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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : B05B 1/34 — A1

(11) International Publication Number: **WO 00/54887**

(43) International Publication Date: 21 September 2000 (21.09.00)

(21) International Application Number: PCT/US00/06935

(22) International Filing Date: 17 March 2000 (17.03.00)

(30) Priority Data:
09/271,281 17 March 1999 (17.03.99) US

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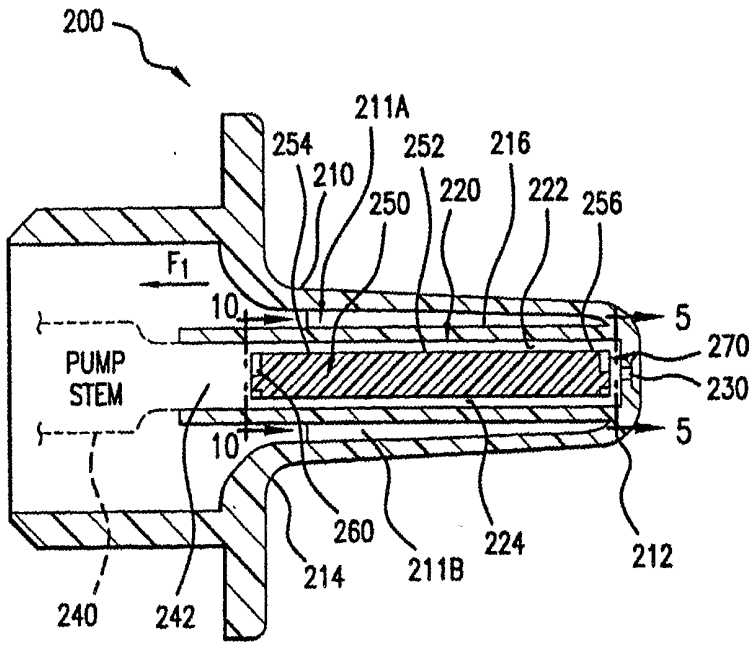
(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: APPARATUS AND METHOD FOR DISPENSING A MEDICINAL SPRAY



(57) Abstract

An apparatus and method for dispensing a medicinal spray is disclosed. The apparatus may include a body (210) which defines a longitudinal chamber (220) and an integrally formed spray orifice (230). The spray orifice is disposed at a distal end (212) of the body (210) and is in communication with the chamber (220). A swirl member (250) having a first end (254) and a second end (256) is disposed within the chamber (220). The first end (254) includes a first swirl structure (260) and the second end (256) includes a second swirl structure (270).

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APPARATUS AND METHOD FOR DISPENSING A MEDICINAL SPRAY

Background of the Invention

Field of the Invention

The present invention relates to an apparatus and method for dispensing a medicinal spray. More specifically, the invention is directed to a nasal spray actuator that includes a swirl pin that provides for both ease of assembly and manufacture of the actuator and, additionally, safety for a user when using the actuator.

Description of the Related Art

Nasal spray actuators are known for dispensing medication from a container to the nostrils of a user. Currently known actuators are available that atomize the liquid that is dispensed from the container so that a fine mist is provided to the user. However, drawbacks exist with the currently known nasal actuators.

One type of known actuator includes a disposable nozzle adaptor that is attached to a nozzle which extends from the container which stores the medication to be dispensed. The nozzle adaptor includes a body, a rod arranged in a cylindrical chamber defined by the body, and a spray nozzle tip which is fitted in the top of the chamber and snap-fitted onto the rod. The spray nozzle tip includes swirl grooves which impart a swirling motion to the liquid as it is dispensed from the nozzle adaptor. A drawback with this known type of actuator is that the rod is inserted into the adaptor body at the distal end of the adaptor body, i.e., that end of the adaptor body that is inserted into the nostril of the user. After the rod is inserted into the adaptor body, the spray nozzle tip is then fitted into the adaptor body and onto the rod. Thus, there is a danger that, due

to the pressure of the fluid as it is dispensed from the container, the spray nozzle tip and rod may be ejected from the adaptor body and into the nostril of the user. Serious injury to the user could result. Therefore, it would be desirable to provide a nasal actuator that could reduce the risk of injury to the user from its use.

Other types of actuators are known which reduce the risk of injury to the user, however, these actuators have drawbacks as well. These actuators reduce the risk of injury to the user by incorporating a design where the rod is inserted into the body of the actuator from the proximal end of the adaptor body, i.e., that end which is not inserted into the nostril of the user. The distal end of the adaptor body is formed as a single structural unit with an orifice formed in it for dispensing the medication from the container to the nostril of the user. Because the orifice has a diameter that is less than the diameter of the rod, the rod cannot be ejected through the orifice and thus, the risk of injury to the user can be significantly reduced.

As illustrated in Figures 1 and 2, with this second type of actuator 100, which is used with the Vicks Sinex product, a rod 110, or pin, includes radially extending structure 115 on a proximal end 112 of rod 110 to "break-up" the liquid so that it may travel along the chamber 120 of actuator 100. The proximal end 112 of rod 110 is positioned at the proximal end 122 of chamber 120 and engages with a shoulder 124 formed in actuator 100 to assist in longitudinally positioning rod 110 within chamber 120. At the distal end 124 of chamber 120, the structure of actuator 100 that defines orifice 102 defines a swirl chamber 104, as can be seen in Figure 3. The swirl chamber 104 imparts a swirling motion to the dispensed liquid.

However, a drawback with the above-described design is that, because two separately configured structures are required in the actuator to dispense the liquid, i.e., the "break-up' structure on the pin and the swirl chamber in the distal end of the actuator, complexity is added to the manufacturing process for the actuator. Additionally, because the pin must be inserted into the actuator in a particular orientation, i.e., so that the "break-up" structure is positioned at the proximal end of the actuator's chamber, complexity is added to the assembly process for the actuator.

Positioning of the pin within the chamber can also be a problem. Because a

shoulder is required, complexity is added to the manufacturing process of the actuator. Also, because no positioning structure is provided at the distal end of the actuator's chamber, the pin could become misaligned within the chamber, i.e., not positioned centrally within the chamber, thus deleteriously affecting the spray pattern of the dispensed spray.

Thus, for at least the reasons described above, it would be desirable to provide an improved nasal spray actuator.

Summary of the Invention

In accordance with the present invention, an apparatus and method for dispensing a medicinal spray is provided. In one embodiment, the apparatus may include a body which defines a longitudinal chamber and an integrally formed spray orifice. The spray orifice is disposed at a distal end of the body and is in communication with the chamber. A swirl member having a first end and a second end is disposed within the chamber. The first end includes a first swirl structure and the second end includes a second swirl structure.

In an embodiment for a method of practicing the present invention, the method may include dispensing a pressurized spray volume from a pump stem of a container into a plurality of pathways, the spray volume entering the plurality of pathways by traveling over a first swirl structure where the first swirl structure is included on a first end of a swirl member. The swirl member is disposed within a chamber in the spray actuator. A circular motion is imparted to the spray volume by directing the spray volume into a second swirl structure where the second swirl structure is included on a second end of the swirl member. The spray volume is then expelled from the spray orifice.

Brief Description of the Drawings

The various features of the invention will best be appreciated by simultaneous reference to the description which follows and the accompanying drawings, in which:

Fig. 1 is a cross-sectional view of a prior art nasal spray actuator;

Fig. 2 is a perspective view of the pin of the actuator of Fig. 1;

Fig. 3 is a cross-sectional view of the swirl chamber of the actuator of Fig. 1 as taken along line 3-3 of Fig. 1;

Fig. 4 is a cross-sectional view of a nasal spray actuator in accordance with the present invention;

Fig. 5 is a cross-sectional view of the nasal spray actuator as taken along line 5-5 of Fig. 4;

Fig. 6 is a side view of the swirl member of Fig. 4;

Fig. 7 is a left end view of the swirl member of Fig. 4 illustrating the first swirl structure;

Fig. 8 is a right end view of the swirl member of Fig. 4 illustrating the second swirl structure;

Fig. 9 is an enlarged end view of the swirl structure of Fig. 7; and

Fig. 10 is a cross-sectional view of the nasal spray actuator as taken along line 10-10 of Fig. 4.

Detailed Description

Fig. 4 illustrates an embodiment for a nasal spray actuator 200 in accordance with the principles of the present invention. As can be seen in Fig. 4, nasal spray actuator 200 includes an external body portion 210 and an internal body portion 216. Body portion 210 defines an orifice 230 at a distal end 212 of body portion 210. Internal body portion 216 defines chamber 220. Chamber 220 extends longitudinally within nasal spray actuator 200 and receives within it an elongated member, or swirl pin, 250. A spray volume that is dispensed from nasal spray actuator 200 travels from pump stem 240 (shown in phantom in Fig. 4) through chamber 220, where it is expelled through orifice 230 and into, for example, the nostril of a user of the actuator.

In the disclosed embodiment, nasal spray actuator 200 also includes three outer ribs, of which ribs 211A and 211B can be seen in Fig. 4. The outer ribs extend longitudinally internal from external body portion 210 to internal body portion 216. Ribs 211A, 211B are rigid members and serve to maintain the internal body portion's position with respect to the external body portion. It is desirable that the internal body portion 216, since it defines chamber 220 within it and mates with the pump stem, is accurately positioned within the spray actuator in order to provide for ease of assembly of the actuator and to optimally dispense spray through it. Whereas the outer ribs may be utilized in the present invention, their use is not required, and, if utilized, any number of outer ribs and any physical configuration for the ribs could be utilized.

As can be seen in Fig. 5, orifice 230 is integrally formed in body portion 210. Additionally, it can be seen that the body portion that defines orifice 230 has a smooth interior surface, i.e., there are no swirl paths included in the body portion. Thus, the swirl paths of the present invention are included on a swirl pin 250 that is disposed within chamber 220 and are not included on the body portion of the actuator.

As will be further explained later in this specification, swirl pin 250 is centrally disposed within chamber 220 along its entire length and engages with the head 242 of pump stem 240 at its first end 254 and with the structure at distal end 212 of body portion 210 that defines orifice 230 at its second end 256. Since the cross-sectional diameter of swirl pin 250 is less than the diameter of chamber 220, the structures of the swirl pin 250 and internal body portion 216 define pathways within chamber 220 which extend along the longitudinal length of chamber 220. The spray volume that is dispensed from pump stem 240 travels through the pathways that are defined within chamber 220. In one embodiment of the present invention, three pathways are defined within chamber 220, of which, pathway 222 and pathway 224 are visible in Fig. 4.

As will be further explained later in this specification, swirl pin 250 includes a mid-portion 252 and, as discussed previously, a first end 254 and a second end 256. First end 254 of swirl pin 250 defines a first swirl structure, or chamber, 260 and second end 256 of swirl pin 250 defines a second swirl structure, or chamber, 270. Each of the first and second swirl chambers 260, 270, respectively, are similarly formed. Thus,

when assembling spray actuator 200, it does not matter which end of swirl pin 250 is disposed in which end of chamber 220. As a result, either first end 254 or second end 256 may be disposed at the distal end 212 of body 210 and, consequently, the other of the ends may be disposed at the proximal end 214 of body 210. Thus, the present invention provides for ease of assembly of nasal spray actuator 200 since either end of swirl pin 250 may be positioned within either end of body 210 and no assembly step is required which orients an end of the swirl pin 250. As can be understood, therefore, the designation in this specification of one end of swirl pin 250 being the "first end" and the other end being the "second end" is provided for reference purposes only. It does not imply that the described position for each end of the swirl pin within the actuator is the only position in which each particular end can be positioned.

In assembling nasal spray actuator 200, swirl pin 250 is inserted into chamber 220 from the proximal end 214 of the actuator body. After swirl pin 250 is inserted within chamber 220, nasal spray actuator 200 is installed onto pump stem 240. Thus, swirl pin 250 is positioned between head 242 of pump stem 240 and the distal end 212 of body portion 210. Because swirl pin 250 is supported along the major portion of its length by ribs which extend from internal body portion 216 into chamber 220, as will be further explained, and engages with the pump stem 240 at its first end 254 and with distal end 212 of body portion 210 at its second end 256, no shoulders are required within nasal spray actuator 200 in order to longitudinally position swirl pin 250 within chamber 220.

As described previously, swirl pin 250 is inserted into nasal spray actuator 200 from the proximal end 214 of body portion 210. Since orifice 230 is integrally formed within body portion 210, i.e., it is not an insert that is fitted into distal end 212 of body portion 210, and since orifice 230 has a significantly smaller diameter than the diameter of swirl pin 250, swirl pin 250 is constrained against being ejected out of the distal end 212 of nasal spray actuator 200. Thus, because swirl pin 250 cannot be ejected from distal end 212, which is the end of the nasal spray actuator that is inserted into the nostril of a user, the nasal spray actuator of the present invention significantly reduces the possibility of injury to a user of the actuator.

Figs. 6-9 further illustrate swirl pin 250. As was described previously, swirl pin 250 includes a mid-portion 252 and first and second end portions 254, 256, respectively. First end portion 254 defines first swirl structure 260 and second end portion 256 defines second swirl structure 270. In one embodiment for swirl pin 250, it has an overall length L_1 of 1.025 inches and a diameter D_1 of 0.0910 inches. However, the present invention is not limited to these dimensions for swirl pin 250. For example, swirl pin 250 may have a length of between 0.50 and 1.50 inches. As will be further described below, in an embodiment, each swirl structure 260, 270 includes channels that are cut a depth L_2 of 0.0150 inches into swirl pin 250.

Since both swirl structures 260, 270 are similarly formed, a detailed description will only be provided for swirl structure 260. As can be seen in Fig. 7, swirl structure 260 defines a plurality of swirl paths. In the illustrated embodiment of Fig. 7, three swirl paths 262, 264, and 266 are provided. As discussed above, each of the swirl paths are defined by a channel that is cut into first end 254 of swirl pin 250. In the disclosed embodiment, each swirl path has a depth of 0.015 inches and generally extends radially from the center of the swirl structure. However, the depth of the swirl paths will vary in different embodiments depending upon the particular type of spray product that is to be dispensed from the spray actuator. Depths of between, for example, 0.0050-0.0200 inches may be utilized for the swirl paths. Further dimensional information for the swirl structures will be provided when discussing Fig. 9. As will be further explained later, the swirl paths are formed such that, as the spray volume travels through the swirl structure that is disposed at the distal end 212 of body portion 210, a circular or swirling motion will be imparted to the spray volume as it is expelled from orifice 230.

As was mentioned previously, second swirl structure 270 is formed similar to first swirl structure 260. For reference purposes, as can be seen in Fig. 8, swirl structure 270 includes three swirl paths 272, 274, and 276. The present invention is not limited to any particular number of swirl paths, however, it is desirable that at least three swirl paths are provided in each swirl structure, for purposes which will be discussed later in this specification.

Fig. 9 illustrates additional dimensional detail for the embodiment of swirl

structure 260. Whereas the present invention is not limited to the precise dimensions disclosed, it is desirable to include relatively small channels within the swirl structures and small pathways so that an excess amount of product, i.e., an amount greater than what is medically required, is not dispensed from the actuator. As can be seen in Fig. 9 and as discussed previously, channels 262, 264, and 266 are included in swirl structure 260. Thus, structures 267, 268, and 269 define channels 262, 264, and 266. In defining the positioning of the swirl channels within swirl structure 260, reference will be made the structures which define the channels. As discussed previously, the diameter D_1 of swirl structure 260 is 0.0910 inches. A first edge 267A of structure 267 is positioned a distance S_1 of 0.010 inches from a central axis 261 which extends through the geometric center of swirl structure 260 and parallel to edge 267A. Second edge 267B of structure 267 is positioned a distance S_2 of 0.0330 inches from the outer-most circumferential edge of structure 267. Second edge 267B is also positioned a distance S_3 of 0.0150 inches from point 268A of structure 268. First edge 267A is positioned 90° from second edge 267B. As can be understood from the above discussion and from viewing Fig. 9, the other structures are positioned similarly to structure 267.

Fig. 10 is a cross-sectional view of the proximal end of the nasal spray actuator. In Fig. 10, the assembled configuration of swirl pin 250 within chamber 220 can be clearly seen. As described earlier, swirl pin 250 is centrally disposed within chamber 220 and is supported along a majority of its length by ribs 216A, 216B, and 216C, which extend from internal body portion 216 and into chamber 220. Whereas the exact longitudinal length of the ribs, and thus the distance along swirl pin 250 that the ribs support the swirl pin, is not rigidly defined, the ribs may be of such a length that they support the swirl pin along approximately 60-80% of its length from the distal end of the swirl pin. The ribs are only required to be long enough to adequately support swirl pin 250 such that the swirl pin is centrally disposed within chamber 220. Each rib is thinly formed in cross-section and may include a tapered end which engages with swirl pin 250. Thus, as can be understood, it is desirable that at least three ribs, as illustrated, are utilized when practicing the present invention. The utilization of at least three

thinly-formed ribs will ensure that swirl pin 250 can be centrally supported within chamber 220. Any lesser number of ribs, depending upon their configuration, may not adequately support swirl pin 250 centrally within chamber 220.

As was explained earlier, the combined structures of internal body portion 216 and the outer circumference of swirl pin 250 define pathways between the two structures within chamber 220. The pathways are defined by that volume of chamber 220 that is not occupied by swirl pin 250. As can be seen in Fig. 10, because the three equally spaced ribs 216A, 216B, and 216C extend from internal body portion 216 and engage with swirl pin 250, three separate pathways 222, 224, and 226 are formed within chamber 220. The number of pathways that are defined within chamber 220 must correlate to the number of ribs that extend from internal body portion 216 in order to equalize the flow of spray through the pathways.

Because the ribs extend into the volume of chamber 220 through which passes the spray volume that is to be dispensed from nasal spray actuator 200, it is desirable to form the ribs with as thin a cross-section as possible. In the disclosed embodiment, each pathway has a radial width of approximately 0.005 to 0.010 inches.

As can be understood, each pathway extends along the longitudinal length of chamber 220, along swirl pin 250, to the distal end 212 of actuator 200. In operation, the spray volume that is to be dispensed from actuator 200 exits head 242 of pump stem 240 and travels through first swirl structure 260 and into the three pathways. The spray volume travels through the pathways, is directed into second swirl structure 270 at the distal end 212 of body portion 210, and is ultimately expelled out of orifice 230.

As can be seen in Fig. 10 in the illustrated embodiment, and as discussed previously, three ribs are provided and three swirl paths are included within first swirl structure 260. This is desirable in order to provide for directing a substantially equivalent volume of spray into each pathway. For example, if three ribs, and thus three pathways, were provided within nasal spray actuator 200 and only one swirl path was provided in first swirl structure 260, this configuration could result in no volume of spray being provided to two of the pathways. Should this occur, a less than optimal spray pattern could be expelled from the nasal spray actuator. Thus, whereas the

present invention is not limited to any particular number of pathways and swirl paths, it is desirable that the number of pathways, and thus the number of ribs, correlate to the number of swirl paths that are included within first swirl structure 260.

The assembly and operation of the nasal spray actuator of the present invention will now be further described. As discussed previously, swirl pin 250 is inserted into chamber 220 of nasal spray actuator 200 from the proximal end 214 of body portion 210. Again, either end of swirl pin 250 may be positioned at either end of chamber 220 since the swirl structures at each end of swirl pin 250 are similarly formed. Swirl pin 250 is centrally disposed within chamber 220 by ribs 216A, 216B, and 216C, which extend within chamber 220 from internal body portion 216. Swirl pin 250 is supported along a majority of its length by the ribs. The assembled nasal spray actuator 200 is then positioned onto head 242 of pump stem 240. When nasal spray actuator 200 is positioned onto pump stem 240, first end 254 of swirl pin 250 engages with head 242 of pump stem 240 and second end 256 of swirl pin 250 engages with the structure at distal end 212 of body portion 210 which defines orifice 230. Thus, when nasal spray actuator 200 is positioned onto pump stem 240, swirl pin 250 engages with both the pump stem and the structure which defines orifice 230. As such, no shoulders are required within nasal spray actuator 200 for longitudinally positioning swirl pin 250 within chamber 220.

To operate nasal spray actuator 200 to dispense a pressurized spray volume from a container that is associated with pump stem 240, a force F_1 is applied against pump stem 240 by finger depression on spray actuator 200, as is well-known in the art. When force F_1 is applied against pump stem 240, a pressurized spray volume is dispensed from pump stem 240 and travels through first swirl structure 260 where it is distributed, substantially equally, into the three pathways that are defined within chamber 220. Because of the relative sizes of the pump stem orifice and the diameter of chamber 220 at the proximal end 214 of body 210, i.e., that portion of chamber 220 that has first swirl structure 260 disposed in it, as the pressurized spray volume passes through first swirl structure 260, no swirling motion is imparted to the pressurized spray volume as it is apportioned into the pathways. This is because the spray volume is traveling from

the smaller orifice in the pump stem into the larger volume of the chamber 220 and the pathways, which does not result in an increase in the velocity of the spray volume, and thus no swirling of the spray volume as it passes through the first swirl structure, as occurs when the spray volume passes through the second swirl structure at the distal end of the actuator. More particularly, when the spray volume passes through the first swirl structure, the spray travels from a position inside the swirl structure to a location outside of the swirl structure through the swirl paths. This is a path of travel which is opposite the path of travel of the spray volume as it passes through the second swirl structure where the spray travels from a position outside the swirl structure where it then passes through the swirl paths and out of the orifice 230. Thus, the path of travel for the spray volume through the first swirl structure is opposite that of the path of travel through the second swirl structure. As such, even though there is a "swirl structure" disposed within chamber 220 at the portion of the chamber where the spray volume is dispensed from the pump stem, the "swirl structure" does not act as a structure that imparts a swirling motion to the spray volume. Rather, the swirl structure assists in making the spray volume that is dispensed from the pump stem more uniform where it is then equally distributed into the three pathways.

As can be understood, therefore, in the present invention, a swirl structure can be provided at the proximal end of the nasal spray actuator chamber without deleteriously impacting the flow of the spray volume. Consequently, swirl structures may be provided at both ends of the swirl pin, which advantageously allows a user to insert the swirl pin into the actuator without being concerned about which end of the swirl pin is disposed in which end of the actuator. Thus, with the swirl pin of the present invention, the actuator may be more easily assembled.

After the spray volume is dispensed from the pump stem 240 and is apportioned into the pathways, the spray volume travels down the pathways and is directed through the swirl paths in second swirl structure 270. Because the spray volume is traveling from a larger diameter orifice, i.e., the pathways in chamber 220, into the smaller orifices of the swirl paths in the second swirl structure 270, the spray volume is accelerated and swirled as it travels through the swirl paths of second swirl structure

270. A swirling motion is imparted to the spray volume as it passes through the swirl paths of second swirl structure 270. The spray volume is then expelled from orifice 230 of nasal spray actuator 200.

Thus, as disclosed, the present invention provides a nasal spray actuator that includes a swirl pin with swirl structures at each end of the swirl pin. Since each of the swirl structures are similarly formed, it is not necessary to longitudinally orient the ends of the swirl pin before inserting the swirl pin into the actuator's chamber. Because of the relative sizes of the orifice of the pump stem and the chamber of the nasal spray actuator, the swirl structure positioned adjacent to the pump stem does not function to impart a swirling motion to the spray volume that is expelled from the pump stem. Rather, the swirl structure serves to assist in directing the spray volume into the plurality of pathways within the nasal spray actuator. Thus, because the swirl pin of the present invention has swirl structures at each of its ends, it provides for ease of assembly of the actuator. Additionally, because the swirl pin is constrained against being ejected from the distal end of the nasal spray actuator, the present invention provides for safety for the user of the nasal spray actuator.

The disclosed embodiments are illustrative of the various ways in which the present invention may be practiced. Other embodiments can be implemented by those skilled in the art without departing from the spirit and scope from the present invention.

What Is Claimed Is:

1. An apparatus for dispensing a medicinal spray, comprising:

a body, the body defining a longitudinal chamber and an integrally formed spray orifice, the spray orifice disposed at a distal end of the body and in communication with the chamber; and

a swirl member having a first end and a second end, the first end including a first swirl structure and the second end including a second swirl structure, the swirl member disposed within the chamber.

2. The apparatus of claim 1 wherein the first swirl structure and the second swirl structure are similarly formed.

3. The apparatus of claim 2 wherein the first and second swirl structures include a channel in the first and second ends of the swirl pin, respectively.

4. The apparatus of claim 3 wherein each of the first and second swirl structures include at least three channels.

5. The apparatus of claim 4 wherein the at least three channels extend radially from a center of the first and second swirl structures.

6. The apparatus of claim 1 wherein the body includes at least three ribs and wherein each of the ribs extends longitudinally within the chamber.

7. The apparatus of claim 6 wherein each of the at least three ribs engage with the swirl member to centrally dispose the swirl member within the chamber.

8. The apparatus of claim 4 wherein the body includes at least three ribs and wherein each of the ribs extends longitudinally within the chamber, the ribs engaging with the swirl member to define at least three pathways, and wherein a

number of the at least three channels equals a number of the ribs.

9. The apparatus of claim 4 wherein each of the at least three channels has a depth between 0.0050 and 0.0200 inches.

10. The apparatus of claim 1 wherein the spray orifice has a first diameter and the swirl member has a second diameter, the first diameter being less than the second diameter.

11. A swirl pin for a nasal spray actuator, wherein the actuator includes a body defining a chamber and an integrally formed spray orifice, the spray orifice disposed at a distal end of the body and in communication with the chamber, comprising:

an elongated member, the elongated member having a first end and a second end, the first end including a first swirl structure and the second end including a second swirl structure, the elongated member being shaped to be disposed within the chamber of the nasal spray actuator.

12. The swirl pin of claim 11 wherein the first swirl structure and the second swirl structure are similarly formed.

13. The swirl pin of claim 11 wherein the first and second swirl structures include a channel in the first and second ends of the elongated member, respectively.

14. The swirl pin of claim 13 wherein each of the first and second swirl structures include at least three channels.

15. The swirl pin of claim 14 wherein each of the at least three channels has a depth between 0.0050 and 0.0200 inches.

16. The swirl pin of claim 11 wherein the spray orifice has a first diameter and the elongated member has a second diameter, the first diameter being less than the second diameter.

17. The swirl pin of claim 11 wherein the elongated member has a length of between 0.50 and 1.50 inches.

18. A method for dispensing a medicinal spray from a container, the container including an actuator having a body that defines a longitudinal chamber therein and an integrally formed spray orifice, the spray orifice disposed at a distal end of the body and in communication with the chamber, the method comprising:

dispensing a pressurized spray volume from a pump stem of the container into a plurality of pathways, the spray volume entering the plurality of pathways by traveling over a first swirl structure included on a first end of a swirl member, the swirl member disposed within the longitudinal chamber;

imparting a circular motion to the spray volume by directing the spray volume into a second swirl structure included on a second end of the swirl member; and

expelling the spray volume from the spray orifice.

19. The method of claim 18 wherein the first swirl structure and the second swirl structure are similarly formed.

20. The method of claim 19 wherein the first and second swirl structures include a channel in the first and second ends of the swirl member, respectively.

21. The method of claim 20 wherein each of the first and second swirl structures include at least three channels.

22. The method of claim 21 wherein each of the at least three channels has a depth between 0.0050 and 0.0200 inches.

23. The method of claim 18 further comprising the step of centrally disposing an entire length of the swirl member within the longitudinal chamber.

24. A method of assembling a nasal spray actuator, the method comprising:

providing a body, the body defining a longitudinal chamber having a first end and a second end, and an integrally formed spray orifice, the spray orifice disposed at a distal end of the body and in communication with the chamber;

providing a swirl member having a first end and a second end, the first end including a first swirl structure and the second end including a second swirl structure; and

inserting the swirl member into the chamber.

25. The method of claim 24 wherein the step of inserting the swirl member into the chamber includes the step of positioning either the first end or the second end of the swirl member at the first end of the longitudinal chamber and the other of the first or second ends of the swirl member at the second end of the longitudinal chamber.

26. The method of claim 24 wherein the step of inserting the swirl member into the chamber includes the step of centrally positioning the swirl member within the chamber.

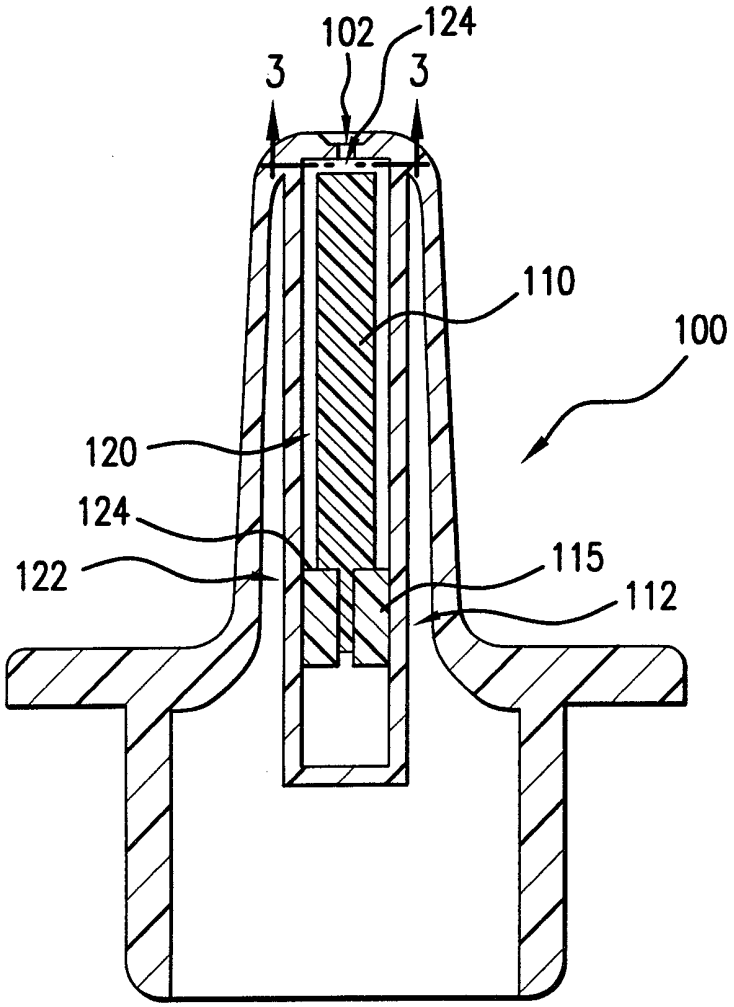

FIG.1
PRIOR ART

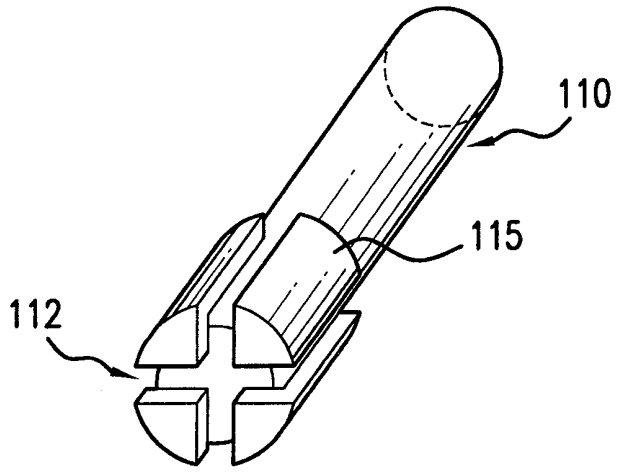

FIG.2
PRIOR ART

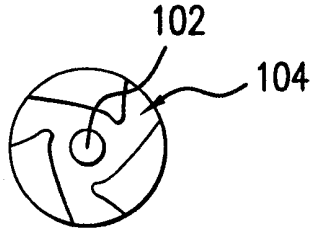

FIG.3
PRIOR ART

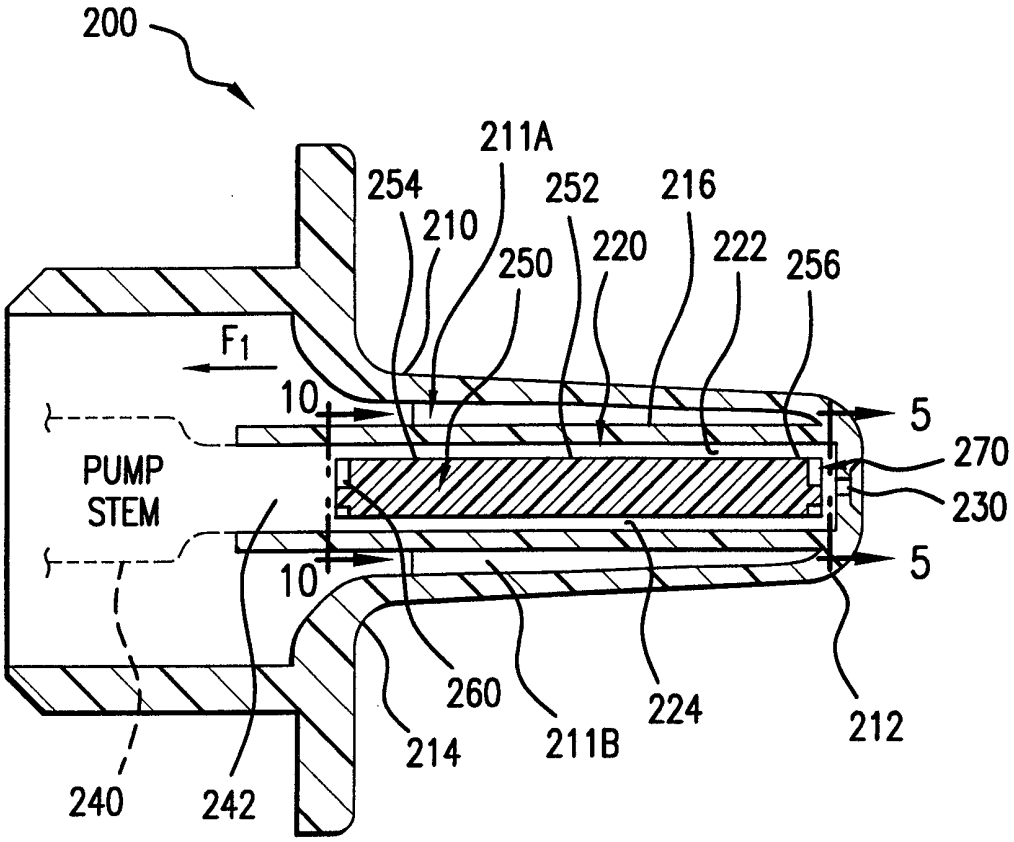
200
211A
254
252
216
210
250
220
222
256
F1
10
5
270
PUMP
STEM
230
10
5
260
224
212
214
211B
240
242

FIG.4

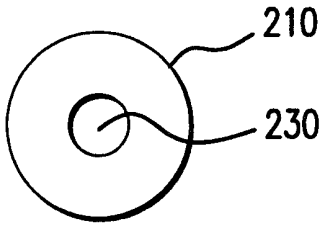
210
230

FIG.5

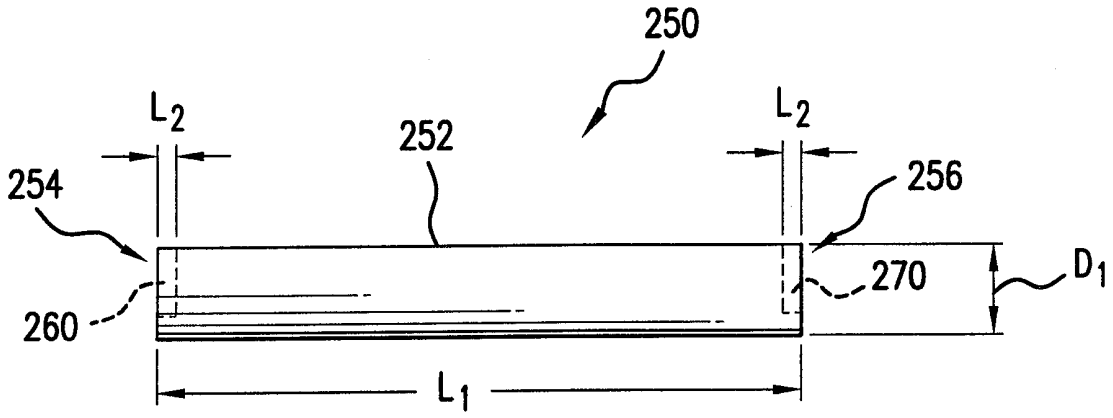

FIG.6

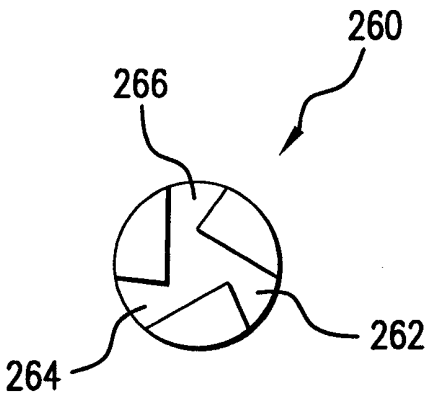

FIG.7

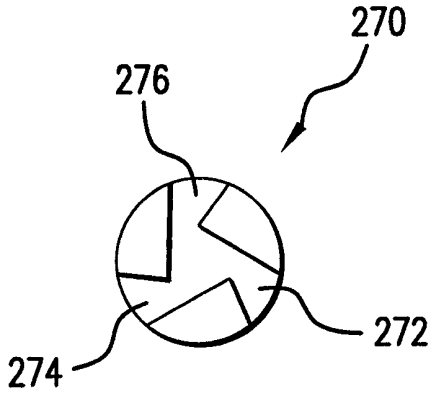

FIG.8

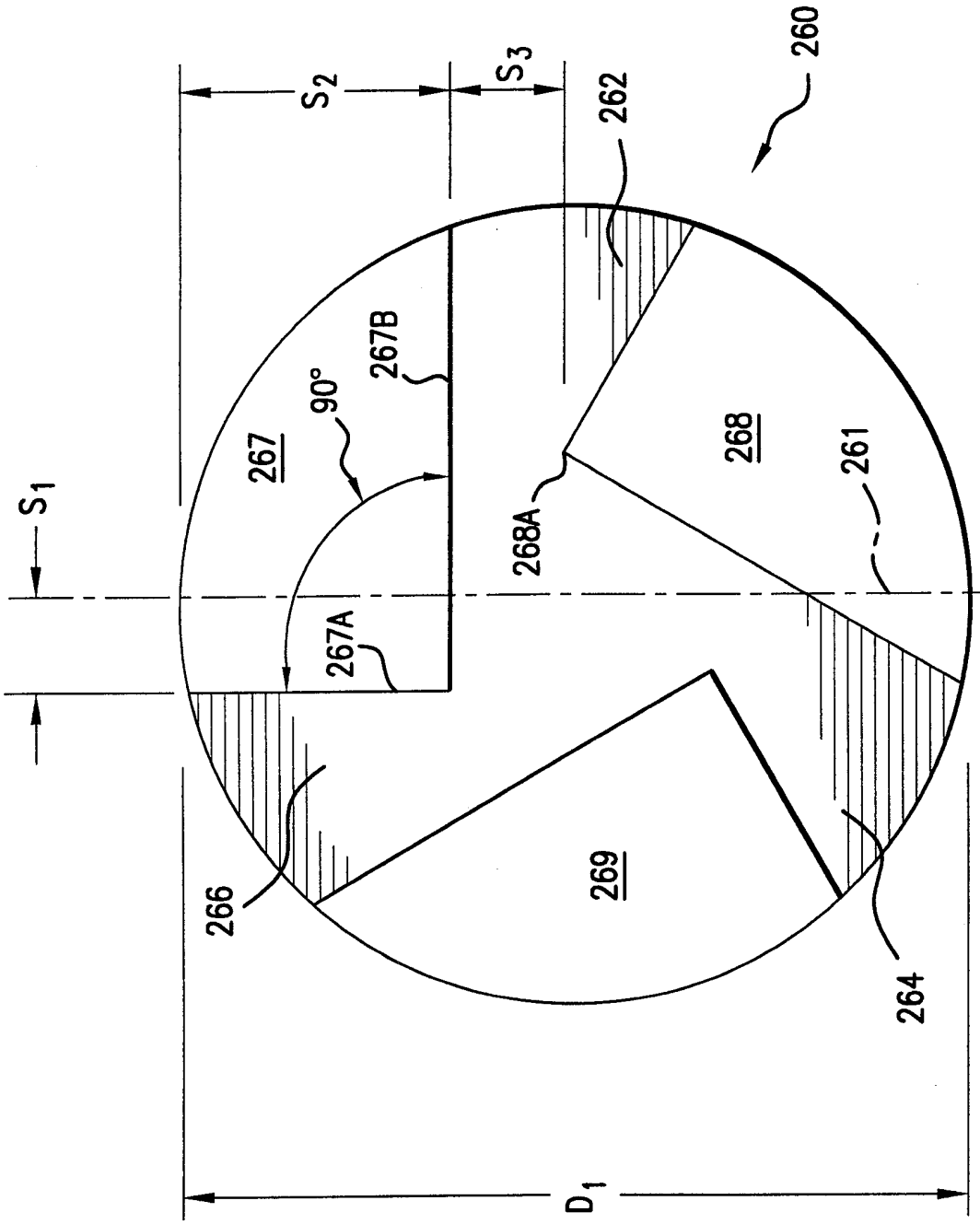

FIG.9

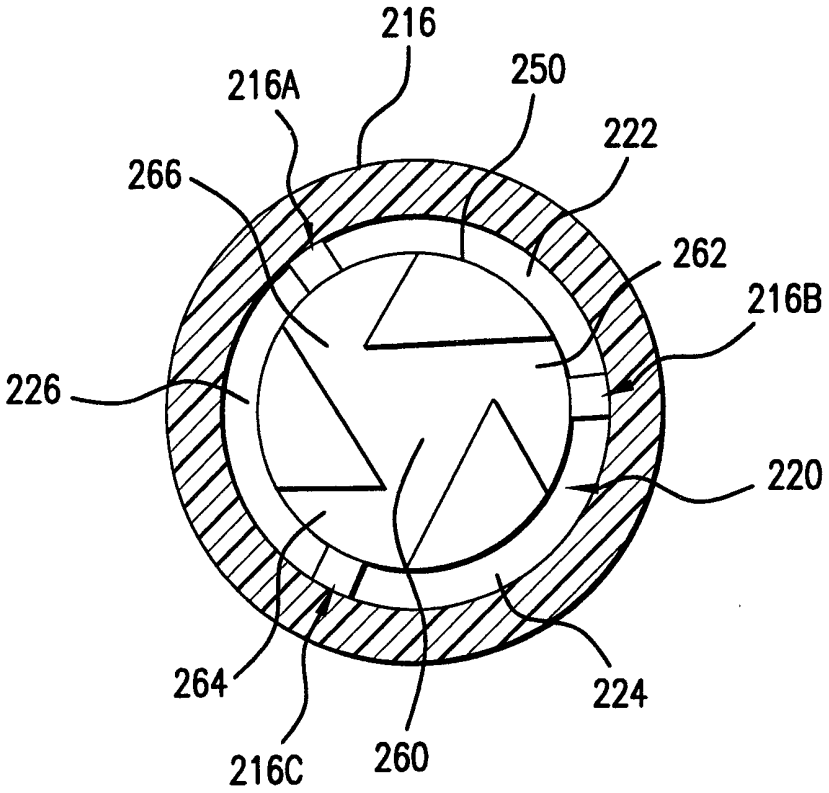

FIG.10

INTERNATIONAL SEARCH REPORT

Interi nal Application No
PCT/US 00/06935

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B05B1/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B05B A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 320 567 A (SCHLICK GUSTAV) 17 October 1929 (1929-10-17) page 1, line 9 - line 15 page 1, line 84 - line 90 figures 3,6	1-3, 10-13,16
A		18-20, 23-26

X	US 1 837 339 A (SCHLICK GUSTAV) 22 December 1931 (1931-12-22) page 1, line 74 - line 77 page 2, line 1 - line 17 figure 1	1-3, 10-13,16
A		18-20, 24-26

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 June 2000	28/06/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Lakkis, A

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INTERNATIONAL SEARCH REPORT

Interr nal Application No
PCT/US 00/06935

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 504 893 A (HOSHI HIROSHI ET AL) 7 April 1970 (1970-04-07) column 2, line 67 -column 3, line 35; figures 1,2	1-4, 10-14, 18-21, 23-26
A	EP 0 412 524 A (TOKO YAKUHIN KOGYO KK) 13 February 1991 (1991-02-13) column 6, line 30 - line 33 column 4, line 33 - line 40 column 5, line 22 - line 27 figures 2,3,5	1,4-7, 9-11, 14-16, 18,21-26
A	EP 0 499 690 A (ELETTRO PLASTICA SPA) 26 August 1992 (1992-08-26)	

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PCT/US 00/06935

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