ANNULAR CONDUIT AEROSOL ACTUATOR
8 Claims, 2 Drawing Figs.

ABSTRACT: An aerosol actuator assembly especially adapted for utilization with dry powder aerosols comprising an annular dispensing conduit formed by insert means placed within an opening in the actuator button. Aerosol formulation flow is directed in such a manner that it is dispensed through the annular conduit in a spiral path.
ANNULAR CONDUIT AEROSOL ACTUATOR

The present invention relates to aerosol dispensers, and more particularly to the structure and arrangement of an aerosol actuator assembly, specifically the dispensing conduit means thereof. The invention is particularly concerned with providing a specifically shaped aerosol actuator dispensing aerosol formulation in a manner whereby the flow pattern of the dispersed aerosol formulation which impinges upon the intended target will be appropriate for the circumstances involved. The invention is regarded as having particular utility in connection with dispensing of dry powder aerosol formulations.

Dry powder aerosols differ in many significant ways from liquid aerosol systems and, consequently, they may require different approaches with regard to dispensing structures and techniques. An example of a dry powder system contemplated in the utilization of the present invention is described and claimed in U.S. Pat. No. 3,081,233 issued Mar. 12, 1963 to P. E. Gunning and D. R. Rink. This patent relates to an aerosol system which differs basically from previously known systems, particularly systems utilizing a slurry-type mixture, in that it involves a self-propelled powder which is delivered from a pressurized container in a dry spray which is substantially liquid free. This dry powder system comprises a free-flowing powder composition which constitutes the active material to be dispensed from the container. At least one component of the powder composition comprises particles of a liquid propellant-sorbent material, with a vaporizable liquid propellant being held in said sorbent material under the vapor pressure of the propellant normally existing in the container at ambient temperature. Upon exposure of the aerosol formulation to the ambient environment externally of the container, the propellant is vaporized by reducing the pressure to which it is exposed. The dry powder system contemplated herein comprises a three-phase system including a vapor phase and a homogeneous, free-flowing powdered composition, the latter containing a vaporizable propellant. The powder composition which constitutes a major portion of the system provides the supporting phase. Thus, one important distinction between the dry powder system contemplated herein and the slurry system previously mentioned resides in the fact that in the slurry system, a liquid propellant constitutes the supporting phase whereas in the dry powder system referred to herein the powder is the supporting phase.

Other significant distinguishing features exist and because of these it becomes necessary to provide dispensing techniques and structures which are especially adaptable for utilization with dry powder systems in order to provide dispensing and application of the dry powder aerosol formulation in the most appropriate and advantageous manner.

One of the more significant aspects relating to successful, effective dispensing and utilization of dry powder aerosol formulations is the nature of the spray pattern achieved when the aerosol formulation is dispensed. The determination of a particular set of circumstances will depend largely upon the nature of the aerosol formulation involved and the type of application intended. In general, the spray produced in dry powder aerosol systems tends to be a rather diffuse and billowy pattern. Control direction of the spray may be accomplished by appropriate adaptation of the arrangement and configuration of the actuator assembly utilized with the aerosol system, particularly the internal conduit means provided which direct the aerosol formulation from the valve stem to the target area to which aerosol formulation is to be applied for ultimate use. Of particular importance is the arrangement and configuration of the orifice means located at the point on the actuator structure at which the aerosol formulation ultimately exits from the dispensing assembly. The configuration and arrangement of the internal conduit means and of the exit orifice means play a very significant role in determining the nature and effect of the spray pattern of the aerosol formulation as it strikes the intended target area.

Another factor of significant importance relates to the cost of manufacture and the ability to apply presently known manufacturing techniques and apparatus in producing a particular aerosol actuator structure. The needs and requirements of the specific spray pattern desired must be successfully met in an actuator assembly which is arranged and configured in such a way that it may be readily manufactured with known techniques and apparatus at a cost which is not prohibitive and which will permit marketing of the aerosol system in a commercially competitive manner.

Accordingly, it is an object of the present invention to provide an improved aerosol actuator assembly, especially adapted for utilization with dry powder aerosol systems, comprising specially shaped aerosol formulation-dispensing conduit means enabling desired control of the dispensing spray pattern of an aerosol formulation which may be manufactured in an economical and efficient manner utilizing presently known manufacturing techniques and apparatus.

Briefly, the present invention may be described as an aerosol actuator assembly, wherein aerosol formulation is dispensed through an annularly shaped conduit in a spirally directed dispensing path. Structurally, the actuator assembly comprises an actuator button having a cylindrical opening into which there is fitted cylindrical insert means having a diameter smaller than the diameter of the cylindrical opening. The gap established therebetween forms the annularly shaped dispensing conduit.

A better understanding of the invention may be had by reference to the following detailed description of the preferred embodiment thereof taken in connection with the accompanying drawing wherein:

FIG. 1 is an elevational view in cross section of an aerosol actuator assembly embodying the present invention, and

FIG. 2 is a cross-sectional view partially broken away taken along line 2-2 of FIG. 1 showing the configuration of the annular dispensing conduit.

Referring now to the drawing wherein like reference numerals designate similar elements, there is shown an molded actuator button of plastic material 10 comprising a cylindrical conduit 12 comprising a chamfered opening 12a and a smaller diameter cylindrical conduit 12b. The conduit 12 is adapted for appropriate engagement with the valve stem (not shown) of an aerosol container whereby a user, by depressing the actuator button 10 by applying finger pressure to the upper surface 14 thereof, may effect actuation of the aerosol container valve stem thereby to disperse aerosol formulation from the valve stem into the conduit 12 and through the internal structure of the actuator button 10, to be hereinafter described in more detail, for ultimate application and use. The manner whereby the actuator button 10 is mounted upon an aerosol container to engage the valve stem and effect actuation thereof is in accordance with principles well known to those skilled in the art. The bottom surface 16 of the button 10 comprises an annular recess defined between a pair of cylindrical walls 18 and 20 to adapt the actuator button 10 for mounting upon an aerosol container in a manner to accommodate and protruding structure surrounding the valve stem and avoid interference between such protruding structure and the bottom surface 16 of the button 10.

The button 10 comprises a cylindrical opening 22 which extends from the front surface 24 of button 10 to the base 26 of the cylindrical opening 22. It should be noted that conduit 12b extends to opening 22 and terminates thereat.

A first insert member 28, which may be formed of molded plastic material, comprising an outer surface 30 having a diameter equivalent to, or closely approximating, the diameter of cylindrical opening 22 is fitted into the opening 22 with the walls of opening 22 and the surface 30 in light frictional engagement to thereby maintain the insert 28 securely within the button 10.
3,595,483

The insert member 28 is annularly shaped and includes a base section 32 which is slightly thicker than a forward section 34. The base section 32 has an inner surface 36 defining an internal diameter which is smaller than the internal diameter defined by the inner surface 38 of section 34. A cylindrical conduit 40 extends through section 34 of insert 28, the conduit 40 being aligned and in communication with the conduit 128 when the insert 28 is positioned within the button 10. It should be noted that, as shown in FIG. 1, the conduit 40 is inclined in a forward direction or to the right and, as shown in FIG. 2, it is also inclined leftward.

A second cylindrically shaped insert member 42 which may also be formed of molded plastic material, having a straight cylindrical outer surface 44 whose diameter coincides with, or closely approximates, the diameter of inner surface 36, is placed within the insert 28 with a portion of outer surface 44 abutting inner surface 36 in tight frictional engagement therewith in a manner whereby insert 42 is securely held within insert 28 when both inserts are placed as shown in the drawing within the button 10.

With the inserts 28 and 42 in place within the button 10, as shown in the drawing, there is formed within the surface of insert 42 and the surface 38 of insert 28 an annular conduit 46 which is in flow communication with conduit 40 and which provides an annular exit orifice at the front of button 10 through which aerosol formulation may be dispensed.

In the operation of an aerosol dispensing system utilizing the actuator assembly of the present invention, downward pressure applied to the upper surface 14 of actuator button 10 will actuate the valve stem (not shown) of an aerosol container due to the engagement with said valve stem of the conduit 128. Depression of button 10 affects depression of the valve stem, thereby causing aerosol formulation to flow through the valve stem from the aerosol container into conduit 128 and through conduit 40 which applies a special directional effect upon the aerosol formulation. It will be noted that, as shown in FIG. 1, the conduit 40 comprises a forward tilt and, as shown in FIG. 2, a leftward tilt which causes the aerosol formulation flowing from conduit 128 through conduit 40 to be directed in a forward manner toward the exit orifice of conduit 46 and in a tangential path relative to conduit 46. Accordingly, as a result of the specific configuration of conduit 40, the aerosol formulation entering conduit 46 will have impacted thereto a forwardly directed as well as a flow which is directed tangentially relative to conduit 46. Due to this action, the aerosol formulation flowing through conduit 46 travels in a spiral path around insert 42, which spiral path is maintained until the aerosol formulation is dispensed through the exit orifice at the end of annular conduit 46.

Accordingly, it will be clear that the aerosol formulation leaving the actuator assembly will have had imparted thereto the spiral spray pattern previously described and that this will affect the manner in which the aerosol formulation impinges upon the target area at which it is directed. Because of the nature of the spray pattern produced by the present invention, certain advantages arise in the dispensing of the aerosol formulation involved. Due to the spiral nature of the spray pattern, as well as the annular shape of the dispensing conduit and exit orifice, a more uniform distribution of dry powder aerosol active material will be found to impinge upon a target area. Depending upon the distance between a target area and the dispensing exit orifice, the dispersed powder will distribute itself across a generally circular area bounded by a circumference having a diameter somewhat larger than the diameter of the exit orifice. The powder distribution will involve more sharply defined outer limits as well as being more evenly distributed over the central portions of the target area. Accordingly, utilization of the invention will generally produce more accurate definition of the area to be covered and more uniform distribution of active powder aerosol material within said area.

The insert 42 and the actuator button 10 may be formed in a one-piece integral arrangement by joiner of these members at the base surface 26 of insert 42 and the portion of the actuator button 10 contiguous therewith. With the insert 42 and the actuator button 10 integrally formed as one piece, the insert 28 may then be inserted into the annular space therebetween in the position shown in FIG. 1, the only difference between an arrangement where the insert 42 is formed separately from the actuator button 10 being that the base 26 of insert 42 is integrally formed with the portion of actuator button 10 contiguous therewith. Formation of insert 42 and actuator button 10 in one piece involves only a minor modification of the present invention, the only difference being a slight modification in the molding procedures involved when molding button 10 and insert 42 as one piece instead of separately.

It will be noted that due to the particular configuration of conduit 128 and conduit 40, it is imperative that the insert 28 be positioned within the actuator button 10 in a manner whereby the conduit 128 and conduit 40 are properly aligned to permit flow of aerosol formulation therebetween. Since both of these conduits are basically cylindric in configuration, the insert 28 must be accurately angularly positioned within the button 10. A slot and key arrangement, with the slot 48 formed in the body of the insert 28 and the key 50 being provided for this purpose. Actuator button 10 comprises a slot 48 formed therein which extends rearwardly into button 10 with an upstanding rectangular key 50 being formed integrally with insert 28 adapted to fit within the slot 48 in a manner to insure proper alignment of conduits 128 and 40.

It will be apparent that an annular dispensing conduit, while providing certain advantages, also gives rise to certain manufacturing complications particularly involving the molding procedures utilized. With conduit 40 directed forwardly and tangentially to conduit 46, it would be difficult if not impossible to mold the annular conduit aerosol actuator of the present invention completely as one integral piece. Accordingly, the specific configuration detailed in the present invention whereby insert 28 is formed as a single piece comprising conduit 40 in the particular configuration described, obviates certain difficulties pertaining to manufacturing and molding techniques. The particular structural configuration and arrangement of the invention not only provides an operational concept which is advantageous in improved powder aerosol dispensing, but it further does so in a manner which avoids potential manufacturing problems.

What we claim:

1. An aerosol actuator assembly comprising an actuator button, means on said button adapted to engage the valve stem of an aerosol container in a manner to enable dispensing of aerosol formulation therefrom, a cylindrical opening defined by an inner cylindrical wall within said actuator assembly extending in flow communication from said valve stem engaging means to the exterior of said assembly, insert means including a cylindrical insert centrally and concentrically located within said cylindrical opening smaller in diameter than said inner cylindrical wall and defining an annular space therebetween, and an annular insert located within said annular space, said cylindrical insert and said annular insert defining an annular dispensing conduit therebetween, said cylindrical insert being removably mounted within said cylindrical conduit, said annular insert comprising a portion thereof in tight frictional engagement with said cylindrical insert, said annular dispensing conduit extending continuously to the outer surface of said actuator assembly with the termination of said conduit defining at said outer surface an annular dispensing orifice, and flow directing conduit means extending through said inner cylindrical wall in flow communication between said valve stem engaging means and said annular dispensing conduit imparting a spiral dispensing flow pattern to said aerosol formulation.

2. An aerosol actuator assembly comprising an actuator button, means on said button adapted to engage the valve stem of an aerosol container in a manner to enable dispensing of aerosol formulation therefrom, a cylindrical opening defined by an inner cylindrical wall within said actuator as-
assembly extending in flow communication from said valve stem engaging means to the exterior of said assembly, insert means including a cylindrical insert centrally and concentrically located within said cylindrical opening smaller in diameter than said inner cylindrical wall and defining an annular space therebetween and an annular insert located within said annular space, said cylindrical insert and said annular insert defining an annular dispensing conduit therebetween, said annular dispensing conduit extending continuously to the outer surface of said actuator assembly with the termination of said conduit defining at said outer surface an annular dispensing orifice, and flow-directing conduit means comprising a cylindrical wall extending through said annular insert means tangentially to said annular dispensing conduit and tilted in the direction of dispensing flow thereby imparting a spiral dispensing flow pattern to said aerosol formulation.

3. An aerosol actuator assembly according to claim 1, wherein said flow-directing conduit means are defined by a cylindrical wall extending through said annular insert means tangentially to said annular dispensing conduit and tilted in the direction of dispensing flow.

4. An aerosol actuator assembly according to claim 1, wherein said annular insert comprises an outer diameter adapting said annular insert to be fitted in tight frictional engagement within said cylindrical opening of said button.

5. An aerosol actuator assembly according to claim 1, wherein said cylindrical insert is formed integrally with said actuator button.

6. An aerosol actuator assembly according to claim 1, wherein said annular insert and said actuator button comprise a slot and key arrangement operative to align said flow-directing conduit means in flow communication with said valve stem engaging means.

7. An aerosol actuator assembly according to claim 1, wherein said cylindrical insert comprises an inner cylindrical surface having a diameter slightly greater than the diameter of said cylindrical insert by an amount equal to the width of said annular dispensing conduit.

8. An aerosol actuator assembly according to claim 1, wherein said annular insert comprises an inner diameter of reduced dimension extending along the length of said annular insert means only from said flow-directing conduit means away from said annular dispensing conduit.