



(51) International Patent Classification:

B60H 1/00 (2006.01)

F24H 1/00 (2006.01)

(21) International Application Number:

PCT/CN2020/076940

(22) International Filing Date:

27 February 2020 (27.02.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

201910149300.9

28 February 2019 (28.02.2019)

CN

(71) Applicant: VALEO AUTOMOTIVE AIR

CONDITIONING HUBEI CO., LTD. [CN/CN]; No.

285, West Jiangjin Road, Shashi District, Jingzhou, Hubei

434007 (CN).

(72) Inventors: TONG, Ziran; No. 285, West Jiangjin Road,

Shashi District, Jingzhou, Hubei 434007 (CN), ZHANG,

Kong; No. 285, West Jiangjin Road, Shashi District,

Jingzhou, Hubei 434007 (CN).

(74) Agent: LIU, SHEN & ASSOCIATES; 10th Floor, Building

1, 10 Caihefang Road, Haidian District, Beijing 100080

(CN).

(81) Designated States (unless otherwise indicated, for every

kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,

CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO,

DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,

HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP,

KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME,

MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,

OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,

(54) Title: HEATING DEVICE WITH A HOUSING ASSEMBLY

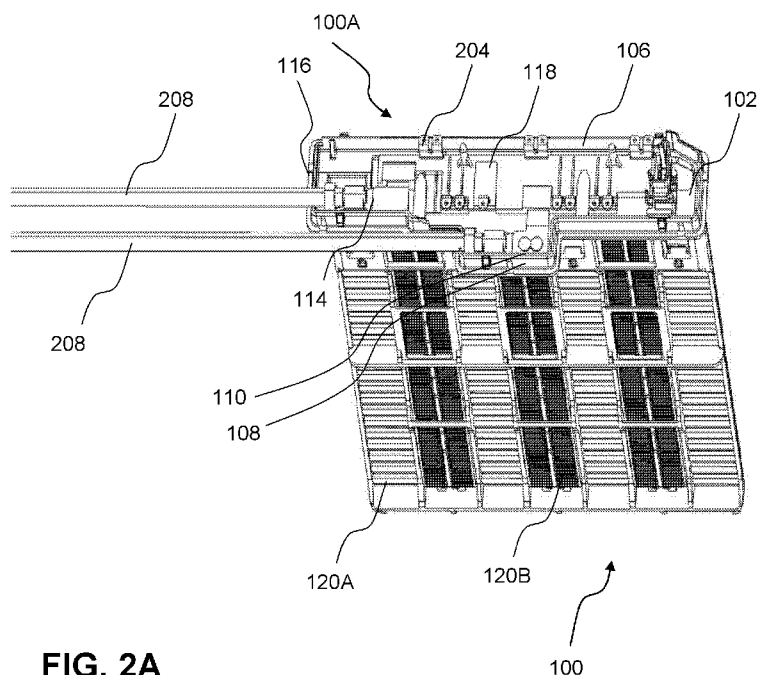


FIG. 2A

(57) Abstract: A heating device for a vehicle is described. The heating device includes a heater core (120A) and a housing assembly (100A). The housing assembly (100A) includes a housing (102) configured with a protruded portion (108), a first terminal (110), and a second terminal (114). The first terminal (110) is configured on the protruded portion (108) of the housing (102) and adapted to be connected with a first bus bar (112). The second terminal (114) is configured on a first end (116) of the housing (102) and adapted to be connected with a second bus bar (118). The first bus bar (112) and the second bus bar (118) are connected to the heater core (120A) to provide an electrical connectivity to the heater core (120A). The first terminal (110) and the second terminal (114) are laterally offset to each other, and are at least partially on opposite sides of a reference line coinciding with an edge of a printed circuit board (210) received in the housing (102). The simple design eliminates risk of electrical leakage between the connections in the design.

SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR,
TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

HEATING DEVICE WITH A HOUSING ASSEMBLY

The present subject matter generally relates to a housing assembly, and in particular, to a housing assembly for facilitating electrical connectivity to a heater core of a Heating Ventilation and Air conditioning (HVAC) system.

5

Generally, HVAC systems are provided in a vehicle to provide comfort driving to the driver and the occupants. The HVAC system may include heat exchangers to provide either hot air or cold air based on a mode of operation of the heat exchangers. To provide hot air to the cabin, hot fluid is received from an engine of the vehicle if the vehicle is an internal combustion engine vehicle. In case the vehicle is an electric vehicle or a hybrid vehicle, a heater core having heating elements provides hot air to the cabin of the vehicle. The heating elements are electrical heating elements powered by an electrical source. In some case, the heater core is used to cold start the engine of the vehicle when the vehicle is in a cold region. If the heater core is utilized to provide comfort conditions to the passengers inside the vehicle's cabin, the heater core is placed in a downstream of an evaporator of the HVAC unit.

Generally, the heater core is coupled to housing for providing electrical insulation for electrical terminals of the heating elements of the heater core. The electrical terminals of the heating elements are extended to the housing and coupled to bus bars provided in the housing. The bus bars are connected with a pair of wires (e.g., pigtail connection) to provide electrical energy to the bus bars. In turn, the bus bars transmit electrical energy to the heating elements in the heater core. Conventionally, both of the wires are adapted to enter into the housing from one side of the housing to enable contact with the electrical terminals of the heating elements. However, such design may cause electrical leakage between the electrical terminals. By providing two connections next to each other may lead to potential electrical insulation issues between the two connections. Further, such design of connections may be cumbersome to connect the two wires with the bus bar.

30

As shown in Fig. 1A, a conventional housing assembly 10 provides housing for a pair bus bars 12 that is adapted to energize a heating element (not shown in Fig. 1A) of a heater device. The pair of bus bars 12 may include terminals and adapted to connect with the heating element. The pair of bus bars 12 may be connected with two wires 14, 16 to power the heating element. The first wire 14 and the second wire 16 enter into the conventional housing assembly 10 from a side 18, where the first wire 14 and the second wire 16 are adjacent to each other. The first wire 14 and the second wire 16 are connected to the corresponding bus bars through terminal connections 20, 22 respectively. As the terminal connections 20, 22 are adjacent to each other, there is a potential risk of electrical leakage between the terminal connections 20, 22 of the first wire 14 and the second wire 16 that may cause short-circuiting.

Accordingly, there is need for a simple design to connect the wires with the bus bar which eliminates risk of electrical leakage between the connections in the design.

An object of the present invention is to provide a housing assembly that obviates the drawbacks associated with the conventional housing assembly.

Another object of the present invention is to provide a housing to encapsulate terminals, which connects heating elements and wires, to provide insulation between terminals.

In the present description, some elements or parameters may be indexed, such as a first element and a second element. In this case, unless stated otherwise, this indexation is only meant to differentiate and name elements which are similar but not identical. No idea of priority should be inferred from such indexation, as these terms may be switched without betraying the invention. Additionally, this indexation does not imply any order in mounting or use of the elements of the invention.

In view of the foregoing, an embodiment of the invention herein provides a housing assembly for facilitating electrical connectivity to a heater core of a heating

device. The housing assembly includes a housing configured with a protruded portion, a first terminal, and a second terminal. The first terminal is configured on the protruded portion of the housing and adapted to be electrically connected with a first bus bar. The second terminal is configured on a first end of the housing and adapted to be electrically
5 connected with a second bus bar. The first bus bar and the second bus bar are connected to the heater core to provide an electrical connectivity to the heater core. Further, the first terminal and the second terminal are laterally offset to each other, and are at least partially on opposite sides of a reference line coinciding with an edge of a printed circuit board received in the housing.

10

In one embodiment, the housing includes a first side wall and a second side wall adapted to be coupled to the first side wall. The first side wall and the second side wall may form a base portion.

15

In another embodiment, the printed circuit board is provided on a second end of the housing in such a way that the first terminal and the second terminal are adjacent to the orthogonal sides of the printed circuit board. In yet another embodiment, the housing assembly comprises a plurality of connectors that is connected to the first bus bar and the second bus bar to couple the first bus bar and the second bus bar with the
20 printed circuit board. In yet another embodiment, the housing assembly comprises a top portion adapted to couple with the housing for encapsulating of the first terminal, the second terminal and the printed circuit board. The top portion and the housing may be of an electrically insulated material.

25

In yet another embodiment, the housing assembly further comprising at least one locking assembly to retain the housing and the top portion in a locked state. Further, the at least one locking assembly being a snap-fit assembly having complementary engagement members provided on the housing and the top portion to lock the housing with the top portion. The first terminal and the second terminal are connected to an
30 electrical energy source by a pair of electrical conductors.

In another aspect of the invention, a heating device is provided for a vehicle. The heating device includes a heater core and the housing assembly. The heater core may further include one or more heating elements with corresponding electrical contacts. The housing assembly includes a housing configured with a protruded portion, a first terminal, and a second terminal. The first terminal is configured on the protruded portion of the housing and adapted to be electrically connected with a first bus bar. The second terminal is configured on a first end of the housing and adapted to be electrically connected with a second bus bar. The first bus bar and the second bus bar are connected to the heater core to provide an electrical connectivity to the heater core. Further, the first terminal and the second terminal are laterally offset to each other, and are at least partially on opposite sides of a reference line coinciding with an edge of a printed circuit board received in the housing.

Other characteristics, details and advantages of the invention can be inferred from the description of the invention hereunder. A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying figures, wherein:

Fig. 1A illustrates a schematic view of a conventional housing assembly of a heater core, in accordance with an embodiment of a prior art;

Fig. 1B illustrates a schematic view of a housing assembly of a heating device of the present subject matter;

Figs. 2A, 2B and 2C illustrate schematic views of a heating device provided with the housing assembly of Fig. 1B, in accordance with an embodiment of the present subject matter;

Figs. 3A, 3B illustrate a first side wall and a second side wall of the housing of Fig. 2A, in accordance with an embodiment of the present subject matter;

FIG. 3C illustrates an assembled view of the housing of FIG. 2A formed by assembling the first portion and the second portion of FIG. 3A and FIG. 3B respectively;

Fig. 4 illustrates a isometric view of the heating device of Fig. 2A, in accordance with an embodiment of the present subject matter; and

Fig. 5 illustrates a perspective view of the housing assembly having a top portion covered therein, in accordance with an embodiment of the present subject matter.

It must be noted that the figures disclose the invention in a detailed enough way to be implemented, the figures helping to better define the invention if needs be. The invention should however not be limited to the embodiment disclosed in the description.

The present subject matter relates to concepts relating to a housing assembly for housing electrical terminals of heating elements of a heating device. According to another aspect, the present subject matter relates to a heating device provided with a housing assembly for housing the electrical terminals of the heating elements. The housing assembly may include a housing having a protruded portion. Further, a couple of terminals are provided on the housing, for example, one terminal is provided on the protruded portion and another terminal is provided on the portion other than the protruded portion. The couple of terminals are connected to heating elements through a pair of bus-bars. As the terminals are laterally offset to each other, and are at least partially on opposite sides of a reference line coinciding with an edge of a printed circuit board received in the housing, a risk of electrical leakage between the terminals is eliminated.

These and other advantages of the present subject matter would be described in greater detail in conjunction with the following figures. While aspects relating to a

housing assembly provided with a heating device as described above and henceforth can be implemented in any number of terminals which are offset to each other to avoid electrical leakage, the embodiments are described in the context of the following system(s).

5

Figs. 1A and 1B illustrate a comparison of a conventional housing assembly with a housing assembly 100A of a heating device of the present subject matter. In one example, Fig. 1A illustrates a schematic view of the conventional housing assembly, and Fig. 1B illustrates a schematic view of the housing assembly 100A of the present
10 subject matter. In conventional housing assembly 10 of Fig. 1A, the two terminals 20, 22 are placed adjacent to each other which may leads to current/potential leakage between the two terminals 20, 22. In contrast, two terminals 110, 114 of the housing assembly 100A of Fig. 1B are laterally offset to each other, thereby eliminating risk of potential leakage between the two terminals 110, 114. Further, construction and assembling of
15 the housing assembly are described in forthcoming figures.

Figs. 2A, 2B and 2C illustrate schematic isometric views of a heating device 100 provided with the housing assembly 100A of Fig. 1B, in accordance with an embodiment of the present subject matter. In one example, Fig. 2A illustrates a
20 schematic view of the heating device 100 with the housing assembly 100A, Fig. 2B illustrates a schematic view of the heating device 100 having a Printed Circuit Board 210, and Fig. 2C illustrates a perspective view of the housing assembly 100A. The heating device 100 includes a heater core 120A having one or more heating elements 120B, and the housing assembly 100A. The housing assembly 100A being coupled on
25 the heater core 120A and adapted to receive corresponding electrical contacts of the one or more heating elements 120B. The housing assembly 100A includes a housing 102, a first terminal 110, and a second terminal 114. In one embodiment, the housing 102 may be provided with a protruded portion 108. In one example, the protruded portion 108 may be formed on a wall of the housing 102. The housing 102 may include
30 a first side wall 104 and a second side wall 106 which are coupled to each other. The housing 102 may further include a first bus bar 112, and a second bus bar 118 to

connect the first terminal 110 and the second terminal 114 with corresponding electrical contacts of the one or more heating elements 120B.

5 The first terminal 110 may be configured on the protruded portion 108 of the housing 102 and is electrically connected to the first bus bar 112. The second terminal 114 may be configured on a first end 116 of the housing 102 and is electrically connected to the second bus bar 118. The housing 102 further receives a printed circuit board (PCB) (not shown in Figs. 2A and 2B) to adjust heating power of the heater core 102A and provide protection function to the heater core 120A. In one embodiment, the
10 PCB may be provided with control circuits (not shown in Figs. 2A and 2B) to control supply of electrical energy to the heater core 120A and to avoid overheating of the heater core 120A. Further, the first terminal 110 and the second terminal 114 are laterally offset to each other, and are at least partially on opposite sides of a reference line coinciding with an edge 212 of the printed circuit board 210 received in the housing
15 102. In other words, the first terminal 110 and the second terminal 114 are provided in such a way that the first terminal 110 is diagonally anterior to the second terminal 114. The first terminal 110 and the second terminal 114 are connected to an electrical energy source by a pair of electrical conductors 208. In one embodiment, the pair of electrical conductors 208 is electrically insulated wires. In one embodiment, the housing 102 is a
20 rectangular housing having a first side wall 104 and a second side wall 106.

Figs. 3A and 3B illustrate the first side wall 104 and the second side wall 106 of the housing 102 of Fig. 2A, in accordance with an embodiment of the present subject matter. In one embodiment, the housing 102 is formed by snap-fitting the first side wall
25 104 and the second side wall 106. In one example, the first side wall 104, as shown in Fig. 3A, includes a first vertical wall 304 having a first horizontal portion 306A. The first horizontal portion 306A may be perpendicularly coupled to the first vertical wall 304. In another example, the second side wall 106, as shown in Fig. 3B, includes a second vertical wall 308 having a second horizontal portion 306B perpendicular to the second
30 vertical wall 308. The second horizontal portion 306B may be perpendicularly coupled to the second vertical wall 308 of the second side wall 106. In another embodiment, the

first vertical wall 304, and the second vertical wall 308 are adapted to couple each other thereby coupling the first horizontal portion 306A with the second horizontal portion 306B as shown in Fig. 3C. In one example, the first side wall 104 is adapted to couple with the second side wall 106 to form a base portion. In one embodiment, the base
5 portion may be a portion which forms when the first horizontal portion 306A is coupled the second horizontal portion 306B.

Fig. 4 illustrates an exploded view of the heating device 100 of Fig. 2A, in accordance with an embodiment of the present subject matter. The electrical contacts
10 404 of the one or more heating elements 120B are coupled to the first bus bar 112 and the second bus bar 118 as shown in Fig. 4. Further, a plurality of connectors 204 is provided in the first bus bar 112 and the second bus bar 118 to couple the first bus bar 112 and the second bus bar 118 with the printed circuit board 210. The plurality of
15 connectors 204 is coupled to the printed circuit board 210 to provide rigid support to the electrical contacts 404 of the one or more heating elements 120B. Further, the printed circuit board 210 is provided at a second end 122 of the housing 102 in such a way that the first terminal 110 and the second terminal 114 are adjacent to the orthogonal sides
of the printed circuit board 210 respectively. In one embodiment, the second end 122 may be opposite to the first end 116. In another embodiment, the printed circuit board
20 210 may partially covers the first bus bar 112 and the second bus bar 118 as shown in Fig. 2B.

Further, the housing assembly 100A includes a top portion 502 adapted to couple with the housing 102 for encapsulating the first terminal 110, the second terminal
25 114, and the printed circuit board 210 as shown in the Fig. 5. In one embodiment, the top portion 502 is complementary to the housing 102 to enable engagement between each other. The housing assembly 100A further includes at least one locking assembly 504 to retain the housing 102 and the top portion 502 in a locked state. In one
embodiment, the at least one locking assembly 504 being a snap-fit assembly having
30 complementary engagement members provided on the housing 102 and the top portion 502 to lock the housing 102 with the top portion 502. In another embodiment, the

housing assembly 100A may include multiple locking assemblies provided throughout the circumference of the housing 102 and the top portion 502. In one embodiment, the top portion 502 and the housing 102 are of an electrically insulated material. In one example, the heating device 100 can be provided in a fossil fuel vehicle to provide heat
5 while cold starting an engine of the vehicle in a cold region. In another example, the heating device can be provided in a HVAC unit of an electric vehicle to provide hot air to the passengers in the vehicle's cabin.

Several modifications and improvement might be applied by the person skilled in
10 the art to the housing assembly 100A as defined above, as long as it comprises the first terminal 110 and the second terminal 114 orthogonally offset to the first terminal 110.

In any case, the invention cannot and should not be limited to the embodiments specifically described in this document, as other embodiments might exist. The
15 invention shall spread to any equivalent means and any technically operating combination of means.

CLAIMS

1. A housing assembly (100A) for facilitating electrical connectivity to a heater core (120A) of a heating device, comprising:

5 a housing (102) is configured with a protruded portion (108);

a first terminal (110) configured on the protruded portion (108) of the housing (102) and adapted to be electrically connected with a first bus bar (112);

a second terminal (114) configured on a first end (116) of the housing (102) and adapted to be electrically connected with a second bus bar (118), wherein the first bus bar (112) and the second bus bar (118) are connected to the heater core (120A) to provide an electrical connectivity to the heater core (120A), characterized in that the first terminal (110) and the second terminal (114) are laterally offset to each other, and are at least partially on opposite sides of a reference line coinciding with an edge of a printed circuit board (210) received in the housing (102).

2. The housing assembly (100A) as claimed in claim 1, wherein the housing (102) comprises a first side wall (104) and a second side wall (106) adapted to be coupled to the first side wall (104), wherein the first side wall (104) and the second side wall (106) forms a base portion.

3. The housing assembly (100A) as claimed in claim 1, wherein the printed circuit board (210) provided on a second end (122) of the housing (102) in such a way that the first terminal (110) and the second terminal (114) are adjacent to the orthogonal sides of the printed circuit board (210).

4. The housing assembly (100A) as claimed in claim 3, further comprising a plurality of connectors (204) connected to the first bus bar (112) and the second bus bar (118) to couple the first bus bar (112) and the second bus bar (118) with the printed circuit board (210).

5. The housing assembly (100A) as claimed in claim 1, further comprising a top portion (502) adapted to couple with the housing (102) for encapsulating the first terminal (110), the second terminal (114) and the printed circuit board (210).

5 6. The housing assembly (100A) as claimed in claim 5, the top portion (502) and the housing (102) are of an electrically insulated material.

7. The housing assembly (100A) as claimed in claim 5, further comprising at least one locking assembly (504) to retain the housing (102) and the top portion (502) in a locked state.

8. The housing assembly (100A) as claimed in claim 7, wherein the at least one locking assembly (504) being a snap-fit assembly having complementary engagement members provided on the housing (102) and the top portion (502) to lock the housing (102) with the top portion (502).

9. The housing assembly (100A) as claimed in claim 1, wherein the first terminal (110) and the second terminal (114) are connected to an electrical energy source by a pair of electrical conductors (208).

20

10. A heating device (100) for a vehicle, comprising:

a heater core (120A) comprises a plurality of heating elements (120B) with corresponding electrical contacts (404);

a housing assembly (100A) adapted to be coupled on the heater core (120A) to receive electrical contacts (404) of the heater core (120A) and provide electrical connectivity to the heater core (120A), comprising:

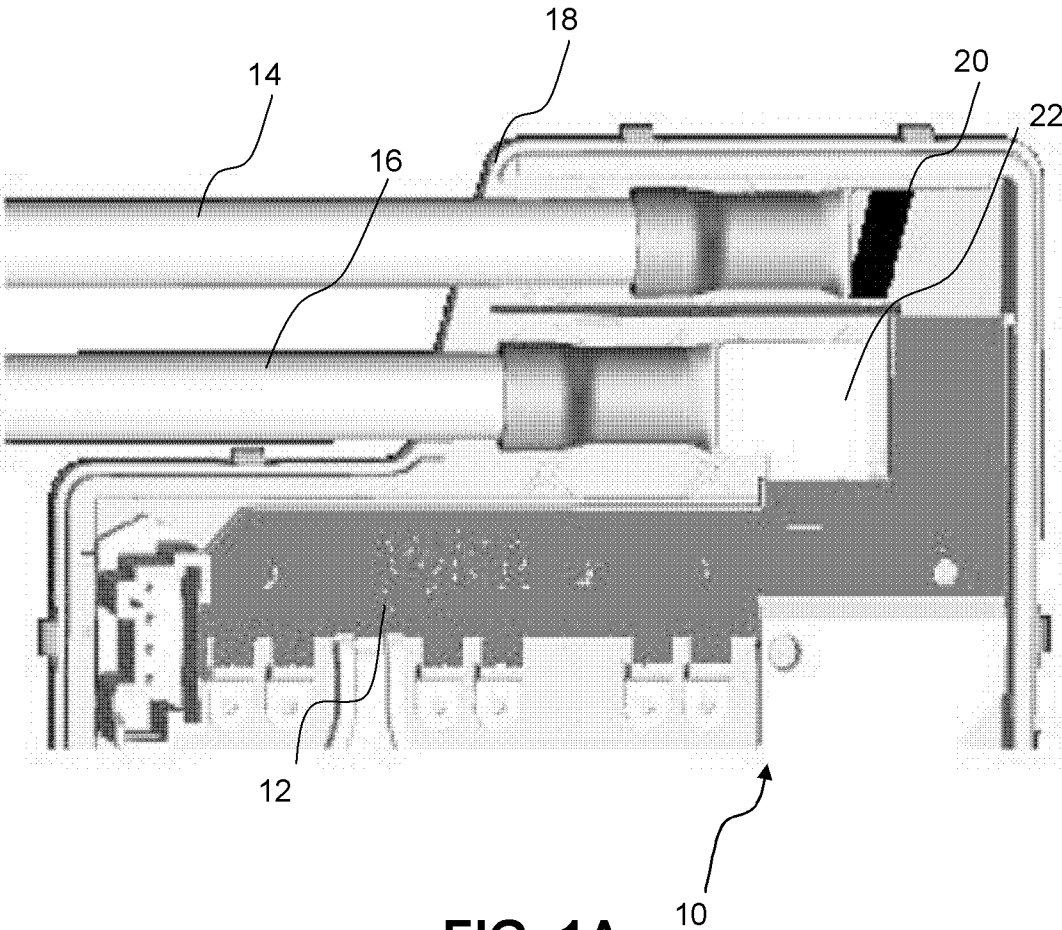
a housing (102) is configured with a protruded portion (108);

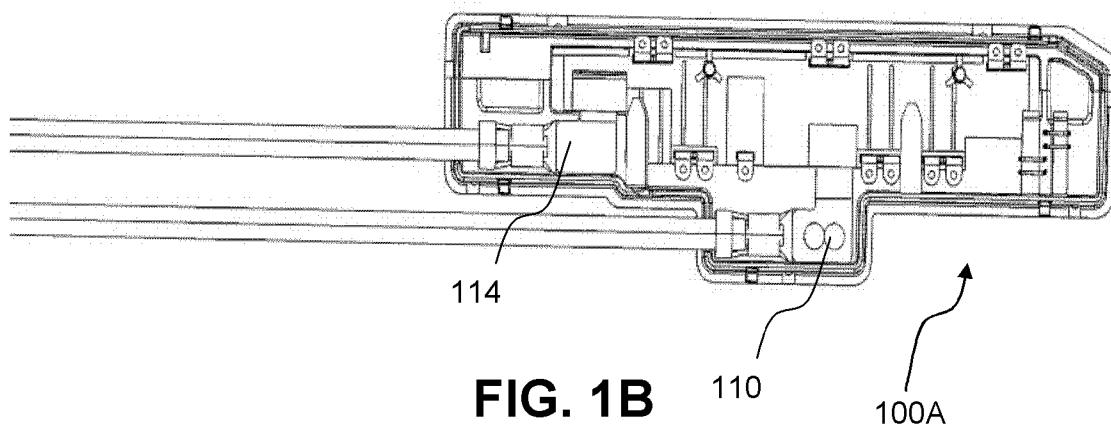
a first terminal (110) configured on the protruded portion (108) of a first side wall (104) and adapted to be electrically connected with a first bus bar (112);

a second terminal (114) configured on a first end (116) of the base portion (102) and adapted to be electrically connected with a second bus bar (118),

30

5 wherein the first bus bar (112) and the second bus bar (118) are connected to the heater core (120A) to provide an electrical connectivity to the heater core (120A), characterized in that the first terminal (110) and the second terminal (114) are laterally offset to each other, and are at least partially on opposite sides of a reference line coinciding with an edge of a printed circuit board (210) received in the housing (102).





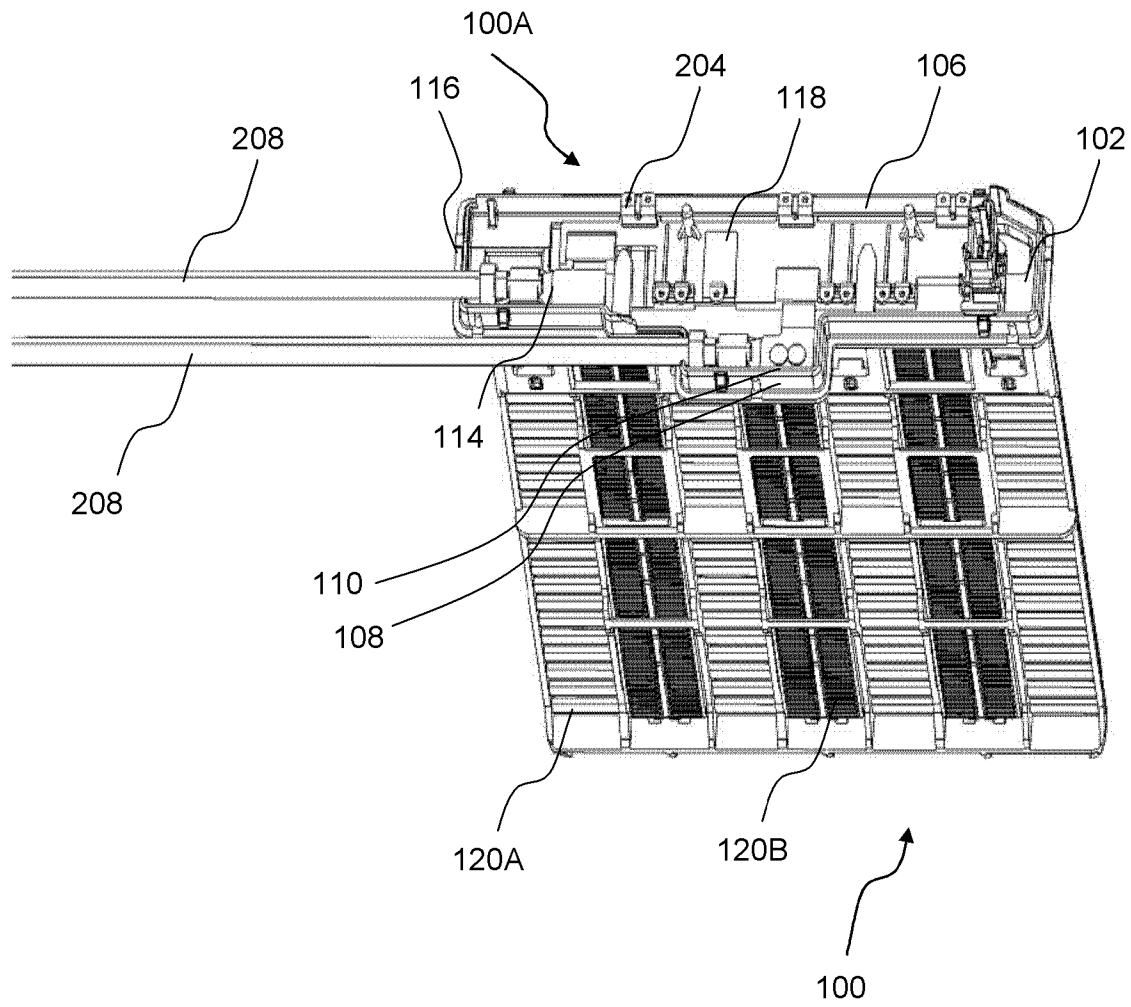


FIG. 2A

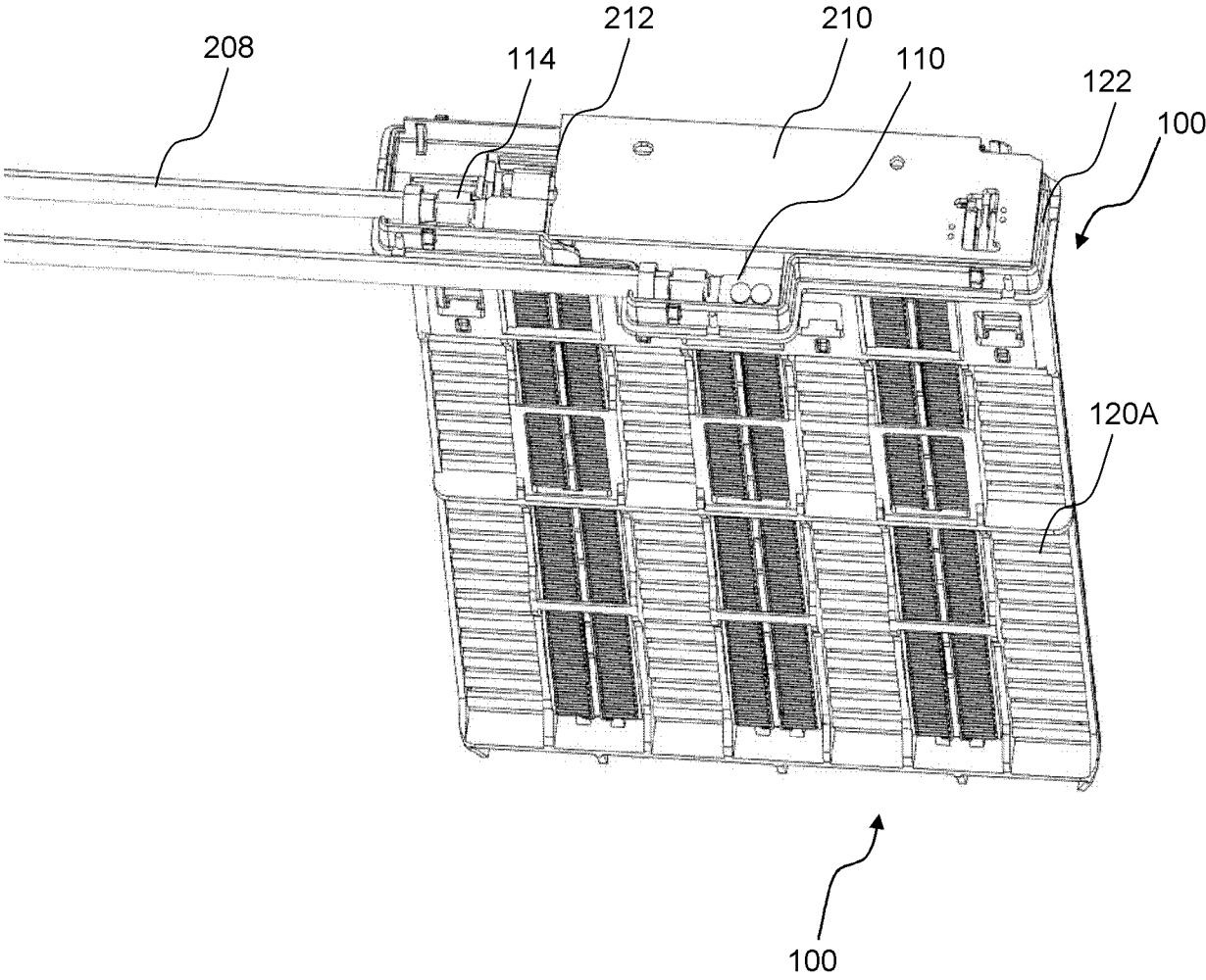
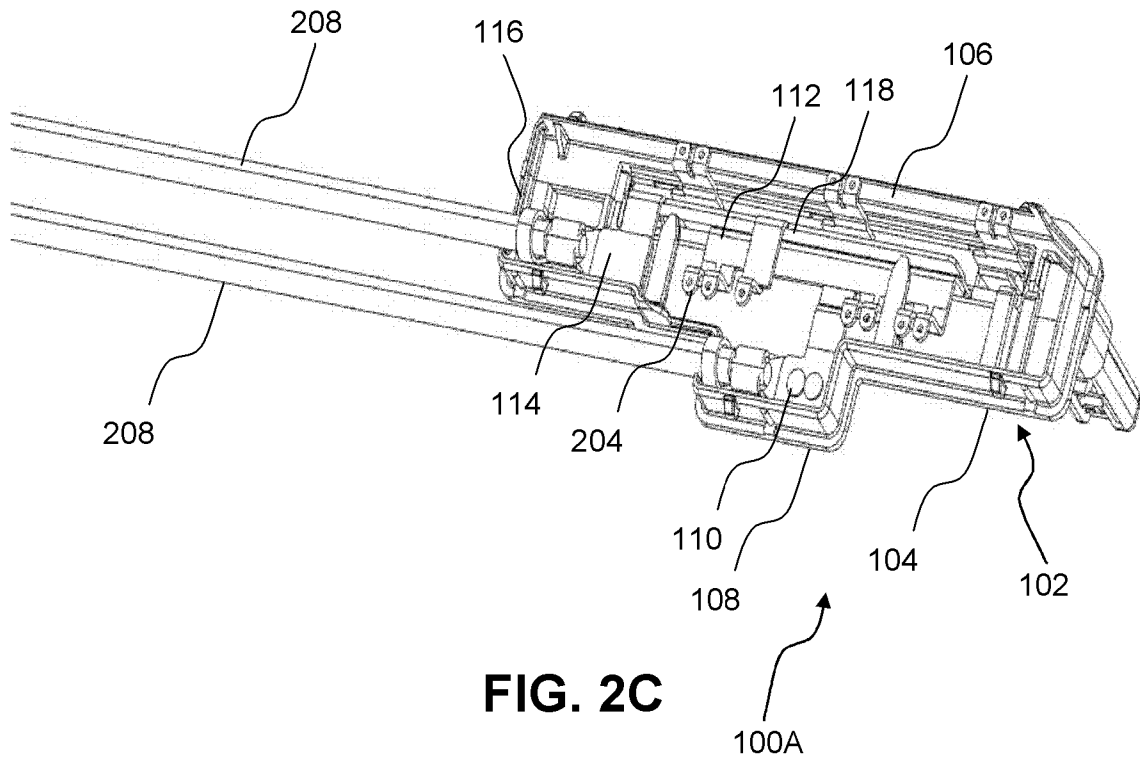


FIG. 2B



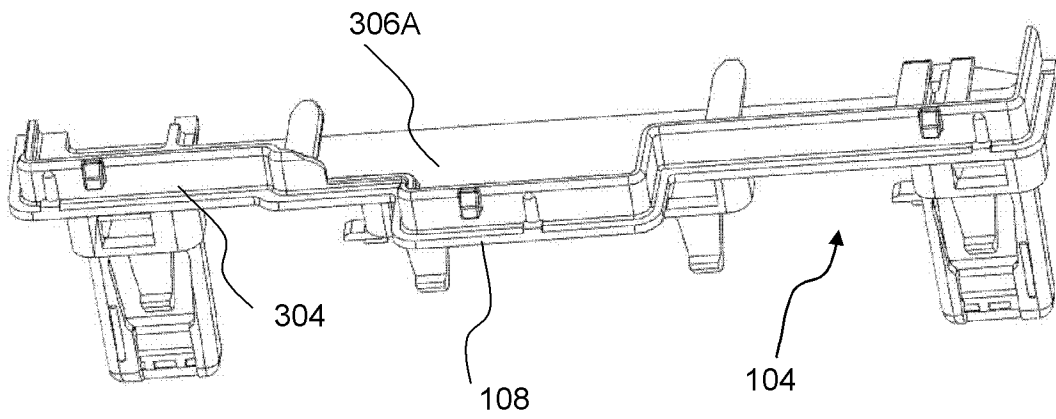


FIG. 3A

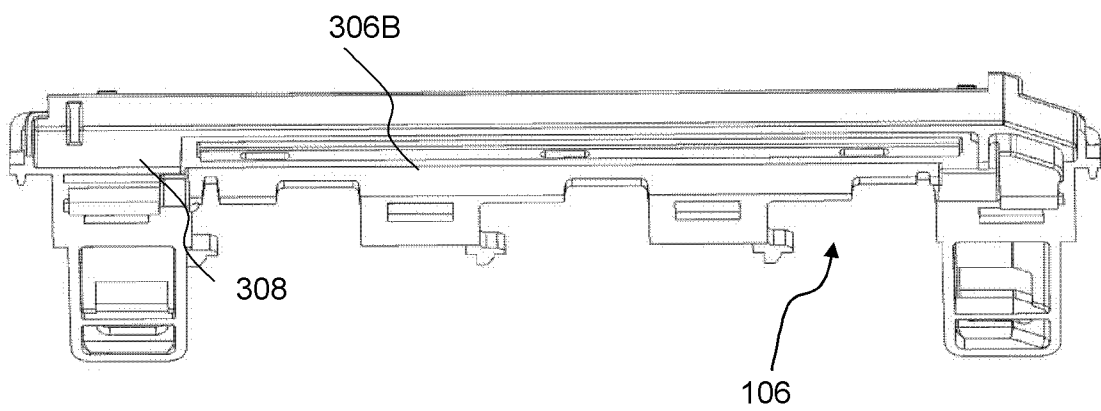


FIG. 3B

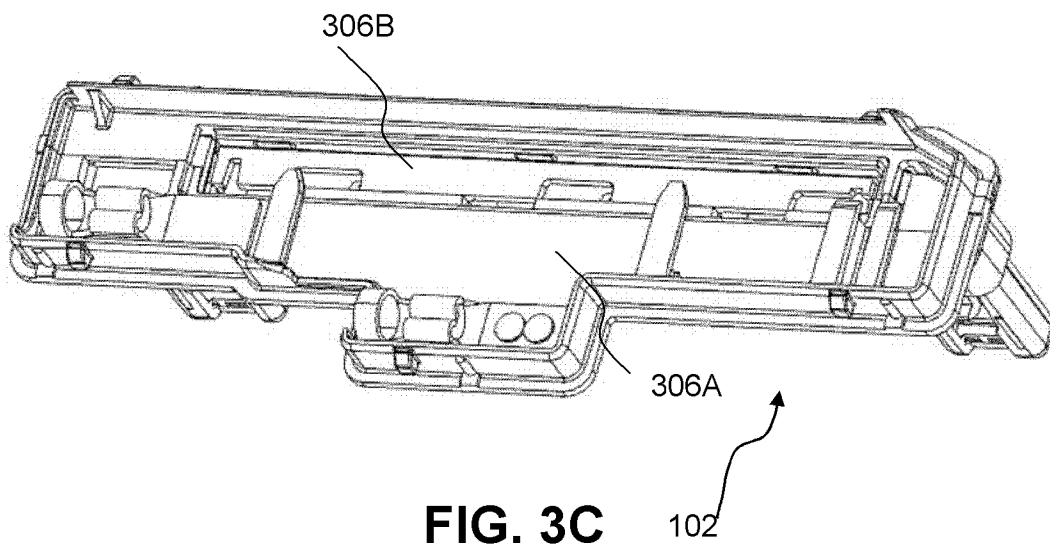


FIG. 3C

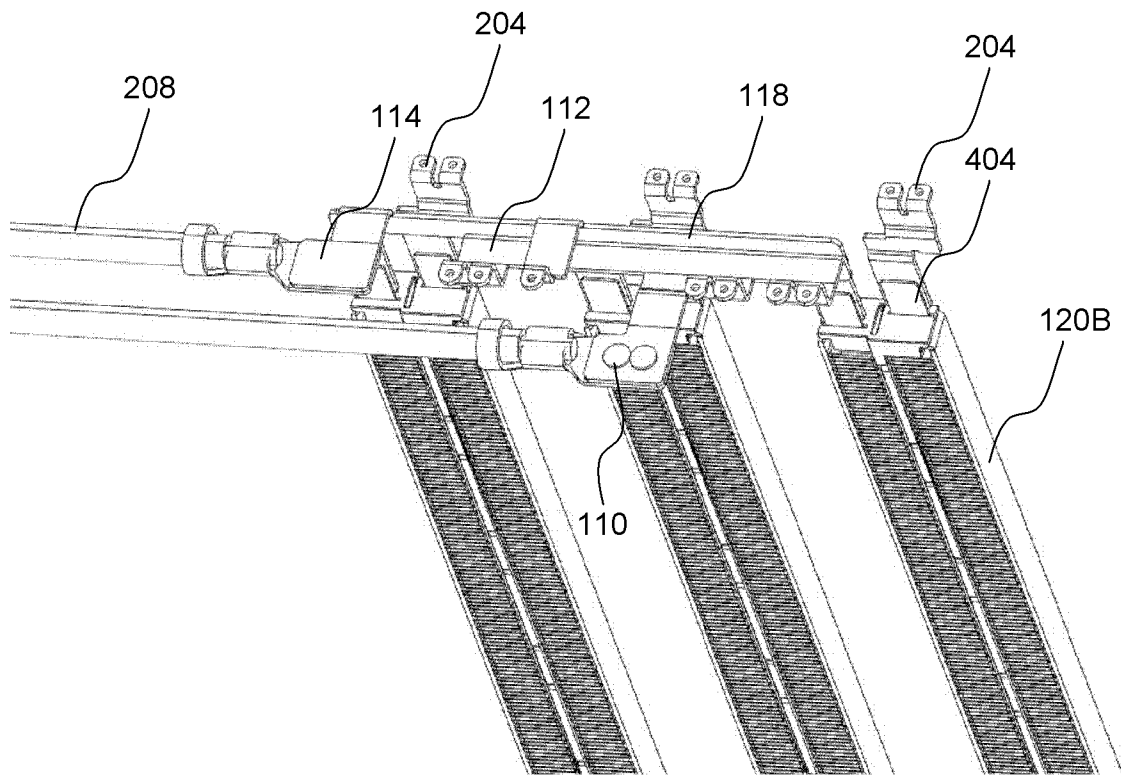


FIG. 4



100

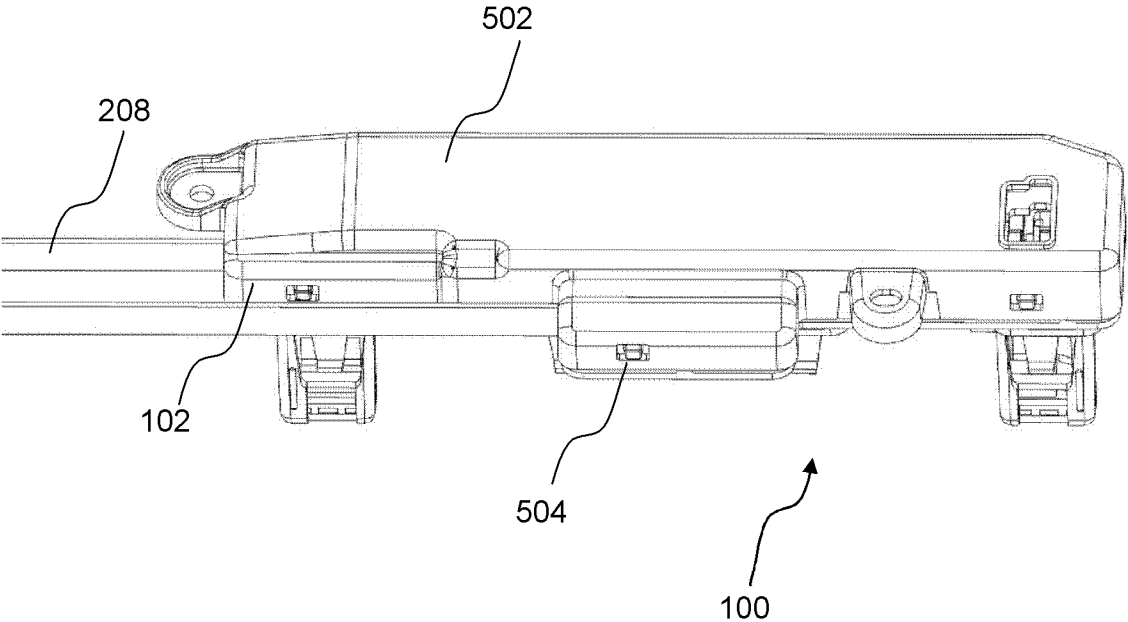


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/076940

A. CLASSIFICATION OF SUBJECT MATTER

B60H 1/00(2006.01)i; F24H 1/00(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B60H; F24H

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,VEN: housing,heater,heating,end,bus,bar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 109210768 A (HANGZHOU SANHUA RES INST CO LTD) 15 January 2019 (2019-01-15) Paragraphs 0034-0067 of the description, figures 1-21	1-10
A	CN 106642654 A (CHONGQING CHAOLI HI-TECH CO LTD) 10 May 2017 (2017-05-10) full document	1-10
A	CN 102917892 A (MITSUBISHI HEAVY IND CO LTD) 06 February 2013 (2013-02-06) full document	1-10
A	CN 105917117 A (MITSUBISHI HEAVY IND AUTOMOTIVE THERMAL SYS CO LTD) 31 August 2016 (2016-08-31) full document	1-10
A	EP 1884383 A1 (BEHR FRANCE ROUFFACH SAS) 06 February 2008 (2008-02-06) full document	1-10
A	KR 20100049397 A (KB AUTOTECH LLC) 12 May 2010 (2010-05-12) full document	1-10
A	KR 20100064775 A (HYUNDAI MOTOR CO LTD et al.) 15 June 2010 (2010-06-15) full document	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

* 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

“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

Date of the actual completion of the international search

06 May 2020

Date of mailing of the international search report

02 June 2020

Name and mailing address of the ISA/CN

National Intellectual Property Administration, PRC
6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing
100088
China

Authorized officer

SONG, Yanqi

Facsimile No. (86-10)62019451

Telephone No. 86- (010) -62085444

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2020/076940

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	109210768	A	15 January 2019	None			
CN	106642654	A	10 May 2017	None			
CN	102917892	A	06 February 2013	EP	2614971	A1	17 July 2013
				JP	2012056351	A	22 March 2012
				US	2013062337	A1	14 March 2013
				WO	2012032944	A1	15 March 2012
CN	105917117	A	31 August 2016	US	2016327316	A1	10 November 2016
				JP	2015178806	A	08 October 2015
				DE	112015001276	T5	19 January 2017
				WO	2015141272	A1	24 September 2015
EP	1884383	A1	06 February 2008	DE	502006007891	D1	28 October 2010
				AT	481257	T	15 October 2010
KR	20100049397	A	12 May 2010	None			
KR	20100064775	A	15 June 2010	None			