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(72) Inventor: **MARUYAMA, Naoyuki**
uchi 2-chome, Chiyoda-ku, Tokyo, 1008310 (JP)

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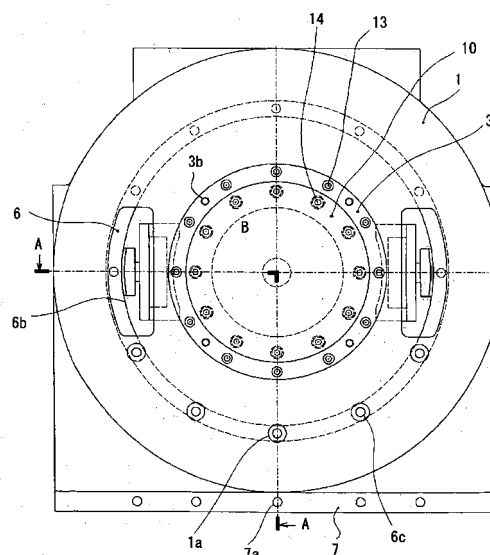
(74) Representative: **HOFFMANN EITL**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(71) Applicant: **MITSUBISHI ELECTRIC CORPORATION**
Chiyoda-ku
Tokyo 100-8310 (JP)

(54) **ELEVATOR-USE HOIST MACHINE AND BEARING REPLACING METHOD FOR ELEVATOR-USE HOIST MACHINE**

(57) In a machine- roomless elevator, an elevator traction machine that enables its bearing to easily be replaced from one side, comprises a housing 1 for fastening thereto a magnetic-circuit-constituting stator 2 that generates electromagnetic force, a stationary shaft 3 adapted to fit into a bearing 4, within an inner circular area of the bearing 4, and thereby to dispose the bearing to be coaxial with the stator 2 axial center, and being detachably fastened to the housing 1 in a space provided in an area surrounding the center of the housing 1, a one-rotary-element-constituting bearing boss 5 adapted to fit with the circumference of the bearing as disposed on the stationary shaft, and able to pass through the space, and a magnetic-circuit-constituting rotor 6 having a predetermined clearance from the stator, being detachably fastened to the bearing boss 5, located on the inside of the rotor, and being capable of being directly/indirectly fastened to the housing 1.

[Fig 1]



Description

TECHNICAL FIELD

[0001] The present invention relates to traction machines for use in an elevator and methods of replacing bearing of the traction machines.

BACKGROUND ART

[0002] In a conventional elevator traction machine installed in a machine room, in cases where a drive sheave is replaced due to hoist rope groove wear, and a bearing or shaft is replaced due to bearing's rolling-element fatigue, or defective condition such as vibrations, caused by abnormal shaft abrasion, a method in which by fastening a rotor to a housing, a drive sheave, a shaft, and a bearing as one part are removed for replacement is indicated (refer to Patent Document 1).

[0003] Furthermore, in a conventional machine-roomless elevator, the traction machine is typically disposed between a hoistway and an elevator car. For this reason, a case is indicated in which the drive sheave or a motor are disposed opposing to a lateral wall side of the hoistway (Refer to Patent Document 2 and 3).

[0004]

Patent Document 1

Japanese Patent Publication 2004-107048 (pages 1 through 7, and Figs. 1 through 10)

Patent Document 2

Japanese Patent Publication 2000-289954 (pages 1 through 6, and Figs. 1 through 11)

Patent Document 3

Japanese Patent Publication 8-511758 (pages 1 through 15, and Figs. 1 through 4)

DISCLOSURE OF INVENTION

[Problem that the Invention is to Solve]

[0005] In the art in Patent Document 1, because, from the housing side as viewed along the shaft, a rotor is fixed and, by demounting a mounting bed located in the direction opposite to the housing, the drive sheave, the shaft and the bearing are drawn out as one part, replacement is performed from both sides along the shaft, thereby requiring a wider replacement space on both side along the shaft.

[0006] When a machine-roomless elevator adopts a constitution of the traction machine being set force in Patent Document 1, the traction machine is disposed between the hoistway wall and the elevator car. For this reason, there is a need for shifting toward the hoistway wall one of the sides of the traction machine along the shaft, which allows no replacement space to be available on both sides along the shaft, thereby causing replacement of the drive sheave, the shaft, and the bearing as

one part to become difficult. Furthermore, a problem has been that even when only the shaft and bearing are replaced, because the replacement includes releasing a hoist rope load by lifting the elevator car, removing the mounting bed, and demounting the drive sheave, shaft and bearing, the replacement requires long hours and costs.

[0007] In a constitution of a traction machine according to the art in Patent Documents 2 and 3, a problem has been that since, in a case where a bearing undergoes damage, the bearing cannot be replaced unless the traction machine is dismounted, after releasing the load of elevator-car-lifting hoist rope and demounting the traction machine itself from its installed position, the traction machine needs to be dismantled to replace the bearing, thus requiring long hours and costs for replacement. Another problem has been that a need for demounting the traction machine inside the hoistway leads to further worsening workability.

[0008] The present invention has been made to solve above-described problems, and an object of the invention is to obtain an elevator traction machine that enables replacement of a shaft to easily be performed unidirectionally in a machine-roomless elevator.

[Means for Solving the Problem]

[0009] The present invention comprises: a housing for fixing thereto a magnetic-circuit-constituting stator; a stationary shaft adapted to fit into a bearing, within the inner circular area of the bearing, and thereby to dispose the bearing to be coaxial with the stator axial center and being detachably fastened to the housing in a space provided in the area surrounding the center of the housing; a bearing boss adapted to fit with the circumference of the bearing as disposed on the stationary shaft, and able to pass through the space; and a magnetic-circuit-constituting rotor having a predetermined clearance from the stator, being detachably fastened to the bearing boss, located inside the rotor, and capable of being directly/indirectly fixed to the housing.

[0010] The present invention also comprises; a housing for fixing thereto a magnetic-circuit-constituting stator; a stationary shaft adapted to fit into a bearing, within the inner circular area of the bearing, and thereby to dispose the bearing to be coaxial with the stator axial center, and being detachably fastened to the housing in a space provided in the area surrounding the center of the housing; a magnetic-circuit-constituting rotor through which the stationary shaft is able to pass, the rotor having a given clearance from the stator, and capable of being directly/indirectly fastened to the housing; and a bearing boss capable of fitting with the circumference of the bearing as disposed on the stationary shaft, and being detachably provided on the inner area of the rotor.

[0011] Furthermore the invention comprises steps of: directly/indirectly fastening the rotor to the housing; mounting and demounting the stationary shaft, the bear-

ing and the bearing boss; inspecting/replacing the bearing; fastening the stationary shaft, the bearing and the bearing boss, and unfastening directly/indirectly the rotor having been fastened to the housing.

[Effects of the Invention]

[0012] The present invention has been implemented with such a constitution, and by a method according to the constitution, therefore, a traction machine for use in an elevator that enables a shaft to easily be replaced unidirectionally, can be achieved.

BRIEF DESCRIPTION OF DRAWINGS

[0013]

Fig. 1 is a front elevation illustrating a traction machine for an elevator according to Embodiment 1 of the present invention;

Fig. 2 is a cross-sectional view taken along Line A-A in Fig. 1;

Fig. 3 is a diagram for explaining time of replacement shown in Fig. 2;

Fig. 4 is a cross-sectional view corresponding to Fig. 2 of a traction machine of an elevator in Embodiment 2 of the present invention;

Fig. 5 is a diagram for explaining time of replacement shown in Fig. 4;

Fig. 6 is a cross-sectional view corresponding to Fig. 2 of a traction machine of an elevator in Embodiment 3 of the present invention;

Fig. 7 is a cross-sectional view corresponding to Fig. 2 of a traction machine for an elevator in Embodiment 4 of the present invention;

Fig. 8 is a detailed diagram of Section "B" in Fig. 7;

Fig. 9 is a cross-sectional view when a bearing 4 of a traction machine for an elevator corresponding to Fig. 2 in Embodiment 5 of the present invention is being replaced; and

Fig. 10 is a cross-sectional view of the traction machine for the elevator corresponding to Fig. 2 in Embodiment 6 of the present invention.

[References of Numerals and Symbols]

[0014] "1" is a housing; "1a," fixing holes; "1b," fixing holes; "2," a stator; "2a," a core section; "2b," coils; "3," a stationary shaft; "3a," fixing holes; "3b," jack-up threaded screw holes; "4," a bearing; "5," a bearing boss; "5a," fixing holes; "5b," a drive sheave; "6," a rotor; "6a," a drive sheave; "6b," braking surfaces; "6c," fixing holes; "6d," threaded screw holes; "6e," a circumference; "7," a traction machine mount; "7a," fixing holes; "7b," threaded screw holes; "8," a rotation detector; "9," a rotary shaft; "10," a cover; "11," bolts; "12," an alignment jig; "13," bolts; "14," bolts; "15," bolts; "16," bolts; "17," an alignment jig; "18," thread studs; and "19," stopper nuts.

BEST MODE FOR CARRYING OUT THE INVENTION

Embodiment 1.

[0015] Fig. 1 is a front elevation illustrating a traction machine of an elevator according to Embodiment 1 of the present invention, Fig. 2, a cross-sectional view taken along Line A-A in Fig. 1.

[0016] Referring to Fig. 2, a stator 2-part of the stationary element constituting an electric motor-is fixed inside the circumference of a housing 1, coils 2b-part of the stator-is wound around a core section 2a of the stator 2, and referring to Fig. 1, arranged coaxially with the circular-shaped housing 1 is a stationary shaft 3 that is fixed to the housing 1 with bolts 13.

[0017] Referring to Fig. 2, in the stationary shaft 3, a bearing boss 5 is pivotally held via a bearing 4, coaxially with the stationary shaft 3, by the bearing 4. Fixing a rotor 6 by bolts 14, coaxially with the bearing boss 5 allows the rotor 6 to rotate coaxially with the stationary shaft 3. A rotary element forming part of the motor is constituted of the bearing boss 5 and the rotor 6, and the rotor 6 includes a drive sheave 6a that causes the hoist rope to travel, and a braking section 6b.

[0018] Furthermore, the housing 1 is fixed to a traction machine mount 7 fixed at an installation position. In Embodiment 1, although the housing 1 and the traction machine mount 7 are separately configured, they may be integrally constituted.

[0019] A rotation detector 8 that is provided coaxially with the center axis of the stationary shaft 3 and fixed to the stationary shaft 3, can detect rotation angles of the rotor 6 fixed to the bearing boss by engaging a rotary shaft 9 that is fixed to the bearing boss 5 and capable of rotating coaxially with the center axis of the stationary shaft 3. Here, the rotation detector 8 is covered with a cover 10 so as not to be visually checked from the outside thereof.

[0020] In addition, fixed to the housing 1 are brakes 11 that oppose sliding surfaces 6b of the rotor 6 and have braking surfaces for acquiring braking force by abutment.

[0021] When an elevator is driven by using the traction machine in the embodiment, the brakes 11 disengage abutment of the rotor braking surfaces 6b with the braking surfaces of the brakes 11, to neutralize the braking force as well as a controller of the traction machine, not shown, energizes the coils 2b of the stator 2, by a predetermined energizing pattern according to a value determined by the rotation detector 8, which thereby causes the rotor 6 to rotate in a predetermined direction. The rotation of the rotor 6 can cause an elevator car to travel in predetermined directions and to floors, via a hoist rope engaged with a drive sheave 6a of the rotor 6.

[0022] Next, a traction machine configuration to be required associated with replacement of the bearing 4 in Embodiment 1 of the present invention will be described.

[0023] Referring to Fig. 2, the outline of the stationary shaft 3 is set to be larger than that of the bearing boss.

Furthermore, the stationary shaft 3 is formed with fixing holes 3a that can be disposed substantially coaxially with the central axis of the bolts 14 so that the bolts 14 fastening the bearing boss 5 and the rotor 6 together is removable from the rotation detector 8 side, and the housing 1 and the rotor 6 are formed with fixing holes 1a and 6c that can each be disposed coaxially with them. Further, the inner circular portion to which the stationary shaft 3 of the housing 1 is fixed, is set to be smaller than that of the circumference of the rotor 6, and the traction machine mount 7 is formed with fixing holes 7a as well.

[0024] The replacement of a bearing 4 will be described as below. Fig. 3 is a diagram for explaining a time of replacing shown in Fig. 2. As the first step, after demounting the cover 10, the bolts 13 that fasten the housing 1 to the stationary shaft 3 are removed, by passing through the fixing holes 3a, the bolts 14 that fasten the rotor 6 to the bearing boss 5 are removed. In this case, because the housing 1 and such the rotor 6 are fitted, according to the loose/free fit tolerance, into the stationary shaft 3 and the bearing boss 5, respectively, their positions remain fixed. Here, in the case where either the housing 1 and the stationary shaft 3, or the rotor 6 and the bearing boss 5 are not fitted to each other, the bolt 13 or 14 corresponding to those that are not aligned by fitting needs to be removed after the next step is performed.

[0025] The next step is that an alignment jig 12 having holes that allow the rotor 6 to be made positioned coaxially with the fixing holes 1a, 3a and 7a, is made abut, on the side of the drive sheave 6a, on a surface perpendicular to the rotor's rotary shaft, and then, from the rotation detector 8 side, the alignment jig 12 is fastened with bolts 15 and 16 via the fixing holes 1a, 3a, and 7a. Tightening the bolts 15 fastens the rotor 6 to the alignment jig 12, and tightening the bolts 16 fastens the traction machine 7 to the alignment jig 12. In tightening the bolts, there is a need for precautions to be taken such that the rotation axis center of the rotor 6 will not deviate from a predetermined position.

[0026] The final step is that after jack screws, not shown, has been passed through jack-up threaded screw holes 3b provided on the stationary shaft 3 shown in Fig. 1, a jack-up operation permits the stationary shaft 3, the bearing 4, and the bearing boss 5 to be removed. Here, the bearing 4 is easy to demount if fitting the stationary shaft 3 into the bearing 4, and the bearing 4 into the bearing boss 5 are each made according to the loose/free fit tolerance.

[0027] Then, replacing the bearing 4 with a new one, and following the above-described steps in reverse order enables the stationary shaft 3, the new bearing 4 and the bearing boss to be remounted, and the traction machine to be restored to an operable condition.

[0028] By constituting the traction machine as described above, and using preceedingly-described process of replacement of the bearing 4, without releasing a lifting load that is applied to the drive sheave 6a of the

rotor 6, and produced by lifting an elevator car, the bearing 4 can be replaced with the hoist rope being engaged with the drive sheave. This arrangement can eliminate a dangerous work such as shifting a load applied to the hoist rope 6, to another member. Elimination of the dangerous work can significantly reduce hours for replacing the bearing 4. A space required for the replacement may be as large as is needed for inserting the alignment jig 12, being only the space on the rotation detector 8 side. Therefore, the bearing 4 can be replaced substantially from one side, thereby requiring no extra replacement space.

[0029] As preceedingly described, the traction machine for the elevator in which the bearing 4 can easily be replaced from one side can be achieved because the traction machine comprises the housing 1 for fastening thereto the magnetic-circuit-constituting stator 2 that generates electromagnetic force, the stationary shaft 3 adapted to fit into the bearing 4, within the inner circular area of the bearing 4, and thereby to dispose the bearing to be coaxial with the stator 2 axial center, and being detachably fastened to the housing 1 in a space provided in the area surrounding the center of the housing 1, the one-rotary-element-constituting bearing boss 5 adapted to fit with the circumference of the bearing as disposed on the stationary shaft, and able to pass through the space, and the magnetic-circuit-constituting rotor 6 having a predetermined clearance from the stator, being detachably fastened to the bearing boss 5 located inside the rotor, and capable of being directly/indirectly fastened to the housing 1.

Embodiment 2.

[0030] In Embodiment 1, the case where replacing the bearing 4 is performed from the opposite side of the drive sheave 6a has been described. In Embodiment 2, a case where such the bearing 4 is replaced from the side of the drive sheave 6a will be described.

[0031] Fig. 4 is a cross-sectional view corresponding to Fig. 2 of a traction machine of an elevator in Embodiment 2 of the present invention. Here, portions that are not particularly indicated are the same as those in Embodiment 1, and in Fig. 4, the same symbols as those in Fig. 2 indicate the same or equivalent parts.

[0032] A constitution differing from the traction machine in Embodiment 1 will be described as below. In Embodiment 1, in order to allow the replacement to be performed from only the side of the rotation detector 8-the opposite side of the drive sheave 6a-such the fixing holes 3a for passing therethrough such the bolts 14 that fasten such the bearing boss 5 to such the rotor 6 have been formed. In a traction machine in Embodiment 2, however, in order to allow the replacement to be performed only from the side of the drive sheave 6a, instead of the fixing holes 3a, the bearing boss 5 is formed with fixing holes 5a for passing therethrough such the bolts 13 for fastening the housing 1 to such the stationary shaft

3.

[0033] In the traction machine in Embodiment 2, there are no fixing holes 1a present, and in place of fixing holes 6c and 7a, threaded screw holes 6d and 7b are formed, respectively.

[0034] The replacement of a bearing 4 will be described as below. Fig. 5 is a diagram for explaining a time of replacing shown in Fig. 4. As the first step, the bolts 14 that fasten the rotor 6 to the bearing boss 5 are first removed, by passing through the fixing holes 5 the bolts 14 that fasten the bearing boss 5 to the housing 1, the bolts 13 that fasten the housing 1 to the stationary shaft 3 are removed. In this case, because the housing 1 and the rotator 6 are fitted, according to the loose/free fit tolerance, into the stationary shaft 3 and the bearing boss 5, respectively, thus their positions remain fixed. Here, in the case where either the housing 1 and the stationary shaft 3, or the rotor 6 and the bearing boss 5 are not fitted to each other, the bolt 13 or 14 corresponding to those that are not aligned by fitting needs to be removed after the next step is performed.

[0035] The next step is that an alignment jig 17 having holes that allow [the rotor 6 and the stationary shaft 3] to be positioned coaxially with the threaded screw holes 6d and 7b, is abutted, from the side of the drive sheave 6a, a surface perpendicular to the rotor's rotary shaft, and then the alignment jig 17 is threadably fastened by passing, from the side of the drive sheave 6a, via fixing holes that are formed on the alignment jig 17, such the bolts 15 and the bolts 16 through the threaded screw holes 6d and 7b. Tightening the bolts 15 fastens the rotor 6 to the alignment jig 17, and tightening the bolts 16 fastens the traction machine 7 to the alignment jig 17. In tightening the bolts, there is a need for precautions to be taken such that the rotation axis center of the rotor 6 will not deviate from a predetermined position.

[0036] The final step is, not shown, that after jack screws, not shown, have been passed through jack-up threaded screw holes corresponding to the jack-up threaded screw holes 3b in Embodiment 1, a jack-up operation is started, which allows the stationary shaft 3, the bearing 4, and the bearing boss 5 to be demounted. Here, the bearing 4 is easy to demount if fitting the stationary shaft 3 into the bearing 4, and the bearing 4 into the bearing boss 5 are each made according to the loose/free fit tolerance.

[0037] Then, replacing the bearing 4 with a new one, and following the above-described steps in reverse order enables the stationary shaft 3, the new bearing 4 and the bearing boss to be remounted, and the traction machine to be restored to an operable condition.

[0038] By constituting the traction machine as described above, and using preceedingly-described process of replacement of the bearing 4, without releasing a lifting load that is applied to the drive sheave 6a of the rotor 6, and produced by lifting an elevator car, the bearing 4 can be replaced with the hoist rope being engaged with the drive sheave. This arrangement can eliminate a

dangerous work such as shifting a load applied to the hoist rope 6, to another member. Elimination of the dangerous work can significantly reduce hours for replacing the bearing 4. A space needed for the replacement may be that needed for work only on the side of the drive sheave 6a, i.e., the bearing 4 can be replaced from one side, which therefore requires no extra replacing space.

[0039] Thus, because Embodiment 2 of the present invention comprises the housing 1 for fastening thereto the magnetic-circuit-constituting stator 2 that generates electromagnetic force, the stationary shaft 3 adapted to fit into a bearing 4, within an inner circular area of the bearing 4, and thereby to dispose the bearing to be coaxial with the stator 2 axial center, and being detachably fastened to the housing 1 in a space provided in an area surrounding the center of the housing 1, the magnetic-circuit-constituting rotor 6 having a predetermined clearance from the stator, being detachably fastened to the bearing boss 5, located on the inside of the rotor, and being capable of being directly/indirectly fastened to the housing 1, and the bearing boss 5 adapted to fit with the circumference of the bearing as disposed on the stationary shaft, and able to pass through the space, then effects that are the same as those in Embodiment 1 can be acquired.

[0040] Furthermore, in Embodiment 2, during the replacement of the bearing 4, there is no need for the alignment jig 12 to be positioned on the opposite side of a place where work is to be performed. Thus, a workspace completely on only the side of the drive sheave 6a enables the work to be performed. In addition, the alignment 17 is disposed on the side of the drive sheave 6a, therefore, replacement efficiency can be improved accordingly.

Embodiment 3.

[0041] Embodiment 1 and 2 have utilized the alignment jigs 12 and 17, respectively, for the replacement of the bearing 4, whereas in Embodiment 3, a case where replacement of the bearing 4 can be performed without employing alignment jigs 12 and 17 will be described.

[0042] Fig. 6 is a cross-sectional view corresponding to Fig. 2 of a traction machine of an elevator in Embodiment 3 of the present invention. Here, portions that are not particularly indicated are the same as those in Embodiment 1, and in Fig. 6, the same symbols as those in Fig. 2 indicate the same or equivalent parts.

[0043] A constitution differing from the traction machine in Embodiment 1 will be described as below. The traction machine in Embodiment 2 is formed, in place of the fixing holes 1a that allow the head portion of the bolts 15 in Embodiment 1 to pass therethrough, with fixing holes 1b that allow only the threaded portion of the bolts 15 to pass therethrough, as well as is formed, in place of the fixing holes 6c that has allowed the threaded portion of the bolts 15 to pass, with the threaded screw hole 6e that allow the bolts 15 passed from the opposite side

of the drive sheave 6a to be threaded thereinto. In Embodiment 3, there are no fixing holes 7a in Embodiment 1 present.

[0044] The replacement of a bearing 4 will be described as below. As the first step, after demounting the cover 10, the bolts 13 that fasten the housing 1 to the stationary shaft 3 are removed, by passing through the fixing holes 3a, the bolts 14 that fasten the rotor 6 to the bearing boss 5 are removed. In this case, because the housing 1 and the rotor 6 are fitted, according to the loose/free fit tolerance, into the stationary shaft 3 and the bearing boss 5, respectively, their positions remain fixed.

[0045] As the next step, after jack screws, not shown, have been passed through the jack-up threaded screw holes 3b provided on the stationary shaft 3, a jack-up operation causes the stationary shaft 3, the bearing 4, and the bearing boss 5 to be moved by a length of $D1$, thereby making the rotor 6 about the housing 1. From the opposite side of the drive sheave 6a, by passing the threaded portion of the bolts 15 through the fixing holes 1b, the housing 1 and the rotor 6 are fastened together. In the tightening, attention needs to be given such that the rotation axis center of the rotor 6 will not deviate from the predetermined position, and a length of $D2$ —the dimension of an engaged portion for fitting the housing 1 into the stationary shaft 3—is required to be larger than $D1$.

[0046] As the final step, by further operating jack screws, not shown, the bearing 4, and the bearing boss 5 can be demounted. Here, the bearing 4 is easy to demount if fitting the stationary shaft 3 into the bearing 4, and the bearing 4 into the bearing boss 5 are each made according to the loose/free fit tolerance.

[0047] Then, replacing the bearing 4 with a new one, and following the above-described steps in reverse order enables the stationary shaft 3, the new bearing 4 and the bearing boss to be remounted, and the traction machine to be restored to an operable condition.

[0048] By constituting the traction machine as described above, and using preceedingly-described process of replacement of the bearing 4, without releasing a lifting load that is applied to the drive sheave 6a of the rotor 6, and produced by lifting an elevator car, the bearing 4 can be replaced with the hoist rope being engaged with the drive sheave. This arrangement can eliminate a dangerous work such as shifting a load applied to the hoist rope 6, to another member. Elimination of the dangerous work can significantly reduce hours for replacing the bearing 4. A space required for the replacement may be only that on the opposite side of the drive sheave 6a, i.e., the replacement of the bearing 4 can be performed from one side, thereby requiring no extra replacing space.

[0049] Thus, Embodiment 3 of the present invention can acquire effects that are the same as those in Embodiment 1.

[0050] In addition, in Embodiment 3, the bearing 4 can be replaced without a need for the alignment jigs employed in Embodiment 1 and 2.

Embodiment 4.

[0051] In Embodiment 4, a case where more accurate work in comparison with that in Embodiment 3 can achieve the replacement of the bearing 4 will be described.

[0052] Fig. 7 is a cross-sectional view corresponding to Fig. 2 of a traction machine for an elevator in Embodiment 4 of the present invention; Here, portions that are not particularly indicated are the same as those in Embodiment 1, and in Fig. 4, the same symbols as those in Fig. 2 indicate the same or the equivalent ones in Fig. 4.

[0053] A constitution differing from the traction machine in Embodiment 3 will be described as below. Fig. 8 is a detailed diagram of Section "B" in Fig. 7; In the traction machine in Embodiment 3, in comparison to the traction machine in Embodiment 3, the housing 1 is provided with cylindrical fitting surfaces 1c that allow the housing 1 to be fitted into the circumference 6f of the rotor 6.

[0054] The replacement of a bearing 4 will be described as below. First, the first step is the same as that described in Embodiment 3.

[0055] The next step is that after jack screws, not shown, have been threaded into the jack-up threaded screw holes provided on the stationary shaft 3, a jack-up operation is started, which moves by a length of $D1$ the stationary shaft 3, the bearing 4 and the bearing boss 5, making the rotor 6 about the housing 1 while the circumference 6e of the rotor 6, and the fitting surfaces 1c of the housing 1 are being fitted to each other. From the opposite side of the drive sheave 6a, by passing the threaded portion of the bolts 15 through the fixing holes 1b, the housing 1 and the rotor 6 are fastened together. In tightening the bolts, there is a need for precautions to be taken such that the rotation axis center of the rotor 6 will not deviate from a predetermined position.

[0056] The final step also enables the stationary shaft 3, the bearing 4, and the bearing boss 5 to be demounted by the work that is the same as in Embodiment 3.

[0057] Then, replacing the bearing 4 with a new one, and following the above-described steps in reverse order enables the stationary shaft 3, the new bearing 4 and the bearing boss to be remounted, and the traction machine to be restored to an operable condition.

[0058] By constituting the traction machine as described above and also implementing preceedingly-described replacing-steps of the bearing 4, not only are effects acquired as has been described in Embodiment 3, but also forming the circumference 6e of the rotor 6, and the fitting surfaces 1c can prevent the rotor 6 from being further displaced while the bearing 4 is replaced. Moreover, even a fitting portion where the circumference 6e of the rotor 6, and the fitting surfaces 1c are fitted each other, can function to support the lifting load, which can reduce the number of tightening bolts 15, which thereby allows the hours for the replacement to be reduced.

[0059] It should be understood that Embodiment 4 of

the present invention can acquire effects that are the same as those in Embodiment 3.

Embodiment 5.

[0060] In Embodiment 5, in the case where the traction machine in Embodiment 3 is disposed on the ceiling of the hoistway, a bearing-4-replacement-method will be described by which any of the stationary shaft 3, the bearing 4 and the bearing boss 5 can be protected from falling during their replacement.

[0061] Fig. 9 is a cross-sectional view when a bearing 4 of a traction machine of an elevator corresponding to Fig. 2 in Embodiment 5 of the present invention is being replaced. Here, portions that are not particularly indicated are the same as those in Embodiment 3, and in Fig. 9, the same symbols as those in Fig. 7 indicate the same or equivalent parts. The traction machine in Embodiment 5 has the same constitution as the traction machine in Embodiment 3.

[0062] The replacement of a bearing 4 will be described as below. As the first step, after the cover 10 has been demounted, the bolts 14 that fasten the rotor 6 to a bearing boss 5 together are removed by passing it through the fixing holes 3a.

[0063] As the next step, by passing thread studs 18 through the fixing holes 3a, the thread studs 18 are each threaded into the respective thread screw holes 6d of the rotor 6, and stopper nuts 19 is each screwed on a predetermined place of the respective thread studs 18.

[0064] As the final step, the bolts 13 that fasten the housing 1 to the stationary shaft 3 are removed, and next, by starting a jack-up operation after jack screws have been threaded into the jack-up threaded screw holes 3b provided on the stationary shaft 3, then the stationary shaft 3, the bearing 4, and the bearing boss 5 are shifted by dimension of D1, so that the rotor 6 abuts the housing 1. In this case, because the housing 1 and the rotator 6 are fitted, according to the loose/free fit tolerance, into the stationary shaft 3 and the bearing boss 5, respectively, thus their positions remain fixed.

[0065] As the final step, not shown, after jack screws, not shown, have been threaded into the jack-up threaded screw holes 3b provided on the stationary shaft 3, a jack-up operation allows the stationary shaft 3, the bearing 4 and the bearing boss 5 to be demounted, when the thread studs 18 and the nuts 19 permit the stationary shaft 3, the bearing 4 and the bearing boss 5 to safely be demounted without letting them fall.

[0066] Here, the bearing 4 is easy to demount if fitting the stationary shaft 3 into the bearing 4, and the bearing 4 into the bearing boss 5 are each made according to the loose/free fit tolerance.

[0067] Then, replacing the bearing 4 with a new one, and following the above-described steps in reverse order enables the stationary shaft 3, the new bearing 4 and the bearing boss to be remounted, and the traction machine to be restored to an operable condition.

[0068] Thus, not only does Embodiment 5 of the present invention provide the same effects as described in Embodiment 3, but also, in the case where the traction machine is disposed on the ceiling of a hoistway, while the stationary shaft 3, the bearing 4 and the bearing boss 5 are being replaced, any of them can be protected from falling.

[0069] Furthermore, in Embodiment 5, the traction machine in Embodiment 3 has been described, whereas in the traction machine set forth in Embodiment 1 and 2, replacement by similar procedures as in Embodiment 5 can be performed by using the thread studs 18 and the nuts 19, which can bring about effects.

15 Embodiment 6.

[0070] In Embodiment 6, a traction machine will be described that allows the outer diameter of the drive sheave to be made smaller and the drive sheave, as part of the bearing boss 5, to easily be replaced.

[0071] Fig. 10 is a cross-sectional view of a traction machine for an elevator corresponding to Fig. 2 in Embodiment 6 of the present invention. Here, portions that are not particularly indicated are the same as those in Embodiment 3, and in Fig. 10, the same symbols as those in Fig. 7 indicate the same or equivalent parts.

[0072] Differences between a traction machine in Embodiment 6 and that in Embodiment 3 will be described as below. In Embodiment 5, the drive sheave 6a of the rotor 6 being present in the traction machine in Embodiment 3 is made smaller in the outer diameter, and in places where the outer diameter portion of the bearing boss 5 fits into the inner diameter portion of the rotor 6, part of the outer diameter portion constitutes a drive sheave 5b.

[0073] The bearing 4 can be replaced in the same way as in Embodiment 3, in which in Embodiment 1 through 5, the stationary shaft 3, the bearing 4, and the bearing boss 5 is demounted at once, whereas, in this case, only the stationary shaft 3 and the bearing 4 are to be demounted. If fitting the bearing 4 into the bearing boss 5 would be performed according to the loose/free fit tolerance, demounting only the stationary shaft 3 and the bearing 4 is possible.

[0074] Furthermore, even when the traction machine is disposed on the ceiling of the hoistway, the bearing can safely be replaced by the substantially same method as in Embodiment 5. In such case, removal of the bolt 14 turns out to be unnecessary.

[0075] Thus, when, by constituting the drive sheave 5b of the bearing boss 5, the drive sheave portion 5a of the bearing boss 5 is desired to be detached and inspected, because, although there is a need for the hoist rope load to be released, the drive sheave portion 5a that is formed on the bearing boss 5 from the same direction as in replacement of the bearing 4, i.e., from the opposite side of the drive sheave 5a, can be replaced, demounting the traction machine itself is not required, which result-

antly permits a smaller workspace and reduced replacement time.

[0076] Therefore, Embodiment 6 of the present invention provides the same effects as those in Embodiment 3 and 5, as well as while the hoist rope load needs to be released, the drive sheave portion 5a that is formed on the bearing boss 5 can be replaced from the same direction as in replacement of the bearing 4, i.e., from the opposite side of the drive sheave 5a, so that the smaller workspace and the reduced replacement time can be achieved.

[0077] Moreover, in Embodiment 5, the traction machine in Embodiment 3 has been explained. It should be understood that Embodiment 5 is applicable to the traction machine in Embodiment 1 as well.

[0078] Furthermore, the traction machine set forth in Embodiment 2 can also constitute the same replacement as that in Embodiment 5 by using, in the similar procedures, the thread studs 18 and the nuts 19, which can bring about effects.

INDUSTRIAL APPLICABILITY

[0079] The present invention is applicable to a traction machine for use in a machine-roomless elevator, and methods of replacing a bearing therefor.

Claims

1. A traction machine for an elevator, the traction machine **characterized in** comprising:

a housing for fixing thereto a magnetic-circuit-constituting stator; a stationary shaft adapted to fit into a bearing, within an inner circular area of the bearing, and thereby to dispose the bearing to be coaxial with the stator axial center, and being detachably fastened to the housing in a space provided in an area surrounding the center of the housing;

a bearing boss adapted to fit with the circumference of the bearing as disposed on the stationary shaft, and able to pass through the space; and

a magnetic-circuit-constituting rotor having a predetermined clearance from the stator, being detachably fastened to the bearing boss, located on the inside of the rotor, and being capable of being directly/indirectly fixed to the housing.

2. A traction machine for an elevator as recited in claim 1, **characterized in that** the rotor is formed with a drive sheave portion.

3. A traction machine for an elevator, the traction machine **characterized in** comprising:

a housing for fixing thereto a magnetic-circuit-constituting stator; a stationary shaft adapted to fit into a bearing, within an inner circular area of the bearing, and thereby to dispose the bearing to be coaxial with the stator axial center, and being detachably fastened to the housing in a space provided in an area surrounding the center of the housing;

a magnetic-circuit-constituting rotor through which the stationary shaft is able to pass, the rotor having a given clearance from the stator, and capable of being directly/indirectly fastened to the housing; and

a bearing boss capable of fitting with the circumference of the bearing as disposed on the stationary shaft, and being detachably provided on an inner area of the rotor.

4. A traction machine for an elevator as recited in claim 3, **characterized in that** the rotor is formed with a drive sheave.

5. A traction machine for an elevator as recited in either claim 1 or 3, **characterized in that** the bearing boss is formed with a drive sheave.

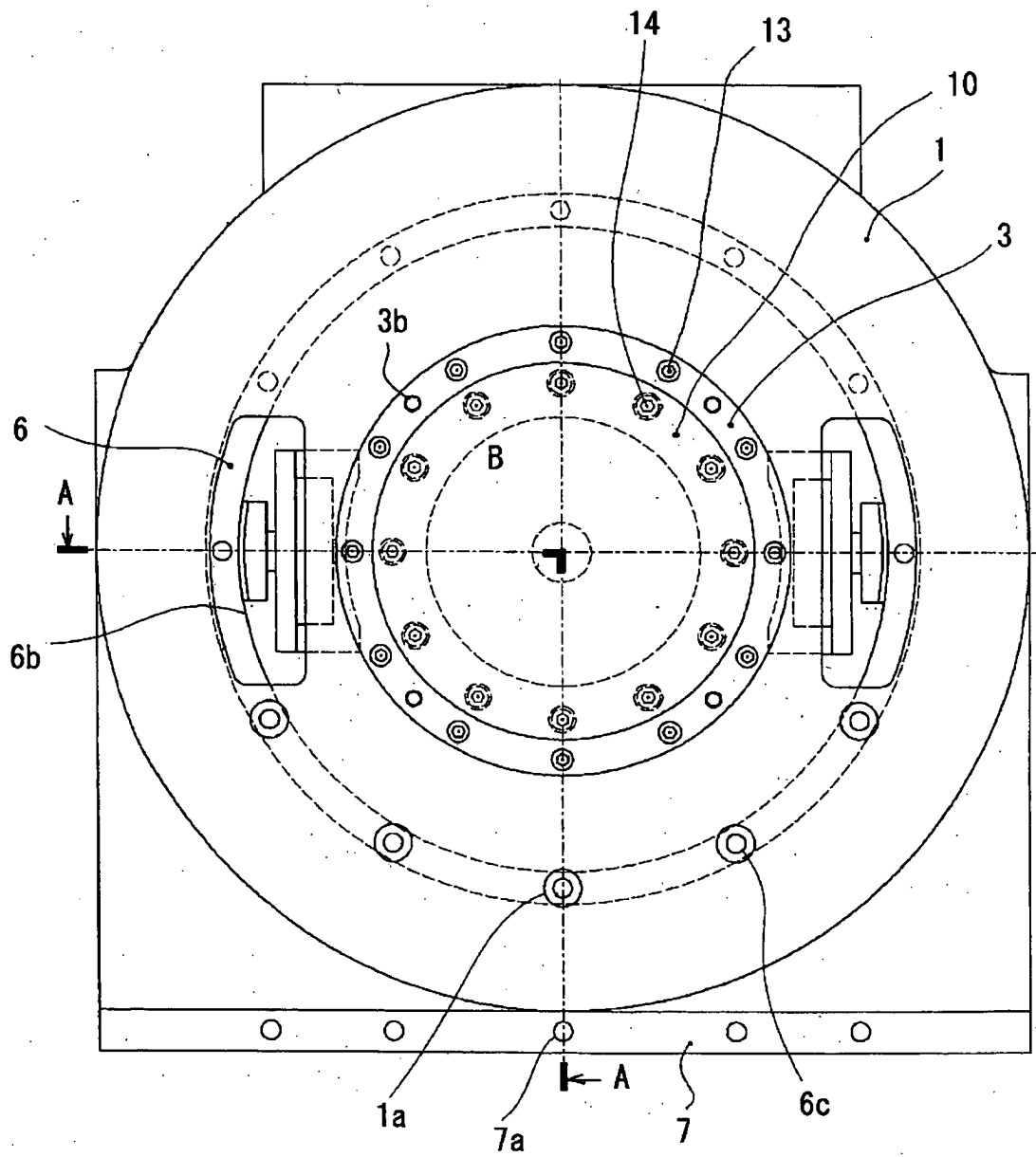
6. A method of replacing the bearing of the traction machine for the elevator as recited in either claim 1 or 3, the method **characterized in** comprising the steps of:

directly/indirectly fastening the rotor to the housing; demounting the stationary shaft, the bearing and the bearing boss;

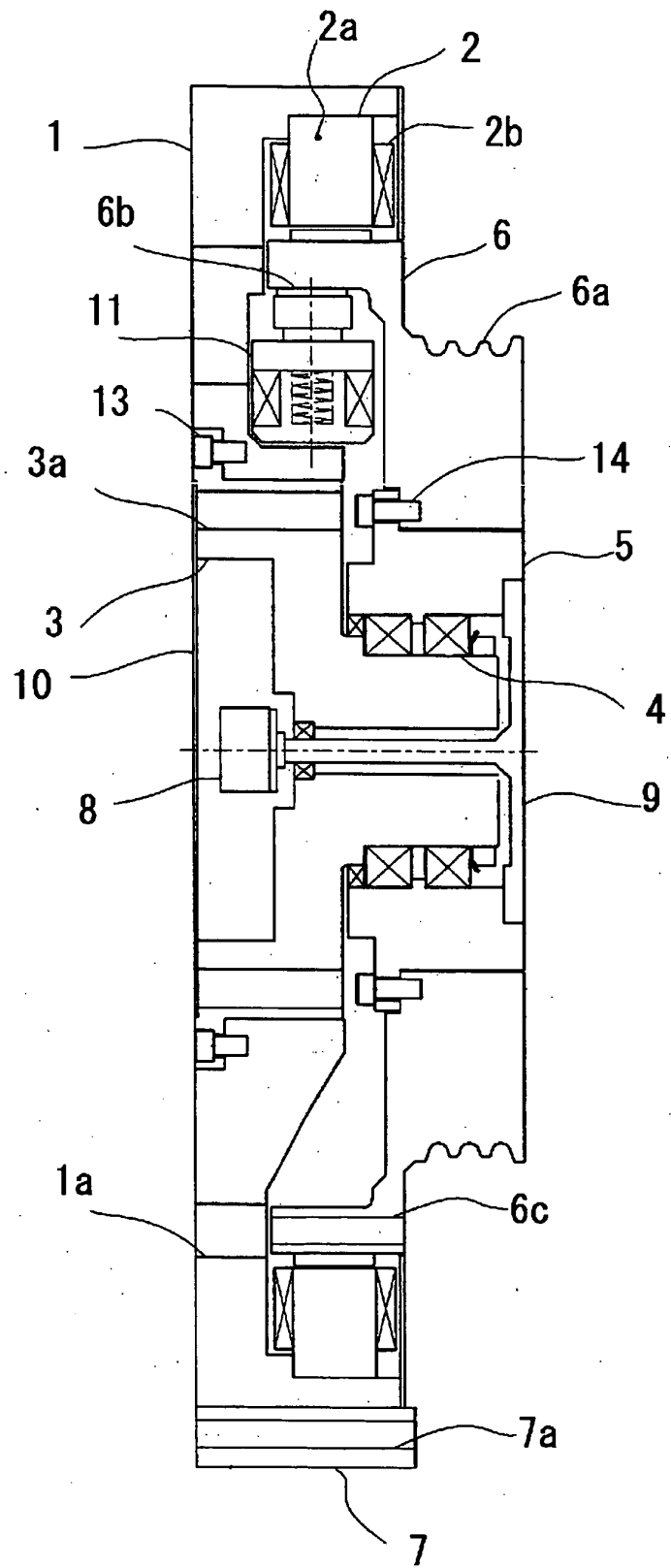
inspecting/replacing the bearing; fastening the stationary shaft, the bearing and the bearing boss; and

unfastening directly/indirectly the rotor having been fastened to the housing.

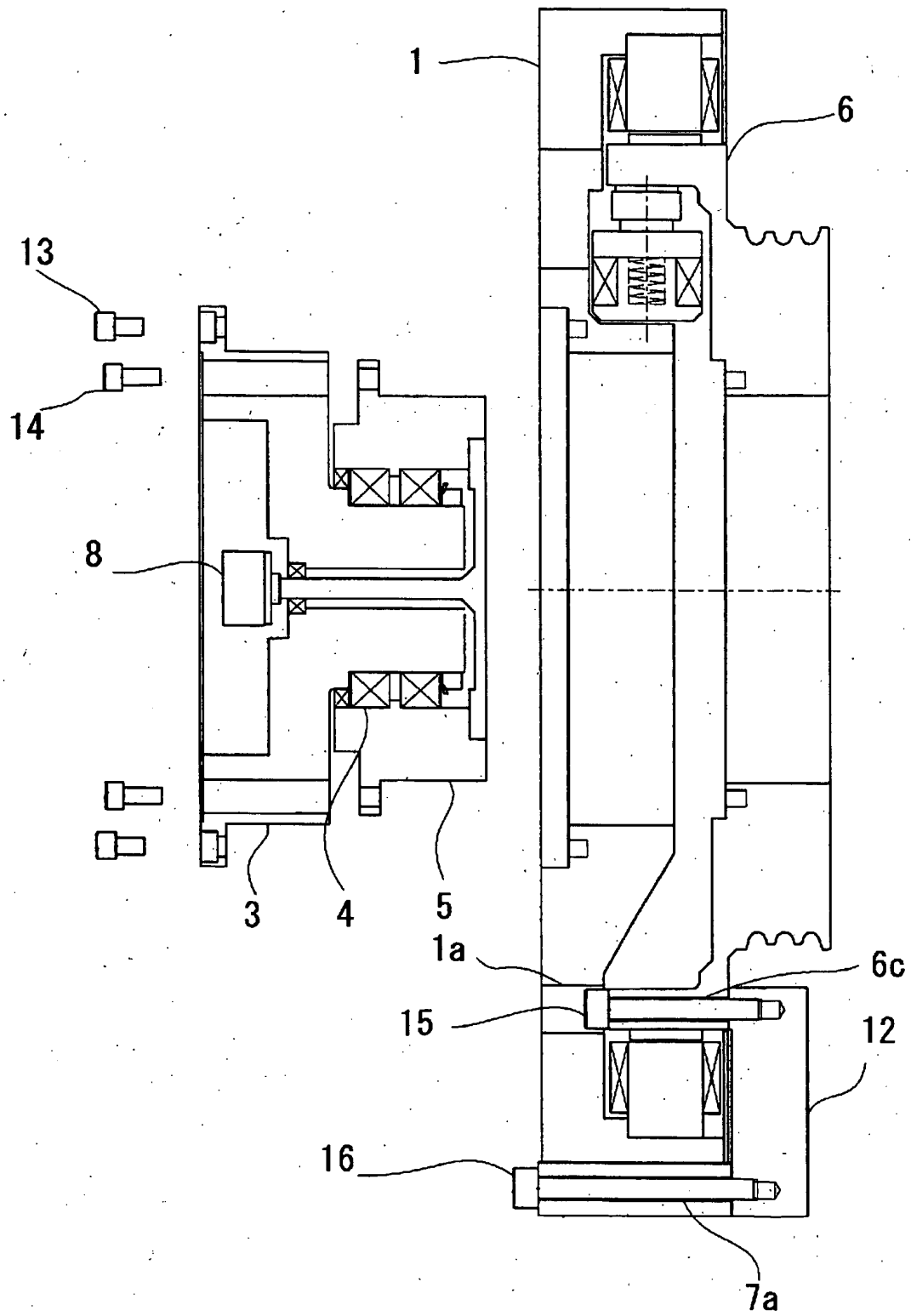
【Fig 1】



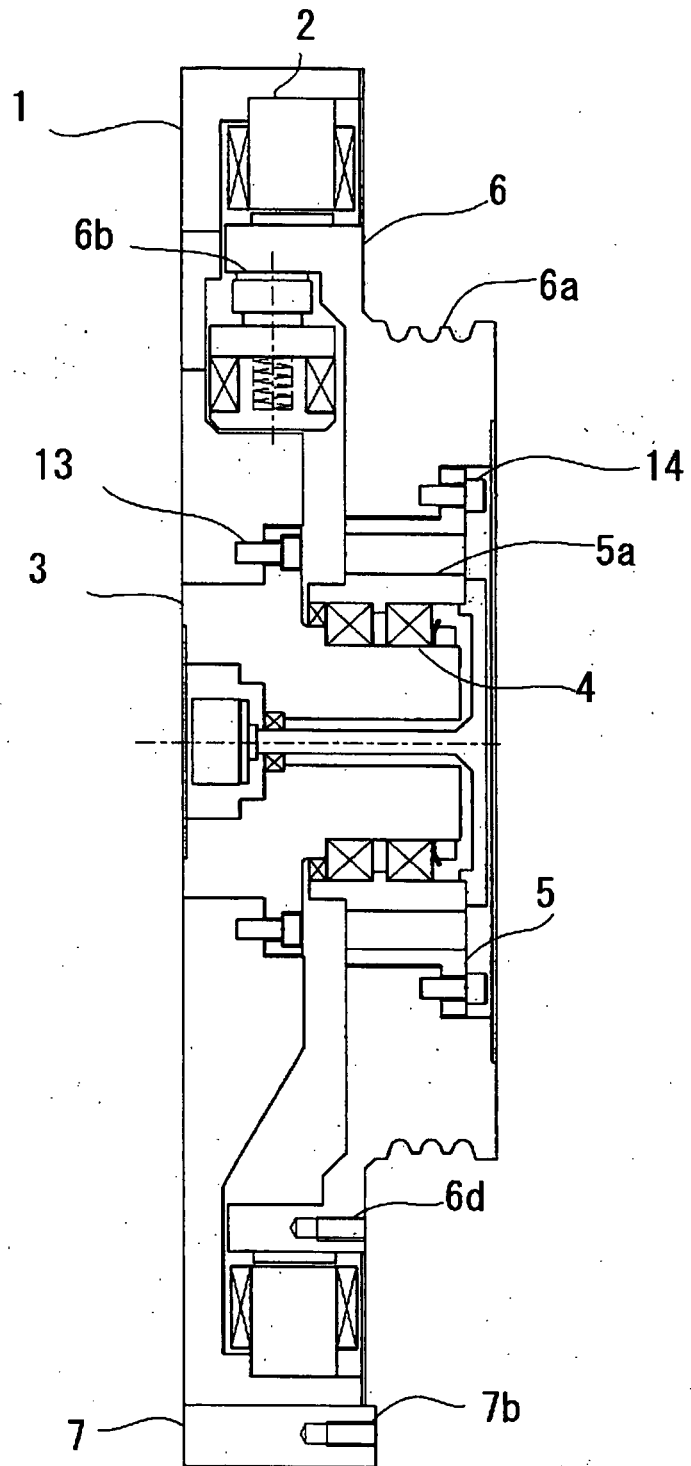
【Fig 2】



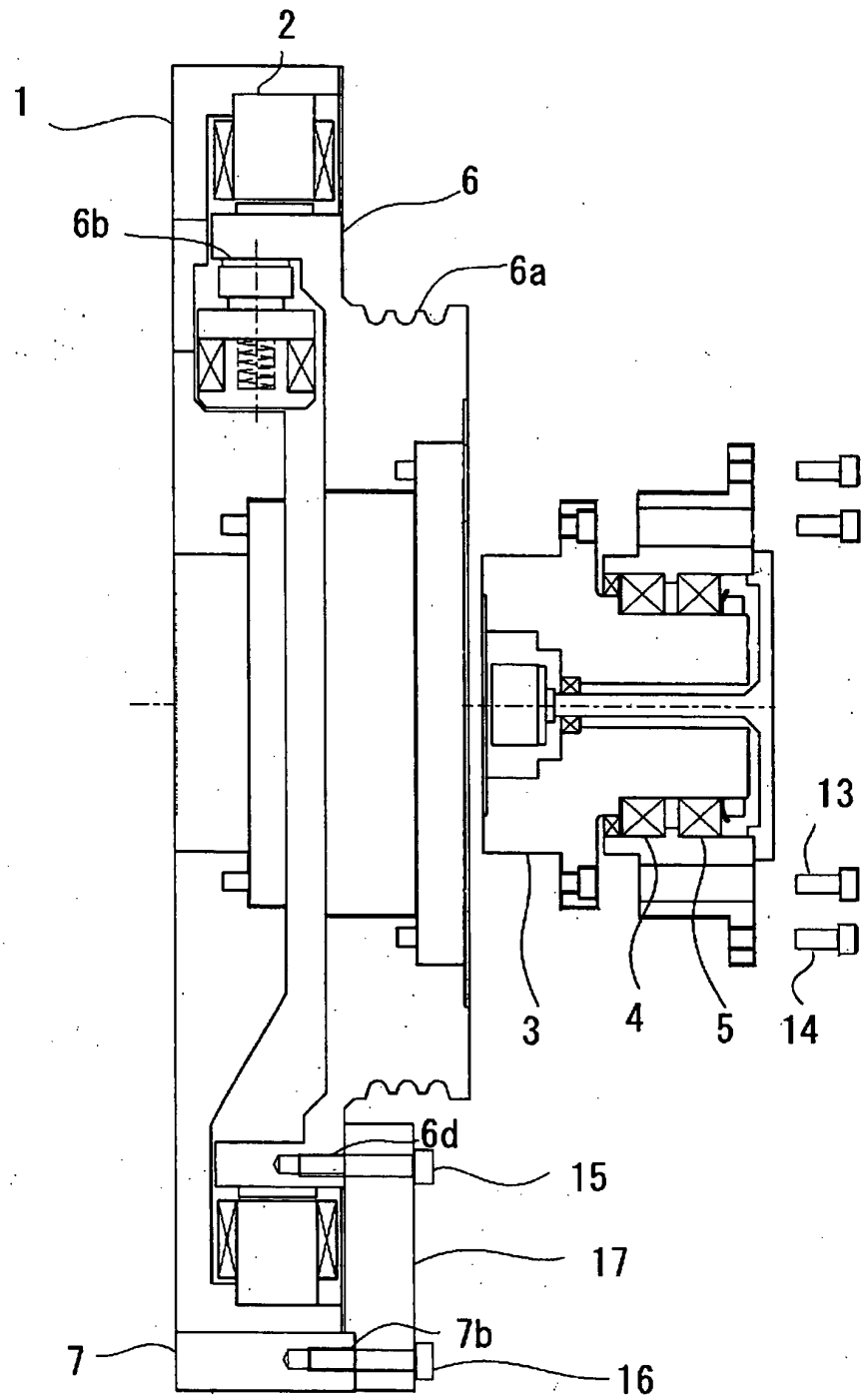
【Fig 3】



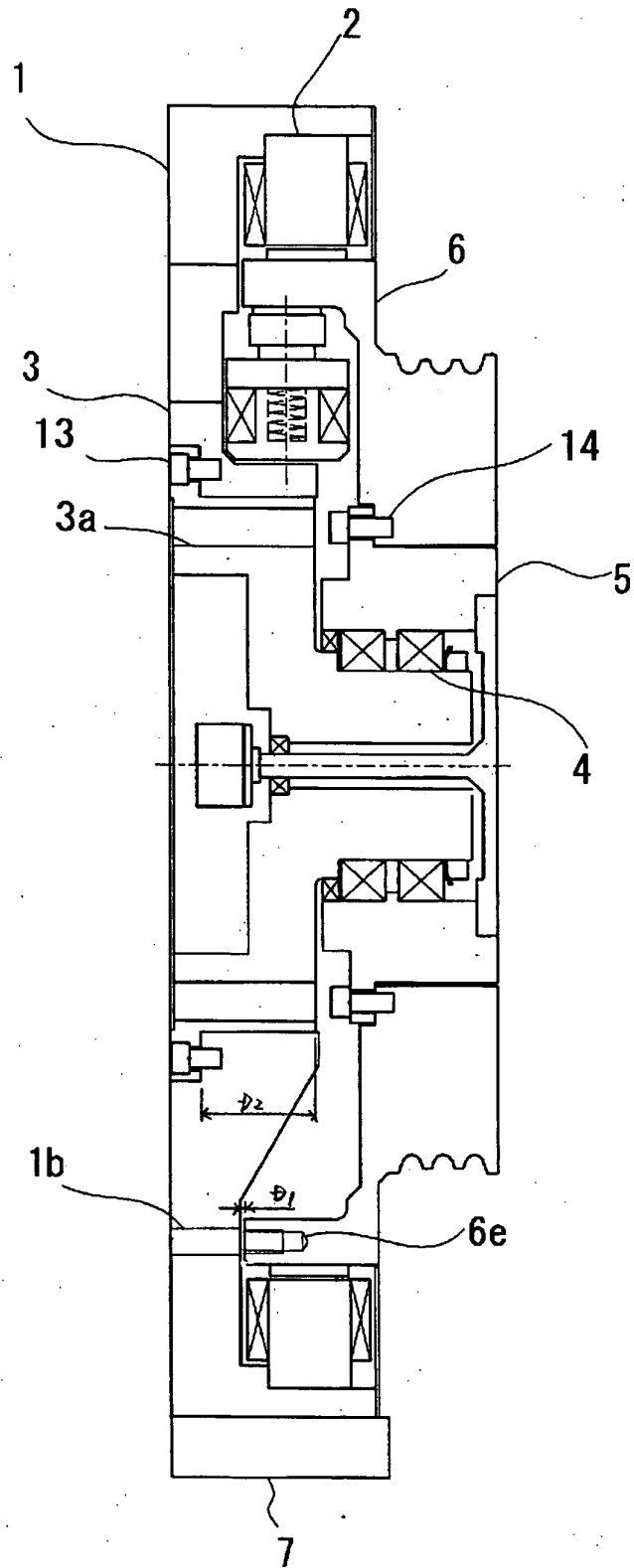
【Fig 4】



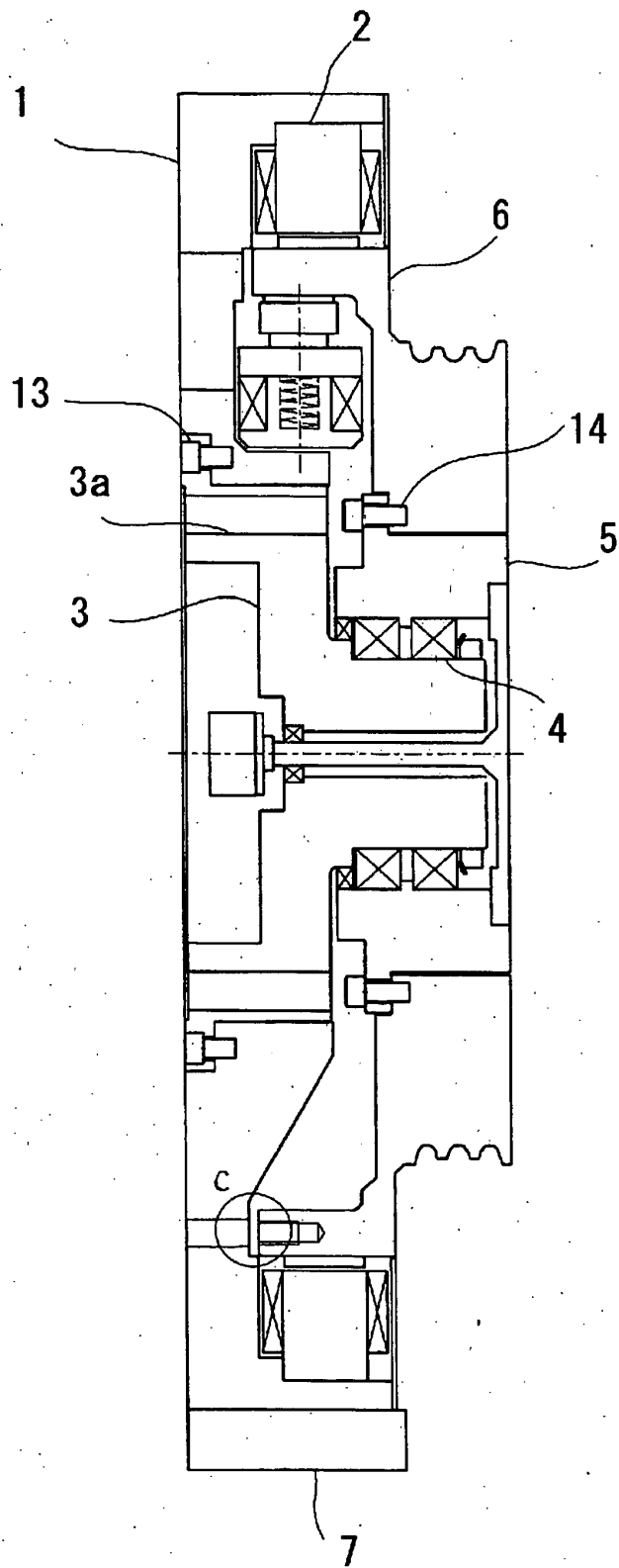
【Fig 5】



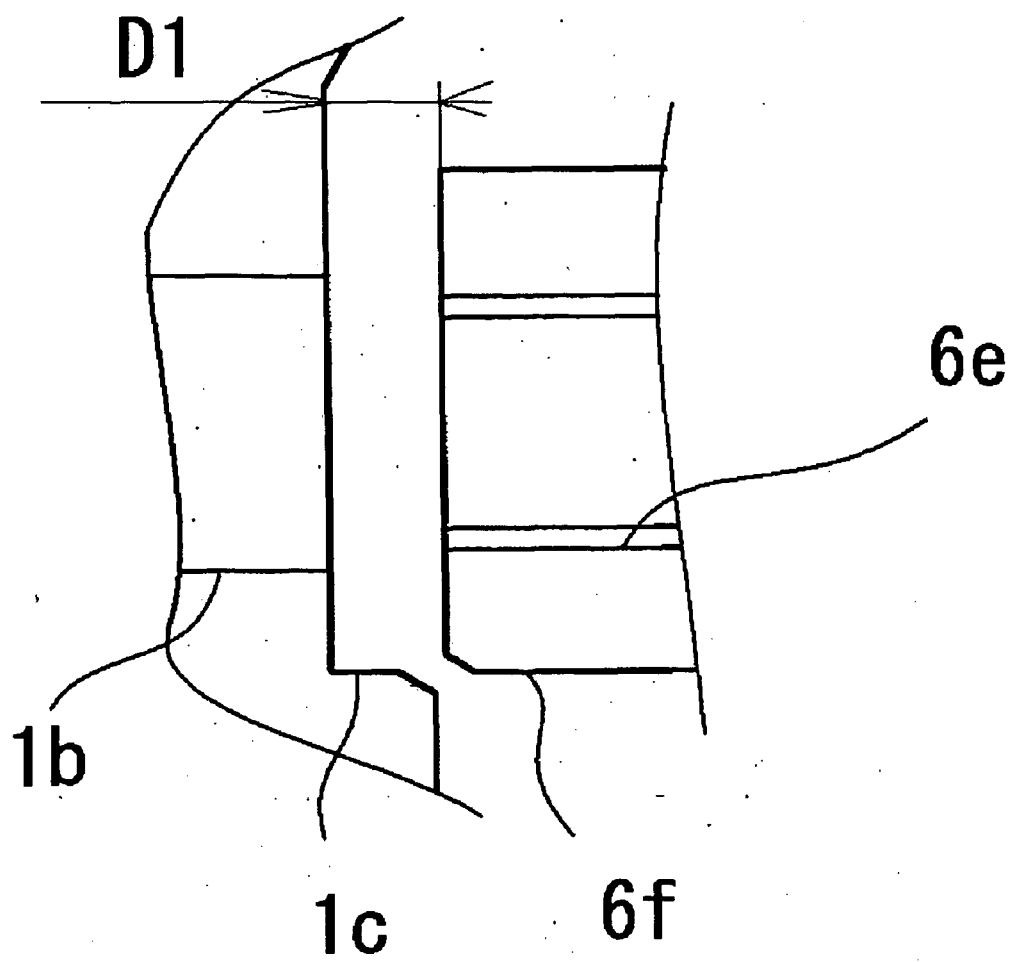
【Fig 6】



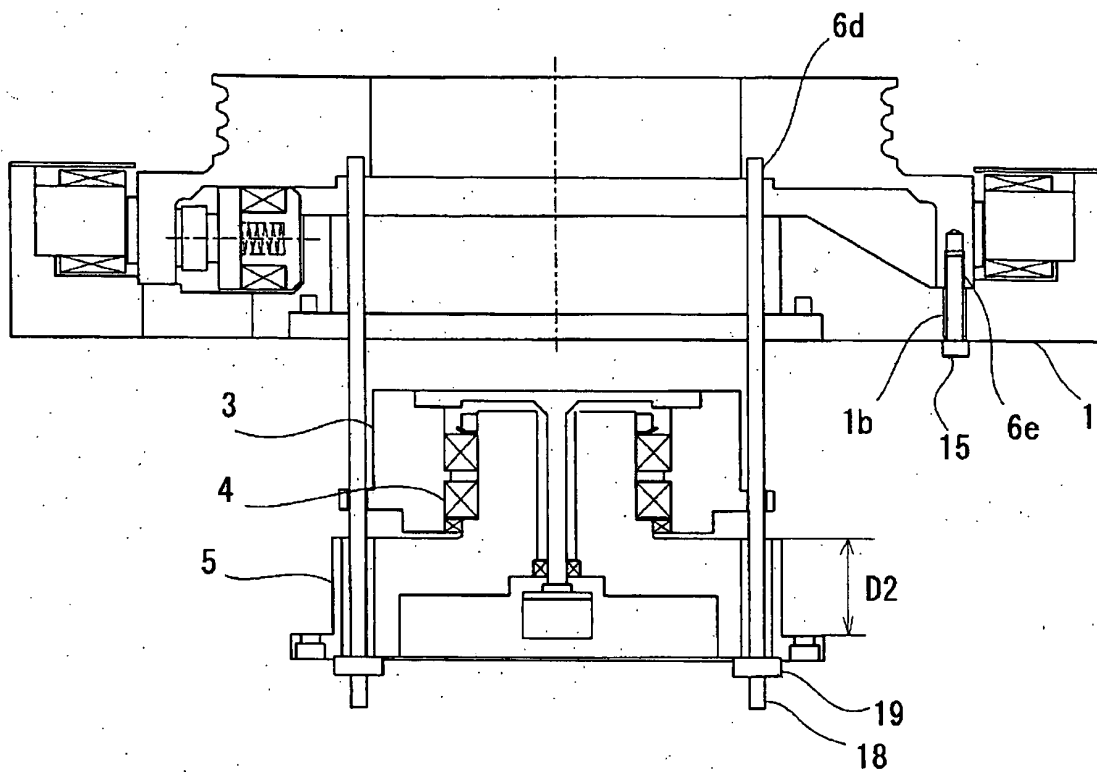
【Fig 7】



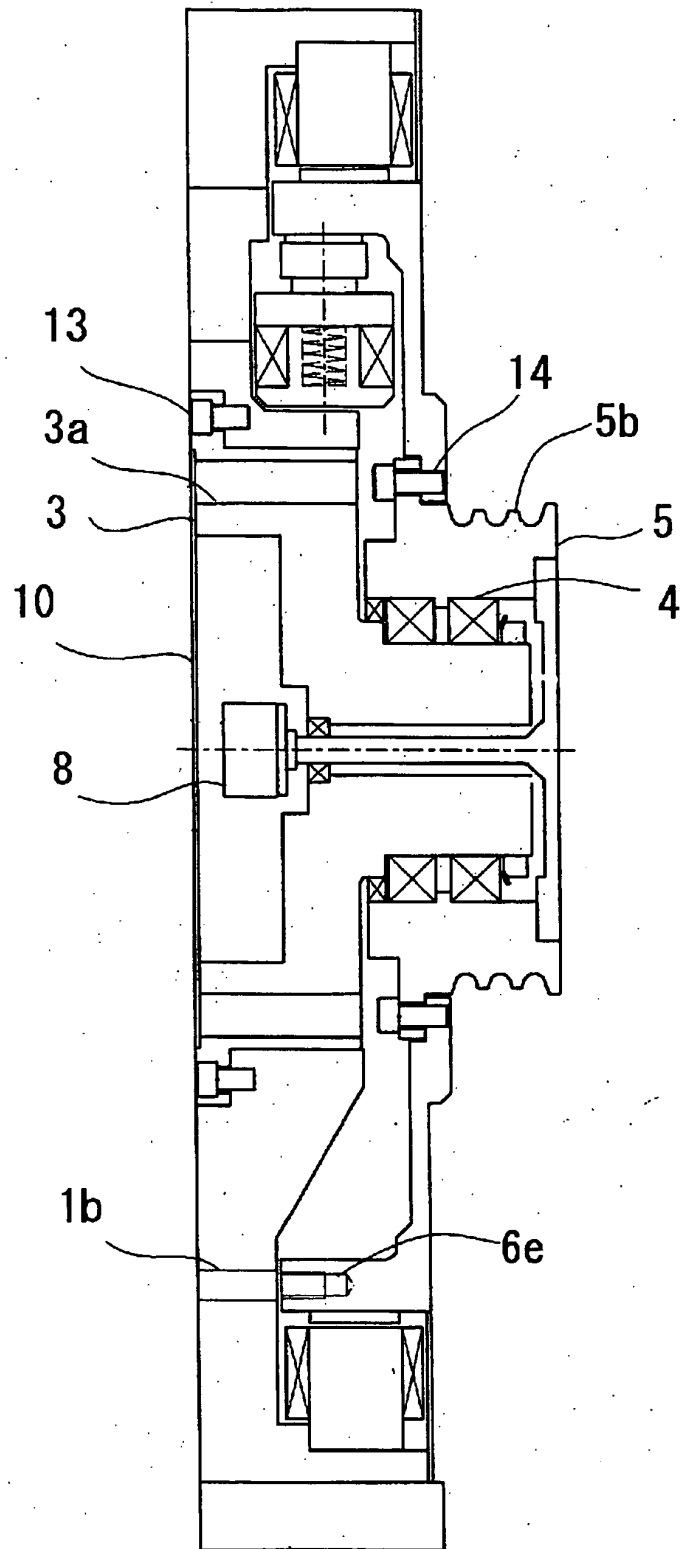
【Fig8】



【Fig 9】



【Fig 1 0】



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2006/301643

A. CLASSIFICATION OF SUBJECT MATTER B66B11/08 (2006.01), B66B7/00 (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	JP 2004-338915 A (Hitachi, Ltd.), 02 December, 2004 (02.12.04), Par. Nos. [0011] to [0023]; Figs. 1 to 3 (Family: none)	1-6
Y	JP 2004-107048 A (Mitsubishi Electric Corp.), 08 April, 2004 (08.04.04), Abstract; Figs. 1 to 4 (Family: none)	1-6
Y	JP 62-222991 A (Otis Elevator Co.), 30 September, 1987 (30.09.87), & US 4679661 A1 & AU 6909087 A & DE 3705752 A1 & FR 2594816 A1 & GB 2187700 A & CH 673730 A5 & CA 1275630 C & IN 168164 A1	2, 4
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
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Date of the actual completion of the international search 10 May, 2006 (10.05.06)		Date of mailing of the international search report 16 May, 2006 (16.05.06)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

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