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(54) **Polishing head for surfaces of stone material**

(57) A polishing head (1) is described, for plane surfaces of stone material, composed of: a slow transmission assembly (2); and a series of quick transmission assemblies (3) connected to a series of tool-carrier as-

semblies (4) arranged on a circumference (6) orthogonal to a main axis of the head (1) constituted by a central shaft (20); in which the tool-carrier assemblies (4) are adapted to move at an absolute peripheral speed that comprises a high radial component.

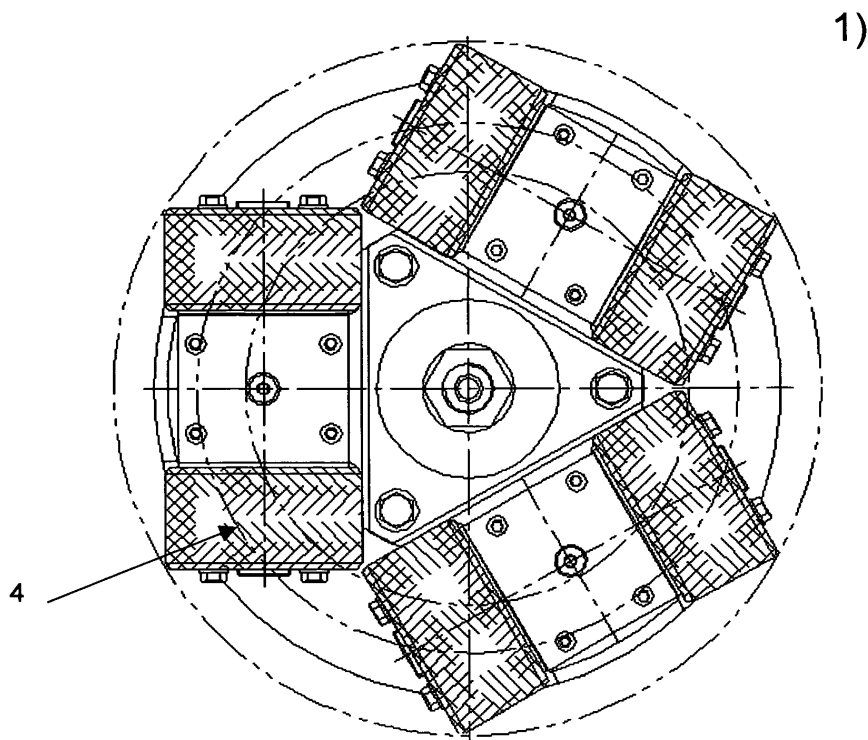


Fig. 1

Description

[0001] The present invention relates to a polishing head for surfaces of stone materials, ceramics, marble or granite.

[0002] A polishing head for surfaces of stone materials is classified in the following International Patent Classes (IPC): B24B - MACHINES, DEVICES, OR PROCESSES FOR GRINDING OR POLISHING; B28D - WORKING STONE OR STONE-LIKE MATERIALS.

[0003] The prior art is represented by a multi-tool head capable of polishing stone and ceramics materials due to a planetary motion of each tool rotating with respect to its own axis and with respect to the main axis of the head.

[0004] The main objective is smoothly polishing the surface, preventing the danger of mechanical oscillations that could generate a scoring in the worked surface.

[0005] In fact, the planetary and cycloidal motion of each tool is obtained by means of a cam- or gear-type transmission connected to an electric motor. The cam- or gear-type transmission multiplies by about five times the input speed, obtaining a rotation of each tool equal to about 2000:2500 revolutions per minute.

[0006] A problem, responsible for the surface quality and the anomalous consumption of the material composing the tool, is given by the different peripheral speed with which the tool abrades the surface to be polished.

[0007] Object of the present invention is providing a polishing head whose tool comes in contact with the surface to be polished with a uniform cutting speed.

[0008] A further object is providing a polishing head in which it is possible to modify the pressure angle with which each tool comes in contact with the surface to be polished.

[0009] A further object is providing a polishing head which is simple and at the same time compact, as guarantee of the prevention of mechanical vibrations and resonances, noise and thermal overheating.

[0010] These objects are obtained by means of a polishing head according to claim 1, comprising a series of tools arranged on a circumference and rotating with a high ratio of the radial component with respect to the tangential component of the absolute peripheral speed.

[0011] A preferred, but not limiting, embodiment of the polishing head of the present invention will be described below, with reference to the enclosed figures, in which:

- figure 1 is a plan view of a polishing head 1 of the invention;
- figure 2 is a front view of the polishing head 1;
- figure 3 is a front sectional view of a quick transmission assembly 3 equipped with cylindrical tool-holders belonging to the polishing head 1;
- figures 4a and 4b are orthogonally-projected views of a tool-holder 4 equipped with a cylindrical tool belonging to the polishing head 1;
- figure 5 is a side sectional view of a slow transmission

assembly 2 connected to the quick transmission assemblies 3 equipped with cylindrical tool-holders belonging to the polishing head 1;

- figures 6a and 6b are plan views of a configuration of tools with pressure angle respectively null and equal to 20° belonging to the polishing head 1.

[0012] According to the figures, the polishing head 1 of the invention is composed of:

- a slow transmission assembly 2;
- a quick transmission assembly 3;
- a tool-holder assembly 4.

[0013] The slow transmission assembly 2 comprises a fixed sleeve 11 surmounted by an interface flange with respect to the machine carrier structure, not shown. A flange 12, integral with an upper flange 13, is constrained to rotate with respect to the fixed sleeve 11 by means of rolling supports 14 and 15. Suitable liquid sealing means 16, 17 and 18 guarantee the insulation of the internal room delimited by the flanges 12 and 13. Inside such room, a first toothed wheel 19 is housed, integral with the fixed sleeve 11.

[0014] The flange 12 comprises a series of vertical holes 24 adapted to house the quick transmission assemblies 3 described below.

[0015] A shaft 20, flanged at its top to allow the connection to the motion-transmitting system given by an electric motor (not shown), is housed inside the fixed sleeve 11. A flange 21 is integral with the shaft 20 by means of a transmission element 22 and with the flange 12 by means of screws 23.

[0016] The motion given to the shaft 20 allows the rotation of the integral assembly composed of the flanges 21, 12 and 13 with respect to the fixed sleeve 11 connected to the machine carrier structure, not shown.

[0017] The quick transmission assembly 3 comprises a prismatic body 31 holed in its center vertically and horizontally. In the vertical hole a shaft 32 is housed, constrained to rotate with respect to the prismatic body 31 through rolling supports 33. A second toothed wheel 34 is connected to the shaft 32 by means of a transmission element 35. In the horizontal hole a shaft 36 is housed, constrained to rotate with respect to the prismatic body 31 through rolling supports 37 and axially locked by means of a pair of flanges 41 fastened to the shaft 36 with threaded ring nuts 42. On the surface of the circular base, the flanges 41 comprise threaded interface holes 43, necessary for the connection with the respective tool-carrier assembly 4 described below.

[0018] Sealing rings 44 ensure the seal to liquids of the room inside the prismatic body 31.

[0019] The two shafts 32 and 36 are connected by means of a toothed transmission composed of two bevel wheels 38 and 39 fastened to their respective shaft by transmission elements 40.

[0020] The pair of shafts 32 and 36 rotate synchro-

nously with respect to the prismatic body 31.

[0021] The tool-holder assembly 4 comprises an annular seat 51 coupled with a cylindrical tool 55 axially locked by means of a ring 53 fastened with screws 54 to the circular base of the casing 51.

[0022] A series of interface holes 52 are further present on such base.

[0023] The polishing head 1 of the invention provides for the union of the slow transmission assembly 2 with the quick transmission assemblies 3 housing the central top of each prismatic body 31 inside the respective vertical hole 24.

[0024] The meshing of the first toothed wheel 19 with each second toothed wheel 34 generates the motion transmission from the slow transmission assembly 2 to the respective quick transmission assemblies 3.

[0025] Experimental tests have demonstrated that the orientation of each tool-carrier assembly 4 tangent to a circumference 6 centred with respect to the main axis of the polishing head 1, namely the axis of the shaft 20, enables a smooth action of the tool on the surface to be polished.

[0026] The polishing head 1 of the invention is also adapted to easily modify the orientation of each tool-carrier assembly 4 with respect to the circumference 6; for example, it is possible to slant the quick transmission assembly by 20° with respect to the circumference centred on the shaft 20, creating a sort of "pressure angle α " with which the tool comes in contact with the surface to be polished.

[0027] In case of a tool arranged with a pressure angle $\alpha = 0^\circ$, the force given to the surface to be polished is wholly radial; in case of a tool slanted with a pressure angle $\alpha = 20^\circ$, the radial component of the force is proportionally reduced.

[0028] The polishing head 1 is made in a preferred embodiment with the following parameters:

SLOW TRANSMISSION ASSEMBLY 2

- rotation speed of the shaft 20 = 430 revolutions/minute;
- diameter of the first fixed toothed wheel 19 = 320 mm.

QUICK TRANSMISSION ASSEMBLY 3

- diameter of the second toothed wheel 34 = 80 mm;
- diameter of the circumference on which the rotation axes lie for each quick shaft 36 = 400 mm;
- angular speed of the tool 55 = 2150 revolutions/min;
- tangential speed of the tool = about 9 m/sec;
- pressure angle $\alpha = 0^\circ$.

Claims

1. Polishing head (1) of plane surfaces of stone material, composed of: a slow transmission assembly (2); a series of quick transmission assemblies (3) connected to a series of tool-carrier assemblies (4) arranged on a circumference (6) orthogonal to a main axis of the head (1) constituted by a central shaft (20); **characterised in that** the tool-carrier assemblies (4) are adapted to move at an absolute peripheral speed that comprises a high radial component.
2. Polishing head (1) according to claim 1, **characterised in that** the orientation of each tool-carrier assembly (4) is adapted to be modified with respect to the circumference (6) creating a sort of "pressure angle (α)" with which the tool comes in contact with the surface to be polished.
3. Polishing head (1) according to claim 2, **characterised in that:** in case of a tool arranged with a pressure angle $\alpha = 0^\circ$, the force given by the tool to the surface to be polished is wholly radial; in case of a tool slanted with a pressure angle $\alpha = 20^\circ$, the radial component of the force given by the tool is proportionally reduced.
4. Polishing head (1) according to any one of the previous claims, **characterised in that** the meshing of a first toothed wheel (19) with second toothed wheels (34) is adapted to generate the motion transmission from the slow transmission assembly (2) to the quick transmission assemblies (3) connected to the respective tool-holder assemblies (4).

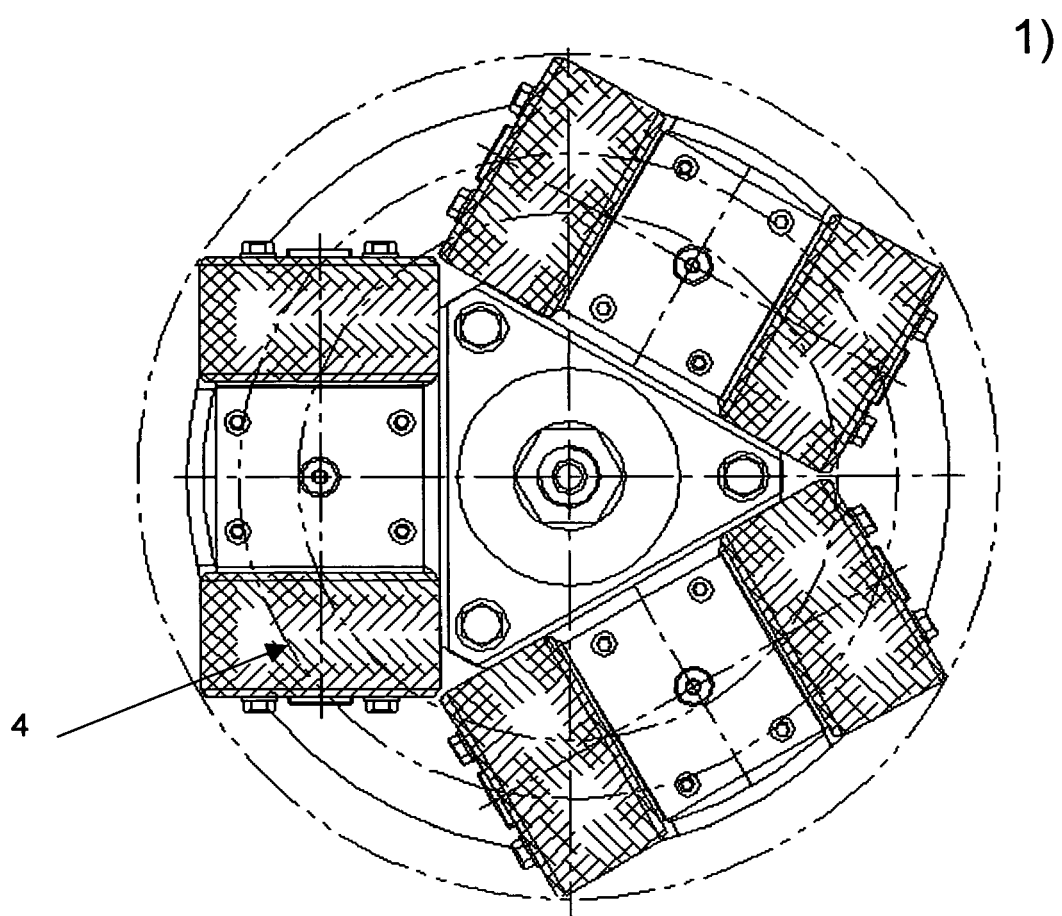


Fig. 1

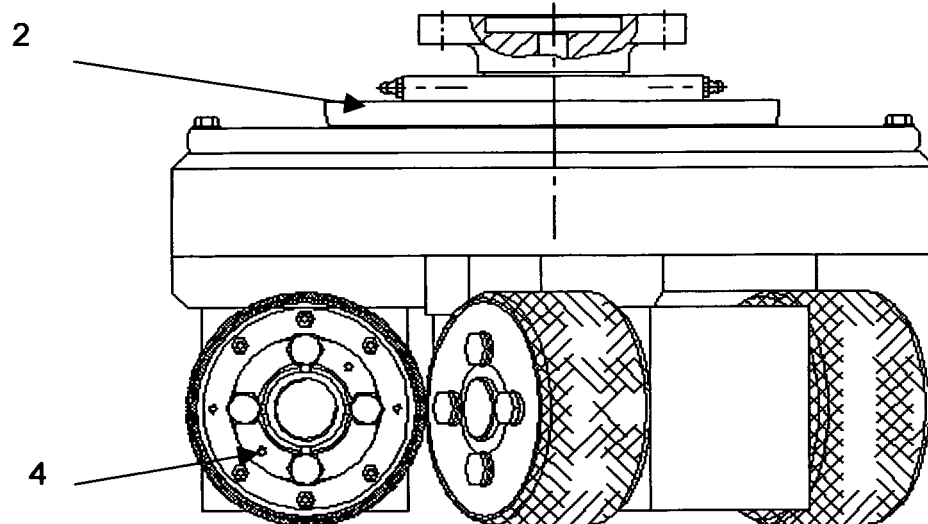
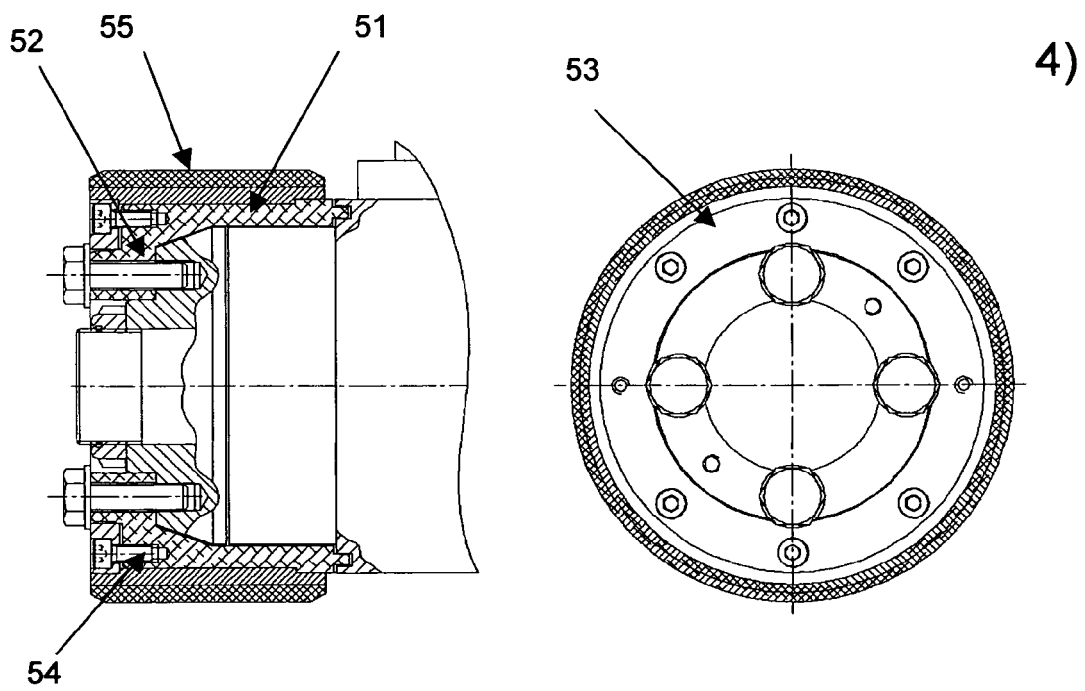
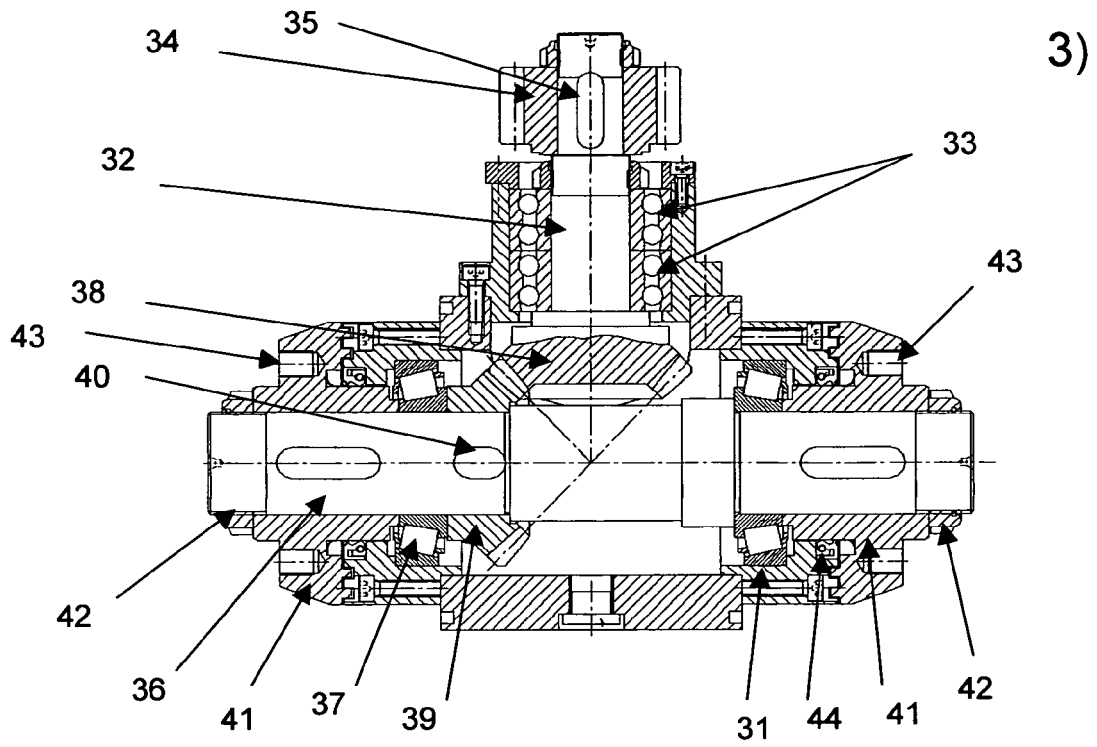


Fig. 2



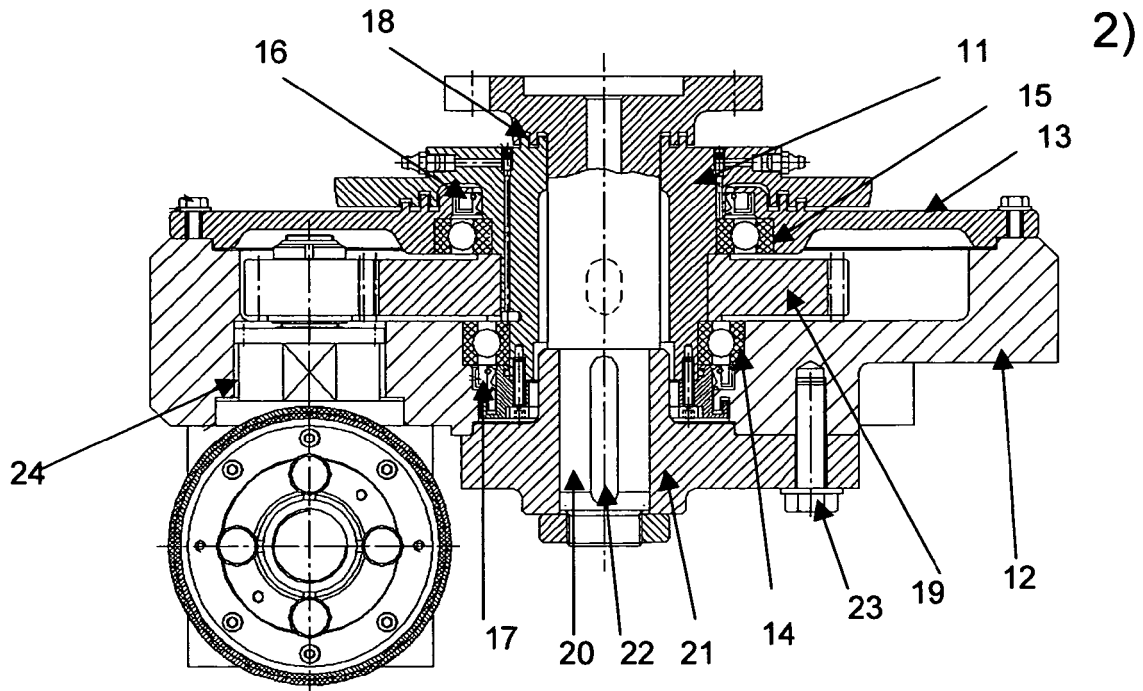


Fig. 5

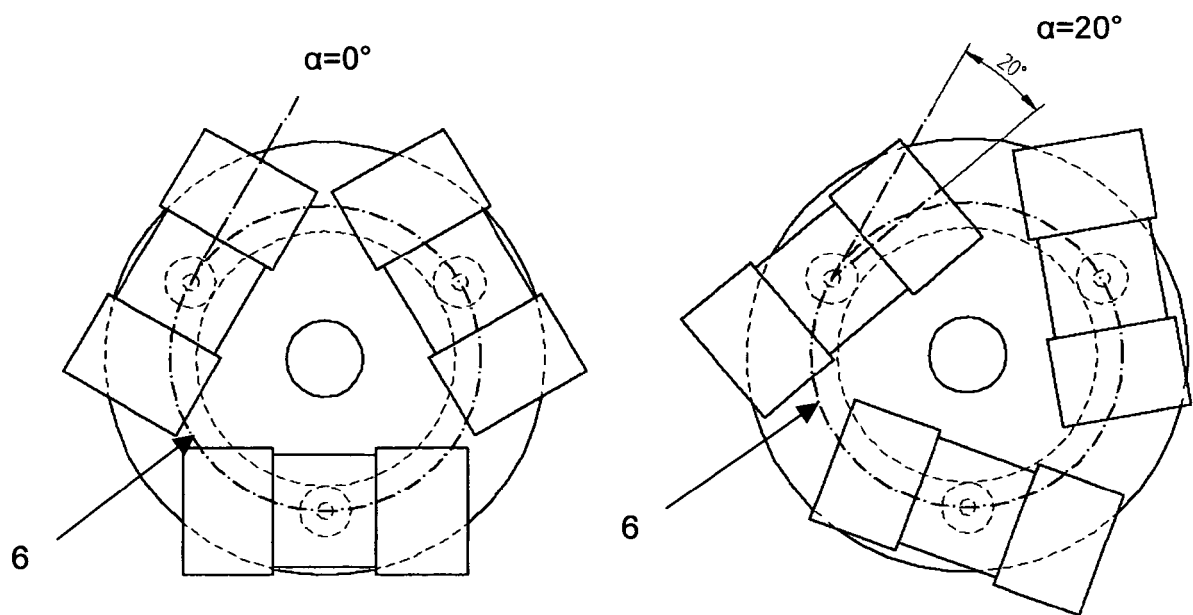


Fig. 6a

Fig. 6b



EUROPEAN SEARCH REPORT

Application Number
EP 10 42 5283

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
			B24B B28D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 February 2011	Examiner Gelder, Klaus
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 10 42 5283

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The members are as contained in the European Patent Office EDP file on
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