

BLADE COATING DEVICE AND COATING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATION

5 This application claims the priority of Chinese patent application No. 202010497169.8, entitled "BLADE COATING DEVICE AND COATING APPARATUS" and filed with the CNIPA on Jun. 03, 2020, disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

The present application relates to the technical field of coating and, in particular, to a blade coating device and a coating apparatus.

BACKGROUND

10 With the rapid development of robot technology, robots are used more and more widely, but at present, there is no fully automatic equipment that can be used in the construction site of epoxy floor, and the existing construction technology generally relies on a polishing dust collector, an automatic mixer, a rolling brush/trowel and manual construction, and these tools need a lot of manual operation to complete the construction of the entire epoxy floor. In addition, the manual
15 construction needs a long-term squatting operation, the labor intensity is high, the process is complex, the labor needs to bear the pungent smell volatilized from raw materials, the construction efficiency is low, and the health and safety of the construction personnel are endangered.

SUMMARY

20 An object of embodiments of the present application is to provide a blade coating device and a coating apparatus capable of automatically mixing, dispensing and spraying materials in combination with a guide cart, so as to solve the problems of low construction efficiency and endangering the health and safety of construction personnel in existing manual construction methods.

25 The embodiments of the present application provide a blade coating device. The apparatus includes a frame; a material mixing and dispensing mechanism, which is provided on the frame, and configured to mix a blade-coating material and for spraying the blade-coating material onto a floor to be blade-coated; and a blade coating actuator, which is configured to perform blade

coating on the floor to be blade-coated where the blade-coating material has been output.

In the above implementation process, the blade-coating material required for manual mixing are simulated and automatically dispensed, a plurality of blade coating actuator are adopted for simultaneous spreading and coating, so that the blade-coating area and effect are ensured, construction efficiency is improved, flexible operation for simulating manual blade-coating is achieved, the health of construction personnel is greatly protected, and problems that construction efficiency is low and the health and safety of construction personnel are endangered in an existing manual construction method are solved.

The embodiments of the present application further provide a coating apparatus including the blade coating device described above and a guide cart, where the blade coating device is disposed on the guide cart and operates according to movement and control of the guide cart.

In the above implementation process, the operation of the blade coating device is controlled by the guide cart, for example, the lifting of the a blade is controlled by controlling the through motor, and the drive assembly is activated to stir the blade-coating material in real time before the blade-coating material enters the feed bin.

Other features and advantages of this disclosure will be described in the following specification, or some of the features and advantages can be inferred from the specification or determined without doubt, or can be learned by implementing the preceding technology of this disclosure.

The object, features and advantages of this application will be more apparent from the detailed description of the preferred embodiments in conjunction with the drawings.

BRIEF DESCRIPTION OF DRAWINGS

To illustrate solutions in embodiments of the present application more clearly, the accompanying drawings used in description of the embodiments of the present application will be briefly described below. It should be understood that the following drawings just illustrate part of embodiments of the present application, and are not regarded as limiting the scope of the present application. Those of ordinary skill in the art can obtain other related drawings based on the accompanying drawings described below on the premise that no creative work is done.

FIG. 1 is a structure diagram of a floor paint coating robot of an underfloor parking according to an embodiment of the present application;

FIG. 2 is a structure diagram of a blade coating device according to embodiments of the present application;

FIG. 3 is a structure diagram of a material mixer according to an embodiment of the present application;

5 FIG. 4 is a structure diagram of a lifting mechanism according to an embodiment of the present application; and

FIG. 5 is a structure diagram of a blade coating actuator according to an embodiment of the present application.

Reference list:

10	100	guide cart
	200	blade coating device
	210	frame
	220	material mixing and dispensing mechanism
	221	mixing motor
15	222	coupler
	223	bearing seat
	224	material inlet
	2241	paint inlet
	2242	curing agent inlet
20	226	dynamic mixing tube
	227	feed bin
	230	lifting mechanism

	231	first guide rod
	232	upper plate
	233	through motor
	234	lower plate
5	235	first linear bearing
	240	blade coating actuator
	241	second guide rod
	242	second linear bearing
	243	elastic element
10	244	roller fixing plate
	245	tension spring
	246	rotating bracket
	247	blade
	228	translation platform module
15	229	material mixer
	2261	stirring element
	22	drive assembly
	24	telescopic assembly
	25	swing assembly
20	248	rotating axle

DETAILED DESCRIPTION

The technical solutions in embodiments of the present application will be described clearly and completely in conjunction with the drawings in embodiments of the present application. Apparently, the embodiments described hereinafter are part, not all, of embodiments of the present application. Generally, the components of this embodiment of the present application described and illustrated in the drawings herein may be arranged and designed through various configurations. Therefore, the following detailed description of the embodiments of the present application and shown in the drawings is not intended to limit the scope of the present application, but merely illustrates the selected embodiments of the present application. Based on the embodiments of the present application, all other embodiments obtained by those skilled in the art are within the scope of the present application on the premise that no creative work is done.

In the present application, the orientational or positional relationships indicated by terms "above", "below", "left", "right", "front", "rear", "top", "bottom", "inside", "outside", "center", "vertical", "horizontal", "landscape", "longitudinal", and the like are based on the orientational or positional relationships illustrated in the drawings. These terms are intended primarily to better describe the present application and its embodiment, and are not intended to define that the indicated apparatus, element or component must have such specific orientations or must be configured or operated in such specific orientations.

Also, the above-mentioned partial terms may be used in other meanings than to indicate an orientation or positional relationship, for example, the term "above" may also be used in some cases to indicate a certain attachment relationship or connection relationship. For those of ordinary skill in the art, specific meanings of these terms in the present application may be construed according to specific circumstances.

In addition, terms like "mounted", "disposed", "provided", "connected" and "connected to each other" are to be construed in a broad sense, for example, as permanently connected, detachably connected or integrally connected; mechanically connected or electrically connected; directly connected or indirectly connected via an intermediate medium; or internally connected between two apparatuses, elements or components. For those of ordinary skill in the art, specific meanings of the preceding terms in the present application may be construed according to specific circumstances.

In addition, the terms "first", "second", etc. are used primarily to distinguish different apparatuses, elements or components (specific types and configurations may be the same or different), and are not used to indicate or imply the relative importance and quantity of the indicated apparatuses, elements or components. Unless otherwise noted, the phrase of "a plurality of" means two or more.

As shown in FIG. 1, a coating apparatus 300 is provided, and the coating apparatus 300 may be a floor paint coating robot of an underfloor parking. The coating apparatus 300 can be applied to the coating of floor paint without manual operation, and the coating apparatus 300 includes a guide cart 100 and a blade coating device 200 which is combined with the guide cart to automatically mix, dispense and spray materials. The guide cart 100 may use, but is not limited to, an automated guided vehicle (AGV) cart. FIG. 2 is a structure diagram of a blade coating device 200 according to an embodiment of the present application. The blade coating 200 specifically includes a frame 210, a material mixing and dispensing mechanism 220 and a blade coating actuator 240.

The frame 210 is adapted to be disposed on the AGV cart to serve as a junction for connecting the entire blade coating device 200 to the guide cart 100, and provides force support for the blade coating device 200. For example, the frame 210 may be welded to the guide cart 100 by a square tube, which may be welded firmly and not easily deformed.

The material mixing and dispensing mechanism 220 is provided on the frame 210, and configured to mix a blade-coating material and output the blade-coating material to a floor to be blade-coated. The mixed blade-coating material presents a spraying effect under the action of pumping, improving the operation efficiency.

In this embodiment, one or more blade coating actuators 240 are configured to perform blade coating on the floor to be blade-coated where the blade-coating material has been sprayed. A plurality of blade coating actuators 240 are used to simultaneously perform blade coating, so that the blade coating area and effect are ensured, and the construction efficiency is improved. In a construction scene for small-area blade coating, one blade coating actuator 240 may be used, and details are not described herein.

In an embodiment, the material mixing and dispensing mechanism 220 is configured to provide active mixing for the blade-coating material, where the active mixing refers to a manner of providing an external force for the blade-coating material to achieve a mixing effect. The active

mixing provided by the material mixing and dispensing mechanism 220 mainly has the following meaning.

In a first aspect, before dispensing the material to the floor to be blade-coated, the material mixing and dispensing mechanism makes the material more fully mixed through the active mixing, thus improving the blade coating effect. In a second aspect, since the material mixing and dispensing mechanism 220 provides the active mixing for the blade-coating material, no active mixing component or mechanism is needed on the guide cart 100 used in combination with material mixing and dispensing mechanism 220, thus improving the versatility of the guide cart 100. For example, after the AGV cart completes the operation of blade-coating the material, the blade coating device 200 can be disassembled and then combined with other operation devices for operation. In a third aspect, the material mixing and dispensing mechanism 220 can directly complete the output of the blade-coating material, so that providing the active mixing at the material mixing and dispensing mechanism 220 can better uniformly mix a plurality of blade-coating materials, which is convenient for automatic real-time dispensing. In a fourth aspect, the material mixing and the material dispensing are integrally provided so that space can be saved. Meanwhile, the material mixing and the material dispensing are provided on the external frame 210, which facilitates the maintenance and replacement of the material mixing and dispensing mechanism 220.

Specifically, referring to FIG. 2, the material mixing and dispensing mechanism 220 includes a translation platform module 228 and a material mixer 229 disposed on the translation platform module 228, where the translation platform module 228 is disposed on the frame 210 and configured to drive the material mixer 229 to reciprocally translate on the translation platform module 228 so that the material mixer 229 moves and evenly dispenses the material to the floor to be blade-coated.

The translation platform module 228 is fixed to the frame 210 by bolts, the material mixer 229 is slidably connected to the translation platform module 228, and the translation platform module 228 provides power and guidance for left-and-right movement of the material mixer 229 to dispense the material. The translation platform module 228 may include a slide rail and a drive element, and the drive element may be a motor, an oil cylinder, or the like. The implementation manner is not limited herein.

Exemplarily, FIGS. 2 and 3 are structure diagrams of the material mixer 229. The material mixer 229 includes a feed bin 227, a dynamic mixing tube 226 and a drive assembly 22.

The feed bin 227 includes a plurality of material inlets 224, and is configured to mix a plurality of blade-coating materials. In this embodiment, the number of material inlets 224 may be two, two material inlets 224 are a paint inlet 2241 and a curing agent inlet 2242, respectively. The paint inlet 2241 and the curing agent inlet 225 may be connected to a material box through a flexible metal tube and a pump, the materials, such as paint and curing agent, in the material box may be pumped into the feed bin 227 through the flexible metal tube, and the material mixer 229 is mainly used for stirring and mixing the paint and the curing agent.

The dynamic mixing tube 226 is communicated with a lower end of the feed bin 227, disposed perpendicular to the floor, and configured to mix the blade-coating material entering the feed bin 227. A sprayer such as a spray nozzle is disposed at a lower end of the dynamic mixing tube 226, so that the mixed blade-coating material can be output to the floor. A stirring element 2261 is disposed in the dynamic mixing tube 226.

The drive assembly 22 is drivingly connected to the stirring element 2261 through a rotating shaft 2262, and configured to provide the active mixing for the blade-coating material.

After the preliminary mixing in the feed bin 227, on the one hand, the active mixing enables further full mixing of the plurality of blade-coating materials before dispensing the blade-coating materials, and on the other hand, active stirring is carried out in the dynamic mixing tube 226 of the material mixing and dispensing mechanism 220, and after the stirring is completed, the blade-coating materials are directly output to the floor to be blade-coated through the lower end of the dynamic mixing tube 226, thereby ensuring the mixing effect of the blade-coating materials, and avoiding the possible problem of an undesirable stirring effect or secondary precipitation of the blade-coating materials (which then affects the spraying effect) due to the time delay of conveying the blade-coating materials to the floor after the stirring is completed.

As an implementation, the drive assembly 22 may include a mixing motor 221 and a coupler 222. The stirring element 2261 may be a strip-shaped propeller, the mixing motor 221 is disposed above the feed bin 227, and a bearing seat 223 is disposed below the mixing motor 221. The mixing motor 221 is connected to the rotating shaft 2262 through the coupler 222, and the rotating shaft 2262 extends through the bearing seat 223 to the feed bin 227 and downward into the dynamic mixing tube 226 to be connected to the strip-shaped propeller in the dynamic mixing tube 226, so that the mixing motor 221 can drive the strip-shaped propeller to rotate and fully stir and mix various blade-coating materials flowing into the dynamic mixing tube 226.

Referring to FIG. 3, the drive assembly 22, the feed bin 227 and the dynamic mixing tube 226 are arranged from top to bottom sequentially, so that the overall structure is compact and space-saving, facilitating movement on the translation platform module 228. The arrangement direction is consistent with the spraying direction, facilitating directly outputting the blade-coating material to the floor without requiring additional correction for the output direction of the blade-coating material.

Exemplarily, the blade-coating materials are a paint and a curing agent, the mixing motor 221 may be connected in communication with a programmable logic controller (PLC) in the AGV cart 100, and the PLC controller controls the mixing motor 221 to start before the paint and the curing agent enter the dynamic mixer through the pump and the flexible metal tube, so that the paint and the curing agent can be fully stirred and mixed in real time after being pumped into the feed bin 227. Furthermore, the paint and the curing agent can be preliminarily mixed in the feed bin 227 and then flowed into the dynamic mixing tube, where the paint and the curing agent are fully mixed after being stirred by the stirring element 2261.

This device further includes a lifting mechanism 230, which is disposed on the frame 210, connected to the blade coating actuator 240 and configured to adjust a height of the blade coating actuator 240.

FIG. 4 is a structure diagram of a lifting mechanism 230. The lifting mechanism 230 includes an upper plate 232 and a lower plate 234, which are arranged in parallel and horizontally, the upper plate 232 is disposed on the frame 210, the lower plate 234 is provided with a plurality of blade coating actuators 240, the upper plate 232 is provided with a through motor 233, and the through motor 233 is drivingly connected to the lower plate 234 through a screw so as to drive the lower plate 234 to go up and down. Two first guide rods 231 are symmetrically provided at the left and right ends of the upper plate 232 and the lower plate 234 to ensure the verticality of the moving track of the lower plate 234 and the blade coating actuators 240, and the first guide rod 231 is connected to the upper plate 232 through a first linear bearing 235.

Furthermore, a linear motion element having a telescopic function, such as an oil cylinder, may be used as the power of lifting, which is not limited herein.

In use, the through motor 233 may be communicated with the PLC controller in the guide cart 100, and when blade coating is required, the blade coating actuator 240 is lowered to a desired height, and after the blade coating is completed, the blade coating actuator 240 is raised to the

original position.

Exemplarily, FIG. 2 is a structure diagram of a blade coating actuator 240. In this embodiment, the number of blade coating actuator 240 is four, and the four blade coating actuators 240 may be integrated on the lower plate 234 to ensure the spraying area and spraying effect and improve the spraying efficiency, simulating manual intelligent blade coating and improving the blade-coating efficiency.

The blade coating actuator 240 includes a second guide rod 241.

The second guide rod 241 is connected to the lower plate 234, and connected to a roller fixing plate 244 through a telescopic assembly 24. To make the connection more stable, the number of second guide rods 241 may be two. The two second guide rods 241 are respectively provided at two ends of the roller fixing plate 244, and a blade 247 is connected below the roller fixing plate 244 through a swing assembly 25, so as to control the blade 247 to swing up and down according to the terrain.

The telescopic assembly 24 includes a second linear bearing 242 and an elastic element 243 in a compressed state. The elastic element 243 may be a spring in a compressed state, which is convenient for the blade 247 to perform blade coating against the floor. The second guide rod 241 is connected to the spring through the second linear bearing 242. Under the action of the telescopic assembly 24, the height of the blade 247 can be finely adjusted according to the change in height of the terrain in an up-down extension manner, so that the blade 247 always moves against the floor, thereby ensuring the blade-coating effect.

The swing assembly 25 includes a rotating bracket 246 and a plurality of tension springs 245.

The rotating bracket 246 is rotatably connected to the roller fixing plate 244 through a rotating axle 248, so that the blade 247 can be rotated with the rotating axle 248 as a fulcrum.

The plurality of tension springs 245 are symmetrically disposed on two sides of the rotating bracket 246 along a length direction of the blade 247, and are configured to provide a force to the blade 247 for restoring an initial state, and the plurality of tension springs 245 can pull the blade 247 to swing according to the terrain. In this embodiment, the number of the tension springs 245 may be four, and each two tension springs 245 form a group of tension springs 245, and two groups of the tension springs 245 are respectively symmetrically disposed on two sides

of the rotating bracket 246, and two ends of each tension spring 245 are respectively connected to the roller fixing plate 244 and the blade 247, so that the blade 247 has a seesaw-like function, and can swing up and down. For an uneven floor, the blade 247 can swing up and down according to the terrain, so that the blade 247 can be protected from rigid contact with the floor on the premise of ensuring the blade-coating function, and thus the blade 247 can be protected.

In use, the PLC controller controls the start of the mixing motor 221 to pump the paint and the curing agent into the material mixer 229, and after the paint and the curing agent are fully mixed through the material mixer 229, the dynamic mixing tube 226 moves under the action of the translation platform module 228 and sprays the mixed blade-coating material to the floor. Then, the operation of the through motor 233 is controlled to adjust the height of the blade 247, so that blade coating is performed by the blade 247 against the floor where the blade-coating materials has been sprayed. In the blade-coating process, the blade 247 extends up and down and swings under the action of the springs 243 and the tension springs 245 according to the unevenness of the floor, thereby improving the blade-coating effect while preventing the blade 247 from coming into rigid contact with the floor.

The blade coating actuator 240 can protect the blade 247 in real time by expansion and contraction of the spring 243 and up and down swinging under the action of the tension springs 245, and allows the blade 247 to move against the floor according to the unevenness of the floor so as to self-adapt to the uneven floor and ensure the blade-coating effect. With the movement of the guide cart 100, the blade coating actuator 240 is controlled to perform driven blade coating. By simulating the effect of manual blade coating, the flexible operation can be performed by replacing the manual operation, the floor paint can be coated according to the requirements and the health of the construction personnel can be protected. The paint and the curing agent can be automatically mixed and the mixed materials can be timely dispensed in coordination with the moving track of the AGV, thus solving the problems of low construction efficiency and endangering the health and safety of the construction personnel in the existing manual construction method.

In all embodiments of the present application, "large" and "small" are relative, "many" and "few" are relative, and "upper" and "lower" are relative, and the expressions of such relative terms will not be repeated in the embodiments of the present application. It should be understood that "in this embodiment", "in an embodiment of the present application" or "as an optional implementation" mentioned throughout the specification means that a particular feature, structure or characteristic related to the embodiments is included in at least one embodiment of

the present application. Therefore, "in this embodiment", "in an embodiment of the present application" or "as an optional implementation" mentioned throughout the specification do not necessarily refer to the same embodiment. Furthermore, these particular features structures or characteristics may be combined in any suitable manner in one or more embodiments. It is also
5 to be understood by those skilled in the art that the embodiments described in the specification are optional embodiments and that the actions and modules involved are not necessarily necessary for the present application.

It should be understood that in various embodiments of the present application, the serial numbers of the above processes do not mean the execution order and the execution order of the
10 above processes should be determined according to their functions and internal logics, which should not limit the implementation processes of the present application in any improper way.

The above are just specific embodiments of the present application and are not intended to limit the scope of the present application. It is easy for those skilled in the art to conceive modifications or substitutions within the scope of the present application. These modifications
15 or substitutions are within the scope of the present application. Therefore, the protection scope of the present application is subject to the scope of the claims.

Claims

1. A blade coating device, comprising:

a frame;

5 a material mixing and dispensing mechanism, which is provided on the frame and configured to mix a blade-coating material and to output the blade-coating material to a floor to be blade-coated; and

a blade coating actuator, which is configured to perform blade coating on the floor to be blade-coated where the blade-coating material has been output.

10 2. The blade coating device according to claim 1, wherein the material mixing and dispensing mechanism provides active mixing for the blade-coating material.

3. The blade coating device according to claim 2, wherein the material mixing and dispensing mechanism comprises a material mixer, and the material mixer comprises:

a feed bin, which comprises a plurality of material inlets and is configured to accommodate the blade-coating material;

15 a dynamic mixing tube, which is communicated with the feed bin and configured to output the blade-coating material to the floor, wherein a stirring element is provided in the dynamic mixing tube; and

a drive assembly, which is drivingly connected to the stirring element and configured to provide the active mixing for the blade-coating material.

20 4. The blade coating device according to claim 3, wherein the drive assembly is disposed on an upper end of the feed bin, a lower end of the feed bin is communicated with the dynamic mixing tube which is disposed perpendicular to the floor to be blade-coated, and the drive assembly is drivingly connected to the stirring element after passing through the feed bin.

25 5. The blade coating device according to claim 3, wherein two material inlets are provided, and the two material inlets are a paint inlet and a curing agent inlet, respectively.

6. The blade coating device according to claim 3, wherein the material mixing and dispensing mechanism further comprises:

a translation platform module, which is disposed on the frame, wherein the material mixer is

disposed on the translation platform module and is configured to be driven to reciprocally translate on the translation platform module.

7. The blade coating device according to claim 5, wherein the material mixer is slidably connected to the translation platform module.

5 8. The blade coating device according to claim 3, wherein the drive assembly comprises a mixing motor and a coupler, and the mixing motor is disposed above the feed bin and is connected to the stirring element through the coupler.

9. The blade coating device according to claim 8, wherein a bearing seat is disposed below the mixing motor, the mixing motor is connected to a rotating shaft through the coupler, and the
10 rotating shaft extends through the bearing seat to the feed bin and downward into the dynamic mixing tube to be connected to the stirring element.

10. The blade coating device according to any one of claims 3 to 9, wherein the stirring element is a strip-shaped propeller.

11. The blade coating device according to any one of claims 3 to 10, wherein the drive assembly,
15 the feed bin and the dynamic mixing tube are arranged from top to bottom sequentially in a setting direction, and the setting direction is consistent with a spraying direction of the blade coating actuator.

12. The blade coating device according to claim 1, further comprising:

a lifting mechanism, which is disposed on the frame, connected to the blade coating actuator
20 and configured to adjust a height of the blade coating actuator.

13. The blade coating device according to claim 12, wherein the lifting mechanism comprises:
an upper plate and a lower plate, which are arranged in parallel and horizontally, wherein the
upper plate is disposed on the frame, the lower plate is provided with a plurality of blade
coating actuators, and the upper plate is provided with a through motor configured to be
25 drivingly connected to the lower plate so as to drive the lower plate to go up and down; and

wherein each of the plurality of blade coating actuators comprises:

a second guide rod, which is connected to the lower plate, wherein a roller fixing plate is
connected to the second guide rod, and a blade is connected below the roller fixing plate.

14. The blade coating device according to claim 13, wherein the blade coating actuator
30 comprises two first guide rods, the two first guide rods are symmetrically disposed at left and

right ends of the upper plate and the lower plate, and a first guide plate is connected to the upper plate.

15. The blade coating device according to claim 14, wherein the blade coating actuator further comprises a swing assembly connecting the lifting mechanism to the blade, and the swing
5 assembly comprises:

a telescopic assembly, which is configured to connect the second guide rod to the roller fixing plate;

a rotating bracket, which is rotatably connected to the roller fixing plate through a rotating axle; and

10 a plurality of tension springs, which are symmetrically disposed on two sides of the rotating bracket along a length direction of the blade, and are configured to provide a force to the blade for restoring an initial state.

16. The blade coating device according to claim 15, wherein four tension springs are provided, each two of the four tension springs form a group of tension springs, two groups of tension
15 springs are symmetrically disposed on two sides of the rotating bracket, respectively, and two ends of each of the four tension springs are connected to the roller fixing plate and the blade, respectively.

17. The blade coating device according to claim 15, wherein the telescopic assembly comprises:

a second linear bearing and an elastic element in a compressed state, wherein the second guide
20 rod is connected to the elastic element through the second linear bearing.

18. The blade coating device according to claim 17, wherein the telescopic assembly comprises a first linear bearing, and each of the two first guides is connected to the upper plate through the first linear bearing.

19. The blade coating device according to any one of claims 13 to 18, wherein a plurality of
25 blade coating actuators are provided, and the plurality of blade coating actuators are integrated on the lower plate.

20. A coating apparatus, comprising the blade coating device according to any one of claims 1 to 19 and a guide cart, wherein the blade coating device is disposed on the guide cart and is configured to operate with movement and control of the guide cart.