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(71) Applicant *(for all designated States except US)*: **SCANIA CV AB** [SE/SE]; S-151 87 Södertälje (SE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **SAMUELSSON, Peter** [SE/SE]; Tallbacksvägen 6, S-645 91 Strängnäs (SE). **HESSE, Johan** [SE/SE]; Granvägen 19, S-611 56 Nyköping (SE). **WINSA, Daniel** [SE/SE]; Erikshällsgatan 79, S-151 46 Södertälje (SE).

(74) Agent: **ELLIOT, Douglas**; Scania CV AB, S-151 87 Södertälje (SE).

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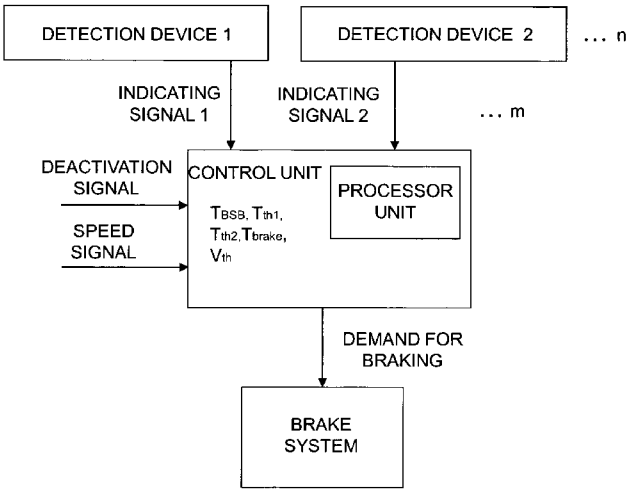

FIG. 1

(57) Abstract: The invention relates to a safety system for vehicles equipped with holding brakes, which system comprises at least one detection device (1, 2...n) situated close to the vehicle's doors or windows. The detection device (1, 2...n) is adapted to generating an indicating signal (1, 2...m) if one or more indicating criteria are fulfilled, and is provided with a control unit adapted to receiving a deactivation signal to the effect that the vehicle's holding brake has been deactivated, and if the deactivation signal indicates that the holding brake has been deactivated and if an indicating signal (1, 2...m) has been generated from a detection device (1, 2...n), then the control unit is adapted to sending a demand for braking to the vehicle's brake system, whereupon the brake system brakes the vehicle. The invention relates also to a safety method in a safety system for vehicles equipped with holding brakes.

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SAFETY SYSTEM AND METHOD

Field of the invention

The present invention relates to a safety system and a safety method for doors and windows in vehicles according to the preambles of the independent claims.

Background to the invention

Vehicles used for transporting people are subject to rules about how they have to be configured and function in order to ensure passenger safety. For example, such a vehicle has usually to have a holding brake, which is an automatic device to prevent the vehicle from set in motion from stationary. This saves the driver from having to continually brake manually, e.g. while the vehicle is stationary at a stopping point. The holding brake, also called door brake, is also activated when any of the vehicle's doors are open and the vehicle is stationary. This means that if at least one door in the vehicle is open, it is not possible to set the vehicle in motion. The holding brake is deactivated automatically when the driver accelerates, provided that the doors are closed.

A vehicle for transporting people usually has a safety system for ensuring that nothing is trapped between the doors when they close. Such a system may comprise various types of seal strips in the doors, pressure sensors, IR detection etc. to detect anything which is between the doors. If anything is detected between the doors when they are about to close, the safety system causes them to reopen. At the same time, the holding brake is then activated, since it is applied as long as the doors are open.

US 6396395 describes a system for controlling various safety devices when a bus is stationary. For example, the doors may be caused to close when the parking brake is released.

Patent specification CN200945861 describes an automatic brake system for a bus. The device can keep the bus in a braked state when passengers are to

board or alight from the bus. A laser detector is provided at the rear door to detect passengers boarding or alighting.

If anything trapped in the door or doors is so small and thin that the door safety system cannot register it, activation of the safety system may possibly not take place until the seal strip is subjected to tension which results in a detectable pressure. As the existing holding brake function can only be activated when the vehicle is stationary or almost stationary, no brake can be applied. If this happens, it is necessary to rely on the driver noticing that something is trapped in the door so that he/she can manually brake the vehicle.

The object of the invention is to further improve the reliability of safety systems for vehicles, and in particular to ensure that nothing is left trapped in the vehicle's doors or windows when it has begun to move away from a boarding point.

Summary of the invention

The object described above is achieved by a safety system for vehicles equipped with holding brakes, which system comprises at least one detection device (1, 2...n) situated close to the vehicle's doors or windows. The detection device (1, 2...n) is adapted to generating an indicating signal (1, 2...m) if one or more indicating criteria are fulfilled, and is provided with a control unit adapted to receiving a deactivation signal to the effect that the vehicle's holding brake has been deactivated, and if the deactivation signal indicates that the holding brake has been deactivated and if an indicating signal (1, 2...m) has been generated from a detection device (1, 2...n), then the control unit is adapted to sending a demand for braking to the vehicle's brake system in the form of a gradually increasing retardation torque, whereupon the brake system brakes the vehicle.

According to another aspect, the object is achieved by a safety method in a safety system for vehicles equipped with holding brakes, which system comprises at least one detection device (1, 2...n) situated close to the vehicle's doors or

windows and adapted to generating an indicating signal (1, 2...m) if one or more indicating criteria are fulfilled, and

- if a deactivation signal has been received to the effect that the vehicle's holding brake has been deactivated, and

- if an indicating signal (1, 2...m) has been generated from said at least one detection device (1, 2...n), then a demand for braking is sent to the vehicle's brake system in the form of a gradually increasing retardation torque, whereupon the brake system brakes the vehicle.

The vehicle may also be automatically braked by the safety system and the method when it has begun to move. This provides assurance that nothing is left trapped in the vehicle's doors or windows when it has begun to move away from a boarding point.

When the vehicle has begun to move and something is trapped in a door, it is for example possible for the tension arising from the weight of the trapped object to cause an indicating signal (1, 2...m) to be generated by a detection device (1, 2...n). The safety system will then ensure that the vehicle is halted automatically and preferably that the door is opened. It is thus possible for whatever has been trapped to be freed without coming to harm.

Preferred embodiments are described in the dependent claims and the detailed description.

Brief description of the attached drawings

The invention is described below with reference to the attached drawings, in which:

Figure 1 depicts an example of a safety system according an embodiment of the invention.

Figure 2 is a flowchart for a safety method according to an embodiment of the invention.

Figure 3 is a flowchart for a safety method according to another embodiment of the invention.

Figure 4 is a flowchart for a safety method according to a further embodiment of the invention.

Figure 5 is a flowchart for a safety method according to yet a further embodiment of the invention.

Detailed description of preferred embodiments of the invention

Figure 1 illustrates schematically the safety system according to the invention. The safety system is suitable for vehicles equipped with holding brakes, since it is to be used when the holding brake cannot be activated. The holding brake is represented in the diagrams by BSB, as an abbreviation for "bus stop brake". The holding brake is activated when the vehicle is stationary, and will be deactivated by, for example, the driver pressing the accelerator pedal. The system further comprises at least one detection device (1, 2...n) situated close to the vehicle's doors or windows and adapted to generating an indicating signal (1, 2...m) if one or more indicating criteria are fulfilled. The detection device (1, 2...n) may take the form of one or more seal strips in the doors, pressure sensors, IR detectors etc. Examples of possible indicating criteria are when a seal strip detects contact, a pressure sensor detects a pressure which exceeds a predetermined value, or an IR detector detects an object. The system comprises also a control unit adapted to receiving a deactivation signal to the effect that the vehicle's holding brake has been deactivated, and if the deactivation signal indicates that the holding brake has been deactivated and if an indicating signal (1, 2,...m) has been generated from said at least one detection device (1, 2...n), then the control unit is adapted to sending a demand for braking to the vehicle's brake system, whereupon the brake system brakes the vehicle. The vehicle can thus be subjected automatically to emergency braking when anything trapped is detected after the vehicle has begun to move.

The control unit comprises preferably a processor unit provided with a processor and memory able to perform calculations and method steps described in relation to the invention.

According to an embodiment, signals are exchanged via CAN (controller area network) which is a serial bus system specially developed for use in vehicles. The CAN data bus allows digital data exchange between sensors, regulating components, actuators, control devices etc. and provides assurance that more than one control unit can have access to the signals from a given sensor, in order to use them for control of components connected to them. Other systems for exchange of signals are nevertheless also conceivable.

According to an embodiment, the control unit is adapted to measuring the time T_{BSB} from when the holding brake is deactivated, and to sending a demand for braking to the vehicle's brake system when T_{BSB} is less than a preset threshold value T_{th1}, provided that a deactivation signal to the control unit has been received to the effect that the holding brake has been deactivated, and provided that an indicating signal (1, 2...m) has been generated from said at least one detection device (1, 2...n). By measuring and monitoring T_{BSB} from when the holding brake was deactivated, the system can verify that not too long a time has passed from when the vehicle left the stopping point to when it is braked. If the time is too long, the vehicle may have reached too high a speed, with consequent risk of harm to passengers if it is braked quickly. T_{th1} is preferably a value between 2 and 20 seconds. This avoids the function being misused when time has passed since the vehicle last halted.

The safety method according to an embodiment is adapted to receiving a speed signal which indicates the vehicle's speed, and to sending a demand for braking to the vehicle's brake system when the vehicle's speed V is less than a preset threshold value V_{th}, provided that a deactivation signal to the control unit has been received to the effect that the holding brake has been deactivated and provided that an indicating signal (1, 2...m) has been generated from said at least one

detection device (1, 2...n). By monitoring the vehicle's speed after the holding brake has been deactivated, the system can verify that it is not too high when the vehicle is braked. If the vehicle has reached too high a speed, there is risk of harm to passengers if the vehicle is braked quickly. V_{th} is preferably a value of between 1 and 15 km/s. This also avoids the function being misused at high speeds.

The control unit is preferably adapted to sending a demand for braking to the vehicle's brake system in the form of a gradual increasing retardation torque. The criteria for how quickly the brake torque may increase are that the vehicle should halt as soon as possible and that passengers should come to no harm. This depends also on the gradient of the road, the weight of the vehicle, etc. The brake torque should nevertheless cause the vehicle to halt within between 0.1 and 5 seconds, preferably within 1 second. Demands for retardation torque are preferably sent to the service brakes.

According to an embodiment, when said demand for braking has been sent to the vehicle's brake system, the control unit is adapted to blocking the vehicle's accelerator pedal. This makes it impossible for the driver to set the vehicle in motion before the safety system has deactivated the emergency stop and has thereby deactivated the demand for braking to the vehicle's brake system.

After an emergency stop has occurred, which means that said demand for braking has been sent to the vehicle's brake system, it is desired to be able to deactivate the emergency stop in order to be able to continue driving the vehicle. To deactivate the emergency stop, the control unit is therefore preferably adapted to measuring the time T_{brake} from when said demand for braking was sent, and to allowing, when T_{brake} is greater than a threshold value T_{th2}, a deactivation demand to be sent to the vehicle's brake system to cancel said demand for braking. The emergency stop can thus not be deactivated until a certain time has passed.

According to an embodiment, the emergency stop can be deactivated by putting the vehicle's gears into neutral. The control unit is then adapted to receiving a neutral-gear signal to the effect that the vehicle's gearbox is in neutral gear. According to an embodiment, the control unit is adapted to sending a deactivation demand to the vehicle's brake system to cancel said demand for braking, if said demand for braking has been sent, a neutral-gear signal has thereafter been received and $T_{brake} > T_{th2}$. A certain time T_{th2} after the emergency stop, the driver can therefore deactivate it by putting the vehicle's gears into neutral. The emergency stop may instead be deactivated by opening of the door or window where a detection device (1, 2...n) has indicated that something is trapped. The control unit is then adapted to receiving an open signal to the effect that the relevant door or window is being or has been opened. According to an embodiment, the control unit is adapted to sending a deactivation demand to the vehicle's brake system to cancel said demand for braking, if said demand for braking has been sent, an open signal has thereafter been received and $T_{brake} > T_{th2}$. After a certain time T_{th2}, the emergency stop can therefore be deactivated by opening of the relevant door or window. A further way of deactivating the emergency stop may be by the driver depressing the accelerator pedal and thus accelerating the vehicle. This does however to be preceded by some other choice having been made, e.g. by the vehicle's gears having been put into neutral or by the relevant door or window having been opened. The control unit is then adapted to receiving an acceleration signal which indicates whether the vehicle is accelerating, and to sending, if said demand for braking has been sent, an acceleration signal has thereafter been received and a neutral-gear signal has been received, a deactivation demand to the vehicle's brake system to cancel said demand for braking. Instead of the criterion "neutral-gear signal received" as in the previous sentence, the criterion may instead be "open signal received". This makes it possible for the driver, provided that some other choice such as putting the vehicle's gearbox into neutral or opening the relevant door or window has been made, to deactivate the emergency stop and continue driving the vehicle. Activation of the vehicle's holding brake may also deactivate the emergency stop. A further criterion other than the holding brake being activated

may be that the door or window where a detection device (1, 2...n) has indicated that something is trapped has to be opened before the emergency stop is deactivated.

The emergency stop may also be deactivated by combining two or more of the above methods, as illustrated in examples below with reference to Figures 3-5.

The control unit may also be adapted to reinstating a braking demand after a number X of successive attempts to start the engine. X may for example be 10 to 30 attempts. It is thus possible to be certain of starting the engine and setting the vehicle in motion irrespective of what happens with other functions.

The invention relates also to a safety method in a safety system for vehicles which is illustrated by the flowchart in Figure 2. Under this method, if a deactivation signal has been received to the effect that the vehicle's holding brake has been deactivated, and if an indicating signal (1, 2...m) has been generated from a detection device (1, 2...n), then a demand for braking is sent to the vehicle's brake system, whereupon the brake system brakes the vehicle. It is thus possible to provide assurance that the vehicle can also be braked automatically when it is in motion.

Figure 3 depicts an example of a preferred method for activating the emergency stop. The holding brake BSB is active, which means that the vehicle is stationary, e.g. at a stopping point to let passengers on and off. Doors and possibly windows close and the driver depresses the accelerator pedal to set the vehicle in motion, thereby deactivating the holding brake. The deactivation of the holding brake sets running the time T_{BSB}, i.e. the time from when the holding brake is deactivated. In this example, the vehicle's speed V is also monitored, but according to an embodiment only one out of T_{BSB} and the vehicle's speed V is monitored.

If an indicating signal (1, 2...m) is generated after deactivation of the holding brake, T_{BSB} is less than a preset threshold value T_{th1} and the vehicle's speed V is

less than a preset threshold value V_{th}, then a demand for braking is sent to the vehicle's brake system. Said demand for braking is preferably sent to the vehicle's brake system in the form of a gradually increasing brake torque, whereupon the vehicle is braked.

During the time when said emergency braking is activated and said demand for braking has therefore been sent to the vehicle's brake system, the vehicle's accelerator pedal is preferably blocked. When the vehicle's speed has dropped below a certain level, the vehicle's holding brake is activated. The holding brake and the emergency stop braking are then applied simultaneously.

Figure 4 depicts an example of how the emergency brake may be deactivated. When a brake torque is demanded, the time T_{brake} from when said demand for braking was sent is measured. According to an embodiment, when T_{brake} is greater than a threshold value T_{th2}, a deactivation demand is sent to the vehicle's brake system to cancel said demand for braking. In this example, for a deactivation demand to be sent to the brake system, it is also necessary that an acceleration signal to the effect that the vehicle is accelerating is received and that the vehicle's gears are in neutral or that the door or window from which an indicating signal (1, 2...m) has been generated has been opened. If the safety system incorrectly detects that something is trapped in the door, the driver has to be able to put the vehicle's gears into neutral in order to be able to deactivate the emergency brake. A neutral-gear signal is then received to the effect that the vehicle's gearbox is in neutral gear.

Figure 5 depicts an example of how the vehicle is restored to a drivable state after a deactivation demand has been sent. Provided that the holding brake is activated, the vehicle is accelerating and a deactivation demand has been sent, then the holding brake is deactivated. If no fault occurs, a deactivation demand is never issued, so a braking demand can be reinstated after a number X of successive attempts to start the engine. In this example X=30 but might be some other number of attempts. The vehicle's braking demand is reinstated when the

holding brake is no longer activated, the vehicle's gearbox is not in neutral gear and T_{BSB} is greater than a threshold value which in the example here depicted is 10 seconds or the time the vehicle takes to reach a certain speed which in the example depicted is 10 km/h. The vehicle is therefore ready to reactivate the emergency stop. The values indicated are merely examples.

The invention relates also to a computer programme product comprising computer programme instructions for enabling a computer system in a vehicle to perform the above steps according to the method when the computer programme instructions are run on said computer system. The invention comprises also a computer programme product which has the computer programme instructions stored in it on a medium which can be read by a computer system.

The present invention is not confined to the embodiments described above. Sundry alternatives, modifications and equivalents may be used. The above embodiments therefore do not limit the scope of the invention, which is defined by the attached claims.

Claims

1. A safety system for vehicles equipped with holding brakes, which system comprises at least one detection device (1, 2...n) situated close to the vehicle's doors or windows and adapted to generating an indicating signal (1, 2...m) if one or more indicating criteria are fulfilled,
characterised in that the system is provided with
- a control unit adapted to receiving a deactivation signal to the effect that the vehicle's holding brake has been deactivated, and
- if the deactivation signal indicates that the holding brake has been deactivated and
- if an indicating signal (1, 2...m) has been generated from said at least one detection device (1, 2...n), then the control unit is adapted to sending a demand for braking to the vehicle's brake system in the form of a gradually increasing retardation torque, whereupon the brake system brakes the vehicle.

2. A safety system according to claim 1, in which the control unit is adapted to measuring the time T_{BSB} from when the holding brake is deactivated, and to sending a demand for braking to the vehicle's brake system when T_{BSB} is less than a preset threshold value T_{th1}, a deactivation signal has been received to the effect that the holding brake has been deactivated, and an indicating signal (1, 2...m) has been generated from said at least one detection device (1, 2...n).

3. A safety system according to claim 1 or 2, in which the control unit is adapted to receiving a speed signal which indicates the vehicle's speed, and to sending a demand for braking to the vehicle's brake system when the vehicle's speed V is less than a preset threshold value V_{th}, a deactivation signal to the control unit has been received to the effect that the holding brake has been deactivated, and an indicating signal (1, 2...m) has been generated from said at least one detection device (1, 2...n).

4. A safety system according to any one of the foregoing claims, in which the control unit is adapted to blocking the vehicle's accelerator pedal if said demand for braking has been sent to the vehicle's brake system.

5. A safety system according to any one of the foregoing claims, in which the control unit is adapted to measuring the time T_{brake} from when said demand for braking was sent, and to allowing, when $T_{brake} > T_{th2}$, where T_{th2} is a preset threshold value, a deactivation demand to be sent to the vehicle's brake system to cancel said demand for braking.

6. A safety system according to claim 5, in which the control unit is adapted to receiving a neutral-gear signal to the effect that the vehicle's gearbox is in neutral gear.

7. A safety system according to claim 5, in which the control unit is adapted to receiving an open signal to the effect that the relevant door or window has been opened.

8. A safety system according to claim 6, in which the control unit is adapted to sending a deactivation demand to the vehicle's brake system to cancel said demand for braking, if said demand for braking has been sent, a neutral-gear signal has thereafter been received and $T_{brake} > T_{th2}$.

9. A safety system according to claim 7, in which the control unit is adapted to sending a deactivation demand to the vehicle's brake system to cancel said demand for braking, if said demand for braking has been sent, an open signal has thereafter been received and $T_{brake} > T_{th2}$.

10. A safety system according to any one of claims 1-6 or 8, in which the control unit is adapted to receiving an acceleration signal which indicates whether the vehicle is accelerating, and to sending, if said demand for braking has been sent, an acceleration signal has thereafter been received and a neutral-gear

signal has been received, a deactivation demand to the vehicle's brake system to cancel said demand for braking.

11. A safety system according to any one of claims 1-5, 7 or 9, in which the control unit is adapted to receiving an acceleration signal which indicates whether the vehicle is accelerating, and to sending, if said demand for braking has been sent, an acceleration signal has thereafter been received and an open signal has been received, a deactivation demand to the vehicle's brake system to cancel said demand for braking.

12. A safety system according to any one of the foregoing claims, in which the control unit is adapted to reinstating a braking demand after a number X of successive attempts to start the engine.

13. A safety method in a safety system for vehicles equipped with holding brakes, which system comprises at least one detection device (1, 2...n) situated close to the vehicle's doors or windows and adapted to generating an indicating signal (1, 2...m) if one or more indicating criteria are fulfilled,
characterised in that the method comprises that
- if deactivation signal has been received to the effect that the vehicle's holding brake has been deactivated and
- if an indicating signal (1, 2...m) has been generated from said at least one detection device (1, 2...n), then a demand for braking is sent to the vehicle's brake system in the form of a gradually increasing retardation torque, whereupon the brake system brakes the vehicle.

14. A safety method according to claim 13, which comprises measuring the time T_{BSB} from when the holding brake is deactivated and sending a demand for braking to the vehicle's brake system when T_{BSB} is greater than a preset threshold value T_{th1}, provided that a deactivation signal has been received to the effect that the holding brake has been deactivated, and provided that an indicating

signal (1, 2...m) has been generated from said at least one detection device (1, 2...n).

15. A safety method according to claim 13 or 14, which comprises sending a demand for braking to the vehicle's brake system when the vehicle's speed is greater than a preset threshold value V_{th}, provided that a deactivation signal has been received to the effect that the vehicle's holding brake has been deactivated, and provided that an indicating signal (1, 2...m) has been generated from said at least one detection device (1, 2...n).

16. A safety method according to any one of claims 13-15, which comprises blocking the vehicle's accelerator pedal if said demand for braking has been sent to the vehicle's brake system.

17. A safety method according to any one of claims 13-16, which comprises measuring the time T_{brake} from when said demand for braking was sent, and to allowing, when $T_{brake} > T_{th2}$, a deactivation demand to be sent to the vehicle's brake system to cancel said demand for braking.

18. A safety method according to claim 17, which comprises receiving a neutral-gear signal to the effect that the vehicle's gearbox is in neutral gear.

19. A safety method according to claim 17, which comprises receiving an open signal to the effect that the relevant door or window has been opened.

20. A safety method according to claim 18, which comprises sending a deactivation demand to the vehicle's brake system to cancel said demand for braking, if said demand for braking has been sent, a neutral-gear signal has thereafter been received and $T_{brake} > T_{th2}$.

21. A safety method according to claim 19, which comprises sending a deactivation demand to the vehicle's brake system to cancel said demand for

braking, if said demand for braking has been sent, an open signal has thereafter been received and $T_{brake} > T_{th2}$.

22. A safety method according to any one of claims 13-18 or 20, which comprises receiving an acceleration signal which indicates whether the vehicle is accelerating, and sending, if said demand for braking has been sent, an acceleration signal has thereafter been received and a neutral-gear signal has been received, a deactivation demand to the vehicle's brake system to cancel said demand for braking.

23. A safety method according to any one of claims 13-17, 19 or 21, which comprises receiving an acceleration signal which indicates whether the vehicle is accelerating, and sending, if said demand for braking has been sent, an acceleration signal has thereafter been received and an open signal has been received, a deactivation demand to the vehicle's brake system to cancel said demand for braking.

24. A safety method according to any one of claims 13-23, which comprises reinstating a braking demand after a number X of successive attempts to start the engine.

25. A computer programme product comprising computer programme instructions for enabling a computer system in a vehicle to perform steps according to the method of any of claims 13-24 when the computer programme instructions are run on said computer system.

26. A computer programme product according to claim 25, in which the computer programme instructions are stored on a medium which can be read by a computer system.

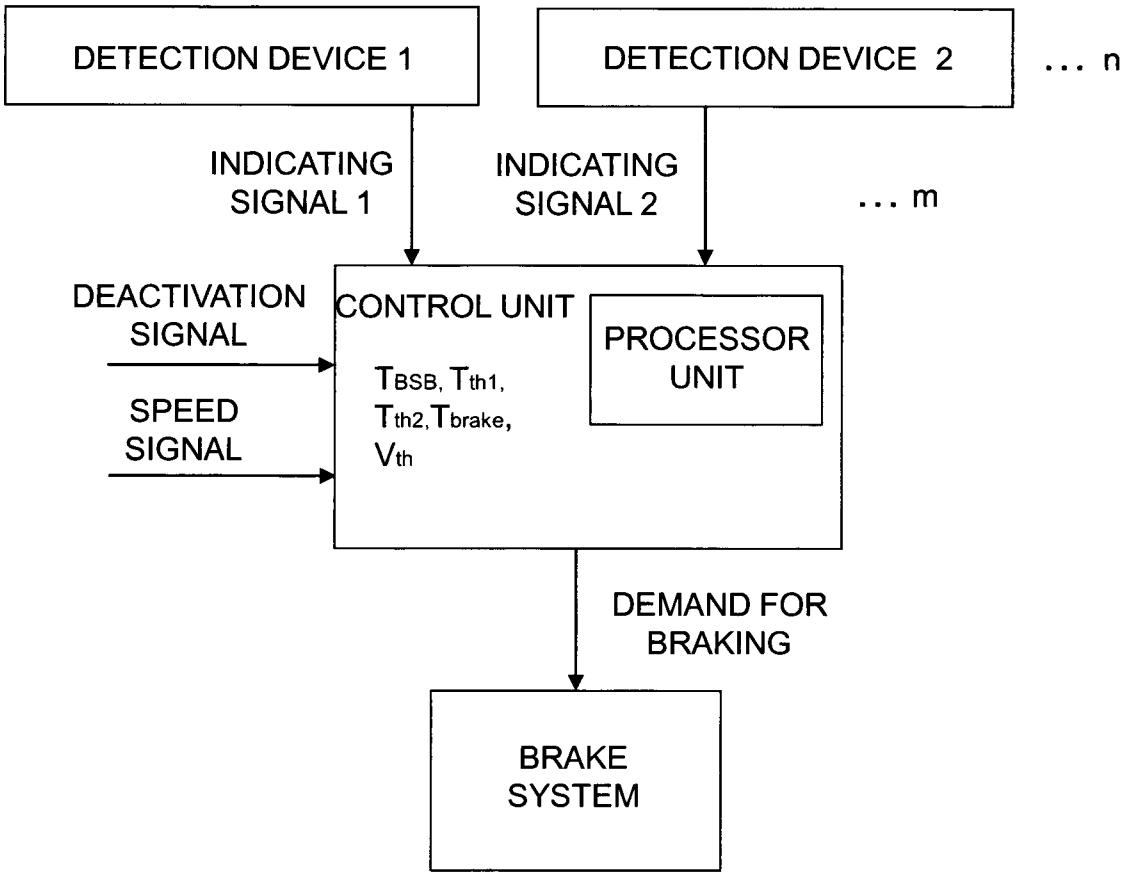
DETECTION DEVICE 1
DETECTION DEVICE 2
... n
INDICATING SIGNAL 1
INDICATING SIGNAL 2
... m
DEACTIVATION SIGNAL
SPEED SIGNAL
CONTROL UNIT
PROCESSOR UNIT
TBSB, Tth1, Tth2, Tbrake, Vth
DEMAND FOR BRAKING
BRAKE SYSTEM

FIG. 1

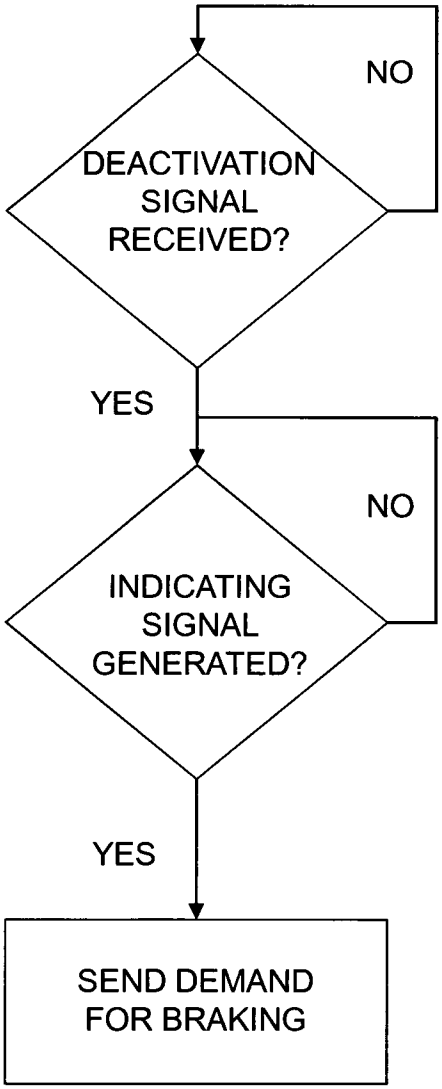
NO
DEACTIVATION SIGNAL RECEIVED?
YES
NO
INDICATING SIGNAL GENERATED?
YES
SEND DEMAND FOR BRAKING

FIG. 2

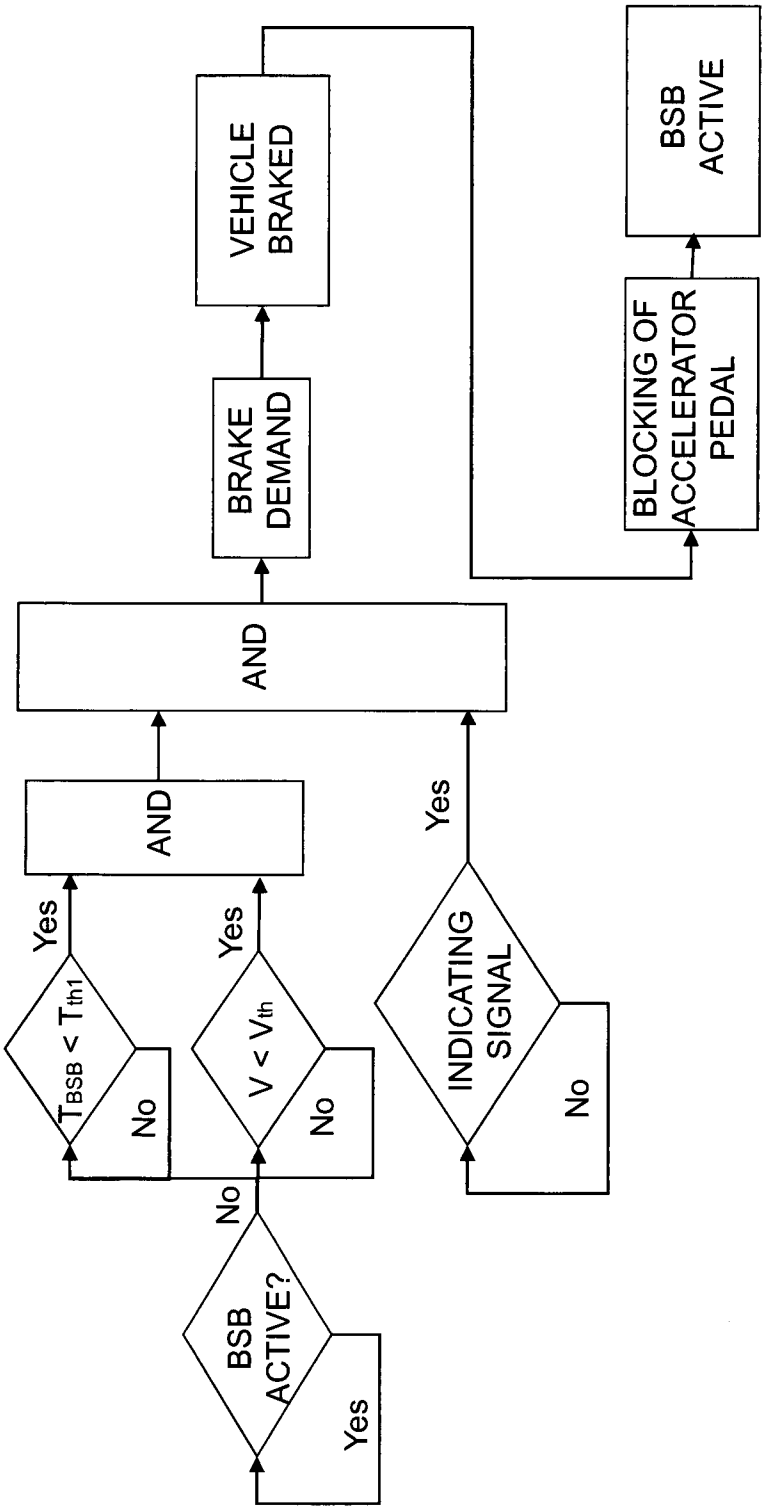
VEHICLE BRAKED
BSB ACTIVE
BRAKE DEMAND
BLOCKING OF ACCELERATOR PEDAL
AND
AND
Yes
Yes
Yes
$T_{BSB} < T_{th1}$
$V < V_{th}$
INDICATING SIGNAL
No
No
No
BSB ACTIVE?
Yes

FIG. 3

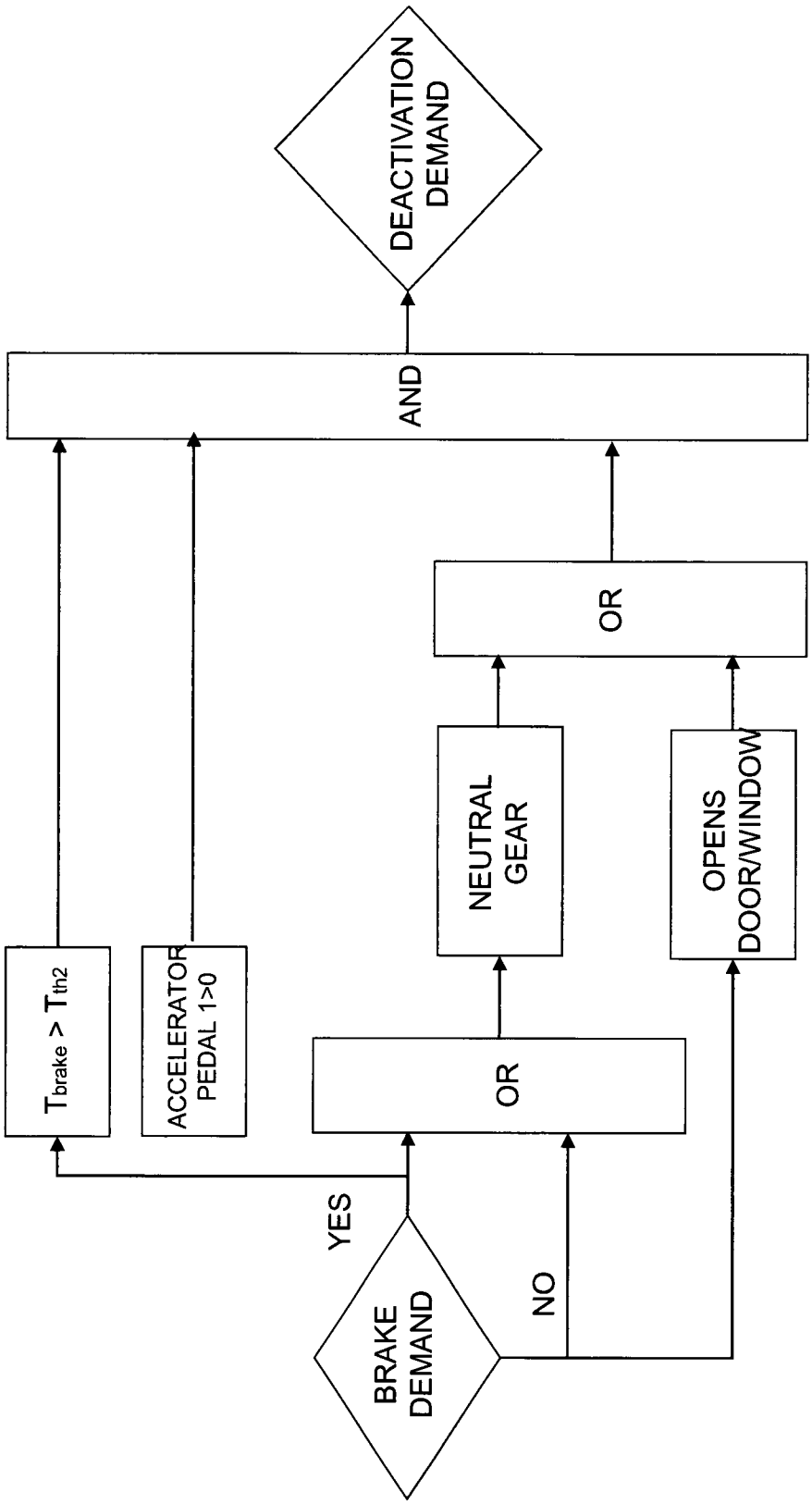
DEACTIVATION DEMAND
AND
OR
NEUTRAL GEAR
OPENS DOOR/WINDOW
OR
$T_{brake} > T_{th2}$
ACCELERATOR PEDAL 1>0
YES
NO
BRAKE DEMAND

FIG. 4

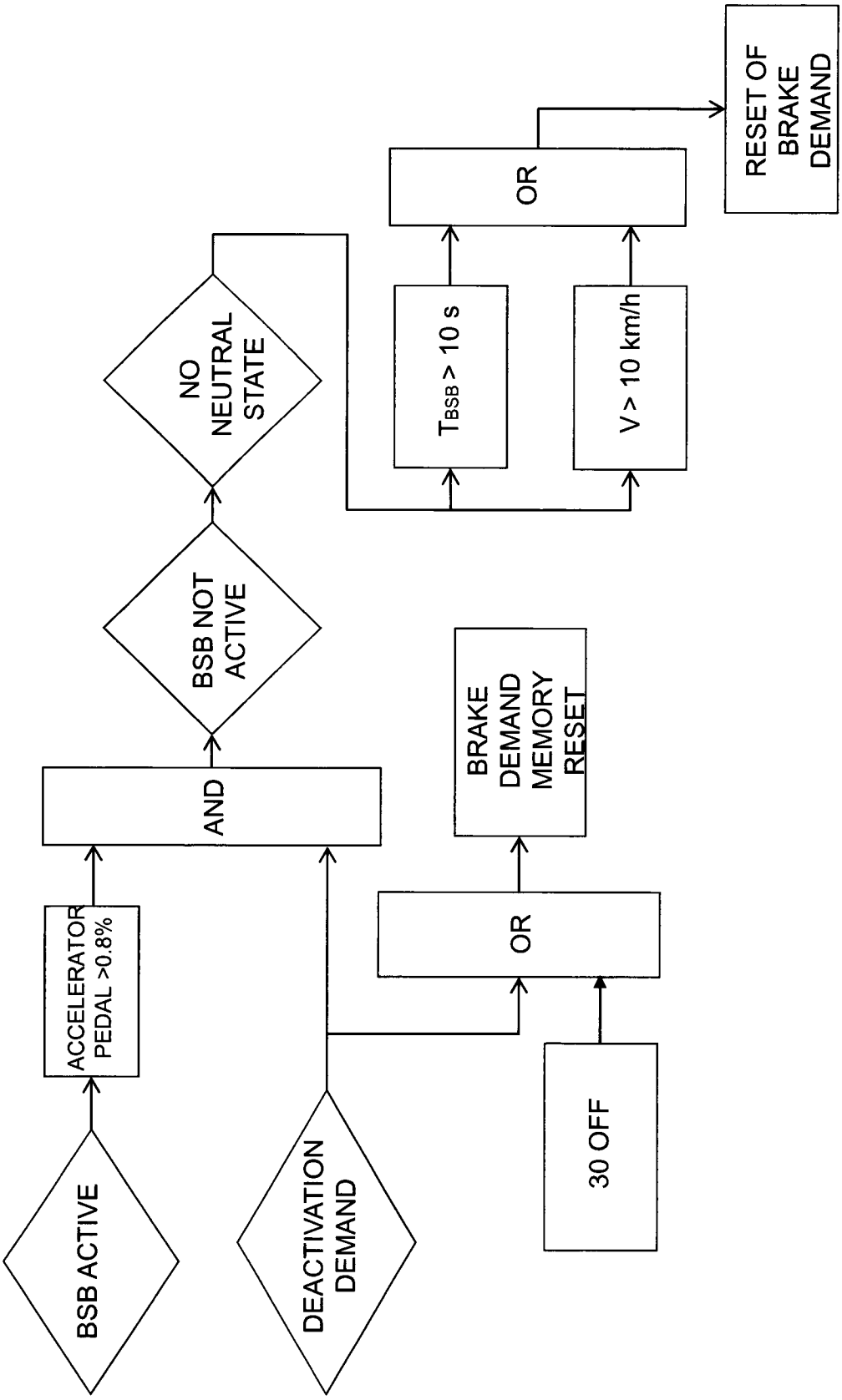
BSB ACTIVE
ACCELERATOR PEDAL >0.8%
DEACTIVATION DEMAND
30 OFF
AND
OR
BRAKE DEMAND MEMORY RESET
BSB NOT ACTIVE
NO NEUTRAL STATE
T_{BSB} > 10 s
V > 10 km/h
OR
RESET OF BRAKE DEMAND

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2011/050405

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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)

IPC: B60K, B60R, B60T, B60W

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

SE, DK, FI, NO classes as above

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

EPO-Internal, PAJ, WPI data, COMPENDEX, INSPEC, IBM-TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 20020189882 A1 (EBERLING CHARLES E ET AL), 19 December 2002 (2002-12-19); paragraphs [0010], [0022]; figure 1; claims 1, 15 --	1-26
A	US 4838617 A (DEITCHMAN WALTER H ET AL), 13 June 1989 (1989-06-13); column 1, line 27 - line 30; column 4, line 7 - line 31; claim 1 --	1-26
A	CA 2077596 A1 (NAULT MICHEL), 5 March 1994 (1994-03-05); figures 1, 4, 6; claim 15 --	1-26

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08-06-2011	22-06-2011

Name and mailing address of the ISA/SE	Authorized officer
Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Tomas Lund Telephone No. + 46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2011/050405

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6601669 B1 (AGNEW DAVID LESLIE), 5 August 2003 (2003-08-05); column 3, line 66 - column 4, line 5; figures 1-2; claim 1 --	1-26
A	US 6450587 B1 (MACGREGOR G DAVID ET AL), 17 September 2002 (2002-09-17); column 3, line 65 - column 4, line 24; column 5, line 5 - line 61; figure 7; claims 2, 9 --	1-26

International application No.
PCT/SE2011/050405

Continuation of: second sheet

International Patent Classification (IPC)

B60T 7/12 (2006.01)
B60K 28/12 (2006.01)
B60R 21/34 (2011.01)

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Cited literature, if any, will be enclosed in paper form.

US	20020189882	A1	19/12/2002	CA	2390311	A1	13/12/2002
				MX	PA02005817	A	12/12/2003
				US	6758298	B2	06/07/2004
US	4838617	A	13/06/1989	NONE			
CA	2077596	A1	05/03/1994	NONE			
US	6601669	B1	05/08/2003	JP	2002205631	A	23/07/2002
US	6450587	B1	17/09/2002	NONE			