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(54) MEDICAMENT POWDER DISPENSING DEVICE

(71) We, AMERICAN CYANAMID COMPANY, a corporation organised and existing under the laws of the State of Maine, United States of America, of Berdan Avenue, Township of Wayne, State of New Jersey, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a dispenser for introducing a solid finely divided medicament into the respiratory system via the mouth or a nostril.

A number of medicaments are introduced into the respiratory system either orally or nasally. For instance, there are a number of nasal inhalators and there are also some devices for introducing finely divided medicament into the oral cavity and thence on into the respiratory system. Hitherto these have been of two general types. The nasal inhalator has a medicament chamber, openings to the atmosphere, and of course a projecting hollow nozzle member which is introduced into the nostril. On inhaling, air is sucked into the chamber, picks up medicament, which in some cases is liquid and other cases is sublimed from crystals. The prior art type of dispenser for introducing finely divided medicament into the oral cavity not only has a different shaped mouthpiece but usually has a container feeding into a venturi tube through which air or a gas flows, picking up the medicament.

Where there is no reason to measure the dose accurately, these types of dispensers are quite satisfactory and they are used on a large scale, particularly the nasal inhalators. However, for many purposes it is desirable to introduce a definitely measured dose, and this is difficult or impossible with the devices available prior to the present invention. The present invention therefore seeks to provide a dispenser for introducing a solid finely divided medicament into the respiratory system which can be used so as to dispense accurately measured doses into the mouth or nostrils.

The dispenser in accordance with the present invention comprises a medicament chamber for receiving a dose of the medicament, a nozzle or mouthpiece for introducing the medicament into a nostril or the mouth and having a conduit communicating with the medicament chamber to receive therefrom medicament dispersed in a propellant gas, at least one gas duct for introducing propellant gas under pressure into the medicament chamber at an angle to the conduit into the nozzle or mouthpiece whereby, in use, the medicament is dispersed in a turbulent gas, and a member movable within the medicament chamber and which when propellant gas is introduced into the medicament chamber functions as a vibrating and spinning element inhibiting the formation of aggregates of the medicament.

One important feature of the dispenser of the present invention is the provision of a medicament chamber into which propellant gas under pressure can be introduced at an angle to the outlet conduit to the nozzle or mouthpiece. This arrangement creates turbulence within the medicament chamber and helps to ensure that all of the dosage introduced into the chamber is carried on into the nose or mouth, and thence on into the respiratory system.

Another important feature of the dispenser of the present invention is that in the medicament chamber there is present a movable element, such as a steel ball or, in another embodiment, half of the hard shell of a capsule carrying a dosage of medicament. These movable members vibrate, collide with the medicament being atomized, and prevent formation of or break up any coarser materials such as coarser aggregates of the powdered medicament. Also, adhering of medicament to the walls of the dispensing chamber is greatly reduced and for the most part completely eliminated.

[Price 25p]

Price 30p

The present invention, therefore, permits discharging of a finely divided spray of solid particles from an accurately predetermined dosage either into the nose or mouth. No problem of over dosage is presented, which was a problem with the dispensers used in the past; and so even with medicaments which in excessive amounts have undesirable effects, complete safety can be assured.

In general, the principles of the present invention can be incorporated into two somewhat different shaped devices. In one device, which is particularly usable with finely divided solid medicaments for oral use, a medicament chamber is formed with a plug and sealer and a funnel-shaped entrance to a mouthpiece. Preferably a conical screen is also provided further to assure that larger aggregates are not dispensed. Propellant gas under pressure is then introduced into the chamber substantially at right angles to the conduit to the mouthpiece. High turbulence results, and as there also is present in the medicament chamber a steel ball or other element which can vibrate and move, thorough and complete breaking up of aggregates results and the exactly predetermined dose is introduced in the best form. In a preferred modification of this type of dispenser, the propellant gas under pressure is introduced through two ducts which direct a large volume of lower velocity gas directly into the chamber and a smaller volume of higher velocity gas into another part of the chamber to increase the turbulence.

The second general type of dispenser of the present invention at first glance appears somewhat similar to a conventional nasal inhalator. However, the air passages are sealed up and a tube or conduit carries propellant gas under pressure into a side of the medicament chamber. As the gas comes in at an angle to the conduit connecting the medicament chamber to the nozzle, there is high turbulence and a very thorough distribution of the medicament in the propellant gas results. The medicament is ordinarily introduced in a half of a capsule and this capsule half advantageously serves as the movable member as it vibrates violently which not only results in completely emptying of medicament dose but also breaks up larger aggregates.

In the second type of dispenser referred to above, ordinarily the inlet gas duct enters at an angle which is not quite a right angle, whereas in the first type described above the gas is usually introduced at right angles to the flow through the mouthpiece. The particular angle is not critical so long as it is a sufficient angle to produce a high degree of turbulence.

It is desirable to form the gas introducing duct to the medicament chamber so that it can be directly pressed on the discharge valve of an ordinary propellant cartridge which contains a volatile liquid or gas, such as "Freon" (registered Trade Mark) of suitable boiling point. This permits a very compact and readily portable package and may be considered as the preferred form of the invention. It should be understood that when the dispenser is pressed onto the discharge valve of the propellant cartridge it should be pressed for a short but still sufficient time to assure that the full dosage of medicament in the medicament chamber is ejected into the mouth or nostril. This presents no problem as an exact time measurement is not needed.

The invention will now be described further with reference to the accompanying drawings, in which:—

Figure 1 is a cross-section through the dispenser for oral use taken on the line 1—1 of Figure 2;

Figures 2, 3 and 4 show separate elements of the dispenser, Figure 4 being an exploded view of all of the elements;

Figure 5 shows the elements of Figure 4 assembled and connected to a propellant cartridge;

Figure 6 is a cross-section through a nasal inhalator of the prior art, and

Figure 7 is a similar cross-section through a nasal inhalator of the present invention.

Figures 1 to 5 relate to a dispenser for oral use. The dispenser has a housing (1) forming part of a medicament chamber, with a mouthpiece (2) and a funnel-shaped inlet (3) to the mouthpiece in the housing (1). A medicament chamber is formed by a plug (5) with a conical end and a sealing O-ring (7). There is also provided a conical screen (4), which can be seen in the exploded view of Figure 4 and in the assembled view in Figure 5.

The medicament chamber is assembled by first introducing the conical screen (4), which is slightly larger at its base than the internal diameter of the housing (1). This conical screen is introduced with its apex into the throat of the mouthpiece (2), as can be seen best in Figure 5. A steel ball (6) is then introduced and the plug (5) inserted to a depth to produce a chamber of the desired dimensions. Medicament chambers of various dimensions can be produced with the same equipment by varying the distance that the plug (5) is inserted into the housing (1). It will be seen that the medicament chamber is between the conical end of the plug (5) and the screen (4).

In use a dose of finely powdered medicament, is introduced through the mouthpiece, the housing (4) being held so that the mouthpiece points up. The finely divided medicament passes through the screen (4) and, if necessary, some tapping of the instrument

may be used in order to be sure that all of the medicament enters the chamber. Then an extension (8) on the housing (1) with a central conduit (9) is pushed onto the valve mechanism (10) of a conventional propellant cartridge, as is shown in Figure 5. This cartridge is of somewhat simplified design as it is not required that it contain material to be sprayed.

When pressed down on the valve, the "Freon" or other propellant gas in the cartridge flows into the medicament chamber through two gas ducts, which can be seen in the cross-section of Figure 1. Gas duct (12) is the larger one and gas duct (13) is the smaller one. Most of the propellant gas enters through the larger duct (12) and because of the size of the duct has relatively low velocity. A smaller portion at much higher velocity enters through the duct (13) and the two streams of gas strike each other and further enhance the turbulence. The steel ball (6) vibrates and bounces around, which assures further fineness of subdivision and also breaks up any larger aggregates of the powder so that everything is blown out through the screen (4) and the mouthpiece (2) and the whole of the predetermined dosage is introduced. A single steel ball (6) is shown, but, of course, more than one may be present and they may be made of other materials.

Figures 6 and 7 show nasal inhalators. In Figure 6 the inhalator (14), with a hollow extension (15) which goes into the nostril, communicates with a medicament chamber (16). The element (15) is screwed onto a boss on the inhalator (14) or can be a friction fit in the conventional manner. When the inhalator is introduced into a nostril and the patient inhales, air flows in through the tubes (17) and a portion of the medicament in the chamber (16) is introduced into the nostril. This type of inhalator is very satisfactory where an accurately predetermined dose is not needed and can be used many times where materials such as sublimable anticongestants are present. However, exact predetermined dosage cannot be provided.

Figure 7 shows an inhalator of the present invention, in which the openings (17) are completely eliminated and a duct (19), which at its other end attaches to the valve of a propellant cartridge enters into the medicament chamber (16) at a right angle. In use the nasal portion or nozzle (15) is removed by unscrewing at (18), or removing it when it is a friction fit, and a half capsule (20) containing finely divided medicament is introduced into the medicament chamber. The nozzle (15) is then fastened on by screwing or by friction fit and the tube (19) is brought into contact with the valve (10) of a propellant cartridge, as is shown for the other form of dispenser in Figure 5. The blast of propellant gas enters at an angle to nozzle 15, causes high turbulence in the chamber (16), which is further advanced by the vibration and spinning of the half capsule (20), resulting in complete emptying thereof and in further turbulence, so that the whole dose is introduced into the nostril.

While in the embodiment shown in Figures 1 to 5 it is usually preferable to introduce the exact dosage through the mouthpiece, it is, of course, possible to remove the plug (5) and introduce a half capsule as in Figure 7 into the chamber, replacing the plug and proceeding then as has been described above in connection with Figures 1 to 5.

WHAT WE CLAIM IS:—

1. A dispenser for introducing a solid finely divided medicament into the respiratory system, comprising a medicament chamber for receiving a dose of the medicament, a nozzle or mouthpiece for introducing the medicament into a nostril or the mouth and having a conduit communicating with the medicament chamber to receive therefrom medicament dispersed in a propellant gas, at least one gas duct for introducing propellant gas under pressure into the medicament chamber at an angle to the conduit into the nozzle or mouthpiece whereby, in use, the medicament is dispersed in a turbulent gas, and a member movable within the medicament chamber and which when propellant gas is introduced into the medicament chamber functions as a vibrating and spinning element inhibiting the formation of aggregates of the medicament.

2. A dispenser according to Claim 1, wherein said movable member comprises at least one ball freely movable within the medicament chamber.

3. A dispenser according to Claim 1, wherein said movable member comprises half of a hard shell capsule by means of which a dose of medicament has been introduced into the medicament chamber.

4. A dispenser according to Claim 1 for oral use, comprising a mouthpiece and integral housing, a funnel-shaped entrance in the housing to the mouthpiece, a conical screen element fitting into the entrance of the mouthpiece, a plug with a conical end introducible into the housing from the end opposite the mouthpiece and provided with sealing means, whereby a medicament chamber of predetermined size can be produced by introducing the plug a predetermined distance, and an extension on the housing at right angles to the mouthpiece axis and defining at least one gas duct for introducing propellant gas under pressure into the medicament chamber.

5. A dispenser according to Claim 4, wherein said extension defines two gas ducts

may be used in order to be sure that all of the medicament enters the chamber. Then an extension (8) on the housing (1) with a central conduit (9) is pushed onto the valve mechanism (10) of a conventional propellant cartridge, as is shown in Figure 5. This cartridge is of somewhat simplified design as it is not required that it contain material to be sprayed.

When pressed down on the valve, the "Freon" or other propellant gas in the cartridge flows into the medicament chamber through two gas ducts, which can be seen in the cross-section of Figure 1. Gas duct (12) is the larger one and gas duct (13) is the smaller one. Most of the propellant gas enters through the larger duct (12) and because of the size of the duct has relatively low velocity. A smaller portion at much higher velocity enters through the duct (13) and the two streams of gas strike each other and further enhance the turbulence. The steel ball (6) vibrates and bounces around, which assures further fineness of subdivision and also breaks up any larger aggregates of the powder so that everything is blown out through the screen (4) and the mouthpiece (2) and the whole of the predetermined dosage is introduced. A single steel ball (6) is shown, but, of course, more than one may be present and they may be made of other materials.

Figures 6 and 7 show nasal inhalators. In Figure 6 the inhalator (14), with a hollow extension (15) which goes into the nostril, communicates with a medicament chamber (16). The element (15) is screwed onto a boss on the inhalator (14) or can be a friction fit in the conventional manner. When the inhalator is introduced into a nostril and the patient inhales, air flows in through the tubes (17) and a portion of the medicament in the chamber (16) is introduced into the nostril. This type of inhalator is very satisfactory where an accurately predetermined dose is not needed and can be used many times where materials such as sublimable anticongestants are present. However, exact predetermined dosage cannot be provided.

Figure 7 shows an inhalator of the present invention, in which the openings (17) are completely eliminated and a duct (19), which at its other end attaches to the valve of a propellant cartridge enters into the medicament chamber (16) at a right angle. In use the nasal portion or nozzle (15) is removed by unscrewing at (18), or removing it when it is a friction fit, and a half capsule (20) containing finely divided medicament is introduced into the medicament chamber. The nozzle (15) is then fastened on by screwing or by friction fit and the tube (19) is brought into contact with the valve (10) of a propellant cartridge, as is shown for the other form of dispenser in Figure 5. The blast of propellant gas enters at an angle to nozzle 15, causes high turbulence in the chamber (16), which is further advanced by the vibration and spinning of the half capsule (20), resulting in complete emptying thereof and in further turbulence, so that the whole dose is introduced into the nostril.

While in the embodiment shown in Figures 1 to 5 it is usually preferable to introduce the exact dosage through the mouthpiece, it is, of course, possible to remove the plug (5) and introduce a half capsule as in Figure 7 into the chamber, replacing the plug and proceeding then as has been described above in connection with Figures 1 to 5.

WHAT WE CLAIM IS:—

1. A dispenser for introducing a solid finely divided medicament into the respiratory system, comprising a medicament chamber for receiving a dose of the medicament, a nozzle or mouthpiece for introducing the medicament into a nostril or the mouth and having a conduit communicating with the medicament chamber to receive therefrom medicament dispersed in a propellant gas, at least one gas duct for introducing propellant gas under pressure into the medicament chamber at an angle to the conduit into the nozzle or mouthpiece whereby, in use, the medicament is dispersed in a turbulent gas, and a member movable within the medicament chamber and which when propellant gas is introduced into the medicament chamber functions as a vibrating and spinning element inhibiting the formation of aggregates of the medicament.

2. A dispenser according to Claim 1, wherein said movable member comprises at least one ball freely movable within the medicament chamber.

3. A dispenser according to Claim 1, wherein said movable member comprises half of a hard shell capsule by means of which a dose of medicament has been introduced into the medicament chamber.

4. A dispenser according to Claim 1 for oral use, comprising a mouthpiece and integral housing, a funnel-shaped entrance in the housing to the mouthpiece, a conical screen element fitting into the entrance of the mouthpiece, a plug with a conical end introducible into the housing from the end opposite the mouthpiece and provided with sealing means, whereby a medicament chamber of predetermined size can be produced by introducing the plug a predetermined distance, and an extension on the housing at right angles to the mouthpiece axis and defining at least one gas duct for introducing propellant gas under pressure into the medicament chamber.

5. A dispenser according to Claim 4, wherein said extension defines two gas ducts

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to the medicament chamber, one of larger cross-section than the other, the gas ducts being positioned so that propellant gas flowing through them produces streams which contact with each other in the medicament chamber.

6. A dispenser according to any one of Claims 1 to 3 for use as a nasal inhalator, wherein said nozzle is detachably connected to the medicament chamber.

7. A dispenser for introducing a solid finely divided medicament into the respiratory system, according to Claim 1 and substantially as hereinbefore described with reference to Figures 1 to 5 or Figure 7 of the accompanying drawings.

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