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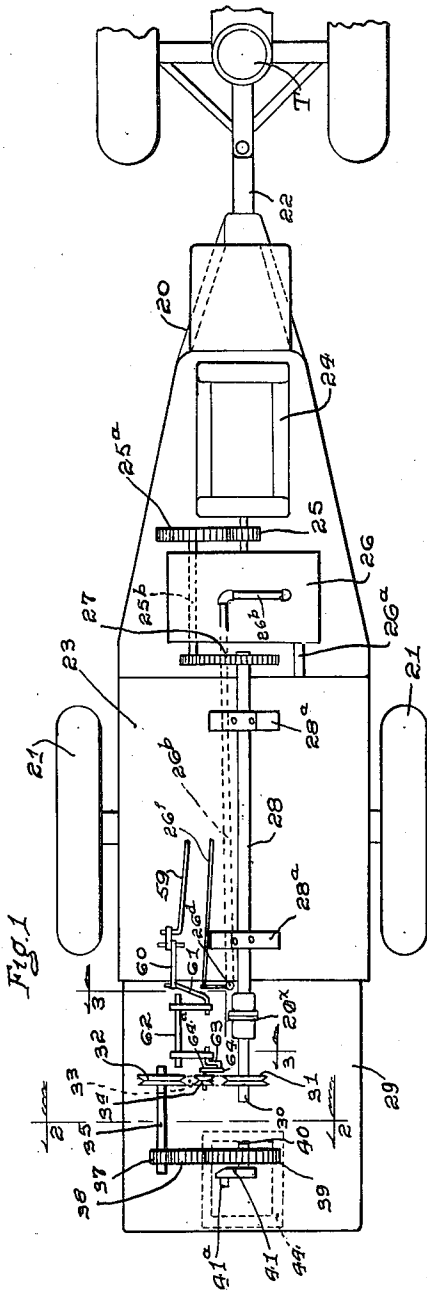
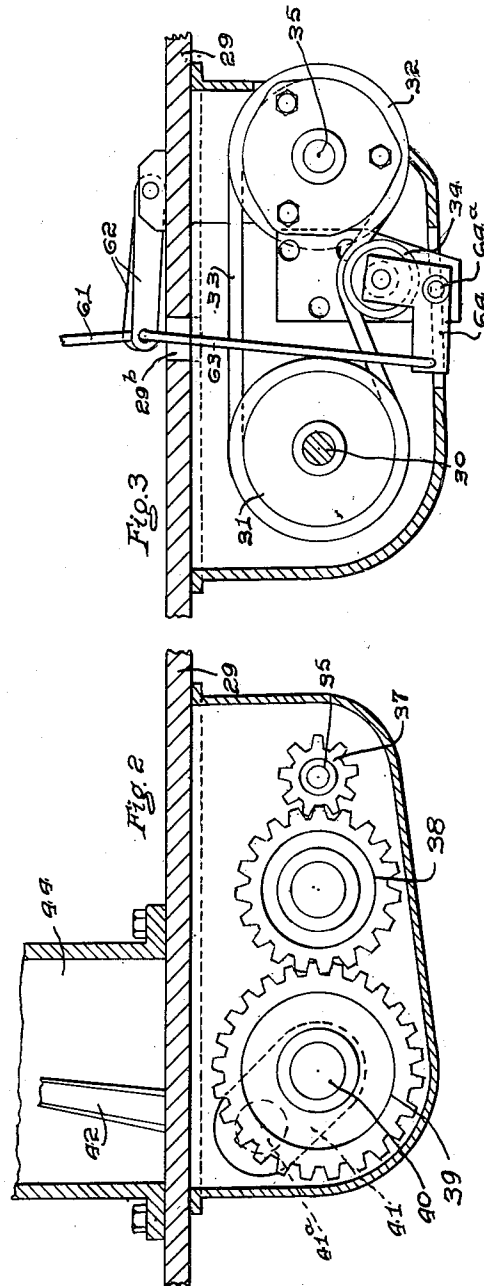
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2,577,828

SPRAYER HEAD CONTROL MECHANISM

Filed Dec. 2, 1947

3 Sheets-Sheet 1



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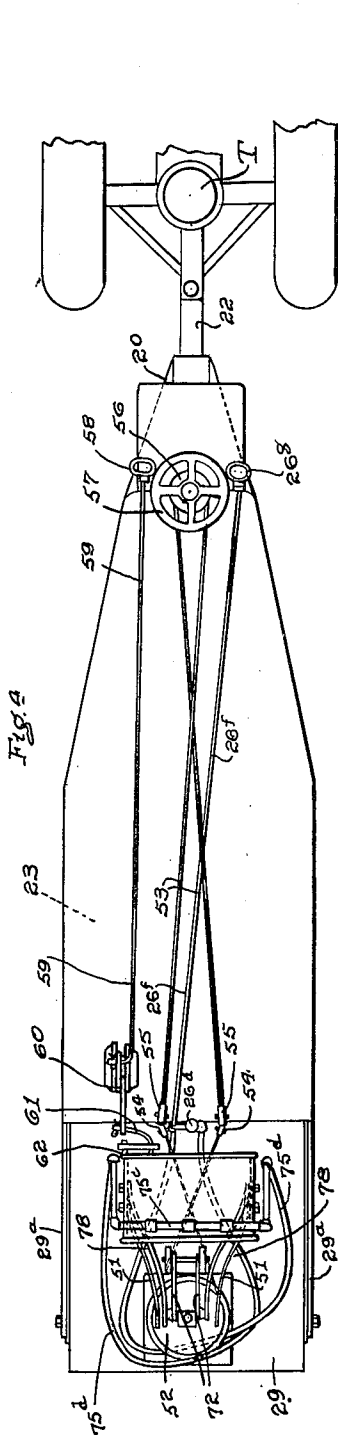
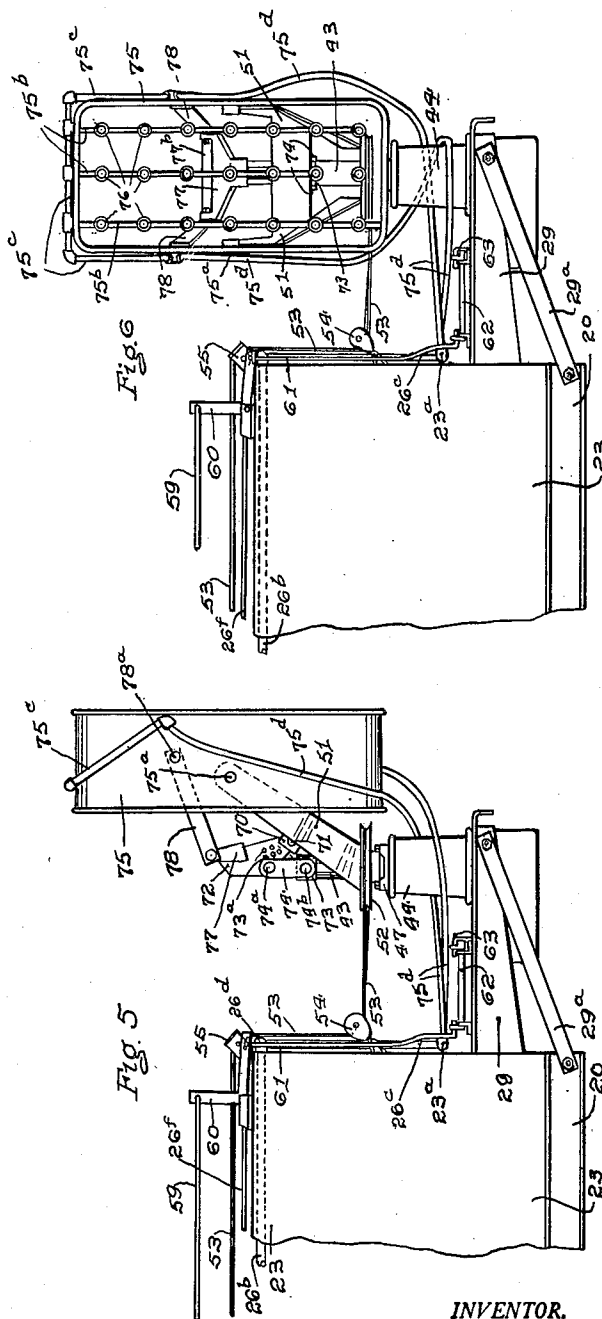
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Filed Dec. 2, 1947

3 Sheets-Sheet 2



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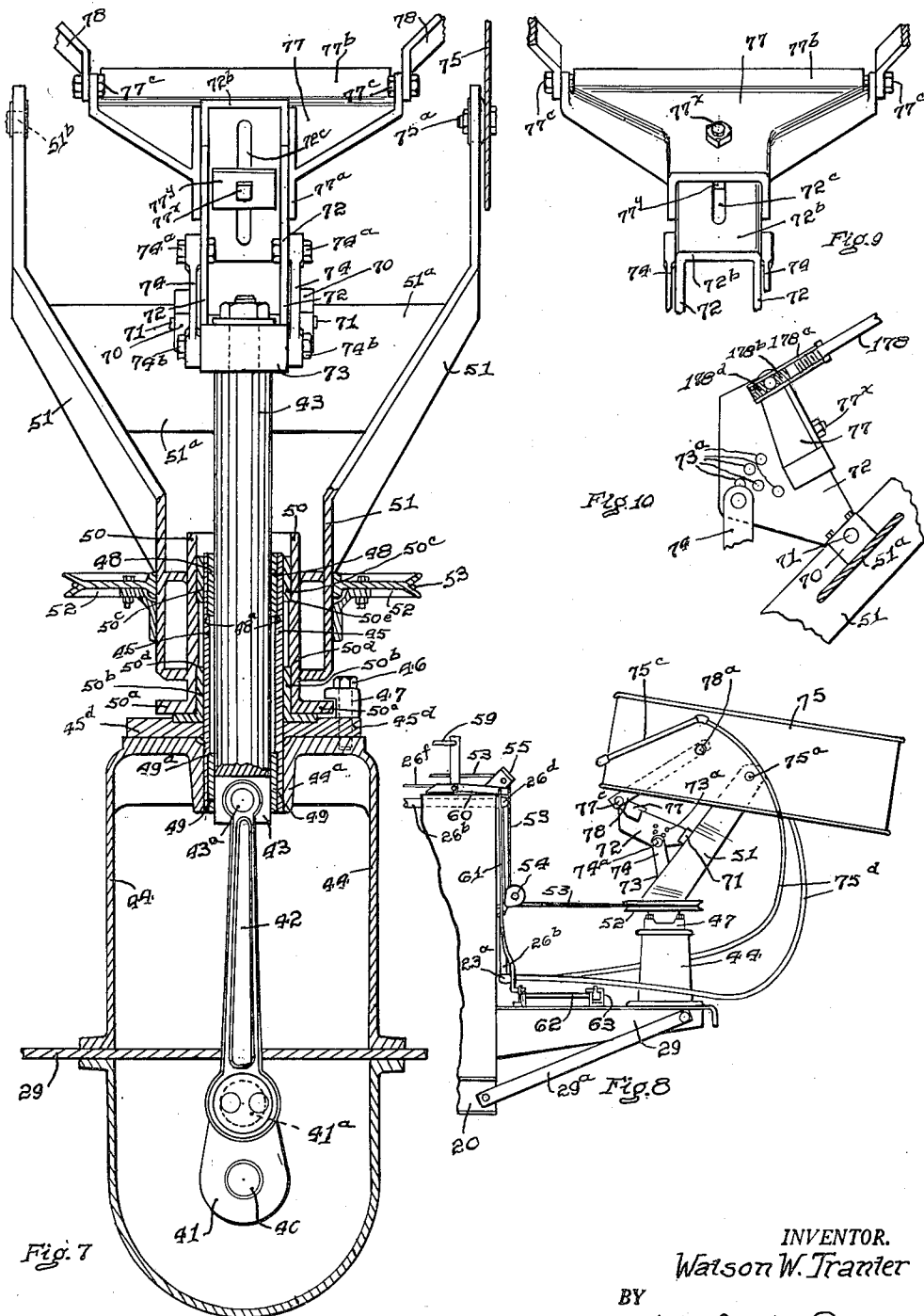
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SPRAYER HEAD CONTROL MECHANISM

Filed Dec. 2, 1947

3 Sheets-Sheet 3



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2,577,828

SPRAYER HEAD CONTROL MECHANISM

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Application December 2, 1947, Serial No. 789,186

3 Claims. (Cl. 299—72)

This invention relates to sprayer head control mechanisms and particularly to those sprayer head controls which move the sprayer heads in a plurality of planes.

In using sprayers, in orchards particularly, it is necessary to meet many conditions if the spray from sprayer head is to reach all parts of the trees to be treated. Some of these conditions are the height of the trees, their girth, their density and in addition, the direction and velocity of the wind at the particular time of use.

The primary object of this invention is the provision of an improved sprayer head movement-controlling mechanism.

Another object of the invention is the provision of an improved sprayer head movement-controlling mechanism having means for causing movement about both substantially horizontal and substantially vertical axes.

Still another object of the invention is the provision of an improved sprayer head movement-controlling mechanism wherein there is provided means for moving the sprayer head about a substantially horizontal axis while another means may be simultaneously moving the sprayer head about a substantially vertical axis.

Another and still further object of the invention is the provision of an improved sprayer head movement-controlling mechanism wherein the sprayer head supporting means is pivotally mounted on a substantially vertical pivot with power transmitting means movable substantially at the axis of the pivot to transmit power to the sprayer head to move it about a substantially horizontal axis.

Another and still further object of the invention is the provision of an improved sprayer head movement-controlling mechanism wherein adjustments of the controlling mechanism are provided to control the characteristics of the sprayer head movement including the vertical angle of movement, the highest and lowest positions in the limits of movement, the acceleration and speeds of movement at various points in travel and the time of substantial stop at the limits of movement for any given speed of the driving element.

Other and further objects will be apparent to those skilled in the art from a reading of the complete specification.

Fig. 1 is a diagrammatic lay-out showing the power connections for the invention.

Fig. 2 illustrates a cross-section on the line 2—2 of Fig. 1.

Fig. 3 is a cross-section on the line 3—3 of Fig. 1.

Fig. 4 is a top plan view of the invention.

Fig. 5 is a side view of the invention with the sprayer head pointing to the rear.

Fig. 6 is a view similar to Fig. 5 but with the sprayer head pointing toward the left.

Fig. 7 is an enlarged partially sectional view of the operating parts of the invention.

Fig. 8 is a view similar to Fig. 5 but with the sprayer head pointing upwardly.

Fig. 9 is a detail view showing a portion of the mechanism of Fig. 7 from the opposite side.

Fig. 10 is a detail view partly in section on the line 10—10 of Fig. 7 but with a modified construction of the link 78.

Similar reference characters refer to the same or similar parts throughout the specification and drawing.

The numeral 20 designates the main frame of the sprayer which is supported by the wheels 21. The forward end of the frame is provided with a hitch 22 with which it is connected to the tractor T. Mounted on the frame 20 is a tank 23 for carrying the supply liquid for the spray.

At the forward end of the main frame 20 is an internal combustion engine 24, which has a drive gear connection 25, 25a to a pump 26. The pump 26 has a suction pipe 26a through which the liquid is drawn from the tank 23. Delivery of the liquid under pressure from the pump 26 is through a pipe 26b which passes through the tank 23 without communication therewith. At the place where the delivery pipe 26b emerges through the rear wall of the tank 23, it connects to a downwardly extending pipe 26c. This pipe 26c terminates in the outlet 23a to the flexible tubes 75d to be later described.

A counter shaft 25b which drives the pump 26 extends through the housing of the pump 26 and is connected to an agitator drive 27. This agitator drive 27 rotates the agitator shaft 28, having agitator blades 28a all in a well-known manner.

Attached to the rear of the main frame 20 is an auxiliary frame 29 which has a pair of brackets 29a, each connected at its outer end to the frame 29 and at its forward end to the main frame 20.

The rear end of the agitator shaft 28 is provided with a double universal connection 29c which is connected to a short shaft 30 on which is mounted a V-pulley 31. This V-pulley 31 is connected to a V-pulley 32 by a V-belt 33. Swingly and pivotally mounted in a position to contact the V-belt 33 is an idler pulley 34, which acts to tighten or loosen the V-belt 33 on the pulleys 31 and 32. The pulley 32 is mounted on a shaft 35 which has at its other end the gear 37. This gear 37 drives a pivotally mounted idler gear 38, which in turn

drives the gear 39 which rotates on and with the shaft 40. The shaft 40 also carries a crank arm 41 which drives the oscillating mechanism for the sprayer head, to be described.

Connected to the crank pin 41a is the lower end of the connecting rod 42, the upper end of which is connected by a wrist pin 43a to a substantially vertically movably crosshead 43. Since rotation of the sprayer head to be described, about a vertical axis, is necessary, the crosshead 43 is cylindrical and has a common axis with the vertical axis of rotation of the sprayer head to be described. The supporting structure for the sprayer head will now be described.

Mounted on the top of the rear platform 29 is the housing 44 which is provided at its upper end with a centrally located downwardly extending cylindrical member 44a. Seated in the inner cylindrical surface of the member 44a, is the hollow shaft or quill 45. Integral or rigid with the hollow shaft 45 is a flange member 45d which is secured by bolts 46 to the housing 44, which also hold the retainer guides 47 in place. The purpose of the retainer guides 47 will later appear. Seated in the upper and lower ends respectively of the hollow shaft 45, are the bearing bushings 48 and 49. These bushings or bearings 48 and 49 are put in place with a press fit against shoulders 48a and 49a to hold them in their proper places as the crosshead 43 moves up and down therewithin.

The direct supporting means for the sprayer head rotate about the hollow shaft or quill 45. A rotating cylindrical member 50 is provided with a rigid flange 50a which extends under and is free to rotate relative to the retainers 47 already described. A flanged bushing 50b is pressed into the lower end of the cylindrical member 50 against the shoulder 50d and forms a thrust bearing pivot for the support of the sprayer head as a whole as will be later made clear. An upper bushing 50c is pressed into the upper end of the cylindrical member 50 against the shoulder 50e, and provides for the support of the upper end of the cylindrical member 50 and the sprayer head carried thereby.

Secured to the cylindrical member 50, are fork members 51, having a connecting web 51a, and which carry the trunnions of the sprayer head to be described. Secured to the fork members 51 is a grooved pulley 52, the plane of which is normal to the axis of rotation of the cylindrical member 50. A cord or wire 53 is seated in the groove of the pulley 52 and its extensions crossed forward thereof to give greater contact with the groove. The ends of the cord or wire 53 pass through lower pulleys 54 and then extend upwardly to the upper edge of the tank member 23, where they pass over the pulleys 55.

From the pulleys 55 the cables 53 extend forwardly to a pulley 56, see Fig. 4, which is mounted rigidly on a vertical shaft which also rigidly carries the manually operated directional wheel 57. The operator in controlling the direction of the sprayer head moves the directional wheel 57 to direct the sprayer head in its pivotal movement about a vertical axis to throw the spray in the desired direction.

Where the delivery pipe 26b connects to the downwardly extending pipe 26c is a valve 26d which has an arm 26e to open and close connection between the pipes 26b and 26c. Connected to the outer end of the arm 26e is a rod 26f which extends forwardly to a position adjacent to that occupied by the operative and terminates in a handle 26g. By pushing or pulling on the handle 26g, the operative may open or close the connec-

tion between the pipe sections 26b and 26c and thus control the liquid delivery to the sprayer head to be described. It is to be understood that when the valve 26d is closed, a suitable by-pass from the pump 26 back to the tank 23 is provided. Since this by-pass valve is not a part of this invention per se, it has not been illustrated nor will it be further described.

Adjacent the directional wheel 57 is a handle 58 on the end of a rearwardly extending rod 59, which connects to one arm of a bell crank lever 60 at its rear end. The other arm of the bell crank lever 60 is connected to a vertically extending rod 61, which at its lower end is connected to an arm of the bell crank lever 62. The other arm of the bell crank lever 62 is connected to a vertical rod 63, which extends through an opening 29b in the platform 29 and is connected to another bell crank 64 which is pivotally supported at 64a below the platform 29. This bell crank 64 carries on one of its arms the idler pulley 34 already described. It will thus be seen that when the operative at the front of the sprayer machine pushes or pulls on the handle 58, the idler pulley 34 will be forced into or out of engagement with the belt 33, which will act as a clutch means to transmit power from the V-pulley 31 to the V-pulley 32 to drive the crank member 41 and to thereby drive the connecting rod 42 and the cross head 43 to drive the vertically oscillating means to control the movement of the sprayer head as will be presently described.

As already stated, the connecting rod 42 drives the cross head 43 and reciprocates the same in a substantially vertical line. At points substantially midway of the ends of the respective arms 51 and mounted on the web 51a are bearings 70, in which is journaled a shaft 71. Secured to this shaft 71 and rotating therewith, are a pair of substantially triangularly shaped lever plates 72 which are connected by a web 72b. The web 72b is provided with an adjusting slot 72c to be later described. Mounted on the top of the cross-head 43 and swivelled on a substantially vertical axis is the swivel block 73. This swivel block 73, and triangular plates 71 are pivotally connected by a pair of links 74. It is to be noted that the plate members 72 may be provided with a plurality of holes 73a, to any one of which the pivot 74a may be secured. By varying the position of the pivot member 74a, the angle of oscillation of the sprayer head may be varied as will be clear from later description.

In addition, it is here noted that by placing the pivot member 74a in various holes 73a, appropriately placed in the members 72, the lower and upper angular limits of travel, the acceleration and speed of angular movement and the length of the substantial pause at the ends of the movements may be changed.

The upper ends of the arms 51 are provided with openings 51b in which are journaled the supporting pivots 75a of the sprayer head shell 75.

The sprayer head shell 75 provides the means for forming a guided path for the air as it picks up the spray from the spray nozzles now to be described. In the form of sprayer head illustrated, the sprayer head shell 75 is of a substantially rectangular shape. Extending from end to end are three supply pipes 75b, which are connected together by a pipe 75c which in turn is connected to the flexible supply hoses 75d. These flexible supply hoses 75d are connected to the connection 23a already described. The spray solution under pressure from the pump 26 forces the liquid into the pipes 75c, 75b and out

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through the nozzles 76, where the liquid forms a spray and gathers the air within the frame or shell 75 for delivery to the plants or trees to be treated. As the details of construction of the nozzle are not a part of the instant invention per se, the construction of the nozzle will not be further described.

As already stated, the triangular members 72 are provided with a rigid reinforcing web 72b, which connects their tops together. Extending across the tops of the triangular members 72, is an adjustable member 77 which has flange portions 77a slidable along the outer surfaces of the triangular members 71 when adjustment takes place. A bolt 77x passes through the adjustable member 77 and slides in the slot 72c of the web member 72b during adjustment. A block 77y straddles the slot 72c and is held in place by the head of the clamping bolt 77x. A reinforcing flange 77b extends across the top of the adjustable member 77. At the sides of the member 77 are pivots 77c to which are pivotally connected the links 78. The opposite ends of the links 78 are pivoted at 78a to the shell 75. It will thus be clear that the swinging movement of the triangular plates 72 will cause the pushing and pulling of the links 78 on the shell 75, causing the latter to oscillate about the pivots 75a as a center and the sprayer head will move to a high angle and then reverse its position until it is at a lower angle.

The operation as a whole will now be described.

With the sprayer trailer connected to a truck or tractor T, the motor 24 is started and the clutch (not shown), to the pump 26 is thrown in and power is supplied to the pump 26 by the pump drive gearing 25, 25a. The shaft 25b rotates to furnish power for the moving parts of the pump 26. The pump 26 draws the liquid through the pipe 26a and discharges it under high pressure through the pipe 26b, the valve 26d, the pipe 26c, the connection 23a to the flexible tubing 75d and thence by the pipes 75c and 75b to the nozzles 76 where the liquid is delivered to the atmosphere.

The agitator shaft 28 drives the double universal joint 29x, which in turn drives the shaft 30, the pulleys 31 and 32, the shaft 35, the gears 37, 38 and 39 and the shaft 40. The shaft 40 turns the crank 41 which through its crank pin 41a and the connecting rod 42, causes the up and down reciprocating motion to the cross-head 43. The swivel block 73 at the top of the cross-head 43 moves up and down with the cross-head and moves the links 74. Since the upper ends of the links 74 are connected to the triangular plates 72 by the pins 74a and since these plates 72 are connected to the links 78, it follows that the latter through their connections to the shell 75 and 78a, will operate to cause the oscillations of the shell 75 and the whole spray head about the supporting pivots 75a which are located in the openings 51a of the spray head supporting arms 51. With the power parts in continuous operation as just described, the circular movement of the crank 41 will cause the oscillatory swinging of the spray head in an up and down movement in a vertical plane. It will be clear that with the adjustment made possible by the insertion of the pin 74a in the desired hole 73a, and the adjustment of the member 77 along the members 72, the members 72 and their web 72b become what amounts to a bell crank member having arms of adjustable length and with the arms at adjustable angles with relation to each other. It is

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this construction which makes possible a variation in the whole angle of travel, the angular relation of the axis of the sprayer head at low and high positions, the speed and acceleration at different points in the movement and the length of the substantial stop at the highest and lowest points in the movement.

As the pressure within the nozzles 76 forces the liquid therefrom, the air within the shell 75 is forced outwardly in a manner which produces a result similar to that of a Venturi tube, a great volume of the air being moved at a great speed. This action causes the spray to be delivered at great distances from the spray head.

While this delivery of spray is taking place, it is found to be advantageous for the operator to be able to turn the spray head about its vertical axis. To do this it is only necessary for the operative to turn the direction wheel 57 in the direction he wishes the sprayer head to turn. This action turns the pulley 56. The pulley 56 is connected to the cable 53, which passes over the pulleys 54, 55 and then around the pulley 52. Since the pulley 52 is rigid with the supporting arms 51 which carry the sprayer head, it follows that the pivoting of the sprayer head is always under direct control of the operative at the directional wheel 57.

With the adjustment of the member 77 along the members 72 and the pin 74a in the proper opening 73a, the tractor or truck draws the sprayer along, for example, through an orchard.

By turning the sprayer head as large trees are passed, the sides of the trees may be reached by the spray from the sprayer head in a most efficient manner.

At the start or finish of an operation, the oscillation of the sprayer head may be started or stopped by the movement of the handle 58 located within reach of the operative. The pressure from the pump 26 may be cut off by operating the valve 26d by the rod 26f and its handle 26g.

A further adjustment may be made by substituting for the links 78, the adjustable links 178 as illustrated in Fig. 9. In this construction, a ball and socket adjustable connection is made. The link 178 screws into a cylindrical shell 178a which has a block 178b against the shoulder 178c. A cotter held block 178d is screwed in the open end of the shell 178a. The ball 177d enters the side of the shell 178a through a suitable opening. A lock nut 178e holds the rod or link 178 in adjusted position.

While an embodiment of the invention has been illustrated and described in detail, it is to be understood that the disclosure is merely illustrative and that modifications and changes may be made without departing from the spirit of the invention and within its scope as claimed.

Having described my invention, what I claim is:

1. A sprayer head movement-controlling mechanism comprising a support, a hollow substantially vertical pivoting means mounted on the support, a sprayer head, an arm support on the pivoting means for supporting the sprayer head, a reciprocating member within the pivoting means, a lever means fulcrumed on the arm support, means connecting one end of the reciprocating member with the lever at a place spaced from its fulcrum, means on the lever for connection to the sprayer head and spaced from the connection to the reciprocating member, and power means for reciprocating the reciprocating member.

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2. A sprayer head movement-controlling mechanism comprising a support, a hollow substantially vertical pivoting means mounted on the support, a sprayer head, an arm support on the pivoting means for supporting the sprayer head, a reciprocating member within the pivoting means, a lever means fulcrumed on the arm support, height varying and angle varying means for adjustably connecting the upper end of the reciprocating member with the lever at any one of a plurality of spaced positions, means on the lever for connecting the sprayer head and spaced from the connection to the reciprocating member, and power means for reciprocating the reciprocating member.

3. A sprayer head movement-controlling mechanism comprising a support, a hollow substantially vertical pivoting means mounted on the support, a sprayer head, an arm support on the pivoting means for supporting the sprayer head, a reciprocating member within the pivoting means, a lever means fulcrumed on the arm support, means connecting one end of the reciprocating member with the lever at a place spaced from its fulcrum, means on the lever for

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connection to the sprayer head and spaced from the connection to the reciprocating member, and power means for reciprocating the reciprocating member, a pivot at the end of the reciprocating member connecting means and openings at various out-of-line positions to selectively receive the pivot for changing the relative distances of the lever connecting means from the lever fulcrum and the angle thereabout.

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