

DESCRIPTION

SPOT CLEANER

[Technical Field]

5 The present invention relates to a spot cleaner that jets air containing simple cleaning air and ultrasonic waves vibrating at an ultrasonic frequency, or air containing plus/minus ions (hereinafter, "cleaning air") with respect to an object to be dust-removed.

10 [Background Art]

Dust removal has been performed by a dust remover with respect to the object to be dust-removed, such as a glass substrate used for a thin film transistor (TFT) liquid crystal panel, a plasma display panel (PDP), a liquid crystal display (LCD) and the like, or a sheet such as elongated paper and film
15 (hereinafter referred to as "object to be dust-removed").

A spot cleaner included in such a dust remover has a function of jetting air to the object to be dust-removed so that dust is scattered from the object to be dust-removed, and sucking the scattered dust together with the cleaning air.

20 A conventional spot cleaner will be explained with reference to the drawings. Fig. 10 is a perspective appearance diagram of a conventional spot cleaner. Fig. 11 is a cross section of the conventional spot cleaner.

The spot cleaner 10 includes, as shown in Fig. 10, a cleaner body 110 and a slit body 120, wherein the slit body 120 is provided below the cleaner
25 body 110.

In the cleaner body 110, as shown in Fig. 11, an air suction chamber 111 (V1), an air jet chamber 112 (P), and an air suction chamber 113 (V2) are arranged side by side. The air suction chambers 111 and 113 are respectively connected to a suction pump (not shown), and the air jet chamber 112 is
5 connected to an air flow pump (not shown).

The air suction chamber 111, the air jet chamber 112, and the air suction chamber 113 respectively include a suction air vent 114, a jet air vent 115, and a suction air vent 116.

In the slit body 120, a depressed surface 121, a flat surface 122, and
10 a depressed surface 123 are formed so as to face an object G to be dust-removed, and a suction slit 124 is formed in the depressed surface 121, an jet slit 125 is formed in the flat surface 122, and a suction slit 126 is formed in the depressed surface 123. The suction air vent 114, the jet air vent 115, and the suction air vent 116 of the spot cleaner 10 are respectively
15 communicated with the suction slit 124, the jet slit 125, and the suction slit 126 of the slit body 120.

In such a spot cleaner 10, cleaning air is jetted from the jet slit 125, so that the dust on the surface of the object G to be dust-removed floats in the space between the spot cleaner 10 and the object G to be dust-removed. At
20 the same time, the dust floating together with the cleaning air is sucked and removed by the suction slits 124 and 126 in the lengthwise position of the jet slit 125.

As another prior art, for example, Japanese Patent Application Laid-open No. H11-104586 also discloses such a spot cleaner.

25 In recent years, an increase in the dust-removing ability has been

desired. An increase in the jet amount and the suction amount of the cleaning air, and further, when the cleaning air contains ultrasonic waves, an increase in the sound pressure of the ultrasonic waves are effective for this purpose. In these cases, however, there is a problem of noise increase, and there is a demand for improving the dust-removing ability while suppressing the noise. There is another demand for removing the scattered dust reliably.

The present invention has been achieved in order to solve the above problems, and it is an object of the present invention to provide a spot cleaner that can realize both suppression of noise and improvement in the dust-removing ability with a simple configuration.

[Disclosure of the Invention]

In order to solve the above problems, a spot cleaner according to claim 1 comprises:

a cleaner body having at least one air suction chamber and at least one air jet chamber;

a slit body fitted to the cleaner body, and including a linear jet slit communicated with the air jet chamber and a linear suction slit communicated with the air suction chamber; and

a cover fitted to the cleaner body so as to cover the outside of the slit body,

wherein cleaning air is jetted toward the surface of a substrate via the linear jet slit communicated with the air jet chamber, so that scattered dust is sucked by the linear suction slit communicated with the air suction chamber.

The spot cleaner according to claim 2 is the spot cleaner according to

claim 1, wherein a buffer space is formed between the cover and the slit body.

The spot cleaner according to claim 3 is the spot cleaner according to claim 2, wherein the suction amount of the cleaning air in the air suction chamber is set larger than the jet amount of the cleaning air from the air jet chamber, so as to maintain the buffer space at a low pressure with respect to the outside space.

The spot cleaner according to claim 4 is the spot cleaner according to any one of claims 1 to 3, wherein in a dust removal unit, one air jet chamber and two air suction chambers putting the air jet chamber therebetween are arranged along the substrate transport direction.

The spot cleaner according to claim 5 is the spot cleaner according to any one of claims 1 to 4, wherein the dust removal unit is arranged in a set of two on the front-back both sides of the substrate so as to face each other.

The spot cleaner according to claim 6 is the spot cleaner according to any one of claims 1 to 5, wherein the jet slit inclines so that the jet direction is opposite to the substrate transport direction.

According to the present invention, a spot cleaner that can realize both suppression of noise and improvement in the dust-removing ability with a simple configuration can be provided.

[Brief Description of the Drawings]

Fig. 1 is a perspective appearance diagram of a spot cleaner;

Fig. 2 is a bottom view of the spot cleaner;

Fig. 3 is a cross section of the spot cleaner;

Fig. 4 is a diagram for explaining the flow of cleaning air in the spot

cleaner;

Fig. 5 is a diagram for explaining the flow of cleaning air in the spot cleaner;

Fig. 6 is a diagram for explaining the flow of cleaning air in the spot
5 cleaner;

Fig. 7 is a cross section of the spot cleaner in another embodiment;

Fig. 8 is a cross section of the spot cleaner in another embodiment;

Fig. 9 is a cross section of the spot cleaner in another embodiment;

Fig. 10 is a perspective appearance diagram of a conventional spot
10 cleaner; and

Fig. 11 is a cross section of the conventional spot cleaner.

[Best Mode for Carrying Out the Invention]

Best mode for carrying out the invention will be explained below with
15 reference to the drawings. Fig. 1 is a perspective appearance diagram of a spot cleaner, Fig. 2 is a bottom view of the spot cleaner, and Fig. 3 is a cross section of the spot cleaner. The cross section of the spot cleaner in Fig. 3 is a cross section along line A-A in Fig. 2. Like reference numerals refer to like parts in the conventional dust cleaner, and the explanation thereof will be
20 repeated for comparison with the conventional art.

A spot cleaner 100 includes, as shown in Figs. 1 and 2, a cleaner body 110, a slit body 120, and a cover 130. The slit body 120 is provided below the cleaner body 110, and the cover 130 is fitted to the outside of the lower part of the cleaner body 110. As shown in Fig. 3, a buffer space 140 is
25 formed so that it is covered with the cleaner body 110, the slit body 120, the

cover 130, and a surface of the object G to be dust-removed as described later.

As shown in Fig. 3, in the cleaner body 110, an air suction chamber 111 (V1), an air jet chamber 112 (P), and an air suction chamber 113 (V2) are arranged side by side. The air suction chambers 111 and 113 are respectively
5 connected to a suction pump (not shown), and the air jet chamber 112 is connected to an air flow pump (not shown).

The air suction chamber 111, the air jet chamber 112, and the air suction chamber 113 respectively include a suction air vent 114, a jet air vent 115, and a suction air vent 116.

10 In the slit body 120, a depressed surface 121, a flat surface 122, and a depressed surface 123 are formed so as to face an object G to be dust-removed, and a suction slit 124 is formed in the depressed surface 121, an jet slit 125 is formed in the flat surface 122, and a suction slit 126 is formed in the depressed surface 123. The flat surface 122 is formed to make the flow
15 rate of the jetted cleaning air constant. The recessed surfaces 121 and 123 are formed to facilitate the flow of the cleaning air to be sucked. The suction air vent 114, the jet air vent 115, and the suction air vent 116 of the spot cleaner 100 are respectively communicated with the suction slit 124, the jet slit 125, and the suction slit 126 of the slit body 120.

20 In this embodiment, the cover 130 is a rectangular cylindrical body having a square opening. The cover 130 may be in various forms, so long as there is at least the buffer space 140 formed between the slit body 120 and the cover 130.

The buffer space 140 is a square space formed between the cleaner
25 body 110, the slit body 120, and the cover 130. As shown in Fig. 3, the buffer

space 140 is also put between the spot cleaner and the object G to be dust-removed at the time of using the spot cleaner 100. The buffer space 140 communicates with the outside via a gap 141 formed between the object G to be dust-removed and the cover 130. The buffer space 140 needs only to be a
5 space covering at least the circumference of the slit body 120, and is not limited to the square space.

The use of the spot cleaner 100 will be explained next. In the spot cleaner 100, the cleaning air is jetted from the jet slit 125, so that the dust on the surface of the object G to be dust-removed floats in the space between the
10 spot cleaner 100 and the object G to be dust-removed. At the same time, when the cleaning air is sucked by the suction slits 124 and 126 in the lengthwise position of the jet slit 122, the air is removed together with the floating dust. The total amount of suction of the cleaning air by the air suction chambers 111 and 113 are set to be larger than the jet amount of the cleaning
15 air from the air jet chamber 112.

The spot cleaner 100 outputs the cleaning air (simple cleaning air, an air containing ultrasonic waves vibrating at an ultrasonic frequency, or air containing plus and minus ions). With such cleaning air, vibration occurs at the time of jet to cause a noise problem. Particularly, in the case of cleaning
20 air containing ultrasonic waves, noise due to ultrasonic vibration becomes noticeable. However, even if the vibration reaches to the cover 130 through the shielded space 140, the cover 130 attenuates the ultrasonic vibration, and hence, noise reaching an operator decreases. Furthermore, since the gap 141 is a narrow space, most noise passes through the cover 130, thereby
25 further reducing the noise reaching an operator.

Furthermore, though the buffer space 140 is communicated with the outside space via the gap 141, it is set such that the suction amount is larger than the jet amount of the cleaning air in the cover 130. Therefore, inside of the buffer space 140 is maintained at a low pressure with respect to the outside space, and hence, the air is sucked from the outside space to the internal buffer space in the gap 141. This point will be explained in detail with reference to the drawings. Figs. 4, 5, and 6 are diagrams for explaining the flow of the cleaning air in the spot cleaner.

In the substrate transport direction, as shown in Fig. 4, the cleaning air jetted from the jet slit 125 is sucked by the suction slits 124 and 126 in the lengthwise position of the jet slit 125. The air is also introduced from the buffer space 140 and the gap 141 and sucked by the suction slits 124 and 126. Therefore, the air does not flow outward from the buffer space 140. Since the suction amount is larger than the jet amount, the buffer space 140 is maintained at a sufficiently low pressure.

In the lateral direction of the jet slit 125, as shown in Fig. 5, even if a part of the cleaning air jetted from the jet slit 125 flows to the lateral direction, air flows into the low-pressure buffer space 140 from the outside space via the gap 141, and the air collides in the buffer space 140 to flow into the low-pressure buffer space 140, and hence, the cleaning air does not flow out from the gap 141.

In the lateral direction of the suction slits 124 and 126, as shown in Fig. 6, the cleaning air is sucked by the suction slits 124 and 126. The air is also introduced from the buffer space 140 and the gap 141 and sucked by the suction slits 124 and 126. Therefore, the cleaning air does not flow out from

the gap 141.

Thus, in the gap 141, air always flows into the cover 130 from the outside space at any places. Therefore, the dust scattered by the cleaning air does not go out of the buffer space 140, and the dust can be sucked by the suction slits 124 and 126.

Thus, since the buffer space 140 can be formed by the cover 130, both suppression of noise and improvement in the dust-removing ability can be realized with a simple configuration.

Another embodiment will be explained with reference to the drawing. Fig. 7 is a cross section of the spot cleaner in another embodiment. Like reference numerals refer to like parts in the above embodiment and the explanation thereof will be omitted.

In the embodiment, the spot cleaner 100 shown in Fig. 2 is arranged in a set of two on the front-back both sides of the object G to be dust-removed so as to face each other. With such a configuration, dust removal can be realized on the front-back both sides of the object G to be dust-removed, and both suppression of noise and improvement in the dust-removing ability can be realized from the above-mentioned reason.

Another embodiment will be explained with reference to the drawing. Fig. 8 is a cross section of the spot cleaner in another embodiment. Like reference numerals refer to like parts in the above embodiments, and the explanation thereof will be omitted. In this embodiment, there is little difference from the embodiment shown in Fig. 3. In the embodiment shown in Fig. 3, the jet slit 125 in the slit body 120 is formed in the substantially vertical direction with respect to the object G to be dust-removed, but in the

embodiment shown in Fig. 8, the jet direction of a jet slit 125' in the slit body 120 inclines in a direction opposite to a substrate transport direction a. Such a configuration has an advantage that, when the object G to be dust-removed enters into the spot cleaner 100, the flow of the cleaning air can be stabilized.

5 When the dust is removed by this spot cleaner 100, the flow rate from the air jet chamber 112 (P) to the air suction chamber 111 (V1) increases, and a part of the air is going to reach the gap 141 of the cover 130 on the air suction chamber 111 (V1) side. However, since the air collides with the air coming in from the outside and flows to the buffer space 140, the cleaning air does not
10 flow out from the cover 130. Therefore, the dust can be removed on the surface of the object G to be dust-removed, and both suppression of noise and improvement in the dust-removing ability can be realized from the above-mentioned reason.

Another embodiment will be explained with reference to the drawings.

15 Fig. 9 is a cross section of the spot cleaner in another embodiment.

In this embodiment, the spot cleaners 100 in which the jet direction of the jet slit 125' in the slit body 120 inclines in the direction opposite to the substrate transport direction a as shown in Fig. 8 is arranged in a set of two on the front-back both sides of the object G to be dust-removed so as to face each
20 other. With such a configuration, the dust can be removed on the front-back both sides of the object G to be dust-removed, and both suppression of noise and improvement in the dust-removing ability can be realized from the above-mentioned reason.

The present invention can be realized in variously modified
25 embodiments. For example, in Figs. 7 and 9, the object G to be

dust-removed is carried on a carrier roller (not shown). In this case, an upward suction force is generated due to the Venturi effect by the air flowing on the upper face of the object G to be dust-removed (the upper dust removal unit 100), and a downward suction force is generated due to the Venturi effect by the air flowing on the lower face of the object G to be dust-removed (the lower dust removal unit 100). By adjusting the balance of the Venturi effects such that the downward suction force is greater than the upward suction force, the object G to be dust-removed can be stably carried.

In this case, the suction force due to the Venturi effect of the lower dust removal unit 100 may be made greater than that of the upper dust removal unit 100, so as to impart a force for pressing the substrate toward the carrier roller (not shown), by making the suction pressure (suction amount) toward the lower dust removal unit 100 equal to the suction pressure (suction amount) toward the upper dust removal unit 100 and making the jet pressure (jet amount) from the lower dust removal unit 100 greater than the jet pressure (jet amount) from the upper dust removal unit 100.

Furthermore, the suction force due to the Venturi effect of the lower dust removal unit 100 may be made greater than that of the upper dust removal unit 100, so as to impart a force for pressing the substrate toward the carrier roller, by making the jet pressure (jet amount) from the lower dust removal unit 100 equal to the jet pressure (jet amount) from the upper dust removal unit 100 and making the suction pressure (suction amount) toward the lower dust removal unit 100 greater than the suction pressure (suction amount) toward the upper dust removal unit 100.

Furthermore, the suction force due to the Venturi effect of the lower

- dust removal unit 100 may be made greater than that of the upper dust removal unit 100, so as to impart a force for pressing the object G to be dust-removed toward the carrier roller, by adjusting the interval between the lower dust removal unit 100 and the rear face of the object G to be
- 5 dust-removed to be shorter than the interval between the upper dust removal unit 100 and the surface of the object G to be dust-removed.

Such a dust removal unit can improve the user-friendliness.

CLAIMS

1. A spot cleaner comprising:
 - a cleaner body having at least one air suction chamber and at least one
 - 5 air jet chamber;
 - a slit body fitted to the cleaner body, and including a linear jet slit communicated with the air jet chamber and a linear suction slit communicated with the air suction chamber; and
 - a cover fitted to the cleaner body so as to cover the outside of the slit
 - 10 body,
 - wherein the linear suction slit is formed in a depressed surface, and cleaning air is jetted toward the surface of a substrate via the linear jet slit communicated with the air jet chamber, so that scattered dust is sucked by the linear suction slit communicated with the air suction chamber.
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2. The spot cleaner according to claim 1, wherein a buffer space is formed between the cover and the slit body.
3. The spot cleaner according to claim 2, wherein the suction amount of the
- 20 cleaning air in the air suction chamber is set larger than the jet amount of the cleaning air from the air jet chamber, so as to maintain the buffer space at a low pressure with respect to the outside space.
4. The spot cleaner according to any one of claims 1 to 3, wherein in a dust
- 25 removal unit, one air jet chamber and two air suction chambers putting the air jet chamber therebetween are arranged along a substrate transport direction.

5. The spot cleaner according to any one of claims 1 to 4, wherein the dust removal unit is arranged in a set of two on the front-back both sides of the substrate so as to face each other.

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6. The spot cleaner according to any one of claims 1 to 5, wherein the jet slit inclines so that the jet direction is opposite to the substrate transport direction.