CLAIMS

1. Dry powder inhaler, comprising:
   - a casing (2) having a mouthpiece (4);
   - an inhalation channel (8) housed in the casing (2) and connected to the mouthpiece (4);
   - a container (7) housed in the casing (2) for storing a powdered medicament, the container (7) having an opening (17);
   - a de-agglomerator (25) having a vortex chamber (26) located at an end of the inhalation channel (8) opposite the mouthpiece (4);
   - a metering device (14) comprising a shuttle (16) having a dosing recess (15) fashioned in a face of the shuttle (16), wherein the shuttle (16) is movable between a filling position, in which the dosing recess (15) is in alignment with the opening (17) of the container (7) and faces said opening (17) so as to be filled with a dose of the powdered medicament, and an inhalation position, in which the dosing recess (15) is in alignment with the vortex chamber (26) and the inhalation channel (8), for enabling inhalation of the dose of the powdered medicament contained in the dosing recess (15) through the mouthpiece (4);

wherein, in a top view, the opening (17) of the container (7) is elongated along a respective major axis (Y-Y) and the dosing recess (15) is elongated along a respective main axis (X-X); wherein, when the shuttle (16) is in the filling position, an edge (27) of the opening (17) of the container (7) encloses the dosing recess (15).

2. The inhaler of claim 1, wherein a direction of movement (F) of the shuttle (16) between the filling position and the inhalation position and said major axis (Y-Y) delimit between them an angle of 90° and wherein said main axis (X-X) and the major axis (Y-Y) delimit between them a first angle (β) other than 0°.

3. The inhaler of claim 2, wherein said first angle (β) is between 10° and 30°.

4. The inhaler of any of claims 1 to 3, wherein the de-agglomerator (25) has two air inlets (34) opening in the vortex chamber (26), said two air inlets (34) being placed on opposite sides of the vortex chamber (26) and along tangential or substantially tangential inflow directions to form an air vortex in said vortex chamber (26); wherein,

in the inhalation position, the dosing recess (15) faces the vortex chamber (26) and is fully enclosed in the vortex chamber (26); wherein the dosing recess (15) has opposite ends located along the main axis (X-X); wherein, in the inhalation position, each of the opposite ends of the dosing recess (15) is next to one of the air inlets (34).

5. The inhaler of claim 4, wherein a diametrical line (Z-Z) connecting the two air inlets (34) and the main axis (X-X) delimit between them a second angle (γ) other than 0°.

6. The inhaler of claim 4, wherein the de-agglomerator (25) comprises two curved walls (31) having concavities facing each other, the two curved walls (31) being staggered from each other and delimiting the vortex chamber (26) and the two tangential air inlets (34); wherein a diametrical line (Z-Z) passing through a free extremity (33) of each of the curved walls (31) and the main axis (X-X) delimit between them a second angle (γ) other than 0°.

7. The inhaler of claim 5 or 6, wherein the diametrical line (Z-Z) is parallel to the major axis (Y-Y) and the first angle (β) is equal to the second angle (γ).

8. The inhaler of any of claims 4 to 7, wherein each of the opposed ends of the dosing recess (15) is located downstream of the respective air inlet (34) with respect to an air inflow entering through said air inlet (34).

9. The inhaler of any of claims 5 to 7 or of claim 8 when depending on any of claims 5 to 7, wherein the vortex chamber (26) is configured to form a clockwise air vortex and the main axis (X-X) is rotated clockwise with respect to the diametrical line (Z-Z); or wherein the vortex chamber (26) is configured to form a counterclockwise air vortex and the main axis (X-X) is rotated counterclockwise with respect to the diametrical line (Z-Z).

10. The inhaler of claim 6, wherein in the inhalation position, the dosing recess (15) is contained within a base circle having a diameter (d) given by a segment extending between the free extremities (34) of the two curved walls (31).

11. The inhaler of any of claims 1 to 10, wherein the edge (27) of the opening (17) of the container (7) is substantially elliptical; or wherein the edge (27) of the opening (17) of the container (7) has two major arched sides and two minor straight sides.

12. The inhaler of any of claims 1 to 11, wherein a perimeter of the dosing recess (15) comprises two parallel straight lines connected by two arcs and the two parallel straight lines are parallel to the main axis (X-X); or wherein the perimeter of the dosing recess (15) is oval or is an ellipse and the main axis (X-X) is a major axis of the ellipse.

13. The inhaler of any of claims 1 to 12, wherein the dosing recess (15) has a capacity for the powdered medicament greater than 10 mg, optionally greater than 15 mg, optionally of 20 mg.

14. The inhaler of any of claims 1 to 13, wherein the dosing recess (15) has a volume of greater than 20 mm^3, optionally 20 mm^3 to 40 mm^3, or optionally 25 mm^3 to 35 mm^3.

15. The inhaler of any of claims 1 to 14, wherein the dosing recess (15) has a length (L) measured along the main axis (X-X) and a width (W) measured perpendicular to the main axis (X-X); wherein a ratio L/W is greater than 1, optionally between 1.4 and 1.8.

16. The inhaler of any of claims 1 to 15, further comprising a protective member (18) provided between the shuttle (16) and the vortex chamber (26); when the shuttle (16) is in the inhalation position, the protective member (18) is slidingly movable on or above the shuttle (16) between a closed position and an open position; wherein in the closed position the protective member (18) fully covers the dosing recess (15) preventing communication between said dosing recess (15) and the vortex chamber (26); wherein in the open position the protective member (18) leaves the dosing recess (15) exposed to the vortex chamber (26).

17. The inhaler of any of claims 1 to 16, comprising the powdered medicament, wherein said powdered medicament is a pharmaceutical composition comprising one or more phosphodiesterase-4 (PDE-4) inhibitors selected from the group consisting of tanimilast, cilomilast, roflumilast, tetomilast, oglemilast, apremilast, piclamilast and a salt thereof.

18. The inhaler of claim 17, wherein the pharmaceutical composition comprises tanimilast.

19. Use of a pharmaceutical composition in the manufacture of a medicament for treating a respiratory disease in a subject, wherein the pharmaceutical composition is a powdered medicament and wherein the pharmaceutical composition is to be administered through an inhaler according to any of claims 1 to 18.

20. The use of claim 19 wherein the pharmaceutical composition comprises one or more phosphodiesterase-4 (PDE-4) inhibitors selected from tanimilast, cilomilast, roflumilast, tetomilast, oglemilast, apremilast, piclamilast and a salt thereof.

21. The use of claim 20, wherein thephosphodiesterase-4 (PDE-4) inhibitor is tanimilast.

22. The use of any of claims 19 to 21, wherein the subject is to be administered a delivered dose of the pharmaceutical composition of greater than 10 mg per actuation.