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(54) Benævnelse: **FORSTØVNINGSDYSE TIL APPARAT TIL DESINFEKTION AF OVERFLADER FRA LUFTEN**

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The present patent application claims the priority of French patent application FR 17/70945 filed on the date of 8 September 2017.

The present invention relates to the field of disinfecting an environment aerially. It is known in this field to nebulise a treatment product, such as a biocide product, by mixing it with a propellant air in order to diffuse it in fine droplets into the environment, in order to treat the surfaces of the latter.

It is known for that to use an apparatus 20, such as that illustrated in figure 1, comprising a tank 21 of treatment product, a transport means, comprising for example, a pump 22, and a pipe 25 (or 4) of this product to a nozzle 24 (or 1) and a motorised fan 23 capable of blowing air to said nozzle 24. The function of the nozzle 24 is to nebulise the treatment product, to mix it with the propellant air and to allow the diffusion of the air/product mixture to the environment to be treated.

Such as illustrated in figures 2 and 3, such a nebulisation nozzle 1 is a part substantially revolving about an axis 2, comprising a substantially cylindrical chamber 3, the axis of which coincides with the axis 2. The treatment product arrives in the nozzle 1 through a pipe 4. This pipe opens into the bottom 5 of the chamber 3, preferably at the centre of said bottom 5. The nozzle 1 also comprises an air inlet 6. This air inlet 6 receives air coming from the motorised fan. It is circular around the periphery of the chamber 3 in order to allow the air to penetrate into the chamber 3. Vanes 7 are arranged between the air inlet 6 and the chamber 3 in order to guide the airflow. The nozzle 1 also comprises a substantially conical diffuser 8 opening outwards, the axis of which is aligned with the axis 2 of the nozzle 1. This diffuser 8 is attached to the chamber 3 on the opposite side of the bottom 5. According to the prior art, such as more specifically illustrated in figures 2 and 3, the vanes 7 are flat and substantially radial relative to the axis 2.

Such a nozzle 1 allows to nebulise the treatment product and to diffuse it into an environment. However, a grain size analysis of the flow exiting such a nozzle 1 shows a size spectrum of droplets, such as illustrated in figure 4, very wide and very irregular, which can be damaging in terms of effectiveness of disinfection. Document GB859114 describes another example of a nozzle for nebulising a liquid.

Also, the apparatus 20 and/or the nozzle 1 must be improved in order to homogenise the size of the droplets, to reduce the size spectrum of the droplets, in order to improve the effectiveness of the disinfection.

The present invention overcomes these different disadvantages and proposes, according to a first aim, a nebulisation nozzle for an apparatus for surface disinfection by air, substantially revolving about an axis, comprising a substantially cylindrical chamber the axis of which coincides with the axis of the nozzle, a pipe opening into the bottom of the chamber, preferably at the centre of said bottom, capable of supplying a treatment product, an air inlet circumventing the periphery of the chamber, vanes arranged between the air inlet and the chamber and a substantially conical diffuser opening outwards, the axis of which is aligned with the axis of the nozzle and attached to the chamber on the opposite side of the bottom where the vanes are curved.

According to another characteristic, the vanes are parallel to the axis of the nozzle and equally angularly distributed around the axis of the nozzle.

According to another characteristic, the concavity of the curvature of the vanes is directed inwards of the nozzle.

According to another characteristic, the vanes have a spiral shape initiated on a circle centred on the axis of the nozzle.

According to another characteristic, the spiral is of logarithmic type.

According to another characteristic, the number of vanes is between 3 and 10, and preferably equal to 5.

According to another characteristic, the diffuser has a rounded fillet on its internal trailing edge.

According to another characteristic, the diffuser comprises, away from the chamber, a first cone, a second cone with a larger diameter and a step between the two cones.

According to another characteristic, the step has a rounded fillet.

A second aim is based on a apparatus for surface disinfection by air comprising a tank of treatment product, a transport means, comprising for example, a pump, and a pipe of this product to a nozzle and a motorised fan capable of blowing air to said nozzle, which nozzle is such as described above and which nozzle is comprised in this disinfection apparatus.

A third and last aim of the invention is based on a use of a nozzle such as described above for the surface disinfection by the nebulisation of a treatment product.

Other characteristics, details and advantages of the invention will emerge more clearly from the detailed description given below for information relative to the drawings, wherein:

- figure 1, already described, shows an apparatus for surface disinfection by air,
- figures 2 and 3, already described, show a nozzle according to the prior art, respectively as a profile cross-sectional view and as a front view,
- figure 4, already described, shows the grain size analysis of the jet obtained by means of the nozzle of figures 2 and 3,
- figures 5 and 6 show a nozzle according to a first embodiment of the invention, respectively as a profile cross-sectional view and as a front view,
- figure 7 shows the grain size analysis of the jet obtained by means of the nozzle of figures 5 and 6,
- figures 8 and 9 show a nozzle according to another embodiment of the invention, respectively as a profile cross-sectional view and as a front view,
- figures 10 and 11 show a nozzle, also according to another embodiment of the invention, respectively as a profile cross-sectional view and as a front view.

According to a first characteristic of the invention, more specifically illustrated in figures 5 and 6, a nozzle is, at all points, identical to a nozzle of the prior art such as illustrated in figures 2 and 3. It is distinguished and is characterised however in that the vanes 7 are curved. This curvature advantageously makes it possible to put the air entering into the chamber 3 in a circular movement according to a vortex. This vortex consequently has a better nebulisation of treatment product which leads to a better homogeneity of the droplets with a smaller spectrum. This is particularly visible in figure 7, which illustrates the grain size analysis of the jet obtained by means of the nozzle of figures 5 and 6 comprising curved vanes 7. The grain size analysis is presented in the form of a spectrum featuring the diameter of the droplets in abscissa, expressed in microns, and the frequency in ordinate, expressed as a percentage, for the bar graph, and the cumulated volume in ordinate, expressed as a percentage, for the continuous curve. It can thus be observed, by comparing the spectrum of figure 4, corresponding to a nozzle according to the prior art, to the spectrum shown in figure 7, corresponding to a nozzle according to the invention, that the distribution of the droplets shows a better regularity, with a substantially Gaussian spectrum and particularly showing an advantageously much more reduced extent. Such a restricted extent spectrum allows to improve the controlling

of the diffusion cone. The distribution of droplets also advantageously has an average diameter which is a lot smaller, which also favours the nebulisation.

According to another characteristic, the vanes 7 are parallel to the axis 2 of the nozzle 1. They are also advantageously equally angularly distributed about the axis 2 of the nozzle 1.

In order to optimise the vortex effect obtained due to the curvature of the vanes 7, this curvature is the same for all the vanes 7 and is such that its concavity copes with the inside of the nozzle 1.

According to a preferred embodiment, the curve of the vanes 7 has a spiral shape. In order to leave a part of the chamber 3 free, the vanes 7 start on a circle 9 centred on the axis 2 of the nozzle 1.

According to a more preferable embodiment, said spiral is of logarithmic type.

The number of vanes can be any number. According to a preferred embodiment, it is between 3 and 10. According to a more preferable embodiment, it is equal to 5.

It has been seen that the diffuser 8 had a conical shape. With an internal trailing edge of the standard diffuser 8, it is observed on the end of the diffuser 8, an accumulation of droplets of significant size. These droplets do not appear on the spectrum, as they are stopped before crossing the measuring instrument. However, this phenomenon can be damaging in that it constitutes a waste of treatment product which is not truly useful, since not diffused.

In order to remove this damaging effect, the diffuser has a fillet 10 on its internal trailing edge. This fillet 10 is preferably round, with a concavity facing the outside of the cone.

Such a modification of the diffuser 8 does not substantially modify the grain size spectrum. The nozzle illustrated in figures 8 and 9 thus conserves the advantages provided by the invention.

According to another characteristic, more specifically illustrated in figures 10 and 11, the diffuser 8 comprises, away from the chamber 2, a first cone 11, and second cone 12 with a larger diameter and a step 13 between the two cones 11, 12.

Such an arrangement advantageously allows to shorten the cone length, reduce the length of the first cone 11, potentially in contact with the flow diffused, and thus allows to reduce friction between the diffused mixture and the diffuser 8. The second cone 12 contributes, advantageously without contact, to protecting the diffused flow.

The step 13 advantageously has, for the same reasons as above, a rounded fillet, similar to the fillet 10.

Such a modification of the diffuser 8 does not substantially modify the grain size spectrum. The nozzle illustrated in figures 10 and 11 thus conserves the advantages provided by the invention.

Patentkrav

1. Forstøvningsdyse (1) til et apparat til overfladedesinfektion ad luftvejen, i det væsentlige ved rotation om en akse (2), omfattende et i det væsentlige cylindrisk kammer (3), hvis akse falder sammen med dysens (1) akse (2), en rørledning (4), der udmunder i bunden (5) af kammeret (3), fortrinsvis i centrum af bunden (5), som er egnet til at tilføre et behandlingsmiddel, en luftindgang (6), der omgiver kammerets (3) periferi, blade (7) anbragt mellem luftindgangen (6) og kammeret (3) og en i det væsentlige konisk udadtil åben spreder (8), hvis akse er på linie med dysens (1) akse (2), og som er sammenføjet med kammeret (3) på den over for bunden *(5)* liggende side, **kendetegnet ved, at** bladene (7) er krumme.

2. Dyse (1) ifølge krav **1,** hvor bladene (7) er parallelle med dysens (1) akse (2) og fordelt i samme vinkelafstand om dysens (1) akse (2).

3. Dyse (1) ifølge et hvilket som helst af kravene **1** eller **2,** hvor bladets (7) konkave side vender mod dysens (1) indre.

4. Dyse (1) ifølge et hvilket som helst af kravene **1** til **3,** hvor bladene (7) har en spiralform med udgangspunkt på en om dysens (1) akse (2) centreret cirkel (9).

5. Dyse (1) ifølge krav **4,** hvor spiralen er af logaritmisk type.

6. Dyse (1) ifølge et hvilket som helst af kravene **1** til **5,** hvor antallet af blade ligger mellem 3 og 10 og fortrinsvis er lig med 5.

7. Dyse (1) ifølge et hvilket som helst af kravene **1** til **6,** hvor sprederen (8) har har en afrundet kant (10) på indersiden af udgangsåbningen.

8. Dyse (1) ifølge et hvilket som helst af kravene **1** til **7,** hvor sprederen (8) i retning fra kammeret (3) omfatter en første kegle (11), en anden kegle (12) med større diameter og en forskydning (13) mellem de to kegler (11, 12).

9. Dyse (1) ifølge krav **8,** hvor forskydningen (13) har en afrundet kant.

10. Apparat til overfladedesinfektion ad luftvejen omfattende en forrådsbeholder (21) til behandlingsmiddel, et transportmiddel (22) og en rørledning (25) til dette middel til en dyse (1) og en motordreven blæser (23), som er egnet til at blæse luft til dysen (1) **kendetegnet ved, at** dysen (1) er som defineret i et hvilket som helst af kravene **1** til **9**, og **at** dysen (1) indgår i desinfektionsapparatet.

11. Anvendelse af en dyse (1) som defineret i et hvilket som helst af kravene **1** til **9** til overfladedesinfektion ved forstøvning af et behandlingsmiddel.

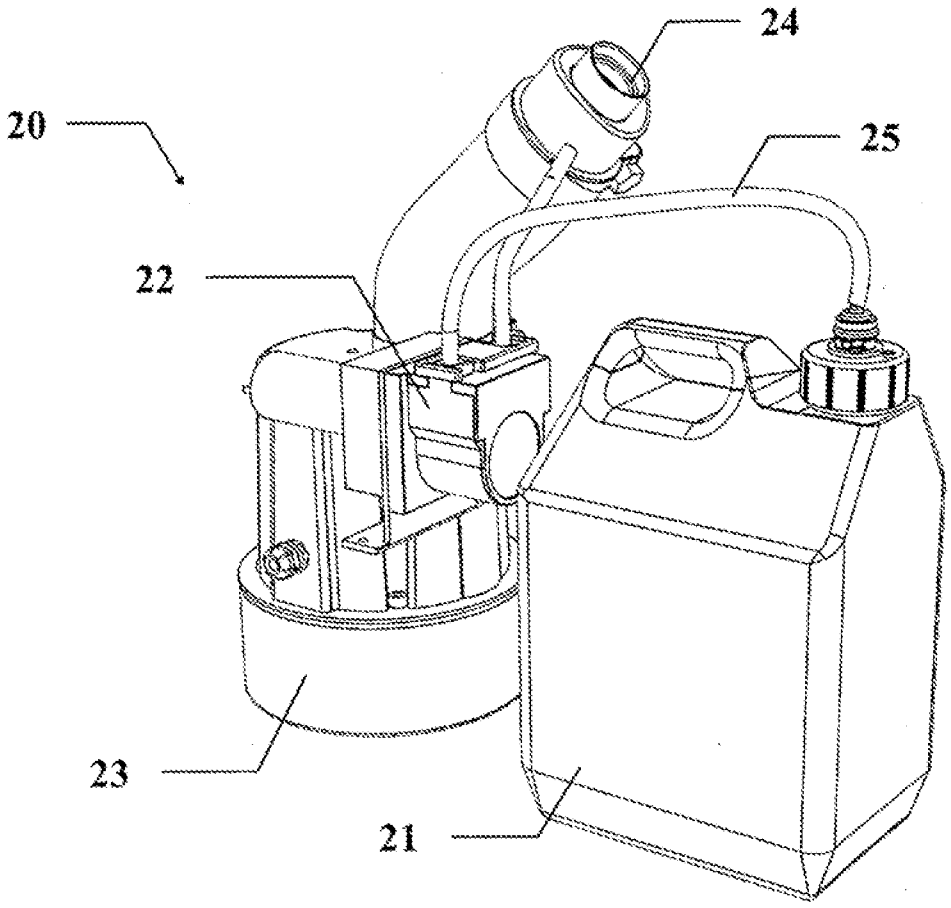

FIG. 1

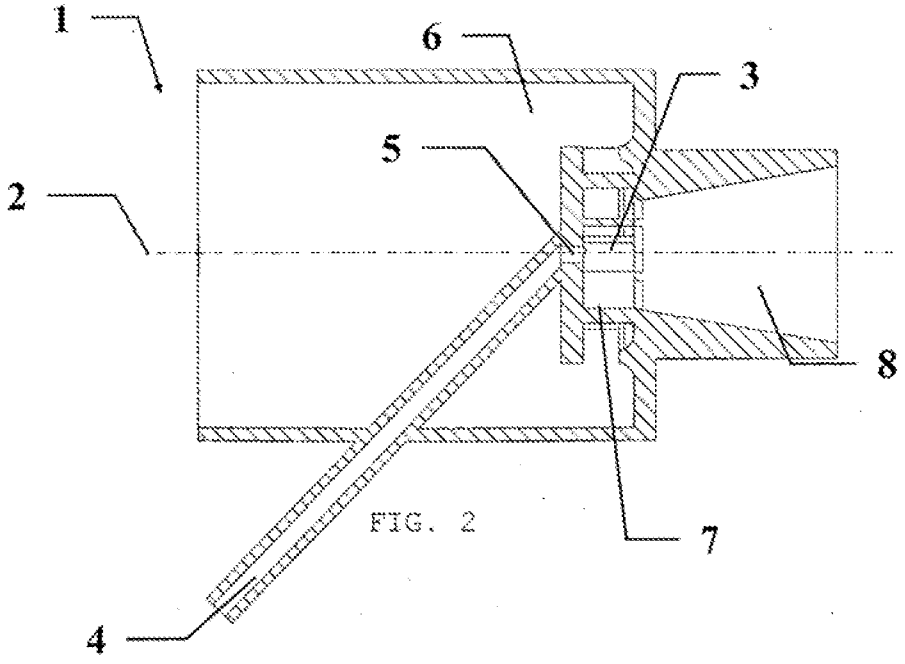

FIG. 2

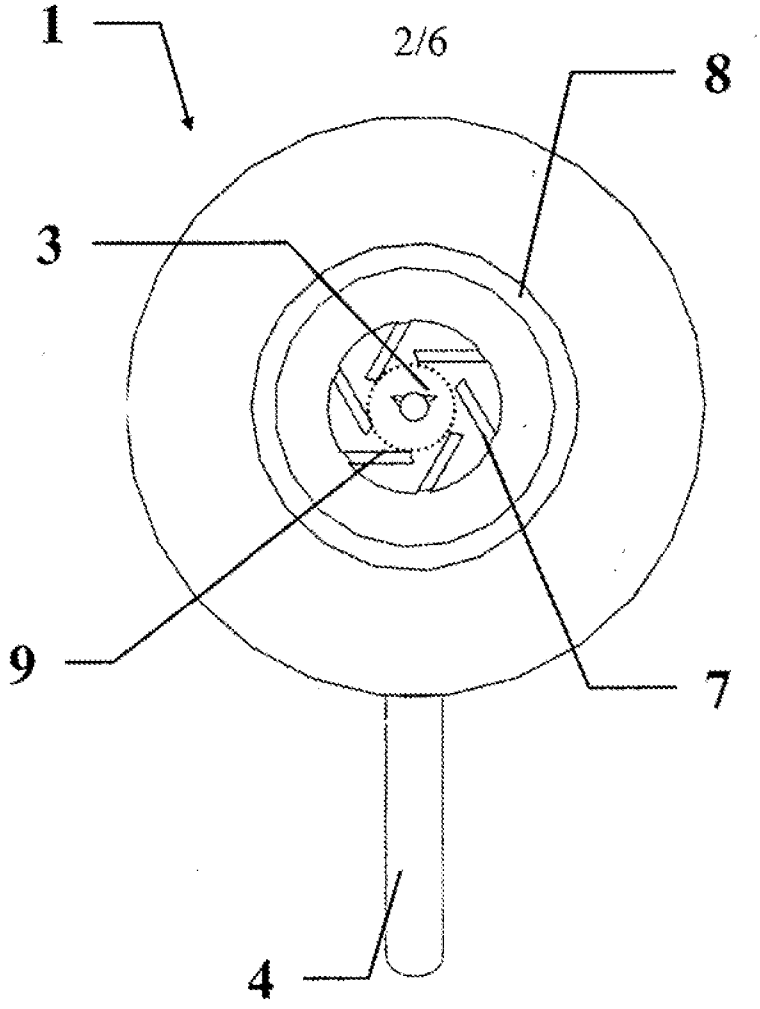

FIG. 3

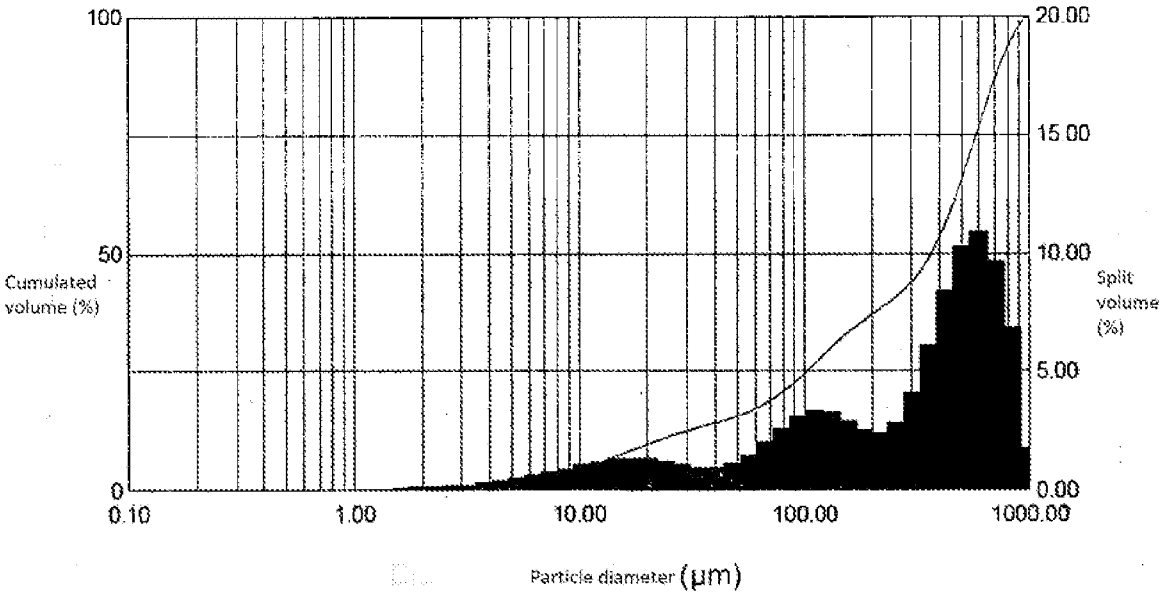
100
50
0
Cumulated volume (%)
20.00
15.00
10.00
5.00
0.00
Split volume (%)
0.10
1.00
10.00
100.00
1000.00
Particle diameter (µm)

FIG. 4

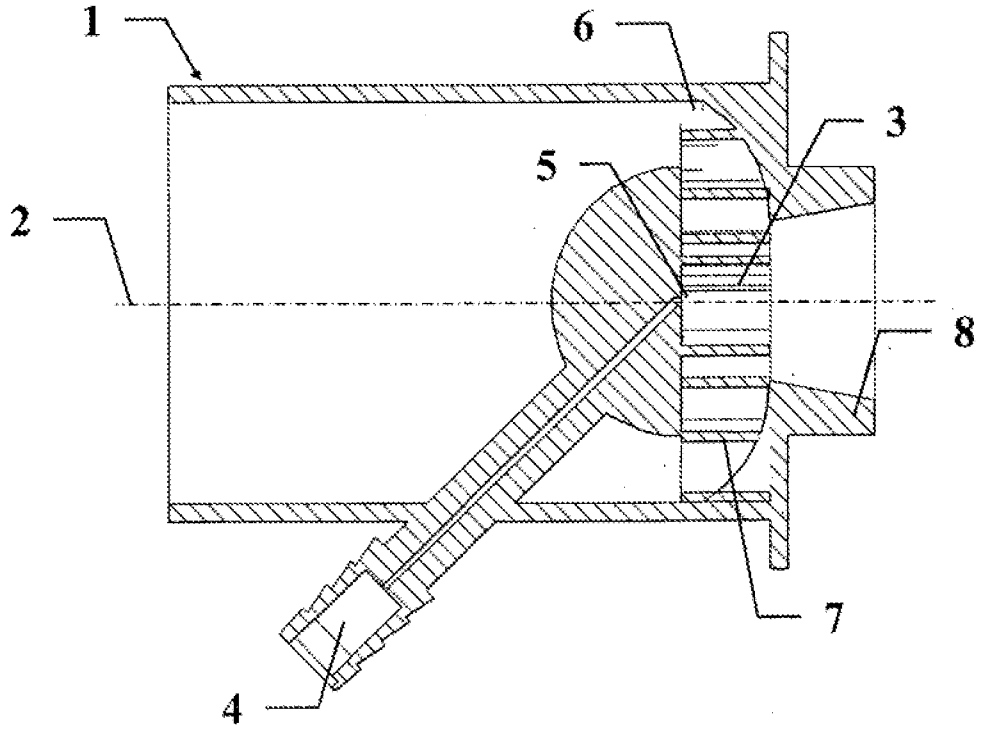

FIG. 5

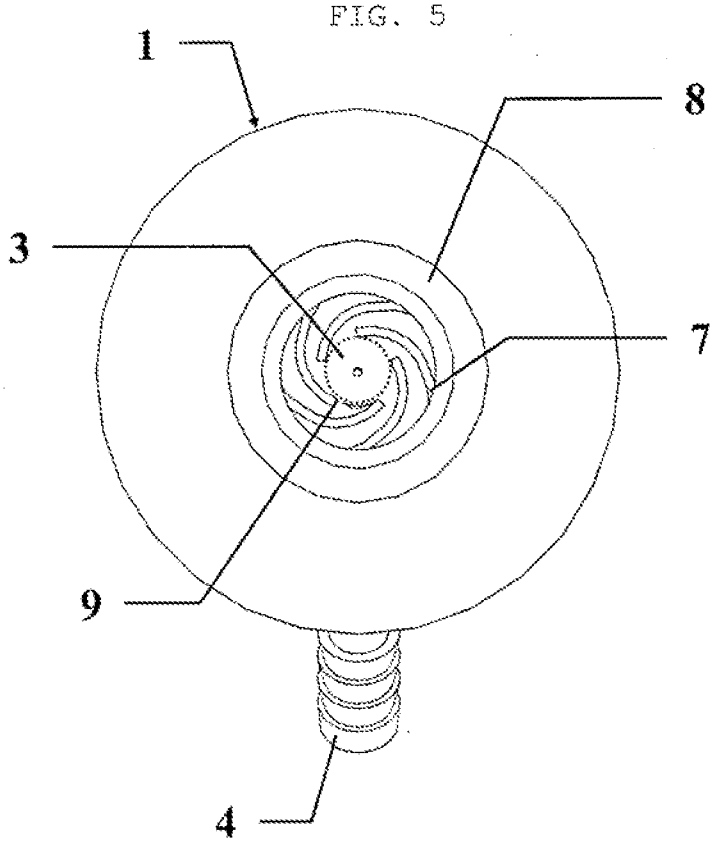

FIG. 6

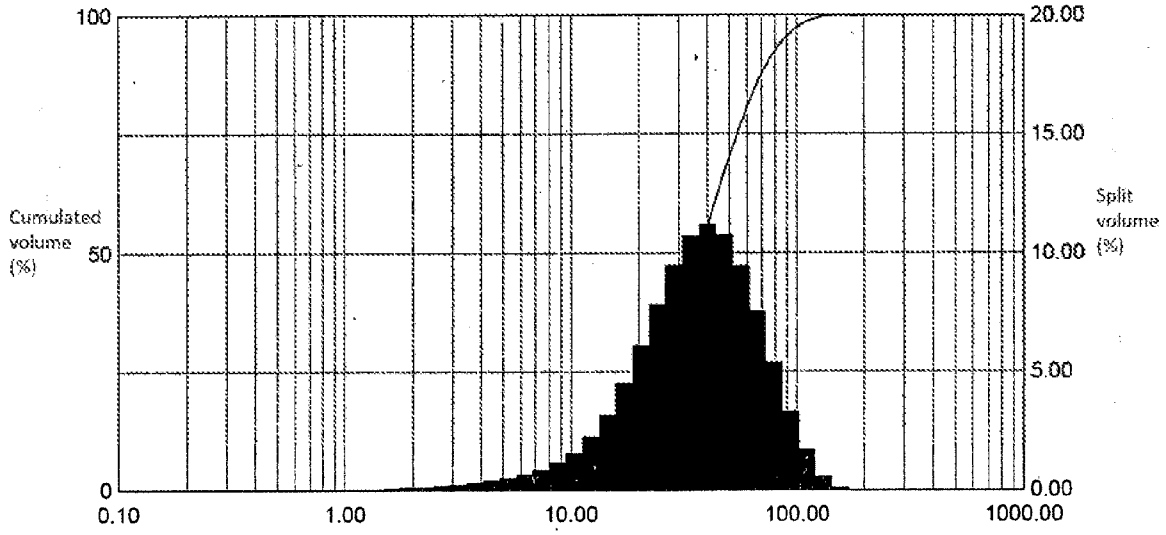
100
50
0
Cumulated volume (%)
20.00
15.00
10.00
5.00
0.00
Split volume (%)
0.10
1.00
10.00
100.00
1000.00

FIG. 7

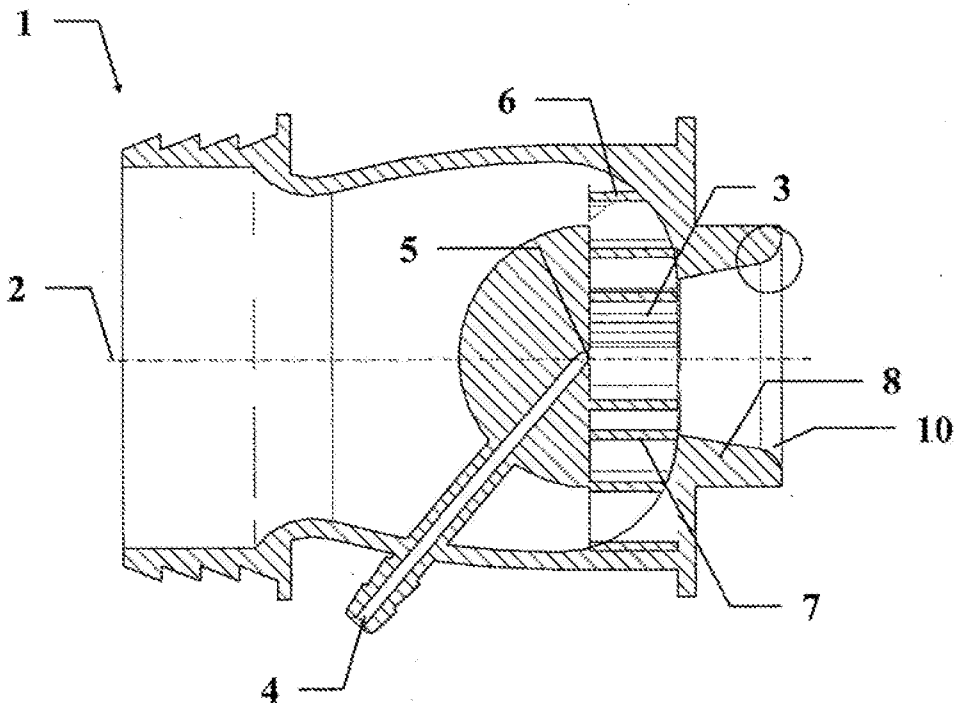
1
6
3
5
2
8
10
7
4

FIG. 8

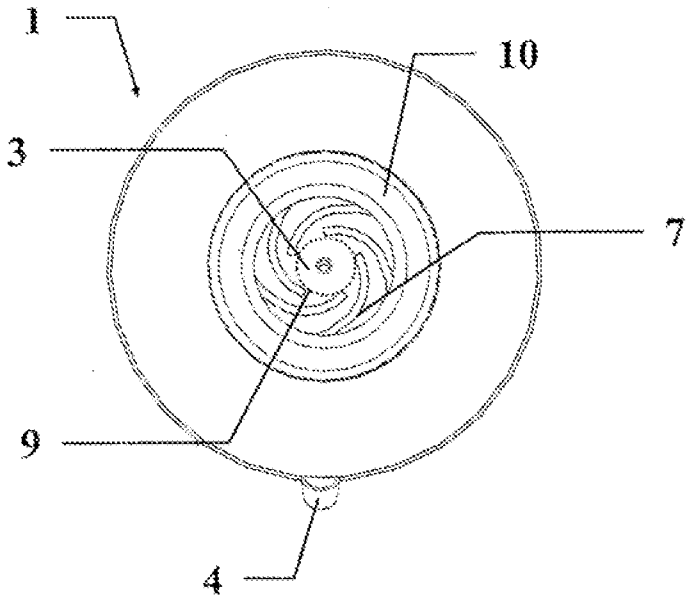

FIG. 9

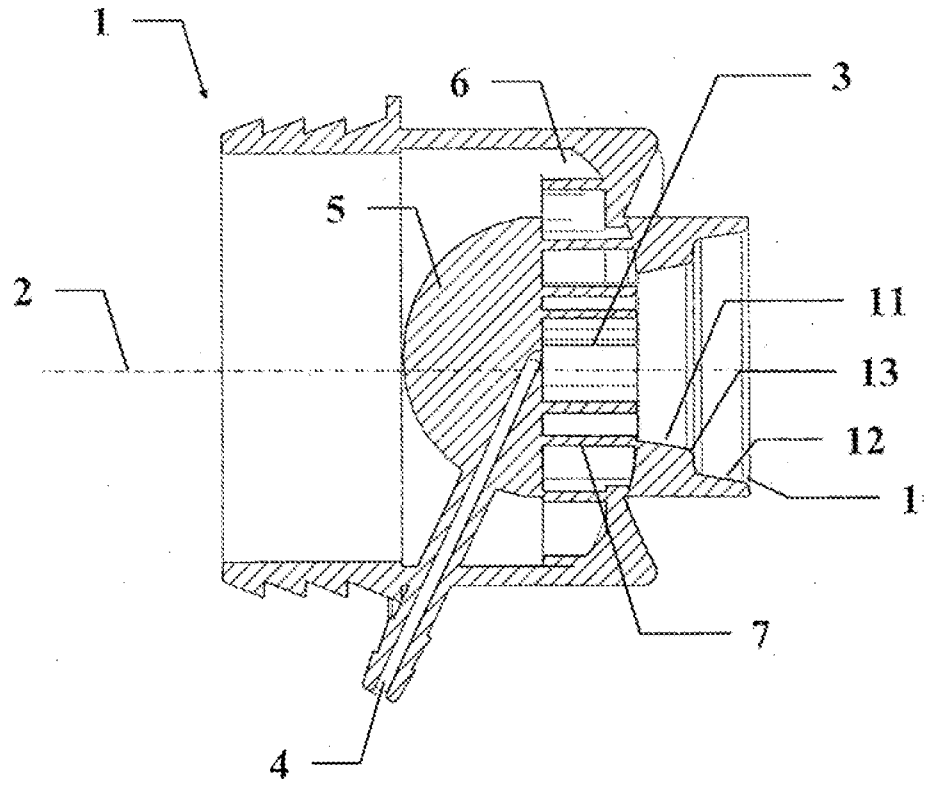

FIG. 10

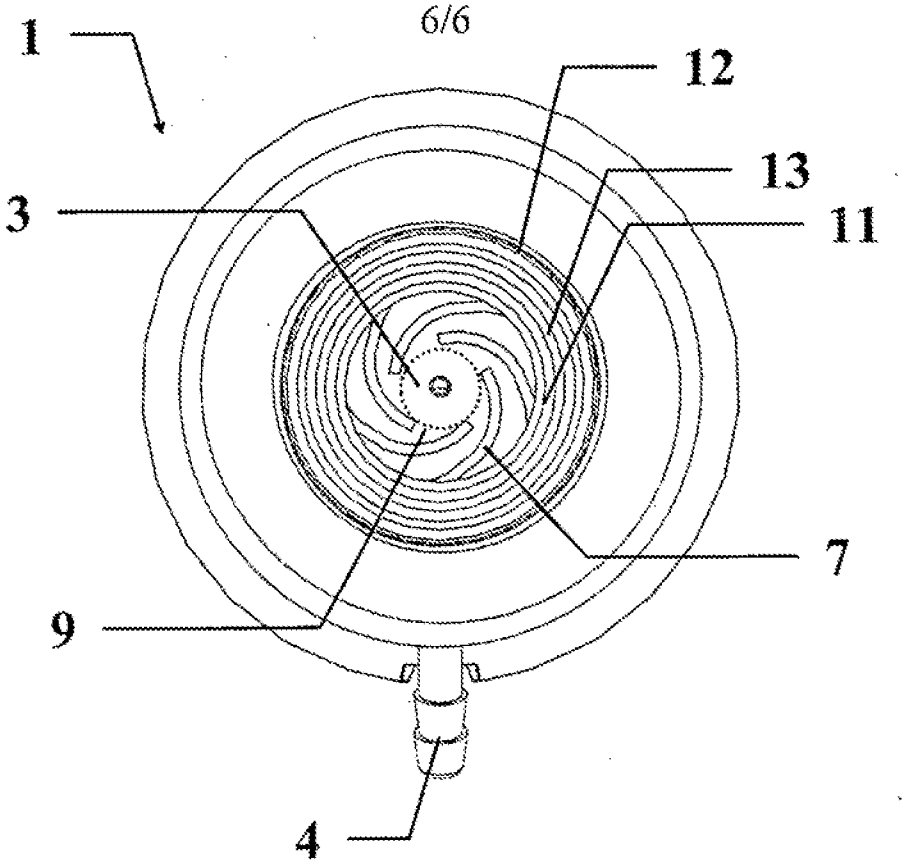

FIG. 11