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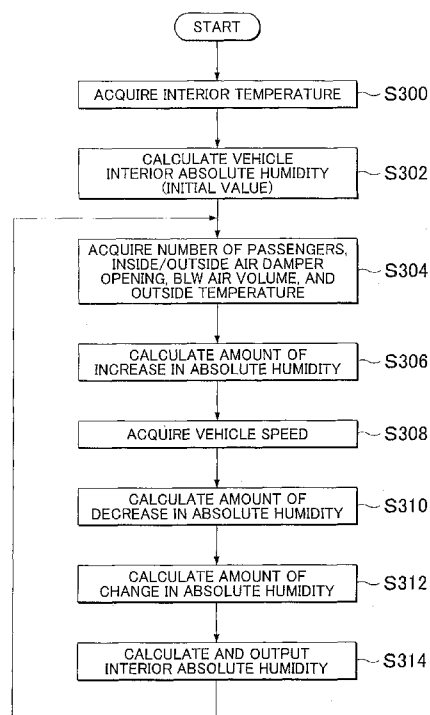
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[Continued on next page]

(54) Title: VEHICLE INTERIOR HUMIDITY CALCULATOR

FIG. 3



(57) Abstract: A vehicle interior humidity calculator includes a processor that calculates an amount of increase (S306) in an absolute humidity of a vehicle interior based on a first predetermined parameter (S304), calculates an amount of decrease (S310) in the absolute humidity of the vehicle interior based on a second predetermined parameter (S308), and calculates the absolute humidity of the vehicle interior (S314) based on an amount of change (S312) in the absolute humid of the vehicle interior obtained from the calculated amount of increase (S306) in the absolute humidity of the vehicle interior and the calculated amount of decrease (S310) in the absolute humidity of the vehicle interior and an initial value (S302) of the absolute humidity of the vehicle interior.



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VEHICLE INTERIOR HUMIDITY CALCULATOR

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

[0001] This disclosure relates to a vehicle interior humidity calculator.

2. Description of Related Art

10 [0002] In an automatic air conditioning controller for a vehicle (for example, see Japanese Patent Application Publication No. 2002-137630 (JP 2002-137630 A)), the humidity of a vehicle interior is predicted based on the number of passengers and the result of determination on the presence or absence of rain, and whether or not a control mode of automatic air conditioning needs to be changed to defroster mode is determined based on the temperature of the vehicle interior and the humidity of the vehicle interior.

15 [0003] However, since only parameters (passenger and rain) that are factors for an increase in humidity of the vehicle interior are taken into consideration in the configuration described in JP 2002-137630 A mentioned above, there is a possibility of the prediction being higher than the actual humidity.

20 SUMMARY OF THE INVENTION

[0004] Thus, this disclosure provides a vehicle interior humidity calculator that can predict the humidity of a vehicle interior with high precision.

[0005] According to an aspect of this disclosure, provided is a vehicle interior humidity calculator including a processor that calculates an amount of increase in an absolute humidity of a vehicle interior based on a first predetermined parameter, calculates an amount of decrease in the absolute humidity of the vehicle interior based on a second predetermined parameter, and calculates the absolute humidity of the vehicle interior based on an amount of change in the absolute humidity of the vehicle interior obtained from the calculated amount of increase in the absolute humidity of the vehicle interior and the

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calculated amount of decrease in the absolute humidity of the vehicle interior and an initial value of the absolute humidity of the vehicle interior.

[0006] With this disclosure, a vehicle interior humidity calculator that can predict the humidity of a vehicle interior with high precision can be obtained.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Features, advantages, and technical and industrial significance of exemplary embodiments of the invention will be described below with reference to the accompanying drawings, in which like numerals denote like elements, and wherein:

10 FIG. 1 is a view showing the configuration of a vehicle interior humidity calculator 1 according to one embodiment;

FIG. 2 is a view showing one example of an air conditioner 20;

FIG. 3 is a flowchart showing one example of a process executed by a processor 10;

FIG. 4 is a view showing the relation of absolute humidity and temperature;

15 FIG. 5 is a view schematically showing a moisture movement factor that is a factor for a change in humidity of the vehicle interior; and

FIG. 6 is a view showing the relation of temperature and absolute humidity.

DETAILED DESCRIPTION OF EMBODIMENTS

20 [0008] An embodiment will be described below in detail with reference to the accompanying drawings.

[0009] FIG. 1 is a view showing the configuration of a vehicle interior humidity calculator 1 according to one embodiment. The vehicle interior humidity calculator 1 includes a processor 10.

25 [0010] The processor 10 may be configured of an arithmetic processing unit including a central processing unit (CPU). The processor 10 includes various functions described below. The various functions (including functions described below) of the processor 10 may be realized by any hardware, software, firmware, or combination thereof. For example, any part or all of the functions of the processor 10 may be realized by an

application-specific integrated circuit (ASIC), a field-programmable gate array (FPGA), or a digital signal processor (DSP). The processor 10 may be realized by a plurality of processors. Hereinafter, as one example, the processor 10 will be described as a realization of an air conditioning electronic control circuit (ECU) that controls an air conditioner.

[0011] The processor 10 is connected with an outside temperature sensor 12, an inside temperature sensor 14, and a vehicle speed sensor (wheel speed sensor) 16. The connection may be a direct connection or may be a connection with another ECU, controller area network (CAN), or the like via a bus.

[0012] The processor 10 is connected with an air conditioner 20. The processor 10 may perform various control of the air conditioner 20. For example, the processor 10 may execute (automatic) switching or the like to defroster mode based on the absolute humidity or the like of a vehicle interior that is calculated in a manner described below, so that fog or the like does not occur on a front windshield or the like.

[0013] The processor 10 acquires control information (hereinafter, air conditioning control information) of the air conditioner 20. The air conditioning control information may include information relating to blower air volume and opening of an inside/outside air damper (hereinafter referred to as "inside/outside air damper opening"). Since the processor 10 is realized as an air conditioning ECU in this example, the air conditioning control information is control information (various control values) generated by the processor 10. Alternatively, the air conditioning control information may be generated based on the setting state (i.e., various setting values) set with an operation switch (e.g., a switch arranged on an instrument panel or the like or a touch switch on a display) operated by a user.

[0014] FIG. 2 is a view showing one example of the air conditioner 20. The air conditioner 20 may be of any configuration. The configuration shown in FIG. 2 is an example.

[0015] In the example shown in FIG. 2, the air conditioner 20 includes a compressor (not shown) that compresses a coolant using an engine or the like that is a

power source. The coolant compressed by the compressor is circulated in a coolant passage, cooled by a condenser, and supplied to an evaporator 26. The evaporator 26 is provided in a vehicle interior. On the front side of the evaporator 26, as shown in FIG. 2, a blower motor (blower fan) 22 of which the rotation speed is adjustable is arranged. The blower motor 22 communicates with the vehicle exterior or the vehicle interior via an inside/outside air damper (outside/inside air door) 29. The blower motor 22 has a function of sending air of the vehicle exterior or the vehicle interior (i.e., outside air or inside air) into the vehicle interior via the evaporator 26.

[0016] When the blower motor 22 rotates in the example shown in FIG. 2, air (i.e., outside air or inside air) that has flown in via the inside/outside air damper 29 passes through the evaporator 26. At this time, the ratio of flow rates of outside air and inside air in air that flows in depends on the opening of the inside/outside air damper 29. For cooling, the evaporator 26 cools the air that passes through the evaporator 26 by vaporizing the coolant compressed by the compressor. On the downstream side of the evaporator 26, a heater core 21 is arranged. At the heater core 21, an air mix door 24 for which opening is adjustable is set. The heater core 21 uses waste heat from the engine to serve a function (reheat function) of mixing warm air into air (cool air) cooled by the evaporator 26. The temperature of air sent into the vehicle interior is adjusted by controlling the opening of the air mix door 24 (i.e., mixing ratio of cool air and warm air). On the downstream side of the heater core 21, each duct is arranged to introduce mixed air to each outlet provided in a predetermined part of the vehicle interior. On the downstream side of the heater core 21, a mode door 28 for introducing mixed air selectively to a predetermined outlet is set.

[0017] FIG. 3 is a flowchart showing one example of a process executed by the processor 10. FIG. 4 is a view showing the relation of absolute humidity and temperature. The process shown in FIG. 3 may be, for example, initiated when an ignition switch is turned on and then repeatedly executed at every predetermined cycle ΔT (e.g., one second) until the ignition switch is turned off.

[0018] In step S300, interior temperature information is acquired from the inside temperature sensor 14.

[0019] In step S302, the initial value of vehicle interior absolute humidity is calculated. The initial value of vehicle interior absolute humidity may be any value. In this example, the initial value of vehicle interior absolute humidity is calculated based on the interior temperature obtained in step S300 mentioned above. That is, based on the relation shown in FIG. 4, the absolute humidity in accordance with the current interior temperature and the current the relative humidity is calculated. At this time, the initial value of vehicle interior absolute humidity may be calculated on the assumption that the current relative humidity is 100%. Alternatively, a different value instead of 100% may be used for the current relative humidity. In this case, the different value may be a fixed value set in accordance with a destination or may be a variable value that is varied based on the current season, date and time, situation of rain (weather information) around the vehicle position, or the like.

[0020] In step S304, the number of passengers, the inside/outside air damper opening, the blower air volume (rotation speed of the blower motor 22), and the outside temperature are calculated and acquired. The number of passengers may be calculated with any method. For example, the number of passengers may be calculated based on a pressure sensor or the like provided to each seat. The outside temperature is acquired from the outside temperature sensor 12. The inside/outside air damper opening and the blower air volume may be based on the air conditioning control information.

[0021] In step S306, the amount of increase in absolute humidity is calculated based on a parameter obtained in step S304 mentioned above. The amount of increase in absolute humidity may be, for example, the amount of increase in absolute humidity per time corresponding to the process cycle ΔT . The amount of increase in absolute humidity may be calculated with any method. For example, the amount of increase in absolute humidity may include at least one of the amount of increase due to moisture released from a passenger and the amount of increase due to ventilation of inside and outside air. Based on the number of passengers, the amount of increase due to a passenger may be calculated

to be larger for a larger number of passengers. Based on the inside/outside air damper opening or the like, the air volume of the ventilation air, the ventilation air entering the vehicle interior, may be calculated to calculate the amount of increase due to ventilation from the calculated air volume of ventilation air and the outside humidity. The outside
5 humidity may be calculated using a map, for example, in accordance with the outside temperature, may be calculated based on weather information or may be acquired from the outside through communication.

[0022] In step S308, the vehicle speed is acquired from the vehicle speed sensor
16. The vehicle speed may be calculated based on the host vehicle position measured
10 with a global positioning system (GPS) receiver or may be calculated based on the detected value of rotation speed of an output shaft of a transmission, instead of or in addition to the vehicle speed from the vehicle speed sensor 16.

[0023] In step S310, the amount of decrease in absolute humidity is calculated
based on the inside/outside air damper opening and the blower air volume obtained in step
15 S304 mentioned above and the vehicle speed obtained in step S308 mentioned above. The amount of decrease in absolute humidity may be, for example, the amount of decrease in absolute humidity per time corresponding to the process cycle ΔT . The amount of decrease in absolute humidity may be calculated with any method. For example, the amount of decrease in absolute humidity may include any one or more of the amount of
20 decrease due to ventilation of inside and outside air, the amount of decrease due to condensation at a low temperature portion (e.g., a glass member such as a front windshield, side glass, or rear glass or the evaporator 26) in the vehicle interior, and the amount of decrease due to moisture absorption by an interior member (particularly, interior member formed of fiber) or a gap portion in the vehicle interior.

[0024] The amount of decrease due to ventilation of inside and outside air may be
25 calculated with any method. For example, the air volume of ventilation air, ventilation air being released to the vehicle exterior, may be calculated based on the inside/outside air damper opening and the vehicle speed for a calculation with the calculated air volume of the ventilation air and the absolute humidity of the vehicle interior. The vehicle speed

may be used to include the dynamic pressure air volume in the air volume of ventilation air, but the dynamic pressure air volume may be not taken into consideration. For the vehicle interior absolute humidity, the vehicle interior absolute humidity (see step S314 described below) calculated in the previous cycle may be used. In the first process routine, the
5 initial value of vehicle interior absolute humidity (see step S302) may be used for the vehicle interior absolute humidity.

[0025] The amount of decrease due to a low temperature portion in the vehicle interior may be calculated with any method. For example, calculation may be based on the relation of the temperature of the low temperature portion, the dew point temperature,
10 and the vehicle interior absolute humidity. For example, in the case where the low temperature portion is a front windshield, the absolute humidity near the front windshield may be calculated using the temperature (glass temperature) of the front windshield. The glass temperature may be calculated based on the inside air temperature, the outside air temperature, and the vehicle speed. For example, the amount of decrease due to a low
15 temperature portion in the vehicle interior may be zero in the case where the temperature of the low temperature portion is higher than the dew point temperature (i.e., the absolute humidity near the low temperature portion is higher than the vehicle interior absolute humidity) and be a value in accordance with the area (design value) of the low temperature portion, the temperature of the low temperature portion, and the vehicle interior absolute
20 humidity in the case where the temperature of the low temperature portion is lower than the dew point temperature. In a similar manner, the vehicle interior absolute humidity (see step S314 described below) calculated in the previous cycle may be used for the vehicle interior absolute humidity. In the first process routine, the initial value of vehicle interior absolute humidity (see step S302) may be used for the vehicle interior absolute
25 humidity.

[0026] The amount of decrease due to moisture absorption by an interior member or the like in the vehicle interior may be calculated with any method. For example, the amount of decrease due to moisture absorption by an interior member or the like in the vehicle interior may be calculated using moisture absorption rate that is proportioned to the

difference of the equilibrium moisture absorption amount and the current adsorption amount. For the equilibrium moisture absorption amount at this time, properties (e.g., of Brunauer–Emmett–Teller (BET) adsorption) that increase as the relative humidity (relative humidity with respect to the interior member) increases may be used. The relative
5 humidity with respect to the interior member may be calculated based on the ratio of the vehicle interior absolute humidity and the absolute humidity within the interior member, the absolute humidity within the interior member is corresponding to the temperature of the interior member. The temperature of the interior member may be calculated based on the inside air temperature or the outside air temperature. In a similar manner, the vehicle
10 interior absolute humidity (see step S314 described below) calculated in the previous cycle may be used for the vehicle interior absolute humidity. In the first process routine, the initial value of vehicle interior absolute humidity (see step S302) may be used for the vehicle interior absolute humidity.

[0027] In step S312, the amount of change in absolute humidity is calculated
15 based on the amount of increase in absolute humidity obtained in step S306 mentioned above and the amount of decrease in absolute humidity obtained in step S310 mentioned above. The amount of change in absolute humidity may be calculated by simply subtracting the amount of decrease in absolute humidity from the amount of increase in absolute humidity.

[0028] In step S314, the vehicle interior absolute humidity is calculated based on
20 the previous value of vehicle interior absolute humidity (vehicle interior absolute humidity obtained in step S314 in the previous process cycle) and the amount of change in absolute humidity obtained in step S312 mentioned above. The vehicle interior absolute humidity (current value) may be computed as a sum of the previous value of vehicle interior
25 absolute humidity and the amount of change in absolute humidity obtained in step S312 mentioned above. For the previous value of vehicle interior absolute humidity, the initial value of vehicle interior absolute humidity obtained in step S302 mentioned above may be used in the first processes cycle. When the process of step S314 ends, the next process cycle starts from step S304. In this case, the absolute humidity obtained in this cycle is

used as the previous value of vehicle interior absolute humidity in step S314 in the next process cycle.

[0029] With the example shown in FIG. 3, the amount of increase in absolute humidity of the vehicle interior is calculated, the amount of decrease in absolute humidity of the vehicle interior is calculated, and the vehicle interior absolute humidity is calculated based on the calculated amount of increase in absolute humidity and amount of decrease in absolute humidity. Since not only the amount of increase in absolute humidity of the vehicle interior but also the amount of decrease in absolute humidity of the vehicle interior is taken into consideration in this manner, a precise vehicle interior absolute humidity in consideration of the factor for a decrease in humidity of the vehicle interior can be calculated.

[0030] With the example shown in FIG. 3, the initial value of vehicle interior absolute humidity is a value based on an assumption or the like as described above, and there may be cases where the discrepancy (error) with respect to the actual vehicle interior absolute humidity is large. However, since the error is gradually reduced through computation at every predetermined cycle, a precise vehicle interior absolute humidity can eventually be calculated. Specifically, for example, assuming a case of a significantly large (or a case of a significantly small) initial value of vehicle interior absolute humidity with respect to the actual vehicle interior absolute humidity, the amount of decrease in absolute humidity calculated in step S310 mentioned above is also larger in absolute value than the actual amount of decrease in absolute humidity. This is because the amount of decrease in absolute humidity is calculated in accordance with the vehicle interior absolute humidity (initial value or previous value), as mentioned above.

[0031] The process shown in FIG. 3 is executed at every constant predetermined cycle ΔT . However, the predetermined cycle ΔT may be variable. That is, the process shown in FIG. 3 may be executed at irregular cycles. In this case, the amount of change (amount of increase in absolute humidity and amount of decrease in absolute humidity) from the previous cycle may be computed in steps S306 and S310.

[0032] FIG. 5 is a view schematically showing a moisture movement factor that is a factor for a change in humidity of the vehicle interior.

[0033] As the factors for an increase in absolute humidity of the vehicle interior, there are moisture P1 included in the outside air that enters the vehicle interior by ventilation and moisture P2 released from a passenger, as shown in FIG. 5. As the factors for a decrease in absolute humidity of the vehicle interior, there are moisture P3 included in the inside air that is released to the vehicle exterior by ventilation, moisture P4 condensed at a low temperature portion (e.g., front windshield) in the vehicle interior, and moisture P5 absorbed by an interior member or the like in the vehicle interior, as shown in FIG. 5.

[0034] Thus, when the absolute humidity of the vehicle interior is simply calculated in consideration of only the factor for an increase in absolute humidity of the vehicle interior, the absolute humidity of the vehicle interior is calculated to be higher. In contrast, with the example shown in FIG. 3 mentioned above, a precise vehicle interior absolute humidity can be calculated since the factor for a decrease in absolute humidity (the amount of decrease in absolute humidity) of the vehicle interior is taken into consideration.

[0035] In order to calculate a precise vehicle interior absolute humidity, it is preferable that both of the two factors P1 and P2 for an increase in absolute humidity of the vehicle interior be taken into consideration and all of the three factors P3, P4, and P5 for a decrease in absolute humidity of the vehicle interior be taken into consideration. For example, in the case of the process shown in FIG. 3, the amount of increase in absolute humidity is preferably calculated in consideration of both of the two factors P1 and P2 for an increase in absolute humidity of the vehicle interior in step S306. In step S310, the amount of decrease in absolute humidity is preferably calculated in consideration of all of the three factors P3, P4, and P5 for a decrease in absolute humidity of the vehicle interior. Note that any one of these may be omitted.

[0036] FIG. 6 is a view showing the relation of temperature and absolute humidity.

[0037] The vehicle interior absolute humidity (calculated absolute humidity) obtained by the process in FIG. 3 mentioned above may be used in any way for various control of the air conditioner 20. For example, as shown in FIG. 6, the intersection of the calculated absolute humidity and the curve for 100% relative humidity may be calculated to obtain the "dew point temperature." In this case, control for preventing fog (e.g., automatic switching to defroster mode or output of an advice prompting a passenger to switch to defroster mode) may be executed when the glass temperature at the front windshield has approached the dew point temperature, for example. As shown schematically in FIG. 6, the relative humidity corresponding to an interior temperature may be calculated based on the interior temperature (acquired from the inside temperature sensor 14) and the calculated absolute humidity.

[0038] With the vehicle interior humidity calculator 1 of this embodiment mentioned above, an excellent effect described below is obtained in particular.

[0039] Since the vehicle interior absolute humidity is calculated in consideration of not only the amount of increase in absolute humidity of the vehicle interior but also the amount of decrease in absolute humidity of the vehicle interior as mentioned above, a precise vehicle interior absolute humidity can be calculated. Therefore, various control of the air conditioner 20 is made possible through use of the calculated vehicle interior absolute humidity, thus eliminating the necessity of a separately provided humidity sensor and enabling a reduction in cost (reduction in the number of parts). Also, highly reliable control of the air conditioner 20 using the precise vehicle interior absolute humidity is made possible. Accordingly, efficient control in a manner such that, for example, condensation does not occur at the front windshield is made possible, and realization of both security and improvement in air conditioning efficiency is made possible.

[0040] While the embodiment has been described above in detail, the invention is not limited to a specific embodiment. Various modifications and changes are possible within the range described in the scope of claims. It is also possible to combine all or a plurality of components in the embodiment mentioned above.

CLAIMS:

1. A vehicle interior humidity calculator comprising
a processor that calculates an amount of increase in an absolute humidity of a vehicle interior based on a first predetermined parameter, and calculates an amount of decrease in the absolute humidity of the vehicle interior based on a second predetermined parameter,
the processor calculating the absolute humidity of the vehicle interior based on an amount of change in the absolute humidity of the vehicle interior obtained from the calculated amount of increase in the absolute humidity of the vehicle interior and the calculated amount of decrease in the absolute humidity of the vehicle interior, and an initial value of the absolute humidity of the vehicle interior.
2. The vehicle interior humidity calculator according to claim 1, wherein
the processor calculates at least one of an amount of dehumidification by ventilation, an amount of dehumidification by condensation, and an amount of dehumidification by moisture absorption to calculate the amount of decrease in the absolute humidity of the vehicle interior.
3. The vehicle interior humidity calculator according to claim 1 or 2, wherein
the second predetermined parameter includes at least one of a detected value of interior temperature, a detected value of exterior temperature, a detected value of vehicle speed, and a control value or a setting value of an air conditioner.
4. The vehicle interior humidity calculator according to claim 3, wherein
the control value or setting value of the air conditioner relates to blower air volume and opening of an inside/outside air damper.
5. The vehicle interior humidity calculator according to claim 1 or 3, wherein

the amount of decrease in the absolute humidity of the vehicle interior includes any one or more of an amount of decrease due to ventilation of inside and outside air, an amount of decrease due to condensation at a low temperature portion in the vehicle interior, and an amount of decrease due to moisture absorption by an interior member or a gap portion in the vehicle interior.

6. The vehicle interior humidity calculator according to claim 5, wherein

an air volume of ventilation air, the ventilation air being released outside the vehicle, is calculated based on an inside/outside air damper opening and a vehicle speed to calculate the amount of decrease due to ventilation of inside and outside air from the calculated air volume of ventilation air and the absolute humidity of the vehicle interior.

7. The vehicle interior humidity calculator according to claim 5, wherein

the amount of decrease due to the low temperature portion in the vehicle interior is calculated based on a relation of a temperature at the low temperature portion, a dew point temperature, and the absolute humidity of the vehicle interior.

8. The vehicle interior humidity calculator according to claim 5, wherein

the amount of decrease due to moisture absorption by the interior member or the gap portion in the vehicle interior is calculated using a moisture absorption rate that is proportioned to a difference of an equilibrium moisture absorption amount and a current adsorption amount.

9. The vehicle interior humidity calculator according to claim 1, wherein

the processor calculates the amount of increase in the absolute humidity of the vehicle interior and the amount of decrease in the absolute humidity of the vehicle interior at every predetermined time, and

the processor calculates the absolute humidity of the vehicle interior at every predetermined time by calculating at every predetermined time a sum of the initial value of

the absolute humidity of the vehicle interior and the amount of change in the absolute humidity of the vehicle interior obtained at every predetermined time.

10. The vehicle interior humidity calculator according to claim 9, wherein

the processor sets the absolute humidity of the vehicle interior in accordance with a detected value of interior temperature and with a predetermined relative humidity as the initial value of the absolute humidity of the vehicle interior.

11. The vehicle interior humidity calculator according to claim 9 or 10, wherein

the second predetermined parameter includes at least one of a previously calculated value of the absolute humidity of the vehicle interior, a detected value of interior temperature, a detected value of exterior temperature, a detected value of vehicle speed, and a control value or a setting value of an air conditioner.

FIG. 1

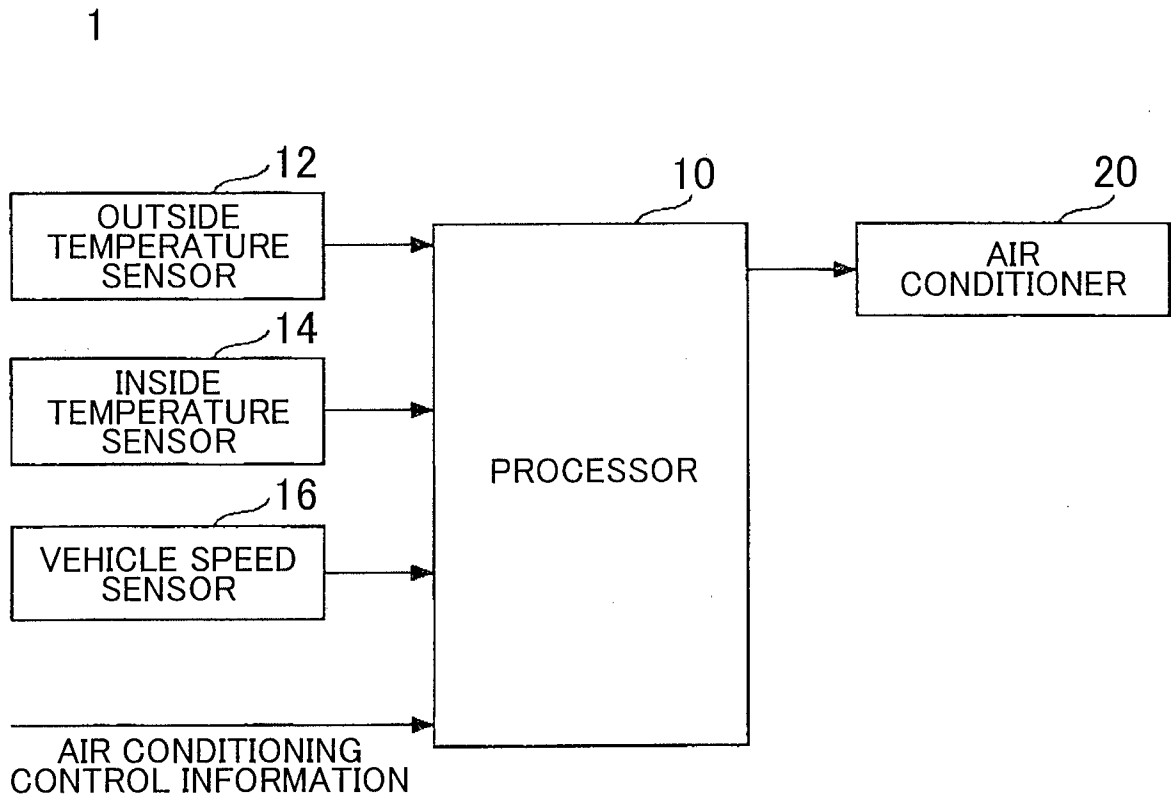


FIG. 2

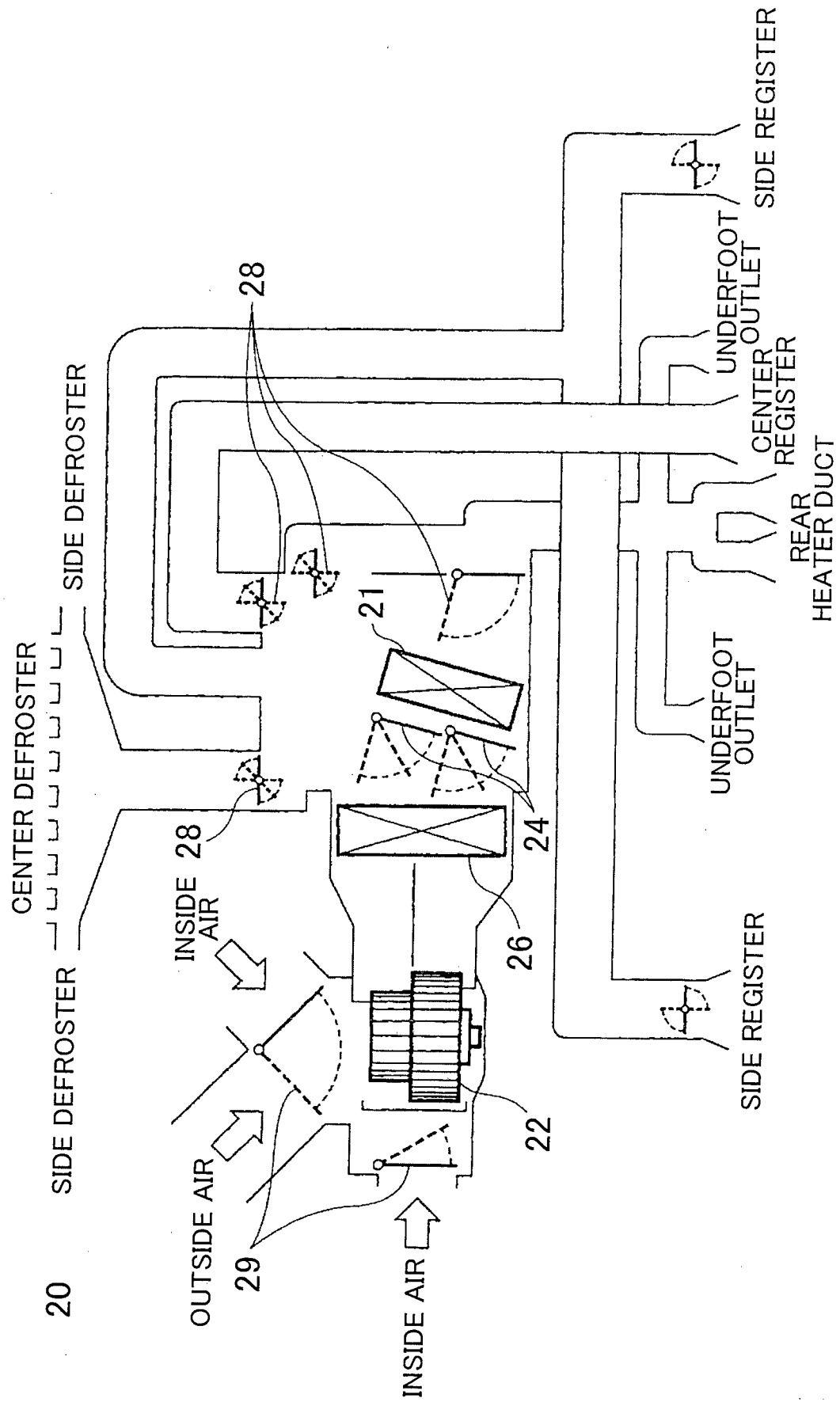


FIG. 3

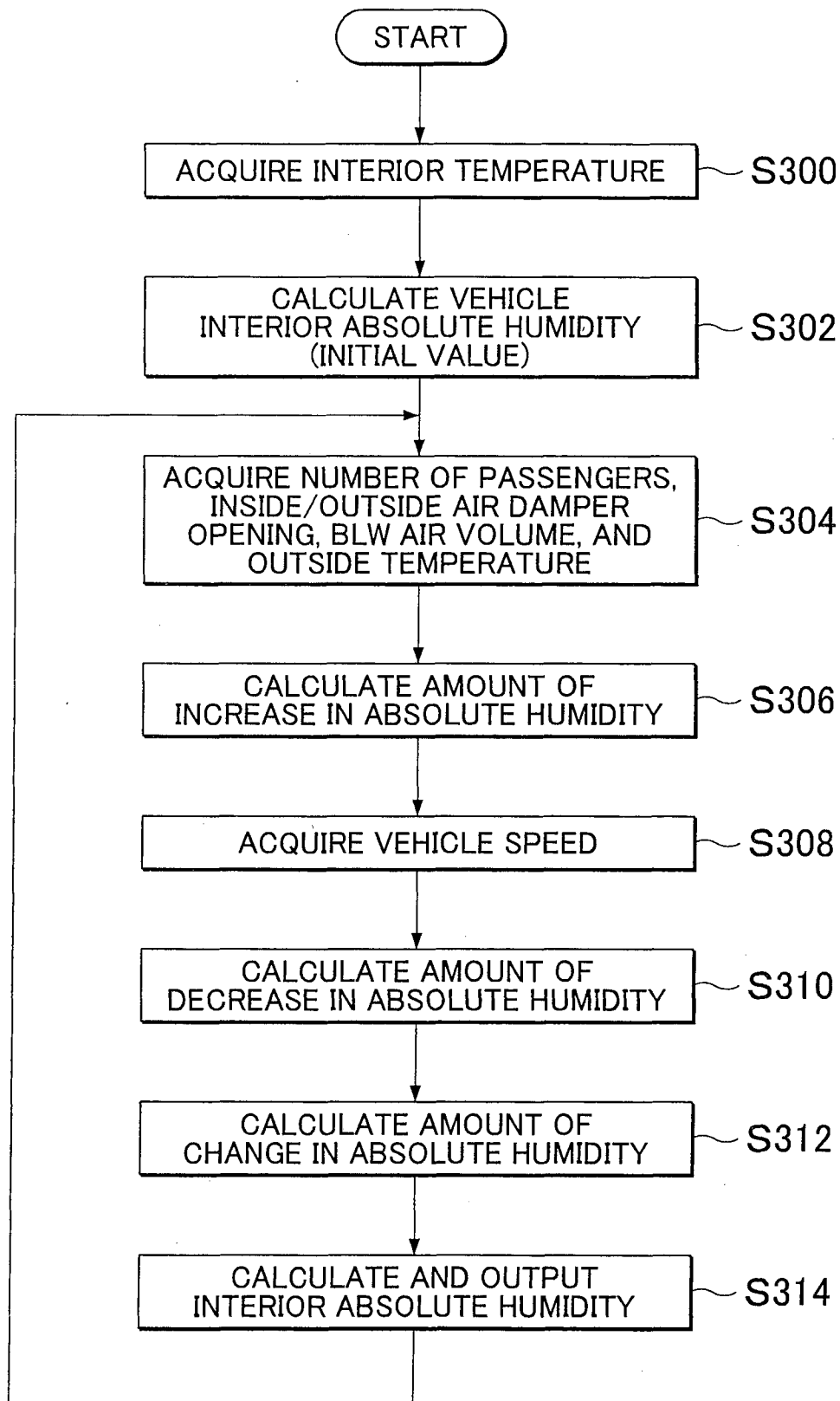


FIG. 4

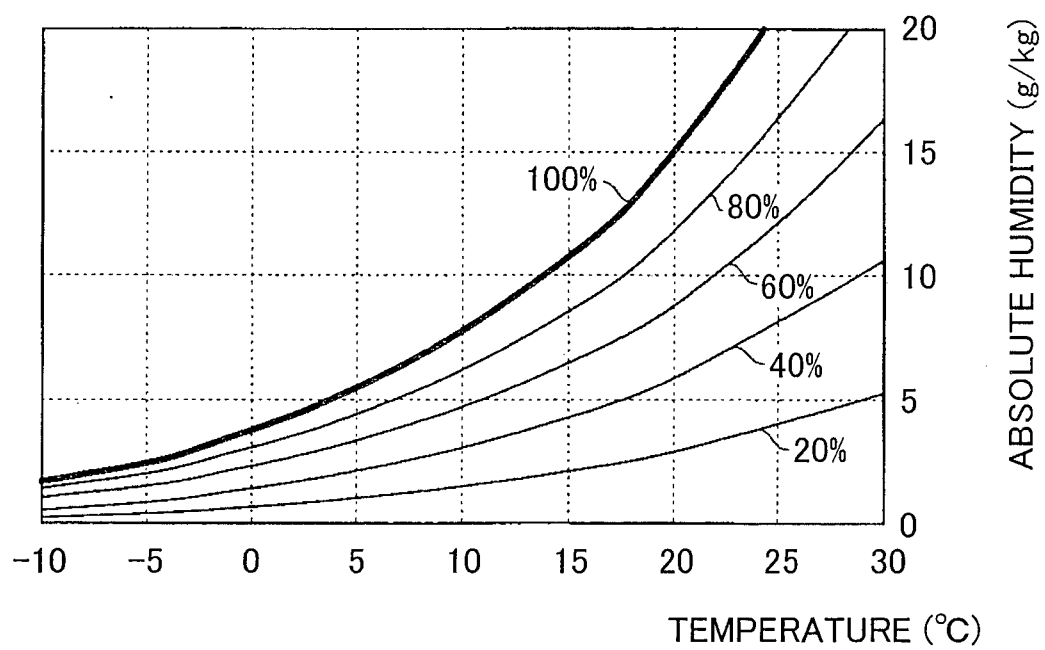


FIG. 5

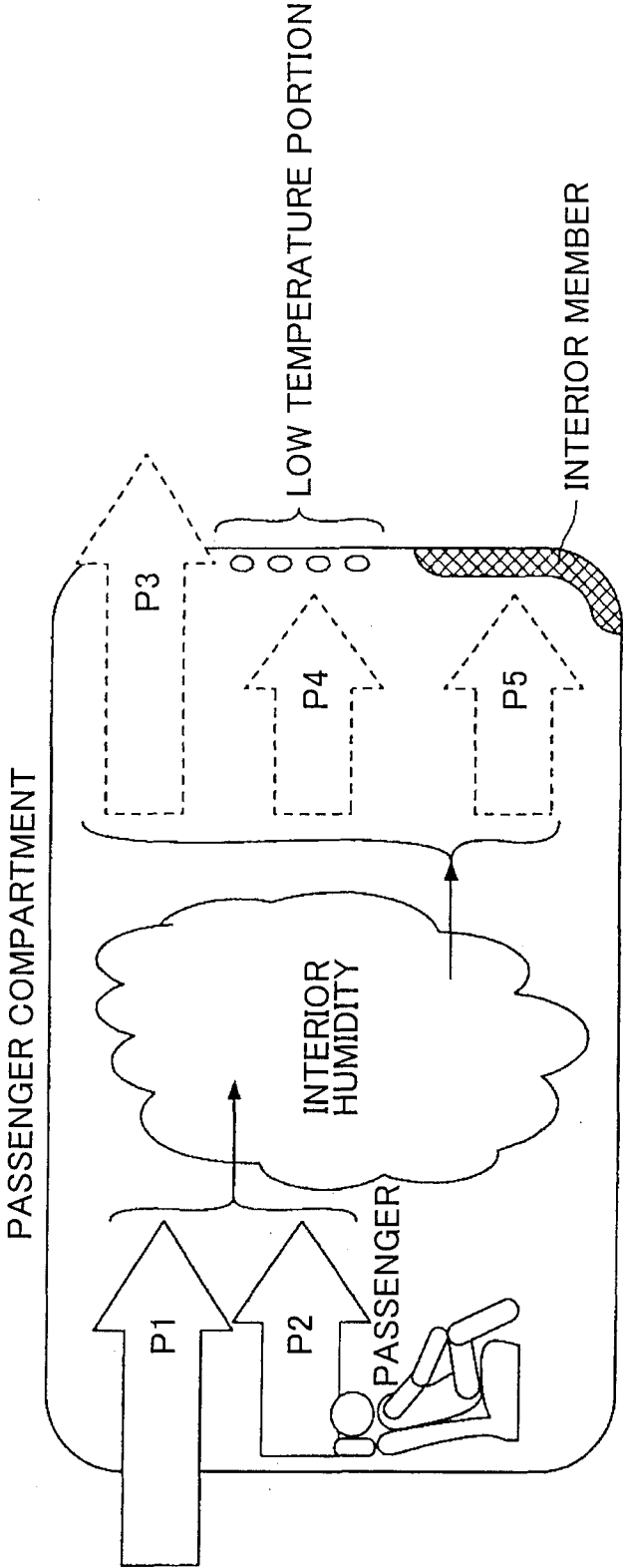
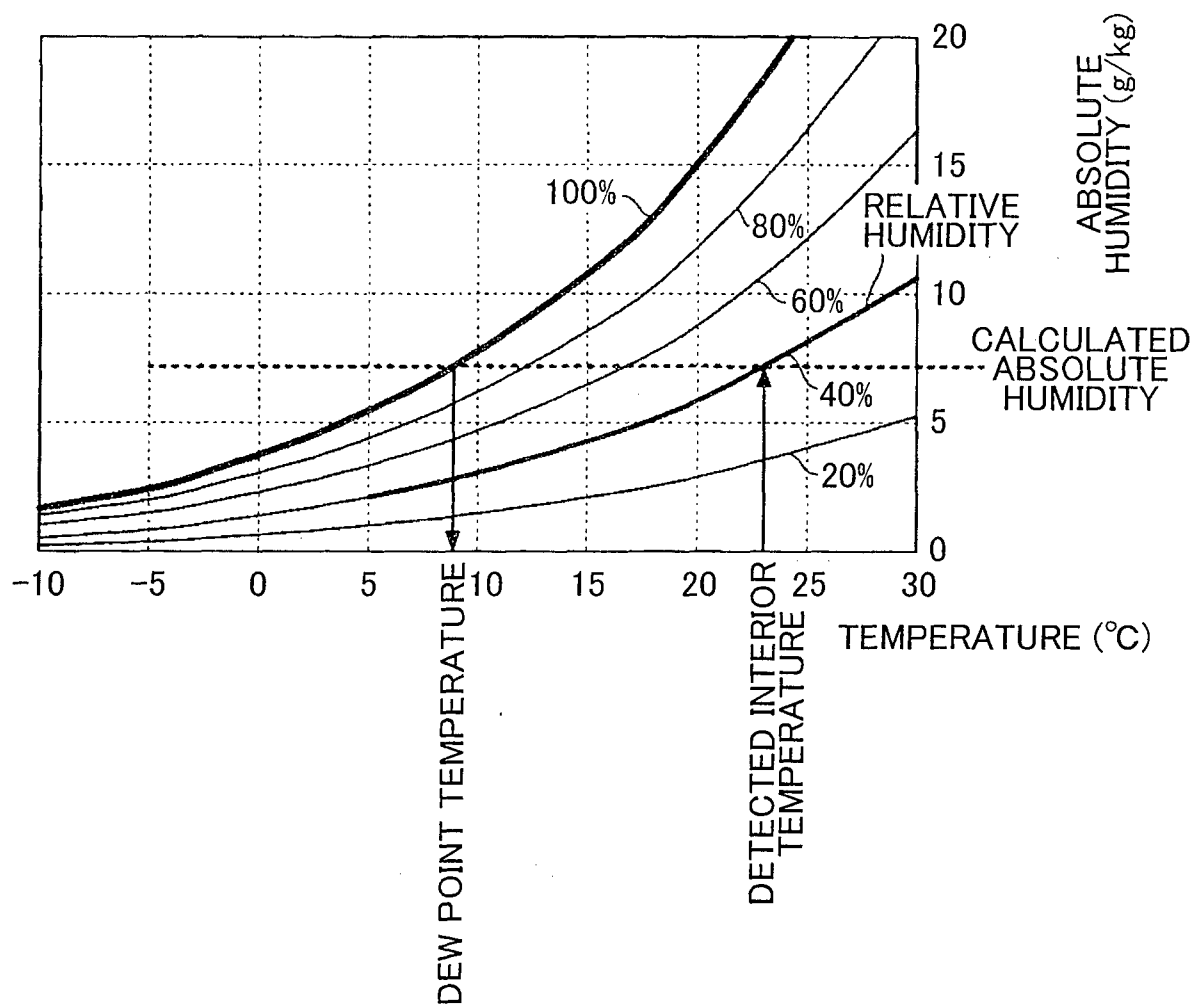


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2014/001775

A. CLASSIFICATION OF SUBJECT MATTER
 INV. B60H1/00 B60H1/32
 ADD.

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

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/095942 A1 (KOORS MARK A [US] ET AL) 25 July 2002 (2002-07-25) paragraphs [0002], [0012], [0015] - [0019]; figure 4	1-11
A	----- WO 2004/028841 A1 (VALEO CLIMATISATION [FR]; BEN YAHIA MOHAMED [FR]) 8 April 2004 (2004-04-08) claims; figure 3	1-11
A	----- US 6 155 061 A (DAVIS JR LEIGHTON IRA [US] ET AL) 5 December 2000 (2000-12-05) columns 3-6; figures 3-7	1-11



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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