

UNITED STATES PATENT OFFICE

2,591,653

DISPENSING CONTAINER FOR DUST

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Application April 1, 1948, Serial No. 18,316

18 Claims. (Cl. 222-193)

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This invention relates to dispensing containers for dusts, and, more particularly, elongated tubular containers for packaging and dispensing insecticidal, fungicidal and like agricultural dusts for use on plants (hereinafter referred to simply as "dusts").

It has been common practice for many years to package dusts in tubular containers provided at the forward or discharge end with a closure having a suitable orifice or orifices through which the dust, dispersed in air, is discharged. At the rearward or "pressure" end, the tubular container is provided with a closure having an opening which permits air for discharging and dispersing the dust to be drawn into and forced through the tubular container; said opening may be either covered with a loosely-woven fabric filter or provided with a suitable check valve to permit the passage of air into the container while preventing the escape of dust through the opening. At the pressure end, such a container is provided with a closely-fitting, telescoping sleeve which is closed at its rearward end except for a ported closure carrying a flap type of check valve. This check valve permits air to be drawn into a pressure chamber, created when the sleeve is withdrawn, but prevents any substantial escape of air therethrough when the withdrawn sleeve is telescoped again upon the tubular container. Thus, by reciprocating the sleeve on the container, air is pumped through the container to discharge a dispersion of dust in air through the discharge orifice or orifices.

One difficulty with many of the prior art dispensing containers of the general type described above is that they cannot be fully filled with dust, and they must be held, when operated, in a substantially horizontal position so that the body of dust contained therein does not cover the discharge orifices; otherwise the dust tends to pack in the container, either over the discharge orifices or over the air inlet valve, thereby unduly impeding the relatively free and uniform flow of air through the gun which is essential for satisfactory operation. The very geometry of the level assumed by the dust in these tubular containers during use limited their maximum length to three or possibly four times their diameter. This, in turn, limited the amount of dust which could be packaged in such containers to about a pound or so of dust; otherwise the diameter of the containers became so large that the packages were cumbersome and unwieldy. Consequently, the user was not able to buy the more economical larger amounts of dust in such dispensing containers.

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Another disadvantage of the prior art containers of the type described was that the user had to stoop or squat to spray dust on small plants or lower leaves because of the limitations on the length of the containers. Attempts to overcome this objection by packing only small amounts of dust in longer containers were uneconomical and only partially successful. Extended discharge orifices have been employed to obtain a greater overall length, but these have either been cumbersome and too easily damaged or have been unsatisfactory in operation, or both. In neither case was it possible to achieve continuous satisfactory operation while holding the containers in any but a generally horizontal position.

To minimize the tendency of the dusts to pack in the described prior art containers and to improve dispersion, it has been proposed to include in the container a tube extending from a point near the opening in the pressure end to a point adjacent the discharge orifices. Such a tube might or might not be provided with vents which would, theoretically, either permit dust to be entrained into the tube or permit air to pass into the mass of dust to prevent it from packing. In most instances such an expedient did increase the dispersion of the dust, but when the length of the container exceeded its diameter by much more than three times or the container was held at an angle which allowed the dust to cover the discharge orifices to an appreciable depth, the dust would still pack, due, presumably, to the depth of dust over the discharge orifice and/or the effect of the air pressure in the container.

The patent of Alexander C. Keyl, Number 2,522,621, dated September 19, 1950, discloses a dispensing container having a length many times greater than its diameter. That patent further discloses an insert disposed within the dust chamber of the container along one side thereof, the insert being constructed to provide a number of closely spaced conduits of small diameter extending from a point adjacent the air inlet end to a point adjacent the discharge end of the dust chamber. By means of such an insert, dispensing containers of a length up to fourteen times their diameter were first made practically operative. However, the operation of such containers, while superior to the operation of containers which were previously known, did not overcome all of the difficulties. It was found that the dispersion and discharge of dust from the container disclosed in the above-mentioned patent was not always uniform under varying conditions of use.

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When the angle of the container was changed and when the stroke of the telescoping sleeve was varied, for example from a relatively, slow, easy stroke to a quick vigorous stroke, the degree of dispersion and quantity of dust dispensed would vary until the "feel" of the device could be acquired by use of the device under the new conditions.

Accordingly, a general object of this invention is to provide a dust dispensing container having a length exceeding four or five times its diameter, but which will function smoothly and consistently under all normal conditions of operation to effect the discharge of a well dispersed dust spray.

Another and more specific object of this invention is to provide a dust dispensing container in which packing of the dust at either end of the container will not prevent the discharge of a uniformly fine dispersion of dust and will not materially alter the normal discharge characteristics of the device.

A particular advantage of containers made in accordance with this invention is that a consistent rate of discharge of a finely and uniformly dispersed dust is obtained regardless of the position in which the device may be held. As a result of its substantial length and relatively small diameter, and its consistent performance at all angles, such a device may be efficiently used to dust foliage high overhead on trees, trellises, and the like or small plants and foliage close to the ground with a minimum of climbing, stretching, and stooping or squatting.

Other and further objects and advantages of our invention will be apparent from the following description of a specific preferred embodiment, the claims, and the drawings, in which:

Fig. 1 is a longitudinal elevation, partly in cross-section, of a container made according to our invention and showing it at an angle near the vertical at which it may be held and operated;

Fig. 2 is a transverse section taken along the line 2—2 of Fig. 1 and showing dust packaged in the container;

Fig. 3 is a detailed fragmentary longitudinal section taken at the discharge end of the tubular container; and

Fig. 4 is a detailed fragmentary longitudinal section taken at the pressure end of the tubular container.

The container comprises an elongated tube 10, preferably made of spirally wound cardboard tubing, or similar light weight material having the required strength and rigidity. The discharge end of the tube 10 is provided with a suitable closure structure in which is contained a mixing or dispersion chamber for insuring thorough dispersion in air of the dust discharged from the container. This closure structure includes a metal rim member 11 which is crimped to the end of the tube 10 and which extends inwardly a short distance and then axially of the tube 10 to form a cylindrical flange 11a spaced inwardly from the wall of the tube 10.

A closure member 12 is removably and frictionally held in place within the internal flange 11a of the rim member 11, as shown in Figure 3 of the drawings. The closure member 12 comprises a disk-shaped cover plate 13 secured in any conventional manner, as by crimping, soldering or the like, to a cup-shaped base member 14, the latter being provided with a plurality of ports 15 in the generally cylindrical side-wall thereof and near the base thereof. The shape of the rim

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member 11 and the closure member 12 is such that an annular space 23 is provided between the wall of the tube 10 and the generally cylindrical wall of the closure member 12. Communication between the main dust chamber, formed inside of the tube 10, and the dispersion chamber within the closure member 12 is thus achieved through the annular space 23 and ports 15. The axial length of the dispersion chamber is preferably substantially less than its diameter, whereby the volume of the dispersion chamber is kept small and substantial turbulence is created throughout the interior thereof by air entering radially through the ports 15.

The cover member 13 is provided with an orifice 15a at or near the center thereof through which the dispersed dust and air are discharged, as shown in Figure 1. The location of the orifice 15a may be merely indicated by a depression formed in the cover member 13 and may be cut or punched by the user after purchase and just prior to first use. Generally, however, we prefer to punch the orifice 15a in the cover 13 prior to filling and closing the tube 10 in order that its size and shape may be better controlled. The shape of the punched-out portion is preferably such that the dust spray will be directed generally at a substantial angle to the axis of the tube, as illustrated in Fig. 1. When preformed, the orifice 15a may be sealed for shipping and storage, after filling with dust, by means of adhesive paper or a similar removable seal (not shown). The tube 10 is normally filled through the open discharge end of the tube prior to inserting the closure member 12. However, it will be seen that the closure member 12 extends a slight distance above the rim member 11 and is shaped to provide an overhanging flange 13a to facilitate removal thereof with a suitable prying tool if it should be desired to fill or refill the tube with a fresh charge of dust after shipment and storage in an empty condition or after an initial charge has been exhausted.

The pressure end of the tube 10 is closed by a crimped on metal closure 16 having a plurality of openings 17 therethrough, the openings 17 being arranged in a circular array about the center of the closure. The openings 17 are normally closed by a flexible diaphragm 18 of paper composition, rubber, or like flexible material riveted at the center to the closure 16. A rigid washer 18a holds the central portion of the diaphragm against the closure member 16. When air is being forced into the tube 10, the annular portion of the diaphragm 18 around the washer 18a will bend to the dotted line position, shown in Fig. 4, thus uncovering the openings 17. This type of check valve directs the incoming air radially outwardly toward the wall of the tube 10.

As indicated in Fig. 1, the tube 10 is provided with the telescoping sleeve 20 adjacent the pressure end thereof. If desired, the outer diameter of the tube 10 may be reduced to accommodate the sleeve 20. The end of the sleeve 20 is provided with a crimped on metal closure 21 having a port 22 normally covered by a flap valve 23, which will open and admit air when the sleeve 20 is withdrawn from its fully telescoped position. It is to be understood that the flap valve 23 is merely illustrative of any type of flap or check valves which may be used at this point to permit one-way movement of air through the metal closure 21.

Within the tube 10 there is provided a special type of liner element 25, which is an improve-

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ment over that disclosed in the aforementioned Keyl application and which is so designed as to bring about an entirely new cooperative relationship between the liner element 25, the air admitting structure at the pressure end of the container, and the closure structure at the discharge end of the container. The liner element 25 extends from a point adjacent the metal closure 16 to a point adjacent the closure member 12 and defines a multiplicity of long, relatively small air conduits 26. The conduits 26 are arranged longitudinally of the tube 10 and are spaced more or less uniformly and in a single layer completely around the inner surface thereof. As shown in the drawings, the liner 25 and air conduits 26 may be comprised of a single layer of ordinary, laminated, corrugated paper board stock in which the corrugations extend lengthwise of the tube. A single layer of the corrugated board is formed as a cylinder and is inserted into the tube 10 to form the liner 25. As shown in the drawing, the ends of the liner 25 are provided with extensions 27 of the outermost ply, which is a non-corrugated ply in this instance, so as to space the ends of the air conduits 26 from the closures 12 and 16 at the ends of the tube 10. The conduits 26 may vary in size and number while retaining all the advantages of the present dispenser. For example, the number of conduits may vary from about 10 to about 50 and the cross-sectional area of each conduit may be from about .125 square inch to about .01 square inch. The diameter of the tube 10 may, of course, be varied within limits but the total cross-sectional area of all the conduits 26 should occupy from about 1% to about 20% of the cross-sectional area of the tube 10. It has been found that about 20 conduits, each having a cross-sectional area of about .02 square inch and a tube having a cross-sectional area of about 4 square inches will produce excellent results with most dusts. In such a dust dispenser the cross-sectional area of the conduits 26 occupies about 10% of the cross-sectional area of the tube 10.

The package is sold with its elements in the normally inoperative, fully telescoped position. To operate the dispensing container, the tube 10 is grasped in one hand and the sleeve 20 is drawn back, creating a pressure chamber 24 into which air is drawn through the port 22 and opened check valve 23. The sleeve 20 is then telescoped on the tube 10, closing the check valve 23 and forcing air through the openings 17 and eventually discharging dust dispersed in air through the orifice 15a toward the plant or leaves at which the discharge end of the container is aimed. The container is operated in this manner until the packaged dust is exhausted, when the container may be refilled or discarded.

According to our analysis of the operation of the container which has been described, the air which is forced through the openings 17 at the pressure end of the tube 10 is directed by the diaphragm 18 toward the conduits 26, thus requiring the entering air to force its way through a mass of dust for only a short distance, under the worst of conditions, before entering the conduits 26. While some dust will sift or be carried by the turbulent air into the conduits 26, the dust will never pack therein sufficiently tightly to materially impede the passage of air there-through. Air passing from the openings 17 into the conduits 26 moves along the conduits and is discharged therefrom directly into the annular space 28 between the tube wall 10 and the gen-

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erally cylindrical wall of the closure member 12. At this point, considerable turbulence is created as the air is forced from the annular space 28 through the restricted path provided by the ports 15.

From the foregoing it will be observed that, when the main dust chamber is substantially full and is tilted upwardly, the air entering the conduits 26 will be forced through a mass of dust and will entrain a substantial amount of it, carrying it through the conduits, into the annular space 28, and finally through the ports 15 and into the dispersion chamber in the closure member 12. When the device is tilted downwardly, the air can pass relatively freely into and through the conduits 26, picking up little or no dust until discharged into the annular space 28, where a heavy concentration of dust is encountered and a substantial amount of it is carried into the dispersion chamber in the closure member 12. When the device is held more or less horizontally, the conduits 26 become less important as the quantity of dust left in the main dust chamber in the tube 10 decreases, but, in any event, the restricted ports 15 into the dispersion chamber cause turbulence just outside the ports 15 and insure entrainment of dust with the air passing into the dispersion chamber. It will be particularly observed that air containing entrained dust will always be able to reach the ports 15 for admission into the dispersion chamber, whether the device is tilted upwardly or downwardly or is held substantially horizontally. Also, because the liner member defining the conduits 26 extends completely around the inner cylindrical surface of the tube 10, the operation of the device is unaffected by rotation about its longitudinal axis.

Since the air and dust passing through the ports 15 enter the dispersion chamber in a radial direction, substantial turbulence will always be created in the chamber, whereby the dust carried by the air into the chamber will be thoroughly and uniformly dispersed. While in this dispersed condition, the dust will be discharged from the orifice 15a onto the plants and other vegetation to be treated.

Thus, the relation between the special valve construction in the closure 16, the conduits 26, and the closure member 12 at the discharge end of the container permits the operation of the dispensing containers at substantially any angle, including the vertical, even when the containers have a length greatly in excess of three or four times their diameter and are substantially filled with dust. The length of the tube 10, relative to its diameter, appears to be limited only to the length and weight of contents which can be conveniently handled by the user. As explained above, tubes three feet long and having a ratio of length to diameter of 14 to 1 are in use and are highly successful.

The advantages of long dispensing containers of the type disclosed should be readily apparent. With a tube three feet long, the user can dust both overhead foliage and low plants or leaves with a minimum of stretching, climbing, stooping and squatting and can use the discharge end of the tube to turn up low leaves and dust the undersides thereof while operating the container. Heretofore such convenience could be accomplished only with expensive mechanical dusting equipment which required the inconvenient loading of bulk quantities of dust. It is also possible to package as much dust in one of my dispensing containers as could be packaged in several of the

short prior art dispensing containers, thereby reducing the packaging cost per pound of dust packaged and allowing the user to buy the more economical large quantities of dust in a dispensing container. Also, since the closure member 12 is readily removed, the containers can easily be refilled.

While we have explained our theories as to how our new construction operates to produce the improved results which have been described, we do not wish to be bound by any such theories of operation. Regardless of whether our container operates for any one or all of the reasons given, or for other reasons, it is to be understood that the invention is not limited to the specific embodiment or to the particular mode of operation disclosed. Rather, those skilled in the art will find that our invention may be variously modified within the scope of the following claims.

What is claimed is:

1. A dust dispenser comprising a tubular element defining a dust reservoir; a first closure at one end of said tubular element including means for admitting air under pressure; a second closure at the opposite end of said tubular element including means for discharging a dispersion of dust and air, said second closure comprising a generally cylindrical element closed at its ends and defining a dispersion chamber concentrically disposed in the discharge end of said tubular element, said cylindrical element having an outer diameter smaller than the inside diameter of said tubular element to provide an annular space between the walls thereof; a plurality of ports in said cylindrical element for communication between said annular space and said dispersion chamber and a discharge opening through the outer end wall of said cylindrical element, means defining a plurality of air conduits extending longitudinally of and spaced substantially uniformly about the inner surface of said tubular element, said conduits terminating at one open end adjacent said first closure and at their opposite open end adjacent said annular space, whereby air admitted through said first closure may pass into and through said conduits and into said annular space for entraining dust, thence with the entrained dust through said ports into said dispersion chamber and through said discharge opening in the form of a dust spray, and means for forcing air through said air admitting means.

2. A dust dispenser as claimed in claim 1 wherein said first closure includes means for directing admitted air toward and into the adjacent open ends of said conduits.

3. A dust dispenser as claimed in claim 1, wherein said first closure includes an apertured end wall and a disk for normally covering and closing the apertures therein, said disk being axially mounted on the inner side of said apertured end wall for limited axial movement to uncover said apertures when air is forced therethrough and to direct said air radially toward and into the adjacent ends of said conduits.

4. A dust dispenser as claimed in claim 1, wherein said first closure includes an apertured end wall having apertures disposed in a circular array about the center thereof and a coaxially disposed disk for normally covering and closing the apertures therein, said disk being secured to said apertured end wall for limited axial movement to uncover said apertures when air is forced therethrough and to direct said air radially toward and into the adjacent ends of said conduits.

5. A dust dispenser as claimed in claim 1, wherein said first closure includes an apertured end wall and a flexible diaphragm normally covering and closing the apertures therein, said flexible diaphragm being secured adjacent its center to the inner side of said end wall with securing means permitting limited flexing of the diaphragm to uncover said apertures when air is forced therethrough and to direct said air radially toward and into the adjacent ends of said conduits.

6. A dust dispenser as claimed in claim 1, wherein a ring having an internal annular flange is crimped over the discharge end of said tubular element and the generally cylindrical element defining the dispersion chamber is removably mounted within said annular flange in frictional engagement therewith.

7. A dust dispenser as claimed in claim 1, wherein said second closure includes a ring crimped over the discharge end of said tubular element and having an internal annular flange of smaller diameter, and the generally cylindrical element defining the dispersion chamber is provided with a flange adjacent its outer end projecting radially therefrom, said generally cylindrical element being removably mounted within said internal annular flange in frictional engagement therewith and with said radially projecting flange spaced from said ring.

8. A dust dispenser as claimed in claim 1, wherein said plurality of air conduits are defined by a cylindrical layer of corrugated paper board with the corrugations extending longitudinally thereof.

9. A dust dispenser as claimed in claim 1, wherein said plurality of air conduits are formed by a cylindrical layer of laminated corrugated paper board with the corrugations extending longitudinally thereof, an outer ply of said corrugated paper board extending longitudinally beyond the ends of said conduits for spacing the ends of the conduits from said first and second closures.

10. A dust dispenser as claimed in claim 1, wherein said conduits are generally aligned with said annular space.

11. A dust dispenser as claimed in claim 1, wherein said ports are uniformly spaced circumferentially about the cylindrical wall of said dispersion chamber and at least one of said conduits is substantially aligned with each of said ports.

12. A dust dispenser as claimed in claim 1, wherein the combined cross-sectional area of said air conduits is not substantially greater than 20 per cent of the cross-sectional area of said tubular element.

13. A dust dispenser as claimed in claim 1, wherein said plurality of ports are spaced substantially uniformly about the circumference of said cylindrical element.

14. A dust dispenser comprising a tubular dust container, a multiplicity of longitudinally extending air conduits therein, said air conduits terminating adjacent but short of the ends of said container and being substantially uniformly spaced in a circular array adjacent the tubular wall thereof; pressure responsive means for admitting air into a pressure end of said container and for directing the admitted air toward the adjacent ends of said air conduits, a generally cylindrical dispersion chamber disposed concentrically within the opposite end of said container, said dispersion chamber having an outer

diameter smaller than the inner diameter of said container to provide an annular space therebetween and having at least four ports for communication between said annular space and said dispersion chamber, said dispersion chamber having a discharge orifice in its outer end wall, and a sleeve member having a check valve therein, said sleeve member being telescopically mounted over the pressure end of said container for pumping air through said air admitted means, whereby air pumped into the container will be directed into and through said air conduits and into said annular space for passage through said ports into said dispersion chamber and finally through said discharge orifice, and whereby dust entrained with said air as it travels through said container will be thoroughly dispersed therein and discharged therewith.

15. In a tubular dust dispensing container including means for introducing air under pressure into one end of said container, a ring telescopically secured to the opposite end of said container, said ring being provided with an internal annular flange defining an axially aligned opening into the container, a tubular dust dispersion chamber having opposite end walls, said dust dispersion chamber being fitted into said opening and frictionally engaged by said annular flange, said chamber extending through said opening into said container for defining an annular space between it and the wall of the container, a plurality of circumferentially spaced ports leading from said annular space into said dispersion chamber through the tubular wall thereof, and a discharge orifice through the outer end wall of said dispersion chamber.

16. The device as claimed in claim 15, wherein the outer end of said dispersion chamber is flanged radially outwardly beyond the internal annular flange of said ring and is spaced from said ring to permit a prying tool to be inserted therebetween for removing said dispersion chamber.

17. The device as claimed in claim 15, wherein said parts are substantially uniformly spaced around the circumference of said dispersion chamber adjacent the inner end wall thereof.

18. A dust dispenser comprising a tubular element defining a dust reservoir, a first closure including means for admitting air under pressure, a second closure at the opposite end of said tubular element including means for discharging a dispersion of dust and air, said second closure comprising a generally cylindrical element closed at its ends and defining a dispersion chamber concentrically disposed in the discharge end of said tubular element, said cylindrical element having an outer diameter smaller than the inside diameter of said tubular element to provide an annular space between the walls thereof, a plurality of ports in said cylindrical element for communication between said annular space and said dispersion chamber and a discharge opening through the outer end wall of said cylindrical element, air passage means extending longitudinally of and substantially uniformly about the inner surface of said tubular element, said means terminating at one end adjacent said first closure and at the opposite end adjacent said annular space, whereby air admitted through said first closure may pass into and through said air passage means, said annular space and thence through said ports into said dispersion chamber for dispersion with dust therein and finally through said discharge opening in the form of a dust spray, and means for forcing air through said air admitting means.

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