

Feb. 26, 1952

F. P. PRIESTLY

2,587,215

INHALATOR

Filed April 27, 1949

3 Sheets-Sheet 1

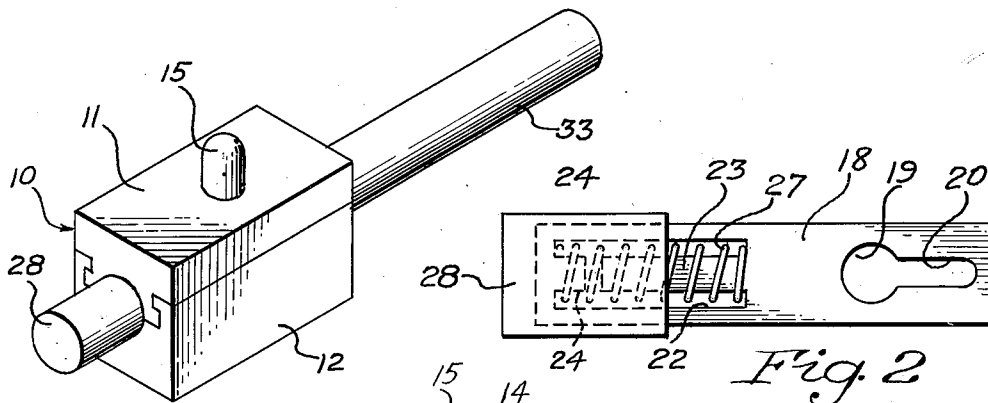


Fig. 1

Fig. 2

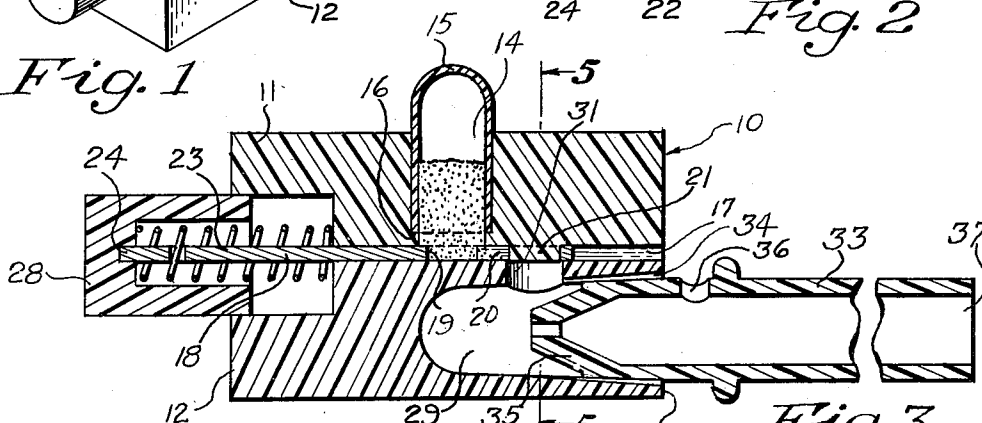


Fig. 3

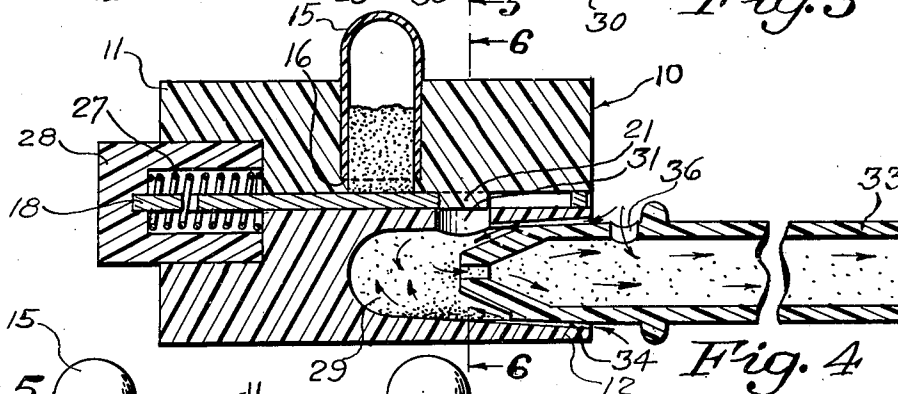


Fig. 4

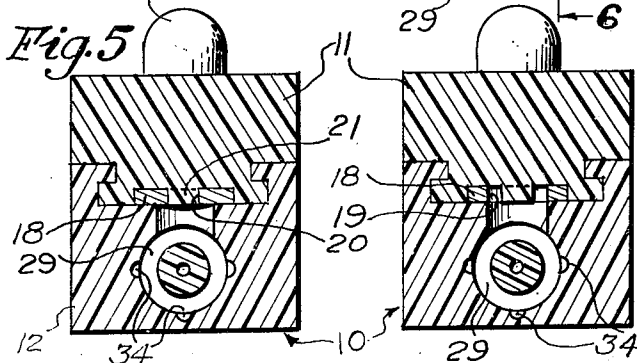


Fig. 5

Fig. 6

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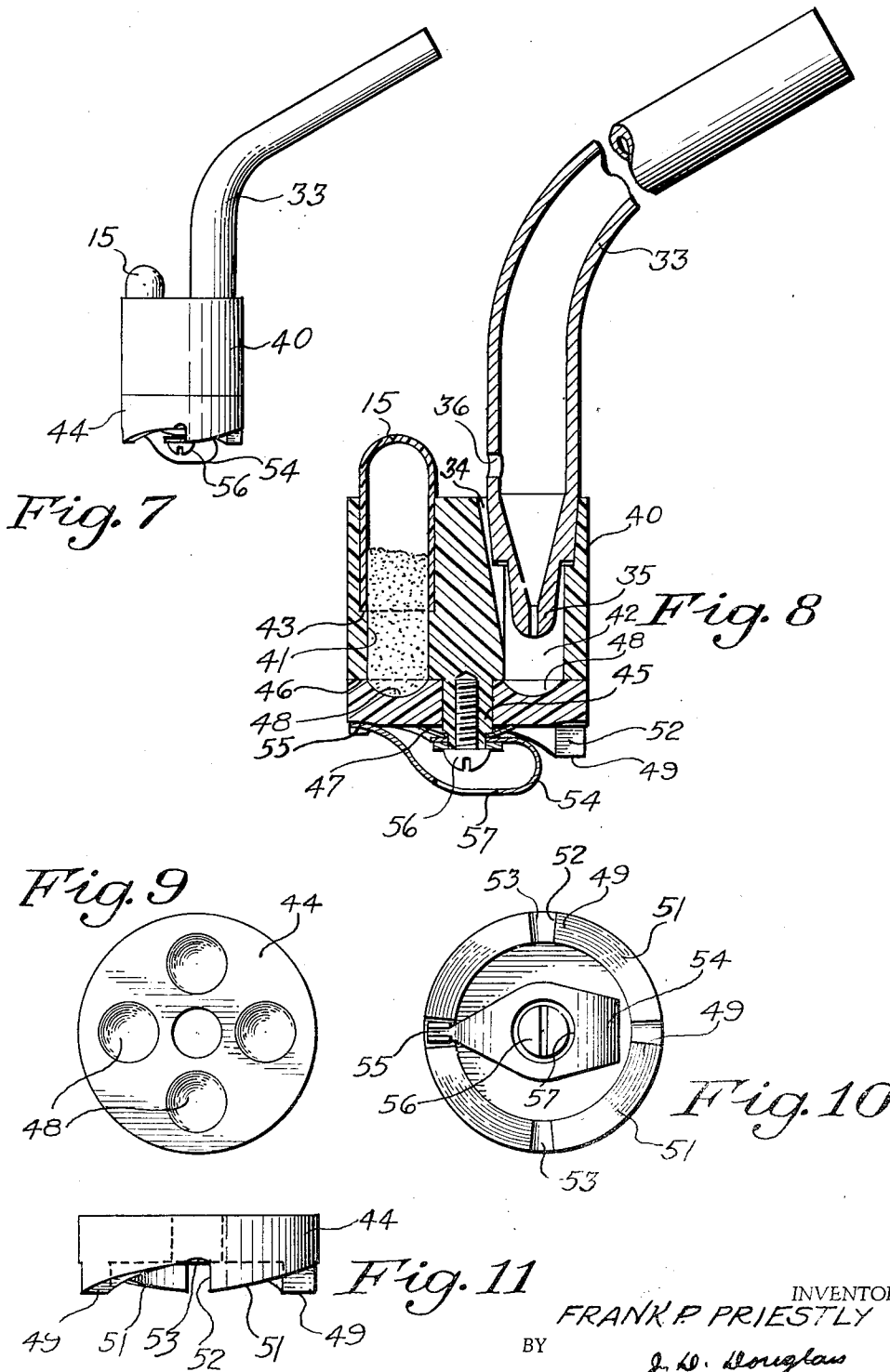
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3 Sheets-Sheet 2



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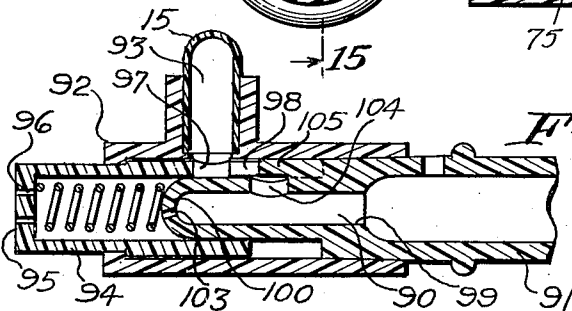
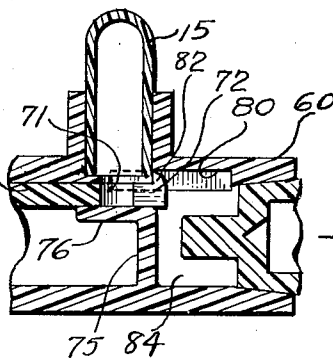
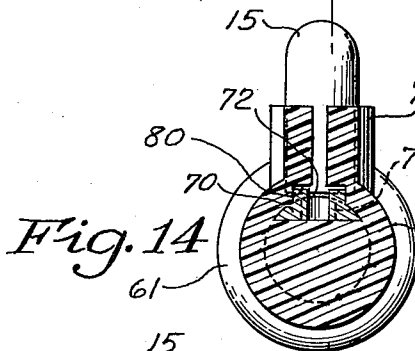
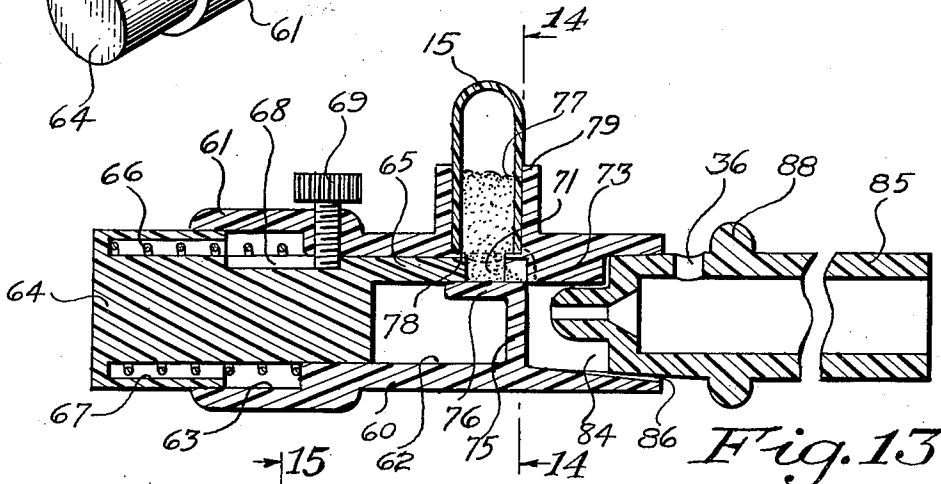
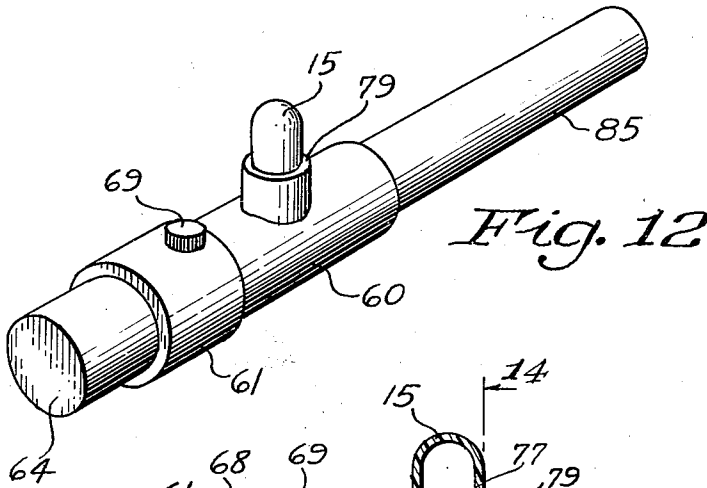
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2,587,215

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3 Sheets-Sheet 3



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## UNITED STATES PATENT OFFICE

2,587,215

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Frank P. Priestly, Chicago, Ill.

Application April 27, 1949, Serial No. 89,851

18 Claims. (Cl. 128—206)

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This invention relates to devices for the diffusion and inhalation of therapeutic powders and more particularly to such devices of such simplicity that they may be used in the home without need for a physician's presence or control.

It has recently been discovered that the inhalation of certain therapeutic powders, principally penicillin and the like, into the nasal and/or oral passages has a highly beneficial effect in the treatment of certain diseases and infections. This is especially true in the treatment of sinusitis and infections of the throat and lungs.

Previous treatment using this type of material has included a "mist" treatment which required complicated apparatus including compressed oxygen in tanks and the like to be found only in a physician's office or hospitals. Later devices for the use of the powder or "dust," as it is called, included masks similar to a respirator mask covering both the nose and mouth and having a container therein for the powder. This device is not completely satisfactory because patients object to the heavy and unattractive device, and too much of the drug is lost during inhalation.

A simple method of inhaling the dust is not very successful because penicillin and other powders are highly hygroscopic and cake together if the normal breath is exhaled across them. A device has been proposed using a small ball similar to buckshot, which, upon inhalation, strikes the capsule or cartridge holding the powder to jar a few grains into the stream of air being inhaled. However, this device must be removed from the mouth or nose before exhaling to avoid contact of the moist breath with the powder.

It is the purpose of my invention to provide an inhaler usable in the home which does not require a special technique for the use thereof. This is accomplished by isolating the main supply of the powder from the mixing or diffusion chamber and providing a means of transporting a measured amount of the powder from the supply chamber to the mixing chamber. Furthermore, I provide a spring means which causes a jarring action each time a new bit of the powder is carried to the mixing chamber. Moreover, my device is designed to use standard size capsules, which makes for a more economical use for filling of medicament and is quite small so that it could be carried in a purse or pocket as simply as a cigarette lighter or the like. My device is also quite inexpensive since it can be made from stock sizes and forms of material without special for-

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mation, requiring, therefore, only a minimum of machine work to form my device.

Other advantages of my invention, and the invention itself, will become apparent from the following description which is illustrated by the accompanying figures which form a part of this specification.

In the drawings:

Fig. 1 is an isometric view of one embodiment of my invention;

Fig. 2 is a top plan view of the push-button and slide mechanism disassembled from the rest of my device;

Fig. 3 is a longitudinal medial section of this embodiment of my invention showing the push button and slide in a retracted position;

Fig. 4 is a view similar to Fig. 3 showing the push button and slide in an inserted position;

Fig. 5 is a sectional view along line 5—5 of Fig. 3;

Fig. 6 is a sectional view along line 6—6 of Fig. 4;

Fig. 7 is a side elevational view of an alternative embodiment of my invention;

Fig. 8 is a vertical medial section of this latter embodiment;

Fig. 9 is a top plan view of the rotary slide means;

Fig. 10 is a bottom plan view of my alternative embodiment;

Fig. 11 is a side elevational view of the slide means;

Fig. 12 is a perspective view of a second alternative embodiment;

Fig. 13 is a vertical medial section of this second alternative;

Fig. 14 is a sectional view on line 14—14 of Fig. 13;

Fig. 15 is a sectional view on line 15—15 of Fig. 14; and

Fig. 16 is a vertical medial sectional view of a third alternative embodiment of my invention.

For the following description, reference is had to the figures throughout which like parts are designated by like reference characters.

Briefly, my invention comprises an inhaler composed of a body having two separate chambers, one for storing a supply of the powder to be inhaled, and one in which a small amount of the powder is diffused in an air stream and from which it is led by a tube to the oral or nasal passages into which it is inhaled. Sliding means is provided to carry the small, and measured, amounts of powder from the supply chamber to the mixing chamber, and to isolate the two cham-

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bers from each other so that whatever moisture gets into the mixing chamber from exhaled breath will not get to the supply of powder.

More specifically, my first embodiment as shown in Figs. 1-6 inclusive comprises a rectangular body 10 which may be made up of two pieces, an upper piece 11 and a lower piece 12, interlocked together as shown. The material indicated in the figures is a plastic material, and while I prefer to use a clear plastic for the body of my invention, the invention is not limited to a device made of this material and may assume other shapes than the rectangular.

The upper piece 11 of the body contains a supply chamber 14 which is a cylindrical opening of a diameter such that a large size pharmacy capsule 15 will fit snugly therein. Near the bottom, the chamber 14 is provided with a shoulder 16 so that the capsule 15 will not be inserted into the opening beyond that point.

A slot 17 is provided between the upper and lower pieces, in which a slide member 18 is slidably disposed. This slide member as best shown in Fig. 2 is a flat rectangular piece of corrosion resistant metal such as Duralumin or stainless steel, or may even be made of plastic material. An opening 19 is provided in the slide which is approximately the same diameter as that of the shoulder 16 of the supply chamber 14, or may be smaller or larger as the dosage for inhalation may indicate. Extending from this opening in a longitudinal direction is a slot 20 which fits over a stop 21, which is shown extending from the upper piece 11 (Figs. 3-6). This stop has a multiple function; it not only acts as a guide for the slide to avoid binding of the slide against the side walls, but also prevents over travel of the slide, therefore locating the opening 19 in its proper position at both ends of travel of the slide. It serves a further purpose in that as the opening 19 is slid from its position beneath the capsule 15, it is bisected by the stop 21, thus loosening the powder in the opening and causing it to drop into the mixing chamber as hereinafter described. As a stop, it also serves to convey the impact of a quick release of the slide to the capsule and the powder therein, causing the powder to be loosened and jarred into the opening 19 of the slide 18.

A novel spring arrangement is used which facilitates the assembly of the device. The slide is formed with an opening comprising essentially a large rectangular opening 22 having a long tongue 23 and a shorter tongue 24 extending into it. A compression spring 27 is then inserted into the opening over the long tongue and compressed and allowed to spring over the shorter tongue. Thus the spring is completely held by the slide member which, with the push button 28, forms a discrete sub-assembly requiring no tools or spring holders to assemble into my device. Since the spring extends beyond the slide on the stop and bottom thereof, it is fully effective to engage the two pieces 11 and 12 and to urge the slide to the left against the stop 21 as viewed in Figs. 3 and 4.

The lower piece 12 of the body contains the mixing or diffusion chamber 29 which is in the form of a cylinder extending from one end 30 of the device. A circular opening 31 extends into the chamber 29 from the top of the piece 12 somewhat displaced from the supply chamber 14 and preferably immediately below the stop 21. The end opening of the mixing chamber may be provided with screw or taper threads

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not shown into which an inhaling tube 33 may be threaded. Grooves 34 are cut in the wall of the opening and, in the case of threads, intersect the threads and extend beyond the end of the inhaling tube to allow air to enter the chamber and to become mixed with the powder. The air which so enters is, subsequently in this description, called primary mixing air.

The tube 33, which is threaded into the mixing chamber 29, is formed with a restriction 35 in the end thereof. This restriction causes a drop in pressure between the mixing chamber 29 and the interior of the tube when air is drawn therethrough. An opening 36 directly into the tube between the restriction 35 and the open end 37 of the tube is provided so that secondary mixing air will enter the stream at that point causing further turbulence in the air stream and better diffusion and pulverization of the powder than is possible with just the mixing which takes place in the chamber.

In use, the half capsule 15 filled with powder is inserted into the chamber 14, or the chamber 14 is lowered over the capsule to avoid spilling the powder. The device is then placed upright and the push button 28 is pressed inward, sliding the slide 18 inward so that the periphery of the opening 19 engages the stop 21 compressing the spring 27. The slide is then permitted to snap back against the stop jarring some of the powder into the opening 19. Moving the slide in again carries the powder over the opening 31 into which it drops being broken up somewhat by the stop 21 which passes through the opening 19 as shown in Fig. 6. This process may be repeated, or the powder in the mixing chamber may now be inhaled depending on the prescribed dosage.

To inhale the powder, the open end 37 of the tube is placed in the nostril or in the mouth and a deep breath is taken. The air entering the oral or nasal cavities must be drawn through the grooves 34 and the opening 36. The air entering the grooves stirs up and mixes with the powder in the chamber 29 diffusing it and carrying it into the tube. However, as previously explained, the restriction causes a pressure drop and secondary air enters through the opening 36 causing further mixing. The diffused mixture is then conducted to the oral or nasal cavities through the tube.

Another embodiment of my invention, the operation of which is the same though the details of construction are somewhat different, is shown in Figs. 7-11. In this embodiment, the body 40 is a single cylindrical piece containing both the supply chamber 41 and the mixing chamber 42. The supply chamber 41 is formed the same way as before with a shoulder 43, although it may be somewhat deeper than that in the previously described embodiment. The method of attaching the tube 33 and its formation, and the provisions for primary and secondary mixing air are exactly the same as in the previous embodiment, except the tube may be bent as shown to account for the difference in orientation of the two devices in use. The mixing chamber is similar, also, except that it extends completely through the body 40.

The slide member 44 of this embodiment is a rotary sliding device, journaled on a cylindrical pivot member 45 extending from the bottom 46 of the body 40. A spring washer 47 is used to urge this slide into close contact with the bottom 46 of the body. A plurality of hollows 48 are

formed in the upper surface of the slide which are adapted to register with the mixing and supply chamber to receive the powder and carry it from the supply chamber to the mixing chamber upon rotation of the slide. In order to provide a method of jarring the powder down into the hollows 48, and to index the slide 44 in its travel, a plurality of projections 49 is formed on the periphery of the slide. Each of the projections comprises a sloping rise portion 51 and an abrupt drop off 52 at the bottom of which there may be provided a slight notch 53 as a detent for better indexing of the hollows. A spring member 54 in the form of a bent leaf spring is provided having a finger 55 to engage these projections. The spring 54 may be seated on the pivot 45 and fastened thereto by a screw 56 threaded into the pivot. An opening 57 in the spring may be provided to give access to the screw. As can be seen, the spring 54 serves additionally as a washer to hold the spring washer 47 in place.

The operation and use of the device is the same as previously described except that instead of sliding the push button in and allowing it to snap out, it is necessary with the latter device only to turn the slide member 44 and allow the spring 54 to snap off the drop off 52 to jar loose the powder.

A second alternative form of my device is illustrated in Figs. 12-15. In this embodiment, the body is of cylindrical shape and is of the push button slide type similar to the preferred embodiment. The body portion 60 is of cylindrical shape having an enlarged end 61. A bore 62 extends through the body and is counterbored at 63 in the enlarged end 61 of the body to receive the push button 64 of the slide member 65. In this embodiment, I prefer to mount the spring 66 in the usual manner, engaging the bottom of an annular kerf 67 in the push button and the bottom of the bore 63 in the body. A longitudinal groove 68 is provided in the slide member which receives the end of a screw 69 threaded into the body. This screw serves as a stop and guide for the slide member similar to the stop 21 of the first embodiment. It is easily removable, and thus the inhalator may be readily disassembled for cleaning.

The powder carrying parts of this embodiment are similar to the first embodiment. The slide member 65 is shaped with a segmental portion 70 in extension from the push button 64 but preferably integral therewith. This portion is formed with an opening 71 and slot 72, similar to those in the slide of the first embodiment. A tongue 73 extends into the slot 72 to loosen the powder in a similar manner as in the first embodiment. In order to keep the powder in the opening, a partition 75 is provided having a horizontal wall 76 extending beneath the opening 71 when the slide is retracted. Directly over this wall 76 an opening 77 is formed for the capsule 15 which may be inserted against a shoulder 78 as before. A reinforcing sleeve 79 may be formed or fixed to the body to support the capsule in this position.

As best shown in Figs. 14 and 15, the body is formed with grooves 80 on either side of the tongue 73 in which small extensions 82 are slidably disposed. These grooves extend into the capsule opening 77, and the extensions are adapted to engage the capsule upon retraction of the slide to jar the powder from the capsule into the slide opening 71.

The mixing chamber 84 is defined by the bore in the body and the partition 75. This chamber

may be similar to that of the preferred embodiment or may be as illustrated. The chamber, as illustrated in Figs. 13 and 15, differs from the preferred embodiment only in that the tube 85 is pressed into the end so that it may be more readily removed for discarding or sterilizing, and a few minor details are changed in an attempt to get more thorough mixture of air and powder. For instance, the only primary air opening 86 is at the bottom of the chamber so that all the primary air sweeps over the powder in the bottom of the chamber, and the entrance of the tube extends into the chamber so that the primary air will sweep more completely through the chamber. It will be realized that these changes are fully as applicable to my preferred embodiment as to this alternative form. A ridge 88 is also shown (Fig. 13) around the tube 85 in order that the tube may be more firmly grasped for insertion or withdrawal from the device and to prevent the user's lips from stopping up the secondary air hole 36.

The operation of the last described device is in all respects similar to that of my preferred embodiment.

Still another form of my invention is illustrated in Fig. 16. In this embodiment, the mixing chamber 90 is formed in the inhaling tube 91. The body portion 92 is a simple tube of circular cross section having a supply chamber 93 formed in one side. This may be similar to the supply chambers of the other embodiments. A push button slide member 94 is slidably disposed in one end of the body portion. This member may also be formed from a tube with one end closed by an end wall 95 preferably having air inlet holes 96 therein for reasons to be explained hereinafter. The powder carrying opening 97 is formed in the member 94 and has a slot 98 similar to the slot 72 in the previously described embodiment.

The tube 91 exteriorly of the body 92 has the same formation as previously described. However, in extension from the portion of tube surrounding the restriction 99 therein, the tube is formed to provide the mixing chamber 90. This is formed by decreasing the diameter of the tube so that the slide member 94 will slide over it. The end is closed by an end wall 100 which may be of hemispherical shape as shown. A hole 103 may preferably be provided in this end wall to allow the passage of the primary mixing air directly into the chamber 90. At the top of the chamber an opening 104 is provided through which the powder may drop, and a tongue 105 is struck upward from this opening similarly to that in previous embodiments.

The operation of this device is the same as that of previous devices. The flow of the primary mixing air may be somewhat different, however, since it preferably comes in directly through the holes 96 in the push button and the hole 103 in the mixing chamber. The powder is picked up by this air, carried through the restriction 99 then mixed more thoroughly by the action of the secondary mixing air and carried into the passages as before.

Whereas in all the embodiments described, the slide member has been in a position to receive the powder from the supply chamber when the push button was retracted; still it will be apparent that this is not necessarily so, and that the device could be readily rearranged to provide that the push button be pushed in to load the

slide member and allowed to retract to cause the powder to enter the mixing chamber.

It will be obvious to those skilled in the art that the use of the secondary mixing air in these devices is not an absolute essential, and that the device will operate without provision for the introduction of such air. In this case, all the air inhaled through the device must pass through the mixing chamber, but this is not disadvantageous except in the slightly poorer mixing which results.

It is also envisioned that my device could be used without a capsule, merely by filling the supply chamber and covering with a cap or by having the powder sealed in the chamber. In the latter case, the inhaler could be thrown away and replaced when the supply of powder was exhausted.

While I have described my invention in several embodiments thereof, it will be realized that it is not limited thereto, and that numerous and extensive departures may be made therefrom without departing from the spirit or scope of my invention.

I claim:

1. An inhaler for therapeutic powder comprising a body, a supply chamber and a mixing chamber formed in said body, a slide operative between said supply chamber and said mixing chamber to carry a small amount of said powder from said supply chamber to said mixing chamber, a tube connected into said mixing chamber and extending outwardly therefrom, and air passages into said mixing chamber for the induction of air.

2. An inhaler for therapeutic powder comprising a body, a supply chamber and a mixing chamber formed in said body, slide means operative between said supply chamber and said mixing chamber to carry a small amount of said powder from said supply chamber to said mixing chamber, tube means connected into said mixing chamber adapted upon inhaling to conduct said powder into the oral or nasal passages, said slide means being adapted to be snapped to jar said powder into said slide means.

3. An inhaler for therapeutic powder comprising a body, a supply chamber and a mixing chamber formed in said body, slide means operative between said supply chamber and said mixing chamber to carry a small amount of said powder from said supply chamber to said mixing chamber, tube means connected into said mixing chamber adapted upon inhaling to conduct said powder into the oral or nasal passages, said slide means being adapted to be snapped to jar said powder into said slide means, and air passages formed beside said tube means to conduct air into said mixing chamber.

4. An inhaler for therapeutic powder comprising a body, a supply chamber and a mixing chamber formed in said body, slide means operative between said supply chamber and said mixing chamber to carry a small amount of said powder from said supply chamber to said mixing chamber, tube means connected into said mixing chamber adapted upon inhaling to conduct said powder into the oral or nasal passages, primary mixing air passages formed beside said tube to conduct air into said mixing chamber and a secondary mixing air opening in said tube outside of said chamber.

5. An inhaler for therapeutic powder comprising a body, a supply chamber and a mixing chamber formed in said body, slide means opera-

tive between said supply chamber and said mixing chamber to carry a small amount of said powder from said supply chamber to said mixing chamber, tube means connected into said mixing chamber adapted for inhaling to conduct said powder into the oral or nasal passages, primary mixing air passages formed beside said tube to conduct air into said mixing chamber, a restriction in said tube, a secondary mixing air opening in said tube between said restriction and the open end of said tube for further mixing of said air and powder.

6. An inhaler for therapeutic powder comprising a body, a supply chamber formed in said body, slide means slidably disposed in said body beneath said supply chamber, an opening in said slide means normally in position beneath said supply chamber, a mixing chamber in said body beneath said slide means, said opening being adapted to be slid by the slide means from its normal position to a position over said mixing chamber to carry a small amount of said powder thereto, a tube extending from said mixing chamber through which the powder may be inhaled.

7. An inhaler for therapeutic powder comprising a body, a supply chamber formed in said body adapted to receive a capsule of said powder, a slot formed in said body beneath said supply chamber, slide means slidably disposed in said slot, an opening in said slide means normally in position beneath said supply chamber, a spring engaging said body and said slide means urging said slide means toward its normal position, stop means adapted to prevent movement of said slide means by said spring beyond its normal position and to stop said slide suddenly upon its release from any position other than its normal position to jar said powder and cause it to fall into said opening, a mixing chamber in said body beneath said slide means, said opening adapted to be slid by said slide means from its normal position to a position above said mixing chamber, and tube means extending from said mixing chamber through which said powder may be inhaled.

8. An inhaler for therapeutic powder comprising a body, a supply chamber formed in said body, slide means slidably disposed in said body beneath said supply chamber, an opening in said slide means normally in position beneath said supply chamber, a mixing chamber in said body beneath said slide means, said opening being adapted to be slid by the slide means from its normal position to a position over said mixing chamber to carry a small amount of said powder thereto, a tube extending from said mixing chamber through which the powder may be inhaled, and an air passage into said mixing chamber to allow entry of the air therinto to mix with said powder.

9. An inhaler for therapeutic powder comprising a body, a supply chamber formed in said body, slide means slidably disposed in said body beneath said supply chamber, an opening in said slide normally in position beneath said supply chamber, a mixing chamber in said body beneath said slide means, said opening being adapted to be slid by the slide means from its normal position to a position over said mixing chamber to carry a small amount of said powder thereto, a tube extending from said mixing chamber through which the powder may be inhaled, primary mixing air passages into said mixing chamber, a restriction in said tube and secondary

mixing air passage into said tube between said restriction and the open end of said tube to provide further mixing of said air and said powder.

10. An inhaler for therapeutic powder comprising a body, a supply chamber and a mixing chamber formed in said body, slide means rotatably disposed on said body beneath said chambers, hollows formed in said slide means adapted to receive a small amount of powder from said supply chamber and to carry it to said mixing chamber when said slide means is turned, and a tube extending from said mixing chamber through which said powder may be inhaled.

11. An inhaler for therapeutic powder comprising a cylindrical body, a supply chamber and a mixing chamber formed therein, slide means rotatably disposed beneath said chambers, hollows formed in said slide means adapted to carry said powder from said supply chamber to said mixing chamber, circumferential projections formed on said slide means each comprising a sloping rise portion and an abrupt drop off, spring means fastened to said body having a finger engaging said projection adapted to index side slide means and to jar the powder from said supply chamber into said hollow upon reaching said drop off and a tube extending from said mixing chamber through which the powder may be inhaled.

12. An inhaler for a therapeutic powder comprising a body, a supply chamber formed in said body of such size that a capsule of said powder may be smoothly inserted thereinto, a shoulder formed in said supply chamber to prevent insertion of said capsule beyond said shoulder, a mixing chamber formed in said body, slide means rotatably disposed on said body beneath said chambers adapted to carry a certain amount of said powder from said supply chamber to said mixing chamber, a tube extending from said mixing chamber through which said powder may be inhaled.

13. An inhaler for a therapeutic powder comprising a body, a supply chamber and a mixing chamber formed in said body, slide means rotatably disposed on said body beneath said chambers adapted to carry said powder from said supply chamber to said mixing chamber in small increments, a tube extending into said mixing chamber through which said powder may be inhaled, primary mixing air passages extending into said mixing chamber, a restriction in said tube and secondary mixing air opening into said tube between said restriction and the open end of said tube to allow additional air to mix with said powder.

14. An inhaler for a therapeutic powder comprising a cylindrical body, a supply chamber and a mixing chamber formed in said body, a cylindrical pivot extending from the center of the bottom of said body, rotary slide means rotatably journaled on said pivot, hollows formed in said slide means adapted to carry said powder from said supply chamber to said mixing chamber in small increments, peripheral projections on said slide means each comprising a sloping rise portion and an abrupt drop off, a spring washer surrounding said pivot adapted to urge said slide means into contact with said body, spring means mounted on said pivot means having a finger

engaging said projections to index said slide means and to jar said powder from said supply chamber into said hollows upon snapping down from said drop off, and tube means extending from said mixing chamber through which the powder may be inhaled.

15. Diffusion means for a therapeutic powder inhaler comprising a mixing chamber formed in said inhaler having an opening for the entry of the powder and a tube opening, means in said inhaler adapted to close the opening for the entry of the powder after the powder is deposited in said chamber, a tube inserted into said tube opening, through which said powder may be inhaled, primary mixing air passages opening into said chamber cut into the walls of said tube opening, a restriction in said tube and a secondary mixing air opening in said tube between said restriction and open end of said tube.

16. Diffusion means for a therapeutic powder inhaler comprising a mixing chamber formed in said inhaler having a tube opening, a tube inserted into said tube opening and extending into said chamber through which said powder may be inhaled, primary mixing air passages extending into said chamber, a restriction in said tube, and a secondary mixing air opening in said tube between said restriction and the open end of said tube.

17. An inhaler for a therapeutic powder comprising a tubular body portion, a supply chamber formed in said body, slide means slidably disposed in one end of said body, tube means at the other end of said body, a mixing chamber formed in said tube means extending into said body, said slide means being disposed thereabout, said mixing chamber being formed with a powder inlet opening at the top, longitudinally displaced from said supply chamber, said slide means having a powder carrying opening normally disposed beneath said supply chamber and adapted to carry a small amount of powder from said supply chamber to a position directly above said powder inlet opening, spring means engaged between said slide means of said tube means to urge said slide means to its normal position.

18. An inhalator for a medicament comprising enclosure means enclosing a supply chamber and a mixing chamber, movable means movably associated with said enclosure means adapted to carry a small amount of said medicament from said supply chamber to said mixing chamber, said enclosure means being formed with outlet means from, and air inlet means into, said mixing chamber.

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