PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:
B60R 21/22	A1	WO 93/16902
		(43) International Publication Date: 2 September 1993 (02.09.93)

(21) International Application Number: PCT/GB93/00347

(22) International Filing Date: 19 February 1993 (19.02.93)

(30) Priority data:
9203802.5 21 February 1992 (21.02.92) GB
9219476.0 15 September 1992 (15.09.92) GB

(71) Applicant *(for all designated States except US):* IRVIN GREAT BRITAIN LIMITED [GB/GB]; Icknield Way, Letchworth, Herts SG6 1EU (GB).

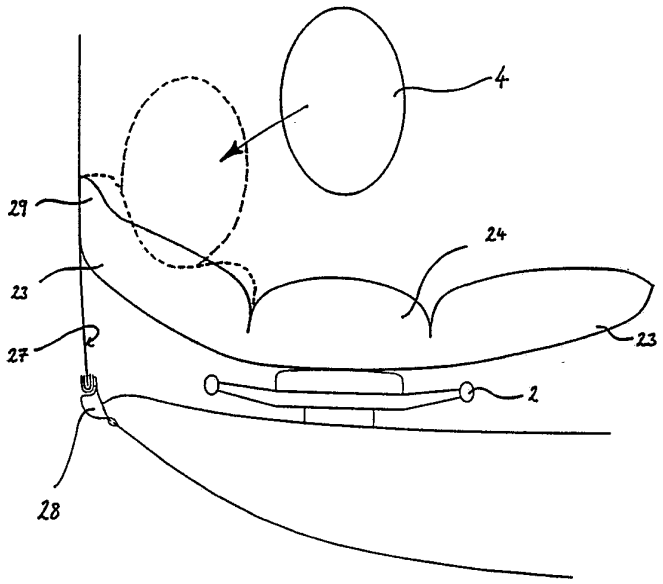
(72) Inventors; and
(75) Inventors/Applicants *(for US only) :* WAYLETT, Kenneth, Edward [GB/GB]; 27 Barford Rise, Luton, Bedfordshire LU2 9SG (GB). PHILLIPS, Edward, Joseph [GB/GB]; 71 Parkland Grove, Ashford, Middlesex TW15 2JF (GB).

(74) Agent: FRANK B. DEHN & CO.; Imperial House, 15-19 Kingsway, London WC2B 6UZ (GB).

(81) Designated States: AT, AU, BB, BG, BR, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, LK, LU, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: IMPACT PROTECTION ARRANGEMENTS FOR THE OCCUPANT(S) OF A MOTOR VEHICLE



(57) Abstract

An impact protection arrangement for or in a motor vehicle comprising impact sensor means (32, 33, 34) which in use detects collision impacts of the vehicle, inflatable bag means (8, 9; 14, 15, 16; 19, 20, 21; 23, 24; 30, 31) for protecting at least the driver in the event of such an impact, and bag inflation means operable in response to the impact sensor means, wherein, when inflated, the bag means includes a portion (8; 14; 19; 24; 31) providing frontal impact protection and a portion (9; 16; 21; 23; 30) providing at least partial sidewise impact protection for an associated vehicle occupant, these portions being communicated upon operation of the inflation means with a common source of gas of the inflation means.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**FR**	France	**MR**	Mauritania
AU	Australia	**GA**	Gabon	**MW**	Malawi
BB	Barbados	**GB**	United Kingdom	**NL**	Netherlands
BE	Belgium	**GN**	Guinea	**NO**	Norway
BF	Burkina Faso	**GR**	Greece	**NZ**	New Zealand
BG	Bulgaria	**HU**	Hungary	**PL**	Poland
BJ	Benin	**IE**	Ireland	**PT**	Portugal
BR	Brazil	**IT**	Italy	**RO**	Romania
CA	Canada	**JP**	Japan	**RU**	Russian Federation
CF	Central African Republic	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CG	Congo			**SE**	Sweden
CH	Switzerland	**KR**	Republic of Korea	**SK**	Slovak Republic
CI	Côte d'Ivoire	**KZ**	Kazakhstan	**SN**	Senegal
CM	Cameroon	**LI**	Liechtenstein	**SU**	Soviet Union
CS	Czechoslovakia	**LK**	Sri Lanka	**TD**	Chad
CZ	Czech Republic	**LU**	Luxembourg	**TG**	Togo
DE	Germany	**MC**	Monaco	**UA**	Ukraine
DK	Denmark	**MG**	Madagascar	**US**	United States of America
ES	Spain	**ML**	Mali	**VN**	Viet Nam
FI	Finland	**MN**	Mongolia		

Impact protection arrangements for the occupant(s) of a motor vehicle

The present invention relates to impact protection arrangements for the occupant(s) of a motor vehicle and more particularly to such arrangements which incorporate one or more inflatable bags, commonly termed "air bags".

It has been proposed previously to provide one or more inflatable bags within a motor vehicle, such bags being arranged to be automatically and very rapidly inflated in the event of an accident in order to provide a degree of protection for an occupant or occupants of the vehicle. Air bags of this kind are customarily stored in a folded state in the vehicle interior in front of the vehicle driver and in front of the front seat passenger. When not inflated, the bags are commonly stored on the driver's side in a central container of the steering wheel and on the front-seat passenger's side in a container behind the frontal interior trim.

In the event of a head on vehicle collision, the air bags are inflated in front of the vehicle occupants, safe-guarding at least their upper body and head against contacting the hard front interior parts of the vehicle, and thereby protecting them from injury.

Such 'frontal-protection' air bag arrangements do not however afford vehicle occupants protection from the side, leaving them vulnerable to injury in the event of a side on collision. Moreover, should the vehicle be involved in a collision oblique to the longitudinal axis of the vehicle, the occupant may slip or bounce off such a 'frontal-protection' air bag arrangement and sustain an injury on interior parts of the vehicle not covered by the bag arrangement. With smaller sizes of air bag, this can even happen in a head on collision.

It has more recently also been proposed to arrange an air bag to inflate between the occupant and an adjacent vehicle side to prevent injury to the occupant in the event of such a side collision. Known 'side-protection' arrangements are intended to protect the occupant from side impacts only.

According to one aspect the present invention provides an impact protection arrangement for or in a motor vehicle comprising impact sensor means which in use detects collision impacts of the vehicle, inflatable bag means for protecting at least the driver in the event of such an impact, and bag inflation means operable in response to the impact sensor means, wherein, when inflated, the bag means includes a portion providing frontal impact protection and a portion providing at least partial sidewise impact protection for an associated vehicle occupant, these portions being communicated upon operation of the inflation means with a common source of gas of the inflation means.

Preferably, the impact sensor means is arranged to detect both frontal and at least partially side on i.e. angled collisions of the vehicle. The inflation means can take any convenient form e.g. a compressed gas source or a pyrotechnic device.

The provision of an inflatable bag means which affords the vehicle occupant both frontal and at least partial transverse protection greatly enhances the occupant's safety within the vehicle. The arrangement of the present invention whereby the different portions of the inflatable bag means are all inflated from a common gas inflation means maintains a relatively simple and thus reliable and low cost impact protection arrangement.

In one set of embodiments the sideways protection is provided by at least one bag portion which is disposed when inflated directly between at least the head of the occupant and the adjacent side door, wall or

window of the vehicle.

Alternatively, "partial" sideways protection may be provided by a bag portion or portions which extend radially outwardly from the steering wheel, and preferably somewhat forwardly therefrom, sufficiently to protect an occupant's head and upper body portion in the event that they are thrown both forwardly and to one side e.g. at an angle of up to around 45° from the longitudinal axis of the vehicle. Thus, the preferred form of bag means when inflated provides a generally concave face which confronts the occupant.

In a particularly preferred such arrangement, the inflated bag means is generally dish-shaped and extends radially outwardly from the steering wheel such that a peripheral portion thereof engages the adjacent vehicle interior side i.e. part of the side wall, door or window next to the occupant.

By arranging the bag means to conform to such a sculptured dish-like configuration, the vehicle driver is provided with partial sideways collision protection. Moreover, the driver is, by virtue of the peripheral portion extending to positively engage the side window/door, prevented from slipping past the bag edge and sustaining injuries against the door, window, dash boad or instrument panel located to the side of the bag. The sculptured shape of the bag will thus act to guide the driver, when thrown forwardly and to one side, towards the centre of the bag. Preferably, and as described in more detail below, the peripheral portion is deflected by engagement with the vehicle side so that its extremity viewed in horizontal cross-section points towards the rear of the vehicle and the degree of concavity is enhanced in the peripheral region. This increases still further the protection provided against oblique collisons.

In each above case, frontal protection is provided by a portion of the bag disposed directly in front of

the head and upper body.

It should be understood that 'portion' as defined herein may simply comprise different parts of a single inflatable bag (such as a dish as described above) or separate bag portions.

Separate inflatable bag means in accordance with the invention, each with its own associated inflation means, may be provided for protecting one or more passengers of the vehicle as well as the driver.

In the case of the driver's side bag means, the first and second bag portions, together with any inflatable passage members communicating them with the inflation means, may be shaped and configured such that they can all inflate substantially unimpeded by the driver's hands and arms, at least when in a normal "straight on" driving condition, and without forcibly dislodging them from the steering wheel.

In a further embodiment, the inflatable bag means comprises two separate inflatable bag portions each connected in parallel by a respective tubular air passage member to the gas inflation means, a first one of the bag portions being arranged to inflate between the occupant and the front of the vehicle and a second one of the bag portions being arranged to inflate between the occupant and an adjacent vehicle side. In a preferred such design, the gas inflation means and the deflated inflatable bag means may conveniently be housed in a lower region of the vehicle side e.g. behind a panel in a side door. The inflated tubular air passage member connecting the gas inflation means to the first bag portion may be arranged to pass between the driver's on- side leg and arm. Alternatively, the passage member may be shaped so as to inflate around and above the driver's on side arm. In a preferred design, part of the first bag portion is itself arranged to inflate over the occupant's on side arm.

The inflatable bag means may alternatively comprise

a first, frontal protection bag portion connected to the gas inflation means by a tubular member, part of such member inflating between the occupant and an adjacent vehicle side and forming the second bag portion. In this arrangement, the tubular member may be shaped to provide limbs which initially inflate upwardly and then forwardly between the occupant and the vehicle side. The forwardly extending limb is preferably arranged so as to bend over a shoulder of the occupant.

A restriction means is preferably provided between the limbs and the first bag portion to ensure that the limbs providing side protection to the vehicle occupant are inflated prior to inflating the frontal protection portion. The restriction means can comprise e.g. a frangible internal partition or throttling member arranged to restrict gas flow to the first bag portion until the limbs are fully inflated. In this embodiment, the gas inflation means and the deflated inflatable bag means are preferably housed in the occupant's seat although any suitable location may be used.

As discussed above, in alternative forms of the invention adapted to provide only partial sideways protection, the inflatable bag means is stored in a steering wheel compartment. One embodiment comprises a first, central bag portion, arranged to inflate between a driver of the vehicle and the steering wheel, and a plurality of outer, second inflatable portions, each extending radially outwardly from the central bag portion, the outer inflatable portions being circumferentially spaced around the central bag portion so as to be able to extend radially past the hands and arms of the driver during inflation. The central bag portion preferably has dimensions not substantially greater than the steering wheel. The inflated outer inflatable portions may be inclined towards the driver of the vehicle so as to afford the driver a selected degree of sideways protection. In a preferred design

each outer inflatable portion comprises a tubular section attached half way along its length to a radially extending limb to define an approximate "T" shape connected to the central bag portion. The tubular sections may be curved along their axes such that when inflated, they define with the limbs a broken cartwheel like ring concentric to the central bag portion.

In a further arrangement, again adapted to provide only partial sideways protection and similarly where the inflatable bag means is stored in a compartment arranged centrally of the vehicle, the inflatable bag means is, when inflated, generally dish-shaped, extending forwardly and radially outwardly from the steering wheel such that a peripheral portion thereof engages the vehicle interior side as described above.

A preferred such bag means is generally dish-shaped, and, whilst being unitary in construction, is formed with a central bag portion and a plurality of preferably individually pivotable segments extending radially therefrom. The presently preferred form has four truncated segments. When inflating, the shape of the bag means as a whole is thus to a degree self-adjusting to the dimensions of both the vehicle interior and driver. The self-adjusting nature of the bag means is advantageous since it allows the bag partly to wrap itself around drivers of all sizes without being unpredictably and undesirably distorted, thereby providing a more adaptable and reliable protection arrangement than known bags.

The independent pivotal movement of each segment may be achieved by completely separating adjacent segments in their outer peripheral regions or by providing areas of sealed together uninflated material between adjacent segments which serve to allow for a limited degree of relative movement.

In a preferred embodiment, there are V-notches in the periphery of the bag means. Such V-notches ensure

that each of the individual segments can pivot to a degree independently. The material isolated in such notches may be removed or may be retained as webbing.

According to a second aspect of the present invention, there is provided an impact protection arrangement for the driver of a vehicle comprising an inflatable bag means stored in a compartment arranged centrally of the vehicle steering wheel and arranged to be inflated following an impact of the vehicle, the inflated bag means being generally dish shaped and extending forwardly and radially outwardly from the steering wheel whereby a peripheral portion thereof engages the adjacent vehicle interior side.

A further aspect of the invention provides an air bag for a vehicle which is sculptured, preferably by being segmented, to provide when inflated a generally concave front face which confronts the driver. It is preferably generally dish shaped.

The peripheral portion which preferably engages the vehicle interior side is arranged to deform into a foot-like section which extends further forwardly away from the steering wheel along the vehicle side interior i.e. it projects towards the rear of the vehicle. The provision of such a foot-section affords the vehicle occupant additional side protection and together with the peripheral portion forms a cushioned corner to 'catch' and retain the driver when thrown forwardly and to one side. The foot-section also importantly serves as a wedging element, acting to maintain the position of the bag peripheral portion.

In a simplified embodiment of the invention suitable for protecting passengers rather than the driver, the inflatable bag means may comprise intercommunicating planar bag portions which together when inflated define a substantial L-shape in plan and which respectively provide frontal and sideways protection.

Although the inflatable bag means may be formed of any suitable material e.g. rubberised fabrics or polyurethane coated fabrics, preferred embodiments are formed from suitably shaped panels of uncoated fabrics which are sewn together.

The preferred embodiments of bag means may however also be formed from a plastic film material e.g. thermoplastics and/or elastomeric polymer films. This represents a new departure from the prior art bags which have all used uncoated or coated fabrics. The use of a plastic film material is highly advantageous since such material can be made significantly thinner than conventional materials used in this field whilst still retaining the strength required in such applications. A greater amount of bag material may therefore be packed into the space available centrally of the steering wheel whereby size constraints previously imposed on the bag are relaxed. This is particularly important in the design of a bag in accordance with the above preferred embodiments which extends radially to protect against oblique collisions.

Preferably, the plastic film material is provided with a friction reducing coating such as poly-tetrafluoroethylene (PTFE), to reduce its burning effect against the skin during a collision.

A problem with porous materials, such as uncoated fabrics can arise from the hot gases which fill and subsequently pass through the bag on inflation and which can burn the occupant. The use of relatively non-porous materials such as thermoplastics and elastomeric polymer films is thus advantageous in avoiding such problems.

Preferred plastic film materials include:

Saturated polyester film e.g. Polyethylene Tetraphthalte (PET)

Orientated Polypropylene film (OPP)

Polyamide film (Nylon)

Polycarbonate film

Polyurethane film.

The preferred film thickness and strength ranges are as follows: 150-250μm
30-40 KN/m

According to a further aspect of the present invention, there is provided an impact protection arrangement for the occupant of a vehicle comprising an inflatable bag means formed from a plastic film material such as a thermoplastic and/or elastomeric polymer film. A further aspect of the invention provides an air bag for a vehicle comprising a plastics film material such as thermoplastic and/or elastomeric polymer film.

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

Figure 1 shows a occupant compartment of a motor vehicle;

Figure 2 shows an inflated air bag means according to a first embodiment of the present invention;

Figure 3 shows an alternative arrangement of the first embodiment;

Figure 4 shows an inflated air bag means according to a second embodiment of the present invention;

Figure 5 shows an inflated air bag means according to a third embodiment of the present invention;

Figure 6 shows a front view of an inflated air bag means according to a fourth embodiment of the present invention;

Figure 7 shows in perspective view the air bag means of the fourth embodiment deployed in a vehicle interior;

Figure 8 shows a cross-sectional view from above of the air bag means of the fourth embodiment;

Figure 9 shows a further perspective view of the

air bag means of the fourth embodiment with the air bag means rotated by 45°;

Figure 10 shows an inflated air bag means according to a fifth embodiment of the present invention; and

Figure 11 shows a control circuit according to the present invention.

Figure 1 shows a vehicle occupant compartment 1 of a motor vehicle, in which a steering wheel 2 is arranged in front of a seat 3. A vehicle occupant 4, in this case the driver, is shown sitting in the seat 3 and holding the steering wheel 2 with his hands 5.

Figure 2 shows the compartment 1 wherein an inflatable air bag means in accordance with a first embodiment of the present invention has been activated. As is shown in Figure 2, the inflated bag means comprises two inflatable bag portions 8 and 9, each connected by a tubular air passage member 10 and 11 to a gas inflation means 12. The gas inflation means consists of a controllable source of pressurised air, typically a gas canister, the air being released into the tubular members 10 and 11 if a front or side on collision of the vehicle has been sensed. The tubular member 10 extends between the driver's on-side leg and arm. The housing for the gas inflation means 12 and the deflated inflatable bag means is shown provided in the door structure 13 although any convenient location for the gas inflation means may be used.

The provision of inflation bag portions 8 and 9 affords the driver 4 both front and side protection. The driver is therefore prevented from injuring himself by colliding directly with the vehicle's interior and is also protected from injuring himself by sliding or bouncing off the inflation bag portion 8 and colliding with the vehicle's side interior. Injuries sustained from side collisions or collisions oblique to the longitudinal axis of the vehicle can thus be avoided.

Figure 3 shows an alternative arrangement of the

first embodiment. The gas inflation means 12 is provided further up the vehicle door structure 13 and the inflatable bag portion 8 is shaped so as to inflate partly above and around the driver's arm.

Figure 4 shows a second embodiment whereby the inflatable bag means 7 comprises a first inflatable bag portion 14 connected to the gas inflation means 12 by a tubular air passage member 15. As is shown in Figure 4, the air passage member 15 includes first and second sections 16 and 17. The first section 16 has limbs arranged to inflate substantially vertically between the vehicle occupant 4 and the side of the vehicle adjacent the occupant and then to bend and pass over a shoulder of the occupant 4 so as to extend substantially horizontally along the side of the vehicle. The second section 17 connects the first section 16 to the bag portion 14, the inflated bag portion 14 thereby being positioned between the vehicle occupant and the front vehicle interior. The inflated first section 16 therefore provides the occupant with side protection and the inflated section 17 and bag portion 14 provide the occupant with front protection.

Since there is less distance and vehicle structure between the occupant and the point of impact in a side collision of the vehicle as compared with a front collision of the vehicle, the time period available to inflate the first section 16 is appreciably smaller (around a third) of the time that is available to inflate the bag portion 14. So as to ensure therefore that the first section 16 is fully inflated as quickly as possible, a restricting means in the form of a frangible diaphragm or valve means is provided between the first and second sections 16, 17 of the tubular air passage member 15. The diaphragm is set to break only when the first section 16 is inflated whereupon air will be admitted to the second section 17 and the bag portion 14.

A third embodiment of the invention is shown in Figure 5. The inflatable bag means 7 of this embodiment comprises a central inflatable bag portion 19 which when inflated is located between the driver 4 and the steering wheel 2 of the vehicle. The bag portion 19 has dimensions which are not substantially greater than that of the steering wheel 2 and is connected by plurality of radially extending air passage limbs 20 to a plurality of outer inflatable portions 21. The limbs 20 are arranged to extend towards the driver 4 so that the outer inflatable portions 21 'hug' around the driver. The outer inflatable portions 21 are attached to the limbs to form 'T' type sections and are arranged circumferentially around the central bag portion 19 to afford the driver 4 at least partial sideways protection. The particular arrangement of the limbs 20 and outer inflatable portions 21 ensures that the driver's arms and hands do not impede their inflation and are not injured by being forced rapidly from the steering wheel during inflations at least when in the normal "straight on" driving condition shown in Figure 5.

Figures 6 to 9 show a fourth embodiment of the present invention. As illustrated in Figure 6, the bag means comprises a single generally disc shaped bag 22 having discrete segments 23 formed therein, each extending from a central bag portion 24. The segments 23 are truncated and arranged circumferentially. Their sides 25 are defined by seams extending radially and joining the opposite substantially circular faces of the bag.

The segments are arranged to be able to pivot, to a degree, independently with respect to the central bag portion and to move relative to one another. Although this may be achieved simply by separating adjacent peripheral portions of the segments 23 along the radially extending seams, in the preferred arrangement shown, there are provided V-shaped notches 26 each of which comprises a substantially triangular area of uninflated material.

These areas of material allow for limited relative movement of each of the peripheral portions. The material left in such notches may be removed to provide less restricted movement of the peripheral portions of the segments or may be retained as webbing.

As shown in Figures 7, 8 and 9, by arranging each segment 23 to pivot independently to a degree, the bag means as a whole is partly self-adjusting to the dimensions of both the vehicle interior 27 and the driver 4. The bag means can thus be used effectively for different sized drivers and vehicle interiors, the independent nature of the peripheral portions ensuring that the bag means does not distort undesirably and unpredictably if one or more of the peripheral portions is forced to inflate in an unexpected and unprovided for fashion.

Four or more segments 23 are preferred.

As shown particularly in Figure 8, the bag means extends forwardly (i.e. towards the rear of the vehicle) and radially outwardly from the steering wheel 2. Its peripheral portion engages the vehicle interior side 27 at for example a door or window. By arranging the bag means 22 to conform to such a sculptured dish-like configuration, the vehicle driver 4 is provided with partial sideways collision protection. Moreover, the driver is, by virtue of the peripheral portion extending to positively engage the side window/ door, prevented from slipping past the bag edge and sustaining injuries by sliding along the vehicle interior side and striking the A-pillar 28 or other vehicle parts. The sculptured shape of the bag furthermore acts to guide the driver 4, when thrown forwardly and to one side, towards the centre of the bag.

In this embodiment, frontal protection is provided predominately by the central bag portion 24 disposed directly in front of the head and upper body. The portion 24 is joined to the outer segments along further seams at

which the opposite faces are not joined but have reduced spacing to permit the required limited pivotal movement of each segment whilst permitting inflation gas to flow to all parts of the bag.

As illustrated in Fig. 8, the peripheral portion which engages the vehicle interior side 27 is arranged to deform into a foot-like section 29 which extends further forwardly away from the steering wheel along the vehicle side interior such that in horizontal cross-section its free end points towards the rear of the vehicle. The provision of such a foot-section affords the vehicle occupant additional side protection and together with the peripheral portion forms a cushioned corner to 'catch' and retain the driver when thrown forwardly and to one side as depicted by the phantom lines in Figure 8. The foot-section 29 also importantly serves as a wedging element, acting to maintain the position of the bag periphery on the vehicle side interior in the event of the driver being thrown particularly powerfully in a direction along the vehicle side interior.

Even when the steering wheel is oriented such that the bag means is offset, as shown in Figure 9, the provision of e.g. four independently pivoted segments ensures that part of each of the two segments nearest the door will deform on contact with the vehicle interior to provide respective foot portions as described above and the required side protection for the driver.

Figure 10 shows a still further arrangement of the inflatable bag means suitable for vehicle passengers. The inflatable bag means shown has two inflated portions in the form of generally rectangular panels 30 and 31 connected perpendicularly to one another. The inflatable bag means is thus L-shaped in plan view and as such provides full upper body frontal and side protection to the occupant of the vehicle. Any suitable means for connecting the inflatable bag means to the gas inflation means may be employed.

Figure 11 shows in general terms a vehicle in plan view with in cutaway section a control arrangement for use with the present invention. Impact sensors 33 and 34 are connected to a diagnostic unit 32 which actuates via connection 35 the gas inflation means 12 (not shown). The impact sensor means 33 and 34 are arranged to relay an impact instruction to the diagnostic unit 32 following a frontal or sideon collision of the vehicle. Each sensor may be provided in any suitable form eg. hydraulic pressure sensors, piezo electric elements or membrane switches. The sensors 33 and 34 may in certain embodiments be arranged so as to only to relay the instruction to the diagnostic means 32 to activate the gas inflation means 12 for a limited angle of collision of the vehicle. For example, for the inflation bag means of the embodiment shown in Figures 5 to 9, this angle may be 45° from a longitudinal axis of the vehicle.

The inflatable bag means may be formed of coated or uncoated fabric in common with known bags. The preferred embodiments may however also be formed from a plastic film material such as a thermoplastic and/or elastomeric polymer film. As described above, these have particular advantages.

Suitable materials include:

Saturated polyester film e.g Polyethylene Tetraphthalte (PET)

Orientated Polypropylene film (OPP)

Polyamide film (Nylon)

Polycarbonate film

Polyurethane film.

These films preferably have a thickness of around 150-250μm. Friction reducing coatings may be provided.

As with known air bags, the above embodiments of bag means of the invention may be provided with openings to allow rapid deflation of the bag as soon as the inflating gas supply has been exhausted after an impact.

The preferred embodiment of bag has an internal

capacity of around 70 litres.

Claims

1. An impact protection arrangement for or in a motor vehicle comprising impact sensor means which in use detects collision impacts of the vehicle, inflatable bag means for protecting at least the driver in the event of such an impact, and bag inflation means operable in response to the impact sensor means, wherein, when inflated, the bag means includes a portion providing frontal impact protection and a portion providing at least partial sidewise impact protection for an associated vehicle occupant, these portions being communicated upon operation of the inflation means with a common source of gas of the inflation means.

2. An impact protection arrangement as claimed in claim 1, wherein sideways protection is provided by a bag portion or portions which extend(s) radially outwardly from the steering wheel, and forwardly therefrom, to provide a generally concave face which confronts the occupant.

3. An impact protection arrangement as claimed in claim 2, wherein the inflated bag means extends radially outwardly from the steering wheel such that a peripheral portion thereof engages in use the adjacent vehicle interior side.

4. An impact protection arrangement as claimed in claim 3, wherein the peripheral portion is deflected by engagement with the vehicle side so that its extremity viewed in horizontal cross-section points towards the rear of the vehicle and the degree of concavity is enhanced in the peripheral region.

5. An impact protection arrangement as claimed in any of claims 2 to 4, wherein the bag means is formed with a

central bag portion and a plurality of individually pivotable segments extending radially therefrom.

6. An impact protection arrangement as claimed in claim 5, wherein the bag means includes four truncated segments.

7. An impact protection arrangement as claimed in claims 5 or 6, wherein V-notches are provided in the periphery of the bag means.

8. An impact protection arrangement as claimed in any preceding claim, wherein the sideways protection is provided by at least one bag portion which is disposed, when inflated, directly between at least the head of the occupant and the adjacent side door, wall or window of the vehicle.

9. An impact protection arrangement as claimed in any preceding claim, wherein the bag portions, together with any inflatable passage members communicating them with the inflation means, are shaped and configured such that they can all inflate substantially unimpeded by the driver's hands and arms, at least when in a normal "straight on" driving condition, and without forcibly dislodging them from the steering wheel.

10. An impact protection arrangement as claimed in claim 1, wherein the inflatable bag means comprises intercommunicating planar bag portions which together when inflated define a substantial L-shape in plan.

11. An impact protection arrangement as claimed in any preceding claim, wherein the impact sensor means is arranged to detect both frontal and at least partially side on i.e. angled collisions of the vehicle.

12. An impact protection arrangement for the driver of a vehicle comprising an inflatable bag means stored in a compartment arranged centrally of the vehicle steering wheel and arranged to be inflated following an impact of the vehicle, the inflated bag means being generally dish shaped and extending forwardly and radially outwardly from the steering wheel whereby a peripheral portion thereof engages the adjacent vehicle interior side.

13. An impact protection arrangement as claimed in any preceding claim, wherein the inflatable bag means is formed from suitably shaped panels of uncoated fabrics which are sewn together.

14. An impact protection arrangement as claimed in any of claims 1 to 12, wherein the inflatable bag means is formed from a plastics film material e.g. thermoplastics and/or elastomeric polymer films.

15. An impact protection arrangement as claimed in claim 14, wherein the plastics material is provided with a friction reducing coating.

16. An air bag for a vehicle which is sculptured to provide, when inflated, a generally concave front face which confronts the driver.

17. An air bag as claimed in claim 16, wherein the bag is, when inflated, generally dish shaped.

18. An air bag as claimed in claim 17, wherein the bag is formed with a central bag portion and a plurality of individually pivotable segments extending radially therefrom.

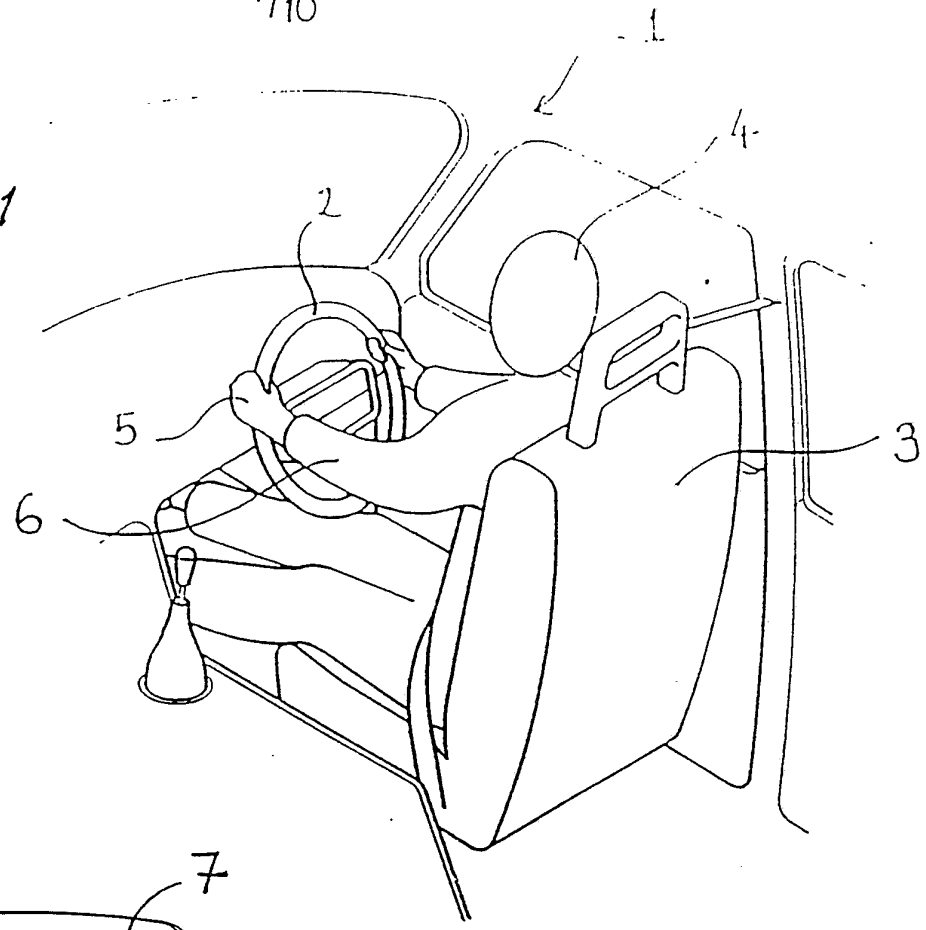
19. An impact protection arrangement for the occupant of a vehicle comprising an inflatable bag means formed from a

plastic film material such as a thermoplastic and/or elastomeric polymer film.

20. An air bag for a vehicle comprising a plastics film material such as thermoplastic and/or elastomeric polymer film.

21. An impact protection arrangement or air bag as claimed in claims 19 or 20, wherein the plastic film material has a thickness range of 150-250 μm and a strength range of 30-40 kN/m.

Figure 1



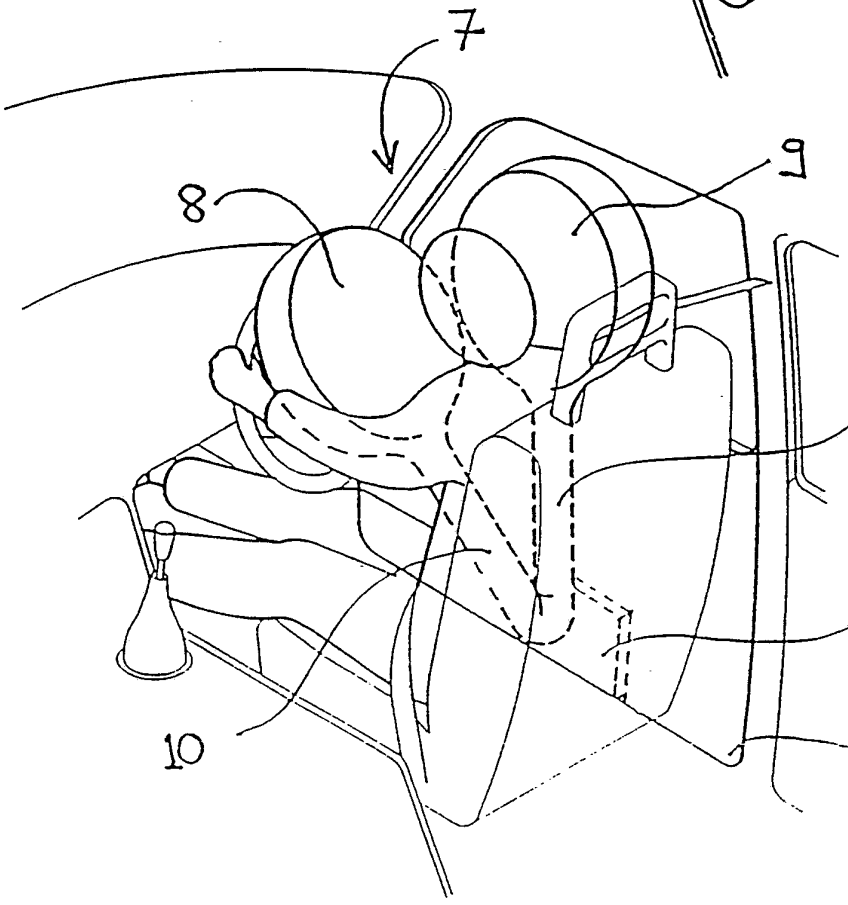


Figure 2

Figure 3

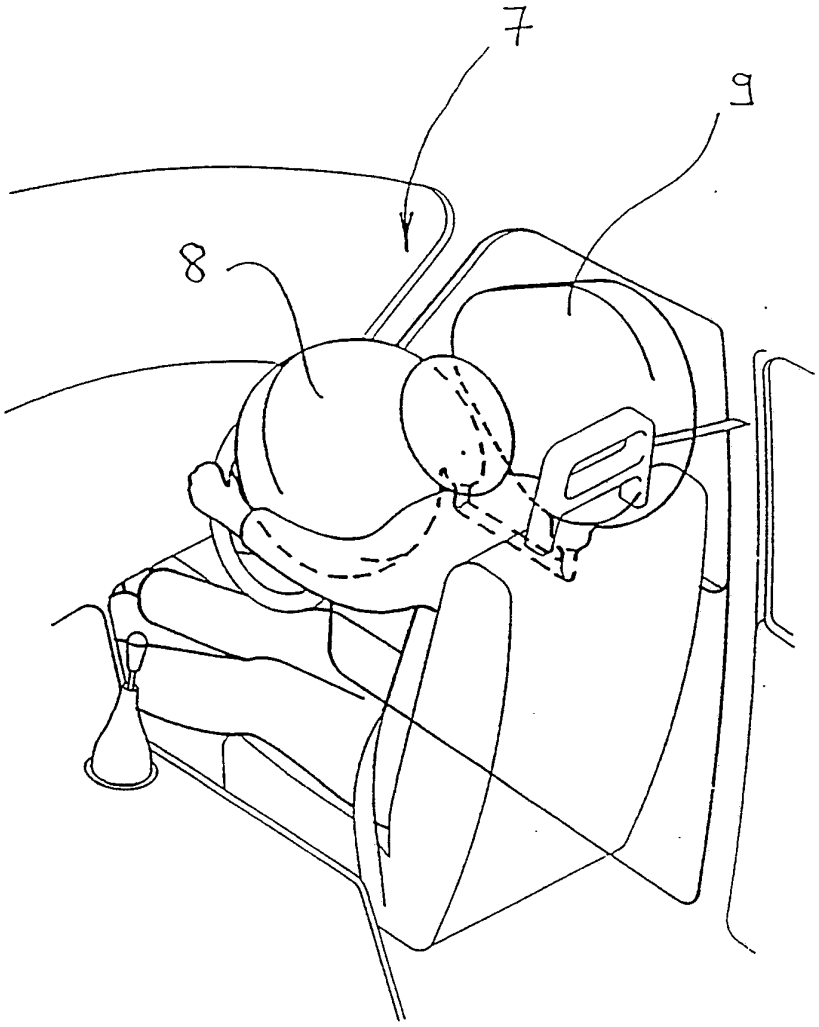


Figure 4

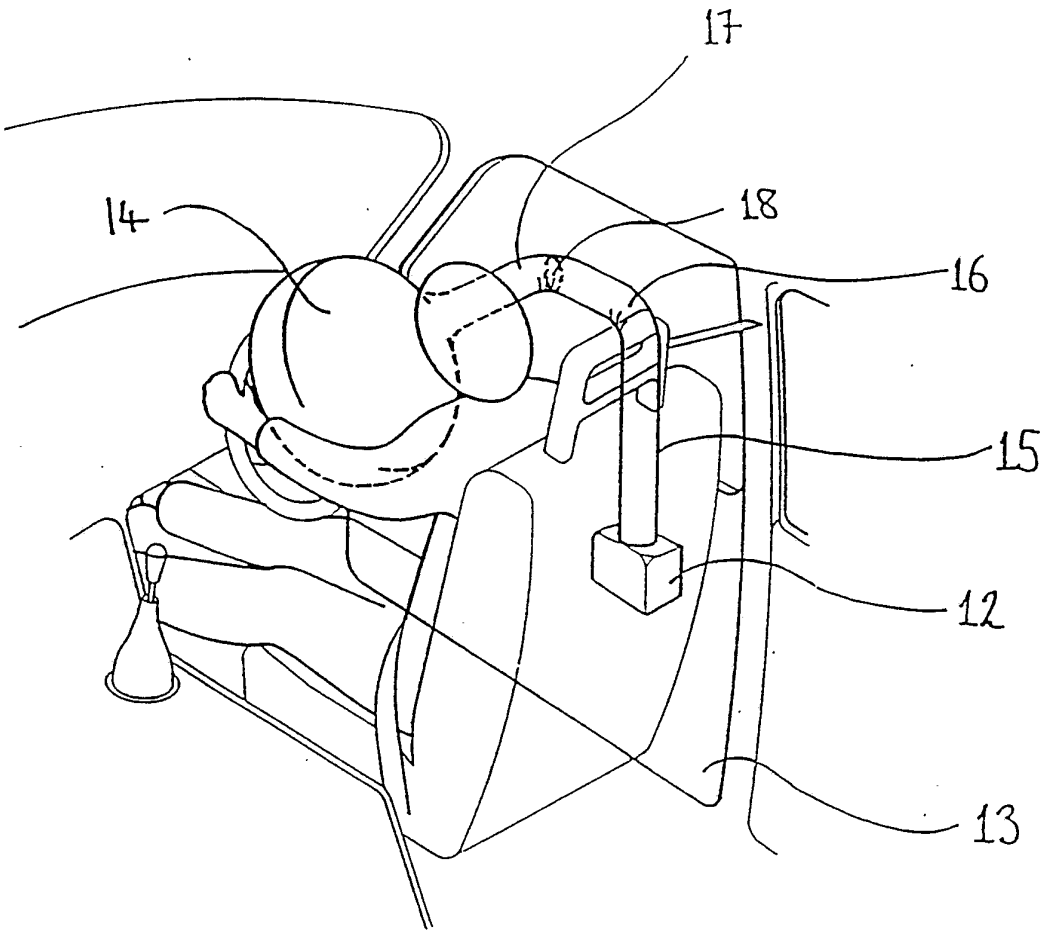


Figure 5

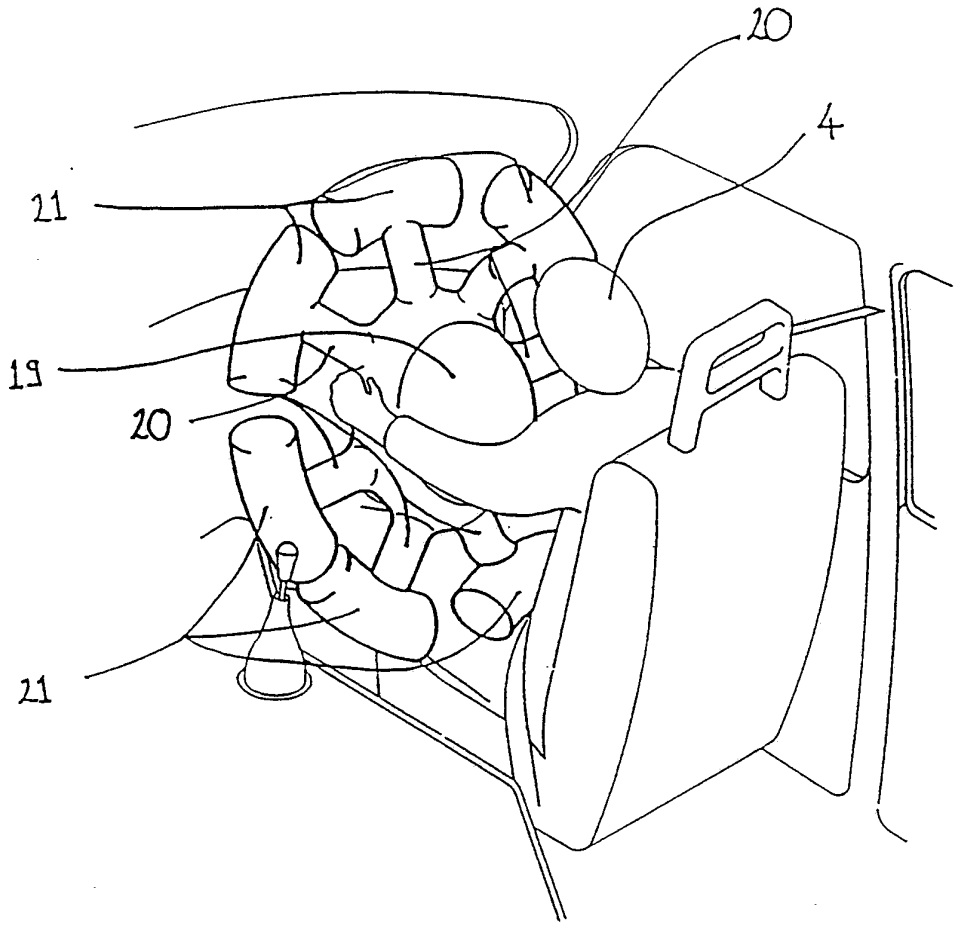


Figure 6

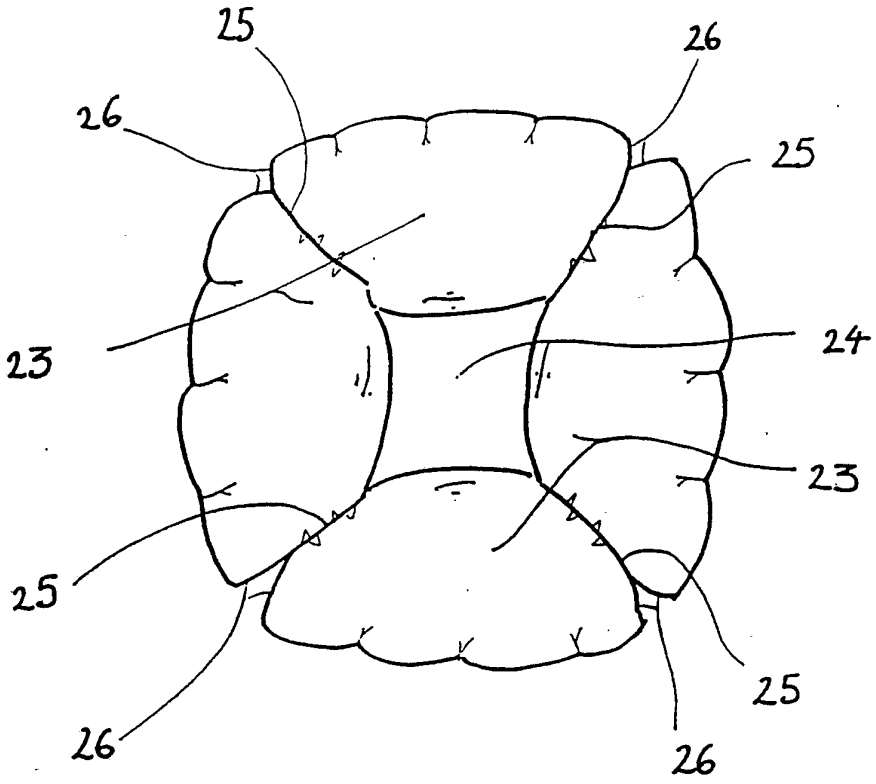


Figure 7

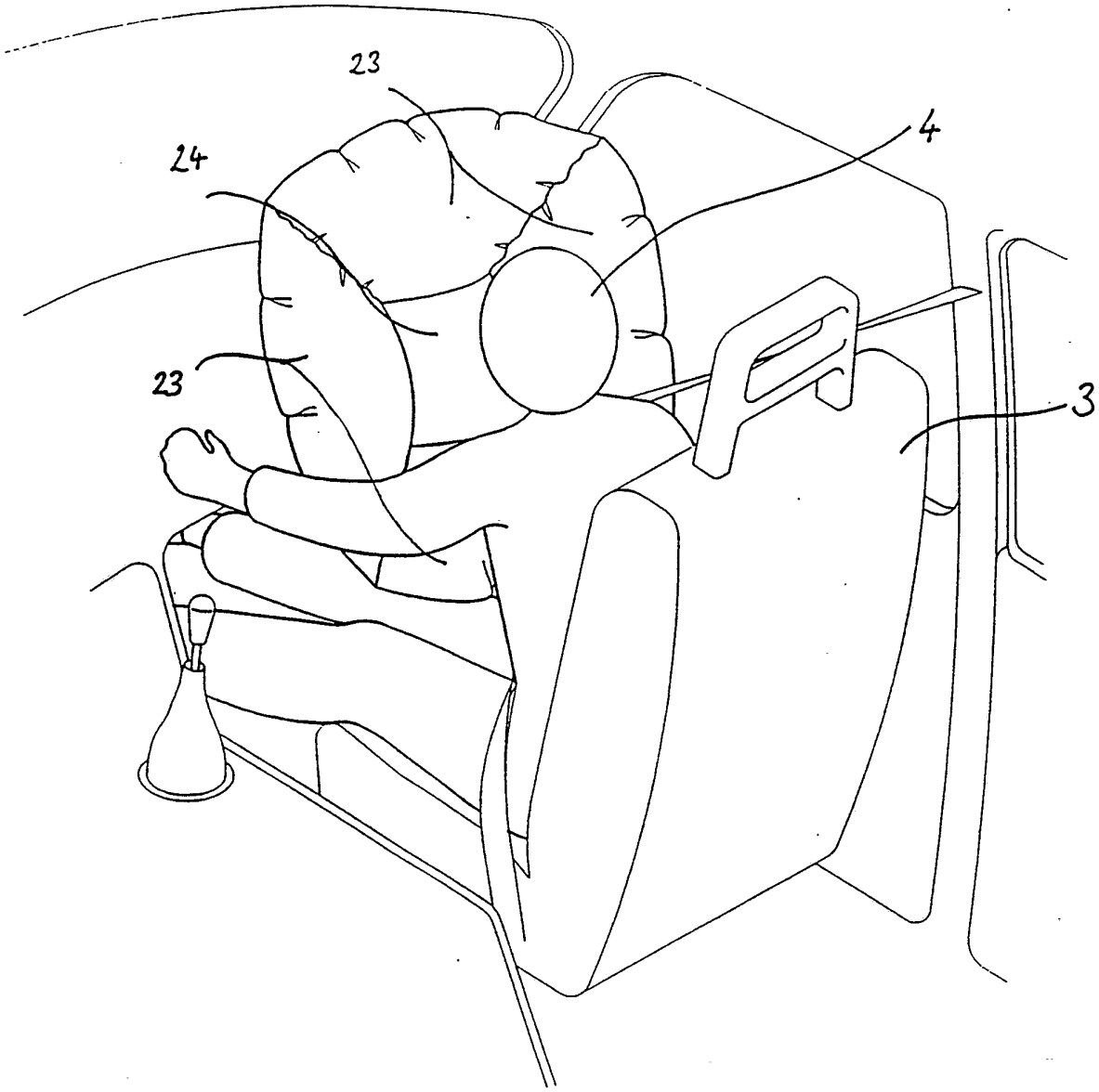


Figure 8

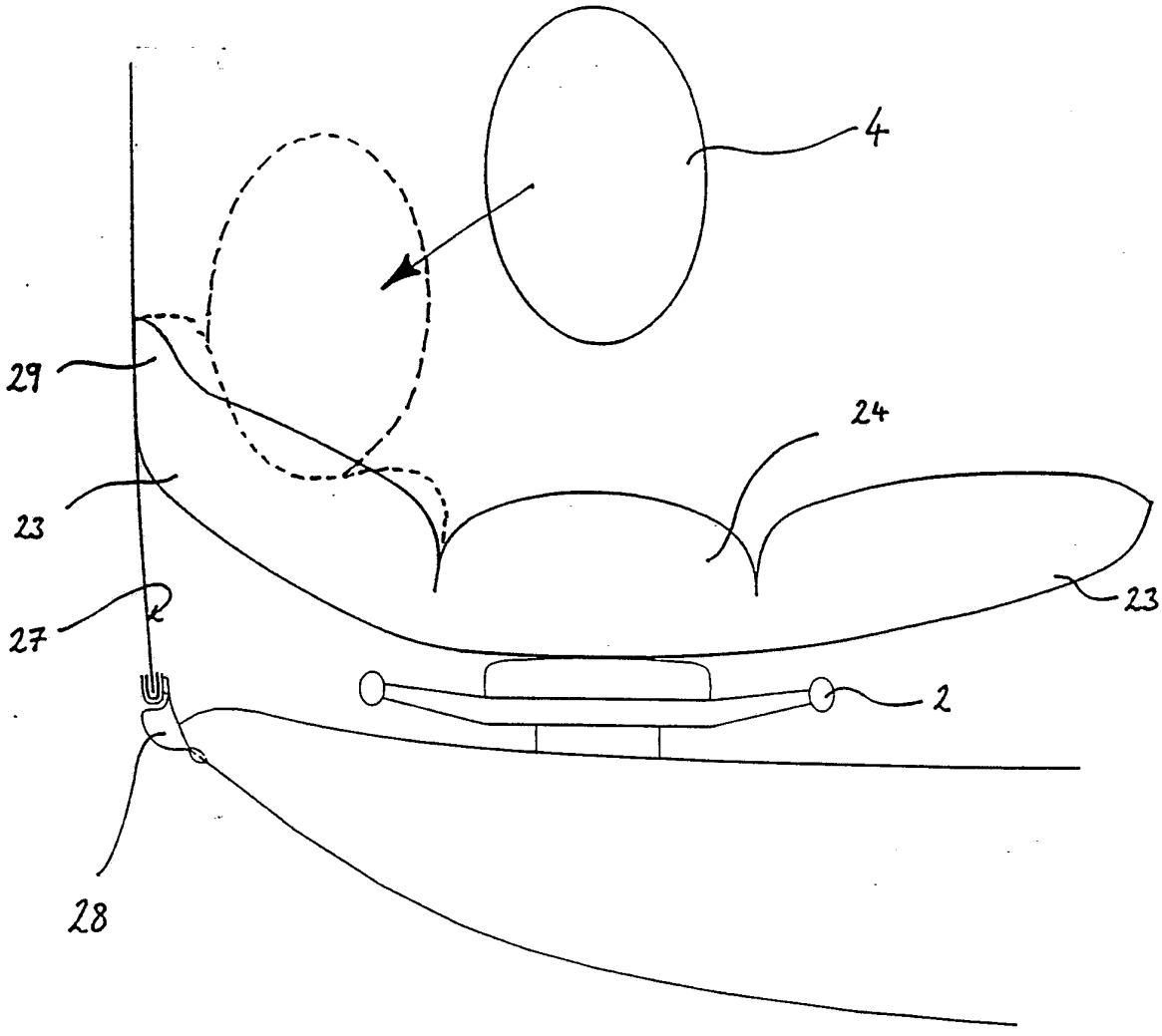


Figure 9

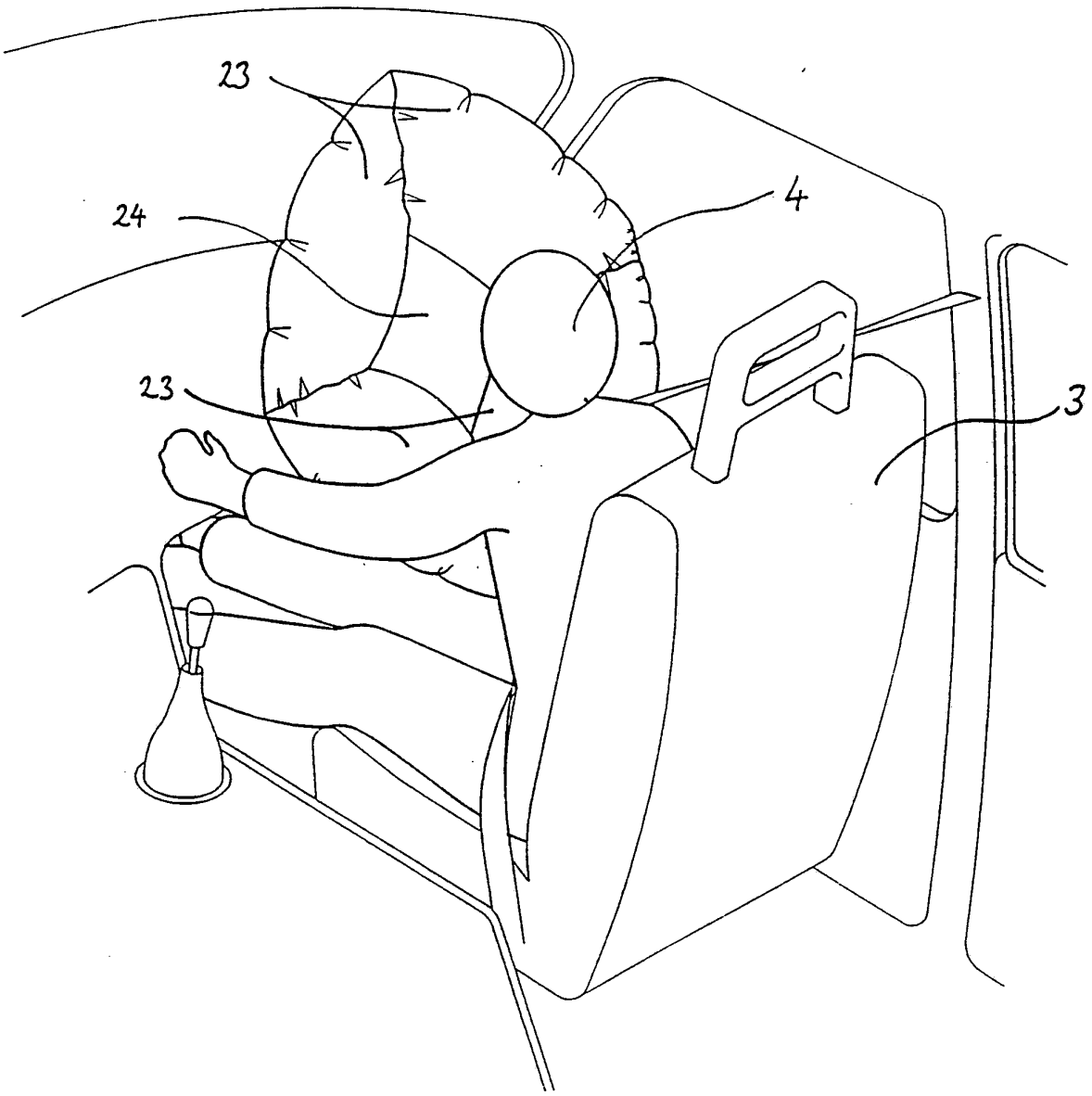


Figure 10

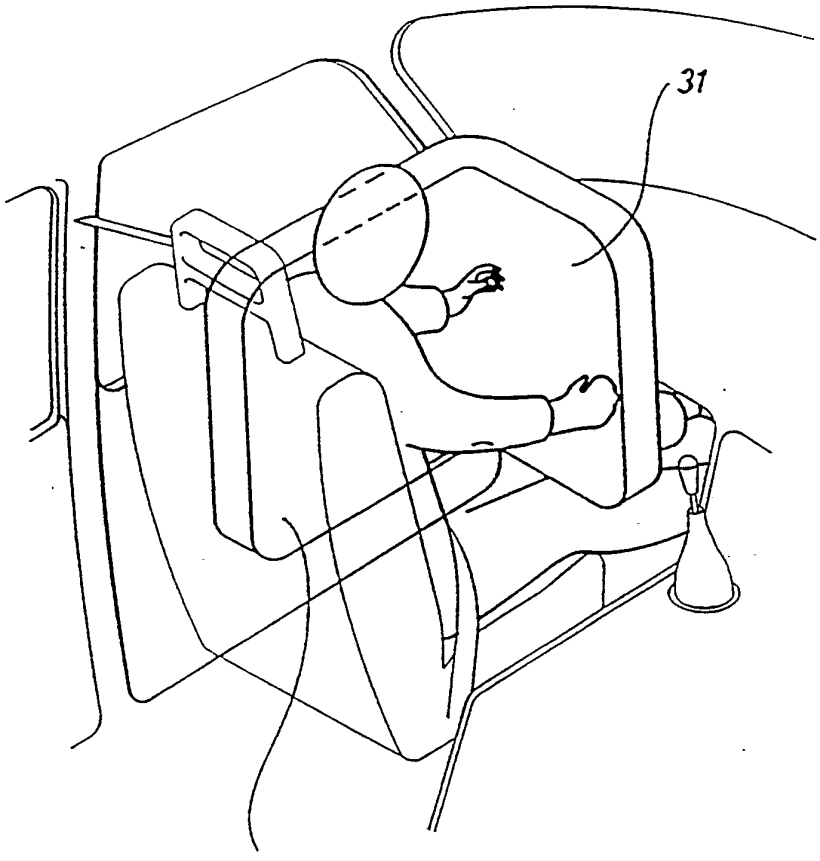
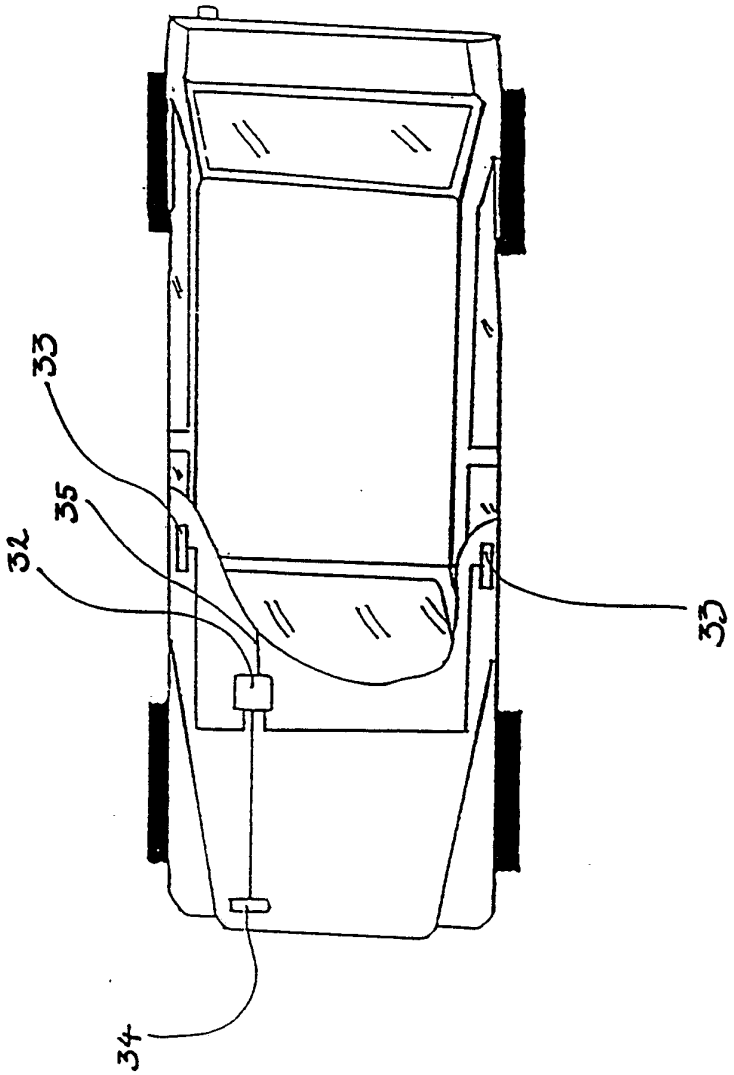


Figure 11



INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 93/00347

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B60R21/22

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	B60R

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X Y	US,A,4 265 468 (SUSZKO ET AL.) 5 May 1981 see figures 1-5 see abstract see column 1, line 55 - column 4, line 5	1-4,8,9, 12,16,17 13,14, 19,20 5,18
Y	EP,A,0 453 678 (STERN & STERN INDUSTRIES INC.) 30 October 1991 see the whole document	13,14, 19,20
X Y	US,A,5 044 663 (SEIZERT) 3 September 1991 see figures 1-6 see abstract see column 2, line 44 - column 6, line 65	1-4,8,9, 12,16,17 13,14, 19,20 5,18

-/--

° Special categories of cited documents :[10]

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

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

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

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

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
15 JUNE 1993	22. 06. 93
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	C.H.A. D'SYLVA

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
Y	US,A,3 888 504 (CLIFFORD BONN,KENNETH R.A. WILSON) 10 June 1975 see column 2, line 8 - column 5, line 16; figures	13,14, 19,20
X	DE,A,2 625 184 (ROSSMAN WINFRIED) 8 December 1977	1,2,9, 16,17, 19,20
Y	see page 2, paragraph 1; figures 1,2	15
A	see page 4, line 4 - page 5, line 19	12
Y	CA,A,2 067 787 (ASAHI KASEI KOGYO K.K.) 17 February 1992 & EP,A,0 496 894 (ASAHI KASEI KOGYO K.K.) 5 August 1992 see page 2, line 49 - page 3, line 42	15
X	FR,A,1 431 098 (VRABIE MIHAI) 31 January 1966	1,13,14, 16,17, 19,20
A	see figures 1,2 see page 1, line 1 - page 3, line 13	8
X	PATENT ABSTRACTS OF JAPAN 27 February 1991 & JP,A,02 303 951 (NISSAN MOTOR CO LTD) 17 December 1990 see abstract	1,8
Y		11
A		2,10
Y	US,A,3 720 426 (JOHNSTON) 13 March 1973 see figures see abstract see column 2, line 13 - column 5, line 22	11
P,X	PATENT ABSTRACTS OF JAPAN 30 July 1992 & JP,A,04 110 252 (IKEDA BUSSAN CO LTD) 10 April 1992 see abstract	1,8,10
X	PATENT ABSTRACTS OF JAPAN 5 September 1991 & JP,A,03 136 945 (IKEDA BUSSAN CO LTD) 11 June 1991 see abstract	16,17

-/--

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
P,X	PATENT ABSTRACTS OF JAPAN 5 June 1992 & JP,A,04 056 651 (BANDO CHEM IND LTD) 24 February 1992 see abstract	16,17
P,A	---	12,18
P,X	PATENT ABSTRACTS OF JAPAN 5 June 1992 & JP,A,04 056 652 (BANDO CHEM IND LTD) 24 February 1992 see abstract	16,17
P,A	---	12,18
A	US,A,4 772 045 (KAWAGUCHI ET AL.) 20 September 1988 see the whole document	1,14,15

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

GB 9300347
SA 70531

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 15/06/93

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A-4265468	05-05-81	None		
EP-A-0453678	30-10-91	US-A-	4977016	11-12-90
		US-A-	5010663	30-04-91
		US-A-	5073418	17-12-91
US-A-5044663	03-09-91	None		
US-A-3888504	10-06-75	AU-A-	3740471	28-06-73
		CA-A-	943571	12-03-74
		CA-A-	955975	08-10-74
		DE-A-	2164627	13-07-72
		FR-A,B	2119064	04-08-72
		GB-A-	1378389	27-12-74
		SE-B-	387281	06-09-76
DE-A-2625184	08-12-77	None		
CA-A-2067787	17-02-92	JP-A-	4100752	02-04-92
		EP-A-	0496894	05-08-92
		WO-A-	9203310	05-03-92
FR-A-1431098		None		
US-A-3720426	13-03-73	None		
US-A-4772045	20-09-88	None		