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

(11) **EP 3 067 155 A1**

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

(43) Date of publication:
14.09.2016 Bulletin 2016/37

(21) Application number: **14900065.5**

(22) Date of filing: **27.11.2014**

(51) Int Cl.:
B24B 45/00 *(2006.01)*

(86) International application number:
PCT/KR2014/011456

(87) International publication number:
WO 2016/027936 (25.02.2016 Gazette 2016/08)

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

(30) Priority: **21.08.2014 KR 20140108745**

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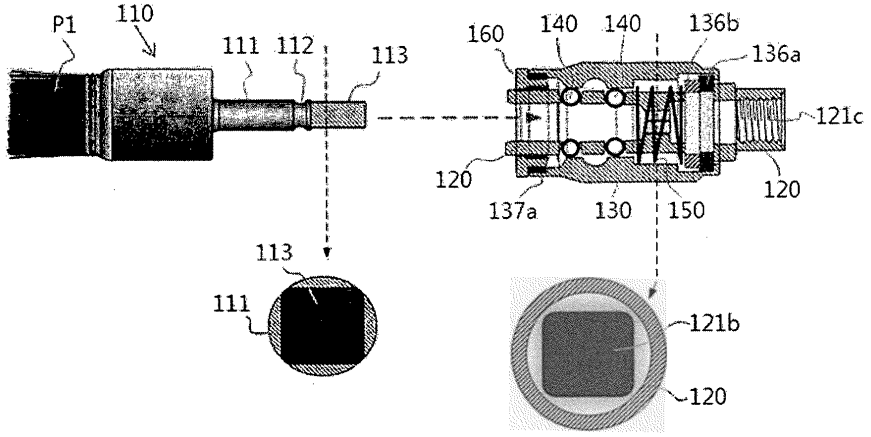
(54) APPARATUS FOR ATTACHING/DETACHING GRINDING TOOL FOR GRINDER

(57) The present invention relates to a polishing holder removing device for a grinder that allows a grinding tool to be simply coupled/decoupled to/from a coupler, which is mounted on a rotary shaft of a body of a hand grinder and is rotated at a high speed, and that can ensure anti-vibration, stability, continuity, and smooth transmission of power in grinding by more firmly coupling the grinding tool to the coupler. The present invention includes a grinding tool, a coupler, a sleeve, locking balls, a spring, and a cap nut, in which a cylindrical shank, a groove, and a rectangular shank are sequentially formed at an end portion of a body of the grinding tool; the coupler has a seating hole and a rectangular hole where the grinding tool is fitted and fixed, a threaded-hole for fastening to a grinder body, and a flange having two lines of through-holes formed around the outer side; a lower dustproof groove having a step and a seating groove are formed at a side in the sleeve, and an upper dustproof groove is formed at the other side in the sleeve; the locking balls are disposed in the ball holes formed in the coupler and moved toward/away from the cylindrical shank and the groove of the grinding tool when the sleeve moves so that the grinding tool can be fixed or released; the spring applies elasticity when the sleeve slides; and the cap nut retains the sleeve.

[Fig.12]



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Description

[Technical Field]

[0001] The present invention relates to a polishing holder removing device for a grinder that allows a grinding tool to be simply coupled/decoupled to/from a coupler, which is mounted on a rotary shaft of a body of a hand grinder and is rotated at a high speed, and that can ensure anti-vibration, stability, continuity, and smooth transmission of power in grinding by more firmly coupling the grinding tool to the coupler.

[Background Art]

[0002] In general, there is a need for secondary machining for incompletely machined portions or rough surfaces, or before painting, after primary machining on parts for various industrial fields including a vehicle or a ship. A grinder that precisely grinds an object by rotating a grindstone is used for work requiring some degree of precision, while a hand grinder, which is light and convenient to use, is generally used to finish parts that do not require high precision.

[0003] In common hand grinders, a rotary shafts is rotated at a high speed by an electric motor or air pressure generated by a compressor, a grinding tool on the rotary shaft polishes an object made of wood, stone, or steel or by grinding the surface or finishes an object by grinding incompletely machined portion, or edges and corners.

[0004] In relation to those hand grinders, a "Grinding Head for a Grinder" has been disclosed in Korean Utility Model No. 0356304, in which a head equipped with a grinding plate is separably fitted on a rotary shaft by a fastener such as a nut, but it is required to repeat tightening or loosening the nut with a specific tool such as a spanner. Further, it unnecessarily takes time to replace the grinding plate and it is required to move the grinder to a place, where the grinding plate can be replaced, when working at a small place or a high place, so it is difficult to continuously work, thereby deteriorating work efficiency.

[0005] Further, in consideration of this problem, Korean Utility Model Nos. 0373648 and 0376952 has proposed structures in which a sleeve that axially moves is mounted around a coupler and a grinding tool can be coupled/decoupled in a one-touch way by moving in/out a locking ball.

[0006] However, in these cases, a worker is supposed to couple/decouple a grinding tool, which is a consumable part, by pushing the sleeve with the grinding tool in one hand, so there is still inconvenience. Further, the locking ball is moved into/out of a groove at the end of a grinding tool, so a grinding tool that rotates at a high speed during grinding vibrates.

[0007] Further, the grinding tool is supported in close contact with the coupler by three projections around the grinding tool, so power is not fully transmitted in work needing a predetermined force and the coupling force is decreased by friction force or fine vibration, so a worker feels great discomfort.

[0008] The applicant(s) has proposed a technique in Korean Patent No. 1056036 in consideration of these problems in the related art. According to the configuration proposed in this document, a grinding tool that is mounted on a rotary shaft of the body of a grinder can be simply coupled/decoupled, so there is no need for a specific tool or fastener, and accordingly, work efficiency can be improved. Further, a grinding tool and a coupler can be coupled in a gear type, so the coupling force of the coupler and the grinding tool is increased, and accordingly, stability can be ensured with minimum vibration in work.

[0009] However, it was found that the product has some important defects in repeated tests before it is supplied to work sites, and it was necessary to improve some functions in order to remove these defects. That is, the defects in this technique are as follows.

[0010] First, when large shock is applied to a grinding tool that is a consumable part in grinding, first and second bodies of the grinding tool are separated and the separated second body is stuck in a coupler of the grinder body, the grinder is broken.

[0011] Second, large vibration is generated, as compared with existing grinders. The second body of grinding tools is made of resin, so vibration is generated by elasticity that is a feature of the material.

[0012] Third, dust produced in grinding is accumulated and hardened on the operation portions of a coupler, which causes malfunction. When the grinder is used at a work site with a large amount of dust, dust such as paint, oil, and iron powder is accumulated and hardened in grooves of bearings, which causes malfunction.

[0013] Fourth, a manufacturing process of abrasives is complicated, so it takes a long period and large costs, and accordingly, competitiveness is deteriorated.

[Documents of Related Art]

[Patent Document]

[0014]

(Patent Document 1) Korean Utility Model No. 0356304 (registered on 6 July, 2004), Title : Grinding Head for Grinder.

(Patent Document 2) Korean Utility Model No. 0373648 (registered on 10 January, 2005), Title : Polishing holder structure for hand grinder.

(Patent Document 3) Korean Utility Model No. 0376952호 (registered on 16 February, 2005) Title: Polishing holder structure for hand grinder.

(Patent Document 4) Korean Patent No. 1056036 (registered on 4 August, 2011), Title: A polishing holder removing device for grinder.

[Disclosure]

[Technical Problem]

[0015] An aspect of the present invention provides a polishing holder removing device for a grinder that does not need a specific tool or fastener by allowing a grinding tool to be simply coupled/decoupled to/from a rotary shaft of a grinder body and can considerably improve work efficiency by making it easy to replace consumable parts and allowing for continuous work.

[0016] Further, an aspect of the present invention also provides a polishing holder removing device for a grinder that can increase coupling force between a coupler and a grinding tool by combining a grinding tool and a coupler in a mechanical contact type using surface contact, prevent vibration and separation in work by holding a grinding tool in a double structure at the front and rear with a bearing, and transmit power well.

[0017] Further, an aspect of the present invention also provides a polishing holder removing device for a grinder that can prevent permeation of dirt using a sealing member at the joint of a grinding tool and a coupler and discharge even dust, which may flow into a grinder body, to the outside using a specific exit formed in a coupler.

[Technical Solution]

[0018] According to an aspect of the present invention, there is provided a polishing holder removing device for a grinder that can fix or release a grinding tool by sliding a coupler mounted on a rotary shaft of a grinder body and a sleeve disposed around the coupler and that includes a grinding tool that is equipped with an abrasive at a portion of the body, a coupler that is mounted on a grinder body, a sleeve that slides on the outer side of the coupler, locking balls that are disposed in the coupler to fix or release the grinding tool, a spring that provides elasticity when the sleeve slides, and a cap nut that retains the sleeve, in which a cylindrical shank, a groove, and a rectangular shank are sequentially formed at an end portion of a body of the grinding tool, the coupler has a seating hole and a rectangular hole where the grinding tool is fitted and fixed, a threaded-hole for fastening to a grinder body, and a flange having two lines of through-holes formed around the outer side, the sleeve is fitted on the coupler to slide left and right, a lower dustproof groove having a step and a seating groove are formed at a side in the sleeve, and an upper dustproof groove is formed at the other side, the locking balls are disposed in the ball holes formed in the coupler and moved toward/away from the cylindrical shank and the groove of the grinding tool when the sleeve moves so that the grinding tool can be fixed or released, the spring is disposed inside a flange of the coupler and a seating groove of the sleeve and applies elasticity when the sleeve slides, the cap nut is fastened to the front end portion of the coupler to retain the sleeve.

[0019] Further, dust exit holes connected to the rectangular hole are formed in the flange of the coupler.

[0020] Further, projections divided by a spherical groove are formed on the inner side of the sleeve to retain the locking balls; and a lower dustproof rubber and washer are disposed in a lower dustproof groove and an upper dustproof rubber is disposed in an upper dustproof groove to prevent permeation of dust.

[Advantageous Effects]

[0021] As set forth above, according to exemplary embodiments of the invention, a grinding tool that is mounted on the rotary shaft of the grinder body can be simply mounted, so there is no specific tool or fastener and a grinding tool can be immediately replaced when a grinder is used, and accordingly, work efficiency can be significantly improved.

[0022] Further, a grinding tool is fastened in a double fixing type by a bearing and a surface contact portion axially formed on the outer side of the grinding tool and on the inner side of the coupler, so a coupling force between the coupler and the grinding tool can be increased. Accordingly, vibration can be minimized in working and power can be smoothly transmitted.

[0023] Further, it is possible to prevent permeation of dust at the gaps between the grinding tool and the coupler and specific exit holes are formed in the coupler, so it is possible to easily discharge even dust, which may flow into the grinder body, using a centrifugal force generated by the coupler rotating.

[Description of Drawings]

[0024] The above and other aspects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an exploded perspective view of parts for illustrating a polishing holder removing device for a grinder;

FIGS. 2A and 2B are a view illustrating the external appearance of a grinding tool and a cross-sectional view taken along line A-A;

FIG. 3 is a view illustrating the external appearance of another configuration of the grinding tool;

FIGS. 4A and 4B are a view illustrating a coupler where a grinding tool is coupled and a cross-sectional view taken along line B-B;

FIGS. 5A and 5B are cross-sectional view illustrating a sleeve and a cap nut;

FIG. 6 is a cross-sectional view illustrating parts combined with the coupler;

FIGS. 7A and 7B are cross-sectional view illustrating assembly and operational relationships of parts;

FIG. 8 is an exploded perspective view of parts in a

polishing holder removing device for a grinder according to the present invention;

FIG. 9 is a perspective view of a coupler assembly combined with parts;

FIGS. 10A, 10B, and 10C are cross-sectional view of a coupler, a sleeve, and a cap nut, respectively;

FIG. 11 is a cross-sectional view of the coupler assembly combined with parts;

FIG. 12 is a view illustrating the grinding tool and the coupler assembly that are separated;

FIGS. 13A and 13B are partial cross-sectional views illustrating operational relationship of parts; and

FIG. 14 is a cross-sectional view illustrating a process of coupling the grinding tool.

[Best Mode]

[0025] Exemplary embodiments of the present invention will now be described in detail with reference to the accompanying drawings.

[0026] Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings.

[0027] The present invention employs some of the configuration in Korean Patent No. 1056036, but improves defects of the patent, so the configuration of this device will be cited first and then the configuration relating to improvement by the present invention will be described in detail.

[0028] As illustrated in FIGS. 1 to 7B, a polishing holder removing device for a grinder includes a grinding tool 11 that is coupled with various abrasives P1, depending on the objects to be machined, a coupler 12 where the grinding tool 11 is fitted and fixed and that is rotated at a high speed by a rotary shaft P3 of a grinder body P2, and a sleeve 13 that elastically slide around the outer side of the coupler 12.

[0029] There are further provided locking balls 14 that are moved into/out of the coupler 12 when the sleeve 13 is moved so that the grinding tool 11 can be coupled/decoupled, a spring 15 that applies elasticity to the sleeve 13, and a cap nut 16 that is coupled to the front portion of the coupler 12 to retain the locking balls 14.

[0030] A pair of flanges 17a and 17b are formed on the body of the grinding tool 11, a groove 18a is formed between the flanges, and an outer toothed-portion 18b longitudinally machined is formed around an extension that extends from the end of the flange 17b.

[0031] The grinding tool 11 is a common consumable part that is discarded after being used for a predetermined period of time and an abrasive P1 is formed like a brush by winding thin metal wires in the embodiment, but grinding stones formed in various shapes such as a disc, a cone, and a cup may be used, depending on the material, size, and use of objects to be machined.

[0032] Further, as illustrated in FIG. 3, the grinding tool 11 may be manufactured by separately forming a first body 19A equipped with the abrasive P1 and a second body 19B having the outer toothed-portion 18b and then combining the bodies, in which a shank 20b having slits 20a may be formed at an end of the first body 19A and an insertion hole 20c may be formed at the second body 19B to combine them.

[0033] In this case, an adhesive may be applied to the slits 20a of the first body 19A so that they can be held like a single unit in the insertion hole 20c of the second body 19B.

[0034] Fourth through holes 21a are formed on the same line around the body of the coupler 12, a threaded-portion 21b and a step 21c are formed at both ends, respectively, and a seating hole 22a for receiving the flanges 17a and 17b of the grinding tool 11 are formed in the body.

[0035] Further, an inner toothed-portion 22b is formed at the center portion connected to the seating hole 22a and a female threaded-portion 22c is formed behind the inner toothed-portion 22b, so it can be thread-fastened to a rotary shaft P3 mounted on a common grinder body P2.

[0036] Meanwhile, the locking balls 14 are disposed in the four through holes 21a formed in the coupler 12, and are moved into/out of the through holes 21a of the coupler 12 to be fitted/separated into/from the groove 18a of the grinding tool 11 when the sleeve 13 slides, so the grinding tool 11 can be freely coupled/decoupled to/from the coupler 12.

[0037] Further, a protrusion 24 having an inclined surface 23a and a step 23b is formed at a side on the inner side of the sleeve 13 that is disposed around the coupler 12, an anti-sliding portion 25 is formed around the outer side of the sleeve 13, and the spring 15 is disposed between the step 23b at the protrusion 24 of the sleeve 13 and the step 21c on the outer side of the coupler, so the sleeve 13 can be elastically moved.

[0038] The cap nut 16 having a locking protrusion 16a is fastened to the threaded-portion 21b at the front end of the coupler 12, so the sleeve 13 can be retained and a single product can be achieved.

[0039] This configuration has been disclosed in Korean Patent No. 1056036 by the applicant(s) and the present invention can provide a hand grinder having higher performance by removing defects in the related art described above, on the basis of the configuration.

[0040] As illustrated in FIGS. 8 to 14, a polishing holder removing device for a grinder according to the present invention include a grinding tool 110 that is equipped with an abrasive P1 at a portion of the body, a coupler 120 that is mounted on a grinder body P2, a sleeve 130 that slides on the outer side of the coupler 120, locking balls 140 that are disposed in the coupler 120 to fix or release the grinding tool 110, a spring 150 that provides elasticity when the sleeve 130 slides, and a cap nut 160 that retains the sleeve 130.

[0041] The grinding tool 110, as described above, can be equipped with not only an abrasive P1 formed like a brush, but also a grinding stone formed in the shape of

a disc, a cone, and a cup, depending on the material, size, and use of an object to be machined, and a cylindrical shank 111, a groove 112, and a rectangular shank 113 are sequentially formed at an end portion of the body of the grinding tool 110.

[0042] Further, the coupler 120 has a seating hole 121a and a rectangular hole 121b where the grinding tool 110 is fitted and fixed, a threaded-hole 121c for fastening to a grinder body P2, and a flange having two lines of through holes 122a and 122b formed around the outer side.

[0043] Two to four through holes 122a and 122b may be formed in two lines around the outer side of the coupler 120 and three ball holes may be formed with intervals of 120°.

[0044] Further, a thread 124a is formed at the front end portion of the coupler 120 and two to four dust exit holes 125 connected vertically from the rectangular hole 121b are formed in the flange 123.

[0045] The sleeve 130 is fitted on the coupler 120 to slide left and right, in which a lower dustproof groove 133 having a step 132a and a seating groove 134 are formed at a side in the sleeve 130 and an upper dustproof groove 135 is formed at the other side.

[0046] A dustproof rubber 136a and a washer 136b are disposed in the lower dustproof groove 133 and an upper dustproof rubber 137a is disposed in the upper dustproof groove 135, so it is possible to prevent permeation of dust produced by grinding. Further, a pair of projections 138b and 138c divided by a spherical groove 138a is formed on the inner side 131 of the sleeve 130.

[0047] The locking balls 140 are disposed in the through holes 122a and 122b formed in the coupler 120 and moved toward/away from the cylindrical shank 111 and the groove 112 of the grinding tool 110 when the sleeve 130 moves so that the grinding tool 110 can be fixed or released.

[0048] Further, the spring 150 is disposed inside a flange 123 of the coupler 120 and a seating groove 134a of the sleeve 130 and can apply elasticity when the sleeve 130 horizontally moves.

[0049] A thread 162a formed on the inner side of the flange 161 of the cap nut 160 is fastened to the thread 124a formed at the front end portion of the coupler 120, so the cap nut 160 can retain the sleeve 130.

[0050] According to the present invention having the configuration described above, the locking balls 140 are put into the two lines of through holes 122a and 122b formed around the coupler 120 and then the sleeve 130 is coupled to the front end portion of the coupler 120 with the spring 150 fitted on the outer side, so the locking balls 140 are retained in the through holes 122a and 122b.

[0051] Thereafter, the cap nut 160 is fastened to the thread 124 formed at the front end portion of the coupler 120, so a single product can be achieved, as illustrated in FIG. 9, and the threaded-hole 121c formed at the rear portion of the coupler 120 can be fastened to the grinder body P2.

[0052] In this state, in order to insert the grinding tool 110 into the seating hole 121a of the coupler 120, the sleeve 130 is pulled to the right, that is, toward the grinder body P2 against the spring 150 and the cylindrical shank 111 of the grinding tool 110 is fitted into the seating hole 121a of the coupler 120, so the grinding tool 110 can be easily mounted.

[0053] That is, as illustrated in FIGS. 13A and 13B, as the cylindrical shank 111 of the grinding tool 110 is inserted, the locking balls 140 are pushed out of the through holes 122a and 122b and temporarily moved to the portion between the projections 138a and 138b. Further, as the sleeve 130 is returned by the restoring force of the spring 150, the projections 138a and 138b push the locking balls 140 and move toward the cylindrical shank 111 and the groove 112 of the grinding tool 110, so the grinding tool 110 can be firmly fixed.

[0054] In this case, As the grinding tool 110 is inserted into the seating hole 121a of the coupler 120, the rectangular shank 113 formed at the end portion of the grinding tool 110 is locked into a rectangular hole 121b formed at the center portion inside the coupler 120, so the grinding tool 110 can be further retained.

[0055] Accordingly, the coupling force between the coupler 120 and the grinding tool 110 rotated at a high speed in grinding is increased, so vibration can be minimized in work and stability can be ensured. Further, power can be very smoothly transmitted from the grinder body P2.

[0056] Further, in order to separate the grinding tool 110 from the coupler 120, as described above, a space to which the locking balls 140 can be moved is formed by pulling the sleeve 130 toward the grinder body P2 and then the grinding tool 110 is pulled out of the seating hole 121a of the coupler 120, so the grinding tool 110 can be easily separated.

[0057] Meanwhile, during various types of grinding with the grinding tool 110 mounted, dust such as paint or iron powder are collected and accumulated in the gaps between parts, so the grinding tool 110 cannot be easily coupled/decoupled to/from the coupler 120 in the related art.

However, in the present invention, since the washer 136b, including the lower dustproof rubber 136a, is disposed in the lower dustproof groove 133 formed on the coupler 120 and the upper dustproof rubber 137a is disposed in the upper dustproof groove 135, dust permeates very little into the coupler 120.

[0058] Further, since the dust exit holes 125 are formed in the flange 123 of the coupler 120 and a centrifugal force is exerted in the coupler 120 and the grinding tool 110 rotated at a high speed, so dust that may remain in the coupler 120 can be discharged outside.

[0059] Further, since the cylindrical shank 111, the groove 112, and the rectangular shank 113 are continuously formed at a side of the body of the grinding tool 110 and fixed by the two lines of locking balls 140 in the coupler 120, the grinding tool 120 is not separated from

the coupler 120 and the existing grinding tool 110 can be used as it is. Accordingly, compatibility of consumable parts can be achieved and factors causing vibration can be effectively removed.

[0060] While the present invention has been illustrated and described in connection with the exemplary embodiments, it will be apparent to those skilled in the art that modifications and variations can be made without departing from the spirit and scope of the invention as defined by the appended claims.

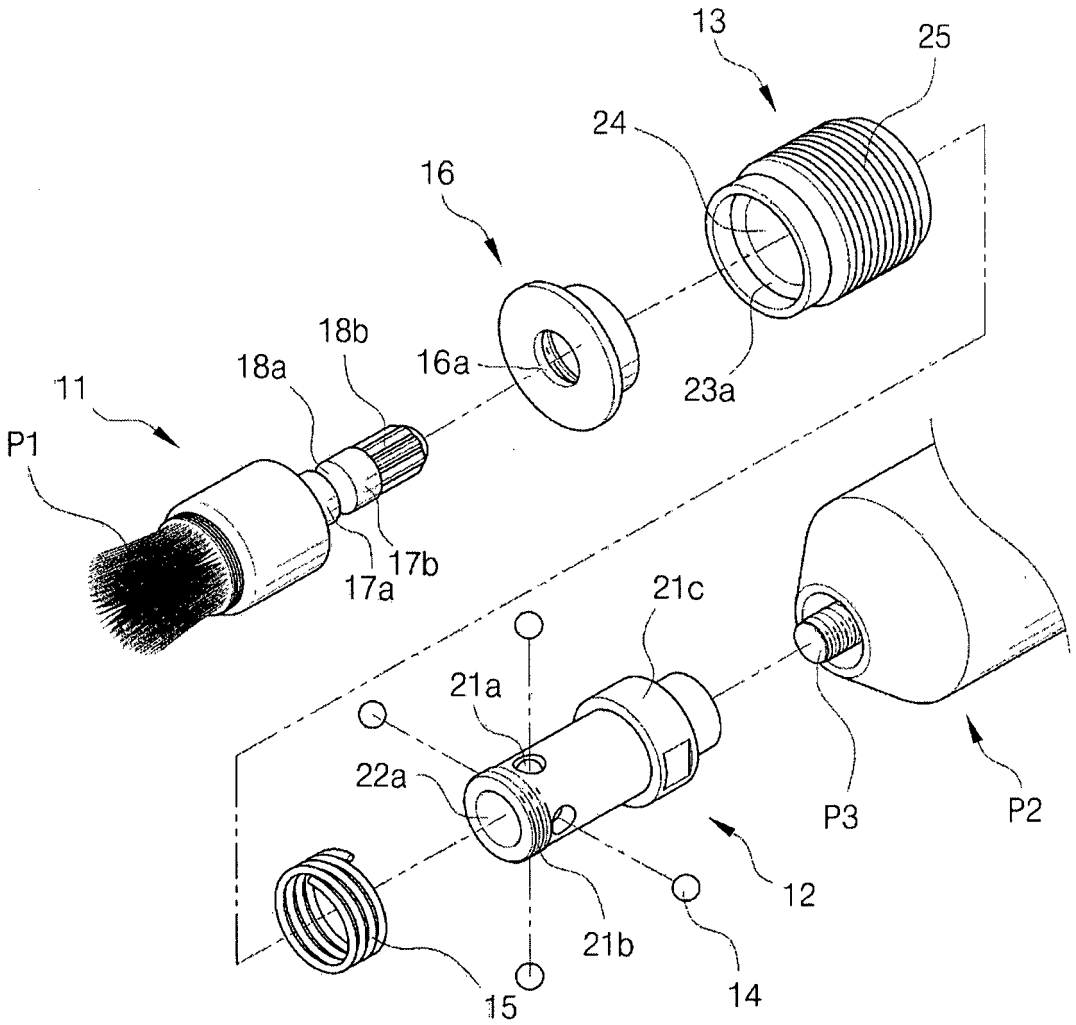
Claims

1. A polishing holder removing device for a grinder that can be fixed or released by a coupler that is mounted on a rotary shaft of a grinder body and a sleeve that is disposed around the coupler to slide, and that includes a grinding tool that is equipped with an abrasive at a portion of the body, a coupler that is mounted on a grinder body, a sleeve that slides on the outer side of the coupler, locking balls that are disposed in the coupler to fix or release the grinding tool, a spring that provides elasticity when the sleeve slides, and a cap nut that retains the sleeve,
   wherein a cylindrical shank, a groove, and a rectangular shank are sequentially formed at an end portion of a body of the grinding tool,
   the coupler has a seating hole and a rectangular hole where the grinding tool is fitted and fixed, a threaded-hole for fastening to a grinder body, and a flange having two lines of through-holes formed around the outer side,
   the sleeve is fitted on the coupler to slide left and right, a lower dustproof groove having a step and a seating groove are formed at a side in the sleeve, and an upper dustproof groove is formed at the other side,
   the locking balls are disposed in the ball holes formed in the coupler and moved toward/away from the cylindrical shank and the groove of the grinding tool when the sleeve moves so that the grinding tool can be fixed or released,
   the spring is disposed inside a flange of the coupler and a seating groove of the sleeve and applies elasticity when the sleeve slides,
   the cap nut is fastened to the front end portion of the coupler to retain the sleeve, and
   dust exit holes connected to the rectangular hole are formed in the flange of the coupler.

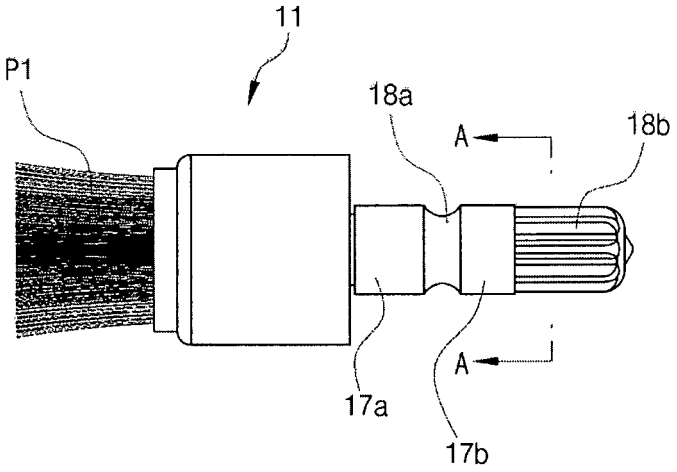
2. The device of claim 1, wherein dust exist holes connected to the rectangular hole are formed in the flange of the coupler.

3. The device of claim 1, wherein projections divided by a spherical groove are formed on the inner side of the sleeve to retain the locking balls, and a lower dustproof rubber and washer are disposed in a lower dustproof groove and an upper dustproof rubber is disposed in an upper dustproof groove to prevent permeation of dust.

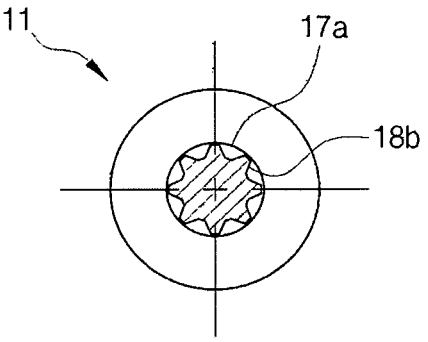
[Fig.1]


13
25
24
16
18b
18a
16a
23a
11
P1
17b
17a
21c
21a
22a
P3
P2
12
21b
14
15

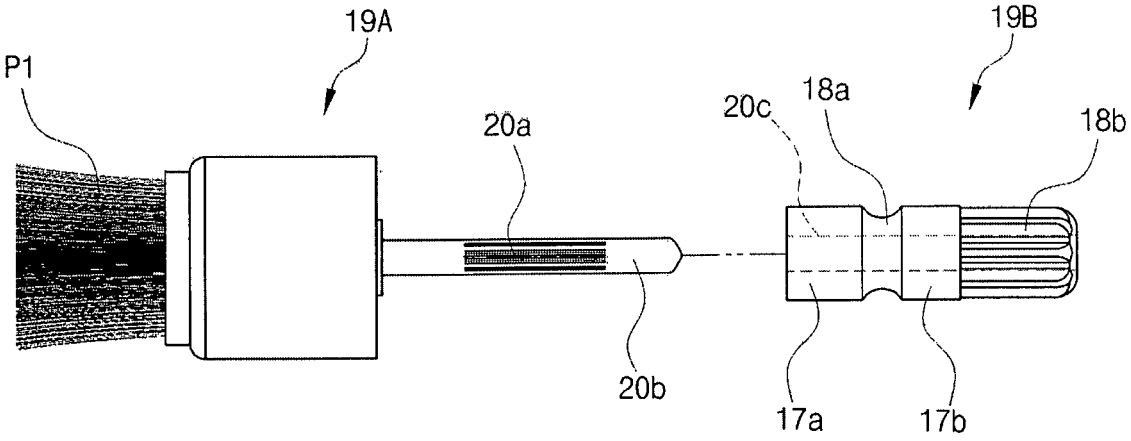
[Fig.2a]



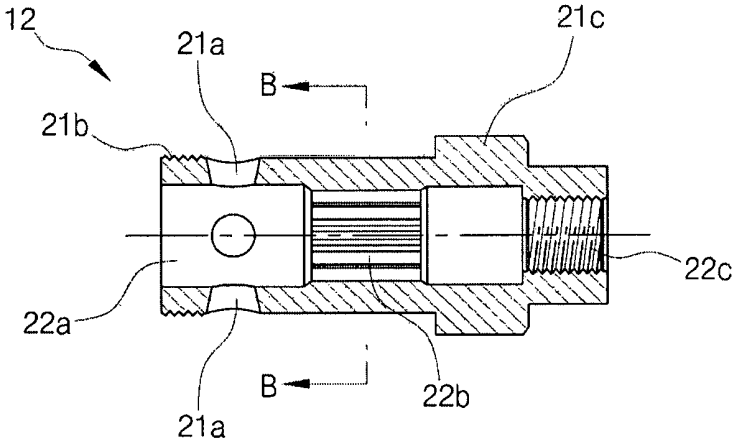
[Fig.2b]



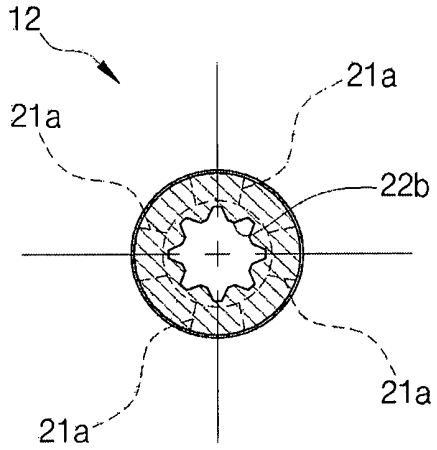
[Fig.3]



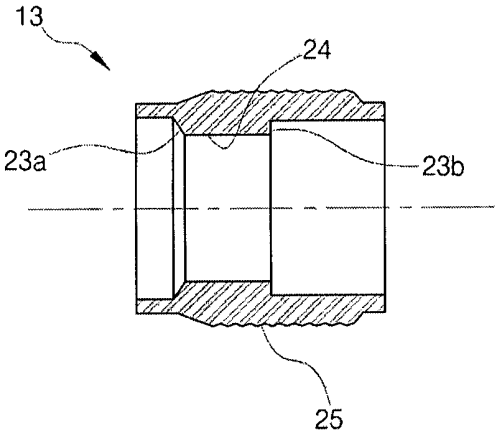
[Fig.4a]



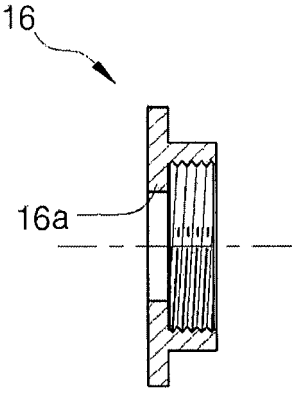
[Fig.4b]



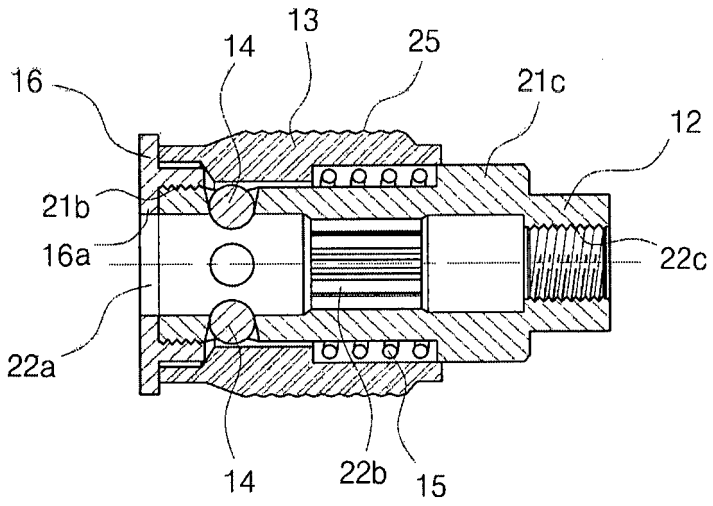
[Fig.5a]



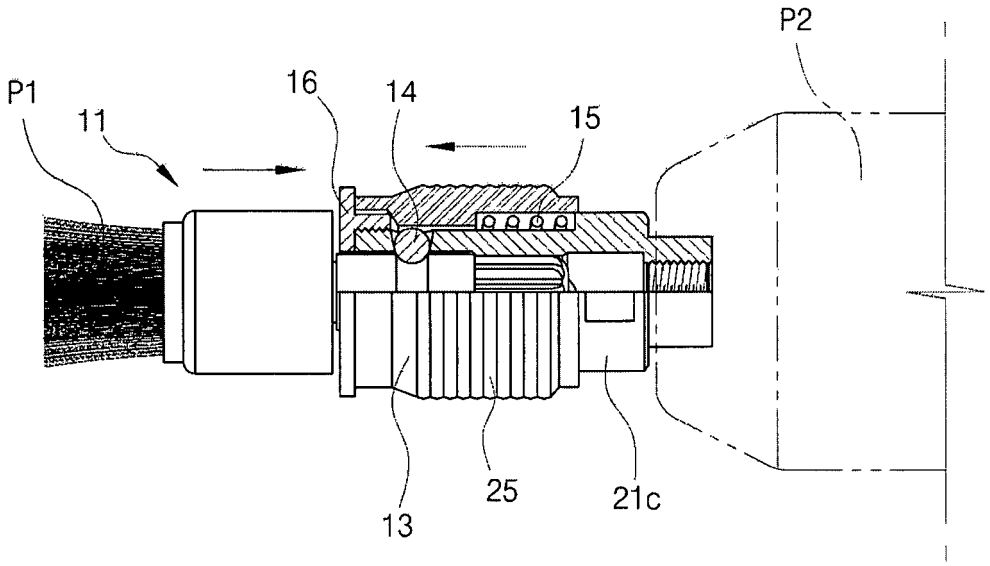
[Fig.5b]



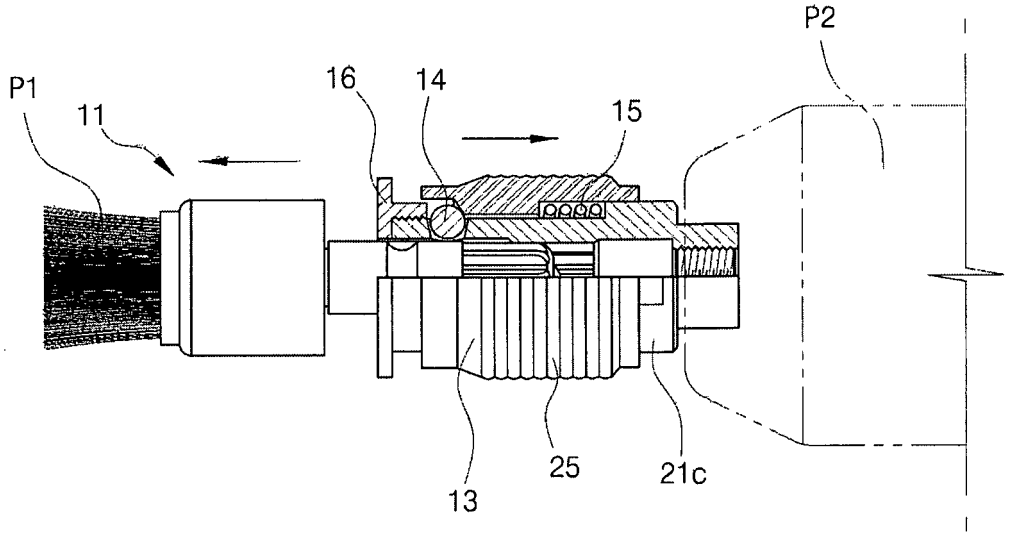
[Fig.6]



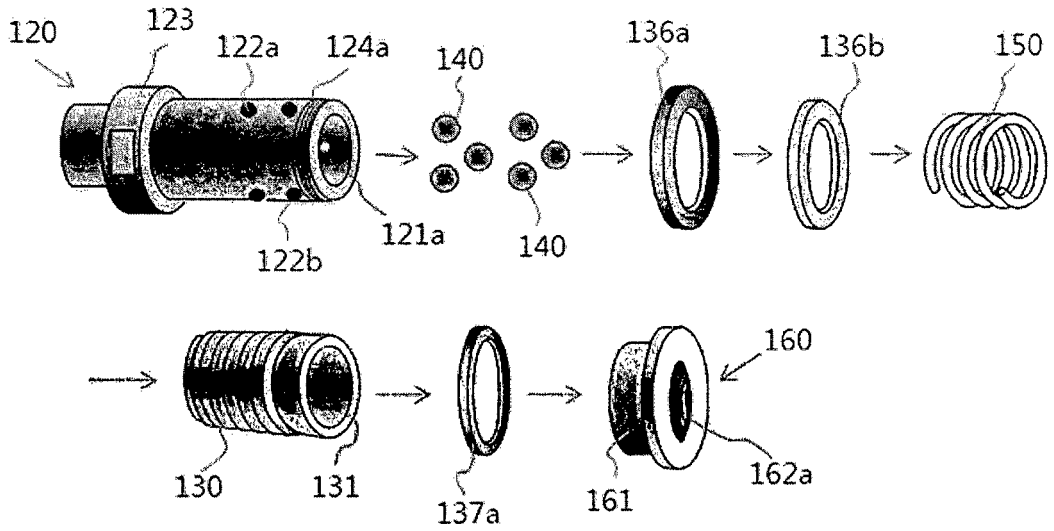
[Fig.7a]



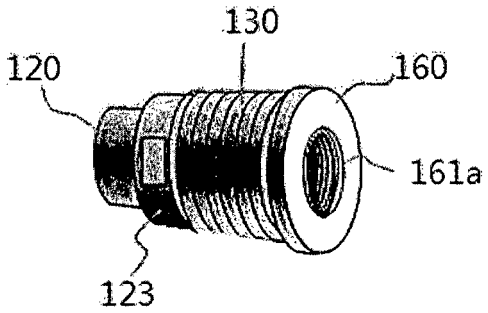
[Fig.7b]



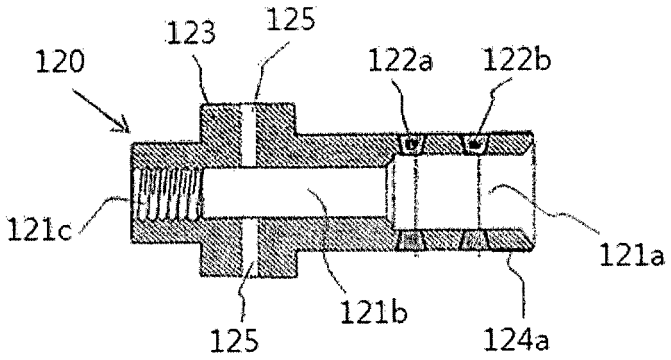
[Fig.8]



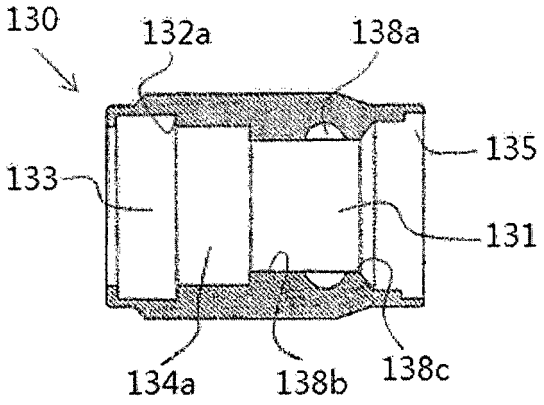
[Fig.9]



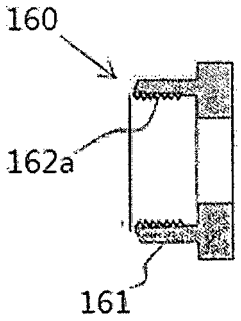
[Fig.10a]



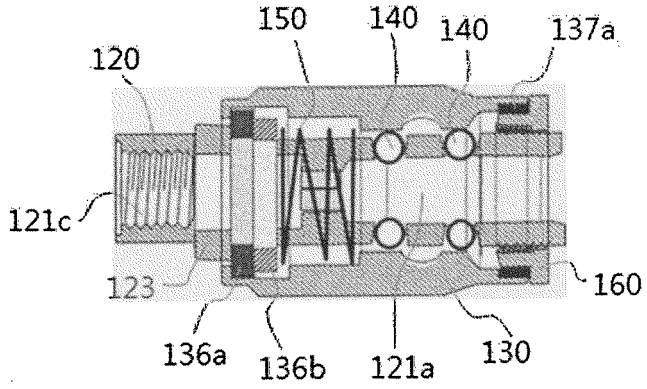
[Fig.10b]



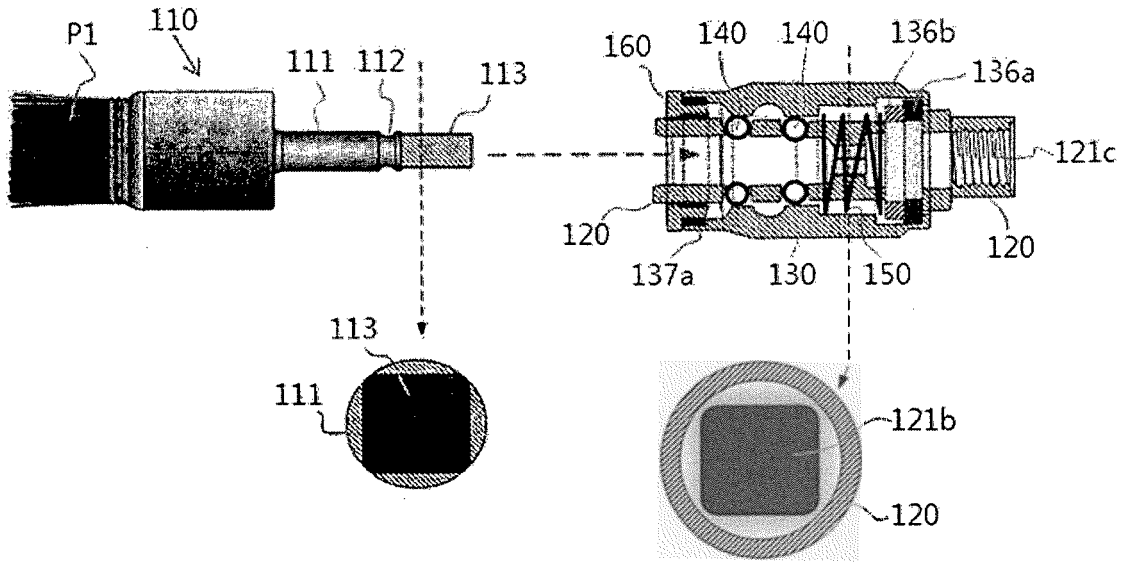
[Fig.10c]



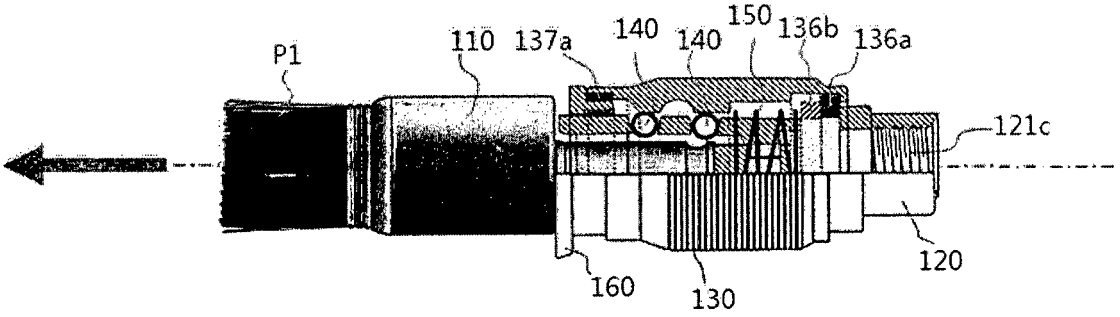
[Fig.11]



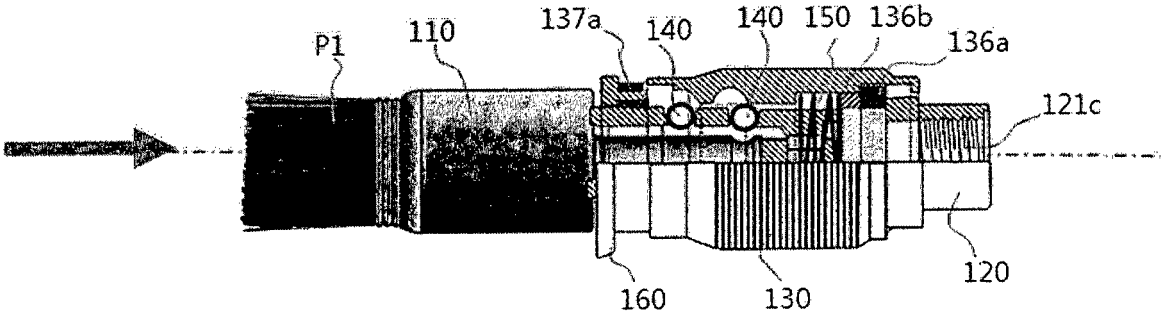
[Fig.12]



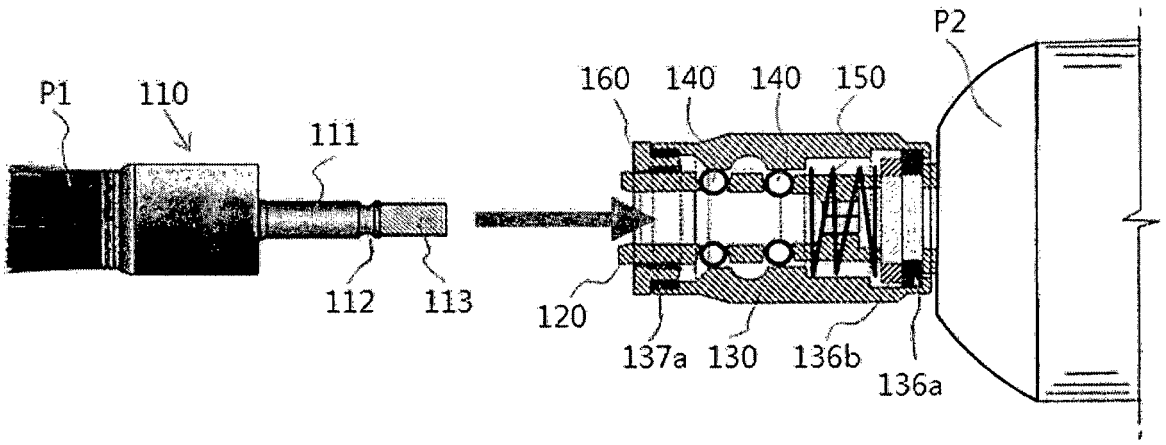
[Fig.13a]



[Fig.13b]



[Fig.14]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2014/011456

A. CLASSIFICATION OF SUBJECT MATTER

B24B 45/00(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B24B 45/00; B24B 23/02; B25F 5/00; F16L 27/02; B24B 23/00; B24B 41/00; F16L 37/00; F16L 37/08; B24B 47/20; B24B 5/18

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

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

eKOMPASS (KIPO internal) & Keywords: grinder, rotary shaft, sleeve, abrasive material, abrasive tool, coupler, cylindrical shaft, groove, flange, square hole, dust discharging hole, protrusion, square shaft

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-1056036 B1 (KIM, Kyung - Jin et al.) 10 August 2011 See paragraphs [0017]-[0026]; claim 1; and figures 1-3.	1-3
A	KR 20-0390750 Y1 (SAM HWA) 25 July 2005 See abstract; claims 1-3; and figures 1-2.	1-3
A	US 7186172 B1 (OHATA, Shinji) 06 March 2007 See abstract; column 1, lines 9-47; and figures 5-6.	1-3
A	KR 20-2010-0006118 U (KIMS ENGINEERING CO.) 17 June 2010 See abstract; paragraphs [0008]-[0014]; and claim 1.	1-3
A	CN 102554719 A (WUXI QILONG MACHINE TOOL CO., LTD.) 11 July 2012 See abstract; paragraphs [0002]-[0005]; and claim 1.	1-3

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 MAY 2015 (19.05.2015)	**19 MAY 2015 (19.05.2015)**

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
Government Complex-Daejeon, 189 Seonsa-ro, Daejeon 302-701, Republic of Korea
Facsimile No. 82-42-472-7140

Authorized officer

Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2014/011456

Patent document cited in search report	Publication date	Patent family member	Publication date
KR 10-1056036 B1	10/08/2011	NONE	
KR 20-0390750 Y1	25/07/2005	NONE	
US 7186172 B1	06/03/2007	NONE	
KR 20-2010-0006118 U	17/06/2010	NONE	
CN 102554719 A	11/07/2012	NONE	

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 0356304 **[0004] [0014]**
- KR 0373648 **[0005] [0014]**
- KR 0376952 **[0005] [0014]**
- KR 1056036 **[0008] [0014] [0027] [0039]**