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[54] **INHALATION-RESPONSIVE AEROSOL DISPENSER**
10 Claims, 12 Drawing Figs.

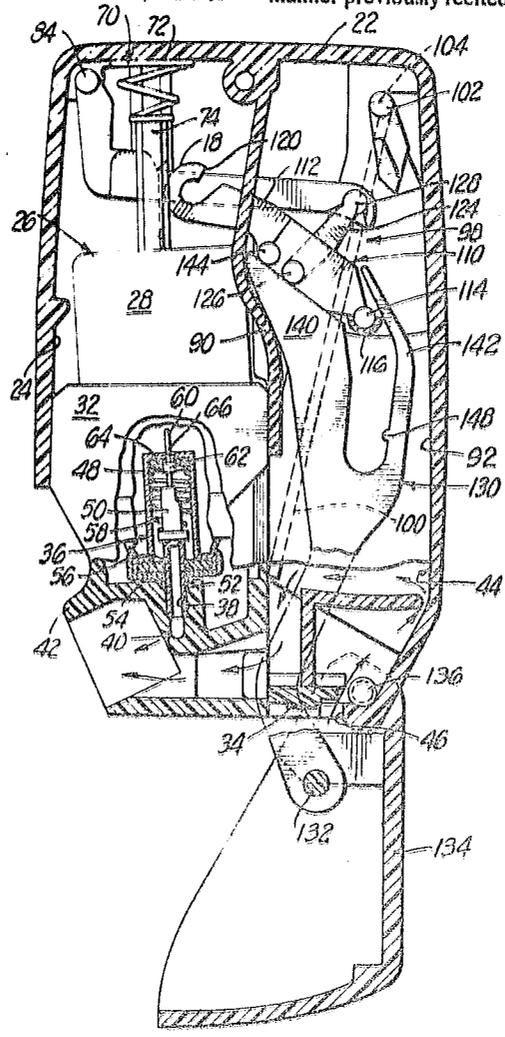
- [52] U.S. Cl. 222/402.2
- [51] Int. Cl. B65d 83/06
- [50] Field of Search 222/402.2,
 402.1, 402.11, 162, 444, 448, 449, 402.13

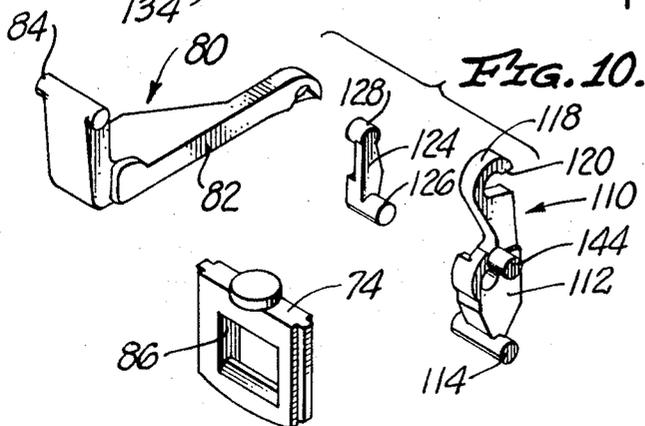
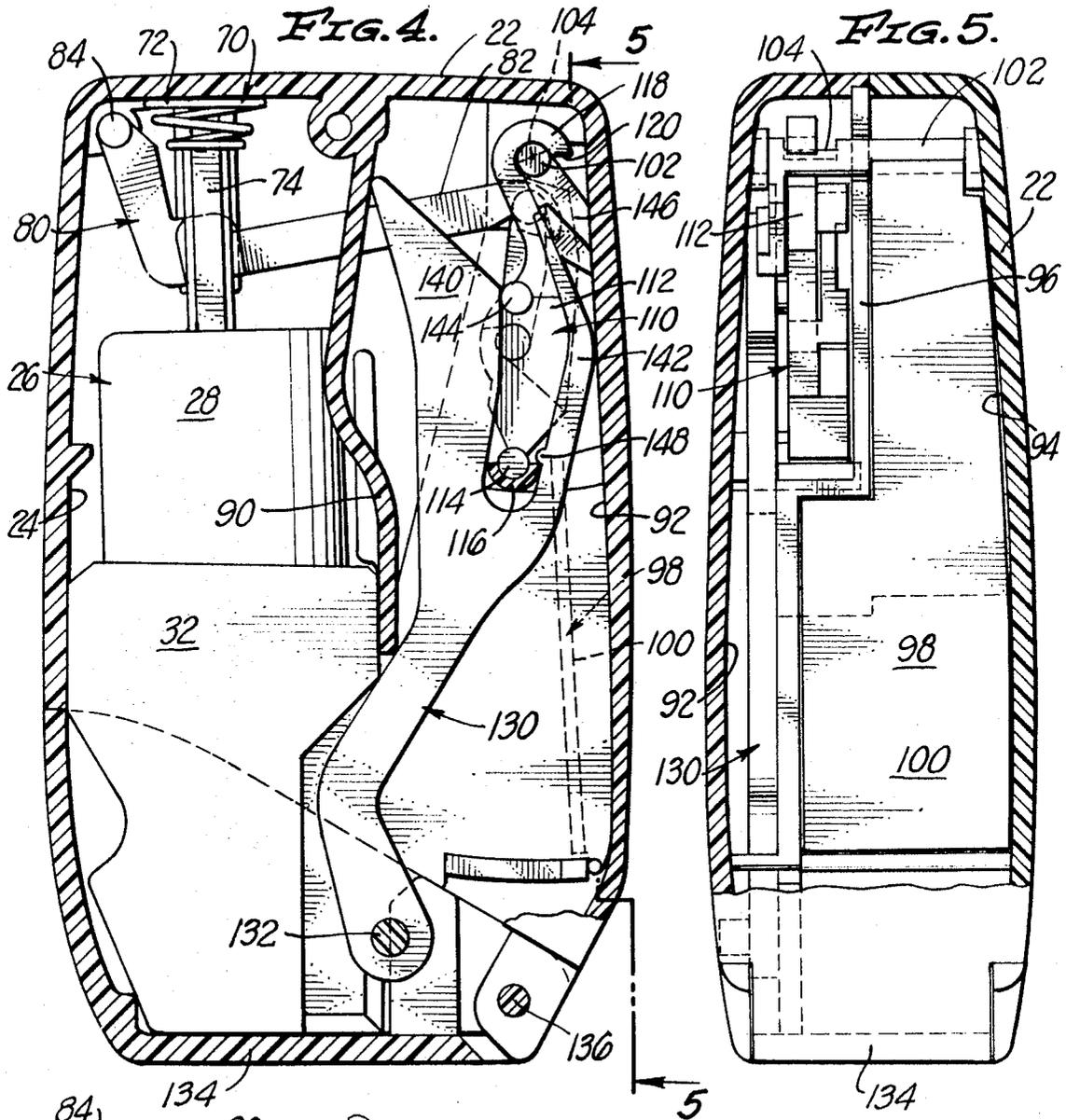
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ABSTRACT: An inhalation-responsive medicament dispenser provided with a housing having therein an aerosol-dispensing device comprising a container equipped with a metering valve spring biased outwardly toward a charging position and movable inwardly into a discharging position. A main spring engages the housing and the aerosol container to bias the metering valve toward its discharging position. A charging lever opposes the action of the main spring to enable the container to move to a position permitting the metering valve to occupy its charging position, and a latch releasably retains the charging lever in a position corresponding to the charging position of the metering valve. An inhalation-responsive vane releases the latch, upon inhalation by the patient through a mouthpiece with which the dispenser is equipped, whereupon the main spring moves the container into a position corresponding to the discharging position of the metering valve, the latter then discharging a metered amount of medicament from the aerosol container into the mouthpiece for inhalation by the patient. Pivotally connected to the housing is a cover which encloses the mouthpiece when the dispenser is not in use. An actuating cam pivotally connected to the cover, and responsive to closing movement thereof, sets the charging lever, the latch and the vane in positions corresponding to the charging position of the metering valve. Subsequently, the cover may be opened so that the patient may inhale through the mouthpiece to obtain a metered amount of medicament in the manner previously recited.





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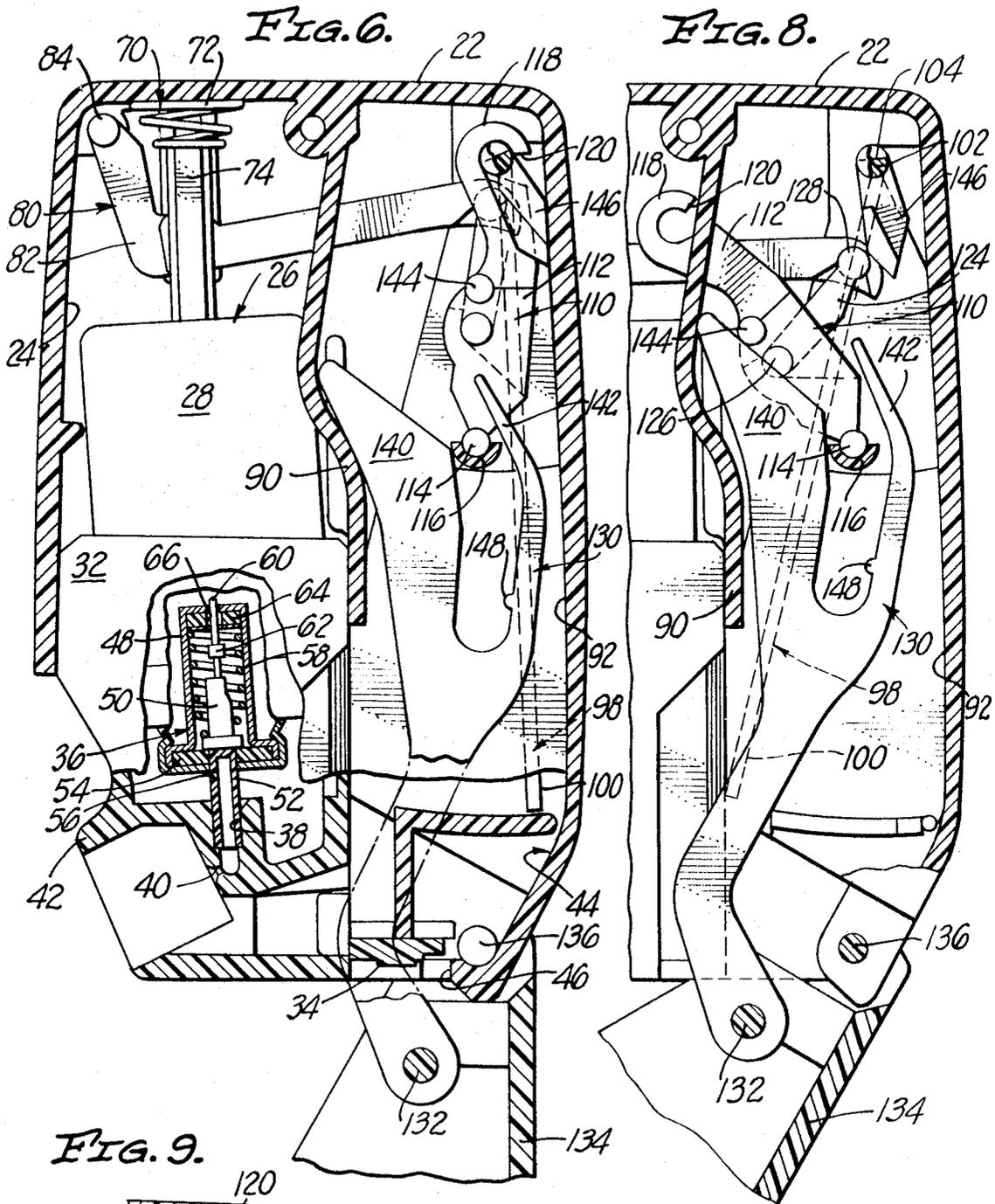


FIG. 9.

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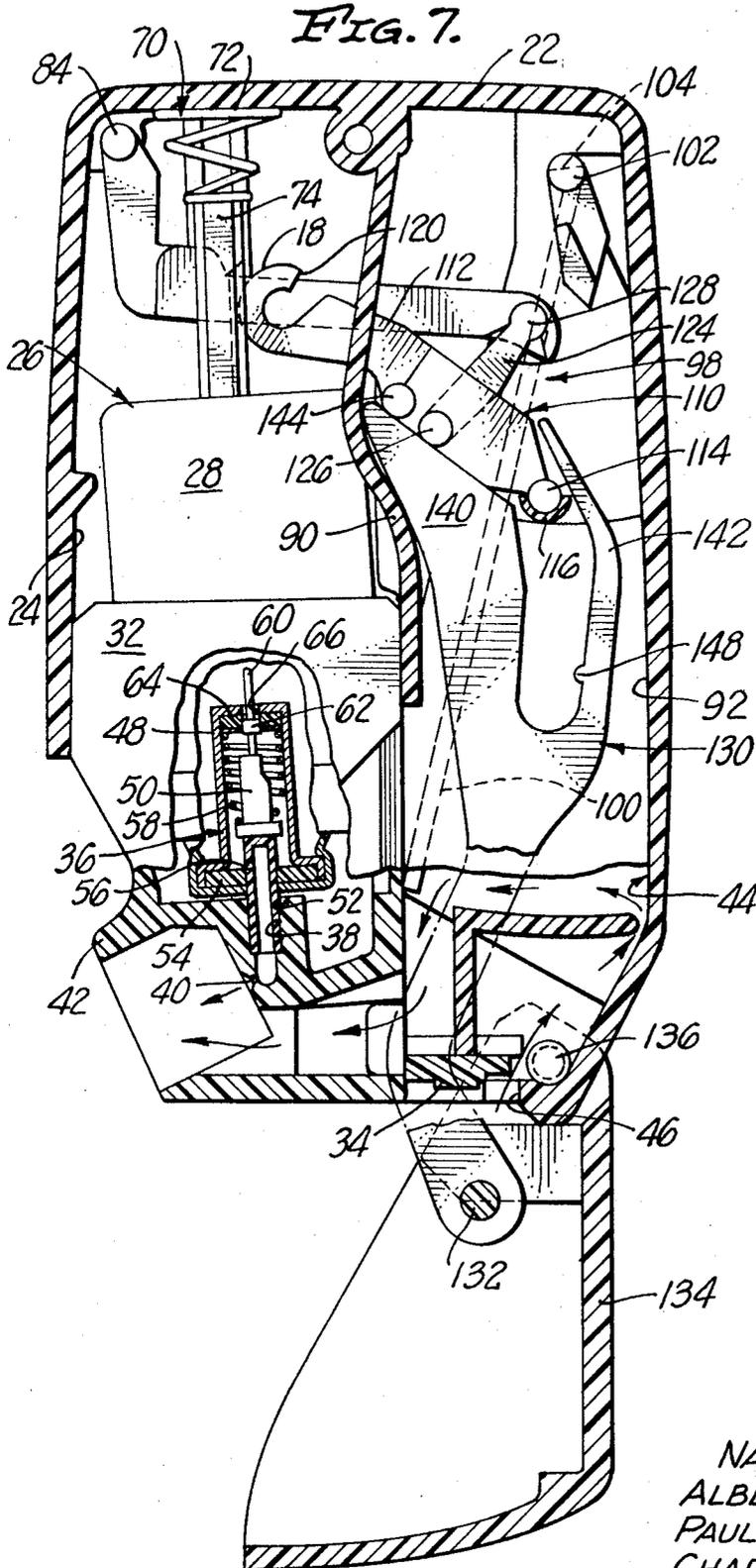


FIG. 11.

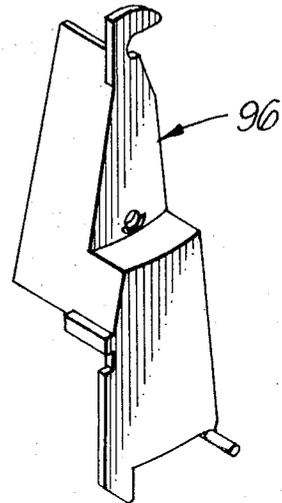
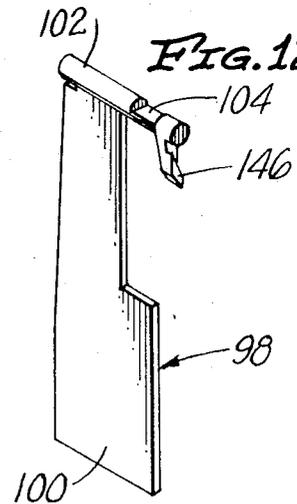


FIG. 12.



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INHALATION-RESPONSIVE AEROSOL DISPENSER

BACKGROUND OF INVENTION

The present invention relates in general to an inhalation-responsive dispenser for administering a metered quantity of a medicament to a patient in inhalation therapy, the medicament being carried by a self-propelling vehicle in an aerosol-dispensing device.

More particularly, the invention contemplates an inhalation-actuable dispenser which utilizes an aerosol-dispensing means comprising a container equipped with a metering valve or valve means movable between a charging position and a discharging position, the metering valve means receiving a metered charge from the container when in its charging position and discharging this metered charge when displaced into its discharging position. The metered charge is dispensed into a stream of air being inhaled by the patient through a mouthpiece with which the dispenser is equipped.

Conventionally, an inhalation-responsive dispenser of the type under consideration includes a housing in which the aerosol container is movably mounted, the metering valve means engaging a seat in the housing which is provided with a passage means for conveying a discharge from the metering valve means to the mouthpiece. A main spring means biases the container in a direction to position the metering valve means in its discharging position. A charging means opposes the action of the spring means to enable the container to move into a position such that the metering valve means may occupy its charging position. A latch means releasably retains the container in the position corresponding to the charging position of the metering valve means. An inhalation-responsive means in the air passage leading to the mouthpiece releases the latch means so that the main spring means produces movement of the container into a position corresponding to the discharging position of the metering valve means, whereby the latter discharges a metered amount of medicament from the container into the mouthpiece for inhalation by the patient.

In the particular type of inhalation-responsive medicament dispenser selected for disclosure herein, the aerosol-dispensing device is equipped with a metering valve means which discharges in response to inward movement, relative to the container, into an inner, discharging position from an outer, charging position, the device being equipped with an auxiliary spring means which biases the metering valve means toward its outer, charging position. The main spring means hereinbefore referred to is a separate spring means, externally of the container, for biasing the container toward the seat for the metering valve means so as to bias the metering valve means inwardly relative to the container toward the discharging position of the metering valve means, in opposition to the action of the auxiliary spring means with which the aerosol-dispensing device is equipped.

SUMMARY AND OBJECTS OF INVENTION

A primary object of the invention is to provide an inhalation-actuable medicament dispenser of the foregoing general character which includes actuating means connected to a pivoted cover for the mouthpiece, and responsive to closing movement of the cover, for displacing the charging means, the latch means and the inhalation-responsive means into their respective positions corresponding to the charging position of the metering valve means. Thus, the dispenser is "cocked" by the simple act of closing the cover over the mouthpiece, which is an important feature. Subsequent opening of the cover readies the dispenser for use.

Another and important object of the invention is to provide an actuating means which comprises a cam means pivotally connected to the cover and provided with cams for placing the charging means, the latch means and the inhalation-responsive means in their positions corresponding to the charging position of the metering valve means.

The foregoing objects and features of the invention, together with various other objects and features thereof which will be evident to those skilled in the inhalation-responsive aerosol dispenser art in the light of this disclosure, may be achieved with the exemplary embodiment of the invention described in detail hereinafter and illustrated in the accompanying drawings.

DESCRIPTION OF DRAWINGS

In the drawings:

FIG. 1 is a longitudinal sectional view of an inhalation-actuable aerosol dispenser which embodies the invention, showing the cover of the dispenser closed and showing the dispenser cocked;

FIG. 2 and 3 are sectional views respectively taken along the arrowed lines 2-2 and 3-3 of FIG. 1;

FIG. 4 is a sectional view taken along the arrowed line 4-4 of FIG. 2;

FIG. 5 is a sectional view taken along the arrowed line 5-5 of FIG. 4;

FIG. 6 is a view similar to FIG. 4, but showing the cover of the dispenser opened;

FIG. 7 is a view similar to FIG. 6, but showing the dispenser of the invention "triggered" to discharge a metered amount of medicament;

FIG. 8 is a view similar to FIG. 7, but showing the cover in the process of being closed to recock the dispenser;

FIG. 9 is a fragmentary view duplicating a portion of FIG. 8 and showing various parts in the positions they occupy just before the dispenser is completely cocked;

FIG. 10 is an exploded perspective view showing parts of a charging means and a latch means of the dispenser of the invention;

FIG. 11 is a perspective view of a partition forming part of the housing of the dispenser; and

FIG. 12 is a perspective view of an inhalation-actuable vane forming part of the dispenser.

DESCRIPTION OF EXEMPLARY EMBODIMENT OF INVENTION

Throughout the drawings, the dispenser of the invention is designated generally by the numeral 20 and includes a housing 22 having therein a compartment 24 for an aerosol medicament-dispensing device or means 26 comprising a container 28 charged with a self-propelling liquid composition including as one component thereof any desired medicament suitable for inhalation therapy.

The aerosol container 28 is slidable upwardly and downwardly in a guideway 30 in a member 32 disposed in the compartment 24 and releasably secured therein by a suitable latch 34. The container 28 is provided at its lower end with a metering valve means 36 engageable with a seat 38 communicating through a passage means 40 with a mouthpiece 42 forming part of the member 32. As best shown in FIG. 7, the mouthpiece 42 forms the terminus of an air passage, designated generally by the numeral 44, through the housing 22, the inlet 46 of the air passage 44 being adjacent the latch 34.

The metering valve means 36 is similar to that disclosed in U.S. Pat. No. 2,721,010, granted Oct. 18, 1955 to Philip Meshberg. Considering the metering valve means 36 briefly it includes a housing 48 within the container 28. Reciprocable in the housing 48 is a metering valve 50 having a tubular stem 52 which projects from the housing 48 and the container 28 into the seat 38 through an annular seal 54. A lateral port 56 in the tubular stem 52 communicates with the interior of this stem. When the container 28 is in its upper position, FIG. 6, the metering valve 50 is in its charging position and the port 56 is located axially outwardly of the annular seal 54. When the container 28 is moved downwardly into the position of FIG. 7, as will be described hereinafter, the metering valve 50 is in its discharging position and the port 56 is axially inwardly of the annular seal 54.

The metering valve 50 is biased axially outwardly toward its charging position, shown in FIG. 6, by an auxiliary spring means comprising a compression coil spring 58 seated at one end against an external collar on the metering valve and at its other end against the housing 48. The metering valve 50 includes an axially inwardly extending pin 60 carrying a collar 62 which is engageable with an annular seal 64, when the metering valve is in its discharging position, FIG. 7, to close a passage 66 interconnecting the interior of the housing 48 and the interior of the container 28. When the container 28 is in the position corresponding to the charging position, FIG. 6, of the metering valve 50, the collar 62 disengages the annular seal 64 to open the passage 66.

Considering the operation of the metering valve means 36 briefly, when the container 28 is in the position corresponding to the charging position of the metering valve 50, as shown in FIG. 6, a metered charge may flow from the interior of the container 28 into the housing 48 through the passage 66. Upon subsequent movement of the container 28 into the discharging position of the metering valve 50, as shown in FIG. 7, the metered charge is discharged from the interior of the housing 48 through the port 56 and the tubular stem 52, into the passage means 40 leading to the mouthpiece 42. Under such circumstances, the collar 62 closes the passage 66 to prevent further flow from the interior of the container 28. Conversely, when the metering valve 50 was in its charging position, FIG. 6, the port was located axially outwardly of the annular seal 54 to disconnect the tubular stem 52 from the interior of the housing 48.

The compression coil spring 58 forming part of the metering valve means 36 biases the aerosol container 28 upwardly into its FIG. 6 position, corresponding to the charging position of the metering valve means. However, a main spring means 70 is capable of overcoming the spring 58 to displace the container 28 downwardly into its FIG. 7 position, corresponding to the discharging position of the metering valve 50. The main spring means 70 comprises a relatively heavy coil spring 72 acting in compression between the upper end wall of the housing 22 and a driver 74 movable upwardly and downwardly along tracks 76, FIG. 3. The driver 74 transmits the force of the spring 72 to the upper, closed end of the aerosol container 28 to bias it downwardly into its discharging position, FIG. 7.

The dispenser 20 includes charging means 80 for placing the aerosol-dispensing device 26 in its charging condition in opposition to the action of the spring 72, which biases it toward its discharging condition. More particularly, the charging means opposes the action of the spring 72 to enable the spring 58 of the metering valve means 36 to displace the container 28 upwardly away from its seat 38 into a position corresponding to the charging position of the metering valve 50, FIG. 6.

The charging means 80 includes an L-shaped charging lever 82 having its shorter arm pivotally connected to the housing 22 at 84. The charging lever 82 extends through an aperture 86 in the driver 74 and is engageable with a knife edge 88 forming the upper edge of the aperture. As will be apparent, when the charging lever 82 is pivoted upwardly, it acts through the driver 74 to compress the spring 72 and permit the spring 58 in the metering valve means 36 to displace the container 28 upwardly into the position thereof corresponding to the charging position of the metering valve 50. The manner in which the charging lever 82 is pivoted upwardly will be considered hereinafter.

Alongside the compartment 24 for the aerosol-dispensing device 26, and separated therefrom by a partition 90, are actuator and vane compartments 92 and 94, FIG. 5. The actuator and vane compartments 92 and 94 are separated by an irregular partition 96, shown in perspective in FIG. 11.

As will be clear from FIG. 7, the lower end of the vane compartment 94 forms a part of the air passage 44 leading to the mouthpiece 42. The vane compartment contains an inhalation-responsive vane means 98 which, as will be described hereinafter, permits the aerosol-dispensing means 36 to deliver a metered charge to the mouthpiece 42 for inhalation by the user of the dispenser 20.

More particularly, the inhalation-actuable vane means 98 includes a depending vane 100 disposed in and closely fitting the vane compartment 94. The vane 100 is provided at its upper end with a pivot shaft 102 suitably pivotally mounted in the housing 22 so that the vane 100 can swing back and forth in the vane compartment 94 between a latching position, FIG. 6, and a latch-releasing position, FIG. 7. The pivot shaft 102 is provided thereon within the actuator compartment 92 with a flat 104 for a purpose to be described. It will be apparent that, when the patient inhales through the mouthpiece 42, the flow of air through the passage 44, as shown in FIG. 7, pivots the vane 100 from its latching position to its latch-releasing position.

The dispenser 20 further includes latch means 110 in the actuator compartment 92 for releasably retaining the aerosol-dispensing device 26 in its charging condition, the latch means being releasable by the inhalation-responsive vane means 98 to permit the main spring means 70 to place the aerosol-dispensing device in its discharging condition, whereby it discharges a metered amount into the stream of air being inhaled by the patient through the mouthpiece 42. Considering the latch means 110 more specifically, it includes a generally upright latch 112 having at its lower end a pivot shaft 114 seated in a semicylindrical bearing 116 carried by the partition 96 and one sidewall of the housing 22. The latch 112 is provided at its upper end with a hook 118 adapted to hook over the flattened portion of the vane pivot shaft 102, as shown in FIG. 6, when the vane 100 is in its latching position. When the vane 100 is pivoted into its latch-releasing position, FIG. 6, by the user's inhalation, the vane pivot shaft 102 is rotated sufficiently to permit the end 130 of the hook 118 to slide across the flat 104 to release the latch means 110. Conversely, as shown in FIG. 9, the hook end 120 may slide across the flat 104 in engaging the latch 112 with the vane pivot shaft 102, prior to pivoting the vane 100 into its latching position.

The latch 112 and the charging lever 82 are interconnected within the actuator compartment 92 by a link 124 pivotally connected to the latch 112 intermediate its ends at 126 and to the charging lever 82 at its free end, at 128. The relationship between the link 124, the charging lever 82 and the latch 112 is such that as the latch is hooked over the vane pivot shaft 102, FIG. 6, the charging lever 82 is also pivoted upwardly into a position corresponding to the charging position of the metering valve means 36. Thus, the latch means 110 releasably retains the charging means 80 in a position corresponding to the charging position of the metering valve means 36. The charging means 80 and the latch means 110 are placed in their foregoing locked positions by an actuating means 130 in the actuator compartment 92, such actuating means also serving to place the vane 100 in its latching position so that the hook 118 of the latch 112 is hooked over the flattened portion of the vane pivot shaft 102.

Considering the actuating means 130 in more detail, it is pivotally connected at 132 to a cover 134 for the mouthpiece 42. The cover 134 is pivotally connected to the housing 22, at 136, for pivotal movement between a closed position, FIGS. 1 to 5, and an open position, FIGS. 6 and 7.

The actuating means 130 comprises a bifurcated cam means which extends upwardly from the cover 134 into the actuator compartment 92 and which terminates in two branch cams 140 and 142. The cam 140, as best shown in FIGS. 7 and 8, engages a pin 144 on the latch 112 to pivot the latch into latching engagement with the vane pivot shaft 102, as will be apparent by considering FIGS. 8, 9 and 4 in that order. This occurs, as will be evident from the drawings, in response to closing movement of the cover 134. At the same time, the link 124 acts on the charging lever 82 to pivot it upwardly into a position corresponding to the charging position of the metering valve means 36. While these events are taking place, the cam 142 engages an arm 146 on the vane pivot shaft 102, as shown in FIG. 9, to pivot the vane into its latching position, FIG. 4. The cam 142 pivots the vane 100 into its latching position as the end 120 of the hook 118 moves across the flat 104 on the vane pivot shaft 102. Consequently, as the vane 100 is

displaced into its latching position, the flattened portion of the vane pivot shaft 102 is rotated into hooked relation with the latch hook 118, as shown in FIG. 4, and also in FIG. 6. As further shown in FIG. 6, once the latch 112 has entered into hooked engagement with the flattened portion of the vane pivot shaft 102, the cover 134 may be opened to disengage the cams 140 and 142 from the latch 112 and the vane 100.

Referring particularly to FIG. 4, the cam 142 is provided thereon with a projection 148 which is engageable with one edge of the semicylindrical bearing 116 to releasably retain the actuating means 130 in a position to hold the cover 134 closed. Upon opening the cover 134 manually, the projection 148 disengages the bearing 116.

EXPLANATION OF OPERATION OF DISPENSER 20

It will be assumed initially that the various parts of the dispenser 20 are in the positions shown in FIG. 4 of the drawings, wherein the dispenser is cocked with the aerosol-dispensing device 26 in its charging condition. More particularly, the latch means 110 retains the charging means 80 in a position corresponding to the charging position of the metering valve means 36, and also retains the vane 100 in its latching position. Further, the cover 134 is closed to maintain the cams 140 and 142 respectively in engagement with the pin 144 on the latch 112 and the arm 146 on the vane pivot shaft 102.

When the dispenser 20 is to be used, the cover 134 is opened, as shown in FIG. 6. This makes the mouthpiece 42 accessible, and also disengages the cams 140 and 142 from the latch pin 144 and from the vane pivot shaft arm 146, respectively.

Next, the patient places the mouthpiece 42 in his mouth and inhales therethrough, thereby causing air to flow through the passage 44, as shown in FIG. 7. This air flow causes the vane 100 to pivot into its latch-releasing position, as shown in FIG. 7. Very little flow is required to accomplish this since the only thing preventing movement of the vane 100 from its latching position to its latch-releasing position is friction between the hook 118 and the vane pivot shaft 102 and friction between the vane pivot shaft and its bearings. Pivoting of the vane 100 toward its latch-releasing position aligns or registers the flat 104 on the vane pivot shaft 102 with the hook end 120, whereby the hook may disengage the vane pivot shaft, under the impetus provided by the main spring 72. The latter, acting through the driver 74, propels the aerosol container 28 into a position corresponding to the discharging position of the metering valve means 36. Thus, a metered charge is delivered to the mouthpiece 42 for inhalation by the user in the same breath used to trigger the dispenser 20. In other words, the act of inhaling results in substantially simultaneous triggering of the dispenser 20 and inhalation of the metered charge dispensed thereby.

Subsequently, the cover 134 is returned to its closed position, thereby causing the various parts to move from the positions shown in FIG. 7 through the positions shown in FIGS. 8 and 9 back to those shown in FIG. 4. This readies the dispenser 20 for subsequent reuse when necessary.

Although an exemplary embodiment of the invention has been disclosed for purposes of illustration, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiment.

We claim as our invention:

1. In an inhalation-actuable dispenser, the combination of:
 - a. a housing having an air passage therethrough which terminates in a mouthpiece;
 - b. a cover for said mouthpiece pivotally connected to said housing for movement between an open and a closed position;
 - c. aerosol-dispensing means in said housing and capable of being placed in either a charging condition or a discharging condition and communicating with said mouthpiece;
 - d. spring-means biasing said aerosol-dispensing means toward its discharging condition;

- e. charging means for placing said aerosol-dispensing means in its charging condition in opposition to the action of said spring means;
 - f. latch means for releasably retaining said aerosol-dispensing means in its charging condition;
 - g. actuating means connected to said cover and responsive to movement thereof between said open and said closed position for actuating said charging means and said latch means; and
 - h. inhalation-responsive means in said air passage, and actuable by air flowing therethrough toward said mouthpiece, for releasing said latch means so that said spring means places said aerosol-dispensing means in its discharging condition, whereby said aerosol-dispensing means discharges into said mouthpiece.
2. In an inhalation-actuable dispenser, the combination of:
 - a. a housing having an air passage therethrough which terminates in a mouthpiece;
 - b. a cover for said mouthpiece pivotally connected to said housing for movement between an open and a closed position;
 - c. aerosol-dispensing means in said housing and including a container having a metering valve means relatively movable between charging and discharging positions of said metering valve means and communicating with said mouthpiece;
 - d. spring means for relatively biasing said metering valve means and said container toward said discharging position of said metering valve means;
 - e. charging means for affording movement of said metering valve means and said container into said charging position of said metering valve means in opposition to the action of said spring means;
 - f. latch means for releasably retaining said metering valve means in said charging position in opposition to the action of said spring means;
 - g. actuating means connected to said cover and responsive to movement thereof between said open and said closed position for actuating said charging means and said latch means; and
 - h. inhalation-responsive means in said air passage, and actuable by air flowing therethrough toward said mouthpiece, for releasing said latch means so that said spring means produces relative movement of said metering valve means and said container into said discharging position of said metering valve means, whereby said metering valve means discharges a metered amount from said container into said mouthpiece.
 3. In an inhalation-actuable dispenser, the combination of:
 - a. a housing having an air passage therethrough which terminates in a mouthpiece;
 - b. a cover for said mouthpiece pivotally connected to said housing;
 - c. aerosol-dispensing means in said housing and including a container having a metering valve means relatively movable between charging and discharging positions of said metering valve means, said metering valve means being spring biased outwardly toward said charging position;
 - d. a seat for said metering valve means in said housing and having passage means for conveying a discharge from said metering valve means to said mouthpiece;
 - e. spring means for biasing said container toward said seat to bias said metering valve means inwardly relative to said container toward said discharging position of said metering valve means;
 - f. charging means for opposing the action of said spring means to enable said container to move away from said seat so that said metering valve means may occupy said charging position;
 - g. latch means for releasably retaining said charging means in a position corresponding to said charging position of said metering valve means;
 - h. actuating means connected to said cover and responsive to closing movement thereof for actuating said charging means and said latch means; and

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i. inhalation-responsive vane means in said air passage, and actuable by air flowing therethrough toward said mouthpiece, for releasing said latch means so that said spring means produces movement of said container toward said seat to move said metering valve means into said discharging position, whereby said metering valve means discharges a metered amount from said container into said mouthpiece.

4. An inhalation-actuable dispenser as defined in claim 3 wherein:

- a. said charging means includes a charging lever pivotally connected at one end to said housing;
- b. the other end of said charging lever is connected to said latch means; and
- c. said charging lever is connected intermediate its ends to said spring means.

5. An inhalation-actuable dispenser according to claim 3 wherein:

- a. said vane means includes a vane having at one end a pivot shaft journaled in said housing;
- b. said pivot shaft has a flat thereon; and
- c. said latch means includes a latch provided with a hook engageable with said pivot shaft and having an end slidable across said flat to release said latch means.

6. An inhalation-actuable dispenser as defined in claim 5 wherein said actuating means includes means for pivoting said

pivot shaft into a position to engage said hook with said pivot shaft with said end of said hook out of register with said flat.

7. An inhalation-actuable dispenser according to claim 3 wherein:

- a. said vane means includes a vane pivotable between a latching position and a latch-releasing position; and
- b. said actuating means includes means for pivoting said vane into said latching position.

8. An inhalation-actuable dispenser as defined in claim 3 wherein:

- a. said actuating means includes cam means pivotally connected to said cover and having a cam in engagement with said latch means; and
- b. said latch means is connected to said charging means.

9. An inhalation-actuable dispenser according to claim 8 wherein:

- a. said vane means includes a vane pivotable in said housing between a latching position and a latch-releasing position; and
- b. said cam means includes a cam for pivoting said vane into its latching position concurrently with actuation of said charging means and said latch means.

10. An inhalation-actuable dispenser as set forth in claim 1 wherein said actuating means includes means for latching said cover in its closed position.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,598,294 Dated August 10, 1971

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It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 63, after briefly, insert -- , --.

Column 3, line 27, after port, insert -- 56 --; and line 73, change "36" to - 26 --.

Column 4, line 31, change "130" to -- 120 --.

Signed and sealed this 20th day of June 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents