

VIBRATORY CONVEYING APPARATUS

Description

[Technical Field]

[0001]

The present invention relates to a vibratory conveying apparatus, more particularly, it relates to a vibratory conveying apparatus suitable for conveying a great number of small electronic components.

[Background Art]

[0002]

Various kinds of vibratory conveying apparatuses for conveying small components such as electronic components are generally used in factories. In such a type of vibratory conveying apparatus, recently, high feed speed and feed precision have been required, and high speed and high performance have been urgently required. Additionally, since a mounting apparatus and other processing apparatuses, for which high precision is required, are provided side by side in a feeding place of such electronic components, it has been pointed out that vibration generated by the vibratory conveying apparatus has influence on action of the processing apparatuses. Thus, various proposals have been conventionally presented so that the vibration generated by the vibratory conveying apparatus may not be transmitted to

the outside to the extent possible.

[0003]

As the above proposal, rubber or a spring is generally placed under a base to absorb vibration. However, there exists a structure that vibration energy itself is prevented from leaking to the outside from the vibratory conveying apparatus. For example, an apparatus has been proposed in which the base and a conveying body are elastically supported by a pair of elastic supporting springs, one end of each piezoelectric device as a vibrating body is connected to the conveying body, the other end thereof is connected to an inertia body (weight), and thus the conveying body is vibrated by reaction of the inertia body (for example, see Patent Documents 1 and 2). Additionally, an apparatus has been proposed in which a Y-shaped vibrating body having two vibrating parts is connected to the base, a conveying body is connected to one of the vibrating parts of the Y-shaped body via the elastic supporting spring, the inertia body (weight) is connected to the other vibrating part, and the two vibrating parts are driven at phases opposite from each other (for example, see Patent Document 3).

[0004]

Further, an apparatus has been proposed in which the vibrating body is supported by the base so as to have a fulcrum at its middle part, the conveying body is connected to the

vibrating body on one side of the fulcrum, and the inertia body (weight) is connected to the vibrating body on the other side of the fulcrum (for example, see Patent Document 4). Furthermore, an apparatus is known in which the conveying body and one end of the vibrating body are connected to each other via an elastic support, the other end of each vibrating body is connected to the inertia body (weight), and another elastic support is interposed between the inertia body and the base (see Patent Documents 5, 6, 7, 8 and 9). In each vibratory conveying apparatus, since the conveying body and the inertia body are vibrated at the phases opposite from each other by addition of the inertia body (weight) connected to the vibrating body, there is an advantage that the vibration energy that is transmitted to the base can be suppressed.

Patent Document 1: Japanese Published Unexamined Patent Application No. 2002-302232

Patent Document 2: Japanese Published Unexamined Patent Application No. H10-203624

Patent Document 3: Japanese Published Unexamined Patent Application No. H6-345238

Patent Document 4: Japanese Published Unexamined Patent Application No. H8-108917

Patent Document 5: Japanese Published Unexamined Patent Application No. H9-142630

Patent Document 6: Japanese Published Unexamined Patent

Application No. H3-51210

Patent Document 7: Japanese Published Unexamined Patent
Application No. H4-153119

Patent Document 8: Japanese Published Unexamined
Utility Model Application No. H2-124919

Patent Document 9: Japanese Published Unexamined
Utility Model Application No. H2-124920

[Disclosure of the Invention]

[Problem to be Solved by the Invention]

[0005]

On the other hand, each of the apparatuses disclosed in the above documents has the following problem: since a conveying body is connected to an inertia body (weight) via a vibrating body and connected to a base via an elastic support, a flow of vibration energy from the conveying body to the base cannot be sufficiently suppressed (Patent Documents, 1, 2 and 4); since, although flow-out of the vibration energy to a set-up surface can be reduced, the vibrating body or a member having a specific structure and shape as a supporting structure is required to be used, manufacturing cost increases, and vibration characteristics and the like are required to be adjusted for an object to be conveyed, that is, it is difficult to flexibly adapt to situation or environment (Patent Documents 3 and 4); since the inertia body (weight) connected to the vibrating body is supported on the base via

the elastic support, this structure is basically the same as a conventional structure that the base is arranged on the set-up surface via rubber or a spring, a flow-out situation of the vibration energy is mainly determined by elastic characteristics of the elastic support between the inertia body and the base, and therefore, the vibration energy that is transmitted to the set-up surface cannot be sufficiently reduced (Patent Documents 5, 6, 7, 8 and 9).

[0006]

Additionally, for example, Patent Document 3 discloses that the conveying bodies are connected to both vibrating parts of each Y-shaped vibrating body respectively, but, in such a constitution that the plurality of conveying bodies are connected to the vibrating body, a load applied to the vibrating body is increased and thus there is a possibility that damage is caused such that the vibrating body, e.g. piezoelectric body, is cracked.

[0007]

Thereupon, the present invention was made in order to solve the above problems, and aims at providing a vibratory conveying apparatus capable of raising vibration efficiency by, for example, suppressing the flow-out of the vibration energy to the outside on the basis of change of a vibration mode, and capable of reducing the load to the vibrating body.

[Means for Solving the Problem]

[0008]

In view of the above problems, the present invention provides a vibratory conveying apparatus including: a base; a first conveying body arranged above the base; a vibrating body for vibrating the first conveying body; a first elastic support connected between the first conveying body and one side of the vibrating body; an inertia body which is connected to the other sides of the vibrating body and constitutes a free end of vibration; and a second elastic support connected between the base and the one side of the vibrating body, and the first elastic support, and further including: a second conveying body; and a third elastic support connected between the second conveying body and the one side of the vibrating body, the first elastic support, and the second elastic support.

[0009]

According to the present invention, since the vibrating body does not directly and unlimitedly vibrate the conveying bodies but generates vibration between connection parts of the first and third elastic supports and the second elastic supports, and the inertia body, reaction from the conveying bodies is less likely to be transmitted to the base. Thus, vibration energy flowing out to the outside is reduced, transmission efficiency of vibration is raised, and vibrating mode of the first conveying body accurately corresponds to

a conveying direction compared with a conventional vibratory conveying apparatus. Accordingly, vertical struggles of the conveying bodies are reduced and the conveyance efficiency is improved. Additionally, since the vibrating body is connected between the inertia body constituting the free end of vibration and a connection point of the first elastic support, second elastic support and third elastic support and thus both ends of the vibrating body are connected to movable parts having a high degree of freedom, respectively, concentration of a load applied to the vibrating body is released. Thus, for example, the vibrating body is prevented from being damaged even if the plurality of conveying bodies are connected. Accordingly, the apparatus is easily designed, and stability and endurance thereof can be raised.

[0010]

In the present invention, it is preferable that the first elastic support and the third elastic support are attached so as to be inclined in directions opposite from each other. Thus, the first conveying body and second conveying body allow components to be conveyed in the directions opposite from each other. Accordingly, for example, the components are conveyed in one direction while a defective component is removed halfway, and simultaneously the removed defective component can be returned in a reverse direction. Thus, the components can be fed at a high speed. Here, it is desirable

that the second conveying body is provided parallel with the first conveying body and receives an object to be conveyed which is removed at a removing part provided in the first conveying body.

[0011]

In the present invention, it is preferable that the vibrating body, the first elastic support, the second elastic support, and the third elastic support are respectively provided in two positions spaced forward and backward in the conveying direction of the first conveying body and the second conveying body, and both the front and rear vibrating bodies are connected to the common inertia body. Thus, the first conveying body and second conveying body are elastically supported at two positions spaced in the conveying direction, respectively, and the two positions are connected to the respective vibrating bodies. Accordingly, conveyance performance can be raised. Additionally, since a single vibration system (resonance system) is constituted by connecting the two vibrating bodies corresponding to the two positions to the common inertia body, vibration characteristic can be stabilized, rigidity of the vibration system can be raised, endurance of each part can be improved, and the whole apparatus can be made compact.

[0012]

In the present invention, it is preferable that the first

elastic support, the second elastic support and the third elastic support are plate-shaped elastic bodies having a common width direction. If the elastic supports each including the plate-shaped elastic body thus have the common width direction, an unnecessary vibrational component except vibration in a direction necessary for conveyance can be reduced.

[0013]

In the present invention, it is preferable that the other side of the vibrating body is arranged higher than the one side thereof. If the other side is thus higher than the one side of the vibrating body, the inertia body can be arranged near the conveying bodies. Thus, the unnecessary vibration mode except the vibrational component necessary for conveyance can be prevented from being generated, and the vibration energy flowing out to the base side due to the unnecessary vibration mode can be prevented from increasing. Additionally, since the inertia body is arranged near the conveying bodies and the unnecessary vibration mode can be prevented from being generated, there is an advantage that the weight and volume of the inertia body can be increased in terms of designing.

[0014]

In the present invention, it is preferable that the inertia body is arranged in a height range of overlapping

with the vibrating bodies. If the inertia body is thus arranged in the height range of overlapping with the vibrating bodies, the inertia body and the vibrating bodies can be made vertically compact, and thus the height of the apparatus can be reduced while a predetermined performance is secured.

[0015]

In the present invention, it is preferable that a connecting member is interposed between the vibrating body and the first elastic support, the second elastic support, and the third elastic support, and a connection position of the connecting member to the vibrating body is on the base side relative to those of the connecting member to the first elastic support, the second elastic support and the third elastic support. Thus, the intensity of vibrational connection between the vibration system including the vibrating body and the first and second conveying bodies can be raised, and the apparatus can be made low and compact.

[Best Mode for Carrying Out the Invention]

[0016]

Hereinafter, an embodiment of the present invention will be described with reference to an example illustrated in the drawings. Fig. 1 is a front side schematic perspective view of a vibratory conveying apparatus 220 of the embodiment form which a conveying block 221B included in a first conveying body and a conveying block 222B included in a second conveying

body are removed, Fig. 2 is a rear side perspective view of the same, Fig. 3 is a front view of the same, Fig. 4 is a rear view of the same, Fig. 5 is a right-hand side view of the same, and Fig. 6 is a schematic plan view showing a constitutional example of the vibratory conveying apparatus.

[0017]

The vibratory conveying apparatus 220 of the embodiment has: a base 221; a first conveying body 222X arranged above the base 221 (see Fig. 6, which includes a trough 222A shown in Figs. 1 and 2 and the conveying block 222B shown in Fig. 6,); vibrating bodies 223 for vibrating the first conveying body 222X; connecting members 224 connected to one sides (lower ends) of the vibrating bodies 223 respectively; first elastic supports 225 connected between the conveying body 222X and the connecting members 224 respectively; an inertia body 226 which is connected to the other ends (upper ends) of the vibrating bodies 223 and constitutes a free end of vibration; and second elastic supports 227 connected between the connecting members 224 and the base 221 respectively.

[0018]

Additionally, extension members 228 are connected and fixed to the sides (rear sides) of the connecting members 224 respectively, one ends (lower ends) of the third elastic supports 229 are connected to the extension members 228 respectively, and the other ends (upper ends) of the third

elastic supports 229 are connected to a second conveying body 222Y (see Fig. 6, which includes a trough 222C shown in Figs. 1 and 2 and a conveying block 222D shown in Fig. 6,). The troughs 222A and 222C are arranged parallel with each other, and approximately at the same level. The first conveying body 222X and second conveying body 222Y are also arranged approximately parallel with each other by the troughs 222A and 222C. Moreover, as shown in Fig. 6, a linear feeding track 222a is formed on the first conveying body 222X, a linear collecting track 222b is formed on the second conveying body 222Y, and the feeding track 222a and the collecting track 222b are arranged parallel with each other. Here, in the embodiment, the feeding track 222a provided on the first conveying body 222X and the collecting track 222b provided on the second conveying body 222Y respectively convey components in directions opposite from each other.

[0019]

The vibrating body 223 is composed of, for example, a piezoelectric device. Specifically, the piezoelectric device is a bimorph type piezoelectric device in which piezoelectric layers are formed on both sides of an elastic plate respectively, and which is constructed so that the elastic plate is bent by a predetermined voltage is applied thereto. A unimorph type piezoelectric device, of course, is applicable in which the piezoelectric layer is formed only

on one side of the elastic plate. AC power having a predetermined frequency is applied to these piezoelectric devices from the outside so that the devices bend and vibrate at the frequency.

[0020]

In the embodiment, two sets of the vibrating body 223, connecting member 224, first elastic support 225 and second elastic support 227 are provided in two positions, front and rear, spaced in the conveying direction, respectively. That is, the first conveying body 222X is elastically supported by the first elastic support 225 and second elastic support 227 in two positions, front and rear.

[0021]

Additionally, the vibrating body 223 arranged at the front in the conveying direction is arranged behind the front first elastic support 225, and connected to the inertia body 226 arranged behind. The vibrating body 223 arranged at the rear is arranged in front of the rear first elastic support 225, and connected to the inertia body 226 arranged in front. That is, the inertia body 226 is arranged between the front and rear vibrating bodies 223, and the two vibrating bodies 223 are connected to the common inertia body 226.

[0022]

The inertia body 226 has an inertia plate 226A connected to the vibrating bodies 223, and an inertia block 226B fixed

to the inertia plate 226A, and the inertia block 226B is suspended and fixed from the inertia plate 226A arranged above. The inertia plate 226A adjacently arranged immediately under the conveying body 222X, and the inertia block 226B is projected downward from the inertia plate 226A so as to be positioned at the height level approximately the same as those of the vibrating bodies 223.

[0023]

The first elastic support 225 and second elastic support 227 each is a plate-shaped elastic body, for example, a plate spring. The first elastic support 225 and second elastic support 227 are arranged along a connecting direction. Thus, both the elastic supports have support characteristics approximate to that in the case where a single plate-shaped elastic body is provided between the base 221 and the first conveying body 222X. That is, if the first elastic support 225 and second elastic support 227 are respectively provided at places shifting from each other in the front and rear direction, an unnecessary vibration mode is generated, the unnecessary vibration mode being in a direction different from an original vibrating direction orthogonal to a posture of the vibrating bodies 223 (for example, vertically rocking vibration mode), and there is a possibility of having an adverse influence on conveyance characteristics of the conveying body 222. However, if both the elastic supports 225 and 227 are

arranged on a common line as described above, the unnecessary vibration mode can be prevented from being generated. Moreover, similar to each above elastic support, the third elastic supports are provided so as to have a width direction along a common line (horizontal line) orthogonal to the connecting direction. Thus, all plate springs in one vibration system have a common width direction, and the unnecessary vibration mode can be prevented from being caused. [0024]

Additionally, the common line of the first and second elastic supports is adapted so as to be parallel with an extending direction of the vibrating body 223. Thus, bending vibration in a direction orthogonal to the extending direction (a direction along a plate surface) of the vibrating body 223 can be efficiently transmitted to the first elastic supports 225, and the first conveying body 222X can be efficiently vibrated. In the embodiment, vibration is applied to the conveying body 222X, the vibration being in a direction slightly vertically inclined from the horizontal direction, and thus components (not shown) on the conveying body 222X can be conveyed along the conveying direction (feeding direction). Accordingly, in order to efficiently transmit such vibration, the vibrating bodies 223 are extended in a direction slightly inclined forward and backward relative to a vertical direction, and the first elastic supports 225

and second elastic supports 227 are parallelly extended with the vibrating bodies 223.

[0025]

Further, the lower end of the vibrating body 223 is connected to the connecting member 224, the upper end thereof is connected to the inertia body 226, and thus the inertia body 226 can be easily made closer to the first conveying body 222X. Accordingly, a moment generated by the first conveying body 222X and the inertia body 226 can be reduced, and thus the vibration efficiency can be raised and the unnecessary vibration mode can be suppressed. Additionally, since the inertia body 226 (particularly, inertia block 226B) is arranged in a height range so as to overlap with the vibrating body 223, the apparatus 220 can be made compact in a height direction even if the weight and volume of the inertia body 226 are increased.

[0026]

In the apparatus 220 constituted as in the above, when AC power is applied to the vibrating bodies 223 and the bending vibration is generated, the connecting members 224 and the inertia body 226 vibrate in a bending direction on both the sides of the vibrating bodies 223. Vibration of the connecting members 224 is amplified by the first elastic supports 225 and second elastic supports 227 on the base 221 serving as a fulcrum, and the first conveying body 222X is vibrated.

Additionally, vibration having a phase reverse to that of the connecting members 224 is generated in the inertia body 226 constituting the free end of vibration. Further, the first conveying body 222X (and second conveying body 222Y) and the inertia body 226 respectively vibrate at phases opposite from each other.

[0027]

Additionally, in the embodiment, the connecting members 224 are connected to the third elastic supports 229 via the extension members 228 respectively, and the second conveying body 222Y is vibrated via the third elastic supports 229. That is, the first conveying body 222X and second conveying body 222Y are connected to each other in parallel in the vibration system, and basically vibrate in the same mode. However, although the first elastic supports 225 are inclined in a direction reverse to the feeding direction and thus the first conveying body 222X receives vibration directed obliquely upward in the feeding direction, the third elastic support 229 is inclined reverse to the first elastic support 225 (reverse to a collecting direction) and thus the second conveying body 222Y receives vibration directed obliquely upward in the collecting direction reverse to the feeding direction. For example, in the case where the first elastic supports 225 each is inclined at 3 to 15° in the direction reverse to the feeding direction, it is preferable that the

third elastic bodies 229 each is also inclined at 3 to 15° in the direction (feeding direction) reverse to the collecting direction.

[0028]

In the embodiment, different from the conventional vibratory conveying apparatus, since one ends of vibrating bodies 223 are connected to the first elastic supports 225 and second elastic supports 227 respectively and the other ends thereof are connected to the inertia body 226, the one end of the vibrating body 223 does not directly and unlimitedly vibrate the first conveying body 222X. Accordingly, it is confirmed that the first conveying body 222X accurately vibrates along the conveying direction and a vertical struggle is reduced. That is, photographing with a high speed video camera or the like reveals that, although conveyance postures of the components are laterally uneven, and the components vertically jump up and down or sometimes move in a reverse direction in the conventional conveying apparatus, the components are well-regulatedly and accurately fed in the conveying direction in the embodiment. It is confirmed that, in the embodiment, the vibration energy is efficiently transmitted to the components, the conveyance postures of the components are easily uniformed in the conveying direction, and the conveying speed is improved.

[0029]

Additionally, the base 221 is connected to the connecting members 224 via the second elastic supports 227, the first conveying body 222X is connected to the connecting members 224 via the first elastic supports 225, the inertia body 226 is connected to the connecting members 224 via the vibrating bodies 223, and thus vibration elements mutually vibrating at the phases opposite from each other are connected to each other. Consequently, the vibration energy that is transmitted to the base 221 can be reduced, and therefore, adverse influence on an adjacent apparatus due to the vibration can be reduced and a noise can be suppressed.

[0030]

Further, in the embodiment, since it is unnecessary to use a specific and complicated shape or structure for the vibrating body 223, first elastic support 225, second elastic support 227 and third elastic support 229, manufacturing cost can be saved. In the example illustrated, the vibrating body 223, first elastic support 225, second elastic support 227 and third elastic support 229 each is in the plate shape.

[0031]

The inventors previously proposed that the third elastic supports 229 connected to the second conveying body 222Y are connected to the inertia body 226. Although vibration can be transmitted to the second conveying body 222Y even in this constitution, it was revealed that, since the inertia body

226 does not simply reciprocally vibrate in the conveying direction but vibrates in a state where vibration for reciprocal rotation around the center of gravity combines with the reciprocal vibration (vibration mode for hulling action), it is difficult to efficiently convey an object to be conveyed to one side in this constitution. That is, if the component is arranged on either of left and right sides in Fig. 3 above the inertia body 226 in this vibration mode, it constantly moves to the center of the gravity side (center part). On the other hand, the object to be conveyed can be securely conveyed in a direction according to the inclination angle of the third elastic support 229 by connecting the third elastic supports 229 to the connecting members 224 respectively as the embodiment.

[0032]

In the embodiment, since the first conveying body 222X and second conveying body 222Y are connected to the connecting members 224 in parallel with each other via the first elastic supports 225 and third elastic supports 229 respectively, a large load is applied to the vibrating bodies 223. However, in the embodiment, the one side of each vibrating body 223 is connected between the first elastic support 225 and second elastic support (and further the third elastic support 229) and the other side thereof is connected to the inertia body 226 constituting the free end of vibration, that is, both

sides of each vibrating body 223 are connected to movable parts having small binding force respectively, and therefore, concentration of the load to the vibrating bodies 223 can be released, and the vibrating bodies 223 can be prevented from being damaged.

[0033]

Additionally, in the embodiment, as shown in Figs. 1 to 4, since the connecting member 224 is connected to the one side (lower end) of the vibrating body 223 relatively low and connected to the first elastic support 225 and second elastic support 227 (and third elastic support 229) relatively high, the height of the apparatus can be reduced, the intensity of vibrational connection between the vibrating bodies 223 and the first conveying body 222X (and second conveying body 222Y) can be raised, and the vibration of the connecting members 224 can be efficiently transmitted to the first conveying body 222X (and second conveying body 222Y). Specifically, in the embodiment, the connecting members 224 and the first conveying body 222X (and second conveying body 222Y) vibrate in a mode in which phases are opposite from each other but amplitudes are approximately the same. That is, the connecting members 224 and the first conveying body 222X (and second conveying body 222Y) vibrate in a mode having a node of the vibration at the center of each first elastic support 225 (and third elastic support 229) in a length direction.

The object to be conveyed can be efficiently conveyed in such a vibration mode. Moreover, a part parentheses in the above description indicates that the vibration mode is basically the same as that in the case where neither second conveying body 222Y nor the third elastic support 229 is provided.

[0034]

Further, as shown in Fig. 5, the first elastic support 225 and third elastic support 229 are adapted to be narrower than the vibrating body 223 and the second elastic support 227. This is because, if the moduli of elasticity of the first elastic support 225 and third elastic support 229 are too high, leakage of the vibration energy to the base 221 cannot be reduced due to integrated vibration of the vibration system including the first conveying body 222X, second conveying body 222Y, vibrating bodies 223, connecting members 224, first elastic supports 225, inertia body 226 and third elastic supports 229. Thereupon, the moduli of elasticity of the first elastic support 225 and third elastic support 229 are reduced, the first and third elastic supports are adapted to be balanced to the second elastic support 227, and thus the leakage of the vibration energy to the base 221 is reduced and effective conveying force is generated in the vibration system.

[0035]

In the apparatus 220, the two third elastic supports 229 are provided at the front and rear of the second conveying

body 222Y in the conveying direction so as to elastically support the second conveying body 222Y. The second conveying body 222Y is arranged in parallel with the first conveying body 222X, and arranged aside of the first conveying body 222X so that the conveying directions of the conveying bodies 222X and 222Y are parallel with each other. In the embodiment, the length of the first elastic support 225 is approximately the same as that of the third elastic support 229, and, in accordance with this, the height of the trough 222A is approximately the same as that of the trough 222C. However, the heights of the troughs 222A and 222C may be different from each other.

[0036]

Here, a proper constitution can be employed for the conveying blocks 222B and 222D in accordance with conveying modes of the components. For example, in the example shown in Fig. 6, the collecting track 222b on the second conveying body 222Y shown in Fig. 6 is arranged slightly lower than the feeding track 222a on the first conveying body 222X shown in Fig. 6. A component (for example, component having a defective posture) is adapted to drop onto the collecting track 222b when being removed from the components conveyed on the feeding track 222a at a component removing part Y.

[0037]

Moreover, different from the embodiment, the vibrating

bodies 223 each may be approximately vertically attached between the connecting member 224 and the inertia body 226. Thus, the vibrating bodies 223 make the inertia body 226 approximately horizontally vibrate, and unbalance between the angle difference between the vibrations of the inertia body 226 and second conveying body 222Y, and the angle difference between the vibrations of the connecting member 224 and first conveying body 222X can be reduced.

[0038]

In a component feeding system 200 shown in Fig. 6, a table 203 is mounted on a mount table 201 via proper vibration-proof means 202 such as a coil spring or vibration-proof rubber, a bowl type vibratory component conveying apparatus 210 and the vibratory component conveying apparatus 220 are mounted on the table 203. The vibratory component conveying apparatus 210 has a bowl-shaped conveying body 211 including a screw-shaped conveying track 211a, and the conveying body 211 is mounted on a rotational vibrator (not shown).

[0039]

The component rising on the conveying track 211a shifts onto the feeding track 222a at a component transfer part X. While the components are conveyed to the right side in Fig. 6 on the feeding track 222a, a component having no predetermined posture is removed onto the collecting track 222b at the

component removing part Y and conveyed to the left side in Fig. 6 on the collecting track 222b. The component conveyed on the collecting track 222b is returned to the conveying body 211 at a component returning part Z, and conveyed on the conveying track 211a.

[0040]

Moreover, a vibratory conveying apparatus of the present invention is not limited to the example illustrated, and various modifications, of course, are applicable without departing from the scope of the present invention. For example, the first elastic support and the second elastic support are integrated into a single elastic member, and the connecting member or vibrating body may be connected to a proper part of the elastic member. Additionally, although the conveying directions of the first conveying body 222X and second conveying body 222Y are opposite from each other, the present invention is not limited to this, and for example, the directions of the conveying bodies may be the same, or three or more conveying bodies may be arranged side by side.

[Brief Description of the Drawings]

[0041]

Fig. 1 is a front side perspective view of a vibratory conveying apparatus of an embodiment according to the present invention.

Fig. 2 is a rear side perspective view of the same.

Fig. 3 is a front view of the same.

Fig. 4 is a rear view of the same.

Fig. 5 is a right-hand side view of the same.

Fig. 6 is a plan view showing the whole constitution of a component feeding system including the same.

[Description of Symbols]

[0042]

220 ... Vibratory conveying apparatus, 221 ... Base, 222X ... First conveying body, 222Y ... Second conveying body, 223 ... Vibrating body, 224 ... Connecting member, 225 ... First elastic support, 226 ... Inertia body, 227 ... Second elastic support, 228 ... Extension member, 229 ... Third elastic support

Claims:

1. A vibratory conveying apparatus comprising:
 - a base;
 - a first conveying body arranged above the base;
 - a vibrating body for vibrating the first conveying body;
 - a first elastic support connected between the first conveying body and one side of the vibrating body;
 - an inertia body which is connected to the other sides of the vibrating body and constitutes a free end of vibration;
 - and
 - a second elastic support connected between the base and the one side of the vibrating body, and the first elastic support,
 - and further comprising:
 - a second conveying body; and
 - a third elastic support connected between the second conveying body and the one side of the vibrating body, the first elastic support, and the second elastic support.
2. The vibratory conveying apparatus according to claim 1, wherein the first elastic support and the third elastic support are attached so as to be inclined in directions opposite from each other.
3. The vibratory conveying apparatus according to claim 1 or 2, wherein the vibrating body, the first elastic support, the second elastic support, and the third elastic support

are respectively provided in two positions spaced forward and backward in the conveying direction of the first conveying body and the second conveying body, and both the front and rear vibrating bodies are connected to the common inertia body.

4. The vibratory conveying apparatus according to any one of claims 1 to 3, wherein a connecting member is interposed between the vibrating body and the first elastic support, the second elastic support, and the third elastic support, and a connection position of the connecting member to the vibrating body is on the base side relative to those of the connecting member to the first elastic support, the second elastic support and the third elastic support.