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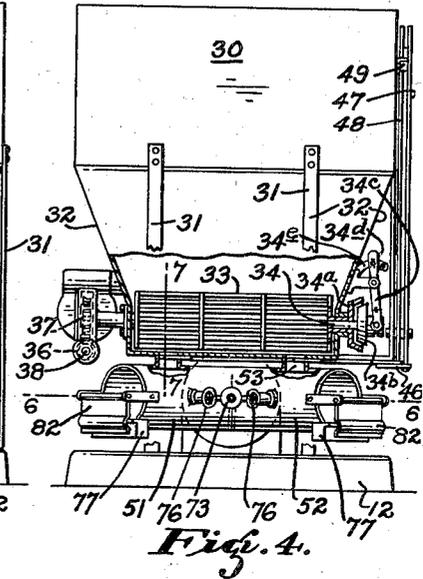
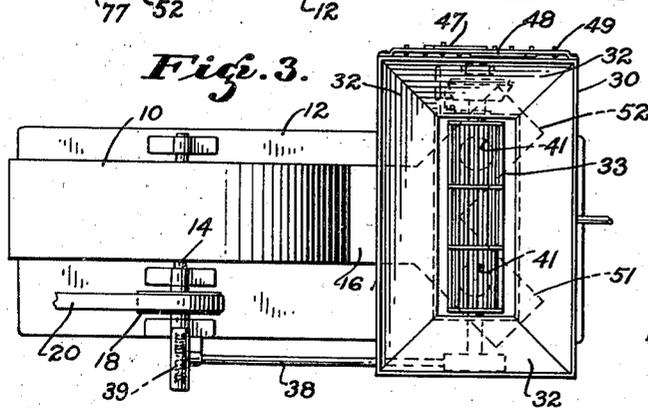
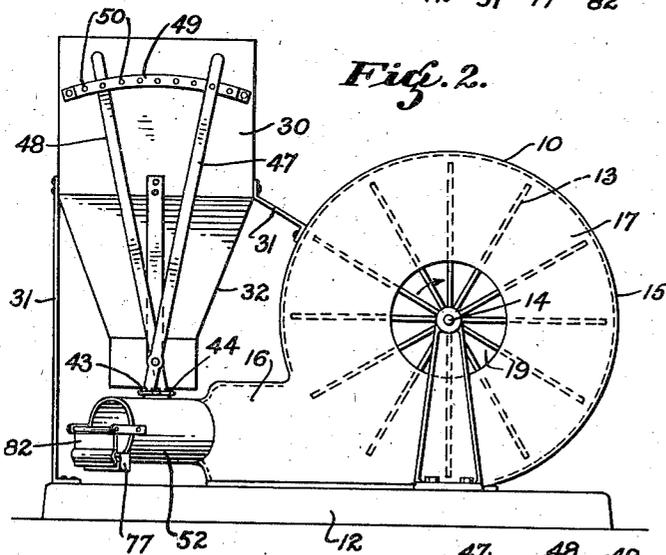
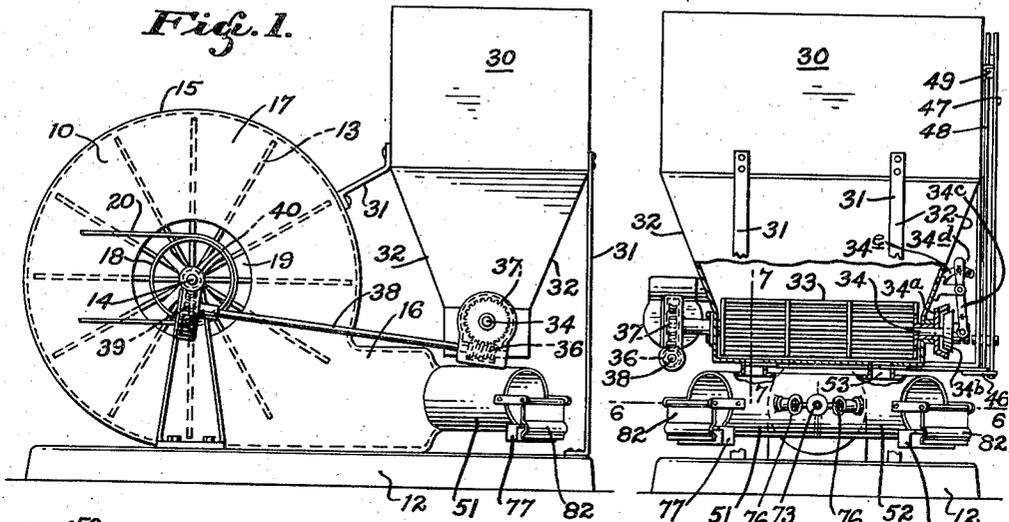
T. L. CAIRNS

2,125,602

ORCHARD SPRAY

Filed Sept. 29, 1934

2 Sheets-Sheet 1



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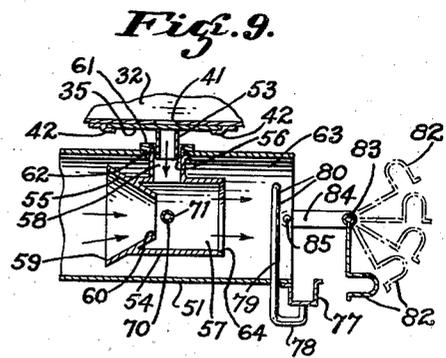
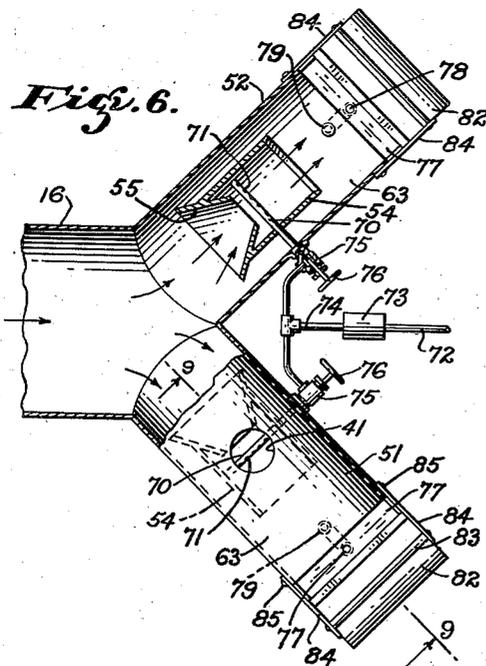
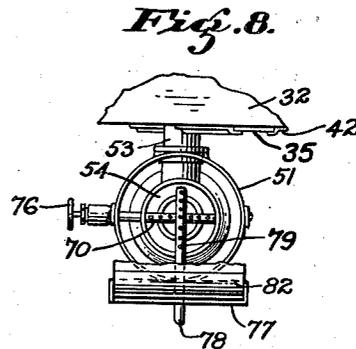
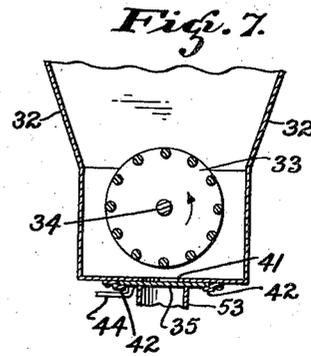
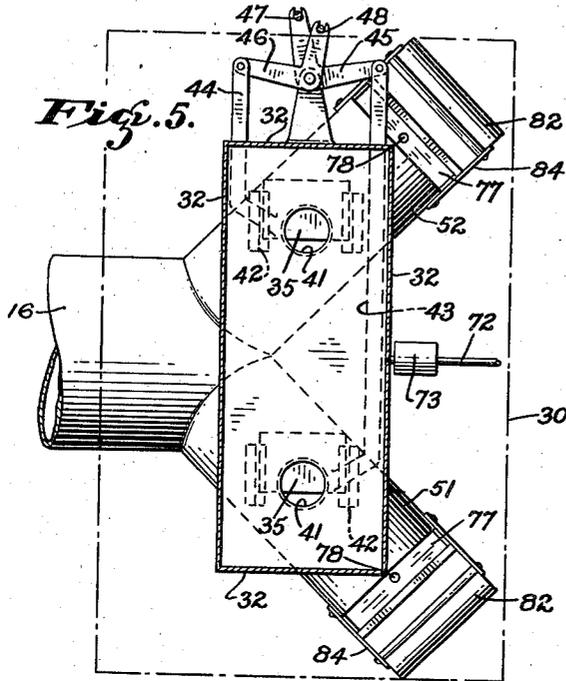
T. L. CAIRNS

2,125,602

ORCHARD SPRAY

Filed Sept. 29, 1934

2 Sheets-Sheet 2



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# UNITED STATES PATENT OFFICE

2,125,602

## ORCHARD SPRAY

Theodore L. Cairns, Lindsay, Calif.

Application September 29, 1934, Serial No. 746,122

### 1 Claim. (Cl. 299—88)

My invention relates to a combination apparatus which can be used for spraying or dusting plants, trees, vines, field crops, etc. When used for dusting, it operates as shown in my U. S. Patent No. 1,880,781 dated October 4, 1932, entitled "Orchard duster".

An object of the present invention is to provide a combination machine that can accomplish all the objects obtained with the machine of my earlier patent and in addition to provide a liquid spray apparatus for use where this type of treatment is desirable.

A further object of my invention is to provide a means for retrieving the liquid which is deposited on the walls of the outlet pipe and then leading this accumulated liquid back into the air stream.

A further object of my invention is to provide a device to spread automatically the liquid spray as it emerges from the outlet pipe.

In the accompanying drawings forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same:

Fig. 1 is a side view of the assembled machine on the drive side,

Fig. 2 is a side view of the assembled machine on the control side,

Fig. 3 is a top plan view,

Fig. 4 is an end view facing the discharge end of the machine,

Fig. 5 is a partial section and top plan view of the discharge end of the machine,

Fig. 6 is a section taken on the line 6—6 of Fig. 4,

Fig. 7 is a section taken on the line 7—7 of Fig. 4,

Fig. 8 is a view looking into the end of a discharge pipe, and

Fig. 9 is a side section taken on the line 9—9 of Fig. 6.

Figs. 1, 2, 3 and 4 illustrate the assembled machine of my invention when set up for liquid spraying comprising the blower, the mixing chambers with the outlet, the spray spreading flaps, and the means for catching the excess liquid and recirculating it back into the air stream.

I have shown the machine set up for use with a liquid spray. When it is to be used for dusting, the spray spreading flaps, the liquid pipe in the mixing chamber, and the liquid recirculating means are removed so as not to interfere with the dust stream.

The blower 10, used to supply an air stream in both liquid spraying and dusting, is mounted on base 12 and is comprised of the casing 15, with

walls 17, the air inlet 19, and the air outlet 16. A multi-bladed fan 13 revolves in the casing 15 and sucks air thru inlet 19 and exhausts it thru outlet 16. The fan is carried on shaft 14, mounted in suitable bearings in the casing walls 17. A source of power (not shown) drives the fan thru pulley 18 and belt 20.

The hopper 30, used only when the machine is operated for dusting, is also supported above the base 12, by any suitable means such as the irons 31. The four sides of the hopper slope inwardly at 32 to guide the sulphur, or other dust spraying material, into contact with the squirrel cage type agitator 33 (see Fig. 4) mounted on shaft 34 at the bottom, and directly over the valves 35 (see Fig. 7). Shaft 34 is rotated slowly by pinion 37 driven by a worm 36 on shaft 38. Shaft 38 is likewise worm driven from the blower shaft 14, by means of pinion 39 and worm 40. The twin worm reductions give the desired speed ratio between shafts 34 and 14.

When it is desired to operate the machine for liquid spraying, the agitator 33 may be disconnected from shaft 34 by means of a clutch, comprised of the clutch member 34a attached to shaft 34, and the clutch member 34b loosely mounted thereon. A shifting yoke 34c fits in a groove in the member 34b, permitting movement of the clutch element by the lever 34d, which is hinged to the base of the hopper and with its other end moving in the guide 34e. The valves 35 remain closed for this operating condition.

Fig. 5 illustrates the valve control means for the valves arranged to uncover the openings 41 in the bottom of the hopper when the machine is used for dusting. These comprise the sliding valves 35, (shown partially opened in Fig. 5) arranged to slide in guides 42 (see Fig. 9) under the control of the links 43 and 44, connected to individual bell cranks 45 and 46, and to separate control levers 47 and 48. These control levers extend up the side of the hopper and engage the guide 49 fastened thereto, and on which is arranged a series of projections 50, to hold the levers in the desired place during operation. By the means described, I attain a separate and individual control over each of the valves 35.

Figs. 4, 5, 6, 8 and 9 illustrate in detail a preferred construction of the outlet pipe as it is arranged when spraying liquid.

The primary mixing chamber 54 comprises a fitting having three openings, two in line with the air stream, the one nearest the latter's source having a Venturi tube 55 therein; the third being positioned around the hopper opening 53, but

with an air inlet 56 formed therebetween. The structure shown in Fig. 9 is T-shaped, although any three-port structure will accomplish a satisfactory result.

5 The primary mixing chamber shown in Fig. 9 consists of a central passageway 57 in direct line with the air stream passing through the outlet pipe 56. Opening into the top of the passageway 57 is a passageway 58, the diameter of which is slightly larger than the outside diameter of the hopper outlet 53. The hopper outlet 53 is positioned in the center of the passageway 58, forming an air inlet 56, which air inlet communicates with the atmosphere.

10 A Venturi tube 55 is mounted in the end of the mixing chamber 54 with the large opening 59 of the venturi facing the blower 10. The opening 59 is of smaller diameter than the outlet pipe 51; hence the air stream from the blower passes both through the venturi and chamber 54, and around it, enveloping the casing of the primary mixing chamber 54. The venturi may have its smaller opening 60 positioned beneath the hopper outlet 58.

15 The chamber 54 is held in place in the outlet pipe 51 by suitable means such as the nut 61 threaded on the walls 62.

20 A secondary mixing chamber 63 is formed in the inlet pipe 51 at the outlet 64 of the chamber 54. In this chamber a turbulent action is set up when the enveloping air stream is disturbed by the air stream emerging from the chamber 54 carrying the dust or the atomized liquid. 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 or liquid in suspension in the air stream.

25 By means of the Venturi tube 55 the velocity of that portion of the air stream passing through the venturi is increased and a vacuum created below the hopper outlet 53 in the case of dusting. The tendency of this vacuum is to draw the dust from the bottom of the hopper into the air stream.

30 It has been found in earlier devices that when the hopper is full the vacuum will draw in less dust than when the hopper is partially empty and with the dust within the hopper 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 35. The valve 35 would have to be closed gradually as the level of the dust in the hopper lowered.

35 By means of the air inlet 56 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 35 at the desired point and no further attention on his part is required to maintain this mixture constant.

40 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 54, 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.

When operated as a dusting machine the spray spreading flap 82, and the liquid pipes 71 and 79 are removed.

While I have described only one branch 51 of the conduit 16, what I have said applies equally to the branch 52. The machine may be built either as a single unit or double unit.

In addition to providing a machine for the introduction of a dry material into the air stream I also provide means for converting the machine into a liquid spray device. For this type of work the machine is used as shown in the drawings, except that the hopper valves 35 remain closed.

A liquid, such as oil or water, is conducted by gravity, to a pipe 70 interposed in the primary mixing chamber 54. The liquid is atomized as it is drawn out of the openings 71 in the pipe 70, by the rapidly moving air stream. These liquid particles are carried in suspension in the air stream until exhausted from the ends of the two pipes 51 and 52. The fog or mist emitted travels from 6 to 8 feet and settles on the plant or tree being sprayed.

The liquid is supplied by gravity to the pipes 70 from a suitable source (not shown) connected to the pipe 72. A strainer 73 removes foreign matter from the oil before it passes thru pipe 74 leading to the needle control valves 75. The handles 76 enable the operator to control at will the amount of liquid introduced into the air stream.

Due to the turbulence in the secondary mixing chamber 63 I have found that about 5% of the atomized liquid is precipitated onto the walls of that chamber and under the influence of the air stream is conducted along said walls to the end thereof.

I provide a novel means (see Figs. 8 and 9) to prevent the loss of this liquid and to cause it to be returned into the air stream. This comprises a catch trough 77 mounted on the end of the mixing chamber 63. A pipe with a horizontal section 78 and vertical section 79 connects with the bottom of the trough. Openings 80 are provided in the vertical section of the pipe on the side opposite the source of the air stream. As the air stream sweeps past these openings 80 it creates a vacuum in the pipe 79 and any oil in the trough 77 is lifted to the openings 80 and atomized into the air stream.

I obtain a novel result in distributing the mist, for by means of flapper 82 hinged at 83 to the bracket 84, the latter being rigidly attached to the chamber wall at 85, the mist is alternately deflected upwardly and downwardly. The air stream reacts on the hinged flapper 82 to cause it to move up and down as shown in dotted lines in Fig. 9. The extent of this up and down movement can be varied to suit the operator, by inserting links 84 of different lengths. The longer the links 84, the less is the disturbance or breaking up of the mist stream. When the flapper 82 is swinging above the center, that is, above its horizontal pivot 83, the air stream emerging from the lower half of the branch 51 will shoot straight out, but the upper half of the air stream will be lifted. As the flapper 82 swings below the center 83, the opposite condition will be established, namely, the upper half of the air stream will shoot straight out and the lower half will be bent downwardly.

In certain parts of this description, I have referred to but one of the mixing chambers 63, and I want it understood that my machine may employ one or more such chambers and that in the drawings, the same reference numerals are given

to duplicated parts in the two-unit structure illustrated.

*Operation as a dusting machine.*—A supply of dust, such as sulphur or other insecticide, is placed in the hopper. The motor or other power supply means for the fan is started, the air stream begins to flow through the conduit 16, and the handles 47 and 48 are moved to open valves 35 to the point where the desired mixture ratio of air and dust is obtained. The dust in the hopper near the outlet pipe 53 is maintained in a loosened condition by means of the squirrel cage agitator 33. As the air stream advances down the conduit 16, it is divided upon contact with edge 55 of the venturi. Part of the stream passes into the venturi and emerges at 60 at a considerably increased velocity and pressure, thereby creating a pull to draw down the dust through the hopper outlet 53. The dust and liquid drawn into the primary mixing chamber 57 is picked up by the air stream and carried through the outlet 64. The balance of the air stream which did not enter the venturi at 55 envelops the exterior of the mixing chamber 57 and rushes by the outlet 64. The difference in velocity between the air emerging from 64 and that on the outside causes a state of turbulence at this point, which might be termed the second mixing chamber, and results 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 the valves 35 is necessary, due to the balancing effect of the air passage 56, which has the effect of automatically drawing through the hopper outlet 53 a constant quantity of the dust.

The machine can be operated as a double dusting unit as shown, or the operator can use it as a single unit by closing one of the valves 35.

*Operation as a liquid spraying machine.*—A source of liquid, such as water or oil, depending upon the results desired, is available and ready

to flow through the valves 75. The motor or other power supply means for the fan is started, the air stream begins to flow through the conduit 16, and either one or both of the valves 75 are opened admitting liquid into pipes 70, from whence the rapidly moving air stream draws the liquid through the openings 71 and atomizes it. By adjusting the valves 75 the operator can obtain the desired air-liquid ratio. As the mixture advances through the chambers 63 a certain percentage of the liquid adheres to the wall and flows into the trough 77. The air stream exerts a pull on this liquid due to the holes 80 in the pipe 79, and a re-entry of this liquid into the air stream is accomplished. As the air stream emerges from the chamber 63 it lifts the flapper 32. The flapper, however, does not assume any one position and hold it, but has been found in practice to vibrate up and down (see Fig. 9).

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 claim, 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:

A vapor spraying machine comprising a conduit, a blower connected to one end of said conduit to produce an air stream therein, a primary mixing chamber suspended within said conduit, a Venturi tube mounted in one end of said chamber with its large end spaced away from the wall of said conduit, a perforated pipe extending into said primary mixing chamber, means for conducting liquid to said pipe, a trough attached at the outlet end of said conduit, means for passing any accumulated liquid from said trough back into the air stream issuing from said conduit.

THEODORE L. CAIRNS.