



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
09.12.2009 Bulletin 2009/50

(51) Int Cl.:
B66B 3/00 (2006.01) B66B 5/02 (2006.01)

(21) Application number: **07739451.8**

(86) International application number:
PCT/JP2007/056010

(22) Date of filing: **23.03.2007**

(87) International publication number:
WO 2008/117368 (02.10.2008 Gazette 2008/40)

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

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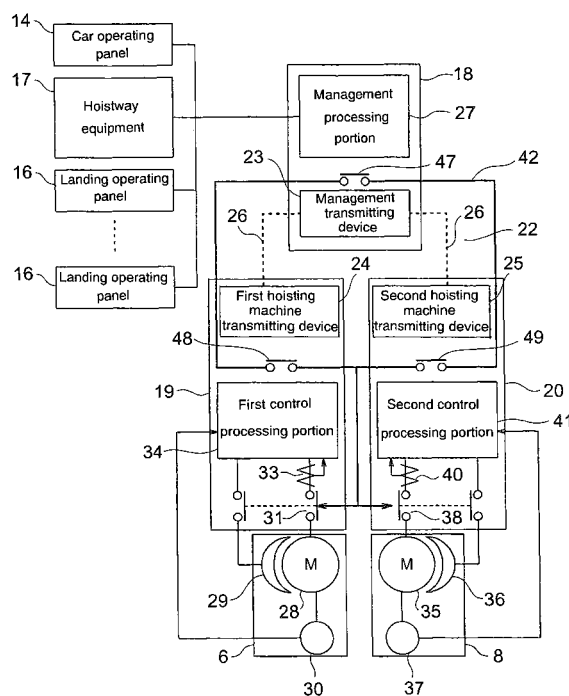
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(54) **ELEVATOR CONTROL SYSTEM**

(57) In an elevator control system that controls driving of a plurality of hoisting machines that raise and lower a common car, a plurality of hoisting machine control apparatuses and a running management apparatus are disposed so as to be separate from each other. The respective hoisting machine control apparatuses control driving of each of the hoisting machines individually. The running management apparatus outputs a control command to each of the hoisting machine control apparatuses. Communication between the running management apparatus and each of the hoisting machine control apparatuses is performed by serial transmission by a transmitting means. An abnormal stoppage circuit that is independent from the transmitting means is disposed on the running management apparatus and each of the hoisting machine control apparatuses. The abnormal stoppage circuit stops supply of electric power to each of the hoisting machines simultaneously if at least one of the running management apparatus or the hoisting machine control apparatuses detects an elevator abnormality.

FIG. 2



Description

TECHNICAL FIELD

[0001] The present invention relates to an elevator control system that controls driving of a plurality of hoisting machines that raise and lower a common car.

BACKGROUND ART

[0002] Conventionally, in order to prevent enlargement of hoisting machines, elevators have been proposed in which a common car is raised and lowered by driving a plurality of hoisting machines. Main ropes that suspend the car are wound around a sheave of each of the hoisting machines. The car is raised and lowered by rotation of the sheaves of the respective hoisting machines. The respective hoisting machines are controlled by one control board (See Patent Literature 1).

[0003] Conventionally, in order to prevent enlargement of control devices, elevators have also been proposed in which elevator control functions are separated into a motor control system that performs motor control of a hoisting machine and an operational control system that performs operational control of a car. The motor control system is installed in a vicinity of the hoisting machine, and the operational control system is installed inside an operating panel of the car. Communication between the motor control system and the operational control system is performed by serial transmission (See Patent Literature 2).

[0004]

[Patent Literature 1]

W02004/024609

[Patent Literature 2]

Japanese Patent Laid-Open No. 2005-47679 (Gazette)

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0005] However, in the elevator that is disclosed in Patent Literature 1, because the respective hoisting machines are controlled by one control board, the control board is enlarged, and installation sites are limited, particularly if the control board is to be installed inside a hoistway. If an abnormality arises in communication between any one of the hoisting machines and the control board, there is a risk that drift may arise in the magnitude of speed of the main ropes that are moved by each of the hoisting machines, and the car may incline.

[0006] In the elevator that is disclosed in Patent Literature 2, if the car is raised and lower by one hoisting machine, the hoisting machine is enlarged. If the car is raised and lower by a plurality of hoisting machines, then if an abnormality arises in any portion of the communi-

cation between the control system of the respective hoisting machines, there is a risk that drift may arise in the magnitude of speed of the main ropes that are moved by each of the hoisting machines, and the car may incline.

[0007] The present invention aims to solve the above problems and an object of the present invention is to provide an elevator control system that can enable overall reductions in control system size, and that can also prevent a car from inclining.

MEANS FOR SOLVING THE PROBLEM

[0008] In order to achieve the above object, according to one aspect of the present invention, there is provided an elevator control system that controls driving of a plurality of hoisting machines that raise and lower a common car, the elevator control system being characterized in including: a plurality of hoisting machine control apparatuses that are separate from each other, and that control driving of each of the hoisting machines individually; a running management apparatus that is separate from each of the hoisting machine control apparatuses, and that outputs a control command to each of the hoisting machine control apparatuses; a transmitting means that performs communication between the running management apparatus and each of the hoisting machine control apparatuses by serial transmission; and an abnormal stoppage circuit that is independent from the transmitting means, and that stops supply of electric power to each of the hoisting machines simultaneously if at least one of the running management apparatus or the hoisting machine control apparatuses detects an elevator abnormality.

EFFECTS OF THE INVENTION

[0009] In an elevator control system according to the present invention, because communication between the running management apparatus and the plurality of hoisting machine control apparatuses is performed by the transmitting means, and an abnormal stoppage circuit that simultaneously stops the supply of electric power to each of the hoisting machines during the occurrence of an elevator abnormality is also disposed independently from the transmitting means, elevator control functions can be divided among the running management apparatus and the plurality of hoisting machine control apparatuses, enabling reductions in overall size of the control system. Reductions in the respective sizes of each of the hoisting machines can also be achieved. In addition, because driving of each of the hoisting machines can be stopped simultaneously by the abnormal stoppage circuit during the occurrence of an elevator abnormality, driving of only one of the first hoisting machines can be prevented, enabling the car to be prevented from inclining.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Figure 1 is a schematic structural diagram that shows an elevator apparatus according to Embodiment 1 of the present invention;

Figure 2 is a block diagram that shows the elevator apparatus in Figure 1;

Figure 3 is a structural diagram that shows an abnormal stoppage circuit from Figure 2; and

Figure 4 is a block diagram that shows an elevator apparatus according to Embodiment 2 of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0011] Preferred embodiments of the present invention will now be explained with reference to the drawings.

Embodiment 1

[0012] Figure 1 is a schematic structural diagram that shows an elevator apparatus according to Embodiment 1 of the present invention. In the figure, a first hoisting machine 2 and a second hoisting machine 3 (a plurality of hoisting machines), and a first deflection sheave 4 and a second deflection sheave 5 are disposed in an upper portion of a hoistway 1.

[0013] The first hoisting machine 2 has: a first hoisting machine main body 6; and a first drive sheave 7 that is rotated by the first hoisting machine main body 6. The second hoisting machine 3 has: a second hoisting machine main body 8; and a second drive sheave 9 that is rotated by the second hoisting machine main body 8.

[0014] A first main rope 12 is wound around the first deflection sheave 4 and the first drive sheave 7, and a second main rope 13 is wound around the second deflection sheave 5 and the second drive sheave 9. A common car 10 and a common counterweight 11 are suspended by the first main rope 12 and the second main rope 13. The car 10 and the counterweight 11 are raised and lowered inside the hoistway 1 by rotation of both the first drive sheave 7 and the second drive sheave 9.

[0015] A car operating panel 14 is disposed inside the car 10. A plurality of destination floor buttons that enable a destination floor for the car 10 to be selected are disposed on the car operating panel 14. Information about the destination floor is output from the car operating panel 14 when the destination floor buttons are operated.

[0016] Landing operating panels 16 are disposed on the landings 15 of the respective building floors. A pair of landing buttons that represent up and down directions, respectively, are disposed on each of the landing operating panels 16. Information about the landing floor is output from the landing operating panel 16 when a landing button is operated.

[0017] Hoistway equipment 17 that includes, for exam-

ple, position detecting apparatuses that detect whether or not the car 10 is passing through, etc., is disposed at predetermined positions inside the hoistway 1. Elevator operating conditions information that includes position information for the car 10, etc., is output from the hoistway equipment 17.

[0018] A running management apparatus 18 that manages operation of the elevator, a first hoisting machine control apparatus 19 that controls driving of the first hoisting machine 2, and a second hoisting machine control apparatus 20 that controls driving of the second hoisting machine 3 are disposed inside the hoistway 1 so as to be separate from each other.

[0019] Respective information from the car operating panel 14, from each of the landing operating panels 16, and from the hoistway equipment 17 is sent to the running management apparatus 18. The running management apparatus 18 outputs control commands that relate to elevator drive control based on the respective information from the car operating panel 14, each of the landing operating panels 16, and the hoistway equipment 17.

[0020] The first hoisting machine control apparatus 19 is disposed in a vicinity of the first hoisting machine 2, and the second hoisting machine control apparatus 20 is disposed in a vicinity of the second hoisting machine 3. The first hoisting machine control apparatus 19 and the second hoisting machine control apparatus 20 respectively control the first hoisting machine 2 and the second hoisting machine 3 individually based on the control commands from the running management apparatus 18.

[0021] Figure 2 is a block diagram that shows the elevator apparatus in Figure 1. In the figure, a transmitting means 22 is connected between both the first hoisting machine control apparatus 19 and the running management apparatus 18 and between the second hoisting machine control apparatus 20 and the running management apparatus 18. The transmitting means 22 performs communication between both the first hoisting machine control apparatus 19 and the running management apparatus 18 and between the second hoisting machine control apparatus 20 and the running management apparatus 18 by serial transmission.

[0022] The transmitting means 22 has: a management transmitting device 23 that is disposed on the running management apparatus 18; a first hoisting machine transmitting device 24 that is disposed on the first hoisting machine control apparatus 19; a second hoisting machine transmitting device 25 that is disposed on the second hoisting machine control apparatus 20; and serial transmission lines 26 that connect the management transmitting device 23 with the first hoisting machine transmitting device 24 and the second hoisting machine transmitting device 25, respectively.

[0023] Respective information from the first hoisting machine control apparatus 19 and the second hoisting machine control apparatus 20 is sent to the running management apparatus 18 by means of the serial transmis-

sion lines 26, and information from the running management apparatus 18 is sent to the first hoisting machine control apparatus 19 and the second hoisting machine control apparatus 20 by means of the respective serial transmission lines 26. In other words, the running management apparatus 18 can communicate individually with the first hoisting machine control apparatus 19 and the second hoisting machine control apparatus 20 using the transmitting means 22.

[0024] The running management apparatus 18 has a management processing portion 27 that processes the respective information from the car operating panel 14, each of the landing operating panels 16, and the hoistway equipment 17. Set speed patterns for controlling the speed of the car 10 are preset in the management processing portion 27. The management processing portion 27 finds the destination floor of the car 10 based on the respective information from the car operating panel 14, each of the landing operating panels 16, and the hoistway equipment 17, and calculates voltage values and electric current values such that the speed of the car 10 follows the set speed patterns while moving toward the destination floor. Information that includes the voltage values and the electric current value that have been calculated by the management processing portion 27 is output as control commands from the running management apparatus 18. The control commands from the running management apparatus 18 are sent to the first hoisting machine control apparatus 19 and the second hoisting machine control apparatus 20, respectively, by the transmitting means 22.

[0025] The first hoisting machine main body 6 has: a first motor 28 that rotates the first drive sheave 7; and a first brake 29 that brakes rotation of the first drive sheave 7. A first encoder (a first rotation detector) 30 that generates a signal that corresponds to the rotation of the first drive sheave 7 is disposed on the first hoisting machine main body 6.

[0026] Power lines from the first hoisting machine control apparatus 19 are electrically connected to the first motor 28 and the first brake 29, respectively. The respective power lines are electrically connected to a driving power source. A first power switch (a first power contact) 31 that can simultaneously open and close electrical connection between the first motor 28 and the driving power source and between the first brake 29 and the driving power source is disposed on the power lines.

[0027] Supply of power from the driving power source to both the first motor 28 and the first brake 29 is enabled by closing the first power switch 31, and is stopped by opening the first power switch 31. A first electric current sensor (a first electric current detector) 33 that detects the electric current value to the first motor 28 is disposed on the power line to the first motor 28.

[0028] The first hoisting machine control apparatus 19 has a first control processing portion 34 that adjusts a supply of power to the first hoisting machine 2 based on the control commands from the running management ap-

paratus 18. The first control processing portion 34 adjusts the supply of power to the first hoisting machine 2 while comparing respective information from the first encoder 30 and the first electric current sensor 33 with the control commands from the running management apparatus 18. Driving of the first hoisting machine 2 is controlled by the adjustment of the supply of power by the first control processing portion 34.

[0029] The respective information from the first encoder 30 and the first electric current sensor 33 is output from the first hoisting machine control apparatus 19 to the running management apparatus 18 without modification. The information from the first hoisting machine control apparatus 19 is sent to the running management apparatus 18 by the transmitting means 22.

[0030] The second hoisting machine main body 8 has: a second motor 35 that rotates the second drive sheave 9; and a second brake 36 that brakes rotation of the second drive sheave 9. A second encoder (a second rotation detector) 37 that generates a signal that corresponds to the rotation of the second drive sheave 9 is disposed on the second hoisting machine main body 8.

[0031] Power lines from the second hoisting machine control apparatus 20 are electrically connected to the second motor 35 and the second brake 36, respectively. The respective power lines are electrically connected to a driving power source. A second power switch (a second power contact) 38 that can simultaneously open and close electrical connection between the second motor 35 and the driving power source and between the second brake 36 and the driving power source is disposed on the power lines.

[0032] Supply of power from the driving power source to both the second motor 35 and the second brake 36 is enabled by closing the second power switch 38, and is stopped by opening the second power switch 38. A second electric current sensor (a second electric current detector) 40 that detects the electric current value to the second motor 35 is disposed on the power line to the second motor 35.

[0033] The second hoisting machine control apparatus 20 has a second control processing portion 41 that adjusts a supply of power to the second hoisting machine 3 based on the control commands from the running management apparatus 18. The second control processing portion 41 adjusts the supply of power to the second hoisting machine 3 while comparing respective information from the second encoder 37 and the second electric current sensor 40 with the control commands from the running management apparatus 18. Driving of the second hoisting machine 3 is controlled by the adjustment of the supply of power by the second control processing portion 41.

[0034] The respective information from the second encoder 37 and the second electric current sensor 40 is output from the second hoisting machine control apparatus 20 to the running management apparatus 18 without modification. The information from the second hoist-

ing machine control apparatus 20 is sent to the running management apparatus 18 by the transmitting means 22.

[0035] The running management apparatus 18 detects whether or not the first hoisting machine 2 and the second hoisting machine 3 are both acting in synchrony based on the respective information from the first hoisting machine control apparatus 19 and the second hoisting machine control apparatus 20. The first hoisting machine control apparatus 19 detects whether or not the first hoisting machine 2 is acting in accordance with the control commands based on the respective information from the first encoder 30 and the first electric current sensor 33. The second hoisting machine control apparatus 20 detects whether or not the second hoisting machine 3 is acting in accordance with the control commands based on the respective information from the second encoder 37 and the second electric current sensor 40. In other words, the running management apparatus 18, the first hoisting machine control apparatus 19, and the second hoisting machine control apparatus 20 each detect the presence or absence of an elevator abnormality while the elevator is operating.

[0036] An abnormal stoppage circuit 42 that stops the supply of power to both the first hoisting machine 2 and the second hoisting machine 3 when there is an elevator abnormality is mounted to the running management apparatus 18, the first hoisting machine control apparatus 19, and the second hoisting machine control apparatus 20. The abnormal stoppage circuit 42 is disposed independently from the transmitting means 22.

[0037] Figure 3 is a structural diagram that shows the abnormal stoppage circuit 42 from Figure 2. In the figure, the abnormal stoppage circuit 42 is a single circuit that is passed through the running management apparatus 18, the first hoisting machine control apparatus 19, and the second hoisting machine control apparatus 20, respectively. The abnormal stoppage circuit 42 simultaneously stops the supply of power from a driving power source 43 to both the first hoisting machine 2 and the second hoisting machine 3 if at least one of the running management apparatus 18, the first hoisting machine control apparatus 19, and the second hoisting machine control apparatus 20 detects an elevator abnormality.

[0038] The abnormal stoppage circuit 42 has: a circuit power source 44; a plurality of (in this example, two) circuit coils 45 and 46; and a plurality of (in this example, three) detecting switches 47, 48, and 49. The circuit power source 44, the circuit coils 45 and 46, and the detecting switches 47, 48, and 49 are connected in series.

[0039] The circuit coil 45 performs opening and closing actions on the first power switch 31. The closing action is performed on the first power switch 31 when electric current is passed from the circuit power source 44 to the circuit coil 45, and the opening action is performed on the first power switch 31 when the passage of electric current from the circuit power source 44 to the circuit coil 45 is stopped. In other words, the circuit coil 45 enables the supply of power to the first hoisting machine 2 by the

passage of electric current from the circuit power source 44, and stops the supply of power to the first hoisting machine 2 by stopping the passage of electric current.

[0040] The circuit coil 46 performs opening and closing actions on the second power switch 38. The closing action is performed on the second power switch 38 when electric current is passed from the circuit power source 44 to the circuit coil 46, and the opening action is performed on the second power switch 38 when the passage of electric current from the circuit power source 44 to the circuit coil 46 is stopped. In other words, the circuit coil 46 enables the supply of power to the second hoisting machine 3 by the passage of electric current from the circuit power source 44, and stops the supply of power to the second hoisting machine 3 by stopping the passage of electric current.

[0041] A detecting switch 47 is disposed on the running management apparatus 18. The detecting switch 47 performs the opening and closing actions in response to the presence or absence of an elevator abnormality as detected by the running management apparatus 18. In other words, the detecting switch 47 is closed during normal operation, and performs the opening action if the running management apparatus 18 detects an elevator abnormality.

[0042] A detecting switch 48 is disposed on the first hoisting machine control apparatus 19. The detecting switch 48 performs the opening and closing actions in response to the presence or absence of an elevator abnormality as detected by the first hoisting machine control apparatus 19. In other words, the detecting switch 48 is closed during normal operation, and performs the opening action if the first hoisting machine control apparatus 19 detects an elevator abnormality.

[0043] A detecting switch 49 is disposed on the second hoisting machine control apparatus 20. The detecting switch 49 performs the opening and closing actions in response to the presence or absence of an elevator abnormality as detected by the second hoisting machine control apparatus 20. In other words, the detecting switch 49 is closed during normal operation, and performs the opening action if the second hoisting machine control apparatus 20 detects an elevator abnormality.

[0044] In other words, the detecting switches 47, 48, and 49 are all closed during normal operation, and perform opening actions individually if any one of the running management apparatus 18, the first hoisting machine control apparatus 19, and the second hoisting machine control apparatus 20 detects an elevator abnormality.

[0045] The passage of electric current to the respective circuit coils 45 and 46 is performed by closing all of the detecting switches 47 through 49 only if none of the running management apparatus 18, the first hoisting machine control apparatus 19, and the second hoisting machine control apparatus 20 has detected an elevator abnormality (i.e., only if a normal state is detected). If at least one of the running management apparatus 18, the first hoisting machine control apparatus 19, and the sec-

ond hoisting machine control apparatus 20 detects an elevator abnormality, the passage of electric current to the respective circuit coils 45 and 46 is stopped by the opening action of any one of the detecting switches 47, 48, and 49.

[0046] Next, operation will be explained. During normal operation, each of the detecting switches 47, 48, and 49 is in a closed state because no abnormality is detected in the elevator by the running management apparatus 18, the first hoisting machine control apparatus 19, or the second hoisting machine control apparatus 20. Both the first power switch 31 and the second power switch 38 are thereby in a closed state, enabling the supply of electric power to the first hoisting machine 2 and the second hoisting machine 3, respectively.

[0047] At this point, the first hoisting machine 2 and the second hoisting machine 3 are driven in synchrony by control from the first hoisting machine control apparatus 19 and the second hoisting machine control apparatus 20 in accordance with the control commands from the running management apparatus 18. The car 10 and the counterweight 11 are thereby raised and lowered inside the hoistway 1.

[0048] If, for example, an inverter that is disposed on the first hoisting machine control apparatus 19 fails and the first hoisting machine control apparatus 19 detects an elevator abnormality, the detecting switch 48 will perform an opening action. The passage of electric current to each of the circuit coils 45 and 46 is thereby stopped, and both the first power switch 31 and the second power switch 38 perform opening actions. The supply of electric power to both the first hoisting machine 2 and the second hoisting machine 3 is thereby stopped simultaneously.

[0049] When the supply of electric power to both the first hoisting machine 2 and the second hoisting machine 3 is stopped simultaneously, driving of the first motor 28 and the second motor 35 stops simultaneously, and the braking actions of the first brake 29 and the second brake 36 are also commenced simultaneously. Movement of the first main rope 12 and the second main rope 13 is thereby also stopped simultaneously. Movement of the car 10 and the counterweight 11 is stopped by the stopping of movement of the first main rope 12 and the second main rope 13.

[0050] In an elevator control system of this kind, because communication among the running management apparatus 18, the first hoisting machine control apparatus 19, and the second hoisting machine control apparatus 20 is performed by the transmitting means 22, and an abnormal stoppage circuit 42 that simultaneously stops the supply of electric power to the first hoisting machine 2 and the second hoisting machine 3 during the occurrence of an elevator abnormality is also disposed independently from the transmitting means 22, elevator control functions can be divided among the running management apparatus 18, the first hoisting machine control apparatus 19, and the second hoisting machine control apparatus 20, enabling reductions in overall size of the

control system. Reductions in the respective sizes of the first hoisting machine 2 and the second hoisting machine 3 can also be achieved. In addition, because driving of both the first hoisting machine 2 and the first hoisting machine 3 can be stopped simultaneously by the abnormal stoppage circuit 42 during the occurrence of an elevator abnormality, driving of only one of the first hoisting machine 2 or the second hoisting machine 3 can be prevented, enabling the car 10 to be prevented from inclining. Fluctuations in the respective tensions of the first main rope 12 and the second main rope 13 that suspend the car 10 can thereby also be suppressed, enabling extension of the service life of the first main rope 12 and the second main rope 13 also to be achieved.

[0051] Because the running management apparatus 18 can communicate with the first hoisting machine control apparatus 19 and the second hoisting machine control apparatus 20 individually using the transmitting means 22, communication between the first hoisting machine control apparatus 19 and the running management device 18 and between the second hoisting machine control apparatus 20 and the running management device 18 can be performed more reliably.

[0052] Because the abnormal stoppage circuit 42 has a circuit power source 44, circuit coils 45 and 46, and detecting switches 47, 48, and 49 that are connected in series, and the passage of electric current to the circuit coils 45 and 46 is stopped and the supply of electric power to the first hoisting machine 2 and the second hoisting machine 3 is stopped simultaneously during the occurrence of an elevator abnormality by at least one of the detecting switches 47, 48, and 49 performing an opening action, driving of each of the first hoisting machine 2 and the second hoisting machine 3 can be stopped simultaneously more reliably. The car 10 can thereby be prevented from inclining more reliably.

Embodiment 2

[0053] Figure 4 is a block diagram that shows an elevator apparatus according to Embodiment 2 of the present invention. In the figure, a transmitting means 22 has: a management transmitting device 23 that is disposed on a running management apparatus 18; a first hoisting machine transmitting device 24 that is disposed on a first hoisting machine control apparatus 19; a second hoisting machine transmitting device 25 that is disposed on a second hoisting machine control apparatus 20; and serial transmission lines 26 that connect the management transmitting device 23, the first hoisting machine transmitting device 24, and the second hoisting machine transmitting device 25 in series.

[0054] The running management apparatus 18, the first hoisting machine control apparatus 19, and the second hoisting machine control apparatus 20 are connected in series by the transmitting means 22 such that information from the running management apparatus 18 is transmitted sequentially through the first hoisting ma-

chine control apparatus 19 and the second hoisting machine control apparatus 20. Communication between the running management apparatus 18 and the first hoisting machine control apparatus 19 and communication between the first hoisting machine control apparatus 19 and the second hoisting machine control apparatus 20 are performed by the transmitting means 22.

[0055] A management processing portion 27 of the running management apparatus 18 finds the destination floor of the car 10 based on respective information from a car operating panel 14, landing operating panels 16, and hoistway equipment 17, and outputs destination floor information as control commands. The control commands from the running management apparatus 18 are sent to the first hoisting machine control apparatus 19 by the transmitting means 22.

[0056] Set speed patterns for controlling the speed of the car 10 are preset in the first hoisting machine control apparatus 19. A first control processing portion 34 calculates voltage values and electric current values as control information such that the speed of the car 10 follows the set speed patterns while moving toward the destination floor. The first control processing portion 34 also adjusts the supply of power to the first hoisting machine 2 while comparing respective information from a first encoder 30 and a first electric current sensor 33 with the calculated control information. Driving of the first hoisting machine 2 is controlled by the adjustment of the supply of power by the first control processing portion 34.

[0057] Information from the first encoder 30 and the first electric current sensor 33 and information from a second encoder 37 and a second electric current sensor 40 is sent between the first hoisting machine control apparatus 19 and the second hoisting machine control apparatus 20 by the transmitting means 22.

[0058] A second control processing portion 41 of the second hoisting machine control apparatus 20 adjusts supply of electric power to the second hoisting machine 3 based on the respective information from the first encoder 30, the first electric current sensor 33, the second encoder 37, and the second electric current sensor 40 such that driving of the second hoisting machine 3 synchronizes with driving of the first hoisting machine 2. Driving of the second hoisting machine 3 is controlled so as to be in synchrony with driving of the first hoisting machine 2 by the adjustment of the supply of electric power by the second control processing portion 41. The rest of the configuration is similar to that of Embodiment 1.

[0059] In an elevator control system of this kind, because the running management apparatus 18, the first hoisting machine control apparatus 19, and the second hoisting machine control apparatus 20 are connected in series by the transmitting means 22 such that information from the running management apparatus 18 is transmitted sequentially through the first hoisting machine control apparatus 19 and the second hoisting machine control apparatus 20, it is no longer necessary to dispose serial transmission drivers for transmitting and receiving in the

management transmitting device 23 for each of the first hoisting machine control apparatus 19 and the second hoisting machine control apparatus 20, enabling the number of serial transmission drivers to be reduced. Consequently, because the number of serial transmission drivers in the management transmitting device 23 does not need to be increased even if the number of hoisting machine control apparatuses is increased, reductions in cost can be achieved.

[0060] Moreover, in each of the above embodiments, communication between the running management apparatus 18 and each of the car operating panel 14, the landing operating panels 16, and the hoistway equipment 17, respectively, may also be performed by serial transmission by the transmitting means 22. The number of wires between the running management apparatus 18 and each of the car operating panel 14, the landing operating panels 16, and the hoistway equipment 17, respectively, can thereby be reduced.

[0061] In each of the above embodiments, the running management apparatus 18 may also be made able to record information that identifies which apparatus among the running management apparatus 18, the first hoisting machine control apparatus 19, and the second hoisting machine control apparatus 20 detected an elevator abnormality (abnormality detection information). Location of an abnormality can thereby be easily identified after operation of the elevator has been stopped simply by checking the record in the running management apparatus 18.

[0062] In each of the above embodiments, the present invention has been applied to an elevator that raises and lowers a car 10 and a counterweight 11 by driving two hoisting machine 2 and 3, but the present invention may also be applied to elevators that raise and lower a car 10 and a counterweight 11 by driving three or more hoisting machines.

Claims

1. An elevator control system that controls driving of a plurality of hoisting machines that raise and lower a common car, the elevator control system being **characterized in** comprising:

a plurality of hoisting machine control apparatuses that are separate from each other, and that control driving of each of the hoisting machines individually;

a running management apparatus that is separate from each of the hoisting machine control apparatuses, and that outputs a control command to each of the hoisting machine control apparatuses;

a transmitting means that performs communication between the running management apparatus and each of the hoisting machine control ap-

- paratuses by serial transmission; and
 an abnormal stoppage circuit that is independent from the transmitting means, and that stops supply of electric power to each of the hoisting machines simultaneously if at least one of the running management apparatus or the hoisting machine control apparatuses detects an elevator abnormality. 5
2. An elevator control system according to Claim 1, **characterized in that** the running management apparatus can communicate with each of the hoisting machine control apparatuses individually by the transmitting means. 10
3. An elevator control system according to Claim 1, **characterized in that** the running management apparatus and each of the hoisting machine control apparatuses are connected in series by the transmitting means such that information from the running management apparatus is transmitted to each of the hoisting machine control apparatuses sequentially. 15 20
4. An elevator control system according to Claim 1, **characterized in that:** 25
- the abnormal stoppage circuit comprises:
- a circuit power source;
 a circuit coil that enables supply of electric power to each of the hoisting machines by passage of electric current from the circuit power source, and that stops supply of electric power to each of the hoisting machines by stopping the passage of electric current; 30 35
 a plurality of detecting switches that perform an opening action individually if any one of the running management apparatus or the hoisting machine control apparatuses detects an elevator abnormality; 40
- the circuit power source, the circuit coil and each of the detecting switches are connected in series; and
 passage of electric current to the circuit coil is stopped by an opening action of at least one of the detecting switches. 45
5. An elevator control system according to Claim 1, **characterized in that** the transmitting means performs communication by serial transmission between the running management apparatus and, respectively, a car operating panel that is disposed inside the car, a landing operating panel that is disposed on an elevator landing, and hoistway equipment that is disposed inside a hoistway in which the car ascends and descends. 50 55
6. An elevator control system according to Claim 1, **characterized in that** the running management apparatus can record information that identifies which apparatus among the running management apparatus and each of the hoisting machine control apparatuses detected an elevator abnormality.

FIG. 1

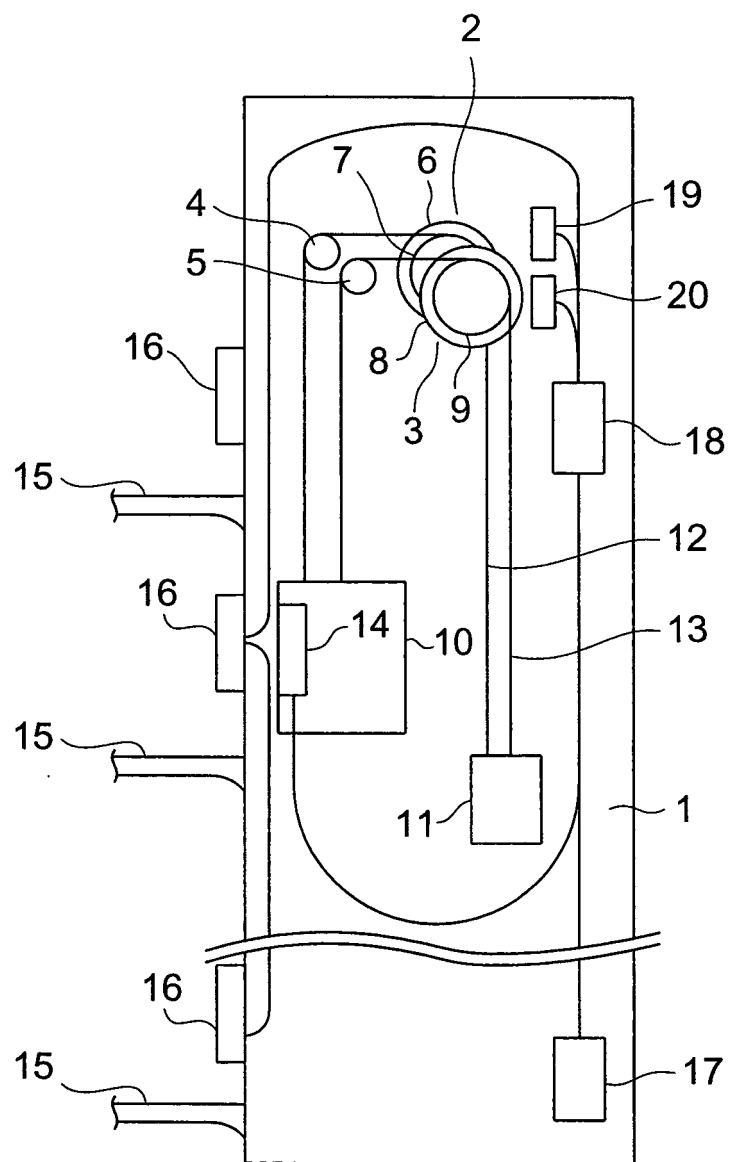


FIG. 2

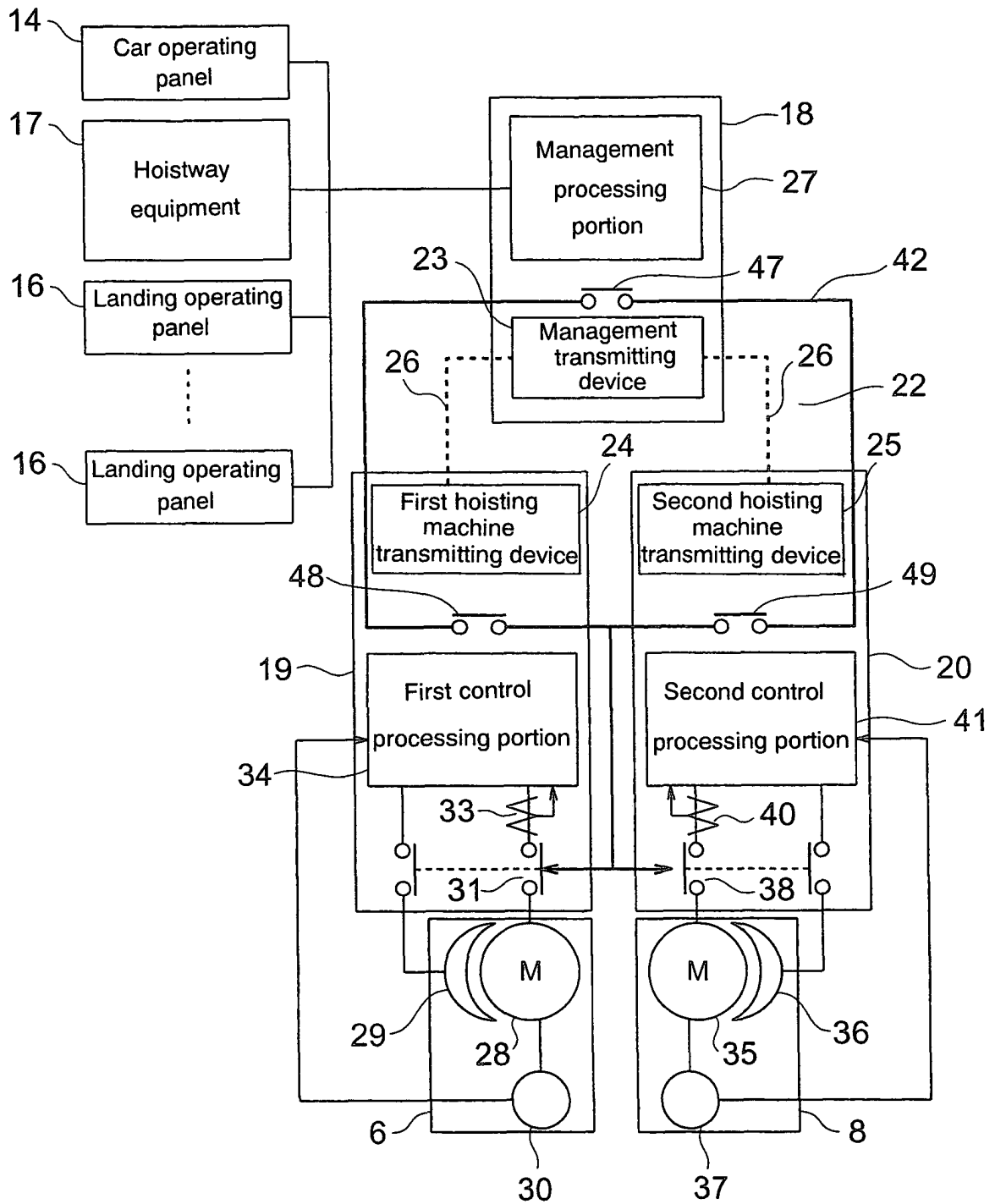


FIG. 3

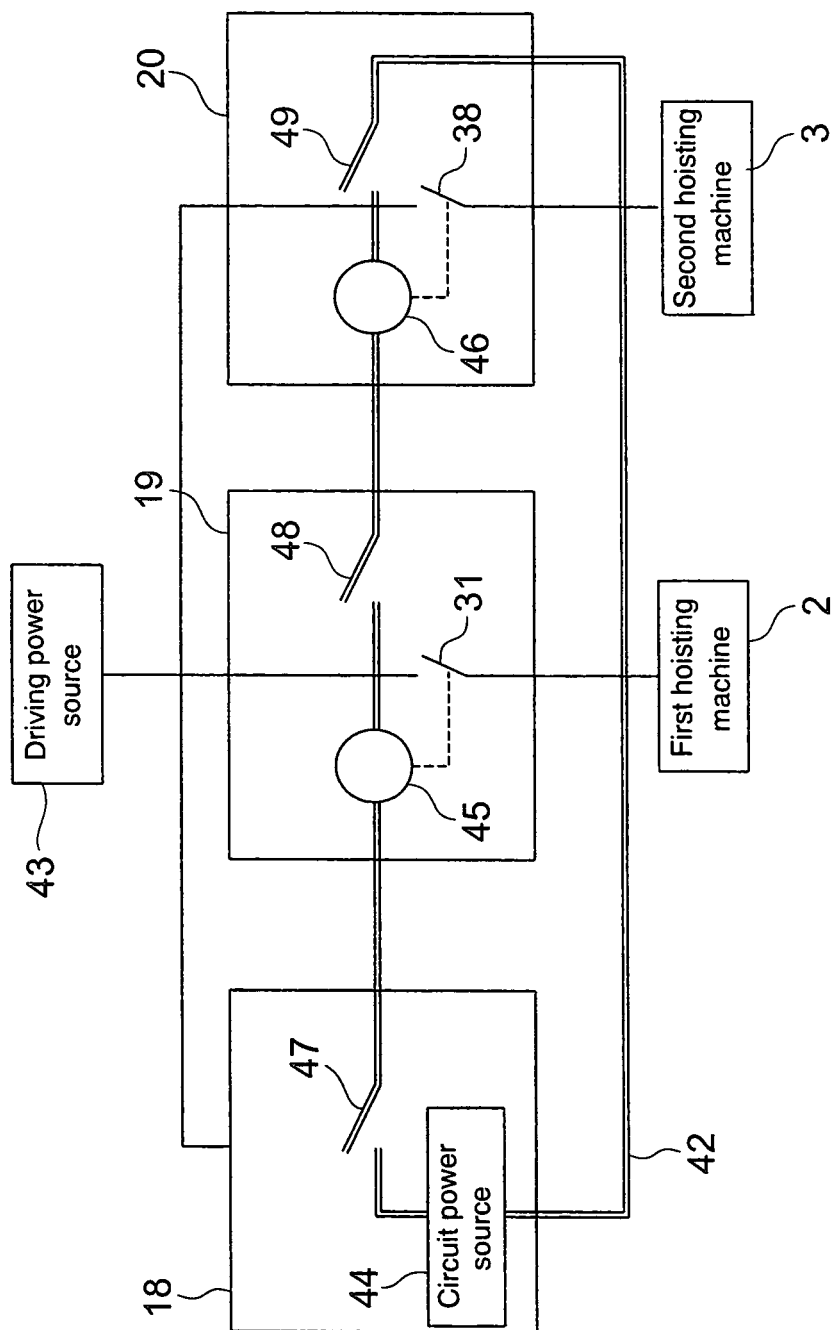
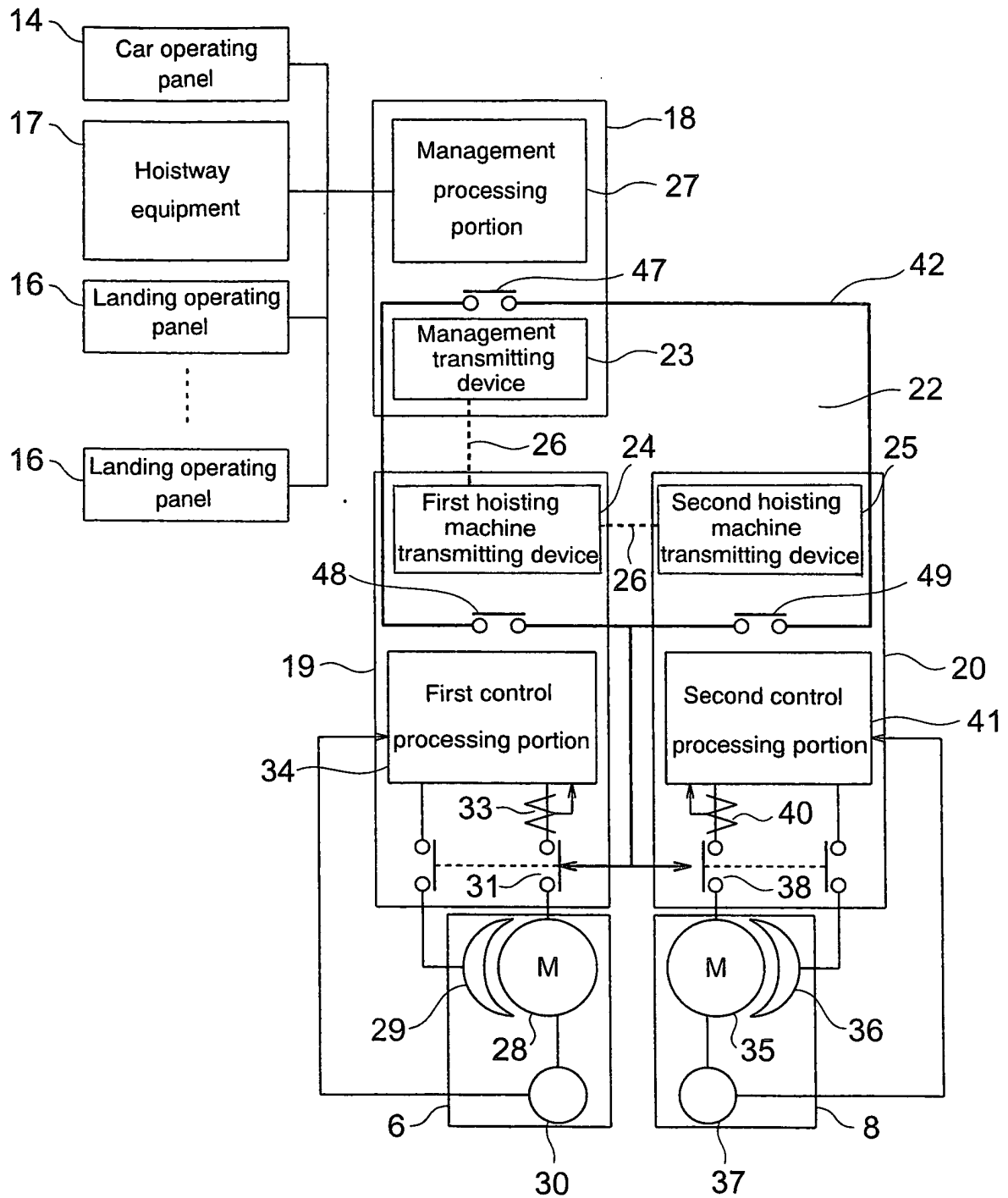


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/056010

A. CLASSIFICATION OF SUBJECT MATTER

B66B3/00(2006.01) i, B66B5/02(2006.01) i

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)

B66B3/00-B66B5/02

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	1996-2007
Kokai Jitsuyo Shinan Koho	1971-2007	Toroku Jitsuyo Shinan Koho	1994-2007

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 2007/023550 A1 (Mitsubishi Electric Corp.), 01 March, 2007 (01.03.07), Par. Nos. [0008] to [0029]; Fig. 1 (Family: none)	1-6
Y	JP 08-84492 A (Mitsubishi Heavy Industries, Ltd.), 26 March, 1996 (26.03.96), Par. Nos. [0018] to [0026]; Figs. 1 to 4 (Family: none)	1-6
Y	JP 3669761 B2 (Toshiba Elevator and Building Systems Corp.), 13 July, 2005 (13.07.05), Par. Nos. [0026], [0036]; Fig. 1 (Family: none)	1-6

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

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
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"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	

Date of the actual completion of the international search
23 October, 2007 (23.10.07)Date of mailing of the international search report
06 November, 2007 (06.11.07)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/056010

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 08-149885 A (Toyo Kanetsu Kabushiki Kaisha), 07 June, 1996 (07.06.96), Par. Nos. [0007] to [0016]; Figs. 1 to 3 (Family: none)	1-6
Y	JP 61-51473 A (Toshiba Corp.), 13 March, 1986 (13.03.86), Page 2, upper right column, line 8 to lower right column, line 3; Fig. 2 (Family: none)	5

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2004024609 A [0004]
- JP 2005047679 A [0004]