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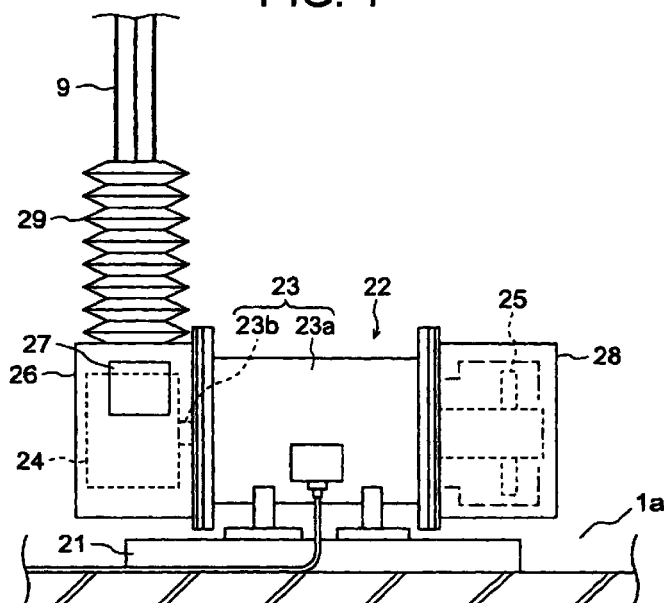
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(54) **ELEVATOR DRIVING DEVICE**

(57) In a driving device for an elevator, a waterproof motor main body is employed. A traction sheave and a brake device are respectively covered with separate waterproof covers, in other words, a waterproof cover for a sheave and a waterproof cover for a brake. The

frame of the motor main body is left exposed in the hoistway. Further, a leading-out part of a rope for leading-out from the waterproof cover for the sheave is surrounded by a tubular waterproof cover.

FIG. 1



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Description

Technical Field

[0001] The present invention relates to a driving device for an elevator installed on the bottom part of a hoistway, and more particularly to a waterproof structure thereof.

Background Art

[0002] Fig. 11 is a structural view showing one example of a conventional elevator in which a rope is deployed. Fig. 12 is a structural view showing an enlarged bottom part of the hoistway of Fig. 11 and showing a state where the car is lowered to a lowermost descending position thereof.

[0003] In the figures, a hoisting machine 2 is disposed in the bottom part 1a of the hoistway 1. The hoisting machine 2 includes a motor 2, a traction sheave 4 rotated by the motor 3, and a brake device 5. The hoisting machine 2 is entirely covered with a waterproof cover 6. The intermediate part of a rope 9 for suspending the car 7 and a counterweight 8 in the hoistway 1 is wound around the traction sheave 4. The waterproof cover 6 is provided with an opening part 6a for leading out the rope 9.

[0004] Both ends of the rope 9 are fixed at the upper part of the hoistway 1. Further, the rope 9 is wound around first and second return pulleys 10 and 11 provided at the upper part of the hoistway 1.

[0005] In such a conventional elevator as described above, since the hoisting machine 2 is covered with the waterproof cover 6, even when the bottom part 1a of the hoistway 1 is submerged under water during a flood or the like, the hoisting machine 2 is not immediately submerged in water. However, if the water level exceeds the height of the opening part 6a provided in the waterproof cover 6, water will even enter into the waterproof cover 6.

[0006] Fig. 12 shows a state where the car 7 is lowered to a lowermost descending position thereof (a state where the car is lowered below a lowermost floor and runs into a buffer (not shown) and stops). In this state, assuming that the height from the bottom surface of the hoistway 1 to the bottom surface of the car 7 is H and the clearance required between the car 7 and the opening part 6a of the waterproof cover 6 at that time is g, the height h1 from the bottom surface of the hoistway 1 to the opening part 6a of the waterproof cover 6 is expressed by $H1 = H - g$. In other words, when the bottom part 1a of the hoistway 1 is submerged in water, if the height of the water surface is located within the range of h1, the hoisting machine 2 will not be submerged under water, so that damage can be avoided.

[0007] However, since the above-described waterproof cover 6 serves to cover the entire part of the hoisting machine 2, both its size and weight are increased.

Therefore, the maintenance space at the bottom part 1a of the hoistway 1 is restricted, hence, much considerable effort is needed to attach/detach or move the waterproof cover 6.

[0008] Further, since the motor 3 is surrounded by the waterproof cover 6, sufficient heat radiation cannot be achieved, making high temperatures easily achievable. Thus, countermeasures such as using a motor 3 with high rated output to suppress the rise in temperature or increasing the insulating degree of the windings have been required. However, these have merely been factors to increase the size or the cost of the motor 3.

[0009] Still further, the entry of water can only be prevented when the water level is not higher than the height h1 of the opening part 6a of the waterproof cover 6.

[0010] Japanese Utility Model Application Laid-open No. Sho 63-45761 discloses an elevator in which a waterproof case is provided on the bottom part of a hoistway and a buffer is provided in the waterproof case. However, in this elevator, the hoisting machine is installed in a machine room at an upper part of the hoistway and no waterproof structure for the hoisting machine is disclosed therein.

[0011] Further, Japanese Utility Model Application Laid-open No. Sho 58-92269 discloses an elevator in which the hoisting machine is disposed on the bottom part of a hoistway and the motor and controller are arranged at positions higher than the sheave of the hoisting machine. However, according to this countermeasure, the hoisting machine will be submerged in water at a water level lower than that when the waterproof cover 6 shown in Fig. 12 is employed.

Disclosure of the Invention

[0012] The present invention has been made in order to solve the above-described problems, and therefore has an object to provide a driving device for an elevator which can ensure a wide space on the bottom part of a hoistway by decreasing the size and weight of a waterproof cover, and in which the motor will have good heat radiation characteristics and the hoisting machine is not submerged under water even when water reaches a higher position.

[0013] The driving device for an elevator according to the present invention is comprised of: a waterproof motor including a motor main body having a rotor in a frame and a motor shaft rotated by the motor main body, disposed on the bottom part of a hoistway; a traction sheave attached to the motor shaft, around which a rope for elevating and lowering a car is wound; and a brake device for braking the rotation of the motor shaft, wherein waterproof covers for covering the traction sheave and the brake device are attached to the motor main body so as to leave the frame exposed.

Brief Description of the Drawings

[0014]

Fig. 1 is a frontal view showing a driving device for an elevator according to Embodiment 1 of the present invention;

Fig. 2 is a plan view showing the driving device for an elevator of Fig. 1;

Fig. 3 is a frontal view showing a car at a lowermost position, compressing the waterproof cover for a rope, shown in Fig. 1;

Fig. 4 is a frontal view showing a driving device for an elevator according to Embodiment 2 of the present invention;

Fig. 5 is a frontal view showing the main parts of the waterproof cover for a rope of the driving device for an elevator according to Embodiment 3 of the present invention;

Fig. 6 is a plan view showing the waterproof cover for the rope shown in Fig. 5;

Fig. 7 is a side view showing the waterproof cover for the rope shown in Fig. 5;

Fig. 8 is a frontal view showing a driving device for an elevator according to Embodiment 4 of the present invention;

Fig. 9 is a circuit diagram showing an electric circuit including the heat generating member shown in Fig. 8;

Fig. 10 is an exploded perspective view showing main parts of a driving device for an elevator according to a fifth embodiment of the present invention;

Fig. 11 is a structural view showing one example of a conventional elevator with a rope deployed; and

Fig. 12 is a structural view showing the expanded bottom part of the hoistway shown in Fig. 11.

Best Modes for Carrying Out the Invention

[0015] Now, preferred embodiments of the present invention will be described with reference to the drawings.

Embodiment 1

[0016] Fig. 1 is a frontal view showing a driving device for an elevator according to Embodiment 1 of the present invention. Fig. 2 is a plan view showing the driving device for an elevator shown in Fig. 1. Fig. 3 is a frontal view showing a car at a lowermost position, compressing the waterproof cover for a rope, shown in Fig. 1. In this case, the entire configuration of the elevator is the same as in Fig. 11 except for the driving device.

[0017] Referring to the drawings, a base 21 is disposed on the bottom part 1a of a hoistway 1. A hoisting machine 22 for elevating and lowering a car 7 is disposed on the base 21. The hoisting machine 22 has a

waterproof motor 23, a traction sheave 24, and a brake device 25.

[0018] The waterproof motor 23 includes a motor main body 23a provided with a rotor and a winding or the like in a frame, and a motor shaft 23b rotated by the motor main body 23a. The traction sheave 24 is fixed to the motor shaft 23b and a rope 9 for elevating and lowering the car 7 is wound around the traction sheave from an upper part thereof. The brake device 25 is connected to an end part in an axial direction of the motor 23 opposite to the traction sheave 24 to brake the rotation of the motor shaft 23b.

[0019] To one end face in the axial direction of the motor main body 23a, a waterproof cover 26 for a sheave made of steel plate, for covering the traction sheave 24 is tightly affixed. The waterproof cover 26 for the sheave is provided with an openable inspection window 27. To the other end face in the axial direction of the motor main body 23a, a waterproof cover 28 made of steel plate for covering the brake device 25 is tightly affixed. These waterproof covers 26 and 28 may also be made of plastic. In this case, all or a part of the waterproof-covers 26 and 28 may be transparent. Further, the frame of the motor 23 is not covered with the waterproof covers 26 and 28, and is exposed in the hoistway 1.

[0020] To an upper part of the waterproof cover 26, a tubular waterproof cover 29 for the rope for surrounding the rope leading-out from the waterproof cover 26 for the sheave is connected. The waterproof cover 29 for the rope has a bellows structure stretchable in the direction of elevation of the car 7.

[0021] In the above-described driving device for the elevator, the motor main body 23a has a waterproof structure, the whole motor 23 need not be covered with a waterproof cover and only the traction sheave 24 and the brake device 25 are respectively covered with the separate waterproof covers 26 and 28. Thus, the all of the waterproof covers 26, 28 and 29 can be made compact and sufficient maintenance work space for the bottom part 1a of the hoistway 1 can be ensured. Further, since the individual waterproof covers 26, 28 and 29 are small and light, attaching and detaching them are greatly facilitated.

[0022] Still further, since the motor 23 is not surrounded with a waterproof cover, the heat radiation characteristics of the motor 23 are good and the size and cost of the motor 23 can be kept from increasing.

[0023] Still further, even when the car 7 is lowered to its lowermost position as shown in Fig. 3, the waterproof cover 29 for the rope is not broken, but only compressed. Accordingly, height h2 from the bottom surface of the hoistway 1 to the upper end part of the waterproof cover 29 for the rope, that is to say, the water level at which the hoisting machine 22 is submerged in water can be made higher than the height h1 in the conventional example.

[0024] Furthermore, either the inspection window 27 or the waterproof covers 26 and 28 composed of

transparent plastic are provided. Accordingly, inspections can be carried out without removing the waterproof covers 26 and 28 so that workability is improved. The inspection window alone may also be made transparent.

[0025] Note that, in Embodiment 1, although the waterproof cover 29 for the rope having the bellows structure is used, where the waterproof cover for the rope does not interfere with the car 7, a bellows structure need not be employed.

Embodiment 2

[0026] According to Embodiment 1, although the traction sheave 24 is arranged at one end part of the motor 23 and the brake device 25 is arranged at the other end thereof respectively, as shown in Fig. 4, the traction sheave 24 and the brake device 25 may both be arranged at one end part of the motor 23. Here, the traction sheave 24 and the brake device 25 may also be covered with one waterproof cover 40.

Embodiment 3

[0027] Fig. 5 is a frontal view showing main parts of a waterproof cover for a rope of a driving device for an elevator according to Embodiment 3 of the present invention, Fig. 6 is a plan view showing the waterproof cover for the rope shown in Fig. 5, and Fig. 7 is a side view showing the waterproof cover for the rope shown in Fig. 5.

[0028] In this embodiment, a pair of rollers 30 and a pair of slide plates 31 serving as rope protecting members for preventing damage to rope 9 due to contact with the waterproof cover 29 are provided inside the waterproof cover 29. Other configurations are equal to those of Embodiment 1.

[0029] In such a driving device for an elevator as described above, for example, even where the waterproof cover 26 for a sheave is inclined, the rope 9 does not directly come into contact with the waterproof cover 29 for the rope, so that the rope 9 or the waterproof cover 29 for the rope can be prevented.

Embodiment 4

[0030] Fig. 8 is a frontal view showing a driving device for an elevator according to Embodiment 4 of the present invention, and Fig. 9 is a circuit diagram showing an electric circuit including the heat generating member shown in Fig. 8.

[0031] In the figures, the heat generating member 32 that generates heat upon turning on power is provided in a waterproof cover 26 for a sheave. A power source 33 and a switch 34 are connected to the heat generating member 32. Other configurations are equal to those of Embodiment 1.

[0032] Generally, since most of the bottom parts 1a

of hoistways 1 are provided below ground level, humidity frequently becomes high. Accordingly, vapor condensation is liable to be generated in the inner part of the waterproof cover 26 for the sheave. However, when the inner part of the waterproof cover 26 for the sheave is heated and dried by the heat generating body 32, the inner part of the waterproof cover 26 for the sheave can be kept from corroding due to the vapor condensation.

10 Embodiment 5

[0033] Fig. 10 is an exploded perspective view showing main parts of a driving device for an elevator according to Embodiment 5 of the present invention. It is an object of Embodiment 5 to reduce manufacturing costs to lower than that of the configuration shown in Embodiment 1.

[0034] In Fig. 10, in an axial end part of a motor main body 23a, an attaching part 23c for attaching a brake device 25 is provided. Further, in the axial end face 23d of the motor main body 23a, a plurality of screw holes 23e are provided. A pair of circular arc shaped adapter plates 34a and 34b which are combined with each other to form one ring are connected to the axial end face 23d of the motor main body 23a through a silicone sealing material 41, and fixed to the motor main body 23a through a plurality of screws 35.

[0035] The adapter plates 34a and 34b are provided with a plurality of through holes 34c through which the screws 35 pass. Further, in the outer sides of the holes 34c of the adapter plates 34a and 34b, a plurality of screw holes 34d are provided.

[0036] To the adapter plates 34a and 34b, a waterproof cover 28 for a brake is tightly fixed through a ring-shaped rubber packing 36. In the rubber packing 36 and the waterproof cover 28 for the brake, a plurality of through holes 36a and 28a corresponding to the screw holes 34d are respectively provided. The waterproof cover 28 for the brake and the rubber packing 36 are fixed to the adapter plates 34a and 34b through a plurality of screws 37 screwed to the screw holes 34d through the through holes 36a and 28a. Other configurations are the same as those of Embodiment 1.

[0037] Usually, the outer peripheral part of the motor main body 23a is formed with a casting and machine work is abbreviated at the axial end face 23d of the brake device 25 side so that a casting skin remains therein. This is because the attaching part 23c for attaching the brake device 25 interferes with the machine work. Therefore, even when the waterproof cover 28 for the brake is directly attached to the motor main body 23a, there is a fear that gaps clearances may be generated, allowing water to enter.

[0038] On the contrary, according to Embodiment 5, the waterproof cover 28 for the brake is attached to the motor main body 23a through the adapter plates 34a and 34b and the rubber packing 36. Further, the silicon sealing material 41 is provided between the adapter

plates 34a and 34b and the motor main body 23a.

[0039] Although the silicon sealing material 41 is initially liquid, it cures over time. Hence, the adapter plates 34a and 34b become tightly fixed to the motor main body 23a without any gaps. The surfaces of the adapter plates 34a and 34b are smoothly machined and the adapter plates 34a and 34b are tightly connected to the waterproof cover 28 for the brake through the rubber packing 36 so that the entry of water is prevented.

[0040] According to the above-described attaching structure of the waterproof cover 28 for the brake, even when the axial end face 23d of the motor main body 23a is not machined, the entry of water can be assuredly prevented, thereby allowing a reduction of production costs.

[0041] In Embodiment 5, although the attaching structure of the waterproof cover 28 for the brake is described, such an attaching structure can be also applied to the waterproof cover 26 side for a sheave.

Claims

1. A driving device for an elevator, comprising:

a waterproof motor including a motor main body having a rotor in a frame and a motor shaft rotated by the motor main body, disposed on the bottom part of a hoistway;
a traction sheave attached to the motor shaft, around which a rope for elevating and lowering a car is wound; and
a brake device for braking the rotation of the motor shaft, characterized in that waterproof covers for covering the traction sheave and the brake device are attached to the motor main body so as to leave the frame exposed.

2. A driving device for an elevator as set forth in claim 1, wherein the waterproof covers include a waterproof cover for a sheave for covering the traction sheave and a waterproof cover for a brake for covering the brake device.

3. A driving device for an elevator as set forth in claim 2, wherein a heat generating member for heating and drying the waterproof cover for the sheave is provided in the waterproof cover for the sheave.

4. A driving device for an elevator as set forth in claim 1, wherein at least a part of the waterproof covers is transparent.

5. A driving device for an elevator as set forth in claim 1, wherein an inspection window is provided in each of the waterproof covers.

6. A driving device for an elevator as set forth in claim 1, wherein the waterproof cover is connected to the

motor main body through adapter plates tightly fixed to the outer circumferential surface of the motor main body through a sealing material and a rubber packing joining to the adapter plates.

7. A driving device for an elevator as set forth in claim 1, further comprising a tubular waterproof cover for a rope, connected to a rope leading-out portion of the waterproof cover and for surrounding the leading-out part of the rope.

8. A driving device for an elevator as set forth in claim 7, wherein the waterproof cover for the rope has a bellows structure stretchable in a direction for elevating the car, and used in an expanded state during ordinary operation to be compressed by the car when the car is lowered to a lowermost position thereof.

9. A driving device for an elevator as set forth in claim 7, wherein rope protecting members for preventing damage to the rope due to contact with the waterproof cover for the rope are provided inside the waterproof cover for the rope.

FIG. 1

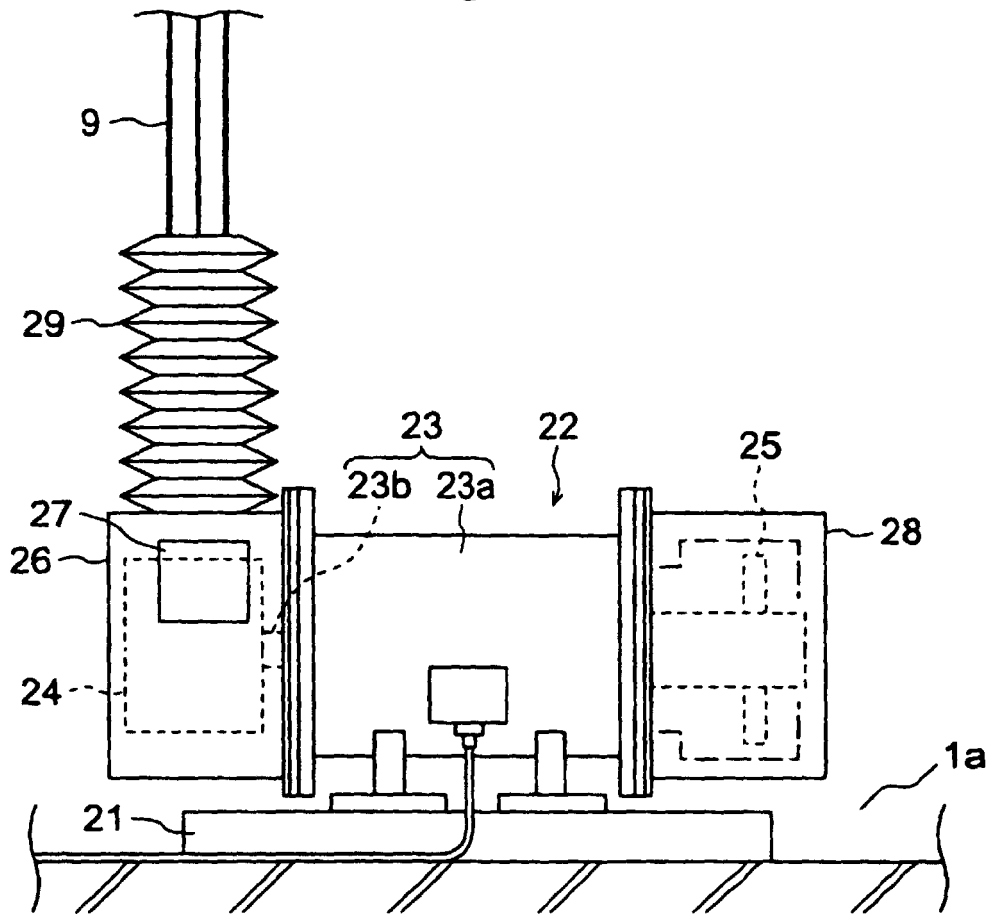


FIG. 2

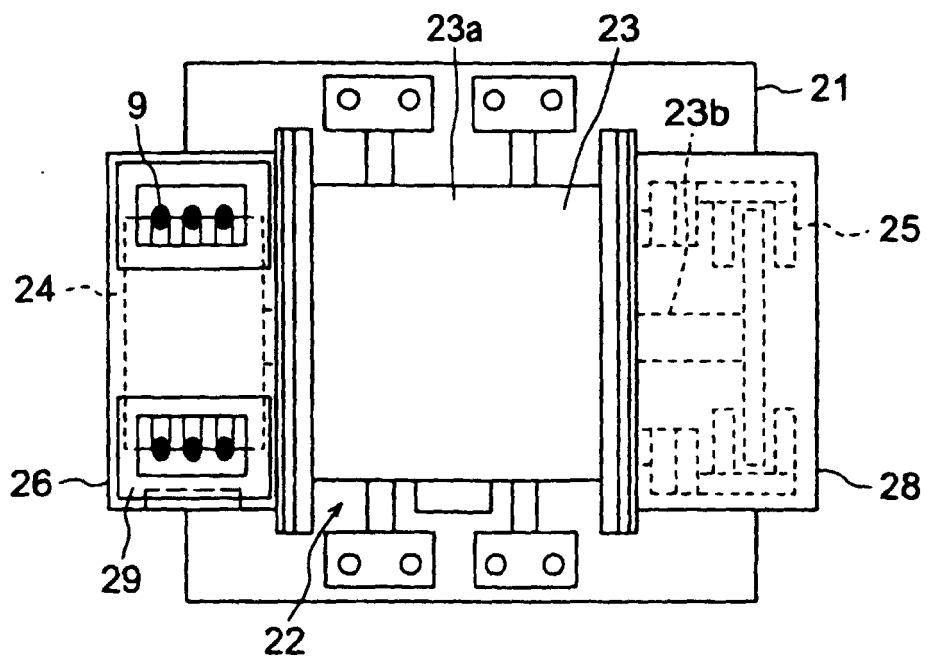


FIG. 3

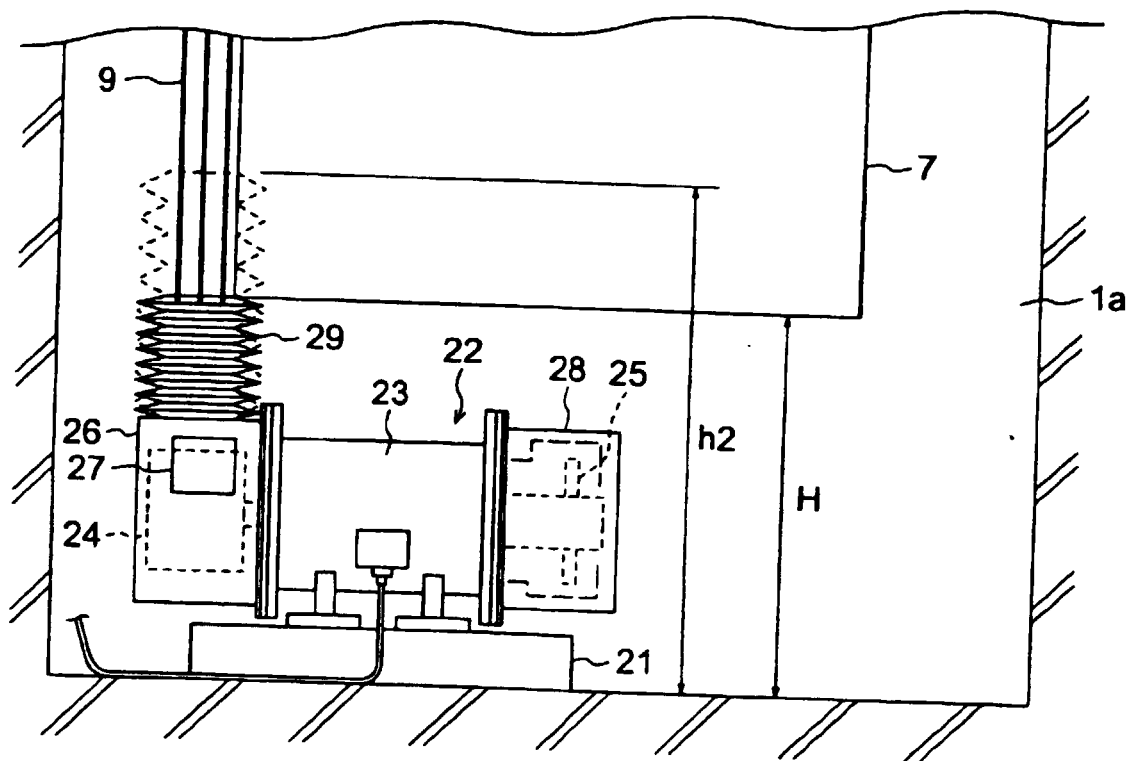


FIG. 4

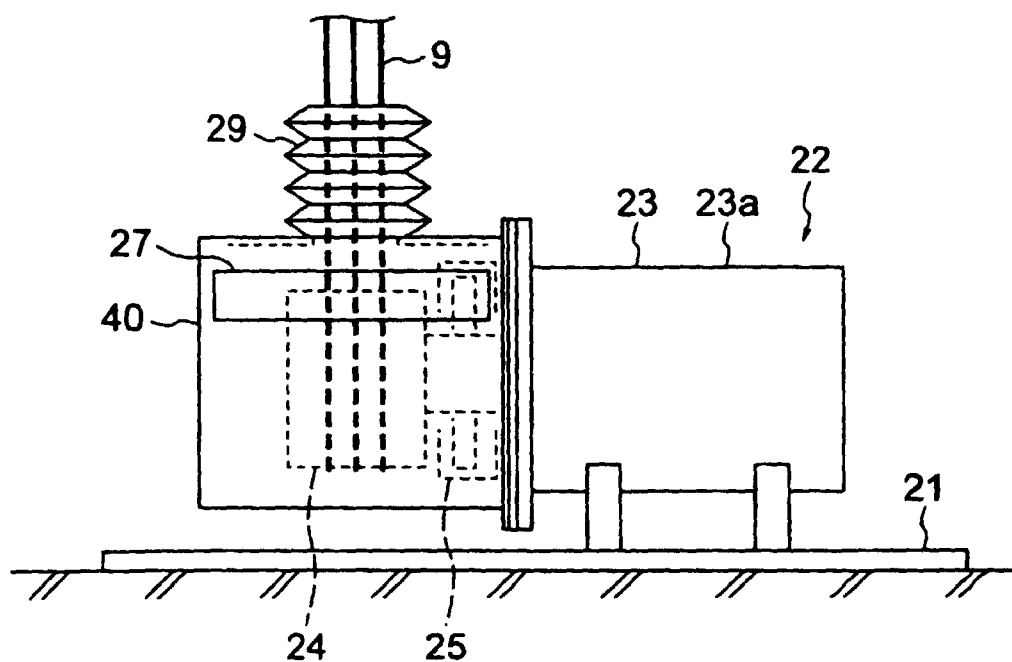


FIG. 5

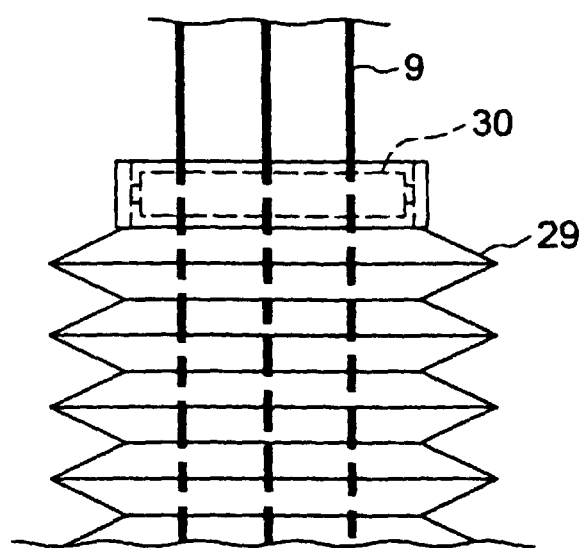


FIG. 6

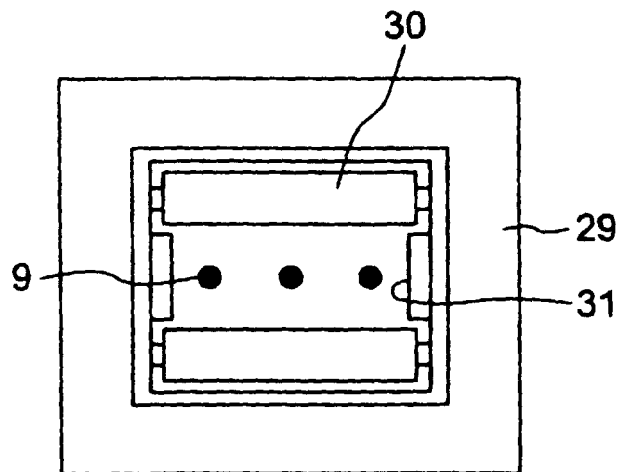


FIG. 7

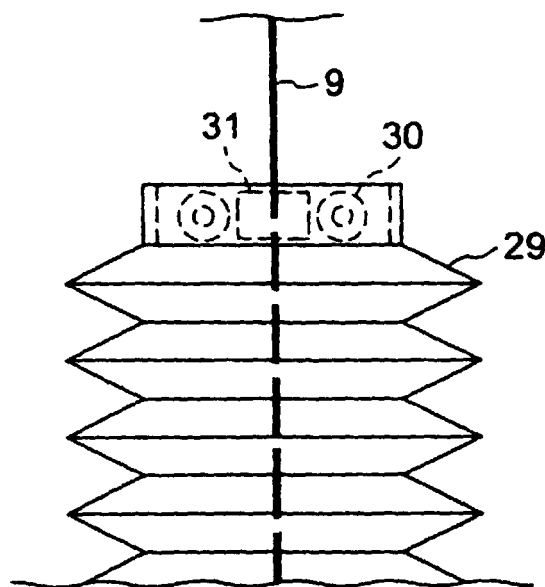


FIG. 8

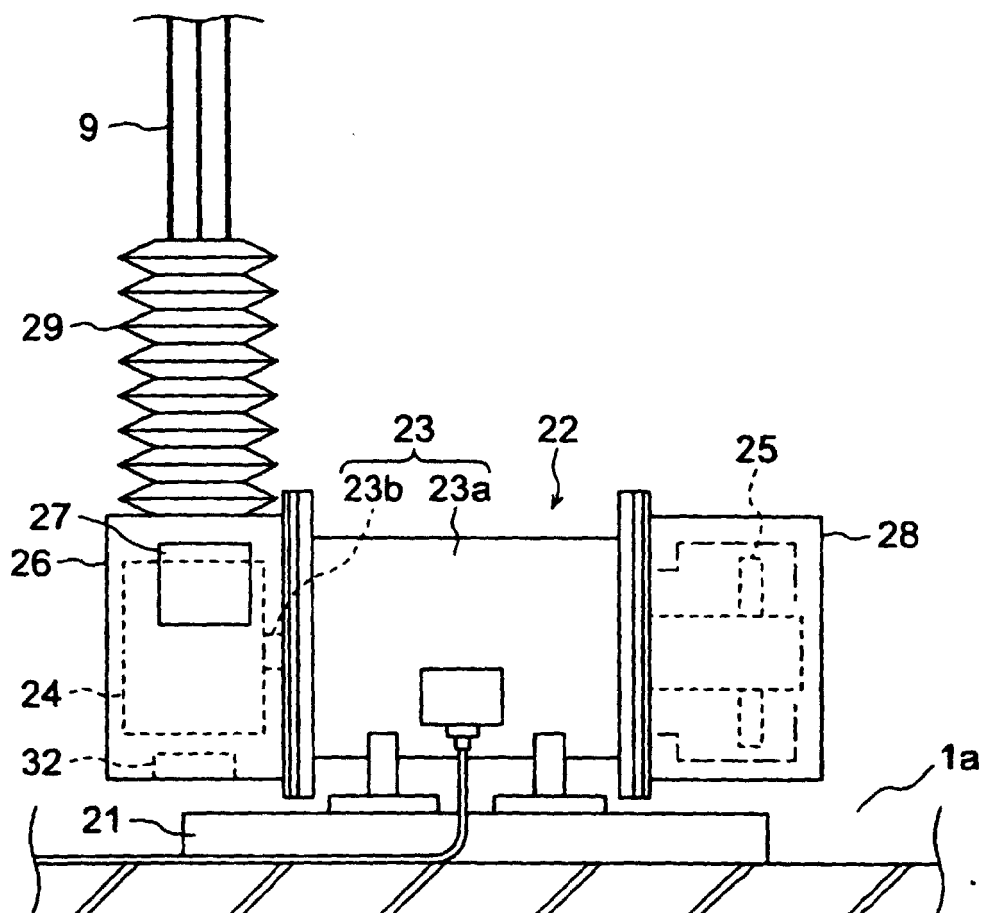


FIG. 9

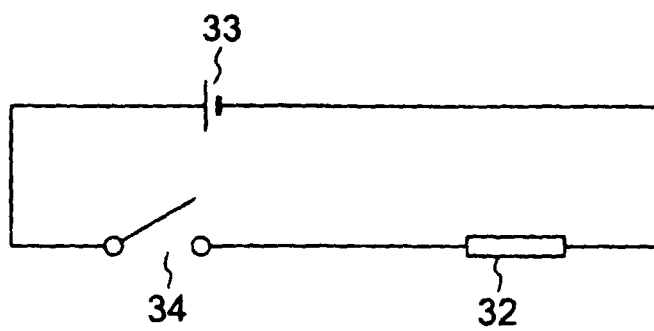


FIG. 10

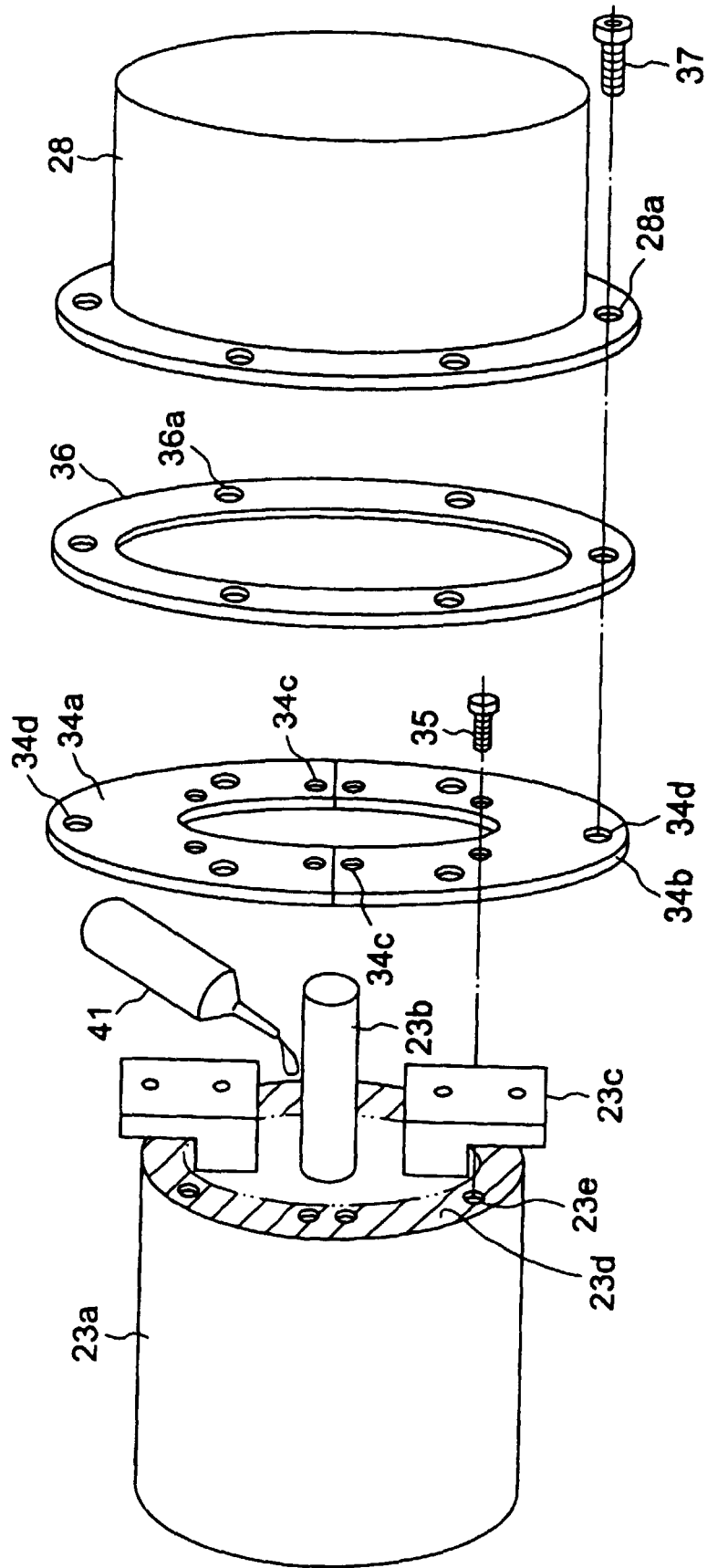


FIG. 11

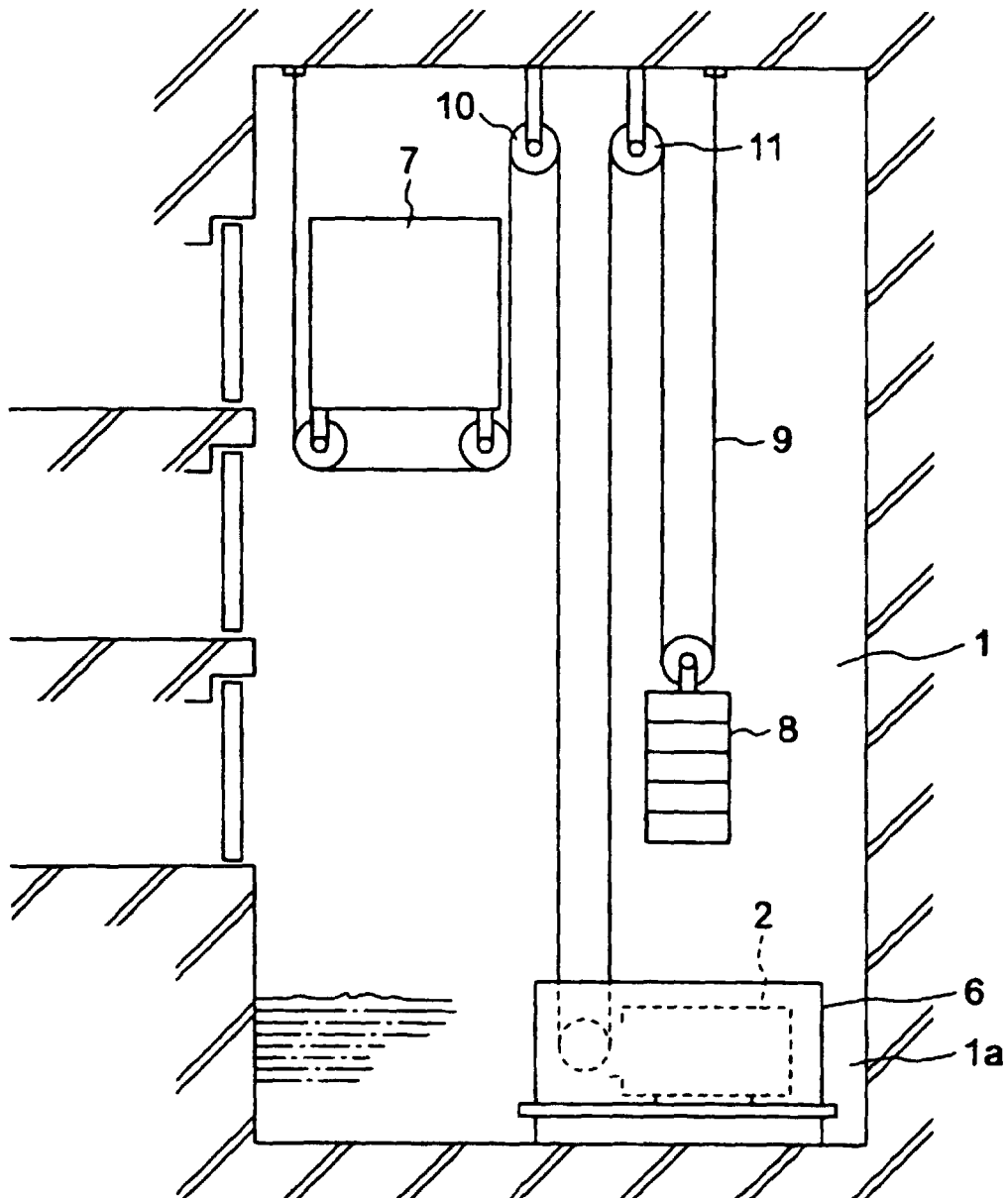
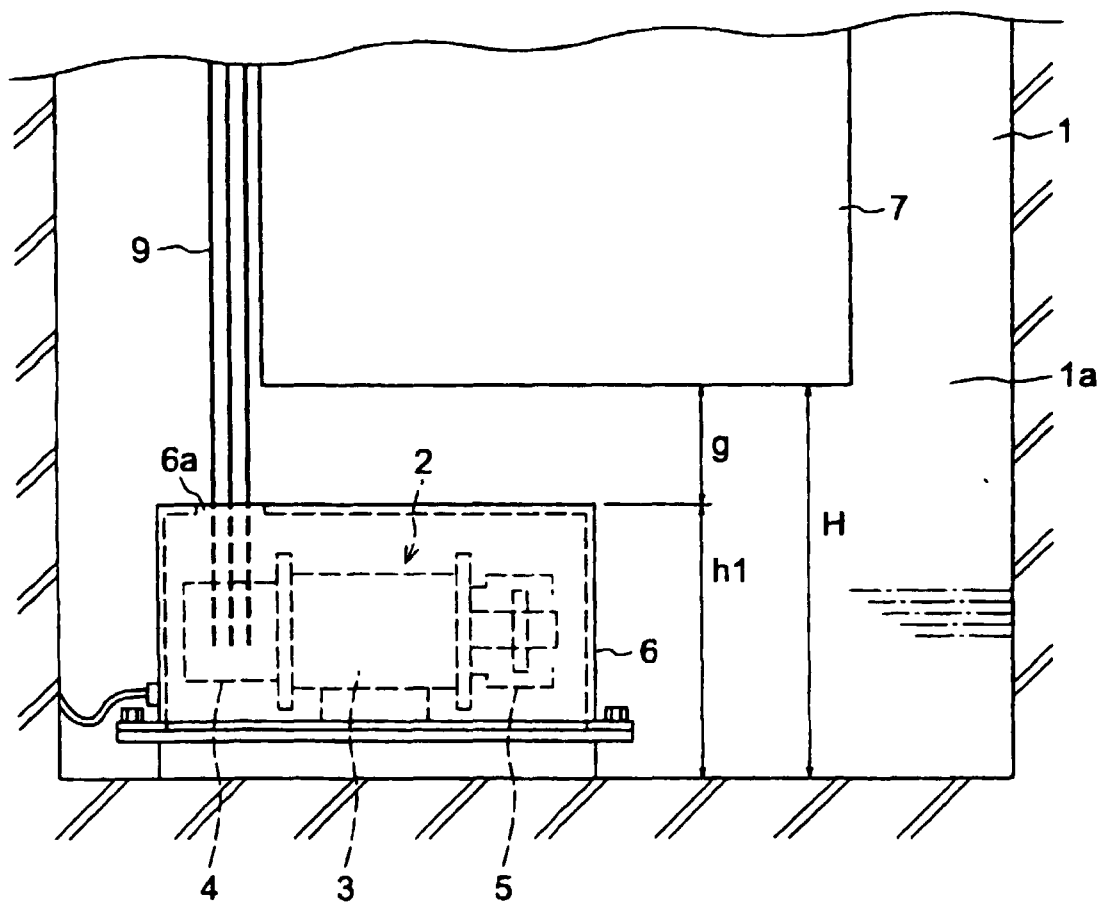


FIG. 12



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP99/00461

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁶ B66B7/00, B66B11/04		
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) Int.Cl ⁶ B66B7/00, B66B11/04		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-1999 Kokai Jitsuyo Shinan Koho 1971-1999 Jitsuyo Shinan Toroku Koho 1996-1999		
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.
A	JP, 59-190184, A (Hitachi, Ltd.), 27 October, 1984 (27. 10. 84) (Family: none)	1-9
A	JP, 08-324912, A (Mitsubishi Electric Corp.), 10 December, 1996 (10. 12. 96) (Family: none)	1-9
☐ 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 26 April, 1999 (26. 04. 99)		Date of mailing of the international search report 11 May, 1999 (11. 05. 99)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
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