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(54) A COLLECTOR CHANNEL HAVING A FLOW ADJUSTMENT DEVICE

(57) The invention is directed to a collector channel (1) in an electrostatic precipitator, provided with a device (7, 8) for adjusting the amount and direction of a gas flow (4) entering the channel (1). A single collector channel (1) or each channel in a bundle of collector channels in an electrostatic precipitator is provided with a flow adjustment device (7, 8) at its entry end for adjusting the flow of gas. Preferably, the device (7, 8) for adjusting the gas flow (4) is a body shaped to form a slit (3) for the gas flow (4) at the entry end of the channel (1). The overall width of the slit (3) and the individual width of the slit (3) at various points along its periphery at the channel entry end may be varied. The slit (3) influences both the flow direction and the total volume flow of gas entering the channel (1), the relative location of the slit edges affecting the flow direction and the width of the slit (3) throttling the flow (4). Using three fastening members (9, 10, 11), the angle of the flow adjustment device (7, 8) relative to the cross section of the channel (1) may be controlled.

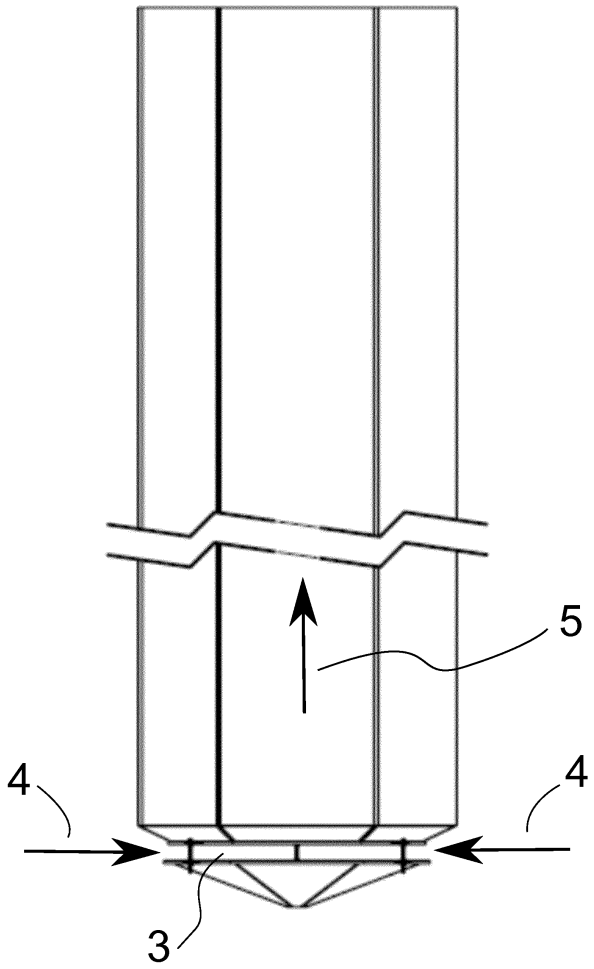

Fig. 2

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Description

Field of the invention

[0001] The invention is directed to a collector channel in an electrostatic precipitator, provided with a device for adjusting the amount and direction of a gas flow entering the channel.

Background

[0002] Electrostatic precipitators (ESP) for e.g. flue gas are provided with collector channels through which the gas flows, the channels having entry ends and exit ends. Disposed in the channels, conventionally along the longitudinal central axis of the channels, are high voltage electrodes for charging solid particles in the gas stream. The charged particles accumulate on the channel walls, from which they are removed by e.g. rapping or washing. The channels typically are arranged in a honeycomb array fashion, i.e. they form a bundle of parallel hexagonal channels. Other sectional shapes are of course possible. The channels are conventionally vertical, the gas flow through them being upwards.

[0003] The channel bundles may be very large for accommodating the flue gases of large combustion plants. For example, a channel bundle in an ESP for a large plant may be many meters in diameter, comprising a large number of channels. Particularly in such an arrangement, distributing the flow of flue gas evenly across the horizontal section of the channel bundle may require restricting or directing devices.

Summary of the invention

[0004] According to the present invention, a single collector channel or each channel in a bundle of collector channels in an electrostatic precipitator is provided with a flow adjustment device at its entry end for adjusting the flow of gas through the individual channel. Thus, the total flow of gas may be evenly distributed between the channels in a bundle, so that an essentially equal volume of gas passes each channel per unit time. Also, the flow within an individual channel may be redistributed by selectively throttling flow entering from varying directions.

[0005] Preferably, the device for adjusting the gas flow is a body shaped to form a slit for the gas flow at the entry end of the channel. Preferably, both the overall width of the slit and the individual width of the slit at various points along its periphery at the channel entry end may be varied. The slit influences both the flow direction and the total volume flow of gas entering the channel, the relative location of the slit edges affecting the flow direction and the width of the slit throttling the flow. Preferably, the tilt of the device relative to the channel cross section may be adjustable, providing for control of gas flow from varying directions along the periphery of the channel entry end.

Detailed description

[0006] A flow adjustment device in a collector channel according to the present invention serves the purpose of distributing the total flow across the channel bundle, and further to induce mixing at the entry end of each channel. For proper operation of the ESP, it is desirable to avoid longitudinal surge flows along the channel longitudinal axis. A slit formed at the entry end of the channel causes turbulence in the entering gas, enhancing the separation of solid particles as the gas flow proceeds along the channel.

[0007] In the present context, the word *slit* may be understood as a passage leading into the entry end of the collector channel, which passage is reduced compared to the entry end of the collector channel without the flow adjustment device. Alternatively or additionally, the word slit may be understood as a passage providing for a disrupted gas flow in that the direction of the flow is altered substantially.

[0008] For example, in the case of a channel having a hexagonal cross section, the flow adjustment device may comprise a hexagonal plate or a 6-sided pyramid. Other shapes are possible; preferably the shape of the device matches the shape of the cross section of the relevant channel. The cross section of the channel is to be understood as taken perpendicularly to the longitudinal axis of the channel.

[0009] In the present context, the width of the slit is to be understood as the distance between opposite edges limiting the slit.

[0010] The overall width of the slit formed by the flow adjustment device at the entry end of the channel may be varied by an adjustment mechanism comprising fastening members. These may be e.g. threaded rods fitting into lugs on both sides of the slit, with multiple nuts for fastening, or turnbuckles. In advanced designs, the fastening members may comprise remotely controllable components like hydraulic cylinders or electric actuators, making continuous control possible.

[0011] Preferably, the width of the slit may vary along the periphery of the channel. Thus for example, if the flow adjustment device comprises a pyramid-shaped body, the base of the pyramid may be tiltable relative to the plane of the channel cross section. This allows for selectively throttling the flow entering the channel from various directions, thereby equalizing the flow also across the cross section of each individual channel. Using three fastening members, the angle of the flow adjustment device relative to the cross section of the channel may be controlled, additional fastening members providing for added rigidity if necessary.

[0012] The edges of the slit may be shaped to induce more or less turbulence. A rounded edge causes less turbulence and thus a smaller pressure loss, while a rugged edge induces more turbulence, which may have a positive influence on the particle separation process occurring in the channel. However, this comes at the cost

of a higher pressure loss.

[0013] The device preferably includes a tapering downstream section to be attached to the entry end of the channel. This arrangement is particularly advantageous with channel bundles, since it provides space for gas flow distribution. If a tapering downstream section is used, the slit is formed between the tapering downstream section and an upstream section of the device.

Brief description of the drawings

[0014]

Fig. 1 is a perspective view of an embodiment of an individual collector channel for an electrostatic precipitator,

Fig. 2 is a side view of the channel of Fig. 1, showing a flow adjustment device according to the invention,

Fig. 3 is another perspective view of an embodiment of an individual collector channel for an electrostatic precipitator

Fig. 4 shows a section of a bundle of channels according to Figs. 1-3,

Fig. 5 is a perspective view of an embodiment of a flow adjustment device according to the invention, and

Fig. 6 is a side view of the device of Fig. 5.

[0015] Fig. 1 shows a vertical collector channel 1 for an electrostatic precipitator in a perspective view from its upper, i.e. exit end. The channel is hexagonal and has a central electrode 2 in the shape of a rod. Fig. 2 is a side view of collector channel 1, provided at its lower end with a device according to the present invention. The device forms a slit 3 allowing air to enter the lower, i.e. entry part of the channel as shown by arrows 4. Arrow 5 shows the overall flow direction of the air. In Fig. 2, the flow adjustment device is level, the slit being of equal width along its periphery.

[0016] Fig. 3 shows the collector channel 1 in a perspective view from its lower end. The device according to the present invention here comprises a hexagonal pyramid with its apex downwards. At the apex, an opening 6 is provided to allow the discharge of solids collected on the inner walls of the channel and loosened by rapping or washing with liquid. Fig. 4 shows a section of a bundle of hexagonal collector channels, as they are typically arranged in a large scale electrostatic precipitator. The central electrodes are not shown.

[0017] Fig. 5 is a side view of an embodiment of a device according to the present invention, detached from the entry end of a collector channel. The embodiment shown comprises a downstream section 7 which may be fixedly attached to the collector channel entry end. The downstream section 7 is of the same sectional shape as the channel, and tapers off towards its entry end. Thus, space for gas flow distribution and for handling the adjustment of individual devices is provided at the entry end of the tube bundle to which the relevant channel belongs. The device of the embodiment shown comprises an upstream section 8 which has the shape of a pyramid.

[0018] Upstream section 8 is attached to downstream section 7 using fastening members, which in the embodiment shown in Fig. 6 comprise connecting rods 9 in lugs 10 and 11 on the upstream and downstream sections, respectively. Rods 9 may have outer threads, and using for example multiple nuts (not shown) or turnbuckle arrangements with opposing threads, the width of slit 3 can be adjusted as required.

[0019] Using flow adjustment devices according to the invention, the gas flow through each channel in a bundle of collector channels is preferably adjusted as the plant comprising the channels is taken into service. The flow through each channel and the flow in varying sections of each channel are adjusted by varying the width of slit 3, if necessary by adjusting the angles of upstream sections 8 relative to downstream sections 7. Anemometers of various design may be used for determining local flow velocities within channels and overall flows in individual channels.

[0020] For a single electrostatic precipitator channel, a downstream section 7 may not be necessary. In this case, lugs or threaded holes for adjustable fastening members may be provided in the channel entry end.

[0021] The shape and size of the downstream and upstream sections of a device according to the invention, as well as the design of the edges may vary. For example, the diameter of the entry end of the downstream section must not necessarily match the diameter of the upstream section; it may be larger or smaller. The relative sizes of the sections influence the overall direction of the slit and thus the direction of a gas flow entering the channel.

[0022] It is to be understood that the embodiments of the invention disclosed are not limited to the particular structures, process steps, or materials disclosed herein, but are extended to equivalents thereof as would be recognized by those ordinarily skilled in the relevant arts. It should also be understood that terminology employed herein is used for the purpose of describing particular embodiments only and is not intended to be limiting.

[0023] Reference throughout this specification to one embodiment or an embodiment means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment. Where reference is made to a numerical value using a term such as, for example, about or substantially, the exact numerical value is also disclosed.

[0024] As used herein, a plurality of items, structural elements, compositional elements, and/or materials may be presented in a common list for convenience. However, these lists should be construed as though each member of the list is individually identified as a separate and unique member. Thus, no individual member of such list should be construed as a de facto equivalent of any other member of the same list solely based on their presentation in a common group without indications to the contrary. In addition, various embodiments and examples of the present invention may be referred to herein along with alternatives for the various components thereof. It is understood that such embodiments, examples, and alternatives are not to be construed as de facto equivalents of one another, but are to be considered as separate and autonomous representations of the present invention.

[0025] Furthermore, the described features, structures, or characteristics may be combined in any suitable manner in one or more embodiments. In this description, numerous specific details are provided, such as examples of lengths, widths, shapes, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention can be practiced without one or more of the specific details, or with other methods, components, materials, etc.

[0026] While the forgoing examples are illustrative of the principles of the present invention in one or more particular applications, it will be apparent to those of ordinary skill in the art that numerous modifications in form, usage and details of implementation can be made.

LIST OF REFERENCE NUMERALS

[0027]

1	Collector channel
2	Central electrode
3	Slit
4	Entering air
5	Overall air flow
6	Opening
7	Downstream section
8	Upstream section
9	Connecting rods
10	Lug
11	Lug

Claims

1. A collector channel for installation in an electrostatic precipitator, said collector channel comprising an entry end and an exit end, **characterized in that** a flow adjustment device is provided at the entry end of the collector channel, said adjustable device providing a slit for directing and throttling a flow of gas entering the collector channel.

2. The collector channel according to claim 1, **characterized in that** the flow adjustment device comprises a section forming a slit between the section and the entry end of the collector channel.

3. The collector channel according to claim 1, **characterized in that** the flow adjustment device comprises a downstream section and an upstream section, whereby the slit is defined by the sections.

4. The collector channel according to claim 3, **characterized in** the downstream section being fixed to the entry end of the collector channel.

5. The collector channel according to claim 3 or 4, **characterized in that** the downstream section and the upstream section are fastened to each other by an adjustment mechanism which is configured to adjust the width of the slit.

6. The collector channel according to any of claims 3 - 5, **characterized in that** the downstream section and the upstream section are fastened to each other by at least three individually adjustable fastening members.

7. The collector channel according to any of claims 3 - 6, **characterized in that** the adjustment mechanism is configured to adjust the mutual orientation between the downstream section and the upstream section.

8. The collector channel according to any of claims 3-7, **characterized in** the upstream section exhibiting a cross-sectional shape taken along a center longitudinal axis of the collector channel, which cross-sectional shape widens towards the exit end of the collector channel.

9. The collector channel according to any of claims 3-8, **characterized in** the cross-section of the upstream section having a width greater than that of the downstream section at the respective edge facing the downstream section.

10. The collector channel according to any of claims 3-9, **characterized in** the cross-section of the upstream section having a width smaller than that of the downstream section at the respective edge facing the downstream section.

11. The collector channel according to any claim 3-10, **characterized in that** the upstream section is provided with a central opening.

12. The collector channel according to any previous

claim, **characterized in** being configured for vertical installation.

13. The collector channel according to any previous claim, **characterized in that**:

- the collector channel exhibits a cross-sectional shape taken across the center longitudinal axis thereof,
- the flow adjustment device exhibits a cross-sectional shape taken across the center longitudinal axis of the collector channel, and **in that**
- the cross-sectional shape of the flow adjustment device matches that of the collector channel.

14. The collector channel according to any previous claim, **characterized in that** it comprises adjustable fastening members having remotely controllable components.

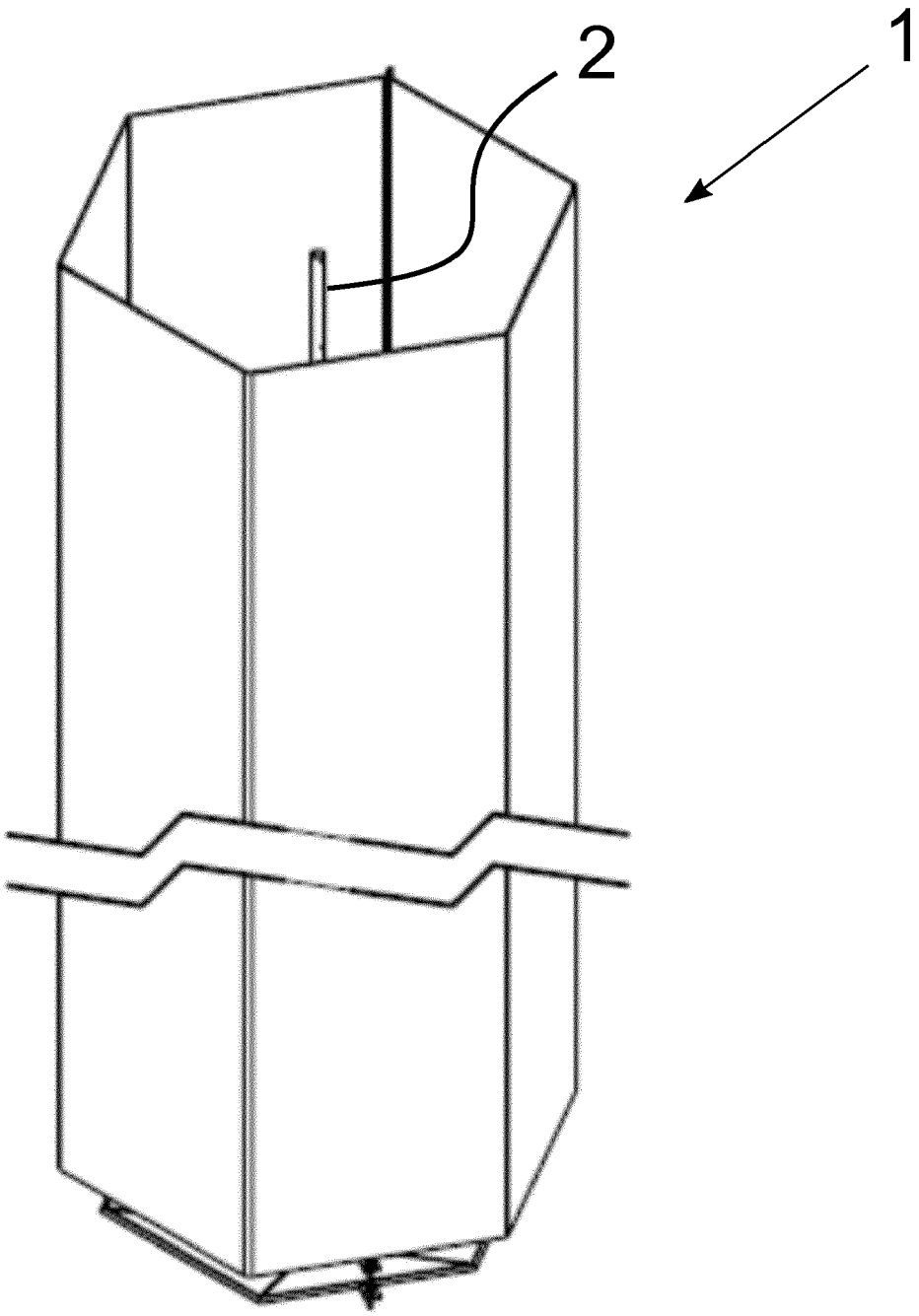

Fig. 1

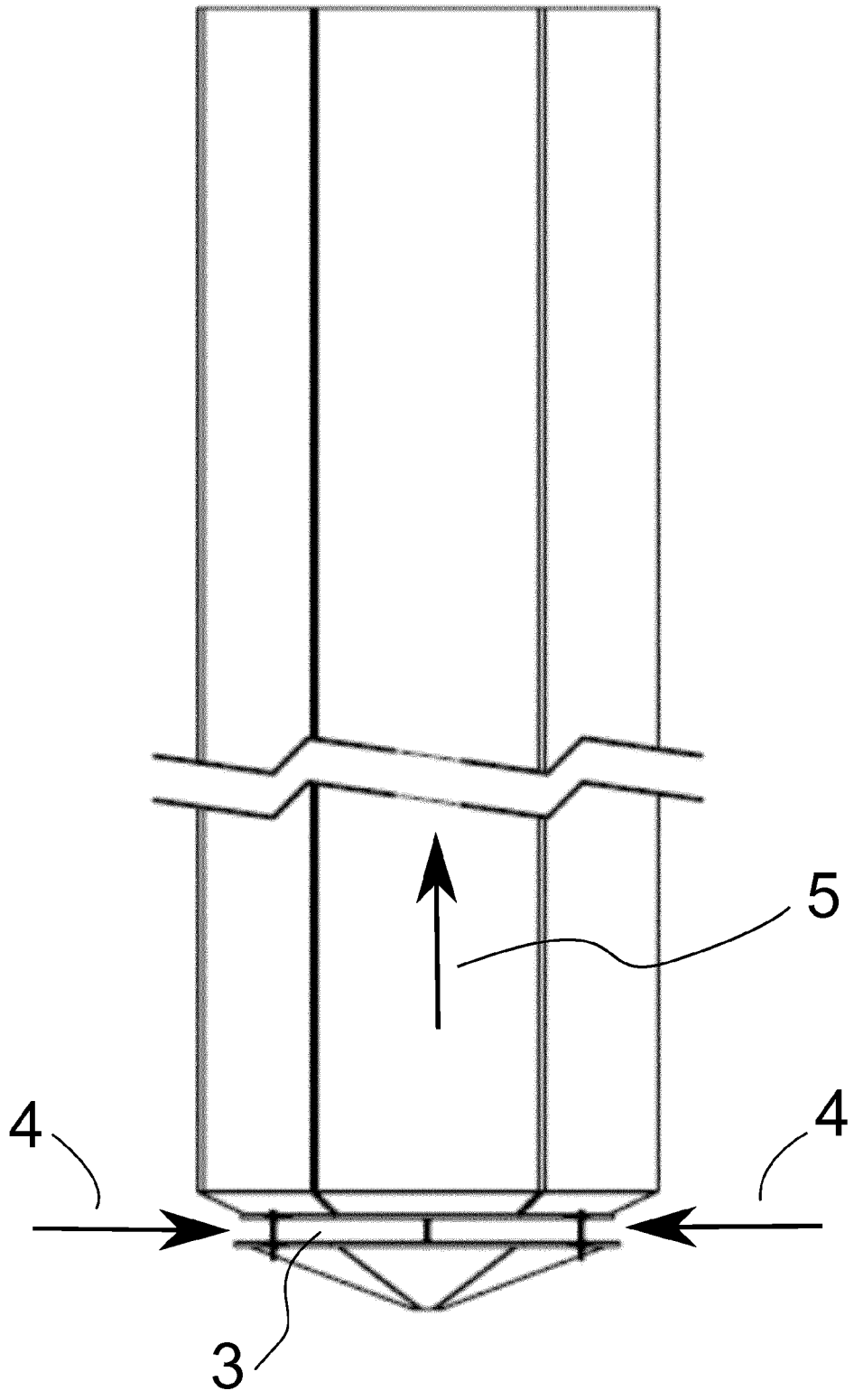

Fig. 2

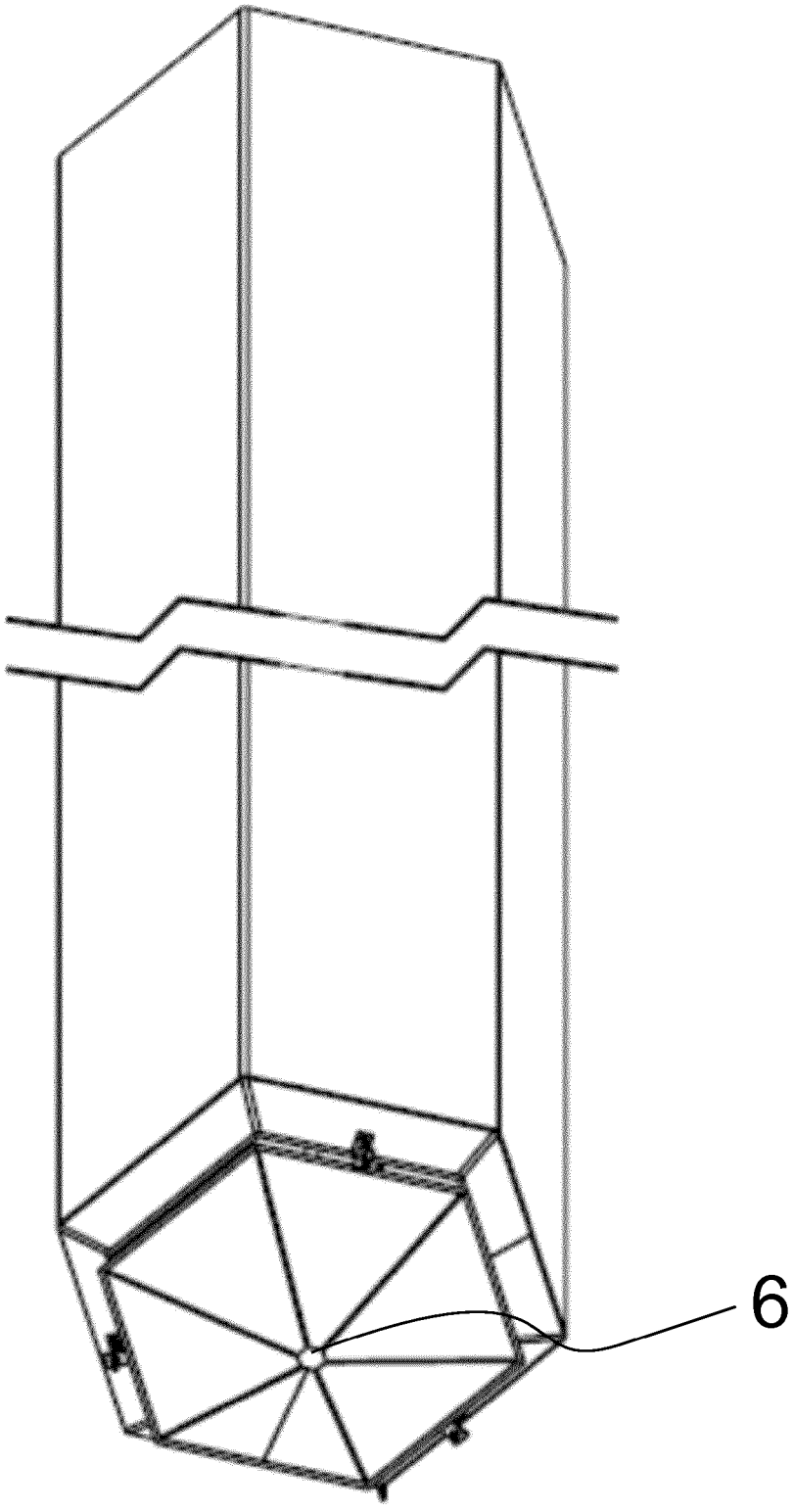

Fig. 3

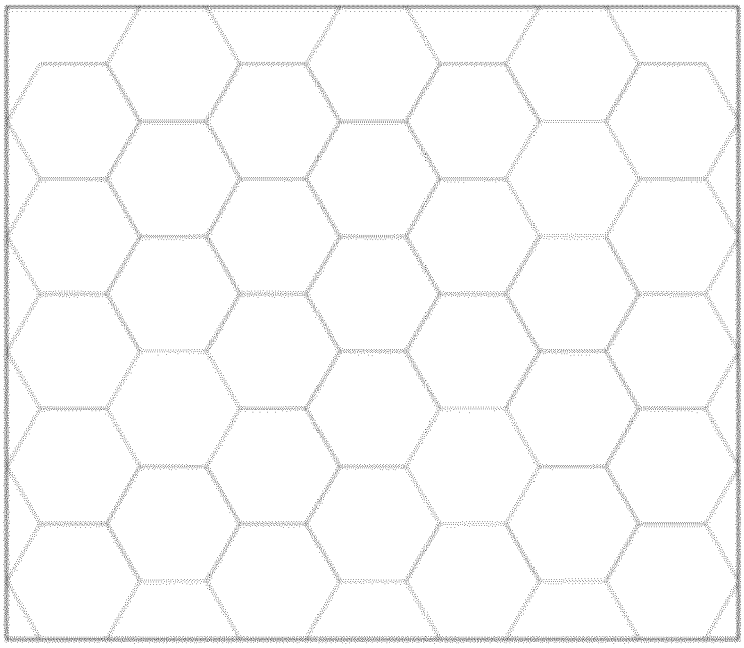

Fig. 4

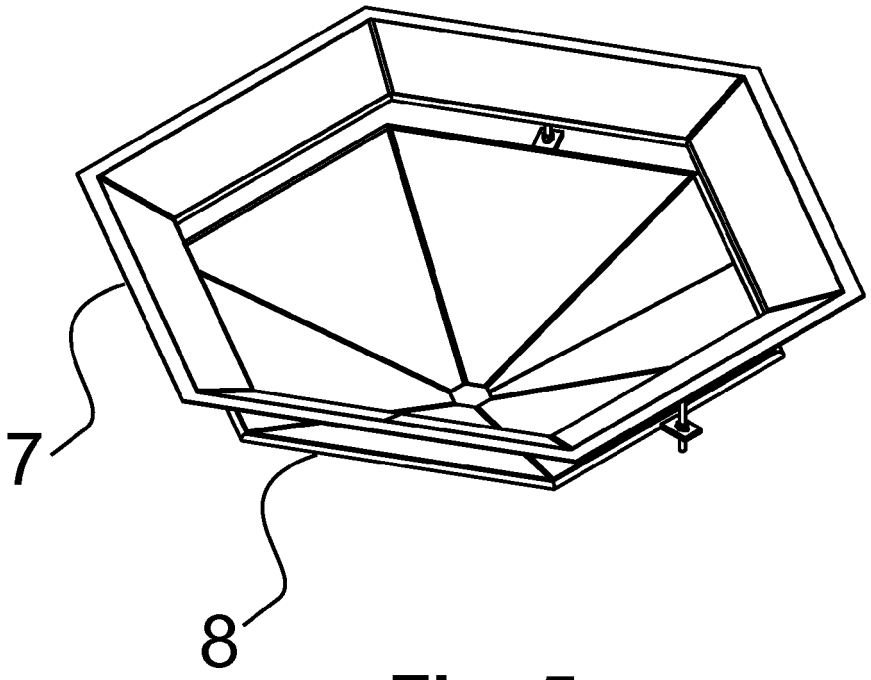

Fig. 5

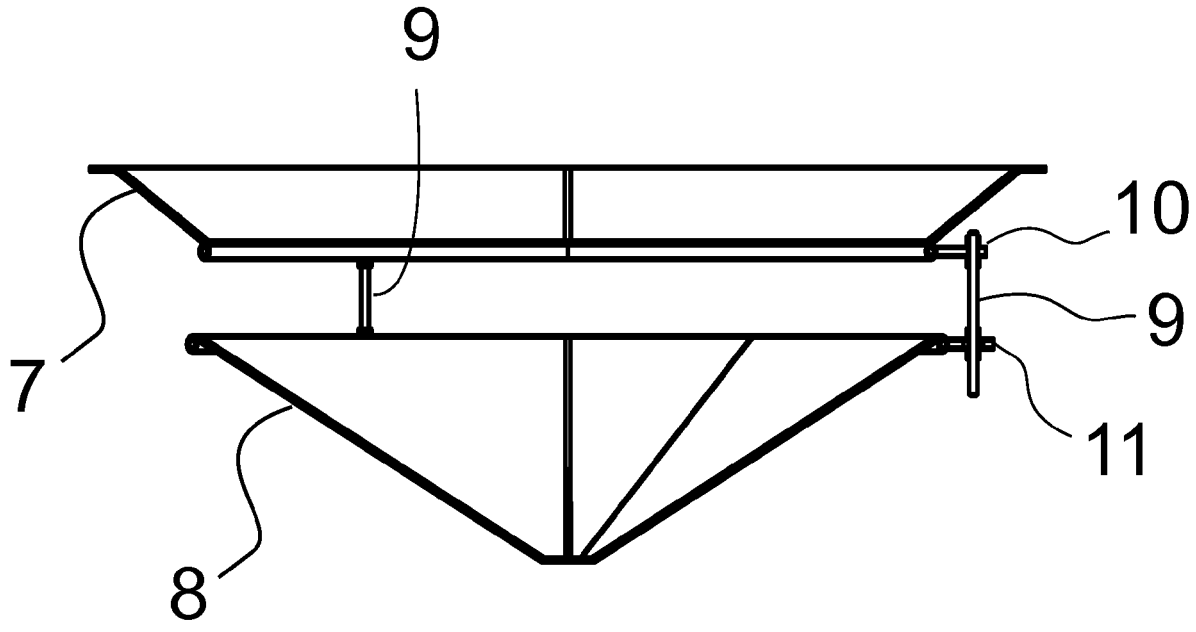

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 17 39 7523

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 April 2018	Menck, Anja

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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