1,880,781

Oct. 4, 1932.

T. L. CAIRNS

ORCHARD DUSTER

Filed March 1, 1932

2 Sheets-Sheet 1

Fig. 1.

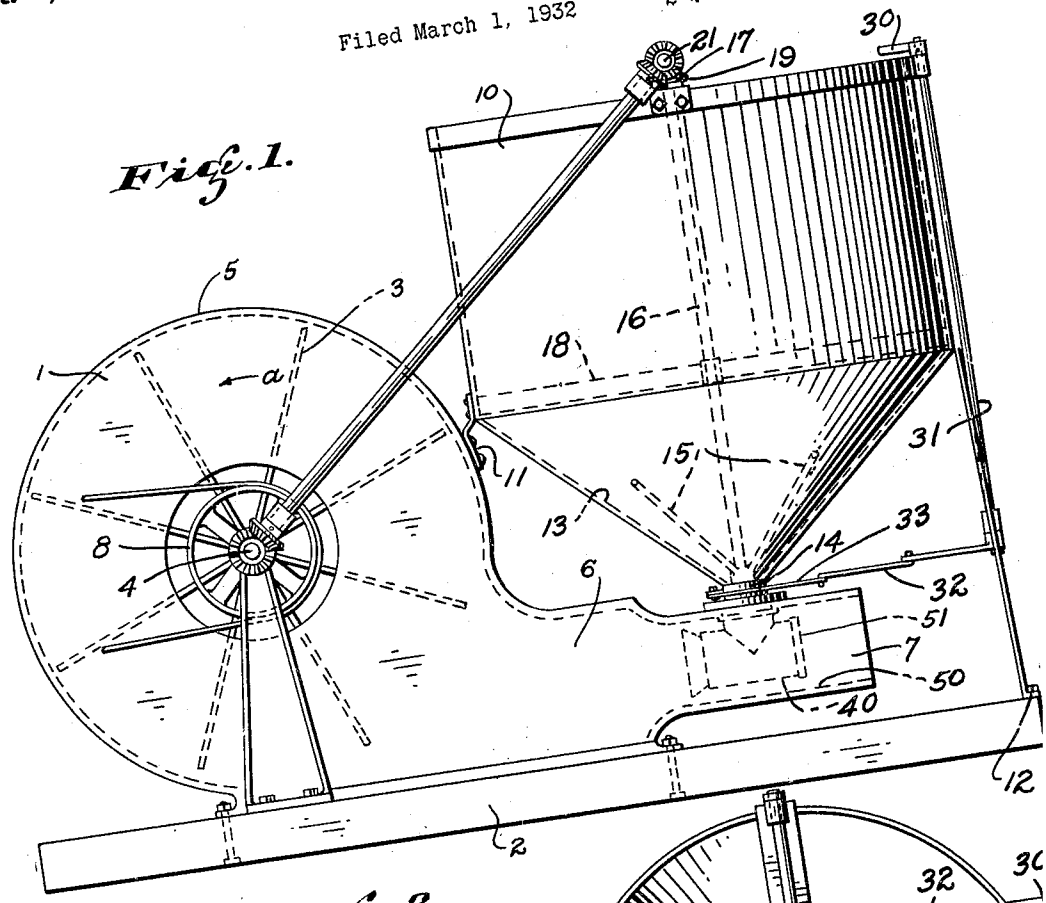
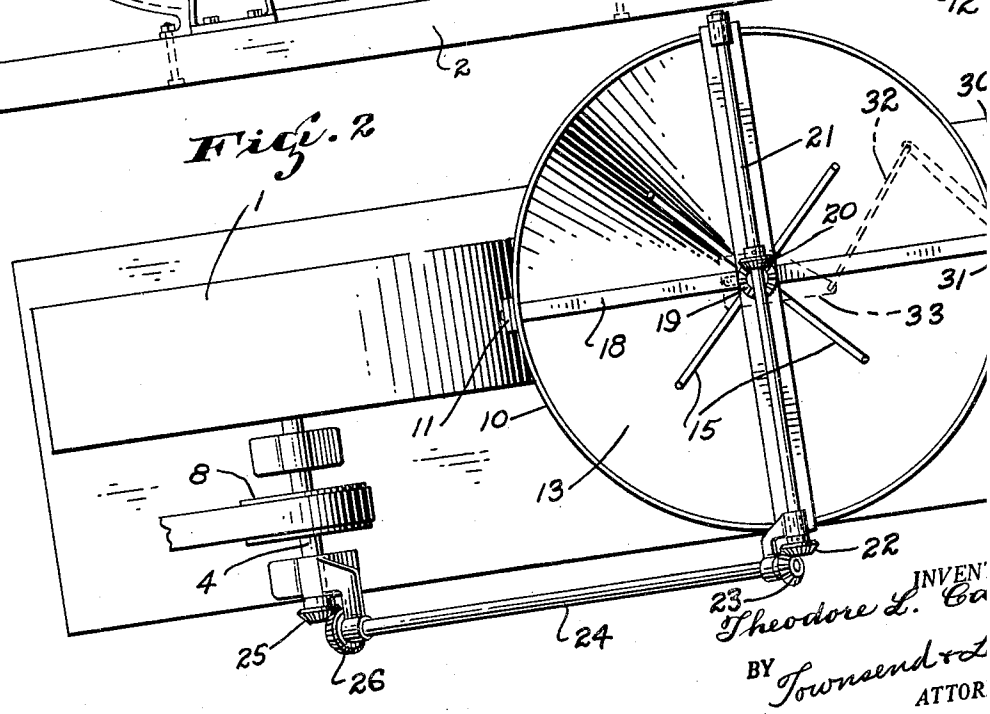


Fig. 2



INVENTOR
Theodore L. Cairns

BY Townsend & Townsend

ATTORNEYS

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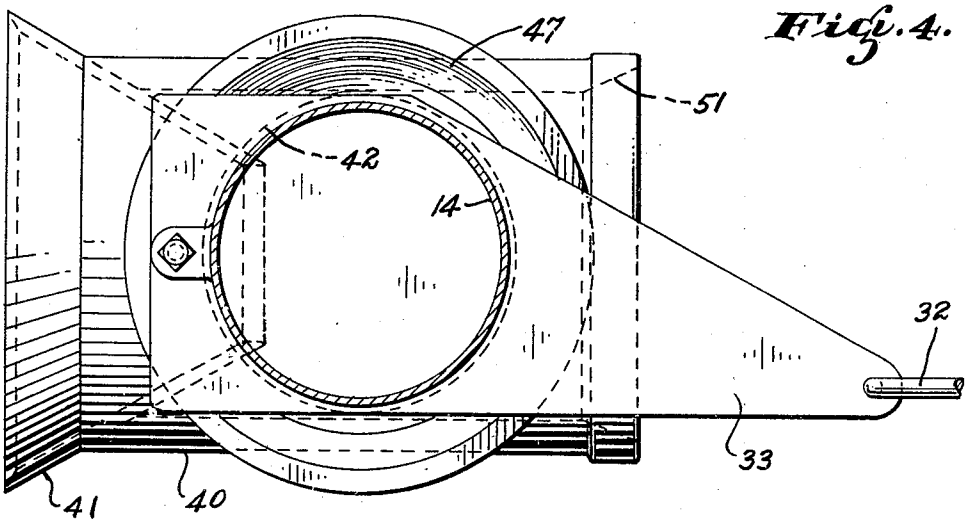
Fig. 4.



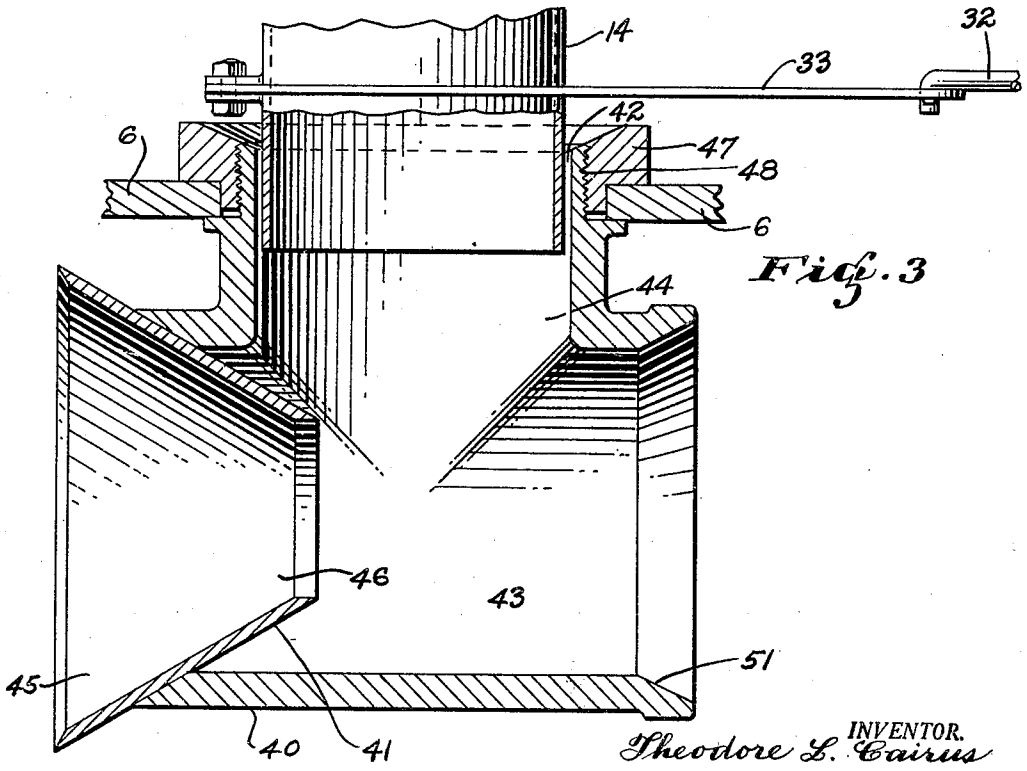


Fig. 3.

INVENTOR.
Theodore L. Cairns

BY
Townsend & Loftus
ATTORNEYS.

Patented Oct. 4, 1932 1,880,781

UNITED STATES PATENT OFFICE

THEODORE L. CAIRNS, OF LINDSAY, CALIFORNIA

ORCHARD DUSTER

Application filed March 1, 1932. Serial No. 596,032.

This invention relates to an improvement in machines used in orchard dusting. The machine functions to blow a very fine insecticidal dust, for instance, sulphur, into the air, and as the dust settles, it deposits itself on the foliage of the trees.

Two types of orchard dusters have been made. The first type is that in which the dust is drawn from the hopper and fed through the blower or fan; the second type is that in which the fan exhausts through an outlet pipe which passes beneath a hopper from which the dust is precipitated into the air stream. In both types, it is common to have an agitator to prevent packing of the dust in the bottom of the hopper.

One advantage claimed for the first type duster is that the hopper can be opened at the top, and can be filled without stopping the machine, because there is no back pressure through the bottom of the hopper tending to blow out the dust when the top is removed. The objection to the first type of duster is that the dust, for instance, sulphur, deposits on the fan blades as a flint-like substance. This, in time, builds up sufficiently to cause friction, heat, sparks and eventually, fire. Actual experience has been that the fan must be opened and the blades cleaned off after eight or nine hours of steady operation. With this type duster, the fire risk is very great.

The disadvantages of the second type machine are that the back pressure, or tendency of the air stream to pass up into the hopper, necessitates using a closed hopper. This requires stopping of the machine each time the hopper supply is replenished. There is thus entailed a considerable loss of time in stopping and starting.

A second objection to this type of machine, as it existed prior to the present invention, is that there is not a sufficient volume of air emanating from the fan or blower, nor a sufficient turbulence in the mixing chamber for the best distribution of the dust. The present invention relates to improvements in this second type of machine, as well as to the first type.

The object of the present invention is to provide a dusting machine with which it is possible to eliminate the fire risk, to run the machine with an open hopper and yet not have the air stream deflect into the hopper, to secure a balancing of the suction which will draw from the hopper a constant flow of dust, regardless of the quantity in the hopper, to increase the air velocity and thereby accomplish a thorough distribution of the dust in the air stream, to create a state of turbulence in the discharge nozzle which further tends to establish a thorough mixing of the dust in the air stream, and to introduce in said air stream a mixing chamber to accomplish the aforesaid results.

The invention is shown by way of illustration in the accompanying drawings, in which—

Fig. 1 is a side elevation of the machine;

Fig. 2 is a plan view of the machine shown in Fig. 1;

Fig. 3 is a cross-section of the mixing chamber;

Fig. 4 is a plan view of the mixing chamber.

In Fig. 1 is shown the assembled dusting machine, composed of a blower, or source of supply for an air stream, a hopper, and means for introducing into the air stream the dust contained in the hopper.

The blower 1 is mounted on base 2, and may be of any conventional type. The one illustrated is composed of a fan with paddles 3 fastened to a shaft 4, and adapted to be rotated in the direction of the arrow A within the housing shell 5. When rotated in this direction, air is drawn in through a suitable inlet adjacent the fan hub shaft 4 and is exhausted into the outlet pipe 6. A suitable hose for directing the stream of air according as use requires may be attached to the end 7 of the outlet pipe 6. The hopper 10 is suitably mounted above the outlet pipe 6, and as shown in Fig. 1, is attached to the blower 1 at 11 and to the base 2 at 12. The bottom of the hopper has a slanting floor 13 adapted to conduct the dust contained in the hopper to the outlet pipe 14.

Suitably mounted in the hopper is an agitator 15 attached to shaft 16 suspended from

a bearing 17. A support 18 is mounted inside the hopper to steady the shaft 16 during rotation. At the top of the shaft 16 is fastened a spur gear 19 which engages with a spur gear 20 carried on shaft 21, which latter shaft is suitably mounted across the top of the hopper. Near one end of the shaft 21 is a second spur gear 22 which engages spur gear 23 mounted on shaft 24 driven by spur gears 25 and 26 from the fan shaft 4. Other suitable driving connections for the agitator shaft 16 may be employed in place of the one just described.

The agitator blades 15 and the lower end, or all of shaft 16, are preferably made of a non-conducting metal to eliminate thereby the fire hazard due to static electricity which may be generated during rotation of the agitator.

The lever 30 through suitable linkage 31 and 32, controls the operation of knife valve 33 located in the outlet pipe 14 at the base of the hopper. In this manner is controlled the quantity of dust introduced into the air stream.

A pulley 8 is attached to the end of fan shaft 4. Any suitable source of power may be used to drive the fan.

Positioned in the outlet pipe 6 is the mixing chamber 40. Thus is provided means in the center of the air stream adapted to increase the velocity of a portion of the air stream, the remainder of said air stream maintaining its normal flow and enveloping said means on all sides, thereby producing a beneficial turbulent action in the outlet pipe as the dust and air approach the end 7, from whence the mixture is conducted through suitable directional means as are well known in the art.

The primary mixing chamber 40 comprises a fitting having three openings, two in line with the air stream, the one nearest the latter's source having a Venturi tube 41 therein; the third being positioned around the hopper opening 14, but with an air inlet 42 formed therebetween. The structure shown in Fig. 3 is T-shaped, although any three-port structure will accomplish a satisfactory result.

The primary mixing chamber shown in Fig. 3 consists of a central passageway 43 in direct line with the air stream passing through the outlet pipe 6. Opening into the top of the passageway 43 is a passageway 44, the diameter of which is slightly larger than the outside diameter of hopper outlet 14. The hopper outlet 14 is positioned in the center of the passageway 44, forming an air inlet 42, which air inlet communicates with the atmosphere.

A Venturi tube 41 is mounted in the end of the chamber 40 nearest the blower 1. The large opening 45 of the venturi faces the blower 1. The opening 45 is of smaller diameter than the outlet pipe 6; hence the air stream from the blower passes both through the venturi and chamber 40 and around it, enveloping the casing of primary mixing chamber 40. The venturi has its smaller opening 46 positioned beneath the hopper outlet 14.

The chamber 40 is held in place in the outlet pipe 6 by means of a nut 47 threaded on the walls 48.

A secondary mixing chamber 50 is formed in the inlet pipe 6 at the outlet 51 of the chamber 40. In this chamber a turbulent action is set up when the enveloping air stream is disturbed by the air stream emerging from the chamber 40 carrying the dust. The velocity of the two air streams will be unequal at this point, resulting in a uniform distortion in the chamber and an equalized distribution of the dust in suspension in the air stream.

By means of the Venturi tube 41, the velocity of that portion of the air stream passing through the venturi is increased, and a vacuum created below the hopper outlet 14. The tendency of this vacuum is to draw the dust from the bottom of the hopper into the air stream. It has been found that when the hopper is full, the vacuum will draw in less dust than with the hopper partially empty when the dust within the hopper is in a fluffed condition. This results in an unequal ratio of dust in the air stream, the dust content increasing as the hopper empties. Several refills of the hopper must be made each hour, and if the operator is to secure a constant dust to air ratio, it would require careful attention on his part and a frequent manipulation of the valve 33. The valve 33 would have to be closed gradually as the level of the dust in the hopper lowered.

By means of the air inlet 42, it has been found that a balancing effect is produced which automatically regulates the suction. A constant quantity of dust is withdrawn, whether the hopper be full or only partially full. In this way, it is possible for the operator to control the mixture ratio by setting the valve 33 at the desired point and no further attention on his part is required to maintain this mixture constant.

The absence of back pressure, or a tendency of the air stream to pass up into the hopper due to the construction of the primary mixing chamber 40, makes it possible to run the machine with the hopper uncovered. The advantage of a construction of this type will be seen when it is realized that the hopper must be filled several times an hour. When it can be done as in this machine, without shutting down the machine, time is thereby saved.

On machines of the type where there is a tendency for the air stream to blow into the hopper, it is necessary to stop the machine,

remove the cover from the hopper—which cover, of course, is a necessity in that type machine—replenish the dust supply in the hopper and replace the cover. Several of such stops during each hour will materially reduce the amount of area covered.

Operation.—A supply of dust, such as sulphur or other insecticide, is placed in the hopper. A suitable length of pipe or hose is attached at 7 to the outlet pipe 6. The motor or other power supply means for the fan 1 is started, the air stream begins to flow through the outlet pipe 6 and the handle 30 is turned to open valve 33 to the point where the desired mixture ratio of air and dust is obtained. The dust in the hopper near the outlet pipe 14 is maintained in a loosened condition by means of the agitator arms 15. As the air stream advances down the outlet pipe 6, it is divided upon contact with edge 45 of the venturi. Part of the stream passes into the venturi and emerges at 46, at a considerably increased velocity and pressure, thereby creating a pull to draw down the dust through the hopper outlet 14. The dust drawn into the primary mixing chamber 40 is picked up by the air stream and carried through the outlet 51. The balance of the air stream which did not enter the venturi at 45 envelops the exterior of the mixing chamber 40 and rushes by the outlet 51. The difference in velocity between the air emerging from 51 and that on the outside causes a state of turbulence at this point, which might be termed the second mixing chamber, resulting in the thorough distribution of the dust particles throughout the volume of air. Once the operator has secured the desired air dust ratio, no further manipulation of valve 33 is necessary, due to the balancing effect of the air passage 42, which has the effect of automatically drawing through the hopper outlet 14 a constant quantity of the dust.

While certain features of the present invention are more or less specifically described, I wish it understood that various changes may be resorted to within the scope of the appended claims, similarly, that the materials and finishes of the several parts employed may be such as the manufacturer may decide or varying conditions or uses may demand.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. In a dusting machine, a combination of means to supply an air stream, an outlet pipe leading from said means, a hopper, means to convey material from said hopper into said air stream, a T-shaped chamber positioned in said outlet pipe, with its continuous passageway in line with said outlet pipe and its center branch extending upwardly surrounding said conveying means, but spaced therefrom to form an air inlet opening and a Venturi tube positioned in the end of the T nearest the air supply means, and having its smaller orifice inside said T.

2. In a dusting machine, a combination of means to supply an air stream, an outlet pipe leading from said means, a hopper, agitating means in said hopper, means to convey material from said hopper into said air stream, a T-shaped chamber positioned in said outlet pipe, with its continuous passageway in line with said outlet pipe and its center branch extending upwardly surrounding said conveying means, but spaced therefrom to form an air inlet opening and a Venturi tube positioned in the end of the T nearest the air supply means, and having its smaller orifice inside said T.

3. In a dusting machine, a combination of a blower, an outlet pipe leading from said blower, a hopper, means positioned in said outlet pipe to create a suction, and a connection between said hopper and said outlet pipe, the outside diameter of said connection being slightly smaller than the opening therefor in the outlet pipe, whereby an air inlet is formed.

4. In a dusting machine, a combination of a blower, an outlet pipe leading from said blower, a hopper, agitating means in said hopper, means positioned in said outlet pipe to create a suction, and a connection between said hopper and said outlet pipe, the outside diameter of said connection being slightly smaller than the opening therefor in the outlet pipe whereby an air inlet is formed.

5. In a dusting machine, a combination of a blower, an outlet pipe leading from said blower, a hopper, agitating means in said hopper, a connection between said hopper and said outlet pipe, the outside diameter of said connection being smaller than the opening therefor in the outlet pipe, whereby an air inlet is formed and a T-shaped passageway so positioned in said outlet pipe as to permit the air stream from said blower to envelop it.

6. In a dusting machine, a combination of a blower, an outlet pipe leading from said blower, a hopper with an opening, means positioned in the air stream adapted to exert a constant pull on material in the hopper comprising a fitting having three openings, two in line with the air stream, the one nearest the latter's source having a Venturi tube therein, the third being positioned around the hopper opening but with an air inlet formed therebetween.

7. In a dusting machine, a combination of means to supply an air stream, an outlet pipe leading from said means, a hopper, agitating means in said hopper, means to convey material from said hopper into said air stream, means positioned in the center of said air stream adapted to increase the velocity of a portion of said air, the remainder of said air

stream maintaining its normal flow and enveloping said means on all sides.

8. In a dusting machine, a combination of means to supply an air stream, a hopper with an opening, and means positioned in the air stream adapted to exert a constant pull on material in the hopper comprising a fitting having three openings, two in line with the air stream, the one nearest the latter's source having a Venturi tube therein, the third being positioned around the hopper opening but with an air inlet formed therebetween.

9. In a dusting machine, a combination of a hopper, means to supply an air stream thereunder and means positioned in the air stream adapted to exert a constant pull on material in the hopper comprising a fitting having three openings, two in line with the air stream, the one nearest the latter's source having a Venturi tube therein, the third being positioned around the hopper opening but with an air inlet formed therebetween.

10. In a dusting machine, a combination of a hopper, means to supply an air stream thereunder, and means positioned in the center of said air stream adapted to increase the velocity of a portion of said air, the remainder of said air stream maintaining its normal flow and enveloping said means on all sides.

11. In a dusting machine, a combination of a hopper, means to supply an air stream thereunder, a primary mixing chamber positioned in the center of said air stream and directly beneath said hopper and a secondary mixing chamber to receive the mixture as it emerges from said primary mixing chamber.

THEODORE L. CAIRNS.