Aug. 11, 1959 C. R. WEINERT 2,899,106

DRY POWDER DISPERSING DEVICE

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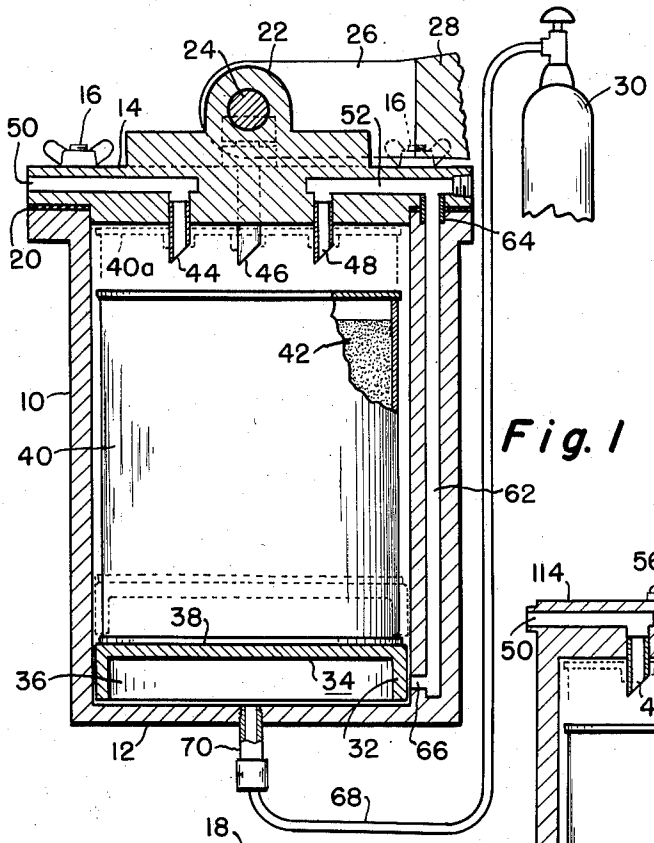


Fig. 1

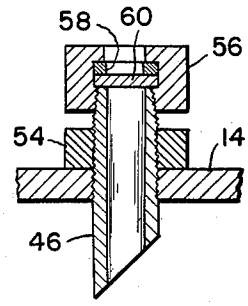


Fig. 3

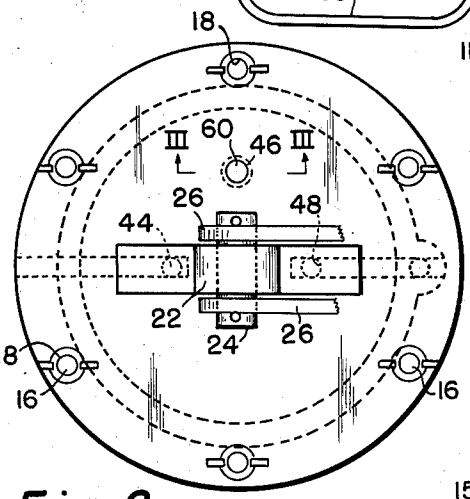


Fig. 2

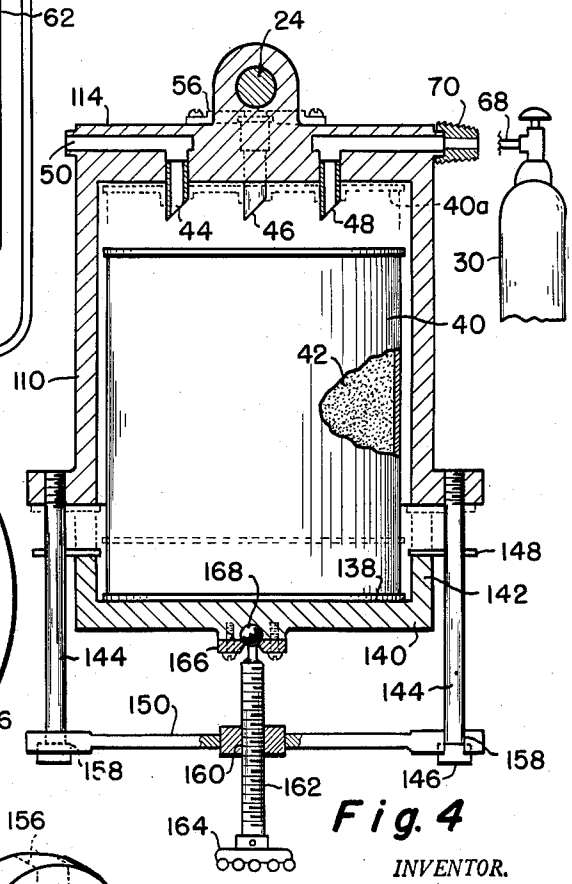


Fig. 4

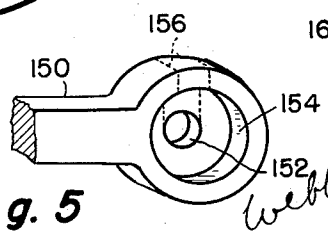


Fig. 5

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DRY POWDER DISPERSING DEVICE

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The present invention relates to a dry powder dispersing device primarily adapted for blowing tear gas dust into the surrounding air to generate clouds of tear gas. This device is preferably installed on a hand truck or motor truck for portability and readily operates either while retained in a temporarily stationary discharging position or while moving with the truck thereby leaving a wall of the dust suspended in air.

According to a feature of the invention a source of compressed gas is carried by the truck above indicated and is connected to the dispersing device to circulate a propelling draft of gas therethrough in a manner to agitate and cause the dust to lift to a point where it will be carried out of the container in the draft of escaping gas. A further feature is that a sealed can holding the dust may be loaded intact in the present device and repose indefinitely in readiness therein in that fashion to keep an effective charge in the device at all times, but without the danger of the powder caking or deteriorating due to exposure. The device according to this invention is internally provided with built-in can puncturing means and further incorporates mechanism which in conjunction therewith causes the can to be punctured in its stored condition in a simple positive operation transforming it to immediate use. Following each use the device is reloaded with a fresh can of powder and spent cans are discarded and replaced with the fresh ones as fast as emptied. Test results show that a sustained running time of approximately 10 seconds is all that is necessary for the compressed gas to completely empty each can.

As above indicated the present device is primarily adapted for dispersing a cloud of tear gas dust but the general structure and working principles thereof have equally important application in other dry spray operations where gas-entrained particles of differing compositions useful as fire-fighting chemicals or surface coating materials or the like are applied by blowing them on or into areas to be treated.

Further features, objects and advantages will either be specifically pointed out or become apparent when for a better understanding of the invention reference is made to the following description taken in conjunction with the accompanying drawings in which:

Figure 1 is a view in elevation, partly in section, of a tear gas system embodying a preferred form of the present invention;

Figure 2 is a top plan view;

Figure 3 is a detail taken along the section lines III—III of Figure 2;

Figure 4 is a view corresponding to Figure 1 but showing a modification of the invention;

Figure 5 is a perspective view showing a detail of manufacture pertaining to the modification of Figure 4.

In Figures 1–3 of the drawings, a gas operated, powder dispersing device is illustrated having a thick walled pressure cylinder 10 of metal which is closed by an integral bottom wall 12 and which carries a thick circular head cover 14 fitting the mouth of the cylinder 10. Adjacent that mouth, the cylinder 10 carries threaded studs 16 arranged in a ring and having companion hold-down nuts which fit down on the complementary ring of bolt holes 18 in the attaching flange of the cover 14 so as to firmly clamp against a seal 20 to form a gas-tight joint with the mouth of the cylinder 10. An upstanding pad eye 22 integral with the cover 14 receives a cross bolt 24 pivoting the device to a pair of fork arms 26 forming part of the bracket mounting structure 28 of a wheeled truck which also carries a valve controlled gas cylinder 30 of conventional construction charged with dry nitrogen or with dry air under the usual commercial pressures maintained on gas of this character. For example, satisfactory results have been obtained with 2000 p.s.i. initial pressure in the gas cylinder 30.

A free piston 34 fairly loosely fitting in the cylinder 10 has a cylindrical shaped skirt 32 which rests on the bottom wall 12 so as to enclose a working chamber 36 and further has an integral piston head 38 forming a shiftable transverse wall in the cylinder supporting a sealed can 40 of tear gas powder 42. The can 40 is a conventional metal can of selected capacity which, for example, corresponds to the one gallon paint can size, and the body of tear gas dust or powder 42 therein is of a light, dry consistency weighing 1 kilogram for the size can in the case just specified and which, in that case, will contain approximately 730 grams of chloracetophenone as the tear gas agent.

A set of can puncturing tubes 44, 46 and 48 with bias-cut ends is arranged at the head of the pressure cylinder 10 with their sharp points inwardly directed from the inside face of the cover 14 so as to confront the top of the can 40 and being fixed with their upper ends cut off squarely and threaded into the cover 14. The tube 44 intersects a horizontally drilled nozzle-like orifice 50 in the head of the cover 14 which operates as a side discharge outlet when the head of the can punctures on the tube 44 in the dotted line position 40*a* of the can. In this punctured position of the can, the tube 48 functions as a supply inlet, being connected to a horizontally drilled supply passage 52 in the cover 14. The tube 46 (Figure 3) threads through the cover 14 and the external threaded extension thereof carries a jam nut 54 snug against the outside of the cover 14 and a safety disk retaining cap 56 forming a safety outlet. The cap 56 has a center opening and surrounds a metal shear ring 58 to clamp to the end of the tube 46 a frangible safety disk 60 which effectively seals and resists the working gas pressure, but which ruptures under excessive pressure enabling the gas to escape directly to atmosphere through the tube 46. In the latter case, the center opening in the cap 56 forms a supplemental discharge outlet directing a jet of the escaping, dust laden gas directly upwardly.

A longitudinal gas diverting passage 62 in the wall of the cylinder 10 communicates at one end with the supply passage 52 for tube 48 through a short indexing sleeve 64 disposed partly in the head 14 and partly in the cylinder 10 and fixed to the latter so as to register with a preformed opening in the seal 20. At the lower end the diverting passage 62 communicates with a port 66 in the wall of the cylinder at a point where the depending cylindrical skirt 32 of the piston normally covers and blocks it. A flexible rubber hose 68 has opposite end connections to the valve of the gas cylinder 30 and to a fitting 70 threaded through the bottom 12 of the cylinder so as to communicate with the working chamber 36.

In operation of the device of Figures 1–3, the valve on

the charged gas cylinder **30** is twisted open by hand admitting gas into the working chamber **36** to drive the piston upwardly with the necessary travel to puncture the top of the can **40**, the necessary puncturing thrust being approximately 50 pounds according to test data. The predetermined final travel of the piston is the motion sufficient to uncover the port **66** and introduce a stream of gas into the diverting passage **62**. The draft of gas emits from the inlet tube **48** and circulates in the can across the top surface of the body of powder **42** so as to agitate and lift the particles with the result that dust-laden gas escapes through the discharge outlet **50** having the tear gas agent entrained therein. The pressure drop in the diverting passage **62** is sufficient to insure that the working pressure in the can **40** and in the cylinder space thereabove never exceeds the pressure in the working chamber **36** thereby preventing the piston from hunting or retracting after it initially jumps and reaches its uppermost position. As an example, 100 p.s.i. working pressure in the can **40** is sufficient to mix in the dust therewith and the design strength of the safety disk **30** is such that it will rupture at approximately 250 p.s.i. Rupture strength of the pressure cylinder **10** is designed, of course, for withstanding several times this amount of pressure and in case the orifice forming the discharge outlet **50** is accidentally or maliciously stopped up, the disk **30** will be the first thing to rupture and relieve the internal pressure without damage to the device.

The gas cylinder **30** can be shut off at will, enabling the pressure in the working chamber **36** to dissipate, thus collapsing the chamber **36** as the head **38** of the piston moves from the dotted line showing of Figure 1 into the solid line position where the skirt **32** thereof reblocks the port **66**. Thus the puncturing, emptying, and release of support from the bottom of the can **40** are completely automatic operations obtained by one moving part, namely, the pressure movable piston. Owing to its large diameter, the piston jumps with practically instantaneous response to the in-rushing gas and inasmuch as approximately 5000 pound thrust is theoretically available, it will be apparent that the completed can puncturing operation takes only a moment.

In the modification of Figures 4 and 5, a pressure cylinder **110** in the device has a set of bias-cut tubes **44**, **46**, **48** of the same type and purpose as the preceding embodiment, and fixed in the head **114** thereof which may be integral with the cylinder structure. The safety outlet **56** and the discharge outlet **50** are the same as in the preceding embodiment, but the gas supply fitting **70** which is connected through the hose **68** to the gas cylinder **30** is mounted directly to the head. A sealed metal can **40** of the tear gas powder **42** is shiftably supported at its lower end within the cylinder **110** by resting on the offset face **138** in an end cover **140** which carries a flanged skirt **142** defining a socket or receiving recess for the can **40**. Two diametrically opposed stay bolts **144** are anchored in a flange at the mouth of the cylinder **110** and have their heads **146** carried in a downwardly offset position so as to retain a vertically slidable metal seal **48** in a guided relationship. A two-armed spider **150** has enlarged opposite end portions each of which is transversely bored at **152** and counterbored at **154** so as to provide sockets for the heads **146** of the stay bolts **144**. The metal is machined away from the enlarged end portions along the dotted lines **156** of Figure 5 so as to provide the side entry slots indicated at **158** in Figure 4 for ready detachment and attachment of the spider to the stay bolts **144**. The spider **150** has a hub bore **160** threadedly receiving a jack screw **162** which carries a small hand wheel **164** fixed at the lower end. A retaining plate **166** carried by the end cover **140** closes the end of a socket formed centrally thereof so as to clamp therein a ball portion on the screw **162** to form a permanent swiveled union connection **168** between the cover **140** and the spider **150** in which the jack screw is permanently retained.

In use, the modification of Figures 4 and 5 is loaded by introducing the can **40** and placing the cover **140** over the exposed end in an aligned position whereupon the spider **150** is properly manipulated and the counterbores became interengaged with the head of the bolts **144**. The wheel **164** is turned by hand to screw the jack screw **162** upwardly and the movement of translation for shifting the can **40** into the dotted line position **40***a* where the tubes poke through the head thereof is the motion sufficient to clamp the seal **148** into a fluid tight joint between the end cover flanged skirt **142** and the mouth of the pressure cylinder **110**. During this movement the downward offset of the face **138** compared to the full length of the can **40** enables the can to extend at all times partly into the cover **40** and partly into the pressure cylinder **110** so as to guide the cover in cooperation with the ball and socket swiveled union connection **168** and insure that the free end of the skirt **142** squarely engages the mouth of the cylinder **110**. The draft of gas from the cylinder **30** when the valve thereon is twisted open enters the can **40** through the puncturing tube **48** so as to agitate and lift the entrained dust **42** which thereafter is caught in the draft and dispersed with the escaping gas.

In installing each of the devices of the preceding embodiments, a point selected for mounting it may, for example, be on the rear bumper of the wheeled truck indicated or other convenient external point at which the bracket mounting bolt **24** is not less than 2 feet or more than 4 feet from the ground and an operator inside the truck controls the valve on cylinder **30** to release the dust **42** into the surrounding air as one continuous continuous blast or intermittently at will, test results showing that 10 seconds total running time is required to release the full charge. Each cylinder **30** contains a standard commercial charge of gas sufficient to discharge the one kilogram content of the dust **42**, and test results show that a fully charged cylinder should be used for each charge, the pressure thereof diminishing from 2000 to 1400 p.s.i. The valve on the cylinder **30** is then closed and the cylinder **30** is reconnected to be recharged or else a fully charged substitute cylinder is used to replace it. The punched holes in the top of the can **40** of Figure 1 provide a convenient means for grasping and lifting the empty can from the pressure cylinder **10**, the threaded fasteners **16**, meantime, having been released by hand to enable the cylinder and the cover **14** to be separated. There may be a slight tendency in some cases for the can to stick on the tubes of Figures 1 and 4, but sticking is obviously no problem in Figure 1 and in Figure 4 the can in its dotted line position **40***a* extends at one end at all times beyond the corresponding end of the mouth of the cylinder **110** and this extending end can readily be removed by hand, the cover **40** meantime having been freed and detached from the pressure cylinder **110**.

Variations within the spirit and scope of the invention described are equally comprehended by the foregoing description.

I claim:

1. In a gas operated device for dispersing tear gas dust, a pressure cylinder having can puncturing means at the top end and can supporting means forming a movable wall chamber within the pressure cylinder at the other end, means for causing relative movement between the can puncturing means and the can supporting means to puncture an interposed can of dust, inlet and outlet passsage means connected to said can puncturing means to cause a draft of working gas to circulate becoming dust laden between entering and leaving the top of the can, and two differently restricted supply and diversion passages jointly communicating with said movable wall chamber, said supply passage constituting the relatively free one of the two passages to freely communicate working pressure released from a source of compressed gas,

and freely deliver same into said movable wall chamber, whereas said diversion passage being the relatively restricted passage and connected to said inlet passage to insure an intervening pressure drop upstream of the can puncturing means thereby preventing working pressure in or about the interposed can from exceeding the pressure in said movable wall chamber.

2. A dispersing device having a discharge outlet, pressure movable means at the opposite end of said device from said outlet for supporting and shifting a container means into a position for discharging the contents thereof through said outlet, and means through which working pressure is introduced and applied in one stream to said pressure movable means to motivate same and substantially simultaneously communicated to the container means for discharging the contents in the above described manner, there being valve surface portions operatively disposed between said pressure movable means and a portion of said pressure introduction means in communication with the container means, and establishing cooperation to automatically open the latter said portion in timed response to movement of said pressure movable means.

3. A dry powder dispersing device comprising a pressure cylinder having a discharge outlet, pressure movable means at the opposite end of said cylinder from said outlet for shiftably supporting a powder container therewithin in a raised position enabling the contents to be discharged through said outlet, means through which working pressure is introduced in a space between said pressure movable means and the adjacent end of the cylinder, and a passage connected at one end so as to operatively communicate working pressure to the container when in the aforesaid raised position and connected at the opposite end to said working pressure space in a position operatively controlled by and covered and uncovered automatically in response to movement of said pressure movable means.

4. A pressure vessel adapted to disperse material from sealed cans by discharging the contents thereof in a draft of escaping gas, comprising pressure cylinder structure including a cylinder and a removable end cover fitted thereto to define a can receiving space therewith and presenting an inside face for engagement with the can at one end, a discharge outlet formed at the head end of said cylinder structure, means including a seal between the cylinder and fitted end cover rendering the vessel completely gas tight to the escape of gas except from said discharge outlet, can puncturing means fixed in said inside face at the head of said structure comprising hollow elements arranged with inwardly directed points and one being connected to said outlet and another adapted to introduce a draft of compressed gas internally of the can, and can support means comprising a shiftable thrust member at the opposite end of said structure to create a driving force on said can for bodily lifting it in said space into an upwardly impaled position on said fixed puncturing means.

5. A pressure vessel adapted to disperse material from sealed cans by discharging the contents thereof in a draft of escaping gas, comprising pressure cylinder structure including a cylinder and a removable end cover fitted thereto to define a can receiving space therewith and presenting an inside face for engagement with the can at one end, a discharge outlet formed at the head end of said structure and constituting the sole operative outlet from said pressure vessel which otherwise is secured together so as to be sealed completely tight against gas escape therefrom, can puncturing means fixed on said inside face at the head of said structure comprising hollow elements arranged with inwardly directed points and one being connected to said outlet and another adapted to introduce a draft of compressed gas internally of the can, means clamped between the cylinder and the fitted end cover forming a joint positively sealing the can receiving space within said structure so as to be completely sealed tight in the above described manner, and can support means comprising a shiftable thrust member at the opposite end of said structure to create a driving force on said can for bodily lifting it in said space into an upwardly impaled position on said fixed puncturing means.

6. A device adapted to disperse material from sealed cans by discharging the contents thereof in a draft of escaping gas, comprising a pressure cylinder structure including a cylinder and a removable end cover fitted thereto to define a can receiving space therewith and presenting an inside face for engagement with the can at one end, a discharge outlet formed at the head of said structure, can puncturing means fixed to said inside face at the head of said structure comprising hollow elements arranged with inwardly directed points and one being connected to said outlet and another adapted to introduce a draft of compressed gas internally of the can, said can puncturing means including a third hollow element providing a safety outlet at its outer end and having a pressure confining disk clamped across the resulting passage leading internally from said element from the inwardly directed point thereof to said outlet and effective to rupture only under excessive pressure therein to vent the structure safely to atmosphere, and means including a shiftable thrust member at the opposite end of said structure to create a driving force on said can for bodily lifting it in said space into an upwardly impaled position on said fixed puncturing means.

7. A device for puncturing and blowing a container empty under forced draft by causing the contents to be caught and dispersed in that draft comprising, a pressure cylinder which is closed at one end and which is fitted with an end cover and with interposed sealing means at the opposite end, means carried by the cylinder for holding the end cover firmly clamped upon the sealing means to seal the intervening joint gas tight, puncturing means at the head of said cylinder comprising sharp pointed tubes arranged with one of said tubes connected to discharge from the interior of the container into a fixed outlet, and another connected to an inlet passage and fixed to blow inwardly into the interior of the container, and a threaded joint included in said cover holding means enabling the cover to shiftably support the container within said cylinder, said cover being formed to present an offset supporting face for lifting the container upwardly thereupon in said cylinder whereby final lifting movement to puncture the container on said puncturing is the motion sufficient to seal the joint.

8. A device for puncturing and blowing a container empty under forced draft by causing the contents to be caught and dispersed in that draft comprising, a pressure cylinder which is closed at one end and which is fitted with an end cover and with interposed sealing means at the opposite end, means carried by the cylinder for holding the end cover firmly clamped upon the sealing means to seal the intervening joint gas tight, puncturing means at the head of said cylinder comprising sharp pointed tubes arranged with one of said tubes connected to discharge from the interior of the container into a fixed outlet, and another connected to an inlet passage and fixed to blow inwardly into the interior of the container, and pressure movable means for supporting the container within said cylinder from a position at the opposite end thereof and movable to lift the container through a distance sufficient to puncture it on said puncturing means.

9. A device for puncturing and blowing a container empty under forced draft by causing the contents to be caught and dispersed in that draft comprising, a pressure cylinder which is closed at one end and which is fitted with an end cover and with interposed sealing means at the opposite end, means carried by the cylinder for holding the end cover firmly clamped upon the sealing means to seal the intervening joint gas tight, means at the

head of said cylinder consisting of an arrangement of sharp, gas directing elements adapted to poke through the top of the container, and passage forming means in said device for connecting different ones of said elements to atmosphere and to a source of compressed gas, at least one of said atmosphere connected passages being at all times free of obstruction.

10. A device for puncturing and blowing a container empty under forced draft by causing the contents to be caught and dispersed in that draft comprising, a pressure cylinder which is closed at one end and which is fitted with an end cover with interposed sealing means at the opposite end, means carried by the cylinder for holding the end cover firmly clamped upon the sealing means to seal the intervening joint gas tight, a plurality of puncturing means for the sealed container fixed at the head of said pressure cylinder, a gas inlet passage disposed parallel to said cylinder and having one end connected to one of said puncturing means at that end of the cylinder, means connecting the other puncturing means to atmosphere, and a pressure movable piston at the opposite end of the cylinder which shiftably supports the container therewithin and which when subjected to working pressure drives the container onto the puncturing means, the opposite end of the passage aforesaid terminating in said cylinder at a point confronting the path of the piston stroke and being controlled thereby such that final movement of the piston to puncture the container is motion sufficient to cause the full flow of working pressure to be diverted into said opposite end of the passage.

11. A dry material disperser comprising a pressure cylinder having a discharge outlet, an end cover for the cylinder having means carrying it at the opposite end from said outlet for shiftably supporting thereupon a container of the material within the cylinder in a position for discharging the contents through said outlet, said carrying means comprising stay bolts having their shanks anchored in the adjacent end of said cylinder, threaded means adapted to be rotated by hand and having a swiveled union at one end to said cover, and a spider having a hub in which the last said means is permanently threaded and having radial arm portions in which intersecting slots and bolt receiving sockets are formed enabling said portions to disengageably straddle the bolts individually with the head socketed therein, and means for introducing a draft of pressure fluid into said container when it occupies the aforesaid discharging position, said cylinder and said end cover having confronting flanges which engage to form a sealed joint therebetween and arranged whereby final movement of the latter for shifting the container into the discharging position in the cylinder is the motion sufficient to clamp said joint fluid tight.

12. A dry material disperser comprising a pressure cylinder having a discharge outlet, an end cover for the cylinder having means carrying it at the opposite end from said outlet for shiftably supporting thereupon a container of the material within the cylinder in a position for discharging the contents through said outlet, said carrying means comprising stay bolts having their shanks anchored in the adjacent end of said cylinder, a spider having arms radiating from the hub portion thereof and detachably connected to the heads of stay bolts, said cover having a downward offset face to support said container whereby the container extends partly within said cover and partly within said cylinder at all times, and rotatable means carried on threads in the hub of said spider and operatively connected with the cover on the side thereof opposite to said container so as to cooperate therewith in centering and guiding the cover upwardly under appropriate rotation of the just named means.

13. A gas operated device for automatically puncturing and dispersing the contents of a can in the form of gas entrained dust, said device comprising pressure cylinder structure including a removable end cover fitted to the head of the pressure cylinder to define a can receiving space therewithin and presenting an inside face for engagement with the can at one end, individual can puncturing means fixed to the cover comprising hollow elements presenting points protruding through said inside face, one of said hollow elements providing a safety outlet at its outer end and having a pressure confining disk contained in the resulting passage between the point on said element and said outlet and effective to rupture only under excessive pressure therein to vent the cylinder to atmosphere, a main discharge outlet formed in said cover and connected to another hollow element, a piston having a head arranged to support a can of the material at the opposite end of said cylinder from the cover and having a skirt slidably received in said cylinder, a fitting in the end of the cylinder adjacent said piston for introducing working pressure into the chamber defined by the skirt thereof so as to lift the can upwardly in the cylinder for puncturing it, from an initial position, and a longitudinally extending passage in the wall of the cylinder having a port at one end closed by the skirt of the piston in said initial position and being connected at the opposite end to one of said hollow elements for delivering said working pressure into the punctured can incident to final puncturing movement of the piston whereby the skirt uncovers said passage.

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