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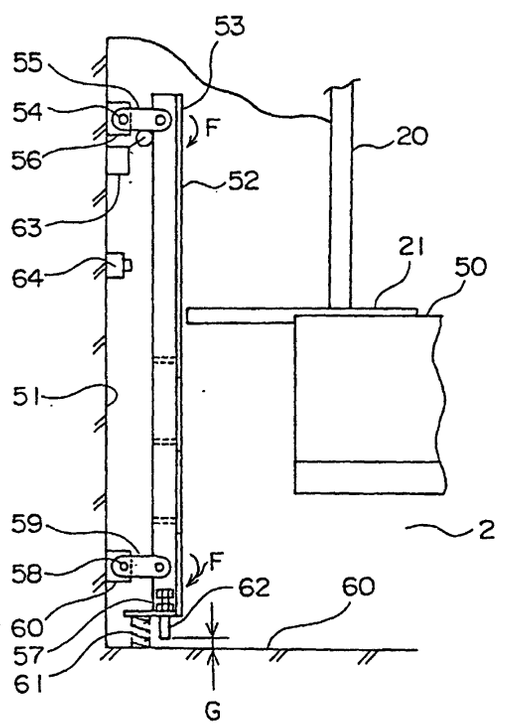
(54) ELEVATOR MAINTENANCE MODE SWITCHING DEVICE

(57) The present invention provides a maintenance mode shifting apparatus for an elevator system that automatically performs a shift to a maintenance mode and can prevent the personnel entrance into the pit by error.

A maintenance mode shifting apparatus for an elevator system includes, for shifting the driving mode of an elevator system to a maintenance mode, a maintenance mode shift switch of self-holding type that detects the entrance of personnel into the elevator pit and shifts to a maintenance mode, and a reset switch that is provided within the elevator hoistway for putting off the maintenance mode shift switch and cannot be operated from the landing when the elevator landing door is closed. The maintenance mode shift switch may be either of weight-detecting or heat-detecting type. A weight detecting switch may include a ladder used by personnel when entering into the pit, a guide-support means that supports the ladder in the way allowing a limited movement to the ladder along the hoistway wall, and a detection switch that detects the movement of said ladder due to the weight of personnel and shifts the elevator to the maintenance mode.

FIG. 1



EP 1 281 654 A1

Description

TECHNICAL FIELD

[0001] This invention relates to a maintenance mode shifting apparatus for an elevator system, and more particularly to a maintenance mode shifting apparatus for an elevator apparatus that shifts into a maintenance mode for improvements in the safety of maintenance of an elevator system of the machine room-less type wherein a hoist is installed within the hoistway pit.

BACKGROUND ART

[0002] Figs. 3 to 7 are views showing one example of a conventional elevator system of the machine room-less type wherein a hoist is installed within the hoistway pit. In these figures, particularly in Fig. 3, the reference number 1 is a hoistway of an elevator system, 2 is an elevator pit located at the lower portion of the elevator hoistway, particularly below the lowermost floor, 3 is a hoist installed within the pit 2, 4 is an elevator car ascending and descending within the hoistway 1, 5 and 6 are return sheaves disposed in the upper section of the hoistway 1 for changing the direction of movement of a rope, 7 are a pair of suspension sheaves disposed underneath the elevator car 4 for driving up the elevator car 4, 8 is a rope passed through a sheave 11 of a counterweight 10 and then wound around the return sheave 5 disposed in the upper section of the hoistway 1, the hoist 3, the return sheave 6 and the suspension sheaves 7, with one end 9 thereof being fastened to the upper section of the hoistway 1 and the other end 12 thereof being fastened to the opposite end of the hoistway 1 at the upper section.

[0003] The counterweight 10 is provided with a sheave 11 at the upper section. 13 are a pair of rails for the elevator car guiding the elevator car 4 during ascending and descending thereof via a pair of guide shoes (not shown) attached to the elevator car 4, 14 are a pair of rails for the counterweight guiding the counterweight 10 via a pair of guide shoes fastened to a wall of the hoistway 1 via a pair of rail brackets (not shown). 15 are a pair of buffers disposed within the pit 2 of the hoistway 1 for the elevator car 4 and 16 are a pair of buffers for the counterweight 10. 17 is a control panel provided within the pit 2 at the lower section of the hoistway 1 of the elevator system.

[0004] As well illustrated in Fig. 4, a landing entrance 18 is provided at the landing of the lower-most floor of the elevator system, and a door 19 of the landing, a three-direction door frame 20 and a door track 21 guiding the door 19 of the landing via the leg of the door are installed in the landing entrance 18. As well illustrated in Fig. 5, the door 19 of the landing is provided with a triangular key 22 releasing the door 19 of the landing, and the door 19 can be unlocked upon the turning of the triangular key 22 to the direction shown by arrow A in Fig. 5. In the figure, 23 is a push rod driven upward when the triangular key 22 is turned to the direction shown by an arrow A, 24 is a hanger plate for hanging via hanger rollers 27 the door 19 of the landing on a rail 26 of a hanger case 25, and 28 is a latch fastened to the hanger plate 24 via a pivot 29. When the latch 28 turns to the direction shown by an arrow B upon the upward movement of the push rod 23, it is unlatched and released from the latch keeper 30.

[0005] Levers 31, 32 and 33 being pin-connected each other are connected to the triangular key 22, and when the triangular key 22 turns to the direction shown by the arrow A, the lever 31 also turns with the triangular key 22 to the direction, inducing the long lever 32 to move downward. The lever 33 is pivotally attached via a pivot 34 to the hanger plate 24 and turns to the direction shown by an arrow D around the pivot 34 when the lever 32 moves downward.

[0006] Mounted on the hanger case 25 is a maintenance mode shift switch 35. 36 is a lever that is driven upward when the lever 33 turns to the direction shown by the arrow D. When the lever 36 is driven upward, a lever 37 pin-connected thereto turns to the direction shown by an arrow E around a pivot 39 fastened to a switch case 38, causing a switch 40 to be activated. Once the maintenance mode shift switch 35 is activated, the maintenance mode is self-locked, thus allowing no resetting unless a reset switch 42 contained in an inspection panel 41 provided in the landing and outside the hoistway as that shown in Fig. 4 is activated.

[0007] In Figs. 4 and 6, 43 is a pit ladder provided for entering into the pit 2 by using the ladder and performing work in case where maintenance is to be performed within the pit 2 after releasing the door 19 of the lowermost floor landing.

[0008] In Fig. 4, the inspection panel 41 provided in the landing of the lower-most floor is for performing maintenance after unlocking by a special key, and disposed within the inspection panel 41 is the reset switch 42 for resetting the maintenance mode shift switch 35. 44 is an illumination for illuminating the inside of the pit 2 that is energized when the maintenance mode shift switch 35 is activated.

[0009] The situation becomes dangerous for performing maintenance within the pit 2, if an elevator system is shifted into an automatic driving mode where the system is driven at a rated speed. It is therefore necessary to shift the elevator driving mode to a manual maintenance mode before entering into the pit 2. For this purpose, the door 19 of the landing of the lower-most floor is unlocked using the triangular key 22. When the triangular key 22 is turned to the direction shown by the arrow A shown in Fig. 5, the latch 28 is unlatched from the latch keeper 30 by the push rod 23, thus permitting the door 19 of the landing to be manually opened.

[0010] Upon unlatching, the maintenance mode shift switch 35 is activated by the link mechanism involving the levers 31, 32, 33, 36 and 37 connected to the trian-

gular key 22 and then the maintenance mode is self-locked. When the elevator system is put in the maintenance mode in this way, the elevator system can be driven by no other modes than a manual speed, thus inducing a situation wherein maintenance can be performed safely because the elevator car becomes non-respondent to calls from other floors during the period of maintenance and the illumination 44 within the pit is turned on to give a brightness necessary for maintenance and also to display that the pit is safe for personnel to get in.

[0011] After finishing maintenance within the pit, personnel opens the door 18 of the landing of the lower-most floor, climb up to the landing, open the cover of the inspection panel 41 and press the reset switch 42 for shifting the maintenance mode back to the automatic drive mode for the elevator system to complete the work. The work procedures are summarized in a flow chart shown in Fig. 7.

[0012] The problem of the conventional maintenance mode shifting apparatus as described above is that, even if personnel performing maintenance have been given training and education, under such circumstances as described below, the personnel could get into the pit 2 believing mistakenly by human error that the elevator system has been put in the maintenance mode although actually it is in the automatic drive mode.

(1) After repeated setting and resetting of the maintenance mode, the personnel could get into the pit in error during the reset state, when the elevator is one for observation in which the hoistway composed of windows is light inside.

(2) After repeated setting and resetting of the maintenance mode, the personnel could get into the pit in error during the reset state, when maintenance is being performed also in the neighboring hoistways separated by metal wire mesh partitions and thus the hoistway is light inside due to the illumination in the neighboring hoistways.

(3) After repeated setting and resetting of the maintenance mode, the personnel could get into the pit in error during the reset state, when the illumination in the hoistway is always put on at the request of the management of the building and thus the pit is always light inside.

(4) When maintenance is being performed by a pair of personnel, one of them could press the reset switch in error while the other is still in the pit.

DISCLOSURE OF INVENTION

[0013] Accordingly, the objective of the present invention, which has been made to solve the above-discussed problems, is to provide a maintenance mode shifting apparatus for an elevator system that enables the prevention of entrance of personnel into the pit by error by directly detecting the presence of the maintaining personnel in the pit. Further, the present invention is to provide a maintenance mode shifting apparatus for an elevator system that shifts to the maintenance mode by directly detecting the presence of maintaining personnel in the pit.

[0014] According to the present invention, a maintenance mode shifting apparatus for an elevator system comprises a maintenance mode shift switch of the self-holding type for detecting the entrance of personnel into the elevator pit and shifting into a maintenance mode for the purpose of shifting the operating mode of an elevator system to the maintenance mode, and a reset switch that is disposed within an elevator hoistway for resetting said maintenance mode shift switch and that cannot be operated from a landing when a door of the elevator landing is closed.

[0015] The maintenance mode shift switch may be a weight detecting switch detecting the entrance of personnel by detecting the weight of the personnel.

[0016] The weight detecting switch may include a ladder that is installed within the pit and stepped on by personnel when entering into the pit, a guide-support means supporting the ladder for allowing a limited movement of said ladder along the hoistway wall, and a detection switch that detects the movement of said ladder due to the weight of the personnel and shifts the elevator to a maintenance mode.

[0017] The maintenance mode shift switch may include a heat-sensitive switch that is provided within the pit and monitors the heat generated by personnel.

[0018] The reset switch may be provided within the hoistway in a position close to the entrance of the landing so that personnel can reach and operate from the landing of the lower-most floor.

BRIEF DESCRIPTION OF THE INVENTION

[0019]

Fig. 1 is a schematic side view showing one embodiment of the maintenance mode shifting apparatus for an elevator system of the present invention;

Fig. 2 is a schematic sectional plan view showing another embodiment of the maintenance mode shifting apparatus for an elevator system of the present invention;

Fig. 3 is a schematic view of a conventional elevator system to which the maintenance mode shifting apparatus for an elevator system of the present invention is applicable;

Fig. 4 is a schematic sectional plan view of the conventional elevator system;

Fig. 5 is a front view showing a conventional maintenance mode shifting apparatus for an elevator system;

Fig. 6 is a sectional side view showing the conventional maintenance mode shifting apparatus for the elevator system; and

Fig. 7. is a maintenance mode shifting procedure

flow-chart in the conventional maintenance mode shifting apparatus for the elevator system.

BEST MODES FOR CARRYING OUT THE INVENTION

[0020] Figs. 1 and 2 show one embodiment of the maintenance mode shifting apparatus of the present invention. In Fig. 1, an entrance 18 having a door 19, a jamb 20 and a door sill 21 is installed on a landing 50 of the lower-most floor of an elevator system, and a ladder 52 extending substantially vertically from the landing 50 of the lower-most floor down to a pit 2 is installed along a wall 51 of a hoistway 1. The ladder 52 is connected at its upper ends 53 to brackets 56 fastened to the hoistway wall 51 via links 55 that are connected to the brackets 56 through pins 54 and at its lower ends 57 to brackets 60 fastened to the hoistway wall 51 via links 59 that are connected to the brackets 60 through pins 58. The ladder 52 can therefore move up and down along the hoistway wall 51 substantially in parallel to the wall. Thus, the links 55 and 59 are guide-support means supporting the ladder 52 in the way guiding and allowing the ladder 52 to make a limited movement along the hoistway wall 51.

[0021] Compression springs 61 are disposed in the space between the lower ends 57 of the ladder 52 and a floor 60 of the pit 2 so that the ladder 52 is always held in a position apart at a predetermined distance above the floor 60 of the pit 2. The ladder 52 is provided at the lower ends 57 with stoppers 62, or bolts that extend from the lower ends 57 toward the floor 60 of the pit 2 and its length of protrusion from the ladder 52 is adjustable. The length of protrusion of the stoppers 62 is adjusted to give gap G of a predetermined distance between each of the lower ends 57 of the ladder 52 and the floor 60 of the pit 2. The strength of the compression springs 61 is at the level that usually holds the ladder 52 at the shown position, or the position providing gap G between the stoppers 62 and the floor 60 of the pit 2, but when personnel step on the ladder 52 to get into the pit 2 for maintenance, allows the ladder 52 to move downward till the stoppers 62 abut against the floor 60 of the pit 2 and thus there is no gap G as a result of the compression of the compression springs 61 by the weight of the personnel, and then makes the ladder 52 go back its original position having gap G underneath when the personnel step off the ladder.

[0022] For the purpose of detecting the downward movement of the ladder 52 in this way, the maintenance mode shifting apparatus for an elevator system includes a maintenance mode shift switch 63 of weight detecting type that is attached to the hoistway wall 51 and detects the downward movement of the ladder 52. In the illustrated example, the maintenance mode shift switch 63 is a detection switch of self-holding type that is activated by the rotational movement of the links 55 connecting the ladder 52 to the hoistway wall 51. The maintenance mode shift switch 63 may be provided in any position within the hoistway 1 so long as it can detect the downward movement of the ladder 52 and causes no trouble in work within the hoistway 1 or the pit 2. Thus, the maintenance mode shift switch 63 is a personnel detecting means detecting the entrance of personnel into the pit 2.

[0023] The maintenance mode shifting apparatus for an elevator system also includes a reset switch 64 for resetting an automatic drive at a rated speed by putting the maintenance mode shift switch 63 in the off position to cancel the maintenance mode, after the maintenance mode shift switch 63 of self-holding type is activated by being brought into the on position. According to the present invention, the reset switch 64 is provided on the hoistway wall 51 within the hoistway 1 in a position close to the entrance 18 of the landing so that, after work, personnel can reach and operate after getting out of the hoistway 1 and stepped up onto the landing 50 of the lower-most floor via the ladder 52. However, it is not possible to reach the reset switch 64 provided within the hoistway when the door 19 of the landing is closed. Thus, the reset switch 64 provided within the elevator hoistway 1 cannot be operated from the landing 50 when the elevator landing door 19 is closed.

[0024] In an elevator system using an elevator system maintenance mode shifting apparatus as described, when it is desired that maintenance is to be performed, a lock mechanism comprising the triangular key 22, the push rod 23, the latch 28 and the latch keeper 30 as exemplified in Fig. 5 is first unlocked on the landing 50 of the lower-most floor. The maintenance mode shifting apparatus for an elevator system according to the present invention includes neither a link mechanism comprising the links 31, 32, 33, 36 and 37 shown in Fig. 5 nor the maintenance mode shift switch 35 to be activated by this link mechanism.

[0025] When personnel step on the ladder 52 installed along the hoistway wall 51 to get into the pit 2 after opening the unlocked door 19 of the landing, the ladder 52 moves downward due to the compression of the compression springs 61 by the weight of personnel, and remains at the position where the stoppers 62 abut against the floor 60 of the pit 2, resulting in the downward movement of the ladder 52 by the distance corresponding to gap G. When moving downward, the ladder 52 neither shows an unstable movement nor induces anxiety in personnel because the ladder 52 is guided and supported by a guide-support means comprising members including the links 55 and 59 in the way allowing a limited movement along the hoistway wall 51. The downward movement of the ladder 52 causes a rotating movement of the links 55 and 59 along the direction shown by an arrow F in Fig. 1, which then causes the movement of the maintenance mode shift switch 63 to the position where it acts and further the self-holding of the maintenance mode, and thus the elevator driving mode is put in a maintenance mode as by the conventional maintenance procedures shown in Fig. 7. When put in a maintenance mode, the elevator system is driven not auto-

matically at a rated speed but at a manual speed, and the inside of the pit 2 is illuminated by the light 44 for maintenance. When personnel step off the ladder 52 after descending on the floor of the pit 2, the ladder 52 moves upward and gets back to its original position shown in Fig. 1 by the action of the compression springs 61. Although the maintenance mode shift switch 63 also returns to the off position, the maintenance mode is maintained because the reset switch 64 is not turned on.

[0026] Although the maintenance mode shift switch 63 is pushed back to the on position again with the downward movement of the ladder 52 caused by the stepping up again of the ladder 52 by the personnel getting out of the pit 2 after finishing maintenance, the action of the entire maintenance mode shifting mechanism of the elevator system remains unaffected because the maintenance mode is maintained. The maintenance mode still continues even when the ladder 52 gets back to its original position shown in Fig. 1 after the personnel has stepped off the ladder 52 and ascended on the landing 50 because the reset switch 64 is not turned on. There are therefore no changes back and forth of the driving mode between maintenance and rated speed drive every time the personnel come to the pit 2 and back to the landing 50 during maintenance for, for instance, fetching materials and tools, and thus the elevator system will never be driven in an unintentional mode. Upon completion of maintenance, personnel reach the reset switch 64 provided on the hoistway wall 51 from the landing 50 installed outside the hoistway and operate the switch to reset an automatic rated speed drive by canceling the maintenance mode, thus making the elevator system provide a normal service to elevator riders.

[0027] As shown in Fig. 2, the elevator system maintenance mode shifting apparatus also includes, for a shift to a maintenance mode, a heat-sensitive switch 65 as another maintenance mode shift switch detecting the entrance of personnel into the pit 2 beside the switch 63 detecting the entrance of personnel by sensing the weight of the personnel on the ladder 52. The heat-sensitive switch 65 is provided on the hoistway wall 51 facing the pit 2, functions as a heat-sensitive sensor, and is enabled to monitor the heat generated by personnel in almost whole area of the floor of the pit 2 and to ensure the detection of the presence of personnel within the pit 2. In this mechanism using both the heat-sensitive switch 65 and the switch 63 of weight-sensing type, an improved reliability of its action can be expected. These maintenance mode shift switches can be used separately. When using the heat-sensitive switch 65 solely as a maintenance mode shift switch, fasten the ladder 52 to the hoistway wall 51 and connect the heat-sensitive switch 65 to an electric circuit instead of the switch 63 detecting the downward movement of the ladder 52.

INDUSTRIAL APPLICABILITY

[0028] As described, an elevator system maintenance mode shifting apparatus according to the present invention is advantageous, particularly for an improvement in the safety of maintenance of an elevator system wherein a hoist is installed within the hoistway pit and no machine room is provided, in that it can prevent maintenance personnel from entering into the pit by error by directly detecting the entrance of personnel into the pit, and by shifting the elevator operation mode to maintenance mode.

Claims

1. A maintenance mode shifting apparatus for an elevator system comprising:

   a maintenance mode shift switch of the self-holding type for detecting the entrance of personnel into the elevator pit and shifting into a maintenance mode for the purpose of shifting the operating mode of an elevator system to the maintenance mode; and
   a reset switch that is disposed within an elevator hoistway for resetting said maintenance mode shift switch and that cannot be operated from a landing when a door of the elevator landing is closed.

2. A maintenance mode shifting apparatus for an elevator system as claimed in claim 1, wherein said maintenance mode shift switch is a weight detecting switch detecting the entrance of personnel by detecting the weight of the personnel.

3. A maintenance mode shifting apparatus for an elevator system as claimed in claim 1 or 2, wherein said weight detecting switch includes a ladder that is installed within the pit and stepped on by personnel when entering into the pit, a guide-support means supporting the ladder for allowing a limited movement of said ladder along the hoistway wall, and a detection switch that detects the movement of said ladder due to the weight of the personnel and shifts the elevator to a maintenance mode.

4. A maintenance mode shifting apparatus for an elevator system as claimed in any one of claims 1 to 3, wherein said maintenance mode shift switch includes a heat-sensitive switch that is provided within the pit and monitors the heat generated by personnel.

5. A maintenance mode shifting apparatus for an elevator system as claimed in any one of claims 1 to 4, wherein said reset switch is provided within the

hoistway in a position close to the entrance of the landing so that personnel can reach and operate from the landing of the lower-most floor.

FIG. 1

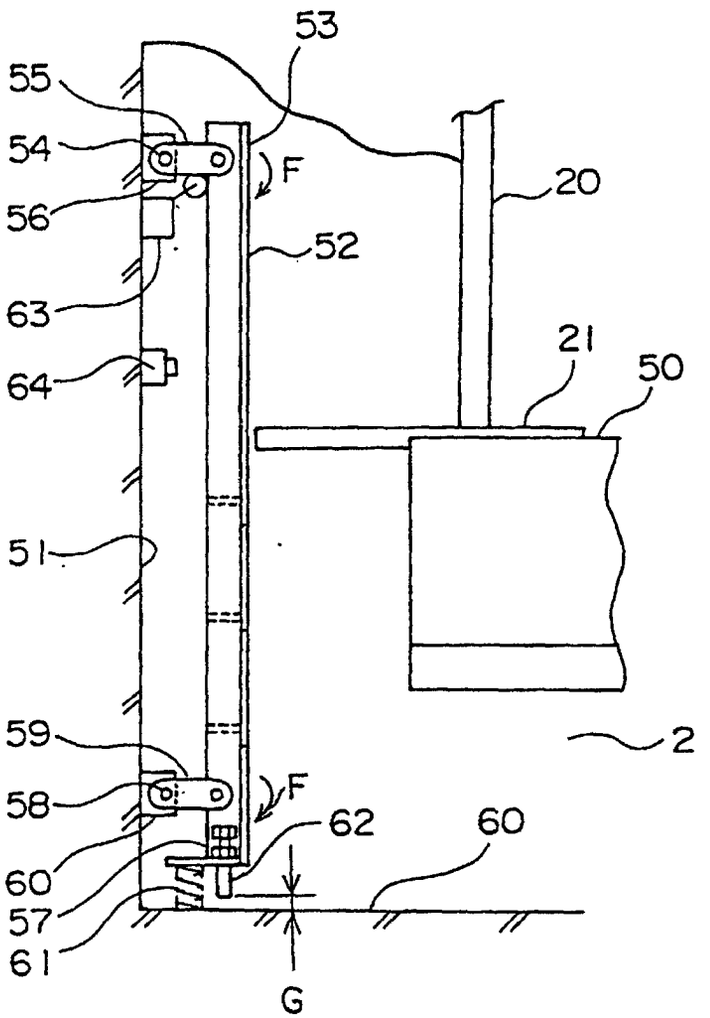


FIG. 2

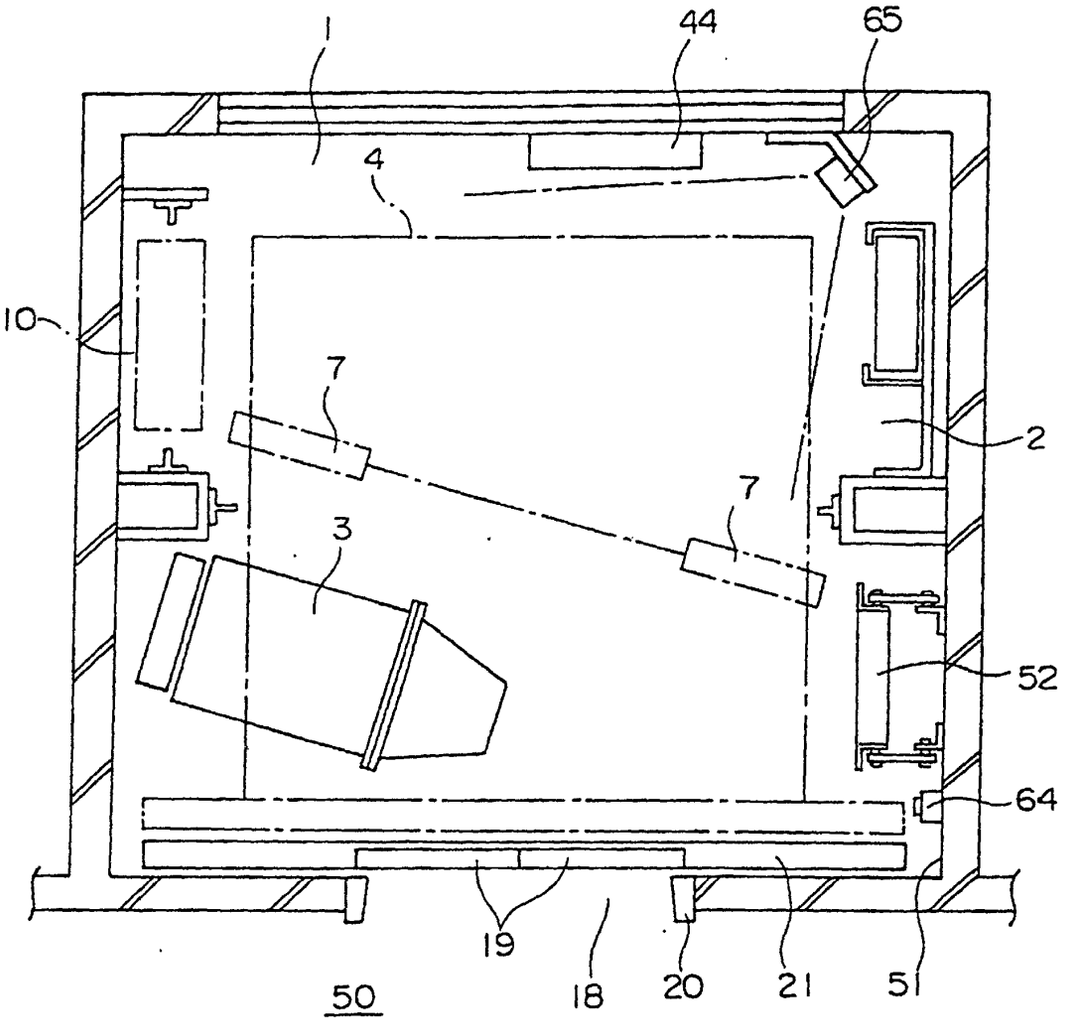


FIG. 3

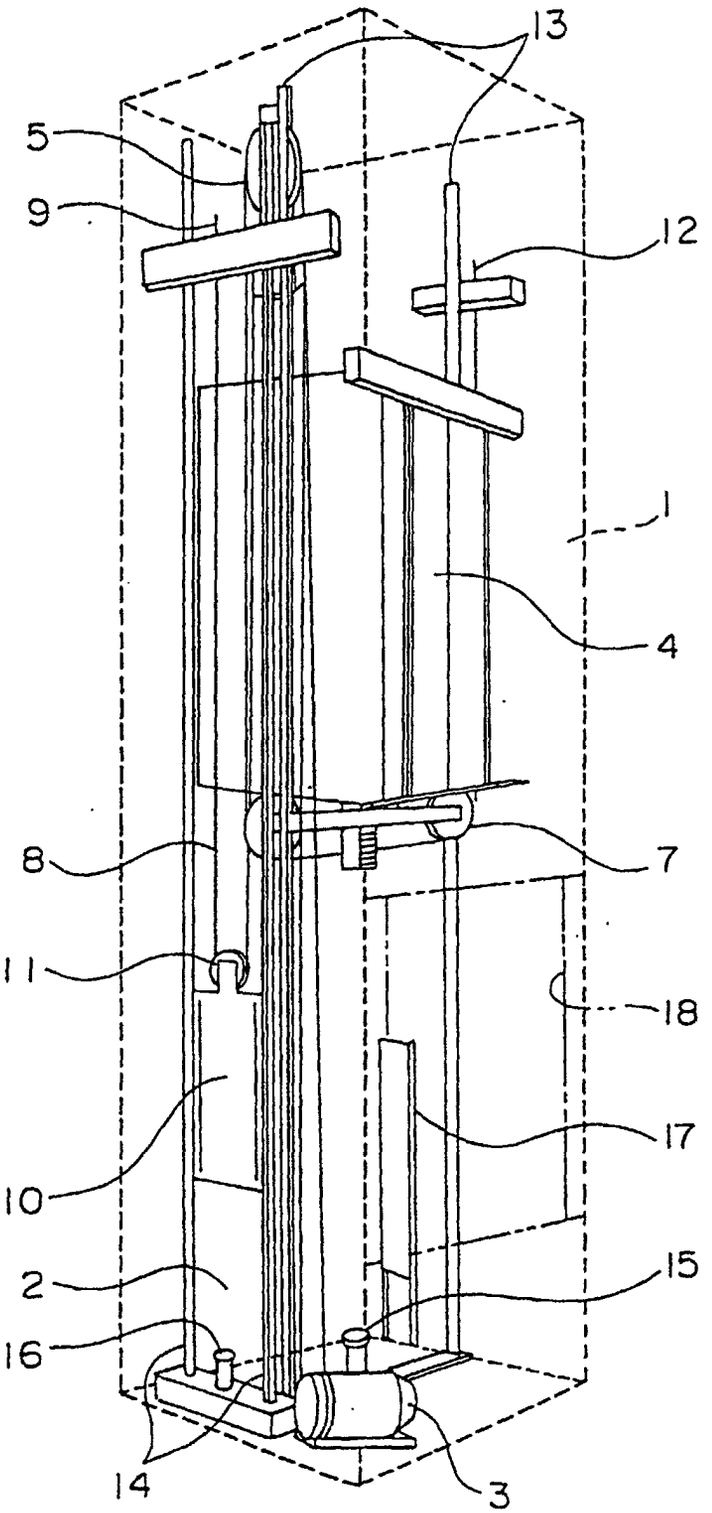


FIG. 4

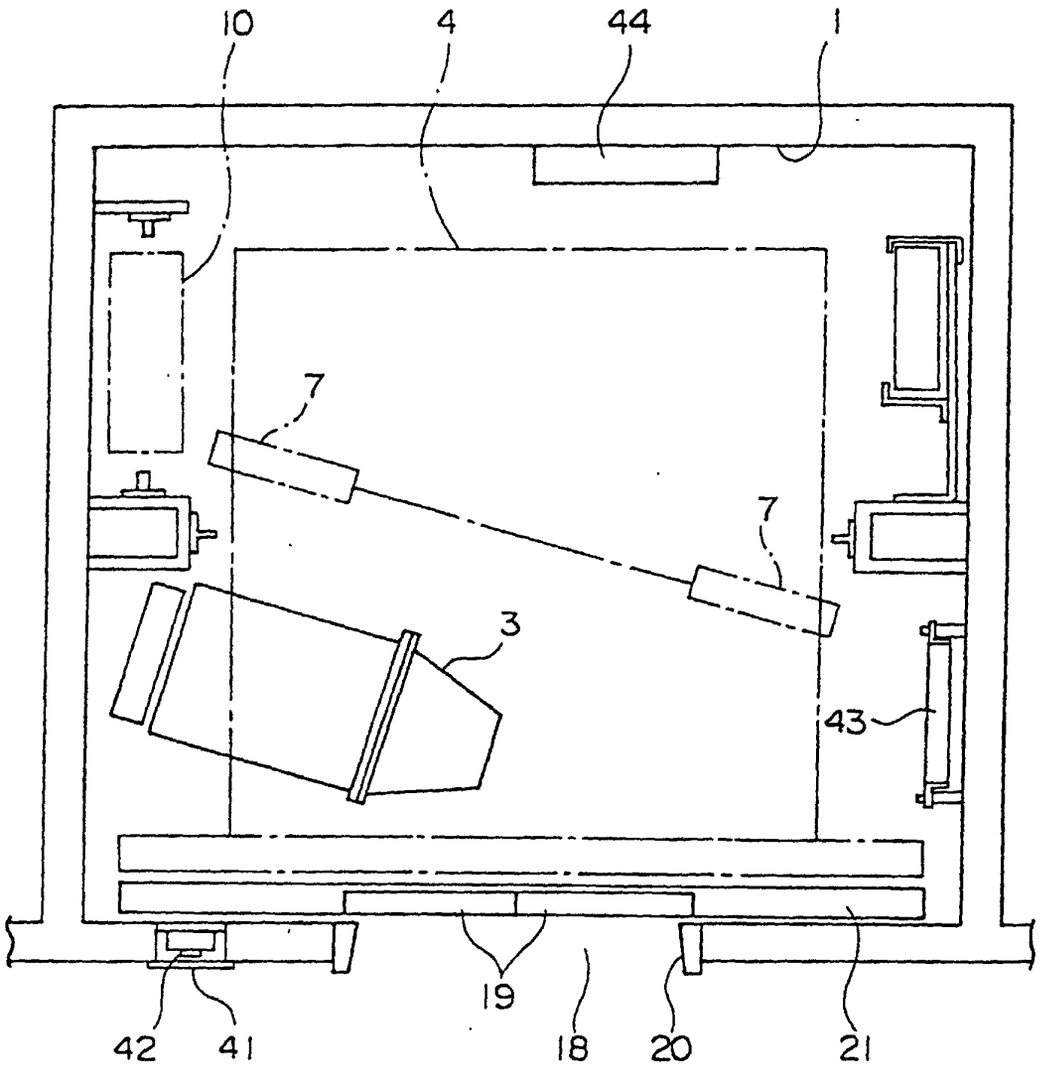


FIG. 5

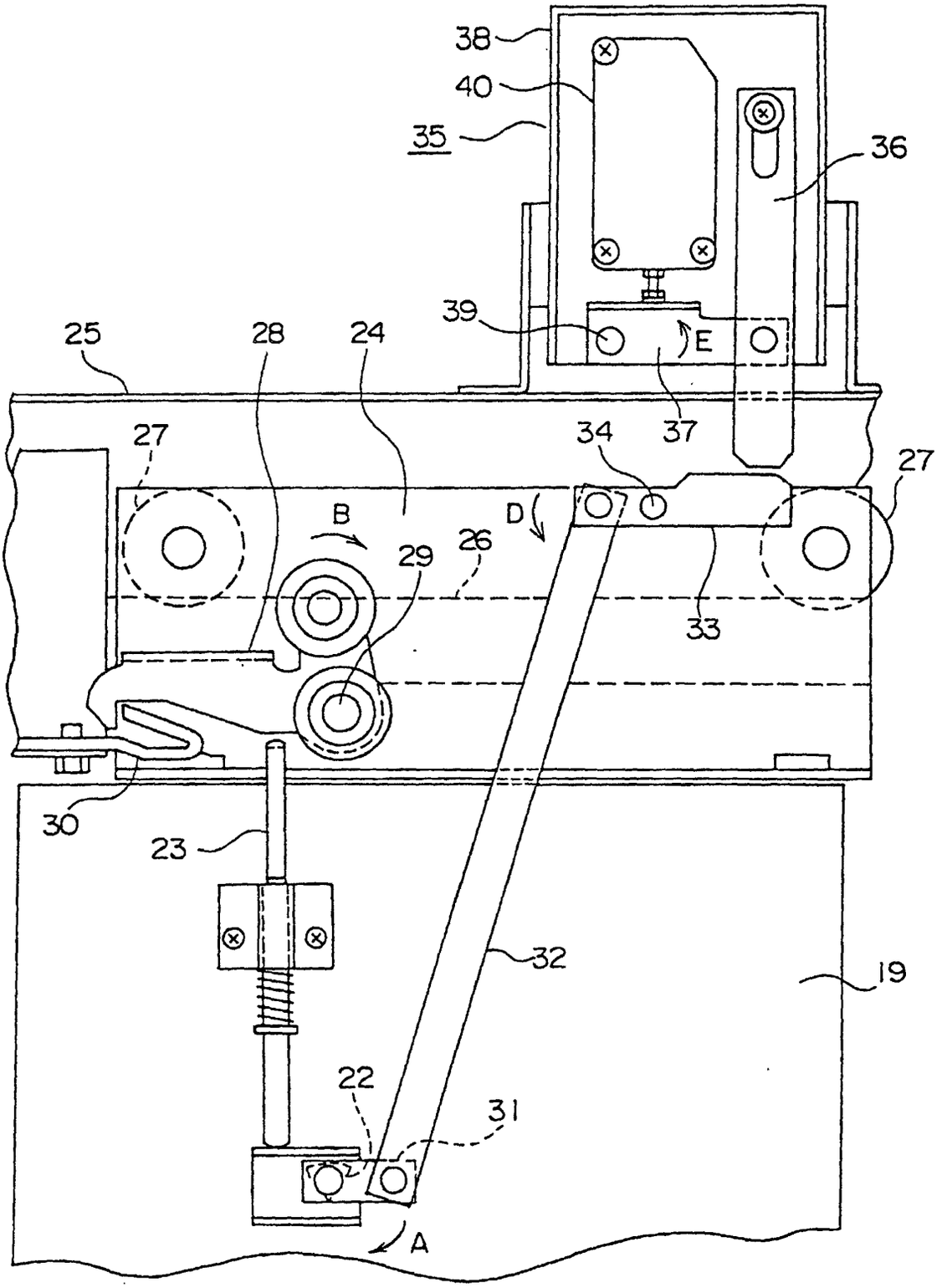


FIG. 6

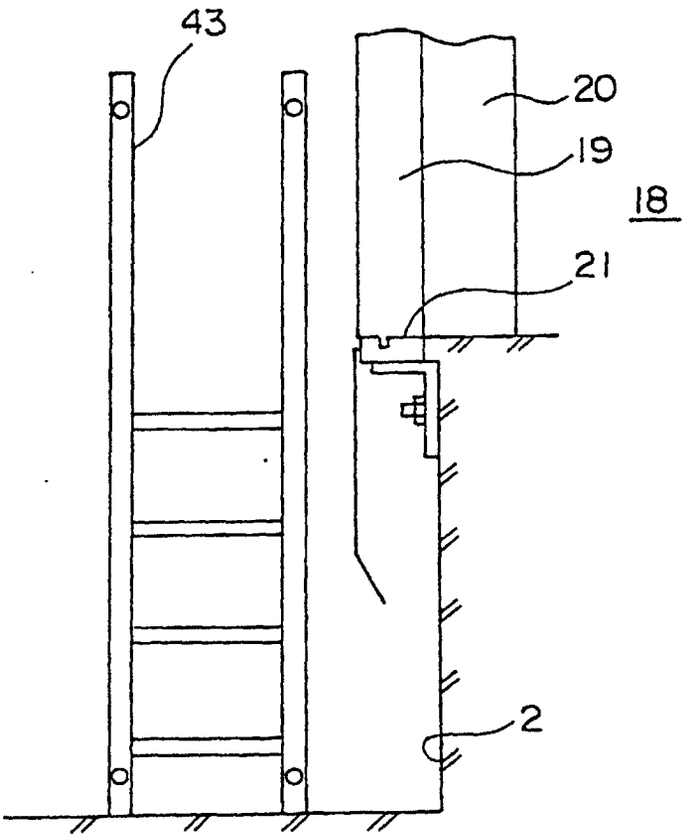
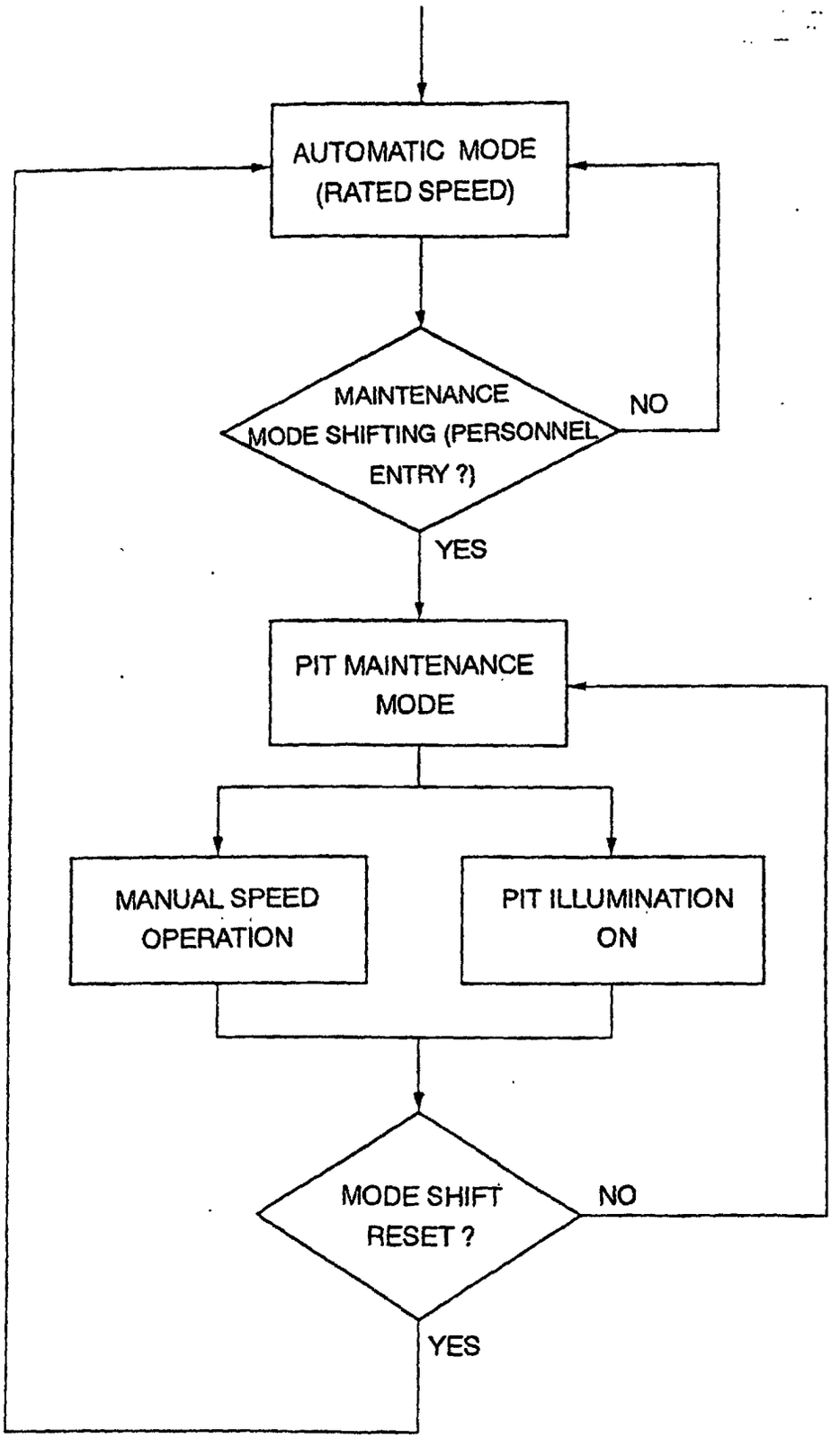


FIG. 7


AUTOMATIC MODE
(RATED SPEED)
MAINTENANCE
MODE SHIFTING (PERSONNEL
ENTRY ?)
NO
YES
PIT MAINTENANCE
MODE
MANUAL SPEED
OPERATION
PIT ILLUMINATION
ON
MODE SHIFT
RESET ?
NO
YES

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/02741

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B 5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] B66b 5/00-7/12

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 1996-2000
Kokai Jitsuyo Shinan Koho 1971-2000 Toroku Jitsuyo Shinan Koho 1994-2000

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP, 7-41264, A (Toshiba Corporation), 10 February, 1995 (10.02.95), (Family: none)	1-5
A	JP, 9-227045, A (Toshiba Elevator Eng. K.K.), 02 September, 1997 (02.09.97), (Family: none)	1-5
A	JP, 11-162662, A (Mitsubishi Electric Building Techno Service Co.), 18 June, 1999 (18.06.99), (Family: none)	1-5
A	JP, 6-22700, Y2 (Kabushiki Kaisha Hitachi Bil. System Service), 15 June, 1994 (15.06.94),	1-5

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05 October, 2000 (05.10.00)	17 October, 2000 (17.10.00)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)