April 20, 1954 G. W. DAUGHERTY 2,676,057

SPRAYING AND DUSTING MACHINE

Filed June 10, 1950

3 Sheets-Sheet 1

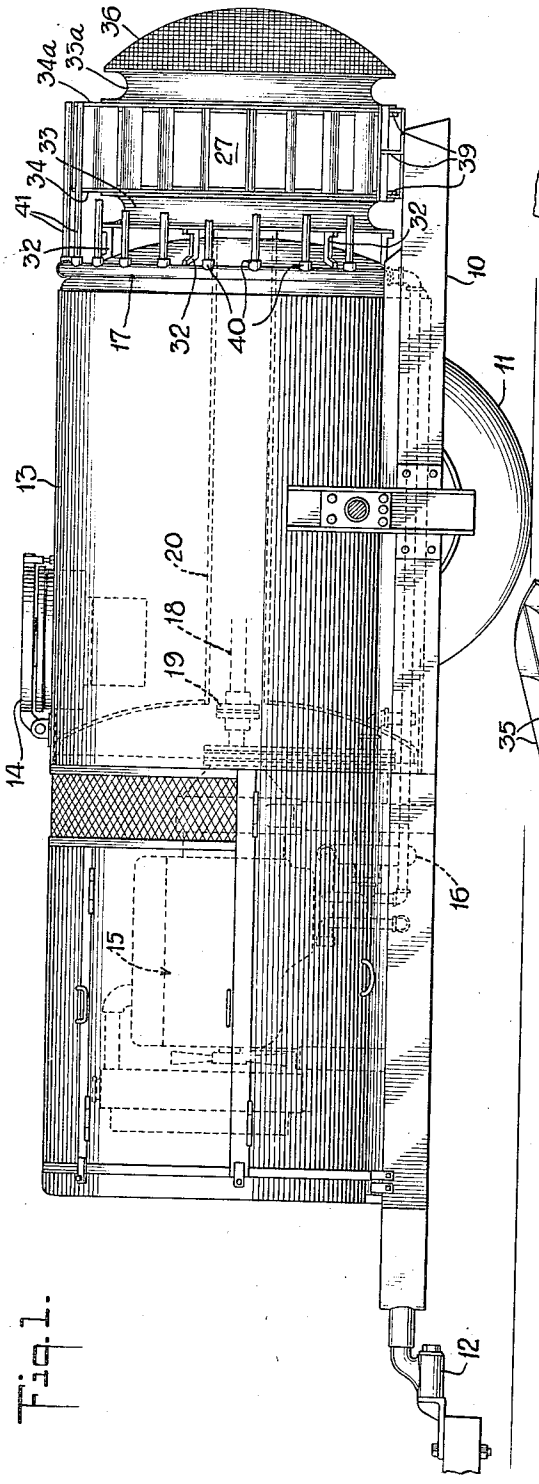


Fig. 1.

Fig. 2.

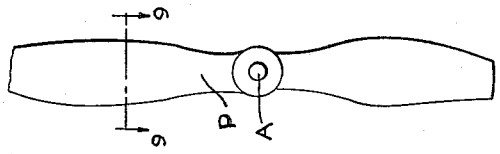


Fig. 3.

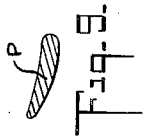
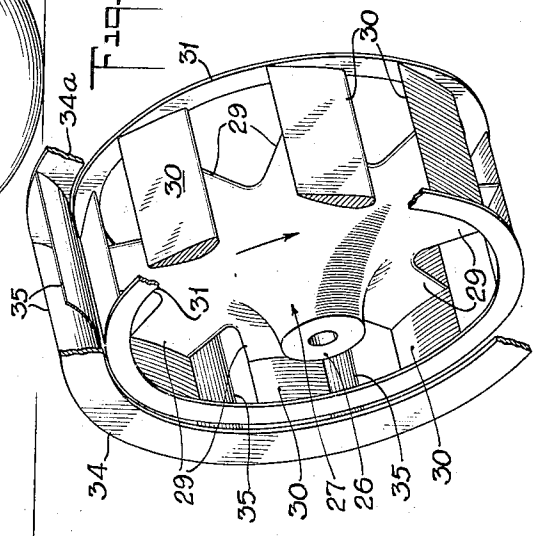


Fig. 4.



INVENTOR
G. W. Daugherty

BY
A. H. Golden
ATTORNEY

April 20, 1954 G. W. DAUGHERTY 2,676,057

SPRAYING AND DUSTING MACHINE

Filed June 10, 1950 3 Sheets-Sheet 2

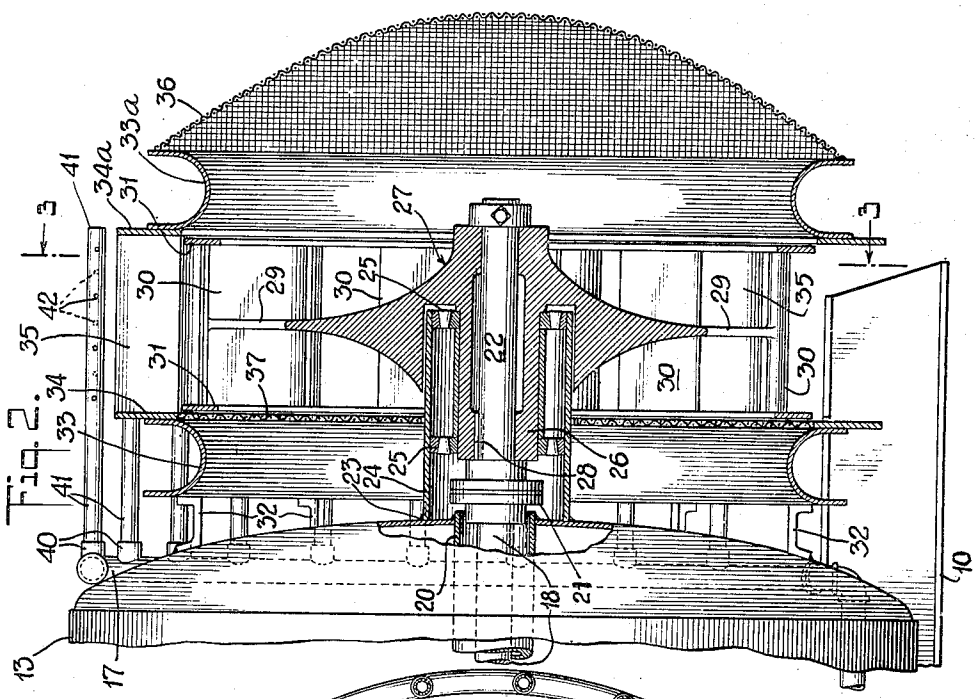


Fig. 2.

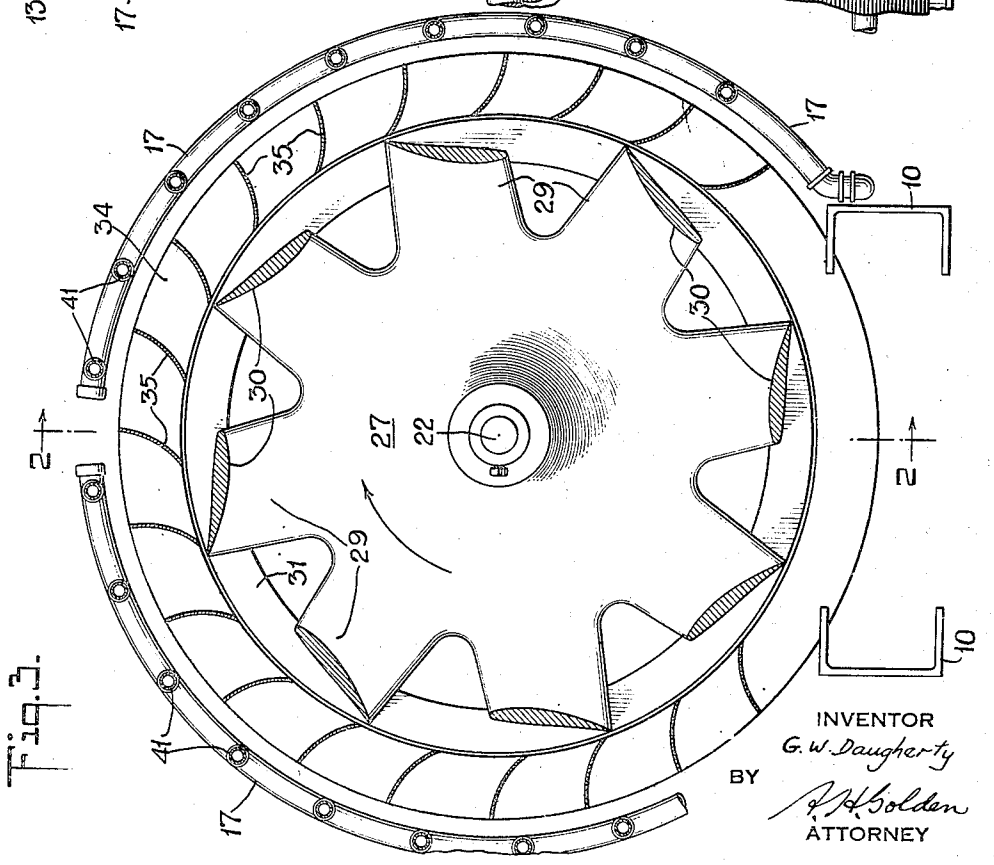


Fig. 3.

INVENTOR
G. W. Daugherty
BY
R. H. Golden
ATTORNEY

April 20, 1954 G. W. DAUGHERTY 2,676,057

SPRAYING AND DUSTING MACHINE

Filed June 10, 1950 3 Sheets-Sheet 3

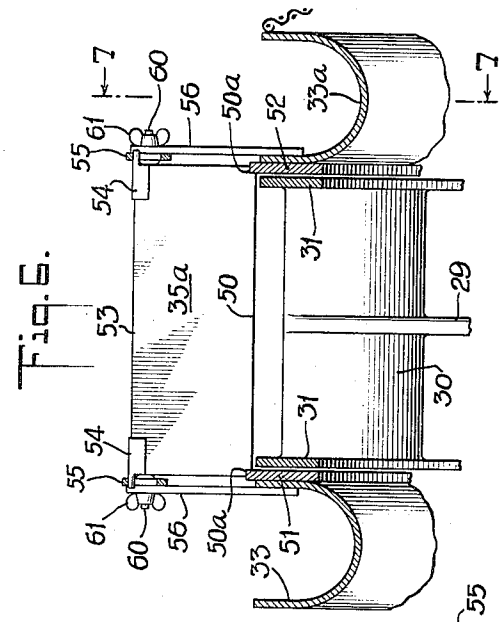


Fig. 6.

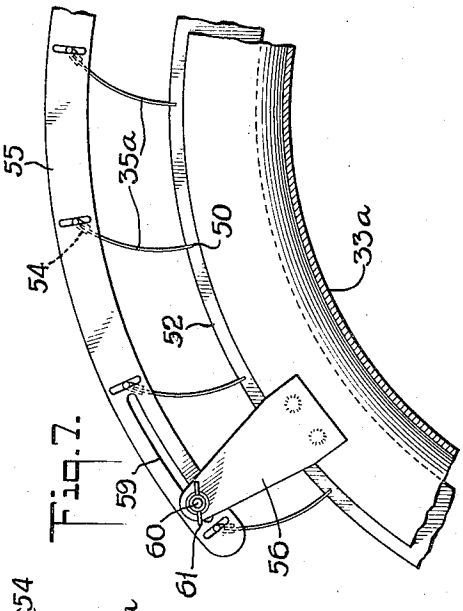


Fig. 7.

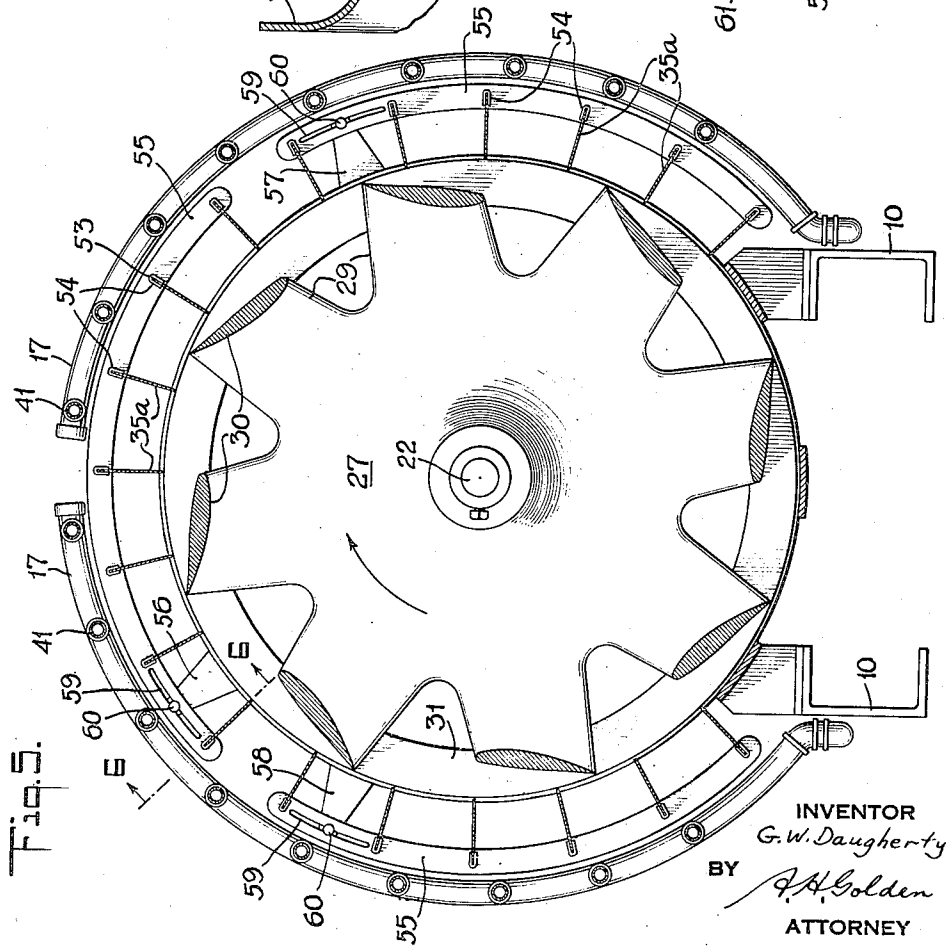


Fig. 5.

INVENTOR
G. W. Daugherty
BY
A. H. Golden
ATTORNEY

Patented Apr. 20, 1954

2,676,057

UNITED STATES PATENT OFFICE

2,676,057

SPRAYING AND DUSTING MACHINE

George W. Daugherty, Tavares, Fla., assignor to Food Machinery and Chemical Corporation, San Jose, Calif., a corporation of Delaware

Application June 10, 1950, Serial No. 167,434

4 Claims. (Cl. 299—45)

1

This application relates to a spraying machine of the type generally set forth and claimed in my Patent No. 2,220,082 granted November 5, 1940, and is a continuation-in-part of my application Serial No. 757,294 filed June 26, 1947, abandoned on June 20, 1950. In my patent, I show a machine for developing an air blast into which is fed spraying and dusting material, the air blast being directed then by suitable deflecting means toward foliage that is to be sprayed or dusted. In this patent, I use air blast developing means in the form of a propeller adapted for rotation about a particular axis and mounted on a vehicle for movement through an orchard, grove or the like. Through the utilization of deflector means, the air blast is directed towards each side of the machine and against the foliage as the machine moves between rows of trees. Through the contribution of my invention set forth in the said patent, it has been made possible to spray trees efficiently and quickly from a continuously moving machine.

In my later Patent No. 2,331,107 I show a further development in a machine of the class set forth in my earlier Patent No. 2,220,082. In the second patent there is set forth a construction whereby the air blast generated in my spraying and dusting machine is more effectively divided for movement angularly relatively to the direction of movement of the machine, and toward the foliage to be sprayed. Thus, in this second patent, the air blast, as in the first patent, is developed in a direction longitudinal of the machine and parallel to the direction of movement of the machine through the orchard or grove being sprayed. It is the function of the air blast deflecting means to deflect the air to each side of the machine and toward the foliage to be sprayed.

In my Patent No. 2,476,960 issued on an application filed January 9, 1946, Serial No. 639,949, I show a spraying and dusting machine of the type under discussion, in which the air blast deflected is in the form of an axially moving ring of air. Through the utilization of a ring-type of deflector, this axially moving ring of air is directed to each side of the machine as the machine moves between a row of trees to be sprayed, for covering the foliage of the trees. Again, I utilize means for developing an air blast that is directed initially axially of the machine and parallel to the direction of movement of the machine during the spraying operation. It is only through the utilization of suitable deflecting means requiring a rather considerable deflection

2

of the air blast that I am able to direct the blast of air and the insecticide carried thereby toward the foliage to be sprayed.

In the invention of this application I depart rather considerably from my prior contributions to this art, although I still adhere to the basic principle of a suitably directed air blast into which may be fed spraying material. It is the object of my present invention to contribute a machine of the class described in which the blast of air is developed initially to move in substantially the direction desired, thereby requiring little or no deflection of the air in order that the air move toward the foliage to be sprayed.

As one feature whereby the broad object of my invention is attained, I utilize means for developing an air blast that moves generally toward the foliage to be sprayed under the influence of the means generating the air blast. More particularly, it is a feature of this part of the invention that the air blast is generated for movement at substantially right angles to the axis of rotation of the air blast generating means so that if the air blast generating means are moved axially between trees, the generated air blast will move toward each side of the machine and toward the trees to be sprayed.

Naturally, in an arrangement of this character, it is necessary to use but a minimum of air deflecting means rather than the considerable deflector system of my prior patents.

As a further feature of my invention, I utilize air blast generating means that will generate an air blast moving radially of the axis of rotation thereof. It is a further feature of this part of the invention that a minimum of tangential movement is imparted to the air blast tending to move the air blast tangentially relatively to the circle of movement of the air blast generating means. Because of this arrangement, it is unnecessary to use a complex deflector sytsem. Naturally, in most cases, the best possible results will be obtained when little or no tangential movement is imparted to the air blast.

Those skilled in the art fully appreciate that a standard type of air foil propeller such as is used in airplanes, and such as is described in my earlier patents to which I have alluded, does not develop a uniform flow of air over the area covered by the revolutions of the propeller. As a matter of fact, very little air movement is created by the end or tip portion of a propeller blade of the class described. In addition, very little air flow is created centrally of the propeller and at its hub.

In my earlier patents and applications to which I have alluded, provision is made for this phenomenon in order to prevent the movement of air from the most efficient portions of the propeller into the areas of air flow covered by the central portion of the propeller and by the tips of the propeller. In addition, I developed a ring type air flow machine shown in my Patent No. 2,476,960 in which the air blast is taken directly from only that part of the propeller that is efficient, and thereby there is avoided the difficulties inherent in the first machines I built. However, the basic problem was not solved by these constructions of the prior art, because of the inherent nature of a propeller of the particular class. In addition, it was always necessary, in the earlier machines made by me, to utilize means for turning the air blast so as to direct it radially toward the foliage.

I have now conceived, and in this application disclose, an air blast generating propeller that is inherently capable of developing a radial air blast. In this propeller, I utilize a series of air blast generating blades, each blade having that cross section which is found in a standard air flow propeller at that part thereof where the greatest amount of air flow is developed. In other words, I have conceived as my invention the taking of that propeller section that is most efficient in a standard propeller, and utilizing it per se as an air blast developing means. Not only do I thus obtain maximum air blast developing efficiency, but I develop a radial air blast moving in the very manner that I require for my spraying machine.

A still further feature of my invention resides in the utilization of deflectors and particularly in means whereby the deflectors may be moved for controlling somewhat the direction of movement of the air blast where such control is necessary.

My invention resides, of course, in the conception and the reduction to practice of the general combination I have described, and it is conceivable that those skilled in the art will be able to develop particular shapes of blades and other air blast creating means that will function adequately to contribute the results I have sought. It is my intention to claim the invention broadly so as to protect myself in the enjoyment thereof, and to prevent the appropriation thereof by those skilled in the art who may use in a machine of the class herein set forth other types of air blast creating means operating in accordance with my teachings to the art.

Referring now to the drawings, Fig. 1 is an elevation of a spraying machine embodying my invention. Fig. 2 is a vertical section and elevation of the rear end of the machine shown in Fig. 1, Fig. 2 being taken substantially along lines 2—2 of Fig. 3. Fig. 3 is a section taken along lines 3—3 of Fig. 2. Fig. 4 is a perspective view of the propeller of my machine showing its relation to the deflectors. Fig. 5 is a view similar to Fig. 3, but showing the utilization of adjustable deflectors. Fig. 6 is a section taken along lines 6—6 of Fig. 5, while Fig. 7 is a section taken along lines 7—7 of Fig. 6. Fig. 8 is an elevation of a standard propeller such as is found in my earlier applications and patents. Fig. 9 is a section taken along lines 9—9 of Fig. 8.

Referring now more particularly to the drawings, and especially Figs. 1 to 4 inclusive, the machine of my invention comprises a chassis 10 supported by a pair of wheels 11 and adapted to be drawn through an orchard, orange grove, or the like by a tractor hitched to the machine at 12. Supported on the chassis 10 centrally of the machine is a tank 13 adapted to contain insecticide and to be filled through a filler cap 14. An internal combustion engine 15 is mounted within the machine and through suitable transmission means drives a pump 16 for pumping spraying material from the tank 13 toward a pair of main pipes 17, best shown in Fig. 3.

The internal combustion engine rotates a main shaft 18 through a flexible coupling 19 and this main shaft passes through a pipe 20 welded to the ends of the tank 13 and forming a through central passage for shaft 18. The extreme right hand end of the shaft 18 is coupled through a flexible coupling 21 to a propeller shaft 22. Shaft 22 is thus supported for rotation with the shaft 18 by the internal combustion engine 15, it being the purpose of this arrangement to drive the shaft 22 at a rather considerable speed for rotating an air blast generating propeller.

The apparatus I have thus far described is not per se the invention of this application. Thus, reference to my earlier patents and my earlier application hereinbefore discussed will indicate rather clearly that the apparatus so far described is quite similar to that I have heretofore contributed. However, heretofore, the propeller driven by a shaft equivalent to the shaft 22 has been of the type generating a blast of air parallel to the shaft 22, this being the axis of rotation of the propeller. In this application, the propeller is so constructed that the blast of air generated will move in a direction at substantially right angles to the axis of shafts 18, 22 and will preferably be radial relatively to the axis of shafts 18, 22. By this variation from my prior art machines, I am able to eliminate the rather complex air deflector means found in my earlier inventions. It is thought that this general statement regarding the relation of my present invention to my prior inventions will be helpful in an understanding of the means now to be described more particularly.

Welded to the end of the tank 13 as shown at 23 in Fig. 2 is a sleeve 24. Sleeve 24 supports roller bearings 25 and through these roller bearings 25 there is supported the hub 26 of the propeller designated generally by reference numeral 27. The hub 26 is keyed at 28 to the shaft 22 for rotation thereby, the roller bearings 25 acting to support the propeller relatively to the sleeve 24. Of course, the particular means I have shown for mounting the propeller 27 are merely exemplary of one preferred manner of so doing, and those skilled in the art will readily appreciate that other means may be employed when desired.

Referring now to Fig. 8, I show there a standard type propeller P such as is found in my earlier applications and patents. The section of propeller P taken along lines 9—9 of Fig. 8 is the section, that, through rotation of the propeller about the axis A, generates a movement of air which is greater than the movement of air generated by any other part of the propeller P. The particular section is well illustrated in Fig. 9, and is of the usual air foil shape employed in the propeller of the class described, as will be well appreciated by those skilled in the art. It is substantially the configuration of this section shown in Fig. 9 that is utilized as the configuration of the section of the propeller blade of my air blast generating propeller now to be described more particularly.

Propeller 27, as is probably best shown in Figs. 2 and 4, has a series of arms 29 extending from the hub 26, and at the end of each of the said arms 29 there is mounted a propeller blade 30. Each propeller blade 30 is formed so that its cross section taken in a plane centrally thereof and perpendicular to the axis of rotation of the propeller, will be substantially the same in configuration as the section of the propeller P shown in Fig. 9. Through the movement of the several blades 30 there will be generated a blast of air that will be generally radial relatively to the axis of shafts 18, 22, as the blades 30, due to their section, will generate but little flow of air in a direction tangential to the circle of movement of the blades. It will be appreciated further, that the number of blades may be increased or decreased, and that their angular spacing from one another may therefore be varied. While I presently prefer a blade 30 of uniform section as illustrated in the drawings, it may be that the blades will be tapered toward their ends. I believe that the theory of operation of the several blades 30 will now be understood by those skilled in the art.

Preferably, but not necessary, the ends of the several blades 30 are reinforced by rims 31 secured thereto and therefore forming part of the propeller 27.

Referring now once again to Figs. 1 and 2, it will be noted that there is welded to the end of the tank 13 a series of brackets 32 and welded in turn to the brackets 32 is a U-section air intake guide member 33 formed as a spinning or casting. U-section member 33 is in turn welded to a ring 34 relatively to which may be welded a series of curved air deflectors 35, also well shown in Fig. 4. Welded to the right-hand end of each deflector 35 is a second ring 34*a*, and welded to ring 34*a* is a U-section member 33*a* similar to the U-section member 33. Suitable brackets 39 extend upwardly from frame 10 of the machine and help support the rings 34, 34*a* and the other parts welded thereto. Suitably secured to the U-member 33*a* is a dished screen 36. A flat screen 37 may be secured across the opening of the ring 34. It will be appreciated that air will move past the inner rounded surfaces of the air intake guide members 33 and 33*a* toward the propeller 27 to be used in creating an air blast by the several blades 30. It will be further appreciated that the screens 36, 37 will protect the propeller against the entrance of large parts of debris or other extraneous material.

The deflectors 35 function to accept the air moved thereagainst by the blades 30 and to direct the air so that it will flow generally radially of the machine toward the foliage being sprayed. The curved form of deflectors 35 is helpful in accepting the air blast and in eliminating those portions thereof having movement components in a tangential direction relatively to the rotation of the propeller. Thus, any air tending to flow other than radial will be accepted by the deflectors 35 and moved radially toward the foliage to be sprayed.

It is well to note that the air blast generated radially at the bottom of the machine may be allowed to move downwardly toward the ground or else be caused to flow circularly and tangentially with the propeller to augment that air moving radially relatively to the deflectors 35. It is also possible to utilize means adapted to channel this portion of the air blast for flow in a particular direction to augment other parts of the air blast, all as is set forth in an application filed by an associate, Richard A. Andrews, Serial No. 770,361, filed August 25, 1947, allowed as Patent No. 2,569,274.

As was set forth generally above, the spraying material is fed by the pump 16 by a pair of main pipes 17 mounted at the end of tank 13. These main pipes 17 are formed with a series of openings to which are secured nipples 40, and threaded into the several nipples 40 are a series of pipes 41, each carrying suitable nozzles 42. Of course, the pipes 41 through the nozzles 42 will feed spraying material for acceptance by the air blast and for movement by the air blast radially toward the foliage to be sprayed.

In Figs. 5, 6, and 7, I show a modified form of my invention wherein the several deflectors 35 are adapted for adjustment, and are not fixed between two rings 34, 34*a* as in my first modification. Thus, in Figs. 5, 6, and 7, the several deflectors are designated by reference numeral 35*a* rather than by reference numeral 35 as in the first modification. The inner edges 50 of the several deflectors 35*a* are welded at their ends 50*a* to rings 51 and 52 that are the equivalent of the rings 34, 34*a* of my first modification. The outer edges of the deflectors 35*a* are designated by reference numeral 53 and have secured at their opposite ends clips 54 that are in turn secured to a curved plate 55, there being three of these curved plates 55 at each side of the deflector assembly.

Welded to one arm of each of the U-section members 33, 33*a* are brackets 56, 57, and 58, there being one bracket at each side for each of the curved plates 55. Each of the curved plates 55 is equipped with a slot 59 in which rides a bolt 60 carried by one of the brackets 56, 57, 58 and threaded for a wing nut 61. It is obvious that each of the curved plates 55 may be moved as from the position of Fig. 5 to a position such as shown in Fig. 7, there to be secured in place by a bolt 60 and a wing nut 61 relatively to one of the brackets 56, 57, 58. The particular deflectors 35*a* shown in Fig. 7 are, of course, now adjusted for a particular condition.

Adjustability is desirable because frequently wind conditions will affect the operation of the machine and the deflectors can be adjusted to offset somewhat the effect of the wind. In addition, tree heights vary, and spraying conditions are, of course, different for various types of trees and insecticide materials. While I show means for adjusting the deflectors in three different groups, those skilled in the art will readily appreciate that it is possible to adjust the deflectors individually or in a different grouping, depending upon conditions.

I think that the construction of my invention and its mode of operation will now be apparent to those skilled in the art.

I now claim:

1. In a spraying machine of the class described, an air blast generating propeller, means mounting said propeller on a vehicle for rotation about an axis substantially parallel to the direction of movement of said vehicle, said propeller having a hub and a series of air blast generating blades circumferentially spaced about said axis on said hub for rotation to generate a blast of air radial at all circumferential points relatively to said hub and axis, each of said blades spanning a substantial linear distance parallel to the axis of rotation thereof, the section of each blade taken centrally of the linear span thereof in a plane perpendicular to the axis of rotation of said propeller being substantially the same in configura-

tion as the section of a conventional air foil, and means for feeding spraying material to said radial blast of air at points circumferentially spaced about said axis of rotation for more than 180°.

2. In a spraying machine of the class described, an air blast generating propeller, means mounting said propeller for rotation about a predetermined axis, said propeller having a hub and a series of air blast generating blades fixed thereto circumferentially spaced about said axis on said hub for rotation to generate a blast of air radial at all circumferential points relatively to said hub and axis, each of said blades spanning a substantial linear distance parallel to the axis of rotation thereof and determining by its span the width of the radial air blast generated by said propeller, the section of each blade taken centrally of the linear span thereof in a plane perpendicular to the axis of rotation of said propeller being substantially the same in configuration as the section of a conventional air foil, and means for feeding spraying material to said radial blast of air at points circumferentially spaced about said axis of rotation for more than 180°.

3. In a spraying machine of the class described, an air blast generating propeller, means mounting said propeller on a vehicle for rotation about an axis substantially parallel to the direction of movement of said vehicle, said propeller having a hub and a series of air blast generating blades fixed to said hub and circumferentially spaced about said axis for rotation to generate a blast of air radial at all circumferential points relatively to said hub and axis, each of said blades spanning a substantial linear distance parallel to the axis of rotation thereof and determining by its span the width of the radial air blast generated by said propeller, the section of each blade taken centrally of the linear span thereof in a plane perpendicular to the axis of rotation of said propeller being substantially the same in configuration as the section of a conventional air foil, and means for feeding spraying material directly to said radial blast of air at radial points relatively to said axis of rotation circumferentially spaced about said axis of rotation in position to be received in the radially flowing blast for movement therewith radially of said axis of rotation toward foliage to be sprayed.

4. In a spraying machine of the class described, an air blast generating propeller, means mounting said propeller for rotation about a predetermined axis, said propeller having a hub and a series of air blast generating blades fixed to said hub and circumferentially spaced about said axis for rotation to generate a blast of air radial at all circumferential points relatively to said hub and axis, each of said blades spanning a substantial linear distance parallel to the axis of rotation thereof and determining by its span the width of the radial air blast generated by said propeller, the section of each blade taken centrally of the linear span thereof in a plane perpendicular to the axis of rotation of said propeller being substantially the same in configuration as the section of a conventional air foil, and means for feeding spraying material directly to said radial blast of air at radial points relatively to said axis of rotation spaced about said axis of rotation in position to be received in the radially flowing air blast for movement therewith radially toward foliage to be sprayed.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
997,678	Jalonick	July 11, 1911
1,778,046	Strobell	Oct. 14, 1930
1,856,120	Valentine	May 3, 1932
2,037,880	Charavay	Apr. 21, 1936
2,331,107	Daugherty	Oct. 5, 1943
2,358,318	Daugherty	Sept. 19, 1944
2,374,955	Raper	May 1, 1945
2,423,008	Daugherty	June 24, 1947
2,429,374	Shade	Oct. 21, 1947
2,431,724	Aydt	Dec. 2, 1947
2,547,927	Daugherty	Apr. 10, 1951
2,569,274	Andrews	Sept. 25, 1951

FOREIGN PATENTS

Number	Country	Date
52,538	Netherlands	Nov. 15, 1940
588,592	Great Britain	May 28, 1947
608,703	Great Britain	Sept. 20, 1948
623,356	Germany	Dec. 19, 1935