page, list (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____ (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____ 3 _____
---	---

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
☐ Applicant asserting small entity status. See 37 CFR 1.27
☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____
Typed or printed name _____ Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/418,535	01/30/2015	Niklas Aberg	SMC 13979 WOUS	2984
78686 7590 09/13/2017 Sandvik/Diamond Innovations 6325 Huntley Road Worthington, OH 43085			EXAMINER FRANCIS, FAYE	
			ART UNIT	PAPER NUMBER
			3725	
DATE MAILED: 09/13/2017				

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

<i>Examiner-Initiated Interview Summary</i>	Application No. 14/418,535	Applicant(s) ABERG ET AL.	
	Examiner FAYE FRANCIS	Art Unit 3725	

All participants (applicant, applicant's representative, PTO personnel):

(1) FAYE FRANCIS. (3) ____.

(2) Corinne Gorski. (4) ____.

Date of Interview: 30 August 2017.

Type: ☒ Telephonic ☐ Video Conference
 ☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
 If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☒Others
 (For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 15.

Identification of prior art discussed: _____.

Substance of Interview
 (For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

discussed were amendment to the claims and cancellation of claim 14 in order to place the application in condition for allowance.

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/FAYE FRANCIS/ Primary Examiner, Art Unit 3725	
---	--

Notice of Allowability

Application No.
14/418,535

Examiner
FAYE FRANCIS

Applicant(s)
ABERG ET AL.

Art Unit
3725

AIA (First Inventor to File)
Status
No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendment filed on 8/21/17.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 15-24. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☒ All b) ☐ Some *c) ☐ None of the:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
4. ☒ Interview Summary (PTO-413),
Paper No./Mail Date herewith.
5. ☒ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

EXAMINER'S AMENDMENT

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in an interview with Ms. Corinne Gorski on Wednesday August 30, 2017.

The application has been amended as follows:

- 1) Claim 14 has been cancelled.
- 2) In line 1 of claims 16-24, "The shaft" has been replaced with --The gyratory crusher--.
- 3) In line 1 of claims 16-17 and 19-24, "14" has been replaced with --15--.

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to FAYE FRANCIS whose telephone number is (571)272-4423. The examiner can normally be reached on M-F 8:30-5:00.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

Art Unit: 3725

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shelley Self can be reached on 571-272-4524. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Faye Francis/
Primary Examiner
Art Unit 3725

FF

<i>Examiner-Initiated Interview Summary</i>	Application No. 14/418,535	Applicant(s) ABERG ET AL.	
	Examiner FAYE FRANCIS	Art Unit 3725	

All participants (applicant, applicant's representative, PTO personnel):

(1) FAYE FRANCIS. (3) ____.

(2) Corinne Gorski. (4) ____.

Date of Interview: 30 August 2017.

Type: ☒ Telephonic ☐ Video Conference
 ☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
 If Yes, brief description: ____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☒Others
 (For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 15.

Identification of prior art discussed: ____.

Substance of Interview
 (For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

discussed were amendment to the claims and cancellation of claim 14 in order to place the application in condition for allowance.

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/FAYE FRANCIS/ Primary Examiner, Art Unit 3725	
---	--

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	7	((("ABERG") near3 ("Niklas"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/08/30 15:47
L2	51	((("ERI KSSON") near3 ("Bengt-Arne"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/08/30 15:47
L3	1	((("ROSDAHL") near3 ("Fredrik"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/08/30 15:47
L4	1050	B02C2/005.cpc.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2017/08/30 15:47
L5	1190	B02C2/06.cpc.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2017/08/30 15:48
L6	341	B02C2/00.cpc.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2017/08/30 15:48
L7	207	(241/209).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/30 15:48
L8	63	(241/210).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/30 15:48
L9	612	(241/207).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/30 15:48
L10	122	(241/213).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/30 15:48
L11	417	(241/215).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/30 15:48
L13	14	6 and (sleeve near5 shaft)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/30 15:49
L14	21	7 and (sleeve near5 shaft)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/30 15:51
L15	33	4 and (sleeve near5 shaft)	US-PGPUB; USPAT;	OR	OFF	2017/08/30

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			15:55
L16	106	5 and (sleeve near5 shaft)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/08/30 15:56
S1	7	(("ABERG") near3 ("Niklas")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/12 10:39
S2	51	(("ERIKSSON") near3 ("Bengt-Arne")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/12 10:39
S3	1	(("ROSDAHL") near3 ("Fredrik")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/12 10:39
S4	1036	B02C2/005.cpc.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2017/04/12 10:42
S5	1164	B02C2/06.cpc.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2017/04/12 10:42
S6	5	("4065064" "5934583" "1402255" "4027825" "20020088885").PN.	US-PGPUB; USPAT	OR	OFF	2017/04/12 10:49
S7	321	B02C2/00.cpc.	US-PGPUB; USPAT; USOCR; FPRS	OR	OFF	2017/04/12 10:51
S8	206	(241/209).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/12 10:51
S9	59	(241/210).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/12 10:51
S11	585	(241/207).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/12 10:52
S12	120	(241/213).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/12 16:39
S13	406	(241/215).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/12 16:40
S14	118	S13 and sleeve	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/12 16:41
S15	0	("1402255").URPN.	USPAT	OR	OFF	2017/04/13 13:35
S16	0	("1402255").URPN.	USPAT; USOCR	OR	OFF	2017/04/13 13:36

S17	1	("1402255").PN.	USOCR	OR	OFF	2017/04/13 13:36
S18	15	("2787424" "2833486" "3133707" "3140834" "3539119").PN. OR ("4027825").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/13 13:49
S19	406	(241/215).OCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/13 14:03
S20	28	S19 and (bushing near5 shaft)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/13 14:03
S21	74	S19 and (sleeve near5 shaft)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/13 14:59
S22	9	("20110006143" "3539119" "3813047" "4037800" "4060205" "5152468" "5820045" "6446892" "8646713").PN.	US-PGPUB; USPAT	OR	OFF	2017/04/14 09:36

8/ 30/ 2017 4:02:36 PM
C:\ Users\ ffrancis\ Documents\ EAST\ Workspaces\ 14418535.wsp

Issue Classification 	Application/Control No. 14418535	Applicant(s)/Patent Under Reexamination ABERG ET AL.
	Examiner FAYE FRANCIS	Art Unit 3725

☐ Claims renumbered in the same order as presented by applicant															
☐ CPA															
☐ T.D.															
☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1	3	17												
	2	4	18												
	3	5	19												
	4	6	20												
	5	7	21												
	6	8	22												
	7	9	23												
	8	10	24												
	9														
	10														
	11														
	12														
	13														
	14														
1	15														
2	16														

NONE	Total Claims Allowed: 10	
(Assistant Examiner)	(Date)	
/FAYE FRANCIS/ Primary Examiner.Art Unit 3725	08/30/2017	O.G. Print Claim(s) 1
(Primary Examiner)	(Date)	O.G. Print Figure 1



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
 United States Patent and Trademark Office
 Address: COMMISSIONER FOR PATENTS
 P.O. Box 1450
 Alexandria, Virginia 22313-1450
 www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 2984

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
14/418,535	01/30/2015	241	3725	SMC 13979 WOUS		
APPLICANTS SANDVIK INTELLECTUAL PROPERTY AB, Sandviken, SWEDEN; INVENTORS Niklas Aberg, Sodra Sandby, SWEDEN; Bengt-Arne Eriksson, Svedala, SWEDEN; Fredrik Rosdahl, Sandviken, SWEDEN; ** CONTINUING DATA ***** This application is a 371 of PCT/EP2013/062861 06/20/2013 ** FOREIGN APPLICATIONS ***** EUROPEAN PATENT OFFICE (EPO) 12179089.3 08/02/2012 ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 03/17/2015						
Foreign Priority claimed ☒ Yes ☐ No 35 USC 119(a-d) conditions met ☒ Yes ☐ No Verified and Acknowledged <u>/FAYE FRANCIS/</u> Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY SWEDEN	SHEETS DRAWINGS 2	TOTAL CLAIMS 15	INDEPENDENT CLAIMS 3
ADDRESS Sandvik/Diamond Innovations 6325 Huntley Road Worthington, OH 43085 UNITED STATES						
TITLE GYRATORY CRUSHER MAIN SHAFT SLEEVE						
FILING FEE RECEIVED 1620	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

Search Notes 	Application/Control No. 14418535	Applicant(s)/Patent Under Reexamination ABERG ET AL.
	Examiner FAYE FRANCIS	Art Unit 3725

CPC- SEARCHED		
Symbol	Date	Examiner
B02C2/005, 06, 00	4/13/2017	FF
Updated.	8/30/2017	FF

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
241	215, 209	4/13/2017	FF
	Updated.	8/30/2017	FF

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

SEARCH NOTES		
Search Notes	Date	Examiner
B02C2/005, 06, 00	4/13/2017	FF
Inventors name search done.	8/30/2017	FF

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	Same as above.	8/30/2017	FF

--	--

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

78686 7590 09/13/2017
Sandvik/Diamond Innovations
6325 Huntley Road
Worthington, OH 43085

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/418,535	01/30/2015	Niklas Aberg	SMC 13979 WOUS	2984

TITLE OF INVENTION: GYRATORY CRUSHER MAIN SHAFT SLEEVE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	12/13/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
FRANCIS, PAYE	3725	241-207000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1. Corinne R. Gorski

2. _____

3. _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

SANDVIK INTELLECTUAL PROPERTY AB

SANDVIKEN, SE

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 505792 (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ /Corinne R. Gorski/

Date _____ October 24, 2017

Typed or printed name _____ Corinne R. Gorski

Registration No. _____ 34339

Electronic Patent Application Fee Transmittal

Application Number:	14418535			
Filing Date:	30-Jan-2015			
Title of Invention:	GYRATORY CRUSHER MAIN SHAFT SLEEVE			
First Named Inventor/Applicant Name:	Niklas Aberg			
Filer:	Corinne R. Gorski			
Attorney Docket Number:	SMC 13979 WOUS			
Filed as Large Entity				
Filing Fees for U.S. National Stage under 35 USC 371				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				960

Electronic Acknowledgement Receipt

EFS ID:	30738972
Application Number:	14418535
International Application Number:	
Confirmation Number:	2984
Title of Invention:	GYRATORY CRUSHER MAIN SHAFT SLEEVE
First Named Inventor/Applicant Name:	Niklas Aberg
Customer Number:	78686
Filer:	Corinne R. Gorski
Filer Authorized By:	
Attorney Docket Number:	SMC 13979 WOUS
Receipt Date:	24-OCT-2017
Filing Date:	30-JAN-2015
Time Stamp:	10:48:38
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$960
RAM confirmation Number	102417INTEFSW00013831505792
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

--

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	13979WOUSIssueFeePartB.pdf	1429443	no	1
			9228f1d234c5b30b7813afe195b31988f19e5335		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30522	no	2
			0c5d50dc696a273317c2bef8cde94cc0e80ce210		

Warnings:

Information:

Total Files Size (in bytes):			1459965
------------------------------	--	--	---------

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/418,535	11/28/2017	9827568	SMC 13979 WOUS	2984

78686 7590 11/08/2017
Sandvik/Diamond Innovations
6325 Huntley Road
Worthington, OH 43085

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 349 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Niklas Aberg, Sodra Sandby, SWEDEN;
SANDVIK INTELLECTUAL PROPERTY AB, Sandviken, SWEDEN;
Bengt-Arne Eriksson, Svedala, SWEDEN;
Fredrik Rosdahl, Sandviken, SWEDEN;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.