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(54) VACUUM COMPENSATOR FOR INTERNAL COMBUSTION ENGINES

(57) Vacuum compensator for internal combustion engines, of special application for its mounting to engines of motor vehicles, the vacuum compensator (1) being mounted on the air intake suction opening from the outside to the air filter case (2), the compensator having a general hollow cylindrical shape, one of its bases being open, and having in its other base a flexible body (8) integral with the side surface of the hollow cylindrical body, provided with a central circular variable diameter opening (9) and with a series of radial cuts (10) which define similar circular sectors; the nature of the flexible material body (8) and the diameter of the central circular opening (9) as well as a number of radial cuts (10) are function of the characteristics of the engine.

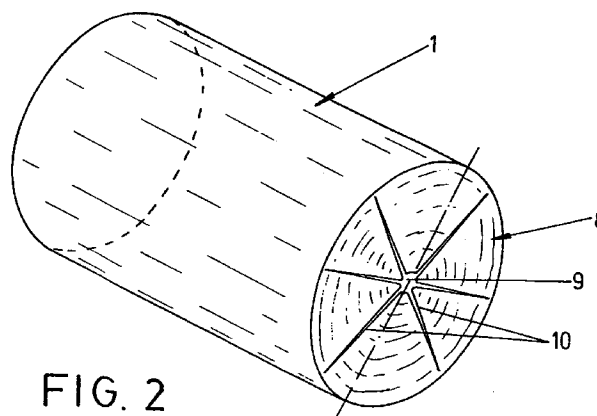


FIG. 2

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Description

OBJECT OF THE INVENTION

As expressed in the title of the present specification, the following invention consists of a vacuum compensator for internal combustion engines, which is useful to compensate for vacuum cutoffs caused in intake manifolds of internal combustion engines, produced with violent accelerations of the turning rates of the same, which produces fuel (gasoline or gas oil, etc.) consumption peaks due to defects of chemical contact between the fuel (diffused or injected), and the combustible agent (oxygen, normally supplied by air).

The vacuum compensator is constituted by a non-hermetic valve, defined by a hollow cylindrical body open at one of its bases and provided in its other base with a flexible material body, perimetrically integral to the side surface of the same and provided in the center with a circular hole, as well as some radial cuts that define some circular sectors, the vacuum compensator remaining installed as the closure of the suction opening of the box that contains the air filter of the engine.

Thus, by means of the installation of the vacuum compensator as the closure of the suction opening of the box that contains the air filter of internal combustion engines, in the presence of a sudden acceleration, the time in which a temporary reduction of the depression available in the intake manifold is produced without producing an increase in the CO production, is achieved.

As a result of this, the great advantage that is obtained is that with the inclusion of the vacuum compensator in internal combustion engines, fuel consumption is reduced, with the subsequent economic savings that this represents.

FIELD OF APPLICATION

The vacuum compensator that is described in the present specification is useful for installation in internal combustion engines in such a way that with the same, in the presence of a sudden acceleration, there is a reduction in the time during which the depression that is available in the intake manifold temporarily reduces, reducing the fuel consumption "peaks" and therefore obtaining an economic saving. Thus, one particular application is in automobiles with the great advantage that a fuel consumption reduction represents an economic savings for users.

BACKGROUND OF THE INVENTION

The vacuum compensator is destined so that it operates when the explosion engine is found in a situation of low energy efficiency combustion, in such a way that said situation is produced when a greater transfer or supply of energy is required of the engine, in other words, when the accelerator that opens the butterfly

valve of the intake manifold is pressed, in such a way that, in any engine and to a greater or lesser degree, a temporary reduction of the depression that is available in the intake manifold, is observed.

The measurement of the drop of the depression available in the intake manifold of the corresponding explosion engine is easily obtained by connecting any "vacuum intake" tube of the intake manifold to a barometer or vacuum gage observing that if the pressure exerted on the accelerator is rapid enough, the effect contrary to the desired one is produced, since in those first instants of sudden acceleration and immediately after having pressed the accelerator, a loss of the turning rate of the engine is observed and this is usually described as "the engine floods".

In short, what happens in internal combustion engines, is that vacuum cutoffs are produced when violent accelerations of the turning rates are carried out in the intake manifolds of the engines, which causes "fuel" (gasoline, gas oil, etc.) consumption peaks due to defects of chemical contact between the fuel (diffused or injected) and the combustible agent (oxygen, normally supplied by air), that is to say, an unnecessary fuel consumption is produced, because the fuel is not taken advantage of for the propulsion of the vehicle.

Starting from the described problem, the object is to achieve a reduction of the time in which the vacuum cutoff is produced in intake manifolds of internal combustion engines upon carrying out sudden accelerations in the turning rates of the same, to reduce or eliminate fuel consumption "peaks" and with this an economic saving.

DESCRIPTION OF THE INVENTION

The present specification describes a vacuum compensator for injection engines especially applicable in automobiles which is mounted in the suction opening for the intake of air from the outside, to the box where the air filter is located, in such a way that the same has a general hollow cylindrical shape with one of its bases open and having in its other base a flexible material body, perimetrically integral to its side surface and the same having a circular central opening, with some radial cuts that define a series of circular sectors identical to each other.

The nature of the flexible material body, provided with a base of the hollow cylindrical body that defines the vacuum compensator, as well as the diameter of its central opening and the number of radial cuts, will be determined in terms of the characteristics of the engine.

The hollow cylindrical body that defines the vacuum compensator will have a maximum height of 10 cm. and its inside diameter will be equal to or larger than the diameter of the suction opening of the box containing the air filter in which it is mounted, it being possible to carry out the anchoring by any conventional means, such as a flange.

In the event that for any reason a vacuum compen-

sator with a diameter larger than the diameter of the suction opening of the box containing the air filter must be mounted, there will be suitable reducing cylinders to adjust them as much as possible to the diameter of the opening of the suction tube.

The circular sectors that define the flexible material body integral to a base of the vacuum compensator, are in continuous movement, opening and closing, between two extreme positions, in such a way that in the situation of maximum energy efficiency combustion, the circular sectors are bent, in relation to their connection to the hollow cylindrical body, their free ends being located in the part farthest apart from each other, while in the situation of low energy efficiency combustion, the circular sectors will be maintained in their inoperative position with their free ends in the position closest to each other, reducing the air intake section, and increasing the air penetration rate throughout the entire intake system.

In order to complete the description that is going to be made hereinafter, and for the purpose of providing a better understanding of its characteristics, the present specification is accompanied by a series of drawings in whose figures, the most significant details of the invention described in the present specification are represented in an illustrative and non-restrictive manner.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a schematic view of the assembly of the vacuum compensator, arranged in the intake of outside air to the box where the air filter is located.

Figure 2 shows a perspective view of the vacuum compensator, defined by a hollow cylindrical body provided with an open base, and the other base provided with perimetrically integral flexible material and that has in the center a circular hole from which originate a series of radial cuts that define some circular sectors.

Figure 3 shows a plan view of the vacuum compensator defined by a hollow cylindrical body, in relation to its base provided with the flexible material body, it being possible to see the central hole thereof, as well as the radial cuts that form the circular sectors of the same.

Figure 4 shows a side raised view of the vacuum compensator defined by a hollow cylindrical body.

Figure 5 shows a perspective view of the vacuum compensator, in relation to the base of the hollow cylindrical body that forms it, which is provided with the flexible material body provided with a central hole and some radial cuts, observing the same in the position in which the free ends of the circular sectors of the flexible material body are located farthest away from each other, upon said circular sectors having been bent in relation to the base of connection to the hollow cylindrical body.

DESCRIPTION OF A PREFERRED EMBODIMENT

In view of the commented figures and in accord-

ance with the numbering used, we can see how the vacuum compensator (1) defined by a generally hollow cylindrical shaped body, is mounted in the intake of air from the outside to the box (2) in which the air filter is located, remaining fastened in this case by a flange (3), although the fastening device may vary by any other conventional device.

The assembly and installation of the vacuum compensator (1), as well as the head (4) of the engine and the intake manifold (5), connected to the air flowmeter (6) by means of a rubber tube (7) with bellowslike ends, the flowmeter being located in the outlet of the box (2) in which the air filter is located, are observed in figure 1 of the drawings.

The vacuum compensator (1) constitutes a rapid action non-hermetic valve, being applicable to compensate vacuum cutoffs, produced in violent accelerations of turning rates in internal combustion engines, caused in intake manifolds of the engines, which produces fuel (gasoline, gas oil, etc.) consumption peaks, due to defect of chemical contact between the fuel (diffused or injected) and the combusive agent (oxygen normally supplied by air).

Just as it has been indicated, the vacuum compensator (1) is defined by a hollow cylindrical body with one of its bases open to allow the free passing of the combusive agent, most frequently air, and the other base has a flexible material body (8), connected perimetrically to the side surface of the body (1) which has a small central circular opening (9), from which originate a series of radial cuts (10) that form a series of bodies in the form of circular sector, in the flexible material body (8), all of them having the same shape.

The central opening (9) of the flexible material body (8) will be of variable diameter in terms of the cubic capacity of the engine, as well as the nature of the flexible material of the body (8), and the number of circular sectors defined by the radial cuts (10) will be defined by the characteristics of stroke, diameter, maximum power and number of valves per cylinder and the feed system of the engine to which it is going to be applied.

On the other hand, the inside diameter of the cylindrical body that defines the vacuum compensator (1) will never be less than the diameter of the suction opening of the box (2) containing the air filter in which it is installed, preventing the height of the cylinder of the valve from being greater than 10 cm. If for different reasons the body (1) must be longer, models to be used in greater cubic capacity engines in which larger diameter vacuum compensators are installed, must be chosen. For installation thereof, reducing cylinders necessary to attain the diameter closest to the original opening of the box (2) containing the air filter of the engine are used.

In the normal operation of the explosion engine, the circular sectors that define the flexible material body (8), are in constant movement, opening and closing between two extreme positions which are:

A) Situation of maximum energy efficiency combustion, wherein the flexible material circular sectors (8) of the vacuum compensator (1), are bent (figure 5) in relation to their connection to the body (1), and their free end vertexes remain farthest away from each other, maintaining an air intake surface and an air circulating rate very similar to the situation in which there is no control valve, that is to say, no vacuum compensator.

B) Situation of low energy efficiency combustion produced when a greater transfer of energy is required of the engine, upon pressing the accelerator that opens the butterfly valve of the intake manifold, in such a way that, upon carrying out a sudden acceleration immediately afterwards, a loss of rotation of the engine is produced, there not being any force that impinges upon the flexible material circular sectors (8), which return to their inoperative position (figure 2).

The measurement of the drop of the depression available in the intake manifold in the presence of a rapid acceleration of is easily obtained by connecting any "vacuum intake" tube of the intake manifold to a barometer or vacuum gage in such a way that if the pressure exerted on the accelerator is rapid enough, the effect contrary to the desired one is produced, since in those first instants of sudden acceleration and immediately after having pressed the accelerator, a loss of the turning rate of the engine is observed and this is usually described as "the engine floods".

In this moment, and as there is no force that impinges on the flexible material circular sectors (8), these sectors tend to adopt their inoperative position, approaching as rapidly as possible a rate that will be defined by the bending constant of the material, since the force that keeps them distant and that is no other than the product of the pressure gradient on both sides of the wall of the vacuum compensator by the surface of each circular sector, has eventually disappeared.

As the free vertexes of the flexible material circular sectors (8) approach each other, the section of the air intake reduces, increasing the penetration rate of the air throughout the entire intake system and until the center itself of the explosion chambers, therefore reestablishing and in a surprising short amount of time, the vacuum generated by the engine in the intake, in such a way that the maximum pressure increase inside the manifold drops an average amount of 20% depending on the engine to which it is applied, maintaining this pressure "peak" for less time than if the vacuum compensator does not exist.

As a result of all the above, in those engines that include a vacuum compensator (1), upon suddenly pressing on the accelerator, a certain number of r.p.m. (for example, 3000) will be obtained in less time than if the engine did not include the vacuum compensator, and all of this without there being an increase of the CO

production.

Likewise, as a result of all of this, another advantage is that the fuel consumption is reduced as the explosion engine has the vacuum compensator, which all represents an economic savings.

Claims

1. Vacuum compensator for internal combustion engines, which is especially applicable for assembly in automobiles, characterized in that the vacuum compensator (1) mounted in the suction opening for the intake of air from the outside to the box (2) containing the air filter, has a generally hollow cylindrical shape, having one of its bases open, and having in its other base a flexible material body (8), integral to the side surface of the hollow cylindrical body, provided with a circular central opening (9) with a variable diameter, and a series of radial cuts (10) that define some identical circular sectors.
2. Vacuum compensator for internal combustion engines, according to claim 1, characterized in that the nature of the flexible material body (8), as well as the diameter of the circular central opening (9) and the number of radial cuts (10) made in the same are dependent on the characteristics of the engine.
3. Vacuum compensator for internal combustion engines, according to claim 1, characterized in that the maximum height of the hollow cylindrical body is 10 cm. and its inside diameter is equal to or larger than the diameter of the suction opening of the box (2) containing the air filter, in which it is assembled.
4. Vacuum compensator for internal combustion engines, according to claims 1 and 3, characterized in that if it is necessary to assemble a vacuum compensator (1) with a diameter larger than the diameter of the suction opening of the box (2) containing the air filter, there will be suitable reducing cylinders in order to adapt said diameter as much as possible to the diameter of the suction opening.
5. Vacuum compensator for internal combustion engines, according to claim 1, characterized in that in the situation of maximum energy efficiency, the circular sectors (8) are bent in relation to their connection to the hollow cylindrical body, its free ends remaining farthest away from each other.
6. Vacuum compensator for internal combustion engines, according to claim 1, characterized in that in the situation of low energy efficiency combustion, the circular sectors (8) are in the inoperative position with their free ends in the closest position, reducing the air intake section, and increasing the

air penetration rate, throughout the entire intake system.

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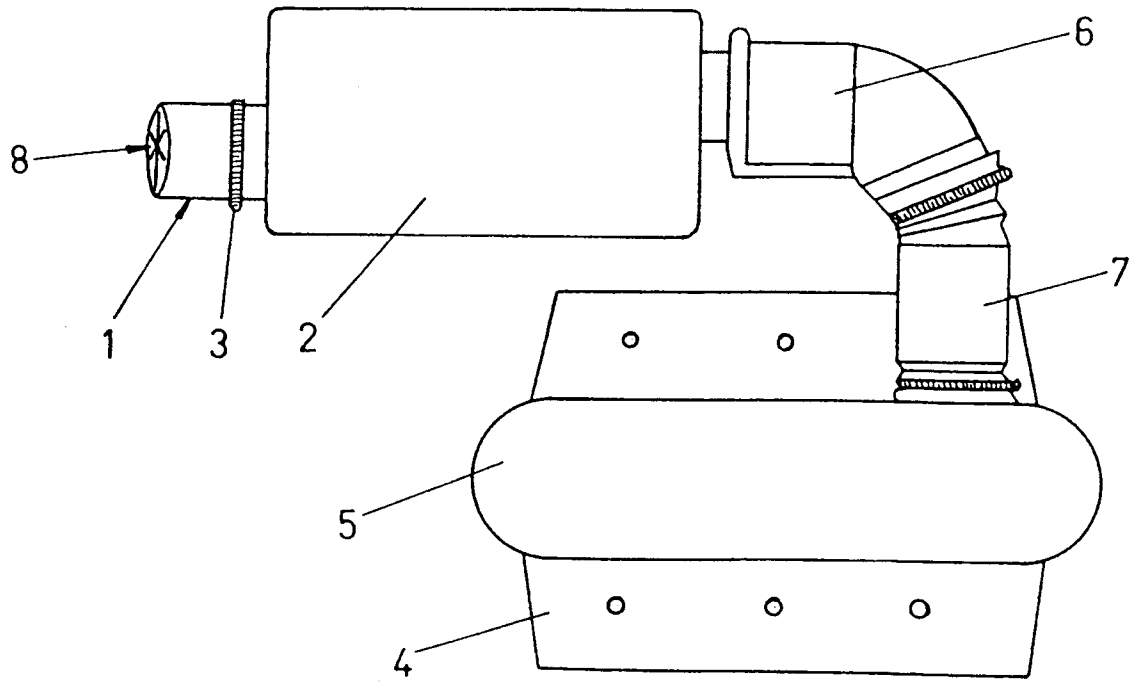


FIG. 1

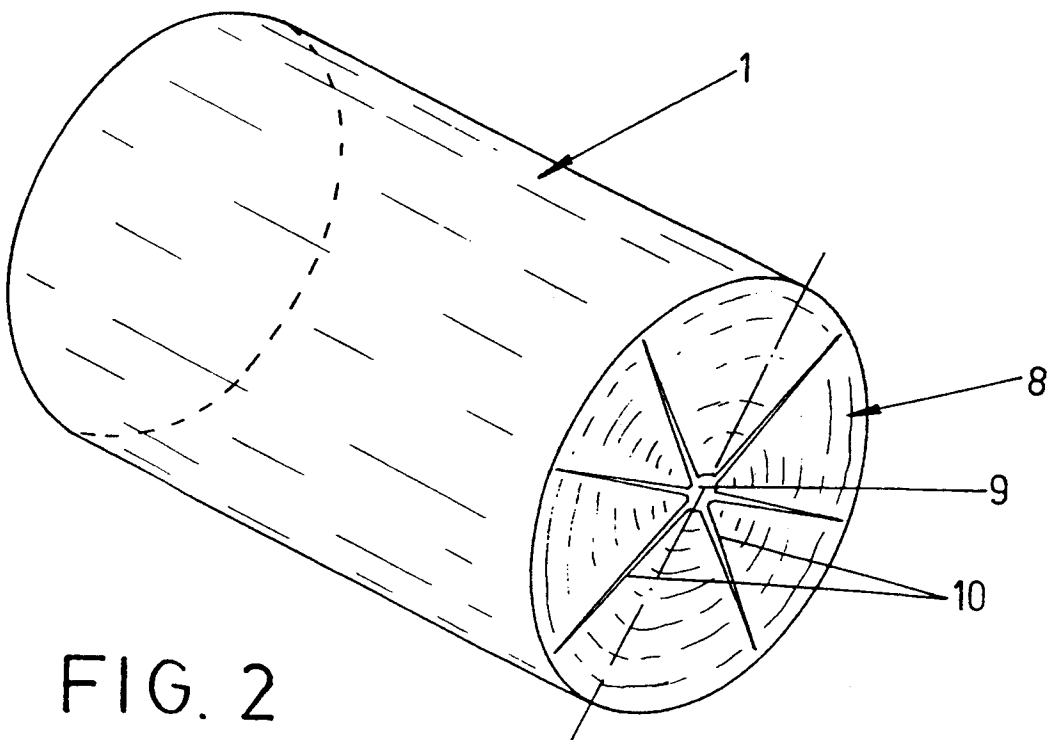


FIG. 2

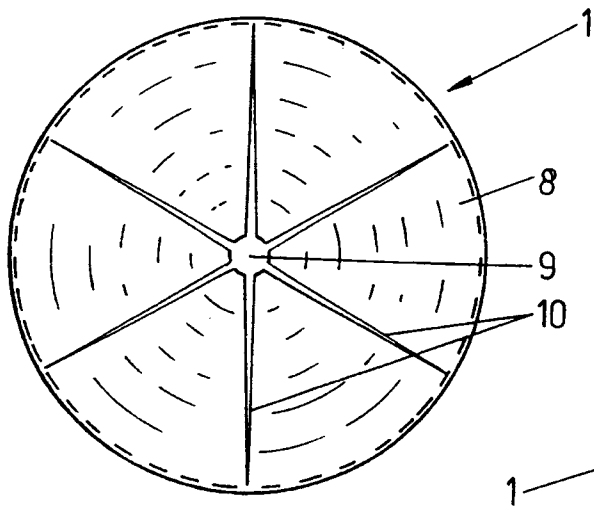


FIG. 3

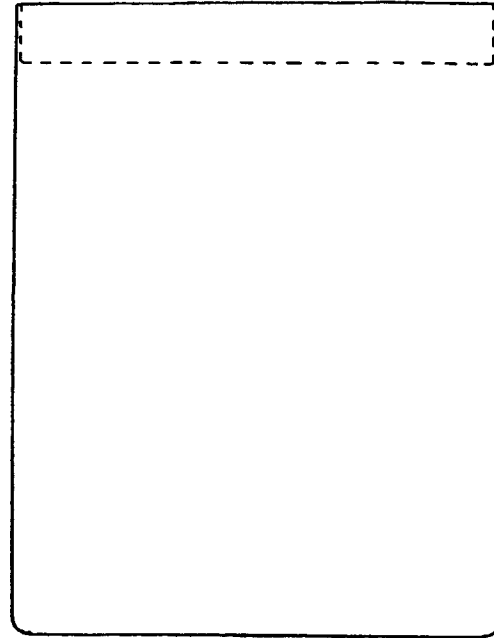


FIG. 4

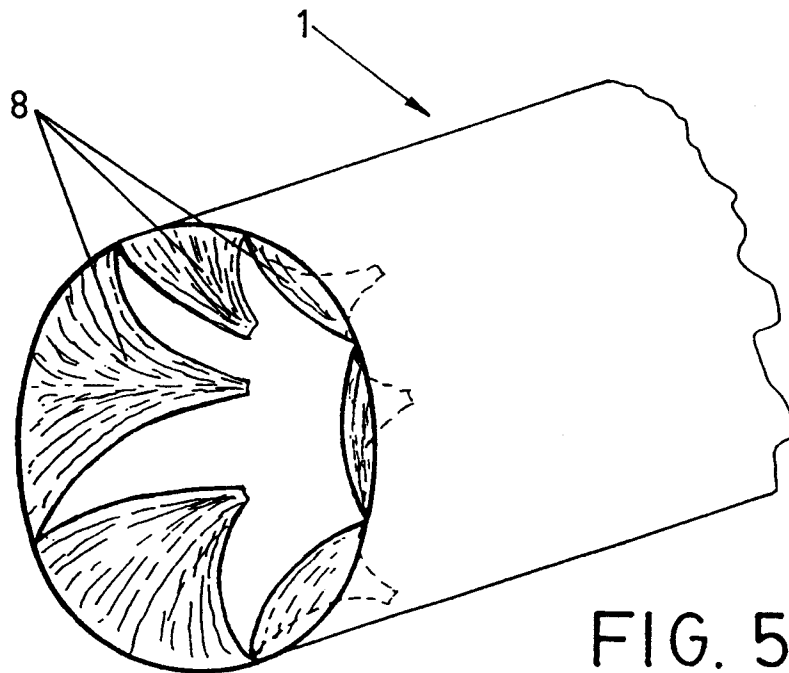


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES 97/00195

A. CLASSIFICATION OF SUBJECT MATTER		
IPC6 F02M35/10, F02B29/00		
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)		
IPC6 F02M35+		
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 practicable, search terms used)		
EPODOC, WPI, CIBEPAT		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2407359 A (KNECHT FILTER WERKE) 25 May 1979 (25.05.79) whole document	1
A	US 3738088 A (COLOSIMO) 12 June 1973 (12.06.73) column 4, lines 18-25; figure 3	1
A	US 4353858 A (SHERBONDY) 03 March 1981 (03.03.81) whole document	1
A	US 4150961 A (ATKINS) 24 April 1979 (24.04.79) whole document	1
A	EP 0013004 A (HIRO MOTORI) 09 July 1980 (09.07.80) page 6, lines 9-25; figures 3-4	2-6
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "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 when the document is taken alone "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		
Date of the actual completion of the international search		Date of mailing of the international search report
27 October 1997 (27.10.97)		31 October 1997 (31.10.97)
Name and mailing address of the ISA/ S.P.T.O		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT
 Information on patent family members

International Application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2407359 A	25.05.79	GB 2006635 A	10.05.79
US 3738088 A	12.06.73	NONE	
US 4253858 A	03.03.81	NONE	
US4150961 A	24.04.79	GB 1565265 A DE 27199221 A JP 53105627 A	16.04.80 13.07.78 13.09.78
EP 0013004 A	09.07.80	JP 55101723 A	04.08.80

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