United States Patent

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[54] **PORTABLE SANDBLASTER**

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[52] **U.S. Cl.** **222/4**, 222/193, 222/402.17, 239/308, 239/367, 239/397

[51] **Int. Cl.** **B05b 7/32**

[58] **Field of Search**.....222/193, 331, 402.17, 4; 239/308, 367, 397

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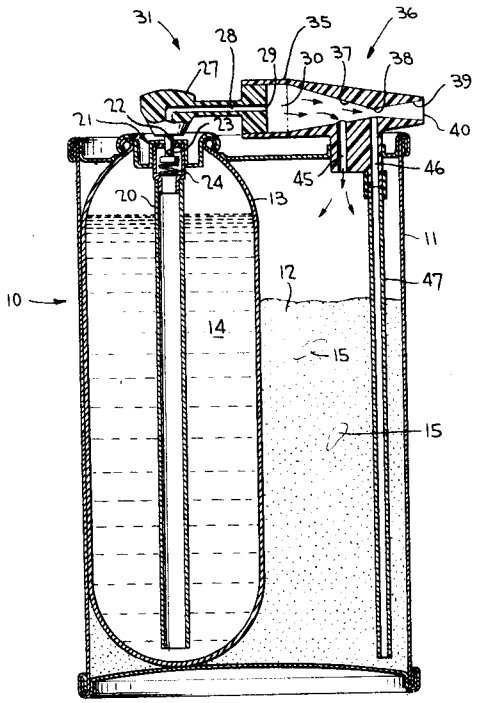
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[57] **ABSTRACT**

Particulate material is dispensed from a portable supply container by application of positive pressure in the open space of the container above the material to fluidize the same, and simultaneously, applying a vacuum through a venturi nozzle. The pressurized fluid for feeding the venturi nozzle and for fluidizing the particulate material preferably originates from a single source, a self-contained propellant tank positioned inside the supply container. An expansion chamber is provided at one end of the venturi nozzle and a dispensing orifice is positioned at the other end. Interconnecting transfer means between the expansion chamber and the open space may be a restricted passage or an open interface; in the latter embodiment a stream splitting lip being formed by said one end of said nozzle. A modified embodiment may be operated in either the upright or inverted position by providing alternative dispensing apertures in the top of the supply container for cooperation with a coupling stopper; sealing and transfer stoppers being positioned to automatically close off the unused aperture and supply pressure to the open space of the container.

16 Claims, 7 Drawing Figures



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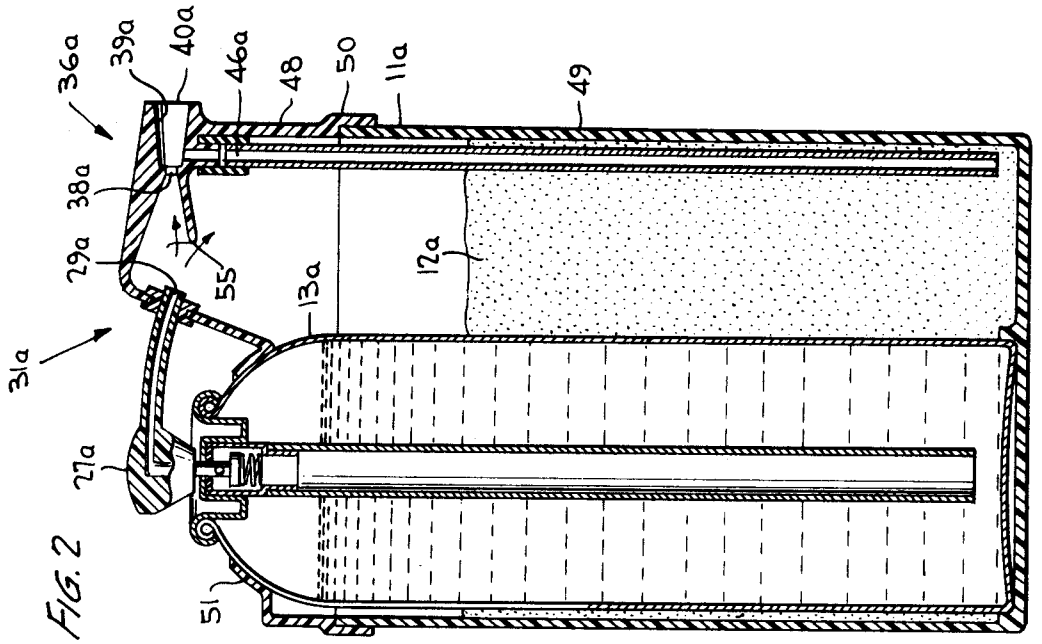


FIG. 2

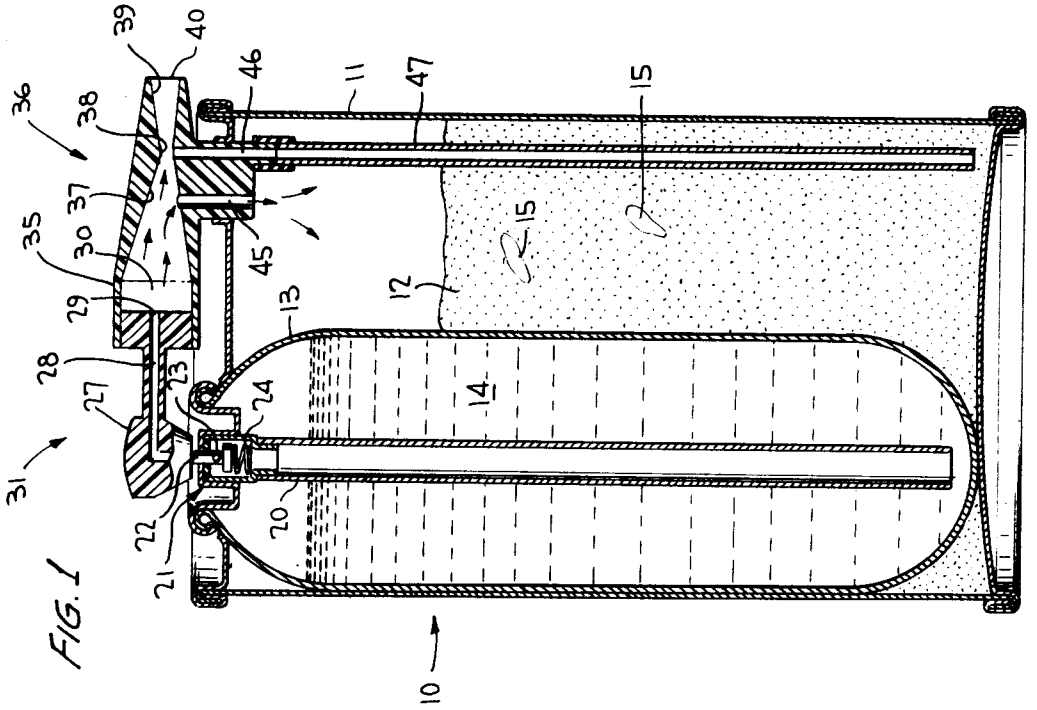


FIG. 1

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FIG. 3

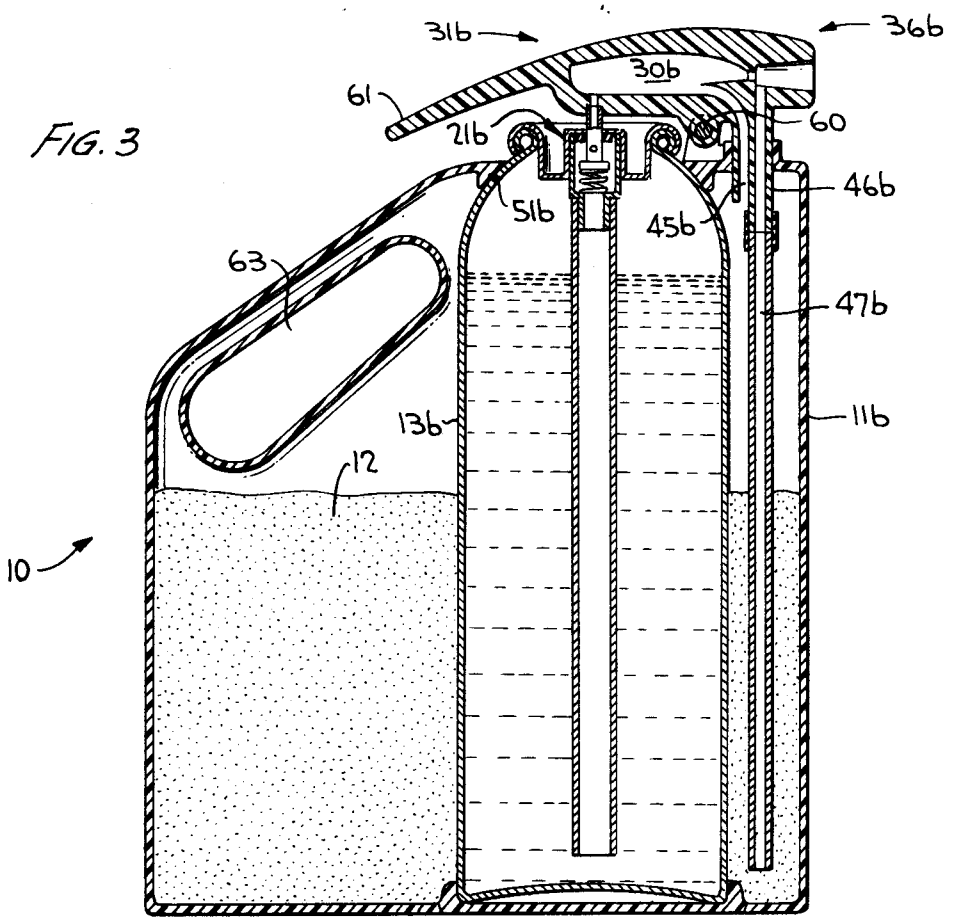


FIG. 4

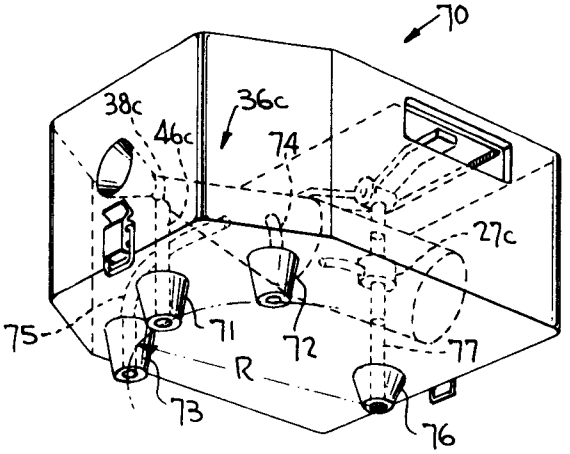
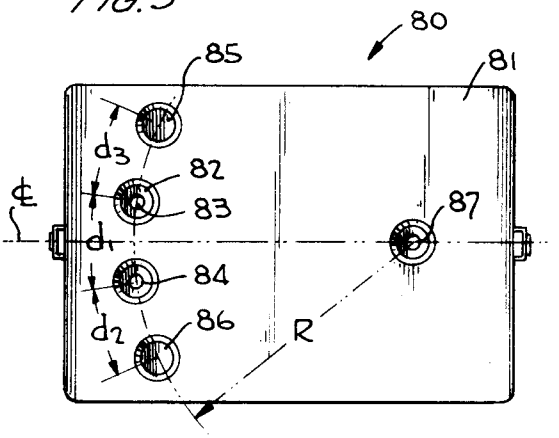


FIG. 5

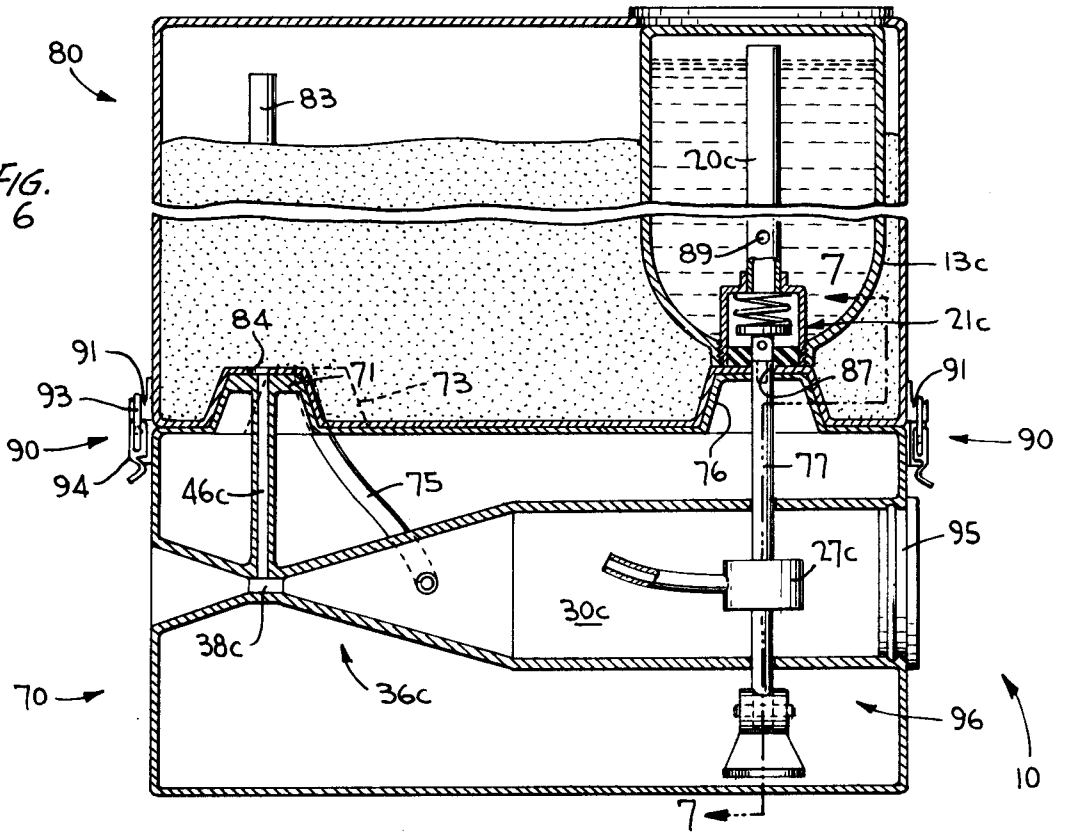


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FIG. 6



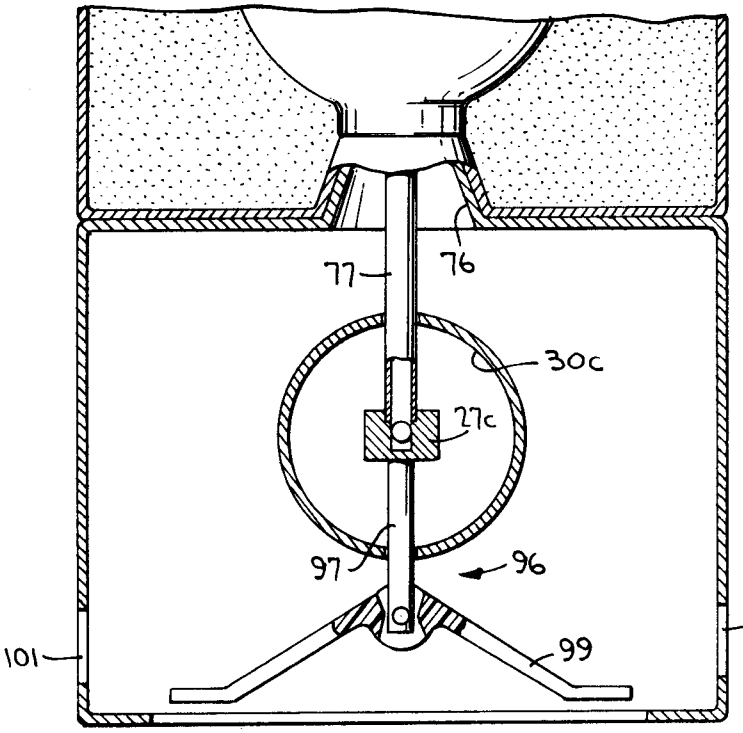


FIG. 7

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PORTABLE SANDBLASTER

The present invention relates to portable dispensers and, more particularly, to improvements in self-contained, Aerosol-type dispenser devices for dispensing particulate material, such as sand and other abrasives.

BACKGROUND OF THE INVENTION

In the art pertaining to sandblasting or abrasive cleaning, it is known to dispense the particulate material through a venturi nozzle. This action accelerates the particles to a maximum speed to thereby increase the kinetic energy of the particles for maximum release momentum and thus maximum cleaning effect as the particles bombard the surface being cleaned. The vacuum generated at or adjacent the point of restriction of the nozzle, that is the point of lowest pressure of the nozzle, is utilized to draw the material from the supply container and into the fast moving stream where the momentum is gained. However, prior to this invention, the dispensing fluid was required to be supplied in large volumes and under great pressure in order to adequately withdraw the material from the container and project it with the necessary velocity to obtain a satisfactory cleaning effect. Accordingly, the use of an Aerosol-type or portable dispensing container for abrasive cleaning with particulate material and similar operations has been impractical. Furthermore, a simple dispensing head for quick conversion of an Aerosol-type container to permit inversion of the container to reach hard-to-get places has previously been unavailable.

BRIEF DESCRIPTION OF THE INVENTION

In accordance with the present invention, a container is provided for holding the supply of the particulate material with an inner tank holding the Aerosol-type propellant. A dispensing head is provided on the container and includes an expansion chamber, a venturi nozzle and a dispensing orifice aligned in that order. A supply passage intersects the venturi nozzle at a position of negative pressure; i.e., point of vacuum, to draw the particulate material into the fluid stream and thereby dispense the same through the dispensing orifice. In accordance with the invention, another passage communicating with the expansion chamber or a point of high pressure, feeds high pressure propellant gas to the interior of the container to fluidize the material and assist in causing the same to flow or be carried through the dip tube and into the venturi nozzle. With this arrangement, it has been found possible to provide a successful Aerosol-type Sandblasting or abrading apparatus; whereas, heretofore larger volumes and pressures of the carrier fluid were required. Other uses within the broad purview of the invention, include use of the device **10** for coating a surface with particulate material or any other system where the projection of the particles is desired.

Several embodiments of the dispensing head are provided by features of the present invention. In one embodiment, the dispensing fluid is projected into a closed expansion chamber through an intermediate orifice whereby the fluid in a liquid state is permitted to vaporize; a portion of the gas formed then proceeding at high velocity through the venturi nozzle and the other portion being transferred to the supply container to fluidize the material. In another embodiment, the expansion chamber is interconnected with the open space of the supply container by an open interface. The defined stream of fluid from the intermediate propellant orifice is preferably split by a projecting lip of the venturi nozzle to assure adequate supply of fluid for both fluidizing the material and operation of the venturi nozzle. A third embodiment of the dispensing head assembly includes an integral expansion chamber, venturi nozzle and dispensing orifice pivotally mounted on the container. The assembly is connected at a point spaced from the pivot to the valve of the propellant container and has an operating thumb lever for depressing said assembly to cause release of the propellant.

In accordance with another feature of the present invention, a detachable dispensing head assembly is provided to adapt a supply container for operation in either the upright or inverted positions. In operation, the supply passage for the material is positioned in a first aperture in the top of the container having a dip tube so that conventional upright operation may be obtained. When the container is to be inverted to operate on hard to reach areas, the supply tube is shifted to an open aperture having no dip tube and thus adapted to feed the particulate material shifted to the top of the container. Auxiliary stoppers are provided to engage the non-selected aperture and are provided with transfer passages communicating with the expansion chamber for pressurizing the corresponding open space within the supply container and thereby fluidizing the particulate material for efficient dispensing. A winged operating plunger is provided to actuate the propellant dispensing head so as to assure two-hand contact of the operator; this feature being important especially when utilizing this embodiment as a large capacity and high propellant power model.

OBJECTIVES OF THE INVENTION

Accordingly, it is one object of the present invention to provide a portable dispenser for sandblasting or similar operations having improved operating characteristics to dispense the particulate material at increased efficiency.

It is another object of the present invention to provide a portable dispenser for particulate material wherein the material is fluidized with positive pressure and simultaneously sucked with a vacuum for more efficient feeding of the material to the dispensing or discharge orifice.

It is another object of the present invention to provide self-contained dispensing apparatus utilizing negative pressure through the use of a venturi nozzle and fluidizing by positive pressure to feed and dispense particulate material at high velocity for cleaning or the like.

It is another object of the present invention to provide a dispensing head and container combination having mating parts for quick connection with either a dip tube or top opening to allow operation in the upright and inverted positions.

Still other objects and advantages of the present invention will become readily apparent to those skilled in this art from the following detailed description, wherein I have shown and described only the preferred embodiments of the invention, simply by way of illus-

tration of the best modes contemplated by me of carrying out my invention. As will be realized, the invention is capable of other and different embodiments, and its several details are capable of modification in various obvious respects, all without departing from the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view showing a first embodiment of the portable dispenser device constructed in accordance with the principles of the present invention;

FIG. 2 is a cross-sectional view of another embodiment of the dispenser device of the invention;

FIG. 3 is a cross-sectional view of still another embodiment of the dispenser device constructed in accordance with the principles of the present invention;

FIG. 4 is a perspective view from below illustrating a dispenser head assembly of still another embodiment of the invention and adapted for upright or inverted operation in accordance with important features of the present invention;

FIG. 5 is a top plan view of a container adapted to mate with the dispensing head assembly of FIG. 4;

FIG. 6 is a cross-sectional view showing the dispensing head and container of FIGS. 4 and 5 in mating engagement, with the combination being orientated in the inverted position and ready for operation; and

FIG. 7 is a cross-sectional view taken along lines 6—6 of FIG. 5 illustrating the valving system of this embodiment.

DETAILED DESCRIPTION OF THE INVENTION

With reference now to FIG. 1 of the drawings, a more complete and detailed review of the construction of a first embodiment of the present invention can be given. A portable dispenser, or as it has come to be known in the trade, an Aerosol dispenser device **10** is provided and comprises an outer container **11** holding a supply of particulate material **12** to be dispensed and an inner tank **13** holding a supply of propellant **14**. The container **11** and tank **13** may be of conventional fabrication, such as tin metal, although other materials, such as plastics and aluminum, may be utilized if desired. The top and bottom of the container **11** are appropriately sealed at the joints and around the top of the inner tank **13** so as to provide an airtight sealed structure. Also, the particulate material **12** to be dispensed may be a conventional abrasive, such as silicon oxide or sand, or a specialized abrasive such as silicon carbide or aluminum oxide. In any case, the material **12** should be dry and sufficiently large in particle size to be capable of being fluidized, as will be seen later in detail.

It may be desirable to include silica gel capsules **15** or the like to absorb any moisture in the supply. The propellant **14** may be any of the conventional fluorinated hydrocarbons, sold under the trademark FREON by the Dupont Corporation, Wilmington, Delaware. The specific fluorinated hydrocarbon, dichlordifluoromethane, is particularly suitable for its high molecular weight and high vapor pressure in that it affords greater propelling force to the particulate matter, and thus higher dispensing efficiency.

A dip tube **20** is positioned in the inner tank **13** to withdraw the propellant **14** in a liquid state; a positive vapor pressure existing in the open space at the top of said tank **13** to force the liquid out. The liquid is dispensed through a valve **21** having hollow valve element **22**; the propellant **14** passing by reason of lateral openings **23** into said element **22** when depressed, as shown in FIG. 1. It will be understood that when the element **22** is released, spring **24** causes a return of the element **22** into the top of the valve **21** thereby blocking off the openings **23**.

A propellant dispensing head or cap **27** is provided on top of the element **22** for engagement by the hand or finger of the operator. A release passageway **28** terminates at an intermediate restricted orifice **29** which opens into an expansion chamber, generally designated by the reference numeral **30**.

The expansion chamber **30** is a part of a dispensing head assembly **31** and is formed by a tubular housing extension **35** integral with a venturi nozzle, generally designated by the reference numeral **36**. The nozzle, also a part of the head assembly **31**, includes an entrance section **37**, a restricted portion **38**, and a final expanding section **39**, which forms a dispensing orifice **40**.

An interconnecting transfer passage **45** is provided in the body of the nozzle **36** and communicates through the entrance section **37** with the expansion chamber **30** where the propellant has expanded and exists at a relatively high pressure. The other end of the passage **45** opens into the open space above the level of particulate material **12**, as shown in FIG. 1.

A supply passage **46**, also formed in the head assembly **31**, communicates with the restricted portion **38** of the nozzle **36** and thereby is subject to the lowest pressure of the propellant fluid, due to the well known Bernoulli's effect. In short, the effect can be stated as the Equation:

$$PV + \tfrac{1}{2} mv^2 = C; \qquad (1)$$

wherein it can be seen that for a given volume of fluid, pressure energy (PV) plus kinetic energy ($\frac{1}{2}mv^2$) is equal to a constant. As the kinetic energy (velocity and thus momentum) increases, it follows that the pressure must decrease proportional to the velocity squared due to the volume remaining the same. Thus, the pressure at the mouth of the supply passage **46** is subatmospheric (a vacuum) and the material **12** in the passage **46** will be sucked into the flow stream through the nozzle **36** and projected through the dispensing orifice **40**. The lower end of the supply passage **46** is connected to a dip tube **47** to permit the supply of particulate material **12** to be drawn from the bottom of the container **11**. The passage is restricted to assure sufficient fluid passing through the nozzle **36** to generate the desired high velocity and low pressure for the venturi effect. However, the gas passing through the passage **45** into the container **11** is also sufficient to fluidize the material in and adjacent the end of the dip tube **47** and, as will presently be seen, this combination of dispensing actions greatly increases the ability of the dispenser device **10** of the present invention to operate on particulate or granular matter which is recognized as being difficult to move in this environment.

To describe the overall operation, the propellant **14** is first forced up through its dip tube **20** and through

the valve **21** and passageway **28** to expansion chamber **30** when the cap **27** is depressed. The liquid exiting from the intermediate orifice **29** immediately expands to form a gaseous vapor at a high pressure and seeks to flow into the nozzle **36**, as shown by the flow arrows. The expanding gas travels directly ahead toward the restricted portion **38** where the high velocity, low pressure flow occurs due to Bernoulli's principle. However, a portion of the flow is diverted through interconnecting transfer passage **45** into the open space above the particulate material **12** in the container **11**. Since the fluid is a gas at high pressure and the particulate material is sufficiently large to allow the gas to pass through the interstices between the particles, the gas flows down to the lower end of the dip tube **47** and then upwardly toward the passage **46**. This gas fluidizing, that is, surrounding of the particles in the supply by the gas, and particularly in the region surrounding the lower end of the dip tube **47** just as it begins to travel upwardly, enhances the dispensing operation by preventing blockage of the flow of the supply. Also, the material is being fluidized as it travels up the dip tube **47** so that it is in effect, being lifted or carried upwardly in the stream of gas for dispensing. From the mouth of the supply passage **46** connected to the upper end of the dip tube **47**, it will be remembered that the lower pressure generated by the nozzle **36** at the same time is sucking the fluidized material into the high velocity stream. Thence, the material is dispensed through the orifice **40** for performing the sandblasting or related operation.

An alternative embodiment is shown in FIG. **2** and will now be described, with the like elements being given the same reference numerals plus a suffix and with additional elements being identified by additional reference numerals. The container **11**a is formed in two sections, an upper section **48** and a lower section **49** with a suitable airtight joint **50** being formed therebetween.

With this arrangement, the upper section **48** of the container **11***a* may be removed to allow insertion of the propellant tank **13***a* with a fresh charge and so that additional particulate material **12** may be placed in the container **11***a*. The upper section **48** is formed with annular sealing joint **51** to maintain the container **11***a* in a condition to be pressurized and to thereby cause the particulate material **12** to flow through the dispensing orifice **40***a* with the maximum force being gained from both the fluidizing and sucking actions.

The venturi nozzle **36***a* in the dispensing head assembly **31***a* is modified version of the nozzle **36**, shown in FIG. **1**. First, the supply passage **46***a* opens downstream of the restricted portion **38***a* of the nozzle. Of importance is that the side walls of the expanding section **39***a* leading to the orifice **40***a* are set back so as to provide a completely free stream; and the supply passage **46***a* intersects the nozzle **46***a* at a position of negative pressure or vacuum, but downstream of the restricted portion **38***a*.

Because of the space existing between the side walls of section **39***a* and the orifice **40***a*, operation on larger sized particulate material **12** is possible. This is so since the position of entrance of the particles into the high velocity flow stream is less restricted and thus allows a greater volume of particulate material to turn the corner for propulsion through the orifice **40***a*.

The fast moving stream defined by the restriction **38***a* in effect creates a boundary layer along the side walls of the section **39***a* to draw the fluid suspended particulate material into the stream. That is, the outer boundary of the stream tends to draw or suck the surrounding fluid and suspended matter into itself, and accordingly, the vacuum effect at the supply passage **46***a* is maintained for efficient feeding and delivery of the fluidized particulate material. The sides of the expanding section **39***a* of the nozzle are not sufficiently long to permit attachment of the flow stream to one side however; i.e., the fluid at the stepped portion of the orifice **40***a* will not be trapped sufficiently to provide a captive vacuum to cause the stream to lock-on to one of the side walls.

The lower portion of the nozzle **36***a* is provided with a projecting lip **55** to split the stream issuing from the intermediate orifice **29***a* to assure adequate supply of fluid for both fluidizing the supply and operation of the venturi nozzle **36***a* (see flow arrows).

Still another embodiment of the Aerosol container device **1** is shown in FIG. **3**. In this instance, the venturi nozzle has been designated by numeral **36***b* and is formed as an integral structure with the head assembly **31***b*, which is pivotally mounted on the top of said container **11***b* by a pivot pin **60**. The transfer passage **45***b* for diverting a portion of the pressurized fluid from the expansion chamber **30***b* is curved toward the expansion chamber **30***b* so as to assure a sufficient supply of the fluid being scooped and thus supplied to said transfer passage **45***b* and the open space above the material in the container **11***b*. The tubing or body forming the transfer passage **45***b* and the supply passage **46***b* is sufficiently flexible (plastic or the like) to permit pivoting of the head assembly **31***b* about the pin **60**. When the operator thus engages the rearwardly extending lever **61**, the valve **21***b* of this embodiment is unseated or opened in response to the downward movement of the rear of the assembly **31***b* toward said valve **21***b* and discharge of the propellant fluid into the expansion chamber **30***b* takes place. A convenient handle for the Aerosol container device **10** is provided by molding a hand hold opening **63**, as shown in FIG. **3**.

During operation, pressurized fluid is prevented from escaping except through the supply passage **46**b by means of the sealing joint **51**. As in the two previous embodiments, this causes the open space above the material to become highly pressurized thereby causing the particulate material in the bottom of the container to be saturated with the gas and fluidized, whereby the movement around the lower end and through the dip tube **47***b* and supply passage **46***b* is greatly enchanced. The fluidization of the particles is of advantage in the region surrounding the lower end of the dip tube since with the particles being suspended in the gas, a blockage of the tube by jamming of the particles together is prevented Suspension of the particles in the tube **47***b* and passage **46***b* also prevents blockage, as well as generating positive feeding or lifting force for the particles, as discussed earlier.

The embodiment of FIGS. **4–7** includes a detachable dispensing head assembly, generally designated by the reference numeral **70**. As illustrated in FIGS. **4** and **6**, the supply passage **46***c* of this embodiment of the invention intersects the restriction **38***c* of the venturi nozzle **36***c* but has a coupling stopper **71** mounted on the

lower end thereof rather than a dip tube. The coupling stopper **71** is flanked by two sealing and transfer stoppers **72, 73** each of which has a transfer passage **74, 75** extending axially therethrough and connected to the venturi nozzle **36c**, as shown in FIG. **4**. As in the embodiment of FIG. **1**, these passages **74, 75** are thus in communication with the positive pressure of the expansion chamber **30c**.

A coupling sleeve **76** provided at the rear of the assembly **70** positions the container **80** with respect to upstanding fluid transfer stem **77**. On this stem **77** is mounted propellant dispensing cap **27c**, which may be identical to the cap **27a** utilized in the FIG. **2** embodiment. As shown in FIG. **4**, the stoppers **71–73** are centered on a radial arc having a radius R taken about the center of the coupling sleeve **76** and the stem **77** and are equally spaced from each other.

In FIG. **5** is shown the plan view of the top of a mating container **80** operable with the dispensing head assembly **70**. A first recessed aperture **82** is provided just above the center line of the top **81** to receive the center coupling stopper **71** in one mode of operation. The recessed aperture **82** is provided with a centrally located dip tube **83** which is positioned by an annular disc s as to mate in operation with the feed tube **46c**.

A second recessed aperture **84** is provided just below the center line of the top **81** and is open for direct communication with the space within the container **80** (see FIG. **6**). Closed recesses **85, 86** flank the apertures **82, 84**, respectively, and the recesses and apertures are positioned along the same radius R, as described with respect to FIG. **4**. Furthermore, spacing d_1 between the apertures **82, 84** and spacing d_2, d_3 between the same and the recesses **85, 86** are equal to each other and to the spacings between the stoppers **71–73** (FIG. **4**).

A third recessed aperture **87** is provided at the rear of the top **81** with which communication with the propellant tank **13c** is made (FIG. **6**). The mating coupling sleeve **76** assures easy mounting of the assembly **70** in the proper position on the tank **13c** so that the stem **77** is set to operate the valve **21c** when depressed.

Thus, it can be seen that the assembly **70** of FIG. **4** may be placed in operating relationship on the container **80** with the stoppers **71–73** and guide sleeve **76** in mating relationship with recessed apertures **82, 84**, and **87**, respectively, and at least one of the closed recesses **85, 86**, as will now be described.

When the container **80** is to be operated in the upright position, the dispensing head assembly **70** is placed on top of the container **80** so that the sleeve **76** mates with the rear aperture **87**, the stopper **71** mates with the aperture **82** with the dip tube **83** (just above the center line in FIG. **5**) and the stoppers **72, 73**, respectively mate with aperture **84**, just below the center line, and the closed recess **85**. Thus, when the expansion chamber **30c** is pressurized through the propellant dispensing cap **27c** and the venturi nozzle **36c** is placed in operation, the particulate material in the container **80** will be withdrawn and dispensed in a manner comparable to the embodiments of FIGS. **1–3**. That is, a suction is provided through the passage **46c** and the dip tube **83** and positive fluidizing pressure is provided through passage **74** to aperture **84** and thence to the open space above the particulate material **12**.

With specific reference to FIG. **6**, the alternative mode of operation may be described; i.e., wherein operation in an inverted position is to be undertaken to get at hard to reach areas, such as immediately adjacent a floor or other obstruction. In this mode, the stopper **71** is first repositioned along the radial arc to cooperate with the open aperture **84** so that when the particulate material **12** is shifted by gravity to the top of the container **80** it is in direct communication with the feed tube **46c**. The stopper **73** is now positioned in engagement with the aperture **82** having the dip tube **83** so as to provide positive pressure therethrough. Since the dip tube **83** extends above the level of the particulate material **12** (see FIG. **6**) the same pressurization of the open space as described above occurs and fluidization for maximum dispensing efficiency takes place; the closed recess **86** properly sealing off the stopper **72** and thus the passage **74**.

When the propellant tank **13c** is in the inverted mode, the dip tube **20c** is now exposed to the vapor phase of the propellant rather than the liquid phase as in the other embodiments (see FIG. **6**). This mode of dispensing of the propellant is suitable where the propellant tank **13c** is large and efficient heat transfer occurs to prevent the temperature of the liquid phase from falling below the threshold temperature where the vapor pressure is drastically reduced. In certain applications, it has been found desirable to form a relatively small lateral hole **89** in the dip tube **20c** adjacent the valve **21c** so that both liquid and vapor phase propellant are withdrawn in either the inverted or upright positions. Preferably, the size of the hold **89** is selected so that the same liquid/vapor proportion is withdraw from the hole **89** and the opening at the bottom of the dip tube **20c** in either selected position.

As best shown in FIGS. **4** and **6**, the dispensing head assembly **70** and the container **80** may be conveniently coupled together in either selected position by providing latches **90** at the front and rear. The latches selected may be of the over-center type wherein hooks **91** are provided at the front and rear of the container **80** (see FIGS. **5** and **6**) and an extra hook **92** is provided at the front (see FIG. **5**). A U-shaped latch element **93** is attached to pivotal lever **94** so as to go into an over-center position with respect to the pivot point of lever **94** when the latches **90** are secured. There is designed sufficient deformability or flexibility in the latch element **93** to permit the slight misalignment of the forward surfaces of the dispensing head assembly **70** and the container **80** as the former is latched into either the upright or inverted modes of operation in engagement with either of the forward hooks **91, 92**, respectively.

The rear of the expansion chamber **30c** of the head assembly **70** is sealed by a removable plug **95**. During the assembly of the parts this permits the cap **27c** to be positioned within said expansion chamber **30c**. The walls of the expansion chamber **30c** are sealed against escape of pressure around the stem **77** and other points by the requisite close fit of parts, or if necessary, suitable O-ring structure may be provided.

In order to depress the cap **27c** for release of the propellant from the tank **13c**, a trigger, generally designated by the reference numeral **96**, is positioned in the top of the dispensing head assembly **70**. A

reciprocating rod **97** of the trigger **96** extends through the upper wall of the chamber **30***c* and is mated with the top of the cap **27***c*. Pivotally mounted on the free end of the rod **97** is winged lever **99** having wings extending outwardly toward the sides of the head assembly **70**, as shown in FIG. **7**. The double winged lever **99** may be spring biased to a center position or freely pivotal, as shown in the drawings. The important fact is that the depressing of only one side of the trigger **96** does not result in activating movement of the rod **97** since the other end of the lever **99** would simply be raised.

Suitable openings **100, 101** are provided in the sides of the head assembly **70** adjacent the trigger **96**. These openings **100, 101** provide a convenient position for insertion of the fingers, when the device **10** is being operated in the upright position, or a position for the thumbs when the container **10***d* is being operated in the inverted position, as shown in FIG. **6**. In the upright position, it will be recognized that the thumbs of the operator are free to engage the adjacent wings of the lever **99** so that the operating rod **97** may be depressed thus releasing the propellant gas to operate the device **10**. In the inverted position, one of the fingers of each hand of the operator naturally falls on the adjacent wing of the lever **99** thereby operating the device **10**. The safety feature of this arrangement will be recognized since both hands must be securely in position before the device of the invention can be operated.

Although all embodiments of the device **10** of the present invention may be made with any capacity and with any amount of propellant force, the embodiment of FIGS. **4–7** is particularly adapted for high capacity uses. For example, the container may be designed to hold in the neighborhood of one-half to two cubic feed of particulate material and the propellant may be charged as high as approximately 200 pounds per square inch. This gives the operator the ability to operate on a large area of surface to be cleaned or abraded with the power normally attributed only to machines of the non-portable type.

In summary of the foregoing, it can be seen that a highly efficient portable dispenser for particulate material has been provided. The material is propelled from the venturi nozzle **36–36***c* with the combination of vacuum lift action and fluidizing and suspension lift of the particles by a positive pressure applied into the open space above the supply. The venturi nozzle **36–36***c* and the expansion chambers **30–30***c* are made in different embodiments so as to best suit the particular application needed. The detachable dispensing head assembly **70** may be secured to the mating container **80** in two different positions to adapt the container **10***d* for operation in an upright or inverted position. The two-hand trigger **96** is utilized to assure safety of operation in this embodiment where extra capacity supply and high-powered propellant may be utilized.

In this disclosure, there is shown and described only the preferred embodiments of the invention, but, as aforementioned, it is to be understood that the invention is capable of various changes or modifications within the scope of the inventive concept as expressed herein.

I claim:

1. A portable dispenser for particulate material comprising a container for holding a supply of said material, a supply passage extending into said container, a source of pressurized propellant fluid, a venturi nozzle connected to said source at one end and defining a dispensing orifice at the other end, said supply passage being connected to said venturi nozzle at a point of vacuum to create a dispensing operation by sucking said material through said supply passage and by projecting the same at a high velocity and final expansion out said orifice, an expansion chamber at the upstream end of said venturi nozzle to permit said propellant fluid to initially expand prior to entering the restricted portion of said venturi nozzle, a restricted passage upstream of said expansion chamber and valve means upstream of said passage to regulate the flow of said propellant fluid, said passage terminating in a restricted orifice opening into said chamber ejecting high velocity propellant fluid into the same for the initial expansion, and transfer means for interconnecting said pressurized source at said expansion chamber with said container to provide a positive pressure to said material, said pressure being sufficient to flow through said material and to thereby fluidize said material in said container and said supply passage for assisting in the material movement to said nozzle to enhance the efficiency of the dispensing operation.

2. The portable dispenser of claim **1** wherein said source of pressurized fluid includes a self-contained tank in said container and a propellant fluid in said tank.

3. The portable dispenser of claim **2** wherein said interconnecting transfer means includes a restricted passage directly communicating between said expansion chamber and an open space above the supply of material in said container.

4. The portable dispenser of claim **1** wherein said interconnecting transfer means includes an open interface between an open space above the supply of material in said container and said expansion chamber.

5. The portable dispenser of claim **4** wherein said pressurized source includes an intermediate restricted orifice to provide a defined stream of fluid upstream of and directed toward said venturi nozzle and said venturi nozzle includes a lip at said one end to intercept said stream of fluid and to split the same between said nozzle and said open space.

6. The portable dispenser of claim **1** wherein said expansion chamber, venturi nozzle and dispensing orifice are formed as an integral dispensing head.

7. The portable dispenser of claim **6** wherein said dispensing head is pivotally mounted on said container at a pivot axis spaced from said valve, said valve being connected to said expansion chamber and being operable to an open position when depressed, and means for pivoting said head toward said valve to operate the same.

8. A portable dispenser for particulate material capable of adaptation for operation in inverted and upright positions comprising a container for holding a supply of said material having a top formed thereon, a first aperture formed in said top communicating with the space formed above said material when said container is in the upright position, a second aperture formed in said top spaced a selected distance from said first aperture,

a dip tube mounted in said second aperture and opening adjacent the bottom of said container, a dispensing head assembly for fitting on said top to dispense said material, a source of pressurized fluid and coupling means on said head assembly adapted to connect said source of pressurized fluid with said head assembly and to selectively engage said first or second aperture to permit withdrawal of said material from the top or the bottom of said container in either the inverted or upright positions, respectively.

9. The portable dispenser defined in claim **8** wherein said source of pressurized fluid includes a self-contained tank in said container and a propellant fluid in said tank.

10. The portable dispenser of claim **9** wherein is further provided first and second sealing stopper means spaced from said coupling means a distance equal to the selected space between said apertures so as to occupy the one of said apertures not in use by said coupling means for dispensing.

11. The portable dispenser of claim **10** wherein is further provided first and second transfer passages in communication with said pressurized source and extending to said first and second stopper means, respectively, to provide positive pressure to the space formed above said material of said container for assisting in the dispensing operation.

12. The portable dispenser of claim **11** wherein is further provided first and second depressions in said top spaced to the outside of said apertures the selected distance to receive the sealing stopper means not being utilized to cooperate with one of said apertures and to block off said transfer passages.

13. The portable dispenser of claim **10** wherein is provided a third aperture in said top communicating with said pressurized source, second coupling means for connecting said source to said dispensing head assembly, said first coupling means and said first and second sealing stopper means being positioned on a radial arc with respect to said second coupling means, whereby the same pressure source may be utilized for both modes of operation of said head assembly.

14. The portable dispenser of claim **9** wherein is provided an expansion chamber formed in said head assembly, a propellant dispensing head positioned in said expansion chamber, said dispensing head having a fluid transfer stem, a valve on said propellant tank to release said propellant through said transfer stem, a venturi nozzle communicating on one side with said expansion chamber and terminating on the opposite side in a dispensing orifice, said coupling means being connected to said venturi nozzle at a point of vacuum to create a dispensing operation.

15. The portable dispenser of claim **14** wherein is provided a winged operator lever in said head member, rod means engaging the top of said dispensing head, said winged operator lever being pivotally mounted on said operating rod and having lateral wings extending to the opposite sides of said dispensing head assembly, whereby simultaneous engagement by both hands of the operator is required to initiate operation of said dispenser.

16. The portable dispenser of claim **8** wherein is further provided deformable latch means to secure said dispensing head assembly and said container together in an operative condition for use in either of said positions.

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