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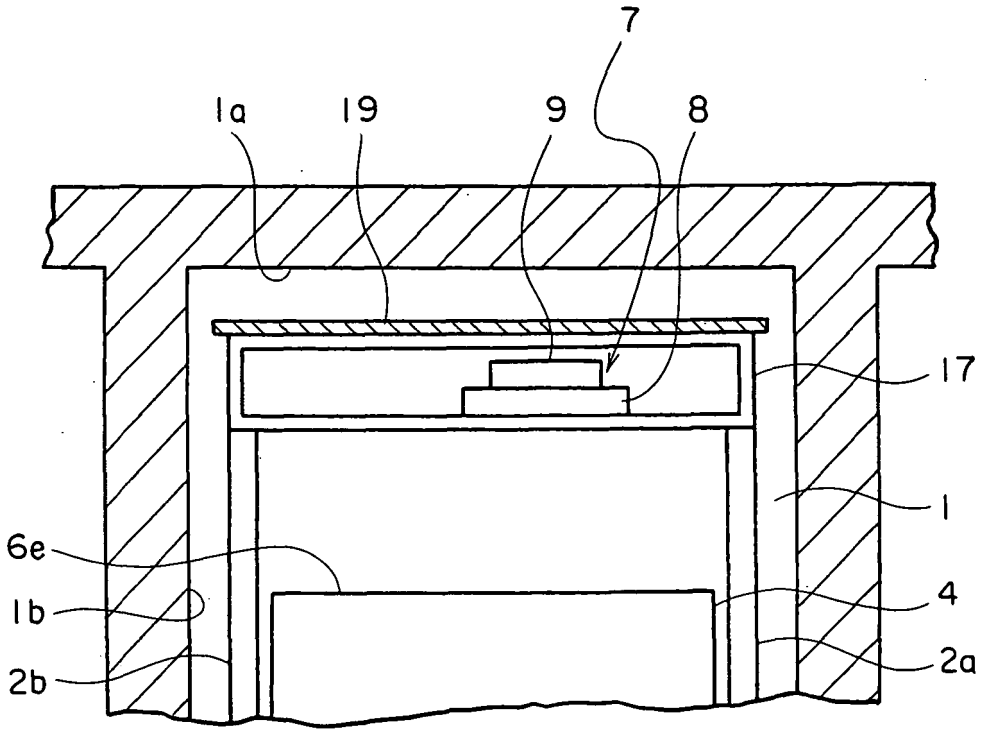
(54) **ELEVATOR APPARATUS**

(57) In an elevator apparatus, a car is raised and lowered in a hoistway by a driving force of a driving machine. The driving machine is supported by a frame body that is arranged in a top portion of the hoistway. On the frame body, there is provided a heat insulator for cutting off heat conducted to the driving machine from outside the frame body. The heat insulator includes, for example, an upper heat insulator fixed to a top portion of the frame body so as to be opposed to a ceiling surface of the hoistway.

FIG. 2



EP 1 886 956 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an elevator apparatus in which a driving machine for raising and lowering a car is arranged in a top portion of a hoistway.

BACKGROUND ART

[0002] In conventional elevator apparatuses, a driving machine for raising and lowering a car is arranged in a top portion of a hoistway. The driving machine is arranged above the car such that the driving machine overlaps the car in a vertical projection plane (see, for example, Patent Document 1).

[0003] Patent Document 1: JP 2000-255933 A

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0004] In such the conventional elevator apparatuses as described above, in which the driving machine is arranged in the top portion of the hoistway, heat from a roof of a building, which is heated by sunlight, is conducted to the top portion of the hoistway, so the top portion is likely to attain high temperature, resulting in a rather short service life of bearings, motor apparatus, etc. used in the driving machine. In particular, in summer months in high temperature or in a building in a high temperature area, an influence of heat on the driving machine is great. To cope with this problem, there is a method available according to which forcible cooling is effected by a fan or the like; however, when, for example, the building remains closed for several days, and the elevator is kept at rest for that period of time, the fan of the elevator apparatus also remains at rest, so the risk of the temperature of the top portion of the hoistway rising is quite high.

[0005] The present invention has been made with a view toward solving the above-mentioned problem in the prior art. It is an object of the present invention to provide an elevator apparatus capable of reducing, with a simple structure, an influence of heat on the driving machine that is arranged in the top portion of the hoistway.

MEANS FOR SOLVING THE PROBLEM

[0006] An elevator apparatus according to the present invention comprises: a car that is raised and lowered within a hoistway; a frame body that is arranged in a top portion of the hoistway; a driving machine supported by the frame body and for raising and lowering the car; a heat insulator provided on the frame body and adapted to cut off heat conducted to the driving machine from outside the frame body.

Further, an elevator apparatus, according to the present invention comprises: a car that is raised and lowered within a hoistway; a driving machine arranged in a top portion of the hoistway, for raising and lowering the car; and a ceiling heat insulator provided on a ceiling surface of the hoistway, for cutting off heat conducted to interior of the hoistway from outside the hoistway.

Furthermore, an elevator apparatus, according to the present invention comprises: a car that is raised and lowered within a hoistway; a driving machine arranged in a top portion of the hoistway, for raising and lowering the car; and an elevator roof heat insulator provided in a region of a roof of a building right above the hoistway, for enhancing a heat insulating property of the region as compared with a heat insulating property of the other regions of the roof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

[Fig. 1] Fig. 1 is a plan view of a main portion of an elevator apparatus according to Embodiment 1 of the present invention.

[Fig. 2] Fig. 2 is a schematic front view of a top portion of a hoistway of Fig. 1.

[Fig. 3] Fig. 3 is a schematic front view of a top portion of a hoistway of an elevator apparatus according to Embodiment 2 of the present invention.

[Fig. 4] Fig. 4 is a schematic front view of a top portion of a hoistway of an elevator apparatus according to Embodiment 3 of the present invention.

[Fig. 5] Fig. 5 is a schematic front view of a top portion of a hoistway of an elevator apparatus according to Embodiment 4 of the present invention.

[Fig. 6] Fig. 6 is a schematic front view of a top portion of a hoistway of an elevator apparatus according to Embodiment 5 of the present invention.

[Fig. 7] Fig. 7 is a schematic front view of a top portion of a hoistway of an elevator apparatus according to Embodiment 6 of the present invention.

[Fig. 8] Fig. 8 is a schematic front view of a top portion of a hoistway of an elevator apparatus according to Embodiment 7 of the present invention.

[Fig. 9] Fig. 9 is a schematic front view of a top portion of a hoistway of an elevator apparatus according to Embodiment 8 of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0008] In the following, preferred embodiments of the present invention will be described with reference to the drawings.

Embodiment 1

[0009] Fig. 1 is a plan view of a main portion of an elevator apparatus according to Embodiment 1 of the present invention. As shown in the figure, inside a hoistway 1, there are installed a pair of car guide rails 2a, 2b

and a pair of counterweight guide rails 3a, 3b. A car 4 is raised and lowered within the hoistway 1 while guided by the car guide rails 2a, 2b. A counterweight 5 is raised and lowered within the hoistway 1 while guided by the counterweight guide rails 3a, 3b.

[0010] The car 4 has a car frame (not shown) and a cage 6 supported by the car frame. The cage 6 has a front surface 6a in which a car entrance is provided, a back surface 6b opposed to the front surface 6a, first and second side surfaces 6c, 6d opposed to each other, a top surface 6e, and a bottom surface (not shown). The counterweight 5 is arranged beside the car 4 such that when the counterweight 5 is at the same height as the car 4, it is opposed to the second side surface 6d.

[0011] The extensions of the central lines of the guide rails 2a, 2b in the vertical projection plane are parallel to and spaced apart from each other in the depth direction of the car 4. That is, the guide rails 2a, 2b are offset with respect to each other in the depth direction of the car 1. The car guide rail 2a is opposed to the first side surface 6c on the rear side of the center of gravity G of the car 4. The car guide rail 2b is opposed to the second side surface 6d on the front side of the center of gravity G of the car 4. The counterweight 5 is arranged in the space within the hoistway 1 and at the rear of the guide rail 2b.

[0012] In the top portion of the hoistway 1, there is arranged a driving machine 7 for raising and lowering the car 4 and the counterweight 5. The driving machine 7 has a driving machine main body 8 including a motor and a brake, and a driving sheave 9 that is rotated by the motor. As the driving machine 7, there is used a thin hoisting machine whose axial dimension is smaller than whose dimension perpendicular to the axial direction thereof. Further, the driving machine 7 is arranged such that the rotation axis of the driving sheave 9 is vertical or substantially vertical.

[0013] Looped around the driving sheave 9 are a plurality of first ropes 11 (of which only one is shown in the figure) and a plurality of second ropes 12 (of which only one is shown in the figure). The first and second ropes 11, 12 have car connection end portions connected to the top portion of the car 4, and counterweight connection end portions connected to the top portion of the counterweight 5, respectively. That is, the car 4 and the counterweight 5 are suspended within the hoistway 1 by the first and second ropes 11, 12 by utilizing a 1:1 roping system.

[0014] The connecting portions of the first ropes 11 on the car 4 and the connecting portions of the second ropes 12 on the car 4 are preferably arranged symmetrically with respect to a center of gravity G within the vertical projection plane. With this arrangement, it is possible to match a suspension center of the car 4 with the center of gravity G.

[0015] In the top portion of the hoistway 1, there are arranged a first car deflector sheave 13 for guiding the first ropes 11 to the top portion of the car 4, a first counterweight deflector sheave 14 for guiding the first ropes 11 to the top portion of the counterweight 5, a second car deflector sheave 15 for guiding the second ropes 12 to the top portion of the car 4, a second counterweight deflector sheave 16 for guiding the second ropes 12 to the top portion of the counterweight 5, and a direction change pulley 17 for turning over the first ropes 11 from the driving sheave 9 toward the first car deflector sheave 13.

[0016] The deflector sheaves 13 through 16 are arranged such that their rotation axes are horizontal. The direction change pulley 17 is arranged such that its rotation axis is vertical or substantially vertical.

[0017] Fig. 2 is a schematic front view showing the top portion of the hoistway 1 of Fig. 1. At the top portions of at least two of the guide rails 2a, 2b, 3a, 3b, there is supported a metal frame body 18 supporting the driving machine 7. While not shown in Fig. 2, the frame body 18 also supports the deflector sheaves 13 through 16 and the direction change pulley 17. The frame body 18 is a structure combining a plurality of structural members including beams and vertical members, and does not cover the driving machine 7, etc.

[0018] The frame body 18 is equipped with an upper heat insulator 19 as an insulator for cutting off the heat conducted to the driving machine 7 from the exterior of the frame body 18. The upper heat insulator 19 is horizontally fixed to the top portion of the frame body 18 so as to be opposed to a ceiling surface 1a of the hoistway 1. The upper heat insulator 19 may be provided so as to overlap the entire car 4 in a vertical projection plane, or so as to overlap solely a portion around the driving machine 7; it should be noted, however, that the larger the area of the heat insulator is, the higher the heat insulating effect for the driving machine 7 becomes. In Fig. 1, the frame body 18 and the upper heat insulator 19 are omitted.

[0019] In this elevator apparatus, with the provision of the upper heat insulator 19 on the frame body 18, it is possible to reduce, with a simple structure, the influence of heat on the driving machine 7, which is arranged in the top portion of the hoistway 1.

Further, an operation of mounting the upper heat insulator 19 to the frame body 18 can be conducted in the plant prior to the shipment of the product, so it is possible to prevent a deterioration in terms of operational efficiency in the installing operation.

Embodiment 2

[0020] Next, Fig. 3 is a schematic front view of the top portion of the hoistway 1 of an elevator apparatus according to Embodiment 2 of the present invention. In the figure, a side heat insulator 20 serving as a heat insulator is fixed to the side surfaces of the frame body 18 so as to be opposed to the hoistway walls 1b. Otherwise, this embodiment is of the same construction as Embodiment 1.

[0021] In this elevator apparatus, the side heat insula-

tor 20 is also fixed to the frame body 18 in addition to the upper heat insulator 19, so it is possible to reduce the influence of heat on the driving machine 7 more reliably. Further, the operation of mounting the side heat insulator 20 to the frame body 18 can also be conducted in the plant prior to the shipment of the product.

Embodiment 3

[0022] Next, Fig. 4 is a schematic front view of the top portion of the hoistway 1 of an elevator apparatus according to Embodiment 3 of the present invention. In the figure, a lower heat insulator 21 serving as the heat insulator is fixed to a lower portion of the frame body 18 so as to be opposed to the top surface 6e of the car 4. Otherwise, this embodiment is of the same construction as Embodiment 2.

[0023] In this elevator apparatus, the lower heat insulator 21 is also fixed to the frame body 18 in addition to the upper heat insulator 19 and the side heat insulator 20, so it is possible to reduce the influence of heat on the driving machine 7 more reliably.

Further, the operation of mounting the lower heat insulator 21 to the frame body 18 can also be conducted in the plant prior to the shipment of the product.

Embodiment 4

[0024] Next, Fig. 5 is a schematic front view of the top portion of the hoistway 1 of an elevator apparatus according to Embodiment 4 of the present invention. In the figure, respectively, superimposed on the surfaces of the heat insulators 19, 20, 21 on the frame body 18 side are metal members 22, 23, 24 reflecting heat conducted to the driving machine 7 from the exterior of the frame body 18. The metal members 22, 23, 24 have undergone a surface treatment to enhance their heat reflectance. Otherwise, this embodiment is of the same construction as Embodiment 3.

[0025] In this elevator apparatus, the heat transmitted through the heat insulators 19, 20, 21 to enter the frame body 18 is reflected by the metal members 22, 23, 24, and at the same time, heat rays radiated from the heat insulators 19, 20, 21 are also reflected by the metal members 22, 23, 24. As a result, it is possible to more reliably reduce the influence of heat on the driving machine 7. Further, intrusion of dust into the frame body 18 from the heat insulators 19, 20, 21 is interrupted by the metal members 22, 23, 24, making it possible to keep the driving machine 7 clean.

Further, a surface treatment is performed on the metal members 22, 23, 24, so it is possible to achieve an improvement in terms of heat reflection efficiency and to more reliably reduce the influence of heat on the driving machine 7.

Embodiment 5

[0026] Next, Fig. 6 is a schematic front view of the top portion of the hoistway 1 of an elevator apparatus according to Embodiment 5 of the present invention. In the figure, a metal member 25 reflecting heat that is conducted to the driving machine 7 from the exterior of the frame body 18 is superimposed on the upper surface of the upper heat insulator 19 so as to be opposed to the ceiling surface 1a of the hoistway 1. A large number of protrusions and recesses are provided on the metal member 25 so as to increase the surface area thereof. Otherwise, this embodiment is of the same construction as Embodiment 3.

[0027] In this elevator apparatus, due to the provision of the metal member 25 on the upper heat insulator 19, it is possible to reflect, by means of the metal member 25, heat rays applied to the upper heat insulator 19, whereby it is possible to more reliably reduce the influence of heat on the driving machine 7.

Further, due to the provision of a large number of protrusions and recesses on the metal member 25, it is possible to promote the heat dissipation from the metal member 25 utilizing the airflow generated within the hoistway 1, which also enables to prevent an increase in the temperature of the driving machine 7.

Embodiment 6

[0028] Next, Fig. 7 is a schematic front view of the top portion of the hoistway 1 of an elevator apparatus according to Embodiment 6 of the present invention. In the figure, fixed to the ceiling surface 1a of the hoistway 1 is a ceiling heat insulator 26 for cutting off heat that is conducted to the interior of the hoistway 1 from the exterior of the hoistway 1 through the ceiling portion thereof. Further, fixed to the hoistway walls 1b of the top portion of the hoistway 1 is a wall surface heat insulator 27 for cutting off heat conducted to the interior of the hoistway 1 from the exterior of the hoistway 1.

[0029] In this elevator apparatus, due to the fixation of the ceiling heat insulator 26 to the ceiling surface 1a, it is possible to efficiently suppress an increase in the temperature in the top portion of the hoistway 1 due to intrusion of heat from the outside, making it possible to reduce the influence of heat on the driving machine 7.

Further, due to the fixation of the wall surface heat insulator 27 to the hoistway walls 1b surrounding the top portion of the hoistway 1, it is possible to more efficiently suppress an increase in the temperature in the top portion of the hoistway 1 due to intrusion of heat from the outside.

[0030] It is also possible for the ceiling heat insulator 26 of Embodiment 6 to be provided on the elevator apparatuses of Embodiments 1 through 5.

Further, it is also possible to superimpose a metal member as that of Embodiments 4, 5 on the ceiling heat insulator.

Embodiment 7

[0031] Next, Fig. 8 is a schematic front view of the top portion of the hoistway 1 of an elevator apparatus according to Embodiment 7 of the present invention. In the figure, fixed to a region of a roof of the building right above the hoistway 1 is an elevator roof heat insulator 28 for enhancing the heat insulation property of that region of the roof as compared with that of the other regions of the roof. Apart from a building heat insulator, which is provided all over the roof, the elevator roof heat insulator 28 is added solely to the region right above the hoistway 1. Otherwise, this embodiment is of the same construction as Embodiment 4.

[0032] In this elevator apparatus, the elevator roof heat insulator 28 is fixed to the roof of the building, so it is possible to efficiently suppress an increase in temperature in the top portion of the hoistway 1, thereby making it possible to reduce the influence of heat on the driving machine 7.

Embodiment 8

[0033] Next, Fig. 9 is a schematic front view of the hoistway 1 of an elevator apparatus according to Embodiment 7 of the present invention. In the figure, a metal member 29 reflecting heat is superimposed on the lower surface of the elevator roof heat insulator 28. Further, the laminated structure formed of the elevator roof heat insulator 28 and the metal member 29 is provided on the roof through the intermediation of a plurality of support legs 30 so as to be spaced apart from the roof by a gap. Otherwise, this embodiment is of the same construction as Embodiment 7.

[0034] In this elevator apparatus, heat rays transmitted through the elevator roof heat insulator 28 are reflected by the metal member 29, so it is possible to efficiently suppress an increase in the temperature in the top portion of the hoistway 1 due to intrusion of heat from the outside, making it possible to reduce the influence of heat on the driving machine 7. Further, due to the provision of a gap between the metal member 29 and the roof, it is possible to more reliably suppress intrusion of heat into the hoistway 1.

[0035] While in the above embodiments the counterweight 5 is arranged beside the car 4, it is also possible for the counterweight to be arranged behind the car such that when it is at the same height as the car, it is opposed to the back surface of the car.

Further, the layout of the elevator apparatus as a whole is not restricted to that of the above embodiments; for example, the present invention is also applicable to an elevator apparatus using the 2:1 roping system.

Yet further, while the above embodiments have only been described in relation to a heat insulating structure, it is also naturally possible to add a cooling means for forcibly cooling the driving machine during operation of the elevator apparatus.

Still further, as the heat insulator, it is possible to use, for example, a flat plate type heat insulator, a sheet-like heat insulator, or a layered heat insulator.

Furthermore, as the metal member, it is possible to use, for example, a flat plate type metal member, or a film-like metal member.

Claims

1. An elevator apparatus, comprising:

a car that is raised and lowered within a hoistway;
a frame body that is arranged in a top portion of the hoistway;
a driving machine supported by the frame body and for raising and lowering the car;
a heat insulator provided on the frame body and adapted to cut off heat conducted to the driving machine from outside the frame body.

2. The elevator apparatus according to Claim 1, wherein the heat insulator includes an upper heat insulator that is fixed to a top portion of the frame body so that the upper heat insulator is opposed to a ceiling surface of the hoistway.

3. The elevator apparatus according to Claim 1, wherein the heat insulator includes a side heat insulator that is fixed to a side surface of the frame body so that the side heat insulator is opposed to a wall of the hoistway.

4. The elevator apparatus according to Claim 1, wherein the heat insulator includes a lower heat insulator that is fixed to a bottom portion of the frame body so that the lower heat insulator is opposed to a top surface of the car.

5. The elevator apparatus according to Claim 1, further comprising a metal member superimposed on the heat insulator, for reflecting heat conducted to the driving machine from the outside of the frame body.

6. The elevator apparatus according to Claim 5, wherein the metal member is subjected to a heat treatment to enhance the heat reflectance of the metal member.

7. The elevator apparatus according to Claim 5, wherein a large number of protrusions and recesses are provided on the metal member so that a surface area of the metal member is increased.

8. An elevator apparatus, comprising:

a car that is raised and lowered within a hoist-

way;
a driving machine arranged in a top portion of the hoistway, for raising and lowering the car; and
a ceiling heat insulator provided on a ceiling surface of the hoistway, for cutting off heat conducted to interior of the hoistway from outside the hoistway.

9. The elevator apparatus according to Claim 8, further comprising a wall surface heat insulator provided on a hoistway wall of the top portion of the hoistway, for cutting off the heat conducted to the interior of the hoistway from the outside of the hoistway.

10. An elevator apparatus, comprising:

a car that is raised and lowered within a hoistway;
a driving machine arranged in a top portion of the hoistway, for raising and lowering the car; and
an elevator roof heat insulator provided in a region of a roof of a building right above the hoistway, for enhancing a heat insulating property of the region as compared with a heat insulating property of the other regions of the roof.

11. The elevator apparatus according to Claim 10, further comprising a metal member superimposed on the elevator roof heat insulator, for reflecting heat.

12. The elevator apparatus according to Claim 11, wherein the elevator roof heat insulator and the metal member form a laminated structure, which is installed on the roof through an intermediation of a support leg so that the laminated structure leaves a gap between the laminated structure and the roof.

FIG. 1

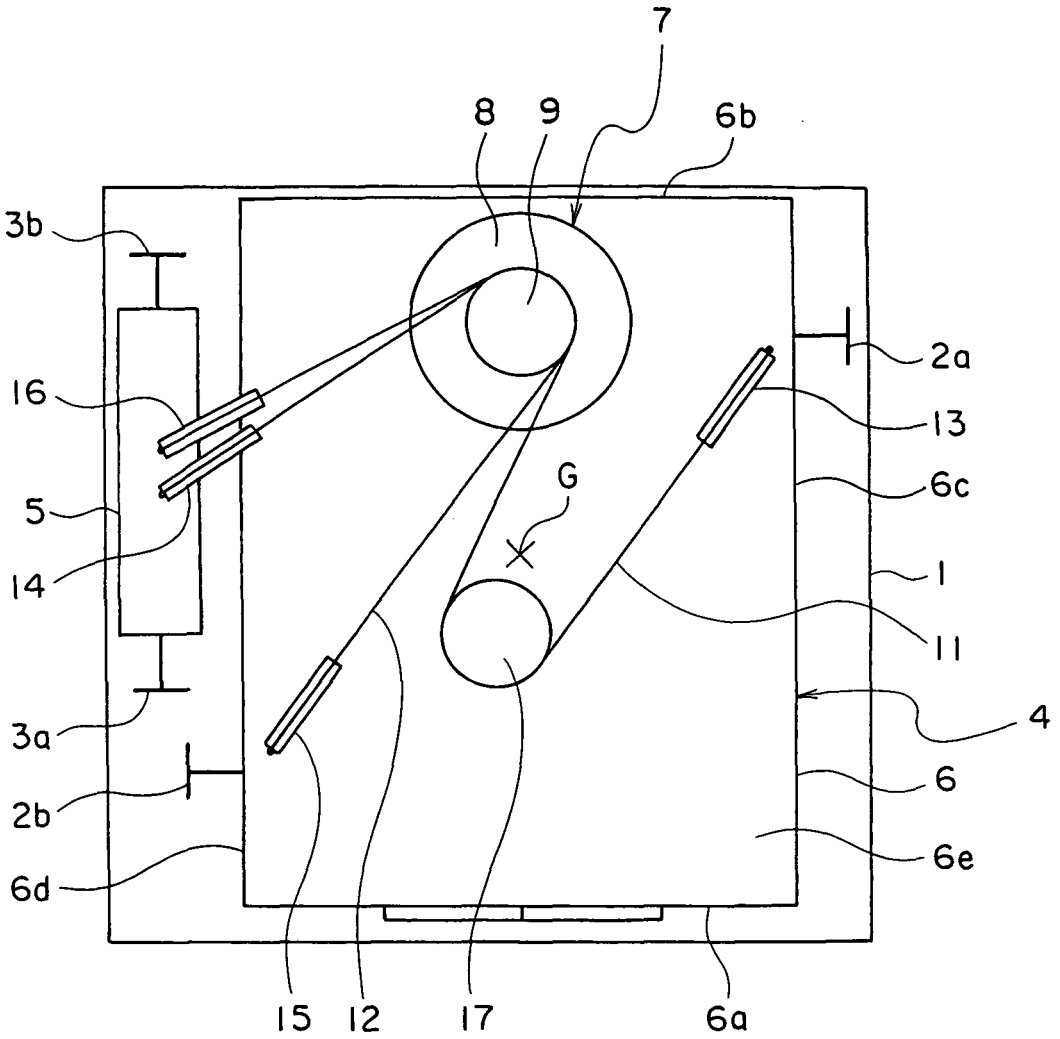


FIG. 2

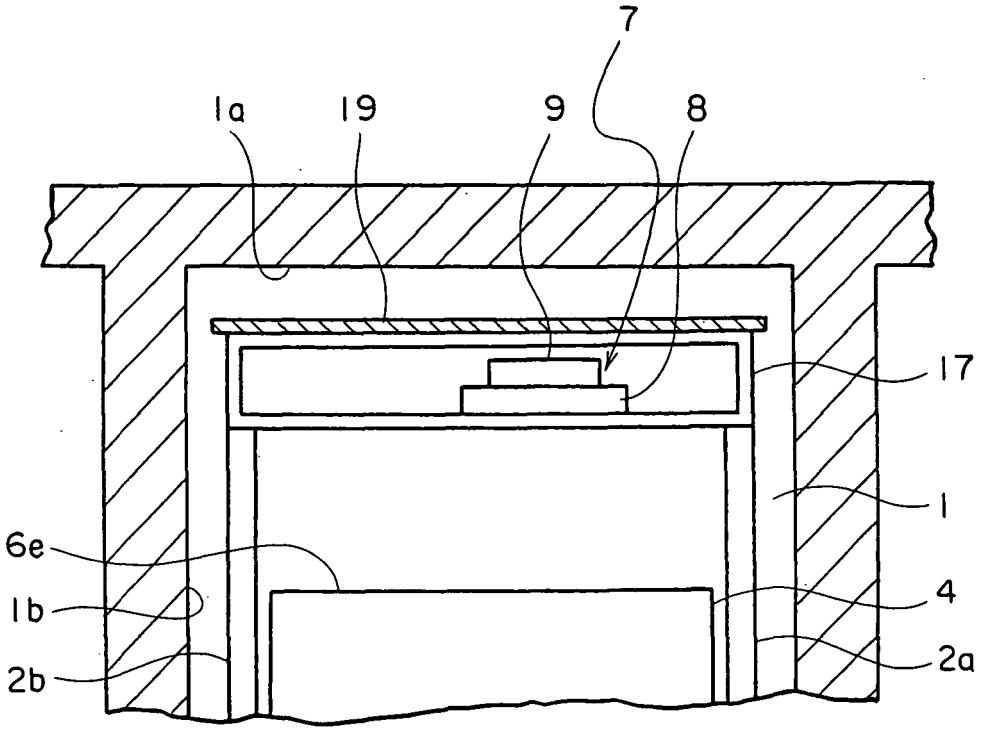


FIG. 3

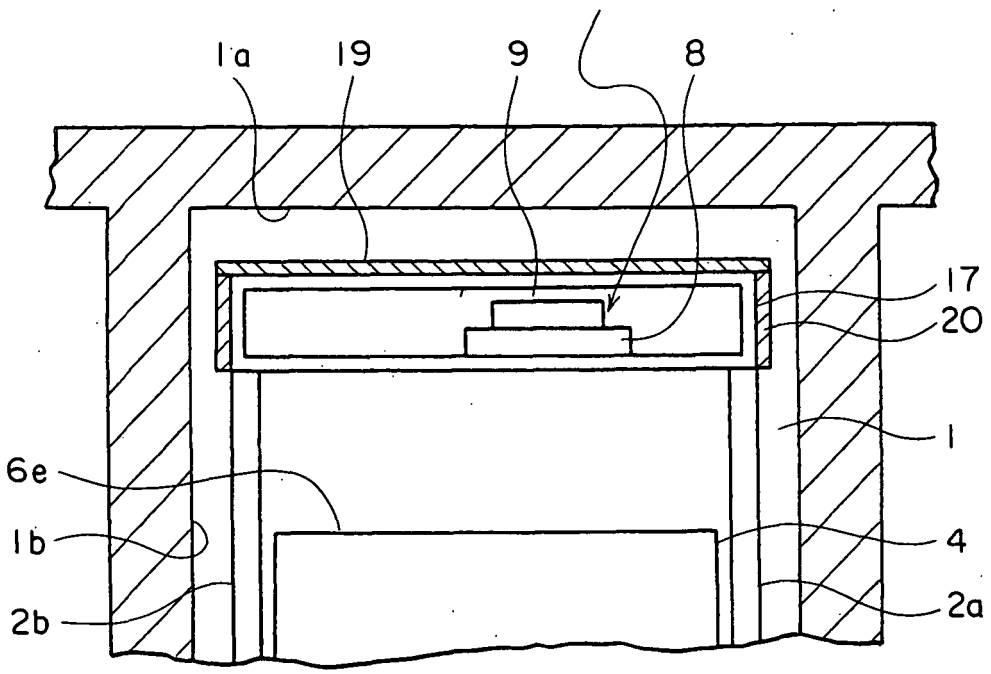


FIG. 4

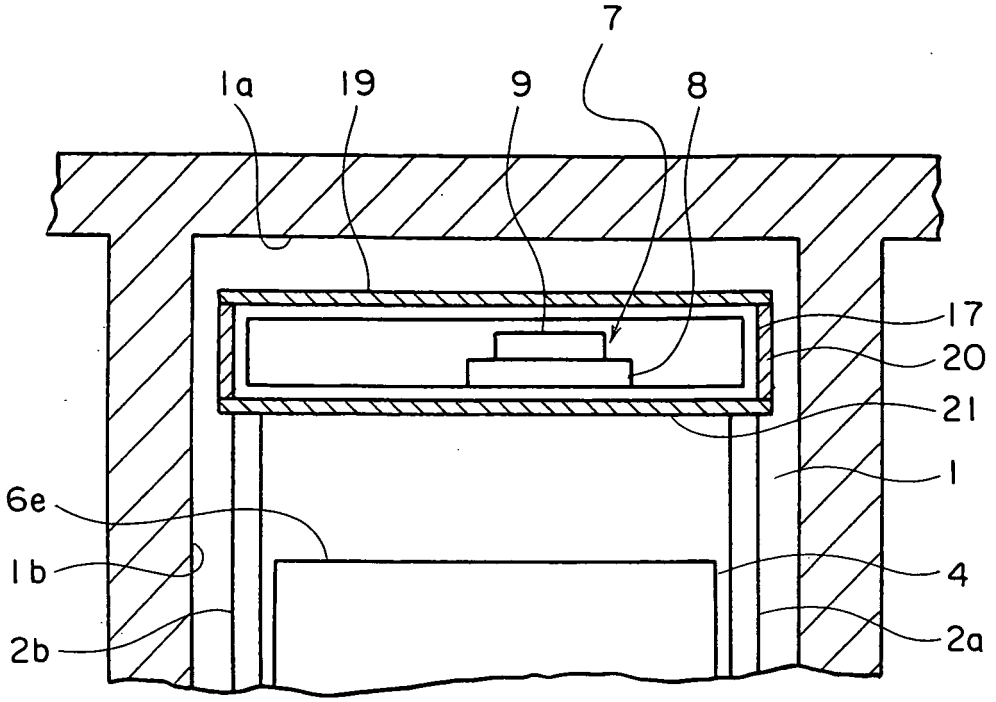

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FIG. 5

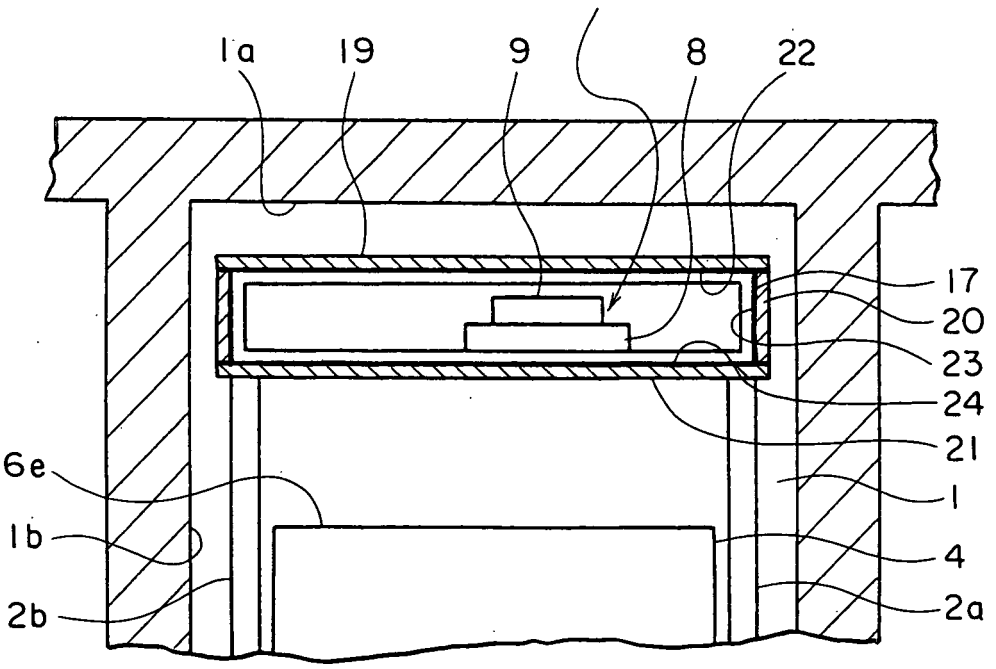
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FIG. 6

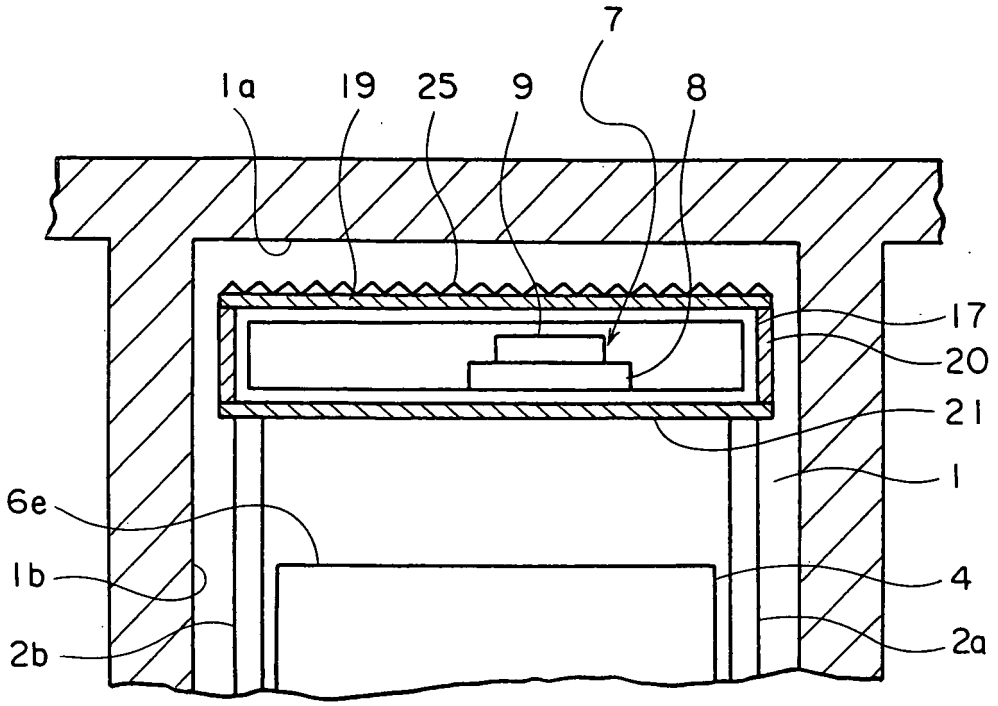

FIG. 7

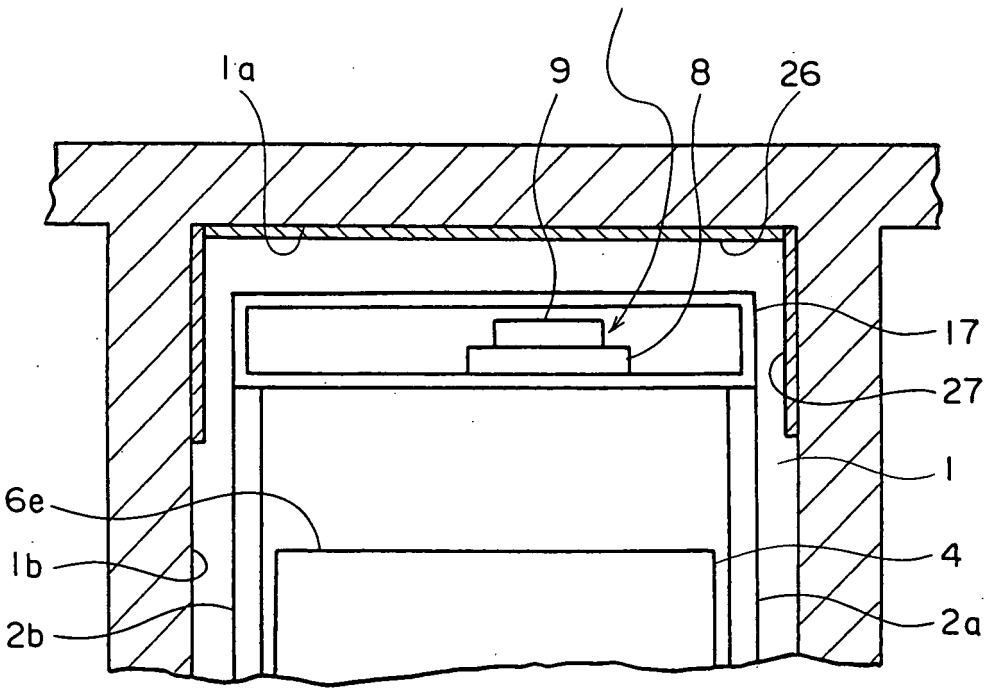

FIG. 8

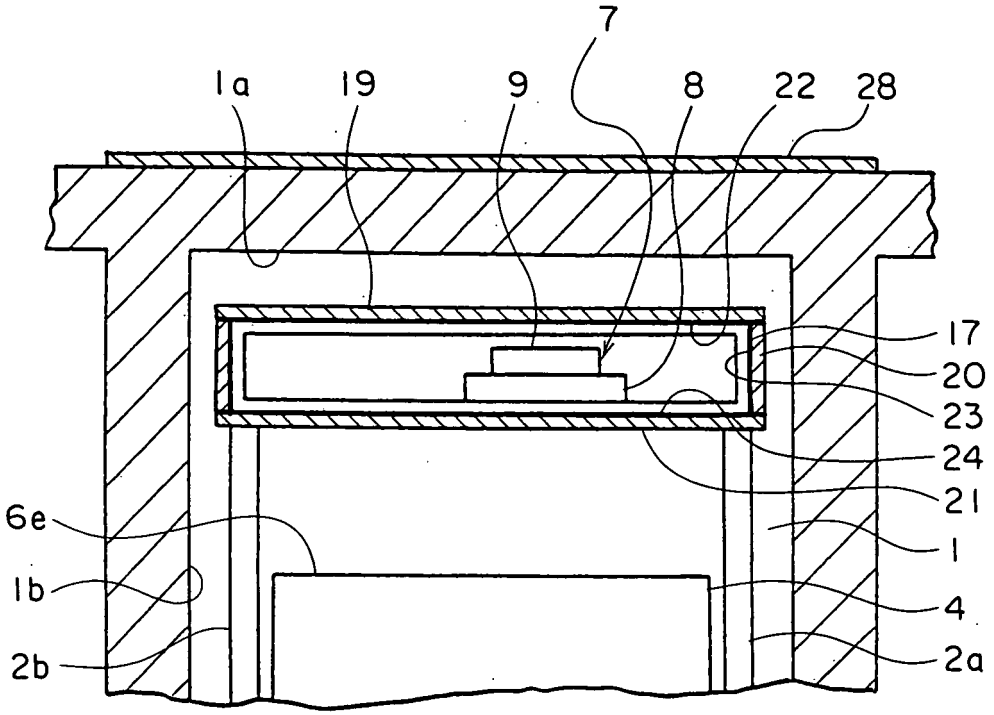
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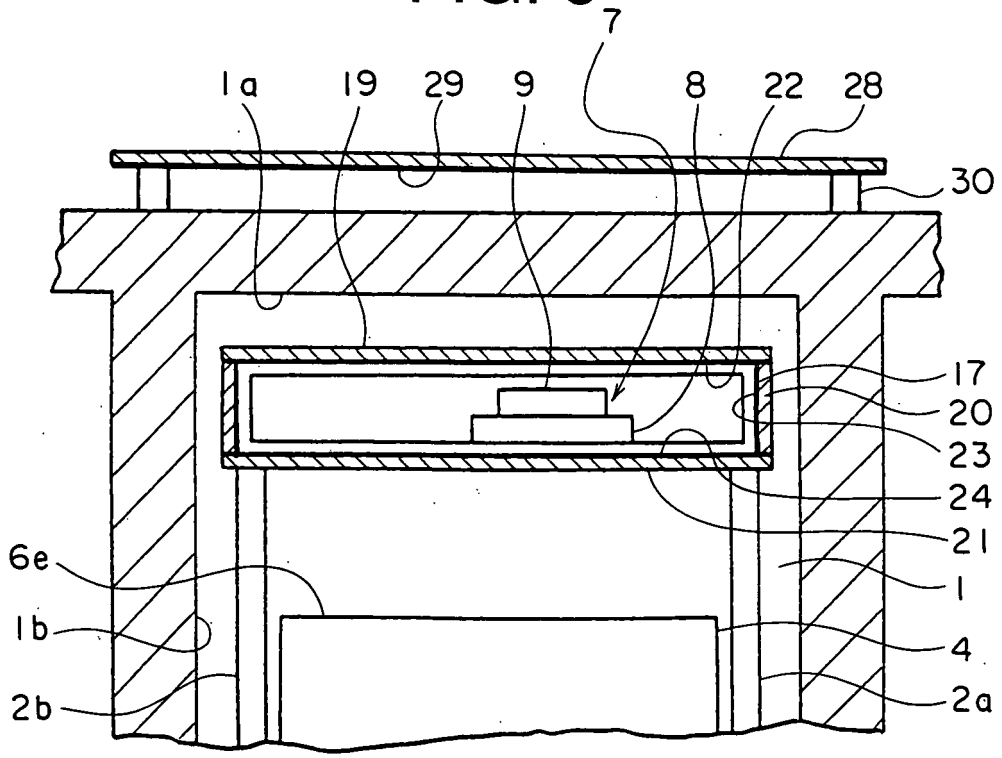
FIG. 9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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2005/010126

A. CLASSIFICATION OF SUBJECT MATTER
B66B7/00(2006.01), ***B66B11/04***(2006.01)

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)
B66B7/00(2006.01)-***B66B11/08***(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2006
Kokai Jitsuyo Shinan Koho 1971-2006 Toroku Jitsuyo Shinan Koho 1994-2006

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 02/24566 A1 (Mitsubishi Electric Corp.), 28 March, 2002 (28.03.02), Abstract; description, page 8, lines 17 to 18; Figs. 1 to 4 & Cn 1390182 A & EP 1327597 A1	1-7
Y	JP 2002-265170 A (Toshiba Elevator and Building Systems Corp.), 18 September, 2002 (18.09.02), Par. Nos. [0020] to [0027]; Figs. 3 to 4 (Family: none)	1-7
A X	JP 2000-73485 A (Misawa Homes Co., Ltd.), 07 March, 2000 (07.03.00), Claims 1, 4 to 5; Par. Nos. [0010] to [0011]; Figs. 1, 4 (Family: none)	1 8

☒ 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
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"P" document published prior to the international filing date but later than the priority date claimed
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"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
28 February, 2006 (28.02.06)	07 March, 2006 (07.03.06)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2005/010126

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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