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(54) LOW-PRESSURE INTERNAL WATER SUPPLY THIN-WALL DRILL BIT

(57) The present invention relates to a thin-walled drill bit with low-pressure internal water supply. The thin-walled drill bit includes a work ring and a plurality of discharging slots. The work ring has a cylindrical structure; the plurality of discharging slots is distributed annularly at the bottom of a sidewall of the work ring; and the plurality of discharging slots is provided at the bottom of an outer sidewall of the work ring, and recessed to an inner side of the work ring by a preset distance, and a distance as recessed is less than a thickness of the sidewall of the work ring. The present invention has the following beneficial effects: 1, avoiding disadvantages in drainage of cooling water at a low pressure; 2, facilitating the discharge of chips from a discharge port to the outside, and thereby increasing the drilling speed; 3, facilitating the discharge of chips, the centering of the work ring during the initial drilling and the reduction of edge collapse under the action of a tapered surface as automatically formed by a drilling surface of the work ring having worked due to an unequal wear extent; 4, narrowing the rounding of inner diameter corners of the drilling surface of the work ring, and thereby facilitating the discharge of chips close to an inner diameter, to an outer diameter; and 5, enhancing the overall strength of the work ring and reducing the risk of flare on the end surface of the work ring.

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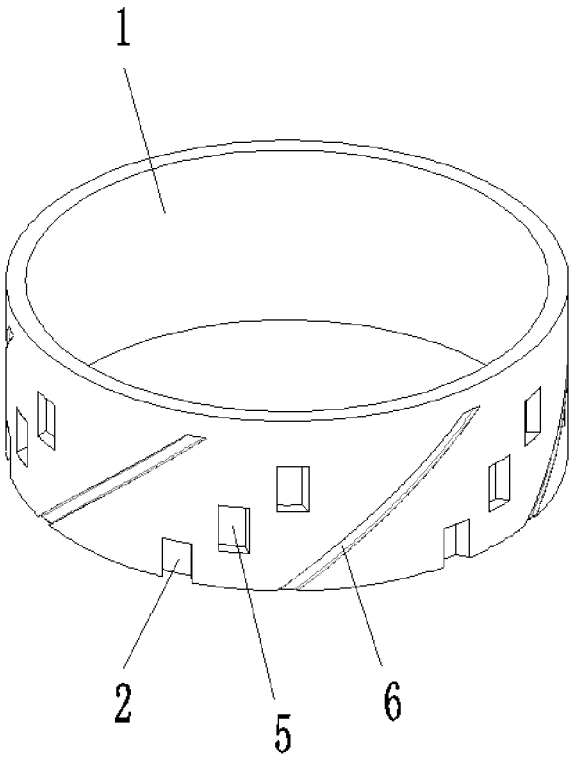

FIG. 4

Description

TECHNICAL FIELD

[0001] The present invention relates to the field of machining tools, in particular to a thin-walled drill bit with low-pressure water supply.

BACKGROUND

[0002] Thin-walled diamond drill bits need water cooling when working. Under normal conditions, a water pump is used to supply sufficient water with high water pressure and strong flowing capacity, and cooling water performs cooling from an inner diameter to an outer diameter via an end surface or drilling surface of the drill bit along a gap between an inner wall of the drill bit and a core of a machined component, while providing a strong boosting force to discharge the chips. Under this case, a higher drilling efficiency can be achieved. Under some abnormal conditions, the cooling water is mainly featured with low supply quantity and insufficient pressure, resulting in poor flowing capacity, poor cooling, and weak boosting force to discharge the chips, which greatly affects the drilling efficiency and easily leads to accidents such as burnout of drill bit and plugging.

[0003] In the prior art, there are three common forms of the thin-walled drill bits, including: a thin-walled drill bit free of a water passage channel and provided with a high-strength work ring; a thin-walled drill bit provided with an ordinary water passage channel and a low-strength work ring, in which case the single length of the water passage channel is greater than or equal to the length of a diamond work layer; and a thin-walled drill bit provided with relay-mode water passage channels, in which case the single length of each water passage channel is smaller than the length of a diamond work layer, the water passage channels are disposed in a multi-stage relay mode to cover the length of the diamond work layer, and the strength of the work ring is generally superior to that of an ordinary water passage channel.

[0004] In the case of the thin-walled drill bit free of the water passage channel under the condition of low-pressure water supply, a drilling surface is difficult to cool, and it is very difficult to discharge the chips in a direction from the inner diameter to the outer diameter, resulting in easily rounded inner diameter corners of the drilling surface (the change from FIG. 1 to FIG. 2), which finally greatly affect the drilling speed.

[0005] The thin-walled drill bit with either the ordinary water passage channel or the relay-mode water passage channels has a structure allowing the cooling water to flow through from the inner diameter to the outer diameter and to act on the drilling surface. When the water supply is sufficient to act on the drilling surface, the cooling effect and chip discharging effects can be significantly improved, as achieved by a high-speed and high-efficiency drill bit (in which a discharge port is equivalent to the aforesaid water passage channel) disclosed by Chinese Patent Application No. 201911348484.8. However, because the water passage channel in the prior art is structured to run through the sidewall of the work ring, when water is supplied under low pressure, part or even most of the water will be drained from the inner diameter through to the outer diameter inside the water passage channel away from the drilling surface under the action of a centrifugal force, failing to cool the drilling surface of the work ring. This further aggravates the poor cooling and the weak boosting force to discharge the chips in the case of low-pressure water supply, consequently affecting the drilling speed.

SUMMARY

[0006] To sum up, the technical problem to be solved by the present invention is to provide a thin-walled drill bit with low-pressure internal water supply, so as to overcome the deficiencies of the prior art.

[0007] A technical solution of the present invention for solving the aforesaid technical problem is summarized as follows: a thin-walled drill bit with low-pressure internal water supply includes: a work ring and a plurality of discharging slots, wherein the work ring has a cylindrical structure, and the plurality of discharging slots is distributed annularly at the bottom of a sidewall of the work ring to discharge chips when the work ring is rotated for machining; and the plurality of discharging slots is provided at the bottom of an outer sidewall of the work ring, and recessed to an inner side of the work ring by a preset distance, and a distance as recessed by each discharging slot is less than a thickness of the sidewall of the work ring.

[0008] The present invention has the following beneficial effects:

1, avoiding disadvantages in drainage of cooling water at a low pressure from water passage channels since the water passage channels penetrate through the sidewall of the work ring in the prior art;

2, facilitating the discharge of chips from a discharging slot to the outside, and thereby increasing the drilling speed;

3, facilitating the discharge of chips, the centering of the work ring during the initial drilling and the reduction of edge collapse under the action of a tapered surface as automatically formed by a drilling surface of the work ring having worked due to an unequal wear extent;

4, narrowing the rounding of the inner diameter corners of the drilling surface of the work ring, and thereby facilitating the discharge of chips close to the inner diameter, to the outer diameter; and

5, enhancing the overall strength of the work ring and reducing the risk of flare on the end surface of the work ring.

[0009] The following improvements may further be made on the present invention based on the aforesaid technical solution.

[0010] Further, a difference between the thickness of the sidewall of the work ring and the distance as recessed by the discharging slot is greater than 0 mm and less than 0.5 mm.

[0011] Further, a symmetrical centerline of two side edges at the bottom of the discharging slot or a centerline of an included angle between the two side edges at the bottom of the discharging slot does not pass through a circle center of a bottom surface of the work ring.

[0012] The beneficial effect of adopting the aforesaid further solution is that: with the rotation of the work ring, chips in the discharging slots can be discharged more easily from the discharging slots under the action of a mechanical pushing force of the discharging slots towards the outer side of the work ring, thereby ensuring the high-speed and high-efficiency operation of the drill bit.

[0013] Further, the two side edges at the bottom of the discharging slot are provided in parallel, and the symmetrical centerline of the discharging slot does not pass through the circle center of the bottom surface of the work ring; and the two side edges at the bottom of the discharging slot are arranged in a spiral with respect to the circle center of the bottom surface of the work ring, and a spiral direction is the same as a rotating direction of the work ring.

[0014] The beneficial effect of adopting the aforesaid further solution is that: the chips can be discharged outwards along the discharging slot under a centrifugal force by the rotation of the work ring, thereby increasing a chip discharging speed.

[0015] Further, the two side edges at the bottom of the discharging slot are sequentially a first side edge and a second side edge respectively along a rotating direction of the work ring; a centerline of an included angle between the first side edge and the second side edge does not pass through the circle center of the bottom surface of the work ring; one end of the first side edge is located at a corresponding position on an inner sidewall of the work ring, and the other end of the first side edge is oriented towards the outer side of the work ring and deflected by an angle α to a direction opposite to the rotating direction of the work ring; and one end of the second side edge is located at a corresponding position on the inner sidewall of the work ring, and the other end of the second side edge is oriented towards the outer side of the work ring and deflected by an angle θ to the rotating direction of the work ring, with $\alpha > 45° > \theta$.

[0016] The beneficial effect of adopting the aforesaid further solution is that: the second side edge of the discharging slot does not block the chips pushed out by the first side edge when the work ring is rotated, thereby increasing the chip discharging speed in a radial direction of the work ring; and with $\alpha > 45° > \theta$, it is more conducive to the discharge of chips towards an outer diameter direction under the condition of low-pressure water.

[0017] Further, two side surfaces of the discharging slot are provided in parallel, and the symmetrical centerline of the two side edges at the bottom of the discharging slot does not pass through the circle center of the bottom surface of the work ring; the two side surfaces of the discharging slot are inclined towards the rotating direction of the work ring relative to the bottom surface of the work ring; and one end of each of the two side surfaces of the discharging slot is located at a corresponding position on the inner sidewall of the work ring, and the other end of the side surface is oriented towards an outer side of the work ring and deflected by a preset angle to the rotating direction of the work ring.

[0018] The beneficial effect of adopting the aforesaid further solution is that: one of the two side surfaces of the discharging slot forms an upward and outward pushing force on the chips when the work ring is rotated, thereby increasing the chip discharging speed in an axial direction of the work ring.

[0019] Further, the sidewall of the work ring is provided with standby discharging slots corresponding to the discharging slots, and each standby discharging slot is disposed above the discharging slot and configured to discharge chips after axial abrasion of the work ring exceeds the discharging slot.

[0020] The beneficial effect of adopting the aforesaid further solution is that: the work ring can perform normal machining even undergoing axial abrasion.

[0021] Further, the discharging slot has a rounded structure at the top, and the standby discharging slot has rounded structures at its both bottom and top.

[0022] The beneficial effect of adopting the aforesaid further solution is to prevent stress concentration and facilitate the flow of cooling water and chips.

[0023] Further, a plurality of chip discharging slots is provided uniformly in the outer sidewall of the work ring along a circumferential direction; and a lower end of each chip discharging slot extends to the bottom of the work ring, and an upper end of the chip discharging slot extends diagonally upwards.

[0024] Further, the chip discharging slot is in a spiral shape, and a spiral direction is the same as the rotating direction of the work ring.

[0025] The beneficial effect of adopting the aforesaid further solution is to facilitate upward discharging of the chips along the discharging slots.

[0026] Further, the discharging slots and the standby discharging slots are provided at corresponding positions inside the chip discharging slots.

[0027] The beneficial effect of adopting the aforesaid further solution is that: the chips discharged from the discharging slots can be discharged upwards in the first time via the discharging slots.

[0028] Further, two side surfaces of each of the discharging slots or the standby discharging slots are sequentially a first side surface and a second side surface respectively along the rotating direction of the work ring;

two side surfaces of each chip discharging slot are sequentially a third side surface and a fourth side surface respectively along the rotating direction of the work ring; and the first side surface overlaps with the third side surface, and the second side surface is spaced from the fourth side surface.

[0029] The beneficial effect of adopting the aforesaid further solution is to increase the chip discharging space and improve the chip discharging efficiency.

[0030] Further, a width of the discharging slot in the circumference direction of the work ring gradually increases from the inner side of the work ring towards the outer side of the work ring.

[0031] The beneficial effect of adopting the aforesaid further solution is that: a tapered surface is formed automatically from the drilling surface of the work ring after its abrasion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032]

FIG. 1 is a diagram of an initial structure of a thin-walled drill bit free of water passage channels; FIG. 2 is a structural diagram of a thin-walled drill bit free of water passage channels, with rounded inner diameter corners;

FIG. 3 is a schematic diagram of water flow during glass machining according to Embodiment 1 of the present invention, with discharging slots disposed in chip discharging slots;

FIG. 4 is a three-dimensional view of Embodiment 1 of the present invention;

FIG. 5 is a bottom view of Embodiment 1 of the present invention;

FIG. 6 is a three-dimensional view of Embodiment 2 of the present invention;

FIG. 7 is a bottom view of Embodiment 2 of the present invention;

FIG. 8 is a schematic diagram of radial discharging of chips according to Embodiment 2 of the present invention;

FIG. 9 is a schematic diagram of radial discharging of chips from an existing drill bit;

FIG. 10 is a three-dimensional view of Embodiment 3 of the present invention;

FIG. 11 is a front view of Embodiment 3 of the present invention;

FIG. 12 is a bottom view of Embodiment 3 of the present invention;

FIG. 13 is a sectional view taken along A-A in FIG. 12;

FIG. 14 is a three-dimensional view of Embodiment 4 of the present invention;

FIG. 15 is a front view of Embodiment 4 of the present invention;

FIG. 16 is an enlarged view of the bottom of a work ring in Embodiment 2 of the present invention after the work ring has worked for a period of time; and

FIG. 17 is a schematic diagram of an angle α and an angle θ.

[0033] Dotted lines herein refer to a symmetrical centerline of two side edges at the bottom of each discharging slot or a centerline of an included angle between the two side edges at the bottom of the discharging slot; solid arrows refer to a rotating direction of the work ring or a flowing path of cooling water; and dashed arrows refer to a discharging direction of chips.

[0034] In the accompanying drawings, the components represented by respective references signs are listed as follows:

1-work ring; 2-discharging slot; 3-first side edge; 4-second side edge; 5-standby discharging slot; 6-chip discharging slot; 7-base; 8-glass; 9-first side surface; 10-second side surface; 11-third side surface; 12-fourth side surface; 13-inner diameter corner; 14-tapered surface.

DETAILED DESCRIPTION

[0035] The principles and features of the present invention will be described below in conjunction with the accompanying drawings, and the examples given are intended to explain the present invention only and are not intended to limit the scope of the present invention.

Embodiment 1

[0036] As shown in FIGs. 3-5, a thin-walled drill bit with low-pressure internal water supply includes a work ring 1 and a plurality of discharging slots 2. The work ring 1 has a cylindrical structure, and the plurality of discharging slots 2 is distributed annularly at the bottom of a sidewall of the work ring 1 to discharge chips when the work ring 1 is rotated for machining. The discharging slots 2 are provided at the bottom of an outer sidewall of the work ring 1, and recessed to an inner side of the work ring 1 by a preset distance, and a distance as recessed by each discharging slot 2 is less than a thickness of the sidewall of the work ring 1. A difference between the thickness of the sidewall of the work ring 1 and the distance as recessed by each discharging slot 2 is greater than 0 mm and less than 0.5 mm.

[0037] The two side edges at the bottom of the discharging slot 2 are provided in parallel, and a symmetrical centerline of the discharging slot 2 does not pass through the circle center of the bottom surface of the work ring 1; and the two side edges at the bottom of the discharging slot 2 are arranged in a spiral with respect to the circle center of the bottom surface of the work ring 1, and a spiral direction is the same as a rotating direction of the work ring 1. In this embodiment, the chips may be discharged outwardly along the discharging slots 1 under a centrifugal force generated by the rotation of the work ring 1, which improves a chip discharging speed and ensures the high-efficiency operation of the drill bit when the drill bit rotates at a high speed.

[0038] The sidewall of the work ring 1 is provided with standby discharging slots 5 corresponding to the discharging slots 2, and each standby discharging slot 5 is disposed above the discharging slot 2 and configured to discharge chips after axial abrasion of the work ring 1 exceeds the discharging slot 2. With the continuous machining, the work ring 1 may be continuously abraded in an axial direction. When the abrasion reaches a certain extent and namely exceeds the discharging slots 2, the standby discharging slots 5 at a second layer may become new discharging slots 2, each of which has the same structure as the initial discharging slot 2. By analogy, the standby discharging slots 5 at an upper layer may be continuously formed as the new discharging slots 2 until the work ring 1 is abraded and loses the ability to work. A plurality of chip discharging slots 6 is provided uniformly in the outer sidewall of the work ring 1 along a circumferential direction; and a lower end of each chip discharging slot 6 extends to the bottom of the work ring 1, and an upper end of the chip discharging slot 6 extends diagonally upwards. Each chip discharging slot is in a spiral shape, and the spiral direction is the same as the rotating direction of the work ring 1. The chip discharging slot 6 is designed such that the chips can be discharged upward along the chip discharging slots 6, and the discharging slots 2 and the standby discharging slots 5 may be provided outside the chip discharging slots 6 or inside the chip discharging slots 6.

[0039] By means of the above design, the water passage channel running through the sidewall of the work ring in the prior art is improved to a discharging slot 2 without running through the sidewall of the work ring 1, which achieves the following advantages.

[0040] First, since the discharging slot 2 is not structured to run through the sidewall of the work ring 1, most or all of the cooling water flows through a drilling surface of the work ring 1 under the flow restriction of the sidewall of the work ring 1 at the discharging slot 2, thereby avoiding the disadvantage in the prior art that, due to the water passage channel running through the sidewall of the work ring in the prior art, the low-pressure cooling water is drained from the inner diameter through to the outer diameter inside the water passage channel away from the drilling surface, leading to a failure in cooling the drilling surface of the work ring 1 by the cooling water.

[0041] Secondly, a relatively larger quantity of cooling water flows to the outer diameter from the inner sidewall at the discharging slot 2 which is the thinnest part of the work ring 1, facilitating the discharge of the chips in a discharge port to the outside and simultaneously facilitating the discharge of the chips from the spiral chip discharging slot 6, thereby contributing to the increase of the drilling speed.

[0042] Thirdly, because a ratio of the perimeter of a machining material layer (diamond) on any diameter of the grinding surface of the work ring 1 to the perimeter of a workpiece material corresponding to this diameter is 1, the discharging slot 2 is now provided in the outer sidewall of the work ring 1, and the width of the discharging slot 2 in the circumferential direction of the work ring 1 gradually increases from the inner side of the work ring 1 towards the outer side of the work ring 1, such that the ratio of the perimeter of the machining material layer (diamond) on the outer diameter of the work ring 1 to the perimeter of the workpiece material corresponding to the outer diameter is less than 1. Consequently, the abrasion of the outer diameter of the work ring 1 will be accelerated. When the drill bit is working, the axial abrasion of the drilling surface of the work ring 1 from the outer diameter to the inner diameter changes from fast to slow, and a tapered surface 14 is automatically formed after the abrasion, thereby facilitating the discharge of chips, the centering of the work ring 1 during the initial drilling, and the reduction of edge collapse under the action of the tapered surface 14.

[0043] Fourthly, after the tapered surface 14 is formed from the drilling surface of the work ring 1, its horizontal width is narrowed, that is, the horizontal width is eroded by the tapered surface 14. Therefore, the rounding of an inner diameter corner 13 of the drilling surface of the work ring 1 is narrowed (the larger the horizontal width, the easier the rounding occurring to the inner diameter corner 13 of the drilling surface), thereby facilitating the discharge of chips close to the inner diameter toward the outer diameter.

[0044] Finally, compared with the water passage channel running through the sidewall of the work ring in the prior art, the discharging slot 2 that does not run through the sidewall of the work ring 1 can enhance the overall strength of the work ring 1 and reduce the risk of flare on the end surface, namely the drilling surface, of the work ring 1.

Embodiment 2

[0045] This embodiment mainly changes the structure of the discharging slots 2, and the remaining portion of this embodiment is consistent with Embodiment 1.

[0046] As shown in FIGs. 6 and 7, the two side edges at the bottom of each discharging slot 2 are sequentially a first side edge 3 and a second side edge 4 along the rotating direction of the work ring 1, and a centerline of an included angle between the first side edge 3 and the second side edge 4 does not pass through the circle center of the bottom surface of the work ring 1. As shown in FIG. 17, one end of the first side edge 3 is located at a corresponding position on the inner sidewall of the work ring 1, and the other end of the first side edge 3 is oriented towards the outer side of the work ring 1 and deflected by an angle α to a direction opposite to the rotating direction of the work ring 1. One end of the second side edge 4 is located at a corresponding position on the inner sidewall of the work ring 1, and the other end of the second side edge 4 is oriented towards the outer side of the work ring 1 and deflected by an angle θ to the rotating direction of the work ring 1, with $\alpha>45°>\theta$. In this embod-

iment, when the work ring 1 is rotated, the first side edge 3 of each discharging slot 2 may form a radial mechanical pushing force under the rotation of the work ring 1, so as to push the chips to the outer side of the work ring 1. Since the angle α of the first side edge 3 formed by deflecting opposite to the rotating direction of the work ring 1 is greater than the angle θ of the second side edge 4 formed by deflecting towards the rotating direction of the work ring 1, the second side edge 4 may not block the chips pushed outward by the first side edge 3. As shown in FIG. 8, with the rotation of the work ring 1, the chips are smoothly discharged along the radial direction of the work ring 1 under the mechanical pushing force of the first side edge 3. In the case of no such a design, the first side edge 3 and the second side edge 4 of each discharging slot 2 may make no defection. As shown in FIG. 9, the second side edge 4 may block the chips pushed outward by the first side edge 3 under the rotation of the work ring 1, thereby reducing the chip discharging speed.

[0047] In addition, this design allows the first side edge 3 and the second side edge 4 to have a narrow distance between their ends proximate to the inner side of the work ring 1 and a wide distance between their ends proximate to the outer side of the work ring 1. That is, a great deal of materials (diamonds) may be machined on the inner side of the work ring 1, and fewer materials may be machined on the outer side, resulting in slower abrasion of the inner side of the work ring 1 than the outer side. Therefore, after working for a certain period, a working end (bottom surface) of the work ring 1 may be correspondingly formed as a taper/tapered surface as shown in FIG. 16. When certain materials such as glass are machined, the inner side of the working end of the work ring 1 may touch the inner side of the surface of the glass firstly, which can effectively prevent the glass from edge collapse.

Embodiment 3

[0048] This embodiment mainly changes the structure of the discharging slots 2, and the remaining portion of this embodiment is consistent with Embodiment 1.

[0049] As shown in FIGs. 10-13, two side surfaces of each discharging slot 2 are provided in parallel, and the symmetrical centerline of the two side edges at the bottom of the discharging slot 2 does not pass through the circle center of the bottom surface of the work ring 1. The two side surfaces of each discharging slot 2 are inclined towards the rotating direction of the work ring 1 relative to the bottom surface of the work ring 1; and one end of each of the two side surfaces of the discharging slot 2 is located at a corresponding position on the inner sidewall of the work ring 1, and the other end of the side surface is oriented towards an outer side of the work ring 1 and deflected by a preset angle to the rotating direction of the work ring 1. Each discharging slot 2 has a rounded structure at the top, and each standby discharging slot 5 has rounded structures at its both bottom and top. The rounded structures can prevent the stress concentration and facilitate flowing of the chips. In this embodiment, when the work ring 1 is rotated, the two side surfaces of the discharging slot 2 may rotate with the work ring 1. Here, one side surface may push the chips upward (axially upward) towards the outside (the outer side of the work ring 1). Since the two side surfaces are provided in parallel, the other side surface may not block the one side surface from pushing out the chips, thereby forming an axial mechanical pushing force to discharge the chips. With the rotation of the work ring 1, the chips are smoothly discharged along the axial direction (as shown by dashed arrows in FIG. 13) of the work ring 1 under the pushing of the two side surfaces of each discharging slot 2.

Embodiment 4

[0050] This embodiment mainly changes the position of each discharging slot 2, and the structure of the discharging slot 2 is consistent with that in Embodiment 1, Embodiment 2 or Embodiment 3, and the remaining portion is consistent with Embodiment 1.

[0051] As shown in FIGs. 14 and 15, the sidewall of the work ring 1 is provided with standby discharging slots 5, and each standby discharging slot 5 is located above the corresponding discharging slot 2 and configured to discharge chips after axial abrasion of the work ring 1 exceeds the discharging slot 2. Each standby discharging slot 5 has rounded structures at its both bottom and top, and the rounded structures may prevent the stress concentration and facilitate flowing and discharging of the chips. A plurality of chip discharging slots 6 is provided uniformly and annularly in the outer sidewall of the work ring 1. Each chip discharging slot 6 is in a spiral shape, and the spiral direction is the same as the rotating direction of the work ring 1. The chip discharging slots 6 are designed such that the chips can be discharged upward along the chip discharging slots 6. The discharging slots 2 and the standby discharging slots 5 are provided inside the chip discharging slots 6. In this embodiment, the chips discharged from the discharging slots 2 are discharged upward in the first time via the chip discharging slots 6, which can accelerate the chip discharging speed.

[0052] Preferably, two side surfaces of each of the discharging slots 2 and the standby discharging slots 5 are sequentially a first side surface 9 and a second side surface 10 along the rotating direction of the work ring 1; and two side surfaces of each chip discharging slot 6 are sequentially a third side surface 11 and a fourth side surface 12 along the rotating direction of the work ring 1. The first side surface 9 overlaps with the third side surface 11, and the second side surface 10 is spaced from the fourth side surface 12. By configuring the first side surface 9 of the discharging slot 2 to overlap with the third side surface 11 of the chip discharging slot 6, the chips discharged from the discharging slot 2 may move backward and namely towards the fourth side surface 12 of

the chip discharging slot 6 under the rotation of the work ring 1. In addition, by configuring the second side surface 10 of the discharging slot 2 to be spaced from the fourth side surface 12, a maximum discharge space may be formed for the chips, which enables the chips to enter the chip discharging slots 6 at a higher speed and greater amount, thereby improving the chip discharging efficiency. By configuring the first side surface 9 of the standby discharging slot 5 to overlap with the third side surface 11 of the chip discharging slot 6, and configuring the second side surface 10 of the standby discharging slot 5 to be spaced from the fourth side surface 12, a maximum discharge space may be formed for the cooling water, and the cooling water flowing out of the standby discharging slot 5 (the cooling water may flow from the standby discharging slot 5 to the outer side of the work ring 1 to assist in the discharging when the work ring 1 is abraded and the standby discharging slot 5 does not become the discharging slot 2) has an optimum boosting effect on the discharging of the chips in the chip discharging slot 6, which can also improve the discharging efficiency. For a case where the discharging slot 2/standby discharging slot 5 does not overlap with one side of the chip discharging slot 6, for example, the discharging slot 2/standby discharging slot 5 may be provided in the middle of the chip discharging slot 6 (the first side surface 9 and the second side surface 10 do not overlap with the third side surface 11 and the fourth side surface 12), or the second side surface 10 may overlap with the fourth side surface 12. Under this case, a space formed between the second side surface 10 of the discharging slot 2/standby discharging slot 5 and the fourth side surface 12 of the chip discharging slot 6 for discharging the chips and the cooling water is rather small, which fails to discharge the chips quickly.

[0053] The above description is only the preferred embodiments of the present invention, and is not intended to limit the present invention. Any modification, equivalent replacement, improvement, etc. made according to the spirit and principle of the present invention shall be regarded as falling within the protection scope of the present invention.

Claims

1. A thin-walled drill bit with low-pressure internal water supply, comprising: a work ring (1) and a plurality of discharging slots (2), wherein the work ring (1) has a cylindrical structure, and the plurality of discharging slots (2) is distributed annularly at the bottom of a sidewall of the work ring (1) to discharge chips when the work ring (1) is rotated for machining; and wherein the plurality of discharging slots (2) is provided at the bottom of an outer sidewall of the work ring (1), and recessed to an inner side of the work ring (1) by a preset distance, and a distance as recessed by each discharging slot (2) is less than a thickness of the sidewall of the work ring (1).

2. The thin-walled drill bit with low-pressure internal water supply according to claim 1, wherein a difference between the thickness of the sidewall of the work ring (1) and the distance as recessed by the discharging slot (2) is greater than 0 mm and less than 0.5 mm.

3. The thin-walled drill bit with low-pressure internal water supply according to claim 1, wherein a symmetrical centerline of two side edges at the bottom of the discharging slot (2) or a centerline of an included angle between the two side edges at the bottom of the discharging slot (2) does not pass through a circle center of a bottom surface of the work ring (1).

4. The thin-walled drill bit with low-pressure internal water supply according to claim 3, wherein the two side edges at the bottom of the discharging slot (2) are provided in parallel, and the symmetrical centerline of the two side edges at the bottom of the discharging slot (2) does not pass through the circle center of the bottom surface of the work ring (1); and the two side edges at the bottom of the discharging slot (2) are arranged in a spiral with respect to the circle center of the bottom surface of the work ring (1), and a spiral direction is the same as a rotating direction of the work ring (1).

5. The thin-walled drill bit with low-pressure internal water supply according to claim 3, wherein the two side edges at the bottom of the discharging slot (2) are sequentially a first side edge (3) and a second side edge (4) respectively along a rotating direction of the work ring (1); a centerline of an included angle between the first side edge (3) and the second side edge (4) does not pass through the circle center of the bottom surface of the work ring (1); one end of the first side edge (3) is located at a corresponding position on an inner sidewall of the work ring (1), and the other end of the first side edge (3) is oriented towards the outer side of the work ring (1) and deflected by an angle α to a direction opposite to the rotating direction of the work ring (1); and one end of the second side edge (4) is located at a corresponding position on the inner sidewall of the work ring (1), and the other end of the second side edge (4) is oriented towards the outer side of the work ring (1) and deflected by an angle θ to the rotating direction of the work ring (1), with α>45°>θ.

6. The thin-walled drill bit with low-pressure internal water supply according to claim 3, wherein two side surfaces of the discharging slot (2) are provided in parallel, and the symmetrical centerline of the two side edges at the bottom of the discharging slot (2) does not pass through the circle center of the bottom

surface of the work ring (1); the two side surfaces of the discharging slot (2) are inclined towards the rotating direction of the work ring (1) relative to the bottom surface of the work ring (1); and one end of each of the two side surfaces of the discharging slot (2) is located at a corresponding position on the inner sidewall of the work ring (1), and the other end of the side surface is oriented towards an outer side of the work ring (1) and deflected by a preset angle to the rotating direction of the work ring (1).

7. The thin-walled drill bit with low-pressure internal water supply according to claim 3, wherein the sidewall of the work ring (1) is provided with standby discharging slots (5) corresponding to the discharging slots (2), and each standby discharging slot (5) is disposed above the discharging slot (2) and configured to discharge chips after axial abrasion of the work ring (1) exceeds the discharging slot (2).

8. The thin-walled drill bit with low-pressure internal water supply according to claim 7, wherein the discharging slot (2) has a rounded structure at the top, and the standby discharging slot (5) has rounded structures at its both bottom and top.

9. The thin-walled drill bit with low-pressure internal water supply according to claim 8, wherein a plurality of chip discharging slots (6) is provided uniformly in the outer sidewall of the work ring (1) along a circumferential direction; and a lower end of each chip discharging slot (6) extends to the bottom of the work ring (1), and an upper end of the chip discharging slot (6) extends diagonally upwards.

10. The thin-walled drill bit with low-pressure internal water supply according to claim 7, wherein the chip discharging slot (6) is in a spiral shape, and a spiral direction is the same as the rotating direction of the work ring (1).

11. The thin-walled drill bit with low-pressure internal water supply according to claim 9, wherein the discharging slots (2) and the standby discharging slots (5) are provided at corresponding positions inside the chip discharging slots (6).

12. The thin-walled drill bit with low-pressure internal water supply according to claim 9, wherein two side surfaces of each of the discharging slots (2) or the standby discharging slots (5) are sequentially a first side surface (9) and a second side surface (10) respectively along a rotating direction of the work ring (1); two side surfaces of each chip discharging slot (6) are sequentially a third side surface (11) and a fourth side surface (12) respectively along the rotating direction of the work ring (1); and the first side surface (9) overlaps with the third side surface (11), and the second side surface (10) is spaced from the fourth side surface (12).

13. The thin-walled drill bit with low-pressure internal water supply according to any one of claims 1 to 12, wherein a width of the discharging slot (2) in a circumference direction of the work ring (1) gradually increases from the inner side of the work ring (1) towards the outer side of the work ring (1).

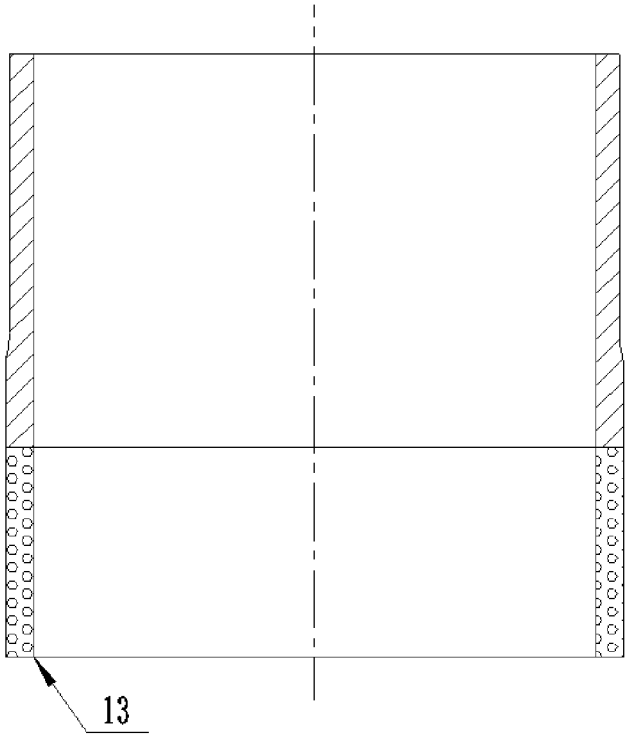

FIG. 1

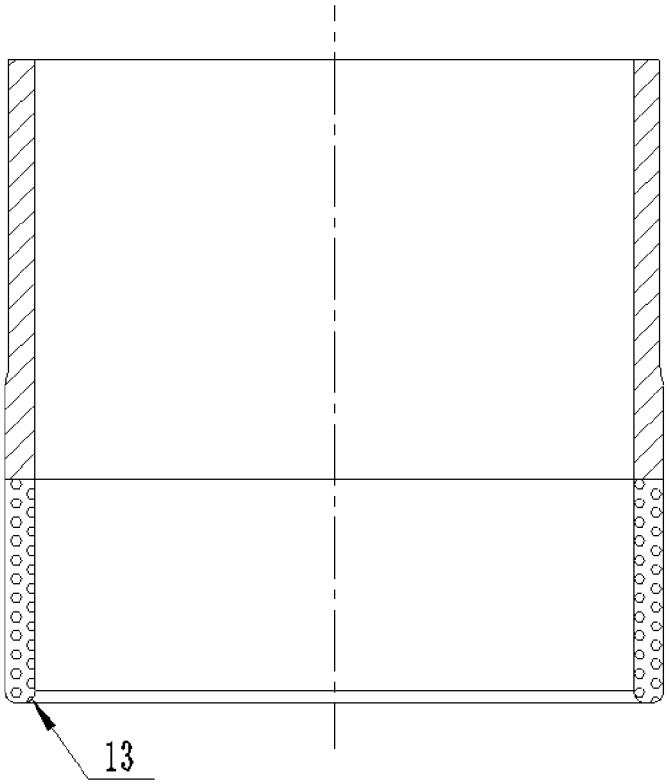

FIG. 2

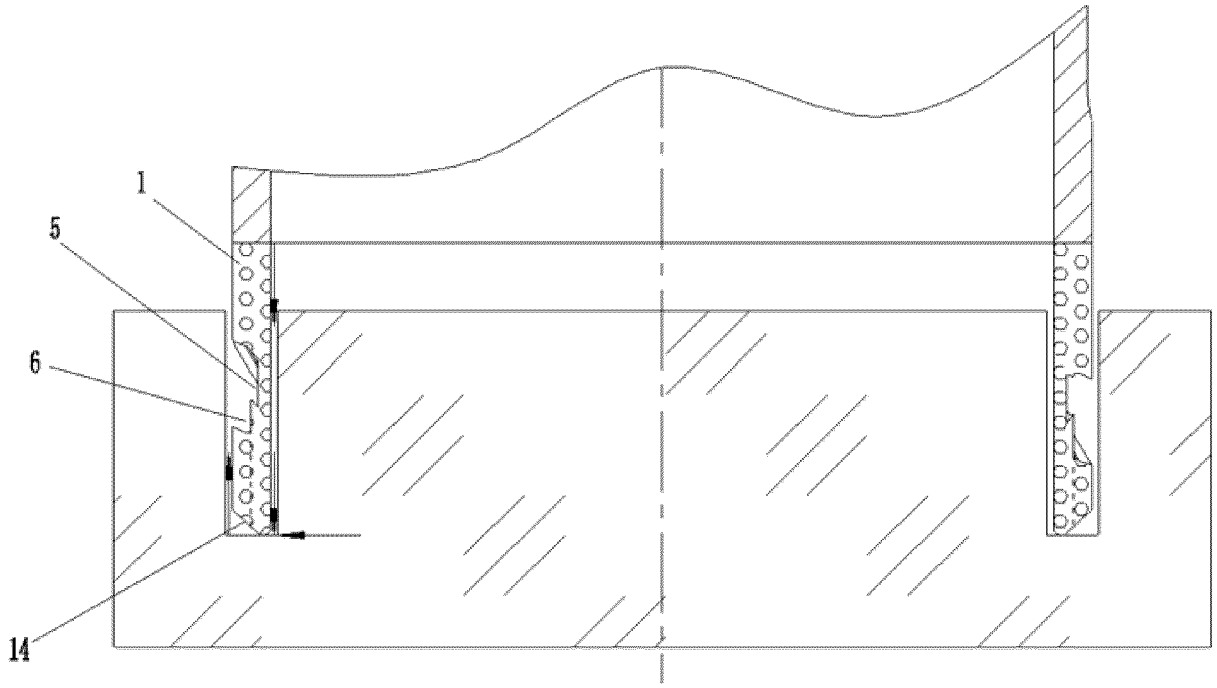

FIG. 3

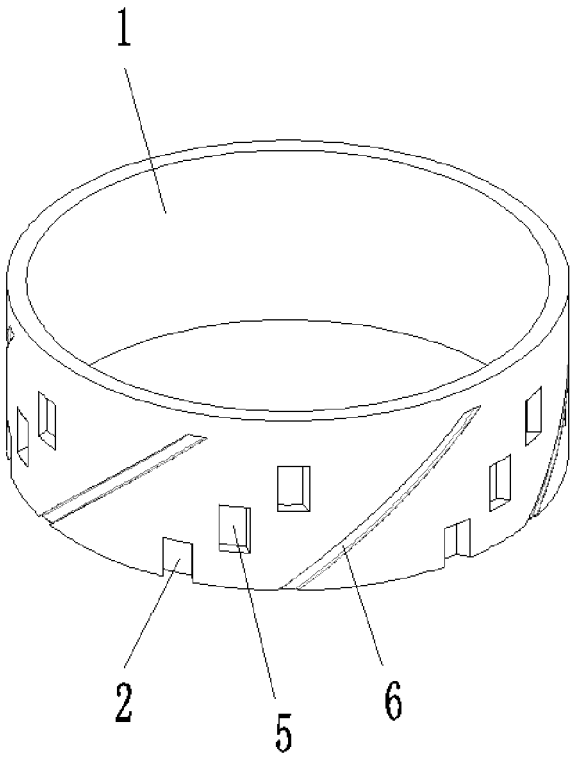

FIG. 4

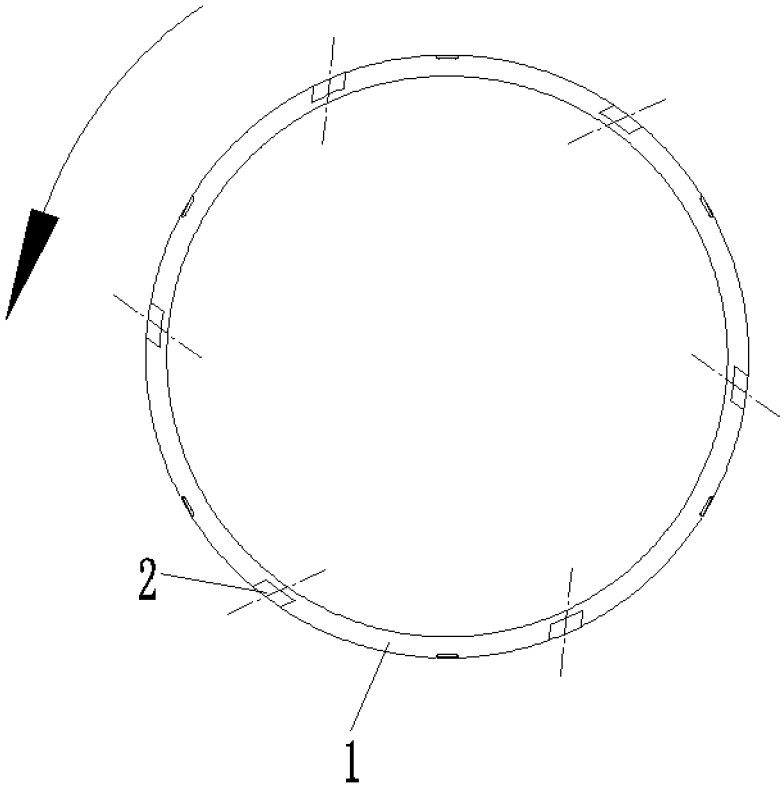

FIG. 5

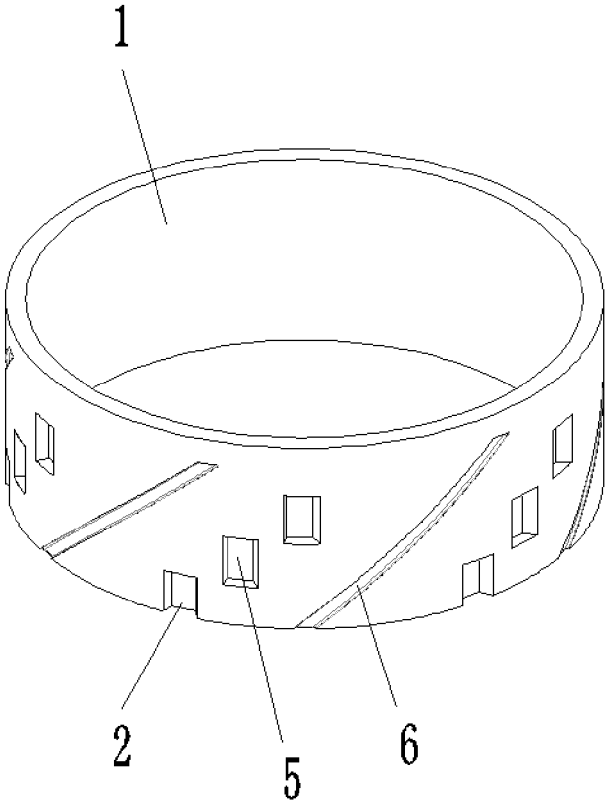

FIG. 6

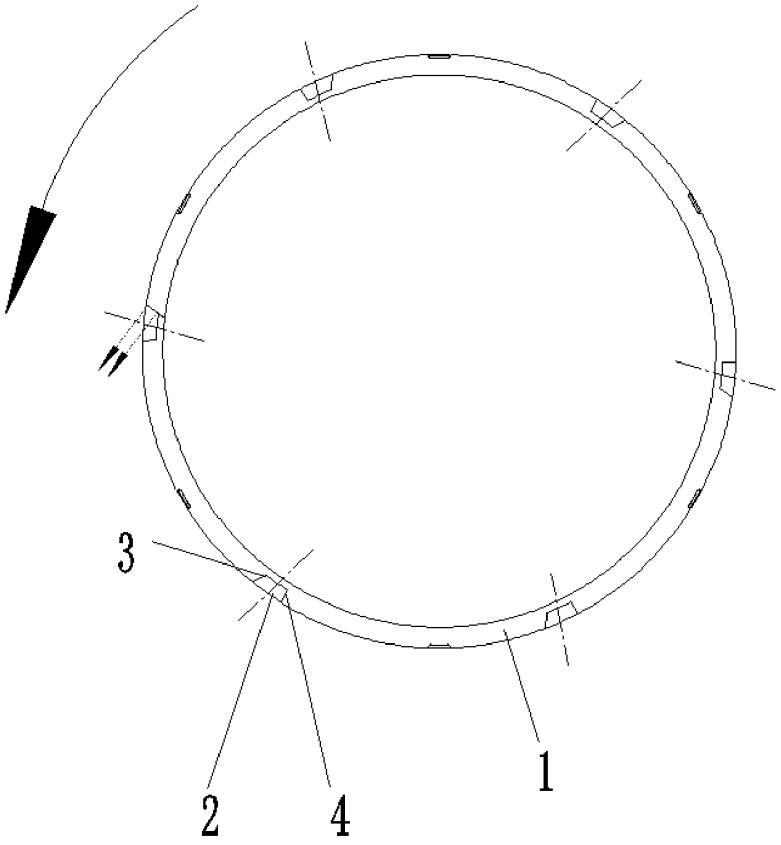

FIG. 7

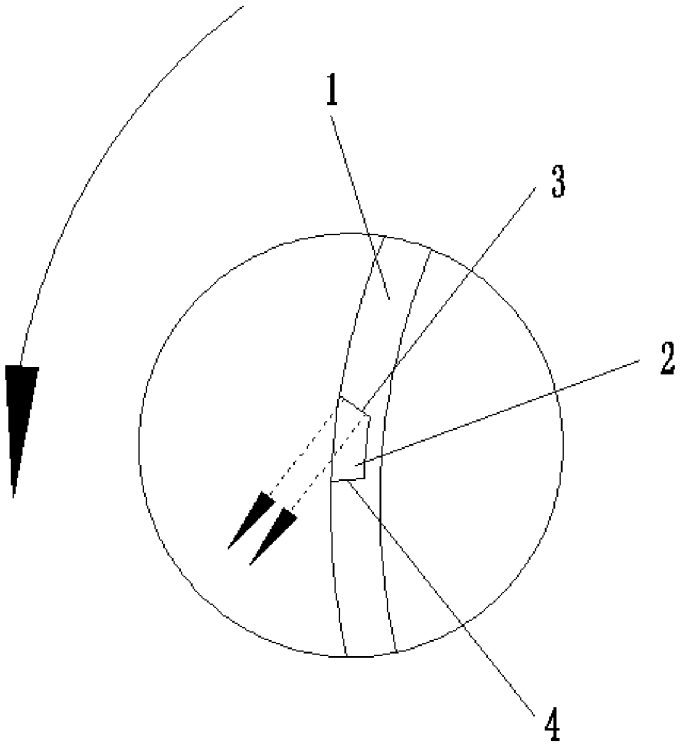

FIG. 8

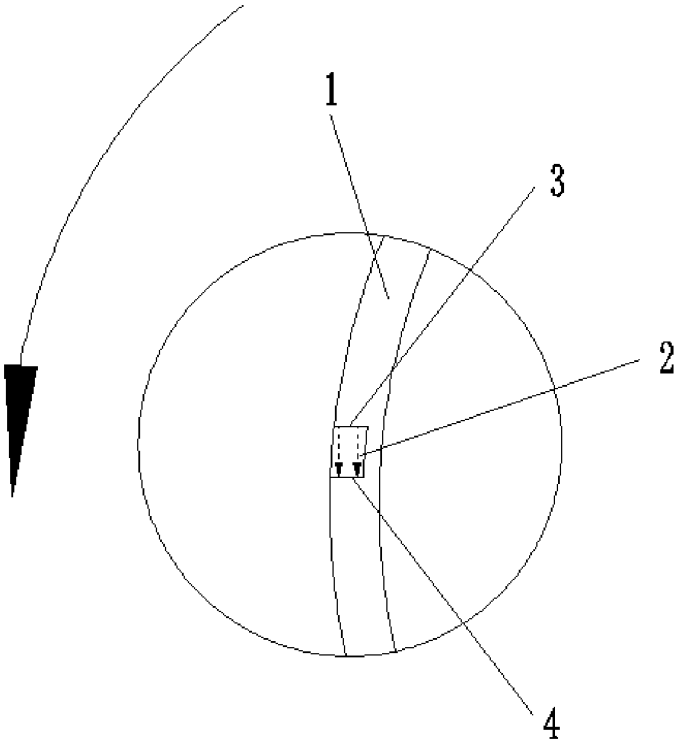

FIG. 9

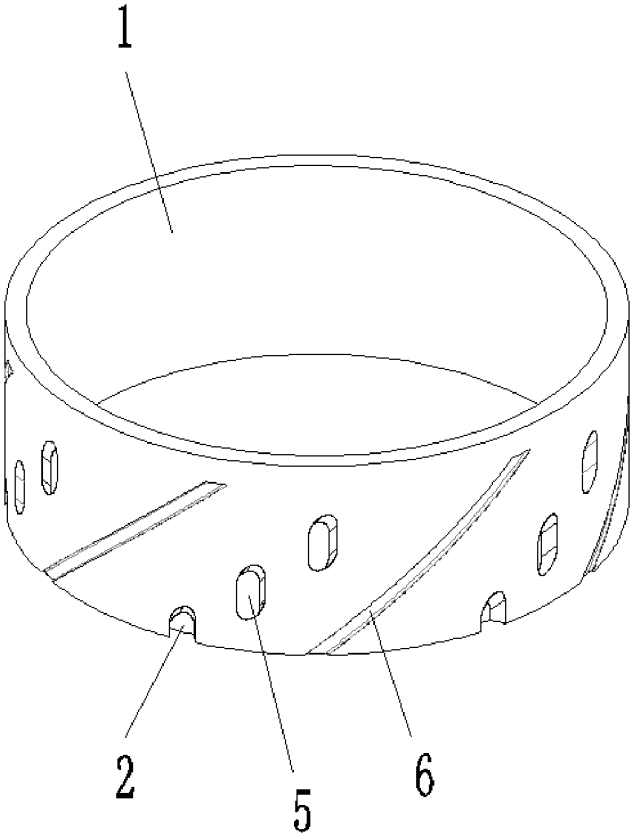

FIG. 10

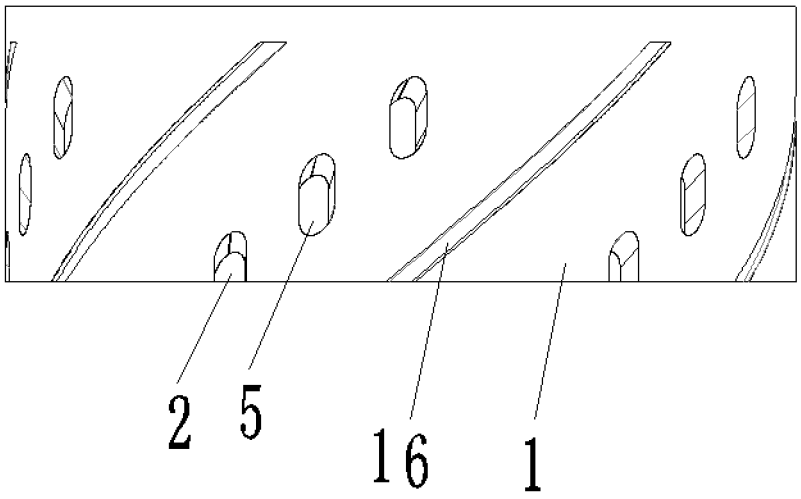

FIG. 11

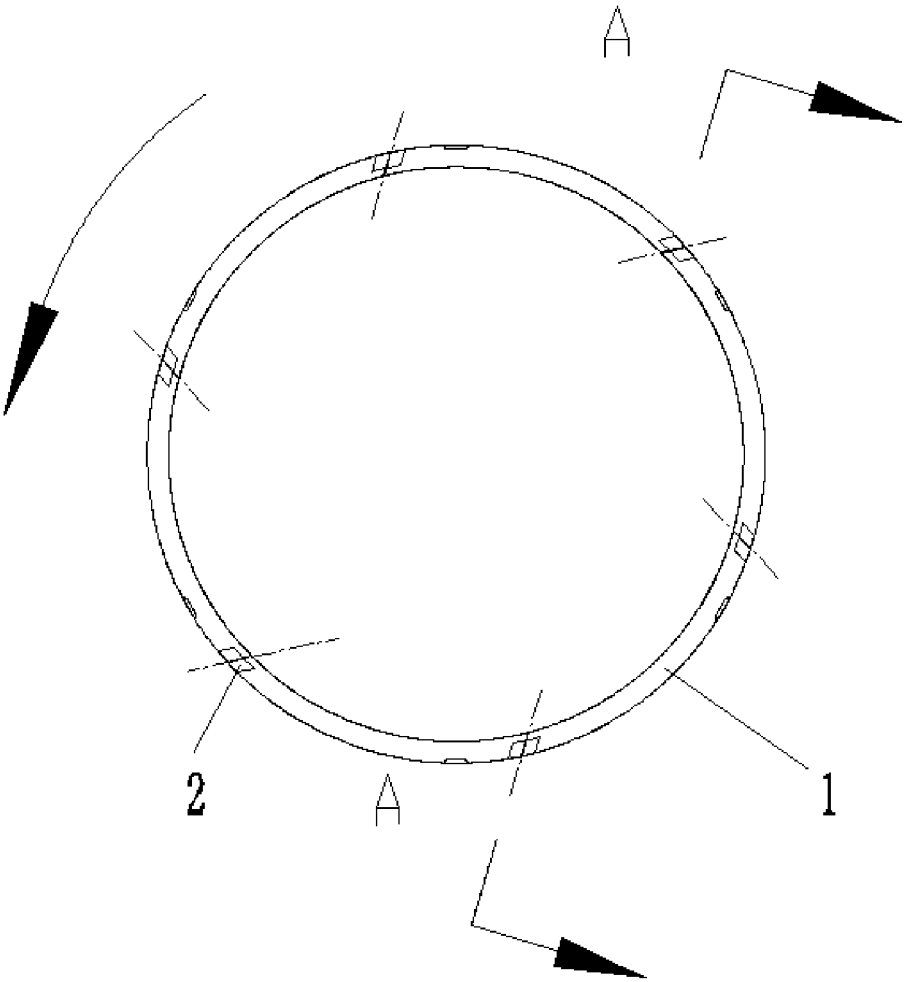

FIG. 12

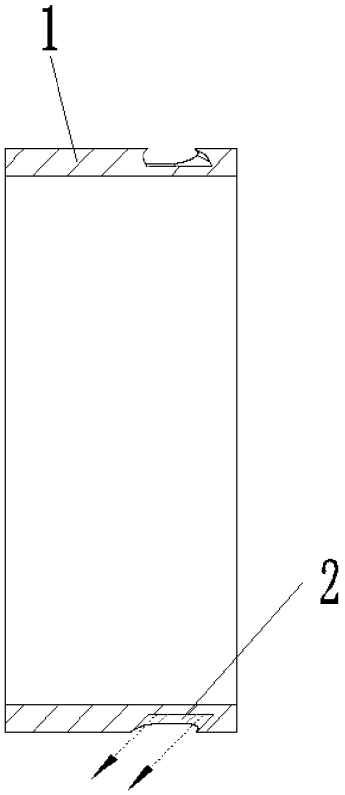

FIG. 13

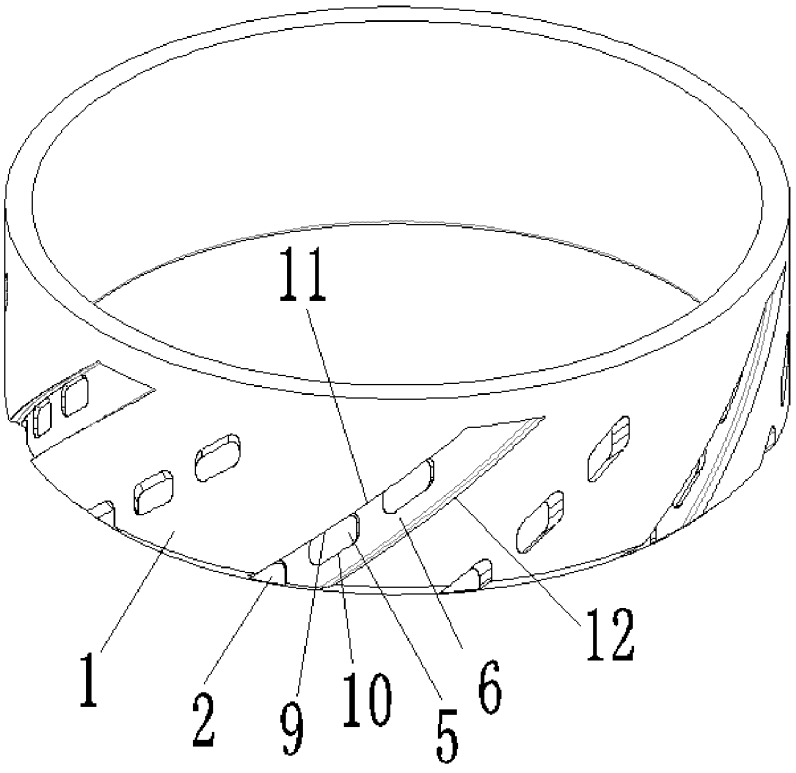

FIG. 14

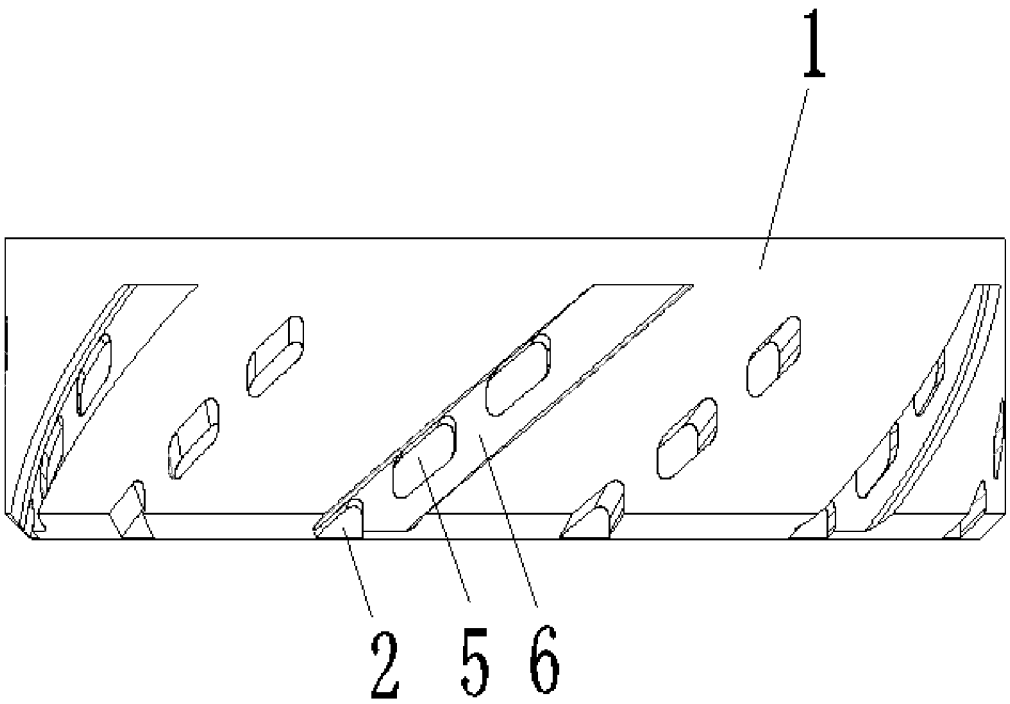

FIG. 15

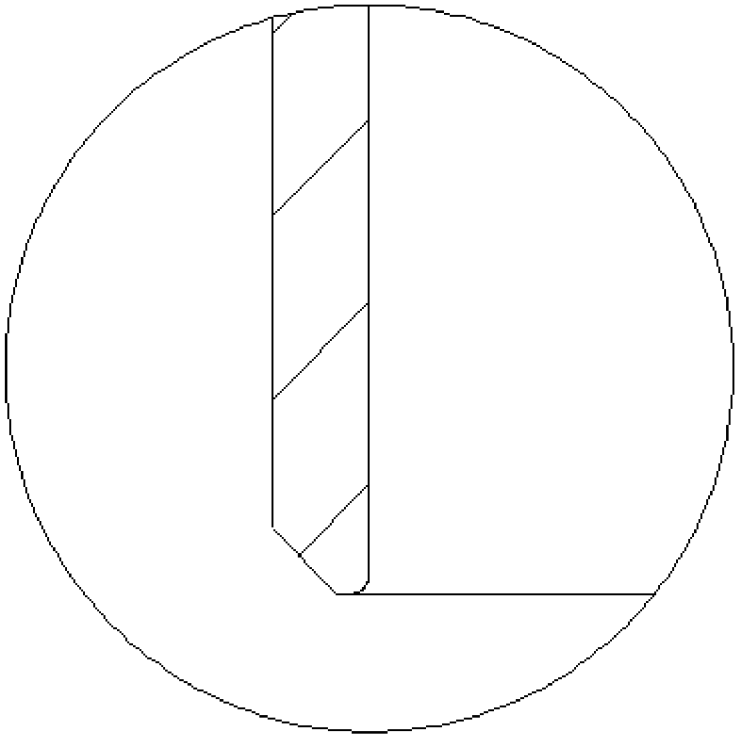

FIG. 16

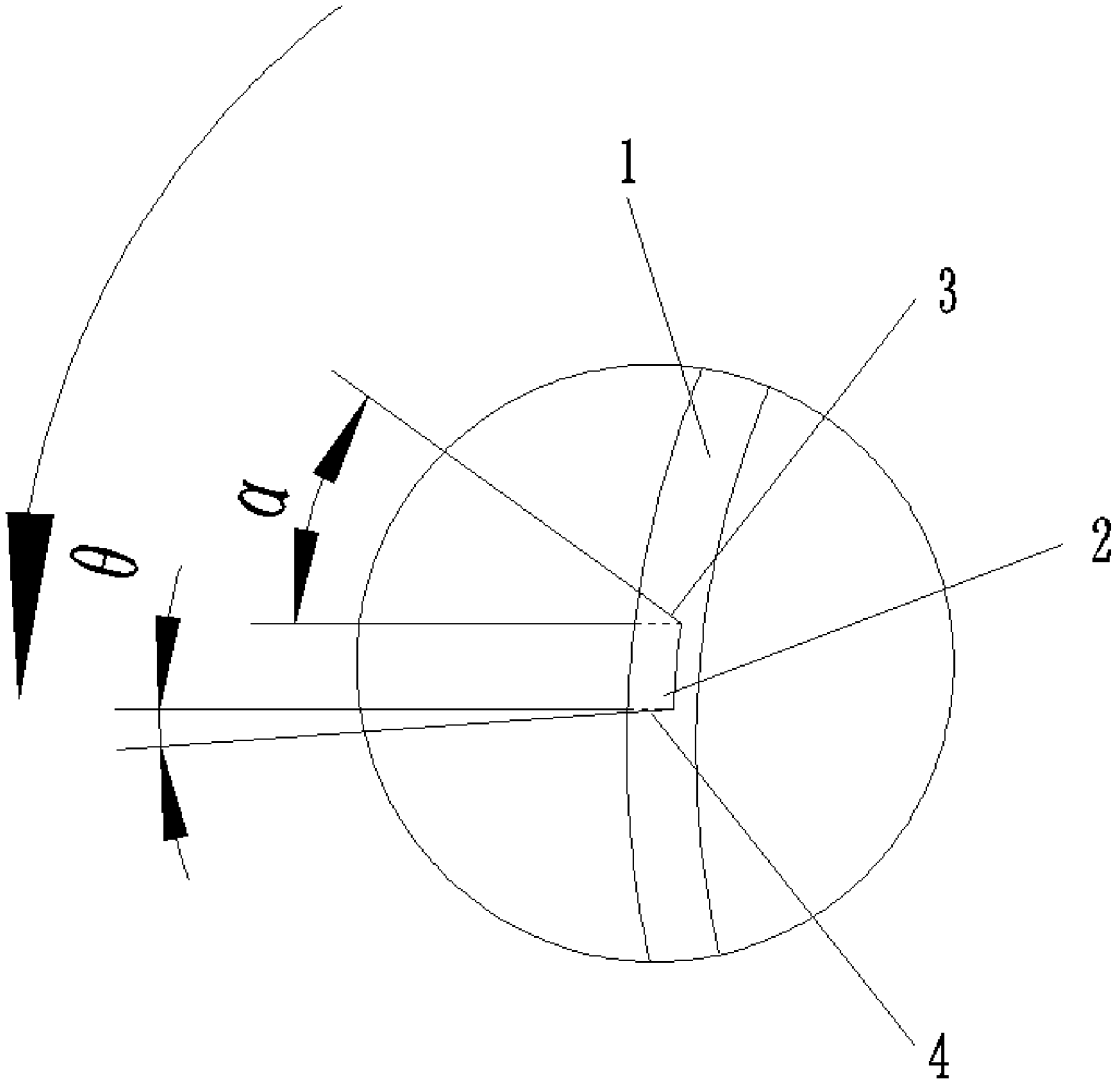

FIG. 17

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/102612

A. CLASSIFICATION OF SUBJECT MATTER

B28D 1/14(2006.01)i; B28D 7/02(2006.01)i; B28D 7/00(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)

B28D

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; VEN; CNTXT; USTXT; WOTXT; EPTXT; CNKI: 桂林创源金刚石有限公司, 薄壁, 钻头, 圆筒, 排料, 料屑, 凹槽, 凹陷, 厚度, thin, wall, drill+, cylinder, blow+, discharg+, swarf, chip, groove?, depress+, thick

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 111775343 A (GUILIN CHAMPION UNION DIAMOND CO., LTD.) 16 October 2020 (2020-10-16) claims 1-13	1-13
PX	CN 212421806 U (GUILIN CHAMPION UNION DIAMOND CO., LTD.) 29 January 2021 (2021-01-29) claims 1-13	1-13
Y	CN 110919877 A (GUILIN CHAMPION UNION DIAMOND CO., LTD.) 27 March 2020 (2020-03-27) description, paragraphs [0046]-[0060], and figures 1-17	1-13
Y	CN 201052641 Y (GUILIN CHAMPION UNION DIAMOND CO., LTD.) 30 April 2008 (2008-04-30) description page 3 last line to page 4 last line, figures 1-4	1-13
Y	CN 101032842 A (GUILIN CHAMPION UNION DIAMOND CO., LTD.) 12 September 2007 (2007-09-12) description page 4 line 8 to page 5 last line, figures 1-10	1-13

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

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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
30 August 2021	**10 September 2021**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** **China**	
Facsimile No. **(86-10)62019451**	Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/102612

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 102528942 A (FUJIAN WANLONG DIAMOND TOOLS CO., LTD.) 04 July 2012 (2012-07-04) entire document	1-13
A	JP 2016087820 A (SUMITOMO METAL MINING CO., LTD.) 23 May 2016 (2016-05-23) entire document	1-13

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/102612

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	111775343	A	16 October 2020	CN	212421806	U	29 January 2021
CN	212421806	U	29 January 2021	CN	111775343	A	16 October 2020
CN	110919877	A	27 March 2020	CN	211566484	U	25 September 2020
CN	201052641	Y	30 April 2008		None		
CN	101032842	A	12 September 2007		None		
CN	102528942	A	04 July 2012	CN	102528942	B	05 March 2014
JP	2016087820	A	23 May 2016		None		

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201911348484 **[0005]**