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(54) BURR TRIMMING DEVICE

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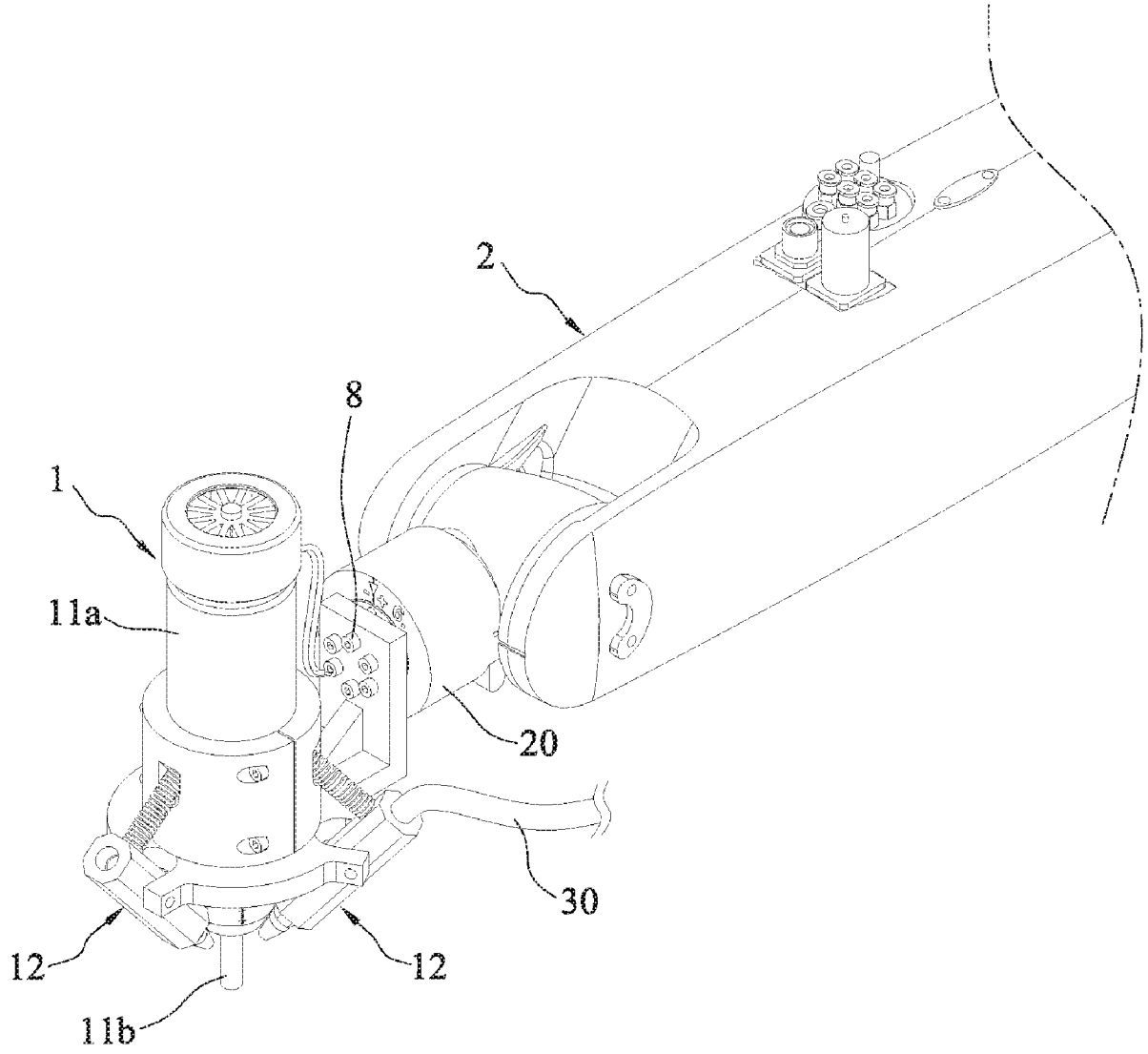
(57) **ABSTRACT**

A burr trimming device includes a removing assembly and a directed spraying assembly disposed on a carrier, wherein the directed spraying assembly has a nozzle facing the removing assembly. The directed spraying assembly rapidly freezes objects such as burrs and then the removing assembly removes the hardened objects by coming into rigid contact therewith, thereby ensuring complete removal of the fine flexible burrs.



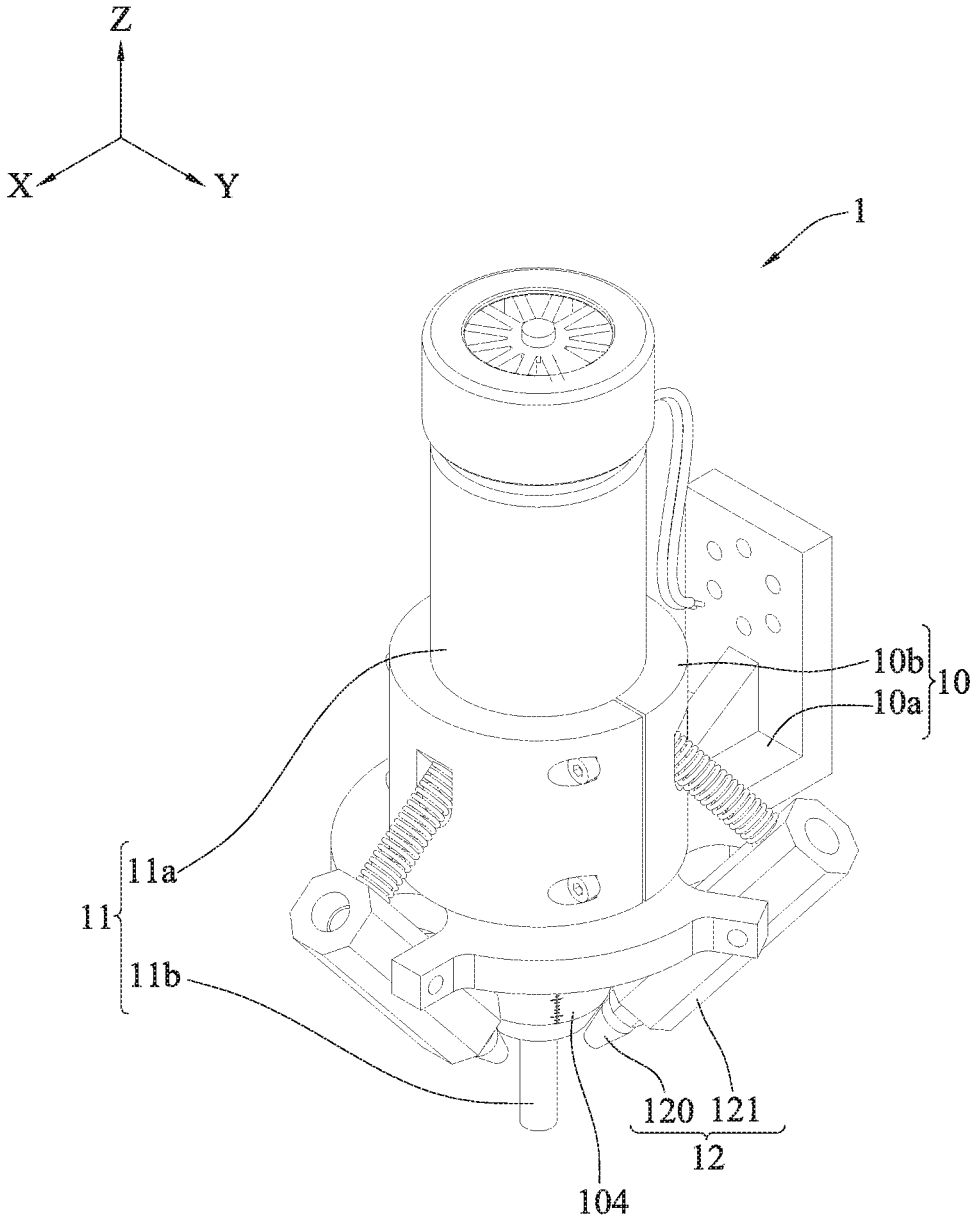


FIG. 1A

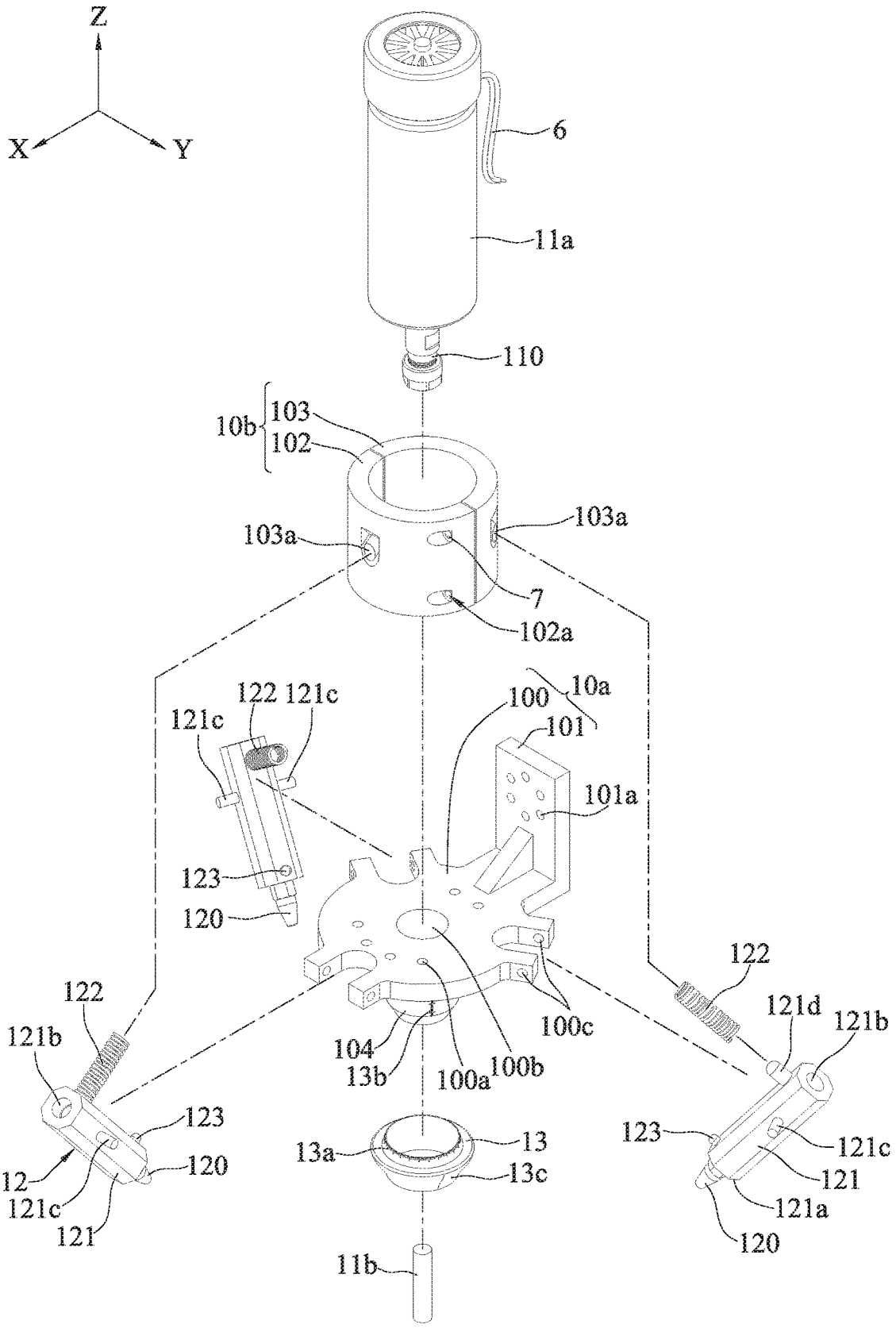

Z
X
Y
6
11a
110
10b
103
102
103a
103a
7
102a
122
121c
121c
100
10a
101
101a
123
120
122
121b
123
12
121c
121
104
13b
100a
100b
100c
122
121d
121b
123
121c
121
121a
120
13a
13
13c
11b

FIG. 1B

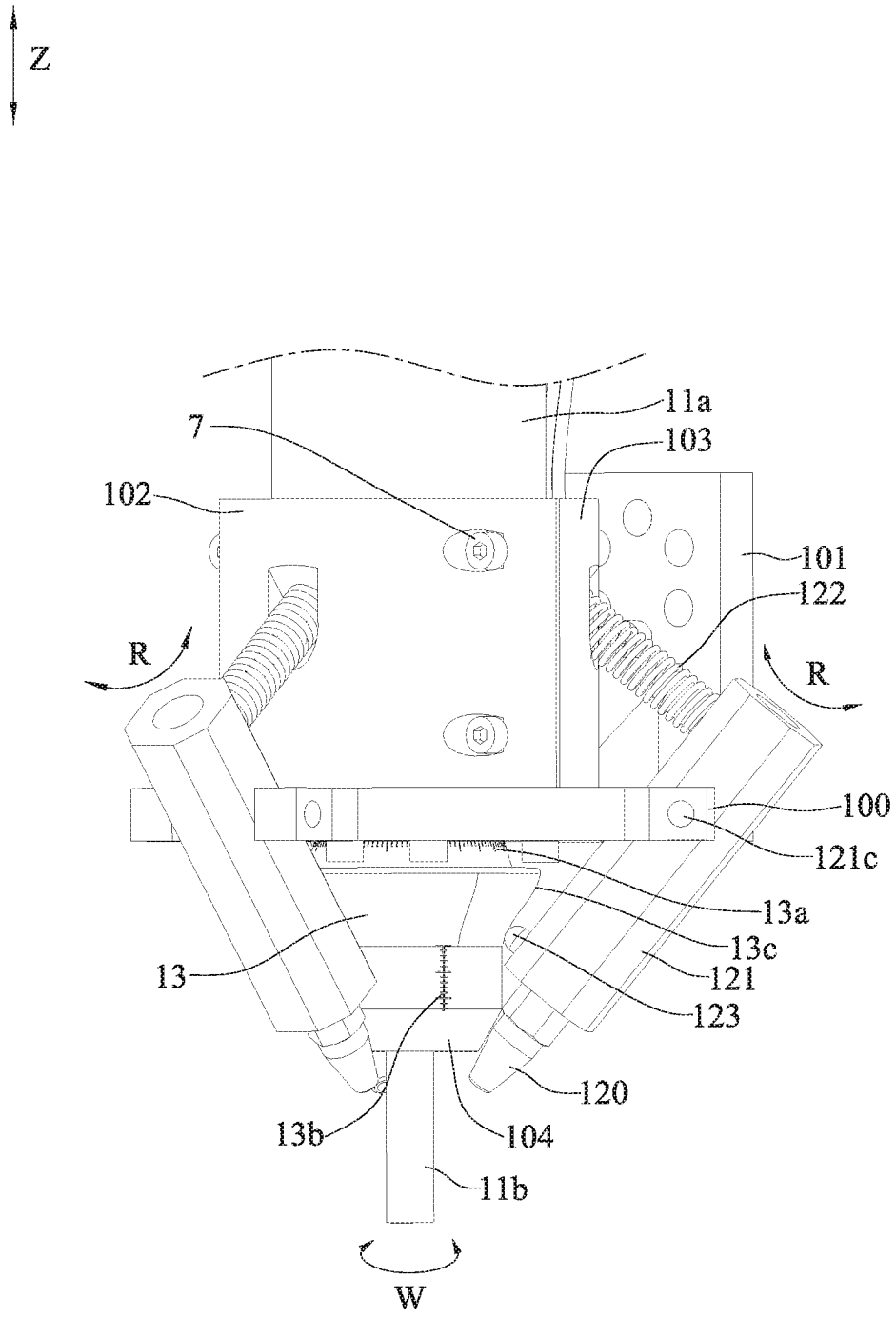

Z
11a
7
103
102
101
122
R
R
100
121c
13a
13c
13
121
123
120
13b
104
11b
W

FIG. 1C

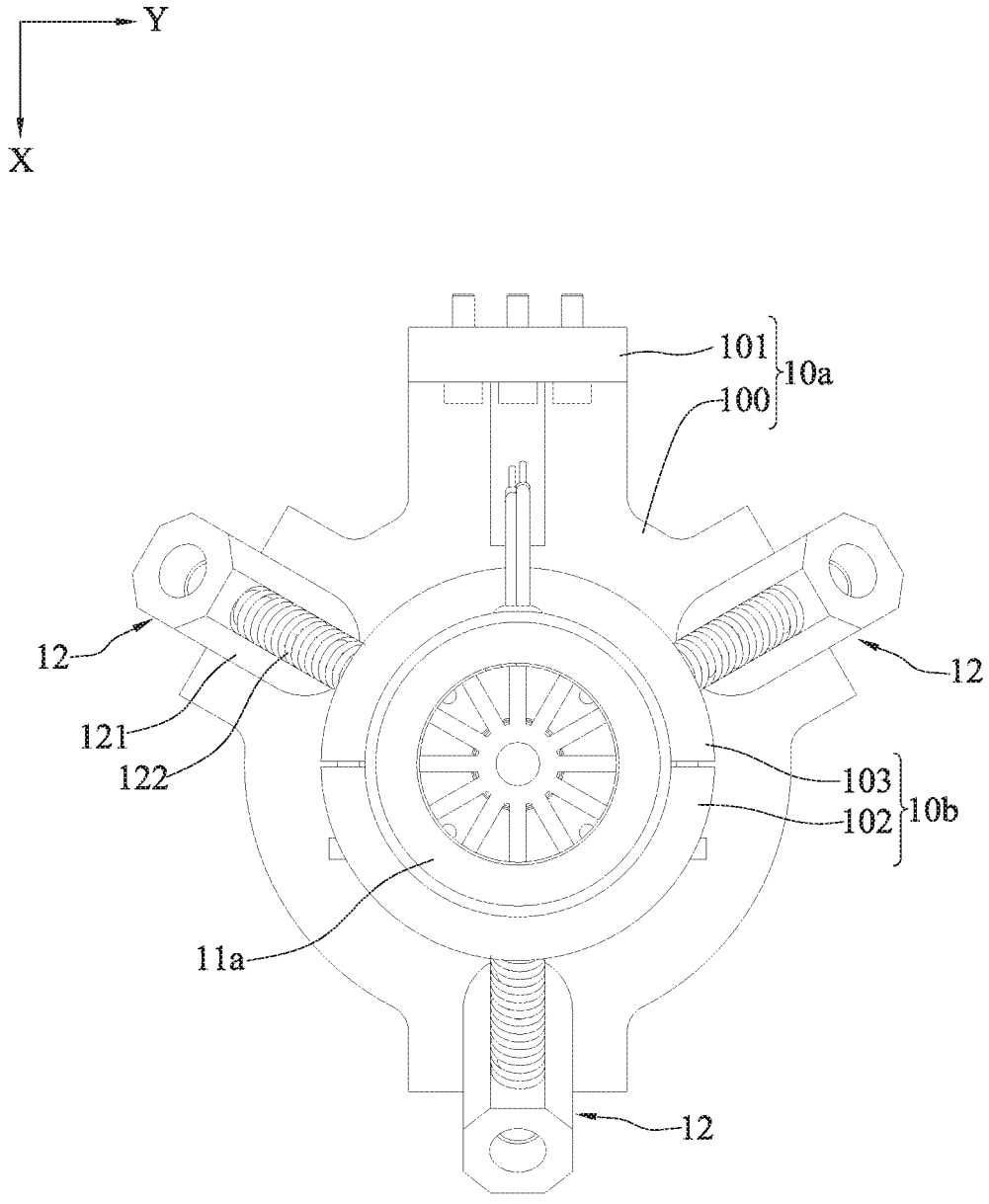


FIG. 1D

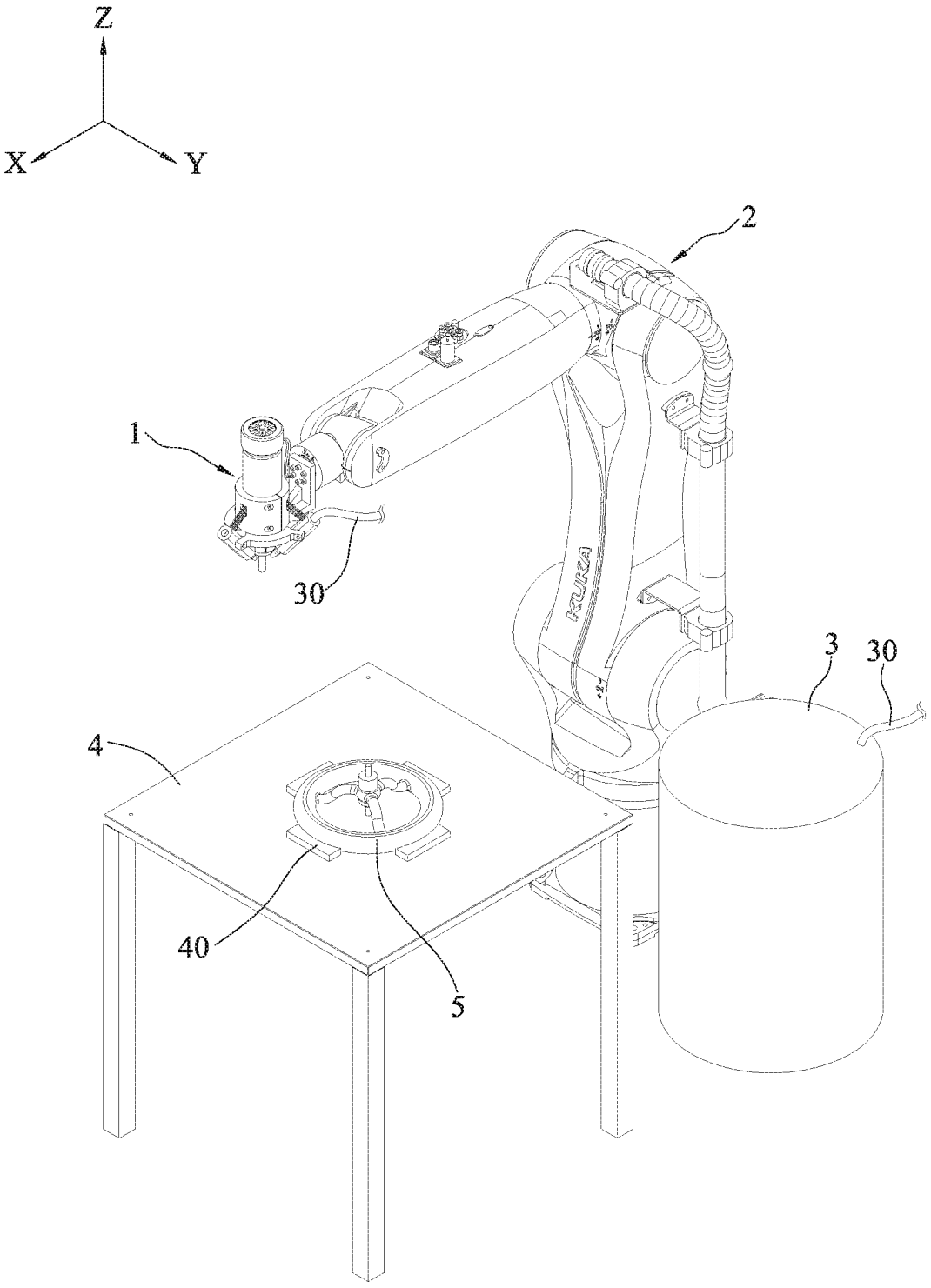


FIG. 2A

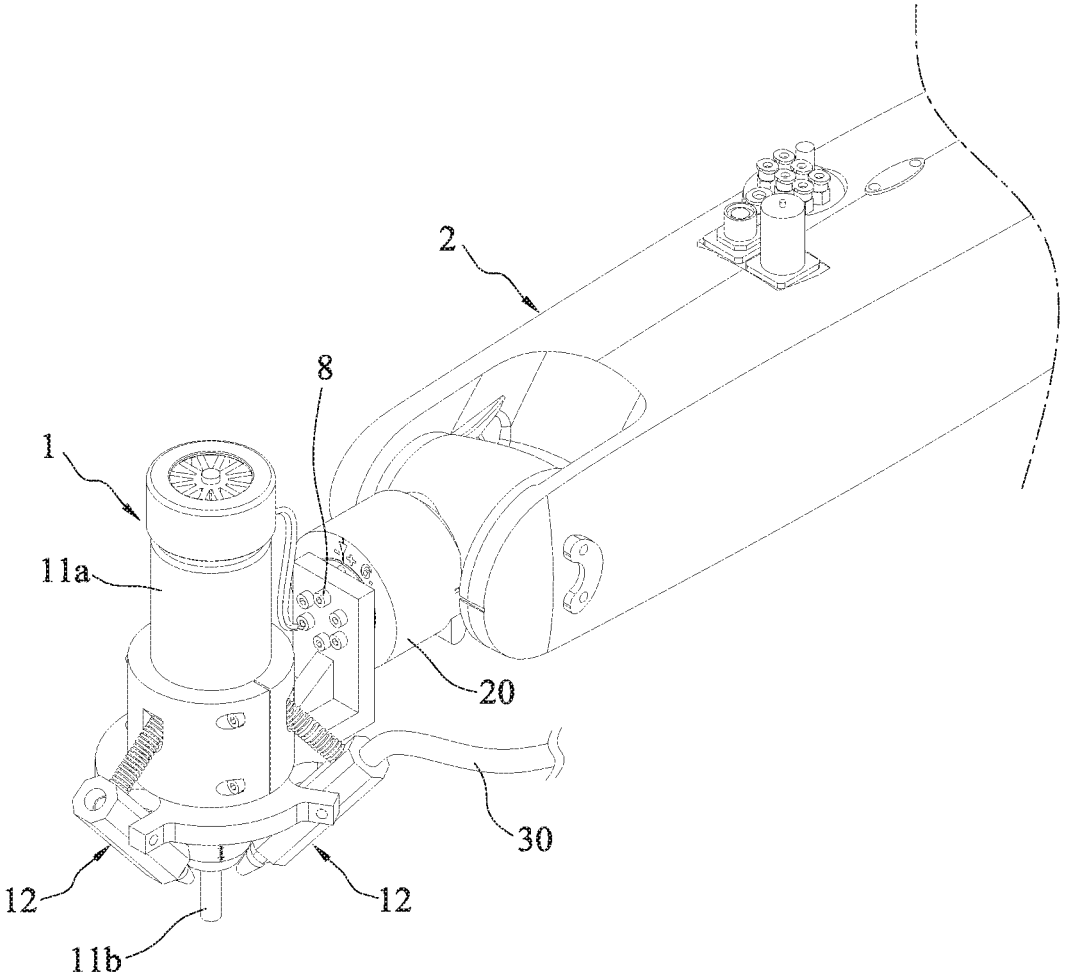


FIG. 2B

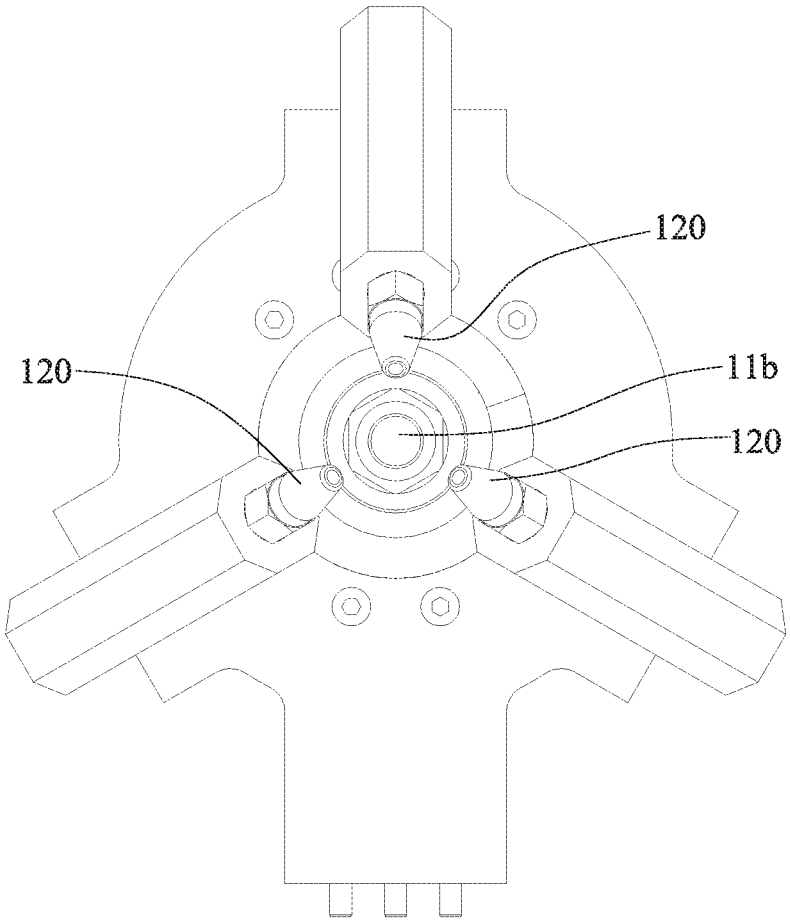


FIG. 3

BURR TRIMMING DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to Taiwan Application Serial No. 109100079, filed Jan. 2, 2020, which is herein incorporated by reference.

BACKGROUND

1. Field of the Disclosure

[0002] The present disclosure relates to burr trimming devices, and more particularly, to a burr trimming device capable of removing flexible burrs.

2. Description of Related Art

[0003] Along with the rapid development of computer numerical control (CNC) technologies, the machining accuracy has been continuously improved and widely used in precision machining industries. However, machining objects such as vehicle steering wheels need to pass accuracy inspection regulations of quality management so as to ensure consistency of quality.

[0004] Currently, to fabricate a steering wheel, an injection molding device is automatically controlled by CNC to fabricate a body of the steering wheel. That is, a mold is used to shape a foam material into the body of the steering wheel. Therefore, during the fabrication process of the steering wheel, after demolding, burrs need to be removed from the body of the steering wheel so as to pass the accuracy inspection of quality management. Thereafter, the body of the steering wheel is covered with a film to form a required finished product.

[0005] Conventionally, burrs can be removed by various methods. For example, burrs can be removed manually. However, such a method leads to a limited accuracy of removal (e.g., uneven roughness, or fine burrs cannot be precisely removed) and therefore fails to meet the accuracy requirement of quality management. In addition, such a method is both time-consuming and labor-consuming and thus increases the fabrication cost and is not conducive to mass production. Alternatively, burrs can be removed by a scraper driven by a mechanical arm. However, the mechanical arm has a limited mechanical movement and cannot drive the scraper to remove burrs at an irregular area (e.g., a dead corner) of the steering wheel. Even if the scraper reaches the top of the burrs at the dead corner, the burrs cannot be completely removed from the bottom thereof due to the flexible property of the burrs made of the foam material, thus failing to meet the accuracy requirement of quality management.

[0006] Therefore, how to overcome the drawbacks of the prior art is becoming an urgent issue in the art.

SUMMARY

[0007] In view of the above-described drawbacks, the present disclosure provides a burr trimming device, which comprises: a carrier having a support frame and a base disposed on the support frame; a removing assembly disposed on the carrier, wherein the removing assembly has a vibrator disposed on the carrier, and the vibrator passes through the base and the support frame; and a directed spraying assembly disposed on the carrier and having a nozzle facing the removing assembly and a guiding member connected to the nozzle, wherein the guiding member is pivotally connected to the support frame.

[0008] According to the present disclosure, the directed spraying assembly rapidly freezes objects and then the removing assembly removes the objects by coming into rigid contact therewith, thus ensuring complete removal of the objects such as fine flexible burrs. Compared with the prior art, the present disclosure can change the type of the removing assembly as needed so as to easily adjust the hardness or sharpness of a knife. As such, the present disclosure facilitates to improve the burr trimming accuracy and leaves no fine burrs so as to meet the accuracy requirement of quality management.

BRIEF DESCRIPTION OF DRAWINGS

[0009] FIG. **1**A is a schematic perspective view of a burr trimming device according to the present disclosure.

[0010] FIG. **1**B is a schematic exploded perspective view of FIG. **1**A.

[0011] FIG. **1**C is a schematic partial perspective view of FIG. **1**A.

[0012] FIG. **1**D is a schematic upper plan view of FIG. **1**A.

[0013] FIG. **2**A is a schematic perspective view of a burr trimming device in an operation environment according to the present disclosure.

[0014] FIG. **2**B is a schematic partially enlarged perspective view of FIG. **2**A.

[0015] FIG. **3** is a schematic lower plan view of FIG. **1**A.

DETAILED DESCRIPTION OF EMBODIMENTS

[0016] The following illustrative embodiments are provided to illustrate the present disclosure, these and other advantages and effects can be apparent to those in the art after reading this specification.

[0017] It should be noted that all the drawings are not intended to limit the present disclosure. Various modifications and variations can be made without departing from the spirit of the present disclosure. Further, terms such as "up," "down," "right," "left," "forward," "backward," "first," "second," "on," "a" etc. are merely for illustrative purposes and should not be construed to limit the scope of the present disclosure.

[0018] FIGS. **1**A and **1**B are schematic perspective views of a burr trimming device **1** according to the present disclosure. As shown in FIGS. **1**A and **1**B, the burr trimming device **1** comprises a carrier **10**, a removing assembly **11** disposed on the carrier **10** and at least one directed spraying assembly **12** disposed on the carrier **10**.

[0019] In an embodiment, based on the configuration of the burr trimming device **1**, an arrow X in the drawings indicates a forward or backward direction, an arrow Y in the drawings indicates a left or right direction, and an arrow Z in the drawings indicates an up or down direction. It should be understood that the orientations are used to illustrate the configuration of the embodiment and not intended to limit the present disclosure.

[0020] The carrier **10** has a support frame **10***a* and a base **10***b* disposed on the support frame **10***a*.

[0021] In an embodiment, the support frame **10***a* is in the shape of a chair and has a bottom portion **100** and a back portion **101** vertically connected to the bottom portion **100**.

[0022] A plurality of fastening holes **100***a* (six in FIG. **1**B) are formed in the bottom portion **100** for fastening the base **10***b* with fastening members such as screws (not shown). A plurality of function holes **101***a* (six in FIG. **1**B) are formed in the back portion **101** so as to connect the back portion **101** to another device such as a mechanical arm **2** through fastening members **8** such as screws, as shown in FIG. **2**B.

[0023] Further, the base **10***b* has, for example, a cylinder sleeve shape and is fastened to an upper side of the bottom portion **100** of the support frame **10***a*. For example, the base **10***b* has two arc-shaped engaging portions **102**, **103**, which are fastened to the bottom portion **100** through fastening members such as screws (not shown). A plurality of holes **102***a* are formed in the two engaging portions **102**, **103** and thus the two engaging portions **102**, **103** are engaged with one another through fastening members **7** such as screws, as shown in FIG. **1**B.

[0024] The removing assembly **11** is of an ultrasonic vibration type, which comprises a vibrator **11***a* and a knife **11***b* disposed on the vibrator **11***a*.

[0025] In an embodiment, the vibrator **11***a* is a high-frequency vibrator such as an ultrasonic shaft, one end thereof has a mounting portion **110** and the other end thereof is electrically connected to an electronic device such as a power supply or controller via a wire **6** (not shown). For example, the mounting portion **110** of the vibrator **11***a* passes through the base **10***b* and a through hole **100***b* of the bottom portion **100** of the support frame **10***a* and thus the vibrator **11***a* is sleeved with the base **10***b*. For example, if needed, a housing **104** can be formed on a lower side of the bottom portion **100** of the support frame **10***a* corresponding in position to the through hole **100***b* so as to encapsulate the mounting portion **110**, as shown in FIG. **1**C, thereby protecting the mounting portion **110**.

[0026] Further, the knife **11***b* such as a ceramic knife serves as a removing tool, which is mounted to the mounting portion **110**, located on the lower side of the bottom portion **100** of the support frame **10***a* and protrudes from the housing **104**.

[0027] The directed spraying assembly **12** has a nozzle **120** facing the removing assembly **11** and a guiding member **121** connected to the nozzle **120**.

[0028] In an embodiment, the guiding member **121** is a pipe body having a first port **121***a* communicated and connected with the nozzle **120** and a second port **121***b* opposite to the first port **121***a* and communicated and connected with a pipeline **30**, as shown in FIG. **2**A. For example, the guiding member **121** has shaft portions **121***c* formed between the first port **121***a* and the second port **121***b* and pivotally engaged to shaft holes **100***c* of the bottom portion **100** of the support frame **10***a* of the carrier **10**.

[0029] Further, the guiding member **121** is disposed on the carrier **10** by an elastic member **122** such as a spring. For example, the guiding member **121** has a positioning protruding portion **121***d* formed at a position close to the second port **121***b*, and the engaging portions **102**, **103** of the base **10***b* of the carrier **10** have another positioning protruding portion **103***a* formed on a peripheral surface thereof. As such, two opposite ends of the elastic member **122** are connected to the positioning protruding portions **121***d*, **103***a*, respectively.

[0030] Furthermore, the number of the directed spraying assembly **12** can be determined according to the practical need. For example, three directed spraying assemblies **12** are approximately equally spaced arranged around a periphery of the base **10***b* (e.g., front, left and right directed spraying assemblies of FIG. **1**D). It should be noted that the arrangement of the directed spraying assemblies **12** is not limited thereto.

[0031] In addition, the directed spraying assembly **12** is disposed obliquely relative to the vibrator **11***a* so as to cause the nozzle **120** to face the removing assembly **11**.

[0032] As shown in FIGS. **1**B and **1**C, the burr trimming device **1** further has an adjusting structure **13** disposed on the carrier **10** for adjusting the orientation of the nozzle **120** facing the removing assembly **11**. The adjusting structure **13** is a ring body disposed around an upper periphery of the housing **104**. Further, the adjusting structure **13** has an inclined outer periphery **13***c* having a substantially arc-shaped profile.

[0033] In an embodiment, the guiding member **121** has an abutting portion **123** formed in position close to the first port **121***a* and coming into contact with the outer periphery **13***c*. As such, when the adjusting structure **13** is rotated (e.g., in a rotating direction W of FIG. **1**C), the adjusting structure **13** is moved up or down along the housing **104** and at this point, the abutting portion **123** is displaced up or down along the outer periphery **13***c* of the adjusting structure **13**. Hence, the guiding member **121** generates a deflected movement through the shaft portions **121***c* (e.g., in a swing direction R of FIG. **1**C) and at the same time, the elastic member **122** is expanded or contracted so as to cause the nozzle **120** to be inclined at a different angle. For example, the abutting portion **123** has a ball shape, an arc-shaped top end of which is in contact with the outer periphery **13***c* so as to facilitate the displacement of the abutting portion **123** along the outer periphery **13***c*.

[0034] Further, referring to FIG. **1**C, if needed, a main scale **13***a* can be formed around the upper periphery of the adjusting structure **13** and a reference scale **13***b* can be formed on the outer surface of the housing **104** corresponding to the main scale **13***a* so as to facilitate determination of the orientation of the nozzle **120** that is adjusted by the adjusting structure **13**.

[0035] As shown in FIGS. **2**A and **2**B, the burr trimming device **1** can be used to remove burrs of a steering wheel body **5**, and the steering wheel body **5** is fastened to a positioning structure **40** of a platform **4**. In particular, when using the burr trimming device **1**, the back portion **101** of the support frame **10***a* of the carrier **10** is fastened to a displacement mechanism **2** such as a mechanical arm (e.g., an adapter plate **20** at an end of the mechanical arm) and a pipeline **30** of a fluid tank **3** used for storing liquid nitrogen is sealing connected to the second port **121***b* of the guiding member **121** of the directed spraying assembly **12**. Then, by displacing the burr trimming device **1** through the displacement mechanism **2**, the vibrator **11***a* (or the knife **11***b*) of the removing assembly **11** of the burr trimming device **1** is displaced along the profile of the steering wheel body **5**. During the movement of the burr trimming device **1**, the guiding member **121** of the directed spraying assembly **12** causes the liquid nitrogen of the fluid tank **3** to be sprayed from the nozzle **120** to the steering wheel body **5**. After the liquid nitrogen rapidly freezes and hardens the burrs of the steering wheel body **5**, the vibrator **11***a* provides high-frequency vibration (ultrasonic vibration) in the axial direction (arrow Z) to the knife **11***b* and rotates the knife **11***b*. As such, when the knife **11***b* is displaced along the profile of the

steering wheel body **5**, the knife **11***b* can crush and remove the hardened burrs of the steering wheel body **5**.

[0036] Therefore, the burr trimming device **1** of the present disclosure, through cooperation between the directed spraying assembly **12** and the removing assembly **11**, enables the knife **11***b* to remove the hardened burrs by coming into rigid contact therewith so as to ensure complete removal of the fine burrs. Compared with the conventional spraying and blowing removing methods, the burr trimming device **1** of the present disclosure can easily adjust the hardness or sharpness of the knife **11***b* so as to facilitate to improve the burr trimming accuracy, thus leaving no fine burrs and hence meeting the accuracy requirement of quality management.

[0037] Further, even if the mechanical arm has a limited mechanical movement, the knife **11***b* can shatter the burrs at an irregular area (e.g., a dead corner) of the steering wheel body **5** through vibration and even come into contact with the top of the hardened burrs at the dead corner. Since the flexible burrs are hardened, the hardened flexible burrs can be completely shattered off by vibration, thereby improving the burr trimming effect.

[0038] Furthermore, a plurality of directed spraying assemblies **12** are arranged and disposed in a ring shape, which can ensure that the periphery of the knife **11***b* belongs to the action range of liquid nitrogen, so as to spray liquid nitrogen on the burrs.

[0039] In addition, when a knife **11***b* of a different specification (such as a length) is installed, by adjusting the orientation of the nozzle **120** of the directed spraying assembly **12** through the adjusting structure **13**, the inclined angle of the nozzle **120** can be adjusted so as to cause the liquid nitrogen to be sprayed toward a predetermined position of the knife **11***b* (e.g., an end of the knife), i.e., directed toward the burrs to be removed by the knife **11***b*. As such, the liquid nitrogen can be precisely sprayed on the burrs instead of being sprayed on a large area of the steering wheel body **5** that could otherwise destroy the structural strength of the steering wheel body **5**. In particular, as shown in FIG. **3**, the knife **11***b* of the removing assembly **11** can be used as a positioning reference for adjusting the mounting of the directed spraying assembly **12**. Further, the main scale **13***a* or the reference scale **13***b* can be used to record the orientation of the nozzle **120** adjusted by the adjusting structure **13** corresponding to knife **11***b*.

[0040] Therefore, according to the present disclosure, the directed spraying assembly rapidly freezes objects and then the removing assembly removes the objects by coming into rigid contact therewith, thus ensuring complete removal of the objects such as flexible burrs. As such, the present disclosure can change the type of the removing assembly as needed so as to facilitate to improve the burr trimming accuracy, thus leaving no fine burrs and hence meeting the accuracy requirement of quality management.

[0041] It should be understood that various kinds of fluids can be used to rapidly freeze the burrs at a low temperature and the present disclosure is not limited to liquid nitrogen. Further, the type of the knife can be selected according to the hardening degree of the burrs.

[0042] The above-described descriptions of the detailed embodiments are to illustrate the implementation according to the present disclosure, and it is not to limit the scope of the present disclosure. Accordingly, all modifications and variations completed by those with ordinary skill in the art should fall within the scope of present disclosure defined by the appended claims.

What is claimed is:

1. A burr trimming device, comprising:

a carrier having a support frame and a base disposed on the support frame;

a removing assembly disposed on the carrier, wherein the removing assembly has a vibrator disposed on the carrier, and the vibrator passes through the base and the support frame; and

a directed spraying assembly disposed on the carrier and having a nozzle facing the removing assembly and a guiding member connected to the nozzle, wherein the guiding member is pivotally connected to the support frame.

2. The burr trimming device of claim **1**, wherein the removing assembly is of an ultrasonic vibration type.

3. The burr trimming device of claim **1**, wherein the removing assembly further has a knife disposed on the vibrator.

4. The burr trimming device of claim **1**, wherein the nozzle is disposed obliquely relative to the vibrator.

5. The burr trimming device of claim **1**, wherein a plurality of directed spraying assemblies are provided and approximately equally spaced arranged around a periphery of the carrier.

6. The burr trimming device of claim **1**, wherein the guiding member is a pipe body having a first port communicated and connected with the nozzle and a second port communicated and connected with a pipeline.

7. The burr trimming device of claim **1**, wherein the guiding member is disposed on the carrier by an elastic member.

8. The burr trimming device of claim **1**, further comprising an adjusting structure disposed on the carrier for adjusting the orientation of the nozzle facing the removing assembly.

9. The burr trimming device of claim **8**, wherein the adjusting structure is a ring body.

10. The burr trimming device of claim **9**, wherein the ring body has an inclined outer periphery and the directed spraying assembly is in contact with the inclined outer periphery.

11. The burr trimming device of claim **1**, wherein the directed spraying assembly is communicated with a fluid tank.

12. The burr trimming device of claim **1**, wherein the carrier is externally connected to a displacement mechanism.

* * * * *