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(54) Title: ADVANCED DRY POWDER INHALER

(57) Abstract: The present invention relates to an inhaler which is suitable for delivering medicament in dry powder form used in prophylaxis and treatment of respiratory diseases from a capsule and comprises a deagglomerating member contributing to an effective inhalation.

ADVANCED DRY POWDER INHALER

The present invention relates to an inhaler suitable for delivering medicament in dry powder form used in prophylaxis and treatment of respiratory diseases by the inhalation route.

It is rather common to use inhalers for delivering medicaments utilized in the treatment and prophylaxis of respiratory diseases. Inhalation treatment is the most commonly preferred treatment method in these diseases as the inhalers provide ease of use; the medicaments have rapider onset of time resulting from local administration and they have fewer side effects. Various inhalers have been designed in order to provide effective and sufficient delivery of the medicaments used in the treatment of respiratory diseases, particularly in asthma and chronic obstructive pulmonary disease. These inhalers vary according to their operating mechanisms, some properties they hold and the physical form of the medicament to be delivered.

In the inhalers used to deliver medicament in dry powder form, the medicament is carried in reservoirs, capsules or blisters packages. It is highly significant to deliver sufficient amounts of the medicament to the patient since the amount of dry powder medicament that is to be delivered to the patient for each inhalation is very low. In the inhalers comprising a reservoir, one dose of dry powder medicament intake is enabled in each inhalation. In the inhalers comprising capsules, there is a metered dose of dry powder medicament in the capsule which is to be placed in the inhaler before each inhalation. In response to each actuation of the device, one capsule is pierced or opened by another method and the dry powder medicament contained in the capsule becomes ready for inhalation. In the inhalers comprising blister packs, at least one blister pocket is opened when the blister package is indexed and the dry powder medicament metered with high preciseness becomes ready for inhalation.

The inhalers in which the dry powder medicament is carried in blister packs or capsules can be multiple-dose or single-dose inhalers. The term "multiple-dose inhaler" refers to inhalers comprising more than one medicament dose. The term "single-dose inhaler", on the other hand, refers to inhalers comprising a single medicament dose.

The inhalers enabling the inhalation of dry powder medicament from capsules are commonly used. In general, one capsule is placed in the capsule chamber of the device before each inhalation in these devices; the capsule in the capsule chamber of the device is

pierced, cut or opened by similar methods when the device is actuated, and the dry powder medicament contained in the capsule becomes ready for inhalation.

Since the active agents used in inhalation treatment induce rather strong effects, the amount of the active agent in one dose of dry powder medicament is quite low. Thus, absorption of a sufficient amount of the active agent in the patient's lung is essential in order to realize an effective inhalation. Absorption of less than the required amount of the active agent in the patient's lung is not sufficient for an effective inhalation. In the inhalers where the dry powder medicament is carried in capsules, agglomeration of the particles of the dry powder medicament contained in the capsule causes failure in delivering a sufficient amount of the active agent to the patient's lungs.

The inhaler marketed under the trade mark Spiriva® Handihaler® by Boehringer and Pfizer is among the inhalers on the market. Though this device is commonly used on the market, it remains incapable in preventing agglomeration of the dry powder medicament contained in the capsule and/or providing to disperse the agglomeration in order to ensure a more effective and secure inhalation.

For the sufficient amount of the active agent comprised by the dry powder medicament contained in capsules to reach the lungs, the medicament in dry powder form has to have an appropriate particle size distribution. Particles having a particle size larger than 20 μm accumulate in pharyngeal and oral cavity of the patient while particles having a particle size smaller than 1 μm adhere to the larynx or are exhaled by the patient. Particle size of the particles absorbed by the alveolus in the lungs is in the range of 1 μm to 5 μm. Therefore, the particle size of the active agent comprised in the dry powder medicament has to be in the range of 1 μm to 5 μm in order to provide its absorption by the alveolus in the lungs. The particles other than the active agent particles, that are excipient particles, have a particle size more than 5 μm, especially more than 10 μm, and these are used in the dry powder formulation to carry the active agent particles from the container in which the dry powder formulation is stored to the patient in course of inhalation. During the inhalation of the dry powder formulation contained in the container of the inhaler, the active agent particles are separated from the excipient particles and reach to the alveolus in the lungs.

The cohesion and adhesion forces between the particles in the dry powder formulation increases as the particle size decreases and thus the particles are prone to form agglomerates.

Particle sizes increase when active agent particles that are in very low amounts agglomerate, which results in failure delivering the active agent to the lungs and/or absorption of required amounts of the active agents. The dry powder formulation contained in the container should be inhaled with uniform particle size distribution to provide the sufficient absorbance of the active agent. When the active agent is not sufficiently absorbed, the desired effect cannot be obtained and an effective inhalation cannot be realized.

In addition, dry powder particles merge with each other and agglomerate into lumps of larger particle sizes and these lumps may also comprise some of the active agent. Moreover, these lumps block the sieve through which the dry powder medicament passes in the inhalers comprising capsules and cause some part of the medicament to remain in the device.

Taking these problems into consideration, the inventor has designed an advanced inhaler.

From a general point of view, the present invention relates to an inhaler in which the problems resulting from the agglomeration of the dry powder medicament contained in the capsule of the inhalers comprising a capsule are obviated.

In more detail, the inhaler of the present invention which is suitable for delivering dry powder medicament and comprises a capsule is composed of a mouthpiece cover hiding the mouthpiece; the bottom casing where the device mechanism is situated; a movable mouthpiece communicating with the bottom casing; an air intake duct through which the air entraining the dry powder medicament passes and which is inserted into the mouthpiece; and a capsule chamber where the capsule is placed characterized by a deagglomerating member having sharp blades that reach from the center to the edges of the deagglomerating member radially.

The air entering the capsule chamber upon inhalation of the patient entrains the dry powder medicament in the capsule through the deagglomerating member of the device. This deagglomerating member possesses more than one sharp blades which rotate upon inhalation of the patient. The sharp blades that rotate upon the inhalation of the patient ensure dispersion of the agglomerates in the dry powder medicament while the air entraining the dry powder medicament passes through the deagglomerating member. As the dry powder medicament would attain to suitable particle size distribution after the agglomerates are dispersed, most of the active agent comprised in the medicament can be delivered to the

patient's lungs. Delivering the required amount of the active agent to the patient's lungs enables an effective inhalation to be realized.

The term "effective inhalation" refers to an inhalation in which pharmaceutically acceptable and required amount of the active agent for the treatment is delivered to the patient's lungs.

In an aspect, the deagglomerating member can be used instead of a sieve in the inhalers comprising capsules. Thus, the air entering the capsule chamber upon the inhalation of the patient entrains the dry powder medicament in the capsule to the patient through the deagglomerating member and the air intake duct.

In another aspect, the deagglomerating member exists together with the sieve in the inhaler comprising a capsule. According to this, the air entering the capsule chamber upon the inhalation of the patient entrains the dry powder medicament in the capsule to the patient through the deagglomerating member, the sieve and the air intake duct respectively. Thus, the agglomerates in the dry powder medicament in the capsule are first dispersed by the sharp blades of the deagglomerating member, then the medicament passes through the sieve and reaches the patient. The inhaler comprising a capsule pertaining to the present invention preferably comprises a sieve together with the deagglomerating member.

According to the present invention, in order to ensure rotation of the deagglomerating member, edges of this component are not attached fixedly to other components of the inhaler. The deagglomerating member is related to the air intake duct by a bar or a stick that connects to both the inside of the air intake duct and the center of the deagglomerating member. One end of the bar passes through the hole at the center of the deagglomerating member and the other end of the bar is attached to the inside of the air intake duct by a support bar. There is a plate which is attached to the end of the bar that passes through the hole at the center of the deagglomerating member and has a diameter more than the diameter of the hole at the center of the deagglomerating member..This plate is perpendicular to the end of the bar. The plate serves as a means for preventing the detachment of the bar from the deagglomerating member The deagglomerating member can rotate easily on this plate and thus enable sharp blades to rotate around the center of the deagglomerating member. The other end of the bar is fixed steadily to the inside of the air intake duct by a support bar. In the case that the deagglomerating member exists together with the sieve in the inhaler

comprising a capsule, the bar passes through the center of both the deagglomerating member and the sieve.

According to another embodiment of the invention, the deagglomerating member is attached from the center to the edges of the sieve by at least one bar as mentioned above in order to enable the rotation of the deagglomerating member easily on the plate(s) that are attached to the end of the bar(s) and thus sharp blades are enabled to rotate around the center of the deagglomerating member. Said bar or stick can be made of a metal or a plastic material, preferably a plastic material such as polyethylene, polypropylene, polystyrene, polyvinyl chloride and polytetrafluoroethylene (PTFE).

The deagglomerating member of the inhaler comprising a capsule is composed of more than one sharp blade though it is preferably composed of 3 to 8 blades. When the patient breathes in so as to inhale the dry powder medicament in the capsule, these blades are rotated. The agglomerates in the dry powder medicament which passes through the deagglomerating member upon the rotation of the sharp blades are deagglomerated.

The deagglomerating member comprising more than one blades can be in any suitable shape though it is preferably circle. The sharp blades are radially situated from the center to the edges of the deagglomerating member. Each sharp blade of the deagglomerating member is situated at an inclined angle in the range of 10° to 90°, for example 10°, 15°, 20°, 25°, 30° or 35° to 40°, 42.5°, 45°, 47.5°, 50°, 55°, 60°, 65°, 70°, 75°, 80°, 85° or 90°, preferably in the range of 25° to 80°, more preferably in the range of 25° to 55°, for example, 25°, 27.5°, 30°, 32.5° or 35° to 40°, 42.5°, 45°, 47.5°, 50°, 52.5° or 55°, to the horizontal plane of the deagglomerating member. Rotational speed of the sharp blades which rotate upon the inhalation of the patient varies depending on the angle values of inclination of the sharp blades. Angle of inclination of the sharp blades is adjusted according to the amount of dry powder medicament inhaled and its particle size distribution, and the sharp blades are ensured to rotate at a suitable speed. During the inhalation, a pressure drop of 4 kPa is needed to be provided in the inhalation devices that is used for the inhalation of the dry powder formulation from a capsule for delivering the dry powder formulation to the lungs in a sufficient amount. When each sharp blade of the deagglomerating member is situated at an inclined angle in the range of 10° to 90°, preferably in the range of 25° to 80° more preferablyin the range of 25° to 55° to the horizontal plane of the deagglomerating member,

the sufficient amount of the dry powder formulation is delivered to the lungs by providing the pressure drop of 4 kPa in the inhalation device during the inhalation of the formulation.

The sharp blades of the deagglomerating member are made of a suitable material though they are preferably made of metal or alloy, more preferably of stainless steel.

In addition, all or any one of the sharp blades can preferably be made of a material comprising an antistatic substance or a material coated with an antistatic substance.

The inhaler of the present invention is composed of various constituents in order to ensure inhalation of dry powder medicament preferably in a pierceable capsule.

According to this, the basic constituents of the inhaler of the present invention are the mouthpiece cover, the bottom casing, the mouthpiece and the center cover. These four constituents are connected to each other by a pin and move around the same axis. The mouthpiece cover covers the mouthpiece and provides to keep it clean. Furthermore, the capsule cannot be placed in the device or the device cannot be actuated unless the mouthpiece cover is opened. Thus, it is necessary to open the mouthpiece cover, then expose and move the mouthpiece so as to use the device.

The mouthpiece and the central cover are attached to each other and they synchronize. Moving the mouthpiece, which is exposed when the mouthpiece cover is pulled upwards, outwardly around an axis enables the capsule chamber to get to an available position for placing a capsule. One capsule is placed in the capsule chamber and the mouthpiece is closed on the capsule chamber. While the mouthpiece is closed on the capsule chamber, the double-cogged rail under the mouthpiece triggers the piercing mechanism which consists of the cogged rod, the piercing member (needles), the spring, the spring and piercing member holder; and then the piercing member moves with the spring and piercing member holder towards the capsule chamber to pierce the capsule for inhaling the dry powder formulation in it. The piercing member and the spring holder can be moved towards the capsule chamber by the cogged rod owing to the spring it possesses. Therefore, the piercing member which synchronizes with the spring holder also moves towards the capsule chamber and pierce the capsule in the chamber. The dry powder medicament contained in the capsule becomes ready for inhalation after the capsule is pierced.

When the patient breathes in so as to inhale the dry powder medicament in the pierced capsule, the dry powder medicament passes through the deagglomerating member having rotatable sharp blades; preferably a sieve and the air intake duct respectively and reaches the patient via the mouthpiece. The sieve which is preferably placed between the deagglomerating member and the air intake duct can be a separate component or attached to any other component of the device. The sieve which is preferably between the capsule chamber and the air intake duct is preferably situated in the midpoint of the center cover, right on the capsule chamber, when the mouthpiece is closed. The sieve is fixed at the end of the air intake duct that is near to the capsule chamber. The air intake duct which is inserted into the mouthpiece; the deagglomerating member; the capsule chamber where the sieve and the capsule are placed are about the same axis with the midpoint of the center cover which is under the mouthpiece as attached to it.

The mouthpiece is moved outwardly away from the capsule chamber after the dry powder medicament in the pierced capsule is inhaled by the patient. The discharged capsule in the capsule chamber which is exposed after the mouthpiece is moved away is taken off the chamber. The capsule chamber is suitably cleaned if necessary and the mouthpiece is closed on the capsule chamber again.

In order to remain stable, the mouthpiece is interlocked with the locking member in the bottom casing where the spring and the piercing member holder; the capsule chamber; the cogged rod; the spring; the cogged member are situated.

The inhalation device can be made of the same or different materials. According to this, each component of the inhaler can be made of a suitable material though it is preferably selected from a group comprising styrene-acrylonitrile, polyoxymethylene, acrylic polymethyl metacrylate, cellulose acetate, polyetheretherketone, polyvinyl chloride, polyethylene, polypropylene, acrylonitrile butadiene styrene, silicon, polycarbonate, polyamide, polystyrene, polyurethane or fluoropolymer types. Furthermore, each component of the device can be in any suitable color.

The capsule used in the inhaler comprising a capsule pertaining to the present invention can be made of any suitable substance though it is preferably made of a substance selected from the group comprising gelatin, chitosan, starch and/or starch derivatives, cellulose and/or cellulose derivatives or synthetic polymers and it is composed of intertwining top and

bottom compartments. The top and the bottom compartments of the capsule can be made of identical or different materials.

According to this, in the case that the capsule used in the present invention is made of cellulose or its derivatives, the capsule material can be selected from, but not limited to, a group comprising hydroxypropyl cellulose, hydroxypropylmethyl cellulose, methyl cellulose, hydroxymethyl cellulose, hydroxyethyl cellulose.

In the case that the capsule used in the present invention is synthetic polymer, the capsule material can be selected from, but not limited to, a group comprising polyethylene, polyetheleneteraphtalate, polycarbonate or polypropylene.

In the case that the capsule material used in the present invention is gelatine, additional agents such as polyethylene glycol, sorbitol, glycerol, propylene glycol, polyethylene oxide - polypropylene oxide block copolymers and/or other polyalcohols and polyethers at different molecular weights can be added into it.

The volume of the capsule containing the dry powder medicament in the inhaler of the present invention is in the range of 0.10 ml to 0.70 ml, preferably in the range of 0.10 ml to 0.52 ml and it is filled up to 0.01-30 %, preferably 0.01-25 % of said volume.

Moreover, the capsule pack containing the dry powder medicament and used in the inhaler of the present invention can be in any suitable shape and color on condition that it holds the specifications mentioned above.

The drawings given in the appendix in order to exemplify the present invention are explained with reference numbers below. The drawings aims to exemplify the invention, yet the invention cannot be limited to these drawings and descriptions.

Figure 1 is a front view of the inhaler of the present invention.

Figure 2 is an exploded view of the inhaler of the present invention.

Figure 3a and figure 3b are perspective views of the deagglomerating member used in the inhaler of the present invention.

The preferred embodiment of the inhaler of the present invention is as in Figure 1 and Figure 2 in the appendix. The preferred embodiment of the deagglomerating member in the inhaler of the present invention is as in Figure 3 in the appendix.

The inhaler of the present invention illustrated in Figure 1 is in pre-use position. In pre-use position, only the mouthpiece cover (1) hiding the mouthpiece (3) and the bottom casing (2) where the mouthpiece (3) and the mechanism of the device are situated are visible. The mouthpiece cover (1) and the bottom casing (2) of the inhaler are connected to each other by a pin (12). The mouthpiece cover (1) covers the movable mouthpiece (3) component which is connected with the bottom casing (2) of the inhaler in pre-use position. Therefore, it enables to keep the mouthpiece (3) clean in pre-use position and carry it everywhere comfortably.

Each component of the inhaler and their communication with each other can be clearly seen in the exploded view of the inhaler of the present invention in Figure 2. The mechanism of the inhaler is situated in the bottom casing (2) of the device. The constituents composing this mechanism are all components that contribute to prepare the inhaler for inhalation and use it effectively in course of inhalation which are situated in the bottom casing (2) except for the mouthpiece (3).

The mouthpiece cover (1), the bottom casing (2), the mouthpiece (3) and the center cover (7) of the inhaler are connected to each other by a pin (12) and they all move around the same axis. The pin (12) enabling the mouthpiece cover (1), the bottom casing (2), the mouthpiece (3) and the center cover (7) to move together also provides the components to move around the same axis by passing through the pin hole (1a, 2a, 3a, 7a) of each component. The center cover (7) is under the mouthpiece (3) of the device as attached to it. Thus, the center cover (7) synchronizes with the mouthpiece (3) of the device.

Before each inhalation, a capsule containing dry powder medicament has to be placed in the capsule chamber (13) of the inhaler illustrated in figure 2. To this end, the mouthpiece (3) which is exposed after the mouthpiece cover (1) is lifted is moved around the same axis such that a capsule can be placed in the capsule chamber (13). Owing to this movement of the mouthpiece (3), the mouthpiece (3) is away from the bottom casing (2) and the capsule chamber (13) becomes available for placing a capsule.

After a capsule is placed in the capsule chamber (13), the mouthpiece (3) is moved back towards the bottom casing. Thus, both the bottom casing (2) and the capsule chamber (13) are covered. The dry powder medicament in the pierced capsule can comfortably and securely be inhaled in this position.

The double-cogged rail (4) which lies under the mouthpiece (3) while the mouthpiece (3) is moved towards the bottom casing after the capsule is placed in the capsule chamber (13) moves together with the mouthpiece and it enters into the bottom casing when the mouthpiece is completely closed. When the piercing mechanism of the inhaler is triggered by the double-cogged rail (4), the cogged rod (11) that is in contact with the center cover (7) of the inhaler pushes the needle and spring holder (8) towards the capsule chamber. The needle and spring holder (8) comprises the needles (9) which provide to pierce the capsule in the capsule chamber (13) and a spring (10) which provides the needles to move towards or away from the capsule chamber (13). The needles pierce the capsule as the cogged rod (11) pushes the needle and spring holder (8) towards the capsule chamber (13). The dry powder medicament becomes ready for inhalation after the capsule is pierced.

There is one protrusion (11a; 11b) on both sides of the cogged rod (11) which enables the cogged rod (11) to connect with the center cover (7). These two protrusions (11a, 11b) fix into the holes (7c, 7d) on the ends of the extensions under the center cover (7) and establish a connection between the cogged rod (11) and the center cover (7). In addition, the bar (11c) which lies between the two sides of the cogged rod (11) is fixed into the recess (8a) on the needle and spring holder. Thus, when the mouthpiece moves towards the bottom casing, the cogged rod (11) pushes the needle and spring holder (8) towards the capsule chamber (13). As the capsule and the spring holder (8) move towards the capsule chamber (13) owing to the spring it possesses, each needle (9) is ensured to pierce the capsule placed in the capsule chamber (13). The dry powder medicament contained in the capsule becomes ready for inhalation after the capsule is pierced.

When the mouthpiece (4) is moved towards the bottom casing (2) in order to provide the needles (9) to pierce the capsule after the capsule is placed in the capsule chamber (13), the piercing mechanism of the inhalation device is triggered and the needle and spring holder (8) is pushed towards the capsule chamber (13) to enable the needles to pierce the capsule.

The deagglomerating member (14) of the present invention is displayed in figure 3a and figure 3b. The external air entering the capsule chamber (13) upon the inhalation of the patient entrains the dry powder medicament in the capsule pierced by the needles (9) comprised by the needle and spring holder firstly through the deagglomerating member (14) comprising sharp blades (14a), then through the sieve (6) and delivers it to the patient via the air intake duct (5). The air intake duct (5), the deagglomerating member (14), the sieve (6) and the capsule chamber (13) are on the same axis with the center (7b) of the center cover.

The deagglomerating member (14), a preferred embodiment of which is illustrated in figure 3a and figure 3b comprises 6 sharp blades (14a). Each sharp blade (14a) is radially situated from the center (14b) to the edges (14c) of the deagglomerating member. Each sharp blade (14a) of the deagglomerating member (14) shown in figure 3b is situated inclined at an angle of $\alpha=45°$ to the horizontal plane of the deagglomerating member (14). When the patient breathes in for each inhalation, the sharp blades (14a) of the deagglomerating member (14) rotate around the center of the deagglomerating member and provide to disperse the agglomerates in the dry powder medicament.

The external air entering the capsule chamber (13) when the patient breathes in for the inhalation of the dry powder medicament in the pierced capsule entrains the dry powder medicament there firstly through the deagglomerating member (14) which ensures to disperse the agglomerates in the dry powder medicament, then through the sieve (6) and delivers it to the patient. According to this, the air entering the capsule chamber (13) upon the inhalation of the patient entrains the dry powder medicament in the pierced capsule through the deagglomerating member (14), the sieve (6) and the air intake duct (5) respectively and delivers it to the patient.

The sieve (6) placed between the deagglomerating member (14) and the air intake duct (5) can be a separate component though it can also be connected with any component of the device. The sieve (6) placed between the deagglomerating member (14) and the air intake duct (5) is preferably situated in the center (7b) of the center cover.

The capsule containing the dry powder medicament in the inhaler of the present invention illustrated in figure 1 and figure 2 is produced according to the prior art. According to the present invention, the particle size of the active agents contained in the capsule is less than 20 μm, preferably less than 10 μm.

The inhaler of the present invention has been designed so as to deliver the dry powder medicament used in monotherapy or combined therapy. The term "monotherapy" refers to inhalation treatments in which dry powder medicaments comprising a single active agent are used whereas the term "combined therapy" refers to inhalation treatments in which dry powder medicaments comprising more than one active agents are used.

The dry powder medicament delivered via the device of the present invention comprises at least one excipient in addition to the active agent or agents. These excipients are generally chosen from a group comprising monosaccharides (glucose, arabinose, etc.), disaccharides (lactose, saccharose, maltose, etc.), oligo- and polysaccharides (dextran, etc.), polyalcohols (sorbite, mannite, xylite), salts (sodium chloride, calcium carbonate, etc.) or combinations thereof. According to the present invention, the medicament in dry powder form comprises lactose as the excipient. The medicament in dry powder form comprises fine or coarse excipients particles preferably having various particle size ranges in order to deliver the required amount to the lungs.

The active agent or the active agents comprised in the dry powder medicament which is stored in capsules used in the device pertaining to the present invention can be selected from a group comprising cromolyns, anti-infectives, antihistamines, steroids, anti-inflammatories, bronchodilators, leukotirene inhibitors, PDE IV inhibitors, antitussives, diuretics, anticholinergics, hormones, xanthines and pharmaceutically acceptable combinations thereof.

The active agent comprised in the medicament in dry powder form delivered via the inhaler pertaining to the present invention is preferably selected from a group comprising tiotropium, oxitropium, flutropium, ipratropium, glicopironium, flunisolid, beclomethasone, budesonide, fluticasone, mometasone, ciclesonide, rofleponide, dexamethasone, montelukast, methylcyclopropane acetic acid, sodium cromoglicat, nedocromil sodium, Npropylene, teophylline, roflumilast, ariflo (cilomilast), salmeterol, salbutamol, formoterol, terbutaline, carmoterol, indacaterol, cetirizine, levocetirizine, efletirizine, fexofenadine and their racemates, free base, enantiomers or diastereomers and their pharmaceutically acceptable salts, solvates and/or hydrates or a combination of said active agents.

The device of the present invention is used in the administration of the medicament in dry powder form which is utilized in the treatment of many respiratory diseases, particularly in

asthma, chronic obstructive pulmonary disease (COPD) and allergic rhinitis. Accordingly, the respiratory diseases include, but not restricted to, allergic or non-allergic asthma at any phases, acute lung injury (ALI), acute respiratory distress syndrome (ARDS), exacerbation of airways hyperactivity, bronchiectasis, chronic obstructive pulmonary including emphysema and chronic bronchitis, airways or lung diseases (COPD, COAD or COLD), pneumoconiosis, aluminosis, anthracosis, asbestosis, chalicosis, ptilosis, siderosis, silicosis, tabacosis and byssinosis. The device pertaining to the invention can be used in prophylactic or symptomatic treatment. In addition, the medicament in dry powder form which is preferably used in the symptomatic treatment of allergic asthma and COPD is administered to the patient via the device pertaining to the present invention.

CLAIMS

1. An inhaler suitable for delivering dry powder medicament comprising a mouthpiece cover (1) which hides the mouthpiece (3); the bottom casing (2) where the device mechanism is situated; a movable mouthpiece (3) communicating with the bottom casing (2); an air intake duct (5) through which the air entraining the dry powder medicament passes and which is inserted into the mouthpiece (3); and a capsule chamber (13) where the capsule is placed characterized by a deagglomerating member (14) having sharp blades (14b) that radially reach from the center (14b) to the edges (14c) of the deagglomerating member (14).

2. The inhaler according to claim 1, wherein each sharp blade (14a) of the deagglomerating member (14) is situated at an inclined angle (α) in the range of 10° to 90° to the horizontal plane of the deagglomerating member.

3. The inhaler according to claim 1, wherein each sharp blade (14a) of the deagglomerating member (14) is situated at an inclined angle (α) in the range of 25° to 80° to the horizontal plane of the deagglomerating member.

4. The inhaler according to claim 1, wherein the sharp blades of the deagglomerating member (14) are made of metal or alloy.

5. The inhaler according to claim 1, wherein the sharp blades of the deagglomerating member (14) are made of stainless steel.

6. The inhaler according to claim 1, wherein all or any of the sharp blades (14) of the deagglomerating member (14) are made of a material comprising antistatic substance or a material coated with antistatic substance.

7. The inhaler according to claim 1, wherein the number of the sharp blades (14a) of the deagglomerating member (14) is more than one.

8. The inhaler according to claim 1, wherein the number of the sharp blades (14a) of the deagglomerating member (14) is in the range of 3 to 8.

9. The inhaler according to claim 1, wherein said inhaler preferably comprises a pierceable capsule.

10. The inhaler according to claim 1, wherein the mouthpiece cover (1), the bottom casing (2), the mouthpiece (3) and the center cover (7) are attached to each other by a pin (12) and move around the same axis.

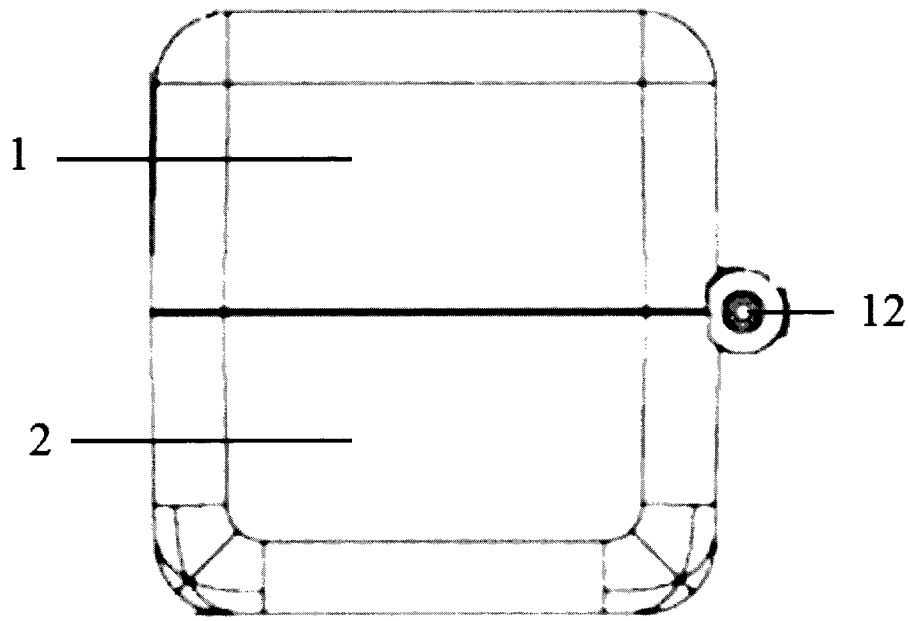
11. The inhaler according to claim 1, wherein the mouthpiece (3) moved outwardly away from the capsule chamber (13) such that the capsule chamber (13) gets to an available position for placing a capsule.

12. The inhaler according to claim 1, wherein the dry powder medicament in the capsule is entrained from the capsule chamber (13) through the deagglomerating member (14), the sieve (6) placed between the capsule chamber (13) and air intake duct (5), and then through the air intake duct (5) and delivered to the patient via the mouthpiece (3) by the external air entering the device upon the patients inhalation.

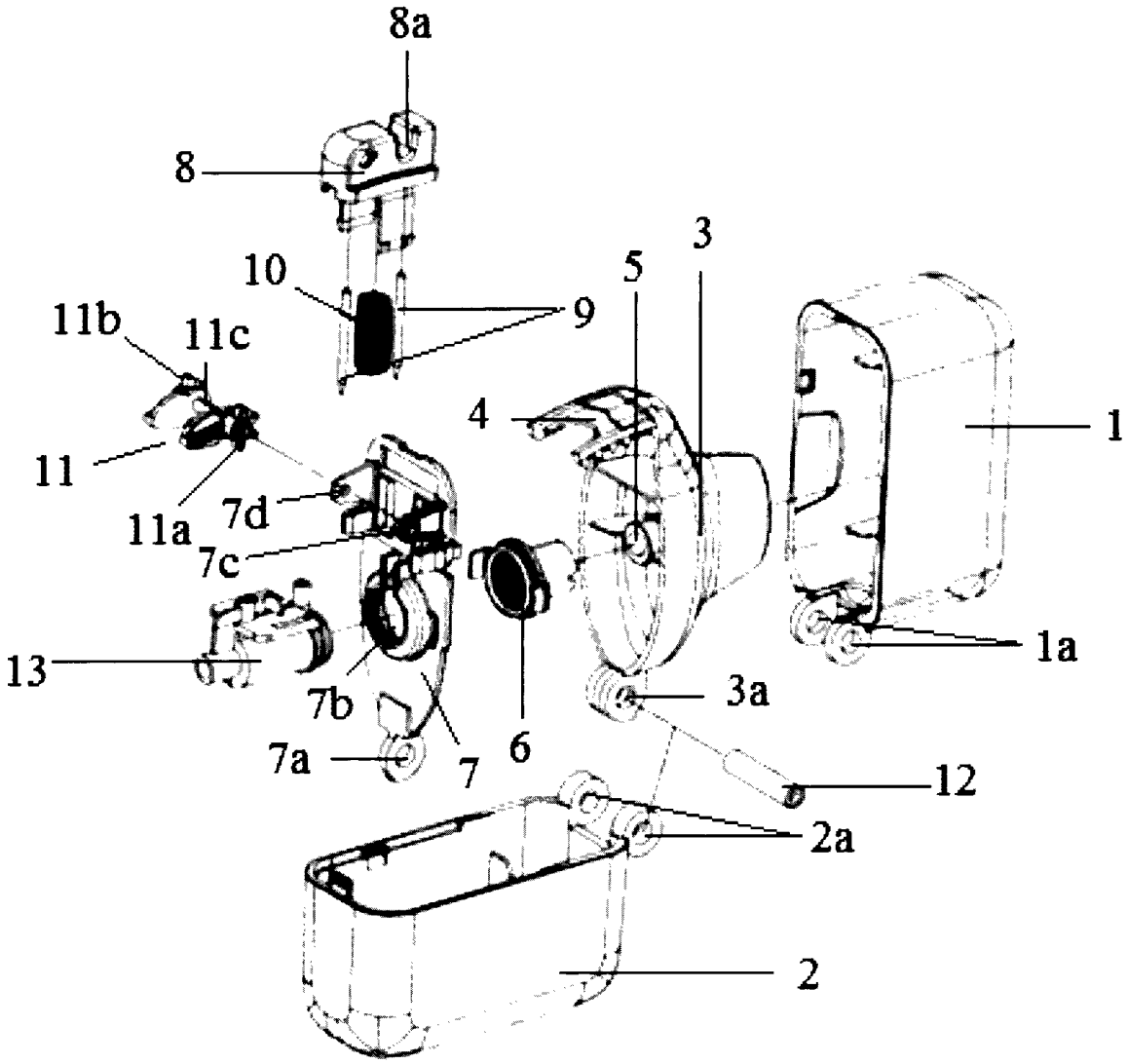
13. The inhaler according to claim 1, wherein the air intake duct (5), the sieve (6) placed between the air intake duct (5) and the capsule chamber (13) and the capsule chamber (13) where the capsule is placed are on the same axis with the midpoint (7b) of the center cover that is under the mouthpiece (3) as attached to it.

14. The inhaler according to claim 1, wherein the sieve (6) is situated in the midpoint (7b) of the center cover when the mouthpiece is closed.

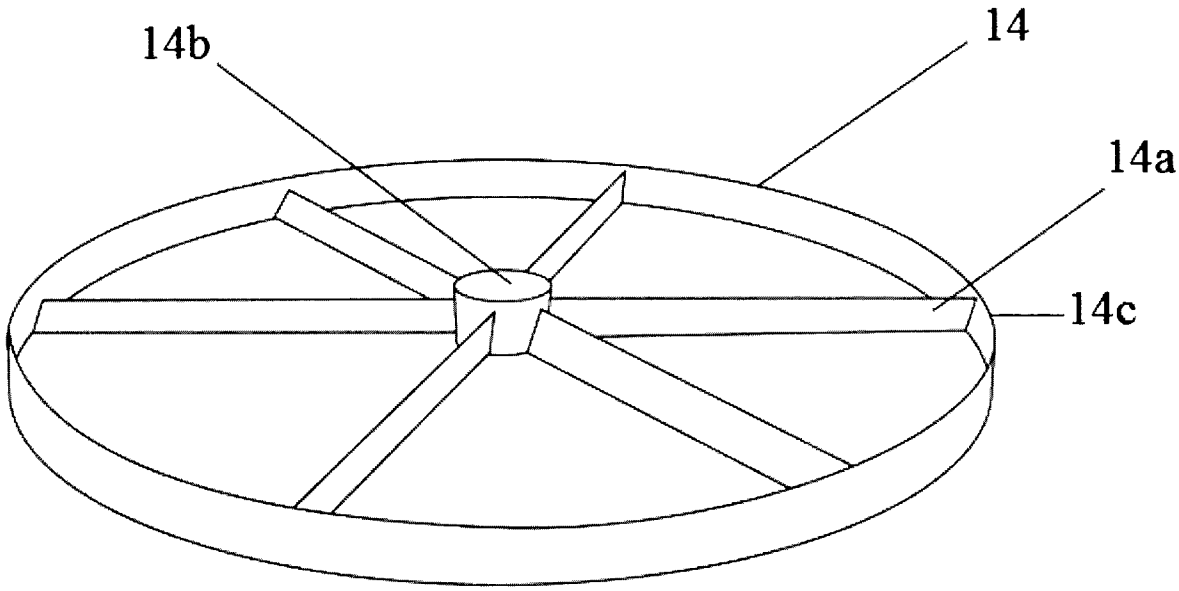
Şekil 1



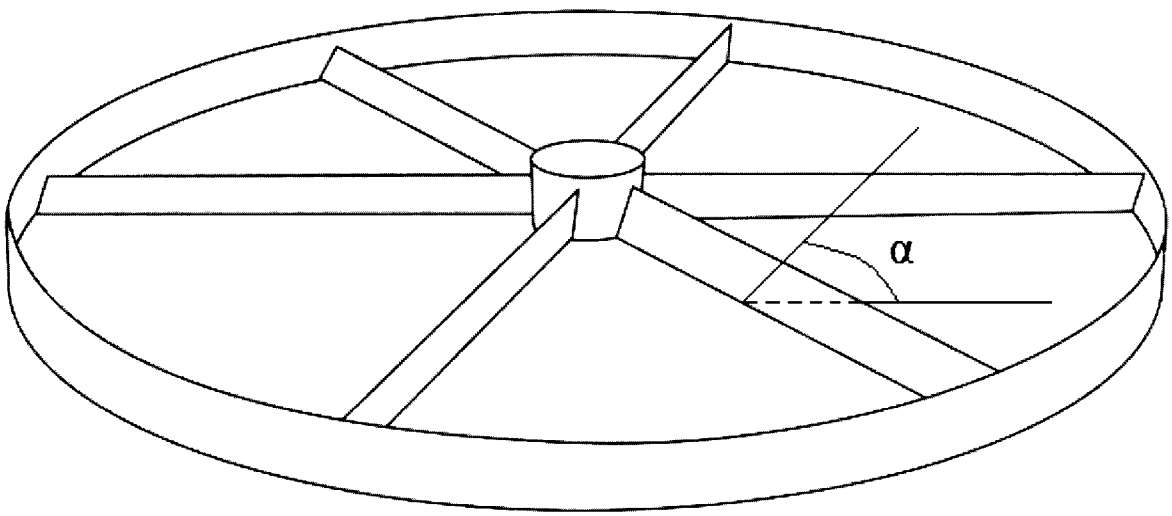
Şekil 2



Şekil 3a



Şekil 3b



INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2011/000134

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61M15/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2009/151408 A2 (MAHMUT BILGIC [TR]) 17 December 2009 (2009-12-17) figure 1 claim 1	1-14
Y	WO 2010/040779 A2 (VECTURA DELIVERY DEVICES LTD [GB]; SARKAR MATTHEW [GB]; MAY ROBERT [GB) 15 April 2010 (2010-04-15) figure 15 claims 33-36 page 23, line 16 - line 20	1-14
A	GB 2 407 042 A (VECTURA LTD [GB]) 20 April 2005 (2005-04-20) abstract figures 1-7 page 18, line 10 - line 19	1-14

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 November 2011	15/11/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Schembri, Valentina

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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