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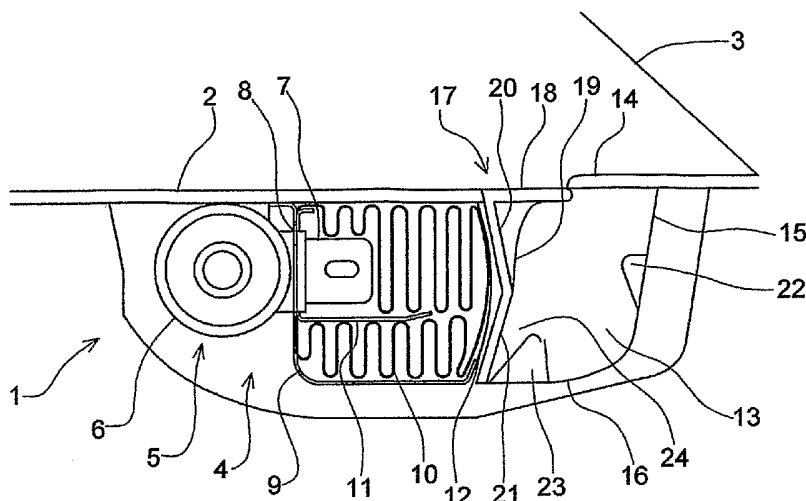
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(54) Title: A SAFETY ARRANGEMENT



(57) Abstract: A safety arrangement mounted in a motor vehicle incorporates an air-bag unit (10) which is mounted in the dashboard (2) of the vehicle. The air-bag unit (10) is adjacent a plenum chamber (13) which forms part of an air supply duct for supplying air to the windscreen (3). A moveable closure element (17) is provided. The closure element initially adopts a first position in which a first part (18) of the closure element closes an aperture formed in an upper wall (14) of the plenum chamber. A second part (20,21) of the closure element divides the interior of the plenum chamber (13) from the interior of the air-bag unit (10). Upon actuation of the air-bag unit (10) the closure element (17) moves to a second position in which the aperture in the upper wall (14) of the plenum chamber is opened, and also the part of the closure element (20,21) initially dividing the plenum chamber (13) from the air-bag unit (10) is moved through the aperture, to a position in front of the windscreen (3).

A SAFETY ARRANGEMENT

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THE PRESENT INVENTION relates to a safety arrangement, and more particularly relates to a safety arrangement to protect an occupant of a vehicle in the event that a crash situation occurs.

- 10 Previously proposed safety arrangements for protecting an occupant seated in the front passenger side of a vehicle have incorporated an air-bag which is positioned in the dashboard of the vehicle, in front of the occupant. Such air-bags, before they are inflated, are usually covered by part of the dashboard which incorporates weakened sections, such as "split lines", which are broken
- 15 by a force exerted by the air-bag as it is inflated, to allow the air-bag to extend out from within the dashboard and be inflated in front of the occupant.

- Such dashboard mounted air-bags are effective at protecting an occupant if the occupant is seated in a normal position, that is to say upright and away
- 20 from the dashboard. However, if the occupant is not seated in a normal position, for instance leaning forwardly with their head close to the dashboard, the occupant will be close to the air-bag during the first stages of the air-bag's inflation. This may result in the air-bag exerting a very large force on the head and neck of the occupant as it is inflated, possibly causing serious
- 25 injury.

The present invention seeks to provide an improved safety arrangement for use in a vehicle.

- 30 According to the present invention, there is provided a safety arrangement mounted in a motor vehicle, the safety arrangement incorporating an air-bag unit which is mounted in the dashboard of the vehicle and positioned adjacent

to a plenum chamber which forms part of an air supply duct for supplying air to the windscreen of the vehicle, there being a moveable closure element which has a first part and a second part, the closure element being configured such that it initially adopts a first position in which the first part of the closure
5 element closes an aperture in an upper wall of the plenum chamber that divides the interior of the plenum chamber from the interior of the vehicle, and the second part of the closure element divides the interior of the plenum chamber from the interior of the air-bag unit; the closure element being moveable, upon actuation of the air-bag unit, from said first position to a
10 second position to open the aperture in the upper wall of the plenum chamber to enable the air-bag to be inflated to extend through the aperture and into the interior of the vehicle.

Preferably, the closure element is an integral element and the second part of
15 the closure element forms at least part of one wall of the plenum chamber, and divides the interior of the plenum chamber from the interior of the air-bag unit.

Advantageously, the second part of the closure element extends substantially
20 the full height of the plenum chamber 4.

Conveniently, the second part of the closure element extends over only part of the height of the plenum chamber, resting on a support located above the lower-most part of the plenum chamber.

25 Preferably, the second part of the closure element is pivotally connected to the second part of the closure element.

Advantageously, the second part of the closure element is cranked so that, on
30 movement of the closure element from the first position to the second position, the first part of the closure element rises up out of the said aperture.

Conveniently, an upper side of the first part of the closure element is substantially flush with an upper side of the dashboard of the vehicle when the closure element is in the first position.

- 5 Preferably, an upper side of the first part of the closure element is off-set from an upper side of the dashboard of the vehicle when the closure element is in the first position.

- Advantageously, the safety arrangement incorporates a first blocking element
10 which is mounted to a wall of the plenum chamber which is opposite the air-bag unit to extend into the plenum chamber and limit the movement of the moveable closure element.

- Conveniently, the safety arrangement incorporates a second blocking
15 element which is mounted to a lower wall of the plenum chamber to extend into the plenum chamber and limit the movement of the moveable closure element.

- Preferably, the air-bag unit incorporates a housing, and a deflector which at
20 least partly divides the housing in to an upper portion and a lower portion, and a source of gas positioned to inject gas into the upper portion; the air-bag being folded into the housing, with a larger proportion of the folded air-bag being in the upper portion of the housing than in the lower portion such that the portion of the air-bag in the upper portion of the housing is inflated
25 substantially before a part of the air-bag in the lower portion of the housing, and the direction of inflation of the air-bag is angled towards the aperture and the location of the second part of the closure element when in the first position.

- 30 In order that the invention may be more readily understood, and so that further features thereof may be appreciated, embodiments of the invention

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will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic sectional view of a safety arrangement in accordance with a preferred embodiment of the invention, mounted in the dashboard of a motor vehicle with the safety arrangement in a normal condition,

FIGURE 2 is a view of the safety arrangement corresponding generally to Figure 1, but showing the safety arrangement during an initial stage after it has been actuated,

FIGURE 3 is a view of the safety arrangement corresponding generally to Figure 1, but showing the safety arrangement at a later stage after it has been actuated,

FIGURE 4 is a diagrammatic sectional view of a safety arrangement in accordance with an alternative embodiment of the invention,

FIGURE 5 is a diagrammatic sectional view of a safety arrangement in accordance with a further alternative embodiment of the invention, and

FIGURE 6 is a diagrammatic sectional view of a safety arrangement in accordance with a yet further alternative embodiment of the invention.

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Referring initially to Figure 1, a safety arrangement 1 is mounted in part of a dashboard 2 of a motor vehicle. The part of the dashboard 2 in which the safety arrangement 1 is mounted is a part of the dashboard which forms a generally horizontal surface which is close to the lower edge of a windscreen 3 of the vehicle.

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The safety arrangement 1 comprises an air-bag unit 4 which is mounted to a lower surface of the dashboard 2, to hang underneath the dashboard 2. The air-bag unit 4 incorporates a gas generator 5.

- 5 The gas generator 5 has a cylindrical main body portion 6 which houses a pyrotechnic charge and a squib so that when the gas generator is actuated, the pyrotechnic charge is ignited by the squib to generate a volume of gas. The main body portion 6 is mounted with its longitudinal length being generally horizontal, parallel to the surface of the dashboard 2, and
10 transverse to the centreline of the vehicle.

A cylindrical diffuser 7 extends radially outwardly from a central portion of the main body 6 of the gas generator, and parallel with the centreline of the vehicle through an aperture 8 in a vertical wall of a housing 9 which houses
15 an air-bag 10. The cylindrical diffuser 7 also passes through an aperture in the air-bag 10. A generally L-shaped deflector 11, having two orthogonal panels, has an aperture in one of its panels which also passes over the deflector 7 and is attached to the housing 9, thus fixing the air-bag 10 to the housing 9 with a substantially gas-tight fit. One panel of the L-shaped
20 deflector 11 extends out horizontally from the vertical wall of the housing 9, parallel to the diffuser 7 and the dashboard 2.

The deflector divides the housing into a relatively large upper portion and a smaller lower portion. The cylindrical diffuser 7 is in the upper part of the
25 housing 9. The purpose of the deflector 11 will be described in further detail below.

The air-bag 10 is folded into the housing 9 with a large proportion of the folded air-bag 10 being in the upper portion of the housing 9 and a smaller
30 proportion in the lower portion of the housing 9. The housing 9 presents an open end 12 out of which the air-bag 10 may move as it inflates.

The air-bag unit 4 is positioned adjacent a plenum chamber 13 which forms part of an air supply duct for supplying air to the windscreen 3. The air duct may de-mist or de-frost the windscreen. The plenum chamber 13 is of generally rectangular cross-section, and has a fixed horizontal upper wall 14, which meets a generally vertical side wall 15 which is spaced away from the air-bag unit 4. The side wall 15 in turn meets a horizontal lower wall 16. The fixed upper wall 14 incorporates apertures to allow air to pass from the plenum chamber 13 into the interior of the vehicle. The apertures are configured to direct air from the plenum chamber 13 to the inner surface of the windscreen 3 in the lower region of the windscreen.

A moveable closure element 17 is provided which has a first part 18 and a second part 19 which are integrally formed. The closure element 17 is pivotally attached to part of the horizontal lower wall 16. The first part 18 of the closure element 17 is a planar plate which is horizontal when in a first or initial position and which effectively forms part of the dashboard 2 and partly divides the interior of the plenum chamber 13 from the interior of the vehicle. The second part 19 of the moveable closure element 17 is a generally planar part which depends from a side edge of the planar plate forming the first part 18. The second part 19 has mutually inclined planar sections 20, 21 and, in the first or initial position closes the open end 12 of the housing 9 of the air-bag unit 4, to divide the interior of the plenum chamber 13 from the interior of the air-bag unit 4. The lowermost edge of the lower section 21 is pivotally mounted to the lower horizontal wall 16 of the plenum chamber 13. The closure element 17 may be retained in the illustrated initial position by one or more frangible elements. The first part 18 of the closure element 17 is slightly off-set from the upper wall 14 of the plenum chamber, with the said first part just lipped under the edge of the upper wall 14.

A generally triangular first blocking element 22 is mounted to the vertical side wall 15 of the plenum chamber 13, so that the blocking element 22 extends from the vertical side wall 15 into the interior of the plenum chamber 13. The

first blocking element 22 presents an upwardly-directed horizontal face that extends outwardly from the vertical side wall 15.

5 A generally triangular second blocking element 23 is mounted to the horizontal lower wall 16, adjacent the lower section 21 of the closure element 17, so as to extend into the interior of the plenum chamber 13. The second blocking element 23 presents an angled blocking face so as to define a V-shaped cavity 24 between the angled blocking face and the lower inclined planar section 21 of the closure element 17.

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The moveable closure element 17 is moveable in response to a force being exerted by the air-bag 10 as the air-bag 10 is inflated.

15 Referring now to Figure 2, in the event that an accident involving the motor vehicle occurs, a control unit in the vehicle produces a signal which actuates the gas generator 5 of the air-bag unit 4. The squib ignites the pyrotechnic charge within the main body 6 of the gas generator 5 and gas is generated. The gas passes out from within the gas generator 5 through the diffuser 7 and into the interior of the air-bag 10, along the lines generally indicated by
20 arrows 25. The deflector 11 deflects the flow of gas 24 away from the lower portion of the housing 9, so that the main volume of gas flows into the upper part of the folded air-bag 10 which is in the relatively large upper portion of the housing 9 above the deflector 11. This results in the air-bag 10 inflating in a direction which is not only outwardly from the air-bag unit 4 but also
25 upwardly towards the interior of the vehicle.

As the air-bag 10 is inflated, the air-bag 10 exerts a force on the moveable closure element 17, causing the frangible element or elements to break, and also causing the moveable closure element 17 to pivot and tilt into the plenum
30 chamber 13 in a direction generally indicated by arrow 26 towards a second position.

As the moveable closure element 17 pivots and tilts into the plenum chamber 13, the size of the V-shaped cavity 24 between the second blocking element 23 and the lower portion 21 of the closure element 17, is reduced as the lower section 21 tilts towards the second blocking element 23.

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As the moveable closure element 17 moves from the first position towards the second position, the first part 18 of the closure element 17 moves away from its initial position to create an opening at the location of the first part 18 of the closure element 17 when the closure element 17 is in the first position. Thus
10 an opening is created in the dashboard of the vehicle. Also, as the moveable closure element 17 moves from the first position to the second position, the second part 19 of the closure element 17 pivots away from the open end 12 of the housing 9 of the air-bag unit 4. This allows the air-bag 10 to inflate out from within the housing 9 of the air-bag unit 4, and to extend through the
15 plenum chamber, with the air-bag 10 then inflating out through the opening at the initial location of the first part 18 of the closure element 17 when in the first position, into the interior of the vehicle.

The moveable closure element 17 pivots into the plenum chamber 13 until the
20 V-shaped cavity 24 is no longer present between the angled face of the second blocking element 23 and the lower part 21 of the closure element 17, as illustrated in Figure 3. The lower part 21 of the closure element 17 then contacts the blocking element 23. The first part 18 of the closure element 17 then engages the horizontal face of the first blocking element 22, and thus
25 further movement of the closure element 17 is prevented. When the closure element 17 is in the position where it is blocked from further movement by the first blocking element and the second blocking element, the closure element 17 is in the second position.

30 It is to be appreciated that the air-bag will inflate through the opening which has been created in the dashboard of the vehicle as a consequence of the movement of the closure element. This aperture or opening is located

adjacent the base of the windscreen and thus the air-bag opens into the passenger compartment or "room" of the motor vehicle at a position which is located away from the occupant. Also the air-bag is not inflated directly towards the occupant, but instead is inflated with a general upward
5 movement, as a consequence of the upward flow of air caused by the configuration of the deflector 11 within the chamber of the gas generator. The air-bag is deflected rearwardly towards the occupant by the windscreen, and, when fully inflated, is in a position to provide adequate protection for the vehicle occupant. Even if the occupant is sitting "out of position", for example
10 leaning forwardly, the air-bag will not impart substantial injuries to the occupant.

Figure 3 illustrates the air-bag inflating through the aperture created in the dashboard at the position where the first part 18 of the closure element was
15 initially located.

Whilst the invention has been described with reference to one embodiment, other embodiments are possible.

20 Figure 4 illustrates an embodiment of the invention which is, generally, extremely similar to that of the embodiment of Figure 1. However, in Figure 4 the air-bag 10 has been omitted for the sake of clarity of illustration, and, in the embodiment of Figure 4, the closure element 37 is shown in solid lines in an initial position and in dotted lines in phantom.

25

It can be appreciated from Figure 4 that the closure element 37 is in many respects similar to the closure element 17 of Figures 1 to 3. The closure element 37 is provided with a first part 38 which is initially located within an aperture formed in the dashboard of the motor vehicle adjacent the
30 windscreen 3. However, the first portion 38 has a slightly curved upper surface and a chamfered leading edge 39, the co-operating edge 40 of the

aperture formed in the dashboard being formed by the upper wall 14 of the cavity edge 40 also being chamfered.

5 The closure element 37 has a second portion 41 which again extends downwardly, the second portion 41 being of gently arcuate form and thus corresponding in general form to the second portion 19 of the closure element 17 of Figures 1 to 3. In the embodiment of Figure 4, a single stop 22 is provided within the plenum chamber.

10 It can be seen that in the embodiment of Figure 4 the first portion 38 of the closure element is substantially flush with the rest of the dashboard, thus providing the dashboard with a pleasing appearance. In this embodiment there is no "discontinuity" or "lipping" at the junction between the first part of the closure element and the part of the dashboard which forms the upper wall
15 extending above the plenum chamber 13.

As can be appreciated from the phantom illustration of the closure element in Figure 4, the closure element 37 will move with a pivotal movement from the initial closed position to the final open position upon deployment of the air-
20 bag.

Figure 5 illustrates yet a further embodiment of the invention which, in many respects, is similar to the embodiment of Figure 4. However, in this embodiment of the invention the closure element 47 has a first part 48 which
25 corresponds with the first part 38 of the closure element of Figure 4, but has a second part 49 which depends into a recess 50 formed in a support 51 which extends upwardly from a lower part of the plenum chamber 13. Thus the closure element 47 is substantially "half-sized" as compared with the closure element of the embodiment of Figures 1 to 3 and the closure element of the
30 embodiment of Figure 4. However, the support 51 serves to constrict the opening provided at the end of the housing of the gas generator which contains the air-bag, thus providing a further impetus to the inflating air-bag to

extend upwardly through the aperture in the dashboard 14 which is created as the closure element 47 moves, on deployment of the air-bag, from the solid line position shown in Figure 5 to the phantom position shown in Figure 5.

5

Figure 6 illustrates yet another embodiment of the invention in which the closure element 57 is a composite closure element. The closure element 57 has a first portion 58 which is planar and which is received within an aperture formed in the dashboard of the vehicle adjacent the windscreen 3, as in the previously described embodiments. The first portion, however, is provided, at its rear edge, with a downwardly directed lug or series of lugs 59 which are pivotally connected to the second portion 60 of the closure element. The second portion of the closure element extends downwardly and is then cranked forwardly to a pivotal mounting 61 provided adjacent the base of the plenum chamber 13. The combination of the lug or lugs 59 and the second portion 60 of the closure element 57 effectively extends across the open mouth of the housing of the gas generator.

Upon deployment of the air-bag, pressure will be applied to the closure member 57, causing the second portion of the closure member to pivot about the pivotal mounting 61. Due to the cranked configuration of the second portion 60 of the closure element, this movement will tend to cause the point of connection between the second portion of the closure member and the depending lug or lugs 59 to move upwardly with an arcuate movement. This will serve to raise the first portion 58 of the closure element 57 up above the part 14 of the dashboard that extends across the upper part of the plenum chamber 13, thus opening the aperture formed in the dashboard at the position where the first part of the closure member was located when the closure member 57 was in its initial position. Again the air-bag will be directed upwardly through this opening to provide protection for a vehicle occupant.

In the present Specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".

CLAIMS:

- 5 1. A safety arrangement (1) mounted in a motor vehicle, the safety arrangement incorporating an air-bag unit (4) which is mounted in the dashboard (2) of the vehicle and positioned adjacent to a plenum chamber (13) which forms part of an air supply duct for supplying air to the windscreen (3) of the vehicle, characterised in that there is a moveable
10 closure element (17) which has a first part (18) and a second part (19), the closure element being configured such that it initially adopts a first position in which the first part (18) of the closure element (17) closes an aperture in an upper wall (14) of the plenum chamber that divides the interior of the plenum chamber (13) from the interior of the vehicle, and the second part (19) of the
15 closure element divides the interior of the plenum chamber (13) from the interior of the air-bag unit (4); the closure element (17) being moveable, upon actuation of the air-bag unit, from said first position to a second position to open the aperture in the upper wall of the plenum chamber to enable the air-bag (10) to be inflated to extend through the aperture and into the interior of
20 the vehicle.
2. A safety arrangement according to Claim 1 wherein the closure element (17) is an integral element and the second part (19) of the closure element forms at least part of one wall of the plenum chamber (13), and
25 divides the interior of the plenum chamber from the interior of the air-bag unit (4).
3. A safety arrangement according to Claim 1 or Claim 2 wherein the second part (19) of the closure element (17) extends substantially the full
30 height of the plenum chamber (13).

4. A safety arrangement according to Claim 1 or Claim 2 wherein the second part (49) of the closure element (47) extends over only part of the height of the plenum chamber, resting on a support (51) located above the lower-most part of the plenum chamber.

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5. A safety arrangement according to Claim 1 or Claim 2 wherein the second part (60) of the closure element (57) is pivotally connected to the second part of the closure element.

10 6. A safety arrangement according to Claim 5 wherein the second part (60) of the closure element is cranked so that, on movement of the closure element from the first position to the second position, the first part (58) of the closure element (57) rises up out of the said aperture.

15 7. A safety arrangement according to any one of the preceding Claims wherein an upper side of the first part (18) of the closure element (17) is substantially flush with an upper side of the dashboard (2) of the vehicle when the closure element (17) is in the first position.

20 8. A safety arrangement according to any one Claims 1 to 6 wherein an upper side of the first part of the closure element is off-set from an upper side of the dashboard of the vehicle when the closure element is in the first position.

25 9. A safety arrangement according to any one of the preceding Claims wherein the safety arrangement incorporates a first blocking element (22) which is mounted to a wall (15) of the plenum chamber (13) which is opposite the air-bag unit (4) to extend into the plenum chamber and limit the movement of the moveable closure element (17).

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10. A safety arrangement according Claim 9 wherein the safety arrangement incorporates a second blocking element (23) which is mounted

to a lower wall (16) of the plenum chamber to extend into the plenum chamber (13) and limit the movement of the moveable closure element (17).

11. A safety arrangement according to any one of the preceding Claims wherein the air-bag unit (4) incorporates a housing (9), and a deflector (11) which at least partly divides the housing in to an upper portion and a lower portion, and a source of gas (5) positioned to inject gas into the upper portion; the air-bag being folded (10) into the housing (9), with a larger proportion of the folded air-bag being in the upper portion of the housing than in the lower portion such that the portion of the air-bag in the upper portion of the housing is inflated substantially before a part of the air-bag in the lower portion of the housing, and the direction of inflation of the air-bag is angled towards the aperture and the location of the second part (19) of the closure element (17) when in the first position.

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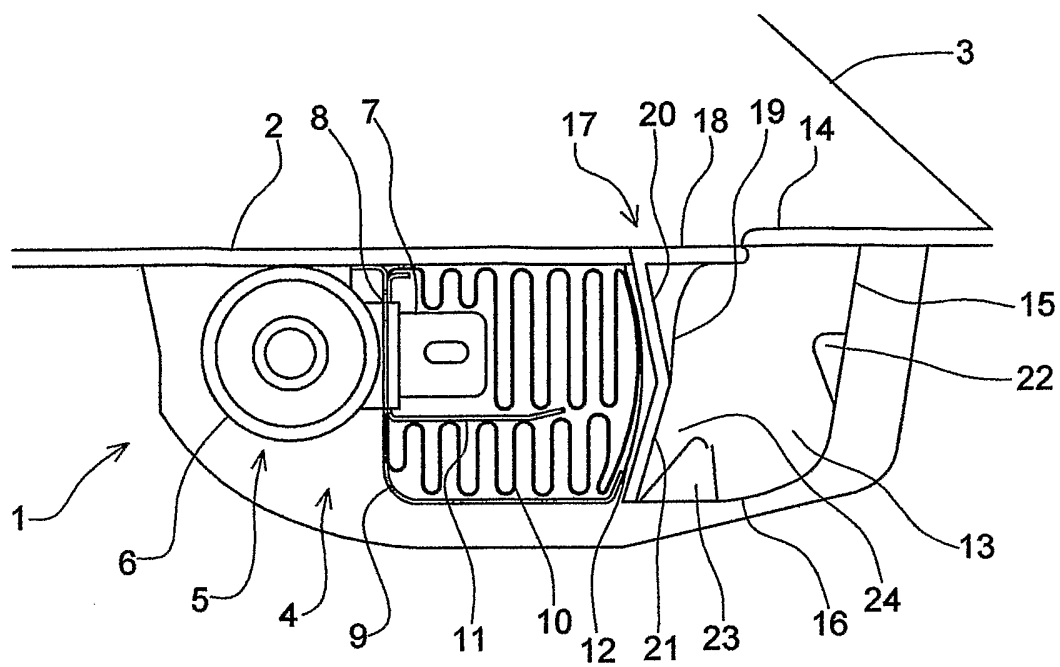
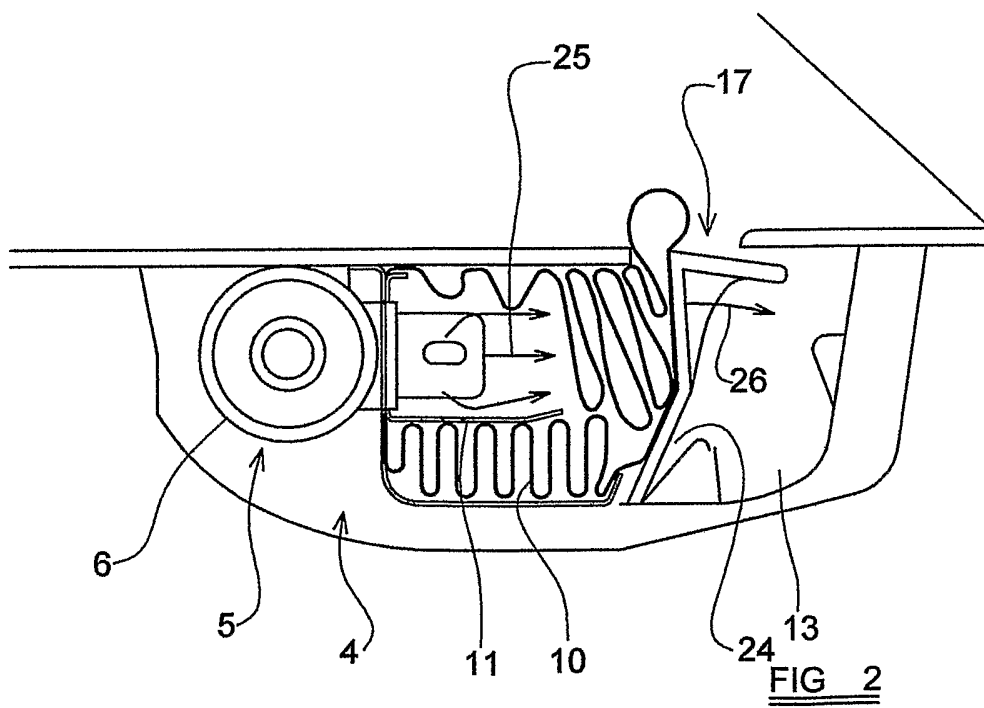
12. A safety arrangement (1) mounted in a motor vehicle, the safety arrangement incorporating an air-bag unit (4) which is mounted in the dashboard (2) of the vehicle and positioned adjacent to a plenum chamber (13) which forms part of an air supply duct for supplying air to the windscreen (3) of the vehicle, characterised in that there is a moveable closure element (17) which has a first part (18) and a second part (19), the closure element being configured such that it initially adopts a first position in which the first part (18) of the closure element (17) closes an aperture in an upper wall (14) of the plenum chamber that divides the interior of the plenum chamber (13) from the interior of the vehicle, and the second part (19) of the closure element divides the interior of the plenum chamber (13) from the interior of the air-bag unit (4); the closure element (17) being moveable, upon actuation of the air-bag unit, from said first position to a second position to open the aperture in the upper wall of the plenum chamber to enable the air-bag (10) to be inflated to extend through the aperture and into the interior of the vehicle wherein the air-bag unit (4) incorporates a housing (9) and a deflector (11) which at least partly divides the housing in to an upper portion

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and a lower portion, and a source of gas (5) positioned to inject gas into the upper portion; the air-bag being folded (10) into the housing (9), with a larger proportion of the folded air-bag being in the upper portion of the housing than in the lower portion such that the portion of the air-bag in the upper portion of the housing is inflated substantially before a part of the air-bag in the lower portion of the housing, and the direction of inflation of the air-bag is angled towards the aperture and the location of the second part (19) of the closure element (17) when in the first position.

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FIG 1FIG 2

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FIG 3

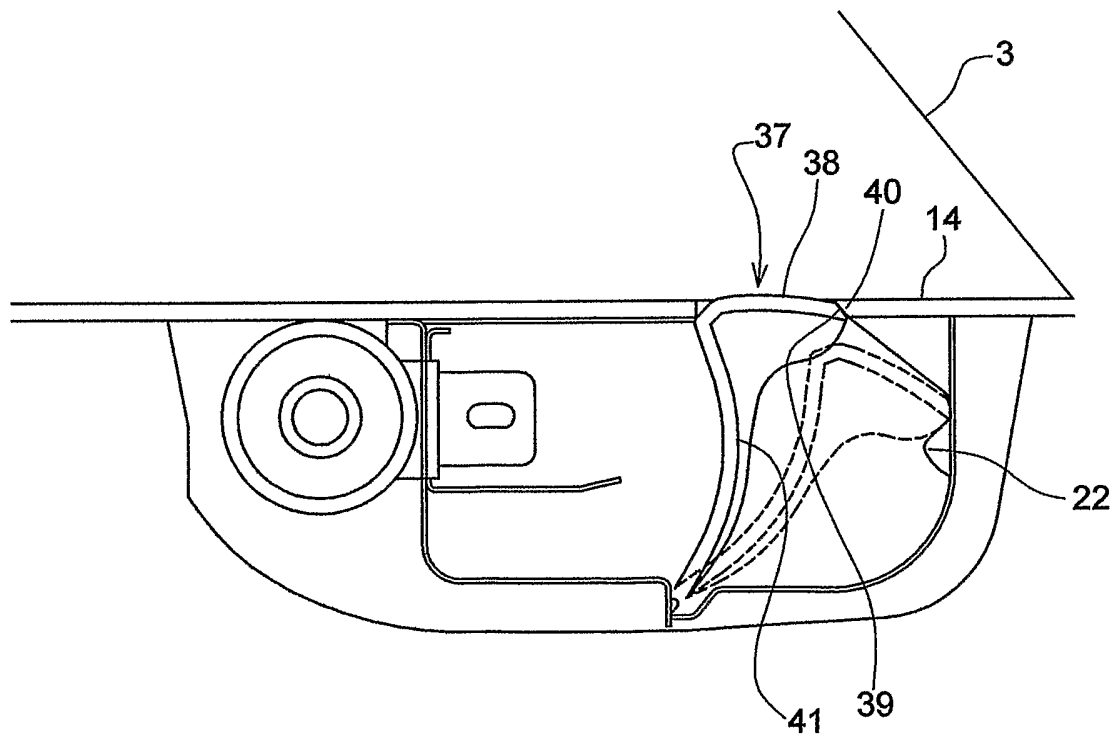
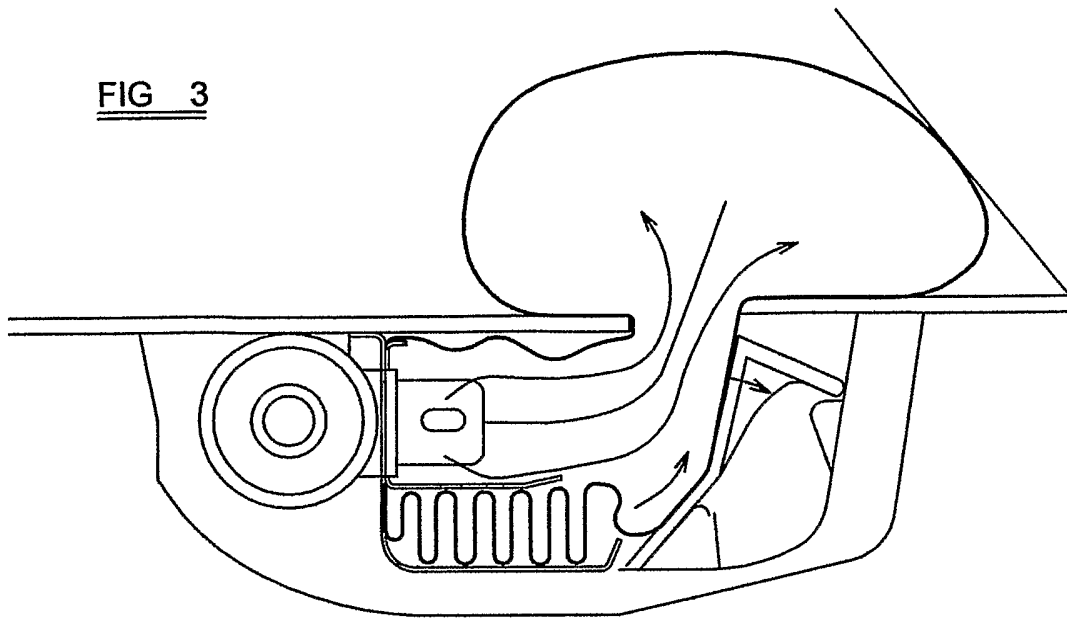
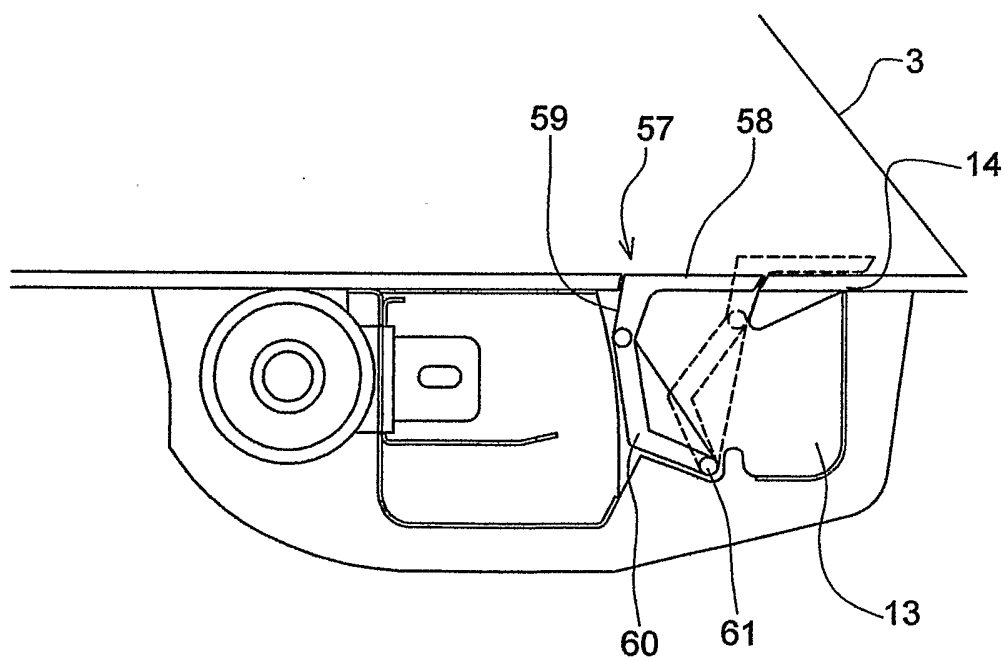
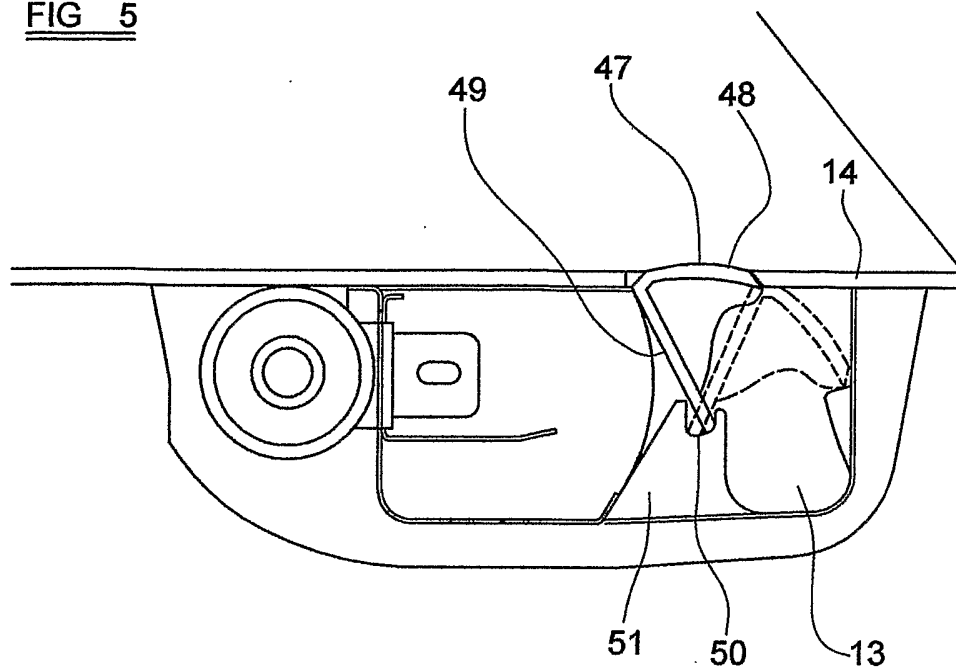


FIG 4

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FIG 5FIG 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 2005/001656

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: B60R, B60H

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, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10253185 A1 (AUTOLIV DEVELOPMENT AB), 3 June 2004 (03.06.2004), figures 1-3, abstract --	1,3,7,8,11, 12
P,X	US 20050121890 A1 (KONG), 9 June 2005 (09.06.2005), figures 1,2, abstract --	1,3,7,8
A	US 20040094939 A1 (DEBLER ET AL), 20 May 2004 (20.05.2004) --	1-12
A	EP 1350662 A1 (DENSO THERMAL SYSTEMS S.P.A.), 8 October 2003 (08.10.2003) --	1-12

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

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PCT/SE 2005/001656

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INTERNATIONAL PATENT CLASSIFICATION (IPC):

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B60H 1/28 (2006.01)

B60R 21/215 (2006.01)

INTERNATIONAL SEARCH REPORT
Information on patent family members

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