July 22, 1969 R. E. PHILLIPS ET AL 3,456,646

INHALATION-ACTUATED AEROSOL DISPENSING DEVICE

Filed Jan. 19, 1967 2 Sheets-Sheet 1

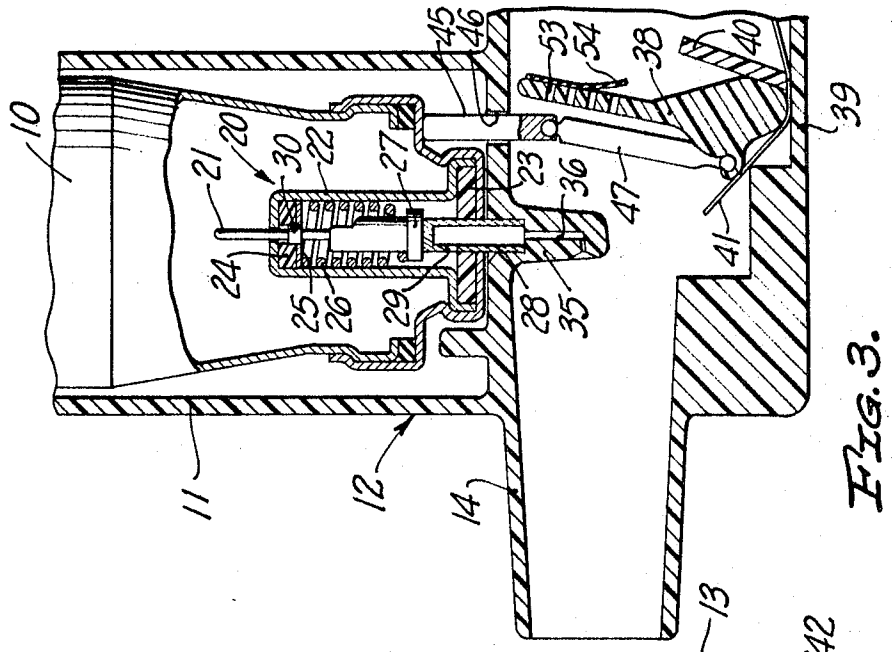

FIG. 3.

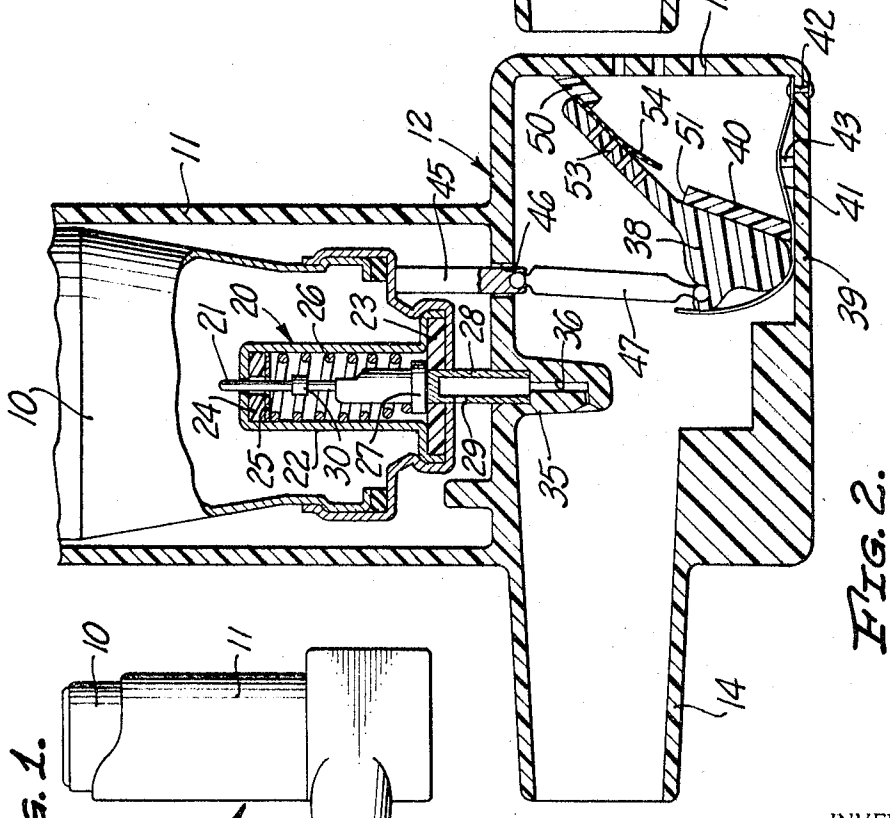

FIG. 2.

FIG. 1.

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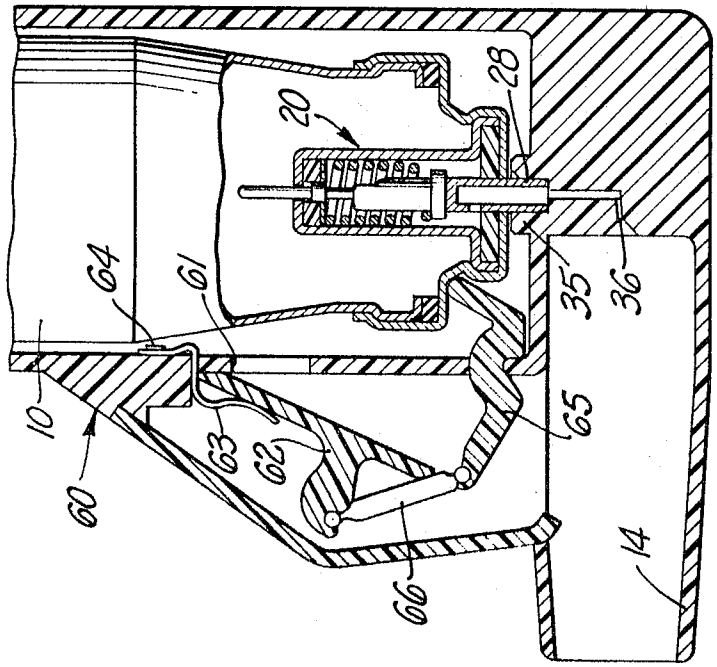

FIG. 5.

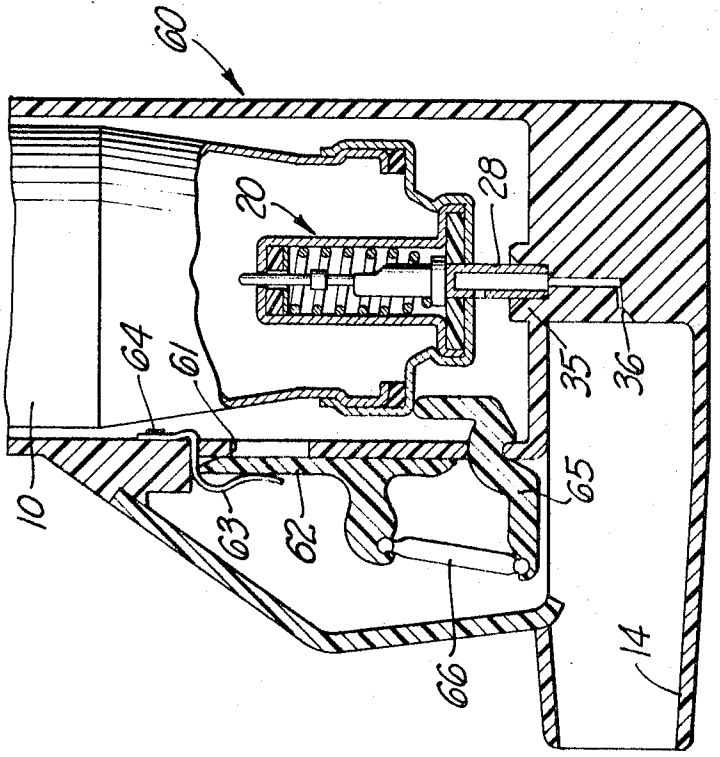

FIG. 4.

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INHALATION-ACTUATED AEROSOL DISPENSING DEVICE

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U.S. Cl. 128—173 7 Claims

ABSTRACT OF THE DISCLOSURE

An aerosol dispensing device for discharging a metered amount of a medicament-containing aerosol into the mouth of a patient during inhalation. The device is initially manually compressed to a charging condition and is automatically discharged by a mechanism actuated by the breathing of the patient.

This invention relates to a dispensing device which is particularly suited for dispensing and administering measured amounts of fluids. The principal use for devices of this type at the present time is in dispensing metered amounts of a medicament-containing aerosol for inhalation therapy.

A variety of devices for administering medicament during inhalation have been developed and used. It is an object of the present invention to provide a new and improved device which utilizes the manual compressive force of the patient for maintaining the device in a charging or ready condition and a trigger actuated mechanism for discharging. A further object is to provide such a device wherein the trigger mechanism is breath actuated, permitting the manually applied force to discharge the dose. An additional object is to provide such a dispensing device which is inexpensive, simple and dependable.

A variety of materials, particularly in the medical field, are being packaged and sold in aerosol containers, usually with a built-in metering valve. It is a particular object of the present invention to provide a new and improved dispensing device for use with commercially available aerosol containers. A further object is to provide such a device in which the user can readily remove and replace the containers. A particular object is to provide such a device wherein the metering valve action is provided by the manually applied forces of the patient upon the container.

It is an object of the invention to provide a dispensing device for use in combination with an aerosol dispensing container equipped with a metering valve movable between charging and discharging positions and having a discharge tube at one end thereof and charged with a self-propelling liquid composition, the device including a housing for receiving the container for reciprocation of the container within the housing, with the housing including means defining an air passage therethrough and including a support member having an opening receiving the discharge tube and providing a discharge passage for the tube into the air passage. A further object is to provide such a device including a vane or trigger member disposed in the air passage and movable between a first position substantially blocking the passage and a second position not blocking the passage, bias means urging the vane member toward the first position, and latch means carried in the housing engaging the container and vane member, with the vane member when in the first position maintaining the container and valve means in the charging position when a compression force is applied to the container urging the valve means to the discharging position, and with a pressure differential in the air passage across the vane member moving the vane member to the second position, permitting

movement of the valve means to the discharging position under continued application of the compression force.

It is a particular object of the invention to provide such a dispensing device in which the pressure differential is produced by the inhalation of the patient. Another object is to provide such a device in which the compression force is manually applied and maintained by the patient.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. The drawings merely show and the description merely describes preferred embodiments of the present invention which are given by way of illustration or example.

In the drawings:

FIG. 1 is a side view of the preferred embodiment of the dispensing device of the invention;

FIG. 2 is an enlarged partial sectional view showing the device of FIG. 1 in the charging position;

FIG. 3 is a view similar to that of FIG. 2 showing the device in the discharging position; and

FIGS. 4 and 5 are views corresponding to FIGS. 2 and 3, respectively, showing an alternative embodiment of the device.

Referring to the device of FIGS. 1–3, a container **10** is slidably positioned within a cylindrical portion **11** of a housing **12**. An air passage is provided through the housing between a plurality of inlet openings **13** and a mouthpiece **14**.

The container **10** may be a conventional aerosol dispensing container such as is described in United States Patent No. 3,001,524. A metering valve **20** may be incorporated in the container **10** and includes a stem **21** movable between a charging position (FIG. 2) and a discharging position (FIG. 3). A tank **22** is fixed in the end of the container **10** with a gasket **23** at the container opening. Another gasket **24** and a plate **25** are positioned at the other end of the tank **22**. A spring **26** is positioned about the stem **21** and is compressed between the plate **25** and a shoulder **27** on the stem. The stem has a tubular outer end **28** with a lateral passage **29**.

When the valve is in the charging position of FIG. 2, fluid from the container **10** flows in the tank **22** around the reduced inner end of the stem **21**. Engagement of the shoulder **27** with the gasket **23** prevents discharge from the container. For discharging, the spring **26** is compressed to the position of FIG. 3, bringing the shoulder **30** of the pin **21** into sealing engagement with the gasket **24** and at the same time, bringing the lateral opening **29** into the interior of the tank **22**. The measured charge of material within the shell is discharged through the tubular end **28** of the stem of the valve.

When the container **10** is inserted in the housing **12**, the end **28** of the valve stem is positioned in a support member **35** of the housing and a passage **36** provides for flow from the valve into the air passage of the housing. The container is preferably but not necessarily removable and replaceable.

A trigger element in the form of a flapper or vane **38** is pivotally carried in the housing between a base portion **39** and an upwardly extending arm member **40**. A spring member **41**, typically a leaf spring of a resilient material such as beryllium copper, is fastened to the housing by a pin **42**, passes over a spacer **43** and through a notch in the member **40**, to engage the vane **38**, urging it in the clockwise direction as viewed in FIG. 2.

A bar **45** slides in an opening **46** in the housing and is pivotally connected to a second bar **47**. The second bar **47** is also pivotally carried on the vane **38**.

The member **40** and a similar projecting member **50** coact to define an opening **51** in the air passage through

the housing. This opening is substantially closed by the vane **38** when in the position of FIG. 2. A plurality of passages **53** may be provided in the vane **38**, the passages normally being closed by a resilient cover **54** carried on the vane **38**.

A cycle of operation of the device starts with the condition of FIG. 2. The valve **20** is in the charging position and the shell **22** is filled with fluid from the container **10**. A compression force is applied to the housing and container, as by placing the thumb at the bottom of the housing and one or two fingers at the top of the container, as viewed in FIG. 1. A downward force is exerted on the bar **45** and the bar **47** and the vane **38**. The arrangement of these parts is such that the bars **45**, **47** function as a latch or toggle and maintain the mechanism in the position of FIG. 2. The patient then places the mouthpiece **14** in his mouth and starts to inhale. This act of inhalation produces a pressure differential across the vane **38**, resulting in a force which moves the vane counterclockwise against the urging of the spring **41** thus triggering the latch or breaking the toggle. The vane moves to the position of FIG. 3 under the continued application of the manual force exerted through the container and the bars **45**, **47**. This permits movement of the container **10** relative to the housing **12** to the valve discharging position of FIG. 3. A measured amount of the fluid from the container is injected into the air passage as the patient is inhaling, providing the desired dosage.

After inhalation, the manual compression force is released, permitting return of the device to the position of FIG. 2. The device is now ready for administration of another dose. The openings **53** in the vane **38** permit exhalation by the patient with the mouthpiece **14** in the patient's mouth. The cover **54** serves to block the passages **53** during inhalation to obtain maximum pressure differential. When the vane moves to the position of FIG. 3, ready flow of air is permitted over the top of the vane and also around the lower portion, since that portion of the vane below the top of the projecting member **40** need not extend the entire width of the opening **51**.

An alternative form of the device is shown in FIGS. 4 and 5. A container **10** is positioned in a housing **60** having the same general configuration as the housing **11**. The tubular end **28** of the valve **20** rests in the support member **35**, with a passage **36** providing communication to the air passage through the housing. In this embodiment, the housing air passage starts at the top of the housing, passing around the container **10** and through an opening **61** to the mouthpiece **14**. A vane member **62** normally closes the passage **61** and is urged to the closed position by a spring **63** fixed to the housing with a pin **64**. A bar **65** is pivotally mounted in an opening in the housing, with one end of the bar engaging the container **10** and the other end of the bar pivotally receiving a second bar **66**. The other end of the bar **66** is pivotally mounted in the vane member **62**.

The operation of the device of FIGS. 4 and 5 is similar to that of the device of FIGS. 1–3. The mechanism is initially in the position of FIG. 4 and the valve is charged. The patient applies the manual compression force, but the bars **65**, **66** remain in the latched position. The patient places the mouthpiece **14** in his mouth and starts to inhale, thereby producing a pressure differential across the vane member **62** causing it to pivot clockwise to the position of FIG. 5. This triggers the latch mechanism, permitting clockwise rotation of the bar **65** and downward movement of the container **10** to the position of FIG. 5, with a resultant discharge of the measured dose into the air passage. When the manual pressure is released, the mechanism returns to the position of FIG. 4.

Although exemplary embodiments of the invention have been disclosed and discussed, it will be understood that other applications of the invention are possible and

that the embodiments disclosed may be subjected to various changes, modifications and substitutions without necessarily departing from the spirit of the invention.

We claim as our invention:

1. In a dispensing device for use in combination with an aerosol dispensing container equipped with a metering valve means movable between charging and discharging positions and having a discharge tube at one end thereof and charged with a self-propelling liquid composition, the improvement comprising:

a housing for receiving said container for reciprocation of said container within said housing, said housing including means defining an air passage therethrough,

said housing including a support member having an opening receiving said discharge tube and providing a discharge passage for said tube into said air passage;

a vane member disposed in said air passage and movable between a first position substantially blocking said passage and a second position not blocking said passage;

bias means urging said vane member toward said first position; and

latch means carried in said housing and engaging said container and said vane member, with said vane member when in said first position maintaining said container and valve means in said charging position when a compression force is applied to said container urging said valve means to the discharging position, and

with a pressure differential in said air passage across said vane member moving said vane member to said second position, permitting movement of said valve means to the discharging position under continued application of said compression force.

2. A device as defined in claim **1** in which said latch means includes a toggle joint positioned between said container and said vane member.

3. A device as defined in claim **1** in which said latch means comprises first and second bars joined at a pivot point with the other end of said first bar engaging said container in force transmitting relation and with the other end of said second bar pivotally engaging said vane member.

4. A device as defined in claim **1** in which said vane member is pivotally mounted in said housing for movement between said first and second positions,

and in which said latch means comprises first and second bars joined at a pivot point, with said first bar slidably positioned in an opening in said housing and with the other end thereof engaging said container for reciprocation in said housing with said container, and with the other end of said second bar pivotally engaging said vane member.

5. A device as defined in claim **1** in which said vane member is pivotally mounted in said housing for movement between said first and second positions,

and in which said latch means comprises first and second bars joined at a pivot point, with said first bar pivotally mounted in an opening in said housing and with the other end thereof engaging said container, and with the other end of said second bar pivotally engaging said vane member.

6. In a dispensing device, the combination of:

a housing including an aerosol dispensing container charged with a self-propelling liquid composition, said housing including means defining an air passage therethrough;

metering valve means coupled to said container and movable between a charging position for receiving a charge from said container and a discharging position for dispensing said charge;

trigger means disposed in said air passage and movable between a first position substantially blocking said

passage and a second position not blocking said passage;

bias means urging said trigger means toward said first position; and

latch means carried in said housing and engaging said container and said trigger means, with said trigger means when in said first position maintaining said container and valve means in said charging position when a compression force is applied to said container urging said valve means to the discharging position, and

with a pressure differential in said air passage across said trigger means moving said trigger means to said second position, permitting movement of said valve means to the discharging position under continued application of said compression force.

7. A device as defined in claim 6 in which said latch means includes a toggle joint comprising first and second

bars joined at a pivot point with the other end of one bar engaging said container in force transmitting relation and with the other end of the other bar carried on said trigger means.

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