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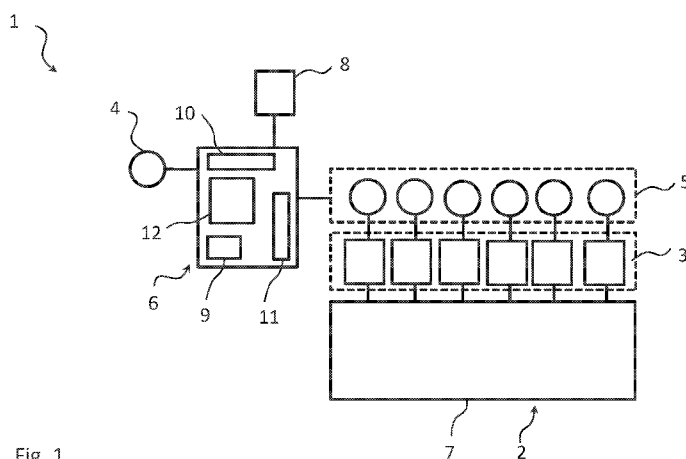


Fig. 1

(57) **Abstract:** An air conditioner system for a vehicle comprises a seat occupancy sensor for providing information about a current occupancy of seats by persons in the vehicle and an air conditioner for providing a conditioned air to a plurality of vent outlets. Each of vent outlets comprises a set of first vent shutters, each first vent shutter being pivotable about an essentially vertical axis and a set of second vent shutters, each second vent shutter being pivotable about an essentially horizontal axis. A first vent shutter actuator is provided for rotating the first vent shutters for altering the flow of the conditioned air in the horizontal direction and a second vent shutter actuator is provided for rotating the second vent shutters for altering the flow of the conditioned air in the vertical direction. A controller is configured to activate the first vent shutter actuator and the second vent shutter actuator in accordance with the information about occupancy of seats by persons in the vehicle for adjusting the first vent shutters and the second vent shutters in such way that the first vent shutters and the second vent shutters direct the conditioned air to the persons in the vehicle.



AIR CONDITIONER SYSTEM FOR A VEHICLE

The present application relates to an air conditioner system.

5 In particular, the application relates to an improved air conditioner system for vehicles.

In the prior art, adjustable air conditioners for vehicles are known, which can be adjusted manually by the driver or by a
10 passenger of the vehicle. In particular, air conditioners with adjustable air temperature and air blowing intensity are known.

It is an object of this application to provide an improved air
15 conditioner system for vehicles.

The application provides an improved air conditioner system for a vehicle, the air conditioner system comprises a seat occupancy sensor for providing information about a current occupancy of seats by persons in the vehicle and an air conditioner for providing a conditioned air to a plurality of vent outlets. Each of vent outlet comprises a set of first vent shutters, each first vent shutter being pivotable about an essentially vertical axis, and a set of second vent shutters, each
20 second vent shutter being pivotable about an essentially horizontal axis. A first vent shutter actuator is provided for rotating the first vent shutters for altering the flow of the conditioned air in the horizontal direction and a second vent shutter actuator is provided for rotating the second vent
25 shutters for altering the flow of the conditioned air in the vertical direction. A controller is configured to activate the first vent shutter actuator and the second vent shutter actuator in accordance with the information about occupancy of seats by persons in the vehicle for adjusting the first vent
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shutters and the second vent shutters in such way that the first vent shutters and the second vent shutters direct the conditioned air to the persons in the vehicle.

5 Conditioned air in this context means that the air is conditioned by the air conditioner according to settings chosen by a user. In particular, the air conditioner in the present context can comprise both an air cooler and an air heater for conditioning the air to a pre-set temperature chosen by the
10 user by cooling or heating of the air in the air conditioner, as the case may be.

In the present context, essentially horizontal means essentially parallel to the basic plane or the plane of the wheel
15 axes of the vehicle and the essentially vertical means essentially perpendicular to the basic plane of the vehicle.

The information about a current occupancy of seats by persons in the vehicle gives a current occupancy state of the vehicle.
20 This information can include a current occupancy of the seats of the vehicle as well as current location of persons on the seats.

The seat occupancy sensor can comprise electrical and/or electro-mechanical sensors installed in the seats of the vehicle.
25 In particular the sensors can be capacitive sensors or mechanical switches that are activated by the weight of persons sitting in the vehicle.

30 The occupancy sensor can comprise an optical sensor configured to capture optical data of the interior the cabin of the vehicle and for determining the current occupancy state of the vehicle.

The actuators, in particular the first vent shutter actuator and the second vent shutter actuator, can comprise electrical motors for adjusting the vent outlets electrically by means of control signals, in particular by a first shutter actuator adjustment signal and by a second shutter actuator adjustment signal.

The air conditioner system represents an intelligent air conditioner system which can recognize whether the passenger seat is occupied or not, and which can accordingly adjust the operation of the air conditioner.

At least one of the adjustable vent outlets can be provided for being placed at a passenger seat in the vehicle for providing conditioned air at the location of the passenger seat and the first vent shutters or the second vent shutters can be configured such that by rotating the first vent shutters or the second vent shutters to a respective closing angle the vent outlet can be closed. The controller can be further configured to activate the first vent shutter actuator or the second shutter actuator for rotating the first vent shutters or the second vent shutters to the respective closing angle if determined that the passenger seat at which the vent outlet is placed is not occupied.

Alternatively or additionally, the controller can be further configured to activate the first vent shutter actuator for rotating the first vent shutters in such way that conditioned air is redirected from an unoccupied passenger seat to an occupied passenger seat.

Thus, the flow of the conditioned air can be delivered purposefully to the persons in the vehicle without wasting the conditioned air.

In such way, the overall efficiency of the air conditioner system can be increased. Consequently, the wear of the air conditioner, the energy waste, and the environmental impact can be minimized as well.

At least one vent outlet can be provided for being placed as a back seat vent outlet for providing conditioned air to a back seat area of the vehicle and the occupancy sensor is configured to determine the presence and a current passenger location on the back seat. The controller is further configured to activate the first vent shutter actuator for adjusting the position of the first vent shutters in such way that the conditioned air is directed to the current passenger location.

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Thus, the passenger on the back seat can be provided with an individually targeted conditioned air even if the passenger changes his/her location on the back seat.

20 The controller can be further configured to activate the second vent shutter actuator for adjusting the first second vent shutters in such way that the conditioned air to a certain body region of the passenger.

25 Thus, certain regions of the passenger body can be dedicatedly ventilated.

The controller can be also configured to activate the second vent shutter actuator for adjusting the second vent shutters in a dynamic manner for alternately directing the conditioned air to different body regions of the passenger.

30

By such dynamic alteration of the air flow direction all body regions of the passenger can be sequentially ventilated, leading to an increased feeling of comfort.

5 At least one vent outlet can be provided as a driver seat vent outlet for providing the conditioned air in the driver seat region of the vehicle and the air conditioner system can further comprise a driver identification device. The controller can be configured to identify the driver based on the information provided by the driver identification device and to activate the first vent shutter actuator and the second vent shutter actuator of the vent outlet based on pre-stored personalized user profile data of the identified driver.

15 The pre-stored personalized user profile data can contain preferred settings which have been previously stored by the identified driver.

The driver identification device can be configured to provide a unique car key identification information.

The driver identification device can comprise a receiver configured to receive the unique car key identification information from a sender which is installed in the wireless key of the vehicle, in particular, when the sender is activated when the driver uses his wireless key to unlock the vehicle.

In an embodiment, the occupancy sensor comprises a sensor for person identification, configured to collect optical, acoustical, and or smell information for identifying persons localised by the occupancy sensor, wherein the controller is further configured to identify the persons present in the vehicle based on the information provided by the person identification sensor and to assign the identified persons to the occupied

locations in the vehicle and to adjust the plurality of vent outlets based on pre-stored personalized user profile data of the identified persons.

- 5 Thus the vent outlets can be adjusted according to preferences or pre-stored personalized user profile data of the identified person.

10 The vent outlets can comprise a user interface for making individual setting adjustments and for storing the individual settings, such that after adjusting the vent outlets, the user can, particularly by pressing a "store" button, store his preferable settings.

15 By storing the settings at a specific location in the vehicle, any earlier settings for the same person and for the same location can be overwritten. Thus the personalized user profile data associated with the person for the specific location can be updated.

20 Thus, the vent outlets can be adjusted according to the latest preferences of the user.

25 According to another aspect of the application, a controller of an air conditioner system for a vehicle is provided. The controller comprises an input interface configured for receiving seat occupancy information, in particular from a seat occupancy sensor. The controller further comprises a processor for generating a first vent shutter actuator adjustment signal
30 for rotating a set of first vent shutters about essentially vertical axes according to the seat occupancy information and a second vent shutter actuator adjustment signal for rotating a set of second vent shutters about essentially horizontal axes according to the seat occupancy information. An output in-

terface is provided for sending out the first vent shutter actuator adjustment signal to a first actuator and for sending out the second vent shutter actuator adjustment signal to a second actuator.

5

Thus, by generating and sending out the shutter adjustment signals according to the seat occupancy information the conditioned air from the air conditioner purposefully directed to the persons occupying the vehicle.

10

The input interface can be further configured for receiving driver identification information and the controller can further comprise a memory unit for storing personalized user profile data. The processor can be configured to identify the driver and to generate a first vent shutter actuator adjustment signal and a second vent shutter actuator adjustment signal according to the stored personalized user profile data of the identified driver.

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20 Thus the driver seat vent outlet can be adjusted according to the preferences of the driver.

According to another aspect of the application, a method for operating an air conditioner system for a vehicle is provided, the method comprises:

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- receiving seat occupancy information from a seat occupancy sensor,
- generating a first vent shutter actuator adjustment signal according to the seat occupancy information, and
- 30 - rotating a set of first vent shutters about an essentially vertical axis according to the first vent shutter actuator signal,
- generating a second vent shutter actuator adjustment signal according to the seat occupancy information, and

- rotating a set of second shutters about an essentially horizontal axis according to the second vent shutter actuator adjustment signal, wherein the first vent shutters and the second vent shutters of each vent outlet direct conditioned air to persons occupying the vehicle.

The generating of the first vent shutter actuator adjustment signal and the second vent shutter actuator adjustment signal is can be done by means of a processor.

Thus, the flow of the conditioned air can be delivered purposefully to the persons in the vehicle without wasting the conditioned air.

The method can further comprise generating a first vent shutter actuator adjustment signal or a second vent shutter actuator adjustment signal for closing the first shutters or the second shutters of at least one vent outlet, if determined that a seat in the vehicle at which the vent outlet is targeted is not occupied.

The determination whether a particular seat is occupied or not can be based on the seat occupancy information.

The seat occupancy information can comprise information about a current position of a passenger on a back seat of the vehicle, and wherein the first vent shutter actuator adjustment signal is generated according to the current passenger location on the back seat.

Thus, the passenger on the back seat can be provided with an individually targeted conditioned air even if the passenger changes his/her location on the back seat.

The method can further comprise:

- receiving driver identification information from a driver identification device,
- 5 - retrieving personalized user profile data of the identified driver,
- generating a first vent shutter actuator adjustment signal and a second vent shutter actuator adjustment signal for adjusting the vent outlets according to the
- 10 personalized user profile data of the identified driver.

According to still another aspect of the application, a vehicle is provided, the vehicle comprising an air conditioner

15 system according to the first aspect of the application for providing conditioned air in the cabin of the vehicle.

Because of the intelligent way of adjusting the vent outlets of the air conditioner system, the conditioned air can be distributed in the cabin of the vehicle in a targeted manner,

20 such that the conditioned air is purposefully provided to the persons in the vehicle.

The exemplary embodiments will hereinafter be described in conjunction with the following drawing figures, wherein like

25 numerals denote like elements, and wherein:

Fig. 1 shows a block diagram of an air conditioner system for a vehicle according to an embodiment,

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Fig. 2 shows a schematic top view of a vehicle according to an embodiment in a first occupancy state,

Fig. 3 shows a schematic top view of the vehicle in a second occupancy state,

Fig. 4 shows a schematic top view of the vehicle in a third
5 occupancy state,

Fig. 5 shows a schematic top view of the vehicle in a fourth occupancy state,

10 Fig. 6 shows a schematic top view of the vehicle in a fifth occupancy state,

Fig. 7 shows a schematic top view of the vehicle in a sixth occupancy state, and

15 Fig. 8 shows a schematic view of a vent outlet according to an embodiment.

In the following description, details are provided to describe
20 embodiments of the application. It shall be apparent to one skilled in the art, however, that the embodiments may be practiced without such details.

Some parts of the embodiment have similar parts. The similar
25 parts may have the same names or similar part numbers. The description of one similar part also applies by reference to another similar parts, where appropriate, thereby reducing repetition of text without limiting the disclosure.

30 Fig. 1 shows a block diagram of an air conditioner system for a vehicle according to an embodiment.

The air conditioner system 1 for a vehicle comprises an air conditioner 2 with a plurality of adjustable vent outlets 3,

an occupancy sensor 4 for providing information about the presence of persons in the vehicle, and a plurality of actuators 5 for adjusting the plurality of vent outlets 3. The air conditioner system 1 further comprises a controller 6, the
5 controller 6 being operationally connected with the sensor 4 and with the plurality of actuators 5.

The air conditioner 2 comprises an air conditioner aggregate 7 configured to deliver a conditioned air to the vent outlets 3.
10

Conditioned air in this context means that the air is conditioned by the air conditioner 2 according to the settings of the air conditioner 2. In particular, the conditioned air can be conditioned to a pre-set temperature value chosen by the
15 user in the course of heating or cooling of the air, as the case may be.

The vent outlets 3 are configured to provide a conditioned air into a cabin of a vehicle. In an embodiment, air can be conditioned, in particular the air temperature can be chosen for
20 individual vent outlets 3 separately.

The adjustable vent outlets 3 are vent outlets with air flow intensity and adjustable air flow direction. In particular,
25 the vent outlets comprise a set of vertically pivoted shutters for a left-right adjustment of the air flow direction and a set of horizontally pivoted shutters for an up-down adjustment of the air flow direction.

30 The vent outlets 3 can be arranged in a cabin of a vehicle in such way that at least one of the adjustable vent outlets 3 is arranged for providing the conditioned air to an area of at least one seat in the vehicle. The actuators 5 are configured

to adjust the shutters in order to adjust the air flow intensity and the air flow direction of the vent outlets.

In another embodiment, coplanar shutters for closing and opening the aperture of the vent outlet are provided.

In a further embodiment, vent outlets with pivotable mounts for adjusting the air flow direction are provided.

10 The controller 6 is configured to control the plurality of actuators 5 in accordance with the information about the presence of persons in a vehicle, received from the sensor 4, in such way that the conditioned air is targeted to the persons present in the vehicle.

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The controller 6 is further configured to control the actuators in such way that one or more vent outlets are deactivated by closing the vertically pivoted shutters or the horizontally pivoted shutters of the respective vent outlets, if the corresponding seats in the vehicle are not occupied.

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By targeting the conditioned air to the persons present in the vehicle, the conditioned air can be used efficiently, since the conditioned air is used purposefully. In particular, the conditioned air is not wasted for those locations in the vehicle, which are not occupied.

25

The controller 6 comprises an input interface 10 which is configured to receive data representing information about the presence of persons in the vehicle and about a current status of the shutters of the vent outlets 3 of an air conditioner 2.

30

The controller further comprises an output interface 11 for providing control signals to the actuators 5.

The controller 6 also comprises a processor 12 configured to process the received data and to determine whether the current status of the vent outlets, in particular the position of the shutters of the vent outlets 3 corresponds to the current presence of persons in the vehicle and for instructing the output interface 11 to provide control signals to the actuators 5 for adjusting the shutters of the vent outlets in such way that the conditioned air is targeted by the vent outlets 3 to the persons present in the vehicle.

The input interface 10 of the controller 6 is further configured to receive data representing information from a driver identification device 8, and wherein the controller further comprises a memory unit 9 for storing personalized user profile data and is configured for identifying the driver and to control the actuators 5 for adjusting the shutters of the vent outlets in such way that the conditioned air is provided according to the stored personalized user profile data of the identified driver.

In an embodiment, at least one vent outlet 3 is provided for being arranged as a back seat vent outlet dedicated to a back seat of a vehicle and the sensor 5 is configured to determine the presence and a current location of any passenger on the back seat of the vehicle. The controller 6 is further configured to control the actuators 5 for adjusting the shutters in such way in such way that the conditioned air is directed to the current location of the passenger.

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In an embodiment, the air conditioner system 1 comprises a passenger identification device which is also operationally connected with the controller 6.

The controller is further configured to identify the driver, based on the information provided by the driver identification device, and to adjust the vent outlets of the air conditioner system based on the stored personalized user profile data of the identified driver.

The driver identification device 8 is configured to provide unique car key identification information.

10 In an embodiment, the driver identification device is configured to provide information from an optical person recognition system installable in the vehicle.

In the operation, the controller receives data via the input interface 10. The received data represents information about current presence of persons in the vehicle or vehicle occupancy information - and about a current status of adjustable vent outlets 3 of the air conditioner 2.

20 By processing received data in the processor 12, the controller 6 determines whether the current status of the adjustable vent outlets 3 corresponds to the current occupancy state of the vehicle.

25 If determined that the current status of the vent outlets 3 does not correspond to the current occupancy state of the vehicle, the processor instructs the output interface 11 to provide control signals to the actuators 5 for changing the state of the vent outlets in such way that the state of the vent outlets 3 corresponds to the current occupancy state of the vehicle.

In particular, if determined that a seat in the vehicle is not occupied, and if determined that a vent outlet which is as-

signed to the unoccupied seat is not deactivated, the processor 9 instructs the output interface 11 to provide control signals to the actuator 5 for deactivating the vent outlet assigned to the unoccupied seat.

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In an embodiment, the operation of the air conditioning system comprises steps of identifying the driver of the vehicle, retrieving the personalized user profile data of the identified driver and adjusting the vent outlets according to the PUMP.

10

Fig. 2 shows a schematic top view of a vehicle according to an embodiment in a first occupancy state.

The vehicle 21 has a vehicle body 22 with a cabin 23, a left front seat 24, a right front seat 25, a back seat 26, and an air condition system 2. The air conditioner system 1 of Fig. 2 corresponds to the air conditioner system 2 of Fig. 1.

The vehicle of Fig. 2 is designed for left-hand traffic as it can be recognized by a steering wheel 27 which is located on the right-hand side of the cabin 23. For a right-hand-traffic vehicle, the left and right sides in the figure should be swapped accordingly.

The front seats 24, 25 and the back seat 26 are occupied by a driver, who is sitting at the steering wheel 27, and three passengers. The driver and the passenger are shown schematically.

In order to avoid an overloading of the figure, Fig. 2 does not show all functional components of the air conditioner system 1, since a detailed description of the air conditioner system 1 is given above.

From the components of the air conditioner system 1 shown in Fig.1, Fig. 2 only shows the air conditioner 2, the sensor 4, the controller 6, and the plurality of vent outlets 3, the plurality of vent outlets 3.

5

The occupancy sensor 4 is schematically shown as a circle in the central region of the cabin.

The plurality of vent outlets 3 is represented in Fig. 2 by
10 six vent outlets 30, 31, 32, 33, 34, 35 with adjustable aperture and vent direction distributed at different locations in the cabin 23.

Four vent outlets 30, 31, 32, 33 are arranged in the front of
15 the cabin 3 of the vehicle 21. Two of the vent outlets 30, 31 in the front are arranged on the left-hand side for providing the conditioned air to the passenger on the left front seat 24. Two of the vent outlets 32, 33 in the front are arranged on the right side for providing the conditioned air to the
20 driver on the driver seat 25.

Two of the vent outlets 34, 35 are arranged in the central part of the cabin 3 and are directed towards the back seat 6.

25 The small arrows at the vent outlets 30, 31, 32, 33, 34, 35 indicate direction of the conditioned air flowing from the vent outlets 30, 31, 32, 33, 34, 35.

The controller 6 receives the occupancy information of the vehicle 21 from the occupancy sensor and the information about
30 the current state - i.e. aperture and the vent direction - of the vent outlets 30, 31, 32, 33, 34, 35.

Based on this information, the controller determines whether the current status of the vent outlets 30, 31, 32, 33, 34, 35 corresponds to the current occupancy situation of the vehicle 21. The controller adjusts the vent outlets by means of actuators 5 (not shown in Fig. 2) if it determines that the current status of the vent outlets 30, 31, 32, 33, 34, 35 does not correspond to the current occupancy state of the vehicle 21.

In the occupancy state of the vehicle 21 as shown in Fig. 2, all vent outlets 30, 31, 32, 33, 34, 35 are open. Thus, the conditioned air is targeted to all persons sitting in the vehicle 21.

Fig. 3 shows the vehicle 21 of Fig. 2 in a second occupancy state.

In the occupancy state of the vehicle 21 shown in Fig. 3, the both front seats 24, 25 are occupied.

The back seat 26 is occupied by one passenger who is sitting at the right edge of the back seat 26.

The occupancy state is detected by the occupancy sensor 4 which sends the information on the occupancy to the controller 6.

Based on the information, the controller 6 adjusts the vent outlets 30, 31, 32, 33, 34, 35 by means of actuators 5, if necessary. Fig. 3 shows such adjusted state of the vent outlets 30, 31, 32, 33, 34, 35.

The four vent outlets 30, 31, 32, 33 which are arranged in the front part of the cabin 3 are open. Thus, the passenger on the left front seat 24 and the driver on the right front seat 25

are provided with the conditioned air as shown by the arrows at the vent outlets 30, 31, 32, 33.

The vent outlets 34 and 35 in the central part of the cabin 23 are adjusted by the controller 6 according to the occupancy situation is such way that the right vent outlet 35 arranged in the central part of the cabin 23 is open, while the left vent outlet 34 arranged in the central part of the cabin 23 is closed, as indicated by a cross on the vent outlet 34 in Fig. 3. Thus, the conditioned air flows from the vent outlet 35 towards the passenger sitting on the back seat 26. By closing the vent outlet 34, more conditioned air is available for purposely directing to the persons sitting in the vehicle 21.

Fig. 4 shows a schematic top view of the vehicle in a third occupancy state.

In the occupancy state shown in Fig. 4, the both front seats 24, 25 are occupied, while the back seat 26 is not occupied.

On determining the occupancy state based on the information provided by the occupancy sensor 4, the controller 6 adjusts the vent outlets 30, 31, 32, 33, 34, 35 accordingly.

In the adjusted state, shown in Fig. 4, the four vent outlets 30, 31, 32, 33 arranged in the front part of the cabin 23 are open. Thus, the passenger on the left front seat 24 and the driver on the right front seat 25 are provided with the conditioned air as shown by the arrows at the vent outlets 30, 31, 32, 33.

The vent outlets 34 and 35 arranged in the central part of the cabin 3 are closed, as indicated by crosses on the vent out-

lets 34 and 35 in Fig. 4. Thus no targeted conditioned air is wasted on the back part of the cabin 23.

Fig. 5 shows a schematic top view of the vehicle in a fourth
5 occupancy state.

In the occupancy state shown in Fig. 5, the passenger front seats 24, 26 are not occupied.

10 On determining the occupancy state based on the information provided by the occupancy sensor 4, the controller 6 adjusts the vent outlets 30, 31, 32, 33, 34, 35 accordingly.

In the adjusted state, shown in Fig. 5, the two vent outlets
15 30, 31 arranged on the left-hand side in the front part of the cabin 23 and the two vent outlets 34, 35 in the central part of the cabin are closed, while the two vent outlets 32, 33 on the right-hand side in the front part of the cabin 23 are open.

20 Thus, the driver on the right front seat 25 is provided with the conditioned air as shown by the arrows.

By closing the vent outlets 30, 31, 34, 35 no targeted conditioned air is wasted on those locations in the cabin 23 where
25 no passengers are present. Thus more conditioned air is available, which can be targeted to the driver.

Fig. 6 shows a schematic top view of the vehicle in a fifth
30 occupancy state.

In the occupancy state shown in Fig. 6, the both front seats 24, 25 are occupied.

The back seat 26 is occupied by one passenger who is sitting in the middle of the back seat 26.

On determining the occupancy state based on the information
5 provided by the occupancy sensor 4, the controller 6 adjusts the vent outlets 30, 31, 32, 33, 34, 35 accordingly.

In the adjusted state, shown in Fig. 6, the four vent outlets 30, 31, 32, 33 arranged in the front part of the cabin 23 are
10 open. Thus, the passenger on the left front seat 24 and the driver on the right front seat 25 are provided with the conditioned air as shown by the arrows at the vent outlets 30, 31, 32, 33.

15 The vent outlets 34 and 35 arranged in the central part of the cabin 3 are open and are directed to the passenger who is sitting in the middle of the back seat 26, as indicated by two parallel arrows at the vent outlets 34 and 35 in Fig. 4. Thus, all persons in the vehicle 21 are targetedly provided with the
20 conditioned air.

Fig. 7 shows a schematic top view of the vehicle in a sixth occupancy state.

25 In the occupancy state shown in Fig. 6, the both front seats 24, 25 are occupied, while the back seat 26 is occupied by one passenger in a position slightly shifted from the middle of the back seat towards its right edge.

30 On determining the occupancy state based on the information provided by the occupancy sensor 4, the controller 6 adjusts the vent outlets 30, 31, 32, 33, 34, 35 accordingly.

In the adjusted state, shown in Fig. 7, the four vent outlets 30, 31, 32, 33 arranged in the front part of the cabin 23 are open. Thus, the passenger on the left front seat 24 and the driver on the right front seat 25 are provided with the conditioned air as shown by the arrows at the vent outlets 30, 31, 32, 33.

The vent outlet 34 is closed and the vent outlet 35 is open. The vent direction of the vent outlet 35 is adjusted in such way that the conditioned air is directed to the passenger who is sitting on the back seat 26, as indicated by an arrow at the vent outlet 35 in Fig. 4. Thus, all persons in the vehicle 21 are targetedly provided with the conditioned air.

Fig. 8 shows a schematic view of a vent outlet according to an embodiment.

The vent outlet 3 comprises a vent outlet ring 40 defining an essentially circular vent outlet opening 41. The vent outlet 3 further comprises a set of first vent shutters 42 and a set of second vent shutters 43. The first shutters 42 are pivotably mounted in such way that each of the first vent shutters 42 can be rotated about an essentially vertical axis. The second vent shutters 43 are pivotably mounted in such way that each of the second vent shutters 43 can be rotated about an essentially horizontal axis.

The rotation axes of the first vent shutters 42 and of the second vent shutters 43 are shown as dash-dotted lines in Fig. 8.

The first vent shutters 42 and the second vent shutters 42 are adjustable by a first vent shutter actuator 51 and by a second vent shutter actuator 52. In this example the first vent shut-

ters 42 and the second vent shutters 43 can be adjusted by rotating the first vent shutters 42 and the second vent shutters 43 about their respective axes.

- 5 In this embodiment, a first step motor with a first rotation axis and a second step motor with a second rotation axis are used as actuators 51, 52. The rotation axes of the step motors are also shown as dash-dotted lines.
- 10 The first vent shutter actuator 51 and the second vent shutter actuator 52 are operationally connected with the first shutters 32 and the second shutters 33 respectively. The operational connection of the step motors 51, 52 is indicated by a dashed line encircling the axis of the respective rotational
- 15 axes.

The second vent shutters 33 are configured in such way that by rotating the second shutters 33 to a certain angle, the vent outlet opening 31 is closed and thus the vent outlet is deactivated. In this embodiment, the vent outlet is closed if the

20 second vent shutters 33 are rotated to a position in which the second vent shutters 33 are arranged coplanar with the vent outlet opening.

- 25 In another embodiment, the vent outlet can comprise aperture adjusting shutters for changing the air flow intensity and a pivotal mount for changing the air flow direction.

The aperture adjusting shutters can be coplanar adjustable

30 shutters, configured to be gradually opened and closed by an actuator.

The pivotal mount can be configured for pivoting the vent outlet by an actuator in order to change the air flow direction of the vent outlet.

5 The vent outlets can further comprise individual blowers with individually adjustable blowing intensity and the adjusting of the plurality of vent outlets can further comprise adjusting of the blowing intensity of the individual blowers by the controller.

10

Although the above description contains much specificity, this should not be construed as limiting the scope of the embodiments but merely providing illustration of the foreseeable embodiments. The above stated advantages of the embodiments should not be construed especially as limiting the scope of the embodiments but merely to explain possible achievements if the described embodiments are put into practice. Thus, the scope of the embodiments should be determined by the claims and their equivalents, rather than by the examples given.

20

Examples for different aspects of the application are listed below.

Example 1. An air conditioner system for a vehicle, the air conditioner system comprising:

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- a seat occupancy sensor (4) for providing information about a current occupancy of seats by persons in the vehicle,

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- an air conditioner (2) for providing a conditioned air to a plurality of vent outlets (3), each of vent outlets (3) comprising

- a set of first vent shutters (42), each first vent shutter (42) being pivotable about an essentially vertical axis,

- a set of second vent shutters (43), each second vent shutter (43) being pivotable about an essentially horizontal axis,

- a first vent shutter actuator (51) for rotating the first vent shutters (42) for altering the flow of the conditioned air in the horizontal direction and

- a second vent shutter actuator (52) for rotating the second vent shutters (43) for altering the flow of the conditioned air in the vertical direction,

a controller (6) being configured to activate the first vent shutter actuator (51) and the second vent shutter actuator (52) in accordance with the information about occupancy of seats by persons in the vehicle for adjusting the first vent shutters (42) and the second vent shutters (42) in such way that the first vent shutters (42) and the second vent shutters (43) direct the conditioned air to the persons in the vehicle.

Example 2. The air conditioner system of example 1, wherein at least one vent outlet (3) is provided for being placed at a passenger seat in the vehicle for providing conditioned air at the location of the passenger seat, and wherein the first vent shutters (42) or the second vent shutters (43) are configured such that by rotating the first vent shutters (42) or the second vent shutters (43) to a respective closing angle the vent outlet can be closed, and wherein the controller (6) is configured to activate the first vent shutter actuator (51) or the second shutter actuator (52) for rotating the first vent shutters (42) or the second vent shutters (43) to the respective closing angle if determined that the passenger seat at which vent outlet is placed is not occupied.

Example 3. The air conditioner system according to example 1 or 2, wherein at least one vent outlet (3) is provided for being placed as a back seat vent outlet for providing the conditioned air in the back seat region of the vehicle, and wherein the sensor (4) is configured to determine a current passenger location on the back seat, and the controller (6) is further configured to activate the first vent shutter actuator (51) for adjusting the position of the first vent shutters (42) in such way that the conditioned air is directed to the current passenger location.

Example 4. The air conditioner of example 3, wherein the controller (6) is further configured to activate the second vent shutter actuator (52) for adjusting the first second vent shutters (43) in such way that the conditioned air to a certain body region of the passenger.

Example 5. The air conditioner of example 3, wherein the controller (6) is further configured to activate the second vent shutter actuator (52) for adjusting the second vent shutters (43) in a dynamic manner for alternately directing the conditioned air to different body regions of the passenger.

25

Example 6. The air conditioner system according to one of the previous examples, wherein at least one vent outlet (3) is provided for being arranged as a driver seat vent outlet for providing the conditioned air in the driver seat region of the vehicle, and wherein the air conditioner system (1) further comprises a driver identification device (8), wherein the controller (6) is configured to identify the driver based on the information provided by the driver identification

device (8) and to activate the first vent shutter actuator (51) and the second vent shutter actuator (52) of the vent outlet (3) based on pre-stored personalized user profile data of the identified driver.

5

Example 7. The air conditioner system of example 6, wherein the driver identification device (8) is configured to provide a unique car key identification information.

10 Example 8. The air conditioner system of example 6, wherein the driver identification device is configured to provide information from an optical person recognition system which is installable in the vehicle.

15 Example 9. A controller of an air conditioner system for a vehicle,
the controller (6) comprising:
an input interface (10) configured for receiving seat occupancy information,
20 a processor (12) for
-generating a first vent shutter actuator adjustment signal for rotating a set of first vent shutters about essentially vertical axes according to the seat occupancy information and
25 - generating a second vent shutter actuator adjustment signal for rotating a set of second vent shutters about essentially horizontal axes according to the seat occupancy information,
an output interface (11) configured for sending out the
30 first vent shutter actuator adjustment signal to a first actuator, and for sending out the second vent shutter actuator adjustment signal to a second actuator.

Example 10. The controller according to example 9, wherein

the input interface is further configured for receiving driver identification information, and wherein the controller (6) further comprises:

a memory unit (9) for storing personalized user profile data, and wherein the processor (12) is configured to identify the driver and to generate a first vent shutter actuator adjustment signal and a second vent shutter actuator adjustment signal according to the stored personalized user profile data of the identified driver.

Example 11. A method for operating an air conditioner system for a vehicle, the method comprising:

- receiving seat occupancy information from a seat occupancy sensor,
- generating a first vent shutter actuator adjustment signal according to the seat occupancy information and
- rotating a set of first vent shutters about an essentially vertical axis according to the first vent shutter actuator signal,
- generating a second vent shutter actuator adjustment signal according to the seat occupancy information, and
- rotating a set of second shutters about an essentially horizontal axis according to the second vent shutter actuator adjustment signal, wherein the first vent shutters and the second vent shutters of each vent outlet direct conditioned air to persons occupying the vehicle.

Example 12. The method of example 11, further comprising:

generating a first vent shutter actuator adjustment signal or a second vent shutter actuator adjustment signal for closing the first shutters or the second shutters of at least one vent outlet, if determined that a seat in the vehicle at which the vent outlet is targeted is not occupied.

Example 13. The method of example 11 or 12, wherein
the seat occupation information comprises information
about a current position of a passenger on a back seat of
5 the vehicle, and wherein the first vent shutter actuator
adjustment signal is generated according to the current
passenger location on the back seat.

Example 14. The method of one of the examples 11 to 13, com-
prising:

- receiving driver identification information from a
driver identification device,
- retrieving personalized user profile data of the iden-
tified driver, and
- 15 - generating a first vent shutter actuator adjustment
signal and a second vent shutter actuator adjustment sig-
nal for adjusting the vent outlets according to the per-
sonalized user profile data of the identified driver.

20 Example 15. Vehicle with a cabin, comprising an air condition-
er system

according to one of the examples 1 to 8 for providing
conditioned air in the cabin of the vehicle.

REFERENCE NUMBERS

	1	air conditioner system
5	2	air conditioner
	3	vent outlet
	4	sensor
	5	actuator
	6	controller
10	7	air conditioner aggregate
	8	driver identification device
	9	memory unit
	10	input interface
	11	output interface
15	12	processor
	13	aperture adjusting element
	14	vent direction adjusting element
	21	Vehicle
20	22	vehicle body
	23	cabin
	24	front left sit
	25	front right sit
	26	back seat
25	27	steering wheel
	30, 31, 32, 33	front seat vent outlets
	34, 35	back seat vent outlets
30	40	vent outlet ring
	41	vent outlet opening
	42	first vent shutter
	43	second vent shutter

30

51 first vent shutter actuator

52 second vent shutter actuator

CLAIMS

1. An air conditioner system for a vehicle, the air conditioner system comprising:
- 5 - a seat occupancy sensor (4) for providing information about a current occupancy of seats by persons in the vehicle,
- an air conditioner (2) for providing a conditioned air to a plurality of vent outlets (3), each of vent outlets
- 10 (3) comprising
- a set of first vent shutters (42), each first vent shutter (42) being pivotable about an essentially vertical axis,
- 15 - a set of second vent shutters (43), each second vent shutter (43) being pivotable about an essentially horizontal axis,
- a first vent shutter actuator (51) for rotating the first vent shutters (42) for altering the flow of the
- 20 conditioned air in the horizontal direction and
- a second vent shutter actuator (52) for rotating the second vent shutters (43) for altering the flow of the conditioned air in the vertical direction,
- a controller (6) being configured to activate the first
- 25 vent shutter actuator (51) and the second vent shutter actuator (52) in accordance with the information about occupancy of seats by persons in the vehicle for adjusting the first vent shutters (42) and the second vent
- shutters (42) in such way that the first vent shutters
- 30 (42) and the second vent shutters (43) direct the conditioned air to the persons in the vehicle.
2. The air conditioner system of claim 1, wherein

at least one vent outlet (3) is provided for being placed at a passenger seat in the vehicle for providing conditioned air at the location of the passenger seat, and wherein the first vent shutters (42) or the second vent shutters (43) are configured such that by rotating the first vent shutters (42) or the second vent shutters (43) to a respective closing angle the vent outlet can be closed, and wherein the controller (6) is configured to activate the first vent shutter actuator (51) or the second shutter actuator (52) for rotating the first vent shutters (42) or the second vent shutters (43) to the respective closing angle if determined that the passenger seat at which vent outlet is placed is not occupied.

3. The air conditioner system according to claim 1, wherein at least one vent outlet (3) is provided for being placed as a back seat vent outlet for providing the conditioned air in the back seat region of the vehicle, and wherein the sensor (4) is configured to determine a current passenger location on the back seat, and the controller (6) is further configured to activate the first vent shutter actuator (51) for adjusting the position of the first vent shutters (42) in such way that the conditioned air is directed to the current passenger location.

4. The air conditioner of claim 3, wherein the controller (6) is further configured to activate the second vent shutter actuator (52) for adjusting the first second vent shutters (43) in such way that the conditioned air to a certain body region of the passenger.

5. The air conditioner of claim 3, wherein the controller (6) is further configured to activate the second vent shutter actuator (52) for adjusting the sec-

ond vent shutters (43) in a dynamic manner for alternately directing the conditioned air to different body regions of the passenger.

5 6. The air conditioner of claim 1, wherein
at least one vent outlet (3) is provided for being arranged as a driver seat vent outlet for providing the conditioned air in the driver seat region of the vehicle, and wherein the air conditioner system (1) further comprises a driver identification device (8), wherein the
10 controller (6) is configured to identify the driver based on the information provided by the driver identification device (8) and to activate the first vent shutter actuator (51) and the second vent shutter actuator (52) of the
15 vent outlet (3) based on pre-stored personalized user profile data of the identified driver.

7. The air conditioner system of claim 6, wherein
the driver identification device (8) is configured to
20 provide a unique car key identification information.

8. The air conditioner system of claim 6, wherein
the driver identification device is configured to provide
information from an optical person recognition system
25 which is installable in the vehicle.

9. A controller of an air conditioner system for a vehicle,
the controller (6) comprising:
an input interface (10) configured for receiving seat occupancy information,
30 a processor (12) for
-generating a first vent shutter actuator adjustment signal for rotating a set of first vent shutters about es-

essentially vertical axes according to the seat occupancy information and

- generating a second vent shutter actuator adjustment signal for rotating a set of second vent shutters about essentially horizontal axes according to the seat occupancy information,

an output interface (11) configured for sending out the first vent shutter actuator adjustment signal to a first actuator, and for sending out the second vent shutter actuator adjustment signal to a second actuator.

10. The controller according to claim 9, wherein the input interface is further configured for receiving driver identification information, and wherein the controller (6) further comprises:
a memory unit (9) for storing personalized user profile data, and wherein the processor (12) is configured to identify the driver and to generate a first vent shutter actuator adjustment signal and a second vent shutter actuator adjustment signal according to the stored personalized user profile data of the identified driver.

11. A method for operating an air conditioner system for a vehicle, the method comprising:

- receiving seat occupancy information from a seat occupancy sensor,
- generating a first vent shutter actuator adjustment signal according to the seat occupancy information and
- rotating a set of first vent shutters about an essentially vertical axis according to the first vent shutter actuator signal,
- generating a second vent shutter actuator adjustment signal according to the seat occupancy information, and

- rotating a set of second shutters about an essentially horizontal axis according to the second vent shutter actuator adjustment signal, wherein the first vent shutters and the second vent shutters of each vent outlet direct
5 conditioned air to persons occupying the vehicle.

12. The method of claim 11, further comprising:
generating a first vent shutter actuator adjustment signal or a second vent shutter actuator adjustment signal
10 for closing the first shutters or the second shutters of at least one vent outlet, if determined that a seat in the vehicle at which the vent outlet is targeted is not occupied.

15 13. The method of claim 11, wherein the seat occupation information comprises information about a current position of a passenger on a back seat of the vehicle, and wherein the first vent shutter actuator adjustment signal is generated according to the current
20 passenger location on the back seat.

14. The method of one of the claim 11, comprising:
- receiving driver identification information from a driver identification device,
25 - retrieving personalized user profile data of the identified driver, and
- generating a first vent shutter actuator adjustment signal and a second vent shutter actuator adjustment signal for adjusting the vent outlets according to the personalized user profile data of the identified driver.
30

15. Vehicle with a cabin, comprising an air conditioner system according to one of the claim 1 for providing conditioned air in the cabin of the vehicle.

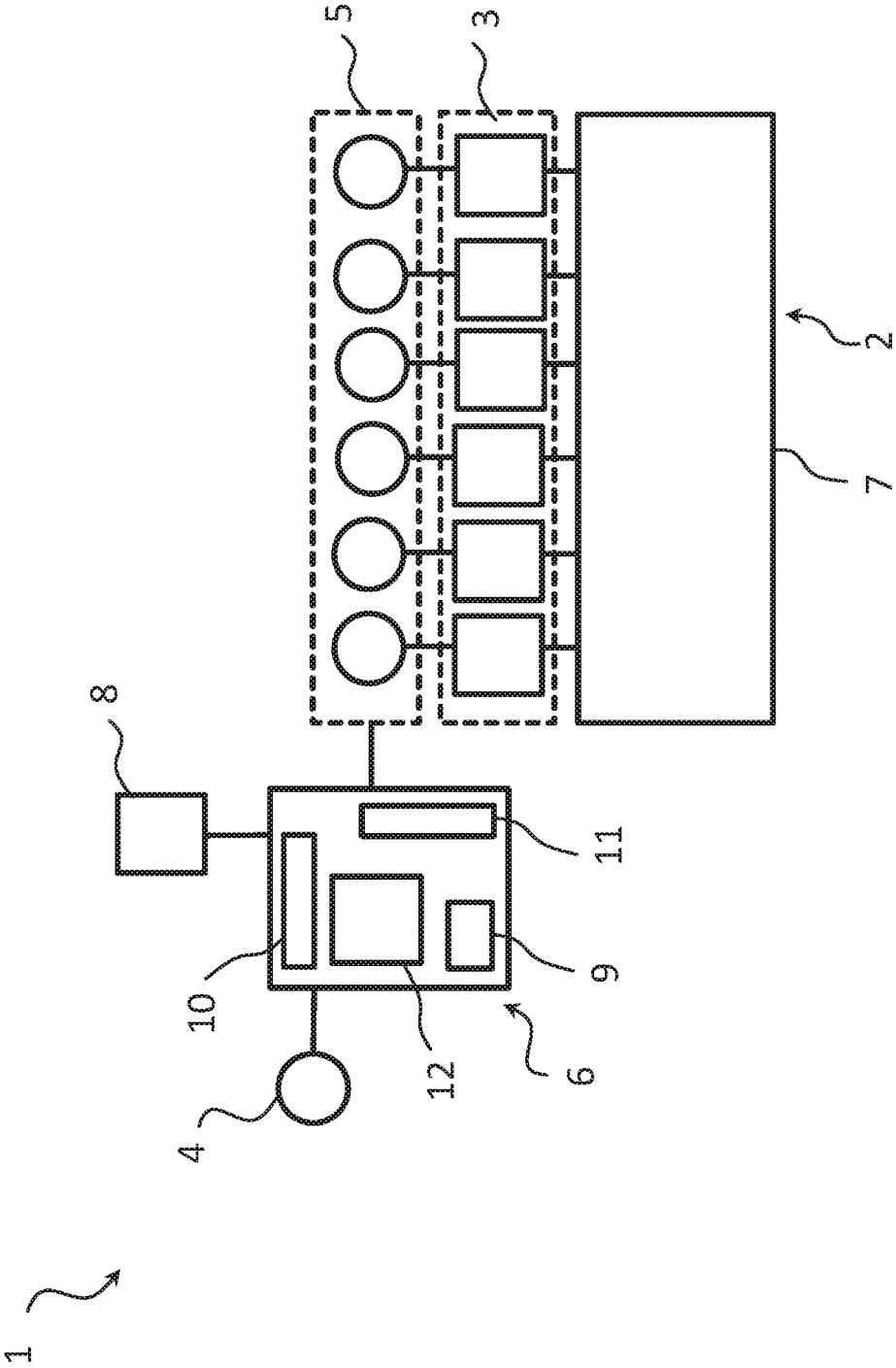
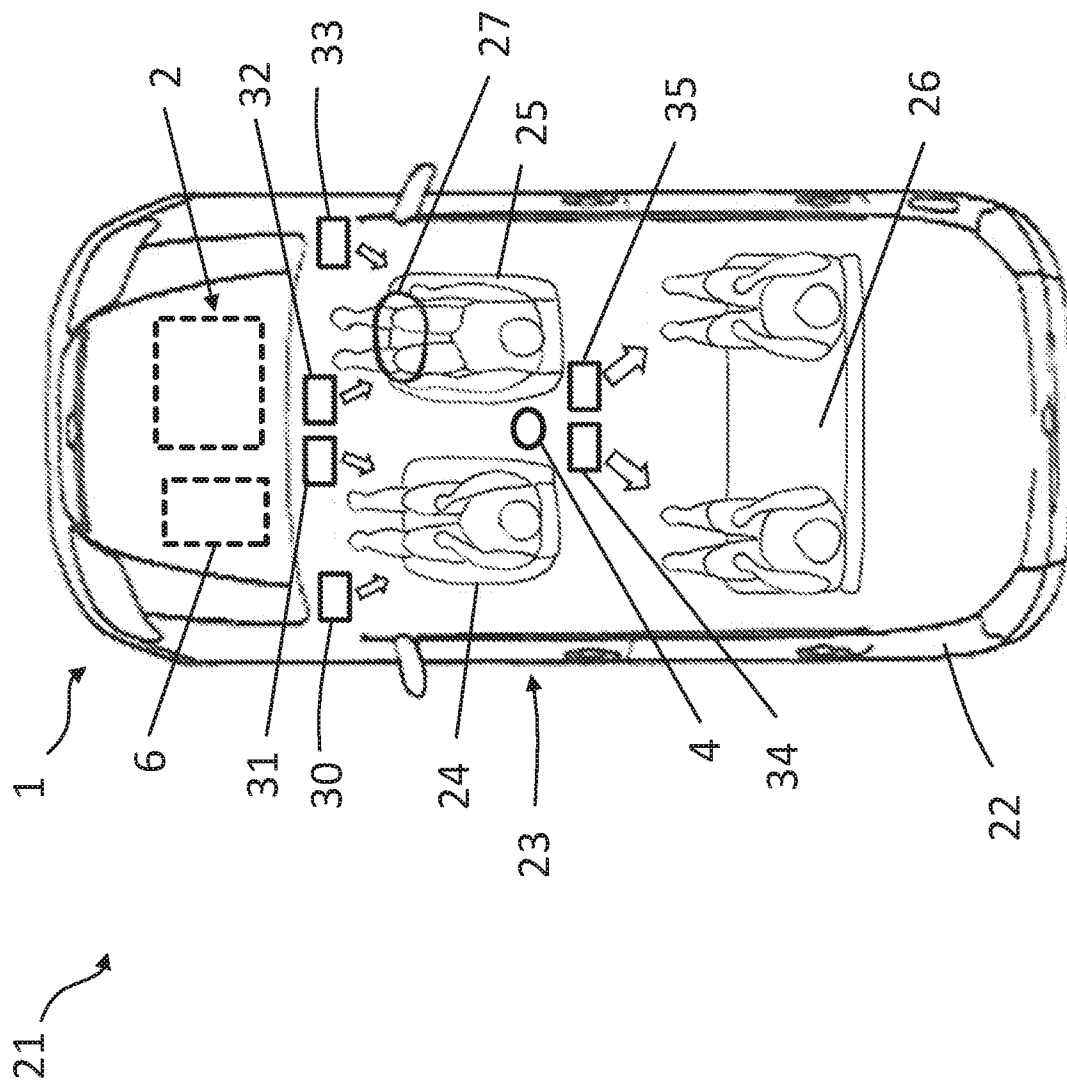
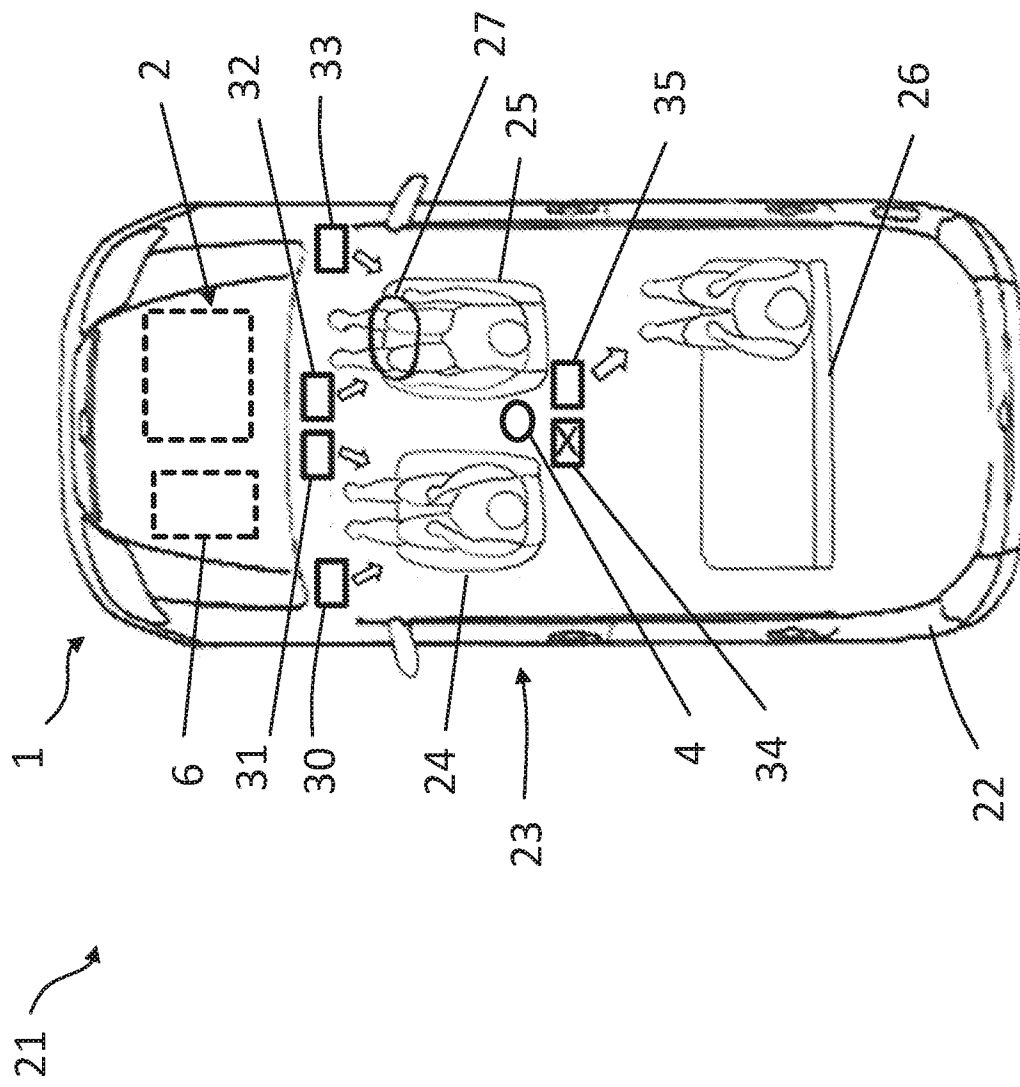


Fig. 1



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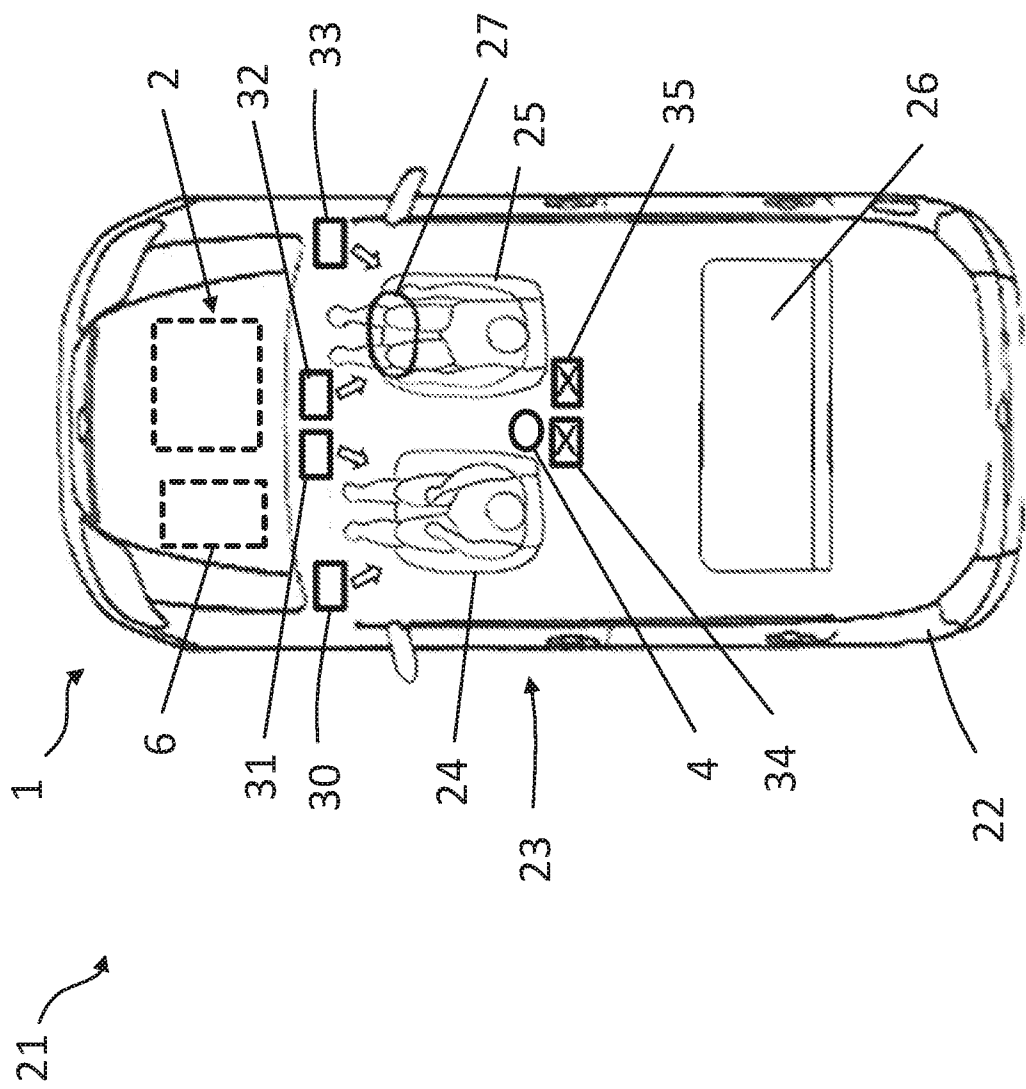
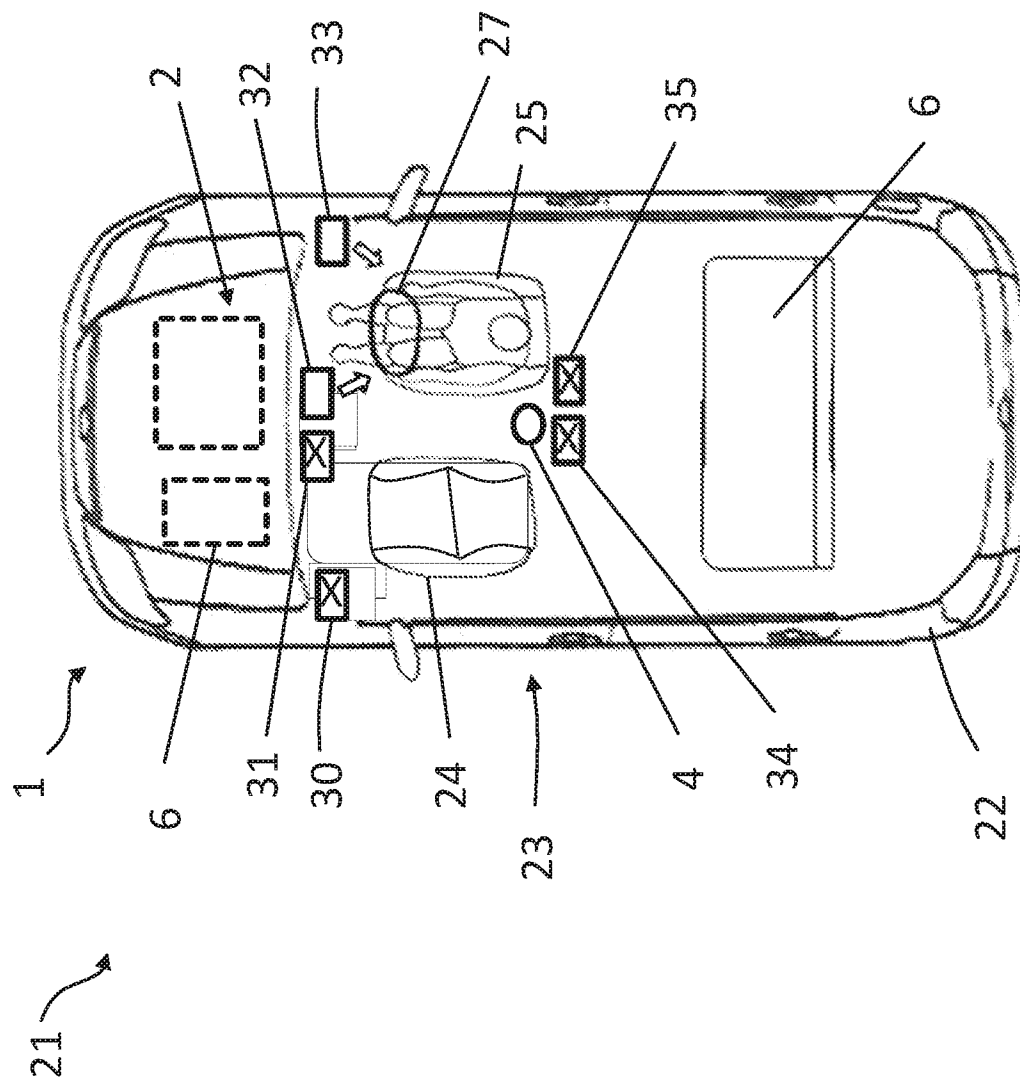
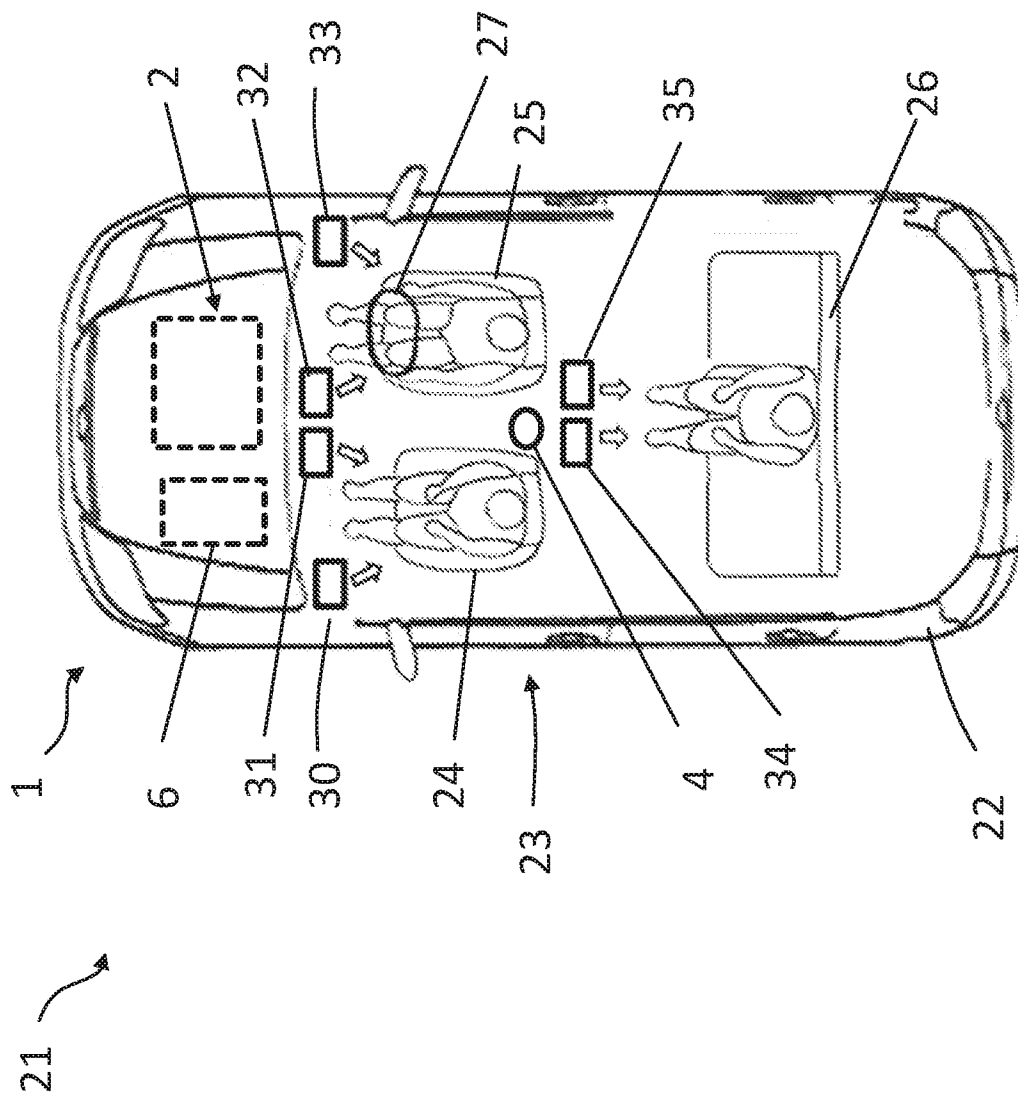


Fig. 4





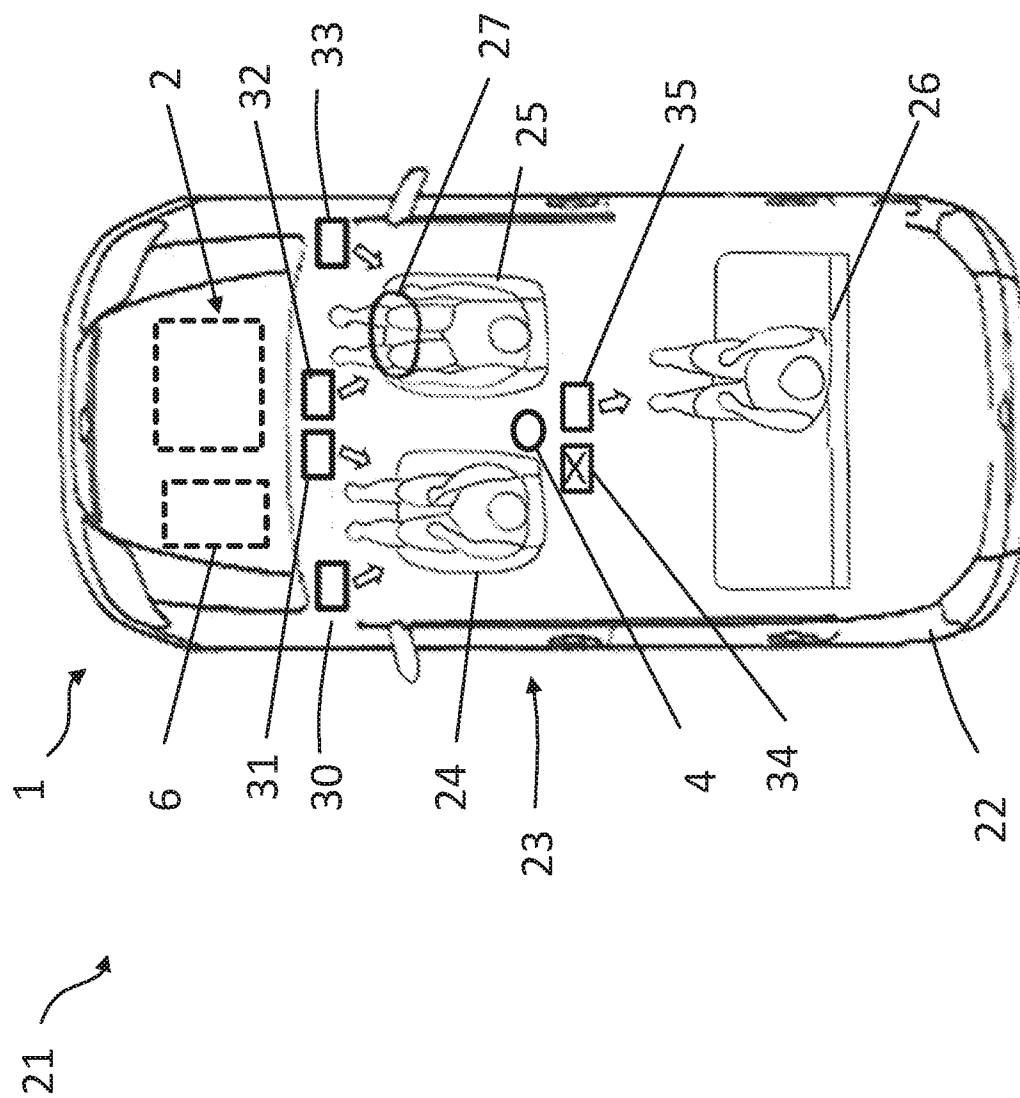


Fig. 7

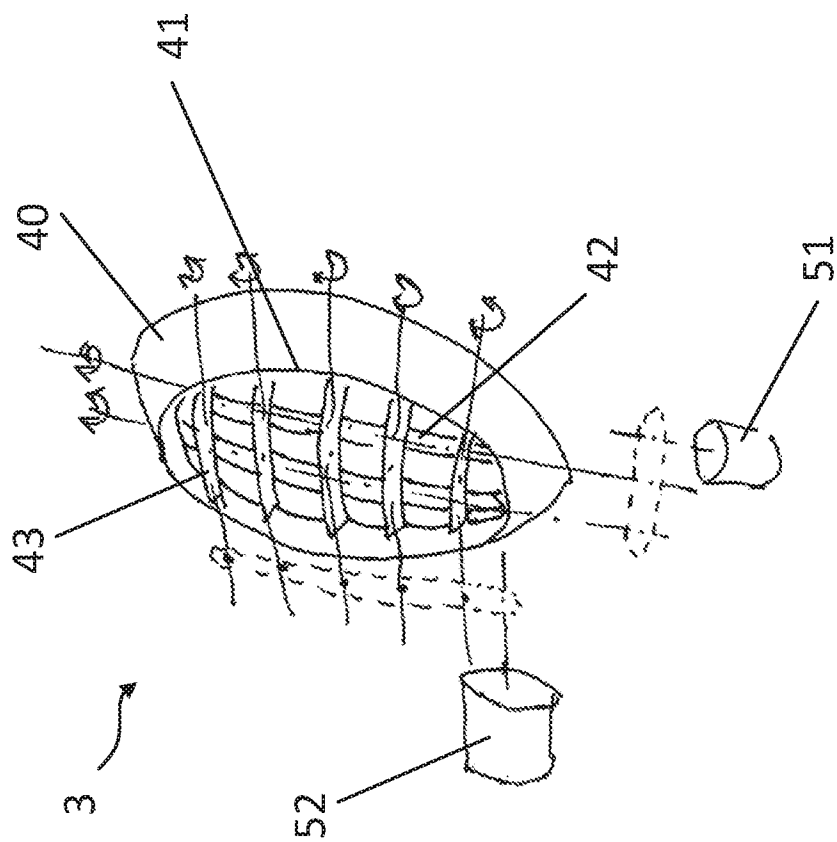


Fig. 8

A. CLASSIFICATION OF SUBJECT MATTER**B60H 1/00(2006.01)i, B60H 1/34(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 1/00; F25B 29/00; B60H 1/24; B60H 1/32; G05D 23/32; B60H 1/34

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & keywords: air conditioner, occupancy sensor, shutter, outlet, actuator and controller

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5878809 A (HEINLE, DIETER) 09 March 1999 See abstract, column 2, line 56 - column 3, line 5, claims 1-3 and figure 1.	1-15
Y	US 6347987 B1 (ICHISHI et al.) 19 February 2002 See abstract, column 5, line 10 - column 6, line 65 and figures 1-6.	1-15
Y	US 2004-0129007 A1 (HIROYUKI TOMITA et al.) 08 July 2004 See abstract, paragraphs [0058]-[0077], claims 1-5 and figures 1, 5.	6-8, 10, 14
A	US 2008-0248736 A1 (AOKI et al.) 09 October 2008 See abstract, paragraphs [0062]-[0067] and figures 1-10.	1-15
A	KR 10-2011-0134611 A (HALLA CLIMATE CONTROL CORP.) 15 December 2011 See abstract and figures 4-6.	1-15



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

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"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

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Date of the actual completion of the international search

30 December 2016 (30.12.2016)

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/IB2016/051954

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5878809 A	09/03/1999	EP 0754578 A2 EP 0754578 A3 JP 09-030237 A JP 2787673 B2	22/01/1997 16/12/1998 04/02/1997 20/08/1998
US 6347987 B1	19/02/2002	DE 19956259 A1 JP 2000-219039 A JP 4281179 B2	08/06/2000 08/08/2000 17/06/2009
US 2004-0129007 A1	08/07/2004	JP 2004-196111 A US 2007-0102291 A1 US 6945060 B2	15/07/2004 10/05/2007 20/09/2005
US 2008-0248736 A1	09/10/2008	JP 2008-273498 A JP 4396759 B2	13/11/2008 13/01/2010
KR 10-2011-0134611 A	15/12/2011	None	