Dec. 2, 1952 J. M. HAIT 2,620,230

INSECTICIDE SPREADING MACHINE

Filed Oct. 4, 1947 6 Sheets-Sheet 1

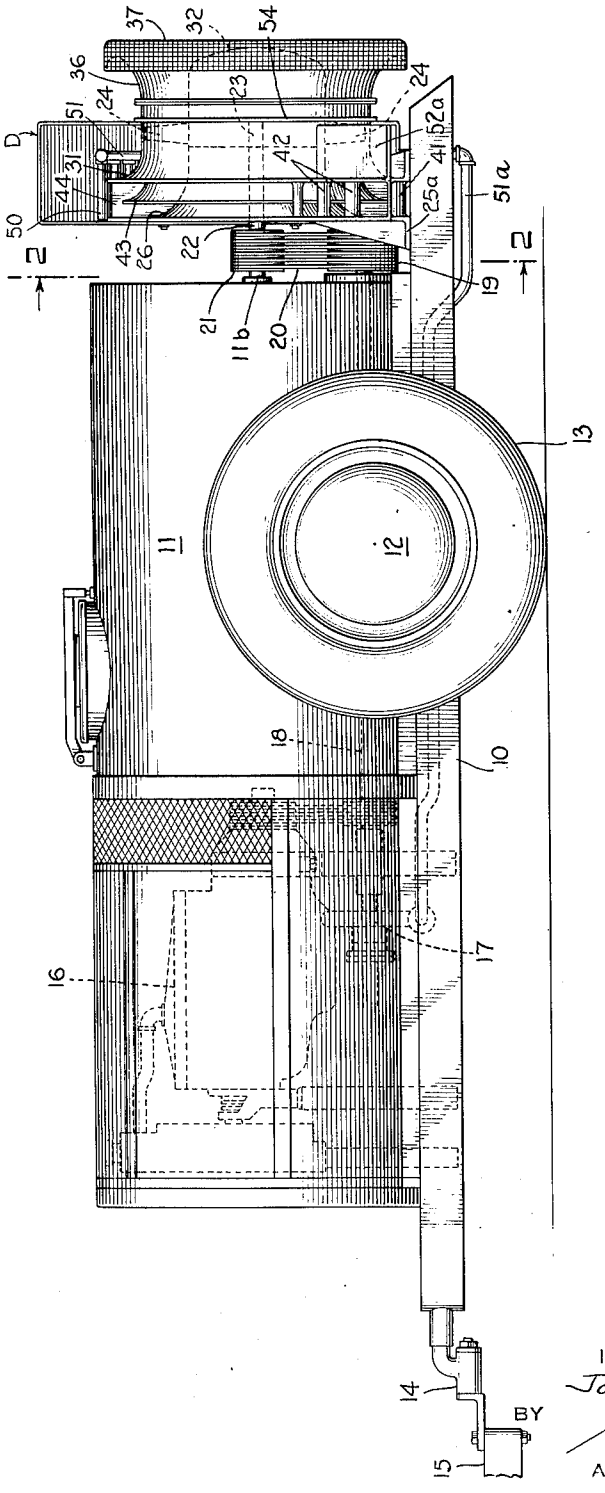


Fig. 1.

INVENTOR
James M. Hait
BY
J. H. Golden
ATTORNEY

Dec. 2, 1952 J. M. HAIT 2,620,230

INSECTICIDE SPREADING MACHINE

Filed Oct. 4, 1947 6 Sheets-Sheet 2

Fig. 1.

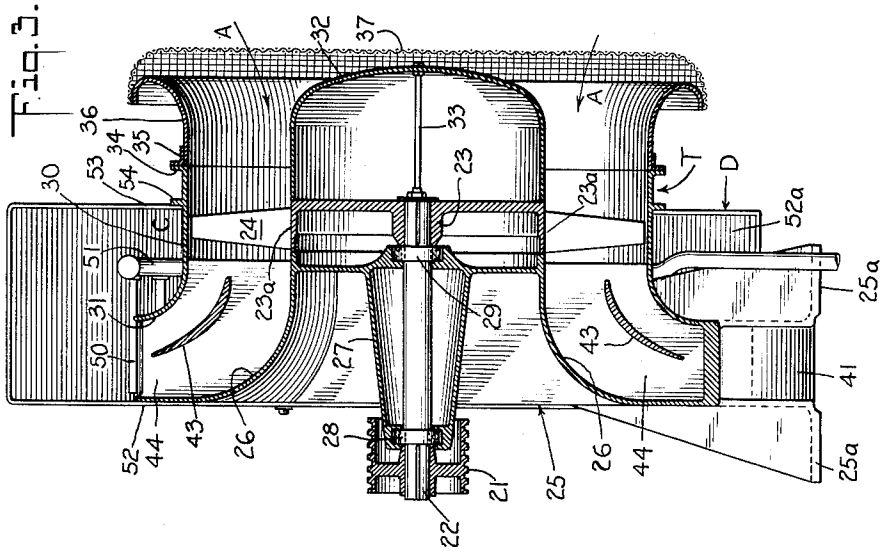
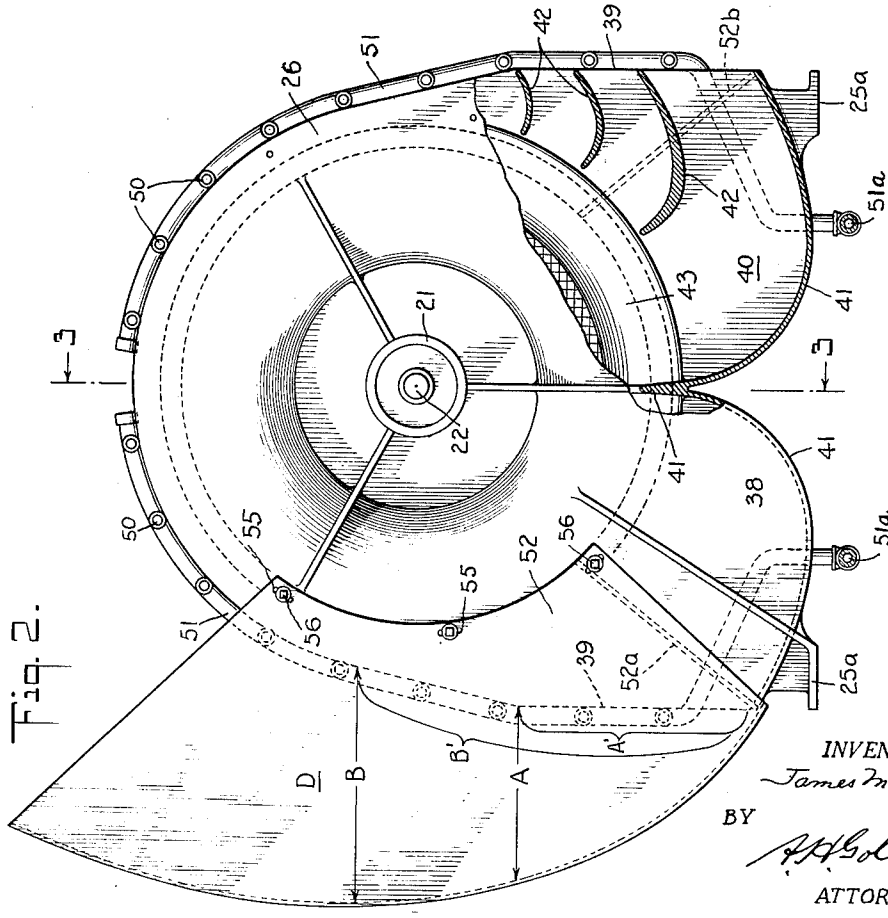


Fig. 2.



INVENTOR.
James M. Hait
BY
A. H. Golden
ATTORNEY

Dec. 2, 1952 J. M. HAIT 2,620,230

INSECTICIDE SPREADING MACHINE

Filed Oct. 4, 1947 6 Sheets-Sheet 3

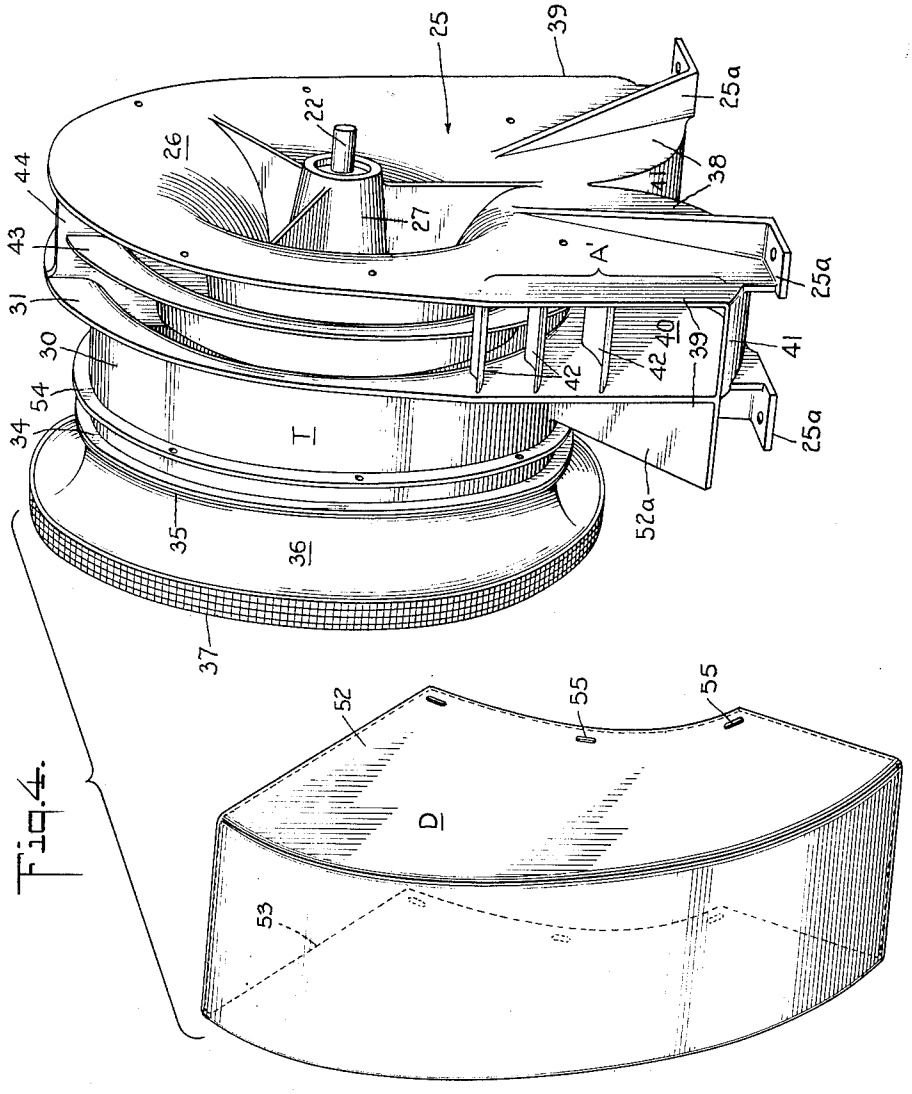


Fig. 4.

INVENTOR.
James M. Hait
BY
A. H. Golden
ATTORNEY

Dec. 2, 1952 J. M. HAIT 2,620,230

INSECTICIDE SPREADING MACHINE

Filed Oct. 4, 1947 6 Sheets-Sheet 4

Fig. 6.

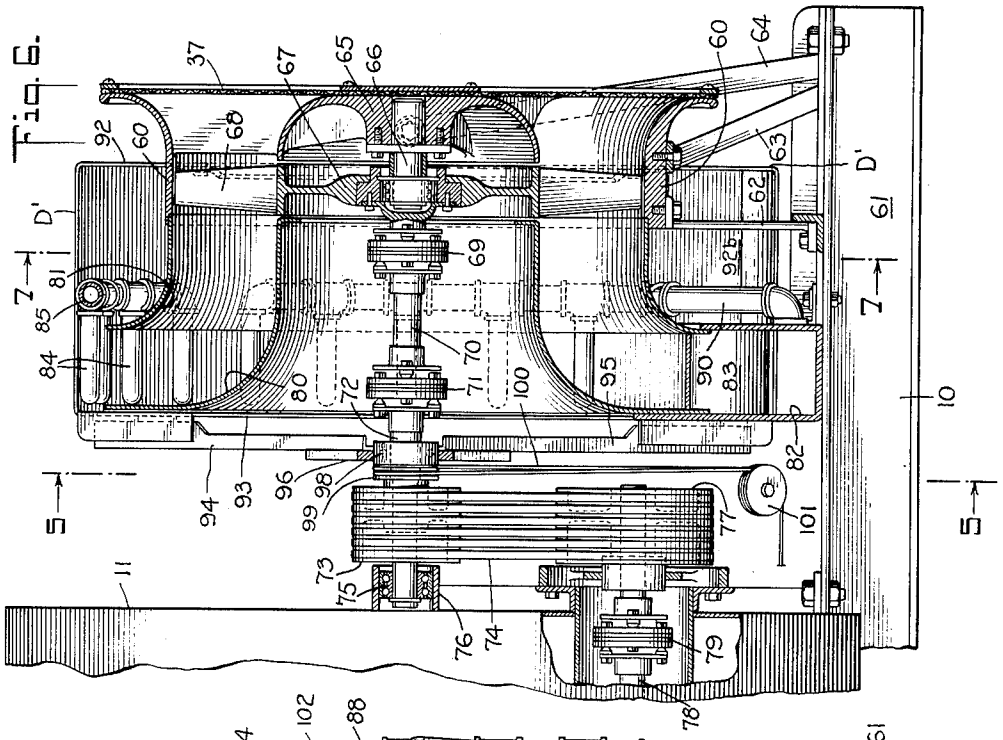
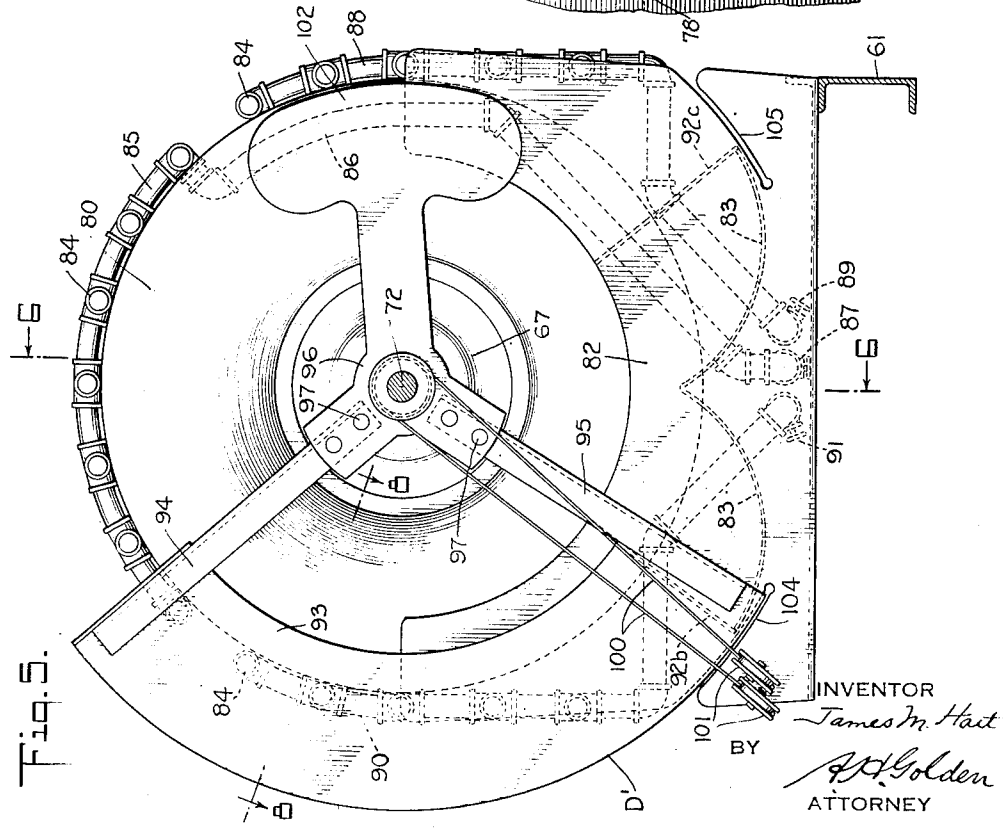


Fig. 5.



INVENTOR
James M. Hait
BY
A. H. Golden
ATTORNEY

Dec. 2, 1952 J. M. HAIT 2,620,230

INSECTICIDE SPREADING MACHINE

Filed Oct. 4, 1947 6 Sheets-Sheet 5

Fig. 8.

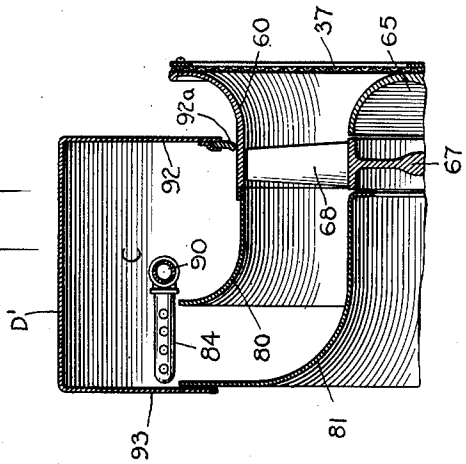


Fig. 9.

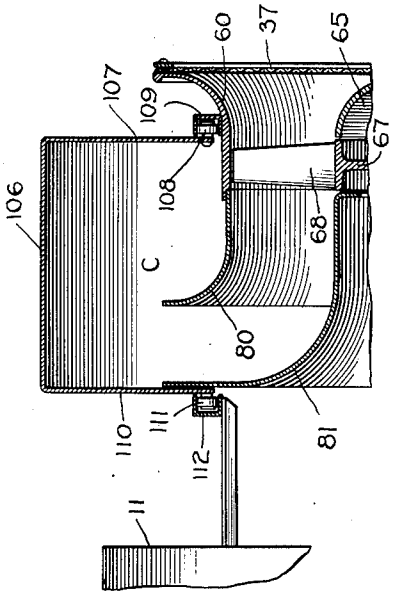
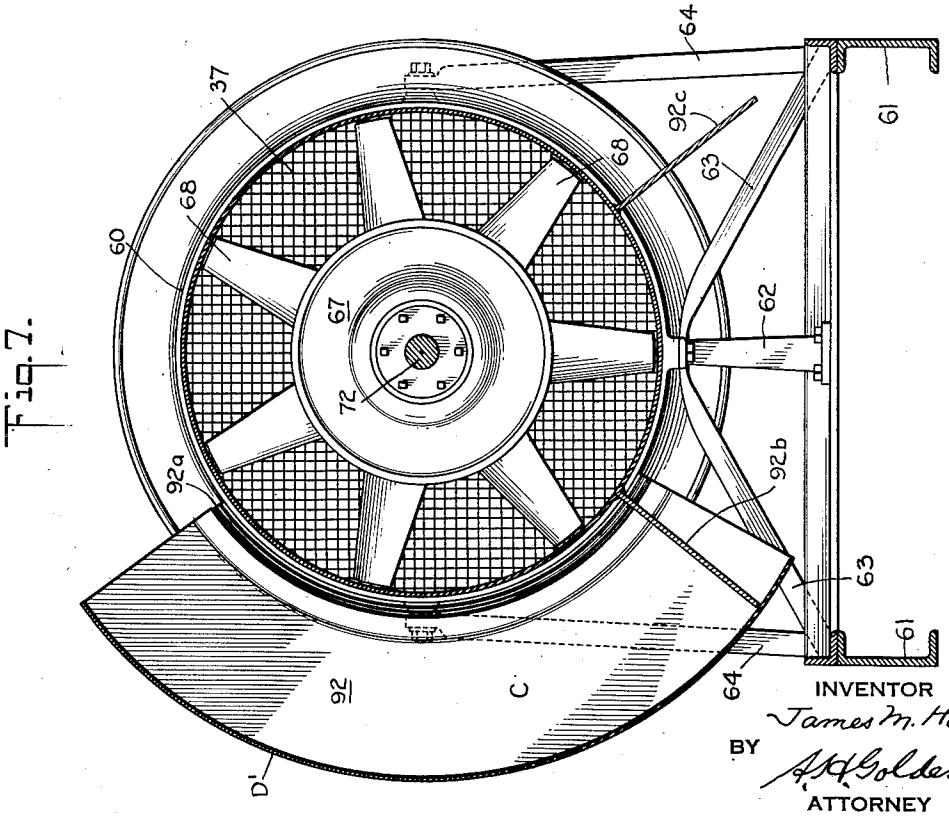


Fig. 7.



INVENTOR
James M. Hait
BY
A. H. Golden
ATTORNEY

Dec. 2, 1952 J. M. HAIT 2,620,230

INSECTICIDE SPREADING MACHINE

Filed Oct. 4, 1947 6 Sheets-Sheet 6

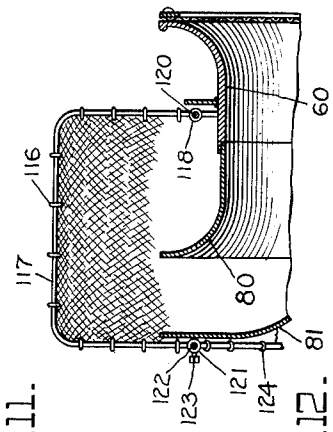


Fig. 11.

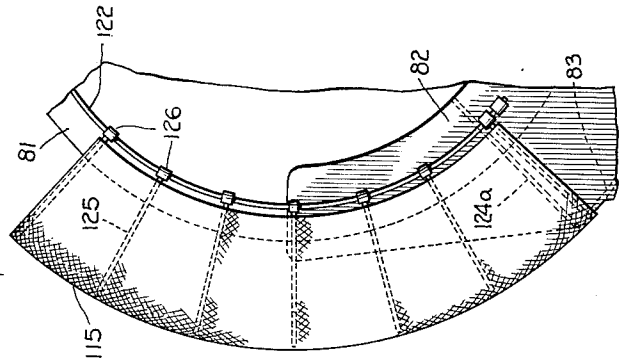


Fig. 12.

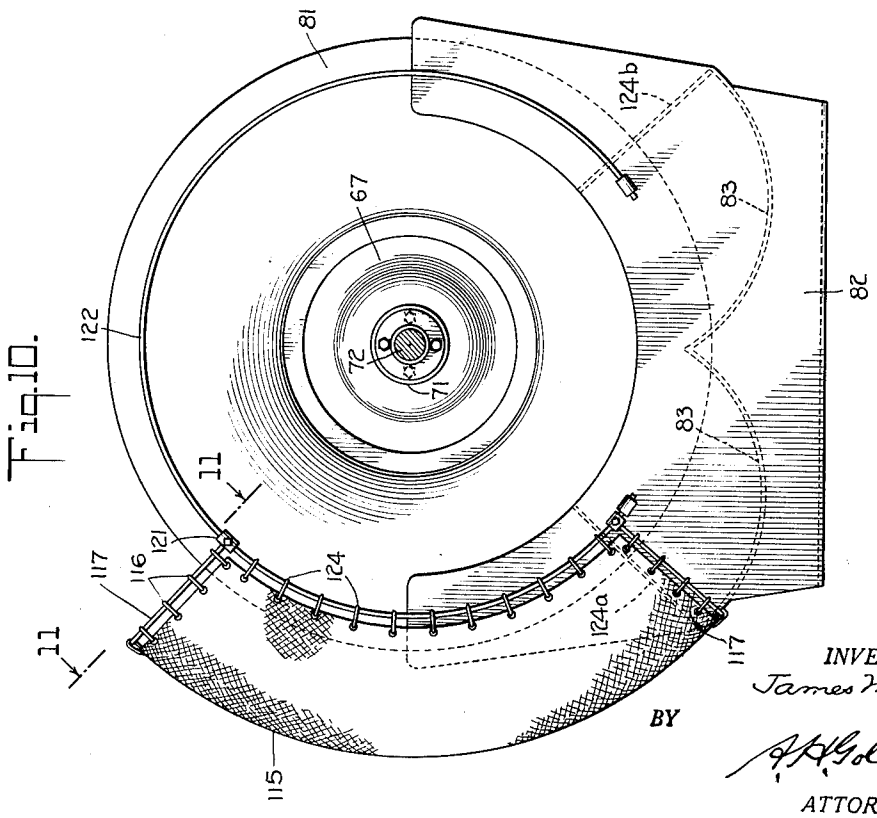


Fig. 10.

INVENTOR.
James M. Hait
BY
A. H. Golden
ATTORNEY

Patented Dec. 2, 1952

2,620,230

UNITED STATES PATENT OFFICE

2,620,230

INSECTICIDE SPREADING MACHINE

James M. Hait, San Jose, Calif., assignor to Food Machinery and Chemical Corporation, San Jose, Calif., a corporation of Delaware

Application October 4, 1947, Serial No. 778,019

24 Claims. (Cl. 299—41)

1

This invention relates to an improved crop spraying and dusting machine of the general type in which a blast of air generated by a fan or propeller is directed radially from a circular discharge head toward the foliage to be sprayed.

In this type of machine it is customary to block off the lower portion of the discharge head opening by means of an arcuate baffle plate so as to prevent discharge of the air downwardly toward the ground immediately beneath the machine. It has been found, however, that this expedient, as heretofore employed, caused a reduction in the efficiency of the machine because the baffle causes a back pressure to be built up within the head, thereby not only interfering with the free discharge of air over the open portion of the discharge head but also placing an undesirable load on the fan or propeller.

It is one of the objects of my invention to provide a spraying and dusting machine of the general type referred to with improved means for blocking off the air over the lower portion of the discharge head with a minimum of interference with the efficiency of the machine.

As a feature of this part of my invention I utilize means at the bottom of the discharge head for effecting a parting of the air blast with one part of the blast flowing in one direction toward one side of the machine and the other part flowing in the opposite direction to the other side of the machine. This is accomplished through the utilization of what I call a dividing surface preferably employed in conjunction with certain modifications in the discharge head hereinafter to be described. By the use of construction in conformity with my invention the air may be effectively blocked off over the lower portion of the discharge head while at the same time being allowed to flow freely and effectively without interfering to any material extent with the efficiency of the machine, all as will be apparent hereinafter.

It is a further object of my invention to provide a spraying and dusting machine of the general type referred to with improved air flow directing means whereby the air discharged from one side of the discharge head may be directed effectively and efficiently in a direction upwardly or to the opposite of the machine.

It will be understood that in the operation of machines of the general type referred to the air is normally discharged entirely around the periphery of the discharge head, except for the blocked off lower portion above referred to, so that the air blast is simultaneously directed to

2

both sides of the machine thereby enabling the spraying of two rows of trees at once. It is sometimes desirable, however, to confine the discharge to one side of the machine only, as where but a single row of trees is to be sprayed, and heretofore this has been accomplished by blocking off a suitable portion of the discharge head opening in a manner similar to that in which the lower portion of the head is blocked off. This has the same effect as the above described blocking off of the lower portion of the head and simply increases inefficiency of the machine.

By the use of my invention, however, this disadvantage is substantially overcome by the use of a suitable air guide which may take the form of a canvas or metal duct readily applied in overlying relation to one side of the discharge head for accepting that portion of the discharged air and moving it in the desired direction. As a more particular feature of this portion of the invention the air guide means may be mounted for ready movement so that it may be shifted from one side to the other of the discharge head whereby the air discharged from either side of the machine may be directed either upwardly or to the other side of the machine as desired.

As an even more particular feature of the invention, I may utilize an air guide or duct of a pliable material such as canvas and adapted for ready manipulation to the desired position or for collapse into a non-operative position.

I have thus outlined rather broadly the more important features of my invention in order that the detailed description thereof that follows may be better understood, and in order that my contribution to the art may be better appreciated. There are, of course, additional features of my invention that will be described hereinafter and which will form the subject of the claims appended hereto. It may also be pointed out that while I shall describe a particular construction of my invention, those skilled in the art will understand that the method of fabrication I suggest is not the only method that can be employed and that my invention is entirely independent of the method of fabrication or the materials utilized. Those skilled in the art will also appreciate that the conception on which my disclosure is based may readily be utilized as a basis for the designing of other structures for carrying out the several purposes of my invention.

Referring now to the drawings, Fig. 1 is an elevation of a machine of the general class referred to, showing my invention embodied therein, but with the air guide or duct at the side opposite

that appearing in the drawing. Fig. 2 is a section taken along lines 2—2 of Fig. 1. Fig. 3 is a section taken along lines 3—3 of Fig. 2. Fig. 4 is an exploded perspective view of the air tunnel and discharge head together with the air guide used therewith. Fig. 5 is a view similar to that of Fig. 2, but illustrating a modified form of air guide. Fig. 6 is a section taken along lines 6—6 of Fig. 5, Fig. 5 being itself a section taken along lines 5—5 of Fig. 6. Fig. 7 is a section taken along lines 7—7 of Fig. 6. Fig. 8 is a section taken along lines 8—8 of Fig. 5. Fig. 9 is a section similar to Fig. 8, illustrating a modified form of the invention. Fig. 10 is a view similar to that of Figs. 2 and 5, but showing a modified form of the invention. Fig. 11 is a section taken along lines 11—11 of Fig. 10. Fig. 12 illustrates a variation of the invention of Fig. 10.

Referring now more particularly to the drawings, and especially to Fig. 1, the machine illustrated embodies a chassis 10 supported by wheels 12 equipped with tires 13 and adapted to be pulled through an orange grove, orchard, or the like by means of a hitch 14 attached to a tractor part 15. Mounted centrally of the chassis 10 is a tank 11 adapted to contain spraying material. At the forward end of the machine, shown at the left side of Fig. 1, I mount an internal combustion engine 16 equipped with the usual accessories, and adapted to actuate a pump 17 suitably connected to the tank 11 and spray carrying pipes to be described hereinafter. The internal combustion engine 16 drives also, through a series of belts and pulleys, a shaft 18 that passes through a passage in the tank 11 to actuate a pulley 19. Pulley 19, through means of a series of belts 20 then actuates a pulley 21 shown in Fig. 3 as well as Fig. 1. The pulley 21 is keyed to a shaft 22 that is supported at one end in a bearing 11b secured to the end of the tank 11. Shaft 22 has secured thereto a propeller 23 having a series of propeller blades 24, it being understood that rotation of the shaft and the propeller will generate a blast of air in a direction toward the left as viewed in Fig. 3.

Referring now to Fig. 4 as well as Figs. 1, 2 and 3, the propeller 23 is adapted for rotation within what I call a tunnel assembly T for developing an air blast that is adapted to pick up material from a series of spray pipes and to carry that material to foliage. This tunnel comprises a casting 25 having a series of four legs 25a through which the casting 25 may be securely bolted or otherwise secured to the chassis 10, as is perhaps best illustrated in Fig. 1. Casting 25 is further formed with a bearing sleeve 27, and this bearing sleeve is adapted to carry ball bearings 28 and 29, best illustrated in Fig. 3, for supporting the shaft 22 on which is mounted propeller 23. The casting 25 includes as part thereof a ring-like deflector 26 formed substantially as an extension of the peripheral surface 23a of the hub of propeller 23. Thus, as is well shown in Fig. 3, the air flowing in the direction of the arrows A, under the influence of the propeller blades 24, will move over the propeller hub surface 23a and against the outwardly curved surface of the deflector 26. In this fashion, the air will be deflected radially of the machine toward the foliage to be sprayed.

Formed integrally with the casting 25, is the outer or confining surface 30 of the tunnel T, illustrated in Figs. 3 and 4. This surface 30 confines the blast of air developed by the propeller blades 24 so as to generate a ring of air through coaction with the deflector 26. For the particular purpose, a portion of the confining surface 30 is flared outwardly as illustrated at 31 for suitable cooperation with the deflector 26.

At that side of the propeller 23 opposite the deflector 26, there is mounted a dome-like member 32 forming a substantial extension of the surface 23a of the propeller hub. It is obvious that the member 32 will assist greatly in the smooth flow of air in the direction of the arrows A relatively to the propeller, and toward the deflector 26. The member 32 may be secured as by a bolt 33 in the position illustrated in Fig. 3, relatively to the shaft 22.

The confining surface 30 is formed with an end flange 34 and secured to this end flange is a circular structural angular member 35 functioning as a reinforcing device. There is then secured to the reinforcing device 35 and the flange 34 a sheet metal intake guide 36 forming an effective part of the tunnel T and suitably curved to facilitate the movement of air into the tunnel under the influence of the propeller blades 24. A protective screen 37 is preferably secured to the intake guide 36 and prevents the entry of debris into the air tunnel, all as those skilled in the art will fully appreciate.

Heretofore it has been the practice to utilize a completely circular deflector 26 and a correspondingly completely circular portion 31 of the confining surface 30. In order to prevent the flow of air radially at the bottom of the machine, a plate is then placed across the exhaust space between flared surface 31 and the end of the deflector 26 to function as has already been referred to at the beginning of this application. As a feature of my invention, I extend the lower portion of the deflector 26 downwardly to form opposed lobes 38 as best seen in Fig. 2. I further extend the sides of the deflector 26 downwardly as indicated by the dotted line 39 at the left side of Fig. 2, and by the solid line at the right side of Fig. 2, so as to effect a rather considerable enlargement of the lower portion of the deflector 26. The lobes 38 and the surfaces 39 referred to are well illustrated also in Fig. 4.

I similarly extend the downward portion of the part 31 of the confining surface 30 to form lobes similar to lobes 38 and designated by reference numeral 40 in Figs. 2 and 4. The casting 25 is then formed with what I term a dividing surface 41 formed as an inverted V, as best illustrated in Fig. 2, and extending longitudinally of the machine between the lobes 38 of the deflector 26 and the corresponding lobes 40 of the flared surface 31 of confining surface 30. Preferably each of the two symmetrical halves of the dividing surface 41 is in the form of a volute or Archimedes spiral so as to direct the air with a minimum of resistance. It will now be appreciated that as the air blast strikes the deflector 26 it will be deflected radially in every angular sector thereof, except where the surface 41 is encountered. Since the dividing surface 41 is formed as an inverted V, it acts as a plow and serves to divide the air blast so that the air blast is well deflected towards both sides of the machine. Those skilled in the art will appreciate that the dividing surface 41 in cooperation with the enlarged chambers formed by lobes 38, 40 will effectively and efficiently deflect the air so that it will move to join the air flowing freely and radially from the exhaust space between the deflector 26 and the flared surface 31.

For further assisting the dividing surface 41

in the movement of the air, I preferably use a series of auxiliary vanes **42** in the enlarged lobe chambers as well illustrated in Fig. 4 and at the right side of Fig. 2. Thus, the vanes **42** lie above the surface **41** within each of the chambers formed by the lobes **38** and assist the dividing surface **41** in the functioning thereof, all as will be apparent. I also mount between the deflector **26** and the flared portion **31** of the confining surface **30** an auxiliary deflector **43** as shown in both Figs. 3 and 4. This auxiliary deflector may be held in place by bolts or by welding to brackets **44** extending between deflector **26** and confining surface **30**. It is the function of the auxiliary deflector **43** to assist deflector **26** in imparting radial direction to the air.

Spray material is supplied to the radially directed air blast by a series of pipe **50** positioned transversely across the exhaust space between part **31** of confining surface **30** and the deflector **26**. These spray carrying pipes **50** are best illustrated in Figs. 1 and 3. In order not to complicate the illustration of the tunnel T in Fig. 1, the spray carrying pipes **50** at one side of the tunnel have been eliminated in Fig. 1, but actually, the pipes will be positioned at both sides of tunnel T in the manner well shown in Fig. 2 and will feed spraying material to the air blast as it issues from between the deflector **26** and confining surface **31**. Spray pipes **50** are carried by main supply pipes **51** extending to a further main supply pipe **51***a* running from the pump **17**, all as is conventional in machines of the class described.

As was discussed earlier in this specification, it is one object of my invention to adapt a machine of the type described so that all of the air blast may be directed effectively and efficiently to but one side of the machine. I have found it is frequently important also that the upward portion of the air blast be augmented, as when it is necessary to spray high trees. I have conceived means for achieving the results of my invention that are very effective and extremely simple. Thus, I mount an air guide, preferably in the form of a duct, over an angular portion of the deflector system so as to overlie a part of the exhaust space between deflector **26** and part **31** of the confining surface **30**.

As seen in Fig. 4, this air guide may take the form of a sheet metal duct D, to be secured with one of its sides **52** against the outer surface of the deflector **26** and the other of its sides **53** against a flange **54** extending outwardly from confining surface **30**, as is well illustrated in Figs. 2 and 3. Each of the sides **52** and **53** of the duct D is formed with a series of slots **55** whereby through cap screws **56** it may be bolted to the deflector **26** and flange **54** while adapted for slight adjustment through means of the slots **55**. It is to be observed that the radius of the duct at its lower end is such that it may telescope in snugly fitting relation over the outer end of the dividing surface **41** to a limited extent, and the slots **55** permit a certain amount of rotative adjustment of the duct so as to vary its direction of discharge without pulling it out of telescoping relation with the surface **41**.

It will be understood of course, that, if desired, the duct D may be secured to the other side of the deflector system instead of that shown, the particular side to which the duct is applied depending upon which side of the machine is to receive the augmented air blast resulting from the utilization of the duct. The duct may also be removed from the machine altogether when it is desired to have the discharge directed to both sides of the machine.

It will be noted that the duct D is illustrated as being in the general shape of a volute or Archimedes spiral so as to provide a path of gradually increasing area for the air which is radially discharged into it from the exhaust space between the deflector **26** and the surface **31**. Actually, the curvature of the duct is not a true volute or Archimedes spiral but is so formed that the cross sectional area of the duct at any point in its length is substantially equal to the total area of that portion of the exhaust space which discharges into the duct ahead of such point. For example, the cross sectional area of the duct at A in Fig. 2 is preferably equal to the cross sectional area of the exhaust space over the zone A'. Likewise the cross sectional area of the duct at B in Fig. 2 is equal to the cross sectional area of the exhaust space along the zone B'. By reason of this proportioning between the cross sectional area of the duct D and the area of the exhaust space discharging into it, a minimum of back pressure is put on the air being discharged into the duct, and the air is turned and guided through the duct to its discharge opening without being obstructed sufficiently to create any significant amount of back pressure.

It may be observed that the narrower the duct D is made the greater its radii of curvature would have to be in order to maintain the proportions referred to above, and in order to maintain these proportions without causing the duct to project to an undesirable distance laterally of the vehicle, the width of the duct may be made as much greater than the width of the exhaust space as desired. This is accomplished in the construction illustrated in the sketch by extending the duct backward over the tunnel so as to obtain a greater width. In this manner the cross sectional area of the duct may be maintained by increasing its width, and thereby enabling its depth to be reduced. In fact, as will shortly be seen, it is feasible to thus enlarge the duct sufficiently to enable it to be of constant radius and still obtain satisfactory results while at the same time gaining the advantage of making it possible to rotate the duct from one side of the machine to the other without having to remove it from the machine.

Since, as pointed out above, the duct D is preferably wider than the exhaust space, means is provided for blocking off that portion of its lower open end which projects rearwardly from the exhaust space beneath the exterior of the tunnel T so as to prevent discharge of air out of the lower end of the duct. Such means may take the form of baffle plates **52***a* and **52***b* secured in any suitable manner to the exterior of the tunnel and projecting radially outward therefrom. These plates are so positioned and are of such size and shape that when the duct is attached, either in the position shown in Fig. 2, or on the opposite side of the machine, one of the plates will fit into the rearwardly projecting portion of the duct and effectively block the discharge of air therefrom.

Referring now to Figs. 5, 6, 7 and 8, I show there a further modification of my invention utilizing a somewhat different form of air guide or duct. In the modification of Figs. 5 to 8 inclusive, the fabrication of the air tunnel corresponding to the air tunnel T of the first modification is somewhat different, but the general

arrangement and operation is, of course, substantially the same. As I have emphasized earlier in this specification, my invention is not to be construed as limited in any way by the fabrication thereof, since different means may be utilized as mechanical operations and processes change.

In brief, the air tunnel of the modification now to be described utilizes a main casting 60, forming part of the outer confining surface of the air tunnel, this casting being securely mounted on the chassis 61 by a series of brackets 62, 63, and 64. The main casting 60 has formed as part thereof a central hub portion 65 carrying a stub shaft 66 on which is rotatably mounted the propeller hub 67 carrying a series of propeller blades 68. The propeller is rotated through a flexible coupling 69 actuated by a shaft 70 in turn driven by a flexible coupling 71 actuated by a shaft 72 driven by a pulley 73 through belts 74. The left-hand end of the shaft 72 is mounted by ball bearings 75 on a sleeve support 76 welded to one end of the tank of the machine. The belts 74 are in turn driven by a pulley 77 actuated from a power shaft 78 through a flexible coupling 79, power shaft 78 corresponding to shaft 18 of the first modification. It is thought that the mounting of the propeller and its actuation will now be rather clear.

The air tunnel of Figs. 5 to 8 inclusive has a deflector 80 that functions exactly as does the deflector 26 of my first modification. It has similarly a confining surface 81 that functions in exactly the same manner as does the part 31 of the confining surface 30 of the first modification. Actually, the deflector 80 and the surface 81 are formed of sheet metal spinnings and are welded or otherwise secured to the main casting 60. The lower portions of the sheet metal deflector 80 and the confining surface 81 are elongated by the addition of a U member 82 as best seen in Fig. 6. In the U member a surface 83 forms lobes and chambers functioning the same as do the lobes 38 and the dividing surface 41 of the first modification. It will be noted now that the functioning of the air tunnel of Figs. 5 to 8 is exactly the same as that of the first modification, but that the fabrication thereof is somewhat different. It is thought unnecessary to describe in further detail the air tunnel construction, as that construction will now be apparent from the description given and from the drawings presented.

Spraying material is supplied to the exhaust space between deflector 80 and surface 81 by three banks of spray supply pipes 84. Thus, an extreme upper bank of pipes 84 is mounted on a main pipe 85 extending into a spray pipe assembly 86 controlled by a valve 87, as is well shown in Fig. 5. At the right hand side of Fig. 5 there is a second bank of pipes 84 supported by a main pipe 88 under the control of a valve 89. The left hand bank of spray supplying pipes 84 is carried by a pipe 90 under the control of a valve 91. It will be understood that suitable piping is provided for conducting the spray material from the pump 17 to the valves 87, 89 and 91.

The duct of the modification of Figs. 5 to 8 is designated generally by the reference letter D' and has one side 92 extending inwardly into juxtaposed relation to the outer surface of the main casting 60 comprising the outer confining surface of the tunnel. The other side of the duct D' is designated by reference numeral 93 and overlies the outer side of the deflector 80. Side 93 has secured thereto at one end a bracket 94 and at the other end a bracket 95, the two brackets being in turn secured to a central spider 96 as by riveting at 97. Central spider 96 is rotatable about the shaft 72 through ball bearings 98 best seen in Fig. 6, and carries a pulley 99 grooved for an actuating cable 100. This actuating cable extends over suitable pulleys 101 to a remote point of the machine from which the cable may be moved to rotate the central spider 96 and therefore the duct D.

It will be noted that the duct D' is formed so that it may be rotated to either side of the discharge head for coaction with the air moving outwardly from the exhaust space between deflector 80 and confining surface 81. It will further be noted that the duct overlies the spray supplying pipes 84 and that it does not, therefore, interfere with the supply of spray material to the air blast. Of course, this spray supply may be varied, and certain pipes completely cut off by operation of the several valves 87, 89, and 91.

For facilitating the rotation of the duct D', the central spider 96 is preferably counterbalanced as by a weight 102, as is well shown in Fig. 5. It will be appreciated that the duct D' does not have the volute-like taper of the duct D of the first modification. Therefore, parts of the duct may be somewhat large for the volume of air accepted thereby when the duct is placed in certain positions, but the duct is always of such adequate size that no hindering pressures will be established therein.

The duct D' is preferably but not necessarily limited in its counter-clockwise movement in Fig. 5 by slots 104 formed in the sides of the U member 82. Similarly, the clockwise movement of the duct is limited by similar slots 105 shown in the right hand side of Fig. 5. The slots 104, 105 serve also to facilitate angular adjustment of the duct D' and to hold the duct in an adjusted position. However, it is possible, if desired, to arrange the construction so that the duct D' may move freely into a position at the bottom of the deflector system so as to be completely out of the path of the air blast, and this is contemplated as a feature of the invention.

In Fig. 7 there is illustrated well the side 92 of the duct D' and the manner in which it overlies the base casting 60 of the tunnel. Side 92 may be provided with a resilient gasket 92*a*, as best illustrated in Fig. 8, whereby to close effectively the chamber C of the duct through which the air blast flows. As in the case of the embodiment illustrated in Figs. 1 to 4 inclusive suitable radially extending baffle plates 92*b* and 92*c* are secured to opposite sides of the tunnel structure for reception into that portion of the lower end of the duct D' which projects rearwardly of the exhaust space when the duct is in operative position so as to effectively block off any discharge of air from the lower end of the duct. Attention is called to the fact that in this modification auxiliary deflectors and vanes are not shown as in the first modification in order to simplify the drawings.

It will be recalled that the duct D' of Fig. 5 is mounted for rotation on the axis of shaft 72. If desired, the duct may be mounted as best illustrated in Fig. 9. Thus, in Fig. 9, the duct is designated by reference numeral 106 and has a side 107 equipped with a series of rollers 108 cooperable with a track 109 secured to the other

surface of the base casting 60. The other side of the duct is designated by reference numeral 110. It also carries a series of rollers 111 mounted for rotation on a track 112 extending preferably from the tank of the machine. Through an arrangement of this sort, the duct 106 is readily rotatable into any desired position.

In Fig. 10 I illustrate a further modification in which the duct is designated by reference numeral 115 and is formed of canvas. At one end the duct 115 is equipped with a series of rings 116 supported by a bail 117 best illustrated in Fig. 11. One end of the bail 117 carries a block 118 adapted to be mounted on a circular supporting wire 120 carried by the base casting 60 of the air tunnel. The other end of the bail 117 carries a block 121 similar to the block 118 and adapted for rotation on a support wire 122, suitably mounted on an integral part of the deflector 81. Naturally, the bail 117 is slidable on the support wires 120, 122 and may be locked in any particular position by a nut 123 carried by the block 121. In this way, one end of the duct 115 may be held in any one of a number of positions relatively to the tunnel. The other end of the duct 115 is similarly supported by a similar bail 117 and is similarly adjustable. Between the two ends secured to the bails 117, the duct 115 has rings 124 securing its sides to the support wires 120, 122 as is clearly illustrated. Actually, the duct 115 will function in the same manner as the duct D' of the modification of Figs. 5 and 6. It may be collapsed readily so as to be out of the way, or may be moved into any desired position. Baffle plates 124*a* and 124*b* similar to those indicated at 52*a* and 52*b* and 92*b* and 92*c* in the previously described modifications and serving the same purpose are indicated in Fig. 10.

Fig. 12 shows a variation of the modification of Figs. 10 and 11 in which the canvas duct 115 is supported by a series of bails 125, each carrying a block 126 at each end thereof for mounting about the support wires 120, 122.

I believe that those skilled in the art will now appreciate the general arrangement of my invention and its functioning, and the rather considerable contribution I have made to this art.

I now claim:

1. In a machine of the class described having a rotating air impeller, a housing surrounding said impeller, said housing having a peripheral outlet opening extending throughout a major portion of its periphery, portions of said housing being shaped and disposed to confine and direct an air blast from said impeller radially of said housing through said outlet; an open sided air duct secured with its open side toward the space between corresponding angular portions of said confining and directing portions of said housing for receiving that portion of the air blast normally flowing between said angular portions, said duct curving to direct the portion of the air blast received thereby relatively to the remainder of the air blast, and means for feeding insecticide to said blast of air to be carried thereby to the foliage.

2. In a machine of the class described having a rotating air impeller, a housing surrounding said impeller, said housing having a peripheral outlet opening extending throughout a major portion of its periphery, portions of said housing being shaped and disposed to confine and direct an air blast from said impeller radially of said housing through said outlet; a curved air duct having an opening and secured with said opening facing the space between corresponding angular portions of said confining and directing portions of said housing for receiving that portion of the air blast normally flowing between said angular portions and directing the said portion of the air blast in conformance with the shape of said air duct, and means for feeding insecticide to said blast of air to be carried thereby to the foliage.

3. In a machine of the class described having a rotating air impeller, a housing surrounding said impeller, said housing having a peripheral outlet opening extending throughout a major portion of its periphery, portions of said housing being shaped and disposed to confine and direct an air blast from said impeller radially of said housing through said outlet; an open sided air duct secured with its open side toward the space between corresponding angular portions of said confining and directing portions of said housing for receiving that portion of the air blast normally flowing between said angular portions for directing and facilitating the flow of said portion of the air blast tangentially and circumferentially toward the remainder of the air blast, said duct tapering in cross section in the direction of the flow of air therethrough whereby to define at each section thereof an opening for the flow of air equal at least to the angular space between said confining and directing portions subtended thereby, and means for feeding insecticide to said blast of air to be carried thereby to the foliage.

4. In a machine of the class described having a rotating air impeller, a housing surrounding said impeller, said housing having a peripheral outlet opening extending throughout a major portion of its periphery, portions of said housing being shaped and disposed to confine and direct an air blast from said impeller radially of said housing through said outlet; an open sided curved air duct having its open side facing the space between corresponding fractional angular portions of said confining and directing portions of said housing for receiving that portion of the air blast normally flowing between said fractional angular portions and directing the said portion of the air blast in conformance with the shape of said air duct, means for feeding insecticide material to said air blast, and means mounting said air duct for rotation into various angular positions relatively to said confining surface and deflector.

5. In a machine of the class described having a rotating air impeller, a housing surrounding said impeller, said housing having a peripheral outlet opening extending throughout a major portion of its periphery, portions of said housing being shaped and disposed to confine and direct an air blast from said impeller radially of said housing through said outlet; an open sided curved air duct having its open side facing the space between corresponding angular portions of said confining and directing portions of said housing for receiving that portion of the air blast normally flowing between said angular portions, the closed side of said duct curving to direct the air received thereby circumferentially of the ring-like blast of air toward the remainder of the air blast flowing from between said confining and directing portions and substantially radially spaced from said confining and directing portions so as not to inhibit the flow of air, means mounting said air duct for rotation on the axis of said air impeller, and means for feeding an insecticide to said blast of air.

6. In a machine of the class described having a rotating air impeller, a housing surrounding said impeller, said housing having a peripheral outlet opening extending throughout a major portion of its periphery, portions of said housing being shaped and disposed to confine and direct an air blast from said impeller radially of said housing through said outlet; an open sided curved air duct having its open side facing the space between corresponding angular portions of said confining and directing portions of said housing for receiving that portion of the air blast normally flowing between said angular portions, the closed side of said duct curving to direct the air received thereby circumferentially of the ring-like blast of air toward the remainder of the air blast flowing from between said confining and directing portions and substantially radially spaced from said confining and directing portions so as not to inhibit the flow of air, means for feeding insecticide material to said air blast, means mounting said air duct for rotation on the axis of said air impeller, and means for rotating said air duct into various angular positions.

7. In a machine of the class described having a rotating air impeller, a housing surrounding said impeller, said housing having a peripheral outlet opening extending throughout a major portion of its periphery, portions of said housing being shaped and disposed to confine and direct an air blast from said impeller radially of said housing through said outlet; a curved channel-like duct adapted for positioning in overlying relation to an angular sector of the air blast flowing from between said confining and directing portions of said housing, and the edges of said duct coacting with the said confining and directing portions so that said air flowing through said angular sector will be guided by said duct.

8. In a machine of the class described, an air tunnel, an air propeller for developing a blast of air flowing outwardly of one end of said tunnel, a ring-like deflector positioned in the path of said air blast and curved outwardly to deflect the air blast generally radially relatively to the axis of rotation of said propeller, said air blast flowing then from the ring-like exhaust space between said one end of the tunnel and the outer end of the curved ring-like deflector, a curved duct having an open side to overlie and enclose the ring-like exhaust space between the end of the tunnel and the outer end of the deflector corresponding in angular extent to the angular extent of the curved duct and forming a chamber into which the air flows from said exhaust space, said duct then receiving the air blast from the portion of the exhaust space it overlies and directing it in accordance with the shape of the duct, and means for feeding spray material to said blast of air.

9. In a machine of the class described, an air tunnel, an air propeller for developing a blast of air flowing outwardly of one end of said tunnel, a ring-like deflector positioned in the path of said air blast and curved outwardly to deflect the air blast generally radially relatively to the axis of rotation of said propeller, said air blast flowing then from the ring-like exhaust space between the said one end of the tunnel and the outer end of the curved ring-like deflector, spray carrying pipes positioned relatively to the ring-like exhaust space to feed spray material to said air blast, a curved duct having an open side to overlie and enclose the spray carrying pipes and the ring-like exhaust space between the end of the tunnel and the outer end of the deflector, said exhaust space corresponding in angular extent to the angular extent of the curved duct, and said curved duct forming a chamber into which the air flows from said exhaust space to be directed by said duct in accordance with the shape of the duct.

10. In a machine of the class described, an air tunnel, an air propeller for developing a blast of air flowing outwardly of one end of said tunnel, a ring-like deflector positioned in the path of said air blast and curved outwardly to deflect the air blast generally radially relatively to the axis of rotation of said propeller, said air blast flowing then from the ring-like exhaust space between the said one end of the tunnel and the outer end of the curved ring-like deflector, a curved duct having an open side to overlie and enclose the ring-like exhaust space between the end of the tunnel and the outer end of the deflector corresponding in angular extent to the angular extent of the curved duct and forming a chamber into which the air flows from said exhaust space, said duct then receiving the air from the portion of the exhaust space it overlies and directing it tangentially and circumferentially of said tunnel, the cross sectional area of said duct tapering from one end to the other in the direction of the air flow therethorugh so that at each section of the chamber formed thereby there will be sufficient space for the free flow of the volume of air normally flowing from the angular extent of the exhaust space subtended at said section, and means for feeding spray material to said blast of air.

11. In a machine of the class described, an air tunnel, an air propeller for developing a blast of air flowing outwardly of one end of said tunnel, a ring-like deflector positioned in the path of said air blast and curved outwardly to deflect the air blast generally radially relatively to the axis of rotation of said propeller, said air blast flowing then from the ring-like exhaust space between the said one end of the tunnel and the outer end of the curved ring-like deflector, spray carrying pipes positioned transversely relatively to the ring-like exhaust space to feed spray material to said air blast, a curved duct having an open side to overlie and enclose the spray carrying pipes and the ring-like exhaust space between the end of the tunnel and the outer end of the deflector corresponding in angular extent to the angular extent of the curved duct and forming a chamber into which the air flows from said exhaust space, said duct then receiving the air from the portion of the exhaust space it overlies and directing it tangentially and circumferentially of said tunnel, the cross sectional area of said duct tapering from one end to the other in the direction of the air flow therethrough so that at each section of the chamber formed thereby there will be sufficient space for the free flow of the volume of air normally flowing from the angular extent of the exhaust space subtended at said section.

12. In a machine of the class described, an air tunnel, an air propeller for developing a blast of air flowing outwardly of one end of said tunnel, a ring-like deflector positioned in the path of said air blast and curved outwardly to deflect the air blast generally radially relatively to the axis of rotation of said propeller, said air blast flowing then from the ring-like exhaust space between the said one end of the tunnel and the outer end of the curved ring-like deflector, a directional division line for said air flow at the lowermost portion of the periphery of said tun-

nel when said tunnel is horizontal, a surface forming said division line by the closing of the exhaust space between the ends of said tunnel and deflector for a short distance at each side of the line of division, said surface curving downwardly at each side from the line of division in the form of an inverted V, and the end surfaces of the tunnel and deflector coacting therewith being correspondingly formed.

13. In the combination of claim 12, a duct having an open side for overlying an additional angular section of the exhaust space between the end of the tunnel and the deflector and forming a chamber into which the air flows from said exhaust space, and means for applying said duct to said tunnel and deflector with the duct overlying the exhaust space at one side of the division forming surface, said duct then receiving the air from the portion of the exhaust space it overlies and directing it relatively to said tunnel.

14. In a machine of the class described, an air tunnel, an air propeller for developing a blast of air flowing outwardly of one end of said tunnel, a ring-like deflector positioned in the path of said air blast and curved outwardly to deflect the air blast generally radially relatively to the axis of rotation of said propeller, said air blast flowing then from the ring-like exhaust space between the said one end of the tunnel and the outer end of the curved ring-like deflector, a directional division line for said air flow at the lowermost portion of the periphery of said tunnel when said tunnel is horizontal, a surface forming said division line by the closing of the exhaust space between the end of said tunnel and deflector for a short distance at each side of the line of division, said surface curving downwardly at each side from the line of division in the form of an inverted V and the surfaces of the tunnel and deflector coacting therewith being correspondingly formed, a curved duct having an open side to overlie and enclose the ring-like exhaust space between the end of the tunnel and the outer end of the deflector corresponding in angular extent to the angular extent of the curved duct and forming a chamber into which the air flows from said exhaust space it overlies and deflecting it tangentially and circumferentially of said tunnel, means mounting said duct for rotation on said tunnel, said duct being then movable from a position forming an extension of one side of the divisional surface or into a position forming an extension of the other side of said divisional surface, and means for feeding spray material to said air blast.

15. In a machine of the class described, an air tunnel, an air propeller for developing a blast of air flowing outwardly of one end of said tunnel, a ring-like deflector positioned in the path of said air blast and curved outwardly to deflect the air blast generally radially relatively to the axis of rotation of said propeller, said air blast flowing then from the ring-like exhaust space between the said one end of the tunnel and the outer end of the curved ring-like deflector, a directional division line for said air flow at the lowermost portion of the periphery of said tunnel when said tunnel is horizontal, a surface forming said division line by the closing of the exhaust space between the ends of said tunnel and deflector for a short distance at each side of the line of division, a curved duct having an open side to overlie and enclose the ring-like exhaust space between the end of the tunnel and the outer end of the deflector corresponding in angular extent to the angular extent of the curved duct and forming a chamber into which the air flows from said exhaust space, said duct then receiving the air from the portion of the exhaust space it overlies and deflecting it tangentially and circumferentially of said tunnel, means mounting said duct for rotation on said tunnel, said duct being then movable from a position forming an extension of one side of the divisional surface or into a position forming an extension of the other side of said divisional surface, and means for feeding spray material to said air blast.

16. In a machine of the class described, an air tunnel, an air propeller for developing a blast of air flowing outwardly of one end of said tunnel, a ring-like deflector positioned in the path of said air blast and curved outwardly to deflect the air blast generally radially relatively to the axis of rotation of said propeller, said air blast flowing then from the ring-like exhaust space between the said one end of the tunnel and the outer end of the curved ring-like deflector, a curved duct having an outer peripheral surface and sides extending therefrom toward said tunnel and deflector, said sides forming with said tunnel and deflector a chamber in communication with the ring-like exhaust space between the end of the tunnel and the outer end of the deflector for a length corresponding in angular extent to the angular extent of the curved duct, said duct then receiving the air from the portion of the exhaust space it overlies and directing it circumferentially of said tunnel, means for rotating said duct into various angular positions relatively to said ring-like exhaust space, and means for feeding spray material to said blast of air.

17. In a machine of the class described, an air tunnel, an air propeller for developing a blast of air flowing outwardly of one end of said tunnel, a ring-like deflector positioned in the path of said air blast and curved outwardly to deflect the air blast generally radially relatively to the axis of rotation of said propeller, said air blast flowing then from the ring-like exhaust space between the said one end of the tunnel and the outer end of the curved ring-like deflector, a curved duct having an outer peripheral surface and sides extending therefrom toward said tunnel and deflector, said sides forming with said tunnel and deflector a chamber in communication with the ring-like exhaust space between the end of the tunnel and the outer end of the deflector for a length corresponding in angular extent to the angular extent of the curved duct, said duct then receiving the air from the portion of the exhaust space it overlies and directing it circumferentially of said tunnel, a track and roller connection between one of the sides of said duct and said tunnel, a similar track and roller connection between the other of the sides of said duct and said deflector, said duct rotating through said track and roller connections into various angular positions relatively to said ring-like exhaust space, and means for feeding spray material to said blast of air.

18. In a machine of the class described, an air tunnel, an air propeller for developing a blast of air flowing outwardly of one end of said tunnel, a ring-like deflector positioned in the path of said air blast and curved outwardly to deflect the air blast generally radially relatively to the axis of rotation of said propeller, said air blast flowing then from the ring-like exhaust space between

the said one end of the tunnel and the outer end of the curved ring-like deflector, a duct formed of a pliable material and having an open side to overlie and enclose the ring-like exhaust space between the end of the unnel and the outer end of the deflector corresponding in angular extent to the angular extent of the duct, frame means for maintaining said pliable material in position to function as a duct, means on said tunnel and deflector for supporting said frame means and duct in various positions angularly spaced about the exhaust space, said duct then receiving the air blast from the portion of the exhaust space it overlies and directing it relatively to said tunnel, and means for feeding insecticide material to said air blast.

19. In a machine of the class described, an air tunnel, an air propeller for developing a blast of air flowing outwardly of one end of said tunnel, a ring-like deflector positioned in the path of said air blast and curved outwardly to deflect the air blast generally radially relatively to the axis of rotation of said propeller, said air blast flowing then from the ring-like exhaust space between the said one end of the tunnel and the outer end of the curved ring-like deflector, a duct formed of a pliable material and having an open side to overlie and enclose the ring-like exhaust space between the end of the tunnel and the outer end of the deflector corresponding in angular extent to the angular extent of the duct, frame means for maintaining said pliable material in position to function as a duct, means for supporting said frame means and duct in various positions angularly spaced about the exhaust space, said duct then receiving the air blast from the portion of the exhaust space it overlies and directing it relatively to said tunnel, and means for feeding insecticide material to said air blast.

20. In a machine of the class described, an air tunnel, an air propeller for developing a blast of air flowing outwardly of one end of said tunnel, a ring-like deflector positioned in the path of said air blast and curved outwardly to deflect the air blast generally radially relatively to the axis of rotation of said propeller, said air blast flowing then from the ring-like exhaust space between the said one end of the tunnel and the outer end of the curved ring-like deflector, a directional division line for said air flow positioned at the lowermost portion of the periphery of said tunnel when said tunnel is horizontal, a surface forming said division line by extending between said tunnel and deflector for a relatively short angular distance at each side of the line of division to close the exhaust space for said distance, the surfaces of the tunnel and deflector at each side of the division line forming a downwardly extending lobe at each side of the division line whereby said surface through extending between said lobes takes substantially the form of an inverted V.

21. In a machine of the class described, an air tunnel, a propeller rotating in the longitudinal axis of said tunnel for generating a blast of air moving axially of said air tunnel, deflector means positioned at the end of said air tunnel in the path of said blast of air for deflecting said blast of air relatively to its normal axial movement, an air duct, means mounting said air duct for rotation on said tunnel and for positioning in any one of a series of rotated positions in the path of a portion of the air blast moving relatively to said air tunnel as directed by said deflector means, said air duct receiving the air and directing the said air relatively to said air tunnel in accordance with the shape of said air guide, and means for feeding insecticide material to said air blast.

22. In a machine of the class described, an air tunnel, a propeller rotating in the longitudinal axis of said tunnel for generating a blast of air moving axially of said air tunnel, deflector means positioned at the end of said air tunnel in the path of said blast of air for deflecting said blast of air relatively to its normal axial movement, an air duct, means mounting said air duct for rotation on said tunnel in the axis of said propeller and for positioning in any one of a series of rotated positions in the path of a portion of the air blast moving relatively to said air tunnel as directed by said deflector means, said air duct receiving the air and directing the said air relatively to said air tunnel in accordance with the shape of said air guide, and means for feeding insecticide material to said air blast.

23. In a machine of the class described, a housing, a rotating fan mounted in said housing for generating a blast of air in said housing, portions of said housing being shaped and disposed to direct the air blast substantially radially from said housing toward foliage to be sprayed, means for introducing liquid spray material into the air blast, and air guide means comprising a generally volute shaped deflector positioned in the path of a segment of the radially directed air blast for re-directing said blast segment tangentially and circumferentially of said housing toward the remainder of said air blast.

24. In a machine of the class described, a housing, means for generating a blast of air in said housing, portions of said housing being shaped and disposed to direct the air blast substantially radially from said housing toward foliage to be sprayed, means for introducing spray material into the air blast, and air guide means comprising a generally volute-shaped deflector positioned in the path of a segment of the radially directed air blast for redirecting said blast segment tangentially and circumferentially of said housing toward the remainder of said air blast.

JAMES M. HAIT.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,726,214	Comins	Aug. 27, 1929
1,778,046	Strobell	Oct. 14, 1930
1,864,198	Johnson	June 21, 1932
2,258,731	Blumenthal	Oct. 14, 1944
2,476,960	Daugherty	July 26, 1949