United States Patent [19]

Cocozza

[11] **3,906,950**

[45] **Sept. 23, 1975**

[54] **INHALING DEVICE FOR POWDERED MEDICAMENTS**

[75] Inventor: **Salvatore Cocozza,** Milan, Italy

[73] Assignee: **I.S.F. S.p.A.,** Milan, Italy

[22] Filed: **Apr. 2, 1974**

[21] Appl. No.: **457,270**

[30] **Foreign Application Priority Data**

Apr. 4, 1973 Italy 22576/73
June 22, 1973 Italy 25698/73

[52] **U.S. Cl.** **128/266;** 128/206
[51] **Int. Cl.²** **A61M 13/00;** A61M 15/08
[58] **Field of Search** 128/266, 206, 208, 194, 128/265

[56] **References Cited**

UNITED STATES PATENTS

2,307,986	1/1943	Bolté et al.	128/266
2,517,482	8/1950	Hall	128/206
2,519,555	8/1950	Fields	128/266
2,581,182	1/1952	Fields	128/206
2,946,332	7/1960	Sacks	128/266
3,507,277	4/1970	Altounyan et al.	128/208
3,669,113	6/1972	Altounyan et al.	128/266

Primary Examiner—Aldrich F. Medbery
Attorney, Agent, or Firm—Depaoli & O'Brien

[57] **ABSTRACT**

An inhaling device for medicinal powders comprising a pump and an inhaler wherein the inhaler has a cavity formed by the interconnection of two compartments for holding a puncturable capsule containing a medicinal powder. Two sliding needles acting against the action of return springs pierce the capsule. In a preferred embodiment, the lower body portion of the inhaler is attached to the pump when in use and may be stored in "at rest" position when the inhaler is inverted into the pump.

22 Claims, 6 Drawing Figures

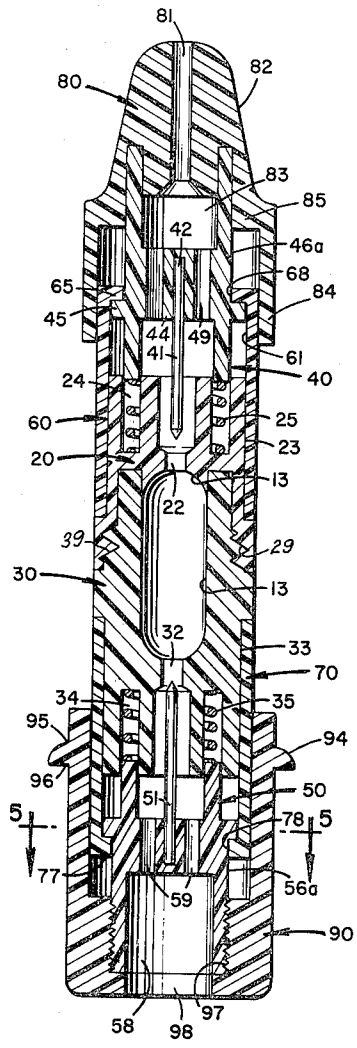
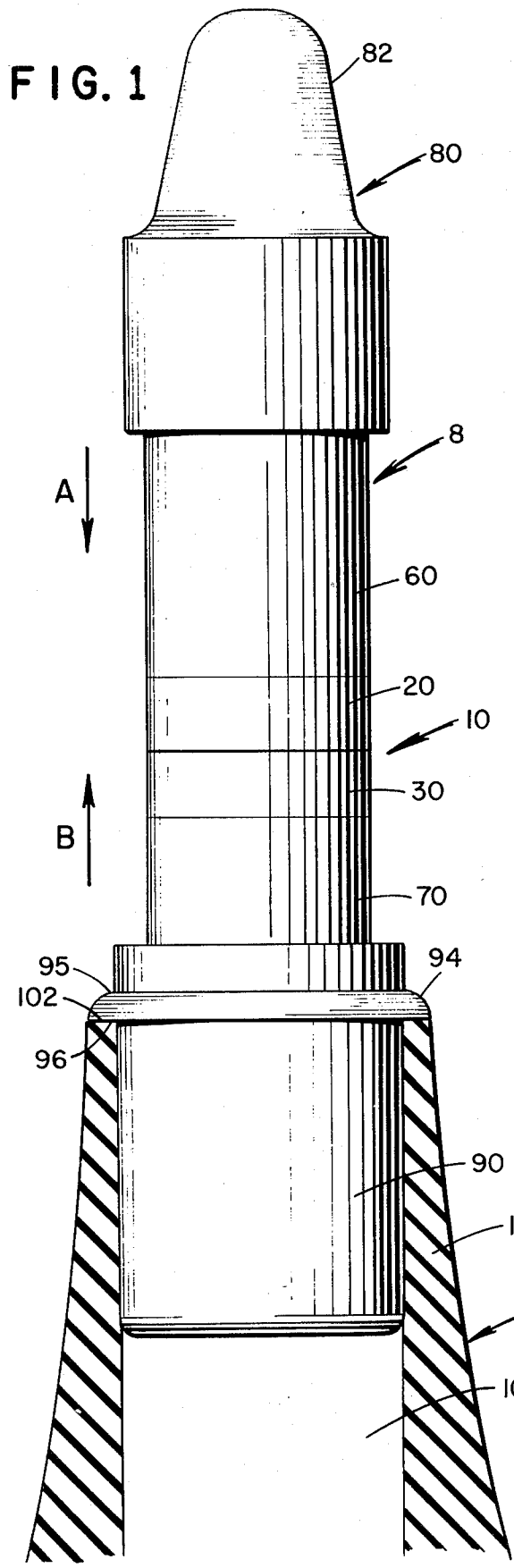


FIG. 1



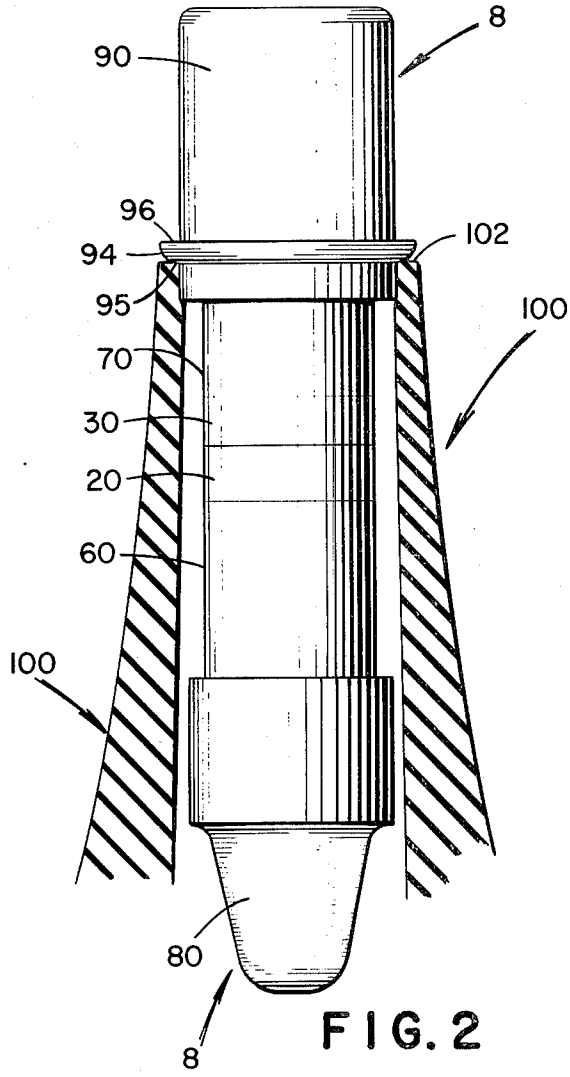


FIG. 2

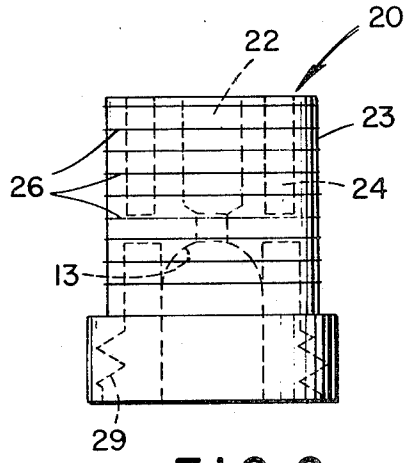


FIG. 6

FIG. 3

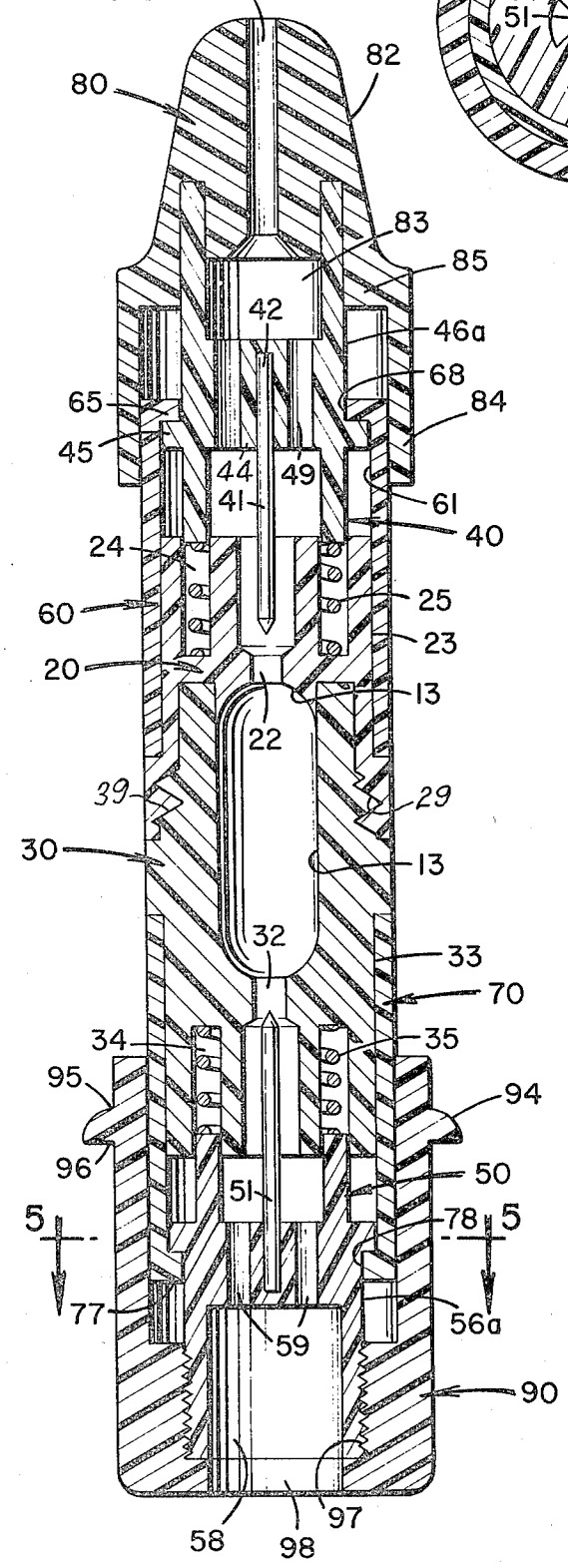


FIG. 5

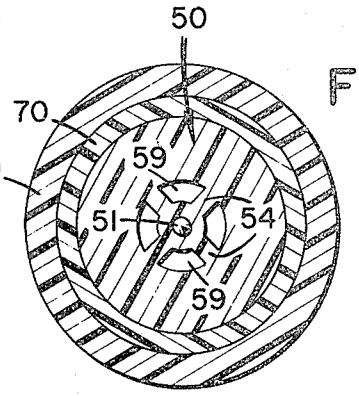
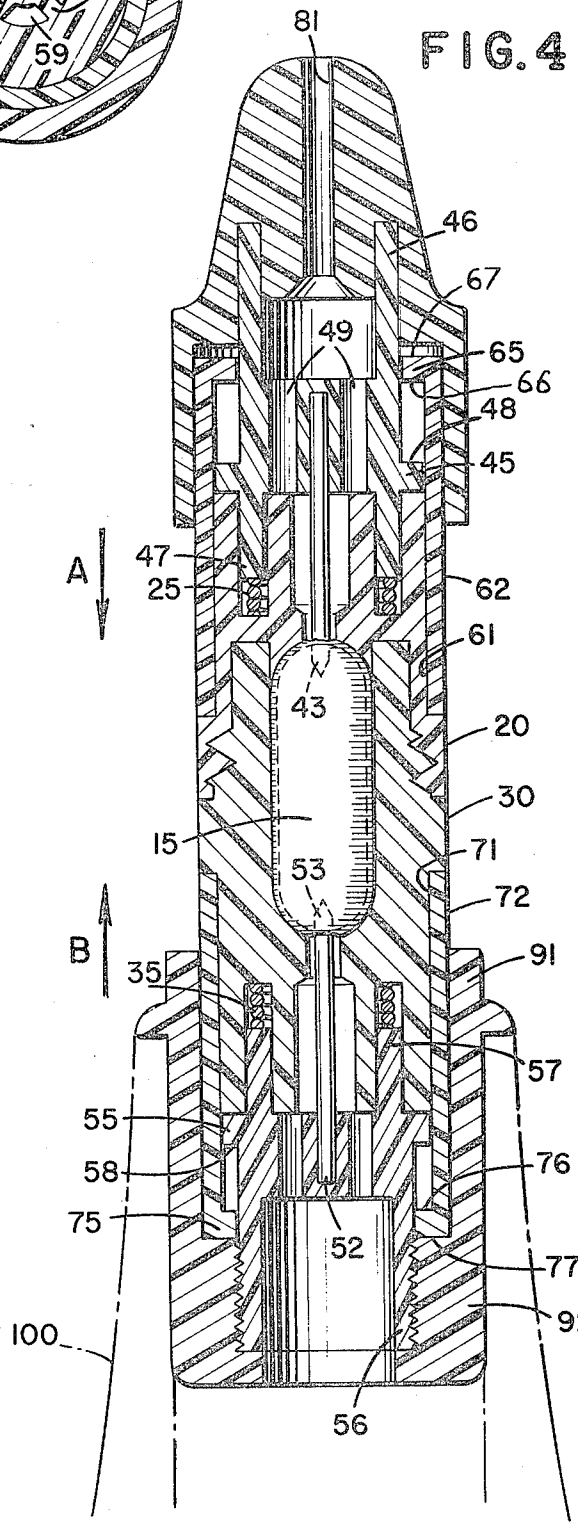


FIG. 4



INHALING DEVICE FOR POWDERED MEDICAMENTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to an inhaler for the administration of medicinal powders. More particularly, the inhaler relates to a traditional pump and an inhaler body having means for piercing a stored capsule containing medicinal powder.

2. Description of the Prior Art

Inhalers are already known utilizing an elastic pump and a needle piercing a capsule which contains a medicinal substance; generally their working is not completely satisfactory as a result of rather complicated construction and cumbersome dimensions. In the inhaler of the present invention, the above mentioned inconveniences have been practically eliminated, so that the inhaler is easily and quickly constructed and of reduced dimensions.

SUMMARY OF THE INVENTION

It is the object of this invention to provide an inhaler having simplified construction and reduced dimensions for use in combination with a conventional pump as an inhaling device for supplying medicinal powders to a body cavity.

It is another object to provide an inhaler having means for partial storage within the pump therefor.

It is an additional object to provide an inhaler having a means wheel to facilitate locking engagement with the pump.

It is a further object to provide an inhaler having a plurality of slidable alignment means.

It is also an object to provide an inhaler having a spring-biased means for penetrating each end of a capsule stored therewithin.

In satisfaction of these objects and in accordance with the spirit of this invention, the inhaler contains a cavity-penetrating element, at one end thereof, through which air-entrained powder is forced out into a body cavity, a central element with an inside cavity for locating a capsule of medicinal powder therewithin, a pair of piercing devices for the endwise perforation of the capsule, and a base element having a polished surface interrupted by a ratchet wheel for connection with the pump. In more detail, the central element of the inhaler body is relatively fixed and formed by two components which are connected to each other, for example, by threading, bayonet insertion, and similar techniques. These components define a cavity therewithin, for placement of the capsule, and are slidably attached to a pair of relatively movable elements which hold piercing needles and which telescopically slide inside the two above-mentioned capsule holder components against the action of a pair of return springs.

The base element of the inhaler is so shaped that when the device is not in use, the inhaler body may be inverted into the pump, therby resulting in a noticeable reduction in overall size and a pleasant compact aspect of the whole which is aesthetically and practically favorable.

The inhaling device is adapted for delivering powdered substances in aerated form from a pierced capsule and comprises a pump and an inhaler, the inhaler comprising a relatively fixed central element formed by two connectable components and defining a cavity for reception of the capsule, and a pair of relatively moveable needle holder elements telescopically slidable within the connectable components against the action of a pair of return springs. The components may be connected by screw means, a bayonet clutch means, or the like. Each of the pair of needle holder elements comprises a capsule-piercing needle. Each of the components is attached to a sleeve having an interior shoulder and each of the pair of needle holder elements has an outwardly disposed shoulder which is capable of reciprocating between a rest position against one of the interior shoulders and a needle-piercing position against one of the connectable components. The inhaler also comprises a nose piece and a pump piece and one of the pair of holder elements is locked by friction to the nosepiece and the other of the pair of needle holder elements may be locked against the piece by micro-ribs having saw teeth.

BRIEF DESCRIPTION OF THE DRAWINGS

The inhaler which constitutes the present invention is shown in the accompanying drawings of the preferred embodiment in which:

FIG. **1** represents a side elevation of the assembled inhaling device comprising the inhaler inserted in a pump in operative condition.

FIG. **2** is a side elevation similar to FIG. **1** with the inhaler inverted in the pump to reduce the size of the device while partially stored therewithin.

FIG. **3** is a longitudinal section through the inhaler while in uncompressed condition.

FIG. **4** is a longitudinal section of the inhaler, similar to FIG. **3** but with the inhaler in a compressed condition, while in operative combination with a pump.

FIG. **5** is a cross-section taken along lines **5**—**5** of FIG. **3**, and

FIG. **6** is a side elevation of the noseward component of the cavity-forming element.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, the inhaler **8** of this invention is employed in combination with a conventional pump **100** and comprises a central storage unit **10** having a central cavity defined by walls **13** within which a medicinal powder-container capsule **15** is inserted as needed by unscrewing a pair of compartments **20, 30.** A pair of stop sleeves **60, 70** are non-slidably attached to the unit **10** and are outside of and in sliding relation to a pair of needle holders **40, 50** containing a pair of capsule-puncturing needles **41, 51.** The pair of stop sleeves **60, 70** is also within and in sliding relation to a pair of end pieces, the nose piece **80** and the pump piece **90,** to which the holders **40, 50** are rigidly attached. The holders **40, 50** are biased away from the central cavity by a pair of springs **25, 35.**

Coaxially disposed throughout the entire inhaler of this invention are a series of central holes for passage of air which enters the inhaler from the pump **100** through base opening **98** and air passage **58,** passes through the four air passages **59** shown in FIG. **5** to central hole **32** around pump needle **51,** enters and passes through the punctured capsule **15** while entraining medicinal powder therefrom, travels past nose needle **41** through central hole **22,** passes through the four air passages **49** into swirl compartment **83,** and exits

from the inhaler through discharge hole **81** in nosepiece **80.**

The unit **10** is formed by screwably connecting the nose compartment **20** and the base compartment **30.** The compartments **20, 30** have coaxially disposed central holes **22, 32,** annularly disposed spring wells **24, 34** which open away from the capsule **15,** outer cylindrical recesses with surfaces **23, 33,** and connecting screw threads **29, 39** by means of which the compartments **20, 30** are connected. Nose return spring **25** is seated within spring well **24,** and pump return spring **35** is seated within spring well **34.**

Nose needle holder **40** and pump needle holder **50** have somewhat H-shaped cross sections and comprise, respectively, annular fixed ends **46, 56** and annular sliding ends **47, 57** which rest against the springs **25, 35** within the spring wells **24, 34,** as shown in FIG. **4.** The holders **40, 50** also comprise four air passages **49, 59** which are separated by four radially spaced longitudinally disposed ribs, ribs **54** only being identified in FIG. **5.** Each set of ribs **44, 54** supports a central portion containing a central needle recess which opens only toward the central cavity. The butt **42** of nose needle **41** and the butt **52** of pump needle **51** are each rigidly attached within these respective central needle recesses so that the respective needle points **43, 53** are coaxially aligned, centrally disposed within the central holes **22, 32,** and in puncturing relationship to the ends of the capsule **15** within the range of compressibility of the springs **25, 35.**

Additionally, the holders **40, 50** respectively comprise circumannular shoulders **45, 55** which extend outwardly exactly as far as the walls **23, 33** of the sleeve recesses of each compartment **20, 30.** The circular sides **48, 58** of the shoulders **45, 55,** opposite to the cavity for the capsule **15,** function as a stop means in cooperation with the nose sleeve **60** and the pump sleeve **70,** respectively, and the outer cylindrical surfaces of the shoulders **45, 55** are in sliding contact with the inner cylindrical surfaces **61, 71** of the sleeves **60,** 70, thus functioning cooperatively therewith as an alignment means.

The nose and pump sleeve **60, 70** respectively comprise elongated cylindrical portions, having outer sides **62, 72** and inner sides **61, 71,** and inwardly extending interior shoulders **65, 75,** having respective cavity-facing circular surfaces **66, 76,** inner cylindrical surfaces **68, 78,** and endward-facing circular surfaces **67,** 77. The surfaces **68, 78** function as a sliding alignment means in cooperation with the cylindrical surfaces **46***a*, 56*a* of the fixed ends **46, 56** of the needle holders **40,** 50. The inner side **61, 71** are non-slidably attached to the recessed outer surfaces **23, 33** and function cooperatively with the cylindrical outer surfaces of the shoulders **45, 55** as another sliding alignment means. Non-slidable attachment may be attained by means of suitable adhesive or by circumferential knurlings of the facing surfaces such as the knurlings **26** which are indicated in FIG. **6.**

The nose piece **80** comprises a tapered penetration portion **82** through which passes the central discharge hole **81** therein, a skirt portion **84** which extends toward the cavity **15,** and a stepped portion **85** therebetween. An annular recess coincides with the inner edge of the step portion **85** and penetrates longitudinally into the penetration portion **82.** Into this annular recess, the fixed end **46** of the nose needle holder **40** is rigidly attached, as with an adhesive. The outer surface **62** of the nose sleeve **60** is in sliding engagement with the inner surface of the skirt **84** and functions cooperatively therewith as an alignment means.

The pump piece **90** comprises an outer rim **91,** a base **92** having an inwardly projecting circular lip to define the base opening **98,** a circular lug **94** spaced pumpward from the edge of the rim **91,** and circumferential serrations **97** along the inner surface of the base **92** and noseward of its circular lip. The lug **94** has a circular and arcuately receding surface **95,** which acts as a storage stop means when the inhaler is in its inverted storage position as shown in FIG. **2,** and a circular and radially extending surface **96** which acts as an operational stop means when the inhaler is inserted into a conventional pump **100,** as shown in FIGS. **1, 3,** and **4.** The serrations **97,** which may be considered as ribbings, corrugations, or knurlings, are matched and engaged by similar serrations in the surfaces **56***a*.

The pump **100** typically has side walls **101,** a circular top edge **102** which engages the surface **96** when the inhaler **8** is in operative position, and an air-containing interior **104** which should have sufficient depth to accommodate the inhaler **8** from the surface **95** to the tip of the penetration portion **82** when the inhaler **8** is in stored position partially within the pump **100.**

In summary, the inhaler **8** comprises three pairs of slidable alignment means:

1. inner cylindrical surfaces of skirt **84** and rim **91** in sliding contact with outer cylindrical surfaces **62,** 72;
2. inner cylindrical surfaces **61, 71** in sliding contact with outer cylindrical surfaces of the shoulders **45,** 55; and
3. inner cylindrical surfaces **68, 78** in sliding contact with outer cylindrical surfaces **46***a*, 56*a*.

Because of these three pairs of slidable alignment means, the inhaler **8** possesses a high degree of trueness so that binding and wear are minimized.

In FIGS. **1–4,** the profile of the cylindrical surface of the lower body portion of the inhaler **8,** which is connected by friction with a pump **100** of suitable dimensions and configuration, is polished and uniform and interrupted by the lug **94** where circular lines of contact **95** and **96** with the cylindrical surface represent the stop points in locking engagement with the pump **100** when the inhaler **8** is ready to use and when it is in storage position, respectively.

The inhaling device operates as follows:

Initially, the inhaler **8,** inverted in the pump **100** (as shown in FIG. **2**), is extracted therefrom and connected by friction locking in its upright position to the pump **100.** Compartment **20** is then screwed off from compartment **30** and the capsule **15** of powder is inserted therein, after which nosepiece **80** and pumppiece **90** are moved towards one another, i.e., a contraction of the inhaler is caused along arrows A–B, which creates two diametrally opposed perforations in capsule **15.** Compare FIG. **1** with FIG. **4.** Thereafter, it is possible to press the pump **100** to provoke the passage of the powder content of the capsule into a human cavity, such as nasal cavity or other cavities of the human body.

The present invention is not to be limited to the specific embodiment having the scope and advantages described hereinbefore, for various modifications can be made without departing from the spirit of the invention

which should be understood as being limited only by the scope of the accompanying claims.

What is claimed is:

1. An inhaling device, for delivering powdered substances in aerated form from a pierced capsule, comprising a pump and an inhaler, said inhaler comprising:
   A. a relatively fixed central element formed by two connectable components and defining a cavity for reception of said capsule, and
   B. a pair of relatively moveable needle holder elements including piercing means mounted therein, which are:
      1. telescopically slidable within said connectable components against the action of a pair of return springs and in the path of movement of air through said inhaler,
      2. disposed in mutually opposed relationship and in straddling relationship to said capsule, and
      3. constituting a means for piercing said capsule when said springs are compressed by slidably moving said needle holder elements toward each other.

2. The inhaling device of claim 1 wherein said components are connected by screw means.

3. The inhaling device of claim 1 wherein each of said pair of needle holer elements comprises a capsule-piercing needle.

4. The inhaling device of claim 1 wherein each of said components is attached to a sleeve having an interior shoulder and each of said pair of needle holder elements has an outwardly disposed shoulder which is capable of reciprocating between a rest position against one of said interior shoulders and a needle-piercing position against one of said connectable components.

5. The inhaling device of claim 4 wherein said inhaler comprises a nose piece and a pump piece and one of said pair of said needle holder elements is locked by friction to said nose piece and the other of said pair of needle holder elements is locked against said pump piece by micro-ribs having saw teeth.

6. An inhaler for storing, entraining, and delivering powders in aerated condition, comprising;
   A. a central storage unit for said powders,
   B. a pair of needle holders including piercing means mounted therein which straddle said unit and are slidably connected thereto,
   C. a nose piece which is non-slidably attached to one of said pair of needle holders,
   D. a pump piece which is non-slidably attached to the other of said pair of needle holders, and
   E. a longitudinally disposed air passage means extending from end to end of said inhaler, through said pump piece, said pair of needle holders, said central storage unit, and said nose piece, said nose piece and said pump piece ecah being longitudinally slidable toward said central storage unit to provide opposed piercing means for the central storage unit, whereby said powders are released.

7. The inhaler of claim 6 wherein said central storage unit comprises a pair of connectable compartments which define and contain, in combination, a cavity therewithin for storage of a capsule containing said powder.

8. The inhaler of claim 7 wherein each of said pair of connectable compartments comprises an annular spring well within which a compression spring is seated.

9. The inhaler of claim 8 wherein each of said pair of needle holders comprises a annular sliding end which is slidably mounted within one of said annular spring wells and in engagement with one of said springs.

10. The inhaler of claim 9 which further comprises a pair of stop sleeves which straddle said unit and are non-slidably attached thereto.

11. The inhaler of claim 10 wherein said pair of stop sleeves is in slidably circumferential and alignment-maintaining relation to said pair of needle holder elements.

12. The inhaler of claim 11 wherein each of said pair of stop sleeves has a cylindrical inner wall and said needle holders comprise circumannular shoulders which extend outwardly into slidable and alignment-maintaining relation with said cylindrical inner walls of said stop sleeves.

13. The inhaler of claim 12 wherein each of said pair of needle holders additionally comprises an annular fixed end, one of said fixed ends being non-slidably attached to said nose piece and the other being non-slidably attached to said pump piece.

14. The inhaler of claim 13 wherein each of said pair of needle holders comprises a capsule-piercing needle, said needles being coaxially disposed in mutually opposed relationship and in straddling relationship to said capsule and being adapted to pierce said capsule when said springs are compressed by slidably moving said nose piece and said pump piece toward each other.

15. The inhaler of claim 14 wherein each of said stop sleeves additionally comprises an inwardly extending interior shoulder which extends into sliding engagement with exterior cylindrical surfaces of said fixed ends, as a sliding alignment means.

16. The inhaler of claim 15 wherein:
   A. said nosepiece, said stop sleeves, and said central storage unit have a smaller exterior diameter than the exterior diameter of said pump piece, and
   B. said pump piece comprises a circumferential and outwardly extending lug having an arcuately receding surface and a radially receding surface,

whereby said arcuately receding surface functions as a storage stop means, when said inhaler is inverted into a pump for storage by inserting said nose piece thereinto, and said radially receding surface functions as an operational stop means, when said inhaler is inserted into said pump by engaging said pump piece therewith.

17. The inhaler of claim 16 wherein said pump piece further has an exterior cylindrical surface which is polished and uniformly interrupted by a friction locking means for the mouthpiece of said pump.

18. The inhaling device of claim 17 wherein the points of contact between the cylindrical surface of the lower body portion and the surface normal to said means are friction locking points between said inhaler and said pump.

19. The inhaling device of claim 17 wherein the points of contact between the cylindrical surface of the lower body portion and the portions of said means have curved surfaces which are stop points for friction locking between said inhaler and said pump when said inhaling device is not in use.

20. The inhaling device of claim 5 wherein:
   A. said nose piece and said pump piece each comprises a skirt portion extending toward said cavity and having an inner cylindrical surface adapted for sliding contact; and

B. each said sleeve comprises an outer cylindrical surface adapted for said sliding contact with one of said inner cylindrical surfaces of said skirt portions of said nose piece and said pump piece to form a first pair of slidable alignment means.

21. The inhaling device of claim **20** wherein:

A. each said sleeve, attached to one of said two connectable components, comprises an inner cylindrical surface adapted for sliding contact; and

B. each said outwardly disposed shoulder of said pair of needle holder elements comprises an outer cylindrical surface adapted for said sliding contact with one of said sleeves to form a second pair of slidable alignment means.

22. The inhaling device of claim **21** wherein:

A. each said interior shoulder of said sleeves attached to said two components comprises an inner cylindrical surface adapted for sliding contact; and

B. each said needle holder element comprises an outer cylindrical surface adapted for said sliding contact with one of said inner cylindrical surfaces of said interior shoulders to form a third slidable alignment means, said first, second, and third pairs of slidable alignment means imparting a high degree of trueness to said inhaler so that binding and wear are minimized.

* * * * *