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(54) **CYCLONIC SEPARATOR DEVICE CONNECTABLE TO ASPIRATORS IN WORKBENCHES, AND ASPIRATOR MACHINE FITTED WITH SAID CYCLONIC SEPARATOR**

ZYKLONABSCHIEDEVORRICHTUNG, DIE AN SAUGER IN WERKBÄNKEN ANSCHLIESSBAR IST, UND MIT DIESEM ZYKLONABSCHIEDER AUSGERÜSTETE SAUGMASCHINE

DISPOSITIF SÉPARATEUR CYCLONIQUE POUVANT ÊTRE CONNECTÉ À DES ASPIRATEURS SUR DES ÉTABLIS, ET MACHINE ASPIRANTE ÉQUIPÉE DUDIT SÉPARATEUR CYCLONIQUE

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Description

Technical field

[0001] The present invention relates to a so-called "cyclone separator" which can be mounted and functionally integrated with a suction device that can be employed in work contexts wherein a swarf of material is created, and wherein such suction device has the main function of collecting and clearing such swarf from the working area (and consequently, the invention also relates to a suction device equipped with such cyclone separator).

Background Art

[0002] As is known, in several working settings there is the need to withdraw material or to carry out a wide range of processes creating swarfs, trash material and various dirt deriving from the materials subjected to the same processes: in these settings it is therefore necessary to provide for the removal of these wastes or swarfs or scrap materials, either to avoid contaminating the product being processed or to ensure the operator performing the processes to remain in a suitable and safe working environment.

[0003] By way of example, soles and / or shoe uppers finishing processes may be cited, which during the rounding or assembly can generate various types of slag (sole or upper trimmings, solid surpluses of adhesives mechanically withdrawn during processing, granules of various materials and so on): in this context, a human operator takes great advantage in the presence of a suction blower, which can even be of the swiveling type so as to position itself, at least as regards its suction orifice, in the most appropriate spatial position to maximize the effect of removing unwanted materials and / or of not interfering in the actions of the operator himself. Generally, the suction blowers of the prior art consist of the aforementioned suction orifice (connected to a hose or joint that can make it fixed or swiveling) adequately de-pressurized precisely in order to exert the suction effect, and a separation system of the sucked in air from the waste or scrap materials sucked in during the activity of the suction blower itself: in turn, these separation systems are often based on the so-called "cyclone technology", which is based on the creation of a whirling motion of the sucked in air, and on the separation of air from the sucked in materials by centrifugal / centripetal effect.

[0004] In this operating setting, despite the intrinsic simplicity of the just mentioned "cyclonic" separation systems, there are still some drawbacks of a practical nature, since such separators have non-optimal limits of efficiency and / or maintenance times, especially where they must work in environments with high production of waste or scrap materials to be withdrawn.

[0005] In greater detail, the devices adopted nowadays on an industrial level for the suction of solid materials currently in use are not able to completely retain the

sucked in material into the predefined collection container, leaving a certain quantity in suspension: this part of material is pushed again towards the outside by the internal pressure generated by the suction blower and this implies the fact that the air thereby contaminated is reintroduced into the environment passing through a filtration system that, having to retain an excessive amount of material, rapidly decreases its filtering efficiency leading to a frequent maintenance and replacement. Furthermore, cyclonic separators still need, typically in order to comply with the current regulations on the reintroduction of air into the environment after its separation from the waste and / or scrap material, filtering elements: such filters are usually shaped as "socks" or "bags" and are mounted externally to the cyclonic separator, so as to intercept the air after the centrifugal separation and to filter it accordingly.

[0006] However, such sock or bag filters are generally not very efficient, suffer from early clogging and lead to significant and repeated maintenance interventions.

[0007] At the same time, cyclonic separators of the known type can generate non-negligible environmental noise, and are therefore a source of discomfort for the operators who have to work alongside them: the greater the suction power to be used, the higher the noise.

[0008] Examples of cyclonic separator known in the art can be found in document KR20030094875, KR20040023417 and KR20030094873.

Detailed description of the invention

[0009] In comparison with the prior art and the problems mentioned above herein, the aim of the present invention is therefore to provide a suction device overcoming the drawbacks of the prior art and providing the operator or the work area where it is operatively activable with a greater and better level of efficiency, reliability, maintainability and therefore of overall management cost.

[0010] Described herein, by way of non-limiting example, is an embodiment of a suction device according to the invention, shown in the attached exemplary, however not limiting, figures, wherein:

- Figure 1 shows an axonometric / perspective view in transparency of a cyclone separator (associated with a suction device, which can be of a known type and therefore is not shown in the figure) according to the present invention; and
- Figures 2, 3 and 4 show views of the individual constitutive components of the cyclone separator of Figure 1.

[0011] The cyclone separator according to the invention is globally indicated with the reference numeral 1 in the attached figures and, as previously mentioned, can be structurally and functionally integrated in a suction device, which can also be of a known type and is therefore

not illustrated in its constitutive details.

[0012] Focusing the attention on the attached figures, note that for its part the cyclone separator, associated as mentioned with an suction device, conveniently comprises a filtering element 2 mounted internally and / or contained within the cyclone separator 1 itself: such filtering element 2 is therefore suitable for intercepting an air flow passing through the cyclone separator 1 and, unlike the cyclone separators of the known type, it is characterized by a peculiar volumetric / topological arrangement of the filtering element itself (bringing advantages that will appear later in the present description).

[0013] From the structural point of view, the cyclone separator 1 comprises a containment body 3a (e.g. with a cylindrical shape) extending along an axis "A" and defining in turn:

- an intake 3b, typically oriented tangentially to an intake ideal plane normal to the axis "A" and positioned at a first end portion of the containment body 3 (which for example, in the attached figures is positioned upwards and sideways on the body 3a); and
- an exhaust 3c subsequently located with respect to the intake 3b along a crossing path subtended between the intake 3b and the exhaust 3c itself. The just defined crossing path appears to be crossable by an air sucked in by the suction device (and such air will typically contain waste and / or scrap materials that must be properly treated in the cyclone separator 1): once treated in the cyclone separator 1, the air can exit through the exhaust 3c, which in the exemplary embodiment of the attached figures is positioned at a second end portion of the containment body 3a.

[0014] On the contrary, as far as the structure of the filtering element 2 is concerned, it can be noted that this is shaped according for example (but not necessarily) to a cylindrical body, and in turn such body comprises:

- a coronal filtering portion 2a mounted internally and / or contained within the cyclone separator 1 in operating conditions of the suction device (in this way, the filtering element 2 is suitable for intercepting an air flow along the aforementioned crossing path); and
- an attestation flange 2b which can be mounted, in a typically reversible manner, in the cyclone separator and, with reference to the exemplary embodiment of the figures, at and / or near the exhaust 3c.

[0015] Conveniently, in order to obtain the maximum performance of cleaning the air flow and to comply with the current regulations, the filtering element 2 can be a "HEPA" type filter, and structurally the coronal filtering portion 2a can consist at least partially of a material made of canvas and / or mesh and / or porous material and / or spongy material (such material can conveniently be

supported by the attestation flange 2b).

[0016] In order to allow the maintenance and / or inspection of the filtering element 2, the invention provides for the possible presence of proper constraining means, preferably of the reversible or removable type, operatively active between the containment body 3a and at least the attestation flange 2b of the filtering element 2.

[0017] According to a further aspect of greater practicality and improved functionalities of the invention with respect to the prior art, vorticity-inducing means 5 can also be present mounted inside the cyclone separator 1 and cooperatively suitable for accelerating an air flow comprising waste and / or scrap materials, and for decreasing an average diameter of turbulent structures within said air flow comprising waste and / or scrap materials along the crossing path.

[0018] The just mentioned vorticity-inducing means 5 can operate in the cyclone separator 1 even in the absence of the filtering element 2, or can also operate in synergy with the latter, multiplying quantitatively and / or qualitatively the operative performance of the invention with respect to similar devices belonging to the prior art and consequently of the suction device which can be structurally and functionally integrated with the invention itself.

[0019] Going into detail, note that the vorticity-inducing means 5 comprise a predetermined number of helical- and / or spiral-shaped channels extending into the containment body 3a an internal space of the containing body 3a itself: such channels are suitable for intercepting the already cited air flow comprising waste and / or scrap materials and typically define a crossing path comprising at least one spiral segment descending from intake 3b to the exhaust 3c.

[0020] With reference to the attached figures, it can also be noted that the helical- and / or spiral-shaped channels are suitable for intercepting the air flow comprising waste and / or scrap materials "upstream" from the filtering element 2 (where present and operating in synergy with the latter, and more precisely upstream in the travel direction of the crossing path defined by the containment body 3a) and preferably for directing it towards the latter.

[0021] In order to ensure a further increase in the quality of the air flow within the cyclone separator 1, and to simultaneously ensure adequate support for the helical- and / or spiral-shaped channels, there is also a separating cylinder 6 coaxially mounted in the main body 3a and circumscribed at least to the filtering portion 2a of the filtering element 2: conveniently, the vorticity-inducing means 5 are mounted on said separating cylinder 6. From the geometric / topological point of view, note that the containment body 3a and the separating cylinder 6 (which, as seen above, also acts as the supporting wall of the helical- and / or spiral-shaped channels) define two coronal spaces 4a and 4b respectively concentric and arranged within the body 3a: moreover, the separating cylinder 6 also acts as a further protection for the filtering element 2, against the material entering the invention 1.

[0022] The operation of the cyclone separator 1 according to the invention is as follows.

[0023] The sucked in material enters the containment body (otherwise called "external cylinder") 3a and is directed towards the vorticity-inducing means 5 (otherwise called "spiral conveyor"), after which the air, which contains the waste and / or scrap materials, is compressed and accelerated by the combined effect of reducing the flow section caused by the spiral conveyor with respect to the inlet section of the outer cylinder and by the action of the centrifugal force created and amplified by the spiral conformation of the conveyor itself.

[0024] The waste and / or scrap materials is then pushed towards a collection container (not shown, since it can be of a known type and for example can be placed under the conveyor, or in other words below the first end portion of the containment body 3a), where it remains permanently due to effect of the high pressure generated during the operating state of the suction device in combination with the effect of the conveyor.

[0025] Naturally, the air exiting the cyclone separator can pass through the filtering element 2, undergoing a further cleaning and separation action from those parts of the waste and / or scrap materials that have not been previously separated by centrifugation and precipitation, then exiting the exhaust 3c.

[0026] The invention achieves a level of practicality of use and a greater utility of use and implementation with respect to the prior art.

[0027] Primarily, thanks to the peculiar construction architecture of the cyclone separator described above herein (and claimed hereinafter) a considerably greater filtering efficiency can be obtained, combined with an increased efficiency and a longer "life cycle" of the filtering element.

[0028] Moreover, the same construction architecture that generates a better functional efficiency is also suitable for obtaining a significant reduction in the noise generated in the cyclonic separator, with great benefit for the quality of the working environment.

[0029] Even more particularly, the fact that all the components of the separator - and in particular the filtering element - are within the "main cylinder" makes the filter itself very well protected (also thanks to the presence of the "internal separator") both from the sucked in material and from the dirt naturally present in the working environment (dirt that is normally deposited on the outside of the external bag type filters of the known type) with further advantages in terms of efficiency, duration and maintenance of the filter and of the entire workstation wherein the present invention operates.

[0030] Moreover, in the case of processing ferrous material that can cause the aspiration of sparks, the presence of the vorticity-inducing means (or in other words, of the "spiral conveyor") also has the ability of preventing potential ignitions of the material already present in the collection container: this occurs thanks to the fact that the sparks are extinguished autonomously on contact

with the walls during the passage in the spiral (prior falling into the collection container) without having to resort to additional structures or the use / presence of firefighting liquids.

5 **[0031]** The entire invention then has a minimal spatial / volumetric footprint, and this also allows to increase its "aesthetic" value.

10 **[0032]** The invention can also be easily integrated into structures and / or working environments of various nature, size and accessibility (as well as according to the most varied retrofitting modes in already existing systems).

15 Claims

1. Cyclone separator (1) associated with a suction device, comprising a filtering element (2) mounted inside and / or contained inside said cyclone separator (1), said filtering element (2) being suitable for intercepting an air flow passing through the cyclone separator (1).

characterized in that

there are also vorticity-inducing means (5) mounted inside the cyclone separator (1) and cooperatively suitable for accelerating an air flow comprising waste and / or scrap materials and / or for decreasing an average diameter of turbulent structures within said air flow comprising waste and / or scrap materials along the crossing path.

2. Cyclone separator according to claim 1, wherein the cyclone separator (1) comprises a containment body (3a) extending along an axis (A) and defining:

- an intake (3b) preferably oriented tangentially to an intake ideal plane normal to said axis (A) and positioned at a first end portion of the containment body (3a); and
- an exhaust (3c) located subsequently with respect to said intake (3b) along a crossing path subtended between the intake (3b) and the exhaust (3c), said crossing path being crossable by an air sucked in by the suction device, said exhaust (3c) being preferably positioned at a second end portion of the containment body (3a).

3. Cyclone separator according to claims 1 or 2, wherein the filtering element (2) is shaped according to a cylindrical body, said cylindrical body comprising:

- a coronal filtering portion (2a), said coronal filtering portion (2a) being mounted inside and / or contained inside the cyclone separator (1) under operating conditions of the suction device, the filtering element (2) being suitable for intercepting an air flow along said crossing path; and

- an attestation flange (2b) which can be mounted, preferably in a reversible manner, in the cyclone separator and preferably at and / or near said exhaust (3c).

4. Cyclone separator according to claim 3, wherein the filtering element (2) is a filter of the "HEPA" type, at least said coronal filtering portion (2a) consisting at least partially of a material made of canvas and / or mesh and / or porous material and / or spongy material, said material being supported by said attestation flange (2b).
5. Cyclone separator according to any one of the preceding claims, wherein there are also constraining means, preferably of the reversible or removable type, operatively active between the containment body (3a) and at least the attestation flange (2b) of the filtering element (2).
6. Cyclone separator according to any one of the previous claims, wherein said vorticity-inducing means (5) comprise a predetermined number of helical- and / or spiral-shaped channels extending into the containment body (3a) towards a space within the containment body (3a) itself and suitable for intercepting said air flow comprising waste and / or scrap materials, said helical- and / or spiral-shaped channels preferably defining a crossing path comprising at least one spiral segment from the intake (3b) to the exhaust (3c).
7. Cyclone separator according to any one of the previous claims, wherein said helical- and / or spiral-shaped channels are suitable for intercepting the air flow comprising waste and / or scrap materials upstream from the filtering element (2) and preferably for directing it towards the latter under operating conditions of the suction device (1).
8. Cyclone separator according to any of the previous claims, wherein there is also a separating cylinder (6) coaxially mounted in the main body (3a) and circumscribed at least to the filtering portion (2a) of the filtering element (2), the vorticity-inducing means (5) being mounted on said separating cylinder (6).

Patentansprüche

1. Zyklonabscheider (1), der mit einer Saugvorrichtung assoziiert ist, umfassend ein Filterelement (2), das im Zyklonabscheider (1) montiert und/oder darin enthalten ist, wobei das Filterelement (2) geeignet ist, um einen Luftstrom abzufangen, der durch den Zyklonabscheider (1) strömt, **dadurch gekennzeichnet, dass** auch Verwirbelung herbeiführende Mittel (5)

bereitgestellt sind, die im Zyklonabscheider (1) montiert und kooperativ geeignet sind, um einen Luftstrom zu beschleunigen, der Abfall und/oder Ausschussmaterialien umfasst, und/oder um einen Durchschnittsdurchmesser wirbelnder Strukturen im Luftstrom zu erhöhen, der Abfall und/oder Ausschussmaterialien entlang des Kreuzungswegs umfasst.

2. Zyklonabscheider nach Anspruch 1, wobei der Zyklonabscheider (1) ein Aufnahmegehäuse (3) umfasst, das sich entlang einer Achse (A) erstreckt und Folgendes definiert:

- einen Einlass (3b), der vorzugsweise tangential zu einer idealen Einlassebene lotrecht zur Achse (A) ausgerichtet und an einem ersten Endabschnitt des Aufnahmegehäuses (3a) positioniert ist, und

- einen Auslass (3c), der nach dem Einlass (3b) entlang eines Kreuzungswegs unterspannt zwischen dem Einlass (3b) und dem Auslass (3c) angeordnet ist, wobei der Kreuzungsweg von einer Luft kreuzbar ist, die von der Saugvorrichtung angesaugt wird, wobei der Auslass (3c) vorzugsweise an einem zweiten Endabschnitt des Aufnahmegehäuses (3a) positioniert ist.

3. Zyklonabscheider nach Anspruch 1 oder 2, wobei das Filterelement (2) gemäß einem zylindrischen Gehäuse ausgeformt ist, wobei das zylindrische Gehäuse Folgendes umfasst:

- einen Kranzfilterabschnitt (2a), wobei der Kranzfilterabschnitt (2a) unter Betriebsbedingungen der Saugvorrichtung im Zyklonabscheider (1) montiert und/oder in diesem enthalten ist, wobei das Filterelement (2) geeignet ist, um einen Luftstrom entlang des Kreuzungswegs abzufangen, und

- einen Stoßflansch (2b), der vorzugsweise in reversierbarer Weise im Zyklonabscheider und vorzugsweise am und/oder in der Nähe des Auslasses (3c) montiert werden kann.

4. Zyklonabscheider nach Anspruch 3, wobei das Filterelement (2) ein Filter vom "HEPA"-Typ ist, wobei zumindest der Kranzfilterabschnitt (2a) mindestens teilweise aus einem Material besteht, das aus Gewebe und/oder Netzwerk und/oder porösem Material und/oder Schwammmaterial gefertigt ist, wobei das Material vom Stoßflansch (2b) getragen wird.

5. Zyklonabscheider nach einem der vorhergehenden Ansprüche, wobei ebenfalls Bindungsmittel bereitgestellt sind, vorzugsweise vom reversierbaren oder entfernbaren Typ, die betriebswirksam zwischen dem Aufnahmegehäuse (3a) und mindestens dem

Stoßflansch (2b) des Filterelements (2) aktiv sind.

6. Zyklonabscheider nach einem der vorhergehenden Ansprüche, wobei die Verwirbelung herbeiführenden Mittel (5) eine vorgegebene Anzahl an schnecken- und/oder spiralförmigen Kanälen umfassen, die sich in das Aufnahmegehäuse (3a) hinführend zu einem Raum im Aufnahmegehäuse (3a) erstrecken und geeignet sind, um den Luftstrom, der Abfall und/oder Ausschussmaterialien umfasst, abzufangen, wobei die schnecken- und/oder spiralförmigen Kanäle vorzugsweise einen Kreuzungsweg definieren, der mindestens ein Spiralsegment vom Einlass (3b) zum Auslass (3c) umfasst.
7. Zyklonabscheider nach einem der vorhergehenden Ansprüche, wobei die schnecken- und/oder spiralförmigen Kanäle geeignet sind, um den Luftstrom, der Abfall und/oder Ausschussmaterialien umfasst, vor dem Filterelement (2) abzufangen und diesen vorzugsweise unter Betriebsbedingungen der Saugvorrichtung (1) hinführend zu diesem zu lenken.
8. Zyklonabscheider nach einem der vorhergehenden Ansprüche, wobei auch ein Abscheidezylinder (6) bereitgestellt ist, der koaxial im Hauptgehäuse (3a) montiert und mindestens auf den Filterabschnitt (2a) des Filterelements (2) beschränkt ist, wobei die Verwirbelung herbeiführenden Mittel (5) auf dem Abscheidezylinder (6) montiert sind.

Revendications

1. Séparateur à cyclone (1) associé à un dispositif d'aspiration, comprenant un élément filtrant (2) monté à l'intérieur et/ou contenu à l'intérieur dudit séparateur à cyclone (1), ledit élément filtrant (2) étant adapté pour intercepter un flux d'air passant à travers le séparateur à cyclone (1), **caractérisé en ce qu'il se trouve également des moyens d'induction de vortacité (5) montés à l'intérieur du séparateur à cyclone (1) et adaptés en coopération afin d'accélérer un flux d'air comprenant des déchets et/ou des matériaux de rebut et/ou pour diminuer un diamètre moyen de structures turbulentes à l'intérieur dudit flux d'air comprenant des déchets et/ou des matériaux de rebut le long du parcours de traversée.**
2. Séparateur à cyclone selon la revendication 1, dans lequel le séparateur à cyclone (1) comprend un corps de contenance (3a) se prolongeant le long d'un axe (A) et définissant :
 - une admission (3b) orientée de préférence tan-

gentiellement à un plan idéal d'admission normal audit axe (A) et positionnée en correspondance d'une première partie d'extrémité du corps de contenance (3a) ; et

- un échappement (3c) situé subséquent par rapport à ladite admission (3b) le long d'un parcours de traversée sous-tendu entre l'admission (3b) et l'échappement (3c), ledit parcours de traversée pouvant être traversé par un air aspiré par le dispositif d'aspiration, ledit échappement (3c) étant de préférence positionné en correspondance d'une seconde partie d'extrémité du corps de contenance (3a).

3. Séparateur à cyclone selon la revendication 1 ou 2, dans lequel l'élément filtrant (2) est façonné selon un corps cylindrique, ledit corps cylindrique comprenant :

- une partie filtrante coronale (2a), ladite partie filtrante coronale (2a) étant montée à l'intérieur et/ou contenue à l'intérieur du séparateur à cyclone (1) dans les conditions de fonctionnement du dispositif d'aspiration, l'élément filtrant (2) étant adapté pour intercepter un flux d'air le long dudit parcours de traversée ; et

- une bride d'aboutement (2b) qui peut être montée, de préférence de manière réversible, dans le séparateur à cyclone et de préférence en correspondance et/ou à proximité de ledit échappement (3c).

4. Séparateur à cyclone selon la revendication 3, dans lequel l'élément filtrant (2) est un filtre de type « HEPA », au moins ladite partie filtrante coronale (2a) consistant au moins partiellement en un matériau en toile et/ou constitué de mailles et/ou en un matériau poreux et/ou en un matériau spongieux, ledit matériau étant supporté par ladite bride d'aboutement (2b).

5. Séparateur à cyclone selon l'une quelconque des revendications précédentes, dans lequel il se trouve également des moyens de contrainte, de préférence de type réversible ou amovible, actifs de manière fonctionnelle entre le corps de contenance (3a) et au moins la bride d'aboutement (2b) de l'élément filtrant (2) .

6. Séparateur à cyclone selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens d'induction de vortacité (5) comprennent un nombre prédéterminé de canaux en forme d'hélice et/ou de spirale se prolongeant dans le corps de contenance (3a) vers un espace à l'intérieur du corps de contenance (3a) lui-même et adaptés pour intercepter ledit flux d'air comprenant des déchets et/ou des matériaux de rebut, lesdits canaux en forme

d'hélice et/ou de spirale définissant de préférence un parcours de traversée comprenant au moins un segment de spirale de l'entrée (3b) vers l'échappement (3c).

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7. Séparateur à cyclone selon l'une quelconque des revendications précédentes, dans lequel lesdits canaux en forme d'hélice et/ou de spirale sont adaptés pour intercepter le flux d'air comprenant des déchets et/ou des matériaux de rebut en amont de l'élément filtrant (2) et de préférence pour le diriger vers ce dernier dans les conditions de fonctionnement du dispositif d'aspiration (1). 10
8. Séparateur à cyclone selon l'une quelconque des revendications précédentes, dans lequel se trouve également un cylindre de séparation (6) monté coaxialement dans le corps principal (3a) et circonscrit au moins à la partie filtrante (2a) de l'élément filtrant (2), les moyens d'induction de vorticité (5) étant montés sur ledit cylindre de séparation (6). 15 20

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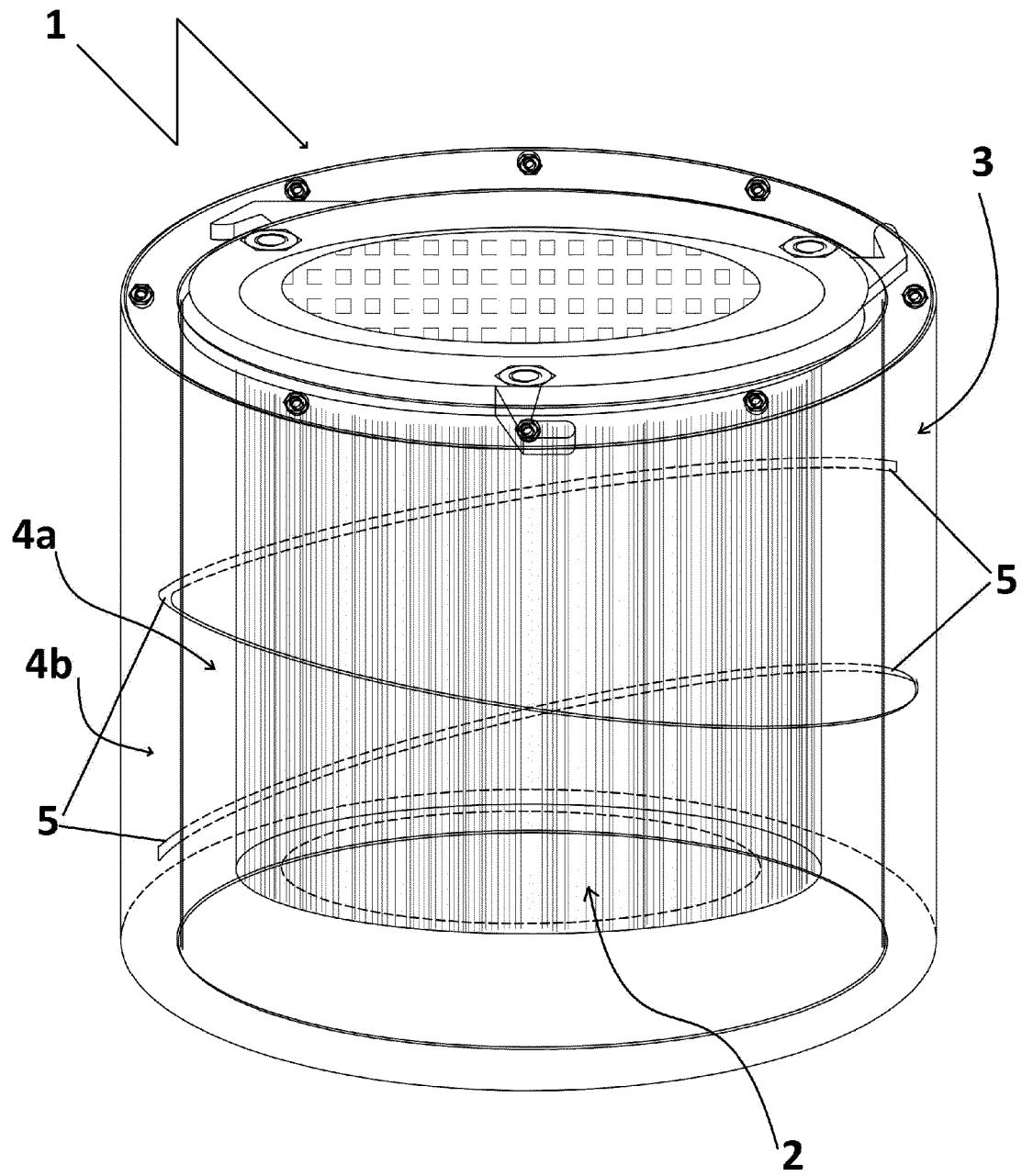


FIG. 1

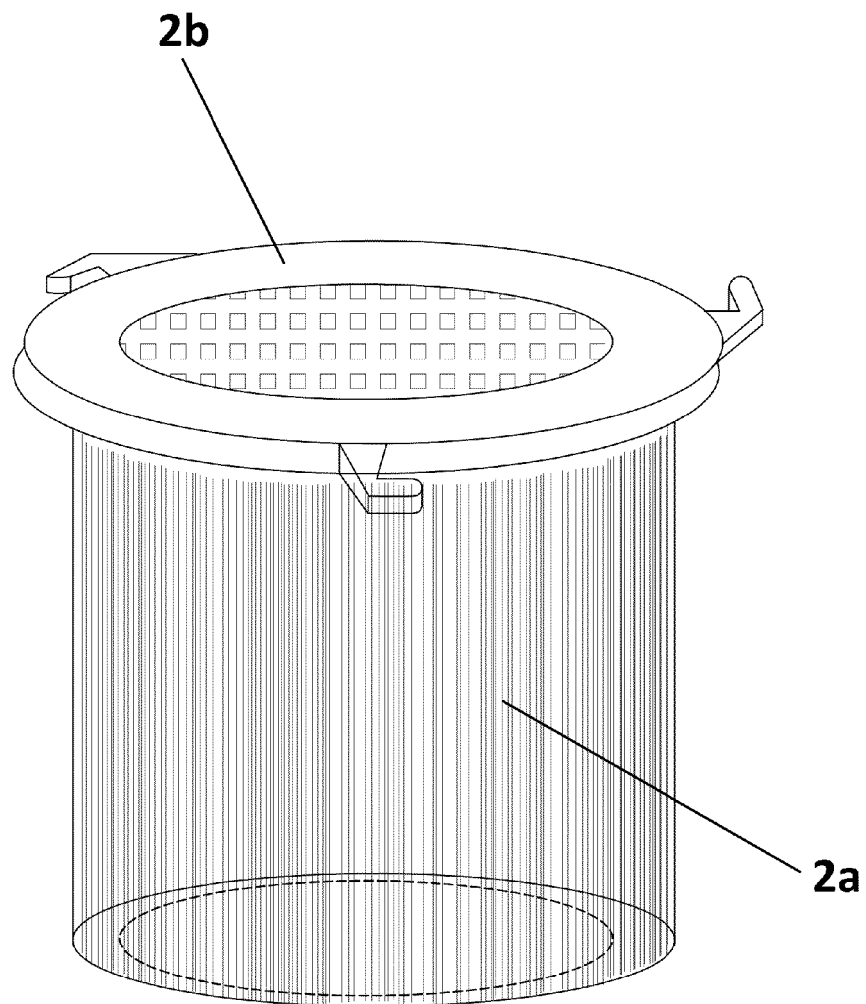
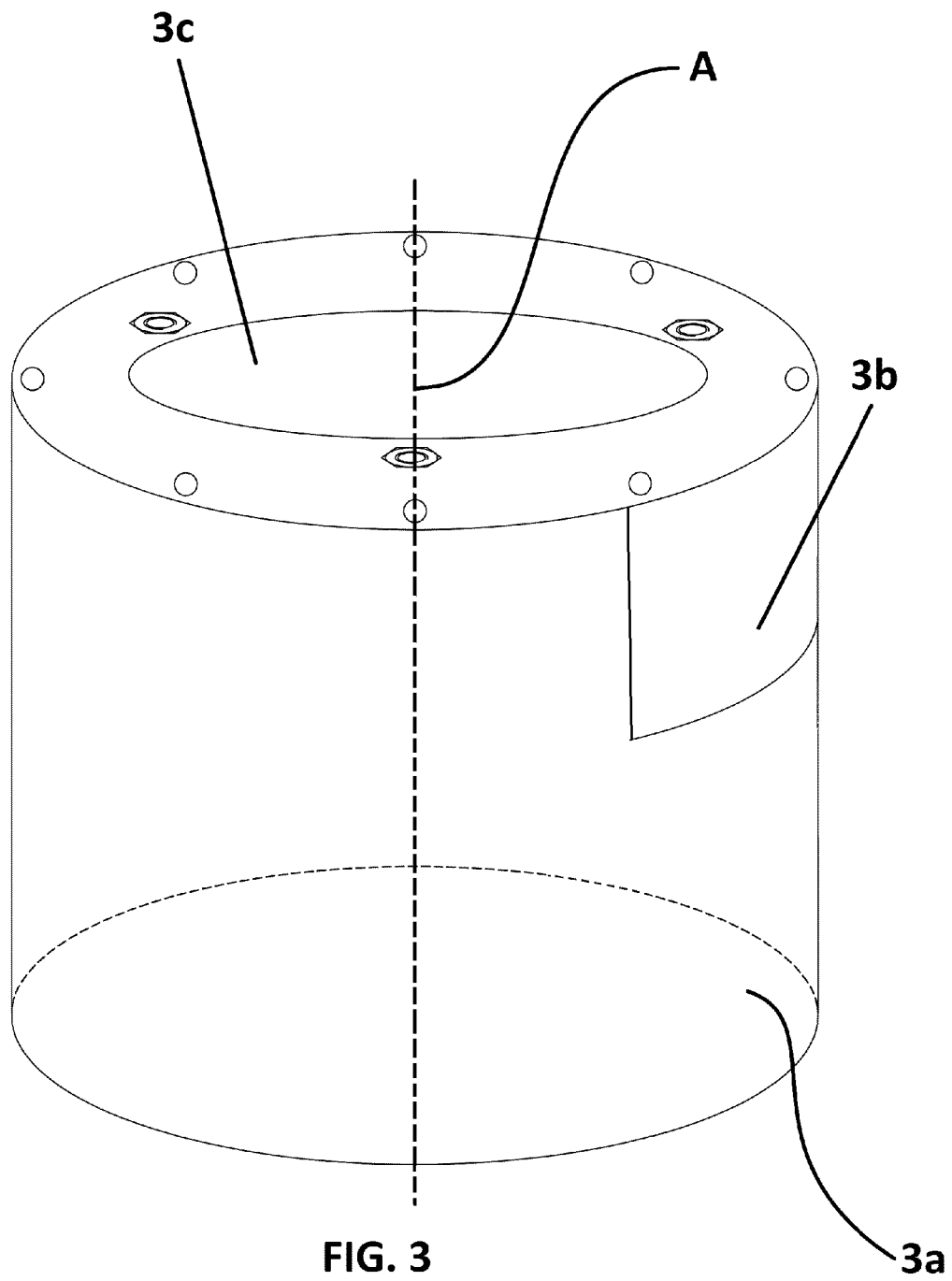


FIG. 2



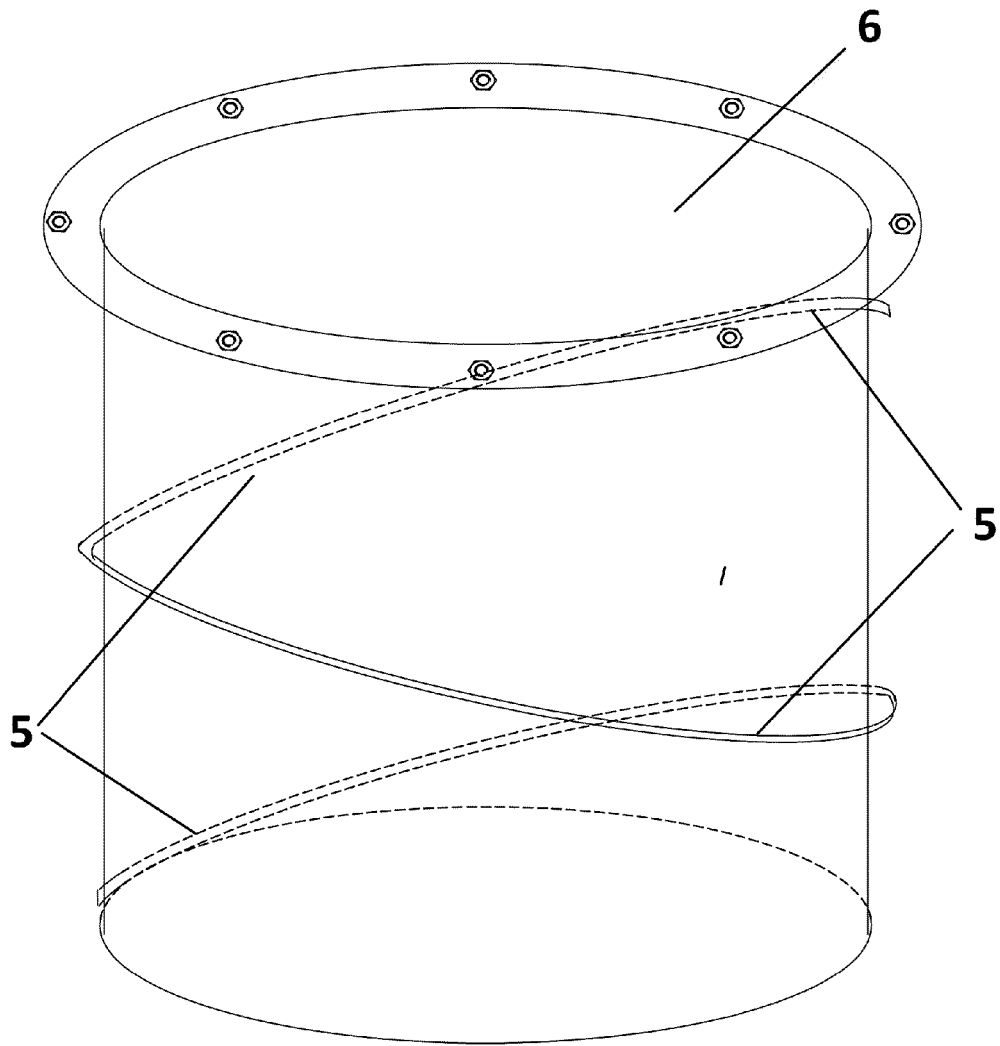


FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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