Aug. 10, 1954 J. J. BYBERG 2,686,045

DUSTER APPARATUS

Filed June 28, 1949 2 Sheets-Sheet 1

Fig 1

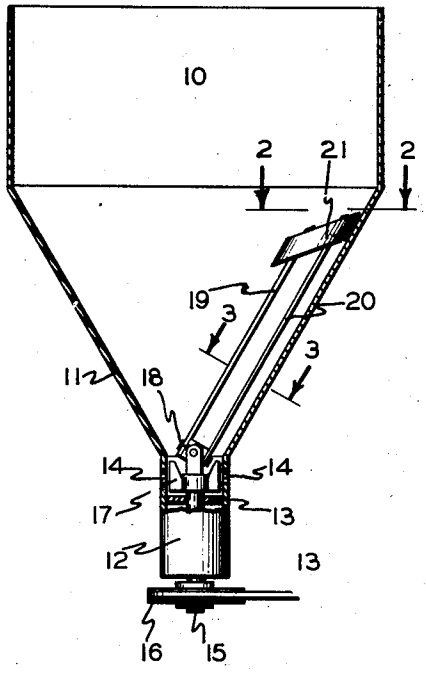
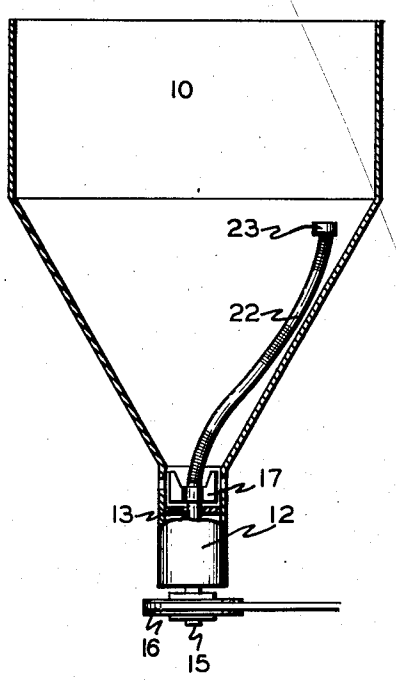


Fig 4



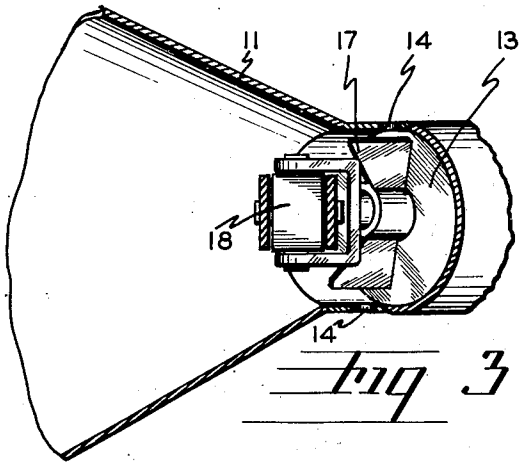


Fig 3

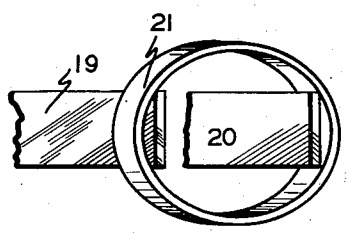


Fig 2

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DUSTER APPARATUS

Filed June 28, 1949 2 Sheets-Sheet 2

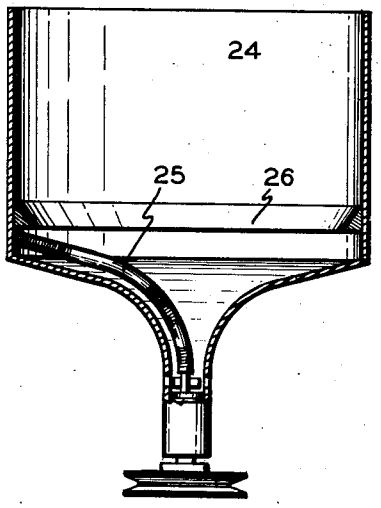


Fig 5

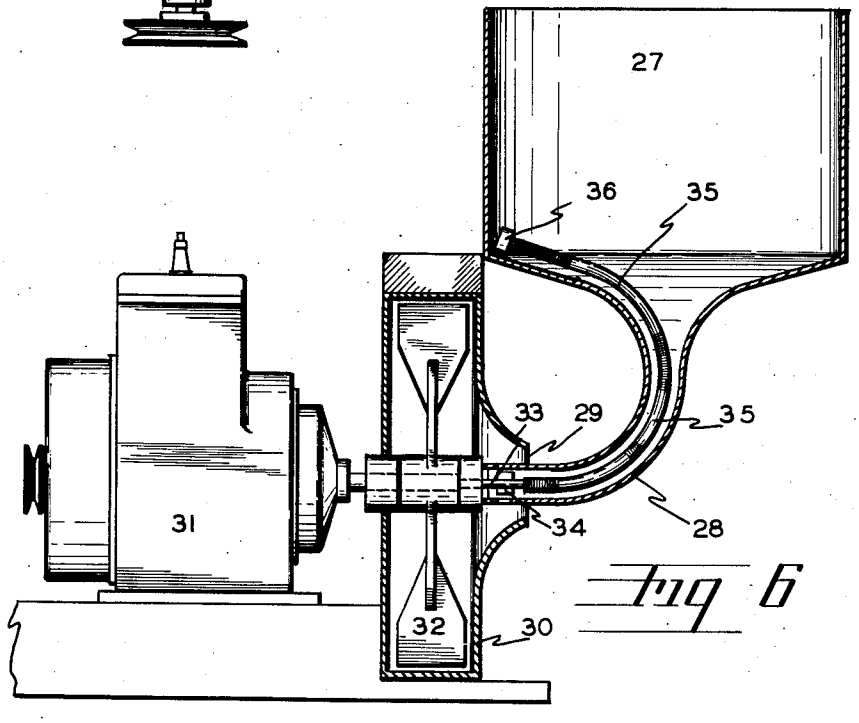


Fig 6

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Patented Aug. 10, 1954

2,686,045

UNITED STATES PATENT OFFICE

2,686,045

DUSTER APPARATUS

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Application June 28, 1949, Serial No. 101,891

1 Claim. (Cl. 259—40)

1

This invention relates in general to devices employed for dispersing or scattering powdered insecticides or similar materials, and, more specifically, relates to power-driven dusters employing blower fans and the like for dispersing the dusting powders into the air, with additional mechanical means for stirring or agitating the dusting powder and for feeding it to the blower or dispersing means.

It is customary with such devices to have a hopper, in which the powdered insecticide or other dusting material is contained and from which it is delivered or fed to the blower or dispersing means, and for the hopper to have a tapered bottom with a discharging outlet. It is well known that merely allowing the material to pass out from the hopper outlet by gravity feed is unsatisfactory due largely to the fact that the material is apt to clog or cake in the hopper outlet. Also it is well known that employing mechanical feeding or agitating means in the hopper outlet or tapered bottom does not alone meet the difficulty with dusting powders which contain such materials as nicotine or powdered adhesives or other substances which may have an affinity for moisture, inasmuch as the dusting powder will have a tendency to bridge above the bottom portion of the hopper, leaving a hollow space in which the operation of such means becomes ineffective.

In recent types of dusting devices attempts have been made to remedy this latter mentioned condition by providing two agitators in the hopper, one serving as feeder agitator at the bottom or outlet section of the hopper and the other located at a higher elevation and intended to prevent blocking and bridging of the material above the lower section. In such arrangement the upper agitator must be operated at a slower speed than the feeder agitator, for if the upper agitator in the main body of the hopper is rotated at the same speed required for efficient operation of the feeder, the material in the hopper will become so mixed with air or "fluffed up" that the actual amount of powder dispersed from the apparatus becomes considerably reduced. However, there are also objectionable features involved even with the use of two agitators in this manner with the upper one being driven more slowly than the lower one.

The upper agitator, when in the form of any of the customary types and even when driven slowly, will cause some fluffing or reduction in density of the powdered material, especially if the top level of the material in the hopper drops

2

below the top of the agitating means, and this reduction in density affects the rate of the actual feeding and resulting dusting. When scientific and accurate dusting is being done with high priced insecticides it is quite imperative that the predetermined poundage distribution per acre be uniformly maintained during the dusting operation. Furthermore, the necessity of having two agitators running at different speeds requires a suitable speed reduction arrangement which also adds to the cost of such dusting devices. Disc agitators and feeders have been used in some dusters, but rapidly rotating discs present another objectionable feature in that they may develop sufficient frictional heat to create a danger when the powdered material contains such combustible substances as sulphur, and sulphur is a very common ingredient in such materials. Other lesser problems have been encountered with dusters of various types, but it is unnecessary to go further into the description of the same.

It is the general object of the present invention to provide an improved duster apparatus to meet the difficulties above indicated.

More specifically, an object of this invention is to provide improved agitating and feeding means in a duster apparatus which will insure satisfactory and uniform feeding of the material and consequently will enable the dusting to be performed more efficiently.

Another object of this invention is to provide improved and simplified agitating and feeding means which will operate throughout the entire lower portion of the hopper and combat any tendency for the material to become caked or to form a bridge impeding the free passage or movement of the material.

A further object of this invention is to provide an improved agitating means which, when driven at high speed in a hopper of dusting powder, will not cause an undue amount of air to become mixed with the powder or the powder to be "fluffed up" or become less dense even when the level of the powder is lowered in the hopper.

A related object is to provide an agitating means which will not develop any appreciable amount of heat in the powder or hopper even when driven at high speed.

An additional object of the invention is to provide an improved agitating means in a dusting apparatus which can be driven at the same speed as the feeder means or at the same speed as the blower fan, while enabling the duster to maintain uniformity in the quantity of the

powder dispersed, thus reducing the cost of the operating mechanism in the apparatus.

A still further object of this invention is to provide an improved agitator in combination with a feeder which, while operating at a high rate of speed and moving throughout the entire bottom area of the hopper, will agitate only a small portion of the dust at any given moment, thus requiring only a minimum amount of power for agitating operation.

These objects and other advantages I attain by providing an improved dusting apparatus having a novel agitating and feeding means, constructed and operating as hereinafter described.

In the following description reference is made to the accompanying drawings, in which:

Fig. 1 is a sectional and more or less diagrammatic elevation of a hopper showing my improved agitating and feeding means installed in the same;

Fig. 2 is a fragmentary top plan view of the agitator taken on line 2—2 of Fig. 1;

Fig. 3 is a section of the same taken on line 3—3 of Fig. 1;

Fig. 4 is a sectional elevation similar to that of Fig. 1 of a hopper showing a modified form of my agitating and feeding means installed therein;

Fig. 5 is a sectional elevation of a hopper showing a further slightly modified installation of my agitating and feeding means; and

Fig. 6 is a sectional elevation of a dusting apparatus including a blower fan distributor and showing my agitating and feeding means employed in conjunction with the same.

Referring first to Fig. 1, the hopper 10 as shown has a conically-shaped bottom 11 terminating in a bottom tubular extension 12. A wall 13 extends across the tubular extension at a spaced distance from the lower end of the tubular extension to prevent the powdered material in the hopper from passing down through the tubular extension and to provide a mounting for a shaft bearing. Discharge ports or orifices, indicated at 14 are located above the transverse wall 13.

A vertical shaft 15, supported in suitable bearings (not shown) mounted in the tubular extension 12 and extending up through the transverse wall 13, carries a pulley 16 at the lower end. A belt connects the pulley 16 with power driving means, such as a suitable engine or motor (not shown), whereby rapid rotation is imparted to the pulley 16 and shaft 15.

Above the transverse wall 13, and approximately on the same level with the discharge ports 14, blades or feeder vanes 17 are secured to the shaft 15. Thus rotation of the shaft 15, and with it the vanes 17, causes the vanes 17 to operate as impellers in forcibly discharging the material in the hopper out through the orifices or ports 14. In the duster apparatus illustrated in Fig. 1, the material passing out through the ports 14 is assumed to be discharged into a blower or other special dispersing means not shown in the figure.

In order to keep the material in the hopper 10 from caking, clogging or bridging over the restricted bottom portion of the hopper I provide a novel and simple agitating means connected to the upper end of the shaft 15 and rotated by the shaft 15. The upper end of the shaft 15 is forked and a block 18 is pivotally mounted on a bearing shaft extending between these forks. A pair of bars 19 and 20 have their lower ends pivotally connected to opposite sides of the block 18, their pivotal connections being located in a plane normal to the axis on which the block 18 is pivotally mounted. Thus the bars 19 and 20 are connected with the vertical shaft 15 by what is in effect a universal joint connection. At their upper ends the bars 19 and 20 are rigidly secured to a loop or ring 21 which serves to hold the bars rigidly in parallel relationship with each other and which also serves as a weight in causing the upper part of this assembly to rest against the bottom wall of the hopper. Preferably the loop or ring is formed by cutting a section obliquely from a pipe or tube.

Due to the weight of the bars 19 and 20 and the metal loop 21 to which they are connected and to the universal joint connection with the shaft 15, the rotation of the shaft 15 will not only produce corresponding rotation of the agitating assembly comprising the bars 19 and 20 and their connecting loop 21, but this agitating assembly will continue to rest against the bottom wall of the hopper while rotating and in addition to rotating will also travel more or less slowly around the inside wall of the hopper and thus effectively prevent any bridging or clogging of the material in the bottom portion of the hopper.

It will be apparent that this agitating means, although operating and moving over the entire bottom area of the hopper, will be encountering only a small portion of the material in the hopper at any given moment. Thus much less power is required in the operation of this agitating means than is the case with agitators of the customary types presently used in hoppers of dusting devices. Also, it will be apparent that even very rapid rotation of this agitating means in contrast to the rotation of customary types of agitators, will produce no extensive or appreciable "fluffing" of the material in the hopper, and this will be true regardless of the level of the material in the hopper. The fact that this agitating means and the dispersing or feeding vanes 17 are driven at the same rate of speed is an added advantage in that no reduction drive parts in this mechanism are required.

While the loop or ring 21 of this particular agitating assembly might be formed or shaped differently, there is a particular advantage in having the loop with the diagonal edges as shown since these edges, by having a slicing as well as rotary motion, will exert a modified scraping action and prevent any packing of the material in its path.

In Fig. 4 the agitating means comprises a flexible shaft 22 having its bottom end secured in any suitable manner to the top of the driven shaft 15, and having an element 23 of sufficient weight mounted on the upper portion to keep the upper end of the flexible shaft down against the inside wall of the hopper and thus prevent the flexible shaft from assuming a vertical position at any time. If desired, the element 23 can be in the form of an irregular or off-center weight, so as to cause the upper end of the flexible shaft to jump slightly as it rotates and as it crawls around the wall of the hopper, thus increasing its vibratory and agitating effect. The shaft 22 may be formed in a variety of ways. For example, it can be made of any suitable materials customarily used in known types of flexible shafts, or such flexible shaft may comprise a narrow and elongated coil spring or a strip of rubber-

like composition of suitable diameter and strength. The weight 23 should be sufficient to prevent the flexible shaft from assuming a vertical position. Of course it would be possible to have the shaft 22 so flexible and lithe and of sufficient weight in the end portion so that it will stay against the inside wall of the hopper without any top weight and so crawl around the hopper wall.

Other means might be employed for keeping the flexible shaft bent down in the desired position while rotating. For example, in the hopper 24 of Fig. 5, instead of having a weight at the top end of the flexible shaft 25 for the purpose of keeping the shaft in the desired position with respect to the bottom wall of the hopper around which it travels, an annular shoulder or ring 26 can be provided on the inside of the hopper 24 as shown. The top end of the flexible shaft 25 will extend under the face of the annular shoulder 26 and thus the flexible shaft will be prevented from rising any higher as it rotates and travels in the hopper. With such arrangement it is practical to use a stiffer flexible shaft or spring 25. In other respects the agitating means and the feeding or dispersing means illustrated in this figure function in the same manner as that previously described.

The manner in which my invention can be carried out very simply and inexpensively in a duster apparatus having the customary separate blower for dispersing the dust into the air is illustrated in Fig. 6. In this case the hopper 27 discharges through an extended tubular bottom channel housing 28, the lower end of which extends through a central feeder opening 29 in the blower housing 30, and the end of the tubular channel housing 28 is secured in concentric position with respect to the shaft of the engine 31 which operates the blower distributor.

The blower distributor includes the usual blower fan 32 which may be mounted directly on the engine shaft as shown. A small extension shaft 33 connected with the engine shaft extends into the end of the tubular channel housing 28 and feeder vanes 34 are mounted on this extension shaft, and the flexible shaft 35, comprising the agitating means for the hopper, is secured to the end of this extension shaft 33. The tubular channel housing 28 has outlet feed openings in its tubular wall in registration with the vanes 34, and thus the material from the hopper, passing down through the tubular channel housing 28, is fed by the rotating vanes 34 through these feed openings and into the blower inlet. From thence the fed material is dispersed into the outer air from the blower housing by the action of the blower fan 32 in the usual manner. A suitable end-thrust dust seal (not shown) is provided beyond the end of the tubular channel housing 28 and around the engine shaft so that the dust as it is fed from the tubular housing into the blower will not leak around the shaft.

The flexible shaft 35 comprising the agitating means in this dust distributor extends through the discharging tubular housing 28 and up adjacent the hopper bottom and acts in the manner previously described. A weight 36, similar to weight 23 of Fig. 4 and serving the same purpose as weight 23, namely to hold the top end of the flexible shaft 35 down, is mounted on the upper end of the flexible shaft 35 as shown. Thus in the duster apparatus of Fig. 6 the agitating means in the hopper, the feeding means at the discharging outlet from the hopper, and the dust-dispersing means are all driven directly from the engine shaft. This of course considerably simplifies the construction and cost of such a dust distributor. The agitating means in this distributor requires a minimum amount of power for its operation, and, although driven at rapid speed, it will cause no excessive disturbance or "fluffing" of the powdered material in the hopper or generate any excessive heat. At the same time this agitating means efficiently prevents any clogging or bridging of the material in the hopper or along the discharging channel, so that the delivery of the material from the hopper to the feeding means, thence to the blower and finally to the outside air, will take place efficiently and uniformly as long as the supply of material in the hopper holds out.

Various modifications could of course be made in the duster apparatus of Fig. 6 without departing from the principle of my invention, and similar other modifications will suggest themselves in the simplified dusters illustrated in Figs. 1, 4 and 5 within the scope of this invention.

I claim:

In a power-driven duster apparatus of the character described, a hopper having a substantially conically-shaped bottom converging into a discharging outlet passageway concentric with said bottom, a rotating shaft in said passageway, means for rotating said shaft, and elongated agitating element extending up into said hopper from the center of said outlet passageway adjacent to and parallel to the wall of said conically-shaped bottom, the bottom end of said agitating element connected to the inner end of said shaft by a substantially universal joint connection so as to allow said agitating element to bear against the inside face of said hopper while said shaft and said element are rotated, and a member on the upper end of said agitating element, said member having a circular periphery, whereby with the rotation of said agitating element the contact of said member with the wall of said hopper will cause said member to crawl around on said wall in a circular path and thus move said agitating element around the inside face of said hopper wall, said member having an external surface corresponding to the surface of a section of a circular cylinder cut off at the bottom in a plane oblique to its axis, the axis of said member coinciding with the axis of rotation of said element, whereby the lower peripheral edge of said member will exert a limited scraping action on said hopper wall when said member rolls on said wall.

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