

DESCRIPTION

Title of Invention: VIBRATING CONVEYOR APPARATUS

Technical Field

[0001]

- 5 The present invention relates to a vibrating feeder configured to transport powdery or granular material while vibrating the material in a casing. In particular, the present invention relates to a vibrating feeder including a cleaner configured to clean powdery or granular material attached to the inside of the casing.

Background Art

10 [0002]

- To transport powdery or granular material such as powdery or granular food, pharmaceuticals, resin materials, and incineration ash, there has been used a vibrating feeder including a feed lane and a casing covering the space above the feed lane (e.g., see Patent Literatures 1 and 2). The vibrating feeder is configured to transport such
- 15 powdery or granular material supplied onto the feed lane by vibrating the feed lane in a reciprocating manner in a feed direction by a vibrator. Examples of such devices also include a vibrating feeder including a feed lane having a large number of air injection holes (e.g., see Patent Literature 3). In this vibrating feeder, hot or cold air is supplied from a portion below the feed lane into a casing through the air injection holes, to dry
- 20 or cool the transported powdery or granular material.

[0003]

- In each of the vibrating feeders described in Patent Literatures 1 and 2, the casing is vibrated together with the feed lane in a reciprocating manner. Meanwhile, in the vibrating feeder described in Patent Literature 3, which is a large-size vibrating feeder
- 25 configured to dry incineration ash of municipal wastes, the casing is fixed and only the

feed lane is vibrated in a reciprocating manner.

[0004]

In the above-described vibrating feeders for powdery or granular material, the material may be attached to the feed lane and/or the inner surface of the casing, due to the
5 hygroscopicity, deliquescency, electrification characteristic, or the like of the material. If the powdery or granular material first transported is thus attached, the attached material may be mixed with another material transported thereafter, to disadvantageously deteriorate the quality of the material. Meanwhile, in the vibration feeder including the feed lane having the air injection holes, powdery or granular
10 material attached to the feed lane may clog the holes, to disadvantageously reduce drying efficiency or cooling efficiency.

[0005]

In Patent Literature 1, a scraper is provided to function as a cleaner configured to clean the thus attached powdery or granular material. The scraper includes a blade portion
15 configured to scrape the inner surface of the casing including the feed lane, and the scraper is disposed in the casing vibrating in a reciprocating manner. Outside the casing, there is provided a tractor configured to move the scraper in the direction opposite to the feed direction. The tractor is controlled in accordance with the feeding rate of the vibrating feeder, so as to move the scraper in the feed direction slightly
20 behind the transported powdery or granular material.

[0006]

In Patent Literature 2, a water-supply pipe configured to spray cleaning liquid to the inner wall surface of the casing including the feed lane is provided to function as the cleaner. Hot water and/or steam is/are ejected from a nozzle of the water-supply pipe
25 during the stoppage period of the vibrating feeder, to remove powdery or granular

material attached to the inner wall surface.

[0007]

In Patent Literature 3, a chain belt driven in the feed direction is provided in the fixed casing, and upstanding leaf springs are provided on the chain belt at predetermined intervals. Powdery or granular material attached to the feed lane is scraped away by lower end portions of the leaf springs pressed onto and rubbing the vibrating feed lane.

Citation List

Patent Literatures

[0008]

10 Patent Literature 1: Japanese Unexamined Patent Publication No. H7-179216

Patent Literature 2: Japanese Unexamined Patent Publication No. 2003-192117

Patent Literature 3: Japanese Unexamined Patent Publication No. H4-335987

Summary of Invention

Technical Problem

15 [0009]

In the vibrating feeder described in Patent Literature 1, the scraper is moved to clean the attached powdery or granular material during the transportation, and therefore the attached material is promptly scraped away. However, the moving scraper is vibrated with the casing in a reciprocating manner, and this disadvantageously shortens the service life of the blade portion of the scraper that contacts the inner surface of the casing while vibrating. In addition, the cleaner, i.e., the scraper having a large inertial mass is also vibrated in a reciprocating manner. For this reason, the capacity of the vibrator has to be increased.

[0010]

25 In the vibrating feeder described in Patent Literature 3, powdery or granular material

attached to the feed lane is scraped away by driving the chain belt during the transportation. However, when getting closer to the fixed casing, the upstanding leaf springs provided on the chain belt are pressed onto the feed lane vibrating in a reciprocating manner. This disadvantageously shortens the service life of the leaf
5 springs and the feed lane.

[0011]

In this regard, the above problems about the service life of the cleaner and the increase in the capacity of the vibrator are not caused in the vibrating feeder described in the Patent Literature 2. However, the cleaning operation by the cleaner can be performed
10 only after the vibrating feeder is stopped. This is disadvantageous in that attached powdery or granular material cannot be removed promptly.

[0012]

In view of the above, an object of the present invention is to provide a vibrating feeder that enables prompt cleaning of powdery or granular material attached to a feed lane
15 vibrating in a reciprocating manner, during transportation of the material, and that is capable of ensuring a longer service life of a cleaner.

Solution to Problem

[0013]

To solve the above-described problems, in the present invention, a vibrating feeder
20 including: a feed lane configured to carry powdery or granular material supplied thereon; a casing covering a space above the feed lane; and a vibrator configured to vibrate the feed lane in a reciprocating manner in a feed direction in which the powdery or granular material is transported, is arranged to further include: a guide rail provided in the casing and extending in the feed direction; a carriage configured to
25 move along the guide rail; a carriage mover configured to move the carriage; a

cleaning head mounted on the carriage and configured to eject cleaning fluid to the feed lane; and a fluid supply passage through which the cleaning fluid is supplied to the cleaning head from outside of the casing.

[0014]

- 5 With the above arrangement, powdery or granular material attached to the feed lane vibrating in the reciprocating manner is promptly cleaned during transportation of the material. In addition, the cleaner does not directly contact the feed lane vibrating in the reciprocating manner, to ensure a longer service life of the cleaner.

[0015]

- 10 The vibrating feeder may be arranged such that: the carriage mover is configured to pull, from a position outside the casing, a towline coupled to the carriage; and the fluid supply passage is formed by a flexible hose which also functions as the towline. With the above arrangement, the carriage, operated from the position outside the casing, is stably moved, and the towline used to move the carriage is also utilized as the fluid
15 supply passage.

[0016]

- The vibrating feeder described above may be further arranged such that the feed lane is provided with a plurality of injection holes through which hot or cold gas flows into the casing. The thus arranged vibrating feeder is suitable for drying or cooling the
20 transported powdery or granular material. In this case, it is preferable that the cleaning fluid is air.

Advantageous Effects of Invention

[0017]

- The present invention enables prompt cleaning of powdery or granular material
25 attached to the feed lane vibrating in the reciprocating manner, during transportation of

the material, and ensures a longer service life of the cleaner.

Brief Description of Drawings

[0018]

[FIG. 1] FIG. 1 is an abbreviated side view of a vibrating feeder of an embodiment.

5 [FIG. 2] FIG. 2 is an abbreviated plan view of the feeder of FIG. 1.

[FIG. 3] FIG. 3 is a cross section of the feeder cut along a line III-III in FIG. 2.

[FIG. 4] FIG. 4 is a plan view of a right lower rail shown in FIG. 3.

[FIG. 5] FIG. 5(a) is a plan view of a carriage and guide rails shown in FIG. 1. FIG. 5(b) is a front elevation of the carriage and the guide rails.

10 [FIG. 6] FIG. 6 is a perspective view illustrating connection between the carriage shown in FIG. 5 and hoses.

[FIG. 7] FIG. 7 is a front elevation of a hose guide shown in FIG. 1.

Description of Embodiments

[0019]

15 The following will describe an embodiment of the present invention, with reference to the drawings. A vibrating feeder of this embodiment is configured to dry powdery or granular material such as food and resin material while transporting the material. As shown in FIG. 1 to FIG. 3, the vibrating feeder includes a feed-lane box 2, a vibrator 11, and a casing 21. A feed lane 1 having a large number of air injection holes (not
20 illustrated) is provided on an upper surface of the feed-lane box 2. The vibrator 11 is configured to vibrate the feed-lane box 2 in a reciprocating manner in a feed direction. The casing 21 covers a space above the feed lane 1. The vibrating feeder is configured to transport powdery or granular material supplied onto the feed lane 1 through a supply port 21a at one end, to a discharge port 21b at the other end. The feed-lane box
25 2 has a plurality of intake openings 3. Hot air supplied through the intake openings 3

flow into the casing 21 through the air injection holes of the feed lane 1, to dry the powdery or granular material being transported.

[0020]

The casing 21 is secured to a base 23 by posts 22. The casing 21 has exhaust openings
5 24 provided through the ceiling of the casing 21. Through the exhaust openings 24, hot air having dried the powdery or granular material is exhausted. The casing 21 is further provided with windows 25 for maintenance. The windows 25 are openable and closable, and provided to side faces of the casing 21. Although not illustrated, each intake opening 3 for hot air is connected to an intake duct, and each exhaust opening
10 24 is connected to an exhaust duct. A vertical gap between the casing 21 and the feed-lane box 2 is covered with a soft screen 4 vertically hung from the casing 21.

[0021]

As shown in FIG. 1, the vibrator 11 includes a counterweight 12, a crank mechanism 14, movable levers 16, and coil springs 17. The counterweight 12 extends in the feed
15 direction below the feed-lane box 2. The crank mechanism 14 couples the feed-lane box 2 with the counterweight 12, and the crank mechanism 14 is driven by a motor 13. Each of the movable levers 16 is rotatably attached to a corresponding one of upstanding supports 15 provided on the counterweight 12. Each movable lever 16 has one end coupled to the feed-lane box 2. Each of the coil springs 17 couples the feed-
20 lane box 2 with the counterweight 12 orthogonally to the direction in which the corresponding movable lever 16 extends. The vibrator 11 is configured to vibrate the feed-lane box 2 in a reciprocating manner obliquely upward relative to the feed direction. The counterweight 12 is supported by the base 23 via support legs 18. The support legs 18 may be vibration-isolating springs.

25 [0022]

As shown in FIG. 3, guide rails 31 and 32 each extending in the feed direction are provided near the left and right sides of the casing 21. A carriage 41 is movable along the guide rails 31 and 32. Each of the left and right guide rails 31 and 32 has upper and lower rails which guide the corresponding wheels of left and right wheels 42a and 42b of the carriage 41. Specifically, the guide rail 31 has an upper rail 31a and a lower rail 31b, and the guide rail 32 has an upper rail 32a and a lower rail 32b. Each of the left wheels 42a has a recessed tire surface to have a recessed V-shape cross section, while each of the right wheels 42b has a flat tire surface. The left lower rail 31b has a projecting V-shape cross section, while the right lower rail 32b has a flat surface. Thus, the wedge engagement between each left wheel 42a and the lower rail 31b prevents the carriage 41 from moving in the left-right direction. Further, each of the left and right upper rails 31a and 32a has a cross section opening upward. This enables the upper surfaces of these rails to be used as guide passages for hoses 36 and a rope 38, which will be described later.

[0023]

Cleaning heads 51 and piping members 52 are attached to the carriage 41 via brackets 53. Each cleaning head 51 is configured to blow air functioning as cleaning fluid to the feed lane 1. Through the piping members 52, air supplied from the left and right hoses 36 is supplied to the cleaning head 51. The hoses 36 will be described later. Each cleaning head 51 extends in a width direction near the feed lane 1. The cleaning head 51 is provided with a large number of nozzles 54 through which air is ejected. The left and right piping members 52 extend downward to be respectively connected with intermediate portions of the cleaning head 51. Each of the intermediate portions is a portion of the head 51 between the center of the head 51 in the width direction and corresponding one of the ends of the head 51 in the width direction. Further, as shown

in FIG. 1, each nozzle 54 is directed toward the feed lane 1 downward and forward in the feed direction at an angle of approximately 45 degrees. Air is blown from each nozzle 54 during the transportation, to remove powdery or granular material attached to the feed lane 1. Note that the left and right piping members 52 may be replaced by a
5 single pipe, the both end portions of which may be connected to the left and right hoses 36, respectively. In this alternative, the single piping member 52 may be a T-shape pipe, and one end of the T-shape pipe may be connected to a central portion of the cleaning head 51.

[0024]

10 To each of the left and right piping members 52, a cleaning head 51a is attached. The cleaning head 51a is configured to blow air to a contact portion between the guide rail 31, 32 and the wheel 42a, 42b. As shown in FIG. 4, the right lower rail 32b having the flat surface has long holes 39 provided at predetermined intervals. Each of the holes 39 has an oblong shape and is long in a direction inclined relative to the feed direction.
15 The attached powdery or granular material removed by air ejected from the cleaning head 51a drops through the long holes 39. The long holes 39 may have another shape, such as an oval shape and a rectangular shape. The reason why each long hole 39 is made long in the direction inclined relative to the feed direction is to prevent the wheels 42b from being caught in the holes 39. Because the left lower rail 31b has the
20 projecting V-shape cross section, the powdery or granular material removed by air ejected from the cleaning head 51a slide down on its V-shape slope. These arrangements prevent the left and right wheels 42a and 42b traveling on the lower rails 31b and 32b from riding over the attached material to cause rattle.

[0025]

25 Two left and right reels 34 and a winch 35 are provided to function as a carriage mover.

As shown in FIG. 2, the reels 34 are located outward of the lengthwise end of the casing 21 that is closer to the discharge port 21b. The reels 34 are driven by a motor 33 so as to pull the carriage 41 in the feed direction. The winch 35 is configured to return the carriage 41 back, i.e., to move the carriage 41 in the direction opposite from the feed direction, and the winch 35 is located outward of the lengthwise end of the casing 21 that is closer to the supply port 21a. The two reels 34 are configured to wind therearound the flexible hoses 36 functioning as a towline and connected to the carriage 41, to move the carriage 41 in the feed direction. As will be described later, the hoses 36 are utilized also as a fluid supply passage to supply air to the cleaning heads 51 and 51a. Hose guides 37 are respectively attached to left and right portions of an end portion of the casing 21 that is closer to the discharge port 21b. The winch 35 is configured to wind a rope 38 connected to the carriage 41, to return back the carriage 41 having moved in the feed direction.

[0026]

Pulled by the reels 34 and the hoses 36, the carriage 41 is moved in the feed direction at a speed slightly slower than the feeding speed of the powdery or granular material, and removes the material attached during the transportation by air ejected from the cleaning heads 51 and 51a. After being moved to the end of the casing 21 closer to the discharge port 21b, the carriage 41 is pulled by the winch 35 with the rope 38, to be returned back to the end of the casing 21 closer to the supply port 21a. The attached material is removed by air ejected from the cleaning heads 51 and 51a also during the above operation to return the carriage 41. As such, the carriage 41 is repeatedly moved in a reciprocating manner in the casing 21 during the transportation of the material, and thereby the powdery or granular material attached to the feed lane 1 and the like is promptly removed.

[0027]

As shown in FIG. 5(a) and FIG. 5(b), the carriage 41 has two front and back mountings 43 apart from each other in the feed direction and coupled with each other by left and right pipes 44. To each mounting 43, there are attached two left wheels 42a and two right wheels 42b. As described above, each left wheel 42a has the recessed tire surface to have the recessed V-shape cross section.

[0028]

The cleaning heads 51 and 51a and the piping members 52 are attached to each of the front and back mountings 43. The left and right hoses 36 are connected to the piping members 52 for the front mounting 43. Air from the hoses 36 is supplied to the piping members 52 for the back mounting 43 through the pipes 44 coupling the mountings 43 with each other. The rope 38 of the winch 35 is connected to the back mounting 43.

[0029]

FIG. 6 illustrates connection between the piping members 52 for the front mounting 43 and the hoses 36. The hoses 36 are guided on the upper surfaces of the left and right upper rails 31a and 32a. The leading end of each hose 36 is slightly lifted up and connected to an elbow 52a. The elbow 52a is attached to an end portion of the corresponding piping member 52 so that the other end of the elbow 52a is oriented to the feed direction. This prevents the hoses 36 from twisting or bending when the hoses 36 are pulled by the reels 34. Thus, air is stably supplied to the piping members 52. Further, because the hoses 36 are guided on the upper surfaces of the upper rails 31a and 32a, respectively, the hoses 36 do not sag in the casing 21. Although not illustrated, the rope 38 connected to the back mounting 43 is also guided on the upper surface of the right upper rail 32a. This prevents the rope 38 from sagging in the casing 21.

[0030]

FIG. 7 shows one of the hose guides 37 attached to the left and right portions of the end portion of the casing 21 that is closer to the discharge port 21b. The hose guide 37 is formed by a pair of rotatable vertical rollers 37a and a pair of rotatable horizontal rollers 37b. The hose 36 passes through a space defined by the vertical rollers 37a and the horizontal rollers 37b. Thus, each hose 36 pulled by the reel 34 is smoothly guided into the casing 21 while being positioned stably.

[0031]

In the above-described embodiment, the carriage is pulled using the two left and right hoses, and the two hoses are connected to the cleaning heads via the piping members of the carriage. However, the carriage may be pulled using a single hose, and the single hose may be connected to the cleaning heads via the piping members of the carriage.

[0032]

In the above-described embodiment, air functioning as the cleaning fluid is blown to the feed lane and the guide rails of the carriage. However, air may be blown to the inner surface of the casing including the ceiling, side walls, and the like, in addition to the above.

[0033]

In the above-described embodiment, the towline of the reel corresponds to the hoses which also functioning as a fluid supply passage, and the towline of the winch is the rope. However, the towline of the reel may be a hose and the towline of the reel may be a rope. Alternatively, the both towlines may be ropes. In this modification, a fluid supply passage has to be provided, separately.

[0034]

In the above-described embodiment, the vibrating feeder is configured to dry powdery or granular material during transportation of the material, and the cleaning fluid is air.

However, in the present invention, the vibrating feeder may be configured to feed an object without drying, or may be configured to cool transported powdery or granular material. In the latter case, liquid may be employed as the cleaning fluid. Further, in the above embodiment, the casing is fixed and only the feed lane is vibrated in a reciprocating manner. However, in the present invention, the vibrating feeder may be configured so that the casing and the feed lane are vibrated together in a reciprocating manner.

[0035]

Furthermore, in the above-described embodiment, the reels and winch configured to move the carriage by pulling the carriage function as the carriage mover. However, the carriage mover is not limited to those described in the embodiment. For example, the carriage may be self-propelled by virtue of a driving source such as an engine and motor.

Reference Signs List

[0036]

- 1: feed lane
- 2: feed-lane box
- 3: intake opening
- 4: screen
- 11: vibrator
- 12: counterweight
- 13: motor
- 14: crank mechanism
- 15: support
- 16: movable lever

- 17: coil spring
- 18: support leg
- 21: casing
- 21a: supply port
- 5 21b: discharge port
- 22: post
- 23: base
- 24: exhaust opening
- 25: window
- 10 31, 32: guide rails
- 31a, 32a: upper rails
- 31b, 32b: lower rails
- 33: motor
- 34: reel
- 15 35: winch
- 36: hose
- 37: hose guide
- 37a: vertical roller
- 37b: horizontal roller
- 20 38: rope
- 39: long hole
- 41: carriage
- 42a, 42b: wheels
- 43: mounting
- 25 44: pipe

51, 51a: cleaning heads

52: piping member

52a: elbow

53: bracket

5 54: nozzle

CLAIMS

[Claim 1]

A vibrating feeder comprising:

a feed lane configured to carry powdery or granular material supplied thereon;

5 a casing covering a space above the feed lane; and

a vibrator configured to vibrate the feed lane in a reciprocating manner in a feed direction in which the powdery or granular material is transported, the vibrating feeder further comprising:

a guide rail provided in the casing and extending in the feed direction;

10 a carriage configured to move along the guide rail;

a carriage mover configured to move the carriage;

a cleaning head mounted on the carriage and configured to eject cleaning fluid to the feed lane; and

a fluid supply passage through which the cleaning fluid is supplied to the cleaning head

15 from outside of the casing.

[Claim 2]

The vibrating feeder according to claim 1, wherein: the carriage mover is configured to pull, from a position outside the casing, a towline coupled to the carriage; and the fluid supply passage is formed by a flexible hose which also functions as the towline.

20 [Claim 3]

The vibrating feeder according to claim 1 or 2, wherein the feed lane is provided with a plurality of injection holes through which hot or cold gas flows into the casing, and the cleaning fluid is air.