(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 617 029 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
18.01.2006 Bulletin 2006/03

(21) Application number: **04709637.5**

(22) Date of filing: **10.02.2004**

(51) Int Cl.:
E05F 11/48 *(1968.09)*

(86) International application number:
PCT/ES2004/000055

(87) International publication number:
WO 2004/094758 (04.11.2004 Gazette 2004/45)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PT RO SE SI SK TR
Designated Extension States:
AL LT LV MK

(30) Priority: **22.04.2003 ES 200301027**

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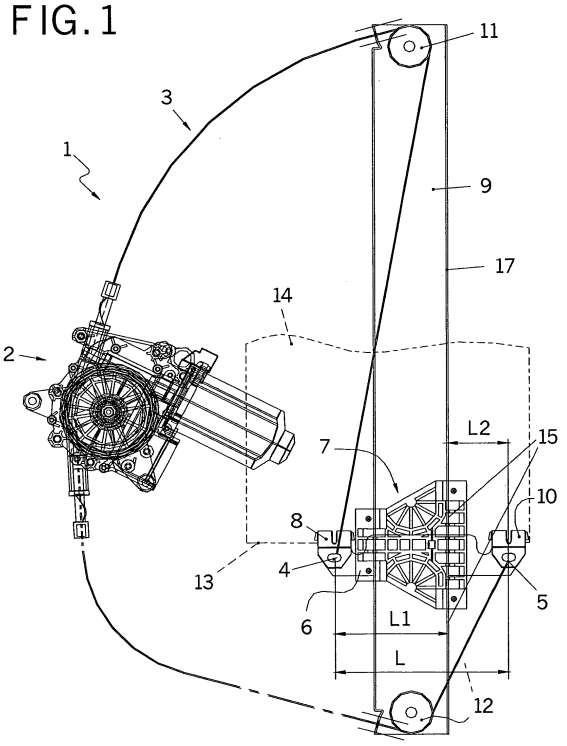
(54) WINDOW REGULATOR FOR MOTOR VEHICLES

(57) It comprises a driving cable the ends of which are joined to a sliding member attached to the lower edge of the window pane which runs through a rail. Attachment of the cable ends to the sliding member is carried out at respective opposed points spaced at a certain distance so that the movement of the cable results in a rotating torque in the sliding member capable of balancing the resistive toque of the window pane. The rotating torque in the sliding member is always in the same direction but having different value depending on the operating direction of the window pane to overcome its own weight.

With a very simple configuration, a low cost and very effective assembly is achieved, capable of overcoming window pitching and blocking effects when moving, even avoiding the use of double rail power window devices.

FIG. 1



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Description

[0001] The invention belongs to the automotive technical field and, more particularly, to the design of single rail power window devices, whether they are motor or hand operated devices.

[0002] The design of a power window device should typically take into account the provision of any mechanical means for compensating, reducing or eliminating the possible pitching of the window pane as it is moved when driven upward or downward. Said pitching occurs due to dynamic friction varying loads arisen during operation of the window pane which, in combination with the cantilever length of the window pane, from its point of anchorage to a sliding member to the free end thereof, result in blocking of the window pane when suddenly making contact the inside and the outside of the window frame where it is moved.

[0003] Conventional power window devices are provided with window pane driving means comprising a driving cable driven by a motor (or by a crank handle, in the case it is hand operated) and window pane fastening means having gripping members holding the window pane by its lower edge, said gripping members being fixedly secured to the sliding member running through a guide rail. The ends of said driving cable are connected to a common point of anchorage in said sliding member.

[0004] Several solutions have been provided for reducing the above pitching problem such as those provided by the same applicant of the present invention, one of which essentially consisting in providing a clamping gripping member having a base body adapted for fastening the window pane lower edge that is hingedly mounted to the sliding member so that it is forcibly displaced angularly to the horizontal before assembly of the window pane, said angular displacement being carried out in a direction opposed to that of the assembly of the window pane. The clamping gripping member design is such that a certain play is allowed for placing the window pane in the correct position in the single rail power window device, and then press-fitting it by means of a screw or any other conventional means.

[0005] The invention provides a new solution for single rail power window devices that is more effective and simpler, allowing application directly when the window pane is in use, said solution being so effective that it even allows replacement of double rail power window devices, thus drastically reducing assembly global costs.

[0006] For this purpose, there is provided a typical configuration of a power window device for motor vehicles essentially comprising a driving cable driven by driving means, such as an electric motor in the case of an automatic power window device. The driving cable has a rising end and a lowering end joined respectively to a sliding member running through a guide rail. Said sliding member is joined to the window pane lower edge so that the window pane is raised or lowered as the sliding member is driven through said rail.

[0007] In contrast with the prior art, in which both ends of the driving cable are anchored at a common point of the sliding member, in the present invention, and as an essential feature thereof, the rising end and the lowering end of said driving cable of the power window device are joined to the sliding member in respective aligned, opposed points that are spaced away at a certain distance. Due to said spacing distance of the driving cable ends, the movement of said cable in any direction results in a rotating torque in the sliding member which allows for balancing the resistive torque of the window pane thus effectively overcoming the usual prior art pitching problems of the window pane as it is moved. The effective solution to the pitching problem is made possible with the power window device of the invention since the load balance is dynamically carried out, that is to say, in use, forces are balanced to each other.

[0008] In prior art devices said pitching occurs as the dynamic center of gravity of the window pane exceeds the line of the driving cable in a point of its travel.

[0009] The spacing distance of the driving cable ends may range from 0 mm (in a conventional power window device) to a maximum value of 300 to 400 mm. Said spacing distance is the sum of the distance from the point of anchorage of the rising end of the cable to the sliding member to the point of contact of said sliding member with the rail plus the distance from the point of anchorage of the lowering end of the cable to the sliding member to said point of contact of the sliding member with the rail.

[0010] In this sense, it is provided that the distance associated with the point of anchorage of the rising end of the cable is substantially longer than the distance associated with the point of anchorage of the lowering end of the cable. Said difference between the values of both anchorage distances is due to the force of gravity according to the window pane weight during lowering movement thereof. During lowering movement of the window, gravity acts on the lowering direction, and therefore it is not an uncompensating force.

[0011] They are many advantages resulting from a power window device as described according to the invention. The power window device of the invention has a simple and economic configuration with which a very effective assembly is achieved, free from the undesirable effects of window pitching and blocking. The use of a single rail power window device as described according to the invention replaces with great effectiveness the prior art single rail power window devices and it even enables replacing conventional double rail power window devices, and therefore global costs of the assembly are dramatically decreased. Besides the simplicity of the power window device of the invention, a further advantage achieved is the avoidance of auxiliary pitching compensating parts, such as the provision of pads in the window frame, etc. On the other hand, with the power window device herein disclosed, the guides in the door may be reduced in size and the size of the sliding member may be also decreased, with the resulting reduction of costs.

[0012] The features and the advantages of the power window device of the present invention will be clearer from the detailed description of a preferred embodiment thereof that will be given hereinafter by way of a non limitative example with reference to the figures herein enclosed, in which:

Fig. 1 is a diagrammatic elevational view of a preferred embodiment of a single rail power window device according to the present invention, shown in its rest position; and

Fig. 2 is a diagrammatic elevational view of the single rail power window device in Fig. 1, shown simultaneously in the operating position, in the rising and lowering movements.

[0013] There follows the different references which have been used to disclose a preferred embodiment of the power window device of the present invention:

(1) single rail power window device;
(2) electric motor;
(3) driving cable:
(4) rising end;
(5) lowering end;
(6) body of the sliding member;
(7) sliding member;
(8, 10) ends of the body of the sliding member;
(9) rail of the power window device;
(11, 12) pulleys;
(13) lower edge of the window pane;
(14) window pane;
(15) point of contact of the sliding member with the rail of the power window device;
(16) side edge;
(B) guide pillar of the window pane in the vehicle door;
(17) sliding and contact area of the rail;
(Fs) tension force of the driving cable in the window rising movement;
(Fb) tension force of the driving cable in the window lowering movement;
(Fxs, Fys) horizontal and vertical component of the tension force (Fs) of the driving cable in the window rising movement;
(Fxb, Fyb) horizontal and vertical component of the tension force (Fb) of the driving cable in the window lowering movement;
(Ms) rising torque; and
(Mb) lowering torque.

[0014] Referring to figures herein attached it is now described an embodiment of a power window device for motor vehicles according to the present invention. According to the view in Fig. 1 of the drawings herein attached in the present specification, there is provided an automatically operated single rail power window device (1) driven by driving means, in this case being an electric motor (2). The electric motor (2) acts on a driving cable (3) having a rising end (4) and a lowering end (5). The rising end (4) is joined to an end (8) of the body (6) of a sliding member (7) running through a guide rail (9) in the power window device (1) whilst the lowering end (5) is joined to an opposed end (10) of said sliding member (7). The anchorage points (8, 10) of the respective rising and lowering ends (4, 5) of the driving cable (3) are spaced apart at a distance (L) which may be a maximum value of about 300-400 mm.

[0015] The sliding member (7) is moved through the rail (9) of the power window device (1) by said driving cable (3) running through corresponding pulleys (11, 12) and it is joined to the lower edge (13) of the window pane (14) (see broken lines in the figure) causing it to be raised or lowered.

[0016] Spacing distance (L) of the ends (4, 5) of the driving cable (3) is the sum of the distances (L1, L2) taken, respectively, from the anchorage point (8, 10) of each end (4, 5) to the contact point (15) of the sliding member (7) running through the sliding area (17) of the rail (9). Distance (L1) should be longer than distance (L2) for taking the force of gravity into consideration according to the weight of the window pane (14) in the lowering movement thereof (balancing load is smaller when lowering).

[0017] With reference to Fig. 2 of the drawings, a rotating torque (Ms) takes place in the rising movement of the window (14) pushing the window pane toward the guide pillar (B), that is the result of the product of the horizontal component (Fxs) of the tension force (Fs) [in the rising movement of the window (14)] of the driving cable (3) at the rising point of anchorage (4) by the distance (L1) to the contact point (15) of the sliding member (7) with the rail (9) of the power window device (1).

[0018] Similarly, a rotating torque (Mb) takes place in the lowering movement of the window (14) that is the result of the product of the horizontal component (Fxb) of the tension force (Fb) [in the lowering movement of the window (14)] of the driving cable (3) at the rising point of anchorage (5) by the distance (L2) to the contact point (15) of the sliding member (7) with the rail (9) of the power window device (1).

[0019] The rising torque (Ms) is substantially greater than the lowering torque (Mb) for balancing the weight of the window (14). The value of distance (L1) is therefore substantially greater than the value of distance (L2), as noted before. Although the value of both rotating torques (Ms, Mb) is different, direction of the rising torque (Ms) is the same than that of the lowering torque (Mb) due to the direction of the action of the corresponding horizontal components (Fxs, Fxb) of the tension forces (Fs, Fb) of the driving cable (3), as it can be seen from fig. 2 of the drawings. Said direction of rotation (clockwise) causes the side edge (16) of the window (14) to be slightly embedded to the pillar (B) of the vehicle door thus balancing the varying forces of dynamic friction arisen during operation of the power window device (1).

[0020] Rising and lowering torques (Ms, Mb) are made possible due to the action that the separate ends (4, 5) of the driving cable (3) exert on the body (6) of the sliding member (7) when moved through the motor (2). The slight clockwise turning movement of the body (6) of the sliding member (7) is made possible due to its configuration which allows a slight rotation in said direction about the contact point (15) with the track of the rail (9) where it is moved.

[0021] Once having been sufficiently described what the power window device of the present invention consists in accordance to the enclosed drawings, it is understood that any detail modification can be introduced as appropriate, provided that variations may alter the essence of the invention as summarised in the appended claims.

Claims

1. Power window device (1) for motor vehicles comprising a driving cable (3) driven by driving means (2), said driving cable (3) having a rising end (4) and a lowering end (5) joined respectively to a sliding member (7) adapted to run through a rail (9), said sliding member (7) being associated with the lower edge (13) of the window pane (14), **characterized in that** said rising and lowering ends (4, 5) of the driving cable (3) are joined to said sliding member (7) at respective opposed points (8, 10) spaced at a distance (L), so that the movement of the cable (3) through said driving means (2) results in a rotating torque (Ms; Mb) on said sliding member (7) capable of balancing the resistive torque of the window pane (14).

2. Power window device as claimed in claim 1, **characterized in that** said spacing distance (L) between said ends (4, 5) of the driving cable (3) is the sum of distance (L1) from the anchorage point (8) of the rising end (4) of the cable (3) to the sliding member (7) to the contact point (15) of said sliding member (7) with the rail (9) plus distance (L2) from the anchorage point (10) of the lowering end (5) of the cable (3) to the sliding member (7) to said contact point (15) of the sliding member (7) with the rail (9) of the power window device (1).

3. Power window device as claimed in claim 1 or claim 2, **characterized in that** distance (L1) associated with the anchorage point (8) of the rising end (4) of the cable (3) is substantially longer than distance (L2) associated with the anchorage point (10) of the lowering end of the cable (5).

4. Power window device as claimed in claim 1, **characterized in that** said spacing distance (L) between the ends (4, 5) of the driving cable (3) has a maximum value ranging from 300 to 400 mm.

FIG. 1

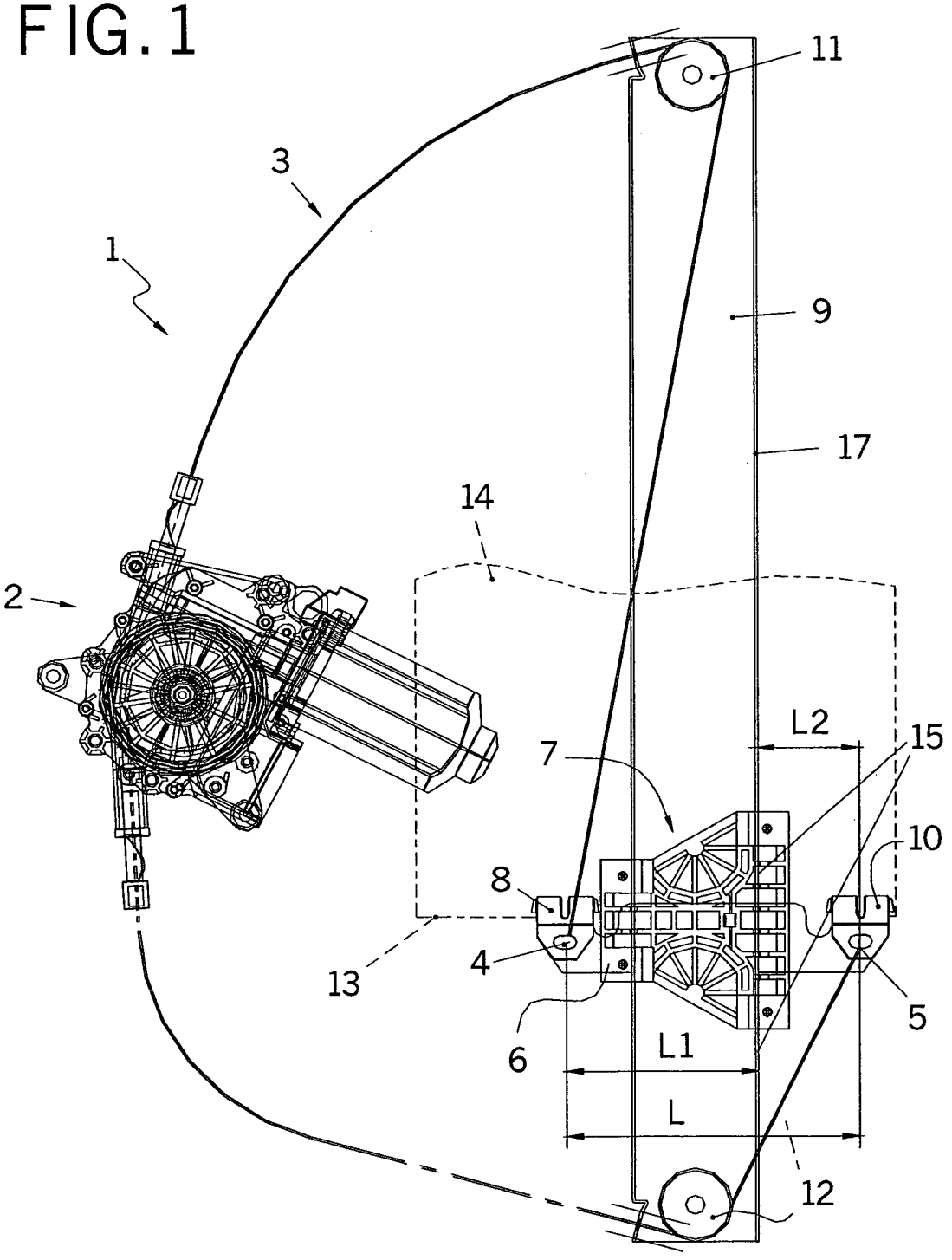
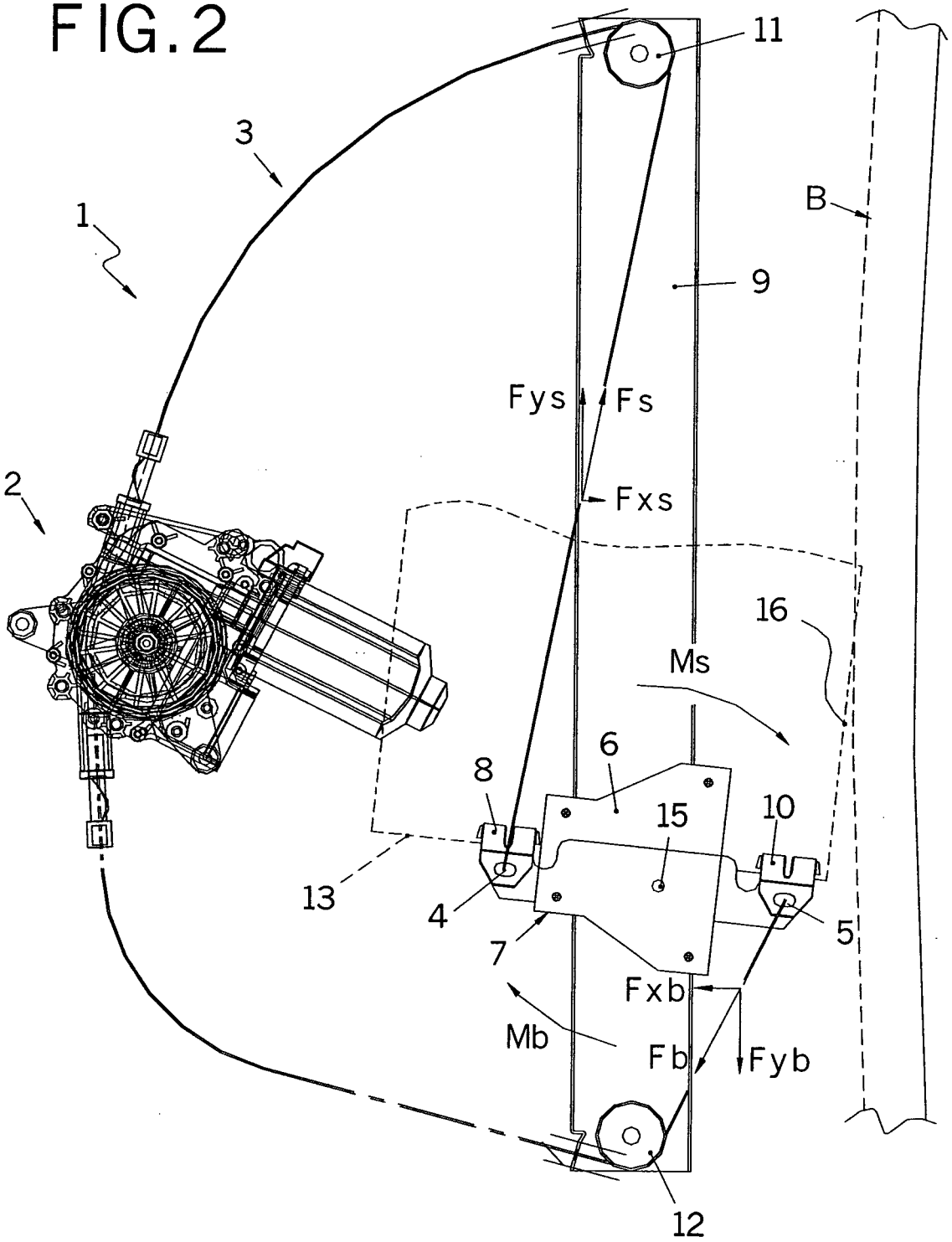


FIG.2



INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2004/000055

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 E05F 11/48

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)

IPC7 E05F 11/48

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)

CIBEPAT, EPODOC, PAJ, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 9228734 A (AICHI MACHINE IND.) 02.09.1997 Abstract; figure 1	1,2
X	JP 9189170 A (MITSUBISHI MOTORS CORP) 22.07.1997 Figures 1-3	1
A	JP 11270223 A (MITSUBISHI MOTORS CORP) 05.10.1999	

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

* Special categories of cited documents:

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 May 2004 (28.05.04)	08 June 2004 (08.06.04)
Name and mailing address of the ISA/ S.P.T.O. Facsimile No.	Authorized officer Telephone No.

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No
PCT/ES2004/000055

Patent document cited in search report	Publication date	Patent familiy member(s)	Publication date
JP 9228734 A	02.09.1997	None	
JP 9189170 A	22.07.1997	None	
JP 11270223 A	05.10.1999	None	

Form PCT/ISA/210 (patent family annex) (July 1992)