

BELT CONVEYOR AND BELT CONVEYOR APPARATUS

TECHNICAL FIELD

[0001]

The present invention relates to a belt conveyor and a belt conveyor apparatus conveying an object to be conveyed in a logistic system.

BACKGROUND ART

[0002]

In various logistic systems, there are a variety of logistic steps such as conveyance, assortment, picking, delivery, etc of an object to be conveyed. For example, changing in this logistic steps is not limited to changing of a conveying direction for the assortment but, rather, includes, if necessary, changing of a conveying direction or a conveying position, stabilizing of a conveying posture, changing of a conveying speed to high level to improve processing capability or changing of the conveying speed from high level to low level.

[0003]

In the following, a related art belt conveyor will be schematically described with reference to Fig.10.

Fig.10 (A) shows a schematic side views of the related art belt conveyor; and Fig.10 (B) shows an enlarging view of a jointing portion E.

[0004]

In the related art, for example, as shown in Fig.10(A), the belt conveyor 100 has a conveying belt 104 conveying the object P to be conveyed in a given direction (in

this figure, in an arrow X direction), and a plurality of slider beds 102 supporting a lower face of the conveying belt 104, and in which the conveying belt 104 is supported and appropriately rotated by both rollers 103 installed at both ends of the belt 104 respectively.

[0005]

In the meanwhile, although the plurality of the slider beds 102 are coupled each other by fixing screws, round shapes R can not be avoidable in the jointing portions E for metal working. For this reason, there occur depressions 107 at the jointing portions E as shown in Fig.10(B) showing the enlarging of the portion E. Therefore, the conveying belt 104 sinks downward at the jointing portions E by weight of the object P to be conveyed such that concave portions 109 are formed, and, hence, the object P fluctuates at the jointing portions E, so that the conveying state becomes unstable. Further, in this case, if the conveying speed comes into high level, there occurs noise.

[0006]

To solve this problem, non-patent document 1 discloses that coupling portions (fasteners) between conveyor belts are configured to reduce frictional sound generated when the conveyor belt touches and slides on the slider beds. Nevertheless, it is in a present time that even though the fasteners between the conveyor belts are improved, the jointing portions between the slider beds come into being in contact with the conveyor belt, thereby keeping the above-mentioned problem not solved.

[0007]

[Non-patent Document 1] Nagoya Industry limited company, plastic fastener MEKA FIRST (which is searched out on January 16, 2008); Internet URL: <http://www.nagoya.sc/meka/index.html>

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED

[0008]

An object of the invention is to provide a belt conveyor and a belt conveyor apparatus in which the local collisions and noises (frictional sound) resulting from the jointing portions between the belt supporting units in conveying the object to be conveyed can be avoidable, so that damages to the conveying belt and the object to be conveyed may reduce and, at the same time, the posture and position of the object to be conveyed may be stable for high speed conveying.

MEANS FOR SOLVING THE PROBLEMS

[0009]

A belt conveyor as set forth in claim 1 according to the present invention comprises a conveying belt conveying an object to be conveyed; a plurality of slider beds supporting a lower face of the conveying belt; and a buffer sheet which is disposed between the conveying belt and the slider beds, and covers at least gaps at jointing portions between the slider beds.

[0010]

In the belt conveyor as set forth in claim 2 according to the present invention, a face of the buffer sheet which is in contact with the conveying belt has a lower friction coefficient than those of upper faces of the slider beds.

[0011]

In the belt conveyor as set forth in claim 3 according to the present invention, the face of the buffer sheet which is in contact with the conveying belt is embossed.

[0012]

In the belt conveyor as set forth in claim 4 according to the present invention, an upstream side of the buffer sheet in a conveying direction of the object is fixed.

[0013]

A belt conveyor apparatus as set forth in claim 5 according to the present invention comprises: an accelerating region and a decelerating region in which conveying speed of an object to be conveyed changes; and a stable speed region in which the conveying speed is kept stable; wherein each belt conveyor disposed in the respective region comprises: a buffer sheet that is disposed between a plurality of slider beds, which supports a lower face of a conveying belt, and the conveying belt, the buffer sheet covering at least a gap at a jointing portion between the slider beds.

EFFECT OF THE INVENTION

[0014]

In accordance with the belt conveyor as set forth in claim 1, in that the conveyor includes the buffer sheet which is disposed between the conveying belt and the slider beds, and covers at least gaps at jointing portions between the slider beds, first, there are formed none of concave-convexes on the conveying face when the object passes through the gaps at the jointing portions in conveying the object and, thus, the noises sounding like collision sounds of the object are eliminated, and, second, depressions in gaps at the jointing portions between the slider beds are blocked, and, thus, the object is prevented from deviating from its position due to impacts at the

jointing portions when the object is conveyed at high speed. In this way, the conveying belt moves stably and, hence, the damages to the belt and the object are reduced. Especially, a current position of the object is prevented from deviating from its position information when conveying the object at high speed and, thus, the object can be accurately managed only with the position information of the object at a time point when initiating the conveying, so that both of conveying at the high speed and simplifying position information of the object can be accomplished at the same time.

[0015]

In accordance with the belt conveyor as set forth in claim 2, in that the face of the buffer sheet which is in contact with the conveying belt has a lower friction coefficient than those of upper faces of the slider beds, increase of resistance against moving of the conveying belt is able to be suppressed, thereby providing the belt conveyor suitable to the high speed conveying.

[0016]

In accordance with the belt conveyor as set forth in claim 3, in that the face of the buffer sheet which is in contact with the conveying belt is embossed, friction area between the buffer sheet and the conveying belt diminishes and, thus, the friction level reduces.

[0017]

In accordance with the belt conveyor as set forth in claim 4, in that an upstream side of the buffer sheet in the conveying direction of the object is fixed, first, even when there occurs a manufacturing error or an aging deformation in the buffer sheet, the buffer sheet can be installed so that the face of the buffer sheet is kept flat, and, second, the buffer sheet is able to move comparatively free after the sheet is fixed, so that

adverse effect on smoothness of the face of the sheet which is in contact with the conveying belt can be minimized. Further, because regarding fixing precision level in attaching the buffer sheet, high precision level is not required, it is possible to provide the belt conveyor with good attachment performance.

[0018]

In accordance with the belt conveyor apparatus as set forth in claim 5 according to the present invention comprising: an accelerating region and a decelerating region in which conveying speed of an object to be conveyed changes; and a stable speed region in which the conveying speed is kept stable; wherein each belt conveyor disposed in the respective region comprises: a buffer sheet that is disposed between a plurality of slider beds, which supports a lower face of a conveying belt, and the conveying belt, the buffer sheet covering at least a gap at a jointing portion between the slider beds, first, effect of the concave-convexes on the conveying face at the jointing portion between the beds disappears and, thus, the noises are suppressed in conveying the object, and, second, the depression of gap at the jointing portion between the slider beds is blocked, and, thus, the object is prevented from deviating from its position when the object is conveyed at high speed. Especially, a current position of the object is prevented from deviating from its position information when conveying the object at high speed and, thus, the object can be accurately managed, for example, only with the position information of the object at the time point when initiating the conveying, resulting in enabling long distance and high speed conveying with very high accuracy.

[0019]

Furthermore, in accordance with the above belt conveyor and belt conveyor apparatus of the invention, load becomes smaller in driving the conveying belt than in

the conventional belt conveyor and, thus, energy consumed in driving the belt reduces, thereby enabling the driving with a motor whose torque is small.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig.1 shows a schematic side view of a belt conveyor according to one embodiment of the invention;

Fig.2 shows a perspective view of a broken section of the belt conveyor in Fig.1 and a view when looking at the belt conveyor in an arrow C direction from C-C line;

Fig.3 shows respectively perspective views of main parts in various embodiments of buffer sheets according to the invention;

Fig.4 shows a cross-sectional view of main parts in an embodiment of a buffer sheet according to the invention in which a plurality of holes are formed;

Fig.5 shows a cross-sectional view of main parts in an embodiment of a rear end portion of a buffer sheet according to the invention;

Fig.6 shows a cross-sectional view of main parts in an embodiment of jointing portions between a plurality of buffer sheets according to the invention;

Fig.7 shows a cross-sectional view of main parts in an embodiment of a buffer sheet according to the invention which is provided with an elastic member;

Fig.8 shows a schematic plan view of a belt conveyor apparatus according to one embodiment of the invention;

Fig.9 shows a schematic side view of an embodiment of a connecting region between belt conveyors in the belt conveyor apparatus according to the invention; and

Fig.10 shows a schematic side view of the related art belt conveyor..

LISTS OF COMPONENTS

[0021]

1: belt conveyor

2: slider bed

3: roller

4: conveying belt

5: buffer sheet

6: driving system

7: controlling system

8: fixing screw

90: belt conveyor apparatus

DETAILED DESCRIPTIONS OF EXEMPLARY EMBODIMENTS

[0022]

Below, a detailed description is given of a belt conveyor according to one embodiment of the present invention with reference to Fig1 to Fig.9. Fig.1 shows a schematic side view of a belt conveyor according to one embodiment of the invention. Fig.2(A) shows a perspective view of a broken section of the belt conveyor in Fig.1; and Fig.2(B) shows a view when looking at the belt conveyor in an arrow C direction from C-C line in Fig.2(A). Fig.3 (A), (B), (C) show respectively perspective views of main parts in various embodiments of buffer sheets according to the invention. Fig.4 shows a cross-sectional view of main parts in an embodiment of a buffer sheet according to the invention in which a plurality of holes are formed. Fig.5 shows a cross-sectional view of main parts in an embodiment of a rear end portion of a buffer sheet according to the

invention. Fig.6 shows a cross-sectional view of main parts in an embodiment of jointing portions between a plurality of buffer sheets according to the invention. Fig.7 shows a cross sectional view of main parts in an embodiment of a buffer sheet according to the invention which is provided with an elastice member.

[0023]

As shown in Fig.1 and Fig.2, a belt conveyor 1 according to this embodiment includes a conveying belt 4 conveying an object P to be conveyed in a given direction (in this figure, in an arrow X direction); a plurality of slider beds 2 supporting a lower face of the conveying belt 4; and a buffer sheet 5 which is disposed between the conveying belt 4 and the slider beds 2, and covers all of gaps 2a at jointing portions between the slider beds 2.

[0024]

In this belt conveyor 1, the conveying belt 4 is supported by both rollers 3 installed at both ends of the belt 4 respectively, and at least one of the two rollers 3 is rotated by a driving system 6 including a motor, etc.

[0025]

The driving system 6 is controlled by a controlling system 7. The buffer sheet 5 may be made of, for example, metal such as stainless steel, etc and, the buffer sheet 5, in particular, an upstream end 5a thereof in a conveying direction is fixed to an upstream end of the slider beds 2 with a fixing screw 8, etc.

[0026]

In the belt conveyor 1 according to the embodiment, in that the conveyor 1 includes the buffer sheet 5 which is disposed between the conveying belt 4 and the slider beds 2, and covers gaps 2a at jointing portions between the slider beds 2, there are

formed none of concave-convexes on the conveying face when the object P passes through the gaps 2a at the jointing portions, and, thus, the noises sounding like collision sounds of the object P are eliminated.

[0027]

Further, depressions in gaps 2a at the jointing portions between the slider beds 2 substantially disappears (from the viewpoint of the conveying belt 4), and, thus, the object P is prevented from deviating from its position due to impacts at the jointing portions when the object P is conveyed at high speed.

[0028]

As a result, the conveying belt 4 moves stably and, hence, the damages to the belt 4 and the object P are reduced. In this way, a current position of the object P is prevented from deviating from its position information when conveying the object P at high speed, for example, at 90 m to 600 m per one minute (there is no problem at higher speed than 90 m to 600 m per one minute), and, thus, the object P can be accurately managed only with the position information of the object P at a time point when initiating the conveying, so that it is easy, for example, to control assortment, and both of conveying at the high speed and simplifying position information of the object P can be accomplished at the same time.

[0029]

In the belt conveyor 1 according to the embodiment, in that an upstream end 5a of the buffer sheet 5 in a conveying direction of the object P is fixed while a downstream end 5b thereof is left free, even when there occurs a manufacturing error or an aging deformation in the buffer sheet 5, the buffer sheet 5 can be installed so that the face of the buffer sheet 5 is kept flat.

[0030]

Further, the buffer sheet 5 is able to move comparatively free after the buffer sheet 5 is fixed, so that adverse effect on smoothness of the face of the buffer sheet 5 which is in contact with the conveying belt 4 can be minimized. Furthermore, because regarding fixing precision level in attaching the buffer sheet 5, high precision level is not required, it is possible to provide the buffer sheet 5 with good attachment performance.

[0031]

In the belt conveyor 1 according to this embodiment, as shown in Fig. 2(A) and Fig.2(B), the conveying belt 4 whose width is smaller than that of the buffer sheet 5 is disposed on the buffer sheet 5 whose width is smaller than a distance between both side frames 9, and, if necessary, position regulating members 9a are installed at both sides of the conveying belt 4 respectively, so that a position of the sides of the conveying belt 4 as well as a position of the upper face of the buffer sheet 5 are regulated.

[0032]

In the belt conveyor 1 according to the embodiment, the face of the buffer sheet 5 which is in contact with the conveying belt 4 has a lower friction coefficient than those of upper faces of the slider beds 2. In this manner, increase of resistance against moving of the conveying belt 4 is able to be suppressed, thereby providing the belt conveyor 1 suitable to conveying the object at high speed, for example, at the speed equal to or higher than 90 m/minute.

[0033]

In the belt conveyor 1 according to the embodiment, the buffer sheet 5 has various surface shapes and, variations of the buffer sheet 5 may employ buffer sheets

35A, 35B and 35C as shown in Fig.3 (A), (B), (C) respectively or may employ a buffer sheet 75 as shown in Fig.4.

[0034]

In Fig. 3(A), the face of the buffer sheet 35A which is in contact with the conveying belt 4 is embossed (36A), so that friction area between the buffer sheet and the conveying belt diminishes and, thus, the friction level reduces.

[0035]

In the buffer sheet 35B shown in Fig. 3(B), embossed shapes 36B has oneness and embossed positions are random, whereas in the buffer sheet 35A shown in Fig. 3(A), embossed shapes 36A has oneness and embossed positions are regular. Such a configuration has not only an advantage that friction area between the buffer sheet and the conveying belt diminishes and, thus, the friction level reduces, but also an advantage that contact distribution between the conveying belt 4 and the embossing 36B is uniform and, thus, the conveying belt 4 is prevent from being worn away only at its local region.

[0036]

In the buffer sheet 35C shown in Fig. 3(C), embossed shapes 36C are random and embossed positions are random. Similarly, such a configuration has not only an advantage that friction area between the buffer sheet and the conveying belt diminishes and, thus, the friction level reduces, but also an advantage that contact distribution between the conveying belt 4 and the embossing 36C is uniform and, thus, the conveying belt 4 is prevent from being worn away only at its local region.

[0037]

In the buffer sheet 75 as shown in Fig.4, a plurality of through-holes 75b are

formed which penetrate through the buffer sheet 75 in a thickness direction thereof. In this manner, air 79 is sucked into between the conveying belt 4 and the buffer sheet 75 and, in turn, the conveying belt 4 can float a little over the buffer sheet due to the sucked air 79, resulting in remarkably reducing the friction level.

[0038]

In the meanwhile, in the buffer sheet 75 as shown in Fig.4, the through-holes 75b are formed so as to be open toward a lateral side of the embossing 75a and a downstream side in the conveying direction. Such a configuration is suitable for the air to be sucked. In addition, a plurality of openings 72C are formed in the slider beds 72.

[0039]

In the belt conveyor 1 according to the embodiment, a plurality of the buffer sheets may be installed so as to be arranged in the conveying direction of the object. Below, examples of such a configuration will be described.

[0040]

In the example as shown in Fig.5, a plurality of the buffer sheets 45, 46 are installed so as to be arranged in the conveying direction of the object. In this case, a rear end 45b of the buffer sheet 45 disposed at the upstream side in the conveying direction of the object is formed so as to taper away toward a tip of the rear end 45b ($T1 > T2 > T3 > T4$). A front end 46a of the buffer sheet 46 disposed at the downstream side in the conveying direction of the object is fixed to the jointing portion between the slider beds 42. In this manner, in case that the plurality of the buffer sheets 45, 46 are installed in a consecutive way, a step which may be otherwise formed in an overlapping region 49 between the buffer sheets can be avoided.

[0041]

In the example as shown in Fig.6, a plurality of the buffer sheets 65A, 65B are installed so as to be arranged in the conveying direction of the object P. In this case, a rear end 65c of the buffer sheet 65A disposed at the upstream side in the conveying direction of the object P is formed so as to extend downward on the tilt along and through a gap 67a between jointing blocks 67 disposed between the slider beds 62. In this manner, in case that the plurality of the buffer sheets 65A, 65B are installed in a consecutive way, a step which may be otherwise formed in a joining region 69 between the buffer sheets can be avoidable.

[0042]

In the examples as shown in Fig.6 and Fig.7, rear ends 55C, 65c of the buffer sheets 55, 65A disposed on the slider beds 52, 62 respectively are subjected to elastic tensions due to elastic members 56, 66. The elastic tensions keep on being applied to the buffer sheets and, thus, smoothness and stability of the buffer sheets are kept in due degree, so that the stable movement of the conveying belt 4 is secured.

[0043]

In the following, a belt conveyor apparatus according to the invention will be described in details with reference to one embodiment.

A belt conveyor apparatus according to the present invention comprises accelerating and decelerating regions in which conveying speed of an object to be conveyed changes, and a stable speed region in which the conveying speed is kept stable; the apparatus is characterized in that each belt conveyor disposed in the respective region comprises a conveying belt conveying the object to be conveyed; a plurality of slider beds supporting a lower face of the conveying belt; and a buffer sheet which is disposed between the conveying belt and the slider beds, and covers at least

gaps at jointing portions between the slider beds. That is, the belt conveyor apparatus according to the present invention employs the above mentioned belt conveyor 1 according to the invention and, the configuration of this belt conveyor 1 includes any one of various examples and variations thereof as shown in Fig.1 to Fig.7.

[0044]

Below, a detailed description is given of a belt conveyor apparatus according to one embodiment of the present invention with reference to Fig.8 and Fig.9. Fig.8 shows a schematic plan view of a belt conveyor apparatus according to one embodiment of the invention. Fig.9 shows a schematic side view of an embodiment of a connecting region between belt conveyors in the belt conveyor apparatus according to the invention.

[0045]

The belt conveyor apparatus according to the embodiment may be an equipment necessary to convey the object at high speed over a long distance, for example, at the airport terminal. The belt conveyor apparatus 90 as shown in Fig.8 is configured as the conveying system which interconnects a main terminal 96 provided with a sorter 97 for conveying and assorting the baggage object and a satellite terminal 94 located far from the main terminal 96 and provided with a sorter 95.

[0046]

The belt conveyor apparatus 90 has accelerating and decelerating regions 92, 93 in which conveying speed of the object to be conveyed changes, and a stable speed region 91 in which the conveying speed is kept stable and high (although the conveying speed generally is not varied in the region 91, the speed may be variable).

[0047]

The belt conveyor apparatus 90 is configured so that as shown in Fig.1, each

belt conveyor disposed in the respective region 91, 92, 93 includes a conveying belt 4 conveying the object to be conveyed; a plurality of slider beds 2 supporting a lower face of the conveying belt 4; and a buffer sheet 5 which is disposed between the conveying belt 4 and the slider beds 2, and covers gaps 2a at jointing portions between the slider beds 2 (the configuration of the belt conveyor 1 may include any one of various examples and variations thereof as shown in Fig.1 to Fig.7).

[0048]

In the accelerating and decelerating regions 92, 93, a number (about 10) of the belt conveyors 1 according to the invention are arranged in a serial way. To be specific, in the accelerating region, a number of the belt conveyors 1 are arranged so that the conveying speed gradually increases, whereas in the decelerating region, a number of the belt conveyors 1 are arranged so that the conveying speed gradually decreases. In the stable speed region 91, a belt conveyor 1 for a comparatively long distance may be installed.

[0049]

Further, the belt conveyor apparatus 90 may have a plurality of conveying lines which go and return respectively. For example, the situation in which the baggage is conveyed from the arriving airplane 99 to the main terminal 96 will be described. First, the baggage collected at the satellite terminal 94 is sent through the sorter 95 to the accelerating region 93 in which, in turn, the conveying speed of the baggage is accelerated. Then, the baggage is conveyed at very high speed (for example, equal to or more than 300 m/minute) over a long distance in the stable speed region 91 toward and near the main terminal 96. Next, in the decelerating region 92, the conveying speed is decelerated to the speed corresponding to the speed at which the sorter 97 conveys the

baggage. Subsequently, the baggage is distributed through the sorter 97.

[0050]

In case that the baggage is loaded into the airplane 99, roles of the above mentioned accelerating and decelerating regions 92, 93 are exchanged (this is possible in that there are many conveying lines).

[0051]

In accordance with the belt conveyor apparatus 90 of the embodiment, the object is prevented from deviating from its position when the object is conveyed at high speed. Especially, a current position of the object is prevented from deviating from its position information when conveying the object at high speed, resulting in enabling long distance and high speed conveying with very high accuracy.

[0052]

In this embodiment, as shown in Fig.9, belt conveyors 81A, 81B neighbor each other in the conveying direction of the object, and a position of the belt conveyor 81A disposed at an upstream side is higher than that of the belt conveyor 81B disposed at a downstream side so that there occurs a slight difference h between heights of the conveying faces of the belt conveyors 81A, 81B.

[0053]

A distance L is set so that the object lands first onto a position 83P of the top of the desired conveying face at the belt conveyor 81B to which the object is conveyed. This can generate a temporary falling state of the object when the object moves between the belt conveyors 81A, 81B having different conveying speed. This reduces the interfering force applied to the object by the conveying belt 84A of the belt conveyor 81A which conveys the object and, at the same time, makes the object land first onto a

position 83P of the top of the desired conveying face (conveying belt 84B) at the belt conveyor 81B to which the object is conveyed. Consequently, the object moves smoothly between the belt conveyors.

[0054]

Although this embodiment is applied to the airport terminal, it is apparent that the belt conveyor and the belt conveyor apparatus according to the invention are applied to all of the conveying systems in the logistic systems other than the airport terminal.

INDUSTRIAL APPLICABILITY

[0055]

According to the invention, the conveying face on which the object slides in the conveying belt comes into being flat, so that the belt conveyor and the belt conveyor apparatus are realized in which the object is conveyed at high speed and with little noises. Therefore, the invention has superior industrial applicability.

CLAIMS

1. A belt conveyor comprising:
 - a conveying belt that conveys an object to be conveyed;
 - a plurality of slider beds that supports a lower face of the conveying belt; and
 - a buffer sheet that is disposed between the conveying belt and the slider beds, the buffer sheet covering at least a gap at a jointing portion between the slider beds, wherein the buffer sheet is made of metal.
2. The belt conveyor according to claim 1,
 - wherein
 - a face of the buffer sheet that is in contact with the conveying belt has a lower friction coefficient than those of upper faces of the slider beds.
3. The belt conveyor according to claim 2,
 - wherein
 - the face of the buffer sheet which is in contact with the conveying belt is embossed.
4. The belt conveyor according to anyone of the claims 1 to 3,
 - wherein
 - an upstream side of the buffer sheet in a conveying direction of the object is fixed.
5. A belt conveyor apparatus comprising:

an accelerating region and a decelerating region in which conveying speed of an object to be conveyed changes; and

a stable speed region in which the conveying speed is kept stable;

wherein

each belt conveyor disposed in the respective region comprises:

a buffer sheet that is disposed between a plurality of slider beds, which supports a lower face of a conveying belt, and the conveying belt, the buffer sheet covering at least a gap at a jointing portion between the slider beds.