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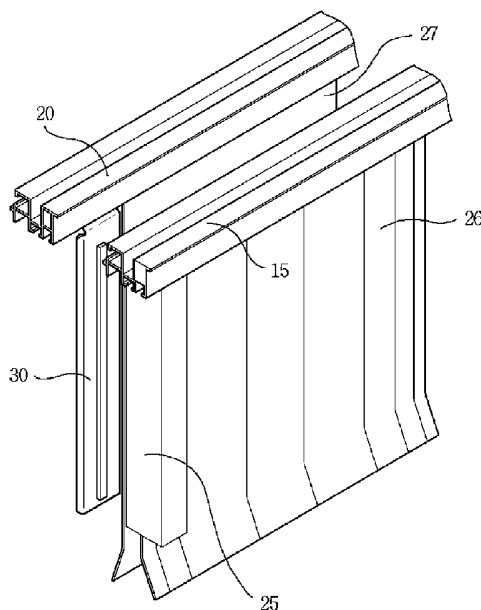
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[Continued on next page]

(54) Title: APPARATUS FOR DETECTING THE POSITION OF AN ELEVATOR CAR



(57) Abstract: There is provided an apparatus for detecting the position of an elevator car with increased precision so as to be able to stop the elevator car exactly at a landing position. The apparatus detects the position of the elevator car by using a reference means and a sensing means adapted to detect the reference means. Either the reference means or the sensing means is mounted to a sill of a landing door assembly, while the other is mounted to a sill of the elevator car.

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Description

APPARATUS FOR DETECTING THE POSITION OF AN ELEVATOR CAR

Technical Field

- [1] The present invention generally relates to an elevator system, and more particularly to an apparatus for detecting the position of an elevator car with increased precision so as to be able to stop the elevator car exactly at a landing position.

Background Art

- [2] A typical elevator system comprises an elevator car, which is raised or lowered in a vertical direction in a hoistway to transport passengers or freight. When the elevator car stops at a landing position of each floor in a building, passengers enter the elevator car from an elevator hall or exit the elevator car. To provide safety and comfort for passengers, it is preferable that the floor of the hall is in a flush relationship with the floor of the elevator car. For this reason, an elevator system generally comprises an apparatus for detecting the position of an elevator car and a control unit for controlling the speed of the elevator car in response to signals outputted from the position detecting apparatus. When the position detecting apparatus determines that the elevator car has arrived exactly at the landing position of each floor, the control unit stops the elevator car.
- [3] In order to provide safe and exact transportation service and comfort for passengers, various techniques for detecting the position of an elevator car have been developed and introduced. One conventional method of detecting the position of an elevator car is to attach a steel tape, which has a plurality of holes arranged apart from each other, to the elevator car so as to move along the overall length of a hoistway together with the elevator car and to detect the number of holes passing by each floor. There is further provided an encoder, which is connected to a motor for driving the elevator car.
- [4] Instead of using the steel tape, another method of detecting the position of an elevator car is to install an induction sensor to the elevator car, and further install an interrupting plate to a guide rail at each floor in a hoistway. Based on the signals outputted from the induction sensor when sensing the interrupting plate, the position of the elevator car can be detected. As to this prior art method, the manufacturers of elevator systems continue to struggle to reduce manufacture and installation costs and time.
- [5] Figs. 8 to 10 are perspective views schematically showing a conventional apparatus for detecting the position of an elevator car.
- [6] A U-shaped interrupting plate 130 is mounted to a guide rail 140 at each floor in a

hoistway, and a U-shaped induction sensor 125 corresponding to the interrupting plate 130 is mounted to an elevator car. As shown in Fig. 10, while the elevator car moves up and down, if the interrupting plate 130 is located in the middle of the U-shaped induction sensor 125, the sensor 125 generates a signal and transmit the signal to a control unit (not shown). In response to the signal, the control unit controls the speed of the elevator car so that the elevator car can stop when a door of the elevator car is completely aligned with a door of an elevator hall (when a floor of the elevator car is flush with that of the elevator hall).

[7] Since the interrupting plate 130 is fixed to the guide rail 140 by means of brackets, bolts and the like, it is very important to accurately determine the mounting position of the interrupting plate 130 so that the elevator car can stop exactly at the landing position.

[8] For determining the mounting position of the interrupting plate 130, one worker gets up on the ceiling of the elevator car to provisionally mount the interrupting plate 130 to the guide rail 140 in the hoistway, while another worker gets in the elevator car or stands on the elevator hall to check whether a sill of the elevator car is in alignment with a sill of the landing door assembly. If it is determined that the two sills are aligned with each other, the worker on the ceiling of the elevator car adjusts the mounting position of the interrupting plate 130 and fixes the interrupting plate 130 to the guide rail 140. The sill is a component that is provided at the floors of the elevator car and the elevator hall, and has a groove for receiving the lower end portions of the car door and the landing door to guide the movement of the doors. When the sill of the elevator car is completely aligned with the sill of the landing door assembly, it is determined that the elevator car has stopped exactly at the landing position. Thus, the sills function as a reference when installing the interrupting plate 130.

[9] However, because the mounting positions of the interrupting plate and the induction sensor are located far away from the reference (i.e., the sills of the elevator car and the landing door assembly), at least two workers are necessary for installing the interrupting plate and the induction sensor, and the precision in installation is reduced. Also, after provisionally mounting the interrupting plate to the guide rail, the worker adjusts the mounting position of the interrupting plate and fixes the same by trial and error while moving the elevator car. Thus, the work efficiency significantly becomes low. Further, as the elevator system operates continuously for a long time, the elevator car or other peripheral component (e.g., the guide rail) is deformed or misaligned. Hence, the process of adjusting the mounting position of the interrupting plate is required at every stated period.

[10] Referring to Fig. 11, British Patent Publication No. 2 166 711 discloses an apparatus for detecting the position of a car in an elevator. The position detecting

apparatus comprises an interrupting plate 130, which is mounted on the upper end portion of a landing door 110, and an induction sensor 125, which is mounted on the upper end portion of a door 105 of an elevator car 101. In such a structure, since the elements 130, 125 of the apparatus are mounted far away from the sills 120, 115, at least two workers are necessary for installation. Thus, the above-described problems still exist.

- [11] Instead of the induction sensing type described above, a proximity sensing type can be applied to detect the position of the elevator car. In this case, reference means and sensing means are installed to the jamb frames of the landing door assembly and the elevator car. However, this installation method is applied to only a side-open door type elevator system, which can provide spaces sufficient enough to install the reference means and sensing means therein. However, it cannot be applied to a center-open door type elevator system. Further, since the reference means and sensing means are mounted far away from the sills, the precision in installation becomes significantly reduced.

Disclosure of Invention

Technical Problem

- [12] It is an object of the present invention to provide an apparatus for detecting the position of an elevator car with increased precision so as to be able to stop the elevator car exactly at a landing position.
- [13] It is another object of the present invention to provide an apparatus for detecting the position of an elevator car, which can be easily installed by one worker without necessitating additional position adjusting process and modifying the existent structure of the elevator system.

Technical Solution

- [14] Consistent with the foregoing objects and in accordance with the invention as embodied herein, there is provided an apparatus for detecting the position of an elevator car by using a reference means and a sensing means adapted to detect the reference means. The apparatus is characterized in that either the reference means or the sensing means can be mounted to a sill of a landing door assembly, while the other is mounted to a sill of the elevator car.
- [15] In accordance with one aspect of the present invention, the reference means is mounted to the sill of the landing door assembly, while the sensing means is mounted to the sill of the elevator car.
- [16] In accordance with another aspect of the present invention, the reference means and the sensing means are located under the sills of the landing door assembly and the elevator car.

[17] Either the reference means or the sensing means is mounted adjacent to an apron, which is jointed under the sill of the elevator car, while the other is mounted adjacent to a toe-guard that is jointed under the sill of the landing door assembly.

[18] Preferably, the reference means is a magnetic member and the sensing means is a hall sensor.

[19] The hall sensor has a plurality of induction coils, which are disposed apart from each other. The induction coils generate induction signals when detecting the magnetic member while the elevator car moves up and down. The apparatus further comprises a control unit for controlling the speed of the elevator car in response to the induction signals.

Brief Description of the Drawings

[20] Fig. 1 is a side view showing an elevator system, which is provided with an apparatus for detecting the position of an elevator car, in accordance with a preferred embodiment of the present invention;

[21] Fig. 2 is an enlarged side view showing the apparatus for detecting the position of the elevator car in accordance with a preferred embodiment of the present invention;

[22] Fig. 3 is an enlarged perspective view showing the apparatus for detecting the position of the elevator car in accordance with a preferred embodiment of the present invention;

[23] Figs. 4 and 5 are side views showing an operating state of the apparatus for detecting the position of the elevator car in accordance with a preferred embodiment of the present invention;

[24] Fig. 6 is a perspective view showing a magnetic member of the apparatus for detecting the position of the elevator car, which is mounted to a sill of a landing door assembly;

[25] Fig. 7 is a perspective view showing a bracket of the magnetic member;

[26] Fig. 8 is a perspective view showing an interrupting plate of a conventional position detecting apparatus, which is mounted to a guide rail;

[27] Fig. 9 is a perspective view showing an induction sensor of a conventional position detecting apparatus, which is mounted to an elevator car;

[28] Fig. 10 is a perspective view showing an operating state of the interrupting plate and the induction sensor depicted in Figs. 8 and 9; and

[29] Fig. 11 is a side view showing an elevator system, which is provided with another conventional position detecting apparatus.

Best Mode for Carrying Out the Invention

[30] Preferred embodiments of the present invention will now be described with reference to the accompanying drawings.

- [31] Fig. 1 is a side view showing an elevator hall and an elevator car where an apparatus for detecting the position of the elevator car, which is in accordance with a preferred embodiment of the present invention, is installed. Figs. 2 and 3 are enlarged side view and perspective view, respectively, which show the position detecting apparatus.
- [32] As shown in the drawings, a landing door 10 moves along a groove 20' of a sill 20 mounted to a floor of an elevator hall, and a car door 5 moves along a groove 15' of a sill 15 mounted to a floor of an elevator car 1. The doors 10, 5 open and close an entrance hole. If the sill 15 of the elevator car 1 is in complete alignment with the sill 20 of the landing door assembly, then it is determined that the elevator car 1 is located exactly at the entrance hole (the landing position).
- [33] In order to locate the elevator car 1 exactly at the landing position, a reference means 30 (e.g., a magnetic member) is mounted to the sill 20 of the landing door assembly, and a sensing means 25 (e.g., a hall sensor) is mounted to the sill 15 of the elevator car 1. Although it is depicted in the accompanying drawings that the reference means 30 and the sensing means 25 are installed under the sills 20, 15, they may be installed to the front surfaces or end portions of the sills 20, 15. Also, the reference means 30 and sensing means 25 are not restricted to the magnetic member and the hall sensor.
- [34] Referring to Fig. 3, the reference means 30 (or the sensing means 25) is installed adjacent to a toe-guard 27, and the sensing means 25 (or the reference means 30) is installed adjacent to an apron 26. The toe-guard 27 and the apron 26 are safeguards, which are mounted under the sills 20, 15, to prevent a passenger or freight from falling down when the elevator doors 5, 10 are opened in an abnormal stop state. In this case, the process of installing the reference means 30 and the sensing means 25 can be easily achieved in a relatively large space where the toe-guard 27 and the apron 26 do not interfere with each other.
- [35] Figs. 4 and 5 are side views showing the elevator car position detecting process by using the magnetic member 30 and the hall sensor 25 when the elevator car 1 moves upward.
- [36] The hall sensor 25, which is installed to the sill 15 of the elevator car 1, includes a plurality of induction coils 25a, 25b, 25c. Although it is depicted in Fig. 4 that three induction coils 25a, 25b, 25c are arranged vertically apart from each other, the number and arrangement of the induction coils 25a, 25b, 25c can vary diversely. As the elevator car 1 moves upward and approaches a certain landing position, the uppermost induction coil 25a of the hall sensor 25 first generates the induction signal by the magnetic field provided by the magnetic member 30. The induction signal is transmitted to a control unit (not shown), and the control unit decelerates the elevator

car 1 gradually. When the sill 15 of the elevator car 1 is flush with the sill 20 of the landing door assembly, that is, the elevator car 1 is in the landing position, all of the induction coils 25a, 25b, 25c generate the induction signals, and the control unit stops the elevator car 1 upon receiving the induction signals from the induction coils 25a, 25b, 25c.

[37] In the same manner, when the elevator car 1 moves downward and approaches a certain landing position, the lowermost induction coil 25c first generates the induction signal by the magnetic field provided by the magnetic member 30. In response to the induction signal from the induction coil 25c, the control unit decelerates the elevator car 1 gradually. When the elevator car 1 is in the landing position and all of the induction coils 25a, 25b, 25c generate the induction signals, the control unit stops the elevator car 1 immediately.

[38] As described above, the magnetic member 30 and the hall sensor 25 are installed to the sills 20, 15, respectively. Therefore, since the gap between the elements 30, 25 of the position detecting apparatus and the sills 20, 15 is extremely small and thus negligible, whether the sill 20 of the landing door assembly is completely aligned with the sill 15 of the elevator car can be accurately detected. Further, although the elevator car 1 or other peripheral component is deformed or misaligned by repeated and prolonged operations, the precision in detecting the position of the elevator car 1 can be optimally maintained.

[39] The reference means 30 or the sensing means 25 may be installed to the wall of the hoistway by using a mounting bracket on the same level as the sill 20 of the landing door assembly. This also provides the same operational effects as described above.

[40] Hereinafter, the installation process of the elevator car position detecting apparatus will be described.

[41] First, a worker installs the hall sensor 25 (or the magnetic member 30) to the sill 15 of the elevator car 1. Then, the worker gets up on the ceiling of the elevator car 1, and slowly drives the elevator car 1 up or down. When the elevator car 1 moves below the elevator hall, the worker stops the elevator car 1 temporarily and installs the magnetic member 30 (or the hall sensor 25) to the sill 20 of the landing door assembly or the wall of the hoistway on the same level as the sill 20. Because the magnetic member 30 and the hall sensor 25 are installed at the predetermined points of the sills 20, 15, it is unnecessary to provisionally mount the magnetic member 30, align the sills 20, 15 and adjust the mounting position of the magnetic member 30 by trial and error while moving the elevator car 1. Accordingly, the magnetic member 30 and the hall sensor 25 can be easily installed by only one worker without the need for additional worker to check whether the sill 15 of the elevator car 1 is in alignment with the sill 20 of the landing door assembly.

- [42] Fig. 6 is a perspective view showing the magnetic member 30 mounted to the sill 20. Fig. 7 is a perspective view showing a bracket of the magnetic member 30.
- [43] The magnetic member 30 includes a L-shaped bracket 32 which has a recess 32' extending vertically, and a magnet 31 which extends along the bracket 32. The magnet 31 is accommodated in the recess 32' of the bracket 32 by its own magnetic force. Also, a fixing means 18 for determining the mounting positions of the magnetic member 30 and the hall sensor 25 are inserted into the grooves of the sills 20, 15 (shown in Fig. 2). The fixing means 18 is preferably a bolt or the like. The worker can easily install the magnetic member 30 and the hall sensor 25 to the sills 20, 15, respectively, by using the fixing means 18. Thus, when installing the position detecting apparatus, the worker can merely fix the magnetic member 30 and the hall sensor 25 by the fixing means 18 without the need for additional position adjusting process.
- [44] The fixing means 18 may have an element for adjusting the positions of the magnetic member 30 and the hall sensor 25 in preparation for occurrence of an installation error. Especially, when the fixing means 18 is a bolt, the positions of the magnetic member 30 and the hall sensor 25 are adjusted by only screwing the bolt 18.

Industrial Applicability

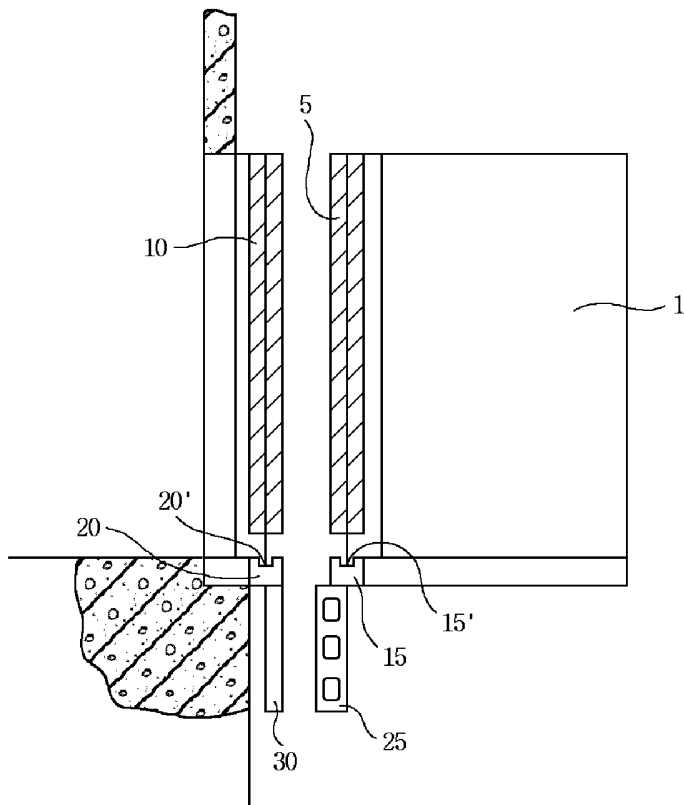
- [45] As described above, since the reference means and the sensing means are installed to the sills of the elevator car and the landing door assembly, it can be accurately detected whether the elevator car stops exactly at a landing position (whether the sill of the landing door assembly is in complete alignment with the sill of the elevator car). Further, although the elevator car or other peripheral component is deformed or misaligned by repeated operations, the precision in detecting the position of the elevator car can be optimally maintained.
- [46] Also, because the reference means and the sensing means are installed at the predetermined points of the sills of the elevator car and the landing door assembly by fixing means, it is unnecessary to provisionally mount the magnetic member, align the sills and adjust the mounting position of the magnetic member by trial and error while moving the elevator car. Accordingly, the position detecting apparatus can be easily installed by only one worker without the need for additional worker to check whether the sill of the elevator car is in alignment with the sill of the landing door assembly.
- [47] The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims, rather than by the foregoing description. All changes, which come within the equivalent meaning and range of the claims, are to be embraced within their scope.

Claims

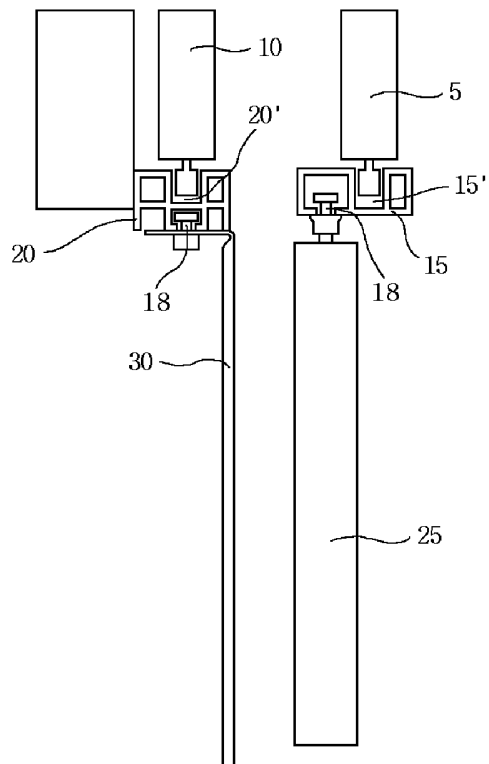
- [1] An apparatus for detecting a position of an elevator car by using a reference means and a sensing means adapted to detect the reference means, the apparatus characterized in that:
either the reference means or the sensing means is mounted to a sill of a landing door assembly, while the other is mounted to a sill of the elevator car.
- [2] The apparatus of Claim 1, wherein the reference means is mounted to the sill of the landing door assembly, and the sensing means is mounted to the sill of the elevator car.
- [3] The apparatus of Claim 1 or 2, wherein the reference means and the sensing means are located under the sills of the landing door assembly and the elevator car.
- [4] The apparatus of Claim 1 or 2, wherein either the reference means or the sensing means is mounted adjacent an apron which is jointed under the sill of the elevator car, while the other is mounted adjacent a toe-guard which is jointed under the sill of the landing door assembly.
- [5] The apparatus of Claim 1 or 2, wherein the reference means is a magnetic member and the sensing means is a hall sensor.
- [6] The apparatus of Claim 5, wherein the magnetic member includes a bracket extending in a vertical direction and a magnet extending along the bracket to be attached thereto.
- [7] The apparatus of Claim 5, wherein the hall sensor has a plurality of induction coils disposed apart from each other, the induction coils generating induction signals when detecting the magnetic member while the elevator car moves up and down,
and wherein the apparatus further comprises a control unit for controlling the speed of the elevator car in response to the induction signals.
- [8] The apparatus of Claim 1 or 2, wherein at least one of the sills has a groove, into which a fixing means is inserted, and at least one of the reference means and the sensing means is mounted to the fixing means.
- [9] The apparatus of Claim 8, wherein the fixing means is a bolt.
- [10] The apparatus of Claim 8, wherein the fixing means includes an element for adjusting the mounting positions of the reference means and the sensing means.
- [11] An apparatus for detecting the position of an elevator car by using a reference means and a sensing means adapted to detect the reference means, the apparatus characterized in that:
either the reference means or the sensing means is mounted to a sill of the

elevator car, while the other is mounted to a wall of a hoistway on the same level as a sill of a landing door assembly.

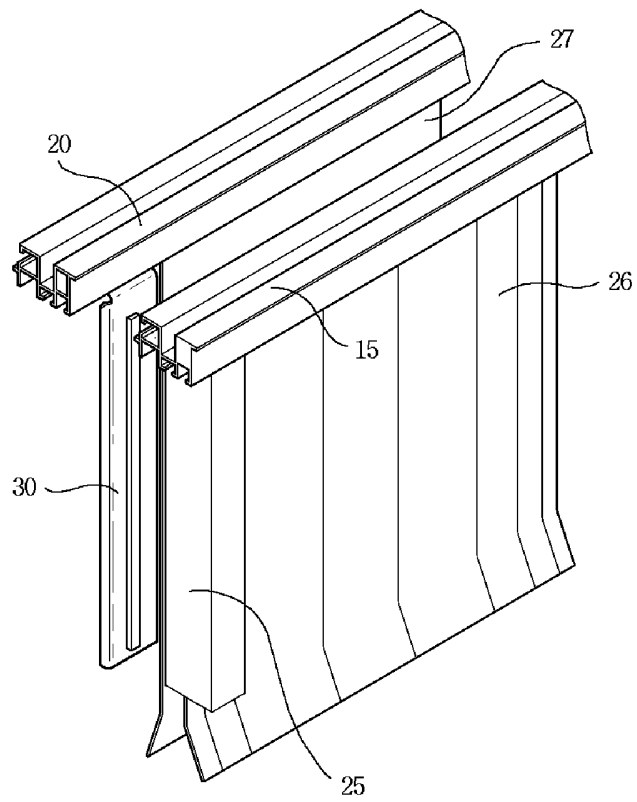
[Fig. 1]



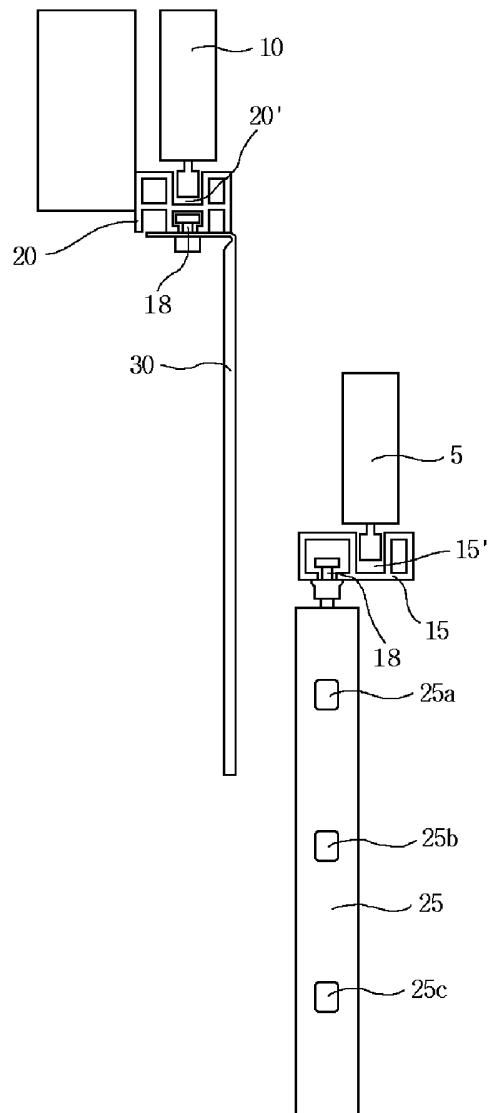
[Fig. 2]



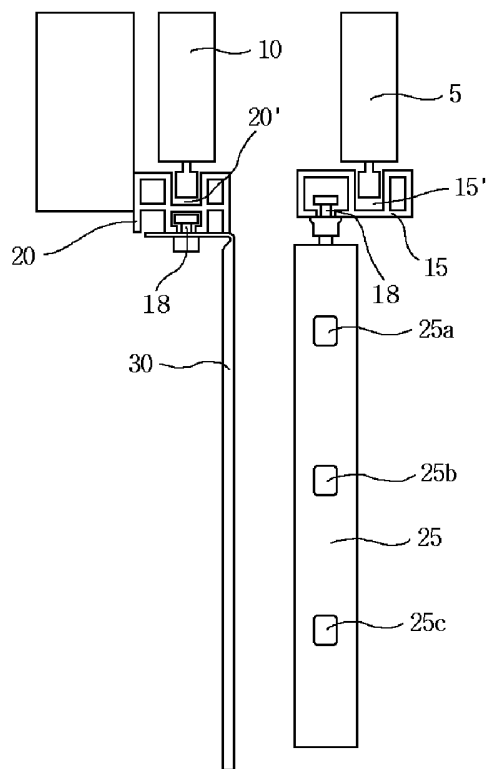
[Fig. 3]



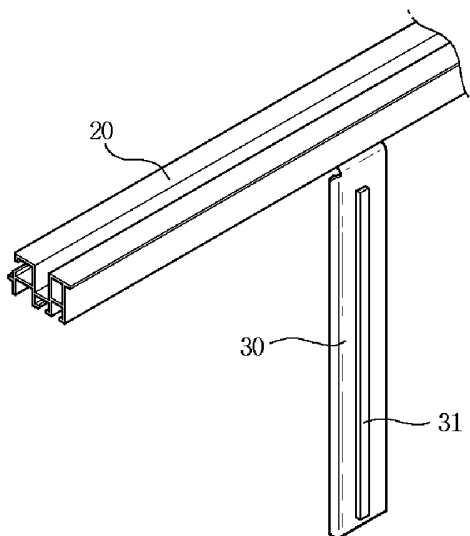
[Fig. 4]



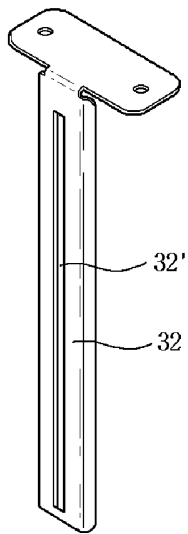
[Fig. 5]



[Fig. 6]

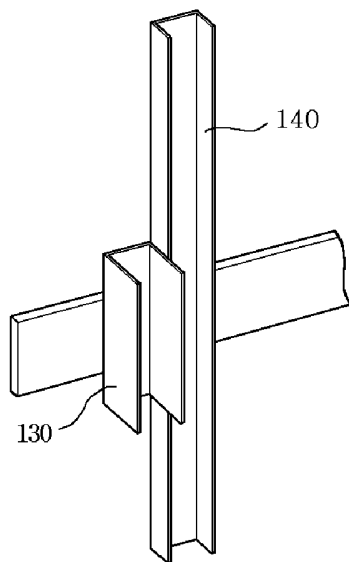


[Fig. 7]



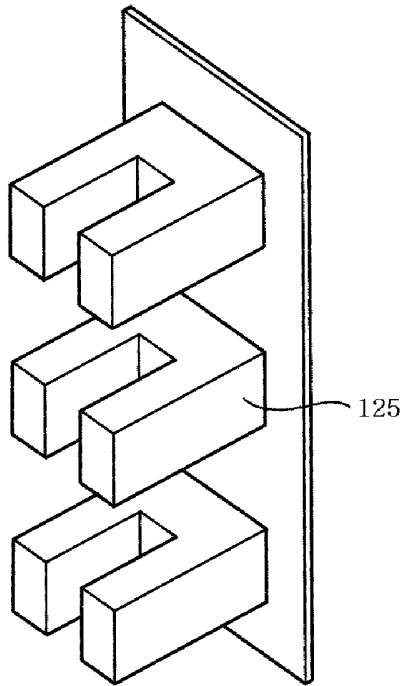
[Fig. 8]

(Prior Art)



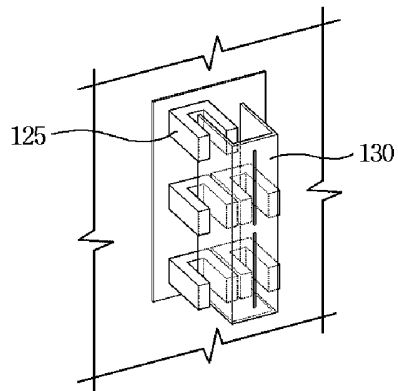
[Fig. 9]

(Prior Art)



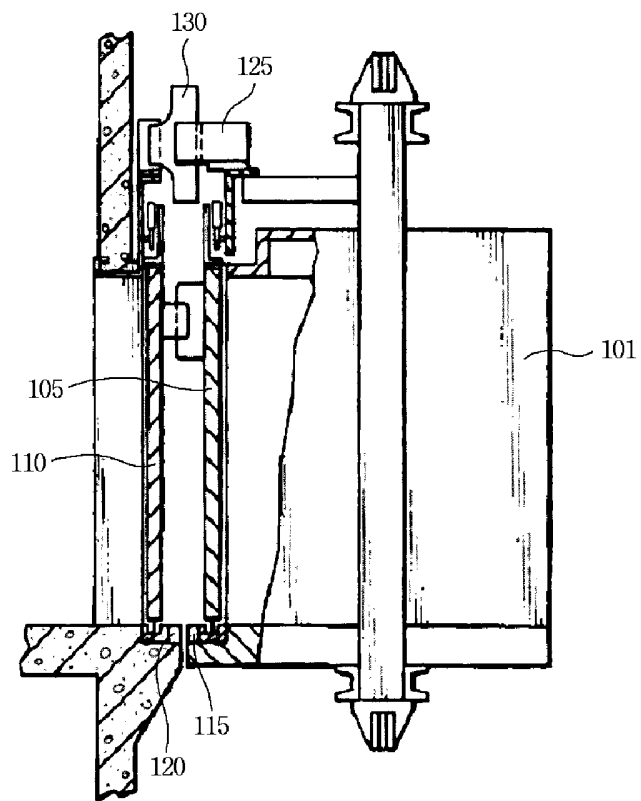
[Fig. 10]

(Prior Art)



[Fig. 11]

(Prior Art)



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2005/003152

A. CLASSIFICATION OF SUBJECT MATTER**IPC7 B66B 3/02**

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)

B66B 1/34, 1/40, 3/02, 11/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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.
X	KR 10-0302556 B1(TOSHIBA CO.) 22 SEPTEMBER 2001 see the abstract	1-2
Y	see the whole document	3-4, 8-11
Y	KR 92-0005430 B1 (KUMSUNG INDUSTRIAL SYSTEM CO.) 03 JULY 1992 see the whole document	5-7

☐ 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

28 DECEMBER 2005 (28.12.2005)

Date of mailing of the international search report

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