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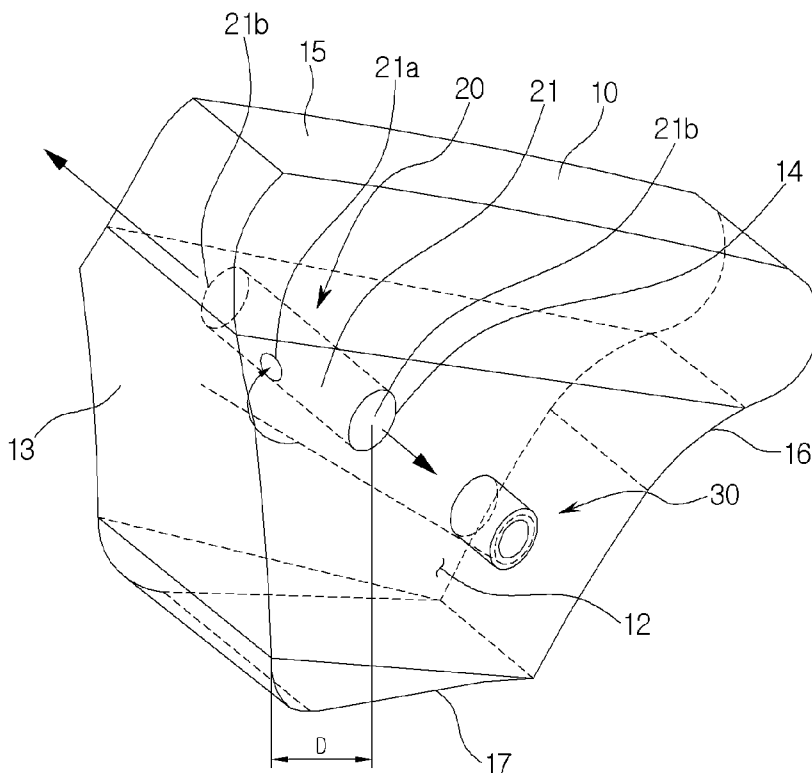
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[Continued on next page]

(54) Title: AIRBAG FOR VEHICLE



(57) Abstract: Provided is an airbag for a vehicle. The airbag includes: an airbag cushion including a front surface coming into contact with an occupant; and a tunnel shaped vent apparatus disposed in the airbag cushion such that, when the airbag cushion is inflated, a gas is discharged toward an outside of the airbag cushion after being introduced into the tunnel shaped vent apparatus. The tunnel shaped vent apparatus is configured such that the tunnel shaped vent apparatus comes into contact with or does not come into contact with the head of the occupant, depending on a location where a head of the occupant comes into contact with the airbag cushion, thereby closing or opening a flow passage of the tunnel shaped vent apparatus.



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Description

Title of Invention: AIRBAG FOR VEHICLE

Technical Field

- [1] The present disclosure relates to an airbag for a vehicle, which can selectively discharge the gas in an airbag cushion, depending on a location where a head of an occupant comes into contact with the airbag cushion.

Background Art

- [2] Generally, an airbag is mounted in a vehicle to protect an occupant upon a vehicle collision.
- [3] Upon a vehicle collision, an airbag cushion of the airbag is inflated and deployed by pressure of a gas flowing into the airbag cushion from an inflator, thereby protecting the occupant.
- [4] An internal volume of the airbag cushion of a usual airbag is designed to have deployment pressure capable of protecting a regular adult.
- [5] Even though the occupant is a regular adult, in case of out of Position (hereinafter referred to as "OOP") condition, when a distance between the airbag cushion and the occupant is excessively short, the occupant may be injured by the excessive initial deployment pressure of the airbag cushion. For example, when the occupant is seated on a seat moved toward the front of the vehicle, or the occupant seated on a seat positioned at a normal position is slanted toward the front of the vehicle, the occupant may be injured by the excessive initial deployment pressure of the airbag cushion.
- [6] Accordingly, a deployment pressure adjustment device, which adjusts the deployment pressure of the airbag cushion depending on conditions of the occupant, such as a physical size of the occupant, a seated position of the occupant, is required.
- [7] There has been known an airbag comprising an airbag cushion having a vent hole so as to smoothly receive the occupant by allowing the gas in the airbag cushion to be discharged toward the outside of the airbag cushion through the vent hole when the occupant comes into contact with the inflated airbag cushion.
- [8] National Highway Traffic Safety Administration (NHTSA) has been evaluating the airbag's performance using the female dummy AF50 and male dummy AM50.
- [9] There has been known airbags including various multiple vent holes so as to protect occupants of various body sizes and seated conditions. For example, there has been known airbags including airbag cushions including open vent holes (hereinafter referred to as "normal vent holes") which are normally opened and vent holes (hereinafter referred to as "safety vent holes") which are selectively opened and closed depending on the deployment condition of the airbag cushion.

- [10] (Patent document)
- [11] US 8,070,183
- [12] US 2012/0306187

Disclosure of Invention

Technical Problem

- [13] The object of the disclosure is to provide an airbag for a vehicle, which can discharge the gas in an airbag cushion toward the outside based on an operating factor having a location where the occupant (dummy) comes into contact with the airbag cushion.

Solution to Problem

- [14] According to an exemplary embodiment, there is provided an airbag for a vehicle, which includes an airbag cushion including a front surface coming into contact with an occupant; and a tunnel shaped vent apparatus disposed in the airbag cushion such that, when the airbag cushion is inflated, a gas is discharged toward an outside of the airbag cushion after being introduced into the tunnel shaped vent apparatus; and configured such that the tunnel shaped vent apparatus comes into contact with or does not come into contact with the head of the occupant, depending on a location where a head of the occupant comes into contact with the airbag cushion, thereby opening or closing a flow passage of the tunnel shaped vent.
- [15] The tunnel shaped apparatus may include a vent tube including at least one gas introduction hole to introduce the gas in the airbag cushion into the tunnel shaped apparatus and at least one gas discharge hole to discharge the introduced gas toward the outside of the airbag cushion.
- [16] A lengthwise side of the vent tube may be disposed parallel to the front surface of the airbag cushion at a predetermined distance from the front surface of the airbag cushion, and the gas discharge hole may be formed at both ends of the vent tube to fluidly communicate with vent holes formed in both side surfaces of the airbag cushion.
- [17] The at least one gas introduction hole may be formed at a middle portion of the vent tube to face the front surface of the airbag cushion.
- [18] The vent tube may be disposed at a location corresponding to the head of a mid-sized occupant (male dummy AM50) coming into contact with the front surface of the airbag cushion.

Advantageous Effects of Invention

- [19] According to one exemplary embodiment of the disclosure, the tunnel shaped vent apparatus which selectively discharges the gas in the airbag cushion based on the operating factor having the location where the head of the occupant comes into contact with the airbag cushion is provided, thereby suitably maintaining the internal pressure of the airbag cushion according to the body size of the occupant.

Brief Description of Drawings

- [20] FIG. 1 is a side view showing the interior of a vehicle with fully inflated airbag cushion according to an exemplary embodiment.
- [21] FIG. 2 is a perspective view showing an airbag cushion with a vent apparatus according to an exemplary embodiment.
- [22] FIG. 3 is a side view showing a state in which a male dummy (AM50) comes into contact with the airbag cushion according to an exemplary embodiment.
- [23] FIG. 4 is a side view showing a state in which a female dummy (AF05) comes into contact with the airbag cushion according to an exemplary embodiment.

Mode for the Invention

- [24] Hereinafter, exemplary embodiments will be described in more detail with reference to accompanying drawings. The present inventive concept is not limited to the following the exemplary embodiments but includes various applications and modifications. The exemplary embodiments will allow those skilled in the art to completely comprehend the scope of the present inventive concept.
- [25] In the vehicle collision test, the male dummy (AM50) represents mid-sized occupants with a body mass of 61 to 90Kg, and female dummy (AF05) represents small-sized occupants with a body mass 31 to 60Kg.
- [26] FIG. 1 is a side view showing the interior of a vehicle with fully inflated airbag cushion according to an exemplary embodiment.
- [27] Referring to FIG. 1, an airbag apparatus 1 includes an airbag cushion 10 having at least one vent hole, an inflator 3 supplying the gas into the airbag cushion 10, and a tunnel shaped vent apparatus 20 selectively discharging the gas in the airbag cushion 10 toward the outside depending on a location where a head of the occupant (dummy) comes into contact with the airbag cushion 10.
- [28] The tunnel shaped vent apparatus 20 is configured to discharge the gas in the airbag cushion 10 based on operating factors having the location where the occupant comes into contact with the airbag cushion 10.
- [29] The tunnel shaped vent apparatus 20 is configured to allow changing the shape of a flow passage thereof by the male dummy's impact force when the mid-sized occupant (hereinafter referred to as male dummy (AM50)) comes into contact with the airbag cushion 10.
- [30] In other words, the tunnel shaped vent apparatus 20 is disposed in the airbag cushion 10 such that the gas introduced in the airbag cushion 10 can be discharged toward the outside of the airbag cushion 10 when the airbag cushion 10 is inflated. Depending on the location where the head of the occupant O comes into contact with the airbag cushion 10, the tunnel shaped vent apparatus 20 comes into contact with or does not

come into contact with the head of the occupant O, thereby closing or opening the flow passage of the tunnel shaped vent apparatus 20.

[31] Here, "contact" means a state that the head of the occupant O indirectly comes into to contact with the tunnel shaped vent apparatus 20 in a state that the front surface 13 of the airbag cushion 10 is interposed between the head of the occupant O and the tunnel shaped vent apparatus 20.

[32] To discharge the gas in the airbag cushion 10, a vent adjustment apparatus 30 may be further provided. According to the deployment condition of the airbag cushion 10, the vent adjustment apparatus 30 adjusts the gas discharge amount.

[33] The vent adjustment apparatus 30 may include a tube member 31 coupled to the perimeter of a vent hole 11 formed in a side surface 12 of the airbag cushion 10, a cord member 33 including one end coupled to a distal end of the tube member 31 and the other end withdrawn toward the interior of the airbag cushion 10, and a withdrawal apparatus 35 including one end coupled to the other end of the cord member 33 and the other end coupled to the front surface 13 of the airbag cushion 10.

[34] In another embodiment of the disclosure, the airbag cushion 10 may include a normal vent hole which is normally opened besides the above mentioned vent adjustment apparatus 30 which adjusts the opening degree of the vent hole 11 according to the deployment condition of the airbag cushion 10.

[35] FIG. 2 is a perspective view showing an airbag cushion with a vent apparatus according to an exemplary embodiment.

[36] Referring to FIG. 2, the airbag cushion 10 includes a front surface 13 facing the occupant O, side surfaces 12 provided at the both sides of the front surface 13, a rear surface 16 facing the front surface 13, and upper and lower surfaces 15 and 17 provided at upper and lower portions of the side surfaces 12.

[37] The airbag cushion 10 may be formed with a single material piece including the front surface 13, side surfaces 12, rear surface 16 and upper and lower surfaces 15 and 17. Alternatively, each surface of the airbag cushion may be comprised of a separate piece of material.

[38] The tunnel shaped vent apparatus 20 is disposed in the airbag cushion 10 and includes a vent tube 21 which allows the gas in the airbag cushion 10 to be introduced therein and discharge the introduced gas toward the outside of the airbag cushion 10.

[39] The vent tube 21 includes at least one gas introduction hole 21a through which the gas in the airbag cushion 10 is introduced and at least one gas discharge hole 21b through which the introduced gas is discharged toward the outside of the airbag cushion 10.

[40] In one embodiment, the vent tube 21 may have a cylindrical shape provided at both ends thereof with the gas discharge holes 21b. The gas discharge holes 21b com-

municate fluidly with the vent holes 14 formed in the both side surfaces of the airbag cushion 10. The vent tube 21 may have various shapes besides the cylindrical shape. FIG. 1 illustrates the straight vent tube, but isn't limited thereto. The shapes of the vent tube may be variously modified.

- [41] The at least one gas introduction hole 21a may be substantially formed at the middle portion of the vent tube 21. The gas introduction hole 21a may be configured to face the front surface 13 of the airbag cushion 10.
- [42] The vent tube 21 is configured such that, when the mid-sized occupant O (hereinafter referred to as male dummy AM50) comes into contact with the front surface 13 of the airbag cushion 10, and the head of the male dummy AM50 is ejected toward the rear surface 16 of the airbag cushion 10, the shape of the vent tube 21 may be modified by the pressure of the head of the male dummy AM50.
- [43] In one exemplary embodiment, the vent tube 21 may be formed with the fabric material same as that of the airbag cushion 10, or formed with other flexible materials.
- [44] The vent tube 21 may be disposed at the both side surfaces 12 of the airbag cushion 10, so that the lengthwise side of the vent tube 21 is arranged parallel to the front surface 13 of the airbag cushion 10. The vent tube 21 is disposed at a predetermined distance from the front surface 13 of the airbag cushion 10.
- [45] The shape of the vent tube 21 is maintained or modified depending on the location where the occupant O (dummy) comes into contact with the front surface 13 of the airbag cushion 10, thereby performing the vent function.
- [46] In other words, the vent tube 21 is operated based on the operating factor having the location where the head of the occupant O comes into contact with the front surface 13 of the airbag cushion 10.
- [47] FIG. 3 is a side view showing a state in which a male dummy AM50 comes into contact with the airbag cushion according to an exemplary embodiment.
- [48] The vent tube 21 is disposed to correspond to the location where the male dummy AM50 comes into contact with the front surface 13 of the airbag cushion 10.
- [49] The gas introduction hole 21a of the vent tube 21 is substantially disposed at the middle portion of the vent tube 21 so as to face the front surface 13 of the airbag cushion 10, so that the gas introduction hole 21a can be closed by the pressure of the head of the male dummy AM50 when the male dummy AM50 comes into contact with the front surface 13 of the airbag cushion 10.
- [50] Through such a configuration, it is possible to prevent the gas from being discharged through the vent tube 21 toward the outside of the airbag cushion 10. Accordingly, the internal pressure of the airbag cushion 10 can be suitably maintained for receiving the male dummy AM50 relatively greater than the female dummy AF05. Upon inflation of the airbag cushion 10, since the airbag cushion 10 is maintained with a suitable

hardness for protecting the male dummy AM50, the airbag cushion 10 can protect the male dummy AM50 while smoothly receiving the male dummy AM50.

[51] When the head of the male dummy AM50 comes into contact with the front surface 13 of the airbag cushion 10, even though the contact location is not exactly corresponding to the gas introduction hole 21a, the vent tube 21 is modified from the tunnel shape. Accordingly, the passage in the vent tube 21 is closed, thereby preventing the gas in the airbag cushion 10 to be discharged toward the outside of the airbag cushion 10.

[52] The vent tube 21 is disposed at the predetermined distance D from the front surface 13 of the airbag cushion 10. In view of the impact force of the male dummy AM50, the distance D may be selected at a location which may come into contact with the male dummy AM50.

[53] FIG. 4 is a side view showing a state in which a female dummy AF05 comes into contact with the airbag cushion according to an exemplary embodiment.

[54] Referring to FIGS. 1 and 4, as described above, upon inflation of the airbag cushion 10, the vent tube 21 is disposed to correspond to the location where the head of the male dummy AM50 comes into contact with the front surface 13 of the airbag cushion 10. Accordingly, the location where the head of the small-sized occupant (hereinafter referred to as female dummy AF05) comes into contact with the front surface 13 of the airbag cushion 10 is below the location where the male dummy AM50 comes into contact with the front surface 13 of the airbag cushion 10.

[55] Accordingly, when the female dummy AF05 comes into contact with the front surface 13 of the airbag cushion 10, the head of the female dummy AF05 comes into contact with the location below the vent tube 21, and the vent tube 21 maintains the tunnel shape.

[56] Under this condition, the gas in the airbag cushion 10 is smoothly introduced into the vent tube 21 through the gas introduction hole 21a and discharged toward the outside of the airbag cushion 10 through the gas discharge hole 21b. As a result, the airbag cushion 10 has suitable internal pressure for protecting the female dummy AF05 while smoothly receiving the female dummy AF05.

[57] In the following description, operation principle of the above mentioned airbag cushion will be described.

[58] Referring to FIGS. 1 and 2, upon a vehicle collision, the gas is generated from the inflator 3, and the gas generated from the inflator 3 is supplied to the interior of the airbag cushion 10.

[59] The gas supplied to the interior of the airbag cushion 10 is supplied into the vent tube 21 through the gas introduction hole 21a of the vent tube 21 which is the tunnel shaped vent apparatus 20 provided in the airbag cushion 10. Accordingly, the vent tube 21 has

a hollow cylindrical shape.

[60] The vent tube 21 forms a tunnel shaped flow passage across the interior of the airbag cushion 10, so that the gas in the airbag cushion 10 is smoothly discharged toward the outside of the airbag cushion 10.

[61] In other words, the lengthwise side of the vent tube 21 is disposed parallel to the front surface 13 of the airbag cushion 10 to maintain the distance D from the front surface 13 of the airbag cushion 10. In this case, the vent tube 21 has substantially complete tunnel shaped flow passage. Accordingly, the gas in the airbag cushion 10 is smoothly introduced into the vent tube 21 and discharged toward the outside of the airbag cushion 10 through the gas discharge hole 21b.

[62] FIG. 3 is a side view showing a state in which a male dummy AM50 comes into contact with the airbag cushion according to an exemplary embodiment of the disclosure.

[63] Referring to FIG. 3, when the male dummy AM50 comes into contact with the front surface 13 of the airbag cushion 10, the head of the male dummy AM50 comes into contact with the location substantially corresponding to the vent tube 21. Accordingly, in a state that the front surface 13 of the airbag cushion 10 is interposed between the male dummy AM50 and the vent tube 21, the head of the male dummy AM50 is ejected toward the vent tube 21. Therefore, the head of the male dummy AM50 blocks off the gas introduction hole 21a of the vent tube 21 or modifies the vent tube 21, thereby blocking off the flow passage of the vent tube 21.

[64] As a result, since the gas introduction hole 21 is blocked off, or the vent tube 21 is modified, the gas in the airbag cushion 10 is prevented from being introduced into the vent tube 21, thereby preventing the gas from being discharged toward the outside of the airbag cushion 10. Accordingly, the internal pressure of the airbag cushion 10 is relatively increased, so that the airbag cushion 10 can maintain the internal pressure to suitably protect the mid-sized male dummy AM50 and to smoothly receive the male dummy AM50.

[65] FIG. 4 is a side view showing a state in which a female dummy AF05 comes into contact with the airbag cushion according to an exemplary embodiment.

[66] Since the female dummy AF05 has a body smaller than the male dummy AM50, upon a collision of the female dummy AF05, relatively low internal pressure of the airbag cushion 10 is required compared to the time when the male dummy AM50 comes into contact with the airbag cushion 10.

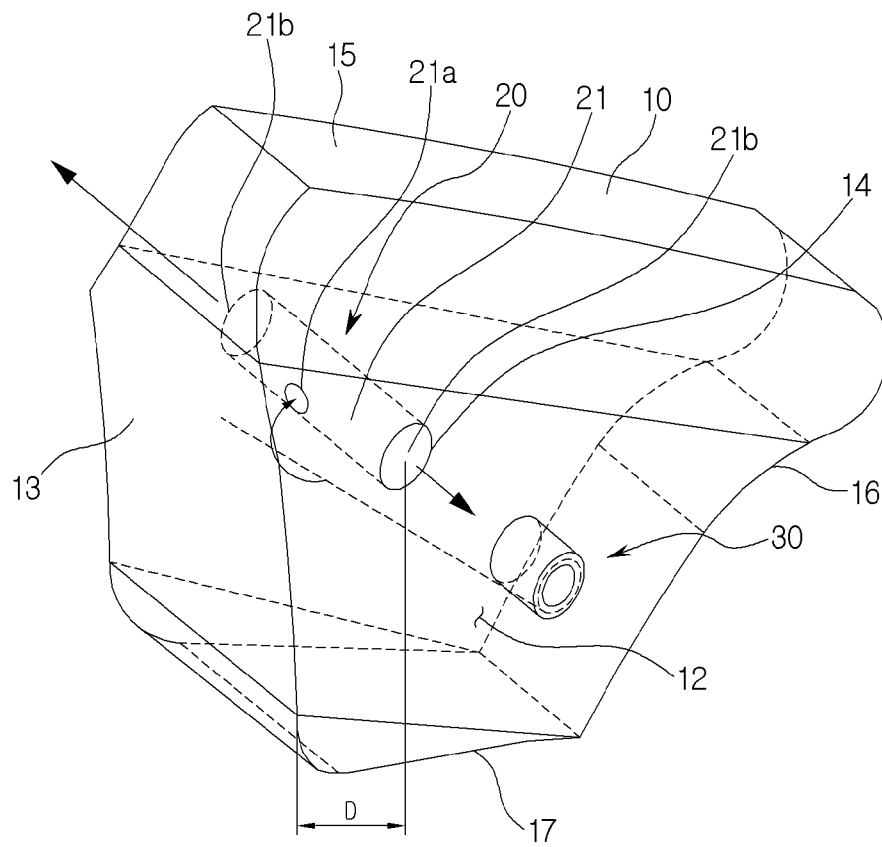
[67] When the female dummy AF05 comes into contact with the front surface 13 of the airbag cushion 10, the location where the head of the female dummy AF05 comes into contact with the front surface 13 of the airbag cushion 10 is located below the vent tube 21.

- [68] Accordingly, even though the head of the female dummy AF05 comes into contact with the front surface 13 of the airbag cushion 10, the head of the female dummy AF05 does not interfere with the vent tube 21. Accordingly, the gas in the airbag cushion 10 is smoothly introduced into the vent tube 21 through the gas introduction hole 21a, and the gas introduced into the vent tube 21 is discharged toward the outside of the airbag cushion 10 through the gas discharge hole 21b.
- [69] Accordingly, when the female dummy AF05 comes into the airbag cushion 10, the internal pressure of the airbag cushion 10 is relatively decreased compared to the time when the male dummy AM50 comes into contact with the airbag cushion 10. Accordingly, the injury of the female dummy AF05 can be decreased.
- [70] As described above, the tunnel shaped vent apparatus 20 according to one exemplary embodiment of the disclosure is configured to be operated based on the operating factor having the height difference between the dummies. Accordingly, the tunnel shaped vent apparatus 20 can be easily operated while having a simple configuration.
- [71] In the above description, the airbag aimed at the male dummy AM50 and the female dummy AF05 is described, but isn't limited thereto. The airbag is applicable to dummies (occupants) of various sizes.
- [72] While exemplary embodiments have been particularly described above, it will be understood by those skilled in the art that various modifications, additions and substitutions in form and details may be made therein without departing from the scope and spirit of the inventive concept as defined by the following claims.

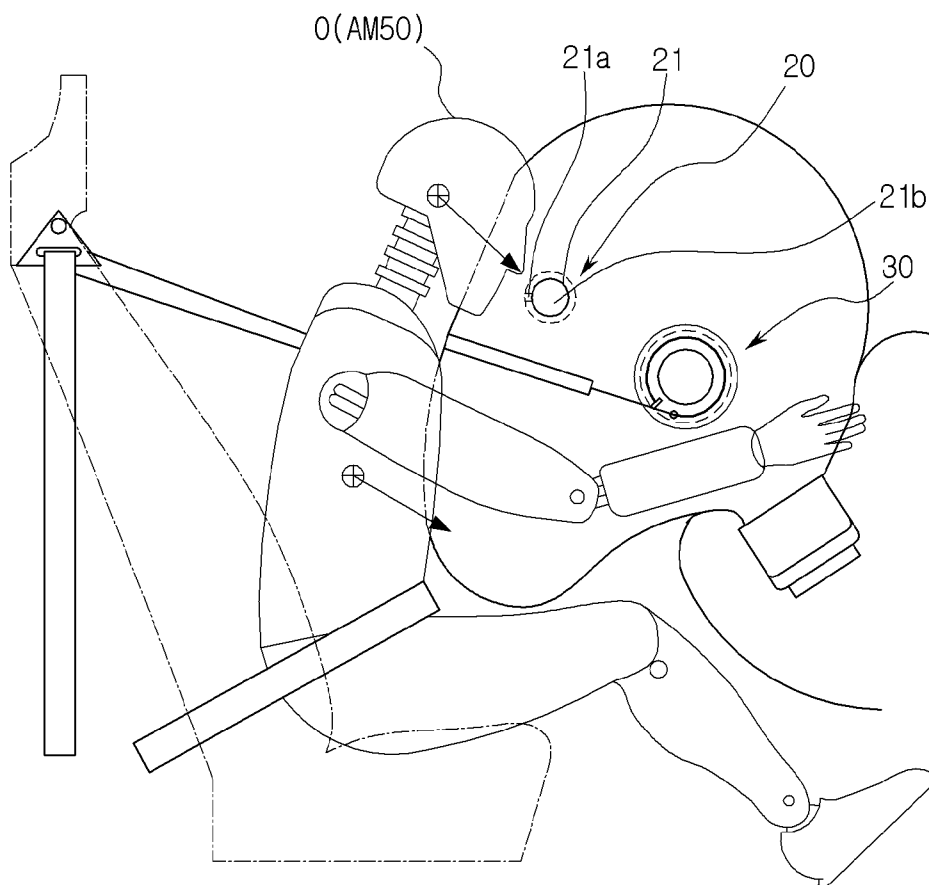
Claims

- [Claim 1] An airbag for a vehicle, comprising:
an airbag cushion comprising a front surface coming into contact with an occupant; and
a tunnel shaped vent apparatus disposed in the airbag cushion such that, when the airbag cushion is inflated, a gas is discharged toward an outside of the airbag cushion after being introduced into the tunnel shaped vent apparatus; and configured such that the tunnel shaped vent apparatus comes into contact with or does not come into contact with the head of the occupant, depending on a location where a head of the occupant comes into contact with the airbag cushion, thereby closing or opening a flow passage of the tunnel shaped vent apparatus.
- [Claim 2] The airbag of claim 1, wherein the tunnel shaped apparatus comprises a vent tube comprising at least one gas introduction hole to introduce the gas in the airbag cushion into the tunnel shaped apparatus and at least one gas discharge hole to discharge the introduced gas toward the outside of the airbag cushion.
- [Claim 3] The airbag of claim 2, wherein a lengthwise side of the vent tube is disposed parallel to the front surface of the airbag cushion at a predetermined distance from the front surface of the airbag cushion, and the gas discharge hole is formed at both ends of the vent tube to fluidly communicate with vent holes formed in both side surfaces of the airbag cushion.
- [Claim 4] The airbag of claim 3, wherein the at least one gas introduction hole is formed at a middle portion of the vent tube to face the front surface of the airbag cushion.
- [Claim 5] The airbag of claim 4, wherein the vent tube is disposed at a location corresponding to the head of a mid-sized occupant (male dummy AM50) coming into contact with the front surface of the airbag cushion.

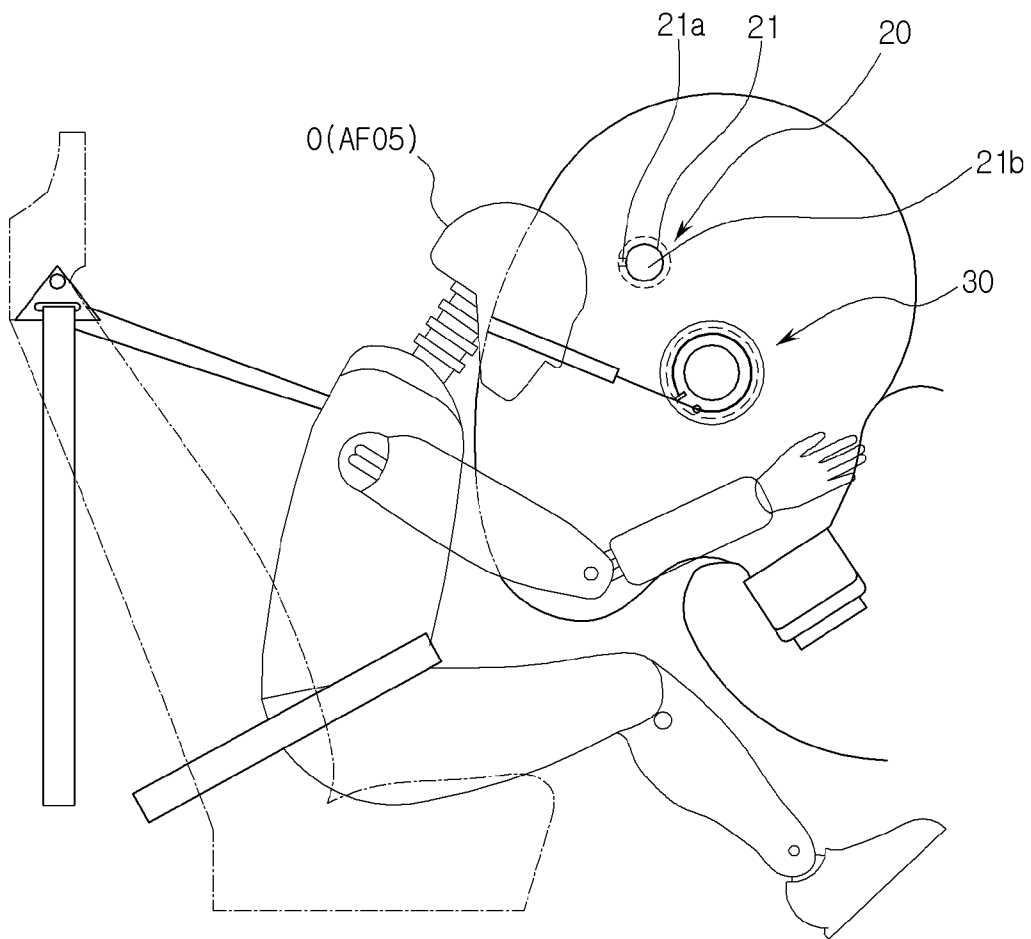
[Fig. 2]



[Fig. 3]



[Fig. 4]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2016/003824**A. CLASSIFICATION OF SUBJECT MATTER****B60R 21/239(2006.01)i, B60R 21/26(2011.01)i, B60R 21/00(2006.01)i**

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)

B60R 21/239; B60R 21/207; B60R 21/20; B60R 21/28; B60R 21/16; B60R 21/2334; B60R 21/26; B60R 21/00

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: airbag, vehicle, cushion, gas, tunnel shaped vent, occupant, introduction hole, discharge hole

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2010-0026356 A (HYUNDAI MOBIS CO., LTD.) 10 March 2010 See paragraphs [0020]-[0042]; and figures 1-5.	1-3
A		4-5
A	JP 2002-079904 A (CALSONIC KANSEI CORP.) 19 March 2002 See paragraphs [0021]-[0034]; and figures 1-7.	1-5
A	JP 2009-227180 A (AUTOLIV DEVELOPMENT AB) 08 October 2009 See paragraphs [0016]-[0035]; and figures 1-8.	1-5
A	JP 4992853 B2 (TAKATA CORP.) 08 August 2012 See paragraphs [0038]-[0069]; and figures 1-5.	1-5
A	KR 10-0999804 B1 (HYUNDAI MOTOR COMPANY) 08 December 2010 See paragraphs [0019]-[0029]; and figures 1-4.	1-5



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

26 July 2016 (26.07.2016)

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Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2016/003824

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 10-2010-0026356 A	10/03/2010	KR 10-1405381 B1	10/06/2014
JP 2002-079904 A	19/03/2002	None	
JP 2009-227180 A	08/10/2009	JP 4959616 B2	27/06/2012
JP 4992853 B2	08/08/2012	EP 2156995 A1	24/02/2010
		EP 2156995 B1	18/09/2013
		JP 2010-036770 A	18/02/2010
		US 2010-0032931 A1	11/02/2010
		US 8070183 B2	06/12/2011
KR 10-0999804 B1	08/12/2010	CN 101367372 A	18/02/2009
		DE 102007057754 A1	19/02/2009
		DE 102007057754 A9	28/05/2009
		JP 2009-046110 A	05/03/2009
		KR 10-2009-0016965 A	18/02/2009
		US 2009-0045611 A1	19/02/2009
		US 7712779 B2	11/05/2010