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10.12.2018 CN 201822067450 U(71) Applicant: CRRC Changchun Railway Vehicles
Co., Ltd.
Changchun, Jilin 130000 (CN)

(72) Inventors:

- CAO, Yanhua
Jilin 130000 (CN)
- ZHAO, Jinlong
Jilin 130000 (CN)
- LI, Changsheng
Jilin 130000 (CN)

(74) Representative: Sharman, Thomas Alexander
Reddie & Grose LLP
The White Chapel Building
10 Whitechapel High Street
London E1 8QS (GB)

(54) RAILWAY TRAIN AND FRESH AIR INLET SNOW-MELTING DEVICE OF TRAIN

(57) Provided is a fresh air inlet snow-melting device of a train, the device comprising an air inlet grating (1), a rainwater separator (2), and a heating device. The rainwater separator (2) is arranged behind the air inlet grating, and is provided with a labyrinth-type air inlet channel and water drainage holes (206). The side, close to the air inlet grating, in the rainwater separator is provided with the heating device. When accumulated snow is formed at an air inlet of the air inlet grating, the heating device can be started to melt the accumulated snow, meanwhile, the labyrinth-type air inlet channel of the rainwater separator can separate water carried in inlet air due to the melting snow and drain the water from the water drainage holes (206). The device eliminates air inlet resistance, ensures the inlet air volume of an air conditioner, also prevents snow water from entering an air-conditioning system, and ensures the performance of the air-conditioning system of a train under the working conditions of snowstorm weather and low temperatures. Further provided is a railway train provided with the fresh air inlet snow-melting device.

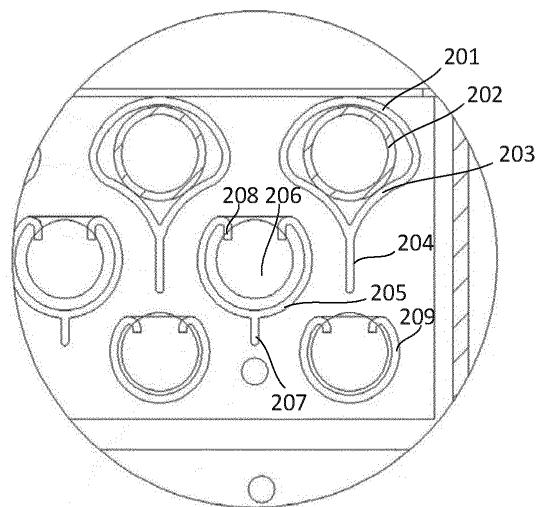


Figure 3

Description

[0001] This application claims the priority to Chinese Patent Application No. 201811503092.X titled "RAILWAY TRAIN AND FRESH AIR INLET SNOW-MELTING DEVICE OF TRAIN", filed with the China National Intellectual Property Administration on December 10, 2018, the entire disclosure of which is incorporated herein by reference.

[0002] This application claims the priority to Chinese Patent Application No. 201822067450.9 titled "RAILWAY TRAIN AND FRESH AIR INLET SNOW-MELTING DEVICE OF TRAIN", filed with the China National Intellectual Property Administration on December 10, 2018, the entire disclosure of which is incorporated herein by reference.

10 **FIELD**

[0003] The present application relates to the technical field of railway trains, and particularly to a railway train and a fresh air inlet snow-melting device of a train.

15 **BACKGROUND**

[0004] A running air conditioning system of the railway train usually deals with various complex environmental conditions to meet the requirements of comfort in passenger compartment. In the environment of snowstorm, deep snow is easily banked up at the inlet of the air inlet grating of the air conditioning unit, which causes increasing of the fresh air inlet resistance and decreasing of the fresh air inlet volume, thereby affecting the performance of the air conditioning system and further affecting the comfort of passengers.

[0005] Therefore, those skilled in the art has a strong desire to provide a new air inlet device to deal with working conditions of snowstorm and low temperature, so as to ensure that the railway train can run safely at such severe environmental conditions as low temperature.

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SUMMARY

[0006] In view of this, a first object of the present application is to provide a fresh air inlet snow-melting device of a train, so that the device can deal with the working conditions of snowstorm and low temperature, so as to ensure that the railway train can run safely at such severe environmental conditions as low temperature.

[0007] A second object of the present application is to provide a railway train including the above fresh air inlet snow-melting device of the train.

[0008] The following technical solutions are provided according to the present application.

[0009] A fresh air inlet snow-melting device of a train includes an air inlet grating, a snow-water separator and a heating device. The snow-water separator is arranged behind the air inlet grating, and is provided with a labyrinth air inlet channel for separating snow-water from snow and water dischargers for discharging the snow-water. The heating device is provided on a side, facing the air inlet grating, in the snow-water separator.

[0010] Preferably, the snow-water separator includes a row of arched baffles and at least one row of U-shaped baffles which are sequentially staggered from near to far relative to the air inlet grating, and the arched baffles are arched toward the direction of the air inlet grating, and an opening of each U-shaped baffle faces the direction of the air inlet grating.

[0011] Preferably, each of the water dischargers is provided under the corresponding U-shaped baffle.

[0012] Preferably, the heating device includes an electric heating pipe, and the electric heating pipe is arranged in one-to-one correspondence with a side, away from the air inlet grating, of each arched baffle.

[0013] Preferably, the snow-water separator further includes a V-shaped baffle, and the V-shaped baffle is connected with the corresponding arched baffle to form a cavity for accommodating the electric heating pipe.

[0014] Preferably, the snow-water separator includes a row of first U-shaped baffles and a row of second U-shaped baffles. A first flow guiding plate extending between the two adjacent first U-shaped baffles is formed on a tip of the V-shaped baffle, and a second flow guiding plate extending between two adjacent second U-shaped baffles is formed on the first U-shaped baffle.

[0015] Preferably, bent edges extending into the corresponding U-shaped baffle are formed on two sides of the opening of each U-shaped baffle, and the spacing between the two bent edges gradually reduces along the extension direction.

[0016] Preferably, the fresh air inlet snow-melting device of the train further includes a temperature sensor and a controller. The temperature sensor is arranged at an air inlet of the air inlet grating, and the controller is configured to control the heating device to be turned on when the temperature at the air inlet of the air inlet grating is lower than a preset value, and to control the heating device to be turned off when the temperature at the air inlet of the air inlet grating is higher than the preset value.

[0017] Preferably, the fresh air inlet snow-melting device further includes a pressure wave valve plate provided behind the snow-water separator in a direction of the air inlet direction.

[0018] A railway train includes the fresh air inlet snow-melting device of the train described in any one of the above.

[0019] In order to achieve the first object, the fresh air inlet snow-melting device of the train according to the present application includes the air inlet grating, the snow-water separator and the heating device. The snow-water separator is arranged behind the air inlet grating and is configured to separate snow-water carried in the inlet air. The snow-water separator is provided with a labyrinth air inlet channel for separating snow-water from snow and water dischargers for discharging the snow-water. The water dischargers are generally formed on the bottom of the snow-water separator. The heating device is provided on a side, facing the air inlet grating, in the snow-water separator. In application, when the deep snow is banked up at the air inlet of the air inlet grating, the heating device can be started to melt the deep snow, meanwhile, the labyrinth air inlet channel of the snow-water separator can separate water carried in inlet air from snow due to the melting snow and discharge the water from the water dischargers. It can be seen that the fresh air inlet snow-melting device of the train integrates the heating device with the snow-water separator, which occupies a small occupation space, does not need to change the existing structure, can melt the deep snow at the air inlet of air inlet grating, eliminates air inlet resistance, ensures the inlet air volume of an air conditioner, also prevents snow-water from entering into an air-conditioning system, and ensures the performance of the air-conditioning system of the train under the working conditions of snowstorm weather and low temperatures.

[0020] In order to achieve the second object, a railway train is further provided according to the present application. The railway train includes the above fresh air inlet snow-melting device of the train. Since the fresh air inlet snow-melting device of the train has the technical effects described above, the railway train having the above fresh air inlet snow-melting device of the train should also have corresponding technical effects.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] To illustrate technical schemes according to the embodiments of the present application or in the conventional technology more clearly, the drawings to be used in the description of the conventional technology or the embodiments are described briefly hereinafter. Apparently, the drawings described hereinafter are only some embodiments of the present application, and other drawings may be obtained by those skilled in the art based on those drawings without creative effort.

Figure 1 is an axonometric view of a fresh air inlet snow-melting device of a train according to an embodiment of the present application;

Figure 2 is a top view of the fresh air inlet snow-melting device of the train according to the embodiment of the present application; and

Figure 3 is a partially enlarged view of portion B in Figure 2.

Reference numerals:

1 air inlet grating,	2 snow-water separator,
201 arched baffle,	202 electric heating pipe,
203 V-shaped baffle,	204 first flow guiding plate,
205 first U-shaped baffle,	206 water discharger,
207 second flow guiding plate,	208 bent edge,
209 second U-shaped baffle,	3 pressure wave valve plate

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0022] Technical solutions of embodiments of the present application are clearly and completely described hereinafter in conjunction with the drawings of the embodiments of the present application. It is apparent that the embodiments described in the following are only some embodiments of the present application, rather than all embodiments. Any other embodiments obtained by those skilled in the art based on the embodiments in the present application without any creative work fall in the scope of protection of the present application.

[0023] Referring to Figures 1 to 3, Figure 1 is an axonometric view of a fresh air inlet snow-melting device of a train according to an embodiment of the present application; Figure 2 is a top view of the fresh air inlet snow-melting device of the train according to the embodiment of the present application; and Figure 3 is a partially enlarged view of portion B in Figure 2.

[0024] A fresh air inlet snow-melting device of a train is provided according to the embodiment of the present application. The fresh air inlet snow-melting device of the train includes an air inlet grating 1, a snow-water separator 2 and a heating device.

[0025] The snow-water separator 2 is arranged behind the air inlet grating 1 in the air inlet direction, and is configured to separate the snow-water carried in inlet air. The snow-water separator 2 has a labyrinth air inlet channel and water dischargers 206. The labyrinth air inlet channel blocks and collides the inlet air, so that the inlet air changes a direction and a speed, so as to separate the snow-water carried in the inlet air and discharge the water from the water dischargers 206. The water dischargers 206 are generally formed at the bottom of the snow-water separator 2, and the heating device is provided on a side, facing the air inlet grating 1, in the snow-water separator 2.

[0026] In summary, compared with the conventional technology, according to the fresh air inlet snow-melting device of the train provided by the embodiment of the present application, when deep snow is banked up at the air inlet of the air inlet grating 1, the heating device can be started to melt the deep snow, meanwhile, the labyrinth air inlet channel of the snow-water separator 2 can separate water carried in inlet air from snow due to the melting snow and discharge the water from the water dischargers 206. It can be seen that the fresh air inlet snow-melting device of the train integrates the heating device with the snow-water separator 2, which occupies a small occupation space, does not need to change the existing structure, can melt the deep snow at the air inlet of air inlet grating 1, eliminates air inlet resistance, ensures the inlet air volume of an air conditioner, also prevents snow-water from entering into an air-conditioning system, and ensures the performance of the air-conditioning system of the train under the working conditions of snowstorm weather and low temperatures.

[0027] In an embodiment, the snow-water separator 2 includes a row of arched baffles 201 and at least one row of U-shaped baffles which are sequentially staggered from near to far relative to the air inlet grating, and the arched baffles 201 are arched toward the air inlet grating 1, that is, an arched surface of each arched baffle 201 affects the inlet air, shunts and guides the inlet air. The inlet air enters into the snow-water separator 2 from a gap between the two arched baffles 201. Since an opening of each U-shaped baffle is toward the air inlet grating 1, the inlet air entering from the gap between the two arched baffles 201 enters into the interior of the U-shaped baffle through the middle of the opening of the U-shaped baffle, the inlet air is guided by the inner wall of the U-shaped baffle to change direction inside the U-shaped baffle and flows out of an edge of the opening of the U-shaped baffle, and continues to move backward through a gap between the arched baffle 201 and the U-shaped baffle. Such snow-water separator 2 has a simple structure, and the labyrinth air inlet channel can be realized by only a few rows of baffles, which is convenient for mass production.

[0028] Furthermore, the snow-water separator 2 further includes a housing. An opening facing the air inlet grating 1 is formed on the housing. The U-shaped baffles and the arched baffles 201 are arranged in the housing, and two ends of each U-shaped baffle and two ends of each arched baffle 201 are respectively connected with a top plate and a bottom plate of the housing.

[0029] Certainly, the above structure is simply a preferred embodiment according to the embodiment of the present application, which is not limited in practice. Those skilled in the art can adjust the structure appropriately according to the actual needs, which is not limited herein.

[0030] Furthermore, it can be seen from the flow process of the inlet air that the separation of the inlet air and snow-water mainly occurs in the U-shaped baffles. Therefore, for ease of discharging of the snow-water, in an embodiment of the present application, each of the water dischargers 206 is arranged under the corresponding U-shaped baffle, that is, each water discharger 206 is arranged at the corresponding position on the bottom plate of the housing of the snow-water separator 2. In this way, after the inlet air collides with the inner wall of the U-shaped baffle, water droplets formed by snow-water will be formed on the inner wall of the U-shaped baffle, and the water droplets are collected downward and flow into the dischargers 206 for discharging.

[0031] In other embodiments, a catchment pan may also be provided under each of the U-shaped baffles, and the water discharger 206 is arranged at the lowest point of the catchment pan.

[0032] In an embodiment, in the embodiment of the present application, the heating device includes an electric heating pipe 202. The electric heating pipe 202 is arranged in one-to-one correspondence with a side, away from the air inlet grating 1, of the arched baffle 201.

[0033] It should be noted that the heating device may also be a heating film, a heating wire and the like, and is arranged on a surface or inside of the arched baffle 201. Certainly, in addition to the arched baffle 201, the U-shaped baffle may also be provided with the heating device.

[0034] In order to avoid contact between the electric heating pipe 202 and snow-water and snow-water, in the embodiment of the present application, the snow-water separator 2 further includes a V-shaped baffle 203, an opening of the V-shaped baffle 203 faces the arched baffle 201. The V-shaped baffle 203 is connected with the corresponding arched baffle 201 to form a cavity for accommodating the electric heating pipe 202, so that a closed cavity can be formed by the V-shaped baffle 203, the arched baffle 201, the top plate and the bottom plate of the snow-water separator 2, which is isolated the electric heating pipe 202 from the outside.

[0035] To further optimize the above technical solution, in order to improve the separation effect of the snow-water

separator 2, in the embodiment of the present application, the snow-water separator 2 includes a row of first U-shaped baffles 205 and a row of second U-shaped baffles 209. The inlet air can enter into an air-conditioning system only after two times of filtration of water. At the same time, the flow direction of the inlet air after passing through the U-shaped baffle changes, in order to avoid mutual interference between the inlet air flowing out of the U-shaped baffles in the same row, a first flow guiding plate 204 extending between the two adjacent first U-shaped baffles 205 is formed on a tip of the V-shaped baffle 203. A second flow guiding plate 207 extending between the two adjacent second U-shaped baffles 209 is formed on the first U-shaped baffle 205. So that the inlet air flows to the second U-shaped baffle 209 under the action of the first flow guiding plate 204 after flowing out of the first U-shaped baffle 205, and flows into the air-conditioning system under the action of the second flow guiding plate 207 after flowing out of the second U-shaped baffle 209.

[0036] It is understandable that the construction of the snow-water separator 2 is not limited to the arched baffle 201, the U-shaped baffle, the V-shaped baffle 203 and the like, and other regular or irregular structures can be used to form a labyrinth channel.

[0037] In order to further improve the separation effect of the U-shaped baffle to snow-water, in the embodiment of the present application, bent edges 208 extending into the U-shaped baffle are formed on two sides of the opening of the U-shaped baffle. The spacing between the two bent edges 208 gradually reduces in the extension direction. The inlet air may be forced to change direction again by using the two bent edges 208 at the opening of the U-shaped baffle when the inlet air flows out of the U-shaped baffle, so that the direction of the inlet air is changed twice in the U-shaped baffle, thereby achieving better separation effect.

[0038] In an embodiment, the fresh air inlet snow-melting device of the train further includes a temperature sensor and a controller. The temperature sensor is arranged at the air inlet of the air inlet grating 1 and is configured to measure the temperature at the air inlet of the air inlet grating 1. The temperature sensor is connected with a controller signal, and the controller is configured to control the heating device to be turned on when the temperature at the air inlet of the air inlet grating 1 is lower than a preset value, and to control the heating device to be turned off when the temperature at the air inlet of air inlet grating 1 is higher than the preset value, so as to realize the automatic control of the snow-melting device and facilitate the use.

[0039] Furthermore, the fresh air inlet snow-melting device of the train further includes the temperature sensor connected with the controller signal. The temperature sensor is configured to monitor the temperature of the heating device. When the heating device overheats, the controller turns off the heating device to avoid failure due to overheating.

[0040] To further optimize the above technical solution, in the embodiment of the present application, the fresh air inlet snow-melting device of the train further includes a pressure wave valve plate 3 provided behind the snow-water separator 2 in a direction of the air inlet.

[0041] Based on the fresh air inlet snow-melting device of the train according to the above embodiments, a railway train is further provided according to the present application. The railway train includes the fresh air inlet snow-melting device of the train described in any one of the above. Since the railway train adopts the fresh air inlet snow-melting device of the train according to the above embodiments, the railway train has the same beneficial effect as the fresh air inlet snow-melting device of the train according to the above embodiments.

[0042] The above embodiments are described in a progressive manner. Each of the embodiments is mainly focused on describing its differences from other embodiments, and references may be made among these embodiments with respect to the same or similar parts.

[0043] The above illustration of the disclosed embodiments can enable those skilled in the art to practice or use the present application. Various modifications to the embodiments are apparent to the person skilled in the art, and the general principle herein can be implemented in other embodiments without departing from the spirit or scope of the present disclosure. Therefore, the present disclosure is not limited to the embodiments described herein, but should be in accordance with the broadest scope consistent with the principle and novel features disclosed herein.

Claims

50 1. A fresh air inlet snow-melting device of a train, comprising:

an air inlet grating;
a snow-water separator; and
a heating device,

55 wherein the snow-water separator is arranged behind the air inlet grating, and is provided with a labyrinth air inlet channel for separating snow-water from snow and water dischargers for discharging the snow-water, and wherein the heating device is provided on a side, facing the air inlet grating, in the snow-water separator.

2. The fresh air inlet snow-melting device of the train according to claim 1, wherein, the snow-water separator comprises a row of arched baffles and at least one row of U-shaped baffles which are sequentially staggered from near to far relative to the air inlet grating, and the arched baffles are arched toward the air inlet grating, and an opening of each U-shaped baffle faces the air inlet grating.

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3. The fresh air inlet snow-melting device of the train according to claim 2, wherein each of the water dischargers is provided under the corresponding U-shaped baffle.

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4. The fresh air inlet snow-melting device of the train according to claim 2 or 3, wherein, the heating device comprises an electric heating pipe, and the electric heating pipe is arranged in one-to-one correspondence with a side, away from the air inlet grating, of each arched baffle.

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5. The fresh air inlet snow-melting device of the train according to claim 4, wherein, the snow-water separator further comprises a V-shaped baffle, and the V-shaped baffle is connected with the corresponding arched baffle to form a cavity for accommodating the electric heating pipe.

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6. The fresh air inlet snow-melting device of the train according to claim 5, wherein, the snow-water separator comprises a row of first U-shaped baffles and a row of second U-shaped baffles, a first flow guiding plate extending between two adjacent first U-shaped baffles is formed on a tip of the V-shaped baffle, and a second flow guiding plate extending between two adjacent second U-shaped baffles is formed on the first U-shaped baffle.

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7. The fresh air inlet snow-melting device of the train according to any one of claims 2, 3, 5 and 6, wherein, bent edges extending into the corresponding U-shaped baffle are formed on two sides of the opening of each U-shaped baffle, and spacing between the two bent edges gradually reduces along an extension direction.

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8. The fresh air inlet snow-melting device of the train according to any one of claims 1 to 3 and 5 to 6, further comprising a temperature sensor and a controller, wherein the temperature sensor is arranged at an air inlet of the air inlet grating, and the controller is configured to control the heating device to be turned on when the temperature at the air inlet of the air inlet grating is lower than a preset value, and to control the heating device to be turned off when the temperature at the air inlet of the air inlet grating is higher than the preset value.

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9. The fresh air inlet snow-melting device of the train according to any one of claims 1 to 3 and 5 to 6, further comprising a pressure wave valve plate provided behind the snow-water separator in a direction of the air inlet.

10. A railway train, comprising the fresh air inlet snow-melting device of the train according to any one of claims 1 to 9.

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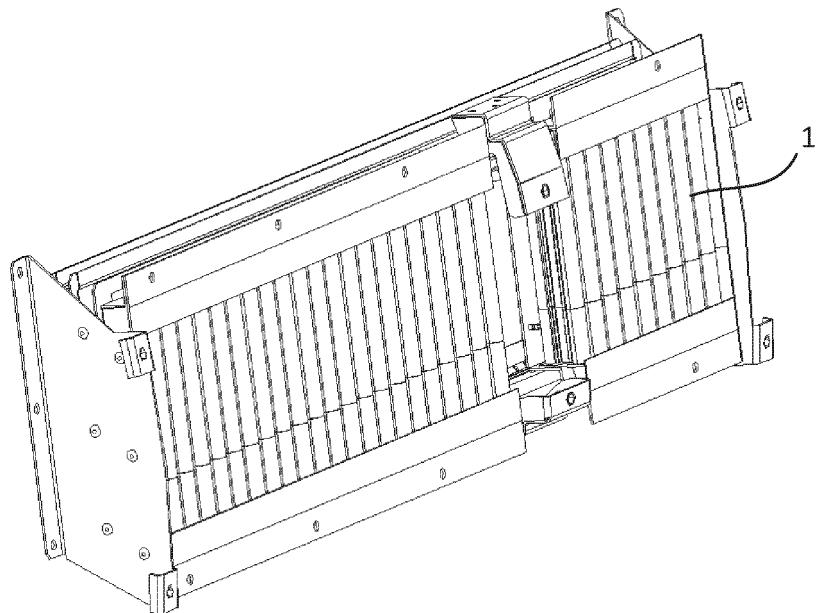


Figure 1

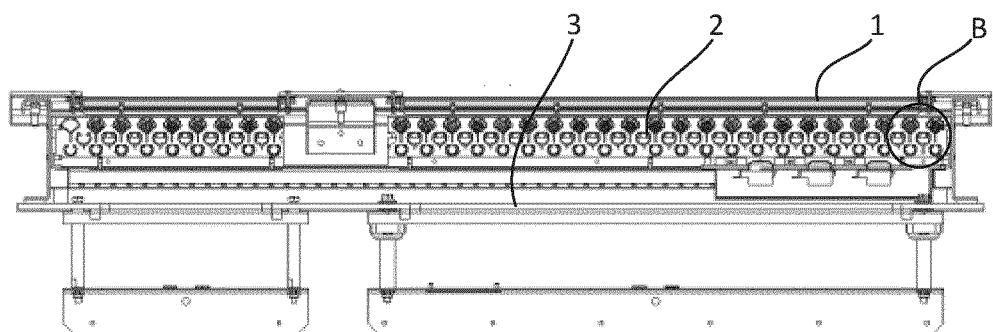


Figure 2

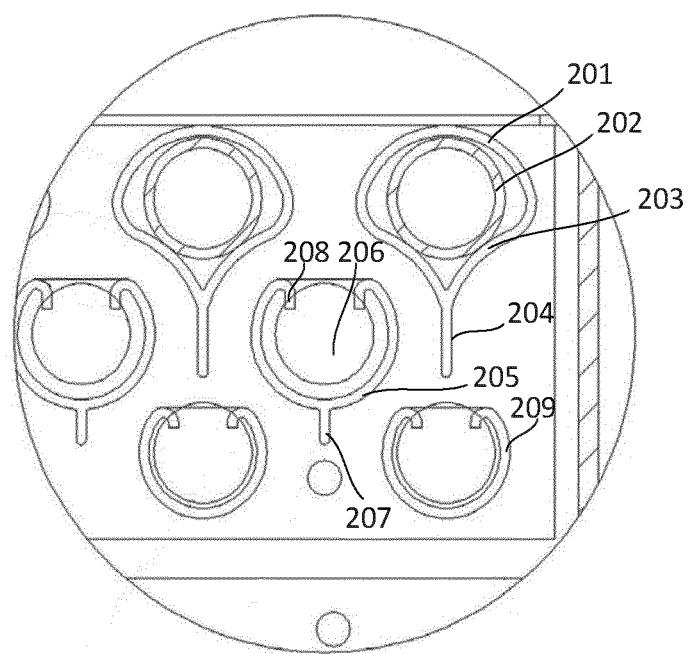


Figure 3

INTERNATIONAL SEARCH REPORT		International application No. PCT/CN2019/120993																					
5	A. CLASSIFICATION OF SUBJECT MATTER B61D 27/00(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC																						
10	B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) B60H1; F24F																						
15	Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched																						
20	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) VEN, CNKI, CPRSABS; 列车, 车辆, 机车, 空调, 加热, 雪, 雨; 格栅, 进风, 排水; vehicle, air, condition+, heat+, drainag+																						
25	C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 2px;">Category*</th> <th style="text-align: left; padding: 2px;">Citation of document, with indication, where appropriate, of the relevant passages</th> <th style="text-align: left; padding: 2px;">Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td style="padding: 2px;">PX</td> <td style="padding: 2px;">CN 209191959 U (CRRC CHANGCHUN RAILWAY VEHICLES CO., LTD.) 02 August 2019 (2019-08-02) claims 1-10</td> <td style="padding: 2px;">1-10</td> </tr> <tr> <td style="padding: 2px;">PX</td> <td style="padding: 2px;">CN 109353362 A (CRRC CHANGCHUN RAILWAY VEHICLES CO., LTD.) 19 February 2019 (2019-02-19) claims 1-10</td> <td style="padding: 2px;">1-10</td> </tr> <tr> <td style="padding: 2px;">X</td> <td style="padding: 2px;">CN 203888576 U (CSR QINGDAO SIFANG CO., LTD.) 22 October 2014 (2014-10-22) description, pages 1-4, and figures 1-3</td> <td style="padding: 2px;">1-10</td> </tr> <tr> <td style="padding: 2px;">A</td> <td style="padding: 2px;">CN 101078562 A (TAIZHOU TAIYI THERMAL ELECTRICAL APPLIANCE CO., LTD.) 28 November 2007 (2007-11-28) entire document</td> <td style="padding: 2px;">1-10</td> </tr> <tr> <td style="padding: 2px;">A</td> <td style="padding: 2px;">JP 2018144522 A (VALEO JAPAN CO., LTD.) 20 September 2018 (2018-09-20) entire document</td> <td style="padding: 2px;">1-10</td> </tr> <tr> <td style="padding: 2px;">A</td> <td style="padding: 2px;">CN 203126861 U (JIANGSU NEW UNITED AIR CONDITIONER SYSTEM CO., LTD.; NEW UNITED GROUP) 14 August 2013 (2013-08-14) entire document</td> <td style="padding: 2px;">1-10</td> </tr> </tbody> </table>		Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	PX	CN 209191959 U (CRRC CHANGCHUN RAILWAY VEHICLES CO., LTD.) 02 August 2019 (2019-08-02) claims 1-10	1-10	PX	CN 109353362 A (CRRC CHANGCHUN RAILWAY VEHICLES CO., LTD.) 19 February 2019 (2019-02-19) claims 1-10	1-10	X	CN 203888576 U (CSR QINGDAO SIFANG CO., LTD.) 22 October 2014 (2014-10-22) description, pages 1-4, and figures 1-3	1-10	A	CN 101078562 A (TAIZHOU TAIYI THERMAL ELECTRICAL APPLIANCE CO., LTD.) 28 November 2007 (2007-11-28) entire document	1-10	A	JP 2018144522 A (VALEO JAPAN CO., LTD.) 20 September 2018 (2018-09-20) entire document	1-10	A	CN 203126861 U (JIANGSU NEW UNITED AIR CONDITIONER SYSTEM CO., LTD.; NEW UNITED GROUP) 14 August 2013 (2013-08-14) entire document	1-10
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35	* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed																						
40	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family																						
45	Date of the actual completion of the international search 09 January 2020																						
50	Date of mailing of the international search report 24 February 2020																						
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/120993

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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.
A	EP 2000338 A1 (CALSONIC KANSEI CORP.) 10 December 2008 (2008-12-10) entire document	1-10
A	DE 3023236 A1 (DAIMLER BENZ AG) 14 January 1982 (1982-01-14) entire document	1-10
A	CN 206679002 U (CHONGQING VOCATIONAL COLLEGE OF PUBLIC TRANSPORTATION) 28 November 2017 (2017-11-28) entire document	1-10

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INTERNATIONAL SEARCH REPORT Information on patent family members					International application No. PCT/CN2019/120993		
5	Patent document cited in search report		Publication date (day/month/year)	Patent family member(s)		Publication date (day/month/year)	
10	CN	209191959	U	02 August 2019	None		
	CN	109353362	A	19 February 2019	None		
	CN	203888576	U	22 October 2014	None		
	CN	101078562	A	28 November 2007	None		
	JP	2018144522	A	20 September 2018	None		
	CN	203126861	U	14 August 2013	None		
	EP	2000338	A1	10 December 2008	JP 4464422 B2 19 May 2010		
					JP 2008302779 A 18 December 2008		
	DE	3023236	A1	14 January 1982	DE 3023236 C2 15 September 1988		
					JP S5733072 A 23 February 1982		
15					JP S6317646 B2 14 April 1988		
					US 4437393 A 20 March 1984		
20	CN	206679002	U	28 November 2017	None		
25							
30							
35							
40							
45							
50							
55							

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201811503092X [0001]
- CN 201822067450 [0002]