

(19) **DANMARK**

(10) **DK/EP 3201059 T3**



Patent- og  
Varemærkestyrelsen

(12) **Oversættelse af  
europæisk patentskrift**

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- (51) Int.Cl.: **B 61 D 27/00 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2020-09-07**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2020-06-03**
- (86) Europæisk ansøgning nr.: **15801881.2**
- (86) Europæisk indleveringsdag: **2015-12-01**
- (87) Den europæiske ansøgnings publiceringsdag: **2017-08-09**
- (86) International ansøgning nr.: **EP2015078165**
- (87) Internationalt publikationsnr.: **WO2016096400**
- (30) Prioritet: **2014-12-17 DE 102014226279**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
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- (54) Benævnelse: **Køretøj med nøddrift til klimaanlæg**
- (56) Fremdragne publikationer:  
**CN-Y- 201 272 357**  
**DE-A1-102010 017 883**  
**DE-B3-102013 011 600**  
**GB-A- 2 472 534**



## Description

The invention concerns a motor vehicle, especially a rail vehicle, with at least two carriages, which are joined to each other by an open gangway connection and each of which is fitted with an air conditioning system, wherein a detection device is provided that detects a failure of a climate control function of one of the air conditioning systems and signals it to a control device, and a method for emergency operation of such a motor vehicle.

Such a motor vehicle and such a method for emergency operation of such a motor vehicle are known from DE 10 2013 011 600 B3.

If a function (cooling or heating) of the air conditioning system for one of the carriages provided in a rail vehicle fails, i.e. the conditioning of the inflow air by cooling or heating is no longer possible, the affected carriage can no longer be air-conditioned according to the requirements. The carriage continues to be supplied with fresh air, however.

In order to be able to maintain a fresh air supply for the affected carriage under these circumstances, the function of the air conditioning system of said carriage is reduced to feeding unconditioned inflow air (mixed with fresh air) into the associated carriages. Said procedure is prior art for rail vehicles.

With the absence of the climate control function for the inflow air for the affected carriage, there is the difficulty of providing suitable temperature-controlled internal air for the affected carriage, because as a rule with such a defect the ventilation of the air conditioning system is continued and unconditioned inflow air is fed into the carriage.

Based on this, it is the object of the invention to develop a motor vehicle, in particular a rail vehicle, of the aforementioned type so that failure of a climate control function of an air conditioning system is less pronounced for the internal air temperature deviation of the affected carriage.

This object is achieved by designing a control device such that it, upon signaling of a failure of a climate control function of an air conditioning system by the detection device, actuates an outflow air device of the carriage affected by the failure of the air conditioning system such that the outflow air volumetric flow thereof is increased, actuates an outflow air device of the carriage adjacent to the affected carriage such that the outflow air volumetric flow thereof is reduced, and actuates the air conditioning system of the adjacent carriage such that a fresh air component of conditioned inflow air is increased.

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During this, the outflow air devices of the affected carriage and the adjacent carriages are actuated so that the internal pressure reduces in the affected carriage.

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Owing to the pressure drop occurring towards the affected carriage, an air flow with conditioned air from the adjacent carriage towards the affected carriage occurs. In this way, the internal air temperature deviation in the affected carriage is considerably reduced by feeding conditioned air from the adjacent carriage. The formation of the air flow is supported by increasing the fresh air component of the conditioned inflow air through the air conditioning system of the adjacent carriage body.

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Advantageously, the control device can shut off or reduce the outflow air volumetric flow in the adjacent carriage. In this case, the outflow air component of the inflow air has not already been discharged by the air conditioning system of the adjacent carriage into the region of this carriage, but can pass into the carriage affected by the failure of the air conditioning system. In principle however, it is important that an inflowing air flow is set up towards the affected carriage.

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Moreover, the control device can adjust a target internal temperature for the adjacent carriage depending on a measured external temperature if a failure of a climate control function of an air conditioning system is signaled. Said control

device function particularly concerns extraordinary external temperature conditions. If for example the temperature is above average, the target internal temperature for the adjacent carriage can be reduced compared to standard conditions, so that inflow air of a suitable temperature can still pass into the carriage affected by the air conditioning system failure. In the opposite case, i.e. very cold weather conditions, the target internal temperature for the adjacent carriage can be raised by a suitable amount compared to a standard operating case. The air passing from the adjacent carriage into the carriage affected by the air conditioning system failure is then still above a suitable high temperature when it reaches the affected carriage.

The rail vehicle can comprise at least three carriages, wherein the control device can actuate the outflow air devices and air conditioning systems of the adjacent carriages equally if a failure of a climate control function of an air conditioning system of the central carriage is signaled. In other words, the air conditioning systems and outflow air devices of both carriages are actuated as in previously described "adjacent" carriages, while the procedure for the affected carriage is maintained.

A method for emergency climate control operation for such a motor vehicle is revealed in Claim 7.

An exemplary embodiment of the invention is described in more detail below with reference to the figure. The single figure shows a schematic side view of a four-part rail vehicle.

In the exemplary rail vehicle shown in the figure, the carriage 1 shown on the left in the figure is conventionally supplied with conditioned air.

An air conditioning system 1.1 disposed approximately in the center of the roof of the carriage 1 is used for this. Fresh air that is sucked in is conditioned together with ambient air and passed into a vehicle interior 1.2 of the carriage 1 from the air conditioning system 1.1 via suitable conditioning channels. The

resulting outflow air is discharged from the vehicle interior via doors 1.4 of the carriage 1 using suitable outflow air devices 1.3 in the roof area.

5 In the exemplary embodiment, the second carriage 3 from the right is now affected by failure of the climate control function of the air conditioning system 3.1 thereof. Only unconditioned inflow air is still passed by the air conditioning system 3.1 into an internal passenger compartment 3.2 of said carriage 3.

10 The carriage 3 forms a triple combination with adjacent carriages 2, 4, to which it comprises carriage gangways that are each open.

15 The rail vehicle comprises a control device (not shown), to which a failure of the climate control function of the air conditioning system 3.1 is signaled by a detection device. The control device then actuates the air conditioning system 2.1, 4.1 of the adjacent carriages 2, 4 to provide an increased fresh air component of the conditioned inflow air. At the same time, the volumetric flow of the outflow air device is significantly increased by increasing the revolution rate of outlet fans 3.3 of the carriage 3 affected by the failure of the conditioning system 3.1. As the outlet fans 2.3, 4.3 of the adjacent carriages 2, 4 are also  
20 shut off, a discharge air volumetric flow 5 from the interiors 2.2, 2.4 of the adjacent carriages 2, 4 to the interior 3.2 of the carriage 3 results.

25 In the event of failure of the climate control function of its air conditioning system 3.1, the carriage 3 is thus supplied with a conditioned discharge air volumetric flow via the adjacent carriages 2, 4.

30 In particularly extreme weather conditions, the control device can also adjust a target internal temperature for the adjacent carriages 2, 4, which in the winter means an increase in temperature and in the summer a reduction in temperature for the target internal temperature.

## Patentkrav

5 1. Køretøj med mindst to vogne (2, 3), der er forbundet med hinanden via en åben vognovergang og hver især er forsynet med et klimaanlæg (2.1, 3.1), hvor der er tilvejebragt en registreringsindretning, der registrerer et udfald af et klimaanlægs (3.1) klimatiseringsfunktion og sender signal til en tilvejebragt styreindretning,

**kendetegnet ved, at**

10 styreindretningen er udformet på en sådan måde, at den ved signalisering af et udfald af et klimaanlægs (3.1) klimatiseringsfunktion fra registreringsindretningen styrer en afgangsluftindretning (3.3) i den vogn (3), der er ramt af klimaanlæggets (3.1) udfald, på en sådan måde, at afgangsluftvolumenstrømmen forøges,

15 styrer en afgangsluftindretning (2.3) i vognen (2) ved siden af den ramte vogn (3), på en sådan måde, at dens afgangsluftvolumenstrøm reduceres, og styrer klimaanlægget (2.1) i den naboliggende vogn (2) på en sådan måde, at en friskluftandel af konditioneret tilførselsluft er forøget.

20 2. Køretøj ifølge krav 1,

**kendetegnet ved, at**

klimaanlæggene (1.1 - 4.1) er udformet på en sådan måde, at klimaanlægget (1.1-4.1) ved udfald af en klimatiseringsfunktion af klimaanlægget (1.1-4.1) indfører tilførselsluft ukonditioneret ind i den tilordnede vogn (1-4).

25 3. Køretøj ifølge et af kravene 1 eller 2,

**kendetegnet ved, at**

styreindretningen frakobler afgangsluftindretningen (2.3) i den naboliggende vogn (2).

30 4. Køretøj ifølge et af kravene 1 til 3,

**kendetegnet ved, at**

styreindretningen ved signalisering af et udfald af et klimaanlægs (1.1-4.1) klimatiseringsfunktion, afhængigt af den målte udvendige temperatur, tilpasser en indvendig indstillingstemperatur til den naboliggende vogn (2).

5. Køretøj ifølge et af kravene 1 til 4,

**kendetegnet ved, at**

5 det omfatter mindst tre vogne (1-4), og styreindretningen ved signalisering af et udfald af et klimaanlægs (1.1-1.4) klimatiseringsfunktion i den midterste vogn (3) styrer afgangsventilatorerne (2.3, 4.3) og klimaanlæggene ensartet i vognene ved siden af den midterste vogn (2, 4).

6. Køretøj ifølge et af kravene 1 til 5,

**kendetegnet ved, at**

10 køretøjet er udformet som skinnekøretøj.

7. Fremgangsmåde til nøddrift ved udfald af et klimaanlæg i et køretøj, hvor køretøjet omfatter mindst to vogne, der er forbundet med hinanden via en åben vognovergang og hver især er forsynet med et klimaanlæg, og et udfald af en klimatiseringsfunktion af et af klimaanlæggene registreres,

**kendetegnet ved, at**

15 en registrering af et udfald af et klimaanlægs klimatiseringsfunktion signaliseres, og afgangsluftindretninger i den vogn, der er ramt af udfaldet af klimaanlægget, derpå styres på en sådan måde, at afgangsluftvolumenstrømmen forøges, afgangsluftindretninger i vognen ved siden af den ramte vogn styres på en sådan måde, at afgangsluftvolumenstrømmen reduceres, og klimaanlægget i den naboliggende vogn styres på en sådan måde, at friskluftandelen af konditioneret tilførselsluft forøges.

25 8. Fremgangsmåde ifølge krav 7,

**kendetegnet ved, at**

klimaanlæggene ved udfald af en klimatiseringsfunktion indfører tilførselsluft ukonditioneret i den dertil tilordnede vogn.

30 9. Fremgangsmåde ifølge krav 7 eller 8,

**kendetegnet ved, at**

afgangsluftindretningerne i den naboliggende vogn frakobles.

10. Fremgangsmåde ifølge et af kravene 7 til 9,

35 **kendetegnet ved, at**

der ved signalisering af et udfald af et klimaanlægs klimatiseringsfunktion, afhængigt af den målte udvendige temperatur, tilpasses en indvendig indstillingstemperatur til den naboliggende vogn.

- 5        **11.** Fremgangsmåde ifølge et af kravene 7 til 10,  
**kendetegnet ved, at**  
afgangsluftindretningerne og klimaanlæggene i vognene ved siden af den midterste vogn styres ensartet i det tilfælde, hvor køretøjet omfatter mindst tre vognkasser, ved signalisering af et udfald af en klimatiseringsfunktion af et  
10 klimaanlæg i den midterste vogn.

