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(54) **Title**: AIR INTAKE SYSTEM AND MOTOR VEHICLE COMPRISING SUCH AN AIR INTAKE SYSTEM

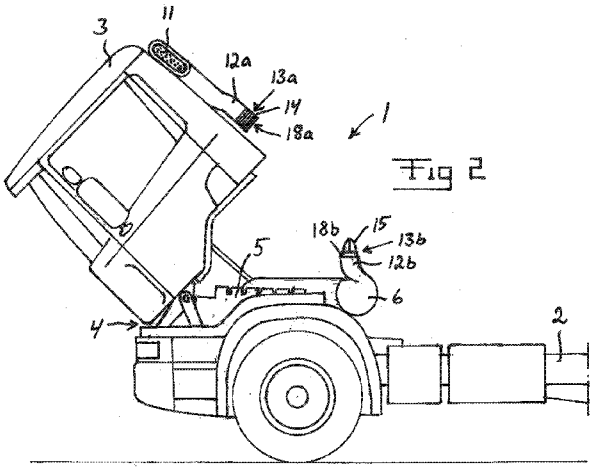


Fig 2

(57) **Abstract**: Air intake system for a motor vehicle with a cabin unit that may be tilted, comprising : - an air intake pipe with a first jointed section (12a) which is fixedly connected with the cabin unit and a second jointed section (12b) which is fixedly connected with the vehicle frame, and - a coupling device to releasably connect said jointed sections with each other. The coupling device comprises a first coupling part (13a) which is connected with the first jointed section and a second coupling part (13b) which is connected with the second jointed section. The first coupling part has an annular contact surface (18a) turned downward, designed to be sealingly engaged with an annular contact surface (18b) turned upward in the second coupling part, when the coupling parts are in engagement with each other. Several through holes are arranged in the second coupling part's contact surface. These holes are in fluid communication with the second jointed section and are arranged to be covered by the first coupling part's contact surface, when the coupling parts are in engagement with each other.

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Air intake system and motor vehicle comprising such an air intake system

FIELD OF THE INVENTION AND PRIOR ART

The present invention relates to an air intake system according to the preamble of patent claim 1 and a motor vehicle comprising such an air intake system.

In certain heavier motor vehicles, such as certain types of towing vehicles and trucks, the motor vehicle's operating space is arranged in a cabin unit, which is articulated to the motor vehicle's vehicle frame and may be tilted backwards and forwards between a lowered position and a raised position in relation to the vehicle frame. The cabin unit is normally in the lowered position and may be tilted forwards to the raised position, so that the engine compartment below the cabin unit is available for service or repairs.

In heavier motor vehicles used for example in dusty or snowy environments, it may be desirable to place the inlet to the combustion engine's air intake system high up on the vehicle's cabin unit, in order thus to avoid a large amount of particles in the form of for example sand, dust, soot or snowflakes being sucked into the air intake system together with the air sucked in through the inlet. Via an air intake pipe the sucked in air is led through the air inlet to an air filter, and then further to the vehicle's combustion engine. In an air intake system for a motor vehicle with a cabin unit that may be tilted and which has the air

inlet mounted on the cabin unit, the air intake pipe comprises a jointed section fixedly connected to the cabin unit, and a jointed section fixedly connected to the motor vehicle's vehicle frame. In order to facilitate a titling of the cabin unit, these jointed sections are releasably connectible with each other with the help of a coupling device, which comprises two coupling parts in a sealing engagement with each other when the cabin unit is in the lowered position, and which are separated from each other when the cabin unit is tilted from the lowered position to the raised position. When the cabin unit is suspended in relation to the vehicle frame, the coupling device must be equipped with a bellows or similar, in order to absorb the movements which arise between said jointed sections in connection with the suspension movements between the cabin unit and the vehicle frame. The two coupling parts should be designed so they may be released from each other in a simple way when the cabin unit is tilted to the raised position, and so they automatically may come into a sealing engagement with each other when the cabin unit is reversed to the lowered position, without requiring any intervention to release locking elements or similar. It is also important that the two coupling parts are maintained in a sealing engagement with each other during the operation of the vehicle, also with regard to the suspension movements between the cabin unit and the vehicle frame. Otherwise, for example water, snow, sand, dust or soot may penetrate into the air intake pipe in the area between the two coupling parts and encumber an air filter arranged downstream of the coupling device. If the air filter for example becomes wet as a result of inflowing water or snow, there is a risk that the particles which previously got stuck in the air filter may be washed away from the filter and sucked into the

combustion engine, which may lead to serious engine damage. Different solutions to this problem have been proposed previously. In US 3 151 695 A, for example, a solution is described where the bellows of the upper coupling part is equipped, at its lower end, with magnets intended to abut a surface of magnetic material in the lower coupling part. This solution assumes, however, that the lower coupling part is made of a magnetic material.

OBJECTIVE OF THE INVENTION

The objective of the present invention is to achieve an alternative and simultaneously simple and appropriate solution to the problem specified above.

SUMMARY OF THE INVENTION

According to the present invention, the above-mentioned objective is achieved with the help of an air intake system, having the characteristics defined in patent claim 1.

The air intake system according to the invention comprises:
- an air inlet arranged on a cabin unit that may be tilted, via which the surrounding air is intended to be sucked into the air intake system,
- an air intake pipe connected to the air inlet, this air intake pipe comprising a first joined section which is fixedly connected with the cabin unit and a second jointed section which is fixedly connected with the vehicle frame, and

- a coupling device to releasably connect said first and second jointed sections with each other, when the cabin unit is in its lowered position, which coupling device comprises a first coupling part connected to said first jointed section and a second coupling part connected to said second jointed section, wherein said coupling parts are arranged to be engaged with each other when the cabin unit is in the lowered position and separated from each other when the cabin unit is in the raised position, and wherein the first coupling part is flexible for absorption of mutual movements between said jointed sections when the two coupling parts are in engagement with each other. and its lower end shows a downward annular contact surface, which surface is designed to sealingly engage with an upward turned annular contact surface in the second coupling part, when the two coupling parts are engaged with each other.

Several through holes are arranged in the second coupling part's contact surface and distributed in the circumferential direction of this contact surface, wherein these through holes are in fluid communication with the second jointed section and are arranged to be covered by the first coupling part's contact surface when the two coupling parts are engaged with each other.

When the motor vehicle's combustion engine is in operation and inlet air is sucked into the engine via the air intake system, there will be generated, via the said holes, under impact of the sucking action which the combustion engine generates in the air intake pipe, a sucking force which strives to retain the first coupling part's contact surface in a sealing engagement with the second coupling part's contact surface. This sucking force counteracts a separation of the contact surfaces from each other, and may thus

prevent for example water, snow, sand, dust or soot from penetrating into the air intake pipe in the area between the two coupling parts in connection with suspension movements between the cabin unit and the vehicle frame. When the combustion engine is switched off, said sucking force ceases and the first coupling part may then with customary ease be released from the second coupling part, in connection with the cabin unit being tilted in relation to the vehicle frame, from its lowered position to its raised position. The inventive solution is simple and effective, and functions entirely automatically without requiring any manual intervention and without requiring any intervention from a manoeuvring element.

Other advantageous features of the arrangement according to the invention are set out in the non-independent patent claims and the description below.

The invention also pertains to a motor vehicle showing the characteristics defined in patent claim 8.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described below with the help of example embodiments, with reference to the enclosed drawings. Shown in:

Fig 1 is a schematic side view of a part of a motor vehicle equipped with an air intake system according to one embodiment of the present invention, with a motor

vehicle's cabin unit that may be tilted, shown in a lowered position,

Fig 2 is a schematic side view of a part of the motor vehicle according to Fig 1, with the cabin unit shown in a raised position,

Fig 3 is a schematic perspective view of a coupling device comprised in the air intake system of the motor vehicle according to Fig 1, with the two coupling parts in the coupling device separated from each other, and

Fig 4 is a section through a part of the coupling device according to Fig 3, with the two coupling parts in the coupling device in engagement with each other.

DETAILED DESCRIPTION OF EMBODIMENTS ACCORDING TO THE INVENTION

Fig 1 and 2 illustrate a motor vehicle 1 equipped with an air intake system 10 according to one embodiment of the present invention. In this case the motor vehicle is a towing vehicle. The motor vehicle 1 comprises a vehicle frame 2 and a cabin unit 3 with a driver's seat. The cabin unit 3 is connected via a joint 4 to the vehicle frame 2 and may be tilted backwards and forwards between a lowered position (see Fig 1) and a raised position (see Fig 2) in relation to the vehicle frame. Said joint 4 is located at the front end of the cabin unit 3. Under normal conditions, such as when the vehicle is driven, the cabin unit 3 is in the lowered position and may be tilted forwards to the raised position so that

the engine compartment below the cabin unit is made available for service or repair. In the engine compartment there is a combustion engine 5, which is arranged on the vehicle frame 2 and to which inlet air is led via the air intake system 10. In the lowered position the cabin unit 3 is carried by the vehicle frame 2 in a conventional manner with suspension elements (not displayed), which are arranged between the vehicle frame and the cabin unit.

The air intake system 10 comprises an air inlet 11 arranged on the cabin unit 3, via which the surrounding air is intended to be sucked into the air intake system. An air intake pipe 12 is connected to the air inlet 11, and the sucked in air is led via the air inlet in the direction toward the combustion engine 5. This air intake pipe 12 comprises a first jointed section 12a which is fixedly connected with the cabin unit 3 and a second jointed section 12b which is fixedly connected with the vehicle frame 2. The air intake system 10 comprises a coupling device 13, to releasably connect said first and second jointed sections 12a, 12b with each other, when the cabin unit 3 is in its lowered position. In the illustrated embodiment, the second jointed section 12b forms an inlet to an air filter 6 arranged on the vehicle frame 2. In this case the coupling device 13 is thus arranged upstream of the air filter 6. As an alternative, the air filter could be mounted on the cabin unit 3 and the coupling device 13 could be arranged downstream of the air filter 6, for example in the manner described in WO 01/84035 A1.

The coupling device 13 comprises a first coupling part 13a connected to said first jointed section 12a and a second coupling

part 13b, connected to said second jointed section 12b. These coupling parts 13a, 13b are arranged to be in engagement with each other when the cabin unit 3 is in the lowered position (see Fig 1) and separated from each other when the cabin unit is in the raised position (see Fig 2 and 3). The first coupling part 13a is arranged to be lifted up and away from the second coupling part 13b in order to automatically be released from this, when the cabin unit 3 is tilted forwards from the lowered position to the raised position, and to fall down toward the second coupling part 13b in order to automatically come into a sealing engagement with this, when the cabin unit 3 is turned back from the raised position to the lowered position. When the cabin unit 3 is in the lowered position the first coupling part 13a rests against the second coupling part 13b. The first coupling part 13a is flexible to facilitate absorption of mutual movements between said jointed sections 12a, 12b when the two coupling parts 13a, 13b are in engagement with each other. This flexibility is suitably achieved with the help of a flexible bellows 14, for example made of a rubber material. The bellows 14 is compressed when the first coupling part 13a is pressed against the second coupling part 13b, in connection with the cabin unit 3 turning back from the raised position to the lowered position. In the illustrated embodiment, the second coupling part 13b comprises a control device 15 turned upward, arranged to be received inside the first coupling part 13a when the first coupling part is led downwards and comes into engagement with the second coupling part, in order to steer the first coupling part 13a into a correct position in relation to the second coupling part 13b, in connection with the cabin unit 3 being turned from the raised position to the lowered position. This control device 15 may be designed in a prior art

manner and consist of several arched ribs 16 that extend in a bow upwards over the inlet opening 17 in the second coupling part 13b.

At its lower end, the first coupling part 13a has an annular contact surface 18a turned downward, designed to be sealingly engaged with an annular contact surface 18b turned upward in the second coupling part 13b, when the two coupling parts 13a, 13b are in engagement with each other. The first coupling part's contact surface 18a is suitably arranged on a lower flange 19 of the first coupling part 13a. In the illustrated example, the first coupling part's contact surface 18a is arranged at the lower end of the bellows 14 and constitutes a part of the same. The first coupling part's contact surface 18a may alternatively be arranged on a flat ring connected with the bellows. The second coupling part's contact surface 18b is suitably arranged on a flange extending radially inwards or on a shoulder 20 of the second coupling part 13b.

Several through holes 21 are arranged in the second coupling part's contact surface 18b and distributed in the circumferential direction on said contact surface 18b. These through holes 21 are in fluid communication with the second jointed section 12b and are arranged to be covered by the first coupling part's contact surface 18a when the two coupling parts 13a, 13b are in engagement with each other. As the holes 21 are in fluid communication with the second jointed section 12b, the holes' internal areas will be impacted by the sucking action generated in the air intake pipe 12 when the combustion engine 5 is in operation, entailing that the first coupling part's contact surface

18a, via the holes 21, is impacted by a sucking force that attaches the first coupling part's contact surface 18a to the second coupling part's contact surface 18b, and thus counteracts a separation of the two coupling parts 13a, 13b from each other. When the engine 5 is switched off, said sucking action ceases.

The air intake system 10 according to the invention is especially designed for use in a heavy goods vehicle, such as a towing vehicle or a truck.

The invention is not limited in any way to the embodiments described above, but numerous possible modifications thereof should be obvious to a person skilled in the art, without such person departing from the spirit of the invention as defined by the appended patent claims.

PATENT CLAIMS

1. Air intake system for a motor vehicle equipped with a vehicle frame (2), a combustion engine (5) arranged on the vehicle frame and a cabin unit (3) jointedly connected with the vehicle frame (2) and which may be tilted backwards and forwards between a lowered position and a raised position in relation to the vehicle frame, wherein the air intake system (10) comprises:

- an air inlet (11) arranged on the cabin unit (3), via which the surrounding air is intended to be sucked into the air intake system,

- an air intake pipe (12) connected to the air inlet (11), leading the air sucked in through the air inlet in the direction of the combustion engine (5), wherein this air intake pipe (12) comprises a first jointed section (12a) which is fixedly connected with the cabin unit (3) and a second jointed section (12b) which is fixedly connected with the vehicle frame (2), and

- a coupling device (13) for the releasable connection of said first and second jointed sections (12a, 12b) with each other when the cabin unit (3) is in its lowered position, which coupling device (13) comprises a first coupling part (13a) connected to said first jointed section (12a) and a second coupling device (13b) connected to said second jointed section (12b), so that said coupling parts (13a, 13b) are arranged to be in engagement with each other when the cabin unit (3) is in the lowered position and separated from each when the cabin unit is in the raised position, and wherein the first coupling part (13a) is flexible for the absorption of mutual

movements between said jointed sections (12a, 12b) when the two coupling parts (13a, 13b) are in engagement with each other, having an annular contact surface (18a) turned downward at its lower end, said surface being designed to sealingly engage with an annual contact surface (18b) turned upward in the second coupling part (13b) when the two coupling parts (13a, 13b) are in engagement with each other, **characterised by** several through holes (21) being arranged in the second coupling part's contact surface (18b) and distributed in a circumferential direction on this contact surface (18b), wherein these through holes (21) are in fluid communication with the second jointed section (12b) and are arranged to be covered by the first coupling part's contact surface (18a) when the two coupling parts (13a, 13b) are in engagement with each other.

2. Air intake system according to claim 1, **characterised by** the first coupling part's contact surface (18a) being arranged on a lower flange (19) of the first coupling part (13a).

3. Air intake system according to claim 1 or 2, **characterised by** the second coupling part's contact surface (18b) being arranged on a flange extending radially inwards or on a shoulder (20) of the second coupling part (13b).

4. Air intake system according to any of claims 1-3, **characterised by** the second coupling part (13b) comprising a control device (15) turned upwards, arranged to be received inside the first coupling part (13a) when the first coupling part (13a) comes into engagement with the second coupling part

(13b), in order to steer the first coupling part (13a) into a correct position in relation to the second coupling part (13b).

5. Air intake system according to any of claims 1-4, **characterised by** the first coupling part (13a) comprising a flexible bellows (14) for absorption of mutual movements between said jointed sections (12a, 12b) when the two coupling parts (13a, 13b) are in engagement with each other.

6. Air intake system according to any of claims 1-5, **characterised by** the first coupling part's contact surface (18a) being arranged at the lower end of the bellows (14) and constituting a part thereof.

7. Air intake system according to any of claims 1-6, **characterised by** the second jointed section (12b) forming an inlet to an air filter (6) arranged on the vehicle frame (2).

8. Motor vehicle comprising a vehicle frame (2), a combustion engine (5) arranged on the vehicle frame and a cabin unit (3) which is jointedly connected with the vehicle frame (2) and may be tilted backwards and forwards between a lowered position and a raised position in relation to the vehicle frame, **characterised by** the motor vehicle (1) comprising an air intake system (10) according to any of claims 1-7.

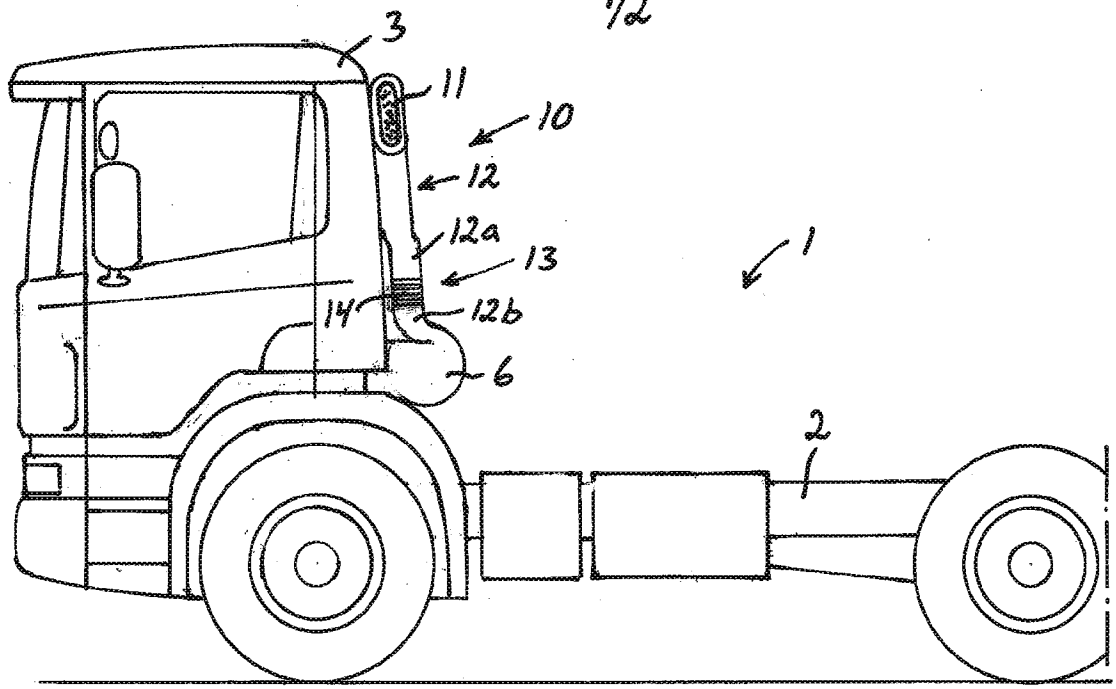

3
11
10
12
12a
13
1
14
12b
6
2

Fig 1

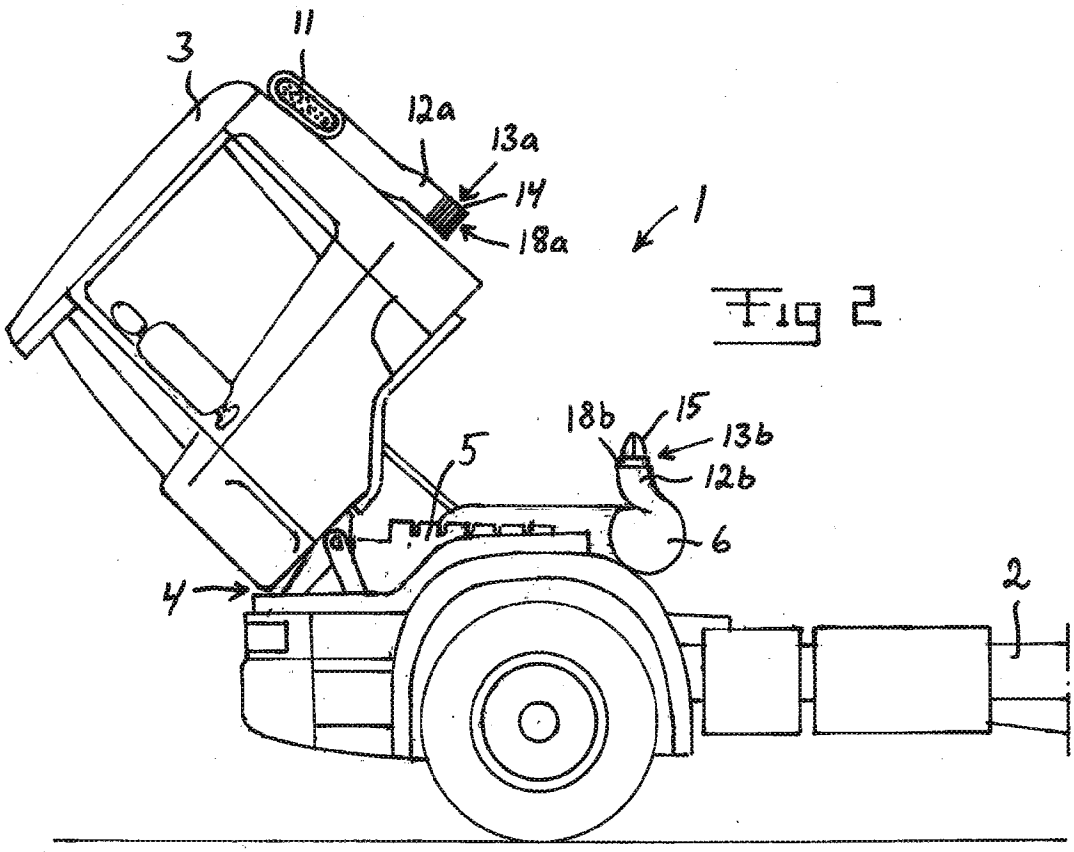

3
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12a
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14
18a
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15
13b
12b
5
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4
2

Fig 2

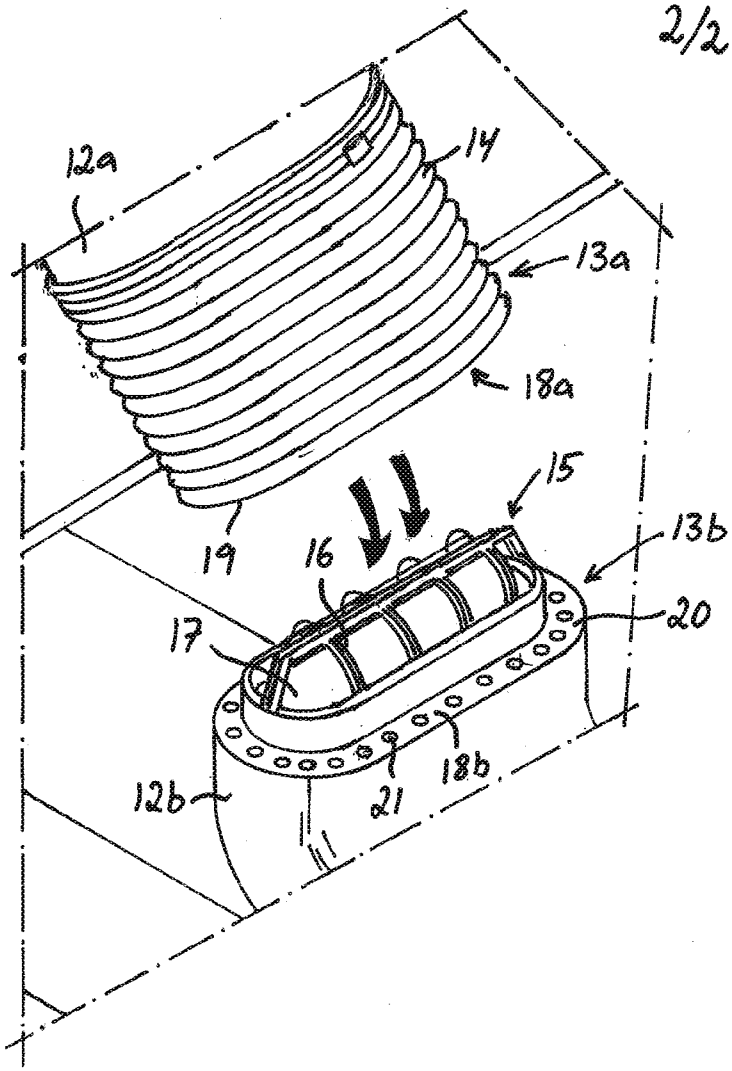

12a
14
13a
18a
15
19
16
13b
17
20
18b
21
12b

Fig 3

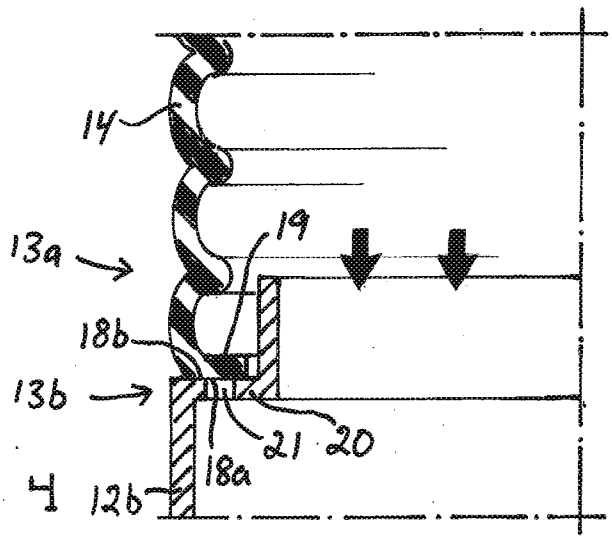

14
19
13a
18b
13b
21
20
18a
12b

Fig 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2013/051386

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, F02M, F16L

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 0184035 A1 (VOLVO LASTVAGNAR AB ET AL), 8 November 2001 (2001-11-08); whole document --	1-8
A	GB 1561285 A (CARRIER DRYSYS LTD), 20 February 1980 (1980-02-20); whole document --	1-8
A	US 3151695 A (MINTZ GERALD E), 6 October 1964 (1964-10-06); whole document --	1-8
A	US 4378945 A (TRAUTMAN GREGORY J), 5 April 1983 (1983-04-05); whole document --	1-8

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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

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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

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Date of the actual completion of the international search	Date of mailing of the international search report
01-04-2014	01-04-2014
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2013/051386

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 8403133 A1 (VOLVO AB), 16 August 1984 (1984-08-16); whole document ---	1-8
A	US 20120304605 A1 (ENDERICH ANDREAS ET AL), 6 December 2012 (2012-12-06); whole document --- --------	1-8

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PCT/SE2013/051386

Continuation of: second sheet

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B60K 13/02 (2006.01)
F02M 35/10 (2006.01)
F16L 37/58 (2006.01)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE2013/051386

WO	0184035	A1	08/11/2001	AU	5282601	A 12/11/2001
				SE	0001596	L 03/11/2001
				SE	516790	C2 05/03/2002
GB	1561285	A	20/02/1980	NONE		
US	3151695	A	06/10/1964	NONE		
US	4378945	A	05/04/1983	AU	7788781	A 05/08/1982
				CA	1173874	A1 04/09/1984
WO	8403133	A1	16/08/1984	DE	3464792	D1 20/08/1987
				EP	0135531	A1 03/04/1985
				JP	4065279	B 19/10/1992
				JP	S60500880	A 06/06/1985
				JP	H0465279	B2 19/10/1992
				SE	435313	C 20/12/1984
				SE	8300679	L 10/08/1984
				US	4575128	A 11/03/1986
US	20120304605	A1	06/12/2012	CN	102713227	A 03/10/2012
				DE	102009057563	A1 16/06/2011
				EP	2510214	A1 17/10/2012
				WO	2011069965	A1 16/06/2011