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(54) HIGH-SPEED CUP-SHAPED WHEEL COOLING STRUCTURE

(57) The present invention relates to a cooling structure of a high-speed cup-shaped wheel. The cooling structure includes a base and a blade ring, wherein the blade ring is arranged on the base and is fixedly connected to the base; the blade ring is provided with a plurality of water channel groups, which is sequentially arranged at intervals in a circumferential direction of the blade ring; and each of the water channel groups includes two or more inner water channels, which are sequentially arranged at intervals in the circumferential direction of the blade ring, the width of each of the two or more inner water channels in a radial direction of the blade ring being gradually increased. Compared with the prior art, the cooling structure of the present invention allows cooling water to cover the entire working surface to improve the cooling efficiency for the working surface and also to effectively improve the utilization efficiency of the cooling water, and can also reduce the influences from machining parameters to advantageously improve the grinding stability and grinding quality, thereby enabling the cup-shaped wheel to adapt to high-speed grinding.

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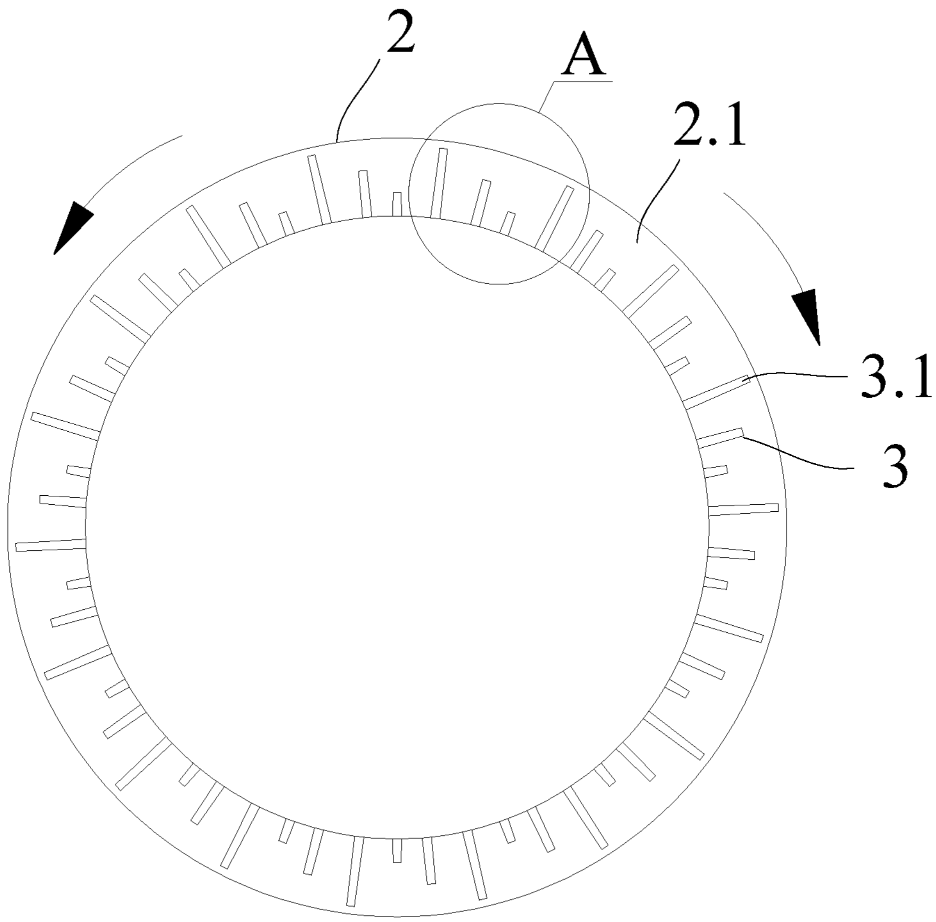

FIG. 6

Description

TECHNICAL FIELD

[0001] The present invention relates to the field of cup-shaped wheel technologies, and in particular to a cooling structure of a high-speed cup-shaped wheel.

BACKGROUND

[0002] A cup-shaped wheel mainly works in three major modes. In the first mode, as shown in FIG. 1 and FIG. 2, a front ring works, and this mode is characterized in that an axial height at an outer circle of a working surface of a blade ring is lower than an axial height at an inner circle of the working surface of the blade ring, and the inner circle of the working surface of the blade ring is finally in contact with a workpiece. In the second mode, as shown in FIG. 3 and FIG. 4, a back ring works, and this mode is characterized in that the axial height at the outer circle of the working surface of the blade ring is higher than the axial height at the inner circle of the working surface of the blade ring, and the outer circle of the working surface of the blade ring is finally in contact with the workpiece. In a third mode, as shown in FIG. 5, both the front ring and the back ring work, and this mode is characterized in that the axial height at the outer circle of the working surface of the blade ring is lower than the axial height at the inner circle of the working surface of the blade ring, and the inner circle of the working surface of the blade ring is finally in contact with the workpiece. After the running-in of the grinding surface of the blade ring in the three modes, with small variation in depth-of-cut and normal abrasion, an axial height difference between an outer diameter and an inner diameter of the grinding surface shows a curved surface form associated with the depth-of-cut.

[0003] In a through-blade ring-type cup-shaped grinding wheel of the prior art, two adjacent blades are spaced apart to form a water passage channel capable of delivering cooling water to a working surface, and the water passage channel has a through structure in a radial direction of a blade ring. When the cup-shaped grinding wheel rotates at a high speed, most of the cooling water entering the blade ring via an inner radial cavity will be thrown out toward the outer circle side of the blade ring via the water passage channel under a centrifugal force since the water passage channel has a through structure in the radial direction of the blade ring, such that the cooling effect on the working surface is extremely poor. Moreover, the amount of cooling water flowing along the inner circle sidewall of the blade ring to the working surface of the blade ring is very small, and the water in a bundle state is easily atomized into small water droplets by an "airflow barrier", which attenuates the cooling effect. Therefore, a region of the working surface close to the inner circle of the blade ring has no cooling water or insufficient cooling water, failing to achieve sufficient cooling.

[0004] In an inner blade ring-type cup-shaped grinding wheel of the prior art, the outer side of a blade ring is blocked, that is, an end of a water passage channel close to an outer circle of the blade ring is blocked. When the cup-shaped grinding wheel rotates at a high speed, most of the cooling water entering an inner circle of the blade ring via an inner radial cavity will tend to gather at the end of the water passage channel close to the outer circle of the blade ring under a centrifugal force, and be thrown out from a region of the working surface close to the outer circle of the blade ring, and the region of the working surface close to the outer circle of the blade ring can be sufficiently cooled at this time. However, the region of the working surface close to the inner circle of the blade ring has no cooling water or insufficient cooling water, failing to achieve sufficient cooling.

SUMMARY

[0005] The present invention is intended to solve one of the above-mentioned technical problems in the prior art to some extent. To this end, an object of the present invention is to provide a cooling structure of a high-speed cup-shaped wheel, in order to improve the cooling efficiency and the utilization efficiency of cooling water and advantageously improve the grinding stability and grinding quality.

[0006] The technical solution for the present invention to solve the above-mentioned technical problems is as follows. A cooling structure of a high-speed cup-shaped wheel includes a base and a blade ring, wherein the blade ring is arranged on the base and is fixedly connected to the base; the blade ring is provided with a plurality of water channel groups, which is sequentially arranged at intervals in a circumferential direction of the blade ring; and

each of the water channel groups includes two or more inner water channels, which are sequentially arranged at intervals in the circumferential direction of the blade ring, the width of each of the two or more inner water channels in a radial direction of the blade ring being gradually increased.

[0007] The present invention has the following beneficial effects: the cooling water flowing out of the two or more inner water channels different in width can cover the entire working surface, thereby improving the cooling efficiency for the working surface and avoiding the failure of sufficient cooling on some regions of the working surface; the cooling water covers the entire working surface, such that the utilization efficiency of the cooling water can be effectively improved; the influences from machining parameters can also be reduced to advantageously improve the grinding stability and grinding quality; and the cooling water covering the entire working surface can also allow the cup-shaped wheel to adapt to high-speed grinding.

[0008] On the basis of the above-mentioned technical solution, the present invention can implement further improvements as described below.

[0009] Further, a number of the inner water channels in each of the water channel groups has a directly proportional relationship with a depth-of-cut of the blade ring.

[0010] The beneficial effect of adopting the above-mentioned further solution is that, with more inner water channels in each water channel group, the outflow uniformity of the cooling water is improved to ensure that the cooling water completely covers the entire working surface, thereby meeting the requirement of the cup-shaped wheel for high-speed machining and improving the cooling efficiency and cooling completeness.

[0011] Further, a width difference between two adjacent inner water channels in each of the water channel groups in the radial direction of the blade ring has an inversely proportional relationship with the number of the inner water channels.

[0012] The beneficial effect of adopting the above-mentioned further solution is that when the cooling water is allowed to flow through the two or more inner water channels, the outer or inner circle edge of the blade ring can be covered with the cooling water to ensure that the cooling water completely covers the entire working surface, thereby meeting the requirement of the cup-shaped wheel for high-speed machining and improving the cooling efficiency and cooling completeness.

[0013] Further, the larger the width of each of the inner water channels in each of the water channel groups in the radial direction of the blade ring, the larger a circumferential spacing between the inner water channel and the adjacent inner water channel thereof.

[0014] The beneficial effect of adopting the above-mentioned further solution is that with larger circumferential spacing between adjacent inner water channels, the strength of the working surface corresponding to a region between two adjacent inner water channels is ensured, such that the cup-shaped wheel can adapt to high-speed grinding.

[0015] Further, a spacing between the inner water channel, having a maximum width in the radial direction of the blade ring, in each of the water channel groups and the adjacent inner water channel thereof is W1; a spacing between the inner water channel, having a minimum width in the radial direction of the blade ring, in the water channel group and the adjacent inner water channel thereof is W2; a spacing between the inner water channel, having the minimum width in the radial direction of the blade ring, in the water channel group and the inner water channel, having the maximum width in the radial direction of the blade ring, in the adjacent water channel group thereof is W3; and W1>W3>W2.

[0016] The beneficial effect of adopting the above-mentioned further solution is that ensuring the strength of the working surface corresponding to the region between two adjacent inner water channels can further ensure the strength of the working surface corresponding to a region between two adjacent water channel groups, such that the cup-shaped wheel can adapt to high-speed grinding.

[0017] Further, a cooling coverage area between the inner water channel, having the maximum width in the radial direction of the blade ring, in each of the water channel groups and the adjacent inner water channel thereof is S 1; a cooling coverage area between the inner water channel, having the minimum width in the radial direction of the blade ring, in the water channel group and the adjacent inner water channel thereof is S2; a cooling coverage area between the inner water channel, having the minimum width in the radial direction of the blade ring, in the water channel group and the inner water channel, having the maximum width in the radial direction of the blade ring, in the adjacent water channel group thereof is S3; and S1>S3>S2.

[0018] The beneficial effect of adopting the above-mentioned further solution is that ensuring the strength of the working surface corresponding to the region between two adjacent inner water channels can further ensure the strength of the working surface corresponding to a region between two adjacent water channel groups, such that the cup-shaped wheel can adapt to high-speed grinding.

[0019] Further, the inner water channel, having the maximum width in the radial direction of the blade ring, in each of the water channel groups is close to an outer circle edge of the blade ring.

[0020] The beneficial effect of adopting the above-mentioned further solution is that the cooling water flowing out of the inner water channel having the maximum width in the radial direction of the blade ring can cover the outer circle edge of the blade ring to improve the cooling efficiency.

[0021] Further, the two or more inner water channels each have a roundabout structure, and an axis of each of the two or more inner water channels deviates from a circle center of the blade ring.

[0022] Further, each of the water channel groups includes a water passage channel, which is arranged at a side of the inner water channel, having the largest length in the radial direction of the blade ring, in the water channel group.

[0023] The beneficial effect of adopting the above-mentioned further solution is that the cooling water is thrown out via the water passage channels towards the outer circle of the blade ring, in order to cover the outer circle region of the blade ring, thereby improving the cooling efficiency of the blade ring.

[0024] Further, the water passage channel has a roundabout structure, and has an axis deviating from the circle center of the blade ring.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a first schematic implementation diagram of a cup-shaped wheel in the prior art in a mode where a front ring works;

FIG. 2 is a second schematic implementation diagram of the cup-shaped wheel in the prior art in a mode where the front ring works;

FIG. 3 is a first schematic implementation diagram of the cup-shaped wheel in the prior art in a mode where a back ring works;

FIG. 4 is a second schematic implementation diagram of the cup-shaped wheel in the prior art in a mode where the back ring works;

FIG. 5 is a schematic implementation diagram of the cup-shaped wheel of the prior art in a mode where both the front ring and the back ring work;

FIG. 6 is a front view of a cup-shaped wheel with respect to Embodiment 1 according to the present invention;

FIG. 7 is a schematic enlarged view of Part A in FIG. 6;

FIG. 8 is a front view of a cup-shaped wheel with respect to Embodiment 2 according to the present invention; and

FIG. 9 is a schematic enlarged view of Part B in FIG. 8.

[0026] In the accompanying drawings, components represented by respective reference numerals are listed below:

1, base;
2, blade ring; 2.1, working surface;
3, water channel group; 3.1, inner water channel; 3.2, water passage channel; and
4, workpiece.

DETAILED DESCRIPTION

[0027] The principles and features of the present invention will be described below in conjunction with the accompanying drawings. The examples are only used to explain the present invention only, and are not intended to limit the scope of the present invention.

Embodiment 1:

[0028] As shown in FIG. 6 and FIG. 7, a cooling structure of a high-speed cup-shaped wheel includes a base 1 and a blade ring 2. The blade ring 2 is arranged on the base 1 and fixedly connected to the base 1. The blade ring 2 is provided with a plurality of water channel groups 3, which is sequentially arranged at intervals in a circumferential direction of the blade ring 2.

[0029] Each of the water channel groups 3 includes two or more inner water channels 3.1, which are sequentially arranged at intervals in the circumferential direction of the blade ring 2. The width of each of the two or more inner water channels 3.1 in a radial direction of the blade ring 2 is gradually increased.

[0030] Cooling water is introduced at the center of the base 1 and enters the inner water channels 3.1. Under the action of a centrifugal force, the cooling water flows from the end of each inner water channel 3.1 close to the inner circle of the blade ring 2 to the end of the inner water channel 3.1 close to the outer circle of the blade ring 2. Because the end of the inner water channel 3.1 close to the outer circle of the blade ring 2 is blocked, the cooling water flows out to a working surface 2.1 of the blade ring 2, and flows on the working surface 2.1 along a tangential direction of the inner water channel 3.1, such that the cooling water cools a partial region of the working surface 2.1.

[0031] The width of each of the two or more inner water channels 3.1 in the radial direction of the blade ring 2 increases gradually, and the cooling water flowing out of the inner water channels 3.1 different in width can cover the entire working surface 2.1, thereby improving the cooling efficiency for the working surface 2.1 and avoiding the failure of sufficient cooling on some regions of the working surface 2.1; the cooling water covers the entire working surface 2.1, such that the utilization efficiency of the cooling water can be effectively improved; the influences from machining parameters can also be reduced to advantageously improve the grinding stability and grinding quality; and the cooling water covering the entire working surface 2.1 can also allow the cup-shaped wheel to adapt to high-speed grinding.

[0032] One end of the inner water channel 3.1 is communicated to the inner circle of the blade ring 2, and the other end of the inner water channel 3.1 is close to the outer circle of the blade ring 2 and is blocked. The cooling structure is simple and is convenient to machine, and the cost can be effectively reduced.

[0033] In the above-mentioned embodiment, the number of the inner water channels 3.1 in each of the water channel groups 3 has a directly proportional relationship with a depth-of-cut of the blade ring 2.

[0034] That is, the larger the depth-of-cut of the blade ring 2 of the cup-shaped wheel, the more the inner water channels 3.1 in each of the water channel groups 3, such that the outflow uniformity of the cooling water is improved to ensure that the cooling water completely covers the entire working surface 2.1, thereby meeting the requirement of the cup-shaped wheel for high-speed machining and improving the cooling efficiency and cooling completeness.

[0035] In the above-mentioned embodiment, a width difference between two adjacent inner water channels 3.1 in each of the water channel groups 3 in the radial direction of the blade ring 2 has an inversely proportional relationship with the number of the inner water channels 3.1.

[0036] That is, when the depth-of-cut of the blade ring 2 of the cup-shaped wheel becomes larger, the more the inner water channels 3.1 in each of the water channel groups 3, the smaller the width difference, in the radial direction of the blade ring 2, between two adjacent inner water channels 3.1. However, the inner water channel 3.1, having the minimum width in the radial direction of the blade ring 2, in each of the water channel groups 3 is smaller. That is, the width of each inner water channel 3.1 in the radial direction of the blade ring 2 decreases with the increase of the depth-of-cut of the blade ring 2.

[0037] When the cooling water is allowed to flow through two or more inner water channels 3.1, the outer or inner circle edge of the blade ring 2 can be covered with the cooling water to ensure that the cooling water completely covers the entire working surface 2.1, thereby meeting the requirement of the cup-shaped wheel for high-speed machining and improving the cooling efficiency and cooling completeness.

[0038] In the above-mentioned embodiment, the larger the width of each of the inner water channels 3.1 in each of the water channel groups 3 in the radial direction of the blade ring 2, the larger a circumferential spacing between the inner water channel and the adjacent inner water channel 3.1 thereof.

[0039] With a larger circumferential spacing between adjacent inner water channels 3.1, the strength of the working surface 2.1 corresponding to the region between the two adjacent inner water channels 3.1 is ensured, such that the cup-shaped wheel can adapt to high-speed grinding.

[0040] In the above-mentioned embodiment, a spacing between the inner water channel 3.1, having a maximum width in the radial direction of the blade ring 2, in each of the water channel groups 3 and the adjacent inner water channel 3.1 thereof is W1; a spacing between the inner water channel 3.1, having a minimum width in the radial direction of the blade ring 2, in the water channel group 3 and the adjacent inner water channel 3.1 thereof is W2; a spacing between the inner water channel 3.1, having the minimum width in the radial direction of the blade ring 2, in the water channel group 3 and the inner water channel 3.1, having the maximum width in the radial direction of the blade ring 2, in the adjacent water channel group 3 thereof is W3; and W1>W3>W2.

[0041] W1 is also a circumferential distance between the inner water channel 3.1 having the maximum width in the radial direction of the blade ring 2 and the adjacent inner water channel 3.1 thereof; W2 is also a circumferential distance between the inner water channel 3.1 having the minimum width in the radial direction of the blade ring 2 and the adjacent inner water channel 3.1; and W3 is also a circumferential distance between the inner water channel 3.1 having the minimum width in the radial direction of the blade ring 2 and the inner water channel 3.1, having the maximum width in the radial direction of the blade ring 2, in the adjacent water channel group 3.

[0042] By setting W1>W3>W2, the strength of the working surface 2.1 corresponding to a region between the two adjacent inner water channels 3.1 is ensured, and the strength of the working surface 2.1 corresponding to a region between the two adjacent channel groups 3 is also ensured, such that the cup-shaped wheel can adapt to high-speed grinding.

[0043] In the above-mentioned embodiment, a cooling coverage area between the inner water channel 3.1, having the maximum width in the radial direction of the blade ring 2, in each of the water channel groups 3 and the adjacent inner water channel 3.1 thereof is S1; a cooling coverage area between the inner water channel 3.1, having the minimum width in the radial direction of the blade ring 2, in the water channel group 3 and the adjacent inner water channel 3.1 thereof is S2; a cooling coverage area between the inner water channel 3.1, having the minimum width in the radial direction of the blade ring 2, in the water channel group 3 and the inner water channel 3.1, having the maximum width in the radial direction of the blade ring 2, in the adjacent water channel group 3 thereof is S3; and S1>S3>S2.

[0044] By setting S1>S3>S2, the strength of the working surface 2.1 corresponding to the region between the two adjacent inner water channels 3.1 is ensured, and the strength of the working surface 2.1 corresponding to the region between the two adjacent channel groups 3 is also ensured, such that the cup-shaped wheel can adapt to high-speed grinding.

[0045] In the above-mentioned embodiment, the inner water channel 3.1, having the maximum width in the radial direction of the blade ring 2, in each of the water channel groups 3 is close to an outer circle edge of the blade ring 2.

[0046] The end of the inner water channel 3.1, having the maximum width in the radial direction of the blade ring 2, close to the outer circle edge of the blade ring 2 is infinitely close to the outer circle edge of the blade ring 2 to allow that a spacing between the inner water channel 3.1 and the outer circle edge of the blade ring 2 is infinitely close to zero, such that the cooling water flowing out from the inner water channel 3.1, having the maximum width in the radial direction of the blade ring 2, can cover the outer circle edge of the blade ring 2, thereby improving the cooling efficiency.

[0047] In the above-mentioned embodiment, the two or more inner water channels 3.1 each have a roundabout structure, and an axis of each of the two or more inner water channels 3.1 deviates from a circle center of the blade ring 2.

[0048] As shown in FIG.6, when the cooling structure of the high-speed cup-shaped wheel in this embodiment rotates counterclockwise, the strength of the blade ring 2 can be improved favorably; and when the cooling structure of the high-speed cup-shaped wheel rotates clockwise, the utilization ratio of the cooling water can be increased favorably.

Embodiment 2:

[0049] As shown in FIG. 8 and FIG. 9, a cooling structure of a high-speed cup-shaped wheel includes a base 1 and a blade ring 2. The blade ring 2 is arranged on the base 1 and fixedly connected to the base 1. The blade ring 2 is provided with a plurality of water channel groups 3, which is sequentially arranged at intervals in a circumferential direction of the blade ring 2.

[0050] Each of the water channel groups 3 includes two or more inner water channels 3.1, which are sequentially arranged at intervals in the circumferential direction of the blade ring 2. The width of each of the two or more inner water channels 3.1 in a radial direction of the blade ring 2 is gradually increased.

[0051] Cooling water is introduced at the center of the base 1 and enters the inner water channels 3.1. Under the action of a centrifugal force, the cooling water flows from the end of each inner water channel 3.1 close to the inner circle of the blade ring 2 to the end of the inner water channel 3.1 close to the outer circle of the blade ring 2. Because the end of the inner water channel 3.1 close to the outer circle of the blade ring 2 is blocked, the cooling water flows out to a working surface 2.1 of the blade ring 2, and flows on the working surface 2.1 along a tangential direction of the inner water channel 3.1, such that the cooling water cools a partial region on the working surface 2.1.

[0052] The width of each of the two or more inner water channels 3.1 in the radial direction of the blade ring 2 increases gradually, and the cooling water flowing out of the inner water channels 3.1 different in width can cover the entire working surface 2.1, thereby improving the cooling efficiency for the working surface 2.1 and avoiding the failure of sufficient cooling on some regions of the working surface 2.1; the cooling water covers the entire working surface 2.1, such that the utilization efficiency of the cooling water can be effectively improved; the influences from machining parameters can also be reduced to advantageously improve the grinding stability and grinding quality; and the cooling water covering the entire working surface 2.1 can also allow the cup-shaped wheel to adapt to high-speed grinding.

[0053] One end of the inner water channel 3.1 is communicated to the inner circle of the blade ring 2, and the other end of the inner water channel 3.1 is close to the outer circle of the blade ring 2 and is blocked. The cooling structure is simple and is convenient to machine, and the cost can be effectively reduced.

[0054] In the above-mentioned embodiment, the number of the inner water channels 3.1 in each of the water channel groups 3 has a directly proportional relationship with a depth-of-cut of the blade ring 2.

[0055] That is, the larger the depth-of-cut of the blade ring 2 of the cup-shaped wheel, the more the inner water channels 3.1 in each of the water channel groups 3, such that the outflow uniformity of the cooling water is improved to ensure that the cooling water completely covers the entire working surface 2.1, thereby meeting the requirement of the cup-shaped wheel for high-speed machining and improving the cooling efficiency and cooling completeness.

[0056] In the above-mentioned embodiment, a width difference between two adjacent inner water channels 3.1 in each of the water channel groups 3 in the radial direction of the blade ring 2 has an inversely proportional relationship with the number of the inner water channels 3.1.

[0057] That is, when the depth-of-cut of the blade ring 2 of the cup-shaped wheel becomes larger, the more the inner water channels 3.1 in each of the water channel groups 3, the smaller the width difference, in the radial direction of the blade ring 2, between two adjacent inner water channels 3.1. However, the width of the inner water channel 3.1, having the minimum width in the radial direction of the blade ring 2, in each of the water channel groups 3 is smaller. That is, the width of each inner water channel 3.1 in the radial direction of the blade ring 2 decreases with the increase of the depth-of-cut of the blade ring 2.

[0058] When the cooling water is allowed to flow through two or more inner water channels 3.1, the outer or inner circle edge of the blade ring 2 can be covered with the cooling water to ensure that the cooling water completely covers the entire working surface 2.1, thereby meeting the requirement of the cup-shaped wheel for high-speed machining and improving the cooling efficiency and cooling completeness.

[0059] In the above-mentioned embodiment, the larger the width of each of the inner water channels 3.1 in each of the water channel groups 3 in the radial direction of the blade ring 2, the larger a circumferential spacing between the inner water channel and the adjacent inner water channel 3.1 thereof.

[0060] With a larger circumferential spacing between adjacent inner water channels 3.1, the strength of the working surface 2.1 corresponding to a region between the two adjacent inner water channels 3.1 is ensured, such that the cup-shaped wheel can adapt to high-speed grinding.

[0061] In the above-mentioned embodiment, a spacing between the inner water channel 3.1, having a maximum width in the radial direction of the blade ring 2, in each of the water channel groups 3 and the adjacent inner water channel 3.1 thereof is W1; a spacing between the inner water channel 3.1, having a minimum width in the radial direction of the blade ring 2, in the water channel group 3 and the adjacent inner water channel 3.1 thereof is W2; a spacing between the inner water channel 3.1, having the minimum width in the radial direction of the blade ring 2, in the water channel group 3 and the inner water channel 3.1, having the maximum width in the radial direction of the blade ring 2, in the adjacent water channel group 3 thereof is W3; and W1>W3>W2.

[0062] By setting W1>W3>W2, the strength of the working surface 2.1 corresponding to the region between the two adjacent inner water channels 3.1 is ensured, and the strength of the working surface 2.1 corresponding to the region between the two adjacent channel groups 3 is also ensured, such that the cup-shaped wheel can adapt to high-speed grinding.

[0063] In the above-mentioned embodiment, a cooling coverage area between the inner water channel 3.1, having the maximum width in the radial direction of the blade ring 2, in each of the water channel groups 3 and the adjacent inner water channel 3.1 thereof is S1; a cooling coverage area between the inner water channel 3.1, having the minimum width in the radial direction of the blade ring 2, in the water channel group 3 and the adjacent inner water channel 3.1 thereof is S2; a cooling coverage area between the inner water channel 3.1, having the minimum width in the radial direction of the blade ring 2, in the water channel group 3 and the inner water channel 3.1, having the maximum width in the radial direction of the blade ring 2, in the adjacent water channel group 3 thereof is S3; and S1>S3>S2.

[0064] By setting S1>S3>S2, the strength of the working surface 2.1 corresponding to the region between the two adjacent inner water channels 3.1 is ensured, and the strength of the working surface 2.1 corresponding to the region between the two adjacent channel groups 3 is also ensured, such that the cup-shaped wheel can adapt to high-speed grinding.

[0065] In the above-mentioned embodiment, the inner water channel 3.1, having the maximum width in the radial direction of the blade ring 2, in each of the water channel groups 3 is close to an outer circle edge of the blade ring 2.

[0066] The end of the inner water channel 3.1, having the maximum width in the radial direction of the blade ring 2, close to the outer circle edge of the blade ring 2 is infinitely close to the outer circle edge of the blade ring 2 to allow that a spacing between the inner water channel 3.1 and the outer circle edge of the blade ring 2 is infinitely close to zero, such that the cooling water flowing out from the inner water channel 3.1, having the maximum width in the radial direction of the blade ring 2, can cover the outer circle edge of the blade ring 2, thereby improving the cooling efficiency.

[0067] In the above-mentioned embodiment, each of the water channel groups 3 includes a water passage channel 3.2, which is arranged at a side of the inner water channel 3.1, having the largest length in the radial direction of the blade ring 2, in the water channel group 3.

[0068] The cooling water is introduced at the center of the base 1 and enters the water passage channels 3.2. Under the action of a centrifugal force, the cooling water is thrown out towards the outer circle side of the blade ring 2 to cover the outer circle region of the blade ring 2, thereby improving the cooling efficiency of the blade ring 2.

[0069] In the above-mentioned embodiment, the two or more inner water channels 3.1 each have a roundabout structure, and an axis of each of the two or more inner water channels 3.1 deviates from a circle center of the blade ring 2; and the water passage channel 3.2 has a roundabout structure, and has an axis deviating from the circle center of the blade ring 2.

[0070] The two or more inner water channels 3.1 and the water passage channels 3.2 each have a roundabout structure, and an axis of each of the two or more inner water channels 3.1 and the water passage channels 3.2 deviates from the circle center of the blade ring 2.

[0071] Described above are merely preferred embodiments of the present invention, which are not intended to limit the present invention. Any modifications, equivalent replacements, improvements and the like made within the spirit and principle of the present invention shall be included within the scope of protection of the present invention.

Claims

1. A cooling structure of a high-speed cup-shaped wheel, comprising a base (1) and a blade ring (2), the blade ring (2) being arranged on the base (1) and fixedly connected to the base (1), wherein the blade ring (2) is provided with a plurality of water channel groups (3), which is sequentially arranged at intervals in a circumferential direction of the blade ring (2); and
each of the water channel groups (3) comprises two or more inner water channels (3.1), which are sequentially arranged at intervals in the circumferential direction of the blade ring (2), the width of each of the two or more inner water channels (3.1) in a radial direction of the blade ring (2) being gradually increased.

2. The cooling structure of the high-speed cup-shaped wheel according to claim 1, wherein a number of the inner water channels (3.1) in each of the water channel groups (3) has a directly proportional relationship with a depth-of-cut of the blade ring (2).

3. The cooling structure of the high-speed cup-shaped wheel according to claim 2, wherein a width difference between two adjacent inner water channels (3.1) in each of the water channel groups (3) in the radial direction of the blade ring (2) has an inversely proportional relationship with the number of the inner water channels (3.1).

4. The cooling structure of the high-speed cup-shaped wheel according to claim 3, wherein the larger the width of each of the inner water channels (3.1) in each of the water channel groups (3) in the radial direction of the blade ring (2), the larger a circumferential spacing between the inner water channel (3.1) and the adjacent inner water channel (3.1) thereof.

5. The cooling structure of the high-speed cup-shaped wheel according to claim 4, wherein a spacing between the inner water channel (3.1), having a maximum width in the radial direction of the blade ring (2), in each of the water channel groups (3) and the adjacent inner water channel (3.1) thereof is W1; a

spacing between the inner water channel (3.1), having a minimum width in the radial direction of the blade ring (2), in the water channel group (3) and the adjacent inner water channel (3.1) thereof is W2; a spacing between the inner water channel (3.1), having the minimum width in the radial direction of the blade ring (2), in the water channel group (3) and the inner water channel (3.1), having the maximum width in the radial direction of the blade ring (2), in the adjacent water channel group (3) thereof is W3; and W1>W3>W2.

6. The cooling structure of the high-speed cup-shaped wheel according to claim 4, wherein a cooling coverage area between the inner water channel (3.1), having the maximum width in the radial direction of the blade ring (2), in each of the water channel groups (3) and the adjacent inner water channel (3.1) thereof is S 1; a cooling coverage area between the inner water channel (3.1), having the minimum width in the radial direction of the blade ring (2), in the water channel group (3) and the adjacent inner water channel (3.1) thereof is S2; a cooling coverage area between the inner water channel (3.1), having the minimum width in the radial direction of the blade ring (2), in the water channel group (3) and the inner water channel (3.1), having the maximum width in the radial direction of the blade ring (2), in the adjacent water channel group (3) thereof is S3; and S1>S3>S2.

7. The cooling structure of the high-speed cup-shaped wheel according to claim 1, wherein the inner water channel (3.1), having the maximum width in the radial direction of the blade ring (2), in each of the water channel groups (3) is close to an outer circle edge of the blade ring (2).

8. The cooling structure of the high-speed cup-shaped wheel according to claim 1, wherein the two or more inner water channels (3.1) each have a roundabout structure, and an axis of each of the two or more inner water channels (3.1) deviates from a circle center of the blade ring (2).

9. The cooling structure of the high-speed cup-shaped wheel according to any one of claims 1 to 8, wherein each of the water channel groups (3) comprises a water passage channel (3.2), which is arranged at a side of the inner water channel (3.1), having the largest length in the radial direction of the blade ring (2), in the water channel group (3).

10. The cooling structure of the high-speed cup-shaped wheel according to claim 9, wherein the water passage channel (3.2) has a roundabout structure, and has an axis deviating from the circle center of the blade ring (2).

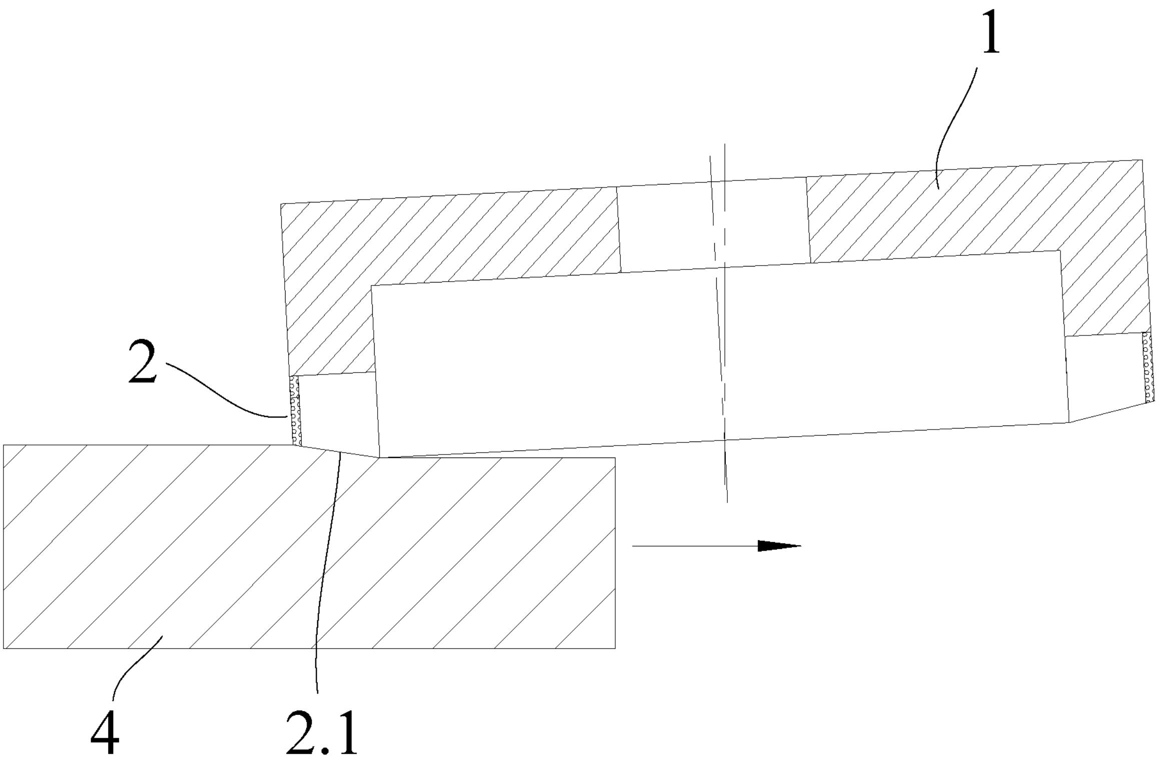

FIG. 1

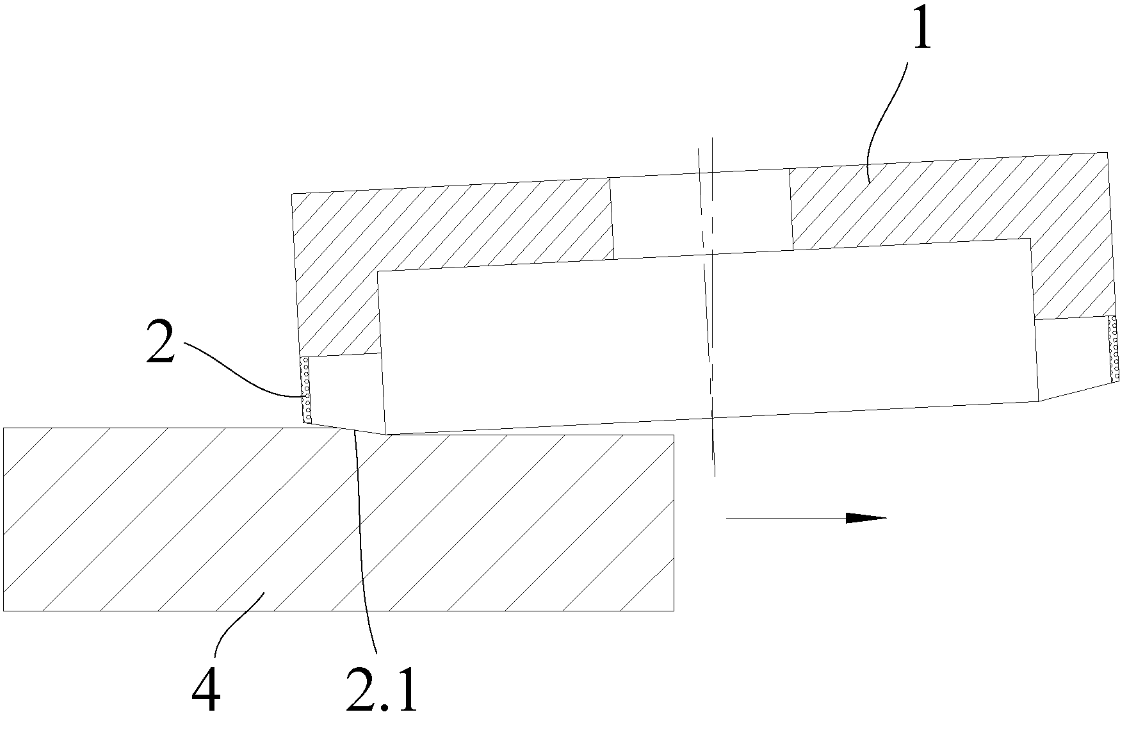

FIG. 2

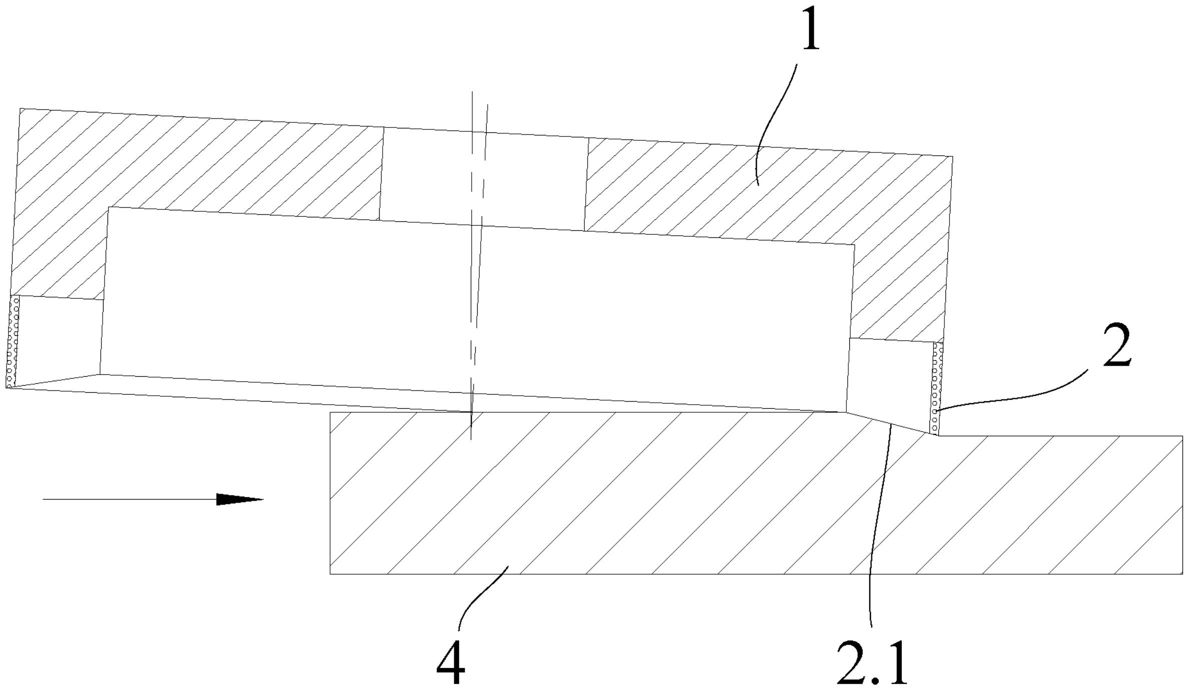

FIG. 3

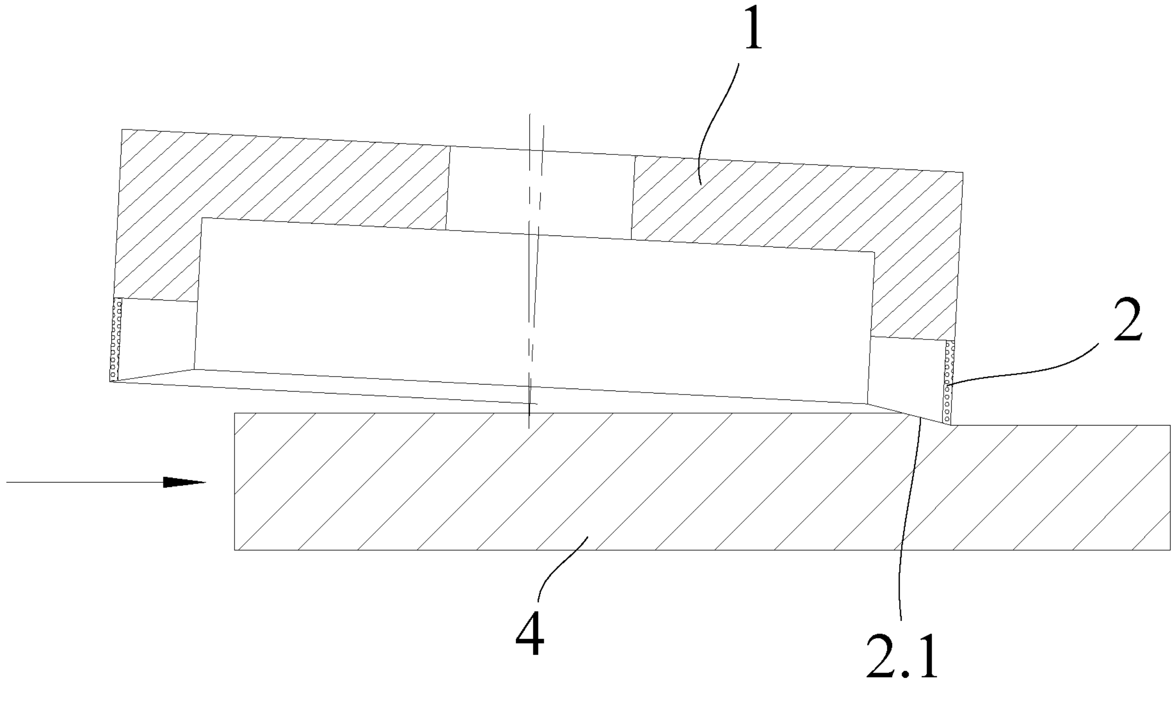

FIG. 4

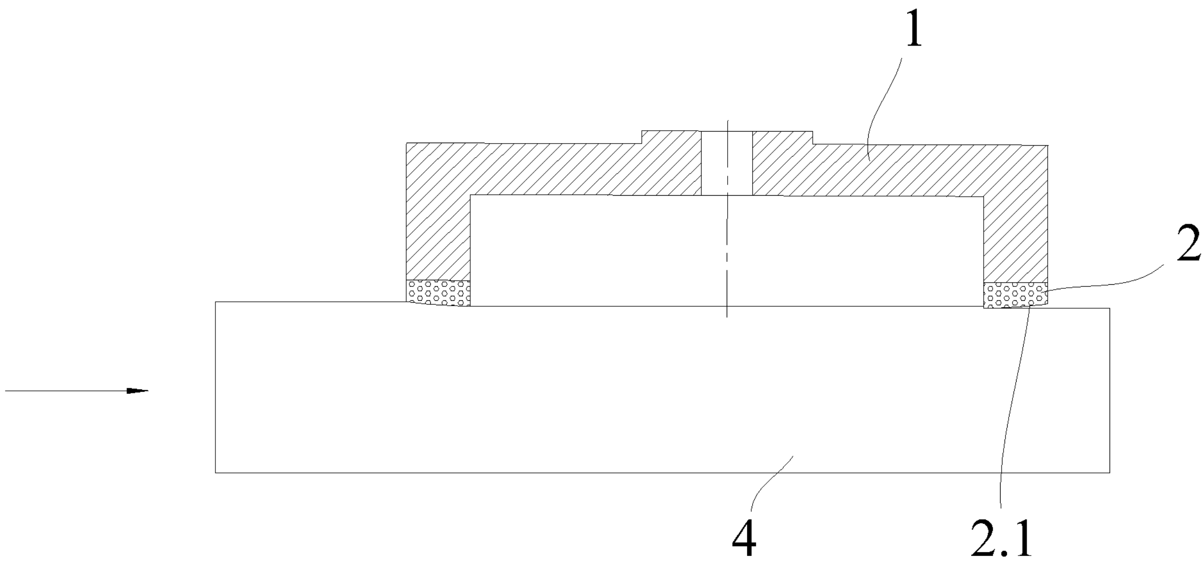

FIG. 5

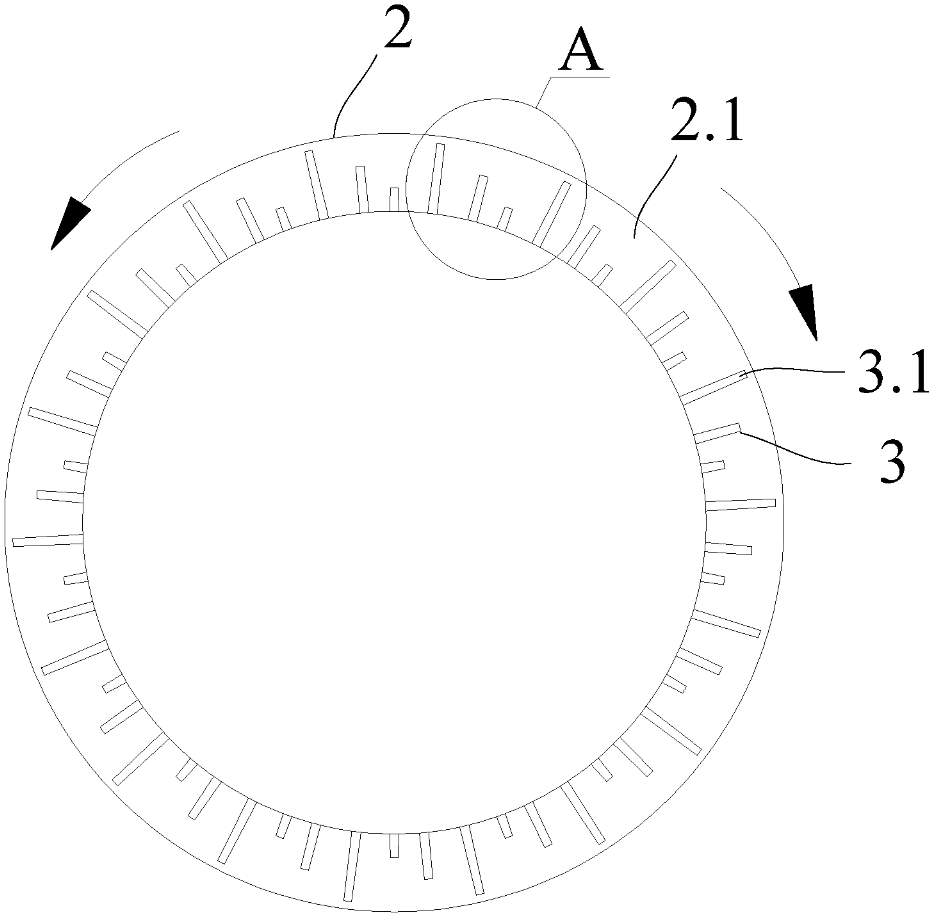

FIG. 6

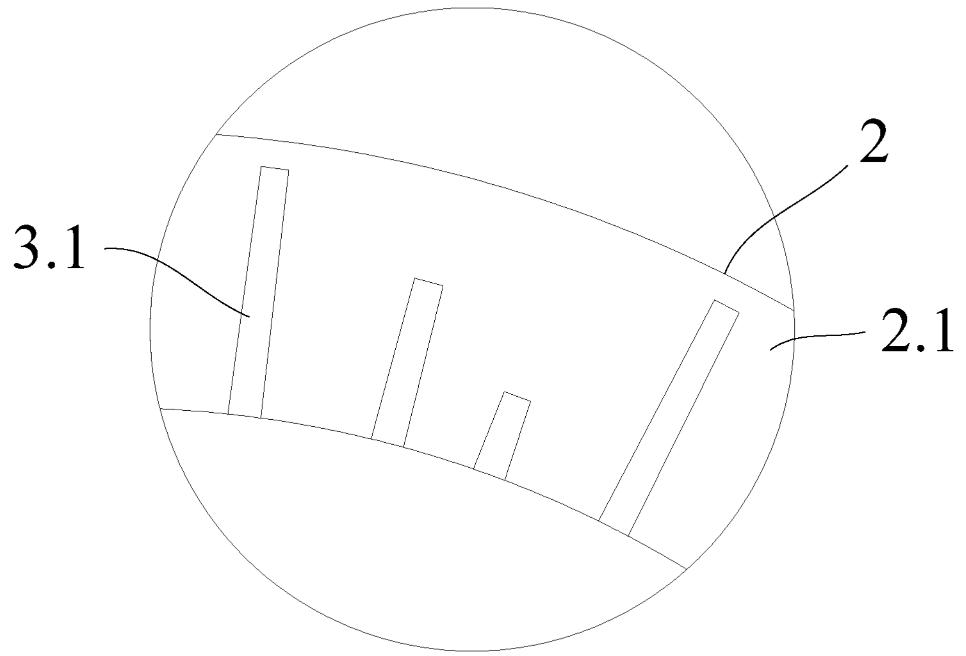

FIG. 7

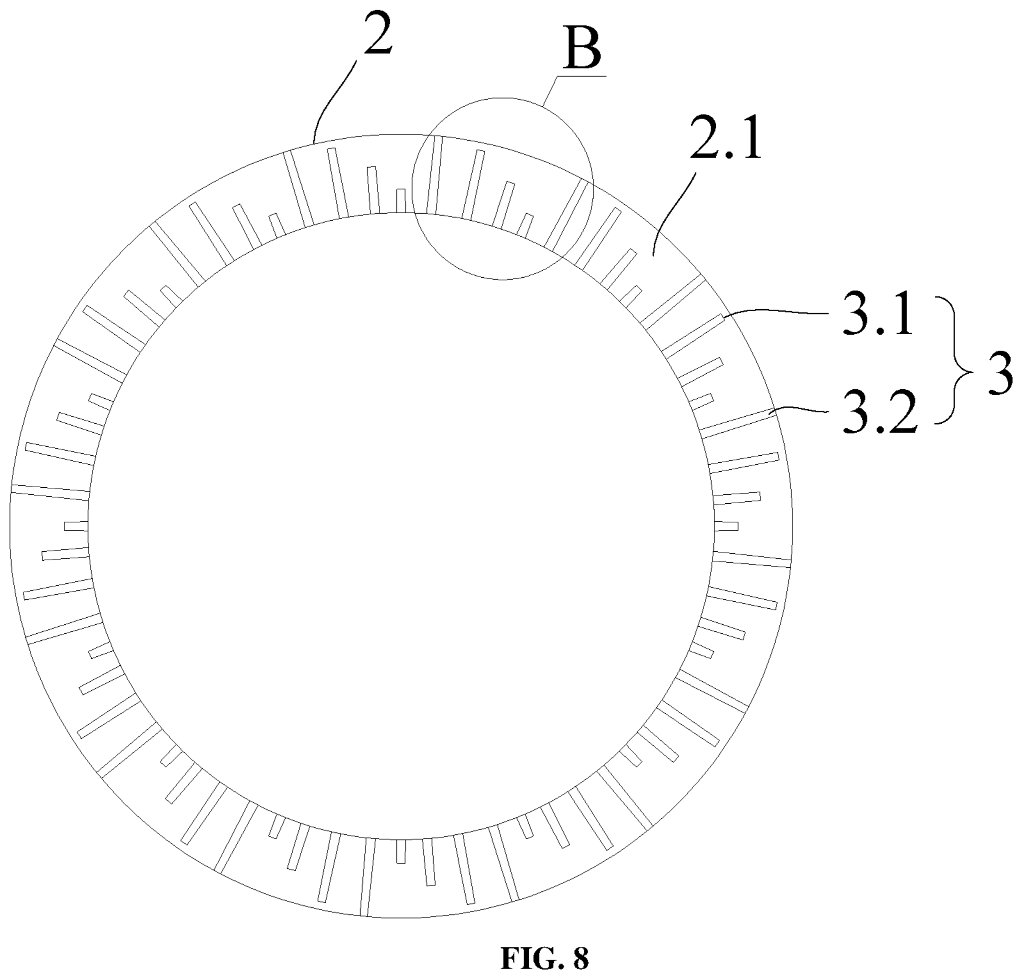

FIG. 8

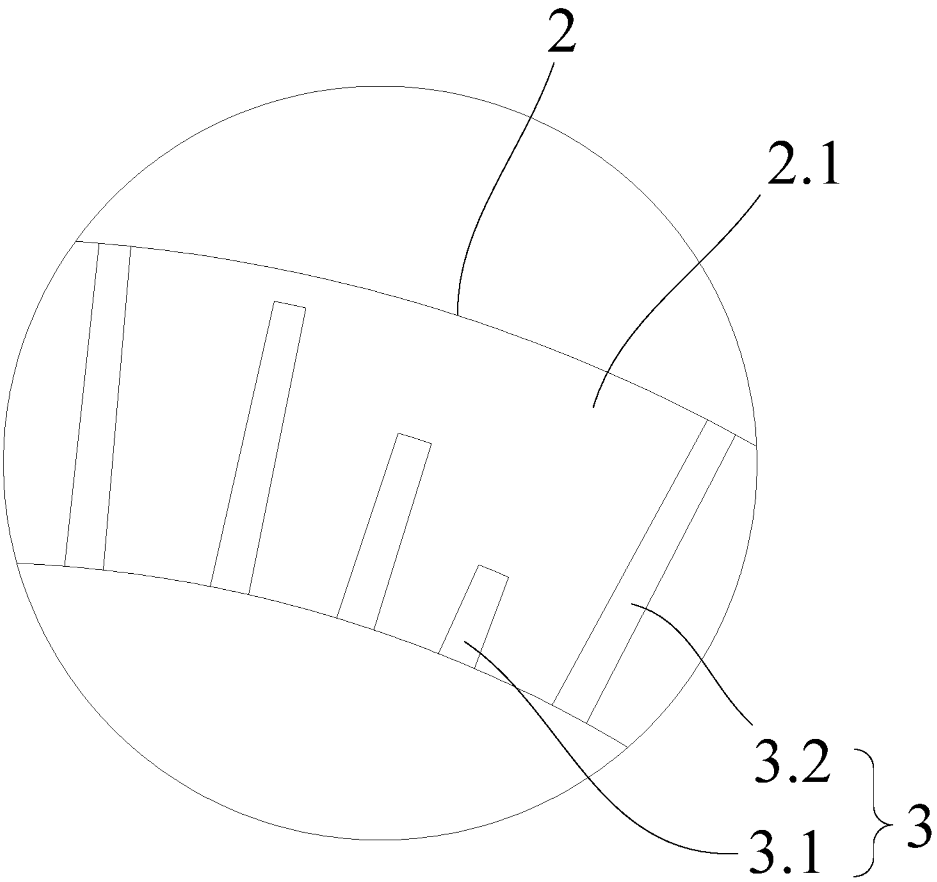

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/110855

A. CLASSIFICATION OF SUBJECT MATTER

B24D 7/10(2006.01)i； B24D 5/10(2006.01)i； B24D 13/18(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)

B24D

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)

CNABS; CNTXT; CNKI; VEN; USTXT; EPTXT; WOTXT: 创源金刚石, 冷却, 降温, 水, 液, 槽, 宽度, 长度, 不同, 距离差, 递增, 递减, 离心, 充分, 完全, 均匀, cool+, water, liquid, groove?, slot?, length, width, differen+, increas+, decreas+, centrifuge, full+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 111958508 A (GUILIN CHAMPION UNION DIAMOND CO., LTD.) 20 November 2020 (2020-11-20) claims 1-10, description paragraphs [0042]-[0085], figures 6-9	1-10
PX	CN 112828782 A (SONG, Jingxin et al.) 25 May 2021 (2021-05-25) description, paragraphs [0060]-[0079], and figures 8-11	1-10
A	CN 205588162 U (GUILIN CHAMPION UNION DIAMOND CO., LTD.) 21 September 2016 (2016-09-21) description, paragraphs [0040]-[0043], and figure 5	1-10
A	CN 111438643 A (GUILIN CHAMPION UNION DIAMOND CO., LTD.) 24 July 2020 (2020-07-24) entire document	1-10
A	CN 203738615 U (ZIGONG CEMENTED CARBIDE CO., LTD.) 30 July 2014 (2014-07-30) entire document	1-10
A	JP 2020093338 A (DISCO ABRASIVE SYSTEMS LTD.) 18 June 2020 (2020-06-18) entire document	1-10

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
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- "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	Date of mailing of the international search report
17 September 2021	**28 September 2021**

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/CN)
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Facsimile No. **(86-10)62019451**

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No. **PCT/CN2021/110855**

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 20110060380 A (OH DONG SEUK) 08 June 2011 (2011-06-08) entire document	1-10

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/110855

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	111958508	A	20 November 2020	CN	212218225	U	25 December 2020
CN	112828782	A	25 May 2021		None		
CN	205588162	U	21 September 2016		None		
CN	111438643	A	24 July 2020	CN	212095976	U	08 December 2020
CN	203738615	U	30 July 2014		None		
JP	2020093338	A	18 June 2020		None		
KR	20110060380	A	08 June 2011		None		

Form PCT/ISA/210 (patent family annex) (January 2015)