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(54) **RESIDUAL WATER REMOVAL APPARATUS AND DISHWASHER**

(57) Provided are a residual water removal device and a dishwasher. A residual water removal device (10) includes a water inlet body (100) and a water drainage body (200). The water inlet body internally has a first channel (110). The water drainage body (200) is connected to the water inlet body (100). The water drainage body (200) internally has a second channel (210). The first channel (110) is in communication with the second channel (210) and has a communication port in communication with the second channel (210). An area of the communication port is smaller than or equal to each of a cross-sectional area of a remaining part of the first channel (110) and a cross-sectional area of the second channel (210). The first channel (110) is constructed to allow a cross section of the first channel (110) to at least partially decrease gradually towards the second channel (210). A communication between the first channel (110) and the second channel (210) is in communication with a residual water outlet through a flow diverting channel (120). The dishwasher includes a water drainage device and the residual water removal device (10). In this way, residual water remaining in a household appliance can be quickly and effectively removed. Therefore, bacteria breeding and odor generation can be avoided to improve user experience of a user.

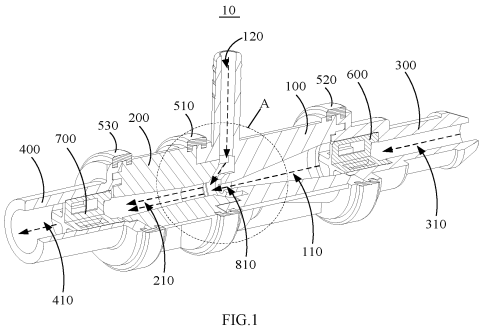


FIG.1

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## Description

**[0001]** The present application claims priority to Chinese Patent Applications No. 202110520920.6 and No. 202121015411.X, filed on May 12, 2021, the entire disclosure of which is incorporated herein by reference.

## FIELD

**[0002]** The present disclosure relates to the field of household appliance technologies, and in particular, to a residual water removal apparatus and a dishwasher.

## BACKGROUND

**[0003]** With the constant improvement of people's living standards, people have higher requirements for the drying performance of household dishwashers. All existing dishwashers commercially available have residual water, i.e., water in a water cup at the bottom of the dishwasher cannot be completely discharged out of the dishwasher. The residual water remains at the bottom of the water cup of the dishwasher for a long period, which makes the dishwasher prone to generating bacteria and producing bad odor to seriously influence user experience.

**[0004]** Currently, the Venturi effect is used to construct a residual water removal apparatus. The tap water with a pressure is supplied at an end of the residual water removal apparatus, another end of the residual water removal apparatus is connected to a water drainage pipe, and a middle portion of the residual water removal apparatus is connected to the water cup containing the residual water. A negative pressure is generated at the middle portion when the tap water is introduced into the residual water removal apparatus, and thus the residual water is sucked into a cavity by the negative pressure. In this way, the residual water and the tap water are discharged out of the dishwasher together through the water drainage pipe. The Venturi device of the existing residual water removal apparatus is integrally formed, and therefore the manufacturing process of the residual water removing device is complex, and manufacturing cost thereof is high. Moreover, the Venturi device integrally formed is difficult to meet an efficiency requirement for removing the residual water.

**[0005]** The above content is merely used to assist in understanding the technical solutions of the present disclosure, but does not represent that the above content is the related art.

## SUMMARY

**[0006]** A main object of the present disclosure is to provide a residual water removal apparatus, aiming to solve at least one of the above technical problems.

**[0007]** In order to achieve the above object, the residual water removal apparatus according to the present disclosure comprises a water inlet body and a water drainage body, the water inlet body internally has a first channel. The water drainage body and the water inlet body are docked together, and the water drainage body internally has a second channel. The first channel is in communication with the second channel and has a communication port in communication with the second channel, and an area of the communication port is smaller than or equal to each of a cross-sectional area of a remaining part of the first channel and a cross-sectional area of a remaining part of the second channel. The first channel is constructed to allow a cross section of the first channel to at least partially decrease gradually towards the second channel. A communication between the first channel and the second channel is in communication with a residual water outlet through a flow diverting channel.

**[0008]** In an embodiment, either the water inlet body or the water drainage body is provided with a central insertion shaft, and another one of the water inlet body and the water drainage body has a central insertion hole adapted to the central insertion shaft.

**[0009]** In an embodiment, a periphery of a docking between the water inlet body and the water drainage body is coated with a first sealing layer.

**[0010]** In an embodiment, the first sealing layer is injection molded at the periphery of the docking between the water inlet body and the water drainage body.

**[0011]** In an embodiment, the water inlet body is provided with a first limit portion at an end of the water inlet body adjacent to the water drainage body, and the water drainage body is provided with a second limit portion at an end of the water drainage body adjacent to the water inlet body. The first sealing layer comprises a first cooperating portion adapted to the first limit portion and the second limit portion.

**[0012]** In an embodiment, the first limit portion comprises a first annular groove formed on a peripheral wall of the water inlet body, and the second limit portion comprises a second annular groove formed on a peripheral wall of the water drainage body. The first cooperating portion comprises a first annular flange embedded in the first annular groove and a second annular flange embedded in the second annular groove. The first sealing layer further comprises a first

sealing ring connecting the first annular flange and the second annular flange.

**[0013]** In an embodiment, the first sealing layer is made of a plastic material.

**[0014]** In an embodiment, the residual water removal apparatus further comprises a water inlet connector sealingly connected to an end of the water inlet body, and the end is distant from the water drainage body. The water inlet connector has a water inlet channel in communication with the first channel, and a first check valve is disposed in the water inlet channel and has a unidirectional conduction from the water inlet channel to the first channel.

**[0015]** In an embodiment, an end surface of one of the water inlet connector and the water inlet body is provided with a first limit post. An end surface of another one of the water inlet connector and the water inlet body has a first limit groove, and the first limit post and the first limit groove are engaged with each other.

**[0016]** In an embodiment, the water inlet connector and the water inlet body are docked together, and a periphery of a docking between the water inlet body and the water inlet connector is coated with a second sealing layer.

**[0017]** In an embodiment, the second sealing layer is injection molded at the periphery of the docking between the water inlet body and the water inlet connector.

**[0018]** In an embodiment, the residual water removal apparatus further comprises a water drainage connector sealingly connected to an end of the water drainage body, wherein the end of the water drainage body being distant from the water inlet body. The water drainage connector has a water drainage channel in communication with the second channel, and a second check valve is disposed in the water drainage channel and has a unidirectional conduction from the second channel to the water drainage channel.

**[0019]** In an embodiment, the water drainage connector and the water drainage body are docked together, and a periphery of a docking between the water drainage body and the water drainage connector is coated with a third sealing layer.

**[0020]** In an embodiment, the third sealing layer is injection molded at the periphery of the the docking between the water drainage body and the water drainage connector.

**[0021]** In an embodiment, the residual water removal apparatus further comprises a throat portion connected to the water inlet body. The throat portion has a throat channel in communication with a water outlet end of the first channel, and a cross-sectional area of the throat channel is smaller than a cross-sectional area of each of the first channel and the second channel. The throat portion further has an annular cavity formed at a periphery of the throat portion. The throat channel is in communication with the second channel through the annular cavity. And the annular cavity being in communication with the flow diverting channel.

**[0022]** In an embodiment, the annular cavity is formed in the water inlet body, and/or the annular cavity comprises a tapered section constructed to allow an inner diameter of the tapered section to gradually decrease from the first channel to the second channel.

**[0023]** The present disclosure further provides a dishwasher. The dishwasher comprises a water drainage device and the residual water removal apparatus. The water drainage device comprises a water cup, and the water cup has a water inlet and a residual water outlet. The residual water removal apparatus comprises a water inlet body and a water drainage body, the water inlet body internally has a first channel. The water drainage body and the water inlet body are docked together, and the water drainage body internally has a second channel. The first channel is in communication with the second channel and has a communication port in communication with the second channel, and an area of the communication port is smaller than or equal to each of a cross-sectional area of a remaining part of the first channel and a cross-sectional area of the second channel. The first channel is constructed to allow a cross section of the first channel to at least partially decrease gradually towards the second channel. A communication between the first channel and the second channel is in communication with a residual water outlet through a flow diverting channel.

Beneficial Effects

**[0024]** In the residual water removal apparatus according to the present disclosure, a Venturi pipe structure is formed of the first channel of the water inlet body and the second channel of the water drainage body. The tap water with a pressure is supplied from the first channel, the second channel is connected to the water drainage pipe, and the communication between the first channel and the second channel is in communication with the residual water outlet through the flow diverting channel. In this way, when the tap water flows from the first channel to the second channel, a negative pressure is generated at the communication between the first channel and the second channel. The residual water flowing out of the residual water outlet is sucked into the communication between the first channel and the second channel through the flow diverting channel, and the residual water and the tap water flow to the water drainage pipe through the second channel to be discharged out of a household appliance. Accordingly, the residual water remaining in the household appliance can be quickly and effectively removed, to avoid generating bacteria and bad odor and improve use experience of a user. Moreover, compared with a structure where a water pump is combined with a heater to remove the residual water, the residual water removal apparatus of the present disclosure has a simple structure and no risk of water pump blockage. Furthermore, the residual water removal apparatus has a relatively high residual water

removal efficiency and is more safety.

**[0025]** In addition, the water inlet body and the water drainage body are arranged separately. Therefore, on the one hand, an integrated molding difficulty of the water inlet body and the water drainage body can be reduced and the molding process is simplified. Thus, manufacturing cost is reduced. On the other hand, since the water inlet body and/or the water drainage body can be constructed to be more complex, the inner channel of each of the water inlet body and the water drainage body is constructed in structural (for example, an annular cavity is formed at the connection between the water inlet body and the water drainage body), to achieve a superior suction effect of the residual water removal apparatus and increase a carrying capacity of the residual water removal apparatus for the residual water. Furthermore, an efficiency and effect of adsorbing the residual water by the residual water removal apparatus are effectively improved.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0026]** In order to clearly explain technical solutions of embodiments of the present disclosure or in the related art, drawings used in the description of the embodiments or the related art will be briefly described below. The drawings described below merely illustrate some embodiments of the present disclosure. Based on structures illustrated in these drawings, other drawings can be obtained by those skilled in the art without creative effort.

FIG. 1 is a schematic structural diagram of a residual water removal apparatus according to an embodiment of the present disclosure.

FIG. 2 is a partial enlarged view of an A part in FIG. 1.

FIG. 3 is a schematic diagram of an exploded structure of the residual water removal apparatus in FIG. 1.

FIG. 4 is a schematic structural diagram of each of a water inlet body and a water drainage body in FIG. 3.

FIG. 5 is a schematic structural diagram of a water inlet connector in FIG. 3.

FIG. 6 is a schematic structural diagram of a water drainage connector in FIG. 3.

Reference signs:

**[0027]**

Table 1

| Sign | Name | Sign | Name | Sign | Name |
|---|---|---|---|---|---|
| 10 | Residual water removal apparatus | 210 | Second channel | 510 | First sealing layer |
| 100 | Water inlet body | 220 | Second limit portion | 511 | First cooperating portion |
| 110 | First channel | 230 | Central insertion shaft | 512 | First sealing ring |
| 111 | Water inlet end | 240 | Sixth limit portion | 520 | Second sealing layer |
| 112 | Water outlet end | 250 | Second limit post | 521 | Second cooperating portion |
| 120 | Flow diverting channel | 300 | Water inlet connector | 522 | Second sealing ring |
| 130 | First limit portion | 310 | Water inlet channel | 530 | Third sealing layer |
| 140 | Central insertion hole | 320 | Third limit portion | 531 | Third cooperating portion |
| 150 | Fourth limit portion | 330 | First limit groove | 532 | Third sealing ring |
| 160 | First limit post | 400 | Water drainage connector | 600 | First check valve |
| 170 | Annular cavity | 410 | Water drainage channel | 700 | Second check valve |
| 171 | Tapered section | 420 | Fifth limit portion | 800 | Throat portion |

(continued)

| Sign | Name | Sign | Name | Sign | Name |
|---|---|---|---|---|---|
| 200 | Water drainage body | 430 | Second limit groove | 810 | Throat channel |

**[0028]** Implementation, functional characteristics and advantages of the present disclosure will be further described with reference to the embodiments in conjunction with the accompanying drawings.

## DETAILED DESCRIPTION

**[0029]** It should be noted that, if embodiments of the present disclosure relate to the description such as "first" and "second", the "first" or "second" is merely for descriptive purpose, rather than indicating or implying relative importance or implicitly indicating the number of indicated technical features. Therefore, the features defined with "first" or "second" can explicitly or implicitly comprise at least one of the features. In addition, the meaning of "and/or" throughout the present disclosure means that three concurrent solutions are comprised. For example, "A and/or B" comprises a solution A, a solution B, or a solution where both A and B are satisfied.

**[0030]** The present disclosure provides a residual water removal apparatus for a household appliance. The household appliance may be an electrical appliance that needs to remove residual water, such as a dishwasher and a washing machine.

**[0031]** In the embodiments of the present disclosure, as illustrated in FIG. 1 to FIG. 3, a residual water removal apparatus 10 comprises a water inlet body 100 and a water drainage body 200. The water inlet body 100 internally has a first channel 110. The water drainage body 200 and the water inlet body 100 are docked together, and the water drainage body 200 internally has a second channel 210. The first channel 110 is in communication with the second channel 210 and has a communication port in communication with the second channel 210, and an area of the communication port is smaller than or equal to each of a cross-sectional area of a remaining part of the first channel 110 and a cross-sectional area of the second channel 210. The first channel 110 is constructed to allow a cross section of the first channel 110 to at least partially decrease gradually towards the second channel 210. A communication between the first channel 110 and the second channel 210 is in communication with a residual water outlet through a flow diverting channel 120.

**[0032]** In this embodiment, the water inlet body 100 is constructed to be in communication with a water inlet pipe. The water inlet body 100 may be in direct communication with the water inlet pipe, or may be in indirect communication with the water inlet pipe through a structure such as a water inlet connector 300. The water drainage body 200 is constructed to be in communication with a water drainage pipe. The water drainage body 200 may be in direct communication with the water drainage pipe, or may be in indirect communication with the water drainage pipe through a structure such as a water drainage connector 400. The water drainage pipe may be a water drainage pipe connected to a water drainage port of a household appliance, or may be an additional water drainage pipe. The drainage channel 120 and the residual water outlet may be directly docked together, or the drainage channel 120 and the residual water outlet may be docked together through a structure such as a flow diverting pipe. The flow diverting channel 120 is in communication with the communication between the first channel 110 and the second channel 210. Therefore, an inner cavity of a flow diverting pipe may be formed as the flow diverting channel 120, or the flow diverting channel 120 may be a channel formed in the water inlet connector 300 or the water drainage connector 400. In an embodiment, the water inlet body 100 and the water drainage body 200 are in a shape of a pipe as a whole in order to facilitate processing. The water inlet body 100 and the water drainage body 200 may be in other shapes, and the shape of the water inlet body 100 and the shape of the water drainage body 200 can be specifically selected and constructed based on actual requirements, which is not specifically defined herein.

**[0033]** The water inlet body 100 and the water drainage body 200 are docked together. In an embodiment, an end of the water inlet body 100 is opposite to and connected to an end of the water drainage body 200. Specifically, the water inlet body 100 and the water drainage body 200 may be connected with each other in such a manner that the water inlet body 100 and the water drainage body 200 are both inserted into an inserted structure or a limit structure. In some embodiments, an end surface of the water inlet body 100 and an end surface of the water drainage body 200 are docked together. The water inlet body 100 and the water drainage body 200 are arranged separately. Therefore, on the one hand, an integrated molding difficulty of the water inlet body 100 and the water drainage body 200 can be reduced and a molding process is simplified. Thus, manufacturing cost is reduced. On the other hand, since the inner structure(s) of the water inlet body 100 and/or the water drainage body 200 can be constructed to be more complex, the inner channel of each of the water inlet body 100 and the water drainage body 200 is constructed in structure (for example, an annular cavity is formed at a connection between the water inlet body 100 and the water drainage body 200), to achieve a superior suction effect of the residual water removal apparatus, and increase a carrying capacity of the residual water

removal apparatus 10 for the residual water. Furthermore, an efficiency and effect of adsorbing the residual water by the residual water removal apparatus 10 are effectively improved.

**[0034]** The first channel 110 penetrates through the water inlet body 100 in an axial direction of the water inlet body 100, and the second channel 210 penetrates through the water drainage body 200 in an axial direction of the water drainage body 200. In order to reduce a fluid resistance, in an embodiment, the cross section of each of the first channel 110 and the second channel 210 is in a circular shape, and the first channel 110 is coaxially arranged with the second channel 210. The first channel 110 and the second channel 210 are in communication with each other, and therefore the first channel 110 and the second channel 210 are directly docked together and in communication with each other, and the communication between the first channel 110 and the second channel 210 is a throat port. Furthermore, the first channel 110 may be in communication with the second channel 210 through a throat channel 810. The throat channel 810 may be formed in the water inlet body 100, or may be formed in the water drainage body 200.

**[0035]** A water inlet end 111 of the first channel 110 is an end of the first channel 110 away from the second channel 210, and a water outlet end 112 of the first channel 110 is an end of the first channel 110 close to the second channel 210. Since the area of the communication port is smaller than each of the cross-sectional area of the remaining part of the first channel 110 and the cross-sectional area of the second channel 210, and the first channel 110 is constructed to allow a cross section of the first channel to decrease gradually from the water inlet end 111 thereof towards the second channel 210, the first channel 110 and the second channel 210 is formed to be a Venturi pipe structure. The second channel 210 is constructed to allow a cross section of the second channel to increase gradually from an end thereof close to the first channel 110 to an end thereof away from the first channel 110, or the cross-sectional areas of the first channel 110 are equal in the axial direction. Tap water with a pressure is supplied from the first channel 110, the second channel 210 is connected to the water drainage pipe, and the communication between the first channel 110 and the second channel 210 is in communication with the residual water outlet through the flow diverting channel 120. When the tap water flows from the first channel 110 to the second channel 210, a negative pressure is generated at the communication between the first channel 110 and the second channel 210. The residual water flowing out of the residual water outlet is sucked into the communication between the first channel 110 and the second channel 210 through the flow diverting channel 120, and the residual water and the tap water flow to the water drainage pipe through the second channel 210 to be discharged out of the household appliance. In this way, the residual water remaining in the household appliance can be quickly and effectively removed, to avoid generating bacteria and producing bad odor, and to improve use experience of a user. Moreover, compared with a structure where a water pump is combined with a heater to remove the residual water, the residual water removal apparatus of the present disclosure has a simple structure and no risk of water pump blockage. Furthermore, the residual water removal apparatus has a relatively high residual water removal efficiency and is more safety.

**[0036]** In the residual water removal apparatus 10 according to the present disclosure, the Venturi pipe structure is formed of the first channel 110 of the water inlet body 100 and the second channel 210 of the water drainage body 200. The tap water with the pressure is supplied from the first channel 110, the second channel 210 is connected to the water drainage pipe, and the communication between the first channel 110 and the second channel 210 is in communication with the residual water outlet through the flow diverting channel 120. When the tap water flows from the first channel 110 to the second channel 210, the negative pressure is generated at the communication between the first channel 110 and the second channel 210. The residual water flowing out of the residual water outlet is sucked by the negative pressure into the communication between the first channel 110 and the second channel 210 through the flow diverting channel 120, and the residual water and the tap water flow to the water drainage pipe through the second channel 210 to be discharged out of the household appliance. In this way, the residual water remaining in the household appliance can be quickly and effectively removed, to avoid generating bacteria and producing bad odor, and to improve use experience of a user. Moreover, compared with a structure where a water pump is combined with a heater to remove the residual water, the residual water removal apparatus of the present disclosure has a simple structure and no risk of water pump blockage. Furthermore, the residual water removal apparatus has a relatively high residual water removal efficiency and is more safety.

**[0037]** In addition, the water inlet body 100 and the water drainage body 200 are arranged separately. Therefore, on the one hand, the integrated molding difficulty of the water inlet body 100 and the water drainage body 200 can be reduced and the molding process is simplified. Thus, the manufacturing cost is reduced. On the other hand, since the inner structure (s) of the water inlet body 100 and/or the water drainage body 200 can be constructed to be more complex, the inner channel of each of the water inlet body 100 and the water drainage body 200 is constructed in structure (for example, the annular cavity is formed at the connection between the water inlet body 100 and the water drainage body 200), to achieve the superior suction effect of the residual water removal apparatus, and increase the carrying capacity of the residual water removal apparatus 10 for the residual water. Furthermore, the efficiency and effect of adsorbing the residual water by the residual water removal apparatus 10 are effectively improved.

**[0038]** In an embodiment, as illustrated in FIG. 1 to FIG. 4, one of the water inlet body 100 and the water drainage body 200 is provided with a central insertion shaft 230, and another one of the water inlet body 100 and the water

drainage body 200 is provided with a central insertion hole 140 adapted to the central insertion shaft 230.

**[0039]** In this embodiment, the central insertion shaft 230 is disposed in a middle portion of an end surface of one of the water inlet body 100 and the water drainage body 200. The central insertion shaft 230 and the central insertion hole 140 are engaged to pre-fix the water inlet body 100 and the water drainage body 200, and therefore coaxiality of the water inlet body 100 and the water drainage body 200 can be ensured. Thus, it is more convenient that a periphery of the docking between the water inlet body 100 and the water drainage body 200 is coated with a first sealing layer 510. In an embodiment, the central insertion shaft 230 is tightly engaged with the central insertion hole 140, and therefore connection stability can be ensured when the water inlet body 100 and the water drainage body 200 are pre-fixed.

**[0040]** In an embodiment, the first sealing layer 510 is coated on the periphery of the docking between the water inlet body 100 and the water drainage body 200.

**[0041]** The first sealing layer 510 is coated on the periphery of the docking between the water inlet body 100 and the water drainage body 200. The first sealing layer 510 may be embedded in the periphery of the docking between the water inlet body 100 and the water drainage body 200, may be adhered to the periphery of the docking between the water inlet body 100 and the water drainage body 200, or may be injection molded at the periphery of the docking between the water inlet body 100 and the water drainage body 200. The connection manner between the first sealing layer 510 and each of the water inlet body 100 and the water drainage body 200 is not limited herein, as long as the first sealing layer 510 is coated on the periphery of the docking between the water inlet body 100 and the water drainage body 200 to seal the docking between the water inlet body 100 and the water drainage body 200. A material of the first sealing layer 510 may be selected and defined based on requirements, for example, the first sealing layer 510 may be made of a rubber material. In this case, the first sealing layer 510 may be coated on the periphery of the docking of the water inlet body 100 and the water drainage body 200 by bonding, sleeving, embedding, and the like. The first sealing layer 510 may be made of a plastic material. In this case, the first sealing layer 510 may be coated on the periphery of the docking between the water inlet body 100 and the water drainage body 200 in an injection molded manner.

**[0042]** In addition, compared with a sealing member disposed on the end surface of each of the water inlet body 100 and the water drainage body 200, since the first sealing layer 510 is coated on the periphery of the docking between the water inlet body 100 and the water drainage body 200, the first sealing layer 510 can connect the water inlet body 100 and the water drainage body 200 while sealing the docking between the water inlet body 100 and the water drainage body 200. Therefore, the connection between the water inlet body 100 and the water drainage body 200 has a high compressive strength and still remains sealed without water leakage in a high-pressure state. Furthermore, compared with a case where the water inlet body 100 and the water drainage body 200 are connected to each other through ultrasonic welding, connection consistency of the water inlet body 100 and the water drainage body 200 is more easily ensured, and a risk of water seepage is reduced. Thus, an overall sealing effect of the residual water removal apparatus 10 is further improved.

**[0043]** Further, referring to FIG. 1 and FIG. 2, the first sealing layer 510 is injection molded at the periphery of the docking between the water inlet body 100 and the water drainage body 200.

**[0044]** In this embodiment, the first sealing layer 510 is injection molded at the periphery of the docking between the water inlet body 100 and the water drainage body 200. That is, encapsulation is performed on the docking between the water inlet body 100 and the water drainage body 200. Specifically, the first sealing layer 510 is an encapsulation ring. In an embodiment, the first sealing layer 510 is made of a plastic material. The plastic material may specifically be polypropylene (PP), polyethylene (PE), and the like. A thickness and width of the first sealing layer 510 may be selected and constructed based on the actual requirements, which is not specifically limited herein. The first sealing layer 510 is injection molded on the periphery of the docking between the water inlet body 100 and the water drainage body 200, and therefore the docking between the water inlet body 100 and the water drainage body 200 is sealed. Furthermore, the water inlet body 100 and the water drainage body 200 are connected to each other through the injection molding process, and therefore other additional structures are not required to be connected to the water inlet body 100 and the water drainage body 200. In this way, sealing performance is good, and connection reliability is superior. That is, the connection between the water inlet body 100 and the water drainage body 200 has the high compressive strength, and can still maintain sealing without the water leakage in the high-pressure state. Compared with a case where the water inlet body 100 and the water drainage body 200 are sealed through a common sealing ring, the residual water removal apparatus is simple and reliable. The number of components of the residual water removal apparatus can be reduced, and thus an assembling process is simplified. Furthermore, the risk of the water leakage is reduced after long-period use. Moreover, compared with a case where the water inlet body 100 is connected to the water drainage body 200 through the ultrasonic welding, the connection consistency of the water inlet body 100 and the water drainage body 200 is more easily ensured, and the risk of the water seepage is reduced.

**[0045]** In an embodiment, as illustrated in FIG. 2, the water inlet body 100 is provided with a first limit portion 130 at an end of the water inlet body 100 adjacent to the water drainage body 200, and the water drainage body 200 is provided with a second limit portion 220 at an end of the water drainage body 200 adjacent to the water inlet body 100. The first sealing layer 510 comprises a first cooperating portion 511 adapted to the first limit portion 130 and the second limit

portion 220.

**[0046]** In this embodiment, the first limit portion 130 may specifically comprise a groove and/or a protrusion formed on a peripheral wall of the water inlet body 100. The first limit portion 130 may comprise at least one groove and at least one protrusion. A plurality of grooves or a plurality of protrusions may be formed at intervals in the axial direction of the water inlet body 100, or may be formed at intervals in a circumferential direction of the water inlet body 100. Similarly, the second limit portion 220 may specifically comprise a groove and/or a protrusion formed on a peripheral wall of the water drainage body 200. The second limit portion 220 may comprise at least one groove and at least one protrusion. A plurality of grooves or a plurality of protrusions may be formed at intervals in the axial direction of the water drainage body 200, or may be formed at intervals in a circumferential direction of the water drainage body 200. In this case, the first cooperating portion 511 specifically comprises a grooves/protrusion adapted to the above groove/protrusion. The first limit portion 130 is disposed on the water inlet body 100, the second limit portion 220 is disposed on the water drainage body 200, and the first sealing layer 510 comprises the first cooperating portion 511 adapted to the first limit portion 130 and the second limit portion 220. In this way, on the one hand, the first sealing layer 510 is injection molded at the docking between the water inlet body 100 and the water drainage body 200 conveniently. On the other hand, a contact area between the first sealing layer 510 and each of the water inlet body 100 and the water drainage body 200 can be increased, to guarantee connection tightness between the first sealing layer 510 and the water inlet body 100 and the water drainage body 200. Meanwhile, the first limit portion 130, the second limit portion 220 and the first cooperating portion 511 are formed to be structure sealed, and the sealing may be performed from a plurality of dimensions. Thus, a sealing effect of the first sealing layer 510 on the water inlet body 100 and the water drainage body 200 is improved.

**[0047]** Further, referring to FIG. 1 to FIG. 4, the first limit portion 130 comprises a first annular groove formed on the peripheral wall of the water inlet body 100, and the second limit portion 220 comprises a second annular groove formed on the peripheral wall of the water drainage body 200. The first cooperating portion 511 comprises a first annular flange embedded in the first annular groove and a second annular flange embedded in the second annular groove. The first sealing layer 510 further comprises a first sealing ring 512 connecting the first annular flange and the second annular flange.

**[0048]** In this embodiment, in order to ensure the connection sealing performance of the first sealing layer 510 on the water inlet body 100 and the water drainage body 200, an outer diameter of the water inlet body 100 is generally identical to an outer diameter of the water drainage body 200, and the water inlet body 100 is coaxially arranged with the water drainage body 200. Therefore, an open depth of the first annular groove can be consistent with an open depth of the second annular groove. The first limit portion 130 may comprise at least one first annular groove, and the second limit portion 220 may comprise at least one second annular groove. When a plurality of first annular grooves and a plurality of second annular grooves are provided, the plurality of first annular grooves and the plurality of second annular grooves are arranged at intervals in the axial direction of the water inlet body 100.

**[0049]** The first limit portion 130 comprises the first annular groove formed on the peripheral wall of the water inlet body 100, and the second limit portion 220 comprises the second annular groove formed on the peripheral wall of the water drainage body 200. In this way, the first annular groove and the second annular groove form glue accommodation grooves. When the first sealing layer 510 is injection molded at the periphery of the docking between the water inlet body 100 and the water drainage body 200, a molten sealing material is uniformly filled in the first annular groove and the second annular groove to respectively form the first annular flange and the second flange, as well as to form the first sealing ring 512 connecting the first annular flange and the second annular flange. With such a structure, on the one hand, the water inlet body 100 is more stably connected to the water drainage body 200, and the sealing effect of the water inlet body 100 and the water drainage body 200 is superior. On the other hand, the coaxiality of the water inlet body 100 and the water drainage body 200 can be ensured. Therefore, a dimension precision of the whole device after the encapsulation can be ensured, and the risk of water seepage is reduced.

**[0050]** In practice, connecting steps of the water inlet body 100 and the water drainage body 200 are described as follows.

**[0051]** Firstly, the water inlet body 100 and the water drainage body 200 are connected to each other in an insertion manner.

**[0052]** After that, the connected water inlet body 100 and water drainage body 200 are placed into a mold cavity of an encapsulation mold.

**[0053]** Thereafter a liquid encapsulation material is injected into the mold cavity of the encapsulation mold. Therefore, the encapsulation material is filled into the annular grooves of the water inlet body 100 and the water drainage body 200, and is coated on a surface of the connection between the water inlet body 100 and the water drainage body 200 to form an encapsulation layer, i.e., the first sealing layer 510.

**[0054]** Finally, after the encapsulation layer is formed, the connected water inlet body 100 and water drainage body 200 are taken out.

**[0055]** In an embodiment, referring to FIG. 1, FIG. 3, and FIG. 5, the residual water removal apparatus 10 further

comprises a water inlet connector 300 sealingly connected to an end of the water inlet body 100, and the end is distant away from the water drainage body 200. The water inlet connector 300 has a water inlet channel 310 in communication with the first channel 110. A first check valve 600 is disposed in the water inlet channel 310, and has a unidirectional conduction the water inlet channel 310 to the first channel 110.

**[0056]** In this embodiment, the water inlet connector 300 is specifically a tubular structure. The water inlet connector 300 may be a structure in other shape. The water inlet channel 310 penetrates through the water inlet connector 300 in an axial direction of the water inlet connector 300. The water inlet connector 300 has an end connected to the water inlet body 100 and another end configured to connect to a tap water pipe. In order to reduce the fluid resistance, in an embodiment, the cross section of the first channel 110 and the cross section of the water inlet channel 310 are both in a circular shape, and the first channel 110 is coaxially arranged with the water inlet channel 310. The water inlet connector 300 may be connected to the water inlet body 100 in various sealing manners, such as a sealing ring, a sealant, and encapsulation, which are not listed herein. In some embodiments, the first check valve 600 is mounted at an end of the water inlet channel 310 close to the first channel 110. The first check valve 600 may have various structures, and has a unidirectional conduction from the water inlet channel 310 to the first channel 110 to prevent water in the first channel 110 from flowing back to the water inlet channel 310. The structure of the first check valve 600 is not specifically defined herein. The water inlet connector 300 and the water inlet body 100 are arranged separately, and therefore the first check valve 600 is conveniently mounted in the water inlet connector 300. Compared with the first check valve 600 disposed in the water inlet pipe, the first check valve 600 is more conveniently mounted by integrally forming the first check valve 600 to the water inlet connector 300. Furthermore, the residual water removal apparatus 10 has high integration and a relatively compact overall structure. As a result, modular production is facilitated to be achieved.

**[0057]** In an embodiment, referring to FIG. 3 to FIG. 5, an end surface of one of the water inlet connector 300 and the water inlet body 100 is provided with a first limit post 160, and an end surface of another one of the water inlet connector 300 and the water inlet body 100 is provided with a first limit groove 330. The first limit post 160 and the first limit groove 330 are engaged with each other.

**[0058]** In this embodiment, at least one first limit post 160 may be provided. When one first limit post 160 is provided, the first limit post 160 may be disposed at a middle portion of an end surface of the water inlet connector 300 or the end surface of the water inlet body 100, or may be disposed at a position of the end surface close to the periphery thereof. When a plurality of first limit posts 160 is provided, the plurality of first limit posts 160 may be arranged at intervals in the circumferential direction of the water inlet body 100. In an embodiment, the end face of the water inlet body 100 is provided with a plurality of first limit posts 160, and the plurality of first limit posts 160 are arranged at intervals in the circumferential direction of the water inlet body 100. The engagement between the first limit post 160 and the first limit groove 330 can pre-fix the water inlet body 100 and the water inlet connector 300, and ensure the coaxiality of the water inlet body 100 and the water drainage body 200. Thus, a second sealing layer 520 is more conveniently coated on the periphery of the docking between the water inlet body 100 and the water inlet connector 300. In an embodiment, the first limit post 160 is tightly engaged with the first limit groove 330, and therefore the connection stability of the water inlet body 100 and the water inlet connector 300 can be ensured during the pre-fixation of the water inlet body 100 and the water inlet connector 300.

**[0059]** Based on the above embodiments, as illustrated in FIG. 1 and FIG. 3, the water inlet connector 300 and the water inlet body 100 are docked together, and a periphery of the docking between the water inlet body 100 and the water inlet connector 300 is coated with the second sealing layer 520.

**[0060]** In this embodiment, the water inlet connector 300 and the water inlet body 100 are docked together, and specifically, the water inlet connector 300 is opposite to and connected to an end of the water inlet body 100. The second sealing layer 520 is coated on the periphery of the docking between the water inlet body 100 and the water inlet connector 300. In this case, the second sealing layer 520 may be embedded in the periphery of the docking between the water inlet body 100 and the water inlet connector 300, may be adhered to the periphery of the docking between the water inlet body 100 and the water inlet connector 300, or may be injection molded at the periphery of the docking between the water inlet body 100 and the water inlet connector 300. The manner of the second sealing layer 520 connected with the water inlet body 100 and the water inlet connector 300 is not limited, as long as the second sealing layer 520 is coated on the periphery of the docking between the water inlet body 100 and the water inlet connector 300 to seal the docking between the water inlet body 100 and the water inlet connector 300. A material of the second sealing layer 520 may be selected and defined based on requirements, for example, the second sealing layer 520 may be made of a rubber material. In this case, the second sealing layer 520 may be coated on the periphery of the docking between the water inlet body 100 and the water drainage body 200 through the bonding, the sleeving, the embedding, and the like. The second sealing layer 520 may be made of a plastic material. In this case, the second sealing layer 520 may be coated at the periphery of the docking between the water inlet body 100 and the water inlet connector 300 in the injection molding manner.

**[0061]** Compared with a sealing member disposed on the end surface of each of the water inlet body 100 and the water inlet connector 300, since the second sealing layer 520 is coated at the periphery of the docking between the

water inlet body 100 and the water inlet connector 300, the water inlet body 100 and the water inlet connector 300 are connected to each other while being sealed at the docking therebetween. Therefore, the connection between the water inlet body 100 and the water inlet connector 300 has the high compressive strength and can still remain sealed without water leakage in the high-pressure state. Furthermore, compared with a connection between the water inlet body 100 and the water inlet connector 300 through the ultrasonic welding, connection consistency of the water inlet body 100 and the water inlet connector 300 is more easily ensured, and the risk of water seepage is reduced. Thus, the overall sealing effect of the residual water removal apparatus 10 is further improved.

**[0062]** In an embodiment, referring to FIG. 5, the second sealing layer 520 is injection molded at the periphery of the docking between the water inlet body 100 and the water inlet connector 300.

**[0063]** In this embodiment, the second sealing layer 520 is injection molded at the periphery of the docking between the water inlet body 100 and the water inlet connector 300. That is, the encapsulation is performed on the docking between the water inlet body 100 and the water inlet connector 300. The second sealing layer 520 is specifically the encapsulation ring. In an embodiment, the second sealing layer 520 is made of a plastic material. The plastic material may specifically be polypropylene (PP), polyethylene (PE), and the like. A thickness and width of the second sealing layer 520 may be selected and constructed based on actual requirements, which is not specifically defined herein. The second sealing layer 520 is injection molded at the periphery of the docking between the water inlet body 100 and the water inlet connector 300, and therefore the water inlet body 100 and the water inlet connector 300 are sealed. Furthermore, the water inlet body 100 and the water inlet connector 300 are connected to each other through the injection molding process, and therefore other additional structures are not required to be connected to the water inlet body 100 and the water drainage body 200. In this way, the sealing performance is good, and the connection reliability is superior. That is, the connection between the water inlet body 100 and the water inlet connector 300 has the high compressive strength and can still remain sealed without water leakage in the high-pressure state. Compared with a case where the water inlet body 100 and the water inlet connector 300 are sealed through the common sealing ring, the residual water removal apparatus is simple and reliable. The number of components of the residual water removal apparatus can be reduced, and thus the assembling process is simplified. Furthermore, the risk of water leakage is reduced during a long-period use. Moreover, compared with the case where the water inlet body 100 and the water inlet connector 300 are connected to each other through the ultrasonic welding, the connection consistency of the water inlet body 100 and the water inlet connector 300 is prone to being ensured, and the risk of water seepage is reduced.

**[0064]** In an embodiment, as illustrated in FIG. 1, FIG. 3 and FIG. 5, the water inlet connector 300 is provided with a third limit portion 320 at an end of the water inlet connector 300 adjacent to the water inlet body 100, and the water inlet body 100 is provided with a fourth limit portion 150 at an end of the water inlet body 100 adjacent to the water inlet connector 300. The second sealing layer 520 comprises a second cooperating portion 521 adapted to the second limit portion 320 and the third limit portion 320.

**[0065]** In this embodiment, the third limit portion 320 may specifically comprise a groove and/or a protrusion formed on a peripheral wall of the water inlet connector 300. The third limit portion 320 may comprise at least one groove and/or at least one protrusion. A plurality of grooves and a plurality of protrusions may be formed at intervals in the axial direction of the water inlet connector 300, or may be formed at intervals in a circumferential direction of the water inlet connector 300. Similarly, the fourth limit portion 150 may specifically comprise a groove and/or a protrusion formed on the peripheral wall of the water inlet body 100. The fourth limit portion 150 may comprise at least one groove and/or at least one protrusion. A plurality of grooves and a plurality of protrusions may be formed at intervals in the axial direction of the water inlet body 100, or may be formed at intervals in the circumferential direction of the water inlet body 100. Further, the second cooperating portion 521 specifically comprises a groove/protrusion adapted to the above groove/protrusion. The third limit portion 320 is disposed on the water inlet connector 300, the fourth limit portion 150 is disposed on the water inlet body 100, and the second sealing layer 520 comprises the second cooperating portion 521 adapted to the third limit portion 320 and the fourth limit portion 150. In this way, on the one hand, the second sealing layer 520 is injection molded at the docking between the water inlet body 100 and the water inlet connector 300 conveniently. On the other hand, a contact area between the second sealing layer 520 with the water inlet body 100 and the water inlet connector 300 can be increased, and connection tightness between the second sealing layer 520 with the water inlet body 100 and the water inlet connector 300 is ensured. Meanwhile, the third limit portion 320, the fourth limit portion 150 and the second cooperating portion 521 are formed to be in structural sealing, and the sealing may be performed from a plurality of dimensions. Thus, a sealing effect of the second sealing layer 520 on the water inlet body 100 and the water inlet connector 300 is improved.

**[0066]** Further, the third limit portion 320 comprises a third annular groove formed on the peripheral wall of the water inlet connector 300, and the fourth limit portion 150 comprises a fourth annular groove formed on the peripheral wall of the water inlet body 100. The second cooperating portion 521 comprises a third annular flange embedded in the third annular groove and a fourth annular flange embedded in the fourth annular groove. The second sealing layer 520 further comprises a second sealing ring 522 connecting the third annular flange and the fourth annular flange.

**[0067]** In this embodiment, the water inlet body 100 is coaxially arranged with the water inlet connector 300 in order

to ensure the sealing performance of the second sealing layer 520 on the water inlet body 100 and the water inlet connector 300. Therefore, an open depth of the third annular groove can be consistent with an open depth of the fourth annular groove. At least one third annular groove and at least one fourth annular groove may be provided. When a plurality of the third annular grooves and a plurality of the fourth annular grooves are provided, the plurality of third annular grooves and the plurality of fourth annular grooves are arranged at intervals in the axial direction of the water inlet body 100.

**[0068]** Since the third limit portion 320 comprises the third annular groove formed on the peripheral wall of the water inlet connector 300, and the fourth limit portion 150 comprises the fourth annular groove formed one the peripheral wall of the water inlet body 100, the third annular groove and the fourth annular groove form glue accommodation grooves. When the second sealing layer 520 is injection molded at the periphery of the docking between the water inlet body 100 and the water inlet connector 300, the molten sealing material is uniformly filled into the third annular groove and the fourth annular groove to form the third annular flange and the fourth annular flange, respectively, as well as to form the second sealing ring 522 connecting the third annular flange and the fourth annular flange. With such a structure, on the one hand, the water inlet body 100 can be more stably connected to the water inlet connector 300, and the sealing effect of the water inlet body 100 and the water inlet connector 300 is superior. On the other hand, coaxiality of the water inlet body 100 and the water inlet connector 300 can be ensured. Therefore, the dimensional precision of the whole device after the encapsulation can be ensured, and the risk of water seepage is reduced.

**[0069]** In practice, steps of the connection between the water inlet connector 300 and the water inlet body 100 are described as follows.

**[0070]** Firstly, the water inlet connector 300 and the water inlet body 100 are connected to each other in the insertion manner.

**[0071]** After that, the inserted water inlet body 100 and water inlet connector 300 are placed in the cavity of the encapsulation mold.

**[0072]** Thereafter the liquid encapsulation material is injected into the cavity of the encapsulation mold, and therefore the encapsulation material is filled into the annular grooves of the water inlet connector 300 and the water inlet body 100, and is coated on a surface of the insertion portion between the water inlet connector 300 and the water inlet body 100 to form an encapsulation layer.

**[0073]** Finally, after the encapsulation layer is formed, the connected water inlet connector 300 and water inlet body 100 are taken out.

**[0074]** It can be understood that the step of connecting the water inlet connector 300 and the water inlet body 100 in the insertion manner may be performed before the step of placing the inserted water inlet body 100 and water drainage body 200 into the cavity of the encapsulation mold. That is, the water inlet connector 300, the water inlet body 100 and the water drainage body 200 are inserted into one another, and then the inserted water inlet connector 300, the water inlet body 100 and the water drainage body 200 are placed in the cavity of the encapsulation mold for encapsulation. In an embodiment, the step of connecting the water inlet connector 300 and the water inlet body 100 together in the insertion manner may be performed after the step of taking out the connected water inlet body 100 and the water drainage body 200 after the encapsulation layer is formed. That is, the water inlet body 100 and the water drainage body 200 are connected to each other through the encapsulation, and the water inlet body 100 and the water inlet connector 300 are then connected to each other through the encapsulation.

**[0075]** In an embodiment, as illustrated in FIG. 1, FIG. 3 and FIG. 6, the residual water removal apparatus 10 further comprises a water drainage connector 400 sealingly connected to an end of the water drainage body 200 away from the water inlet body 100. The water drainage connector 400 has a water drainage channel 410 in communication with the second channel 210. A second check valve 700 is disposed in the water drainage channel 410, and has a unidirectional conduction the second channel 210 to the water drainage channel 410.

**[0076]** In this embodiment, the water drainage connector 400 is specifically a tubular structure. The water drainage connector 400 may also be a structure in other shape. The water drainage channel 410 penetrates through the water inlet connector 300 in an axial direction of the water drainage connector 400. The water drainage connector 400 has an end connected to the water drainage body 200 and another end configured to be connected to the water drainage pipe. In order to reduce the fluid resistance, in an embodiment, a cross section of the second channel 210 and a cross section of the water drainage channel 410 are both in a circular shape, and the second channel 210 is coaxially arranged with the water drainage channel 410. The water drainage connector 400 may be in seal connection to the water drainage body 200 in various manners, such as a sealing ring, a sealant, and encapsulation, which are not listed herein. In some embodiments, the second check valve 700 may be mounted at an end of the water drainage channel 410 close to the second channel 210. The second check valve 700 may have various structures, and has a unidirectional conduction the second channel 210 to the water drainage channel 410 to prevent water in the water drainage channel 410 from flowing back to the second channel 210. The structure of the second check valve 700 is not specifically defined herein. The water drainage connector 400 and the water drainage body 200 are arranged separately, and therefore the second check valve 700 is conveniently mounted in the water drainage connector 400. Compared with the second check valve

700 disposed in the water drainage pipe, the second check valve 700 is more conveniently mounted by integrally forming the second check valve 700 with the water drainage connector 400. Furthermore, the residual water removal apparatus 10 has the high integration in this way and a relatively compact overall structure. As a result, the modular production is facilitated to be performed.

**[0077]** In an embodiment, as illustrated in FIG. 3, FIG. 4 and FIG. 6, an end surface of one of the water drainage connector 400 and the water drainage body 200 is provided with a second limit post 250, and an end surface of another one of the water drainage connector 400 and the water drainage body 200 is provided with a second limit groove 430. The second limit post 250 and the second limit groove 430 are engaged with each other to limit relative rotation between the water drainage connector 400 and the water drainage body 200.

**[0078]** In this embodiment, at least one second limit post 250 may be provided. When one second limit post 250 is provided, the second limit post 250 may be disposed on a middle portion of an end surface of the water drainage connector 400 or the water drainage body 200, or may be disposed at a position of the end surface close to the periphery. When a plurality of the second limit posts 250 is provided, the plurality of second limit posts 250 may be arranged at intervals in the circumferential direction of the water drainage body 200. In an embodiment, the plurality of second limit posts 250 is disposed on the end face of the water drainage body 200, and is arranged at intervals in the circumferential direction of the water drainage body 200. The engagement between the second limit post 250 and the second limit groove 430 can pre-fix the water drainage body 200 and the water drainage connector 400, and ensure the coaxiality of the water drainage body 200 and the water drainage body 200. Thus, the third sealing layer 530 is more conveniently coated at the docking between the water drainage body 200 and the water drainage connector 400. In an embodiment, the second limit post 250 is tightly engaged with the second limit groove 430, and therefore connection stability can be ensured during the pre-fixation of the water drainage body 200 and the water drainage connector 400.

**[0079]** Based on the above embodiments, referring to the drawings and FIG. 3, the water drainage connector 400 and the water drainage body 200 are docked together, and a periphery of the docking between the water drainage body 200 and the water drainage connector 400 is coated with a third sealing layer 530.

**[0080]** In this embodiment, the water drainage connector 400 and the water drainage body 200 are docked together, and specifically, the water drainage connector 400 is opposite to and connected to an end of the water drainage body 200. The third sealing layer 530 is coated on the periphery of the docking between the water drainage body 200 and the water drainage connector 400. The third sealing layer 530 may be embedded in the periphery of the docking between the water drainage body 200 and the water drainage connector 400, may be adhered to the periphery of the docking between the water drainage body 200 and the water drainage connector 400, or may be injection molded at the periphery of the docking between the water drainage body 200 and the water drainage connector 400. The connecting manner of the third sealing layer 530 with the water drainage body 200 and the water drainage connector 400 is not defined herein, as long as the third sealing layer 530 is coated on the periphery of the docking between the water drainage body 200 and the water drainage connector 400 to seal the docking between the water drainage body 200 and the water drainage connector 400. A material of the third sealing layer 530 may be selected and defined based on requirements, for example, the third sealing layer 530 may be made of a rubber material. In this case, the third sealing layer 530 may be coated on the periphery of the docking between the water drainage body 200 and the water drainage body 200 through bonding, sleeving, embedding, and the like. The third sealing layer 530 may be made of a plastic material. In this case, the third sealing layer 530 may be coated on the periphery of the docking between the water drainage connector 400 and the water drainage body 200 in the injection molding manner.

**[0081]** Compared with the sealing member disposed on the end face of each of the water drainage body 200 and the water drainage connector 400, since the third sealing layer 530 is coated at the periphery of the docking between the water drainage body 200 and the water drainage connector 400, the water drainage body 200 and the water drainage connector 400 are connected to each other while being sealed at the docking therebetween. Therefore, the connection between the water drainage body 200 and the water drainage connector 400 has a high compressive strength and can still remain sealed in the high-pressure state. Furthermore, compared with a connection between the water drainage body 200 and the water drainage connector 400 through the ultrasonic welding, the connection consistency of the water drainage body 200 and the water drainage connector 400 is prone to being ensured, and the risk of water seepage is reduced. Thus, the overall sealing effect of the residual water removal apparatus 10 is further improved.

**[0082]** In an embodiment, referring to FIG. 6, the third sealing layer 530 is injection-molded at the periphery of the docking between the water drainage body 200 and the water drainage connector 400.

**[0083]** In this embodiment, the third sealing layer 530 is injection molded at the periphery of the docking between the water drainage body 200 and the water drainage connector 400. That is, the encapsulation is performed on the docking between the water drainage body 200 and the water drainage connector 400. The third sealing layer 530 is specifically an encapsulation ring. In an embodiment, the third sealing layer 530 is made of a plastic material. The plastic material may specifically be polypropylene (PP), polyethylene (PE), and the like. A thickness and width of the third sealing layer 530 may be selected and constructed based on actual requirements, which is not specifically defined herein. The third sealing layer 530 is injection molded at the periphery of the docking between the water drainage body 200 and the water

drainage connector 400, and therefore the water drainage body 200 and the water drainage connector 400 are sealed. Furthermore, the water drainage body 200 and the water drainage connector 400 are connected to each other through the injection molding process, and therefore other additional structures are not required to be connected to the water inlet body 100 and the water drainage body 200. In this way, the sealing performance is good, and the connection reliability is superior. That is, the connection between the water drainage body 200 and the water drainage connector 400 has a high compressive strength, and can still remain sealed without water leakage in the high-pressure state. Compared with a case where the water drainage body 200 and the water drainage connector 400 are sealed through a common sealing ring, the residual water removal apparatus is simple and reliable. The number of components of the residual water removal apparatus can be reduced, and thus the assembling process is simplified. Furthermore, the risk of water leakage is reduced during a long-period use. Moreover, compared with a case where the water drainage body 200 and the water drainage connector 400 are connected to each other through the ultrasonic welding, the connection consistency of the water drainage body 200 and the water drainage connector 400 is prone to being ensured, and the risk of water seepage is reduced.

**[0084]** In practice, steps of connecting the water drainage connector 400 and the water drainage body 200 are described as follows.

**[0085]** Firstly, the water drainage connector 400 and the water drainage body 200 are connected to each other in the insertion manner.

**[0086]** After that, the inserted water drainage body 200 and the water drainage connector 400 are placed in the cavity of the encapsulation mold.

**[0087]** Thereafter the liquid encapsulation material is injected into the cavity of the encapsulation mold. Therefore, the encapsulation material is filled in the annular grooves of the water drainage body 200 and the water drainage connector 400, and is coated on a surface of an insertion portion between the water drainage body 200 and the water drainage connector 400 to form an encapsulation layer.

**[0088]** Finally, after the encapsulation layer is formed, the connected drainage connector 400 and water drainage body 200 are taken out.

**[0089]** It can be understood that the step of connecting the water drainage connector 400 and the water drainage body 200 in the insertion manner may be performed before the step of placing the inserted water inlet body 100 and water drainage body 200 in the cavity of the encapsulation mold. That is, the water inlet body 100, the water drainage body 200 and the water drainage connector 400 are inserted into one another, or the water inlet connector 300, the water inlet body 100, the water drainage body 200 and the water drainage connector 400 are inserted into one another, and thereafter the inserted water inlet body 100, the water drainage body 200 and the water drainage connector 400 are placed in the cavity of the encapsulation mold for encapsulation, or the inserted water inlet connector 300, water inlet body 100, water drainage body 200 and water drainage connector 400 are placed in the cavity of the encapsulation mold for encapsulation. The step of connecting the water inlet connector 300 and the water inlet body 100 in the insertion manner may be performed after the step of taking out the connected water inlet body 100 and the water drainage body 200 after the encapsulation layer is formed. That is, after the water inlet body 100 and the water drainage body 200 are connected to each other through the encapsulation, and the water drainage body 200 and the water drainage connector 400 are then connected to each other through the encapsulation.

**[0090]** In an embodiment, as illustrated in FIG. 1, FIG. 3 and FIG. 6, the water drainage connector 400 is provided with a fifth limit portion 420 at an end of the water drainage connector 400 adjacent to the water drainage body 200, and the water drainage body 200 is provided with a sixth limit portion 240 at an end of the water drainage body 200 adjacent to the water drainage connector 400. The third sealing layer 530 comprises a third cooperating portion 531 adapted to the fifth limit portion 420 and the sixth limit portion 240.

**[0091]** In this embodiment, the fifth limit portion 420 may specifically comprise a groove and/or a protrusion formed on a peripheral wall of the water drainage connector 400. The fifth limit portion 420 may comprise at least one groove and/or at least one protrusion. A plurality of grooves and a plurality of protrusions may be formed at intervals in the axial direction of the water drainage connector 400, or may be formed at intervals in a circumferential direction of the water drainage connector 400. Similarly, the sixth limit portion 240 may specifically comprise a groove and/or a protrusion formed on the peripheral wall of the water drainage body 200. The sixth limit portion 240 may comprise at least one groove and/or at least one protrusion. A plurality of grooves and a plurality of protrusions may be formed at intervals in the axial direction of the water drainage body 200, or may be formed at intervals in the circumferential direction of the water drainage body 200. In this case, the third cooperating portion 531 specifically comprises a groove/protrusion adapted to the above groove/protrusion. The fifth limit portion 420 is disposed on the water drainage connector 400, the sixth limit portion 240 is disposed on the water drainage body 200, and the third sealing layer 530 comprises the third cooperating portion 531 adapted to the fifth limit portion 420 and the sixth limit portion 240. In this way, on the one hand, the third sealing layer 530 is injection molded at the docking between the water drainage body 200 and the water drainage connector 400 conveniently. On the other hand, a contact area of the third sealing layer 520 with the water drainage body 200 and the water drainage connector 400 can be increased, and connection tightness between the third sealing

layer 520 and the water drainage body 200 and water drainage connector 400 is ensured. Meanwhile, the fifth limit portion 420, the sixth limit portion 240 and the third cooperating portion 531 form to be in structural sealing, to seal from a plurality of dimensions. Thus, a sealing effect of the third sealing layer 530 on the water drainage body 200 and the water drainage connector 400 is further improved.

**[0092]** Further, referring again to FIG. 1, FIG. 3 and FIG. 6, the fifth limit portion 420 comprises a fifth annular groove formed on the peripheral wall of the water drainage connector 400, and the sixth limit portion 240 comprises a sixth annular groove formed on the peripheral wall of the water drainage body 200. The third cooperating portion 531 comprises a fifth annular flange embedded in the fifth annular groove and a sixth annular flange embedded in the sixth annular groove. The third sealing layer 530 further comprises a third sealing ring 532 connecting the fifth annular flange and the sixth annular flange.

**[0093]** In general, the water drainage body 200 is coaxially arranged with the water drainage connector 400 in order to ensure the connection sealing performance of the third sealing layer 530 on the water drainage body 200 and the water drainage connector 400. Therefore, an open depth of the fifth annular groove can be consistent with an open depth of the sixth annular groove. At least one fifth annular groove and at least one sixth annular groove may be provided. When a plurality of the fifth annular grooves and a plurality of the sixth annular grooves are provided, the plurality of fifth annular grooves and the plurality of sixth annular grooves are arranged at intervals in the axial direction of the water drainage body 200.

**[0094]** Since the fifth limit portion 420 comprises the fifth annular groove formed on the peripheral wall of the water drainage connector 400, and the sixth limit portion 240 comprises the sixth annular groove formed on the peripheral wall of the water drainage body 200, the fifth annular groove and the sixth annular groove form glue accommodation grooves. When the third sealing layer 530 is injection molded at the periphery of the docking between the water drainage body 200 and the water drainage connector 400, the molten sealing material is uniformly filled in the fifth annular groove and the sixth annular groove to form a fifth annular flange and a sixth annular flange, respectively, as well as to form the third sealing ring 532 connecting the fifth annular flange and the sixth annular flange. With such a structure, on the one hand, the water drainage body 200 can be more stably connected to the water drainage connector 400, and the sealing effect of the water drainage body 200 and the water drainage connector 400 is superior. On the other hand, coaxiality of the water drainage body 200 and the water drainage connector 400 can be ensured. Therefore, the dimensional precision of the whole device after the encapsulation can be ensured, and the risk of water seepage is reduced.

**[0095]** In an embodiment, referring to FIG. 1 to FIG. 4, the residual water removal apparatus 10 further comprises a throat portion 800 connected to the water inlet body 100. The throat portion 800 has a throat channel 810 in communication with the water outlet end 112 of the first channel 110, and a cross-sectional area of the throat channel 810 is smaller than a cross-sectional area of each of the first channel 110 and the second channel 210. An annular cavity 170 is formed at a periphery of the throat portion 800, and is in communication with the flow diverting channel 210. The throat channel 810 is in communication with the second channel 210 through the annular cavity 170.

**[0096]** In this embodiment, the throat portion 800 is specifically in a cylindrical shape. The throat portion 800 is connected to the water inlet body 100, that is, the throat portion 800 is connected to the water outlet end 112 of the first channel 110. The throat portion 810 is in communication with the second channel 210 through the annular cavity 170, that is, an end surface of the throat portion 800 is spaced apart from the inlet end of the second channel 210. A length of the first channel 110 and a length of the second channel 210 may be constructed based on actual requirements, and a length of the throat channel 810 is generally much smaller than the length of each of the first channel 110 and the second channel 210. The cross-sectional area of the throat channel 810 is smaller than the cross-sectional area of each of the first channel 110 and the second channel 210. Therefore, the cross-sectional area of the throat channel 810 is the smallest. The throat channel 810 may be formed in the water inlet connector 300, or may be formed in the water drainage connector 400. The annular cavity 170 may be formed in the water inlet connector 300, or may be formed in the water drainage connector 400. It can be understood that the annular cavity 170 is formed around a periphery of the throat portion 800. A ratio of a maximum inner diameter of the annular cavity 170 to an inner diameter of the throat channel 810 may be selected and constructed based on actual requirements.

**[0097]** The annular cavity 170 is formed at the periphery of the throat portion 800. In this way, after a water flow flows into the throat channel 810 from the first channel 110, a pressure of the water flow at the throat channel 810 is increased and a flow rate thereof is decreased. After the water flow flows into the annular cavity 170, the pressure of the water flow is decreased instantaneously and the flow rate thereof is increased. Therefore, a negative pressure is generated in the annular cavity 170. In this way, the residual water at the residual water outlet is sucked into the annular cavity 170 through the flow diverting channel 120 under the negative pressure, and therefore the residual water flows into the water drainage channel 410 along with the tap water to be discharged from the water drainage pipe. Compared with a traditional Venturi pipe generating a negative pressure in the throat channel 810, the annular cavity 170 is formed at the periphery of the throat portion 800, and therefore the flow diverting channel 120 is in communication with the annular cavity 170, and the negative pressure is generated in the annular cavity 170. In this way, the negative pressure can be increased, and the carrying capacity of the residual water device 10 for the residual water can be improved. Furthermore, the

efficiency and effect of adsorbing the residual water by the residual water removal apparatus 10 can be effectively improved. In an embodiment, the ratio of the maximum inner diameter of the annular cavity 170 to the inner diameter of the throat channel 810 is greater than or equal to 2, and is smaller than or equal to 5. In this way, the negative pressure generated in the annular cavity 170 and the capacity of the residual water can be improved to the greatest extent. Thus, the efficiency and effect of adsorbing the residual water by the residual water removal apparatus 10 are improved to the greatest extent.

**[0098]** Further, as illustrated in FIG. 1 and FIG. 2, the annular cavity 170 is formed in the water inlet body 100. The flow diverting channel 120 and the throat channel 810 are also formed in the water inlet body 100. In other embodiments, the annular cavity 170, the flow diverting channel 120 and the throat channel 810 may be disposed in the water drainage body 200.

**[0099]** In an embodiment, the annular cavity 170 comprises a tapered section 171, and the tapered section 171 has an inner diameter gradually decreasing from the first channel 110 towards the second channel 210. Therefore, the annular cavity 170 is formed as the tapered section 171 as a whole, and the annular cavity 170 has an inner diameter gradually decreasing from the first channel 110 towards the second channel 210. A part of the annular cavity 170 may be formed as the tapered section 171. In an embodiment, a section of the annular cavity 170 close to the second channel 210 is formed as the tapered section 171. The annular cavity 170 comprises the tapered section 171, and therefore the tapered section 171 is configured to guide the residual water and tap water in the annular cavity 170. Thus, a flow rate of the water flow flowing from the annular cavity 170 to the second channel 210 is accelerated, to further improve the efficiency of removing the residual water by the residual water device 10.

**[0100]** The present disclosure further provides a dishwasher. The dishwasher comprises a water drainage device and the residual water removal apparatus 10. The water drainage device comprises a water cup, and the cup has a water inlet and a residual water outlet. The specific structure of the residual water removal apparatus 10 refers to the above embodiments. The water inlet body 100 of the residual water removal apparatus 10 is in communication with the water inlet, and the communication between the first channel 110 and the second channel 210 of the residual water removal apparatus 10 is in communication with the residual water outlet through the flow diverting channel 120. Since all the technical solutions of all the above embodiments are used in the dishwasher, the dishwasher has at least all the beneficial effects of the technical solutions of the above embodiments, which will not be repeated herein.

**[0101]** In practice, the dishwasher further comprises a body. The body comprises an inner container configured to mount a bowl. A water outlet groove is defined by the inner container. The water cup is disposed at a bottom of the water outlet groove, and is configured to collect sewage after the bowl is cleaned. A residual water outlet is provided at a bottom of the water cup. The residual water outlet is connected to a water drainage pipe, and the water drainage joint connector of the residual water removal apparatus 10 may be in communication with the water drainage pipe. In an embodiment, a drainage pump is provided, and has an end connected to the water drainage pipe and another end in communication with the residual water outlet of the water cup. After dishes are washed by the dishwasher, the sewage enters the water cup. In this case, the drainage pump starts to operate, and water in the water cup is directly discharged through the water drainage pipe. However, the drainage pump cannot completely discharge the water in the water cup, and a small amount of residual water remains in the water cup. In this case, the drainage pump stops operating. In order to discharge the residual water in the water cup, the water inlet pipe is arranged towards the water inlet connector 300. After the water flow passes through the water inlet connector 300, the water inlet body 100, the water drainage connector 400, and the water drainage body 200, the negative pressure generated at the communication between the first channel 110 and the second channel 210 can suck away the residual water through the flow diverting 120. Thus, the residual water between the drainage pump and the bottom of the water cup can be thoroughly removed.

**[0102]** The above description is merely alternative embodiments of the present disclosure, and is not therefore intended to limit the scope of the present disclosure. Without departing from the principle of the present disclosure, any equivalent structural modification made by using the specification and accompanying drawings of the present disclosure, or the specification and accompanying drawings of the present disclosure directly/indirectly applied to other related technical fields, are comprised within the scope of the present disclosure.

## Claims

**1.** A residual water removal apparatus, comprising:

a water inlet body internally having a first channel; and

a water drainage body internally having a second channel, the water drainage body and the water inlet body being docked together,

wherein the first channel is in a communication with the second channel and has a communication port in communication with the second channel, an area of the communication port being smaller than or equal to each

of a cross-sectional area of a remaining part of the first channel and a cross-sectional area of a remaining part of the second channel;
wherein the first channel is constructed such that a cross section of the first channel at least partially decreases gradually towards the second channel; and
wherein the first channel and the second channel are in communication with a residual water outlet through a flow diverting channelat the communication between the first channel and the second channel.

**2.** The residual water removal apparatus according to claim 1, wherein one of the water inlet body and the water drainage body is provided with a central insertion shaft, and another one of the water inlet body and the water drainage body has a central insertion hole adapted to the central insertion shaft.

**3.** The residual water removal apparatus according to claim 1, wherein a periphery of a connection between the water inlet body and the water drainage body is coated with a first sealing layer.

**4.** The residual water removal apparatus according to claim 3, wherein the first sealing layer is injection molded at the periphery of the connection between the water inlet body and the water drainage body.

**5.** The residual water removal apparatus according to claim 3, wherein the water inlet body is provided with a first limit portion at an end of the water inlet body adjacent to the water drainage body;

the water drainage body is provided with a second limit portion at an end of the water drainage body adjacent to the water inlet body; and
the first sealing layer comprises a first cooperating portion adapted to the first limit portion and the second limit portion.

**6.** The residual water removal apparatus according to claim 5, wherein the first limit portion comprises a first annular groove formed on a peripheral wall of the water inlet body;

the second limit portion comprises a second annular groove formed on a peripheral wall of the water drainage body;
the first cooperating portion comprises a first annular flange embedded in the first annular groove and a second annular flange embedded in the second annular groove; and
the first sealing layer further comprises a first sealing ring connecting the first annular flange and the second annular flange.

**7.** The residual water removal apparatus according to claim 3, wherein the first sealing layer is made of a plastic material.

**8.** The residual water removal apparatus according to any one of claims 1 to 7, further comprising:

a water inlet connector sealingly connected to an end of the water inlet body, wherein the end of the water inlet body being distant from the water drainage body,
wherein the water inlet connector has a water inlet channel in communication with the first channel, a first check valve being disposed in the water inlet channel and having a unidirectional conduction from the water inlet channel to the first channel.

**9.** The residual water removal apparatus according to claim 8, wherein an end surface of either the water inlet connector or the water inlet body is provided with a first limit post; and
an end surface of another one of the water inlet connector and the water inlet body has a first limit groove, the first limit post and the first limit groove being engaged with each other.

**10.** The residual water removal apparatus according to claim 8, wherein the water inlet connector and the water inlet body are docked together; and
a periphery of a connection between the water inlet body and the water inlet connector is coated with a second sealing layer.

**11.** The residual water removal apparatus according to claim 10, wherein the second sealing layer is injection molded at the periphery of the connection between the water inlet body and the water inlet connector.

**12.** The residual water removal apparatus according to any one of claims 1 to 7, further comprising:

a water drainage connector sealingly connected to an end of the water drainage body, wherein the end of the water drainage body being distant from the water inlet body,
wherein the water drainage connector has a water drainage channel in communication with the second channel, a second check valve being disposed in the water drainage channel and unidirectionally openable from the second channel to the water drainage channel.

**13.** The residual water removal apparatus according to claim 12, wherein the water drainage connector and the water drainage body are docked together; and
a periphery of a connection between the water drainage body and the water drainage connector is coated with a third sealing layer.

**14.** The residual water removal apparatus according to claim 13, wherein the third sealing layer is injection molded at the periphery of the connection between the water drainage body and the water drainage connector.

**15.** The residual water removal apparatus removal device according to claim 1, further comprising:

a throat portion connected to the water inlet body,
wherein the throat portion has a throat channel in communication with a water outlet end of the first channel, a cross-sectional area of the throat channel being smaller than a cross-sectional area of each of the first channel and the second channel;
wherein the throat portion further has an annular cavity formed at a periphery of the throat portion;
wherein the throat channel is in communication with the second channel through the annular cavity, and wherein the annular cavity being in communication with the flow diverting channel.

**16.** The residual water removal apparatus according to claim 15, wherein the annular cavity is formed in the water inlet body; and/or
the annular cavity comprises a tapered section constructed such that an inner diameter of the tapered section gradually decreases from the first channel to the second channel.

**17.** A dishwasher, comprising:

a water drainage device comprising a water cup, the water cup having a water inlet and a residual water outlet; and
a residual water removal apparatus according to any one of claims 1 to 16,
wherein the water inlet body of the residual water removal apparatus is in communication with the water inlet; and
wherein a communication between a first channel and a second channel of the residual water removal apparatus is in communication with a residual water outlet through a flow diverting channel.

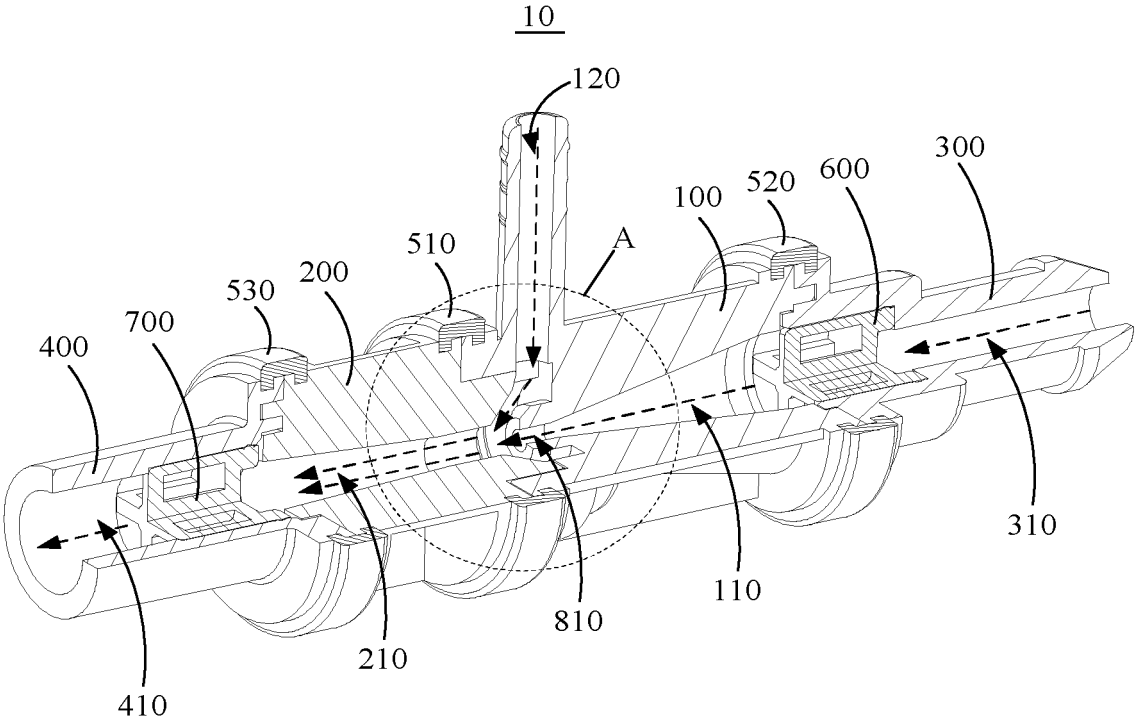
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FIG.1

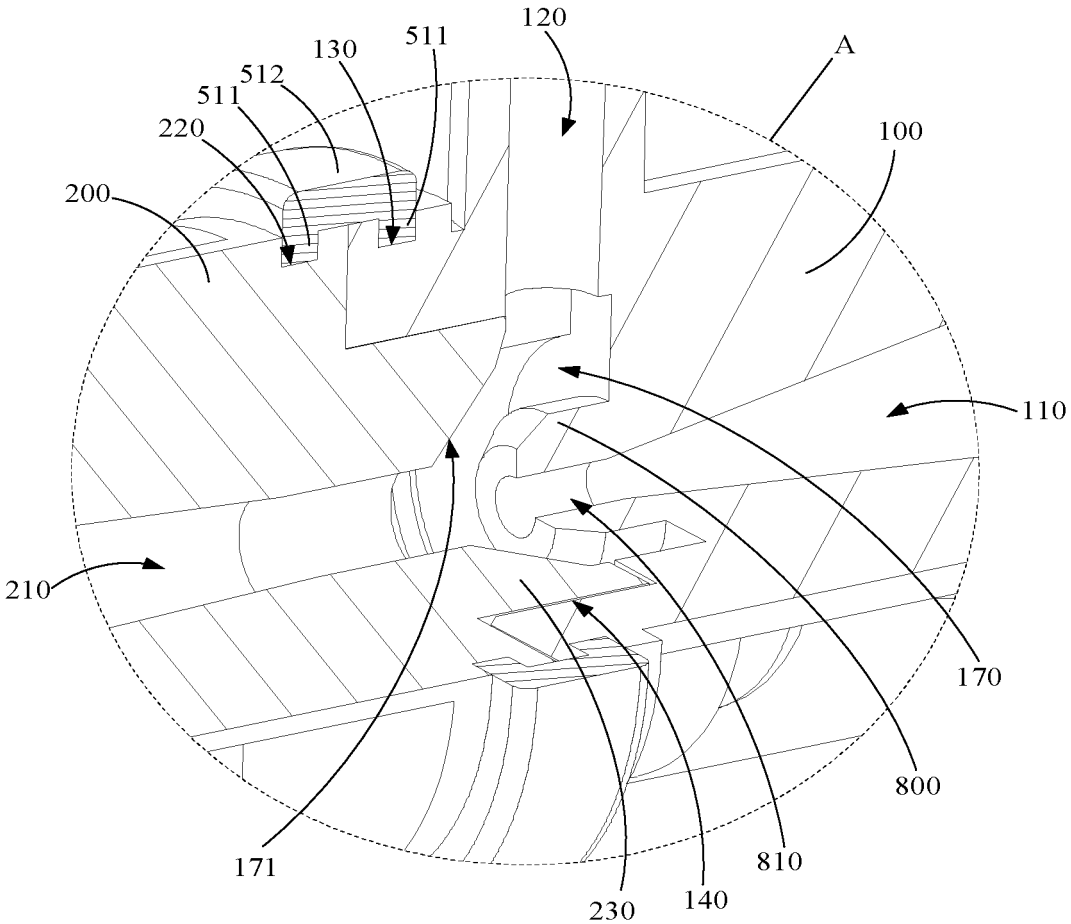
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FIG. 2

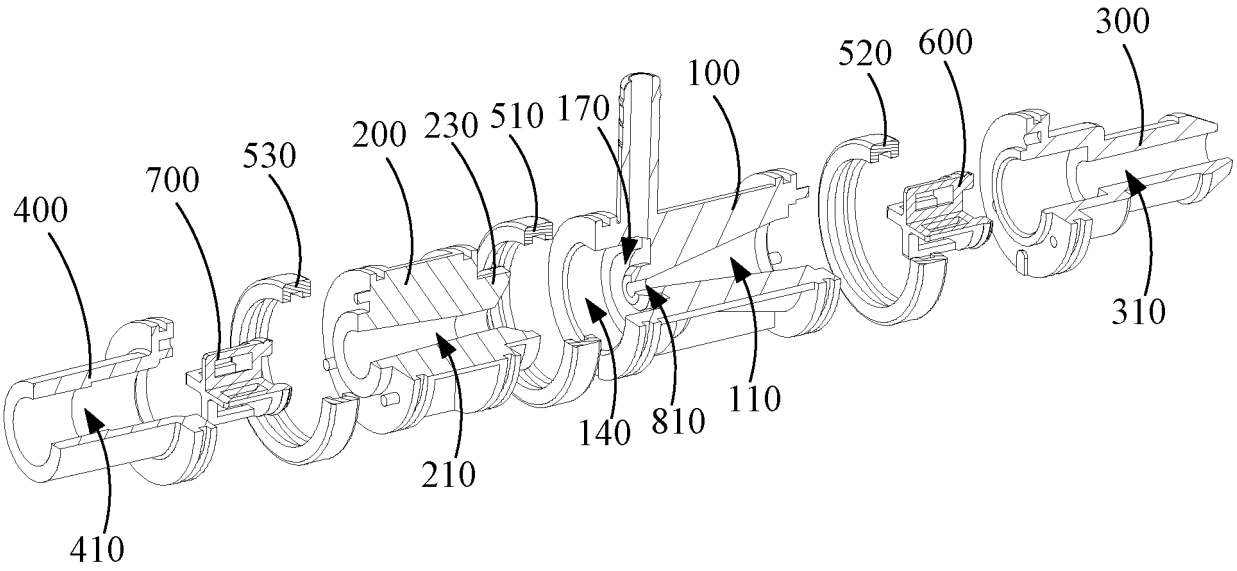
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FIG. 3

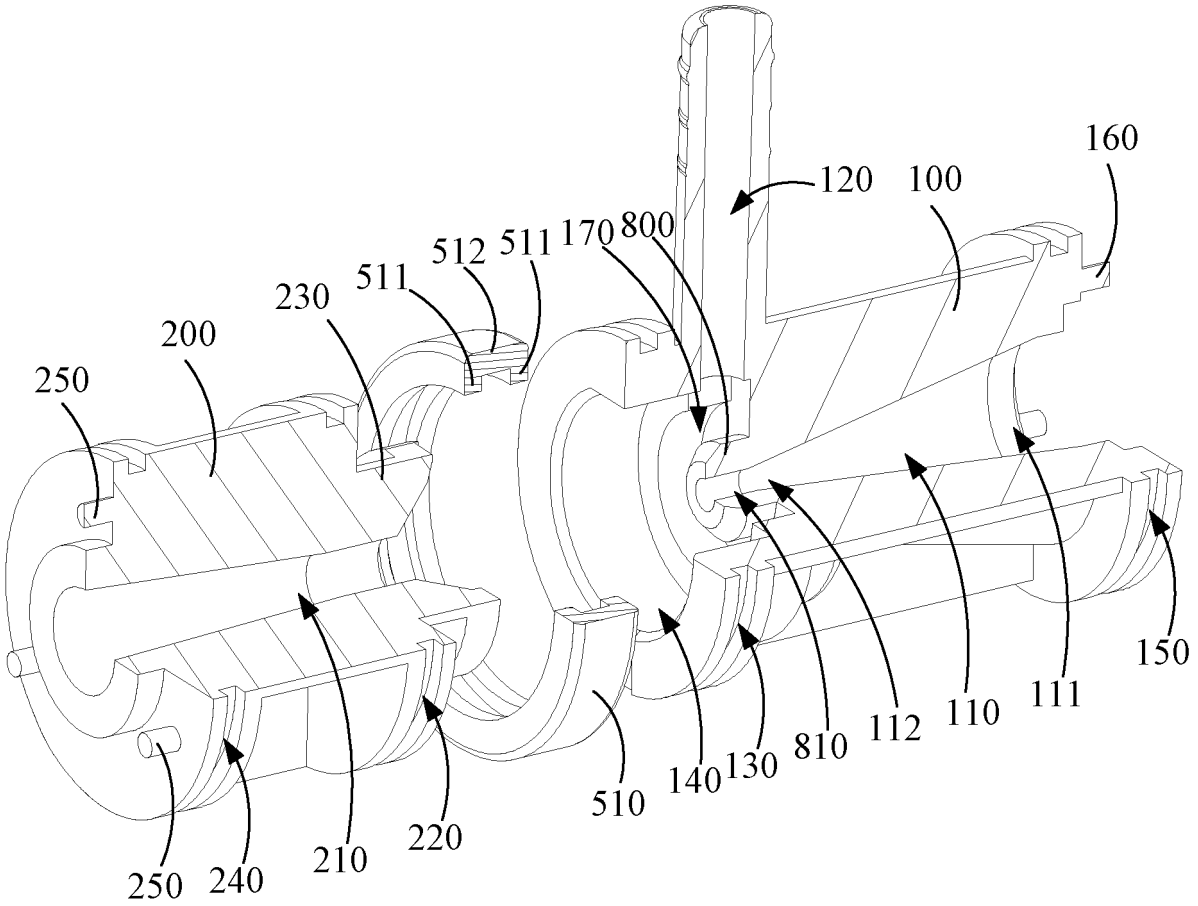
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FIG. 4

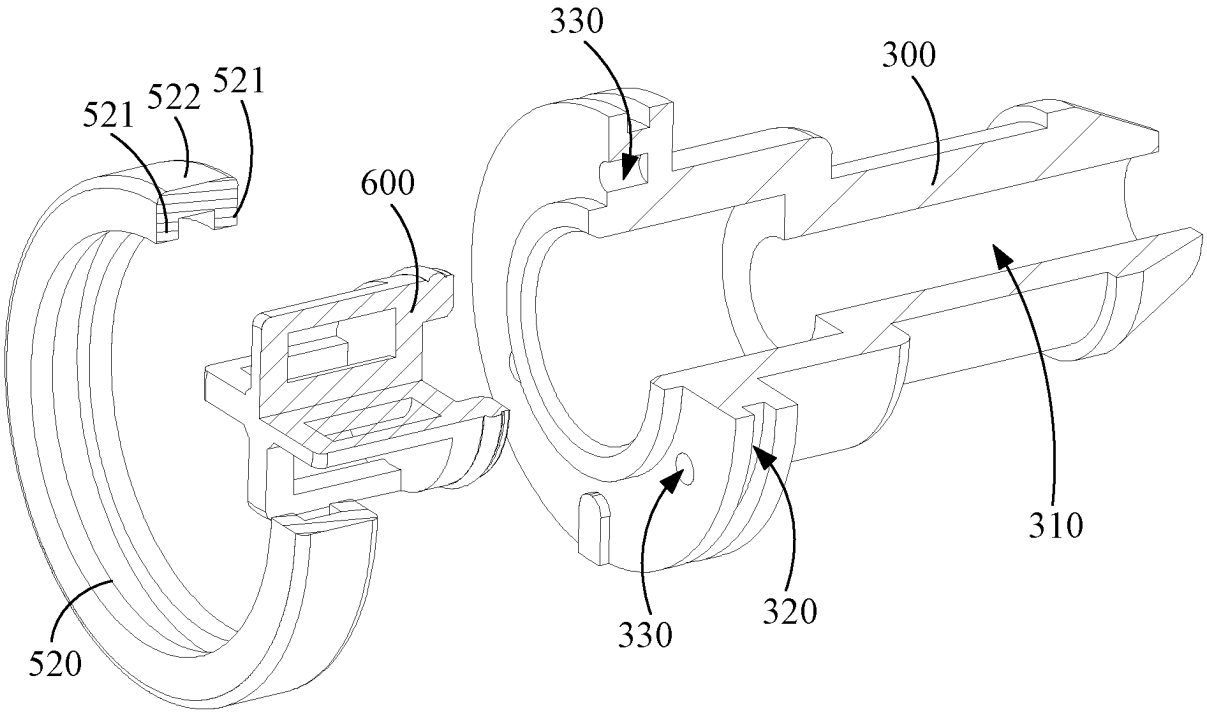
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FIG. 5

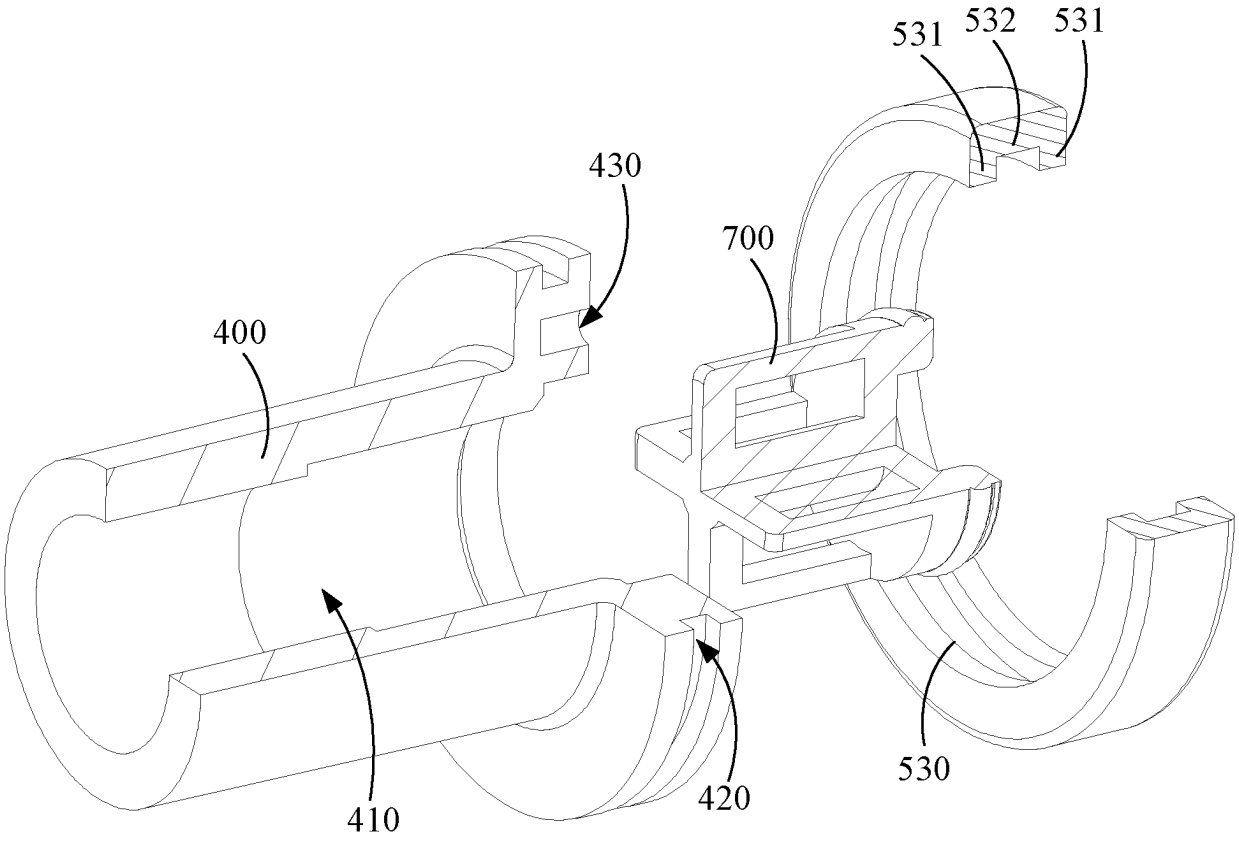
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FIG. 6

## INTERNATIONAL SEARCH REPORT

International application No.
**PCT/CN2021/134193**

**A. CLASSIFICATION OF SUBJECT MATTER**

A47L 15/42(2006.01)i; A47L 15/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

A47L15/-; CPC: A47L15/4223

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)

VEN; GBTXT; EPTXT; USTXT; WOTXT; CNABS; CNTXT: 美的, 朱喜青, 刘日超, 李翔, 排水, 出水, 残留, 洗碗机, 文丘里管, 文氏管, 负压, 横截面, 变小, 减小, 进水, 引流, 通道, 喉部, 凹槽, 配合, 限位, 单向阀, 密封, drainage?, drain???, residual? water, dish 1w washer?, tableware? 1w washer?, Venturi, tube?, pipe?, negative+ pressure+, cross 1w section, small??, reduc???, channel?, throat, groove?, notch??, fit+, match+, limit+, check valve, seal+.

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | CN 110403546 A (FOSHAN SHUNDE MIDEA WASHING APPLIANCES MFG CO., LTD.) 05 November 2019 (2019-11-05)<br>description, paragraphs [0051]-[0065], and figures 1 and 2 | 1-7, 17 |
| Y | CN 110403546 A (FOSHAN SHUNDE MIDEA WASHING APPLIANCES MFG CO., LTD.) 05 November 2019 (2019-11-05)<br>description, paragraphs [0051]-[0060], and figures 1 and 2 | 8-14 |
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| X | CN 110301878 A (FOSHAN SHUNDE MIDEA WASHING APPLIANCES MFG CO., LTD.) 08 October 2019 (2019-10-08)<br>description, paragraphs [0055]-[0071], and figures 1 and 2 | 1-7, 17 |

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

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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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 |
|---|---|
| **08 February 2022** | **23 February 2022** |
| Name and mailing address of the ISA/CN<br>**China National Intellectual Property Administration (ISA/CN)**<br>**No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China**<br>Facsimile No. **(86-10)62019451** | Authorized officer<br>Telephone No. |

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/134193

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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**INTERNATIONAL SEARCH REPORT**
**Information on patent family members**

International application No.
**PCT/CN2021/134193**

| Patent document cited in search report | | | Publication date (day/month/year) | Patent family member(s) | | | Publication date (day/month/year) |
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| | | | | EP | 0728439 | A2 | 28 August 1996 |
| | | | | EP | 0728439 | A3 | 13 January 1999 |
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| | | | | KR | 20140033895 | A | 19 March 2014 |
| | | | | KR | 102068151 | B1 | 20 January 2020 |
| CN | 110840361 | A | 28 February 2020 | None | | | |
| CN | 109750445 | A | 14 May 2019 | None | | | |
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| | | | | EP | 2699141 | B1 | 04 March 2015 |
| | | | | DE | 102011007685 | A1 | 25 October 2012 |
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