July 15, 1952 G. V. TAPLIN ET AL 2,603,216

POWDER INHALER

Filed June 3, 1947

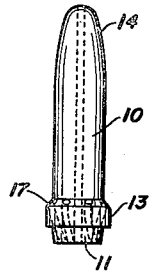


FIG. 1.

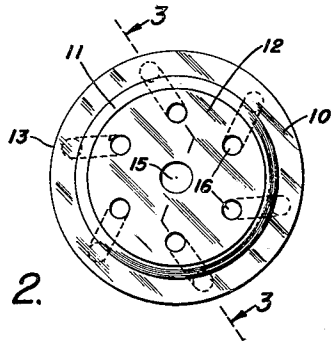


FIG. 2.

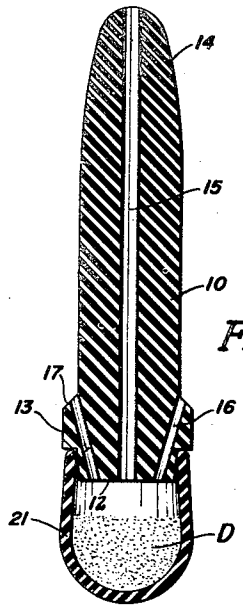


FIG. 3.

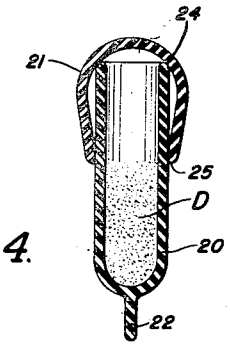


FIG. 4.

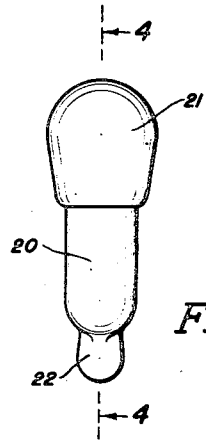


FIG. 5.

INVENTOR.
GEORGE V. TAPLIN
FREDERICK A. BRYAN
BY
ATTORNEY

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POWDER INHALER

George V. Taplin and Frederick A. Bryan,
Brighton, N. Y.

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6 Claims. (Cl. 128—206)

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The present invention relates to apparatus for administering therapeutic agents by inhalation. In a more specific aspect this invention relates to inhalers of the type disclosed in our pending application Serial No. 733,280, filed March 8, 1947, now Patent No. 2,533,065.

In our application Serial No. 733,280 we have disclosed a method of administering therapeutic agents in which the agent is prepared in dry, micro-pulverized form and inhaled. Two different forms of apparatus for administering the therapeutic agent are described, one, an insufflator adapted to be used repeatedly, and the other, a disposable inhaler which is adapted to administer a single dose of the therapeutic agent and is intended to be used only once and then thrown away.

One object of the present invention is to provide an improved piece of apparatus for administering therapeutic agents in the dry, pulverized state.

A further object of the invention is to provide a piece of apparatus for the purpose described which is semi-disposable, and which comprises an inhaler that is adapted to be used repeatedly with disposable capsules, each containing a single, measured dosage of the drug which is to be administered.

Another object of the invention is to provide a disposable capsule or container for use with an inhaler of the character described which will hold a single dose of the powdered medicine and will keep that dose dry indefinitely until used.

Still another object of the invention is to provide an inhaler of the character described which will be extremely low in cost; in fact, which can be made so cheaply that it can be thrown away after a patient has completed a series of treatments for a specific ailment.

A still further object of the invention is to provide an inhaler which does not require coordination of the patient in order to use it.

Other objects of the invention will be apparent hereinafter from the specification and from the recital of the appended claims.

In the drawings:

Fig. 1 is a side elevation of an inhaler made according to a preferred embodiment of this invention;

Fig. 2 is a bottom plan view of the inhaler on a considerably enlarged scale;

Fig. 3 is a sectional view, showing the inhaler ready for use and having a part of the capsule or container for the therapeutic agent secured thereto, the section through the inhaler being taken on the line 3—3 of Fig. 2;

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Fig. 4 is a section on the line 4—4 of Fig. 5 showing a capsule or container made according to the present invention; and

Fig. 5 is a side elevation of this capsule or container.

The claims of our pending application Serial No. 733,280 referred to above are confined to therapeutic agents and to a process for administering such agents by inhalation. In the present application we are claiming apparatus for administering such therapeutic agents by inhalation.

The apparatus of the present invention comprises an inhaler and capsules or disposable containers for holding the drug which is to be administered. The capsule is adapted to contain a measured dosage of the drug. When the drug is to be administered, the capsule is opened and the part of it, which holds the therapeutic agent, is pushed over one end of the inhaler. Then the patient breathes through the other end of the inhaler, drawing the powdered drug up through the inhaler into his nose or mouth.

Referring now to the drawings by numerals of reference, 10 denotes an inhaler made according to this invention. It is an elongated body preferably made of a plastic material, such as polystyrene. It has a base portion 11 whose lower face is a flat, generally plane surface 12; and it is formed with a shoulder or flange 13 a short distance above the base and with an ogival shaped nose portion 14 at its opposite end. A hole 15 extends axially through the inhaler. Other holes 16 are formed through the inhaler from the outside of the upper face 17 of the shoulder 13 to the bottom 12 of the base 11. These holes are equispaced around the axis of the inhaler, and are preferably inclined in two directions to the axis of the inhaler, namely sidewise and lengthwise. They are oblique or skew to the axis of the inhaler and they converge toward the bottom face 12 of the inhaler.

The micro-pulverized therapeutic agent D, which is to be used in the inhaler, is adapted to be sold in capsules. A preferred type capsule is shown in Figs. 4 and 5. It comprises a bottom part 20 and a top or cover part 21. The bottom part 20 is preferably made with a tab 22 which can be grasped in the fingers while pulling the two parts apart to open the capsule. The cover is preferably made, as shown, to narrow toward its mouth, so that it may resiliently engage the bottom part 20 and seal the drug in the capsule.

Either part 20 or 21 of the capsule may be made of a size to fit over the base portion 11 of the inhaler to hold the drug while it is being inhaled by the patient through the inhaler. In the em-

bodiment shown, the top portion 21 is designed for this purpose. Therefore, the capsule is inverted just before use so that the therapeutic agent D in it will run out of the bottom of the capsule into the top thereof. Then the two parts of the capsule are pulled apart by holding part 21 in the fingers of one hand and drawing part 20 out of it by pulling on tab 22 with the fingers of the other hand. Then part 21 with the dry, micro-pulverized drug therein is shoved over the base 11 of the inhaler to secure it to the inhaler. The base 11 is preferably tapered inwardly from shoulder 13 to its bottom face 12 to permit the cap portion 21 to slide easily over it. Yet cap portion 21 is made sufficiently resilient to hold tightly around base portion 11 when it is in position.

In use, the patient places the end 14 of the inhaler into one of the nostrils or into the mouth and breathes in. Air is thus drawn in through the holes 16 into the powder container or capsule part 21. The skew arrangement of the ducts 16 creates a turbulence in the powder D in the container 21, and the powder suspended in air is drawn up through the duct 15 into the nostril or mouth.

The parts 20 and 21 of the capsule are preferably made of a cellulose type plastic such as cellulose acetate or butyrate which is not only resilient but non-hygroscopic. This latter is an important feature of the invention. Ordinarily, medicinal capsules are made of gelatin. When a gelatin capsule is used to hold a powdered drug such as is intended to be employed in the inhaler of the present invention, it has been found that the gelatin gives up its water content which may be as high as eleven to fifteen percent. This makes the drug moist, and the particles stick together, causing the drug to be inhaled in lumps or gobs instead of in the micro-pulverized particulate form desired, and tending to clog the inhaler duct 15. Furthermore, when a gelatin capsule has lost its moisture content, it shrinks in size, gets brittle, easily breaks off and loses its resilience. It is no longer suitable for use for storing drugs such as are intended to be used in inhalers made according to this invention.

The use of non-hygroscopic capsules is therefore an important achievement of this invention. Plastic capsules can be molded to have rounded edges as indicated at 24 and 25. Thus the sharp edges of the ordinary gelatin capsule can be avoided. There is no danger of these edges breaking and dropping into the powdered drug, where it may be drawn into duct 15 with the powder, clogging the duct. This has happened with gelatin capsules. When the capsules are made of a proper plastic or of glass, however, the pulverized drug will be preserved dry until ready for use. Thus assurance is had that the inhaler will work freely and easily, and that the efficiency of our novel method of administration of therapeutic agents in the dry, powdered state by inhalation may be achieved.

The inhaler 10 itself can be made very cheaply. It is so cheap that like the capsule it can be thrown away when it has served its purpose. Ordinarily, though, a patient will keep and use the inhaler until he has completed his course of treatments for the specific ailment for which he is undergoing treatment. Thus, he may use one inhaler for a course of treatment during which he may use a dozen or more capsules, each containing a single dose of the drug to be administered.

The capsules may be sold in containers or may be carried loosely in a pocket. The inhaler itself can easily be carried in a pocket also. When a person needs a dose of the drug which he is to take, all that he needs to do is to open up a capsule, place the part of it, that contains the powdered drug, on the base of the inhaler, put the other end of the inhaler into the nose or mouth and breathe in. This apparatus does not require any coordination on the part of the patient; he or she does not have to time his or her breathing to the alternate pressing and releasing of a bulb as is the case when an insufflator is used. With the present apparatus all that the patient has to do is to draw in, inhale. The apparatus of this invention is very convenient to use and to carry.

While the invention has been described in connection with a particular embodiment thereof, it will be understood that it is capable of various further modifications, and that this application is intended to cover any variations, uses or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth and as fall within the scope of the invention as defined by the appended claims.

Having thus described our invention, what we claim is:

1. Apparatus for administration of a therapeutic agent in the dry, powdered state, comprising an elongated inhaler having one end shaped to be inserted into a nostril, and having an air duct extending centrally therethrough from said nostril end to the other end thereof, said inhaler having a flange or shoulder formed externally thereon adjacent said latter end, and a plurality of air ducts disposed circularly about said central duct and extending from the outside of the shoulder to said other end of the inhaler, said last-named ducts converging toward one another at the latter end of the inhaler and being also oblique to the central duct.

2. Apparatus for administration of a therapeutic agent in the dry, powdered state, comprising in combination, an elongated inhaler having one end thereof shaped to enter a nostril, and a disposable cup-shaped container adapted to hold a measured dose of the agent, said inhaler having a shoulder formed externally thereon adjacent its latter-named end and having a duct extending centrally therethrough from one end thereof to the other and a plurality of ducts arranged circularly about said central duct and extending from the outside of the shoulder to the latter-named end of the inhaler, said last-named ducts converging toward the latter-named end of the inhaler and extending obliquely of the central duct, and said container being made of a resilient material and being adapted to fit over the latter-named end of the inhaler and abut against the shoulder thereof.

3. Apparatus for administration of a therapeutic agent in dry, powdered form by inhalation comprising in combination, an inhaler body member having a central air passage extending through it from top to bottom and open at both ends and having a shoulder formed externally thereon adjacent its bottom end, said body member being provided with a plurality of air passages, which are disposed about said central passage and which are open at both ends,

said last-named air passages extending from the top of said shoulder to the bottom of the body member, and a hollow container for the agent removably secured to the body member at the bottom thereof to surround the bottom open ends of all the air passages whereby all said air passages communicate with the interior of the container.

4. Apparatus for administration of a therapeutic agent in dry, powdered form by inhalation comprising in combination, an inhaler body member having a central air passage extending through it from top to bottom and open at both ends, and having a shoulder formed externally thereon adjacent its bottom end, said body member having a plurality of air passages disposed about said central air passage and open at both ends and extending from the top of the shoulder to the bottom of the body member, said last-named air passages converging toward the central air passage from top to bottom, and a hollow container for the agent removably secured to the body member at the bottom thereof to abut against the bottom of said shoulder and to surround the bottom open ends of all the air passages of the body member whereby all said air passages communicate with the interior of the container.

5. Apparatus for administration of a therapeutic agent in a dry, powdered form by inhalation comprising in combination, an inhaler body member having a central air passage extending through it from top to bottom and open at both ends and having a shoulder formed externally thereon adjacent its bottom end, said body member having a plurality of air passages disposed about said central passage and open at both ends and extending from the top of the shoulder to the bottom of the body member, said last-named air passages being disposed in skew arrangement to the central air passage but converging toward the central passage from top to bottom, and a hollow container for the agent removably secured to the body member at the bottom thereof to abut against the bottom of said shoulder and to surround the bottom open ends of all the air passages of the body member whereby all said air passages communicate with the interior of the container.

6. Apparatus for administration of a therapeutic agent in dry, powdered form, comprising an elongated body member having a central outlet air passage extending through it which is open at both ends, said body member having its upper end shaped to be inserted in a human respiratory opening and having an external shoulder formed thereon adjacent its lower end, said body member being provided with a plurality of air inlet passages which are open at both ends and which are straight and which extend from the top of said shoulder to the lower face of said body member, and a hollow cup-like container for the agent, said container having its bottom end closed and its upper end open and being removably secured to the body member at the lower end thereof in abutment against the lower face of said shoulder, to surround both the lower end of said central outlet air passage and the lower ends of said plurality of air inlet passages whereby all said passages communicate with the interior of said container, said outlet and inlet air passages terminating at their lower ends in substantially the same plane.

GEORGE V. TAPLIN.
FREDERICK A. BRYAN.

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