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(54) HEAT EXCHANGER AND GAS-LIQUID SEPARATOR

(57) A heat exchanger (1), comprising a container (11) and a heat exchange tube (12); the heat exchange tube (12) comprises a heat exchange main body portion (123) located in the container (11), at least one end portion of the heat exchange tube (12) is limited or fixedly connected to the container (11), and the end portion is provided with an assembly portion (121), the container (11) is provided with an insertion opening (111), at least a part of the end portion of the heat exchange tube (12) is inserted into the insertion opening (111), the container (11) comprises a locking portion (112), and the locking portion (112) is located on the peripheral wall of the insertion opening (111) of the container (11). The heat exchanger (1) further comprises a locking element (13), the locking element (13) and the heat exchange tube (12) are separately shaped, at least a part of the locking element (13) is located in the locking portion (112) and the assembly portion (121), and the heat exchange tube (12) is limited or fixedly connected to the container (11) by means of the locking element (13).

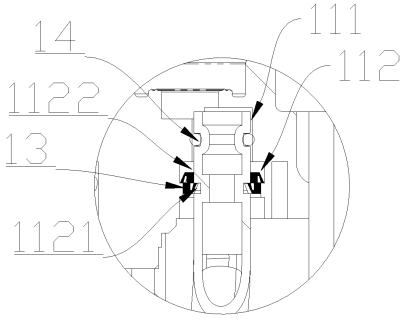

FIG. 2

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Description

[0001] This application claims the priority to Chinese Patent Application No. 202010473025.9, titled "HEAT EXCHANGER AND GAS-LIQUID SEPARATOR", filed with the China National Intellectual Property Administration on May 29, 2020, the entire disclosure of which is incorporated herein by reference.

FIELD

[0002] The present application relates to a heat exchanger applied in a vehicle thermal management system and a gas-liquid separator having the heat exchanger.

BACKGROUND

[0003] The heat exchanger includes a heat exchange tube and a container, and a high-pressure refrigerant flows through the inside of the heat exchange tube. There is a low-pressure refrigerant circulation around the outside of the heat exchange tube, and the high-pressure refrigerant releases some of its heat to the low-pressure refrigerant. In order to keep the low pressure refrigerant, the low pressure refrigerant is located between the container and the heat exchange tube. The heat exchange tube needs to pass through the container and connect with the refrigerant line of the circulation system. The heat exchange tube and the container cover must be assembled in a pressure-tight manner, which is complicated and difficult to seal when the pressure difference between the container spaces is large.

[0004] At present, the heat exchange tube and the container cover can be assembled by providing a connecting member on the heat exchange tube, and, the connecting member can bear the load in the axial direction and is connected and sealed with the container cover. From the point of view of the connecting member, the processing difficulty of the heat exchange tube is increased.

SUMMARY

[0005] An object of the present application is to design a heat exchanger and a gas-liquid separator having the heat exchanger, which can improve the tightness between the heat exchange tube and the container, and simplify the processing difficulty of the heat exchange tube.

[0006] The present application adopts following technical solution:

a heat exchanger includes a container and a heat exchange tube, and the heat exchange tube includes a heat exchange main body. The heat exchange main body of the heat exchange tube is located in the container, and at least one end of the heat exchange tube is connected to the container in a limited or fixed manner. The end has a fitting portion, the container has an insertion port. The end of the heat exchange tube is at least partially inserted into the insertion port. The container includes a locking portion located at a peripheral wall of the insertion port, and the heat exchanger further includes a locking element. The locking element and the heat exchange tube are formed separately. The locking element is at least partially located at the locking portion and the fitting portion. The heat exchange tube is connected to the container in a limited or fixed manner.

[0007] A gas-liquid separator is further disclosed according to the present application, which includes the above heat exchanger. The container includes a head and a shell, and the shell and the head are sealed and fixedly connected.

[0008] In the above technical solution, the heat exchanger includes a locking element. The end of the heat exchanger includes a fitting portion, and the locking element and the heat exchange tube are separately processed and formed. The processing difficulty of the locking element and the heat exchange tube is small, the container includes a locking portion and an insertion port, the locking portion is located at the peripheral wall of the insertion port. The locking element is at least partially located at the locking portion and the fitting portion, and the heat exchange tube is connected with the container in a limited or fixed manner, and the assembly is convenient. The whole heat exchanger has a simple structure and low production cost. The gas-liquid separator using the heat exchanger in the above scheme has good sealing performance and low production cost.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] In order for a clearer illustration of technical solutions in embodiments of the present disclosure or the conventional technology, drawings used in the description of the embodiments or the conventional technology are described briefly hereinafter. Apparently, the drawings described in the following illustrate some embodiments of the present disclosure, other drawings may be obtained by those ordinarily skilled in the art based on these drawings without any creative effort.

FIG. 1 is a schematic structural diagram of a heat exchanger provided by the present application;

FIG. 2 is the partial enlarged structural schematic diagram of part A shown in FIG. 1;

FIG. 3 is the structural schematic diagram of the container heat exchange tube joint in FIG. 2;

FIG. 4 is a partial cross-sectional structural schematic diagram of the heat exchange tube in FIG. 1;

FIG. 5 is a three-dimensional structure schematic diagram of the heat exchange tube in FIG. 1;

FIG. 6 is a top-view structural schematic diagram of an embodiment of the locking element in FIG. 2;

FIG. 7 is a schematic cross-sectional structure diagram of the locking element in the C-C direction in FIG. 6;

FIG. 8 is a schematic three-dimensional structure diagram of an embodiment of the locking element in FIG. 2;

FIG. 9 is a schematic cross-sectional structure diagram of a gas-liquid separator with a heat exchanger provided by the present application;

FIG. 10 is a schematic diagram of the working principle of the gas-liquid separator in FIG. 9.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0010] The embodiments are described below with reference to the accompanying drawings.

[0011] The thermal management system of the vehicle includes a gas-liquid separator. The gas-liquid separator is used to separate the liquid and gaseous components of the working medium in the thermal management system. The working medium is mainly a refrigerant, and the refrigerant includes a carbon dioxide refrigerant. In this application, the gas-liquid separator includes a heat exchanger, and the heat exchanger includes a heat exchange tube and a container. The high-pressure refrigerant inside the heat exchange tube may exchange heat with the low-pressure refrigerant located between the outside of the heat exchange tube and the inside of the container. Of course, the heat exchanger in the present application may also be used in the case of other heat exchange requirements or used alone.

[0012] In this embodiment, with reference to FIG. 1 to FIG. 9, the heat exchanger 1 includes a container 11 and a heat exchange tube 12. The heat exchange main body 123 of the heat exchange tube is located in the container 11, and at least one end of the heat exchange tube 12 is connected to the container 11 in a limited position. In this embodiment, the heat exchange tube and the container are in a locked connection, and at least one end of the heat exchange tube 12 includes a fitting portion 121. In this embodiment, both ends of the heat exchange tube are provided with fitting portions. The container 11 has an insertion port 111, the container 11 includes a locking portion 112. The locking portion 112 communicates with the insertion port 111, and the heat exchanger 1 further includes a locking element 13. The locking element 13 and the heat exchange tube 12 are formed separately, and the locking element 13 is located between the locking portion 112 and the fitting portion 121. In this embodiment, the heat exchange tube 12 and the container 11 restrict the relative position of the heat exchange tube and the container through the locking element 13. Of course, elements other than the locking element may also be added to limit or fix the position, or a direct fixed connection method can be used. The locking element can be fixed by welding wire, the heat exchange tube and the container, and the limit and fixing method are not limited.

[0013] The locking element 13 and the heat exchange tube 12 can be processed separately, and the processing difficulty is small. The locking element 13 is limited between the locking portion 112 and the fitting portion 121. After the heat exchange tube 12 is inserted into the insertion port 111, the heat exchange tube 12 and the container 11 are limited and locked by the locking element 13, and the assembly is safe, reliable and convenient. The heat exchanger of the present application has a simple structure and low production cost.

[0014] Referring to FIG. 2 and FIG. 4, in this embodiment, the fitting portion 121 further includes a high pressure sealing portion 122. In an axial direction of the fitting portion 121, the high pressure sealing portion 122 is farther from the heat exchange main body 123 of the heat exchange tube 12 than the locking element 13. The high pressure sealing portion 122 is in sealing connection with the container 11. The high pressure sealing portion 122 and the container 11 may be directly sealed by welding, or may be indirectly sealed by a sealing ring, and the fixing method is not limited.

[0015] Referring to FIG. 2, FIG. 4 and FIG. 5, in this embodiment, the high pressure sealing portion 122 is provided with a first groove 1221, and the heat exchanger further includes a sealing ring 14. The sealing ring 14 is placed in the first groove 1221, and the high pressure sealing portion 122 is sealedly connected with the container 11 through the sealing ring 14. The fitting portion 121 is provided with a second groove 1222, and the first groove 1211 is farther away from the heat exchange main body 123 of the heat exchange tube 12 than the second groove 1222. The locking element 13 is located in the second groove 1222, and the fitting portion 121 is engaged with the locking element 13. Here, the first groove and the second groove can be circular arc grooves, square grooves, etc., and the groove forms are not limited.

[0016] Referring to FIG. 6 and FIG. 7, in this embodiment, the locking element 13 includes an inner snap portion 131 and an outer snap portion 132. The inner snap portion includes a first mounting portion 1311, a first connecting portion 1312 and a first buckling portion 1313. The outer snap portion 132 includes a second mounting portion 1321, a second connecting portion 1322 and a second buckling portion 1323. The first connecting portion 1312 is connected with the second connecting portion 1322. The inner snap portion and the outer snap portion are integrally connected by the first connecting portion 1312 and the second connecting portion 1322. The first buckling portion 1313 abuts against the groove wall of the second groove 1222 of the fitting portion, and the second buckling portion 1323 abuts against the lock-

ing portion 112. A top surface of the first mounting portion 1311 abuts against the container, and a bottom surface of the first mounting portion is at least partially fixedly connected with a top surface of the second connecting portion. An outer side of the second connecting portion is at least partially fixedly connected with the first buckling portion 1313, so that a first rebound space 134 is formed among the first buckling portion 1313, the first connecting portion 1312 and the second connecting portion 1322. A bottom surface of the second buckling portion is in contact with the container. An inner side surface of the second connecting portion is at least partially fixedly connected with the second buckling portion, so that a second rebound space 135 is formed between the second buckling portion, the first connecting portion and the second connecting portion. The fastener is detachably connected with the container, so that the processing cost is low and the manufacturing is convenient.

[0017] Referring to FIG. 8, in this embodiment, the number of the inner snap portion 131 is at least one, the number of the outer snap portion 132 is at least one. One of the first buckling portion 1313 and the second buckling portion 1323 is located on the inner wall of the locking element 13, and the other one of the first buckling portion 1313 and the second buckling portion 1323 is located on the outer wall of the locking element 13. The inner snap portion 131 and the outer snap portion 132 are arranged inside and outside, and can be arranged in a one-to-one correspondence, and can also be arranged in a staggered position. Here, the inner snap portion 131 and the outer snap portion 132 are an integral structure that is annularly connected to each other, and the connection manner of the inner snap portion and the outer snap portion can also be in other forms, which is not limited.

[0018] In this embodiment, the container 11 includes a locking portion 112, and the container 11 has an insertion port 111. The end of the heat exchange tube 12 is at least partially inserted into the insertion port 111, the locking portion 112 is located at the peripheral wall of the insertion port 111. The locking portion 112 is used to accommodate the locking element 13, and the insertion port 111 is designed in a shape that is easy to assemble. Here, the form of the insertion port can be cylindrical insertion port or square insertion port, and the form of the insertion port is not limited.

[0019] Referring to FIG. 3, in this embodiment, the locking portion 112 is a placing groove, and the placing groove includes a first locking element placing groove 1121 and a second locking element placing groove 1122. A step 1123 is provided at the connection between the first locking element placing groove 1121 and the second locking element placing groove 1122. The first buckling portion 1323 is placed in the first locking element placing groove 1121, and the first buckling portion 1323 abuts against the groove wall of the second groove 1222 of the fitting portion 121. The second buckling portion 1323 is placed in the second locking element placing groove 1122, and the second buckling portion 1323 abuts against the step 1123. The side wall of the first connecting portion 1312 abuts against the inner wall of the first locking element placing groove 1121.

[0020] Referring to FIG. 9, in this embodiment, the gas-liquid separator 2 has the above-mentioned heat exchanger 1. The container includes a sealing head 21 and a shell 22, and the sealing head 21 and the shell 22 are sealed and fixedly connected. The sealing head 21 includes a first sealing head 211 and a second sealing head 212. The first sealing head 211 has a high-temperature and high-pressure liquid inlet 2112, the second sealing head 212 has a high-temperature and high-pressure liquid outlet 2122. The first sealing head 211 and the end of the heat exchange tube 12 are limited and clamped by the locking element 13". The second sealing head 212 and the end of the heat exchange tube are limited and clamped by the locking element 13". The high-temperature and high-pressure liquid inlet 2112 is communicated with one end of the heat exchange tube 12, and the high-temperature and high-pressure liquid outlet 2122 is communicated with the other end of the heat exchange tube 12. The shell 22 includes an outer shell 221 and an inner shell 222. The first sealing head 211 and the outer shell 221 are sealed and fixedly connected, the second sealing head 212 and the outer shell 221 are sealed and fixedly connected. An accommodating cavity 23 is formed between the shell 22 and the sealing head 21, and the accommodating cavity 23 includes a first cavity 231 and a second cavity 232. The first cavity 231 at least includes the part between the inner shell 222 and the outer shell 221, and the second cavity 232 at least includes the part between the sealing head 21 and the inner shell 222. The first cavity 231 and the second cavity 232 communicate with each other.

[0021] In this embodiment, the gas-liquid separator 2 further includes a gas-liquid separation device 24, and the gas-liquid separation device 24 is located in the first cavity 231. The gas-liquid separation device includes a screw 241, a deflector 242, a suction pipe assembly 243 and a fixing member 244. The first sealing head 211 and the inner shell 222 are fixedly connected by the fixing member 244, and the inner shell 222, the first sealing head 211 and the fixing member 244 form a first cavity 231. The first sealing head 211 is provided with an inlet 2111 for a working medium, where the working medium is a gas-liquid mixture, and the inlet 2111 communicates with the screw 241. The screw 241 is limited to the first sealing head 211, the outlet direction of the screw 241 is along the tangential direction of the side wall of the inner shell, and the screw 241 is at least partially arranged in the fixing member 244. The deflector 242 is located below the screw 241, and the suction pipe assembly 243 is used to output the gaseous working medium components out of the inner shell by means of pipe transport. One end of the suction pipe assembly 243 is limited to the first sealing head 211, and the other end of the suction pipe assembly 243 is freely set in the first cavity 231. The helical part of the screw 241 is at least partially in tight fit

with the suction pipe assembly 243 to limit the position. This arrangement structure not only firmly and tightly fixes the screw, but also enables the gas-liquid mixture to be delivered tangentially from the outlet of the screw to the inner shell.

[0022] In this embodiment, the deflector 242 includes a guide portion, and the guide portion is an annular guide plate. The deflector is disposed outward along the inner wall of the inlet end of the deflector 242, and the deflector may guide the working medium to the inner wall of the inner shell 222, which is helpful for the separation of gas-liquid and liquid working medium. The suction pipe assembly 243 includes an outer suction pipe 2431, an inner suction pipe 2432 and an oil return device 2433. The outer suction pipe 2431 and the deflector 242 are integrated in structure, and the oil return device 2433 is arranged at one end of the outer suction pipe 2431 close to the second sealing head 212. The inner suction pipe 2432 is located in the outer suction pipe 2431, and the inner suction pipe 2432 communicates with the first sealing head 211. The outer suction pipe 2431 is used to output the gaseous refrigerant component from the screw 241 and the deflector 242 to the oil return device in the manner of pipe transportation, where the oil return device is configured to enrich the gaseous refrigerant with oil. The inner suction pipe 2432 is used to transport the gaseous refrigerant component from the oil return device through the first sealing head 211 in a manner of pipe transportation, where the gaseous refrigerant component leaves the first cavity 231 and enters the second cavity 232.

[0023] In this embodiment, the gas-liquid separator further includes a drying bag 25, and the outer suction pipe 2431 has a limit portion 251. The limit portion 251 is a protrusion spaced at a set distance, and the drying bag 25 is limited with the external suction pipe 2431 by the limit portion, so that the drying bag may absorb moisture in the working medium.

[0024] In this embodiment, the first sealing head 211 is provided with a circulation channel connecting the first cavity 231 and the second cavity 232. The heat exchange main body 123 of the heat exchange tube is mounted in the second cavity 232. The heat exchange main body 123 of the heat exchange tube at least partially includes a spiral tube 1231, a straight tube 1232, and a fin 1233. The spiral tube and the straight tube are integrated, and the spiral tube and the straight tube are connected. The spiral tube can be a round tube or a flat tube. The form of the tube is not limited here. The inner wall of the spiral tube 1231 is closely attached to the outer wall of the inner shell 222 through the fins 1233, and the spiral tube may not be provided with the fins 1233. A spiral channel 1234 is formed between the spiral tube 1231, the inner shell 222 and the outer shell 221, and the heat exchange tube is filled with a high-temperature and high-pressure working medium. A low-temperature and low-pressure gaseous working medium flows between the inner shell 222 and the outer shell 221, and the low-temperature and low-pressure gaseous working medium and the high-temperature and high-pressure working medium conduct heat exchange between the spiral channels. The spiral channel is conducive to improving the heat exchange efficiency between the working media, and the straight tube is located at one end of the inner shell for storing liquid. The arrangement of the straight tube relatively reduces the heating and evaporation of the liquid-phase refrigerant in the liquid storage section, which is conducive to maintaining the liquid storage volume.

[0025] In this embodiment, the gas-liquid separator further includes a filter 26 and an air outlet 2121. The filter 26 covers the air outlet 2121 and is fixed between the bottom of the inner shell 222 at the liquid storage end and the second sealing head 212. The end of the heat exchanger having a straight tube 1232 penetrates the filter 26. The end of the heat exchange tube having a straight tube at least partially passes through the filter, and is clamped with the high-temperature and high-pressure liquid outlet 2122 of the second sealing head through the locking element 13". The filter 26 may filter the gas after heat exchange, so that the gas that may enter the compressor is more pure, and the problems caused by impurities are reduced.

[0026] Referring to FIG. 10, during the operation of the gas-liquid separator, the gas-liquid two-phase low-temperature and low-pressure working medium may enter the screw 241 through the inlet 2111, and after mixing through the screw 241, the working medium leaves the screw 241 through the outlet of the screw. In the first cavity 231, the gas-liquid mixed working medium moves along the inner wall of the inner shell 22, the gas-phase working medium rises, the liquid-phase working medium sinks, and the liquid-phase working medium is stored in the first cavity 231 (low-pressure liquid storage cavity). The gas-phase working medium rises and enters the outer suction pipe 2431 from the entrance of the outer suction pipe, and the outer suction pipe brings the gas-phase working medium to the oil return device 2433. The oil return device 2433 makes the gas-phase working medium with oil, the gas-phase working medium with oil enters the inner suction pipe 2432, and flows into the communication channel in the first sealing head 211 and enters the second cavity 232. The gas-phase working medium leaves the space formed between the fixing member 244 and the outer shell 221 from the first sealing head 221, and slowly flows into the spiral channel 1234 formed between the spiral tube 1231 and the inner shell 222 and the outer shell 221. A high-temperature and high-pressure working medium is mounted in the heat exchange tube, and a low-temperature and low-pressure separated gaseous working medium flows between the inner shell 22 and the outer shell 21. The low-temperature and low-pressure gaseous working medium and the high-temperature and high-pressure working medium conduct heat exchange between the spiral channel 1234. The gaseous working medium after heat exchange flows to the filter 26 at the second sealing head 212 along the direction of

the straight tube, and the gaseous working medium after heat exchange is filtered by the filter 26 and leaves the gas-liquid separator from the air outlet 2121.

[0027] It should be noted that the above embodiments are only used to illustrate the present application, and not to limit the technical solution described according to the present application, such as the definition of directionality such as "front", "rear", "left", "right", "up" and "down". This specification has described the present application in detail with reference to the above embodiments, however, those skilled in the art should understand that they can still modify or equivalently replace the present application, and all technical solutions and improvements that do not depart from the spirit and scope of the present application should be covered within the scope claimed by the claims of the present application.

Claims

1. A heat exchanger, comprising a container and a heat exchange tube, wherein the heat exchange tube comprises a heat exchange main body, and the heat exchange main body of the heat exchange tube is located in the container, and at least one end of the heat exchange tube is connected to the container in a limited or fixed manner, the end has a fitting portion, the container has an insertion port, the end of the heat exchange tube is at least partially inserted into the insertion port, the container comprises a locking portion located at a peripheral wall of the insertion port, and the heat exchanger further comprises a locking element, the locking element and the heat exchange tube are formed separately, the locking element is at least partially located at the locking portion and the fitting portion, the heat exchange tube is connected to the container in a limited or fixed manner.

2. The heat exchanger according to claim 1, wherein the fitting portion further comprises a high pressure sealing portion, in an axial direction of the fitting portion, the high pressure sealing portion is farther from the heat exchange main body of the heat exchange tube than the locking element, and the high pressure sealing portion is in sealing connection with the container.

3. The heat exchanger according to claim 2, wherein the high pressure sealing portion is provided with a first groove, and the heat exchanger further comprises a sealing ring, the sealing ring is at least partially arranged in the first groove, and the high pressure sealing portion is sealedly connected with the container through the sealing ring, the fitting portion is provided with a second groove, and the first groove is farther away from the heat exchange main body of the heat exchange tube than the second groove, the locking element is at least partially arranged in the second groove, and the fitting portion is engaged with the locking element.

4. The heat exchanger according to any one of claims 1 to 3, wherein the locking element comprises an inner snap portion and an outer snap portion, the inner snap portion comprises a first connecting portion and a first buckling portion, the outer snap portion comprises a second connecting portion and a second buckling portion, the first connecting portion is connected with the second connecting portion, the first buckling portion abuts against the groove wall of the second groove of the fitting portion, and the second buckling portion abuts against the locking portion.

5. The heat exchanger according to claim 4, wherein the inner snap portion comprises a first mounting portion, and the outer snap portion comprises a second mounting portion, a top surface of the first mounting portion abuts against the container, and a bottom surface of the first mounting portion is at least partially fixedly connected with a top surface of the second connecting portion, an outer side of the second connecting portion is at least partially fixedly connected with the first buckling portion, so that a first rebound space is formed among the first buckling portion, the first connecting portion and the second connecting portion, a bottom surface of the second buckling portion is in contact with the container, an inner side surface of the second connecting portion is at least partially fixedly connected with the second buckling portion, so that a second rebound space is formed between the second buckling portion, the first connecting portion and the second connecting portion.

6. The heat exchanger according to claim 5, wherein a number of the first buckling portion is at least one, a number of the second buckling portion is at least one, one of the first buckling portion and the second buckling portion is located on the inner wall of the locking element, and the other one of the first buckling portion and the second buckling portion is located on the outer wall of the locking element, the inner snap portion and the outer snap portion are of an integral structure.

7. The heat exchanger according to claim 6, wherein the locking portion has a placing groove recessed from an inner wall of the insertion port, and the locking element is at least partially located in the placing groove.

8. The heat exchanger according to claim 7, wherein the placing groove comprises a first locking element placing groove and a second locking element placing

groove, a step is provided at the connection between the first locking element placing groove and the second locking element placing groove, the first buckling portion is placed in the first locking element placing groove, the second buckling portion is placed in the second locking element placing groove, the second buckling portion abuts against the step, the side wall of the first connecting portion abuts against the inner wall of the first locking element placing groove.

9. A gas-liquid separator, comprising the heat exchanger according to any one of claims 1 to 8, wherein the container comprises a head and a shell, and the shell and the head are sealed and fixedly connected.

10. The gas-liquid separator according to claim 9, wherein the sealing head comprises a first sealing head and a second sealing head, the first sealing head has a high-temperature and high-pressure liquid inlet, the second sealing head has a high-temperature and high-pressure liquid outlet, the first sealing head and the heat exchange tube are clamped by the locking element, the second sealing head and the heat exchange tube are clamped by the locking element, the shell comprises an outer shell and an inner shell, the first sealing head and the outer shell are sealed and fixedly connected, the second sealing head and the outer shell are sealed and fixedly connected, an accommodating cavity is formed between the shell and the sealing head, and the accommodating cavity comprises a first cavity and a second cavity, the first cavity at least comprises the part between the inner shell and the outer shell, the second cavity at least comprises the part between the sealing head and the inner shell, the first cavity and the second cavity communicate with each other.

11. The gas-liquid separator according to claim 10, wherein the gas-liquid separator further comprises a gas-liquid separation device, and the gas-liquid separation device is located in the first cavity, the first sealing head and the inner shell are fixedly connected by the fixing member, and the inner shell, the first sealing head and the fixing member form a first cavity, the first sealing head is provided with a gas-liquid mixture inlet.

12. The gas-liquid separator according to claim 11, wherein the gas-liquid separation device comprises a screw, a deflector, a fixing member and a suction pipe assembly, the gas-liquid mixture inlet is communicated with the screw, and the screw is fixed with the first head, an outlet direction of the screw is perpendicular to an axis of the gas-liquid separator, and the screw is at least partially arranged in the fixing member, the deflector is arranged below the screw, and the suction pipe assembly is used for outputting the gaseous refrigerant component out of the gas-liquid separator in the manner of pipe transport.

13. The gas-liquid separator according to claim 12, wherein the first sealing head is further provided with a circulation channel connecting the first cavity and the second cavity, a heat exchange main body of the heat exchange tube is located in the second cavity, and the main body of the heat exchange tube at least comprises spiral tubes, fins and straight tubes, the sprial tube and the straight tube are in communication, and the sprial tube and the straight tube are integral structures, wherein an inner wall of the spiral tube is closely attached to the outer wall of the inner shell through the fins, a spiral channel is formed between the spiral tube, the outer wall of the inner shell and the inner wall of the outer shell, and the straight tube is located at one end of the inner shell for liquid storage.

14. The gas-liquid separator according to claim 13, further comprising a filter and an air outlet, wherein the filter covers the air outlet, and the filter is fixed between the bottom of the inner shell at the liquid storage end and the second sealing head, the end of the heat exchange tube having a straight tube at least partially passes through the filter and is clamped to the high-temperature and high-pressure liquid outlet of the second sealing head.

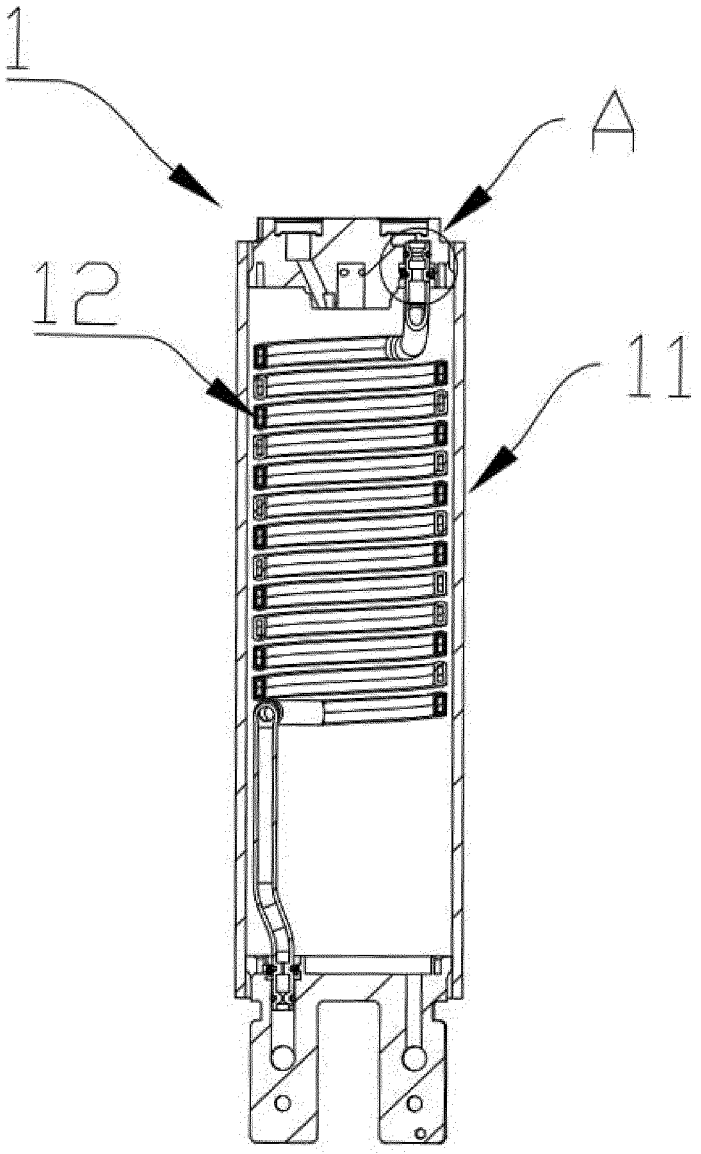


FIG. 1

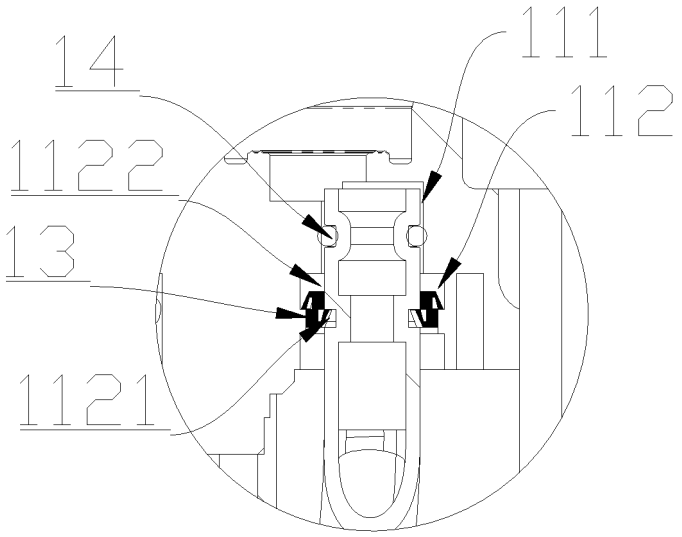


FIG. 2

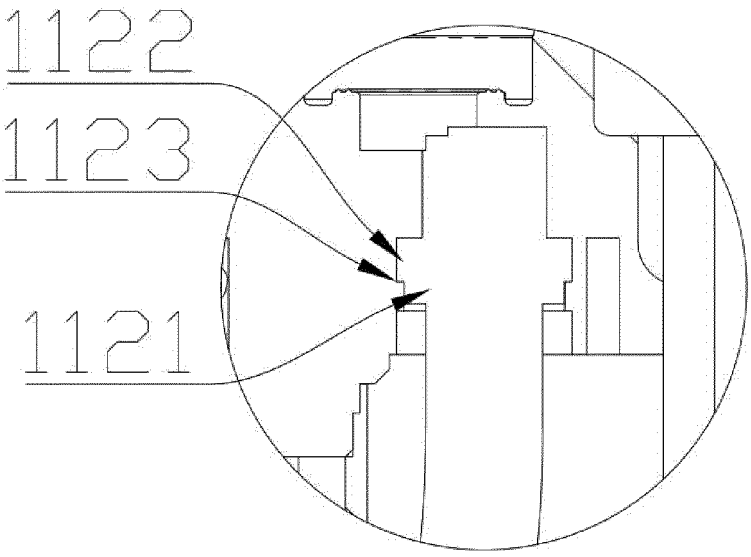


FIG. 3

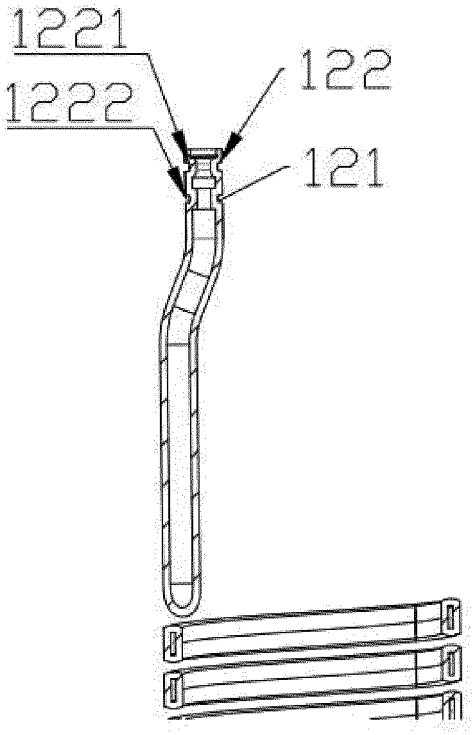


FIG. 4

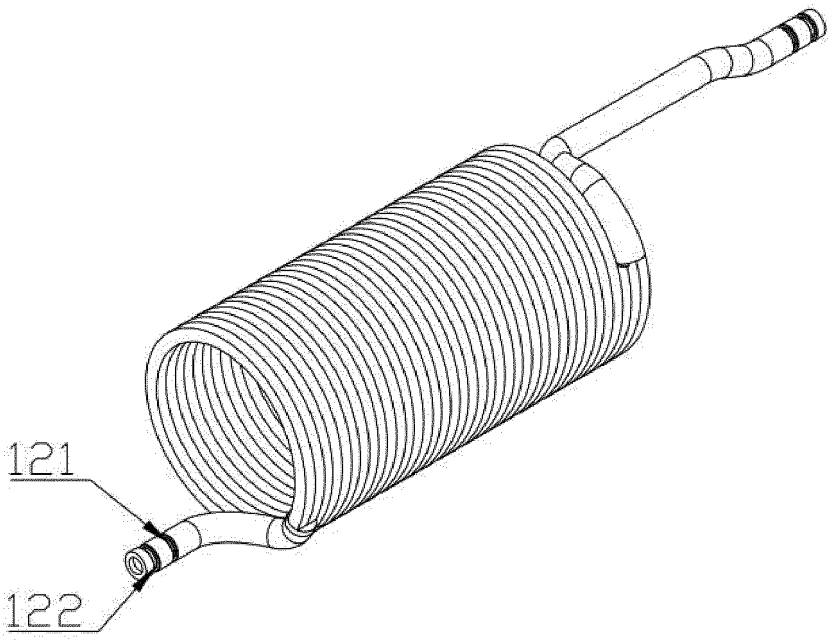


FIG. 5

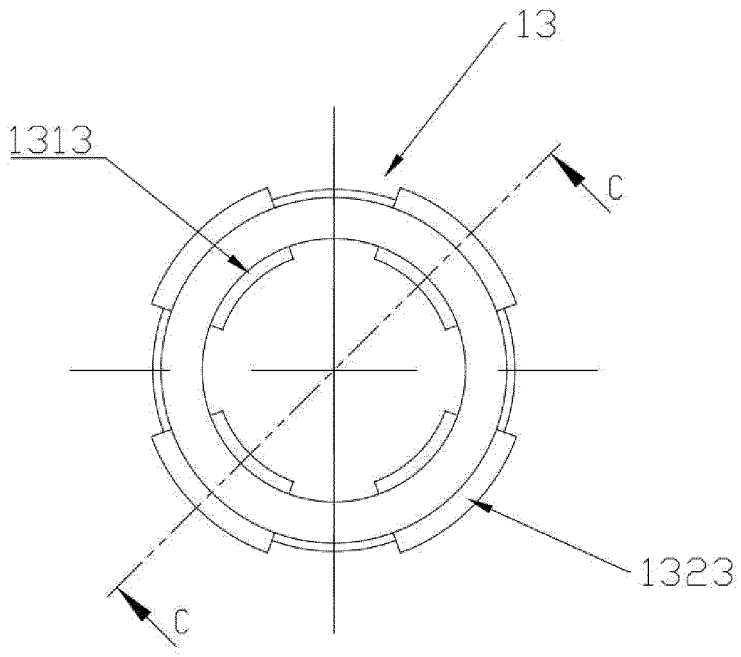

13
1313
C
C
1323

FIG. 6

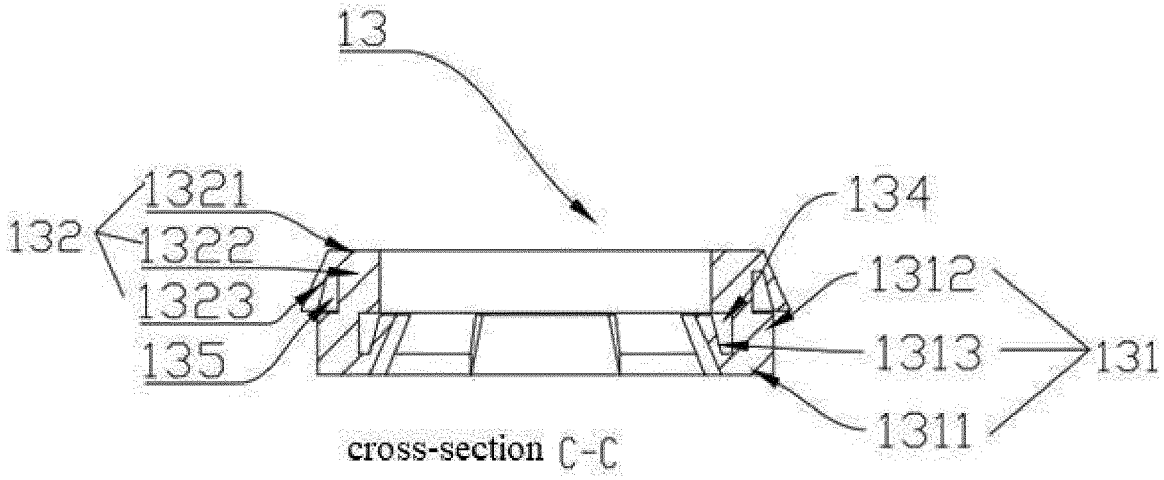

13
1321
132
1322
1323
135
134
1312
1313
131
1311
cross-section C-C

FIG. 7

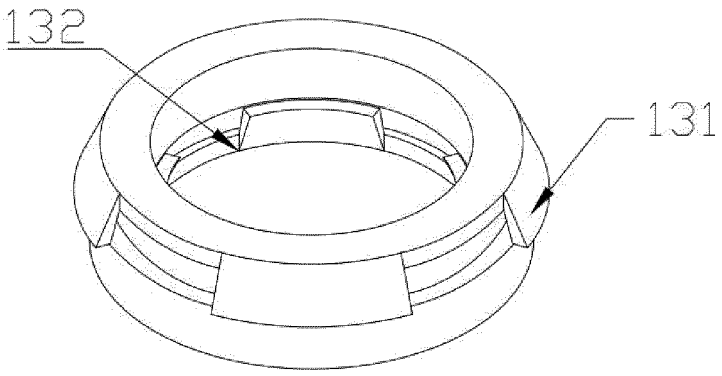
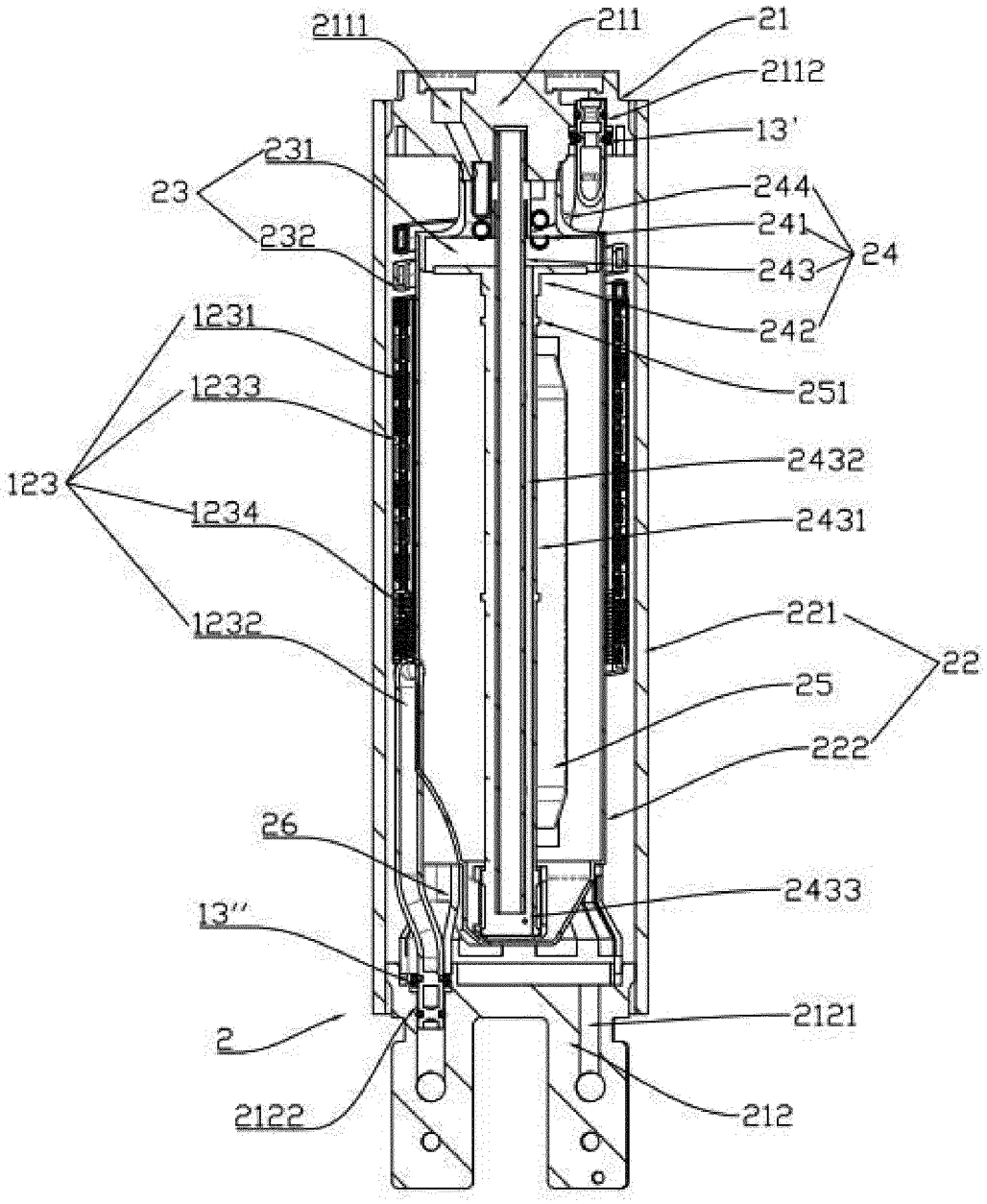


FIG. 8


2111
211
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2112
13'
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232
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243
24
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1232
221
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26
2433
13''
2121
2
212
2122

FIG. 9

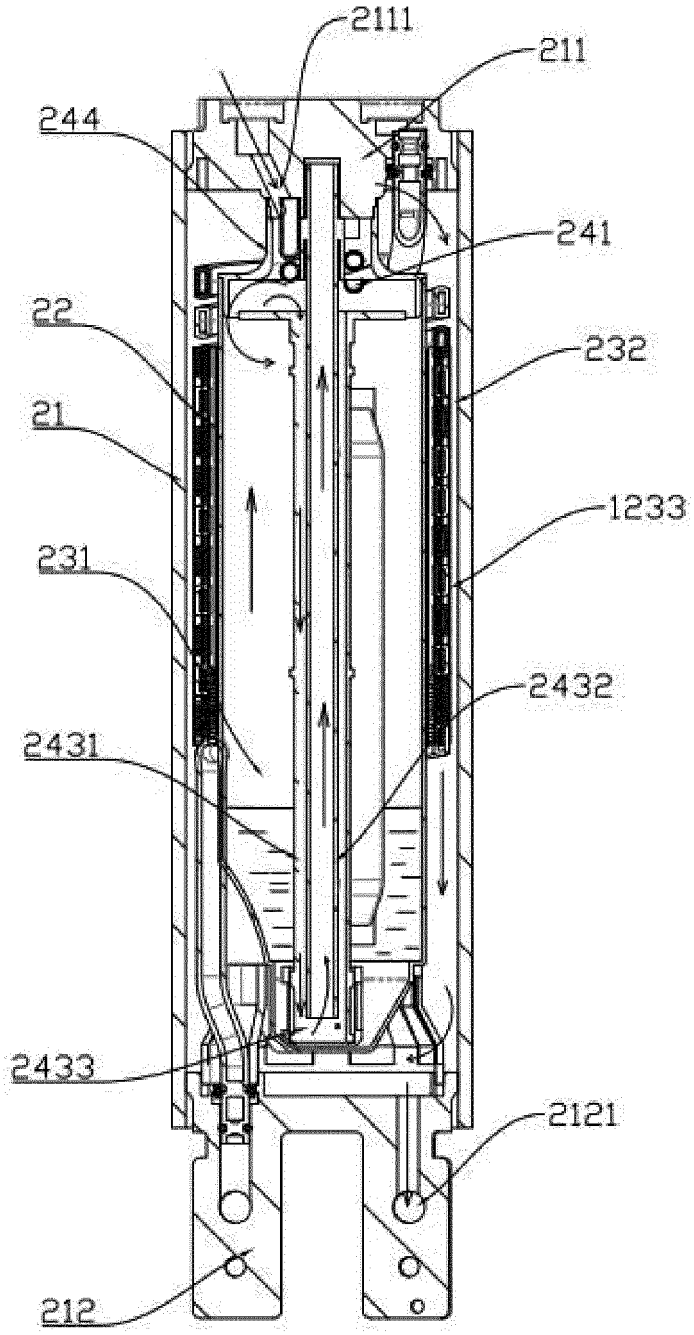

FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/093202

A. CLASSIFICATION OF SUBJECT MATTER

F25B 43/02(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)

F25B43, F25B41, F25B1, F25B13, F25B9, F16L, B60H1

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)

CNABS, CNKI, SIPOABS, DWPI; 气液分离, 储液器, 蓄液器, 贮液器, 热交换管, 换热管, 螺旋, 盘旋, 蛇形, 锁定, 装配, 紧固, 密封; separator, reservoir, receiver, accumulator, heat exchange, tube, pipe, spiral, coiling, helical, screw, lock, assembly, fasten, fix, seal, gasket

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 105805990 A (ZHEJIANG SANHUA AUTOMOTIVE COMPONENTS CO., LTD.) 27 July 2016 (2016-07-27) description, paragraphs [0046]-[0070], and figures 5-9	1-4, 9-14
X	CN 109425157 A (HANON SYSTEMS) 05 March 2019 (2019-03-05) description, paragraphs [0025]-[0033], and figures 1-4	1-4, 9-14
X	WO 2020040476 A1 (HANON SYSTEMS) 27 February 2020 (2020-02-27) description, paragraphs [0027]-[0037], and figures 1-6	1-4, 9-14
A	CN 108759202 A (DONGGUAN ARCIO HEAT ENERGY EQUIPMENT CO., LTD.) 06 November 2018 (2018-11-06) entire document	1-14
A	CN 210372417 U (GUANGDONG MEDIA REFRIGERATION EQUIPMENT CO., LTD. et al.) 21 April 2020 (2020-04-21) entire document	1-14
A	US 2008223073 A1 (HALLA CLIMATE CONTROL CANADA I) 18 September 2008 (2008-09-18) entire document	1-14

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

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"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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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 July 2021	**18 August 2021**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** **China**	Authorized officer
Facsimile No. **(86-10)62019451**	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/093202

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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A	US 2014174120 A1 (MAGNA POWERTRAIN BAD HOMBURG GMBH) 26 June 2014 (2014-06-26) entire document	1-14

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/093202

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				CZ	308314	B6	06 May 2020
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				EP	2751502	B8	15 April 2020
				CN	103765130	B	08 August 2017
				JP	6072037	B2	01 February 2017
				WO	2013029769	A1	07 March 2013
				DE	102011111964	A1	28 February 2013
				US	10024587	B2	17 July 2018
				EP	2751502	B1	11 March 2020

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202010473025 **[0001]**