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(54) **COMBINED ELECTROPLATED GRINDING WHEEL**

(57) The present invention relates to a combined electroplated abrasive wheel. The combined electroplated abrasive wheel includes a body and an electroplating component for electroplating a workpiece, wherein the electroplating component is connected to the body in a combined manner. The electroplating component disposed on the combined electroplated abrasive wheel is connected to the body in the combined manner without additionally disposing a "rib frame" structure, thereby avoiding a problem that cooling water in the abrasive wheel having the "rib frame" structure is not able to enter an inner diameter cavity smoothly and affects a water amount. The interior of the abrasive wheel is hollowed out as much as possible, thereby increasing the water amount of the inner diameter cavity. Further, the electroplating component may be detached from the body, thereby realizing replacement of components, replacing a working procedure for reconditioning the original body, reducing a damage to the body, increasing a reuse rate of the body and the productivity, and lowering the cost.

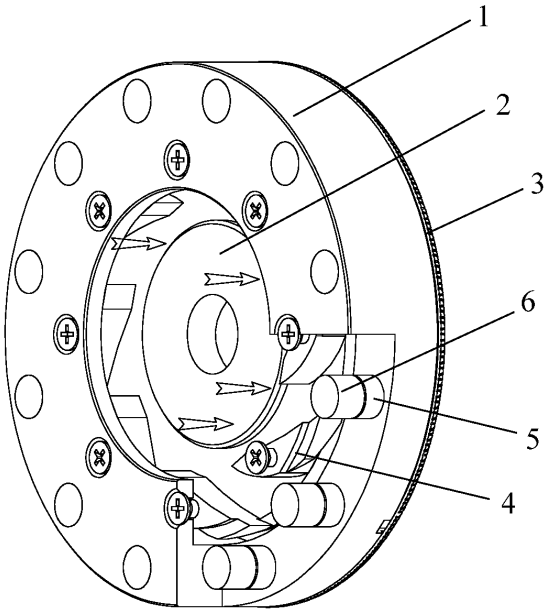

FIG. 2

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Description

TECHNICAL FIELD

[0001] The present invention relates to the technical field of abrasive wheel tools, and more particularly to a combined electroplated abrasive wheel.

BACKGROUND

[0002] Firstly, if external cooling is adopted for equipment without an internal cooling water supply structure, an airflow barrier will be formed at an inner diameter, an outer diameter and a grinding surface of an end face of an abrasive wheel due to rotation of the abrasive wheel, blocking cooling water from entering a grinding region. Particularly, a high rotational speed leads to a strong airflow barrier, which is not suitable for a technical application of high-speed grinding. Further, in the case of external cooling, cooling water cannot act in a direction from the outer diameter to the inner diameter under the action of a centrifugal force, so that a cooling effect on a portion of the working end face close to the inner diameter is extremely poor. The prior art is shown in FIG. 1.

1. In an improved method, a body of the abrasive wheel is hollowed out as much as possible, and a hollowed-out region serves as a water passage, so that the cooling water is injected into an inner diameter cavity to cool the grinding surface along a radial direction from the inner diameter to the outer diameter under the action of the centrifugal force. When the body is hollowed out, it is necessary to ensure the connection strength of a "rib frame" of the remaining part, as the "rib frame" will also hit the cooling water during high-speed rotation to form a turbulent layer or water mist, such that the cooling water cannot enter the inner diameter cavity smoothly and a cooling water amount is negatively affected.
2. Even if the cooling water enters the inner diameter cavity, a part of cooling water still runs off due to penetration, and thus, the amount of cooling water passing through the inner diameter and the end face of the abrasive wheel under the action of the centrifugal force is also very small.
3. Due to the high machining difficulty of the body of the abrasive wheel and the high cost of machining, reconditioning the body of the abrasive wheel is a common method to reduce the cost. However, working procedures for performing reconditioning on the original body are complex. Working procedures such as deplating diamonds, finishing the body to satisfy precision requirements and replating the diamonds are required. An electroplating step is particularly complex; the productivity is low and the cost is high.

[0003] Secondly, for an abrasive wheel electroplated with diamonds, an abrasive material is disposed in a single layer. Since an exposed height of a diamond is less than half of its particle size, a space in the grinding region (a region in which the abrasive wheel is in contact with a workpiece) is narrow and occupied and blocked by cuttings, so that the amount of cooling water passing along the radial direction from the inner diameter to the outer diameter under the action of the centrifugal force is very small. The finer the diamonds are, the more difficult for the cooling water to pass, thereby greatly limiting the cooling effect and further affecting the grinding efficiency.

[0004] Thirdly, since a diamond of a micro-powder level is often adopted for the abrasive wheel electroplated with diamonds, in order to ensure normal operation of the abrasive wheel, it is required to machine the body of the abrasive wheel with high-precision machining equipment so as to satisfy higher machining precision requirements. If the precision is not satisfactory, a diamond layer is prone to perforation and delamination, the workpiece may be burnt and broken, and the body may be damaged, so that the times by which the body may be reconditioned is reduced or the body even cannot be reused.

SUMMARY

[0005] In order to overcome the shortcomings in the prior art, the technical problem to be solved by the present invention is to provide a combined electroplated abrasive wheel.

[0006] In order to solve the above technical problem, the technical solution of the present invention is as follows. A combined electroplated abrasive wheel includes a body and an electroplating component for electroplating a workpiece, wherein the electroplating component is connected to the body in a combined manner.

[0007] The combined electroplated abrasive wheel of the present invention has the following beneficial effects. The electroplating component disposed on the abrasive wheel may be connected to the body in the combined manner without additionally disposing a "rib frame" structure, thereby avoiding a problem that cooling water in the abrasive wheel having the "rib frame" structure cannot smoothly enter an inner diameter cavity and affects a water amount. The interior of the abrasive wheel is hollowed out as much as possible, thereby increasing the water amount of the inner diameter cavity. Further, the electroplating component may be detached from the body, thereby realizing replacement of components, replacing a working procedure for reconditioning the original body, reducing a damage to the body, increasing a reuse rate of the body and the productivity, and lowering the cost.

[0008] Based on the above technical solution, the present invention may further include the following improvements.

[0009] Further, the first method for connecting the electroplating component to the body in a combined manner is as follows. The electroplating component includes a first connection disc, an absorption member, a first elec-

troplated abrasive disc body and a first diamond plating layer; the body includes a water inlet end surface and a hollow annular groove, wherein the water inlet end surface is an annular plate structure with a first water inlet in the center; an outer diameter of the water inlet end surface and an outer diameter of the annular groove are equal and coaxially connected into a whole; the water inlet end surface is connected to a top surface of the annular groove, and a hollowed-out region is formed between the water inlet end surface and an inner annular wall of the annular groove; the first connection disc and the first water inlet are oppositely placed in the hollowed-out region and detachably connected to the water inlet end surface; a gap is reserved between the first connection disc and the inner annular wall of the annular groove to form a water passage; the absorption member is disposed in the annular groove; the first electroplated abrasive disc body is adsorbed at the outer side of a bottom surface of the annular groove through the absorption member; the first diamond plating layer is attached to the outer surface of the first electroplated abrasive disc body; and the first connection disc includes a plurality of blade components that is distributed on the side surface of the first connection disc close to the water inlet end surface in a vortex form.

[0010] The above further technical solution has the following beneficial effects. The body and the first connection disc of the abrasive wheel achieve an effect of external rotation and internal cooling. The first connection disc is disposed in the hollowed-out region, i.e., the inner diameter cavity; a gap formed by the inner annular wall of the annular groove, the outer diameter of the connection disc and the blade components serves as the water passage, and the cooling water is injected into the inner diameter cavity to cool a grinding surface along a radial direction from the inner diameter to the outer diameter under the action of a centrifugal force. The electroplated abrasive disc body is adsorbed on the body through the absorption member, and serves as a detachable and replaceable component, so that electroplated abrasive disc bodies of different particle sizes may be interchanged, thereby replacing the working procedure for reconditioning the original body, reducing the damage to the body, increasing the reuse rate of the body and the productivity, and reducing the cost.

[0011] Further, the second method for connecting the electroplating component to the body in a combined manner is as follows. The electroplating component includes a mandrel, a second connection disc, a press cover, a first abrasive body and a second abrasive body;

the second connection disc sleeves the lower end of the mandrel, and is fixedly connected to the mandrel; a plurality of shunting components of an arc blade structure are fixedly connected to the second connection disc and arranged in a vortex form;

the body sleeves the mandrel to form an annular water inlet passage with the mandrel; the body is located at the upper end of the second connection disc and fixedly connected to the second connection disc; a plurality of shunting passages is formed by the body, the plurality of shunting components and the upper end surface of the second connection disc, and arranged in a vortex form; the outer edge of the body extends downward to the lower end thereof and surrounds the second connection disc to form an annular water outlet with the outer side wall of the second connection disc; the water inlet passage is in communication with the plurality of shunting passages, and the plurality of shunting passages are all in communication with the water outlet;

the press cover is placed at the upper end of the body and fixedly connected to the body; the press cover sleeves the mandrel to form an annular second water inlet with the mandrel, and the second water inlet is in communication with the water inlet passage;

the first abrasive body is placed at the lower end of the body, and detachably connected to the body; and the second abrasive body is placed at the outer side of the body, and detachably connected to the body.

[0012] The above further technical solution has the following beneficial effects. The cooling water can be guided to flow out via the water inlet, the water inlet passage, the shunting passages and the water outlet, thereby achieving the effect of external rotation and internal cooling. The cooling water uniformly cools the grinding surface of the first abrasive body under the action of the centrifugal force, thereby effectively improving the cooling efficiency and the cooling effect. The mandrel, the second connection disc, the shunting components, the body, the press cover, the first abrasive body and the second abrasive body are easily manufactured with extremely low costs, thereby reducing the investment of machining equipment and lowering the machining difficulty and the machining cost, achieving easy replacement and operation before use, reducing the damage to the body, increasing the reuse rate of the body and the productivity, and lowering the cost.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

FIG. 1 is a structural schematic diagram of an abrasive wheel in the prior art according to an embodiment of the present invention;

FIG. 2 is a sectional view of a combined electroplated abrasive wheel in a first connection method according to an embodiment of the present invention;

FIG. 3 is an overall structural schematic diagram of the combined electroplated abrasive wheel in the first connection method according to an embodiment of the present invention;

FIG. 4 is a front view of the combined electroplated

abrasive wheel in the first connection method according to an embodiment of the present invention;
FIG. 5 is a structural schematic diagram of a first electroplated abrasive disc body and an elastic cushion according to an embodiment of the present invention;
FIG. 6 is a schematic diagram of the first electroplated abrasive disc body connected to a body according to an embodiment of the present invention;
FIG. 7 is a first schematic diagram of a blade component according to an embodiment of the present invention;
FIG. 8 is a second schematic diagram of the blade component according to an embodiment of the present invention;
FIG. 9 is a first schematic diagram of water grooves distributed on a first diamond plating layer according to an embodiment of the present invention;
FIG. 10 is a second schematic diagram of water grooves distributed on the first diamond plating layer according to an embodiment of the present invention;
FIG. 11 is a third schematic diagram of water grooves distributed on the first diamond plating layer according to an embodiment of the present invention;
FIG. 12 is a schematic diagram of an anti-loosening fastener according to an embodiment of the present invention;
FIG. 13 is a mounting schematic diagram of the anti-loosening fastener according to an embodiment of the present invention;
FIG. 14 is a front view of a combined electroplated abrasive wheel in a second connection method according to an embodiment of the present invention;
FIG. 15 is a structural schematic diagram of a first abrasive body detached from a combined electroplated abrasive wheel according to an embodiment of the present invention;
FIG. 16 is a structural schematic diagram of the combined electroplated abrasive wheel in the second connection method according to an embodiment of the present invention;
FIG. 17 is a front view of a second connection disc and a shunting component according to an embodiment of the present invention;
FIG. 18 is a side view of the combined electroplated abrasive wheel in the second connection method according to an embodiment of the present invention;
FIG. 19 is an enlarged schematic view of a position I in FIG. 18;
FIG. 20 is a sectional view of DD in FIG. 18;
FIG. 21 is a sectional view of BB in FIG. 20;
FIG. 22 is a sectional view of KK in FIG. 21;
FIG. 23 is an enlarged schematic view of a position M in FIG. 20; and
FIG. 24 is an enlarged schematic view of a position N in FIG. 20.

[0014] In the drawings, components represented by different numerals are listed as follows:
1. body; 2. first connection disc; 3. first electroplated abrasive disc body; 4. blade component; 5. magnet; 6. plug; 7. plug mounting hole; 8. fixing screw; 9. first water groove; 10. first elastic cushion; 11. dismounting hole; 12. positioning step; 13. equipment mounting hole; 14. electroplated abrasive disc body folded edge; 15. folded edge mounting groove; 16. anti-loosening fastener; 101. water inlet end surface; 102. annular groove; 301. first diamond plating layer; 401. blade; 402. water press plate; 1011. first water inlet; 17. mandrel; 18. second connection disc; 19. shunting component; 20. press cover; 21. first abrasive body; 22. second abrasive body; 23. second elastic cushion; 24. first screw; 25. second screw; 26. third screw; 27. water inlet passage; 28. shunting passage; 29. water outlet; 30. second water inlet; 31. magnetic member; 32. insert block; 211. second electroplated abrasive disc body; 212. second diamond plating layer; 213. second water groove; 221. electroplated abrasive ring body; and 222. third diamond plating layer.

DETAILED DESCRIPTION

[0015] Principles and features of the present invention will be described below in combination with the accompanying drawings. Embodiments are merely used to explain the present invention rather than limit the scope of the present invention.

[0016] In Embodiment 1, a combined electroplated abrasive wheel is provided, including a body 1 and an electroplating component for electroplating a workpiece, wherein the electroplating component is connected to the body 1 in a combined manner.

[0017] In the above embodiment, the electroplating component disposed on the abrasive wheel may be connected to the body in the combined manner without additionally disposing a "rib frame" structure, thereby avoiding a problem that cooling water in the abrasive wheel having the "rib frame" structure cannot smoothly enter an inner diameter cavity and affects a water amount. The interior of the abrasive wheel is hollowed out as much as possible, thereby increasing the water amount of the inner diameter cavity. Further, the electroplating component may be detached from the body, thereby realizing replacement of components, replacing a working procedure for reconditioning the original body, reducing a damage to the body, increasing a reuse rate of the body and the productivity, and lowering the cost.

[0018] Based on Embodiment 1, in Embodiment 2, as shown in FIGs. 2, 3, 4 and 6, the first method for connecting the electroplating component to the body is as follows.

[0019] The electroplating component includes a first connection disc 2, an absorption member, a first electroplated abrasive disc body 3 and a first diamond plating layer 301; and the body 1 includes a water inlet end surface 101 and a hollow annular groove 102, wherein the

water inlet end surface 101 has an annular plate structure with a first water inlet 1011 in the center, an outer diameter of the water inlet end surface 101 and an outer diameter of the annular groove 102 are equal and coaxially connected into a whole, the water inlet end surface 101 is connected to the top surface of the annular groove 102, and a hollowed-out region is formed between the water inlet end surface 101 and an inner annular wall of the annular groove 102. The first connection disc 2 and the first water inlet 1011 are oppositely placed in the hollowed-out region and detachably connected to the water inlet end surface 101, and a gap is reserved between the first connection disc 2 and the inner annular wall of the annular groove 102 to form a water passage; the absorption member is disposed in the annular groove 102, the first electroplated abrasive disc body 3 is adsorbed at the outer side of the bottom surface of the annular groove 102 through the absorption member, and the first diamond plating layer 301 is attached to the outer surface of the first electroplated abrasive disc body 3; and the first connection disc 2 includes a plurality of blade components 4 that is distributed on the side surface of the first connection disc 2 close to the water inlet end surface 101 in a vortex form.

[0020] It is to be understood that the outer diameter of the annular groove 102 overlaps with the outer diameter of the water inlet end surface 101, and a diameter of the water inlet is less than an inner diameter of the annular groove 102, so that the connection disc 2 is connected to a position on the water inlet end surface 101 close to an inner diameter of the water inlet end surface 101.

[0021] Arrows in FIG. 4 indicate a flow direction of cooling water, that is, a radial direction from the inner diameter to the outer diameter.

[0022] In the above embodiment, firstly, the body 1 and the connection disc 2 of the abrasive wheel achieve an effect of external rotation and internal cooling, the connection disc 2 is disposed in the hollowed-out region, i.e., the inner diameter cavity, and the gap formed by the inner annular wall of the annular groove 102, the outer diameter of the connection disc 2 and the blade components serves as the water passage; and the cooling water is injected into the inner diameter cavity to cool a grinding surface along the radial direction from the inner diameter to the outer diameter under the action of a centrifugal force. Secondly, the electroplated abrasive disc body is adsorbed on the body through the absorption member, and is a detachable and replaceable component, so that electroplated abrasive disc bodies of different particle sizes may be interchanged to replace the working procedure for reconditioning the original body, thereby reducing the damage to the body, increasing the reuse rate of the body and the productivity, and lowering the cost.

[0023] The word "interchange" may be understood as follows: the body part may be considered as tooling, and rings (disks) of different particle sizes may be assembled on the tooling according to requirements to perform grinding. That is, the electroplated abrasive disc body 3 of a different particle size specification may be obtained by selecting the particle size specification for the diamond of the diamond plating layer 301 according to different requirements, and then is assembled on the tooling.

[0024] Based on Embodiment 2, in Embodiment 3, as shown in FIG. 2, the absorption member includes a plurality of cylindrical magnets 5 and a plurality of cylindrical plugs 6; the plurality of magnets 5 is placed around the bottom surface of the annular groove 102 at intervals; the magnets 5 and the plugs 6 are equal in number; the plurality of plugs 6 is in one-to-one correspondence with the plurality of magnets 5 and located above the corresponding magnets 5; and the magnets 5 are mounted on the bottom surface of the annular groove 102 through the plugs 6 by interference fit.

[0025] In the above embodiment, a plurality of magnets is disposed around the bottom surface of the annular groove 102 of the body and mounted on the bottom surface of the annular groove 102 through the plugs, and each magnet firmly adsorbs the electroplated abrasive disc body 3 on the body by a magnetic force to prevent the electroplated abrasive disc body 3 from being separated from the body during operation.

[0026] Based on Embodiment 3, in Embodiment 4, as shown in FIG. 3, a plurality of plug mounting holes 7 whose number is equal to that of the plurality of plugs 6 is formed in the water inlet end surface 101 of the body 1; the plugs 6 and the plug mounting holes 7 are equal in diameter, the plurality of plug mounting holes 7 is in one-to-one correspondence with the plurality of plugs 6, and each of the plugs 6 is inserted into the annular groove 102 from the corresponding plug mounting hole 7 respectively; and the lower end of the plug 6 is connected to the corresponding magnet 5, and the upper end of the plug 6 is clamped in the plug mounting hole 7.

[0027] In the above embodiment, the plug mounting holes 7 can facilitate mounting the plugs 6 on the magnets 5, and can accurately position the plugs 6.

[0028] Based on Embodiment 4, in Embodiment 5, as shown in FIG. 7 and FIG. 8, each of the blade components 4 includes a blade 401 and a water press plate 402; the blade 401 has a circular arc block structure, and the respective blades 401 are distributed on the connection disc 2 in a vortex form and close to the edge of the connection disc 2; the blade 401 and the connection disc 2 are integrally formed; the respective water press plates 402 are located at the water passage respectively and integrally disposed at the ends of the corresponding blades 401; and a thickness of the water press plate 402 gradually increases from front to back in a vortex rotation direction to form an oblique angle structure.

[0029] Specifically, as shown in FIG. 7, the respective blades 401 on the connection disc 2 are distributed in a clockwise vortex direction opposite to a rotation direction of the body 1. Alternatively, as shown in FIG. 8, the respective blades 401 on the connection disc 2 are distributed in a counterclockwise vortex direction. Thus, the connection disc 2 in a different blade form may be se-

lected according to production and machining requirements.

[0030] In the above embodiment, the water press plate 402 generates a pushing force on the cooling water to ensure the water to flow rapidly through a small gap.

[0031] Based on Embodiment 5, in Embodiment 6, the combined electroplated abrasive wheel further includes a plurality of fixing screws 8 for connecting the body 1 and the connection disc 2, wherein the fixing screws 8 and the blades 401 are equal in number, and the plurality of fixing screws 8 is in one-to-one correspondence with the blades 401 and passes through the water inlet end surface 101 of the body 1 and the corresponding blades 401 sequentially from top to bottom.

[0032] It is to be understood that a plurality of screw holes is correspondingly formed in the blades 401 and the water inlet end surface 101 of the body 1, and the screws 8 are correspondingly inserted into the screw holes of the blades 401 and the screw holes of the water inlet end surface 101.

[0033] In the above embodiment, the connection disc 2 is detachably connected to the body 1 by the fixing screws 8, so that the mounting is rapid and convenient.

[0034] Based on Embodiment 2, in Embodiment 7, the first electroplated abrasive disc body 3 is of an annular sheet structure in a shape same as the bottom surface of the annular groove 102; and first water grooves 9 are densely formed in the first diamond plating layer 301, wherein each first water groove 9 has a strip groove structure.

[0035] In the above embodiment, the first electroplated abrasive disc body 3 may play a role of a chip pocket and a chip removal groove to greatly improve cooling and chip removal capacities, and thus is suitable for high-speed machining and conducive to substantially improving the grinding efficiency.

[0036] Based on Embodiment 7, in Embodiment 8, as shown in FIG. 11, the first water grooves arranged densely are in a radial shape, and an axis of each first water groove 9 passes through the circle center, so that the cooling water cools a grinding region (a region in which the abrasive wheel is in contact with a workpiece) along the radial direction from the inner diameter to the outer diameter under the action of the centrifugal force.

[0037] In Embodiment 8, as shown in FIG. 10, the first water grooves arranged densely are all inclined at the same preset angle, and a direction thereof helps the cooling water cool the grinding region along the radial direction from the inner diameter to the outer diameter.

[0038] Specifically, "inclined at the same preset angle" refers to that the axis of each water groove does not pass through the circle center, and the respective water groove are disposed in parallel and extend forward in a vortex rotation direction of the cooling water. Alternatively, "inclined at the same preset angle" refers to that the axis of each water groove does not pass through the circle center, and the respective first water grooves are disposed in parallel and extend backward in the vortex rotation direction of the cooling water.

[0039] It is to be understood that the circle center refers to a circle center of the electroplated abrasive disc body 3.

[0040] In Embodiment 8, as shown in FIG. 9, the first water grooves arranged densely have a crossed network structure, and generate a working face to form "network surface" grinding, so as to cool the grinding region.

[0041] In the above embodiments, three water groove forms are all passages through which the cooling water reaches the grinding working face (the diamond plating layer), and may improve cooling and chip removal effects in different extents. The cooling and chip removal capacities of the first water grooves in the radial shape, the inclined shape and the network shape are sequentially increased.

[0042] Based on Embodiment 7, in Embodiment 9, the combined electroplated abrasive wheel further includes a first elastic cushion 10 of an annular band structure, wherein the first elastic cushion 10 and the annular groove 102 are equal in inner diameter, and the first elastic cushion 10 is clamped between the bottom surface of the annular groove 102 and the first electroplated abrasive disc body 3.

[0043] In the above embodiment, the elastic cushion 10 slightly deforms under force, and thus may compensate the defects of equipment/abrasive wheel/assembly precision in a small range.

[0044] Based on Embodiment 9, in Embodiment 10, as shown in FIG. 5, the combined electroplated abrasive wheel further includes a positioning step 12; and the positioning step 12 is disposed around an inner diameter of the bottom surface of the annular groove 102 and axially extends toward the first electroplated abrasive disc body 3 to form a circular flange structure.

[0045] In the above embodiment, the positioning step 12 can position the elastic cushion 10 and the electroplated abrasive disc body 3 to prevent offset, thereby improving the precision and safety.

[0046] In Embodiment 10, in order to prevent the electroplated abrasive disc body 3 from loosening, an anti-rotation and anti-loosening component for fastening the electroplated abrasive disc body 3 on the body 1 is disposed.

[0047] As shown in FIG. 12 and FIG. 13, the abrasive wheel further includes the anti-rotation anti-loosening component. The anti-rotation anti-loosening component includes an electroplated abrasive disc body folded edge 14, a folded edge mounting groove 15 and an anti-loosening fastener 16. The electroplated abrasive disc body folded edge 14 is a square plate with a screw hole in a middle portion and disposed at the lower edge of the outer diameter of the electroplated abrasive disc body 3, the folded edge mounting groove 15 corresponding to the electroplated abrasive disc body folded edge 14 is disposed on the annular groove 102 of the body 1, and the electroplated abrasive disc body folded edge 14 is embedded into the folded edge mounting groove 15. The anti-loosening fastener 16 penetrates through the elec-

troplated abrasive disc body folded edge 14 and the folded edge mounting groove 15 sequentially from outside to inside in a threaded connection manner to fix the electroplated abrasive disc body 3 on the body 1, so as to achieve an anti-rotation and anti-loosening effect of the electroplated abrasive disc body 3.

[0048] Specifically, a plurality of anti-rotation and anti-loosening components may be disposed circumferentially.

[0049] Based on the above Embodiments 1 to 10, in Embodiment 11, the combined electroplated abrasive wheel further includes a plurality of dismounting holes 11 for dismounting the first electroplated abrasive disc body 3; and the plurality of dismounting holes 11 is formed around an outer diameter of the bottom surface of the annular groove 102 at equal intervals.

[0050] In the above embodiment, the electroplated abrasive disc body 3 is pried up from the dismounting holes 11 to rapidly separate the electroplated abrasive disc body 3 from the body, thereby improving the production efficiency.

[0051] Based on the above Embodiments 1 to 10, specifically, as shown in FIG. 7, a circular connection protruding block for connecting a main shaft of external equipment is disposed at a central position of the first connection disc 2 and protrudes toward the water inlet end surface 101, and an equipment mounting hole 13 is formed in a central position of the circular connection protruding block.

[0052] In the above embodiment, the circular connection protruding block facilitates mounting the external equipment.

[0053] The combined electroplated abrasive wheel of the present invention has the following advantages.

1. The body part serving as the tooling may be used many times, thereby greatly saving body materials, reducing a machining volume of the body, and substantially reducing the consumption of the body materials and the machining cost.
2. The electroplated abrasive disc body of the diamond plating layer is easily manufactured by stamping at extremely low cost.
3. By the conventional machining methods such as stamping and rolling, it is very easy to machine dense water passages on the working face, and the passages may play the role of the chip pocket and the chip removal groove to greatly improve the cooling and chip removal capacities, and thus is suitable for high-speed machining and conducive to substantially improving the grinding efficiency.
4. The electroplated abrasive disc body is easily replaced before use.
5. The elastic cushion slightly deforms under force, and thus may compensate the defects of equipment/abrasive wheel/assembly precision in the small range.
6. The electroplated abrasive disc body may be produced in a simpler process with substantially reduced environmental protection expenses, and thus is suitable for automatic production.

[0054] Based on Embodiment 1, in Embodiment 12, as shown in FIGs. 14 to 24, a second method for connecting the electroplating component to the body is as follows.

[0055] The electroplating component includes a mandrel 17, a second connection disc 18, a press cover 20, a first abrasive body 21 and a second abrasive body 22.

[0056] The second connection disc 18 sleeves the lower end of the mandrel 17, and is fixedly connected to the mandrel 17; and a plurality of shunting components 19 of an arc blade structure is fixedly connected to the second connection disc 18 and arranged in a vortex form.

[0057] The body 1 sleeves the mandrel 17 to form an annular water inlet passage 27 with the mandrel 17; the body 1 is located at the upper end of the second connection disc 18 and fixedly connected to the second connection disc 18; a plurality of shunting passages 28 is formed by the body 1, the plurality of shunting components 19 and the upper end surface of the second connection disc 18, and arranged in a vortex form; the outer edge of the body 1 extends downward to the lower end thereof and surrounds the second connection disc 18 to form an annular water outlet 29 with an outer side wall of the second connection disc 18; and the water inlet passage 27 is in communication with the plurality of shunting passages 28, and the plurality of shunting passages 28 is all in communication with the water outlet 29.

[0058] The press cover 20 is placed at the upper end of the body 1 and fixedly connected to the body 1; the press cover 20 sleeves the mandrel 17 to form an annular second water inlet 30 with the mandrel 17; and the second water inlet 30 is in communication with the water inlet passage 27.

[0059] The first abrasive body 21 is placed at the lower end of the body 1, and detachably connected to the body 1.

[0060] The second abrasive body 22 is placed at the outer side of the body 1, and detachably connected to the body 1.

[0061] Specifically, in Embodiment 12, the body 1 is of an annular structure.

[0062] In the above embodiment, the mandrel 17, the second connection disc 18, the shunting components 19, the body 1 and the press cover 20 are manufactured by stamping, lathing or molding grinding; the second electroplated abrasive disc body 211 of the first abrasive body 21 is manufactured by stamping; a plurality of particle size segments is simultaneously electroplated in batches, respectively; and an insulation sealing step may be easily avoided through the corresponding tooling. In the use process, the first abrasive body 21 of the required particle size segment is connected to the body 1 in a mechanical manner or magnetic adsorption manner.

[0063] The second water inlet 30, the water inlet pas-

sage 27, the shunting passages 28 and the water outlet 29 formed by the mandrel 17, the second connection disc 18, the shunting components 19, the body 1 and the press cover 20 are in communication with one another sequentially to guide the cooling water to flow out via the second water inlet 30, the water inlet passage 27, the shunting passages 28 and the water outlet 29, so as to achieve the effect of external rotation and internal cooling.

[0064] The plurality of shunting passages 28 is formed by the plurality of shunting components 19, the upper end surface of the second connection disc 18 and the body 1, and arranged in a vortex form.

[0065] During the rotation of the mandrel 17, the cooling water can be guided to flow to the water outlet 29 through the plurality of shunting passages 28 under the action of the centrifugal force, so that the cooling water is uniformly sprayed out along the water outlet 29, thereby uniformly cooling the grinding surface of the first abrasive body 21. Thus, the cooling efficiency and the cooling effect can be effectively improved.

[0066] The second connection disc 18, the shunting components 19, the body 1 and the press cover 20 are easily manufactured by stamping, rolling, lathing or molding grinding at extremely low cost, thereby reducing the investment of machining equipment and further lowering the machining difficulty and the machining cost.

[0067] The first abrasive body 21 is detachably connected to the body 1, and is a detachable and replaceable component. The first abrasive body 21 may be separated from the body 1 to be electroplated with abrasive materials in batches simultaneously, and then assembled on the body 1 after completion of electroplating, thereby improving the productivity and lowering the cost, achieving easy replacement and operation before use, reducing the damage to the body 1 and increasing the reuse rate of the body 1.

[0068] Based on Embodiment 12, in Embodiment 13, as shown in FIG. 22 and FIG. 23, the first abrasive body 21 includes a second electroplated abrasive disc body 211 and a second diamond plating layer 212.

[0069] The second electroplated abrasive disc body 211 is placed at the lower end of the body 1, and detachably connected to the body 1; and the second diamond plating layer 212 is attached to the lower end surface of the second electroplated abrasive disc body 211.

[0070] In the above embodiment, the second electroplated abrasive disc body 211 is detachably connected to the body 1, and is a detachable and replaceable component; the first abrasive body 21 may be separated from the body 1 to be electroplated with abrasive materials in batches simultaneously, and then assembled on the body 1 after completion of electroplating, thereby improving the productivity and lowering the cost, achieving easy replacement and operation before use, reducing the damage to the body 1 and increasing the reuse rate of the body 1.

[0071] Based on Embodiment 13, in Embodiment 14, as shown in FIG. 19, the lower end of the second electroplated abrasive disc body 211 has an annular structure, and a plurality of second water grooves 213 is disposed on the lower end surface of the second electroplated abrasive disc body 211, wherein one end of each of the plurality of second water grooves 213 is in communication with the inner side of the second electroplated abrasive disc body 211, and the other end of the second water groove 213 is in communication with the outer side of the second electroplated abrasive disc body 211.

[0072] In the above embodiment, the plurality of second water grooves 213 is machined in the second electroplated abrasive disc body 211 by machining, i.e., stamping and rolling to guide the cooling water to perform cooling and chip removal on the second electroplated abrasive disc body 211 and the second diamond plating layer 212, so as to improve cooling and chip removal capacities. The lower end surface of the second electroplated abrasive disc body 211 may also be machined into a network structure to further improve the cooling and chip removal capacities, and thus is suitable for high-speed machining and conducive to substantially improving the grinding efficiency.

[0073] Based on Embodiment 14, in Embodiment 15, as shown in FIG. 23, the plurality of second water grooves 213 is formed in the lower end surface of the second electroplated abrasive disc body 211 in a vortex form; and the second diamond plating layer 212 is arranged between each two adjacent second water grooves 213.

[0074] In the above embodiment, the second water grooves 213 are arranged in the vortex form, so that the cooling water may rapidly flow through the second water grooves 213 under the action of the centrifugal force, thereby improving the cooling and chip removal capacities and substantially improving the grinding efficiency.

[0075] Based on Embodiment 12, in Embodiment 16, as shown in FIG. 14 and FIG. 15, the second abrasive body 22 has an annular structure and sleeves the upper end of the side wall of the body 1; the second abrasive body 22 is located at the lower end of the press cover 20; and the press cover 20 tightly presses the second abrasive body 22 on the body 1.

[0076] In the above embodiment, the second abrasive body 22 is detachably connected to the body 1, and is a detachable and replaceable component; the body is manufactured by stamping the second abrasive body 22, and then the manufactured electroplated body may be simultaneously electroplated with abrasive materials in batches respectively to obtain the respective electroplated particle size segments; and the respective electroplated particle size segments may be independently electroplated, and then assembled on the body 4separately one by one after completion of electroplating. The second abrasive body 22 is suitable for automatic mass production, thereby improving the productivity and reducing the cost, achieving easy replacement and operation before use, reducing the damage to the body 1 and increasing the reuse rate of the body 1.

[0077] Based on Embodiment 12, in Embodiment 17,

as shown in FIG. 24, the second abrasive body 22 includes an electroplated abrasive ring body 221 and a third diamond plating layer 222.

[0078] The electroplated abrasive ring body 221 has an annular structure, and sleeves the upper end of the side wall of the body 1; the electroplated abrasive ring body 221 is located at the lower end of the press cover 20, and the press cover 20 tightly presses the electroplated abrasive ring body 221 on the body 1; and the third diamond plating layer 222 is attached to an outer side wall of the electroplated abrasive ring body 221.

[0079] In the above embodiment, the electroplated abrasive ring body 221 is detachably connected to the body 1, and is a detachable and replaceable component; the body is manufactured by stamping the electroplated abrasive ring body 221, and then, the manufactured electroplated body may be simultaneously electroplated with abrasive materials in batches respectively to obtain the respective electroplated particle size segments; and the respective electroplated particle size segments may be independently electroplated, and then assembled on the body 1 after completion of electroplating. The electroplated abrasive ring body 221 is suitable for automatic mass production, thereby improving the productivity and reducing the cost, achieving easy replacement and operation before use, reducing the damage to the body 1 and increasing the reuse rate of the body 1. An axial space of the combined-type multifunctional electroplated abrasive wheel may be saved without disposing a transition space for the particle size segments. The number of grooves for consumable particle sizes may be increased to increase a utilization rate of the combined-type multifunctional electroplated abrasive wheel.

[0080] Based on Embodiments 12 to 17, as shown in FIG. 22, the combined electroplated abrasive wheel further includes the followings.

[0081] A plurality of mounting holes is formed in the body 1 corresponding to the lower end of the second abrasive body 7, and arranged at intervals sequentially to form an annular structure; and an insert block 32 and a magnetic member 31 are disposed in each mounting hole, wherein the magnetic member 31 is placed at the lower end of the insert block 32 and connected to the insert block 32, and the insert block 32 is fixedly connected to the inner wall of the mounting hole.

[0082] Specifically, the plurality of the magnetic members 31 magnetically adsorbs and connects the second electroplated abrasive disc body 211 on the end surface of the body 1. This structure enables the first abrasive body 21 to be easily replaced very conveniently. Each magnetic member 31 is a magnet.

[0083] Based on Embodiment 12, in Embodiment 18, as shown in FIG. 22 and FIG. 23, the combined electroplated abrasive wheel further includes a second elastic cushion 23; an annular groove with a downward opening is formed in the lower end of the body 1; and the second elastic cushion 23 has an annular structure, is embedded in the annular groove, and is clamped between the body 1 and the first abrasive body 21.

[0084] In the above embodiment, the second elastic cushion 23 slightly deforms under force, and thus may compensate the defects of equipment/abrasive wheel/assembly precision in the small range.

[0085] Based on Embodiment 12, in Embodiment 19, as shown in FIG. 21, the combined electroplated abrasive wheel further includes a plurality of first screws 24; the first screws 24 and the shunting components 19 are equal in number; and all of the first screws 24 pass through the second connection disc 18 and the corresponding shunting components 19 sequentially upward from the lower end surface of the second connection disc 18 and are connected to the body 1, so as to fasten the second connection disc 18, the corresponding shunting components 19 and the body 1.

[0086] In the above embodiment, a plurality of first screws 24 facilitates mounting and dismounting the second connection disc 18, the corresponding shunting components 19 and the body 1 rapidly and conveniently.

[0087] Based on Embodiment 12, in Embodiment 20, as shown in FIG. 21, the combined electroplated abrasive wheel further includes a plurality of second screws 25; and the plurality of second screws 25 all passes through the press cover 20 downward from the upper end surface of the press cover 20 and extends into the body 1, so as to fasten the press cover 20 and the body 1.

[0088] In the above embodiment, the plurality of second screws 25 facilitates mounting and dismounting the press cover 20 and the body 1 rapidly and conveniently.

[0089] Based on Embodiment 12, in Embodiment 21, as shown in FIG. 18 and FIG. 20, the combined electroplated abrasive wheel further includes a plurality of third screws 26; the plurality of third screws 26 all passes through the first abrasive body 21 from the outer side wall of the first abrasive body 21 and extends into the body 1, so as to fasten the first abrasive body 21 and the body 1.

[0090] In the above embodiment, the plurality of third screws 26 facilitates mounting and dismounting the first abrasive body 21 and the body 1 rapidly and conveniently.

[0091] The foregoing descriptions are merely preferred embodiments of the present invention, and are not intended to limit the present invention. Within the spirit and principles of the present invention, any modifications, equivalent substitutions, improvements, and the like are within the protection scope of the present invention.

Claims

1. A combined electroplated abrasive wheel, comprising a body (1) and an electroplating component for electroplating a workpiece, wherein the electroplating component is connected to the body (1) in a combined manner.

2. The combined electroplated abrasive wheel according to claim 1, wherein the electroplating component comprises a first connection disc (2), an absorption member, a first electroplated abrasive disc body (3) and a first diamond plating layer (301); the body (1) comprises a water inlet end surface (101) and a hollow annular groove (102), wherein the water inlet end surface (101) has an annular plate structure with a first water inlet (1011) in the center, an outer diameter of the water inlet end surface (101) and an outer diameter of the annular groove (102) are equal and coaxially connected into a whole, the water inlet end surface (101) is connected to a top surface of the annular groove (102), and a hollowed-out region is formed between the water inlet end surface (101) and an inner annular wall of the annular groove (102); the first connection disc (2) and the first water inlet (1011) are oppositely placed in the hollowed-out region and detachably connected to the water inlet end surface (101), and a gap is reserved between the first connection disc (2) and the inner annular wall of the annular groove (102) to form a water passage; the absorption member is disposed in the annular groove (102), the first electroplated abrasive disc body (3) is adsorbed at the outer side of the bottom surface of the annular groove (102) through the absorption member, and the first diamond plating layer (301) is attached to the outer surface of the first electroplated abrasive disc body (3); and the first connection disc (2) comprises a plurality of blade components (4) that is distributed on the side surface of the first connection disc (2) close to the water inlet end surface (101) in a vortex form.

3. The combined electroplated abrasive wheel according to claim 2, wherein the absorption member comprises a plurality of cylindrical magnets (5) and a plurality of cylindrical plugs (6); the plurality of magnets (5) is placed around the bottom surface of the annular groove (102) at intervals; the magnets (5) and the plugs (6) are equal in number; the plurality of plugs (6) is in one-to-one correspondence with the plurality of magnets (5) and located above the corresponding magnets (5); and the magnets (5) are mounted on the bottom surface of the annular groove (102) through the plugs (6) by interference fit.

4. The combined electroplated abrasive wheel according to claim 3, wherein plug mounting holes (7) whose number is equal to that of the plurality of plugs (6) are formed in the water inlet end surface (101) of the body (1); the plugs (6) and the plug mounting holes (7) are equal in diameter; the plurality of plug mounting holes (7) is in one-to-one correspondence with the plurality of plugs (6); and each of the plugs (6) extends into the annular groove (102) from the corresponding plug mounting hole (7), wherein the lower end of the plug (6) is connected to the corresponding magnet (5), and the upper end of the plug (6) is clamped in the plug mounting hole (7).

5. The combined electroplated abrasive wheel according to claim 4, wherein each of the blade components (4) comprises a blade (401) and a water press plate (402); the blade (401) has an arc block structure, and the respective blades (401) is distributed on the first connection disc (2) in a vortex form and close to the edge of the first connection disc (2); the blades (401) and the first connection disc (2) are formed integrally; the respective water press plates (402) are located at the water passage respectively and integrally disposed at the end of the corresponding blade (401); and a thickness of the water press plate (402) gradually increases from front to back in a vortex rotation direction to form an oblique angle structure.

6. The combined electroplated abrasive wheel according to claim 5, further comprising a plurality of fixing screws (8) for connecting the body (1) and the first connection disc (2), wherein the fixing screws (8) and the blades (401) are equal in number, and the plurality of fixing screws (8) is in one-to-one correspondence with the blades (401) and passes through the water inlet end surface (101) of the body (1) and the corresponding blades (401) sequentially from top to bottom.

7. The combined electroplated abrasive wheel according to claim 2, wherein the first electroplated abrasive disc body (3) is of an annular sheet structure in a shape same as the bottom surface of the annular groove (102); and first water grooves (9) are densely formed in the first diamond plating layer (301), and each first water groove (9) has a strip groove structure.

8. The combined electroplated abrasive wheel according to claim 7, wherein the first water grooves (9) arranged densely are in a radial shape, and an axis of each first water groove (9) passes through the circle center; or, the first water grooves (9) arranged densely are all inclined at the same preset angle; or, the first water grooves (9) arranged densely have a crossed network structure.

9. The combined electroplated abrasive wheel according to claim 7, further comprising a first elastic cushion (10) of an annular band structure, wherein the first elastic cushion (10) and the annular groove (102) are equal in inner diameter, and the first elastic cushion (10) is clamped between the bottom surface of the annular groove (102) and the first electroplated abrasive disc body (3).

10. The combined electroplated abrasive wheel accord-

ing to claim 9, further comprising a positioning step (12), wherein the positioning step (12) is disposed around the inner diameter of the bottom surface of the annular groove (102) and axially extends toward the first electroplated abrasive disc body (3) to form a circular flange structure.

11. The combined electroplated abrasive wheel according to any one of claims 1 to 10, further comprising a plurality of dismounting holes (11) for dismounting the first electroplated abrasive disc body (3), wherein the plurality of dismounting holes (11) is formed around the outer diameter of the bottom surface of the annular groove (102) at equal intervals.

12. The combined electroplated abrasive wheel according to claim 1, wherein the electroplating component comprises a mandrel (17), a second connection disc (18), a press cover (20), a first abrasive body (21) and a second abrasive body (22);

the second connection disc (18) sleeves the lower end of the mandrel (17), and is fixedly connected to the mandrel (17); a plurality of shunting components (19) of an arc blade structure is fixedly connected to the second connection disc (18) and arranged in a vortex form;
the body (1) sleeves the mandrel (17) to form an annular water inlet passage (27) with the mandrel (17); the body (1) is located at the upper end of the second connection disc (18) and fixedly connected to the second connection disc (18); a plurality of shunting passages (28) is formed by the body (1), the plurality of shunting components (19) and an upper end surface of the second connection disc (18), and arranged in a vortex form; the outer edge of the body (1) extends downward to the lower end thereof and surrounds the second connection disc (18) to form an annular water outlet (29) with an outer side wall of the second connection disc (18); the water inlet passage (27) is in communication with a plurality of shunting passages (28), and the plurality of shunting passages (28) are all in communication with the water outlet (29);
the press cover (20) is placed at the upper end of the body (1) and fixedly connected to the body (1); the press cover (20) sleeves the mandrel (17) to form an annular second water inlet (30) with the mandrel (17), and the second water inlet (30) is in communication with the water inlet passage (27);
the first abrasive body (21) is placed at the lower end of the body (1), and detachably connected to the body (1); and
the second abrasive body (22) is placed at the outer side of the body (1), and detachably connected to the body (1).

13. The combined electroplated abrasive wheel according to claim 12, wherein the first abrasive body (21) comprises a second electroplated abrasive disc body (211) and a second diamond plating layer (212); and
the second electroplated abrasive disc body (211) is placed at the lower end of the body (1), and detachably connected to the body (1); and the second diamond plating layer (212) is attached to a lower end surface of the second electroplated abrasive disc body (211).

14. The combined electroplated abrasive wheel according to claim 13, wherein the lower end of the second electroplated abrasive disc body (211) has an annular structure, and a plurality of second water grooves (213) is formed in the lower end surface of the second electroplated abrasive disc body (211); and one end of each of the plurality of second water grooves (213) is in communication with the inner side of the second electroplated abrasive disc body (211), and the other end of the second water groove (213) is in communication with the outer side of the second electroplated abrasive disc body (211).

15. The combined electroplated abrasive wheel according to claim 14, wherein the plurality of second water grooves (213) is formed in the lower end surface of the second electroplated abrasive disc body (211) in a vortex form; and the second diamond plating layer (212) is arranged between each two adjacent second water grooves (213).

16. The combined electroplated abrasive wheel according to claim 12, wherein the second abrasive body (22) has an annular structure and sleeves the upper end of the side wall of the body (1); and the second abrasive body (22) is located at the lower end of the press cover (20), and the press cover (20) tightly presses the second abrasive body (22) on the body (1).

17. The combined electroplated abrasive wheel according to claim 12, wherein the second abrasive body (22) comprises an electroplated abrasive ring body (221) and a third diamond plating layer (222); and
the electroplated abrasive ring body (221) has an annular structure, and sleeves the upper end of the side wall of the body (1); the electroplated abrasive ring body (221) is located at the lower end of the press cover (20), and the press cover (20) tightly presses the electroplated abrasive ring body (221) on the body (1); and the third diamond plating layer (222) is attached to the outer side wall of the electroplated abrasive ring body (221).

18. The combined electroplated abrasive wheel according to claim 12, further comprising a second elastic

cushion (23), wherein an annular groove with a downward opening is disposed at the lower end of the body (1); and the second elastic cushion (23) has an annular structure, is embedded in the annular groove, and is clamped between the body (1) and the first abrasive body (21).

19. The combined electroplated abrasive wheel according to claim 12, further comprising a plurality of first screws (24), wherein the first screws (24) and the shunting components (19) are equal in number; all of the first screws (24) pass through the second connection disc (18) and the corresponding shunting components (19) sequentially upward from the lower end surface of the second connection disc (18) and are connected to the body (1), so as to fasten the second connection disc (18), the corresponding shunting components (19) and the body (1).

20. The combined electroplated abrasive wheel according to claim 12, further comprising a plurality of second screws (25), wherein the plurality of second screws (25) all passes through the press cover (20) downward from an upper end surface of the press cover (20) and extends into the body (1), so as to fasten the press cover (20) and the body (1).

21. The combined electroplated abrasive wheel according to claim 12, further comprising a plurality of third screws (26), wherein the plurality of third screws (26) all passes through the first abrasive body (21) from the outer side wall of the first abrasive body (21) and extends into the body (1), so as to fasten the first abrasive body (21) and the body (1).

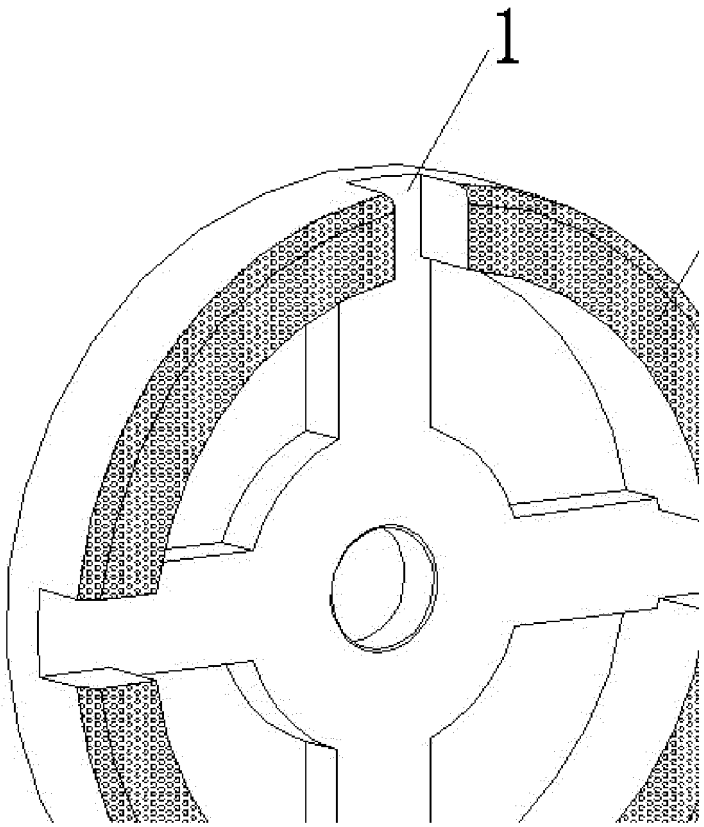

FIG. 1

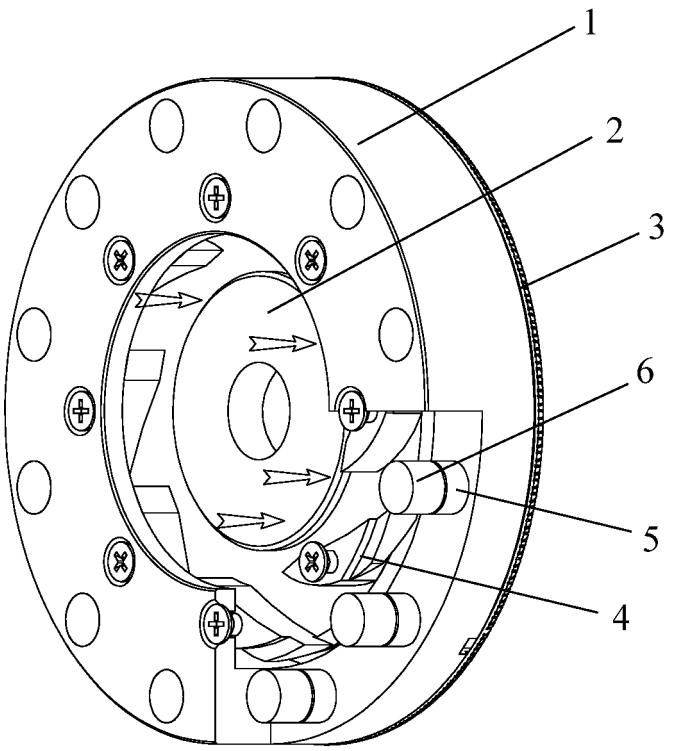

FIG. 2

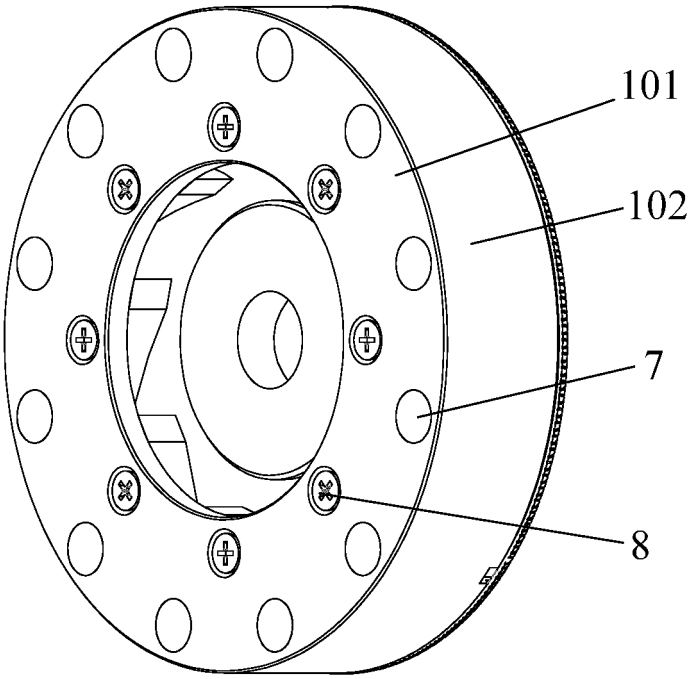

FIG. 3

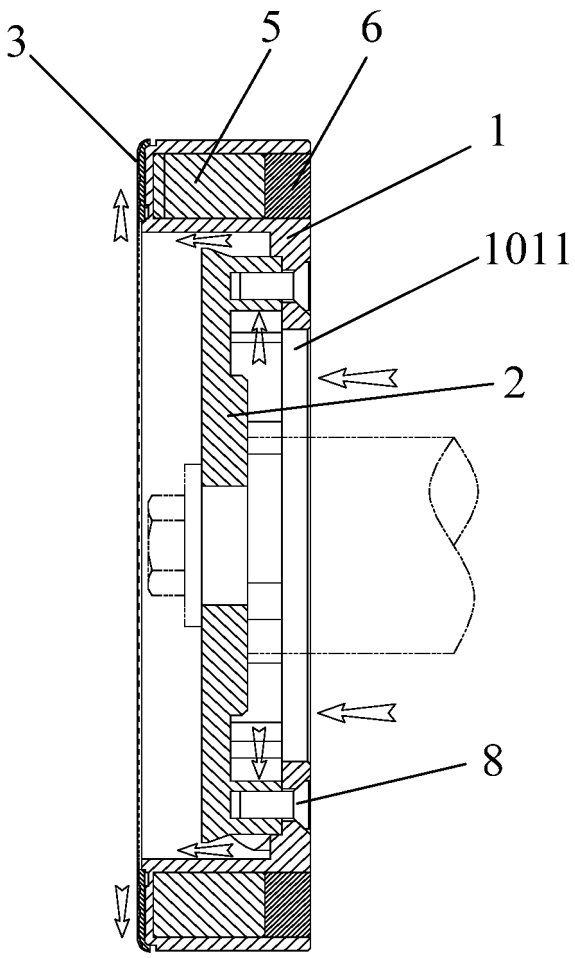

FIG. 4

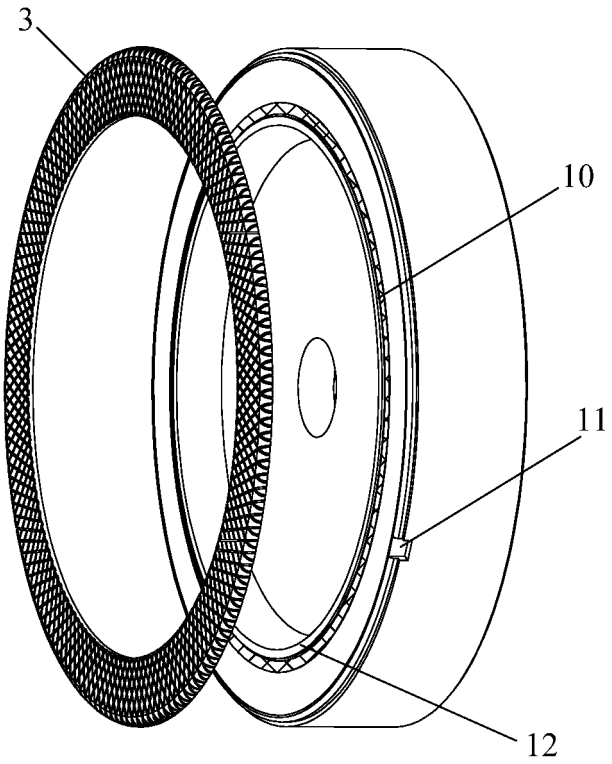

FIG. 5

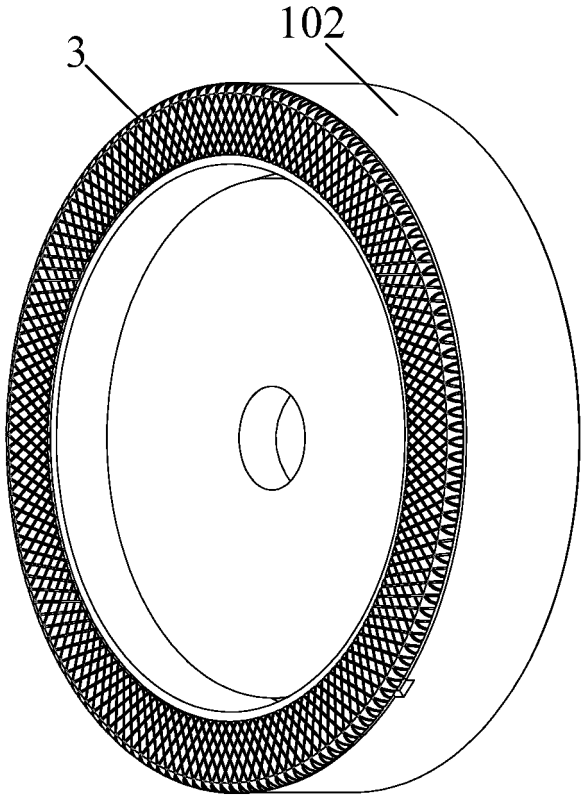

FIG. 6

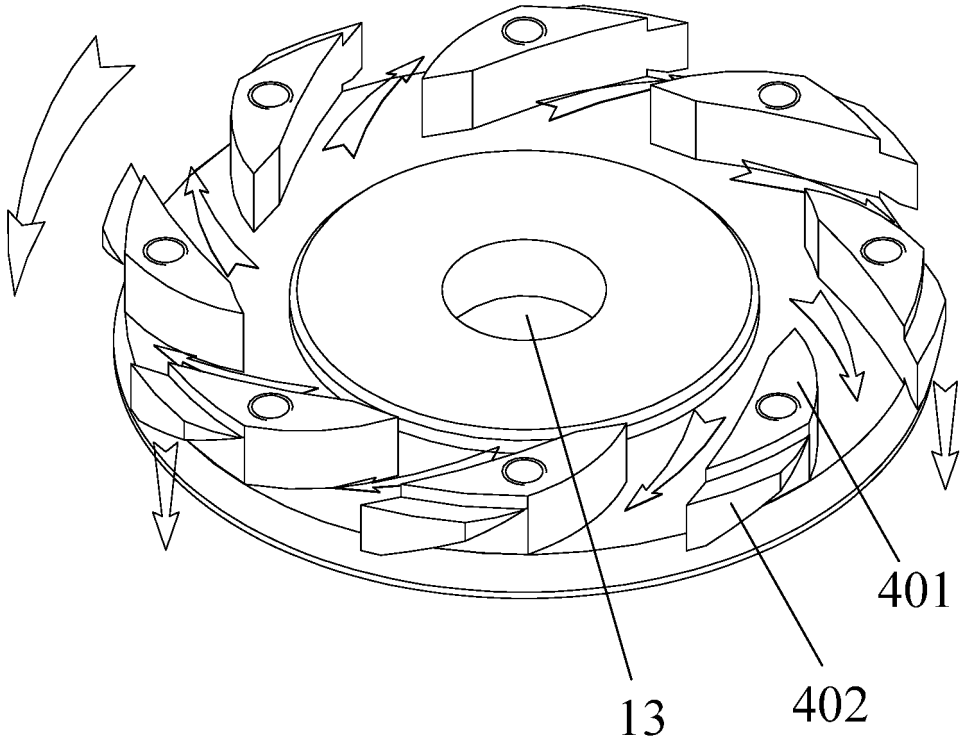

FIG. 7

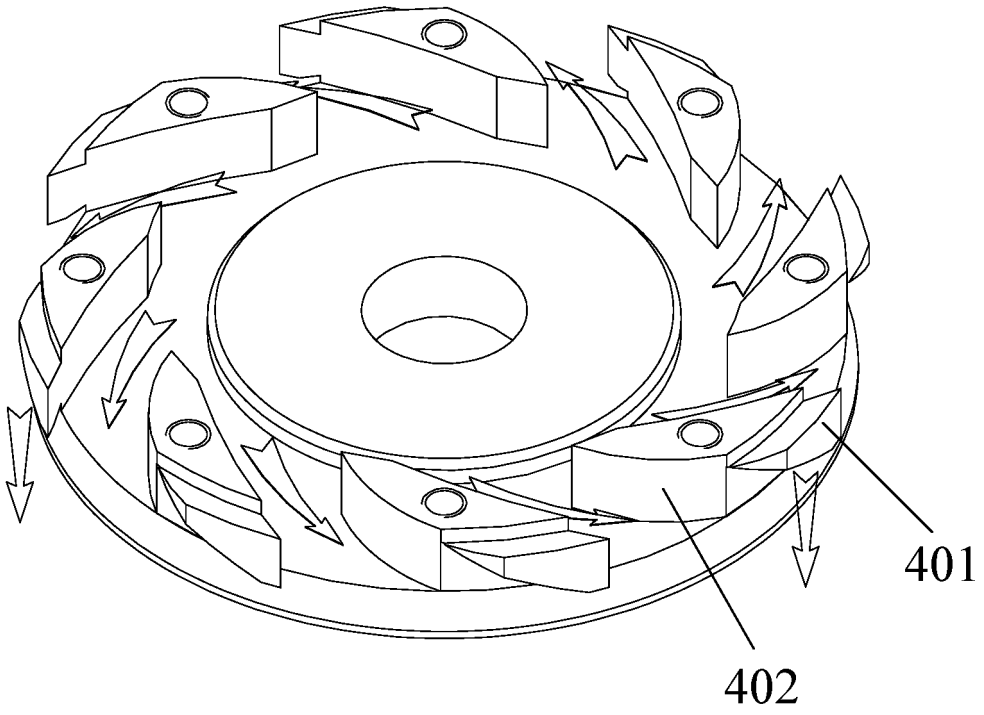

FIG. 8

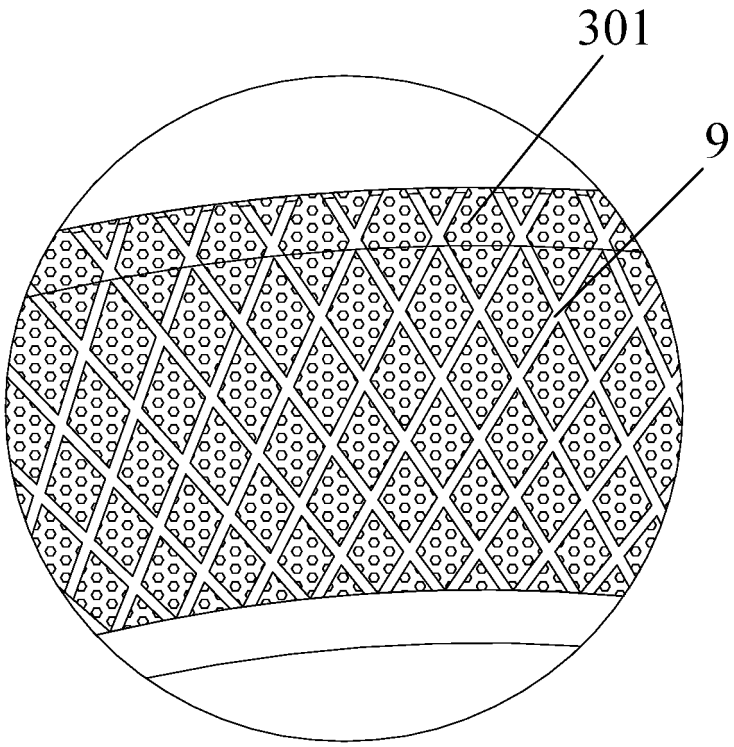

FIG. 9

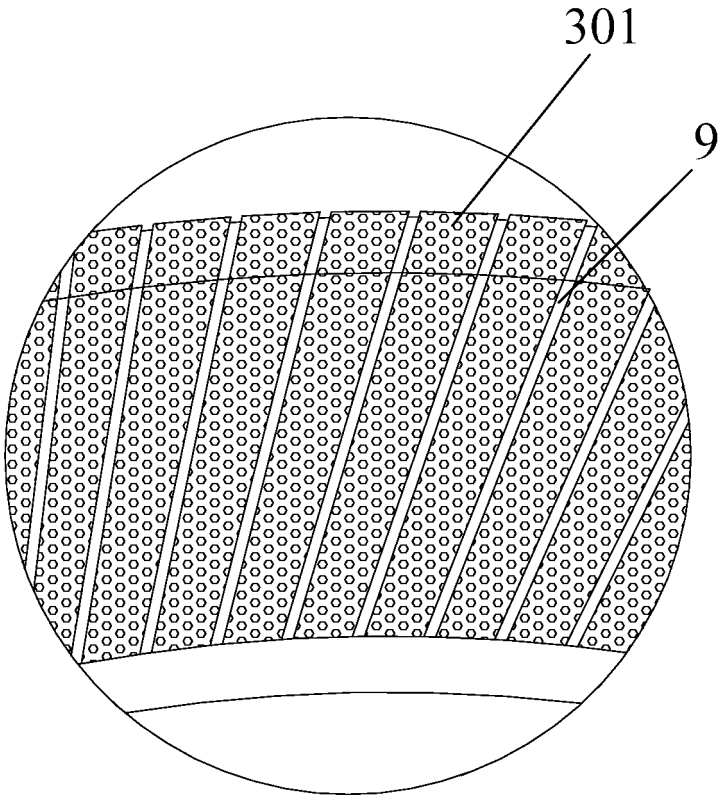

FIG. 10

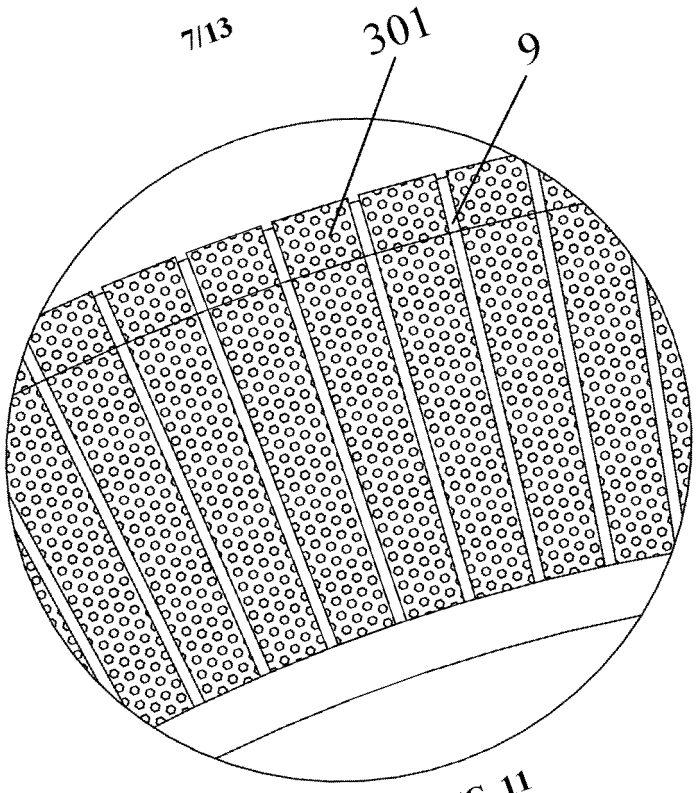

FIG. 11

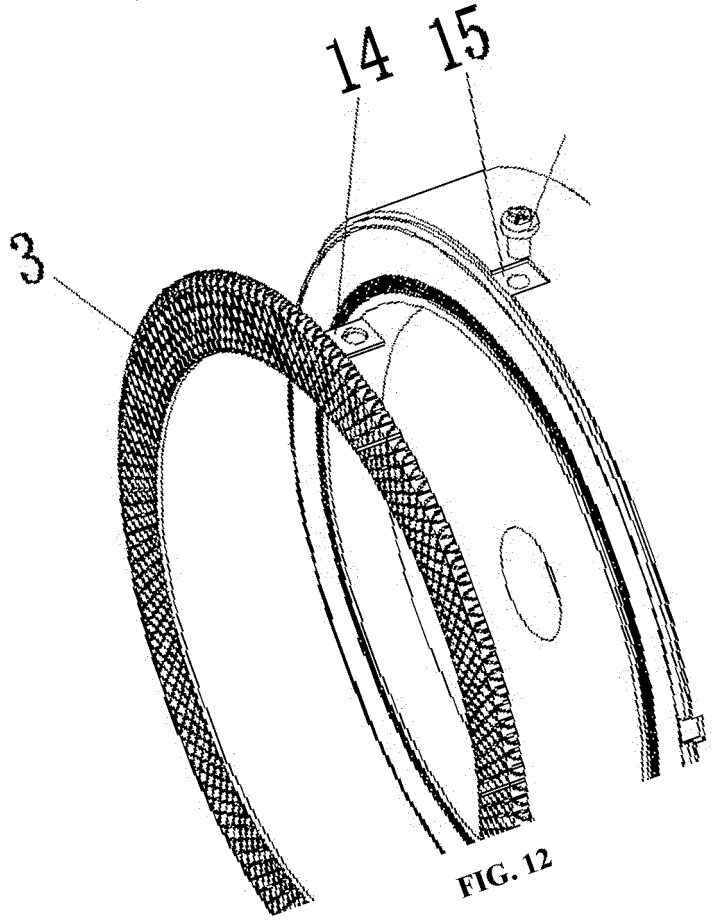

FIG. 12

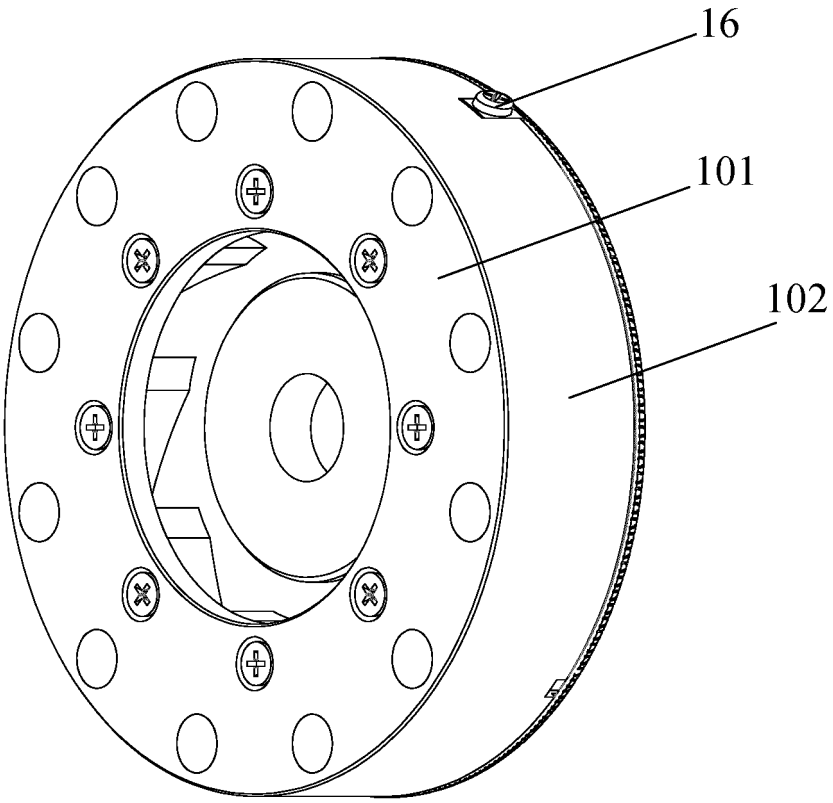

FIG. 13

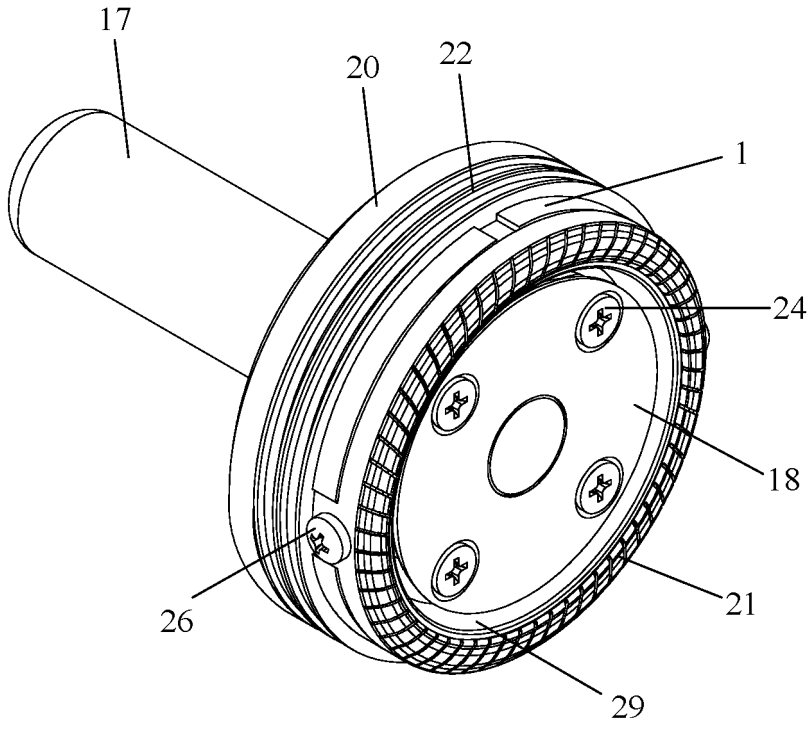

FIG. 14

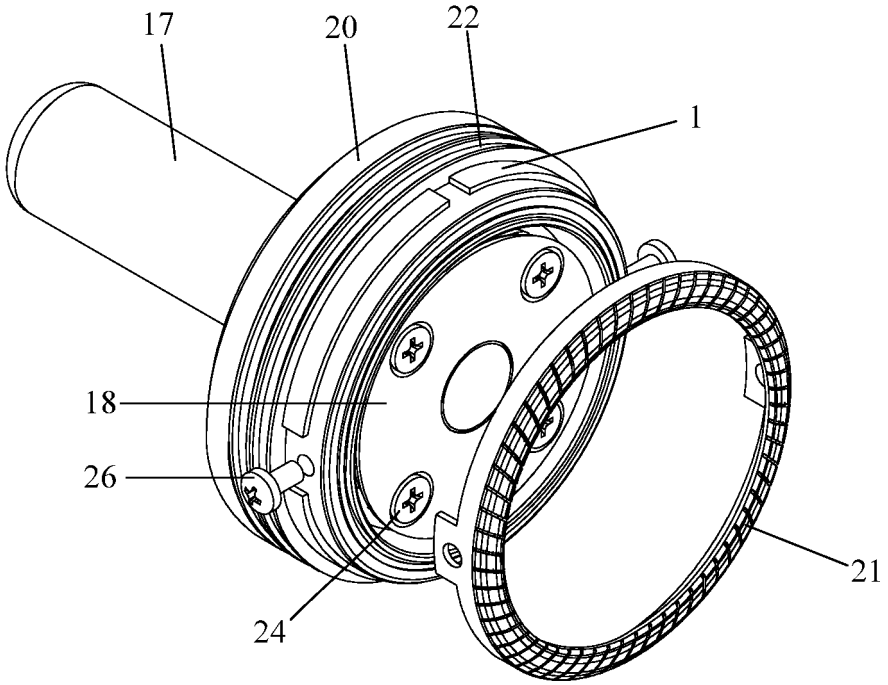

FIG. 15

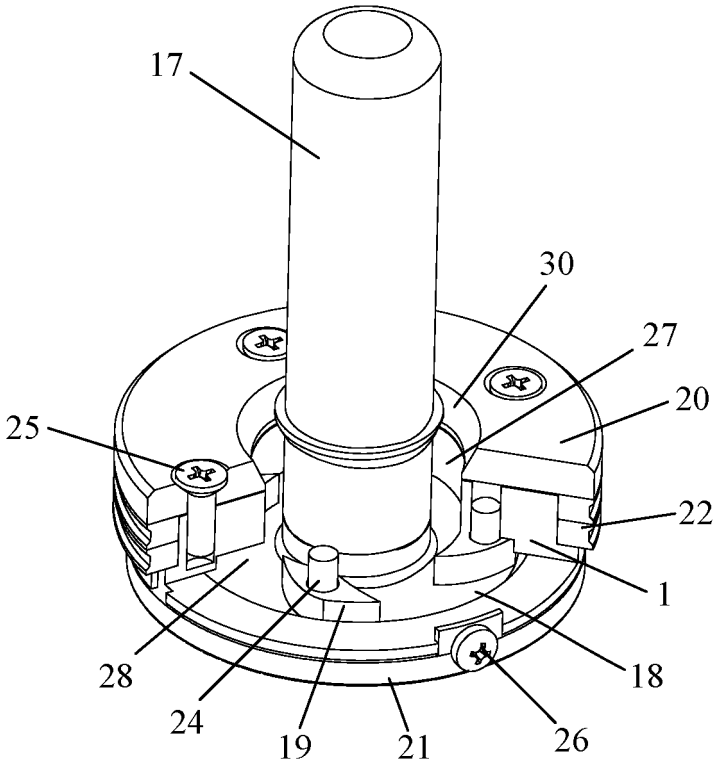

FIG. 16

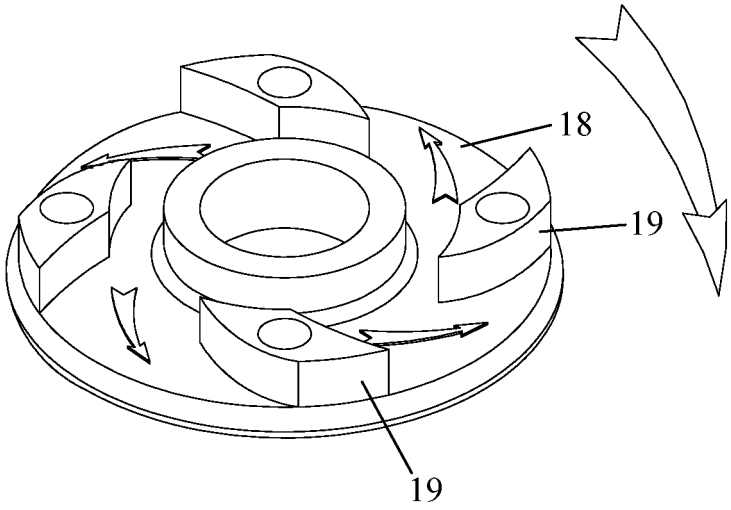

FIG. 17

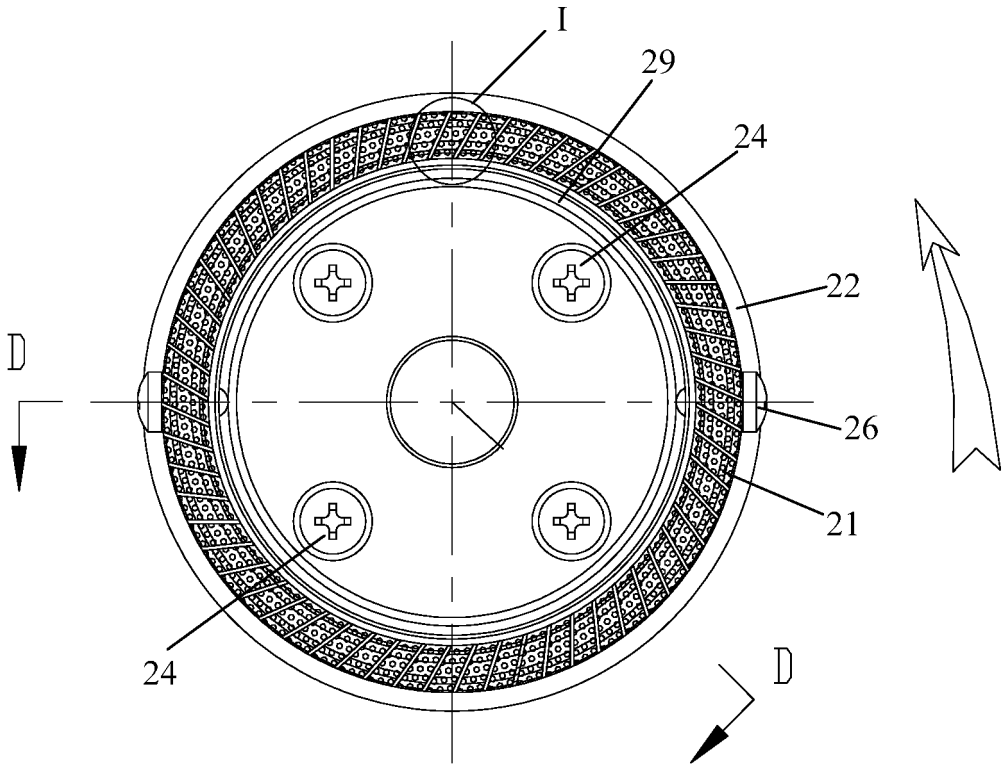

FIG. 18

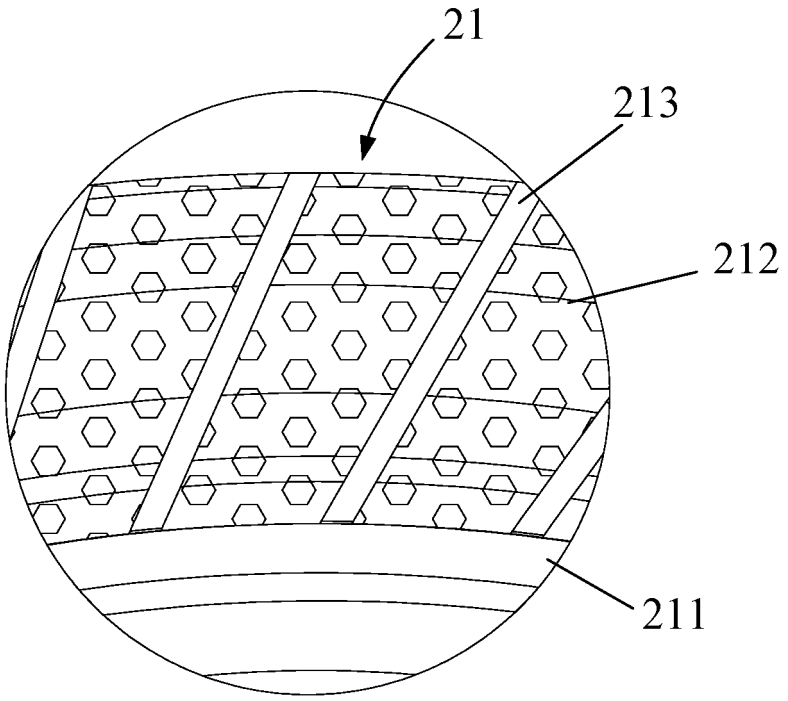

FIG. 19

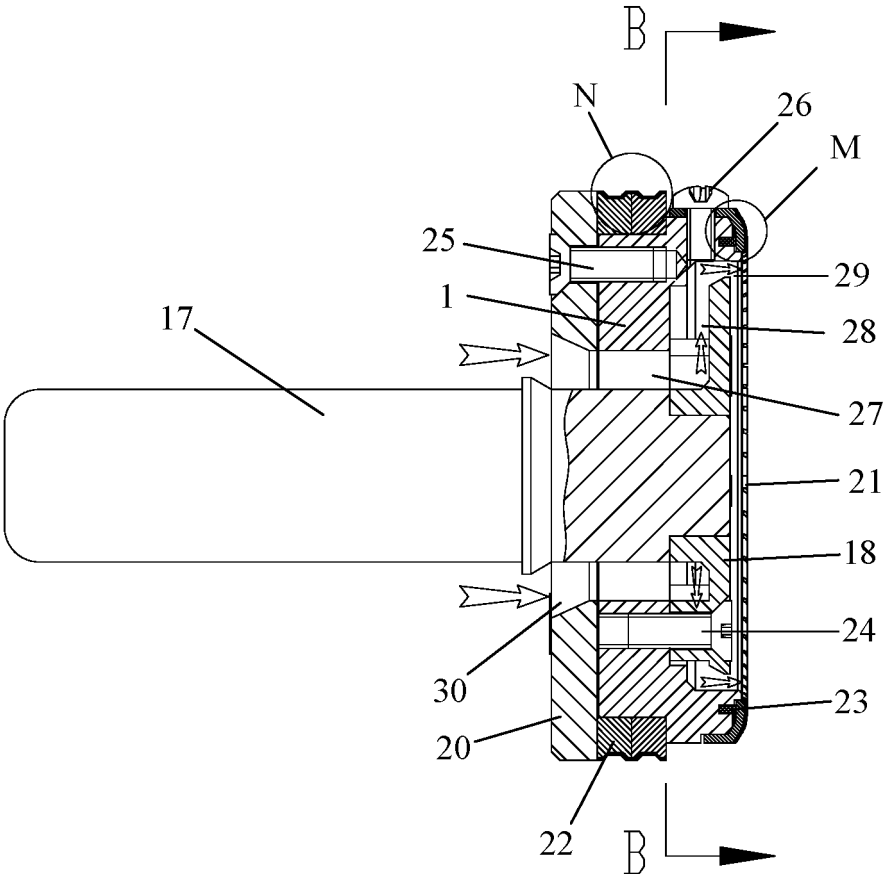

FIG. 20

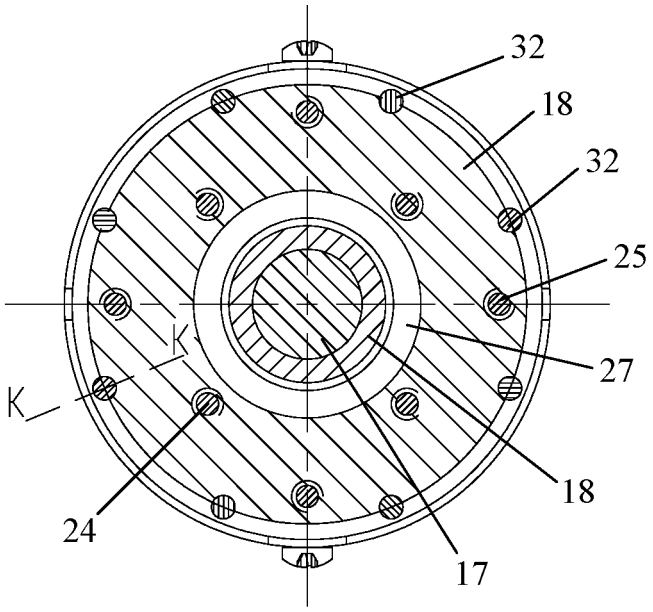

FIG. 21

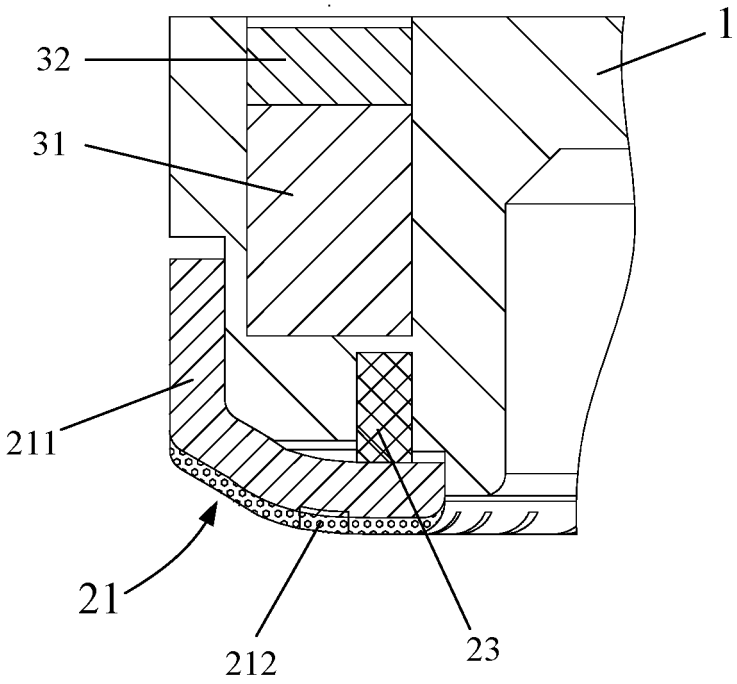

FIG. 22

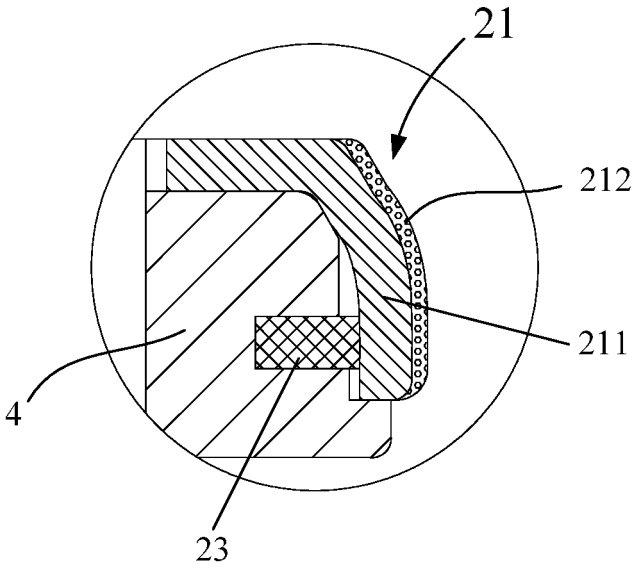

FIG. 23

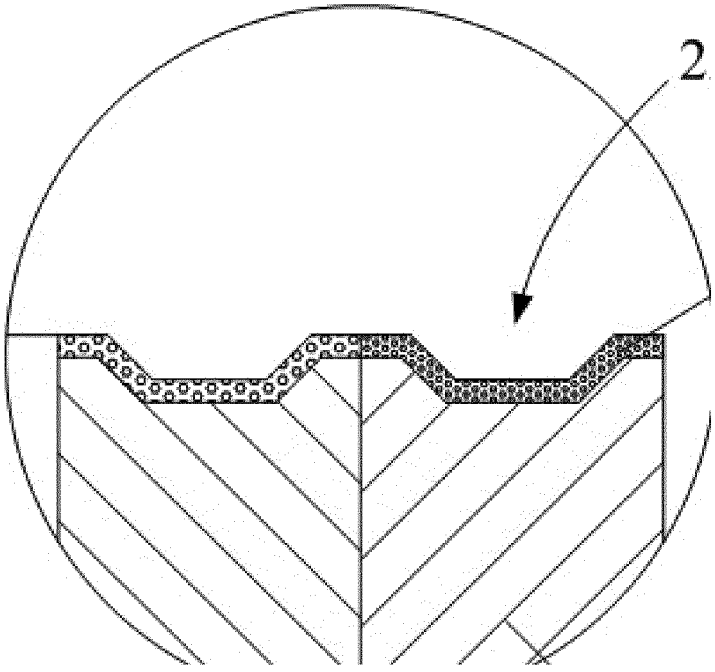

FIG. 24

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2020/137275

A. CLASSIFICATION OF SUBJECT MATTER

B24D 7/10(2006.01)i; B24D 7/16(2006.01)i; B24D 7/18(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)

B24D7; B24B55; B24D13; B24D5

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)

CNKI, SIPOABS, VEN; CNABS: 电镀, 砂轮, 叶片, 涡流, 扇叶, 磁, plat+, galv+, electro+, blader, blade, vane, eddy+, vortex +, whirl+, magnetic

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 211491111 U (SONG, Jingxin et al.) 15 September 2020 (2020-09-15) claims 1-10	claims 1, 12-21
PX	CN 211388377 U (SONG, Jingxin et al.) 01 September 2020 (2020-09-01) claims 1-10	claims 1-11
PX	CN 110919555 A (SONG, Jingxin et al.) 27 March 2020 (2020-03-27) claims 1-10	claims 1-11
PX	CN 110919554 A (SONG, Jingxin et al.) 27 March 2020 (2020-03-27) claims 1-10	claims 1, 12-21
X	CN 204195477 U (TAIWAN ASAHI DIAMOND INDUSTRIAL CO., LTD.) 11 March 2015 (2015-03-11) see description, paragraphs 0023-0028, figures 1-3	1
A	CN 204195477 U (TAIWAN ASAHI DIAMOND INDUSTRIAL CO., LTD.) 11 March 2015 (2015-03-11) see description, paragraphs 0023-0028, figures 1-3	2-21
A	CN 207522407 U (JIANGSU LIYUAN TECHNOLOGY CO., LTD.) 22 June 2018 (2018-06-22) entire document	1-21

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 March 2021	**23 March 2021**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** **China**	Authorized officer
Facsimile No. **(86-10)62019451**	Telephone No.

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International application No.
PCT/CN2020/137275

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 110480511 A (GUILIN CHAMPION UNION DIAMOND CO., LTD.) 22 November 2019 (2019-11-22) entire document	1-21
A	CA 2690596 A1 (WALTER COMPANY LTD J) 15 July 2011 (2011-07-15) entire document	1-21

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2020/137275

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 211491111 U	15 September 2020	None	
CN 211388377 U	01 September 2020	None	
CN 110919555 A	27 March 2020	None	
CN 110919554 A	27 March 2020	None	
CN 204195477 U	11 March 2015	TW M492804 U	01 January 2015
CN 207522407 U	22 June 2018	None	
CN 110480511 A	22 November 2019	None	
CA 2690596 A1	15 July 2011	CA 2690596 C	24 April 2018

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