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 a tubular container provided at the discharge end with a closure having a suitable orifice or orifices through which the packaged dust, dispersed in air, is discharged. At the other or "pressure" end, the tubular container is provided with a closure having an opening which permits the discharging and dispersing air to be forced into the tubular dust container; said opening may be either covered with a loosely-woven fabric filter or provided with a suitable check valve which permits the passage of air into the container and inhibits the escape of dust through the opening. At the pressure end, such containers are provided with a slideable, closely-fitting sleeve having a ported closure carrying a flap type of check valve which permits air to be drawn into a pressure chamber created when the sleeve is withdrawn but preventing a substantial escape of air when the withdrawn sleeve is telescoped upon the tubular container. Thus, by reciprocating the sleeve on the container, air would be theoretically pumped through the container to discharge dust in a finely dispersed spray through the discharge orifices.

The difficulty with the above described dispensing containers 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 does not cover the discharge orifices; otherwise the dust packs in the container and over the orifices, preventing any discharge or at least causing too much dust to be discharged in an undispersed condition. The very geometry of the level assumed by the dust during use limited the maximum length of the tubular containers to three or possibly four times the 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 container became so large that the package was cumbersome and unwieldy. Consequently, the user was not able to buy the more economical larger amounts of dust in such dispensing containers. Another disadvantage of the short 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.

To minimize the effect of the dusts packing in the described prior art containers and to improve dispersion, it has been proposed to include in the container a tube extending from near the opening in the pressure end to or adjacent the discharge orifices. Such tubes might or might not be provided with vents which would theoretically either permit dust to be entrained into the tube or permit air to be forced into the mass of dust to prevent it from packing. In most instances the tubes 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.

It is the object of this invention to provide a dust dispensing container in which the dust will not pack and prevent discharge, regardless of the angle at which the container is held during operation. It is another object of this invention to provide a dust dispensing container in which the length of the container may exceed four or five times the diameter. In fact, in the commercial embodiment of my invention now being used, the container is two and a half inches in diameter and thirty-six inches long, a ratio of length to diameter of 14 to 1.

A particular advantage of a container made according to my invention is that, with a diameter which permits the container to be conveniently gripped in one hand, the container may be made long enough to allow the user to dust small plants and low leaves without stooping or squatting. Another advantage of my container is that it permits a more economical packaging of dusts in a dispensing container, due not only to the larger and more economical quantity of dust which may be sold in one package but also to the lower packaging cost per pound of dust packaged.

Other and further objects and advantages of my 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 of a container made according to my invention and showing it at an angle near vertical at which it may be held and operated.

Fig. 2 is a cross-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 lower or discharge end. Fig. 4 is a detailed fragmentary longitudinal section taken at the upper or pressure end.

In general, except for the dispensing element employed, and greatly increased length (relative to the diameter) the preferred embodiment of my invention as shown in the drawings is substantially the same as dust-dispensing tubular container systems well known to the art. That is, the container is comprised of an elongated tube 10, preferably made of spirally wound cardboard tubing or similar inexpensive tubing having the required strength and rigidity.

The discharge end of the tube 10, in which the dust to be dispensed is packaged, is closed by a suitable closure having discharge orifices; in this instance, the closure is comprised of an internally flanged metal rim 11 crimped to the end of the tube 10 and a removable metal cap 12 tightly and frictionally held by the rim 11. A group of narrow slits or small holes 15 in the cap 12 aid in locating eccentrically thereof to provide the discharge orifices through which the packaged dust and air are discharged in a spray jet, as indicated in Fig. 1. The orifices 15 are usually indicated by depressions in the cap 12 and are usually cut or punched by the user after purchase and just prior to first use. Frequently, however, I prefer to punch the orifices 15 in the cap 12 prior to filling and closing the tube 10; in such instances, the orifices 15 are sealed for shipping and storage with a patch of adhesive paper or a similar removable seal. It is to be understood that in either case the tube of the embodiment disclosed is first filled, by means of suitable filling equipment, through the open discharge end of the tube prior to closing with the cap 12. The cross-sectional area of the tube 10 occupied by the packaged dust is indicated by the stippled area in Fig. 2.

The pressure end of the tube 10 is closed with a cap 16 having an opening 17 covered by a patch of loosely woven cloth or like filter material 18 which will permit air to pass through the filter but which will entrap most of the dust which might otherwise escape from the tube 10 through the opening 17. As indicated in Fig. 5, the cap and filter closure may be replaced by a crimped metal closure 116 having an opening 117 normally closed by a flap valve 118 of paper or like flexible material stapled to the closure 116; when air is being forced into the tube 10, the flap 118 will bend to the dotted line position shown, uncovering the opening 117.

As indicated in Fig. 1, the outer diameter of the tube 10 is preferably reduced adjacent the pressure end, to receive the telescoping sleeve 20. The package is sold with its elements in the normal operative fully telescoped position, in which the tube 10 and sleeve 20 appear to be a continuous tube. The end of the sleeve 20 is provided with a crimped metal closure 21 binding a closure normally covered by a flap valve 23 operating in a manner similar to the above described flap valve 118. It is to be understood that the flap valves 118 and 23 are merely illustrative of the flap or check valve structures which may be used to permit one-way movement of air toward the discharge end of the tubular container 10 through the closures 16 and 21.

To operate the dispensing container, the tube 10 is grasped in one hand 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 opening 17 and discharging dust dispersed in air through the orifices 15 toward the playing of leaves at which the discharge end of the container is aimed. The container is so operated as desired until the packaged dust is exhausted, when the container is discarded.

But for the fact that none of the prior art dust-dispensing containers would continue to operate successfully at the angle shown in Fig. 1 and few would operate at any angle with a tube as proportionately long as the tube 10, the above described construction and operation is well known in the art. The operativeness of my container is due to the internal dust dispersing element 30 extending from adjacent the pressure end of the tube 10 to a point adjacent the discharge end. The dust dispersing element 30 is comprised of a number of long, relatively small air conduits 31. The group of long, small tubes occupies approximately a full length of the cross-sectional area of the tube 10, the discharge ends of the conduits being located adjacent to and directed towards the discharge orifices 15. As shown in the drawings, the internal dispersing element is preferably comprised of a plurality of plies of ordinary corrugated paper board stock in which the corrugations extend lengthwise of the tube 10 to provide the plurality of conduits 31. As shown in Fig. 2, the plies of corrugated paper board stock have a width slightly greater than the diameter of the tube 10 so that the plies are frictionally held in alignment with the discharge orifices 15. As shown in Figs. 1, 3, and 4, the ends of the paper board plies are provided with small longitudinal tabs 32 to space the ends of the conduits 31 from the closures at the ends of the tube 10.

The element 30 permits the operation of the dispensing container of the type described at substantially any angle, including the vertical, and with dust-containing tubes greatly in excess of three or four times the diameter. The length of the tube 10, relative to its diameter, would be limited only to length of tube 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.

The advantages of long dispensing containers of the type disclosed should be readily apparent. With a tube three feet long, the user can dust low plants or leaves without stooping or squatting and can use the discharge end of the tube to turn up low leaves and dust the undersides thereof while operating the container. Hereby dispensing dust without stooping 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 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.

Why my element 30 renders the container operative under conditions where the single relative large internal dispersing tubes of the prior art would be inoperative is not understood. One
theory advanced is that the conduits 31 are so small in diameter that the normal pressure effect-
ed by operation of the sleeve 20 causes the dis-
charge air forced through the conduits 31 to
assume turbulent flow rather than the smooth or
viscous flow which would obtain in a single
tube of equal cross-sectional area. Thus, the
air discharged adjacent the orifices 15 would be
in a more turbulent condition and would erode
away any packed dust adjacent the orifices 15.
Another theory advanced is that even if a flap
valve 18 is employed at the pressure end of the
tube 10 rather than the filter 18, such valves are
not efficient enough to prevent the negative pres-
sure created in the pressure chamber 24 from
also being created inside the tube 10, and since
the small conduits 31 offer a frictional resistance
to air flow through them, the air entrapped in
the entire mass of dust in the tube 10 is sub-
jected to intermittent negative pressure, thus
keeping the dust in a fluffly, unpacked condition.
Or the effect of the element 30 may be purely
mechanical in that the relatively large cross-
sectional area of the element 30 is adjacent the ori-
faces 15 prevents the accumulation of a mass of
dust over the orifices 15 and in the small space
between the orifices and the discharge ends of
the conduits 15 sufficient to pack the dust to the
extent that such dust will not be readily dis-
persed by the jets of air discharged by the con-
duits 31.

Regardless of whether my container operates
for any one or all of the foregoing reasons or for
some other reason, it is to be understood that this
invention is not to be limited to any given theory
of operation or to the specific embodiment dis-
closed. Rather, those skilled in the art will find
that my invention may be varied and modified
within the scope of the following claims.

What is claimed is:
1. In a dust dispensing container, in combina-
tion with a dust containing tube, a closure at one
end having a discharge outlet, a closure at the
other end having an opening permitting air to be
forced into said tube and a valved sleeve over
said other end reciprocable to pump air into said
tube, an internal dust dispersing element com-
prised of a plurality of relatively small conduits
extending lengthwise of said tube from a point
adjacent said discharge outlet to a point adja-
cent said openings, the total cross-sectional area
of said dust-dispersing element being greater
than the area of said outlet, said element being
located with respect to said outlet so that the
outlet will lie substantially within the projected
cross-sectional area of said element.
2. A dust dispensing container as defined in
claim 1 in which said discharge outlet is com-
prised of a plurality of orifices and including
means to space said dust-dispersing element from said orifices.
3. A dust dispensing container as defined in
claim 1 in which said tube is a long tube having
a length exceeding four times its diameter and
said dust-dispersing element is comprised of cor-
rugated paper board in which the corrugations
extend lengthwise of the tube to provide the plu-
rality of small conduits.
4. In a dust dispensing container, a dust con-
taining tube of spirally wound paper stock, a
closure at one end of said tube having a plurality
of discharge orifices grouped eccentrically there-
of, a second closure at the other end of said tube,
and an internal dust-dispersing element com-
prised of a plurality of plies of corrugated paper
board extending lengthwise of said tube from a
point adjacent said orifices to a point adjacent
said second closure, the corrugations of said paper
board extending lengthwise of said tube to pro-
vide a plurality of small conduits, said element
having a total cross-sectional area greater than
the area of the group of orifices and being held
within said tube so that said orifices will fall sub-
stantially within the projected cross-sectional
area of said element.
5. In a dust dispensing container as defined in
claim 4, in which said second closure is provided
with an opening, means permitting air to be
forced into said tube through said opening but
inhibiting the escape of dust from within said
tube, means to space said dust-dispersing element
from said orifices and said opening, and means to
pump air through said opening.
6. A dust dispensing container as defined in
claim 4 in which the ratio of the length of said
tube to its diameter exceeds four to one.

ALEXANDER C. KEYL.

REFERENCES CITED

The following references are of record in the
file of this patent:

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,777,278</td>
<td>Huntington</td>
<td>Sept. 30, 1930</td>
</tr>
<tr>
<td>2,035,398</td>
<td>Muller</td>
<td>Mar. 24, 1938</td>
</tr>
<tr>
<td>2,122,230</td>
<td>Rutkowski</td>
<td>June 28, 1938</td>
</tr>
<tr>
<td>2,156,268</td>
<td>Rose</td>
<td>May 2, 1939</td>
</tr>
</tbody>
</table>