

**APPARATUS FOR COLLECTING POWDER IN EXHAUST GAS WITH AN
INCREASED COLLECTION CAPACITY AND EXHAUST GAS TREATMENT
EQUIPMENT PROVIDED WITH SAME**

5 Technical Field

- [1] The present invention relates to technology for treating exhaust gas in a semiconductor manufacturing process and, more particularly, to an apparatus for collecting powder contained in exhaust gas.

10 Background Art

- [2] Semiconductor devices are manufactured by repeatedly performing processes such as photolithography, etching, diffusion, and metal deposition on a wafer in a process chamber. Various process gases are used during such semiconductor manufacturing process, and residual gas is present in the process chamber after the process is completed. Since the residual gas in the process chamber contains toxic components, it is discharged by a vacuum pump and purified by an exhaust gas treatment apparatus such as a scrubber. Powder is present in the exhaust gas, but the powder in the exhaust gas is either a by-product generated in the process chamber or is formed when some components contained in the exhaust gas are solidified due to changes in temperature and pressure in the process of residual gases from the process chamber being discharged through the exhaust line. Since powder in exhaust gas can accumulate in an exhaust line and block the flow path, it is collected through a apparatus for collecting powder that is installed on the exhaust line.
- [3] A apparatus for collecting powder typically consists of a filter and a housing that accommodates the filter, and the powder that does not pass through the filter accumulates in the internal space of the housing and is collected. As the powder collection capacity increases, it is advantageous for improving process efficiency. The powder collection capacity depends on the size of the internal space of the housing, and, thus, it is necessary to effectively increase the size of the housing.

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Prior Art Search

Patents

- [4] (Patent Reference 0001) Republic of Korea Registered Patent No. 10-1806170 "Dry Scrubber" (07.12.2017) (Patent Reference 0002) Republic of Korea Public Patent Gazette No. 10-2003-0063786 "Effluent Gas Dry Purification Apparatus and Method" (31.07.2003)

5 **Details of the Invention**

Problems to be Solved

- [5] The purpose of the present invention is to provide an apparatus for collecting powder in exhaust gas with an increased collection capacity and exhaust gas treatment equipment provided with same.

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Means of Solving the Problems

- [6] In order to achieve the purpose of the present invention, according to one aspect of the present invention, provided is an apparatus for collecting powder in exhaust gas, comprising an adsorption reaction device for treating exhaust gas using an adsorption reaction, wherein the apparatus for collecting powder in exhaust gas comprises a filter body, which includes a filter member which filters the exhaust gas and feeds it to an adsorption reaction device and is disposed below the adsorption reaction device; and a housing which provides an internal space for storing powder separated from the filter member and is installed below the adsorption reaction device; and a housing which provides an internal space for storing powder separated from the filter member and is installed below the adsorption reaction device and which provides a filter installation space internally for installing the filter body, and an expansion unit which is formed so as to protrude sideways from the filter installation unit and provides an expansion space which communicates internally with the filter installation space, and the internal space is expanded by the expansion space so as to increase the powder collection capacity, and a suction port for sucking in the exhaust gas is installed in the expansion unit.
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Effects of the Invention

- [7] The aforementioned objects of the present invention can all be achieved by means of the present invention. Specifically, an expansion unit, which expands sideways in the housing where powder is collected, can increase the collection capacity of powder and, thus increase the lifespan of the exhaust gas treatment equipment.
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[8] In addition, the route by which exhaust gas flows in the internal space of the housing increases due to the expanded space within the housing thus increases the quantity of powder falling due to gravity, allowing the lifespan of filters to be extended.

5 [9] Two gas supply ports are also provided, one on either side, thus allowing selection according to direction from which gas is fed, thereby reducing the length of the gas supply segment.

Brief Description of the Drawings

10 [10] FIG. 1 depicts a perspective view of an exhaust gas treatment apparatus provided with an apparatus for collecting powder according to one embodiment of the present invention.

FIG. 2 depicts a lateral view of the apparatus for collecting powder depicted in FIG. 1.

FIG. 3 depicts a plan view of the apparatus for collecting powder depicted in FIG. 1.

FIG. 4 depicts a front view of the apparatus for collecting powder depicted in FIG. 1.

15 FIG. 5 depicts a plan view depicting the apparatus for collecting powder depicted in FIG. 1 having the housing cut along the A-A' line in FIG. 2 so as to reveal the interior.

FIG. 6 depicts a lateral view depicting the apparatus for collecting powder depicted in FIG. 1 having the housing cut along the B-B' line in FIG. 3 so as to reveal the interior.

FIG. 7 depicts a perspective view depicting the filter striking module depicted in FIG. 6.

20 FIG. 8 depicts a perspective view depicting another embodiment of the filter striking module depicted in FIG. 6.

FIG. 9 depicts a perspective view depicting another embodiment of the filter striking module depicted in FIG. 6.

Details for Carrying Out the Invention

[11] Hereinafter, the configuration and operation of an embodiment of the present invention will be described in detail with reference to the drawings.

30 [12] FIG. 1 depicts a perspective view of an exhaust gas treatment equipment according to one embodiment of the present invention. Referring to FIG. 1, an exhaust gas treatment equipment (100) according to one embodiment of the present invention comprises a apparatus for collecting powder (110) for collecting powder in exhaust gas using a filter as

a type of dry scrubber, and an adsorption reaction device (190) for treating exhaust gas discharged from the apparatus for collecting powder (110) using an adsorption reaction.

- [13] The apparatus for collecting powder (110) filters exhaust gas through a filter and collects powder contained in the exhaust gas. Exhaust gas discharged from the apparatus for collecting powder (110) is fed to an adsorption reaction apparatus (190).
- [14] With reference to FIG. 1 to FIG. 6, the apparatus for collecting powder (110) comprises a housing (120), a filter module (150) installed so as to be located inside the housing (120), and a striking module (160) installed in the housing (120).
- [15] The housing (120) includes a filter installation unit (130) and housing (140) which is formed expanding from the filter installation unit (130). The internal space of the housing (120) forms a powder storage space where collected powder is stored.
- [16] The filter installation unit (130) is generally cylindrical and provides an upright cylindrical filter installation space (131) inside of which a filter module (150) is disposed. The central axis (X) of the cylindrical filter installation space (131) extends along a vertical direction. The filter installation unit (130) includes a base floor plate (132) and a base side wall (135) extending upward from the base floor plate (132). The base floor plate (132) is generally a flat circle disposed horizontally, and the top surface of the base floor plate (132) forms the floor of the filter installation space (131). The filter module (150) is placed at the centre of the base floor plate (132) in the filter installation space (131). The base side wall (135) extends upward from the edge of the base floor plate (132) to form a side wall of the filter installation space (131). The upper inside region of the base side wall (135) is open to form an opening (137) through which the filter installation space (131) communicates with the outside. A worker can access the filter installation space (131) through the opening (137) to install or remove the filter module (150). In addition, the opening (137) can be appropriately sealed during the process of coupling the adsorption reaction apparatus (190) to the apparatus for collecting powder (110).
- [17] The expansion unit (140) is formed by expanding to a shape in which part of a side of the filter installation section (130) protrudes sideways. The expansion unit (140) forms an expansion space (141) which communicates with the filter installation space (131)

internally. The expansion space (141) is formed by partially expanding in the radial direction with respect to the central axis (X) from the circular filter installation space (131). The expansion space (141) forms the internal space of the housing (120) together with the filter installation space (131). The expansion unit (140) includes an expansion floor plate (142), an expansion top plate (145) located above and apart from the expansion floor plate, and an expansion side wall (147) connecting the expansion floor plate (142) and expansion top plate (145). The usage time of an apparatus for collecting powder (110) can be extended by the increase of powder collection capacity due to the expansion space (141) formed by the expansion unit (140).

[18] The expansion floor plate (142) is disposed to be flat and is joined to the base floor plate (132) of the filter installation unit (130). The expansion floor plate (142) is preferably formed integrally with the base floor plate (132). The expansion floor plate (142) is a shape expanded outward from a semicircular arc of the round base floor plate (132). The upper surface of the expansion floor plate (142) forms the floor of the expansion space (141). The upper surface of the base floor plate (132) and upper surface of the expansion floor plate (142) are connected so as to be flat, thereby forming the floor of the entire internal space of the housing (120).

[19] The expansion top plate (145) is located so that it is above, apart from, and facing the expansion floor plate (142) and is generally the same shape as the expansion floor (142). The expansion top plate (145) is a shape that is flat and expands outward from the base side wall (135). The lower surface of the expansion top plate (145) forms the ceiling of the expansion space (141). An installation port (146) on which a filter striking module (160) is installed is formed on the expansion top plate (145).

[20] An expansion side wall (147) is a vertically upright wall which forms a side wall of the expansion space (141). The bottom of the expansion wall (147) is connected to the edge of the expansion floor plate (142), the top of the expansion side wall (147) connects with the edge of the expansion top plate (145), and both ends in the expansion circumferential direction connect with the base side wall (135). The expansion side wall (147) includes a first extension wall unit (148a) and a second extension wall unit (148b), and a connecting wall unit (148c) connecting the two extension walls (148a and 148b).

- [21] The first extension wall unit (148a) is formed by extending from the base side wall (135) and extends in a straight line along the circumferential direction of the expansion side wall (147). One circumferential direction end of the first side wall unit (148a) forms a tangential plane and connects with the base side wall (135), and the other circumferential direction end connects with the connecting side wall unit (148c). The internal surface of the first extension wall unit (148a) links as it forms a tangential plane with the internal wall surface of the expansion side wall (147) also.
- [22] The second extension wall unit (148b) is disposed such that it faces and is parallel with the first extension wall unit (148a). The second extension wall unit (148b) is formed by extending from the base side wall (135) and extends in a straight line along the circumferential direction of the expansion side wall (147). One circumferential direction end forms a tangential plane and connects with the base side wall (135), and the other circumferential direction end connects with the connecting wall unit (148c). The internal wall surface of the second extension wall unit (148b) forms a tangential plane and connects with the internal wall surface of the expansion side wall (147) also.
- [23] The connecting wall unit (148c) extends in the shape of curve that is convex with respect to the filter installation unit (130) along the circumferential direction of the expansion side wall (147). The two circumferential direction ends of the connecting side wall unit (148c) form a tangential plane and connect with the first extension wall unit (148a) and the second extension wall unit (148b), respectively. The present embodiment is described a form in which the connecting wall unit (148c) extends in a semicircular arc along the circumferential direction of the expansion side wall (147). The internal wall surface of the first extension wall unit (148a) and the internal wall surface of the second extension wall unit (148b) form a tangential plan and connect with the internal wall surface of the connecting wall unit (148c).
- [24] A gas suction pipe (149) which communicates with the internal space of the housing (120) is coupled to the connecting wall unit (148c). Exhaust gas to be treated is drawn into the internal space of the housing (120) through the gas suction pipe (149). The gas suction pipe extends in a straight line along the horizontal direction and is disposed such that it extends along the tangential direction of the connecting wall unit (148). The gas suction pipe (149) connects with the furthest point from the filter installation unit (130) in the connecting wall

- unit (148c) and extends along both sides of the connecting wall unit (148c). Both ends of the gas suction pipe (149) are open to form a first and second suction port (149a and 149b) at each end of the gas suction pipe (149), respectively. The one of the first gas suction port (149a) and second gas suction port (149b) which can reduce the length of the gas supply segment is selected to be used as a gas suction port, and a pressure gauge, safety valve, etc. can be installed on the remaining one to ensure safety of processes and operation. Gas flow inside the housing (120) when the second gas suction port (149b) of the two gas suction ports (149a and 149b) is selected is shown with dashed arrows in FIG. 5. Referring to FIG. 5, exhaust which has flowed through the second gas suction port (149b) into the internal space of the housing (120) flows uniformly around the filter module (150) along the first extension wall (148a) of the connecting wall unit (148c) and the base side wall (135). As the exhaust gas flows in the internal space of the housing (120), relatively heavy substances within the powder contained in the exhaust gas fall due to gravity and accumulate in the internal space of the housing (120).
- [25] A plurality of wheels (129) is installed in the housing (120) to facilitate movement of the exhaust gas treatment equipment (100).
- [26] The filter module (150) is installed in the filter installation space (131) of the housing (120).
[27] The filter module (150) includes a filter body (151), which includes a filter, and a plurality of support legs (158), which support the filter body (151).
- [28] The filter body (151) filters the exhaust gas which has flowed into the internal space of the housing (120) and feeds it to the adsorption reaction apparatus (190). The filter body (151) is generally in the form of an upright cylinder and is disposed coaxially with the cylindrical filter installation space (131). The filter body (151) includes a bottom plate member (152), a top plate member (153), and a filter member (154). The filter body (151) is located apart from the floor of the filter installation space (131).
- [29] The bottom plate member (152) is disposed horizontally in the shape of a flat circular plate.
- [30] The top plate member (153) is disposed horizontally above and apart from the bottom plate member (152) in the shape of a flat circular plate. A discharge port (153a), by which filtered exhaust gas is discharged, is formed in the centre of the top plate member (153). A

discharge port (153a) is located on the central axis (X). The filter body (151) and adsorption reaction apparatus (190) communicate through the discharge port (153a).

- 5 [30] The filter member (154) is disposed between the bottom plate member (152) and top plate member (153) and filters exhaust gas flowing into the inside. Although not depicted, the filter member (154) can be configured such that a plurality is installed along the radial direction and consecutive filtering occurs as it goes toward the centre. Powder adhered to the surface of the filter member (154) can be removed by being knocked off by the filter striking module (160).
- 10 [31] Each of the plurality of support legs (158) extends downward from the filter body (151) to separate the filter body (151) from the floor of the filter installation space (131).
- 15 [32] The filter striking module (160) performs a dust removal function on the filter by applying a physical impact to the filter body (151) to brush away and remove powder adhered to the surface of the filter member (154). FIG. 7 depicts the filter module (160) as a perspective view. Referring to FIG. 1 to FIG. 7, the filter module (160) includes the operating unit (180) and a link structure (170) connecting to the operating unit (180).
- 20 [33] The operating unit (180) is installed on the outside of the housing (120) for operation by an operator. Specifically, the operating unit (180) is installed on an installation port (146) that is formed on the expansion top plate (145) of the housing (120). The operating unit (180) includes a pressure plate (181), a port coupler (183), and a flexible tube (185) coupled between the pressure plate (181) and port coupler (183).
- 25 [34] The pressure plate (181) is located above and apart from the installation port (146). The flexible tube (185) and link structure (170) connect to the pressure plate (181). An operator can operate the link structure (170) by pressing down and moving the pressure plate (181).
- 30 [35] The port coupler (183) is located below and apart from the pressure plate (181) and is coupled to the installation port (146) formed on the expansion top plate (145) in a sealed state. The elastic tube (185) is coupled to the port coupler (183).

- [36] The flexible tube (185) is disposed such that it extends vertically between the pressure plate (181) and port coupler (183), which are located vertically apart. The upper end of the flexible tube (185) is connected to the pressure plate (181) and the lower end of the flexible tube (185) is connected to the port coupler (183). The flexible tube (185) provides an elastic force in the direction in which the pressure plate (181) and the port coupler (183) become distant from each other. External force on the pressure plate (181) causes it to move downward from its initial position then the elastic force of the flexible tube (185) causes it to return to its original position when the external force is removed. The present embodiment is described with the use of conventional bellows for the flexible tube (185).
5 The internal space of the flexible tube (185) communicates with internal space of the housing (120) through the installation port (146) formed on the expansion top plate (145), and the internal space of the elastic tube (185) is sealed from the outside.
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- [37] The link structure (170) includes a lever unit (178) and a connecting rod (171) that connects the lever unit (178) and the pressure plate (181).
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- [38] The lever unit (178) is located in the internal space of the housing (120). The lever unit (178) includes a support (174), a first extension rod (173) that extends from the support (174), and a plurality of second extension rods (175) that extend from the support (174).
20 The support (174), first extension rod (173), and plurality of second extension rods (175) are integrally formed.
- [39] The support (174) contacts the floor in the internal space of the housing (120) and is located between the filter body (151) and the installation port (146). The support (174) is a rod in the shape of a circular pipe and is disposed to extend horizontally along the width direction of the filter body (151).
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- [40] The first extension rod (173) is formed by extending from the support (174) toward the installation port (146). The end of the first extension rod (173) is coupled such that the connecting rod (171) and the first hinge (172) cause it to be able it to rotate around the rotational axis (X1). The first rotational axis (X1) is a straight line extending in parallel with the extension direction of the support (174). In a state in which the pressure plate (181) of the operating unit (180) has been placed in its initial position, the first extension rod (173) extends obliquely such that it goes upward as it goes from the support (174) toward
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the installation port (146). This is for the purpose of securing a sufficient distance so that an end of the first extension rod (173) can move downward.

[41] The plurality of second extension rods (175) is formed by extending from the support (174) toward the filter body (151) on the opposite side of the first extension rod (173). The plurality of second extension rods (175) is disposed side by side in turn along the width direction of the filter body (151) in a state of being apart from each other. The present embodiment is described with three second extension rods (175); however, the present invention is not limited thereto. For example, there could be one, two, four, or more second connecting rods (175), and these would also be within the scope of the present invention. Each end of the plurality of second extension rods (175) is located underneath the filter body (151). Each of the of second extension rods (175) the plurality forms an angle smaller than 180 degrees with the first extension rod (173). A striking unit (176) bent and extending upward at the end of each of the second extension rods (175) of the plurality is formed. The end of the striking unit (176) moves upward to strike the bottom of the filter body (151).

[42] The adsorption reaction apparatus (190) treats exhaust gas discharged from the apparatus for collecting powder (110)) using an adsorption reaction. The adsorption reaction apparatus (190) is coupled to the top of the apparatus for collecting powder (110) such that it closes the opening (137) formed in the housing (120) of the powder collection apparatus (110). Although not depicted, an adsorption layer is formed of an adsorbent which absorbs the gas constituent to be treated in the exhaust gas inside the adsorption reaction apparatus (190), and the adsorption layer communicates with the discharge port (153a) of the apparatus for collecting powder (110). The adsorption reaction apparatus (190) could be furnished with a plurality of adsorption layers formed of adsorbents of different types such that a plurality of gas constituents is treated. The adsorption reaction apparatus (190) is generally cylindrical and disposed coaxially with the filter body (151) in an upright form. The side wall (193) of the adsorption reaction apparatus (190) is formed along the vertical direction with the base side wall (135) of the housing (130) to form a single cylinder shape.

[43] Hereinafter, the operation of the filter striking module (160) will be described in detail with reference to FIG. 6. Referring to FIG. 6, in a state where external force is not being applied to the operating unit (180) by a worker, the striking unit (176) of the link structure (170), as depicted with solid lines, is located in a state of being below and apart from the filter

body (151). This state is referred to as the normal state of the filter striking module (160) in the present embodiment. When a worker presses the pressure plate (181) of the operating unit (180) in the normal state and causes it to move downward, the connecting rod (171) coupled to the pressure plate (181) descends downward. The angle between the connecting rod (171) and first extension rod (173) decreases as the end of the first extension rod (173) of the lever unit (178) coupled by the first hinge (171) to the end of the connecting rod (171) also descends downward with the downward descent of the connecting rod (171). The end of the second extension rod (175) moves toward the bottom of the filter body (151) as the support (174) moves slightly toward the filter body (151) with the downward descent of the end of the first extension rod (173). The end of the second extension rod (175) moves upward to cause the striking unit (176) formed at the end of the second extension rod (175) to strike the bottom of the filter body (151). This state is referred to as the striking state of the filter striking module (160) in the present embodiment. The striking unit (176) is caused to strike the bottom of the filter body (151), and, thus, the state of coupling between the adsorption reaction apparatus (190) and filter body (151), which are disposed vertically on the coaxial line, can be maintained stably. The striking of the striking unit (176) causes the powder adhered to the surface of the filter member (154) to drop and accumulate on the floor of the housing (120). When the external force applied to the operating unit (180) is removed, the elasticity of the flexible tube (185) causes the pressure plate (181) to return to its original position, and the filter striking module (160) automatically returns to the normal state.

[44] Although the present embodiment was described above with the filter striking module (160) being operated manually by a worker, it could also be configured unlike this such that it is operated automatically by adding a mechanical apparatus such as a pressure piston to the installation port (146), and this would also be within the scope of the present invention.

[45] FIG. 8 depicts a filter striking module according to another embodiment of the present invention as a perspective view. Referring to FIG. 8, the filter striking module (260) includes an operating unit (180) and a link structure (270) connecting with the operating unit (180).

[46] The operating unit (180) includes a pressure plate (181), a port coupler (183), and a flexible tube (185) coupled between the pressure plate (181) and the port coupler (183), and a

detailed description is omitted because it is configured the same as the operating unit (180) depicted in FIG. 7.

[47] The link structure (270) includes a lever unit (278), a connecting rod (171) connecting the
5 lever unit (278) and a pressure plate (181), and a striking member (276) coupled to the lever unit (278).

[48] The lever unit (178) includes a support (174), a first extension rod (173) extending from
the support (174), and a second
10 extension rod (175) extending from the support (174). Because the lever unit (178) is generally of the same configuration as the lever unit (178) depicted in FIG. 7 except that only one second extension rod (175) is furnished in the lever unit (178), a detailed description thereof is omitted. The present embodiment is described with only one second connecting rod (175); however, there could be a plurality as depicted in FIG. 7, and this would also be
15 within the scope of the present invention.

[49] The striking member (276) is coupled to the end of the second extension rod (175) such
that the second hinge (277) allows it to rotate around the second rotational axis (X2). The
20 second rotational axis (X2) is a straight line extending in parallel with the extension direction of the support (174). The striking member (276) includes striking rod (276a) which extends in both directions along the radial direction of the second rotational axis (X2) with the second hinge (277) in between and is located above the second extension rod (175). A first striking unit (276b) and second striking unit (276c) protruding upward are formed at both ends of the striking rod (276a). With the operation of the operating unit
25 (180) causing the rise of the ends of the second extension rod (175), one of the first striking unit (276b) and second striking unit (276c) strike the filter body (151 of FIG. 6, then the other strikes the filter body (151) consecutively. In the embodiment depicted in FIG. 8, it would be preferable to limit the range of rotation of the second hinge (277) such that the two striking units (276b and 276c) are always oriented upward.

[50] Because the connecting rod (171) is generally the same as the configuration of the
30 connecting rod (171) depicted in FIG. 7, a detailed description is omitted.

- [51] FIG. 9 depicts with a perspective view a filter striking module according to another embodiment of the present invention. Referring to FIG. 9, the filter striking module (360) includes an operating unit (180) and a link structure (370) connecting with the operating unit (180).
- 5 [52] The operating unit (180) includes a pressure plate (181), a port coupler (183), and a flexible tube (185) coupled between the pressure plate (181) and port coupler (183), and, because it the same configuration as the operating unit (180) depicted in FIG. 7, a detailed description thereof is omitted.
- 10 [53] The link structure (370) includes a lever unit (378) and a connecting rod (171) connecting the lever unit (378) and pressure plate (181).
- [54] The lever unit (378) includes a support leg (375) and a lever (376) coupled to the support leg (375) such that it can rotate.
- 15 [55] The support leg (375) is a rod shape extending vertically and extending upward from the floor of the internal space of the housing (120), and it is located between the filter body (151) and installation port (146). A lever (376) is coupled to the top of the support leg (375) such that a third hinge (374) allows it to rotate around a third rotational axis (X3). The third rotational axis (X3) is a straight line extending along the width direction of the filter body (151).
- 20 [56] The lever (376) is a long-extending rod shape and is coupled to the top of the support leg (375) at one point between both ends in the length direction of the lever (376) such that the third hinge (374) allows it to rotate. One end (376a) of the lever (376) is coupled with the connecting rod (171) such that the first hinge (172) allows it to rotate, and the other end (376b) of the lever (376) is located below the filter body (151 of FIG. 6).
- 25 [57] Operation of the operating unit (180) causes the other end (376b) of the lever to rise and strike the filter body (151 of FIG. 6).
- 30 [58] Because the connecting rod (171) is generally the same as the configuration of the connecting rod (171) depicted in FIG. 7, a detailed description thereof is omitted.

[59] The striking member (276) of the embodiment depicted in FIG. 8 could be hingedly coupled to the end of the lever (376) and used,, and this would also be within the scope of the present invention.

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[60] Although the present invention has been described through the above embodiments, the present invention is not limited thereto. The above embodiments may be modified or changed without departing from the spirit and scope of the present invention, and those skilled in the art will recognise that such modifications or changes belong to the present invention.

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Description of numerals

[61]	100: Exhaust gas treatment equipment	110: Apparatus for collecting powder
	120: Housing	130: Filter installation unit
5	131: Filter installation space	132: Base floor plate
	135: Base side wall	137: Opening
	140: Expansion unit	141: Expansion space
	142: Expansion floor plate	145: Expansion top plate
	146: Installation port	147: Expansion side wall
10	148a: First extension wall unit	148b: Second extension wall unit
	148c: Connecting wall unit	149: Gas suction pipe
	149a: First gas supply port	149b: Second gas supply port
	150: Filter module	151: Filter body
	152: Bottom plate member	153: Top plate member
15	153a: Discharge port	154: Filter member
	158: Support leg	160: Filter striking module
	170: Link structure	171: Connecting rod
	172: First hinge	173: First extension rod
	174: Support	175: Second extension rod
20	176: Striking unit	178: Lever unit
	180: Operating unit	181: Pressure plate
	183: Port coupler	185: Flexible tube
	190: Adsorption reaction apparatus	260: Filter striking module
	270: Link structure	278: Lever unit
	276: Striking member	276a: Striking rod

	277: Second hinge	360: Filter striking module
	370: Link structure	374: Third hinge
	375: Support leg	376: Third lever
	378: Lever unit	X1: First rotational axis
5	X2: Second rotational axis	X3: Third rotational axis

CLAIMS

1. An apparatus for collecting powder contained in an exhaust gas before the exhaust gas is introduced into an adsorption reaction device which treats the exhaust gas using an adsorption reaction, wherein
5 the apparatus for collecting powder in exhaust gas comprises a filter body, which includes a filter member which filters the exhaust gas and feeds the exhaust gas to the adsorption reaction device and is disposed below the adsorption reaction device; and
10 a housing which provides an internal space for storing powder separated from the filter member and is installed below the adsorption reaction device; and
which is a space projected below the adsorption reaction device and which includes a filter installation unit which provides a space internally for installing the filter body, and an expansion unit which is formed so as to protrude sideways from the filter installation unit and provides an expansion space which communicates internally with the filter installation space, and
15 the internal space is expanded by the expansion space so as to increase the powder collection capacity,
and a gas suction port which sucks in the exhaust gas is installed in the expansion unit.
2. The apparatus for collecting powder in exhaust gas of claim 1, wherein the filter installation
20 space is an erect cylinder,
and the filter body is located on a central axis of the filter installation space.
3. The apparatus for collecting powder in exhaust gas of claim 2, wherein the filter body is cylindrical and is disposed coaxially with the filter installation space.
4. The apparatus for collecting powder in exhaust gas of claim 1, wherein the expansion unit
25 includes an expansion floor plate, an expansion top plate located above and spaced apart from the expansion floor plate, and an expansion side wall connected to the expansion top plate and the expansion floor plate.
5. The apparatus for collecting powder in exhaust gas of claim 4, wherein the expansion side wall includes a first extension wall unit which forms and extends a plane tangential to a

- side wall of the filter installation unit along a circumferential direction, a second extension wall unit which forms and extends a plane tangential to the filter installation unit along a circumferential direction and faces the first extension wall unit, and a connecting wall unit, which extends in the shape of a convex curve with respect to the filter installation unit and extends the first extension wall unit and the second extension wall unit.
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6. The apparatus for collecting powder in exhaust gas of claim 5, wherein the connecting side wall extends in an arc along a circumferential direction.
7. The apparatus for collecting powder in exhaust gas of claim 5, wherein the first extension wall unit and the second extension wall unit each form and extend a surface tangential to the connecting side wall.
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8. The apparatus for collecting powder in exhaust gas of claim 5, further including a gas suction pipe having a gas suction port formed therein so as to introduce the exhaust gas into the internal space, and which is coupled to the connecting wall.
9. The apparatus for collecting powder in exhaust gas of claim 8, wherein the gas suction pipe is disposed so as to extend along a direction tangential to the connecting side wall horizontally, and the exhaust gas introduced via the gas suction pipe flows sequentially along the connecting wall unit, one of the two extension wall units, and a side wall of the filter installation unit.
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10. The apparatus for collecting powder in exhaust gas of claim 8, wherein the gas suction pipe is formed by extending both sides from the point where it is coupled to the connecting side wall, and the gas suction ports are formed on both ends of the gas suction pipe respectively.
- 20
11. The apparatus for collecting powder in exhaust gas of claim 10, wherein one of the two gas suction ports is selectively closed, and the exhaust gas flows into the internal space by only one gas suction port.
12. The apparatus for collecting powder in exhaust gas of claim 1, further comprising a filter striking module, which applies a physical impact to the filter body so as to dislodge powder adhering to the external surface of the filter member.
- 25
13. The apparatus for collecting powder in exhaust gas of claim 12, wherein the filter striking module includes an operating unit which is coupled to the installation port formed in the expansion unit, and a link structure which is operated by the operating unit so as to strike the filter body in the internal space of the housing.
- 30

14. The apparatus for collecting powder in exhaust gas of claim 13, wherein the link structure includes a lever unit located in the internal space and a connecting rod which connects the lever unit and operating unit,
- 5 wherein the lever unit includes a support which makes contact with the floor of the internal space, a first extension rod which extends from the support is hingedly coupled to the connecting rod, and a second connecting rod which extends from the support to the opposite side of the first extension rod;
- the end of the second extension rod is located below the filter body; and
- 10 the operation of the operating unit causes an end of the first extension rod to descend downward and an end of the second extension rod to rise upward with respect to the support and strike underneath the filter body.
15. The apparatus for collecting powder in exhaust gas according of claim 14,
- wherein the link structure further includes a striking element which is hingedly coupled to an end of the second extension rod,
- 15 wherein a plurality of striking units spaced apart from each other by the hinge are formed in a radial direction of the rotational axis on the striking element.
16. The apparatus for collecting powder in exhaust gas according of claim 13,
- wherein the link structure includes a lever unit located in the internal space and a connecting rod which connects the lever unit and the operating unit,
- 20 and the lever unit includes a support leg and a lever rotatably coupled to the support leg,
- wherein one end of the lever is hingedly coupled to the connecting rod, and the other end of the lever is located below the filter body,
- and the operation of the operating unit causes one end of the lever to descend downward and the other end of the lever to rise upward and strike underneath the filter body.
- 25 17. An exhaust gas treatment equipment comprising: an adsorption reaction device for treating exhaust gas using an adsorption reaction; and
- a device for collecting powder in exhaust gas that collects powder contained in exhaust gas before the exhaust gas flows into an adsorption reaction device;

wherein the device for collecting powder in exhaust gas includes a filter body, which includes a filter member that filters and feeds the exhaust gas to the adsorption reaction device, and which is disposed below the adsorption reaction device, and includes a housing which provides a filter installation space internally for storing the powder separated from the filter member,

5 which housing is a space projected below the adsorption reaction device, and which includes a filter installation unit which internally provides a filter installation space where the filter is installed, and an expansion unit which is formed so as to protrude sideways from the filter installation unit and provides an expansion space which communicates
10 internally with the filter installation space, and

the internal space is expanded by the expansion space so as to increase the powder collection capacity, and

a suction port for sucking in the exhaust gas is installed in the expansion unit.