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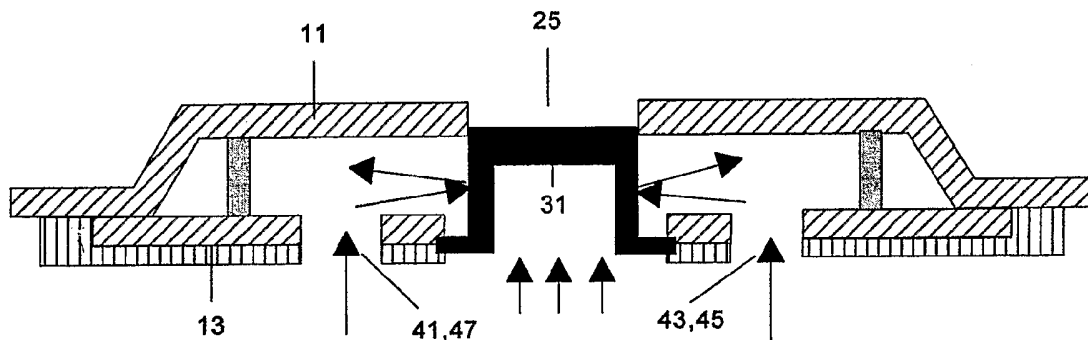
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ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: AIRBAG WITH A CLOSABLE VENTING DEVICE



(57) Abstract: An airbag having a venting device defined by an upper part surrounding the venting opening (25) and a lower part (13) separated by a separating element (15), configuring a chamber (21) in which the lower part (13) has a closing element (31, 33, 35, 37) in its central part opposite the venting opening (25) and includes a plurality of openings (41, 43, 45, 47) to receive the gas from the bag, said closing element being able to totally or partially close the venting opening (25) when the inner pressure of the bag (23) exceeds predetermined limits (P2, P3).

Airbag with a closable venting device**FIELD OF THE INVENTION**

5 The present invention refers to a venting device for airbags used in automobiles to cushion the blows suffered by drivers and passengers in the event of crashes or collisions.

BACKGROUND OF THE INVENTION

10

Airbags basically consist in a folded bag which inflates rapidly by means of a gas produced by a generator when certain sensing devices detect a collision of the vehicle. The bag is thus deployed in front of the driver or passenger, depending on its location, and prevents their bodies from hitting against any
15 part of the vehicle.

15

In normal bag deployment, the inner pressure produced by the generator when filling it with gas can be high enough as to cause the bag to be so hard that the occupant bounces off it. To prevent this drawback they have been provided with a venting opening in order to reduce the inner pressure of the bag and
20 consequently the possibility of causing injuries when activated.

20

The use of several means for closing this venting opening in order to achieve better control of the inner pressure in the bag than that provided by only changing the size thereof is also known. In this sense the use of patches to prevent the gas from immediately exiting through the discharge opening except
25 when the patch is broken when a certain pressure inside the bag is reached can be mentioned. The art has proposed different types of patches with different means for controlling breaking according to, in a greater or lesser degree, a certain resistance to the gas pressure inside the bag. Thus the presence of the necessary pressure for the bag to perform its protective
30 function is made compatible with the assurance that the gas pressure will not

reach an excessive value with a risk for the people for whom the bag deploys.

On the other hand, the need has also arisen for venting devices allowing to increase the gas outflow according to the specific characteristics of each collision and the type of passenger affected, and in this sense several venting
5 device solutions are known, providing adjustable surface venting openings, facilitating an increase in the venting area as the pressure inside the bag increases.

A new need that has arisen also poses the need for airbags that allow reducing the venting area, even completely eliminating it in certain conditions of the
10 impact, which requires closing mechanisms which must operate in a manner opposite that of the art known to date. The aforementioned traditional patches had to completely cover the outlet opening until the inner pressure of the gas in the bag reached a certain level and then broke, not operating anymore. Now the opposite is required: devices allowing closing the venting opening when it
15 is already open when the inner pressure of the bag reaches certain levels.

Some proposals are known to this respect such as those disclosed in Spanish patent ES 2182629, in US patent 6,139,048 and in US patent application 2004/0090054 which use shifting elements to close the venting opening making use of the stresses produced in the bag due to the pressure difference
20 combined with the occupant load difference. The present invention proposes a solution to the problem based on different principles.

SUMMARY OF THE INVENTION

25 The object of the present invention is to achieve an airbag with a closable venting device which for very severe collisions allows partial or total closure of the venting opening after a first phase in which it is open discharging gas.

This object is achieved by means of a venting device defined at its upper portion by an area of the bag surrounding the venting opening and at its lower
30 portion by a part joined by its contour to the inside of said area, having in its central portion, opposite the venting opening, a closing element and including a

plurality of openings, said area and said part being separated by a separating element made from a resilient material and configured such that a chamber is formed between them which receives the gas from the bag through the openings located in said part and discharges it through the opening of the bag, being able the venting device to partially or completely reduce the gas outflow by means of partially or completely closing the gas outlet pathways towards the opening of the bag occurring when the closing element is deformed or broken when pressure inside the bag exceeds predetermined limits.

An advantage of the present invention is that the operation of the venting device depends solely on the inner pressure of the bag, which is very interesting due to the possibilities of controlling this variable. The final product is stronger since it does not depend on other characteristics such as stresses/deformations.

Another advantage of the present invention is that the inner pressure of the bag is more stable as a venting device operation control parameter than other parameters depending on factors such as the manner in which the bag deploys or the location of the occupant with respect to the bag.

Another advantage of the present invention is that it facilitates both total closing of the venting opening of the bag and partial closing for those cases of intermediate severity between the conditions of maximum and minimum collision severity.

Other features and advantages of the present invention will be inferred from the following detailed description of an illustrative and by no means limiting embodiment of its object based on the attached drawings.

25

DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic elevational view of the venting device according to the present invention.

30 Figure 2 is a schematic plan view of the lower part of the venting device according to the present invention.

Figure 3 is a schematic elevational view of the venting device according to the present invention in the state corresponding to a low severity collision.

Figure 4 is a schematic elevational view of the venting device according to the present invention in the state corresponding to a medium severity collision.

- 5 Figure 5 is a schematic elevational view of the venting device according to the present invention in the state corresponding to a high severity collision, showing a cylindrical deformation of the closing element.

Figures 6 and 7 are similar views to Figure showing closing elements with tronco-conical and spherical deformations, respectively.

- 10 Figure 8 is a schematic elevational view of the venting device according to the present invention in the state corresponding to a high severity collision, using a breakable closing element.

DETAILED DESCRIPTION OF THE INVENTION

15

The venting device of the airbag according to a preferred embodiment of the present invention is formed by an upper area 11 and a lower part 13 separated by a separating element 15 defining a chamber 21. In a preferred configuration the separating element 15 is a circular annulus.

- 20 The upper area 11 is formed by a portion of the bag 23 of the airbag inside which the venting opening 25 of area A is located.

Area A must be gauged in order to achieve sufficient gas discharge in general airbag operating conditions, since the closing device will only operate in exceptional cases and must therefore be greater than or equal to the area V

25 required for the bag to operate correctly in conditions of less severe collisions.

- The lower part 13, preferably made with the same material as the bag, although a material less resilient could also be used, has in its central portion, opposite the venting opening 25, a closing element 31 made from a resilient material, preferably silicone, and includes a plurality of openings 41, 43, 45, 47 of area
- 30 B, gauged so as to discharge the amount of gas required in conditions of less severe collisions.

Part 13 is joined to the bag 23 along its contour 19 by means of a layer 49 of adhesive material. It may be alternatively joined by sewing, ultrasounds or any other production process. For its part, the closing element 31 is joined by means of an adhesive or any other suitable means to part 13 along the contour
5 of the opening provided for that purpose in its central portion

In conditions of less severe collisions there will be a certain inner pressure P_1 inside the bag determining the ventilation area V required for suitably restraining the occupant. Therefore, the sum of the areas B of the openings 41, 43, 45, 47 must be equivalent to area V . In Figure 3 it can be observed that, in
10 this case, the gas enters the chamber 21 through the openings 41, 43, 45 and 47 and exits through the venting opening 25 following the direction indicated by the arrows. The inner pressure P_1 of the bag is not enough to deform the closing element 31 which remains, so to speak, in its rest position.

In conditions of intermediate severity there will be greater inner pressure,
15 called P_2 , inside the bag than in the previous cases, and consequently less amount of gas must be discharged, which is achieved by means of the partial closing of the gas outlet pathways occurring with the partial deformation of the closing element 31 due to P_2 , as can be seen in Figure 4.

In conditions of more severe collisions a greater inner pressure, called P_3 ,
20 occurs inside the bag than in the previous cases, deforming the closing element completely and covering the venting opening 25, preventing the air from exiting the bag, as can be seen in Figure 5.

It must be mentioned that the function of the separating element 15 is that of creating the chamber 21 allowing the closing element 31 to have enough room
25 to be deformed in the mentioned manner, and that it must be made in a resilient material so that it does not make the bag rigid in the area occupied by the venting device, allowing the bag to be folded. On the other hand, said material must be stable in the operating and temperature conditions required for airbags. They will be preferably made of silicone.

30 The closing element may be constituted by a sheet having different widths in different areas of the sheet. Depending on its size, the shape of the sheet

deformation can be different. While the closing element 31 is configured for having a cylindrical deformation, closing elements 33 and 35 are configured for having, respectively, a tronco-conical and a spherical deformation.

In accordance with the deformation shape of the closing element under the bag
5 internal pressure, the venting opening 25 and the needed separation in chamber 21 will be sized for obtaining the maximum closure.

In an alternative embodiment, it can be used a closing element 37 configured so that, when the internal pressure in the bag reaches a predetermined level (P3), a part of it is broken forming a tab that closes the venting opening 25 as it
10 is shown in Fig. 8.

Although various embodiments of the invention have been described and represented it is obvious that modifications may be introduced therein that are comprised within the scope of the invention, the latter not being considered limited to said embodiment but rather to the content of the following claims.
15

CLAIMS

- 1.- An airbag the inflatable bag (23) of which has a gas venting opening (25), characterised in that it comprises a venting device defined in its upper area by an area (11) of the bag (23) surrounding said opening (25), and in its lower portion by a part (13), joined at its contour (19) to the inside of said area (11), having a closing element (31, 33, 35, 37) in its central part opposite the venting opening (25) and including a plurality of openings (41, 43, 45, 47), said area (11) and said part (13) being separated by a separating element (15) made from a resilient material and configured so that a chamber (21) is formed between them which receives the gas of the bag through the openings (41, 43, 45, 47) of the part (13) and discharges it through the venting opening (25), it being possible to partially or totally reduce the gas outflow by means of partially or totally closing the gas outlet pathways towards the venting opening (25) occurring by deforming of the closing element (31, 33, 35), or totally closing the venting opening (25) after the breaking of the closing element (37), when the inner pressure of the bag (23) exceeds predetermined limits (P2, P3).
- 2.- An airbag according to claim 1, characterised in that said closing element (31, 33, 35) is made from a resilient material.
- 3.- An airbag according to claim 1, characterised in that said closing element (31, 33, 35) is made from silicone.
- 4.- An airbag according to claim 2, characterised in that the closing element (31) is configured for having a cylindrical deformation.
- 5.- An airbag according to claim 2, characterised in that the closing element (33) is configured for having a tronco-conical deformation.

6.- An airbag according to claim 2, characterised in that the closing element (35) is configured for having a spherical deformation.

5 7.- An airbag according to claim 1, characterised in that the closing element (37) is configured so that, when the internal pressure in the bag reaches a predetermined level (P3), a part of it is broken forming a tab that can close the venting opening (25).

10 8.- An airbag according to claim 1, characterised in that the part (13) is made from the same material as the bag (23).

9.- An airbag according to claim 1, characterised in that the part (13) is made from a material less resilient as the bag (23).

15

10.- An airbag according to claim 1, characterised in that the separating element (15) is made from silicone.

11.- An airbag according to claim 10, characterised in that the separating
20 element (15) is a circular annulus.

12.- An airbag according to claim 1, characterised in that the part (13) is joined to the bag by means of a layer of adhesive element (49).

25 13.- An airbag according to claim 1, characterised in that the part (13) is joined to the bag by sewing means.

14.- An airbag according to claim 1, characterised in that the surface of the opening (25) of the bag is greater than or equal to the sum of the surface of the
30 openings (41, 43, 45, 47) of the part (13).

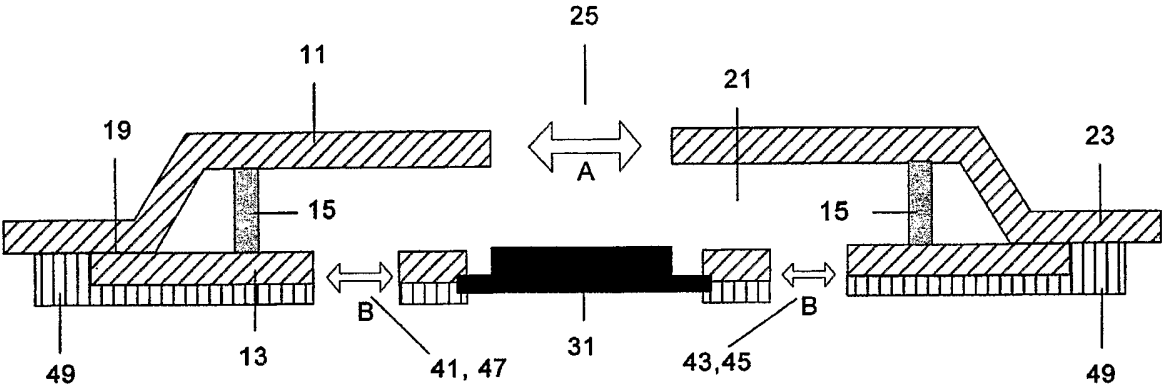


FIG. 1

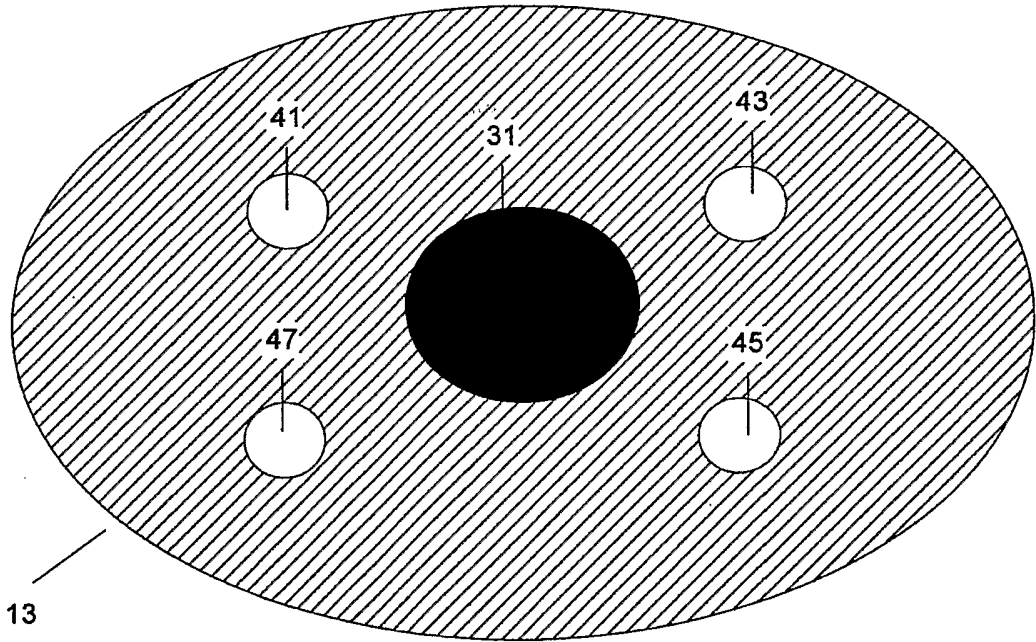


FIG. 2

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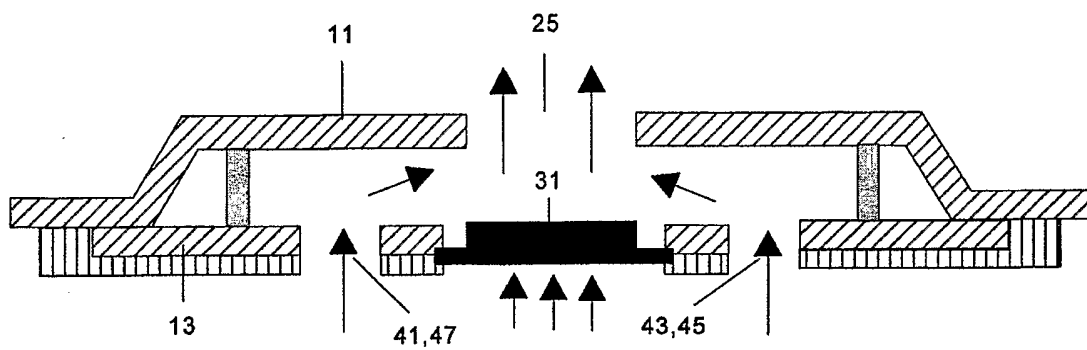


FIG. 3

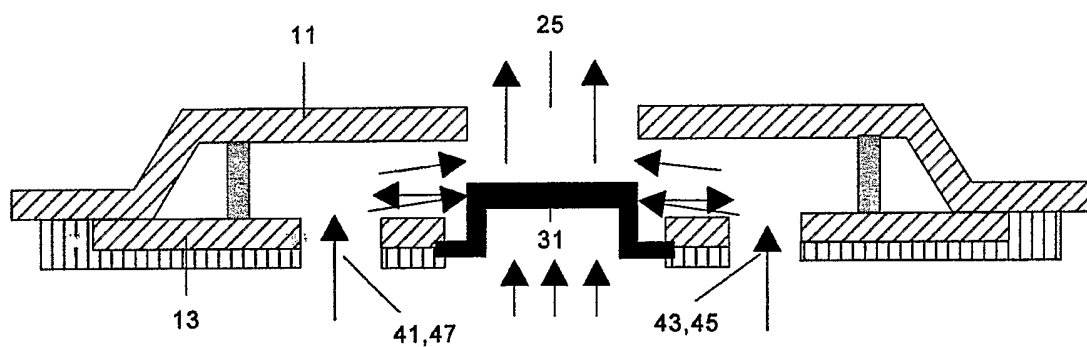


FIG. 4

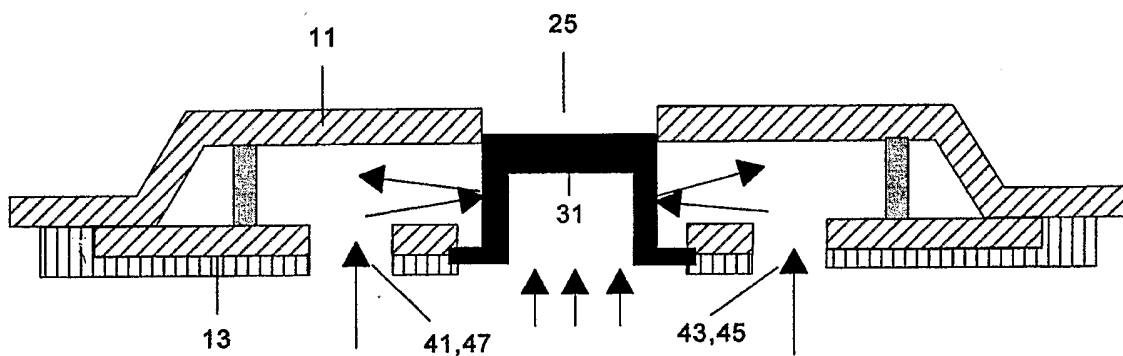


FIG. 5

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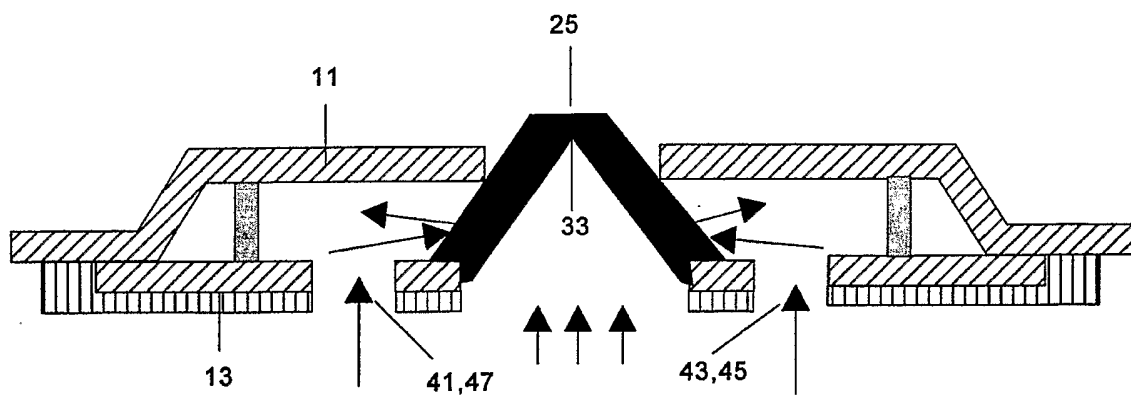


FIG. 6

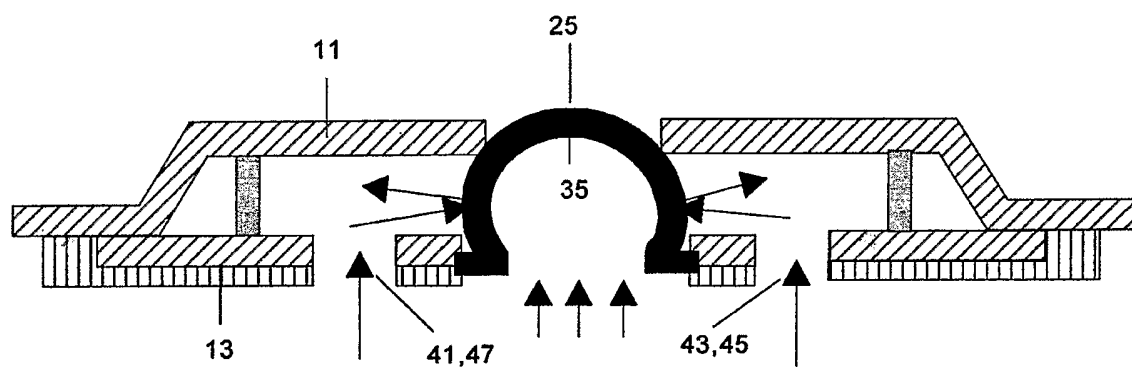


FIG. 7

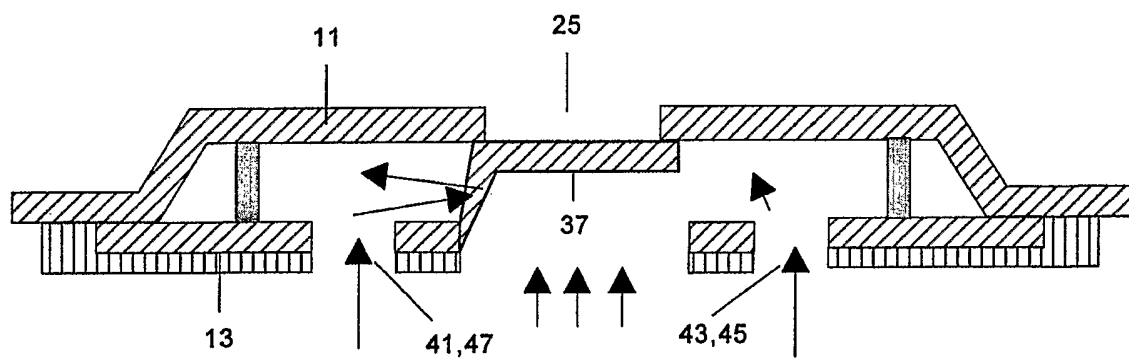


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No

EP2005/052972

A. CLASSIFICATION OF SUBJECT MATTER

B60R21/16

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

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 3 820 814 A (ALLGAIER R,DT ET AL) 28 June 1974 (1974-06-28) column 3, line 52 - line 64 -----	1,2,6, 12,13 3-5,8,9, 14



Further documents are listed in the continuation of Box C.



See patent family annex.

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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.

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Date of the actual completion of the international search

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Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 3820814	A	28-06-1974	DE	2116347 A1	19-10-1972
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