

CONVEYING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a conveying system which horizontally or vertically conveys an article while maintaining a horizontal posture of the article so as not to be changed.

2. Description of the Related Art

A conveyance in a hospital will be described as an example.

In a hospital, there are two kinds of conveyances. One of the conveyances relates to data such as a clinical chart and an X-ray film, and the other one of conveyances relates to an article such as a blood specimen and a medicine. The conveyance for the data has been electronically handled. On the other hand, there has been a strong demand for improvement of the conveyance for the article.

In the above described conveyance for the article in a hospital, a linear motor system, an air shooter, or a motor-driven self-running carriage is mainly employed. According to the conveyance, a first horizontal track on which an article is moved is arranged on one floor, the first horizontal track is continuously connected to a vertical track, and the vertical track is continuously connected to a second horizontal track arranged on another floor. Accordingly, the article can move between two points (i.e., one floor and another floor in the hospital).

In the aforementioned conventional systems, however, there has been a problem in that the posture of the article is changed at 90° when the



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horizontal conveyance is switched to the vertical conveyance and vice versa. The relationships between an article and a horizontal track or a vertical track will be described with reference to Fig. 4. In Fig. 4, reference numeral 8 designates an article to be conveyed; 9, a continuous track formed by horizontal tracks for a horizontal conveyance and a vertical track for a vertical conveyance. As shown in Fig. 4, first the article is moved on the horizontal track in a direction of the arrow from the right and down-side, and then the direction of movement of the article is changed at 90° so that the article is upwardly moved on the vertical track, and thereafter the direction of movement of the article is changed at 90° again so that the article is horizontally moved on the horizontal track to the left. At this time, as shown in the figure, the posture of the article is changed at 90° when the horizontal conveyance is switched to the vertical conveyance and vice versa. This change is not acceptable when, in a hospital, an article is a specimen or medicine which must be moved vibrationlessly while being always held horizontally.

SUMMARY OF THE INVENTION

The present invention is accomplished in view of the above-mentioned circumstances, an object of the present invention is to provide a conveying system which is so designed that a posture of an article which is being conveyed is not changed in horizontality when the horizontal conveyance is switched to the vertical conveyance and vice versa.

According to the first aspect of the present invention, there is provided an article conveying system installed in a building having a plurality of floors, comprising:



horizontal tracks along which a container carrier is moved are laid on the plurality of floors, an article is loaded in the container carrier;

5 a vertical conveying chamber, which vertically connects the horizontal tracks of the plurality of floors to one another, is provided at a suitable position; and

10 a lifter apparatus provided in the vertical conveying chamber, the lifter apparatus being movable to and stayable at respective heights of the horizontal tracks of all of the floors, and the lifter apparatus having a movable cage in which a horizontal rail is provided, the horizontal rail
15 is slidable to eliminate a gap between each of the horizontal tracks and the horizontal rail at a stop position being equal height to the horizontal track so as to serve as a part of the horizontal track.

20 According to the second aspect of the present invention, the lifter apparatus has a rotary stand supporting the horizontal rail so that the horizontal rail is horizontally rotatable, and accomplishing a turn of the horizontal rail to a predetermined position during the lifter apparatus
25 is vertically moved.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram showing the arrangement of an article conveying system;

30 Fig. 2 is a perspective view for a description of a connection of a horizontal track and a vertical track in the embodiment according to the present invention;

Fig. 3 is an explanatory diagram showing an arrangement of a track on a floor;



Fig. 4 is an explanatory diagram the relation among a horizontal track, a vertical track and an article to be conveyed; and

Fig. 5 is a flow chart for a description of the control operations performed by a conveyance control unit.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A conveying system of a preferred embodiment of the present invention will be described with reference to the accompanying drawings.

Fig. 1 is an explanatory diagram outlining an arrangement of the conveying system of the preferred embodiment.

In Fig. 1, reference numeral 6 designates a plurality of horizontal tracks; and 11, a lifter section. The plurality of horizontal tracks are respectively provided on a plurality of floors in a hospital etc., to move an article horizontally on the same plane. The lifter section 11 is so provided that an article can move in a direction perpendicular to the horizontal tracks 6. The horizontal tracks 6 are so provided that a carriage-like container carrier 7 is moved along a predetermined path. More specifically, the horizontal tracks are arranged as shown, for instance, in Fig. 3. In the embodiment, the container carriers 7 or the horizontal tracks 6 are driven by a linear motor system in which one of the container carrier 7 and the horizontal track 6 is employed as the primary side (e.g., coil) and the other one is employed as the secondary side (e.g., conductor or magnet). In the lifter section 11, a horizontal rail 5 that serves as a part of the horizontal track 6 to make the container carrier 7 run, is supported by a rotary stand 3 on a lift stand 1. The lifter section 11 has a lift stand



frame 2 therein. The lift stand frame 2 is suspended with a wire 4 so as to vertically move the horizontal rail 5. That is, after the lifter section 11 is vertically moved, the horizontal rail 5 is set to be flush with a selected one of the horizontal tracks 6 by sliding, and serves as a part of the selected horizontal track 6 so as to make the container carrier 7 run.

Now, the arrangement of the horizontal track 6 in one floor will be described with reference to Fig. 3. Fig. 3 is an explanatory diagram outlining the arrangement of tracks which are laid on a floor in a hospital to convey an article to many positions on the floor. In Fig. 3, reference numeral 6 designates a horizontal track which is provided below the floor or above the ceiling. A container carrier 7 is moved on the track. Reference numeral 11 designates a lifter section which is used when the container carrier 7 is vertically moved from to a horizontal track on another floor. Reference numeral 13 designates shifters which are located at the intersections of a main line and branch lines; that is, they are branching shifters. Reference numeral 14 designates a conveyance control unit which controls the operation of the conveying system. Reference numeral 19 designates ward stations which are provided at the positions near the inlets of lifter section 11. The places described below are so called "stations". At the stations, articles are loaded in or unloaded from the container carrier 7. Reference numeral 15 designates an outpatient receipt station; 16, a clinical chart room station; 17, a medicine store room; 18, an emergency outpatient station; 20, a rehabilitation receipt station; 21, an artificial dialysis room station; 22, a pharmacy room station; 23, a



dispensary (outpatient diagnosis) first station;
24, a dispensary second station; and 25, an X-ray
room station.

5 The lifter section 11 will be described with
reference to Fig. 2 in detail which is a
perspective view for a description of the
connection of a horizontal track and a vertical
track. Members that are the same as those in the
above described construction are referenced
10 correspondingly, and their detailed description
will be therefore omitted. In Fig. 2, reference
numeral 2 denotes a lift stand frame. The lift
stand frame 2 is provided at the position where it
does not obstruct the connection of the horizontal
15 rail 5 to the horizontal track 6, in such a manner
that the lift stand frame 2 supports the lift stand
1. The lift stand frame 2 has a metal fitting at
the middle of the upper part thereof to which the
wire 4 is connected, so that the lift stand is hung
20 down and that the lift stand frame 2 is vertically
moved by means of an electric motor (not shown) or
the like. Reference numeral 3 designates a rotary
stand on which the horizontal rail 5 is laid. The
horizontal rail 5 thus laid is turned about the
25 vertical axis. In this case, the angle of rotation
of the horizontal rail 5 is determined in advance
in accordance with the direction of conveyance of
the container carrier 7 on an aimed floor. On the
other hand, during the vertical movement before the
30 lift stand 1 reaches the aimed floor, the
conveyance control unit 14 operates to turn the
rotary stand 3 so that the horizontal rail 5 is set
in a direction of the horizontal track on the aimed
floor. When the directions of the horizontal
35 tracks on all the floors are the same or 180°, the
provision of the rotary stand may be omitted. In
the case where the length of the horizontal rail 5



is shorter than the lift stand 1 as shown in Fig. 2, the horizontal rail 5 is slid to the position indicated by the broken lines in a direction of the arrow so that the container carrier 7 may be moved on the horizontal track 6. In addition, when the horizontal rail 5 is stored, it is slidably returned to the position indicated by the solid lines in Fig. 2 so that it may not obstruct the vertical movement of the lift stand 1.

Next, a case in that the container carrier conveys an article from a position on a floor to a position on another floor will now be described.

First, the conveyance of an article on a floor will be described. It is assumed that a clinical chart is conveyed from the clinical chart room station 16 of Fig. 3 to the dispensary (outpatient diagnosis) first station 23. An user of the conveying system prepares a concerned clinical chart at the clinical chart room, and then the user loads it in the container carrier 7 at the clinical chart room station 16, and instructs the conveyance control unit 14 to convey it to the destination thereof (i.e., the dispensary first station 23). In accordance with the instruction, the conveyance control unit 14 determines a route along which the container carrier 7 is to be moved, in view of a path between the clinical chart room station 16 and the destination, the dispensary first station 23. In accordance with the determination of the route by the conveyance control unit 14, the container carrier 7 which has started from the clinical chart room station 16 is moved along the horizontal track 6 provided above the ceiling or below the floor toward the destination. In this operation, at a branch point of the horizontal track 6 where the shifter 13 is provided, the conveyance control unit 14 changes a direction of movement of the container



carrier 7 by the shifter 13 in accordance with a requirement. Thus, the container carrier 7, in which the clinical chart has been loaded, reaches the destination, the dispensary first station 23. Thereupon, the recipient (receiver) receives the clinical chart from the container carrier 7. Thereafter, in response to an instruction made by the recipient, the conveyance control unit 14 moves the emptied container carrier 17 to the position where the next conveyance of an article is to be carried out.

With respect to the case where the container carrier is moved from one floor to another floor, the operation of the embodiment will be described with reference to a flow chart of Fig. 5. Fig. 5 shows the control of the conveyance control unit 14.

First, in Step S101, in response to the request for conveyance, the conveyance control unit 14 moves a lift stand 1 of the lifter section 11 to the floor where the container carrier should be moved in while being vertically moved. In Step S102, the container carrier 7 to be conveyed is guided by the use of the horizontal track 6 to the inlet of the lifter section on the floor where that container carrier 7 is positioned. Next, in Step 103, the conveyance control unit 14 detects whether or not the horizontal track 6 and the horizontal rail 5 are in the same direction. If they are not in the same direction, Step S104 is effected. In Step S104, the conveyance control unit 14 operates the lift stand 1 which has been moved to the floor from which the request for conveyance comes; more specifically, the conveyance control unit 14 turns the rotary stand 3 of the lift stand 1 as required, so that the horizontal rail 5 on the rotary stand 1 is aligned with the horizontal track 6 along



which the container carrier 7 moves. This operation is carried out before the arrival of the lift stand 1. When, in the above-described Step S103, the horizontal track 6 and the horizontal rail 5 are in the same direction, Step S105 is effected.

In Step S105, the conveyance control unit 14 activates a drive device built in the horizontal rail 5 so as to forwardly slide the horizontal rail 5 and couple the horizontal rail 5 to the horizontal track 6 on which the container carrier 7 is located to thereby serve as a part of the horizontal track 6. After coupling the horizontal rail 5 to the horizontal track 6, Step S106 is effected. In Step S106, the conveyance control unit 14 moves the container carrier 7 (which is on the horizontal track 6) onto the horizontal rail 5 which has been coupled to the horizontal track 6. After moving the container carrier 7 onto the horizontal rail 5, the conveyance control unit 14 handles the container carrier 7 as follows: That is, in Step S107, the conveyance control unit 14 operates so that the horizontal rail 5 which has integrated with the horizontal track 6 is returned; and in the following Step S108, the unit 14 moves the lift stand vertically so that the aforementioned container carrier is moved to the aimed floor, the destination. Before the container carrier 7 reaches the aimed floor, the conveyance control unit 14 may operate for the container carrier 7 as follows: That is, in Steps S109 and S110, similarly as in the case of the above-described Steps S103 and S104, the rotary stand is turned until the direction of the horizontal rail 5 becomes equal to the direction of the horizontal track 6 along which the container carrier 7 moves.



After the lift stand 1 reaches the aimed floor, Step S111 is effected. In Step S111, similarly as in the case of the above-described Step S105, the horizontal rail 5 is moved outwardly and coupled to the horizontal track 6 along which the container carrier 7 moves, so that the horizontal rail 5 is integral with the horizontal track 6. After the horizontal rail 5 is made integral with the horizontal track 6 on the aimed floor in the above-described manner, Step S112 is effected. In Step S112, the conveyance control unit 14 operates to move the container carrier 7 onto the horizontal track 6. As for the lifter section 11, the conveyance control unit 14 operates in Step S113 as follows: That is, the conveyance control unit 14 operates to draw in the horizontal rail 5 which has been extended outwardly in Step S111. Thereafter, in Step S114, the conveyance control unit 14 operates to allow the lift stand 1 to stand by for the request for movement to another floor. Thus, one routine of operations has been accomplished.

In the above-described embodiment, the container carrier is moved by means of the linear motor; however, the invention is not limited thereto or thereby. That is, the technical concept of the invention is applicable to a conveying system which employs a motor-driven self-running carriage in which an electric motor is built.

As was described above, with the conveying system of the present invention, an article to be conveyed are moved between a horizontal track and a vertical track with its posture being maintained so as not to be changed. Therefore, the stable conveyance is performed in which the posture of an article which is being conveyed is not changed in horizontality.





What Is Claimed Is:

1 1. An article conveying system installed in
2 a building having a plurality of floors,
3 comprising:

4 horizontal tracks along which a container
5 carrier is moved are laid on the plurality of
6 floors, an article is loaded in the container
7 carrier;

8 a vertical conveying chamber, which
9 vertically connects the horizontal tracks of the
10 plurality of floors to one another, is provided at
11 a suitable position; and

12 a lifter apparatus provided in the
13 vertical conveying chamber, the lifter apparatus
14 being movable to and stayable at respective heights
15 of the horizontal tracks of all of the floors, and
16 the lifter apparatus having a movable cage in which
17 a horizontal rail is provided, the horizontal rail
18 is slidable to eliminate a gap between each of the
19 horizontal tracks and the horizontal rail at a stop
20 position being equal height to the horizontal track
21 so as to serve as a part of the horizontal track.

1 2. The article conveying system of claim 1,
2 wherein the lifter apparatus has a rotary stand
3 supporting the horizontal rail so that the
4 horizontal rail is horizontally rotatable, and
5 accomplishing a turn of the horizontal rail to a
6 predetermined position during the lifter apparatus
7 is vertically moved.

