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(71) Applicant: **MITSUBISHI DENKI KABUSHIKI KAISHA**
Chiyoda-ku, Tokyo 100-8310 (JP)

(72) Inventor: **Aoki, Hukami,**
c/o Mitsubishi Denki K.K.
Tokyo 100-8310 (JP)

(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

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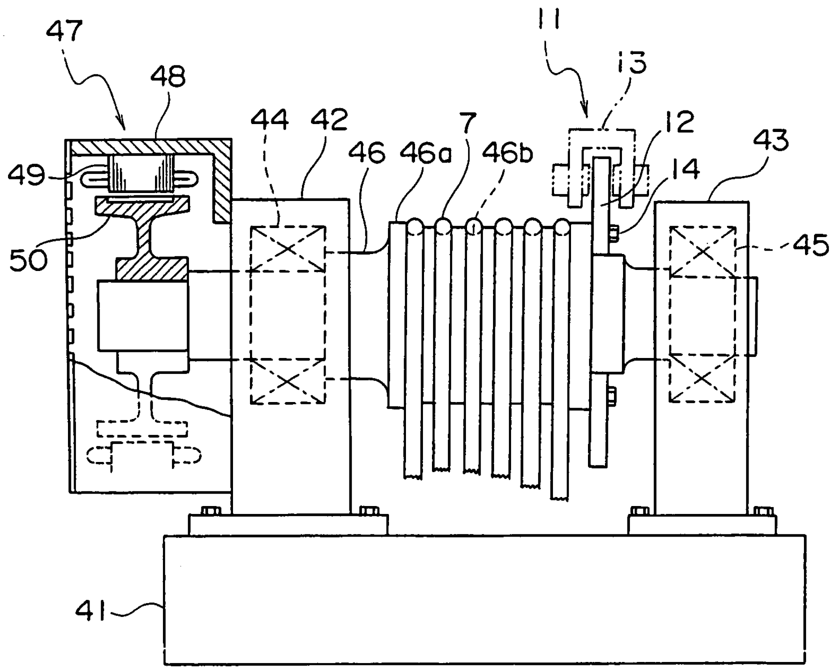
(54) **Elevator hoisting machine**

(57) In an elevator hoisting machine, a rotating shaft is rotatably supported in a bearing mount. The rotating shaft is rotated by a driving force from a drive motor. An elevator car is raised and lowered by means of a main rope by rotation of the rotating shaft. A main rope winding portion around which the main rope is wound is formed integrally on the rotating shaft. A rope groove into which the main rope is inserted is disposed on the main rope winding portion.

FIG. 4



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Description

TECHNICAL FIELD

[0001] The present invention relates to an elevator hoisting machine for raising and lowering an elevator car by means of a main rope.

BACKGROUND ART

[0002] In conventional elevator hoisting machines, a drive sheave being a separate member from a rotating shaft is fixed to the rotating shaft, which is rotated by a drive motor. Rope grooves are formed in the drive sheave, and a main rope for suspending an elevator car is wound around the drive sheave.

[0003] The drive sheave is required to rotate smoothly while constantly bearing the rope load and generating traction. Hence, it is necessary for the drive sheave to have sufficient hardness and strength, and to be manufacture precisely. Furthermore, since a large hoisting torque is transmitted from the drive motor, the drive sheave is fitted to the rotating shaft firmly by methods including shrink fitting, using keys, etc. Consequently, conventional drive sheaves are constituted by thick-walled, high-strength castings, hindering reductions in the size and weight of elevator hoisting machines.

[0004] Furthermore, when using a main rope composed of a steel rope, D/d (drive sheave diameter/main rope diameter) is required to be equal to or greater than 40 from the viewpoint of flexibility, etc., of the steel rope, thereby also enlarging the drive sheave.

[0005] In answer to this, main ropes composed of a synthetic fiber rope have been achieved in recent years. Since synthetic fiber ropes of this kind have high coefficients of friction and superior flexibility, it is possible to lower D/d to around 25, making reductions in the size of the drive sheave possible.

[0006] However, particularly in high-capacity hoisting machines used in large elevators, since the diameter of the rotating shaft is large, if the diameter of the drive sheave is reduced, the difference between the diameter of the drive sheave and the diameter of the rotating shaft is also reduced. In other words, if the diameter of the drive sheave is reduced to a minimum, the drive sheave becomes thin-walled, making manufacture and fitting of the drive sheave onto the rotating shaft difficult. Hence, from the viewpoint of manufacture and assembly, there is a risk that reductions in the size of the drive sheave, and in turn reductions in the size and weight of the hoisting machine, will be limited.

DISCLOSURE OF THE INVENTION

[0007] The present invention aims to solve the above problems and an object of the present invention is to provide an elevator hoisting machine facilitating assembly and also enabling reductions in size and weight by reducing the number of parts.

[0008] According to one aspect of the present invention, there is provided an elevator hoisting machine including: a bearing mount; a rotating shaft rotatably supported in the bearing mount, rotation of the rotating shaft raising and lowering an elevator car by means of a main rope; a drive motor for rotating the rotating shaft; and a braking device for braking the rotation of the rotating shaft, wherein a main rope winding portion provided with a rope groove into which the main rope is inserted is formed integrally on the rotating shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Figure 1 is a side elevation showing an elevator hoisting machine according to Embodiment 1 of the present invention;

Figure 2 is a perspective showing a construction of a main rope from Figure 1;

Figure 3 is a side elevation showing an elevator hoisting machine according to Embodiment 2 of the present invention; and

Figure 4 is a side elevation showing an elevator hoisting machine according to Embodiment 3 of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0010] Preferred embodiments of the present invention will now be explained with reference to the drawings.

Embodiment 1

[0011] Figure 1 is a side elevation showing an elevator hoisting machine according to Embodiment 1 of the present invention. In the figure, a pair of bearing mounts 2 and 3 are fixed on a base 1. Bearings 4 and 5 are supported in the bearing mounts 2 and 3, respectively, and first and second end portions of a rotating shaft 6 are rotatably supported by means of these bearings 4 and 5. The rotating shaft 6 is composed of a carbon steel, for example.

[0012] A main rope winding portion 6a is formed integrally on an intermediate portion of the rotating shaft 6, a main rope 7 for suspending a car and a counterweight (neither shown) being wound around the main rope winding portion 6a. A plurality of rope grooves 6b into which the main rope 7 is inserted are disposed on the main rope winding portion 6a. The main rope winding portion 6a is forged during manufacture of the rotating shaft 6. The rope grooves 6b may be formed by turning, or they may also be formed by forging. When the rope grooves 6b are formed by forging, the number of manufacturing processes is reduced and waste material is not generated.

[0013] A drive motor 8 for rotating the rotating shaft 6 includes: a stator 9 fixed to the base 1; and a rotor 10 mounted to an intermediate portion of the rotating shaft 6. The rotating shaft 6 is rotated directly by the drive motor 8 without intermediation by gears.

[0014] A braking device 11 for braking rotation of the rotating shaft 6 includes: a brake disk 12 rotated together with the rotating shaft 6; and a braking device body 13 for braking rotation of the brake disk 12. A diameter of a portion of the rotating shaft 6 adjacent to the main rope winding portion 6a is smaller than a diameter of the main rope winding portion 6a, the brake disk 12 being fixed to the rotating shaft 6 by being joined to an axial end surface of the main rope winding portion 6a. Furthermore, the brake disk 12 is fixed to the rotating shaft 6 by means of a plurality of bolts 14 extending parallel to an axial direction of the rotating shaft 6 and engaged in the end surface of the main rope winding portion 6a.

[0015] Next, Figure 2 is a perspective showing a construction of the main rope 7 from Figure 1. In the figure, an inner strand layer 24 having a plurality of inner strands 22 and filler strands 23 disposed in gaps between these inner strands 22 is disposed around a core wire 21. Each of the inner strands 22 is composed of a plurality of aramid fibers and an impregnating material such as a polyurethane or the like. The filler strands 23 are composed of a polyamide, for example.

[0016] An outer strand layer 26 having a plurality of outer strands 25 is disposed around an outer circumference of the inner strand layer 24. Each of the outer strands 25 is composed of a plurality of aramid fibers and an impregnating material such as a polyurethane or the like in a similar manner to the inner strands 22.

[0017] A friction-reducing coating layer 27 for preventing abrasion of the strands 22 and 25 due to friction among the strands 22 and 25 is disposed between the inner strand layer 24 and the outer strand layer 26. A protective coating layer 28 is also disposed on an outer circumferential portion of the outer strand layer 26.

[0018] A synthetic fiber rope of this kind has a high coefficient of friction compared to a steel rope and is superior in flexibility.

[0019] In an elevator hoisting machine constructed as above, since the main rope winding portion 6a is formed integrally on the rotating shaft 6 without using a separate drive sheave, the number of parts can be reduced, and the need for shrink fitting and a key work is eliminated, enabling assembly to be facilitated. Furthermore, the diameter of the main rope winding portion 6a is minimized, enabling overall reductions in size and weight.

[0020] An elevator hoisting machine of this kind can be used with a main rope composed of a steel rope if a sufficient diameter is ensured at the main rope winding portion 6a, but the elevator hoisting machine of this kind is more effective when used with the main rope 7 composed of the synthetic fiber rope in order to enable reductions in size and weight.

[0021] Furthermore, since the main rope winding portion 6a is composed of the same material as the rotating shaft 6, the rope grooves 6b are easily worn if the steel rope is used. In contrast to this, the rope grooves 6b are less likely to become worn in the case of the synthetic fiber rope. In addition, since the synthetic fiber rope has a high coefficient of friction, it is not necessary to provide undercut grooves to increase friction inside the rope grooves 6b, and from these viewpoints also, the elevator hoisting machine of this kind is more effective when used with the main rope 7 composed of the synthetic fiber rope.

[0022] Furthermore, since the end surface of the main rope winding portion 6a integrated with the rotating shaft 6 can be used to mount the brake disk 12, the brake disk 12 can be fixed to the rotating shaft 6 simply and firmly.

Embodiment 2

[0023] Figure 3 is a side elevation showing an elevator hoisting machine according to Embodiment 2 of the present invention. In the figure, a bearing mount 32 is fixed on a base 31. A bearing 33 is supported in the bearing mount 32, and an intermediate portion of a rotating shaft 34 is rotatably supported by means of this bearing 33. The rotating shaft 34 is composed of a carbon steel, for example.

[0024] A main rope winding portion 34a is formed integrally on a first end portion of the rotating shaft 34, a main rope 7 being wound around the main rope winding portion 34a. A plurality of rope grooves 34b into which the main rope 7 is inserted are disposed on the main rope winding portion 34a.

[0025] A drive motor 35 for rotating the rotating shaft 34 includes: a case 36 fixed to the bearing mount 32; a stator 37 fixed inside this case 36; and a rotor 38 mounted to the rotating shaft 34. The rotating shaft 34 is rotated directly by the drive motor 35 without intermediation by gears. Furthermore, in this example, the type of drive motor 35 used employs a permanent magnet in the rotor 38. A bearing 39 for rotatably supporting a second end portion of the rotating shaft 34 is held in the case 36.

[0026] A braking device 11 for braking rotation of the rotating shaft 34 includes: a brake disk 12 rotated together with the rotating shaft 34; and a braking device body 13 for braking rotation of the brake disk 12. The brake disk 12 is fixed to the rotating shaft 34 by being joined to an axial end surface of the main rope winding portion 34a. Furthermore, the brake disk 12 is fixed to the rotating shaft 34 by means of a plurality of bolts 14 extending parallel to an axial direction of the rotating shaft 34 and engaged in the end surface of the main rope winding portion 34a.

[0027] Hence, the main rope winding portion 34a may be formed in one end portion of the rotating shaft 34, effectively enabling an overall reduction in size when the number of rope grooves 34b is small.

Embodiment 3

[0028] Figure 4 is a side elevation showing an elevator hoisting machine according to Embodiment 3 of the present invention. In the figure, a pair of first and second bearing mounts 42 and 43 are fixed on a base 41. Bearings 44 and 45 are supported in the bearing mounts 42 and 43, respectively, and a rotating shaft 46 is rotatably supported by means of these bearings 44 and 45. The rotating shaft 46 is composed of a carbon steel, for example.

[0029] A main rope winding portion 46a is formed integrally on the rotating shaft 46, a main rope 7 being wound around the main rope winding portion 46a. A plurality of rope grooves 46b into which the main rope 7 is inserted are disposed on the main rope winding portion 46a.

[0030] A drive motor 47 for rotating the rotating shaft 46 includes: a case 48 fixed to the first bearing mount 42; a stator 49 fixed inside this case 48; and a rotor 50 mounted to an end portion of the rotating shaft 46. The rotating shaft 46 is rotated directly by the drive motor 47 without intermediation by gears. Furthermore, in this example, the type of drive motor 47 used employs a permanent magnet in the rotor 50.

[0031] A braking device 11 for braking rotation of the rotating shaft 46 includes: a brake disk 12 rotated together with the rotating shaft 46; and a braking device body 13 for braking rotation of the brake disk 12. A diameter of a portion of the rotating shaft 46 adjacent to the main rope winding portion 46a is smaller than a diameter of the main rope winding portion 46a, the brake disk 12 being fixed to the rotating shaft 46 by being joined to an axial end surface of the main rope winding portion 46a. Furthermore, the brake disk 12 is fixed to the rotating shaft 46 by means of a plurality of bolts 14 extending parallel to an axial direction of the rotating shaft 46 and engaged in the end surface of the main rope winding portion 46a.

[0032] In an elevator hoisting machine of this kind, the drive motor 47 is disposed so as to be overhung outside the pair of bearing mounts 42 and 43. Consequently, this construction is suitable when a comparatively compact drive motor 47 is used, facilitating further overall reductions in size such as enabling the base 41 to be made smaller, etc.

[0033] Moreover, in Embodiments 1 to 3, a gearless type of hoisting machine is shown, but the present invention can also be applied to a geared type of hoisting machine in which a driving force from the drive motor is transmitted to the rotating shaft by means of a speed reduction mechanism.

[0034] According to another embodiment an elevator hoisting machine has the following elements:

1) An elevator hoisting machine comprising: a bearing mount; a rotating shaft rotatably supported in said bearing mount, rotation of said rotating shaft raising and lowering an elevator car by means of a main rope; a drive motor for rotating said rotating shaft; and a braking device for braking said rotation of said rotating shaft, wherein a main rope winding portion provided with a rope groove into which said main rope is inserted is formed integrally on said rotating shaft.

2) The elevator hoisting machine according to 1), wherein said braking device includes a brake disk rotated together with said rotating shaft, and a braking device body for braking rotation of said brake disk, a diameter of a portion of said rotating shaft adjacent to said main rope winding portion being smaller than a diameter of said main rope winding portion, and said brake disk being fixed to said rotating shaft by being joined to an axial end surface of said main rope winding portion.

3) The elevator hoisting machine according to 2), wherein said brake disk is fixed to said rotating shaft by means of a plurality of bolts extending parallel to an axial direction of said rotating shaft and engaged in said end surface of said main rope winding portion.

4) The elevator hoisting machine according to 1), wherein a rotor of said drive motor is mounted to said rotating shaft, said rotating shaft being driven directly by said drive motor.

5) The elevator hoisting machine according to 4), wherein first and second end portions of said rotating shaft are supported by said bearing mount, said rotor being mounted to an intermediate portion of said rotating shaft, and said main rope winding portion also being formed on an intermediate portion of said rotating shaft.

6) The elevator hoisting machine according to 4), wherein an intermediate portion of said rotating shaft is supported by said bearing mount, said main rope winding portion being formed at a first end portion of said rotating shaft, and said rotor being mounted to said rotating shaft on an opposite side of said bearing mount from said main rope winding portion.

7) The elevator hoisting machine according to 4), wherein a first end portion and an intermediate portion of said rotating shaft are supported by said bearing mount, said main rope winding portion being formed an intermediate portion of said rotating shaft, and said rotor being mounted to a second end portion of said rotating shaft.

8) The elevator hoisting machine according to 1), wherein said rope groove is formed by forging.

Claims

1. An elevator hoisting machine comprising:

a bearing mount (32, 42, 43) having a through opening;
a rotating shaft (34, 46) rotatably supported in and extending through at least a portion of said through opening of said bearing mount (32, 42, 43), rotation of said rotating shaft (34, 46) raising and lowering an elevator car by means of a main rope (7);
a drive motor (35, 47) for rotating said rotating shaft (34, 46);
a braking device (11) for braking said rotation of said rotating shaft (34, 46),
a main rope winding portion (34a, 46a) provided with a rope groove (34b, 46b) into which said main rope (7) is inserted formed integrally on said rotating shaft (34, 46) and,
a rotor (38, 50) of said drive motor (35, 47) mounted to said rotating shaft (34, 46), said rotating shaft (34, 46) being driven directly by said drive motor (35, 47); and

characterized in that:

a first end portion and an intermediate portion of said rotating shaft (46) are supported by said bearing mount (42, 43), said main rope winding portion (46a) being formed on an intermediate portion of said rotating shaft (46), and said rotor (50) being mounted to a second end portion of said rotating shaft (46).

FIG. 1

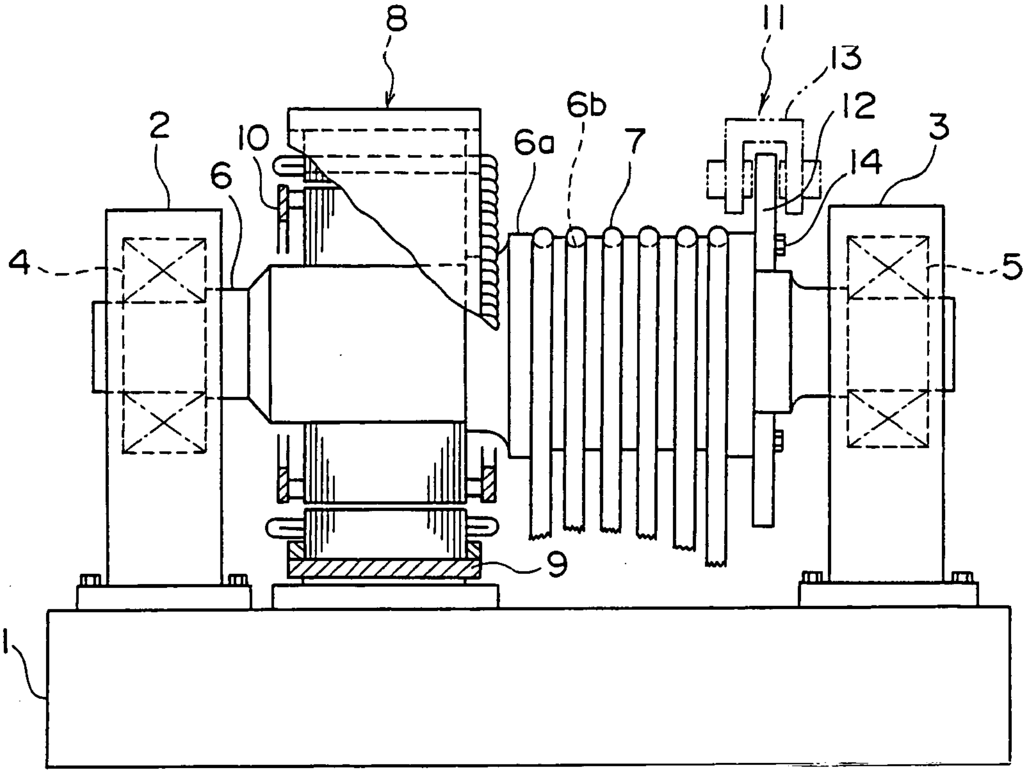


FIG. 2

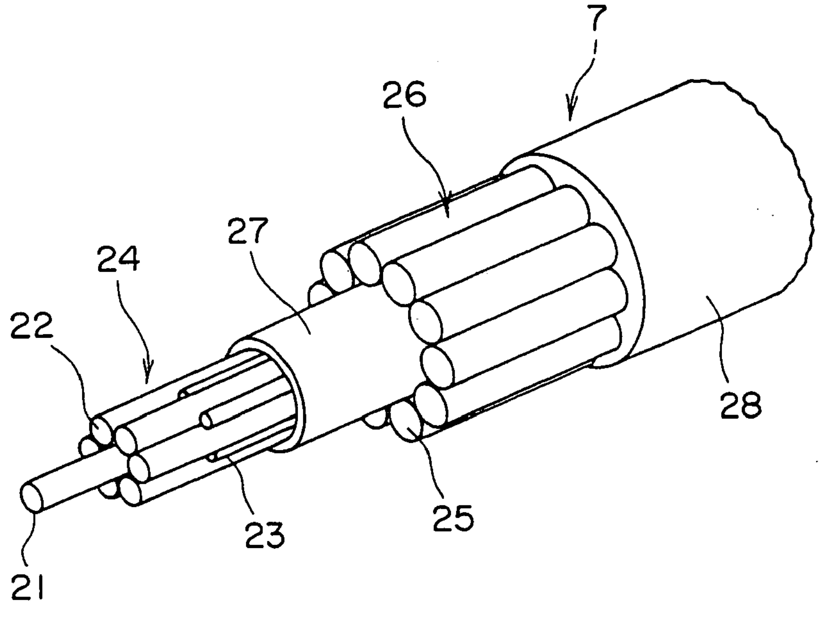


FIG. 3

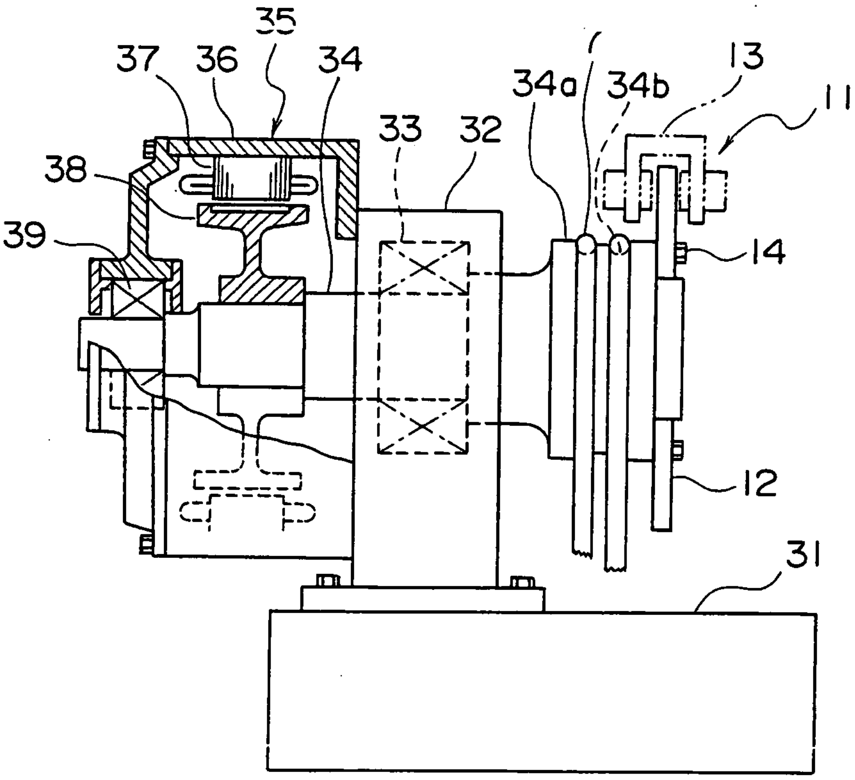
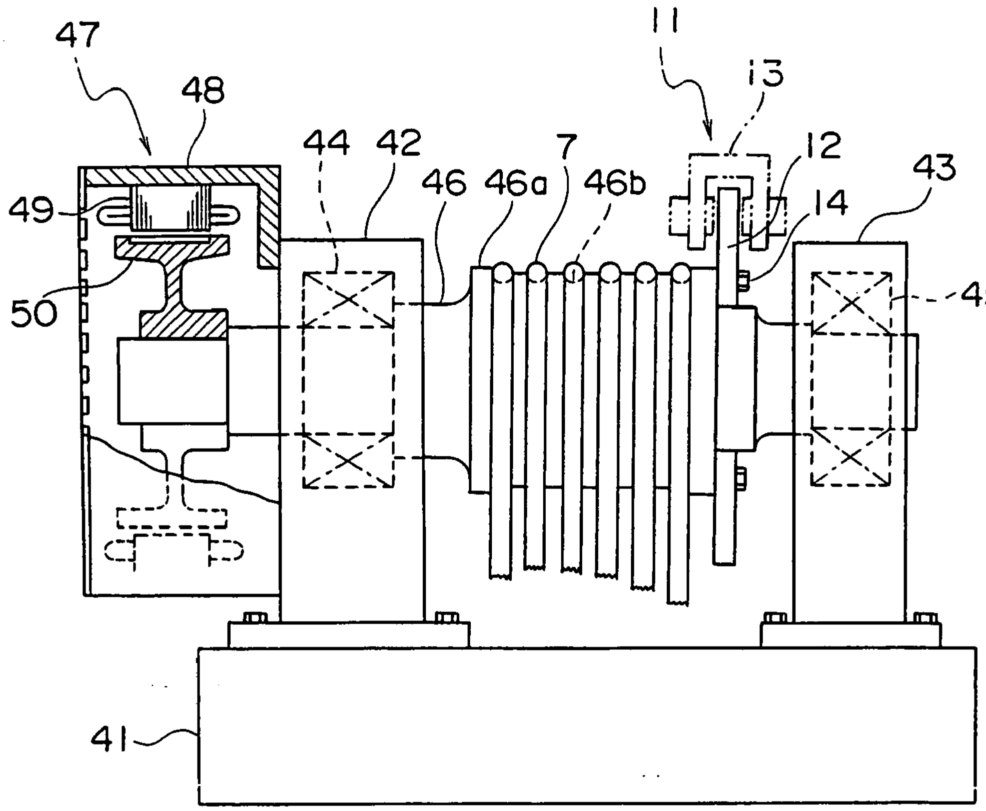


FIG. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 07 00 9944

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 10, 31 October 1997 (1997-10-31) & JP 09 142761 A (MITSUBISHI ELECTRIC CORP), 3 June 1997 (1997-06-03) * abstract * -----	1	INV. B66B11/08 B66B11/04
A	EP 1 010 660 A (MITSUBISHI ELECTRIC CORP) 21 June 2000 (2000-06-21) * column 1, line 11 - line 55 * -----	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			B66B

The present search report has been drawn up for all claims

3

Place of search	Date of completion of the search	Examiner
Munich	20 June 2007	ECKENSCHWILLER, A

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 07 00 9944

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20-06-2007

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