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- **ZOU, Yong**
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(54) **HYDRONIC HEATER AND VEHICLE**

(57) Provide is a vehicle, having a water heater. The water heater includes a plurality of water tanks (1) sequentially connected along a preset direction, each water tank (1) is provided with a water inlet passage (11), a water outlet passage (12) and a plurality of branch passages (13) communicated between the water inlet passage (11) and the water outlet passage (12), one of the water tanks (1) is further provided with a heater water inlet (14) and a heater water outlet (15); each water inlet passage (11) is communicated with the heater water inlet (14), and each water outlet passage (12) is communicated with the heater water outlet (15); and a heating assembly (2) is arranged between two adjacent water tanks (1).

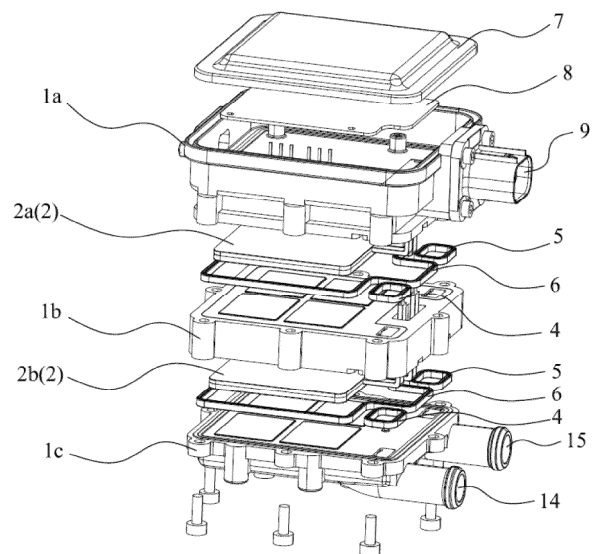


Fig. 2

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Description

[0001] The present application claims the benefit of Chinese Patent Application No. 202311604383.9, filed on November 28th, 2023, titled "Water heater and vehicle", the contents of which are incorporated herein by reference in their entirety.

Technical field

[0002] The application relates to a water heater and a vehicle.

Background

[0003] In the related art, the flow passage has a significant impact on the heat power of PTC (Positive Temperature Coefficient) water heaters, and the flow passage's construction influences the flow resistance and heat exchange capacity of the flow medium. When the heat exchange capacity is low, the heat emitted by the PTC heating element cannot be removed by the flow medium in time, increasing the resistance value of the PTC heating element and significantly reducing the heating power of the PTC water heater, affecting product performance and heat efficiency. And if the heat efficiency of the PTC water heater is low, it will consume more electricity of hybrid vehicles and electric vehicles, reducing the endurance mileage of hybrid vehicles and pure electric vehicles.

Summary of the invention

[0004] The present application provides a water heater and a vehicle, aiming at addressing the technical problem of low heat efficiency of the existing water heater.

[0005] In order to solve the above technical problems, in one aspect, an embodiment of the application provides a water heater, which includes:

a plurality of water tanks, and the plurality of water tanks are sequentially connected along a preset direction, each water tank is provided with a water inlet passage, a water outlet passage and a plurality of branch passages communicated between the water inlet passage and the water outlet passage, one of the water tanks is further provided with a heater water inlet and a heater water outlet; each water inlet passage is communicated with the heater water inlet, and each water outlet passage is communicated with the heater water outlet; and a heating assembly, and the heating assembly is arranged between two adjacent water tanks.

[0006] According to the water heater provided by the embodiment of the application, the flow medium enters the water heater from the heater water inlet, and is diverted to the water inlet passage of each water tank

in parallel. The flow medium flows to the water outlet passage after exchanging heat with the heating assembly in the branch passage, and finally converges to the heater water outlet and is discharged to the outside of the water heater. With the arrangement of a plurality of water tanks, the flow passages in the water heater are layered. Meanwhile, the branch passages are added to enable the layered flow passages and branch passage to be arranged in parallel. In this way, the flow rate of the medium fluid is moderated, the local temperature is kept from rising too high, the heat exchange effect is improved, and the heat efficiency is increased.

[0007] Optionally, the branch passages on the same water tank are arranged in parallel along a direction perpendicular to the preset direction.

[0008] Optionally, a water inlet sealing ring and a water outlet sealing ring are further arranged between two adjacent water tanks, the water inlet sealing ring is hermetically connected between the water inlet passages of two adjacent water tanks, and the water outlet sealing ring is hermetically connected between the water outlet passages of two adjacent water tanks.

[0009] Optionally, and a heating sealing element is further arranged between two adjacent water tanks, and the heating sealing element is used for sealing the heating assembly arranged between two adjacent water tanks.

[0010] Optionally, each water tank includes a bottom housing and a heat dissipation plate connected with the bottom housing, and the branch passage is arranged between the bottom housing and the heat dissipation plate; and

between two adjacent water tanks, the bottom housing of one water tank is connected with the heat dissipation plate of another water tank.

[0011] Optionally, there are three water tanks, defined as a first water tank, a second water tank and a third water tank along the preset direction; and

there are two heating assemblies, defined as a first heating assembly and a second heating assembly along the preset direction; and

the first heating assembly is arranged between the bottom housing of the first water tank and the heat dissipation plate of the second water tank, the second heating assembly is arranged between the bottom housing of the second water tank and the heat dissipation plate of the third water tank.

[0012] Optionally, the heater water inlet and the heater water outlet are arranged on the third water tank;

the water inlet passage and the water outlet passage on the first water tank are arranged through the bottom housing of the first water tank;

the water inlet passage and the water outlet passage on the second water tank are arranged through the heat dissipation plate and the bottom housing of the

second water tank; and
the water inlet passage and the water outlet passage
on the third water tank are arranged through the heat
dissipation plate of the third water tank.

[0013] Optionally, a side of the heat dissipation plate of the second water tank facing the first heating assembly is provided with a first protrusion, and the first protrusion abuts against the first heating assembly; and a side of the heat dissipation plate of the third water tank facing the second heating assembly is provided with a second protrusion, and the second protrusion abuts against the second heating assembly.

[0014] Optionally, the water heater further includes a cover plate and an electronic control assembly, the cover plate is connected with the heat dissipation plate of the first water tank and forms an installation space with the heat dissipation plate of the first water tank; the electronic control assembly is installed in the installation space, and the electronic control assembly is electrically connected with each heating assembly.

[0015] Optionally, the bottom housing and the heat dissipation plate of each water tank are connected by friction welding.

[0016] In another aspect, an embodiment of the present application provides a vehicle, including the water heater described above.

Brief description of drawings

[0017]

Fig. 1 is a schematic diagram of a water heater according to an embodiment of the present application.

Fig. 2 is an exploded diagram of Fig. 1.

Fig. 3 is a schematic diagram of the first water tank shown in Fig. 2.

Fig. 4 is a schematic diagram of the second water tank shown in Fig. 2.

Fig. 5 is a schematic diagram of the third water tank shown in Fig. 2.

Fig. 6 is a schematic diagram of the internal flow passage shown in Fig. 1.

[0018] The reference signs in the drawings are as follows.

1. Water tank; 1a. First water tank; 1b. Second water tank; 1c. Third water tank; 11. Water inlet passage; 12. Water outlet passage; 13. Branch passage; 14. Heater water inlet; 15. Heater water outlet; 16. Bottom housing; 17. Heat dissipation plate; 171. First protrusion; 172. Second protrusion; 18. Electrical channel;
2. Heating assembly; 2a. First heating assembly; 2b. Second heating assembly ;
3. Splitter plate;

4. Water inlet sealing ring;
5. Water outlet sealing ring;
6. Heating sealing element;
7. Cover plate;
8. Electronic control assembly;
9. High-voltage connector;
10. Low-voltage connector.

Detailed description of disclosed embodiments

[0019] In order to make the technical problems, technical solutions and beneficial effects of the present application more clear, the application will be further explained in detail below with reference to the drawings and embodiments. It should be understood that the specific embodiments described here are only used to illustrate the application, rather than to limit the application.

[0020] As shown in Fig. 1 to Fig. 6, the water heater provided by the embodiment of the application includes a plurality of water tanks 1 connected in sequence along a preset direction; each water tank 1 is provided with a water inlet passage 11, a water outlet passage 12 and a plurality of branch passage 13 communicating between the water inlet passage 11 and the water outlet passage 12, and one of the water tanks 1 is also provided with a heater water inlet 14 and a heater water outlet 15. Each water inlet passage 11 is communicated with the heater water inlet 14, and each water outlet passage 12 is communicated with the heater water outlet 15.

[0021] A heating assembly 2 is arranged between two adjacent water tanks 1.

[0022] According to the water heater provided by the embodiment of the application, the flow medium enters the water heater from the heater water inlet 14, and is diverted to the water inlet passage 11 of each water tank 1 in parallel. The flow medium flows to the water outlet passage 12 after exchanging heat with the heating assembly 2 in the branch passage 13, and finally converges to the heater water outlet 15 and is discharged to the outside of the water heater. With the arrangement of a plurality of water tanks 1, the flow passages in the water heater are layered. Meanwhile, the branch passages 13 are added to enable the layered flow passages and branch passage 13 to be arranged in parallel. In this way, the flow rate of the medium fluid is moderated, the local temperature is kept from rising too high, the heat exchange effect is improved, and the heat efficiency is increased.

[0023] In an embodiment, as shown in Fig. 6, the branch passage 13 on the same water tank 1 is arranged in parallel along the direction perpendicular to the preset direction. In the same water tank 1, two adjacent branch passages 13 are diverted by a splitter plate 3. The branch passage 13 in each water tank 1 introduces the flow medium in the water inlet passage 11 to the water outlet passage 12 in parallel, so that the flow medium is fully heated and the heating efficiency is improved.

[0024] Preferably, on the same water tank 1, the width

of each branch passage 13 is equal, and each branch passage is M-shaped, so that the flow rate is uniform and the flow resistance is reduced.

[0025] In the embodiment shown in Fig. 1 to Fig. 6, two branch passages 13 are arranged on the same water tank 1, and the two branch passages 13 are arranged in parallel, and the width of the two branch passages 13 are equal. In other embodiments, not shown in the figure, the number of the branch passages on the same water tank can also be set to anything other than 2, such as 3 or 4, and the number of the branch passages can be adjusted according to actual needs.

[0026] In an embodiment, as shown in Fig. 2, a water inlet sealing ring 4 and a water outlet sealing ring 5 are further arranged between two adjacent water tanks 1. The water inlet sealing ring 4 is hermetically connected between the water inlet passages 11 of two adjacent water tanks 1, and the water outlet sealing ring 5 is hermetically connected between the water outlet passages 12 of two adjacent water tanks 1.

[0027] By arranging the water inlet sealing ring 4 between adjacent water inlet passages 11, the flow medium in the water inlet passages 11 is prevented from overflowing from the joint of the water inlet passages 11. By arranging the water outlet sealing ring 5 between adjacent water outlet passages 12, the flow medium in the water outlet passages 12 is prevented from overflowing from the joint of the water outlet passages 12.

[0028] In an embodiment, as shown in Fig. 2, a heating sealing element 6 is further arranged between two adjacent water tanks 1, and the heating sealing element 6 is used for sealing the heating assembly 2 arranged between two adjacent water tanks 1. In this way, the flow medium does not come into touch with and damage the heating assembly 2, and that external dust does not pollute the heating assembly 2.

[0029] In an embodiment, the heating assembly 2 is a heating chip.

[0030] In an embodiment, as shown in Figs. 2 to 5, each water tank 1 includes a bottom housing 16 and a heat dissipation plate 17 connected with the bottom housing 16, and the branch passage 13 is arranged between the bottom housing 16 and the heat dissipation plate 17.

[0031] Between two adjacent water tanks 1, the bottom housing 16 of one water tank 1 is connected with the heat dissipation plate 17 of the other water tank 1, so that each heating assembly 2 can contact with one heat dissipation plate 17. This ensures the heat dissipation and cooling of each heating assembly 2, and avoids the overheating of each heating assembly 2.

[0032] In an embodiment, the bottom housing 16 and the heat dissipation plate 17 of each water tank 1 can be connected by friction welding to ensure the sealing structure of each water tank.

[0033] In a specific embodiment, as shown in Fig. 1 to Fig. 5, there may be three water tanks 1, namely a first water tank 1a, a second water tank 1b, and a third water tank 1c along the preset direction. The splitter plate 3 of

the first water tank 1a is arranged on the bottom housing 16 of the first water tank 1a, the splitter plate 3 of the second water tank 1b is arranged on the bottom housing 16 of the second water tank 1b, and the splitter plate 3 of the third water tank 1c is arranged on the heat dissipation plate 17 of the third water tank 1c.

[0034] There are two heating assemblies 2, and the two heating assemblies 2 are the first heating assembly 2a and the second heating assembly 2b along the preset direction.

[0035] The first heating assembly 2a is arranged between the bottom housing 16 of the first water tank 1a and the heat dissipation plate 17 of the second water tank 1b, the second heating assembly 2b is arranged between the bottom housing 16 of the second water tank 1b and the heat dissipation plate 17 of the third water tank 1c.

[0036] Specifically, the first water tank 1a, the second water tank 1b and the third water tank 1c can be connected by screws. This connection method allows the first heating assembly 2a and the second heating assembly 2b to be pressed to achieve the heating purpose.

[0037] Further, as shown in Figs. 1 to 5, the heater water inlet 14 and the heater water outlet 15 are arranged on the third water tank 1c.

[0038] The water inlet passage 11 and the water outlet passage 12 on the first water tank 1a are arranged through the bottom housing 16 of the first water tank 1a. The water inlet passage 11 and the water outlet passage 12 on the second water tank 1b are arranged through the heat dissipation plate 17 and the bottom housing 16 of the second water tank 1b. The water inlet passage 11 and the water outlet passage 12 on the third water tank 1c are arranged through the heat dissipation plate 17 of the third water tank 1c.

[0039] The flow medium flows into the water inlet passage 11 on the first water tank 1a through the heater water inlet 14, the water inlet passage 11 on the second water tank 1b and the water inlet passage 11 on the third water tank 1c. It then enters the first water tank 1a, the second water tank 1b and the third water tank 1c. After heat exchange, it passes through the water outlet passage 12 on the first water tank 1a, the water outlet passage 12 on the second water tank 1b, and the water outlet passage 12 on the third water tank 1c before converging to the heater water outlet 15 and finally flowing out of the heater water outlet 15. The first heating assembly 2a and the second heating assembly 2b heat the flow medium during the above circulation process.

[0040] In a specific embodiment, as shown in Figs. 4 and 5, the side of the heat dissipation plate 17 of the second water tank 1b facing the first heating assembly 2a is provided with a first protrusion 171. The first protrusion 171 improves the contact between the heat dissipation plate 17 of the second water tank 1b and the first heating assembly 2a, resulting in a higher heat transfer efficiency.

[0041] The side of the heat dissipation plate 17 of the third water tank 1c facing the second heating assembly 2b is provided with a second protrusion 172. The second

protrusion 172 improves the contact between the heat dissipation plate 17 of the third water tank 1c and the second heating assembly 2b, thereby increasing heat transfer efficiency.

[0042] Preferably, there are 4 first projections 171 arranged on the heat dissipation plate 17 of the second water tank 1b, and each first protrusion 171 is rectangular. There are 4 second projections 172 arranged on the heat dissipation plate 17 of the third water tank 1c, and each second protrusion 172 is rectangular.

[0043] In an embodiment, as shown in Fig. 1 and Fig. 2, the water heater further includes a cover plate 7 and an electronic control assembly 8, and the cover plate 7 is connected with the heat dissipation plate 17 of the first water tank 1a and forms an installation space with the heat dissipation plate 17 of the first water tank 1a. The electronic control assembly 8 is installed in the installation space, and the electronic control assembly 8 is electrically connected with each heating assembly 2 to turn it on or off, thus controlling the heating of each heating assembly 2.

[0044] In this state, the heat dissipation plates 17 of the 3 water tanks 1 will be used for heat dissipation of 1 electronic control assembly 8 and 2 heating assemblies 2.

[0045] In an embodiment, as shown in Fig. 2 to Fig. 6, in order to reduce the occupied space of the water heater and improve the space occupation rate, an electrical channel 18 for electrical connection may be arranged at the edge positions of the second water tank 1b and the third water tank 1c, so as to facilitate the electrical connection between the electronic control assembly 8 and each heating assembly 2.

[0046] In this state, the heating sealing element 6 may also be used to seal the electrical channel 18 to ensure the stability of electrical communication.

[0047] In an embodiment, as shown in Figs. 1 to 3, in order to realize the current supply and external communication of the electronic control assembly 8, the first housing 1a is further provided with a high-voltage connector 9 and a low-voltage connector 10. The high-voltage connector 9 is used for supplying current to the electronic control assembly 8, and the low-voltage connector 10 is used for external communication.

[0048] An embodiment of the application provides a vehicle, including the water heater described above.

[0049] It should be noted that while this water heater provided by the application can be applied to the PTC water heater field of vehicles, it is not restricted to that field.

[0050] The above are merely the preferred embodiments of this application, and are not intended to limit the application. Any modification, equivalent substitution and improvement made within the spirit and principle of this application shall be included in the protection scope of this application.

Claims

1. A water heater, comprising:

a plurality of water tanks (1), wherein the plurality of water tanks (1) are sequentially connected along a preset direction, each water tank (1) is provided with a water inlet passage (11), a water outlet passage (12) and a plurality of branch passages (13) communicated between the water inlet passage (11) and the water outlet passage (12), one of the water tanks (1) is further provided with a heater water inlet (14) and a heater water outlet (15); each water inlet passage (11) is communicated with the heater water inlet (14), and each water outlet passage (12) is communicated with the heater water outlet (15); and
a heating assembly (2), wherein the heating assembly (2) is arranged between two adjacent water tanks (1).

2. The water heater of claim 1, wherein the branch passages (13) on the same water tank (1) are arranged in parallel along a direction perpendicular to the preset direction.

3. The water heater of claim 1, wherein a water inlet sealing ring (4) and a water outlet sealing ring (5) are further arranged between two adjacent water tanks (1), the water inlet sealing ring (4) is hermetically connected between the water inlet passages (11) of two adjacent water tanks (1), and the water outlet sealing ring (5) is hermetically connected between the water outlet passages (12) of two adjacent water tanks (1).

4. The water heater of claim 1, wherein a heating sealing element (6) is further arranged between two adjacent water tanks (1), and the heating sealing element (6) is used for sealing the heating assembly (2) arranged between two adjacent water tanks (1).

5. The water heater of claim 1, wherein each water tank (1) comprises a bottom housing (16) and a heat dissipation plate (17) connected with the bottom housing (16), and the branch passage (13) is arranged between the bottom housing (16) and the heat dissipation plate (17); and
between two adjacent water tanks (1), the bottom housing (16) of one water tank (1) is connected with the heat dissipation plate (17) of another water tank (1).

6. The water heater of claim 5, wherein there are three water tanks (1), defined as a first water tank (1a), a second water tank (1b) and a third water tank (1c) along the preset direction; and

there are two heating assemblies (2), defined as a first heating assembly (2a) and a second heating assembly (2b) along the preset direction; and

the first heating assembly (2a) is arranged between the bottom housing (16) of the first water tank (1a) and the heat dissipation plate (17) of the second water tank (1b), the second heating assembly is arranged between the bottom housing (16) of the second water tank (1b) and the heat dissipation plate (17) of the third water tank (1c).

7. The water heater of claim 6, wherein the heater water inlet (14) and the heater water outlet (15) are arranged on the third water tank (1c);

the water inlet passage (11) and the water outlet passage (12) on the first water tank (1a) are arranged through the bottom housing (16) of the first water tank (1a);

the water inlet passage (11) and the water outlet passage (12) on the second water tank (1b) are arranged through the heat dissipation plate (17) and the bottom housing (16) of the second water tank (1b); and

the water inlet passage (11) and the water outlet passage (12) on the third water tank (1c) are arranged through the heat dissipation plate (17) of the third water tank (1c).

8. The water heater of claim 7, wherein a side of the heat dissipation plate (17) of the second water tank (1b) facing the first heating assembly (2a) is provided with a first protrusion (171), and the first protrusion (171) abuts against the first heating assembly (2a); and
a side of the heat dissipation plate (17) of the third water tank (1c) facing the second heating assembly (2b) is provided with a second protrusion (172), and the second protrusion (172) abuts against the second heating assembly (2b).

9. The water heater of claim 6, wherein the water heater further comprises a cover plate (7) and an electronic control assembly (8), the cover plate (7) is connected with the heat dissipation plate (17) of the first water tank (1a) and forms an installation space with the heat dissipation plate (17) of the first water tank (1a); the electronic control assembly (8) is installed in the installation space, and the electronic control assembly (8) is electrically connected with each heating assembly (2).

10. The water heater of claim 5, wherein the bottom housing (16) and the heat dissipation plate (17) of each water tank (1) are connected by friction welding.

11. A vehicle, comprising the water heater of any one of claims 1-10.

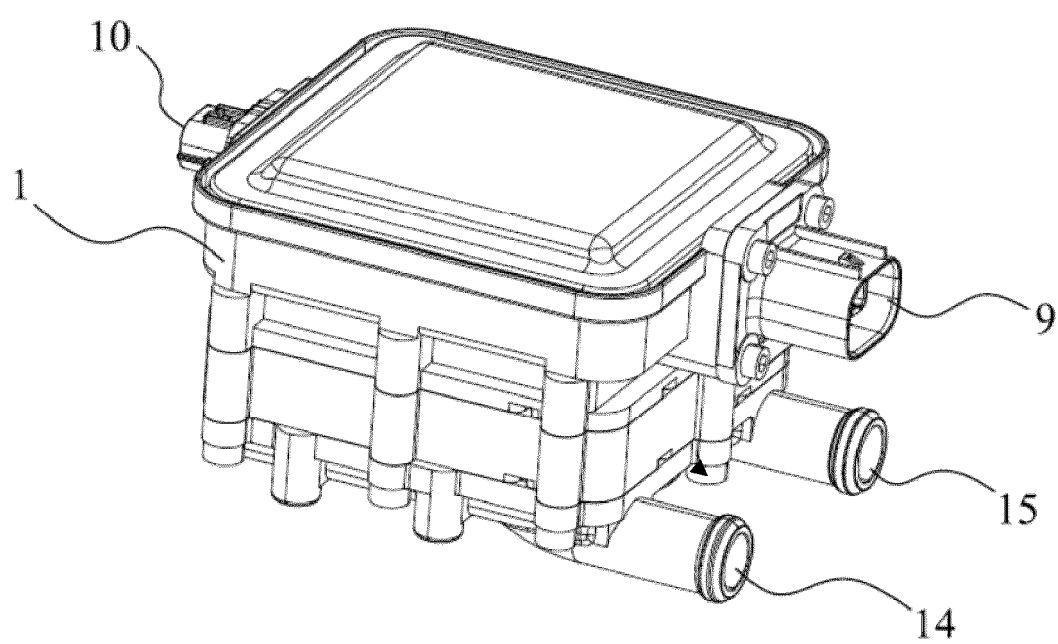


Fig. 1

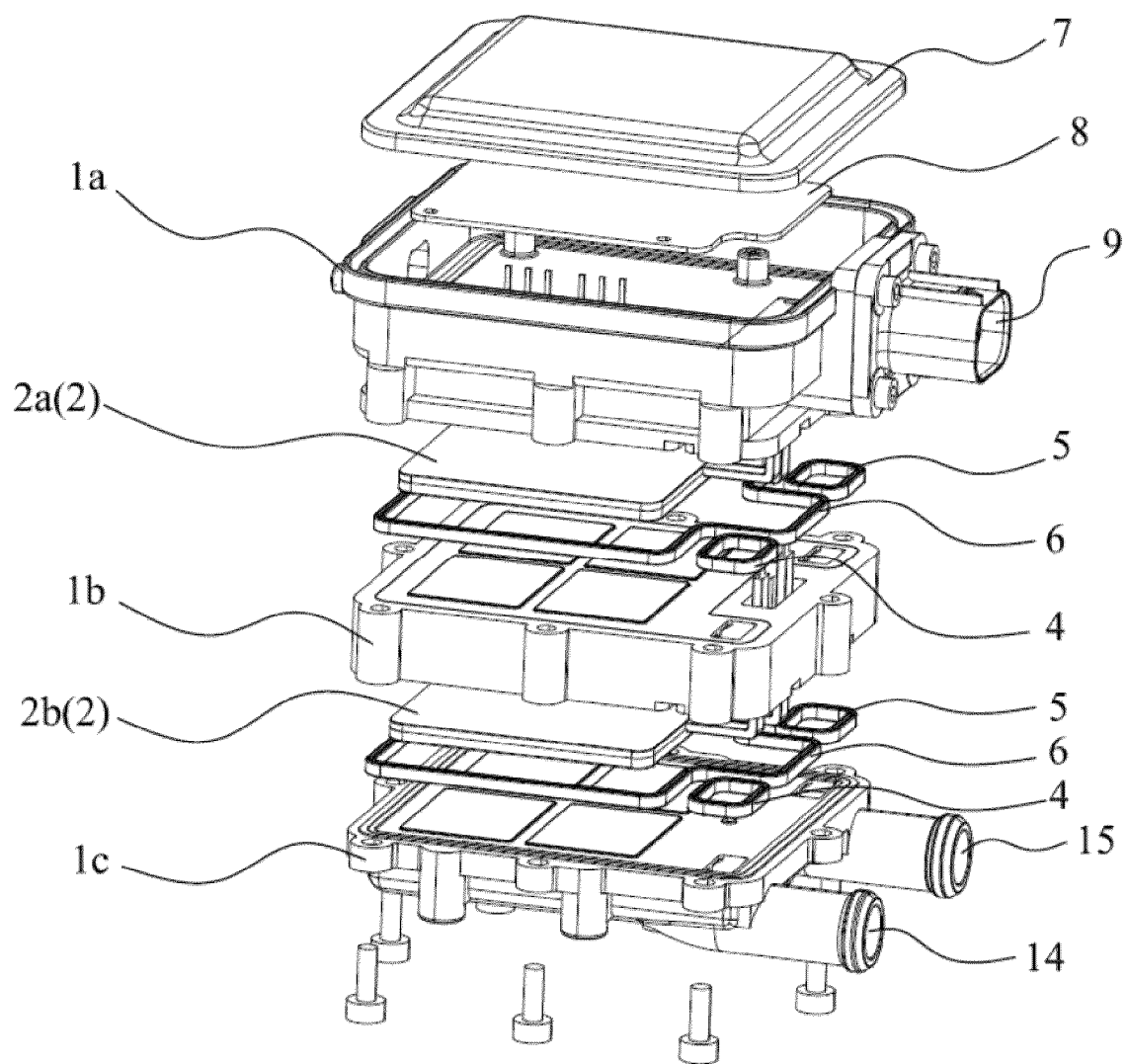


Fig. 2

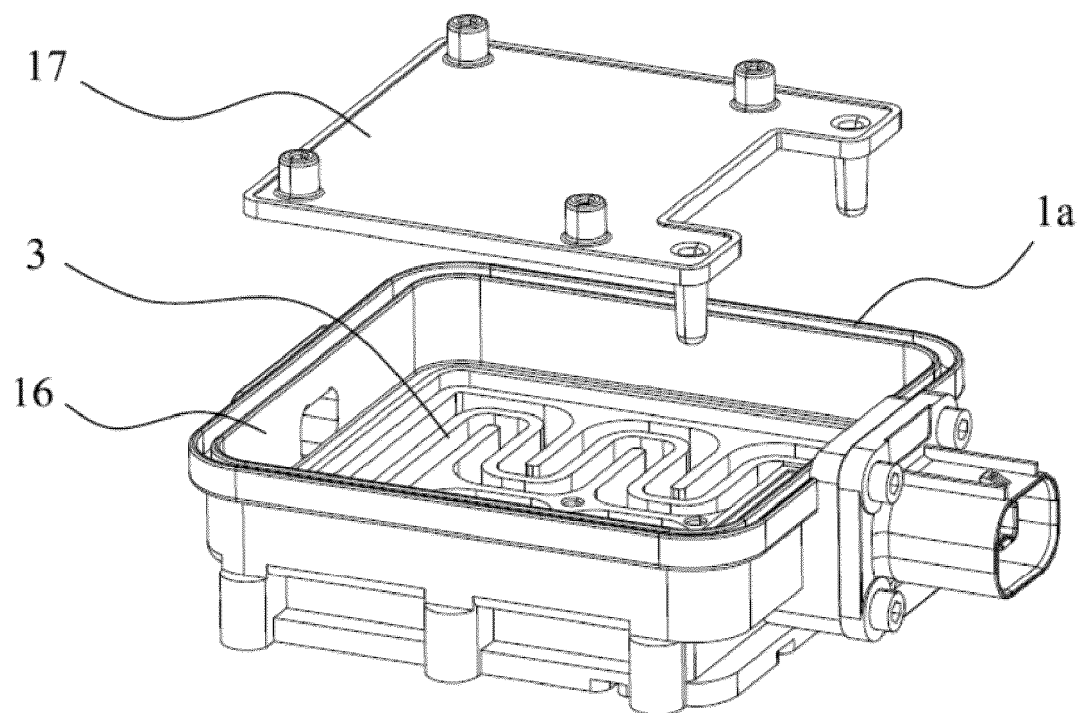


Fig. 3

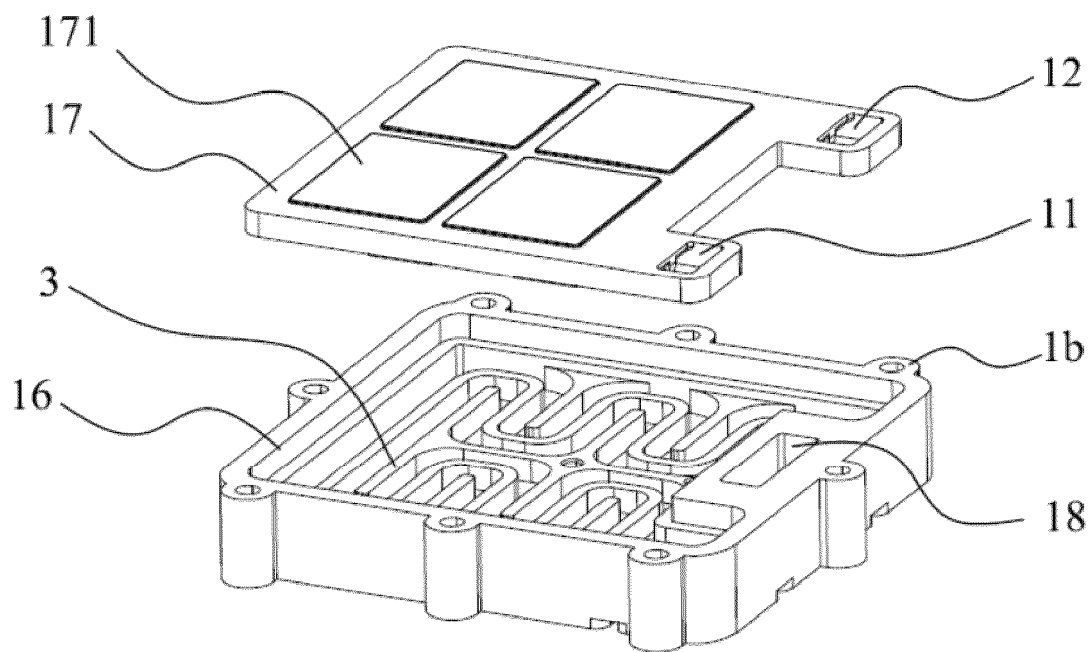


Fig. 4

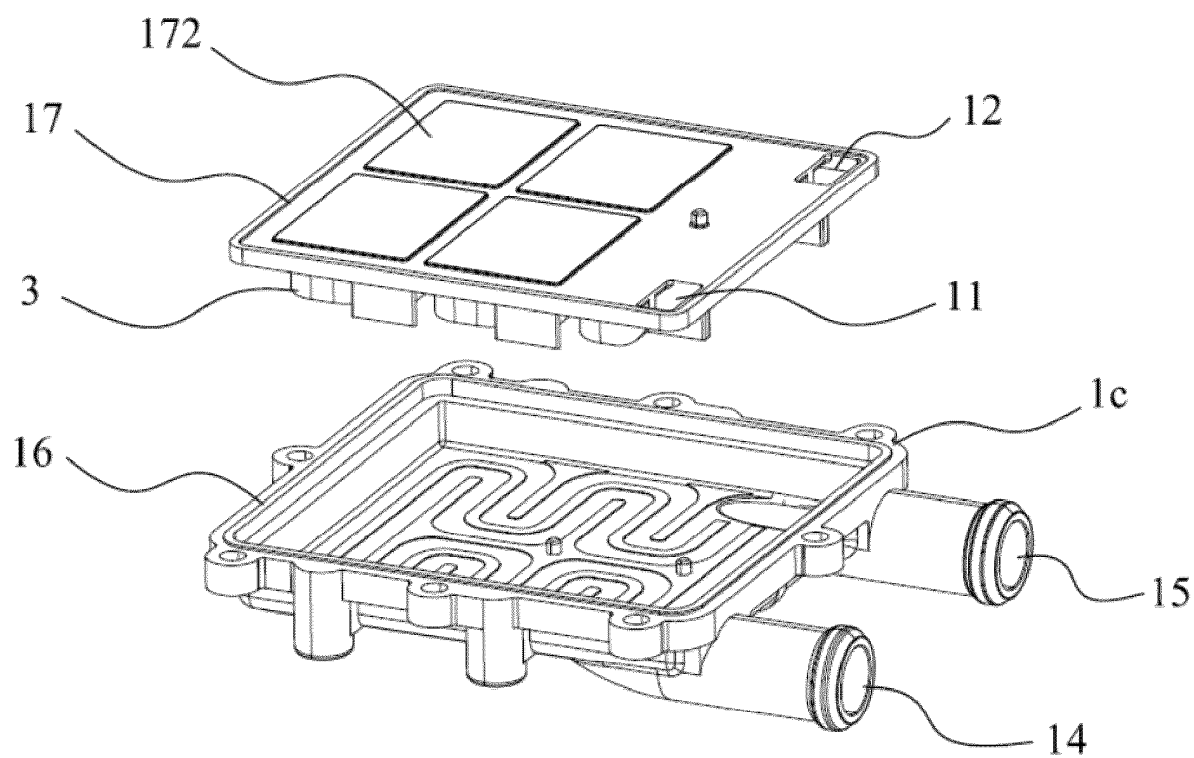


Fig. 5

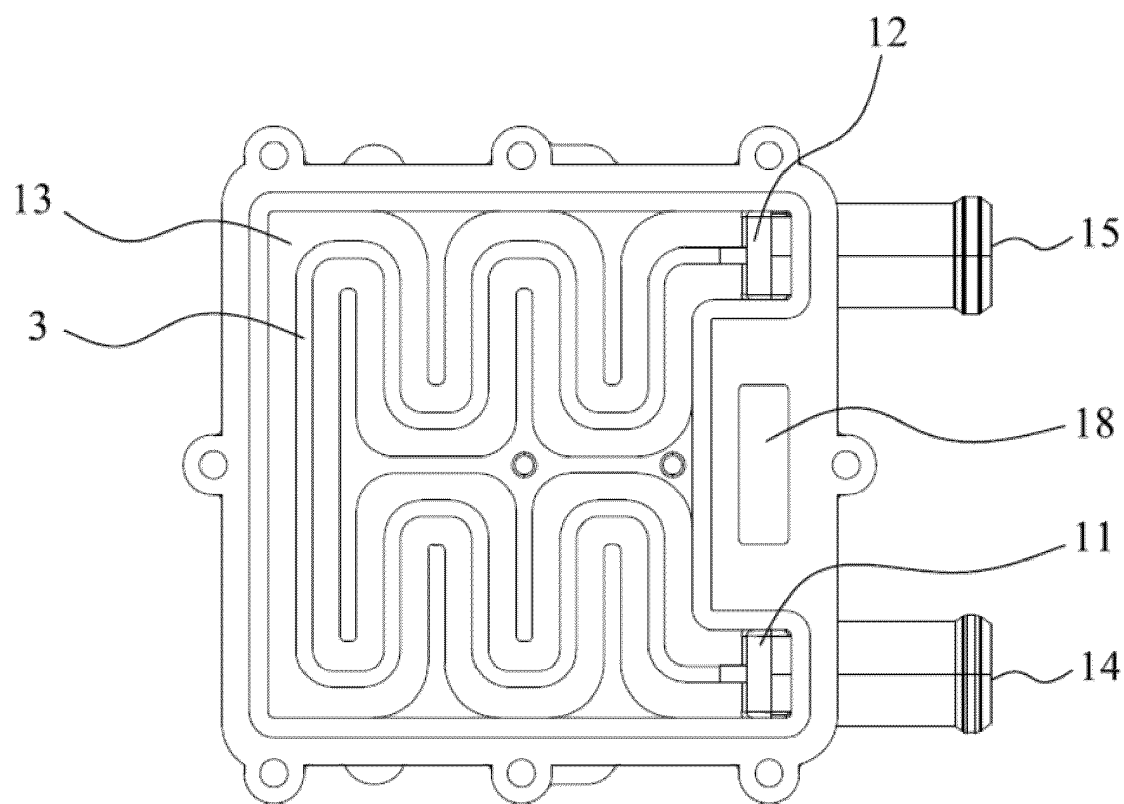


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/070518

A. CLASSIFICATION OF SUBJECT MATTER

F24H1/16(2022.01)i; F24H9/1818(2022.01)i; F24H9/13(2022.01)i; B60H1/22(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)

IPC: F24H, B60H

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)

CNTXT, ENTXTC, WPABSC, ENTXT, DWPL, CNKI: 车辆, 液, 水, 加热, 多层, 分层, 堆叠, 分支, 支流, 并联, 并连, PTC, vehicle, liquid, water, heat+, multi+, stack+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	CN 114992862 A (XIAOGAN HUAGONG GAOLI ELECTRON CO., LTD.) 02 September 2022 (2022-09-02) description, paragraphs [0029]-[0045], and figures 1-6	1-11
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A	CN 110887220 A (MAHLE INTERNATIONAL GMBH) 17 March 2020 (2020-03-17) entire document	1-11

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

* Special categories of cited documents:	"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
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Date of the actual completion of the international search 22 July 2024	Date of mailing of the international search report 31 July 2024
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2024/070518

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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

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