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(54) **WATER COOLING DEVICE CAPABLE OF SWITCHING PUMP LOOP**

(71) Applicant: **JINGWAY TECHNOLOGY CO., LTD.**, Yun Lin County (TW)

(72) Inventor: **Feng-Chang WANG**, Yun Lin County (TW)

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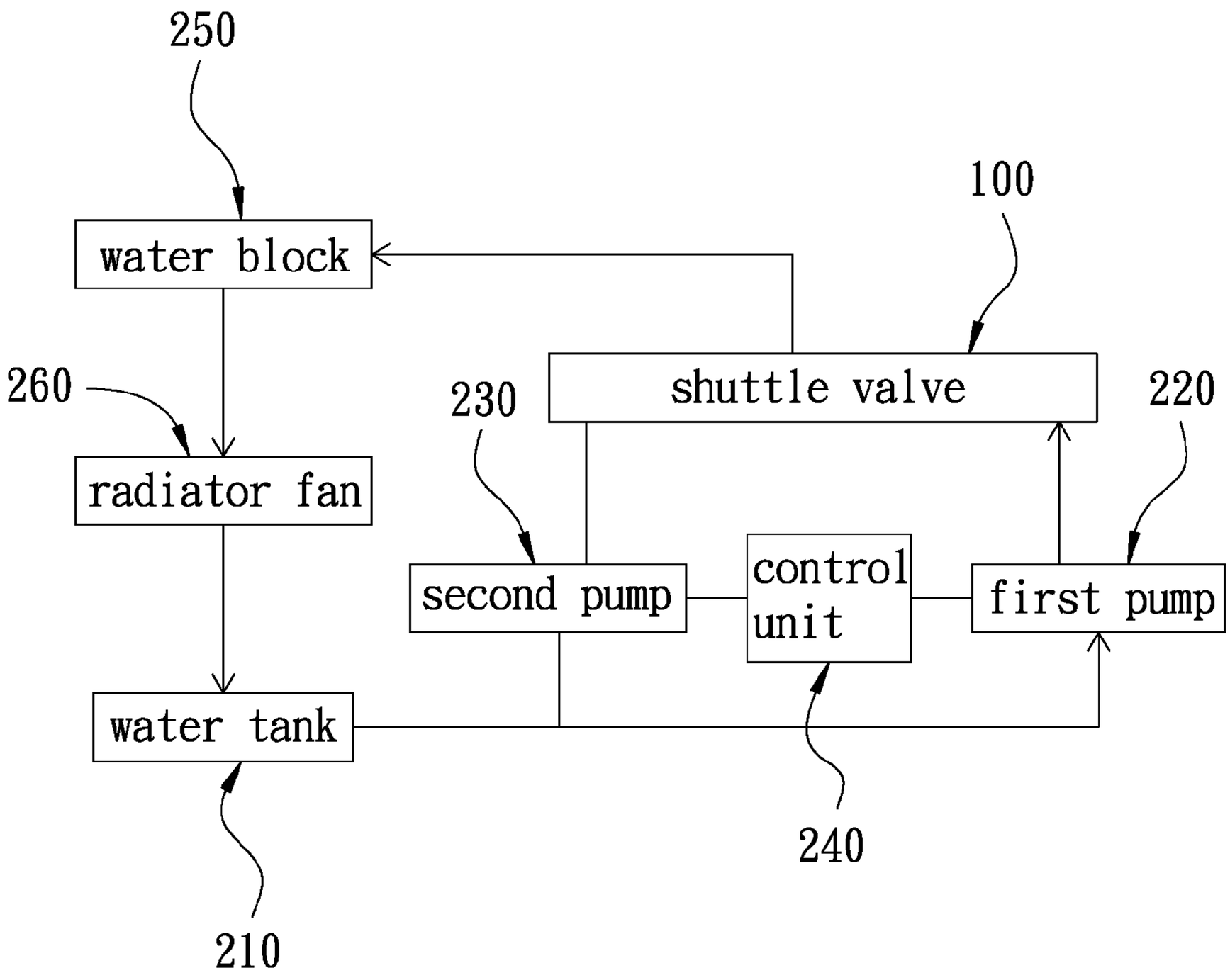
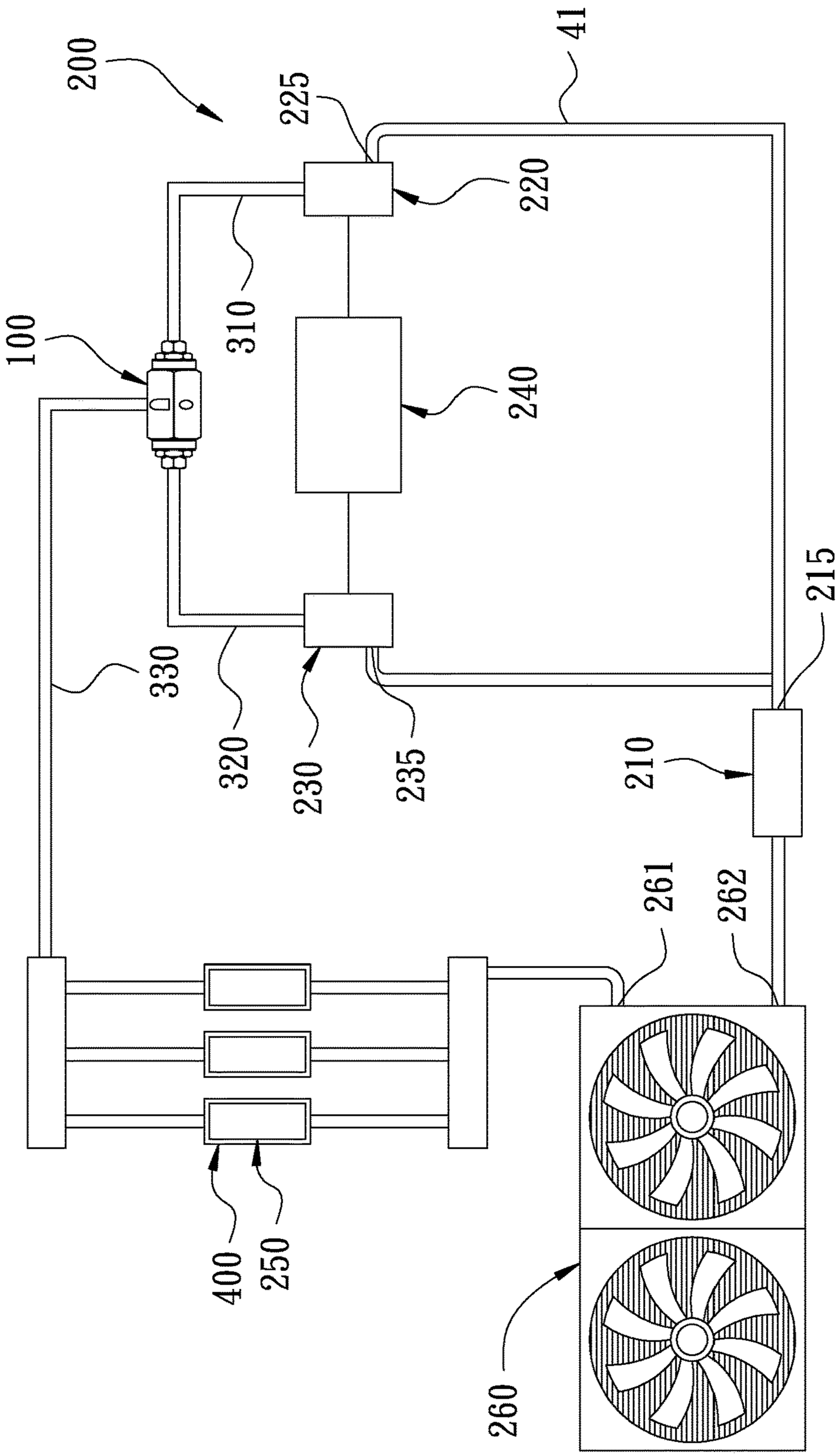
(57) **ABSTRACT**

A water cooling device capable of switching a pump loop is provided. The water cooling device sends a liquid coolant through a first pump or a second pump and moves a shuttle valve to a first position or a second position, so that the liquid coolant can flow into the shuttle valve from different directions and then flow out from an output hole. The shuttle check does not consume power, but also can achieve the non-return function. Then, the liquid coolant flows into a water block to cool a load. After that, the liquid coolant flows to a radiator fan for heat dissipation and then flows to the water tank for circulation, achieving the effect of bidirectionally switching the pump loop. The water cooling device can continue to operate without stopping.




200
225
41
220
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100
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262
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250
260

FIG. 1

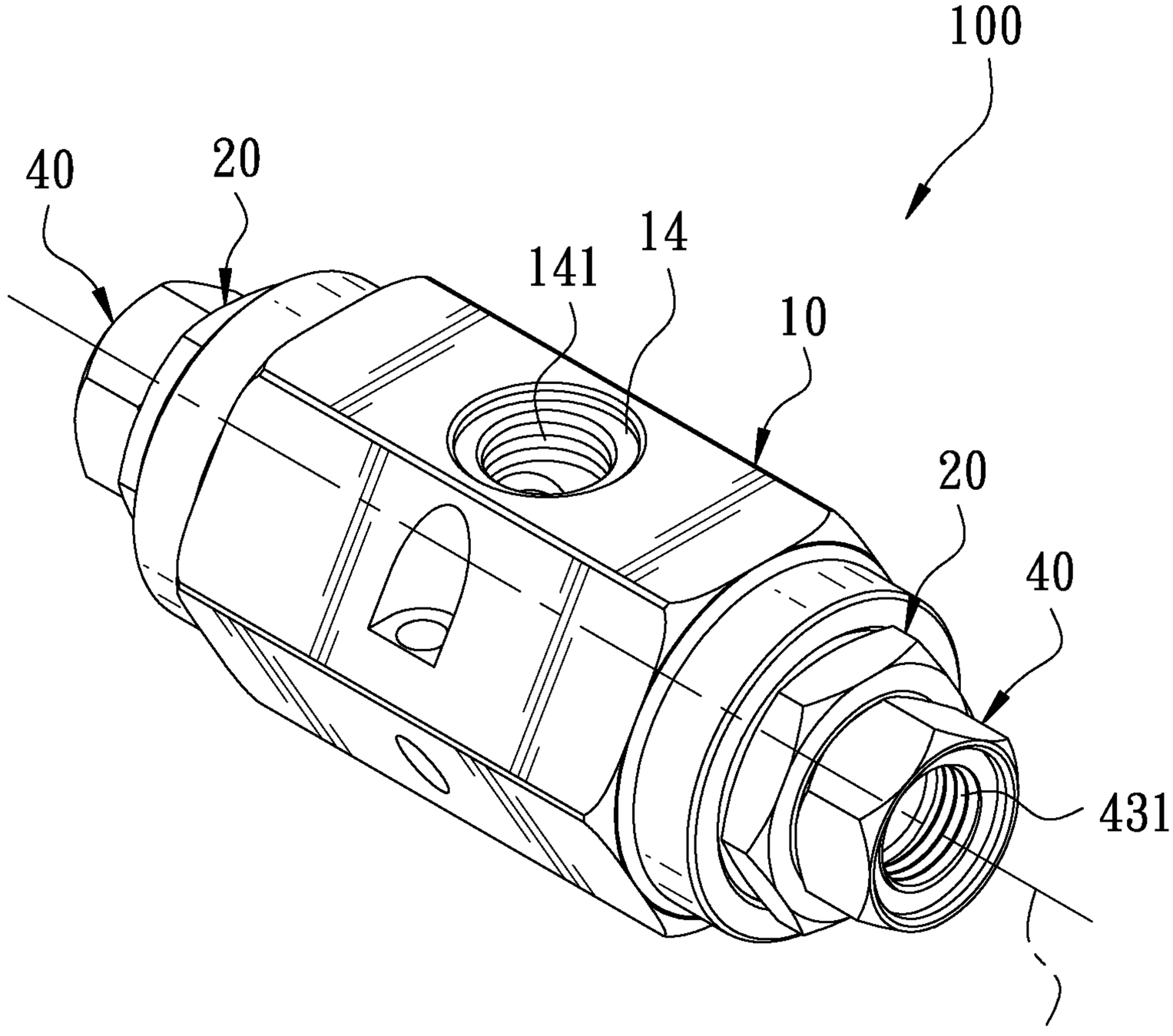
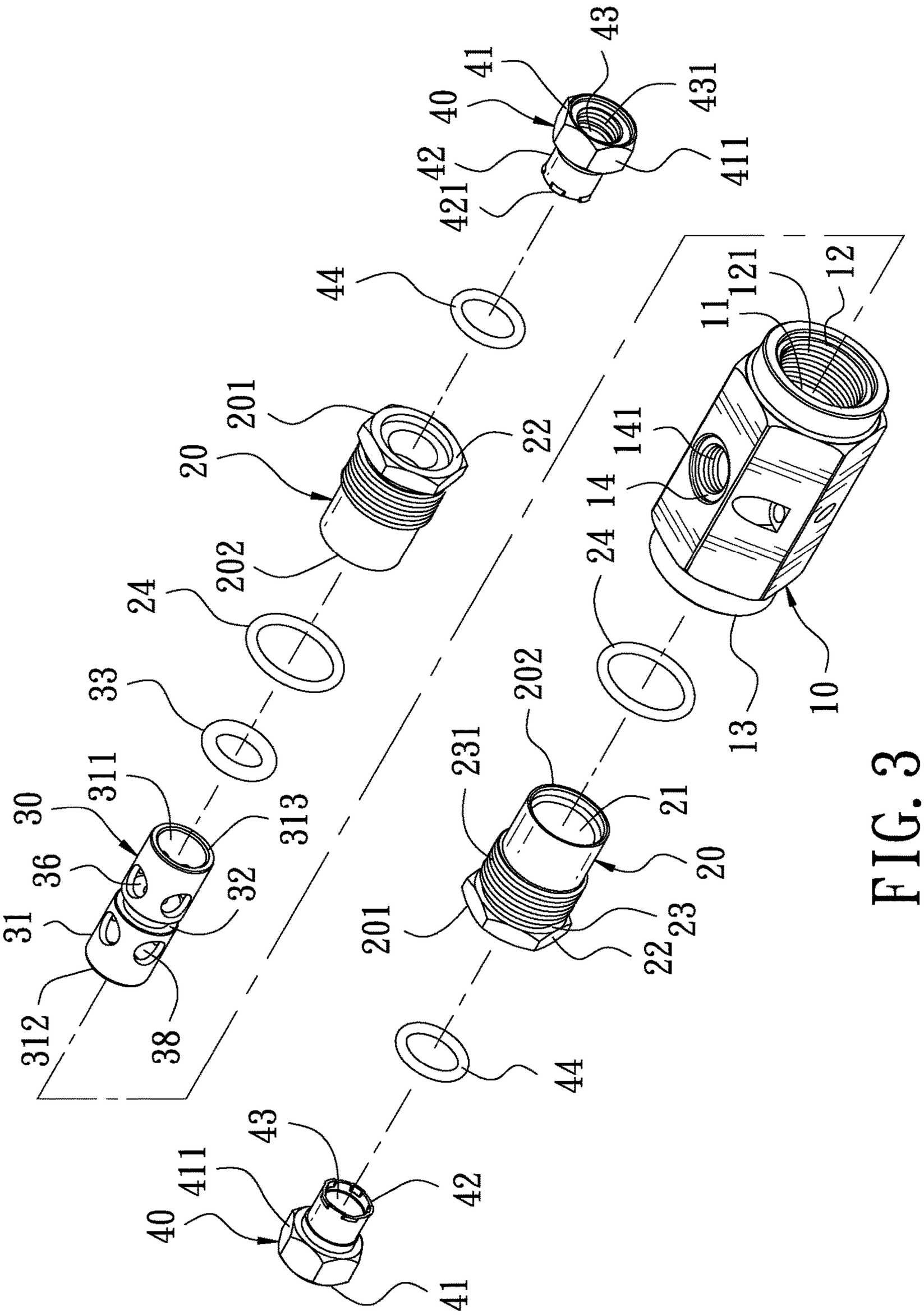


FIG. 2


43
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431
40
42
411
421
44
201
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202
24
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311
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36
32
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312
38
231
202
21
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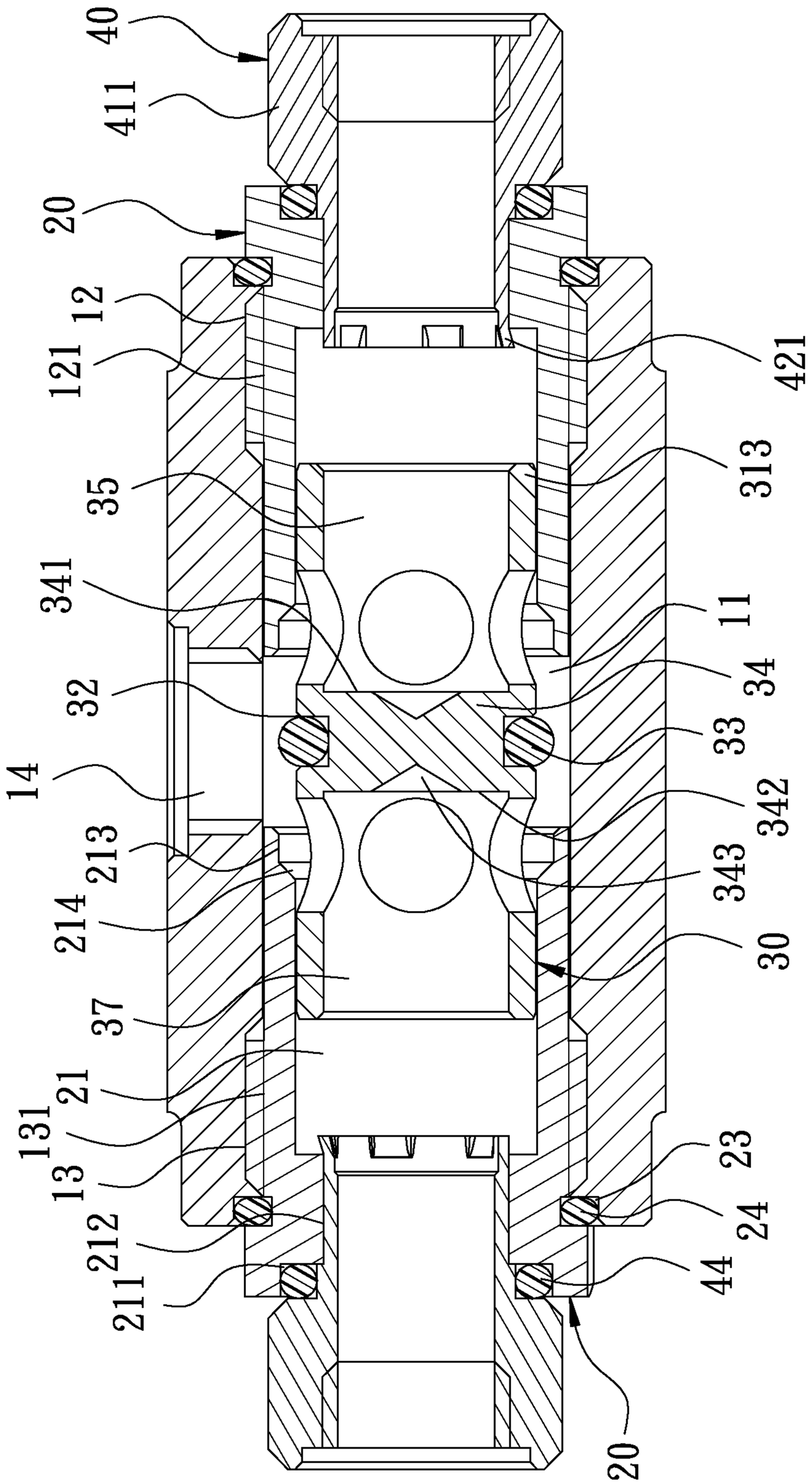
44

FIG. 3


40
411
20
12
121
421
35
313
341
11
32
34
33
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342
213
343
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30
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23
212
24
211
44
20

FIG. 4

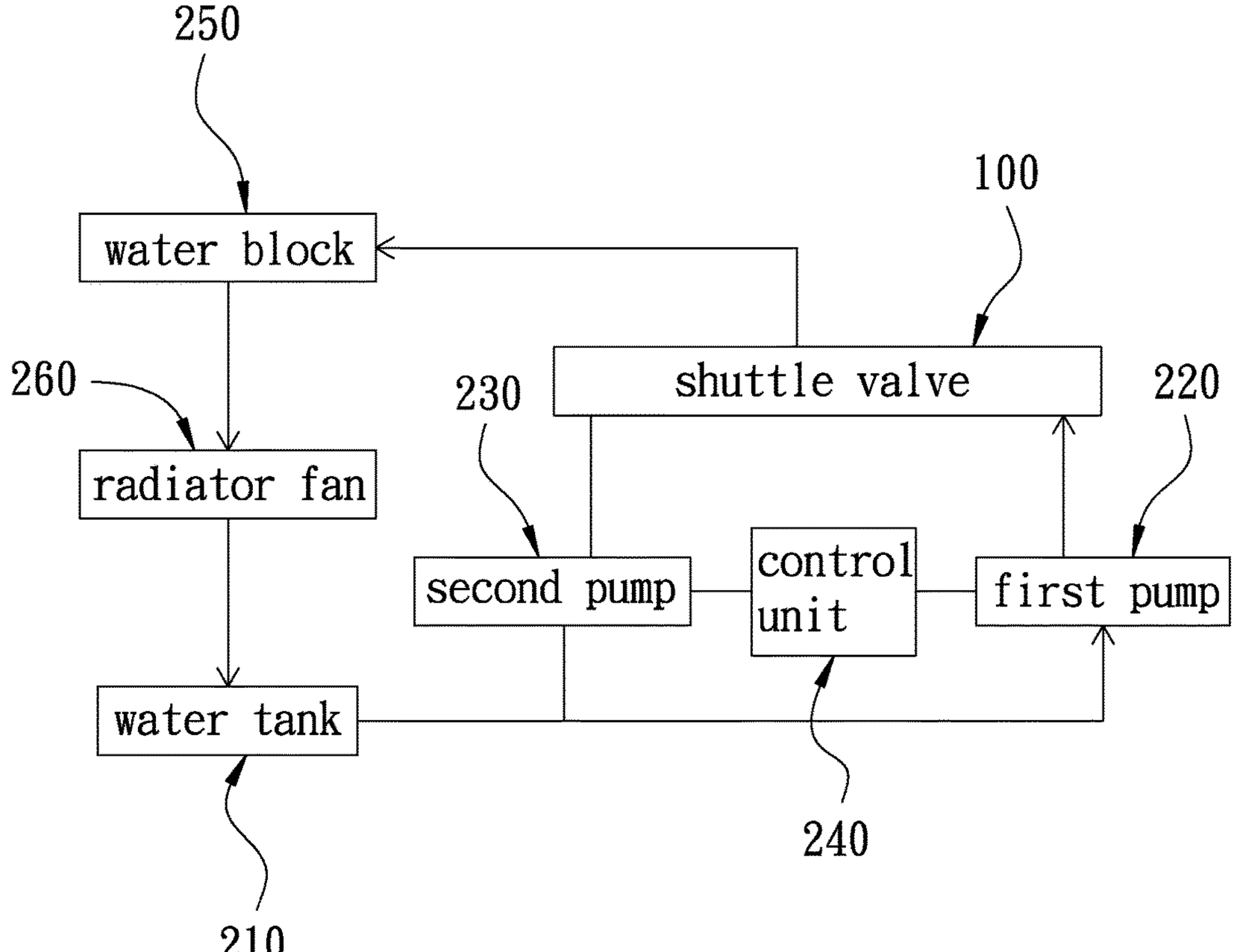

250
water block
100
260
shuttle valve
230
220
radiator fan
second pump
control unit
first pump
water tank
240
210

FIG. 5

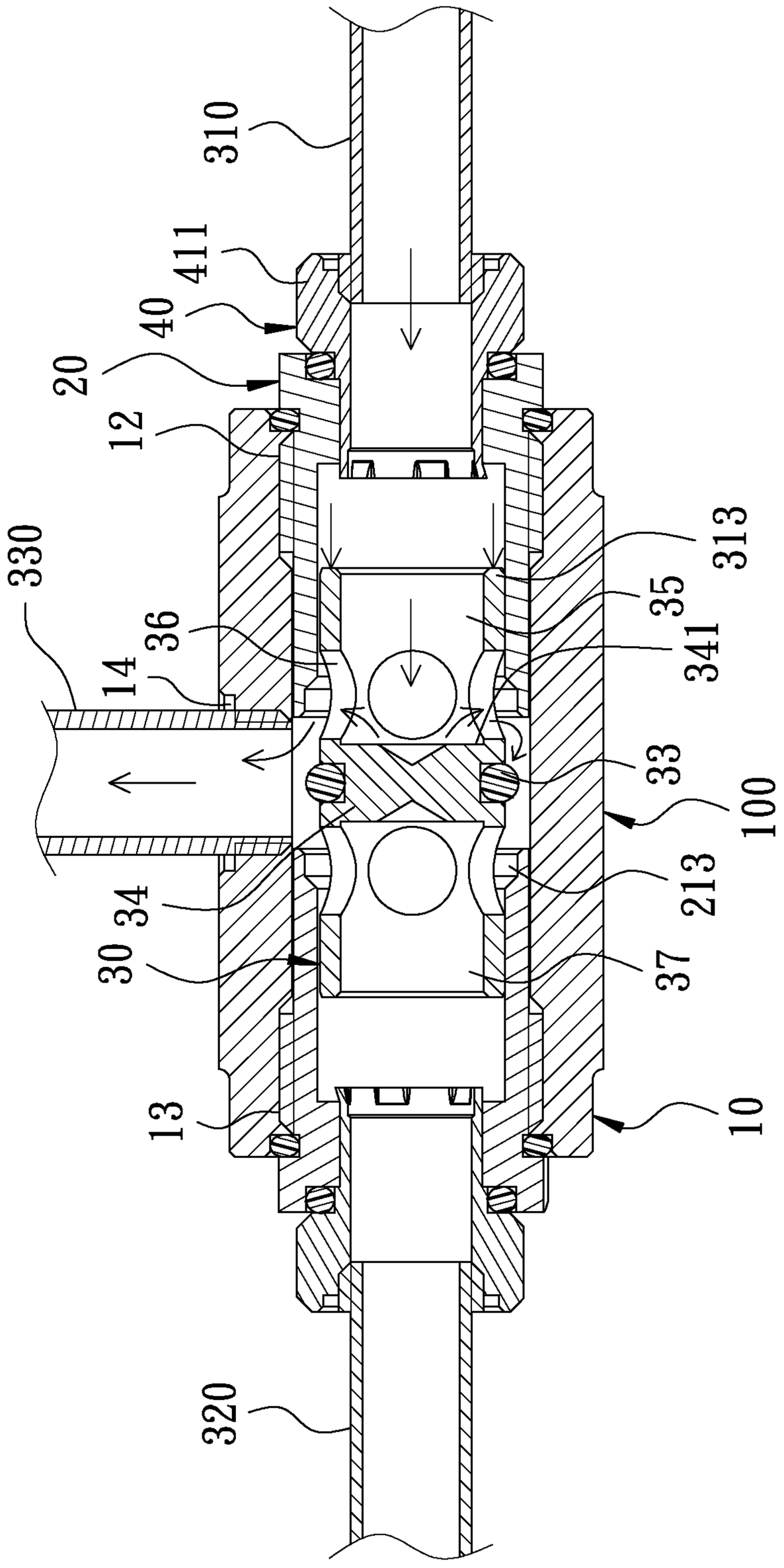
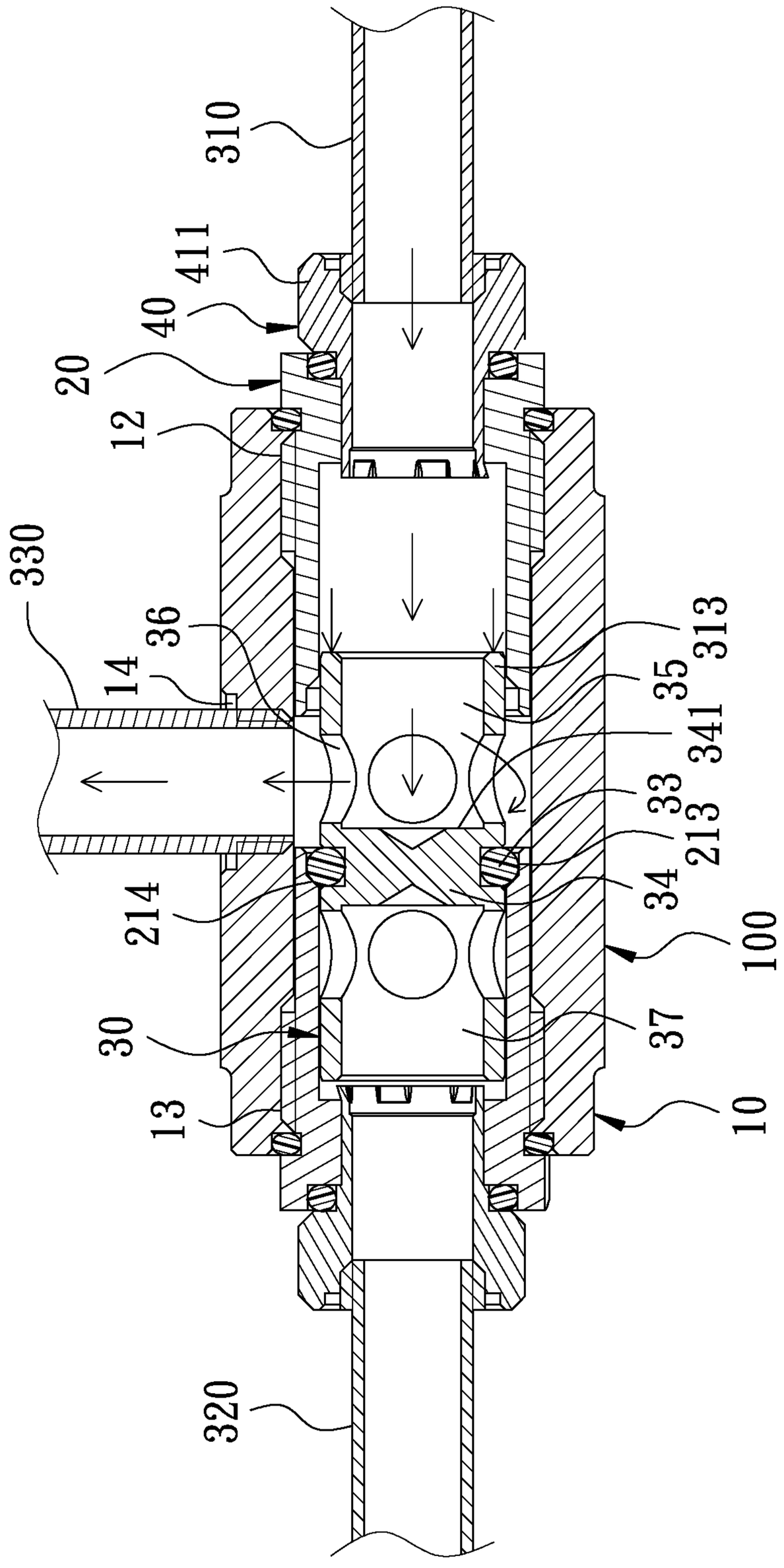


FIG. 6


310
411
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12
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36
14
313
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341
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213
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214
100
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37
13
10
320

FIG. 7

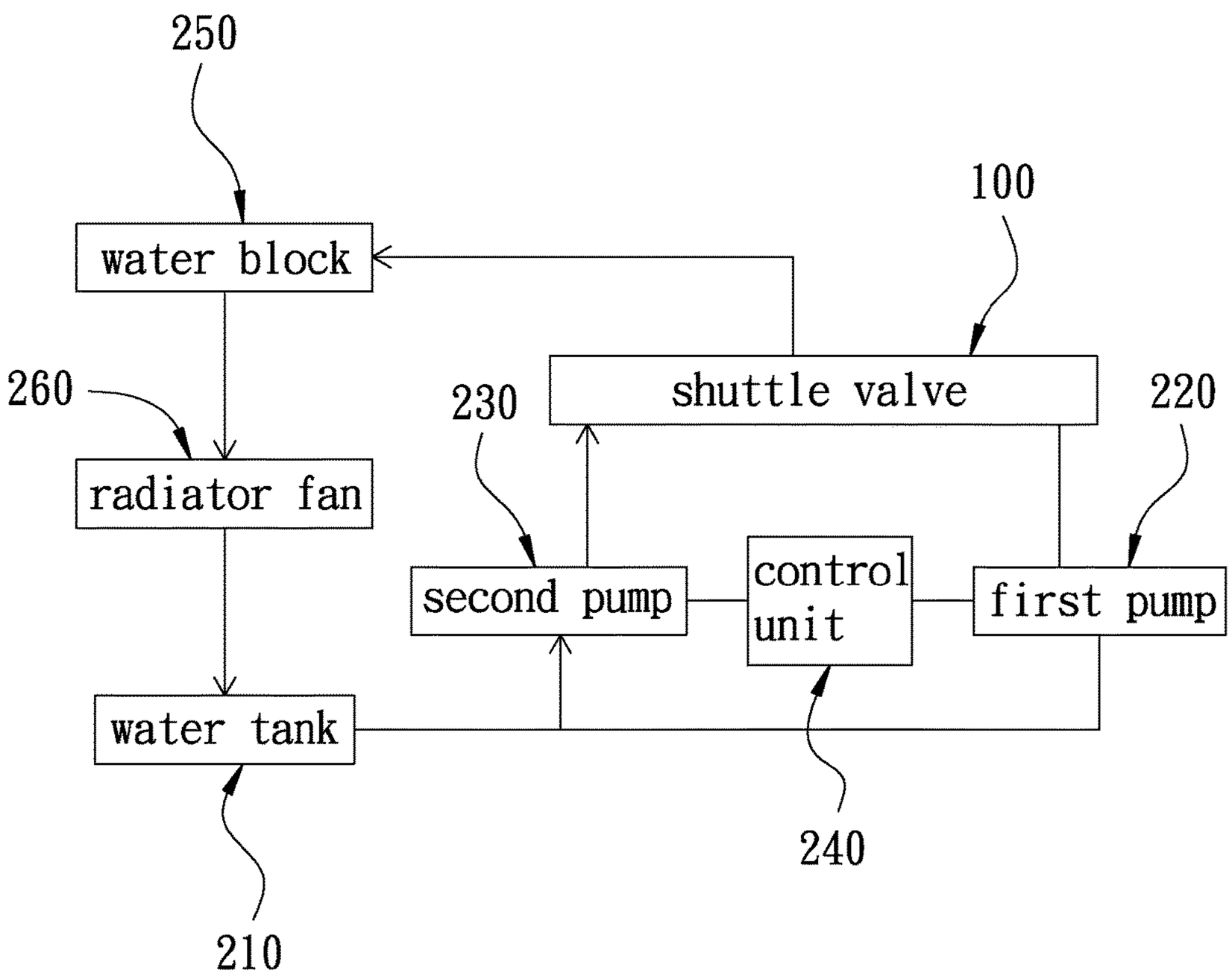
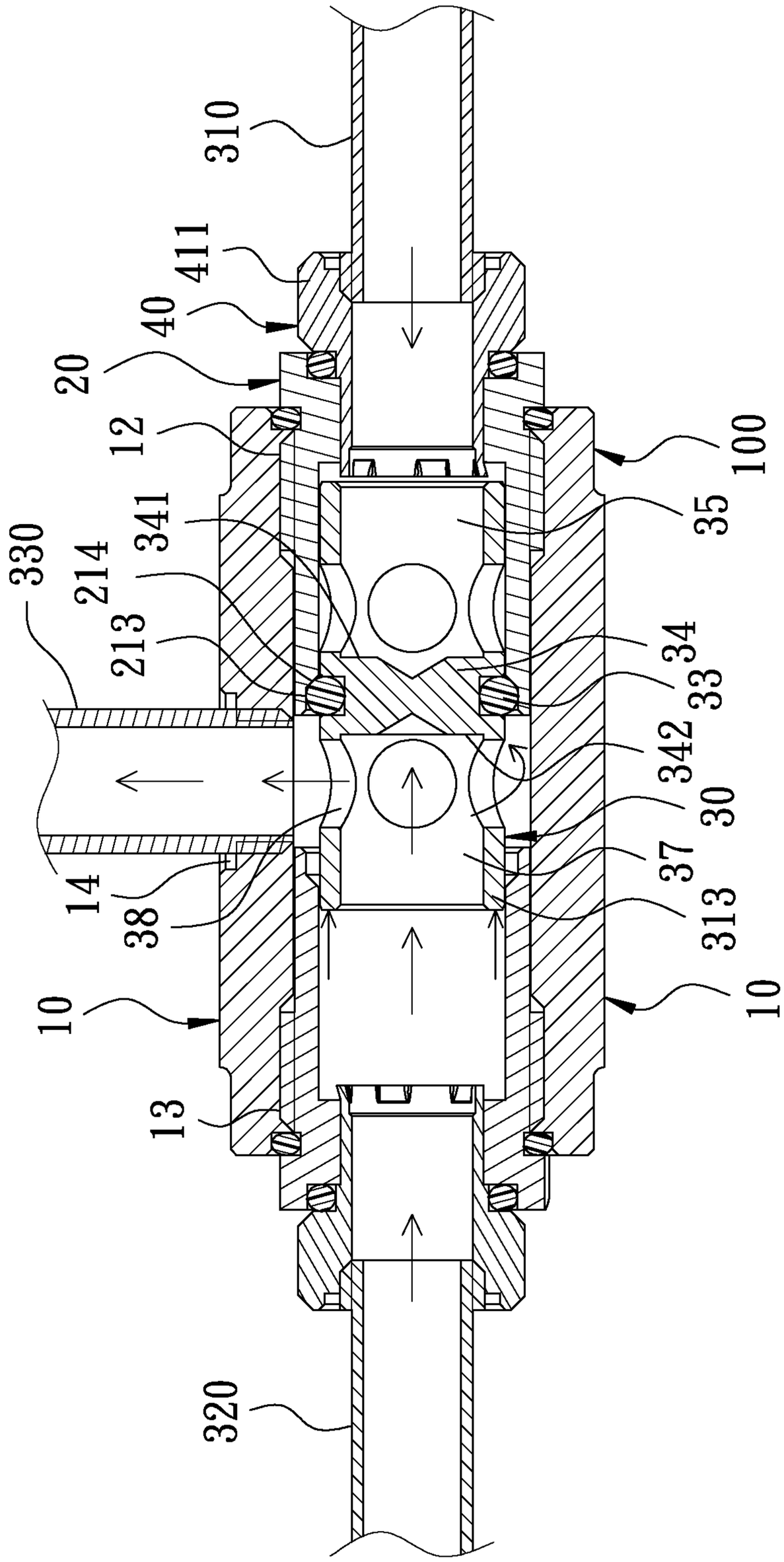

250
water block
100
260
shuttle valve
230
220
radiator fan
second pump
control unit
first pump
water tank
240
210

FIG. 8


310
411
40
20
12
330
214
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341
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100
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313
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38
10
13
320

FIG. 9

WATER COOLING DEVICE CAPABLE OF SWITCHING PUMP LOOP

FIELD OF THE INVENTION

[0001] The present invention relates to a heat dissipation device, and more particularly to a water cooling device capable of switching a pump loop and running continuously.

BACKGROUND OF THE INVENTION

[0002] Most industrial computers, server computers, and heat-dissipating components are running all day long. The server of the computer generates high heat during operation. Although the computer is installed with a cooling fan, the heat form the computer equipment is continuously generated, and the air convection function of the cooling fan is poor, so the heat dissipation effect is limited. Therefore, in order to effectively reduce the temperature, there is a water cooling device developed by the industry. The water cooling device is installed on the heating element of the electronic device. The continuous circulation of the liquid coolant is used to adjust the operating temperature of the computer server.

[0003] However, the conventional water cooling device has a deficiency. Since the conventional water cooling device uses a solenoid valve to prevent the reverse flow of the liquid coolant, the electromagnetic valve is prone to malfunction if it is in a long-term wet state. The water cooling system may be interrupted, which affects the operation of the computer and interrupts the work. Accordingly, the inventor of the present invention has devoted himself based on his many years of practical experiences to solve these problems.

SUMMARY OF THE INVENTION

[0004] The primary object of the present invention is to provide a water cooling device capable of switching a pump loop. The check valve can switch the pump loop, without power consumption, and can maintain the heat dissipation performance all year round.

[0005] In order to achieve the aforesaid object, a water cooling device capable of switching a pump loop is provided. The water cooling device comprises a water tank, a first pump, a second pump, a control unit, a shuttle valve, a water block, a radiator fan, a first loop, and a second loop. The water tank has a liquid coolant therein. The first pump has a water inlet connected with a water outlet of the water tank. The second pump has a water inlet connected with the water outlet of the water tank. The control unit is electrically connected to the first pump and the second pump, respectively. The shuttle valve has a main body. The main body has a chamber therein. The chamber includes a first axial hole, a second axial hole and an output hole communicating with one another. The first axial hole is connected with the first pump. The second axial hole is connected with the second pump. The chamber is provided with a check valve. The check valve is movable in the chamber and defines a first position and a second position. When the check valve is in the first position, the first axial hole communicates with the output hole, and the second axial hole doesn't communicate with the first axial hole and the output hole. When the check valve is in the second position, the second axial hole communicates with the output hole, and the first axial hole doesn't communicate with the second axial hole and the output hole. The water block is connected to the output hole of the shuttle valve. The radiator fan has a first end connected to the water block and a second end connected to the water tank. When the check valve is in the first position, the water tank, the first pump, the first axial hole of the shuttle valve, the output hole of the shuttle valve, the water block and the radiator fan communicate with one another to form the first loop. When the check valve is in the second position, the water tank, the second pump, the second axial hole of the shuttle valve, the output hole of the shuttle valve, the water block and the radiator fan communicate with one another to form the second loop.

[0006] In the water cooling device capable of switching a pump loop provided by the present invention, the liquid coolant is sent by the first pump or the second pump. The shuttle valve can be moved to the first position or the second position, so that the liquid coolant can flow into the chamber from the first axial hole or the second axial hole and then flow out from the output hole. The shuttle check does not consume power, but also can achieve the non-return function. Then, the liquid coolant flows into a water block to cool a load. After that, the liquid coolant flows to the radiator fan for heat dissipation and then flows to the water tank for circulation, achieving the effect of bidirectionally switching the pump loop. The water cooling device can continue to operate without stopping.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** is a configuration diagram of the system of the present invention;

[0008] FIG. **2** is a perspective view of the shuttle valve of the present invention;

[0009] FIG. **3** is an exploded view of the shuttle valve of the present invention;

[0010] FIG. **4** is a sectional view of the shuttle valve of the present invention;

[0011] FIG. **5** is a block diagram of the system of the present invention, showing the connection of the first loop;

[0012] FIG. **6** is a schematic view of the present invention when in use, showing the liquid coolant flowing into the chamber;

[0013] FIG. **7** is a schematic view of the present invention when in use, showing the liquid coolant flowing into the first axial hole;

[0014] FIG. **8** is a block diagram of the system of the present invention, showing the connection of the second loop; and

[0015] FIG. **9** is a schematic view of the present invention when in use, showing the liquid coolant flowing into the second axial hole.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings.

[0017] FIG. **1** is a configuration diagram of the system of the present invention. The present invention discloses a water cooling device **200** capable of switching a pump loop, and comprises a water tank **210**, a first pump **220**, a second pump **230**, a control unit **240**, a shuttle valve **100**, a water block **250**, a radiator fan **260**, a first loop, and a second loop.

[0018] The water tank **210** is provided with a liquid coolant.

[0019] The first pump **220** has a water inlet **225** connected with a water outlet **215** of the water tank **210**.

[0020] The second pump **230** has a water inlet **235** connected with the water outlet **215** of the water tank **210**.

[0021] The control unit **240** is electrically connected to the first pump **220** and the second pump **230**, respectively.

[0022] The shuttle valve **100**, referring to FIGS. **2-4**, comprises a main body **10**.

[0023] The main body **10** has a chamber **11** therein. The chamber **11** includes a first axial hole **12**, a second axial hole **13**, and an output hole **14** communicating with one another. The first axial hole **12** and the second axial hole **13** are disposed at two opposite sides of the main body **10**, respectively. The central axes of the first axial hole **12** and the second axial hole **13** are located at a same axis **101**. The first axial hole **12**, the second axial hole **13** and the output hole **14** are provided with internal threads **121**, **131**, **141**, respectively. Each of the first axial hole **12** and the second axial hole **13** is threadedly connected with a positioning plug **20**. The positioning plug **20** has a first end **201**, a second end **202**, and a through hole **21** between the first end **201** and the second end **202**. The outer wall of the positioning plug **20** is provided with a stopper **22** at the first end **201**. The stopper **22** has an outer diameter greater than respective inner diameters of the first axial hole **12** and the second axial hole **13**, so that the stopper **22** can respectively block the first axial hole **12** and the second axial hole **13**. The outer wall of the positioning plug **20** is provided with a groove **23** beside the stopper **22**. The groove **23** is provided with a sealing ring **24**. The outer wall of the positioning plug **20** is provided with an external thread **231** beside the groove **23** so that the positioning plug **20** can be screwed with the internal threads **121**, **131** of the first axial hole **12** and the second axial hole **13**. The through hole **21** is provided with a stop section **211** at the first end **201**. The stop section **211** has an inner diameter greater than that of the through hole **21**. The through hole **21** is provided with a limit section **212** beside the stop section **211**. The limit section **212** has an inner diameter less than that of the through hole **21**. The through hole **21** is provided with a positioning section **213** at the second end **202**. The positioning sections **213** of the positioning plugs **20** are spaced from each other. The positioning section **213** has an inner diameter greater than that of the through hole **21**. An enlarged section **214** is provided between the positioning section **213** and the through hole **21**. The enlarged section **214** has an inner diameter that gradually increases toward the second end **202**. In addition, the chamber **11** is provided with a check valve **30**. The check valve **30** is disposed between the through holes **21**. The check valve **30** has a shuttle member **31**. Two ends of the shuttle member **31** have a first opening **311** and a second opening **312** corresponding to the first axial hole **12** and the second axial hole **13**. The first opening **311** and the second opening **312** of the shuttle member **31** are provided with damping members **313**. In this embodiment, the damping members **313** are end faces at the two ends of the check valve **30**. The size of the damping members **313** can be increased by reducing the inner diameters of the first opening **311** and the second opening **312** so as to increase the damping value. The shuttle member **31** is provided with an annular groove **32** on an outer wall of a middle portion thereof. The annular groove **32** is sleeved with a positioning ring **33**. The shuttle member **31** is provided with a baffle **34** perpendicular to the axis **101**. The baffle **34** has a first surface **341** and a second surface **342** corresponding to the first axial hole **12** and the second axial hole **13**, respectively. The first surface **341** and the second surface **342** are respectively recessed with a conical groove **343**. The check valve **30** has a first passage **35** and three first perforations **36** communicating with the first opening **311** and disposed between the first opening **311** and the first surface **341**. The first passage **35** communicates with the output hole **14**. The check valve **30** has a second passage **37** and three second perforations **38** communicating with the second opening **312** and disposed between the second opening **312** and the second surface **342**. The second passage **37** communicates with the output hole **14**. The check valve **30** is movable in the chamber **11** and defines a first position and a second position. When the check valve **30** is in the first position, the positioning ring **33** is positioned at the positioning section **213** of the second axial hole **13**, the baffle **34** closes the second passage **37**, and the first axial hole **12**, the first passage **35** and the output hole **14** communicate with one another. When the check valve **30** is in the second position, the positioning ring **33** is positioned at the positioning section **213** of the first axial hole **12**, the baffle **34** closes the first passage **35**, and the second axial hole **13**, the second passage **37** and the output hole **14** communicate with one another. In addition, the positioning plug **20** is provided with a rotary joint **40**. The rotary joint **40** has a first end **41**, a second end **42**, and a perforation hole **43** between the first end **41** and the second end **42**. The first end **41** of the rotary joint **40** is formed with a screw head **411** extending radially outwardly. The screw head **411** protrudes out of the through hole **21** of the positioning plug **20**. The screw heads **411** of the positioning plugs **20** are threadedly connected with a first connecting pipe **310** and a second connecting pipe **320**, respectively. The other end of the first connecting pipe **310** is connected to the first pump **220**, and the other end of the second connecting pipe **320** is connected to the second pump **230**. The perforation hole **43** is provided with an internal thread **431** at the first end **41**. The rotary joint **40** is further provided with a stop ring **44**. The stop ring **44** is accommodated in the stop section **211**. The stop ring **44** is interposed between the screw head **411** and the stop member **22**. The second end **42** of the rotary joint **44** is located at the limit section **212**. An outer wall of the second end **42** is provided with a plurality of spaced protrusions **421**. The protrusions **421** of the rotary joint **40** pass through the limit section **212** and are engaged with the through hole **21** so that the rotary joint **40** can be rotated in the limit section **212**.

[0024] The water block **250** is connected to the output hole **14** through a third connecting pipe **330**.

[0025] The radiator fan **260** has a first end **261** connected to the water block **250** and a second end **262** connected to the water tank **210**.

[0026] When the check valve **30** is in the first position, the water tank **210**, the first pump **220**, the first axial hole **12** of the shuttle valve **100**, the output hole **14** of the shuttle valve **100**, the water block **250** and the radiator fan **260** communicate with one another to form the first loop.

[0027] When the check valve **30** is in the second position, the water tank **210**, the second pump **230**, the second axial hole **13** of the shuttle valve **100**, the output hole **14** of the shuttle valve **100**, the water block **250** and the radiator fan **260** communicate with one another to form the second loop.

[0028] Firstly, the first pump **220** is turned on by the control unit **240**. Please refer to FIG. **5**, FIG. **6** and FIG. **7**, when the first pump **220** is started, the liquid coolant flows from the first pump **220** to the shuttle valve **100**. The liquid coolant pushes the baffle **34** of the check valve **30**, and the positioning ring **33** is positioned at the positioning section **213** of the second axial hole **13**, so that the check valve **30** is located in the first position. Because the inner diameter of the enlarged section **214** is less than the outer diameter of the positioning ring **33**, the check valve **30** cannot be moved further. At this time, the baffle **34** closes the second passage **37**. The liquid coolant flows in from the first axial hole **12** toward the first surface **341** and then flows through the first perforations **36** to the output hole **14**. Then, the liquid coolant flows to the water block **250** to lower the temperature of a load **400**. Finally, the liquid coolant flows to the radiator fan **260** to dissipate heat and then flows back to the water tank **210** to form the first loop.

[0029] Please refer to FIG. **8** and FIG. **9** again. When the control unit **240** closes the first pump **220** and activates the second pump **230**, the liquid coolant flows from the second pump **230** to the shuttle valve **100** to push the baffle **34** to move the check valve **30**, and the positioning ring **33** is positioned at the positioning section **213** of the first axial hole **12** so that the check valve **30** is in the second position. The baffle **34** closes the first passage **35**. The liquid coolant flows in from the second axial hole **13** toward the second surface **341** and then flows through the second perforations **38** to the output hole **14**. Then, the liquid coolant flows to the water block **250** to lower the temperature of the load **400**. Finally, the liquid coolant flows to the radiator fan **260** to dissipate heat and then flows back to the water tank **210** to form the second loop. Therefore, the shuttle valve **100** can achieve the non-return function without consuming power. When the first pump **220** or the second pump **230** malfunctions, the other pump can continue to operate to achieve the effect of bidirectionally switching the pump loop, so that the water cooling system requires no downtime and can operate without interruption to achieve the best cooling effect.

[0030] When the liquid coolant passes through the first surface **341** or the second surface **342**, it may flow along the slope of the conical groove **343** in the direction of the first perforations **36** or the second perforations **38**, thereby reducing the turbulence phenomenon and increasing the flow velocity and flow rate of the liquid coolant.

[0031] The protrusions **421** of the rotary joint **40** pass through the limit section **212** and are engaged with the through hole **21**, so that the rotary joint **40** can be rotated at the limit section **212** to adjust the position of the rotary joint **40** corresponding to the angle of the first connecting pipe **310** and the second connecting pipe **320**.

[0032] Although particular embodiments of the present invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the present invention. Accordingly, the present invention is not to be limited except as by the appended claims.

What is claimed is:

1. A water cooling device capable of switching a pump loop, comprising:

a water tank, having a liquid coolant therein;

a first pump, having a water inlet connected with a water outlet of the water tank;

a second pump, having a water inlet connected with the water outlet of the water tank;

a control unit, being electrically connected to the first pump and the second pump, respectively;

a shuttle valve, having a main body, the main body having a chamber therein, the chamber including a first axial hole, a second axial hole and an output hole communicating with one another, the first axial hole being connected with the first pump, the second axial hole being connected with the second pump, the chamber being provided with a check valve, the check valve being movable in the chamber and defining a first position and a second position, wherein when the check valve is in the first position, the first axial hole communicates with the output hole, and the second axial hole doesn't communicate with the first axial hole and the output hole; wherein when the check valve is in the second position, the second axial hole communicates with the output hole, and the first axial hole doesn't communicate with the second axial hole and the output hole;

a water block, connected to the output hole of the shuttle valve;

a radiator fan, having a first end connected to the water block and a second end connected to the water tank;

a first loop, wherein when the check valve is in the first position, the water tank, the first pump, the first axial hole of the shuttle valve, the output hole of the shuttle valve, the water block and the radiator fan communicate with one another to form the first loop; and

a second loop, wherein when the check valve is in the second position, the water tank, the second pump, the second axial hole of the shuttle valve, the output hole of the shuttle valve, the water block and the radiator fan communicate with one another to form the second loop.

2. The water cooling device as claimed in claim **1**, wherein the check valve has a shuttle member, two ends of the shuttle member have a first opening and a second opening corresponding to the first axial hole and the second axial hole respectively, the shuttle member is provided with a baffle, the baffle has a first surface and a second surface corresponding to the first axial hole and the second axial hole respectively, each of the first surface and the second surface is recessed with a conical groove, the check valve has a first passage and at least one first perforation communicating with the first opening and disposed between the first opening and the first surface, the first passage communicates with the output hole, the check valve has a second passage and at least one second perforation communicating with the second opening and disposed between the second opening and the second surface, the second passage communicates with the output hole, the check valve has a length less than that of the main body, when the check valve is in the first position, the baffle closes the second passage, and the first axial hole, the first passage and the output hole communicate with one another; when the check valve is in the second position, the baffle closes the first passage, and the second axial hole, the second passage and the output hole communicate with one another.

3. The water cooling device as claimed in claim **2**, wherein the first axial hole and the second axial hole have internal threads respectively, each of the first axial hole and the second axial hole is threadedly connected with a positioning plug, the positioning plug has a first end, a second

end and a through hole between the first end and the second end, an outer wall of the positioning plug is provided with a stopper at the first end, the stopper has an outer diameter greater than inner diameters of the first axial hole and the second axial hole, so that the stopper can block the first axial hole and the second axial hole, the outer wall of the positioning plug is provided with a groove beside the stopper, the outer wall of the positioning plug is provided with an external thread beside the groove so that the positioning plug can be screwed with the internal threads of the first axial hole and the second axial hole, the groove is provided with a sealing ring, the through hole is provided with a stop section at the first end, the stop section has an inner diameter greater than that of the through hole, the through hole is provided with a limit section beside the stop section, the limit section has an inner diameter less than that of the through hole, the through hole is provided with a positioning section at the second end, the positioning section has an inner diameter greater than that of the through hole, an enlarged section is provided between the positioning section and the through hole, and the enlarged section has an inner diameter that gradually increases toward the second end.

4. The water cooling device as claimed in claim **3**, wherein the through hole of the positioning plug is provided with a rotary joint, the rotary joint has a first end, a second end and a perforation hole between the first end and the second end, the first end of the rotary joint is formed with a screw head extending radially outwardly, the screw head protrudes out of the through hole of the positioning plug, the perforation hole is provided with an internal thread at the first end, the rotary joint is provided with a stop ring, the stop ring is accommodated in the stop section, the stop ring is interposed between the screw head and the stop member, the second end of the rotary joint is located at the limit section, an outer wall of the second end is provided with a plurality of spaced protrusions, and the protrusions of the rotary joint pass through the limit section and are engaged with the through hole so that the rotary joint can be rotated in the limit section.

5. The water cooling device as claimed in claim **3**, wherein the shuttle member is provided with an annular groove, the annular groove is sleeved with a positioning ring, the positioning ring has an outer diameter less than the inner diameter of the positioning section, and the outer diameter of the positioning ring is greater than the inner diameter of the enlarged section.

6. The water cooling device as claimed in claim **2**, wherein the first opening and the second opening of the shuttle member are provided with damping members, the damping members are end faces of two ends of the check valve, the damping members can be increased in size by reducing inner diameters of the first opening and the second opening so as to increase their damping values.

7. The water cooling device as claimed in claim **2**, wherein the first axial hole and the second axial hole are disposed at two opposite sides of the main body respectively, central axes of the first axial hole and the second axial hole are located at a same axis, and the check valve is provided with the baffle perpendicular to the axis.

* * * * *