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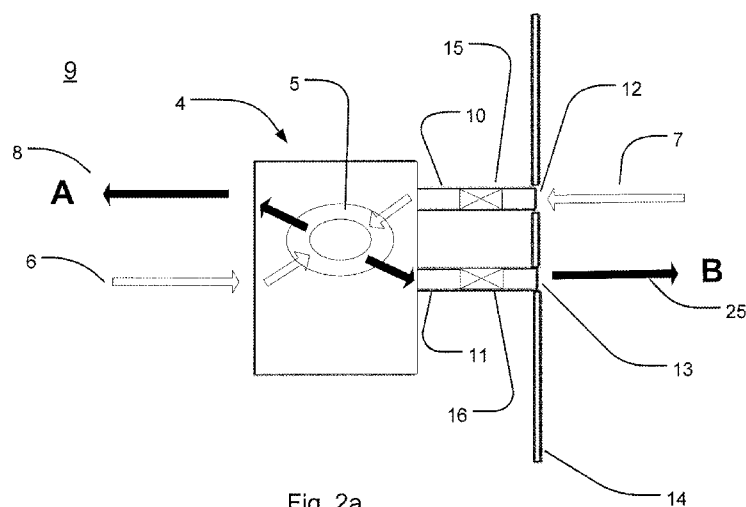


Fig. 2a

(57) Abstract: The invention relates to a wind power plant that comprises a dehumidifying device arranged in the interior of said plant and at least one valve. The dehumidifying device is in fluid communication with the interior of the plant via an air inlet and an air outlet. The dehumidifying device is in fluid communication with the ambient air via at least one air conduit. At least one valve is arranged to prevent ambient air to enter the interior of the plant via the dehumidifying device when said dehumidifying device is not in operation. The invention also relates to a method of operating the wind power plant.

A DEVICE AND A METHOD FOR IMPROVED DEHUMIDIFICATION OF A WIND POWER PLANT

Technical field

The present invention generally relates to a device and a method for
5 reducing operation time of a dehumidifying device being part of a wind power
plant. More specifically, present invention relates to the wind power plant
comprising the dehumidifying device arranged in the interior of said plant and
at least one valve, said dehumidifying device being in fluid communication
with the interior of the plant via an air inlet and an air outlet and said
10 dehumidifying device being in fluid communication with the ambient air via at
least one air conduit.

Background of the invention

15 Considerable amounts of moist stemming from the wind tower
fundament may end up in the interior of a wind power plant. Furthermore,
when the wind power plant has been at standstill for a prolonged time period,
its interior, both nacelle as well as the tower, may become cold and humid.
Especially, in the areas having high day-time temperatures and low night-time
20 temperatures, the humid air may make all interior surfaces of the wind power
plant components moist. Further on, in locations with high environmental
humidity, such as off-shore locations, significant amounts of moisture may get
inside the wind power plant. This increased air humidity of the interior of the
wind power plant may have detrimental effect on the plant performance. In
25 order to avoid above-mentioned, undesired effects, it is essential to ensure
that the wind power plant interior is kept dry at all times. This is typically
achieved by means of a dehumidifying device positioned either in the tower or
in the nacelle. Said device may be designed in different ways. In one version
it may comprise a ventilator and an adsorption medium. Its operation is
30 normally controlled by a humidity measuring device (hygrostat) that measures
relative air humidity in the interior of the plant and when needed starts the
operation of the dehumidifying device. Typically, the dehumidifying device is
in contact with the ambient air via air pipes.

Due to the shape of the tower, tall and relatively narrow, a natural air movement, known as stack effect, occurs in the tower. In short, due to differences in air density at the bottom and the top of the tower, said differences resulting from temperature differences as well as differences in the humidity level, the air moves upwards in the wind tower. This, in turn, gives rise to a pressure difference between the ambient air and the air located in the bottom section of the tower where the dehumidifying device is located. As a rule, the cabinet of the dehumidifying device is not tightly sealed relative the wind tower and a certain amount of air already in the cabinet is allowed to seep into the tower when the dehumidifying device is not in operation. As stated above, the dehumidifying device is connected to the ambient air by means of air pipes. Direct fluid communication between the tower interior and the ambient air via the dehumidifying device is thereby established. Due to the above-stated pressure difference between the ambient air and the tower air, said pressure difference being a consequence of the stack effect in the tower, ambient air is sucked into the wind tower when the dehumidifying device is not in operation. As this ambient air generally is relatively humid it contributes to an increased relative humidity of the interior of the wind tower. This increased relative air humidity in the tower is detected by a hydrostat that subsequently starts the operation of the dehumidifying device. Given the considerable amounts of humid ambient air (up to 50 m³/h) that may enter the tower in a manner described above, the dehumidifying device is in operation for a significant time period. This reduces its useful life and incurs additional service costs.

Furthermore, ventilation system in the nacelle may cause a substantial pressure difference between the ambient air and the nacelle air. This may result in humid, ambient air entering the nacelle via the dehumidifying device thus entailing the start of operation of the dehumidifying device. The above-stated drawbacks may thereby arise.

Summary of the invention

In view of the above, an objective of the present invention is to provide a wind power plant with a significantly reduced operation time of a dehumidifying device.

Another objective is to provide a wind power plant that requires reduced maintenance.

Yet another objective of the present invention is to provide an improved method for operating such a wind power plant comprising a dehumidifying device.

5 In view of at least these objects, the invention relates to a wind power plant comprising a dehumidifying device arranged in the interior of said plant and at least one valve, said dehumidifying device being in fluid communication with the interior of the plant via an air inlet and an air outlet and said dehumidifying device being in fluid communication with the ambient
10 air via at least one air conduit, wherein the at least one valve is arranged to prevent ambient air to enter the interior of the plant via the dehumidifying device when said dehumidifying device is not in operation.

By providing at least one valve it is achieved that the relatively humid
15 ambient air may be prevented from entering the interior of the plant via the dehumidifying device. This may be achieved by closing the at least one valve when the dehumidifying device is not in operation. In addition, said dehumidifying device, when being in operation, inherently does not allow wet ambient air to enter the interior of the plant without being dehumidified. In this
20 way, the negative impact of the stack effect on the overall power plant performance may be significantly reduced. Analogously, the overall power plant performance, in conjunction with the detrimental effect of the ventilation system in the nacelle on the relative humidity of the nacelle air, may be improved. Consequently, the relative humidity of the air inside the plant may
25 remain substantially unchanged for prolonged time periods. Thus, the need for frequently starting the operation of the dehumidifying device in order to dehumidify the air already in the tower or in the nacelle is significantly reduced. This reduced use of the dehumidifying device will induce less wear on said device and accordingly prolong its useful life. Further, by reducing
30 operation time of the dehumidifying device, the frequency of required service calls related to said device will be greatly reduced.

The dehumidifying device may be arranged in a tower of the wind power plant. In this way, the negative impact of the stack effect on the overall power
35 plant performance may be significantly reduced.

Each valve may be a one-way valve. In this way, a restriction of the air flow direction may be achieved. As an advantage, a simplified valve design may be obtained.

- 5 Each valve may be spring loaded. In this way, thanks to the spring force exerted on the valve, the opening of said valve may be rendered more difficult. This may be useful when the dehumidifying device is not in operation and the ambient air has a slightly higher pressure than the air inside the plant. In these circumstances, due to the fact that the valve is spring loaded, the
10 humid ambient air is not allowed to enter into the wind power plant via the dehumidifying device.

- Each valve may be weight loaded. In this way, thanks to the weight exerted on the valve, the opening of said valve may be rendered more
15 difficult. This may be useful when the dehumidifying device is not in operation and the ambient air has a slightly higher pressure than the air inside the plant. In these circumstances, due to the fact that the valve is weight loaded, the humid ambient air is not allowed to enter into the plant via the dehumidifying device.

- 20 A connecting piece may be attached to at least one of said air inlet and said air outlet, wherein one of the at least one valve may be arranged in each connecting piece. In this way, the humid ambient air may be prevented from entering into the interior of the plant by means of said at least one valve. This connecting piece, comprising the valve, may be installed on the existing
25 dehumidifying devices lacking means to prevent ambient air from entering the interior of the plant. As an advantage the integration of said valve into existing designs of the dehumidifying devices is facilitated. Thus, rather small system modifications are sufficient in order to significantly reduce the required operating time for the dehumidifying device, thereby significantly improving
30 the performance of the entire system.

- Operation of said valve may be controlled by a humidity measuring device arranged to measure humidity in the interior of the plant. The humidity measuring device (hydrostat) may be arranged to constantly monitor the
35 relative air humidity inside the plant. Once the relative air humidity inside the plant exceeds a preset value, approximately 60 %, the hydrostat starts the operation of the dehumidifying device. This, in turn, may open said valve thus

allowing ambient air to enter into the dehumidifying device. At the same time, wet air originating from the dehumidifying device may be exhausted from the dehumidifying device. Advantageously, this arrangement ensures that the relative humidity in the interior of the plant is kept low.

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Said dehumidifying device may be in fluid communication with the ambient air via one air conduit only, wherein said valve may be arranged in the air conduit. In this way, humid, ambient air may be prevented by means of said valve to enter the dehumidifying device and subsequently the interior of the plant when the dehumidifying device is not in operation. Consequently, the relative humidity of the air inside the plant may remain substantially unchanged for prolonged time periods. Thus, the dehumidifying device does not need to be frequently started in order to reduce the relative air humidity in the plant. This may significantly prolong the useful life of the dehumidifying device.

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Said dehumidifying device may be in fluid communication with the ambient air via one air conduit only, wherein said air conduit is connected with the dehumidifying device via an air outlet and wherein said valve is arranged in the air outlet. In this way, humid, ambient air may be prevented by means of said valve to enter the dehumidifying device and subsequently the interior of the plant, when the dehumidifying device is not in operation. Consequently, the relative humidity of the air inside the plant may remain substantially unchanged for prolonged time periods. Thus, the dehumidifying device does not need to be frequently started in order to reduce the relative air humidity in the plant. This may significantly prolong the useful life of the dehumidifying device.

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Said dehumidifying device may be in fluid communication with the ambient air via one air conduit only, wherein a first valve may be arranged in a plant air inlet and a second valve may be arranged in a dehumidified air outlet of the dehumidifying device. In this way, humid, ambient air may be prevented by means of said valves to enter the interior of the plant, when the dehumidifying device is not in operation. Consequently, the relative humidity of the air inside the plant may remain substantially unchanged for prolonged time periods. Thus, the dehumidifying device does not need to be frequently

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started in order to reduce the relative air humidity in the plant. This may significantly prolong the useful life of the dehumidifying device.

5 The number of air conduits via which said dehumidifying device is in fluid communication with the ambient air may be two, wherein a valve is arranged in each air conduit. In this way, humid, ambient air may be prevented by means of said valves to enter the dehumidifying device and subsequently the interior of the plant, when the dehumidifying device is not in operation. Consequently, the relative humidity of the air inside the plant may
10 remain substantially unchanged for prolonged time periods. Thus, the dehumidifying device does not need to be frequently started in order to reduce the relative air humidity in the plant. This may significantly prolong the useful life of the dehumidifying device.

15 The number of air conduits via which said dehumidifying device is in fluid communication with the ambient air may be two, wherein said air conduits are connected with the dehumidifying device via an ambient air inlet and a wet air outlet, respectively, and wherein a first valve may be arranged in the ambient air inlet and a second valve may be arranged in the wet air
20 outlet. In this way, humid, ambient air may be prevented by means of said valves to enter the dehumidifying device and subsequently the interior of the plant, when the dehumidifying device is not in operation. Consequently, the relative humidity of the air inside the plant may remain substantially unchanged for prolonged time periods. Thus, the dehumidifying device does
25 not need to be frequently started in order to reduce the relative air humidity in the plant. This may significantly prolong the useful life of the dehumidifying device.

 The number of air conduits via which said dehumidifying device is in
30 fluid communication with the ambient air may be two and a first valve may be arranged in the plant air inlet and a second valve may be arranged in the dehumidified air outlet of the dehumidifying device. In this way, humid, ambient air may be prevented by means of said valves to enter the interior of the plant, when the dehumidifying device is not in operation. Consequently,
35 the relative humidity of the air inside the plant may remain substantially unchanged for prolonged time periods. Thus, the dehumidifying device does not need to be frequently started in order to reduce the relative air humidity in

the plant. This may significantly prolong the useful life of the dehumidifying device.

According to a second aspect, the invention relates to a method for
5 operating a wind power plant, said wind power plant comprising a
dehumidifying device being in fluid communication with the interior of the
plant as well as the ambient air, said method comprising preventing by
operation of at least one valve air from entering the interior of the plant via
said dehumidifying device when said dehumidifying device is not in operation.

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The method allows, as has been discussed above in view of the wind
power plant, that the relatively humid ambient air may be prevented from
entering the interior of the plant via the dehumidifying device. In this way, the
negative impact of the stack effect on the overall power plant performance
15 may be significantly reduced. Analogously, the overall power plant
performance, in conjunction with the detrimental effect of the ventilation
system in the nacelle on the relative humidity of the nacelle air, may be
improved. Consequently, the relative humidity of the air inside the plant may
remain substantially unchanged for prolonged time periods. This may make it
20 possible to start the operation of the dehumidifying device less frequently,
reducing thereby the amount of wear induced on said device prolonging
accordingly its useful life.

Furthermore, the inventive method may make it possible to reduce
frequency of required service calls related to said device, thereby improving
25 the overall performance of the wind power plant.

In one embodiment said method is comprising measuring relative air
humidity of the air in the interior of the plant, establishing whether the
measured relative air humidity value exceeds a preset relative air humidity
30 value, opening, if said measured value exceeds said preset value, each valve
and thereby allowing ambient air and plant air to enter the dehumidifying
device, dehumidifying plant air in the dehumidifying device and releasing the
dehumidified plant air into the interior of the plant.

As has been discussed above, in view of the wind power plant, the
35 operation of the dehumidifying device may be conditioned by the measured
relative air humidity value exceeding the preset relative air humidity value.
These conditions may only be fulfilled after a fairly long time period as

undesired intake of the humid ambient air into the plant is significantly reduced. The undesired intake is prevented by means of operation of said at least one valve. When the relative humidity reaches undesirably high levels the dehumidifying device is activated. Accordingly, plant air is allowed to enter
5 into said device, dehumidified therein and subsequently released into the interior of the plant. Consequently, the air in the plant is kept relatively dry at all times and optimal performance of the wind power plant may be achieved.

In a further embodiment, said method is comprising mixing plant air
10 with the ambient air entering the dehumidifying device, dehumidifying the mixture of plant air and ambient air in the dehumidifying device and releasing the dehumidified mixture of plant air and ambient air into the interior of the plant.

As has been discussed above, in view of the wind power plant, the
15 dehumidifying device may be arranged to simultaneously suck in both plant air as well as ambient air. Plant and ambient air are thereafter mixed, dehumidified adequately and released into the interior of the plant. This may contribute to a more efficient operation of the dehumidifying device.

20 Other objectives, features and advantages of the present invention will appear from the following detailed disclosure, from the attached claims as well as from the drawings.

Generally, all terms used in the claims are to be interpreted according
25 to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the [element, device, component, means, step, etc]" are to be interpreted openly as referring to at least one instance of said element, device, component, means, step, etc., unless explicitly stated otherwise. The steps of any method disclosed herein do not
30 have to be performed in the exact order disclosed, unless explicitly stated.

Brief description of the drawings

The above, as well as additional objects, features and advantages of
35 the present invention, will be better understood through the following illustrative and non-limiting detailed description of preferred embodiments of

the present invention, with reference to the appended drawings, where the same reference numerals will be used for similar elements, wherein:

Fig 1 shows a schematic cross section of a wind power plant;

5 Fig 2a schematically illustrates airflows to, from and within a dehumidifying device in conjunction with a wind power plant according to a first embodiment of the present invention;

Fig 2b highly schematically illustrates main components of the dehumidifying device according to the first embodiment of the present
10 invention;

Fig 3 schematically illustrates airflows to, from and within a dehumidifying device in conjunction with a wind power plant according to another embodiment of the present invention;

Fig 4 shows highly schematically a front view of the dehumidifying
15 device;

Fig 5a is a schematic close-up of a connecting piece comprising a valve in conjunction with a dehumidifying device according to one embodiment of the present invention;

Fig 5b is a schematic close-up of a connecting piece comprising a valve
20 in conjunction with a dehumidifying device according to another embodiment of the present invention.

Detailed description of preferred embodiments

25 Fig 1 shows a schematic cross section of a wind power plant 1. A nacelle 2 is arranged on top of a tower 3. A dehumidifying device 4 is placed few meters above the ground level in the interior of the wind tower 3. The dehumidifying device 4 may be placed anywhere in the interior of the wind power plant 1. Consequently, the dehumidifying device 4 may be placed
30 higher up in the tower 3 or even in the nacelle 2. The dehumidifying device 4, the purpose of which is to remove excess moisture from the plant air, is arranged to receive the plant air, which in some case may be mixed with ambient air, and to discharge, after dehumidification, a major part of the air into the interior of the wind power plant.

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Fig 2a schematically illustrates airflows to, from and within a dehumidifying device 4 in conjunction with a wind power plant according to a

first embodiment of the present invention while fig 2b highly schematically illustrates main components of the dehumidifying device 4 according to the first embodiment of the present invention.

5 The main parts of a dehumidifying system comprising the dehumidifying device 4 itself will be briefly described in the following.

The dehumidifying device 4 is arranged to receive the mixture comprising tower air 6 and ambient air 7 for dehumidification and to discharge a major part of this mixture as dehumidified air 8 into the interior of the tower 9.

10 In accordance with the invention, the dehumidifying device 4 is in fluid communication with the surroundings via at least one air conduit, and in the shown embodiment, the system comprises two air conduits 10, 11 extending between two apertures 12, 13 in the tower wall 14 and the dehumidifying device 4. At least one valve is arranged to prevent ambient air 7 to enter the
15 interior of the tower 9 via the dehumidifying device 4 when it is not in operation, and in said first embodiment of the invention, this is achieved by using two valves 15, 16 that are arranged one in each of said air conduits 10, 11. The valves 15, 16 will be more thoroughly described below with reference to fig 5a and 5b.

20 The dehumidifying device 4 has a casing 17 that is provided with vent holes 18, 19. These vent holes may, inter alia, act as an inlet for tower air 6 and ambient air 7 and as an outlet for the dehumidified air 8.

The dehumidifying device 4 comprises a ventilator 20 that is arranged in the interior of said dehumidifying device 4. The ventilator 20 may be operated
25 in such a manner that the required amount of air already in the tower 6 is introduced into the dehumidifying device 4. In addition to tower air 6, the ventilator 20 may be arranged to, at the same time, draw in relatively humid ambient air 7 via the ambient air supply conduit 10 to be introduced into said dehumidifying device 4. The dehumidifying device 4 further comprises a
30 dehumidifying means 5, highly schematically disclosed in fig 2a, the purpose of which is to dehumidify the air introduced into the device. The dehumidifying means 5 is positioned downstream of the ventilator 20. The ventilator 20 may also be used for discharging wet air 25 into the ambient air via the wet air exhaust conduit 11.

35 A humidity measuring device (not shown) may be comprised in the dehumidifying system. The humidity measuring device measures the relative humidity of the tower air 6 and sends signals to the dehumidifying device 4

when relative humidity exceeds a preset value, thereby controlling the operation of said dehumidifying device 4.

5 The valves 15, 16 may, as an alternative, be positioned in the two tower wall apertures 12, 13. Furthermore, they may also be located at the inlet for tower air 21 and at the outlet for dehumidified air 22, respectively. The dehumidifying device 4 with the ancillary air conduits and apertures may be positioned either in any part of the tower or in the nacelle of the wind power plant.

10 There are different ways to dehumidify air already in the device 4. By way of example, dehumidification by means of adsorption using a suitable medium such as silica gel, or dehumidification by means of condensation, using cooling coils, may be used in the dehumidifying device 4. Obviously, other dehumidifying methods may be used.

15 A connecting piece that will be more thoroughly described below with reference to fig 5a and 5b may be attached to the vent holes.

During operation of the dehumidifying device, all valves are open and ambient air 7 is drawn in through a first of said air conduits constituting an ambient air intake conduit 10, whereupon the ambient air 7 is mixed with the tower air 6, whereupon the mixture is fed by means of the ventilator 20 to the dehumidifying means 5. As stated above, a major part (A) of the mixture of the ambient air 7 and the tower air 6 is dehumidified and subsequently exhausted as dehumidified air 8 into the interior of the tower 9. A portion (B) is separated from the mixture of the ambient air 7 and the tower air 6 whereupon moisture is transferred thereto. Subsequently, this portion (B) is exhausted into the ambient air via a second of said air conduits. The air conduit constitutes a wet air exhaust conduit 11 that discharges into the aperture 13 in the tower wall 14.

As has been explained above, the inventive dehumidifying system comprises a humidity measuring device (not shown) which is arranged to constantly monitor the relative air humidity in the interior of the tower 9. This humidity measuring device (hygrostat) is typically positioned either close to the dehumidifying device 4 or on a slightly elevated platform. Once the relative air humidity inside the tower exceeds a preset value, normally approximately 60 %, the hygrostat is arranged to start the operation of the ventilator 20 being part of the dehumidifying device 4. The ventilator 20 is activated creating thereby low pressure area on the device 4 side of the valve 15 positioned in the ambient air supply conduit 10. As a result, the valve 15 is

opened and ambient air 7 may get into the dehumidifying device 4. At the same time, the required amount of the air already in the tower 6 is introduced into the dehumidifying device 4. These two air streams are brought together downstream of the ventilator 20. Typically, the ventilator 20 draws in at least 80 % tower air 6 and max 20 % ambient air 7. A major portion of the mixture of ambient and tower air (A) is adequately dehumidified in the dehumidifying means and normally has, after dehumidification, a relative air humidity of approximately 35 %, being well below the preset value. This adequately dehumidified air is subsequently released into the interior of the tower 9. The remaining portion of the air mixture (B), to which at least part of the moisture originating from the tower air has been transferred, has a significantly increased humidity and is exhausted into the ambient air via an air conduit 11 that discharges into the aperture 13 in the tower wall 14. Typically, about 35 m³/h of ambient air needs to be introduced into the tower while at the same time approximately 30 m³/h of wet air needs to be exhausted from the tower in order to maintain pressure equilibrium between ambient air and the air inside the tower.

By arranging valves 15, 16 in the air conduits 10, 11 the humid, ambient air 7 is prevented from entering the dehumidifying device 4 and subsequently the interior of the wind tower 9, when the dehumidifying device 4 is not in operation. In this way, the negative impact of the stack effect on the overall power plant performance is significantly reduced and, consequently, the relative humidity of the air inside the tower may remain unchanged for prolonged time periods. Thus, the use of the dehumidifying device 4 may be substantially reduced. This may significantly prolong its useful life.

In another embodiment, related to the one disclosed in fig 2a, and schematically illustrated in fig 3, a dehumidifying device 4 is in fluid communication with ambient air via a single air conduit 26 extending between an aperture 27 in the tower wall 14 and the dehumidifying device 4. A reference is also made to the highly schematic drawing of the main components of the dehumidifying device illustrated in fig 2b.

The dehumidifying device 4 is arranged to receive air already in the tower for dehumidification and to discharge a major part of this air as dehumidified air 8 into the interior of the tower 9.

Said dehumidifying device 4 has a casing 17 provided with vent holes 18, 19, 30. These vent holes may, inter alia, act as an inlet 21 for tower air, an

outlet 22 for the dehumidified air and an inlet 30 for nacelle air 29. The dehumidifying device 4 comprises a ventilator 20 that is arranged at its interior. The ventilator 20 may be operated in such a manner that the required amount of air already in the tower 6 is introduced into the dehumidifying device 4. At the same time, nacelle air 29 is introduced into the dehumidifying device 4. The dehumidifying device further comprises a dehumidifying means 5, the purpose of which is to dehumidify the air that has entered the device 4. The dehumidifying means 5 is positioned downstream of the ventilator 20. A single air conduit 26 is used to exhaust the air discharged from the dehumidifying device 4 having a significantly increased humidity into ambient air via the aperture 27 in the tower wall, as indicated by means of the arrow 25. A valve 28 is arranged in the air conduit 26 with the purpose to prevent ambient air 6 from entering the interior of the wind tower 9 when dehumidifying device 4 is not in operation.

A humidity measuring device (not shown) may be comprised in the dehumidifying system. The humidity measuring device measures the relative humidity of the tower air 6 and sends signals to the dehumidifying device 4 when relative humidity exceeds a preset value controlling thereby the operation of said dehumidifying device 4.

The valve 28 may, as an alternative, be positioned in the aperture 27 in the tower wall. Alternatively, two valves may be located at the tower air inlet 21 into the dehumidifying device 4 and the dehumidified air outlet 22 respectively. As stated above, a variety of dehumidifying methods may be used. The nacelle air 29 is supplied from the nacelle (not shown) of the wind power plant as a consequence of the ventilator 20 action as well as relatively low pressure in the lower sections of the tower, this lower pressure being created by the wet air exhaust. This nacelle air 29 is sucked in via the nacelle air inlet 30.

By arranging the single valve 28 in the air conduit 26, the humid, ambient air is prevented from entering the dehumidifying device 4 and subsequently the interior of the wind tower 9, when the dehumidifying device 4 is not in operation. In addition to positive effects stated in connection with fig 2a and 2b, the use of a single valve simplifies the overall design of the dehumidification system.

Fig 4 shows highly schematically a front view of a dehumidifying device 4 according to one embodiment of the present invention. The dehumidifying device 4 comprises four vent holes, wherein the leftmost vent hole 31 is used for releasing the dehumidified tower air 8 into the interior of the tower, the rightmost vent hole 32 is used for exhausting the wet air 25 out into the ambient air and two vent holes 33, 34 positioned on the front surface of the dehumidifying device are used for intake into the device of tower air 6 and ambient air 7 respectively. In one embodiment, the vent hole 31 for releasing the dehumidified air 8 into the interior of the tower 9 and the vent hole 33 for intake into the dehumidifying device 4 of tower air 6 are provided with a one-way valve 35, 36 respectively. The purpose of these valves 35, 36 is to block the flow of the relatively humid ambient air 7 into the interior of the tower 9 when the dehumidifying device 4 is not in operation. To this end these valves 35, 36 are in closed position when the dehumidifying device 4 doesn't operate.

However, other alternatives, such as positioning valves on all four vent holes are equally envisageable. Furthermore, as has been described in fig 3, it is conceivable that the dehumidifying device 4 doesn't comprise an ambient air intake vent hole. The dehumidifying device 4 with the ancillary air conduits and apertures may be positioned either in any part of the tower or in the nacelle of the wind power plant.

General functioning principle of the dehumidifying device 4 has been described and shown in fig 2b to which reference is made.

By positioning valves 35, 36 directly on the dehumidifying device 4 ambient air 7 is efficiently prevented from entering into the interior of the tower 9. As a consequence, the relative humidity of the air inside the tower remains substantially unaffected for prolonged time periods.

Fig 5a and 5b are schematic cross sectional close-ups of connecting pieces 37 comprising valves in conjunction with a dehumidifying device 4 according to different embodiments of the present invention. Fig 5a shows a vent hole 34 in the form of an inlet for ambient air 7 to which a substantially cylindrical-shaped connecting piece 37 has been attached. A one-way valve 38 is positioned in the interior of the connecting piece 37. The connecting piece 37 has one end attached to the vent hole 34 and the other end constitutes ambient air inlet. Said valve is a butterfly valve having a plate 39. The valve plate 39 extends slantingly across the interior of the connecting

piece 37. Said plate 39 may be so orientated that it creates an acute angle α with a vertical reference 40. An adequately sized weight 43 is positioned on the valve plate 39. A pivot axis 42 of the valve plate 39 may be eccentrically arranged relative to the centre of the plate 39. Fig 5b shows a vent hole 34 in the form of an inlet for ambient air to which a substantially cylindrical-shaped connecting piece 37 has been attached. The plate 39 of the one-way valve 38 extends slantingly across the interior of the connecting piece 37. Additionally, said valve is spring loaded 41.

It is to be understood that connecting pieces may have different shapes and sizes. For instance, suitably orientated elbow-shaped or curved connecting pieces are conceivable. Said connecting pieces may be attached to other vent holes. Other valve types than butterfly valves may be used. The valve plate 39 may be arranged perpendicularly to the inner walls of the connecting piece 37 and its pivot axis 42 may intersect the centre of the plate. Furthermore, different types of springs as well as weights or any combination thereof may be used in order to load the valves.

The butterfly valve 38 is arranged in such a way that it, in closed position, completely blocks air flows in both directions. The valve remains in closed position as long as the dehumidifying device 4 is not in operation. Once the hydrostat starts, in accordance with fig 2a, the operation of the dehumidifying device 4 the ventilator (not shown) begins to simultaneously draw in ambient and tower air according to one embodiment of the present invention. This increased air flow will open the valves being part of the dehumidification system. In particular, the one-way valve 38, different embodiments of which are illustrated in fig 5a and 5b, will open. It is to be understood that, in conjunction with the dehumidifying device 4, valve opening triggered by the hydrostat signal to valve actuators or other devices that open said valves is equally envisageable.

Advantageously, due to impact of the suitably directed force exerted on the valve plate 39, the opening of said valve 38 may be rendered more difficult. Said force that is obtained by e.g. weight or spring loading the valve, schematically shown in fig 5a and 5b, renders the undesirable opening of the valve 38 more difficult. This is useful when the dehumidifying device 4 is not in operation and the ambient air may have a significantly higher pressure than the air inside the tower. In these circumstances, natural tendency of the humid ambient air is to enter into the tower, via the dehumidifying device 4, in order to equalise the pressures. However, due to the fact that the valve 38

may be adequately loaded, the humid ambient air is not allowed to enter into the tower via the dehumidifying device.

5 The invention has mainly been described above with reference to a few embodiments. However, as is readily appreciated by a person skilled in the art, other embodiments than the ones disclosed above are equally possible within the scope of the invention, as defined by the appended patent claims.

CLAIMS

1. A wind power plant comprising a dehumidifying device arranged in the interior of said plant and at least one valve, said dehumidifying device
5 being in fluid communication with the interior of the plant via an air inlet and an air outlet and said dehumidifying device being in fluid communication with the ambient air via at least one air conduit, wherein the at least one valve is arranged to prevent ambient air to enter the interior of the plant via the dehumidifying device when said dehumidifying device is not in
10 operation.

2. A wind power plant according to claim 1, wherein said dehumidifying device is arranged in a tower of the wind power plant.

15 3. A wind power plant according to any of the preceding claims, wherein each valve is a one-way valve.

20 4. A wind power plant according to any of the preceding claims, wherein each valve is spring loaded.

5. A wind power plant according to any of the preceding claims, wherein each valve is weight loaded

25 6. A wind power plant according to any of the preceding claims, wherein a connecting piece is attached to at least one of said air inlet and said air outlet, wherein one of the at least one valve is arranged in each connecting piece.

30 7. A wind power plant according to any of the preceding claims, wherein operation of said valve is controlled by a humidity measuring device arranged to measure humidity in the interior of the plant.

35 8. A wind power plant according to any of claims 1 to 7, wherein said dehumidifying device is in fluid communication with the ambient air via one air conduit only, wherein said valve is arranged in the air conduit.

9. A wind power plant according to any of claims 1 to 7, wherein said dehumidifying device is in fluid communication with the ambient air via one air

conduit only and wherein said air conduit is connected with the dehumidifying device via an air outlet and said valve is arranged in the air outlet.

5 10. A wind power plant according to any of claims 1 to 7, wherein said dehumidifying device is in fluid communication with the ambient air via one air conduit only and wherein a first valve is arranged in a plant air inlet and a second valve is arranged in a dehumidified air outlet of the dehumidifying device.

10 11. A wind power plant according to any of claims 1 to 7, in which the number of air conduits via which said dehumidifying device is in fluid communication with the ambient air is two and wherein a valve is arranged in each air conduit.

15 12. A wind power plant according to any of claims 1 to 7, in which the number of air conduits via which said dehumidifying device is in fluid communication with the ambient air is two and wherein said air conduits are connected with the dehumidifying device via an ambient air inlet and a wet air outlet, respectively, and wherein a first valve is arranged in the ambient air
20 inlet and a second valve is arranged in the wet air outlet.

 13. A wind power plant according to any of claims 1 to 7, in which the number of air conduits via which said dehumidifying device is in fluid communication with the ambient air is two and wherein a first valve is
25 arranged in the plant air inlet and a second valve is arranged in the dehumidified air outlet of the dehumidifying device.

 14. A method of operating a wind power plant comprising a dehumidifying device being in fluid communication with the interior of the
30 plant as well as with the ambient air, said method comprising

 preventing ambient air, by operation of at least one valve, from entering the interior of the plant via said dehumidifying device when said dehumidifying device is not in operation.

35 15. A method of operating a wind power plant according to claim 14, said method comprising the steps of

- measuring relative humidity of the air in the interior of the plant,
establishing whether the measured relative air humidity value
exceeds a preset relative air humidity value,
opening, if said measured value exceeds said preset value, each
5 valve and thereby allowing ambient air and plant air to enter the
dehumidifying device,
dehumidifying plant air in the dehumidifying device, and
releasing the dehumidified plant air into the interior of the plant.
- 10 16. A method of operating a wind power plant according to claim 15,
said method comprising the steps of
- mixing plant air with the ambient air entering the dehumidifying
device,
15 dehumidifying the mixture of plant air and ambient air in the
dehumidifying device, and
releasing the dehumidified mixture of plant air and ambient air into
the interior of the plant.

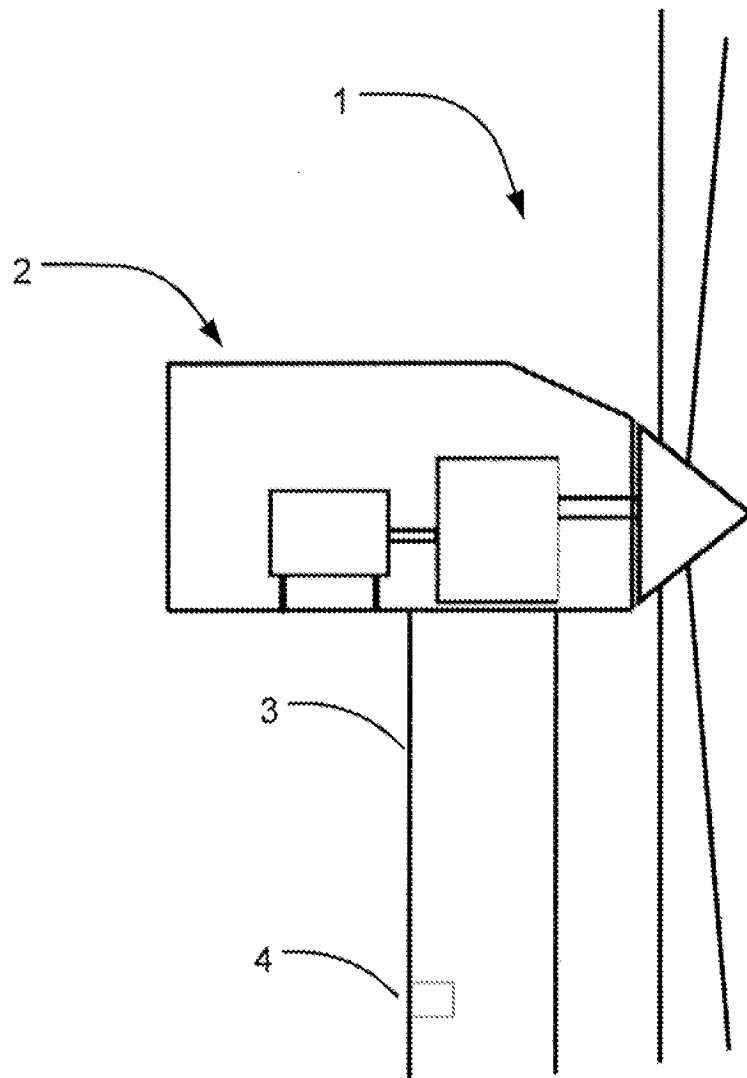
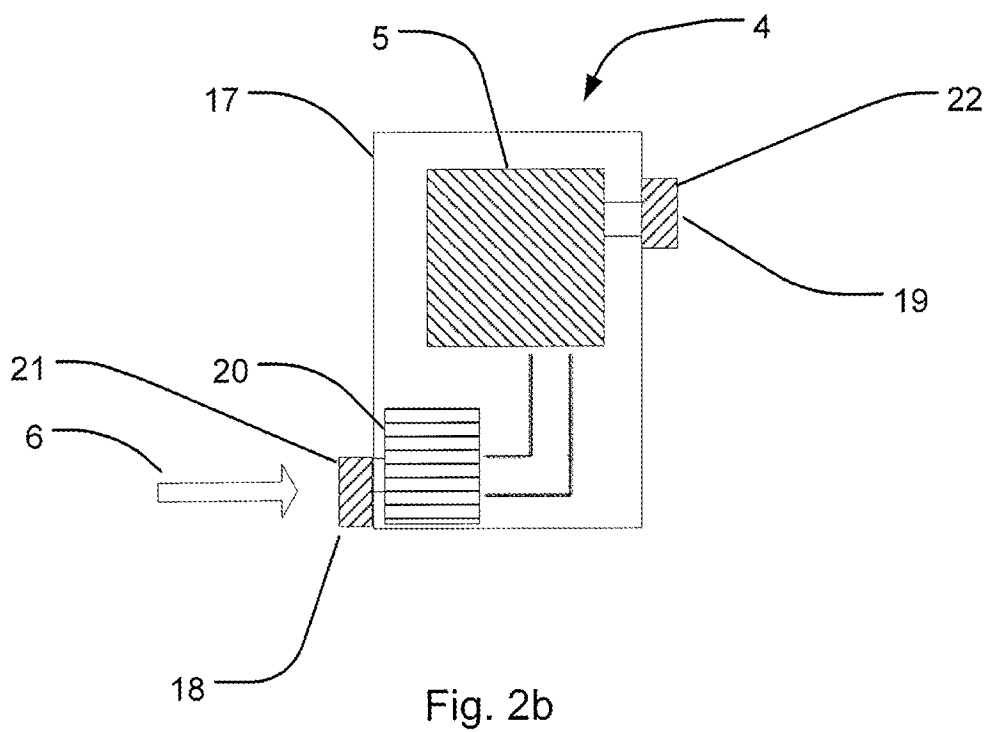
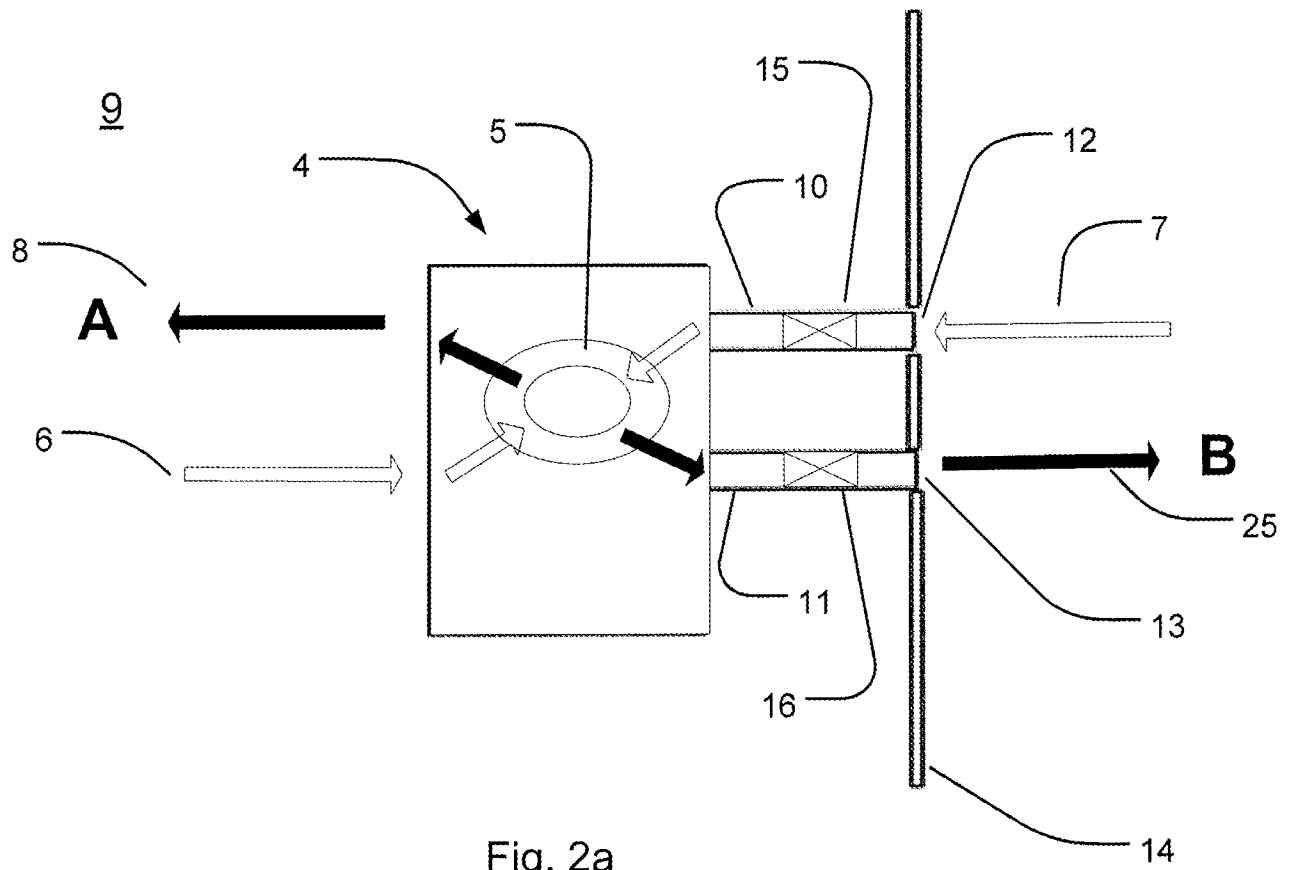


Fig. 1



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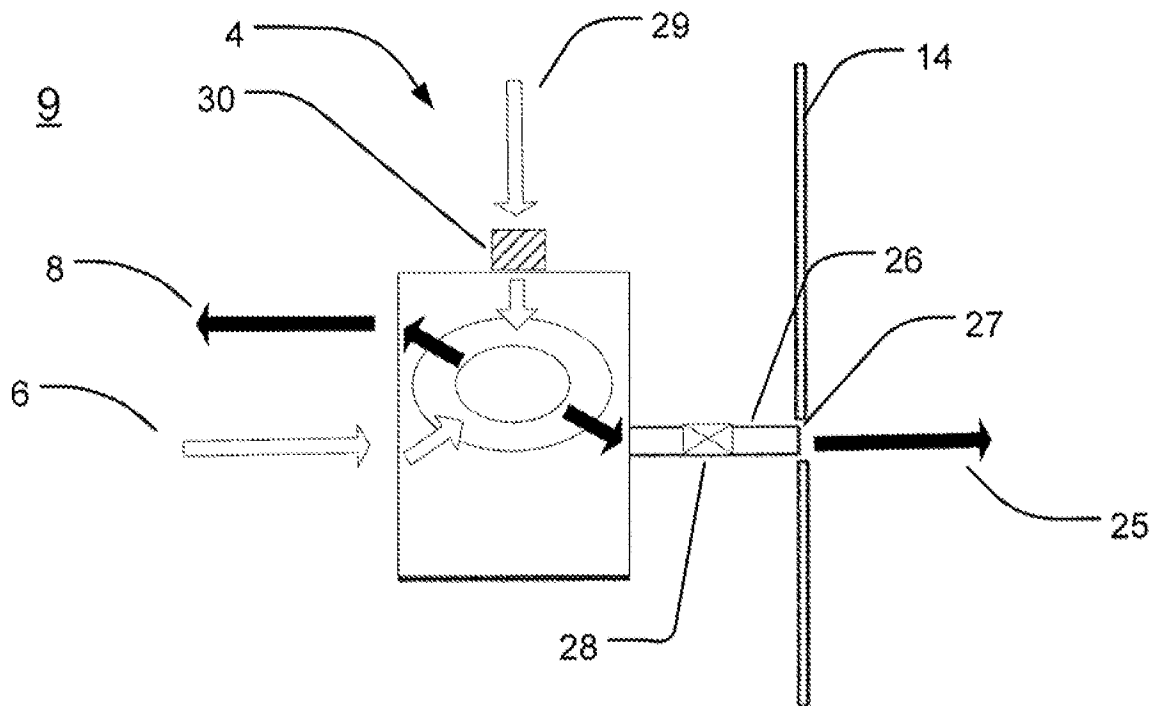


Fig. 3

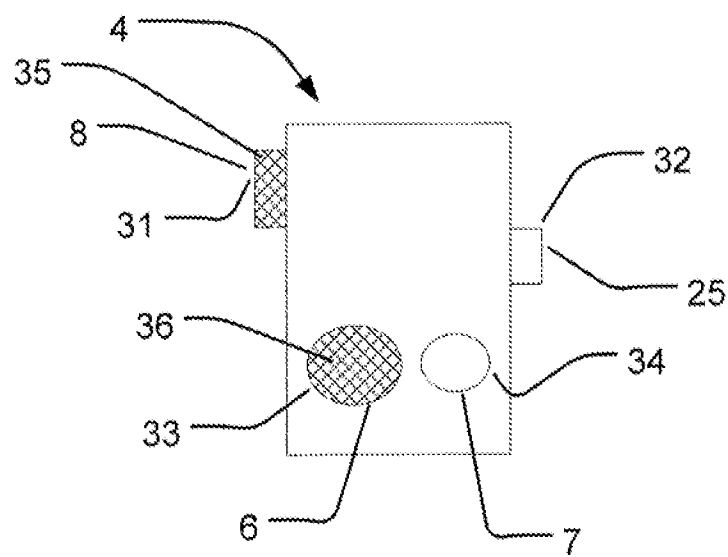


Fig. 4

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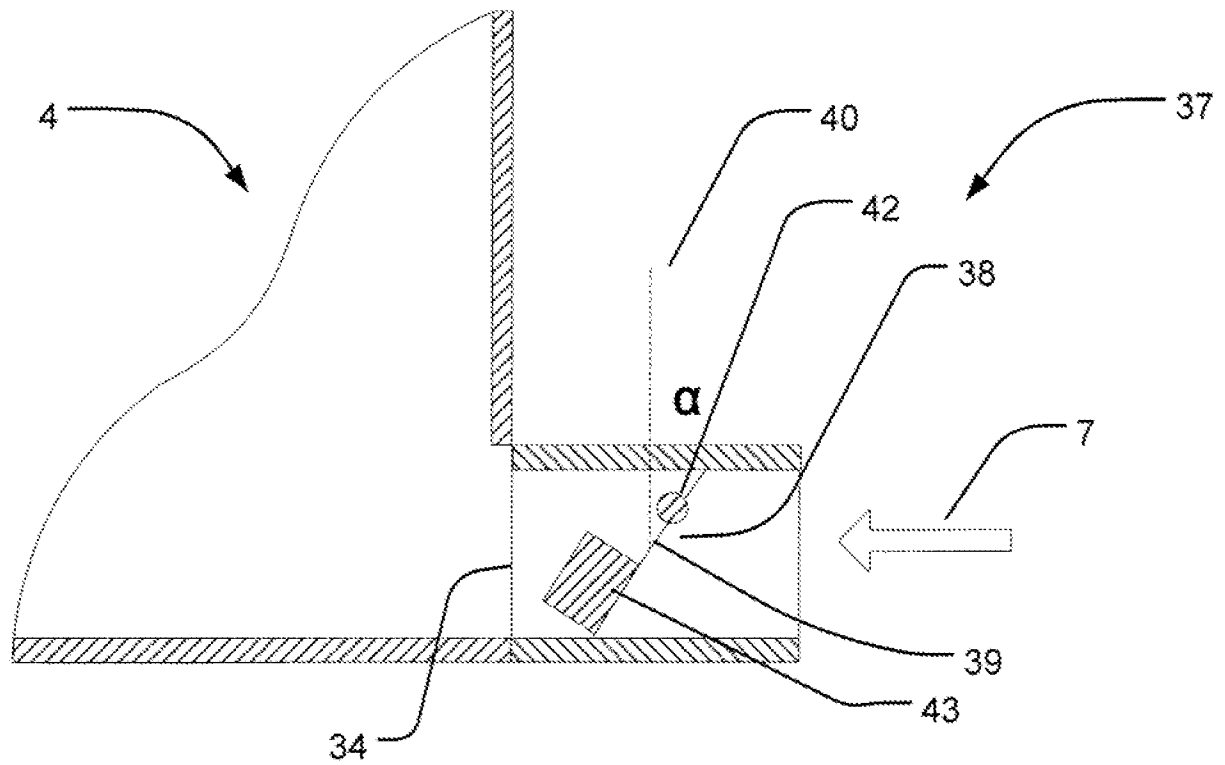


Fig. 5a

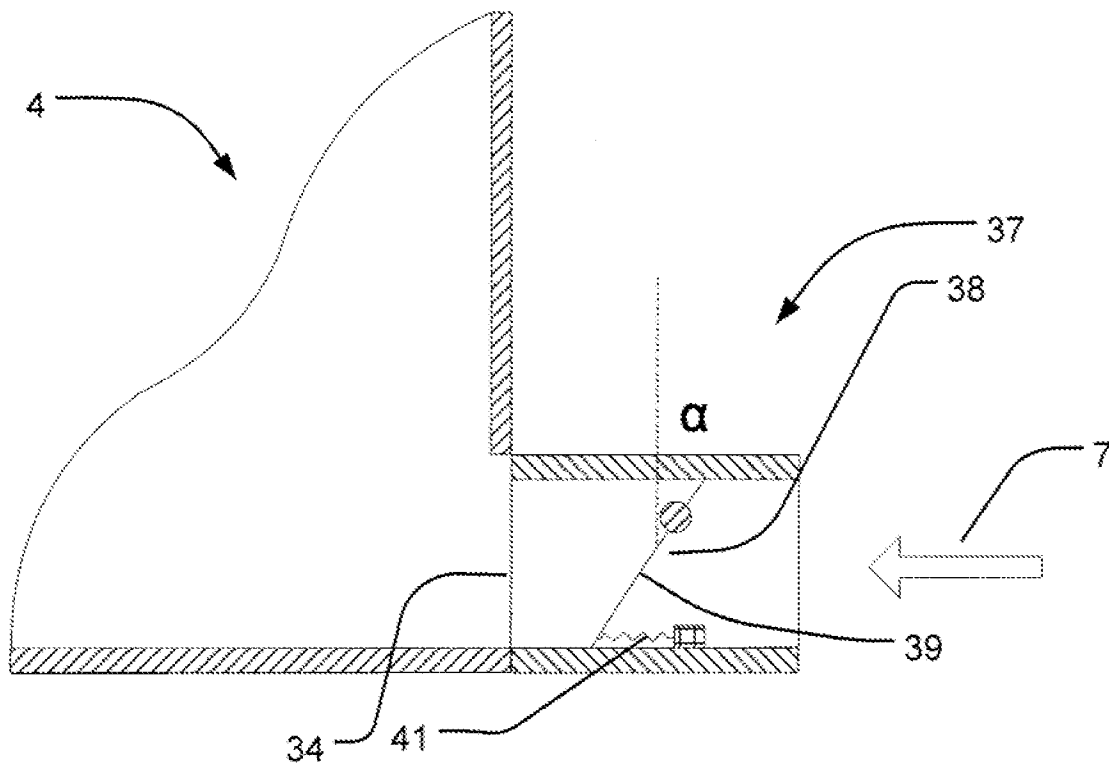


Fig. 5b