

Summary of the Disclosure

In a first aspect the present invention provides a dry powder inhaler comprising:

- a mouthpiece for patient inhalation;
- a cover movable about a hinge to open and close the mouthpiece;
- a delivery passageway for directing an inhalation induced air flow through the mouthpiece;
- a channel extending from the delivery passageway;
- a reservoir for containing medicament, the reservoir having a dispensing port connected to the channel;
- a cup received in the channel and movable between the dispensing port and the delivery passageway, wherein the cup comprises a cup cam follower;
- a cup spring biasing the cup towards the delivery passageway;
- a yoke movable between at least a first position and a second position and including a yoke cam; whereby closing the cover moves the yoke between the first position and the second position such that yoke cam engages the cup cam follower and urges the cup against the cup spring to the dispensing port;
- and wherein the yoke cam, the cam follower, or both comprises a plastics material which includes a slip additive.

In a second aspect the invention provides a dry powder inhaler comprising a moving component which is:

- made from a plastics material which includes a slip additive; or
- at least partially coated with an oil, soap or stearic acid.

The inventors have surprisingly found that the dislocation of the cover results from an increase in friction between two moving parts within the inhaler: particularly the yoke cam and the cup cam follower. The increased friction is caused by excess dry powder coating and interfering with the interaction between the components. The increased friction results in an abnormally large reset force being required to slide the cup cam follower along the yoke cam, and therefore to close the cover of the DPI. The force can be increased to the extent that the hinges of the cover become dislocated and the cup cam follower does not return the dispensing port to receive a further dose of medicament. Although the applicant does not wish to be bound by theory, it is thought that the dislocation could occur owing to a large moment being required at the hinge because of the large force applied by the yoke.

Claims

1. A dry powder inhaler comprising:
 - a mouthpiece for patient inhalation;
 - 5 a cover movable about a hinge to open and close the mouthpiece;
 - a delivery passageway for directing an inhalation induced air flow through the mouthpiece;
 - a channel extending from the delivery passageway;
 - a reservoir for containing medicament, the reservoir having a dispensing port connected to the channel;
 - 10 a cup received in the channel and movable between the dispensing port and the delivery passageway, wherein the cup comprises a cup cam follower;
 - a cup spring biasing the cup towards the delivery passageway;
 - a yoke movable between at least a first position and a second position and including a yoke cam;
 - 15 whereby closing the cover moves the yoke between the first position and the second position such that the yoke cam engages the cup cam follower and urges the cup against the cup spring to the dispensing port;
 - and wherein the yoke cam, the cup cam follower, or both, comprises a plastics material which includes a slip additive.
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2. A dry powder inhaler according to claim 1 wherein the plastics material is a polytetrafluoroethylene-containing plastics material.
3. A dry powder inhaler according to claim 1 or 2, wherein the slip additive is a siloxane.
- 25 4. A dry powder inhaler according to any one of claims 1 to 3, wherein the inhaler additionally comprises at least one cover cam mounted on the mouthpiece cover and movable with the cover between open and closed positions, wherein the cover cam includes at least a first and second cover cam surfaces;
- 30 and the yoke includes yoke cam followers which are biased against the cam surfaces by an actuation spring;
- wherein the cover cam surfaces are arranged such the yoke cam followers successively engage the first cover cam surface when the cover is closed, and the second cover cam surface when the cover is opened;
- 35 and the first cam surface is spaced further from the hinge than the second cam surfaces;

and therefore the yoke cam followers are moved by the actuation spring from the first to the second cover cam surfaces as the cover is opened and thereby the yoke is moved from the second to the first position;

and the yoke cam followers are moved against the actuation spring from the second to the first cover cam surfaces as the cover is closed and thereby the yoke is moved from the first to the second position.

5. A dry powder inhaler according to claim 4, wherein the cover cam includes an additional intermediate cover cam surface between the first and second cover cam surfaces wherein the yoke cam followers are moved by the actuation spring from the first to the intermediate to the second cover cam surface as the cover is opened and the yoke cam followers are moved against the actuation spring from the second to the intermediate to the first cover cam surface as the cover is opened.

6. A dry powder inhaler according to any preceding claim, the inhaler containing a formulation comprising albuterol sulphate.

7. A dry powder inhaler according to any preceding claim, the inhaler containing a formulation comprising 4.7% (w/w) albuterol and 95.3% (w/w) lactose monohydrate.

8. A dry powder inhaler according to any one of claims 1 to 5, the inhaler containing a formulation comprising fluticasone propionate.

9. A dry powder inhaler according to claim 8 wherein the formulation contains from 3.5% to 4.5% (w/w) fluticasone propionate and from 95.5 to 96.5% (w/w) lactose monohydrate, or from 0.8% to 2.5% (w/w) fluticasone propionate and from 97.5% to 99.2% (w/w) lactose monohydrate, or from 0.4% to 0.6% (w/w) fluticasone propionate and from 99.4% to 99.6% (w/w) lactose monohydrate.

10. A dry powder inhaler according to any one of claims 1 to 5, the inhaler containing a formulation comprising budesonide, formoterol fumarate dihydrate and lactose monohydrate.

11. A dry powder inhaler according to claim 10, wherein the delivered doses of budesonide and formoterol in μg are 80/4.5, 160/4.5 or 320/9.

12. A dry powder inhaler according to any one of claims 1 to 5, the inhaler containing a formulation comprising fluticasone propionate, salmeterol xinafoate and lactose monohydrate.
- 5 13. A dry powder inhaler according to claim 12 wherein the formulation contains 1 % (w/w) fluticasone propionate, from 0.5% to 1.0% (w/w) salmeterol xinafoate and lactose monohydrate; or contains 2.5% (w/w) fluticasone propionate, from 0.5% to 1.0% (w/w) salmeterol xinafoate and lactose monohydrate; or contains 5% (w/w) fluticasone propionate, from 0.5 to 1 .0% (w/w) salmeterol xinafoate and lactose monohydrate.