Nov. 1, 1955 C. M. MOORE 2,722,453

OSCILLATING SPRAY RIG PIPE

Filed Sept. 12, 1952 3 Sheets-Sheet 1

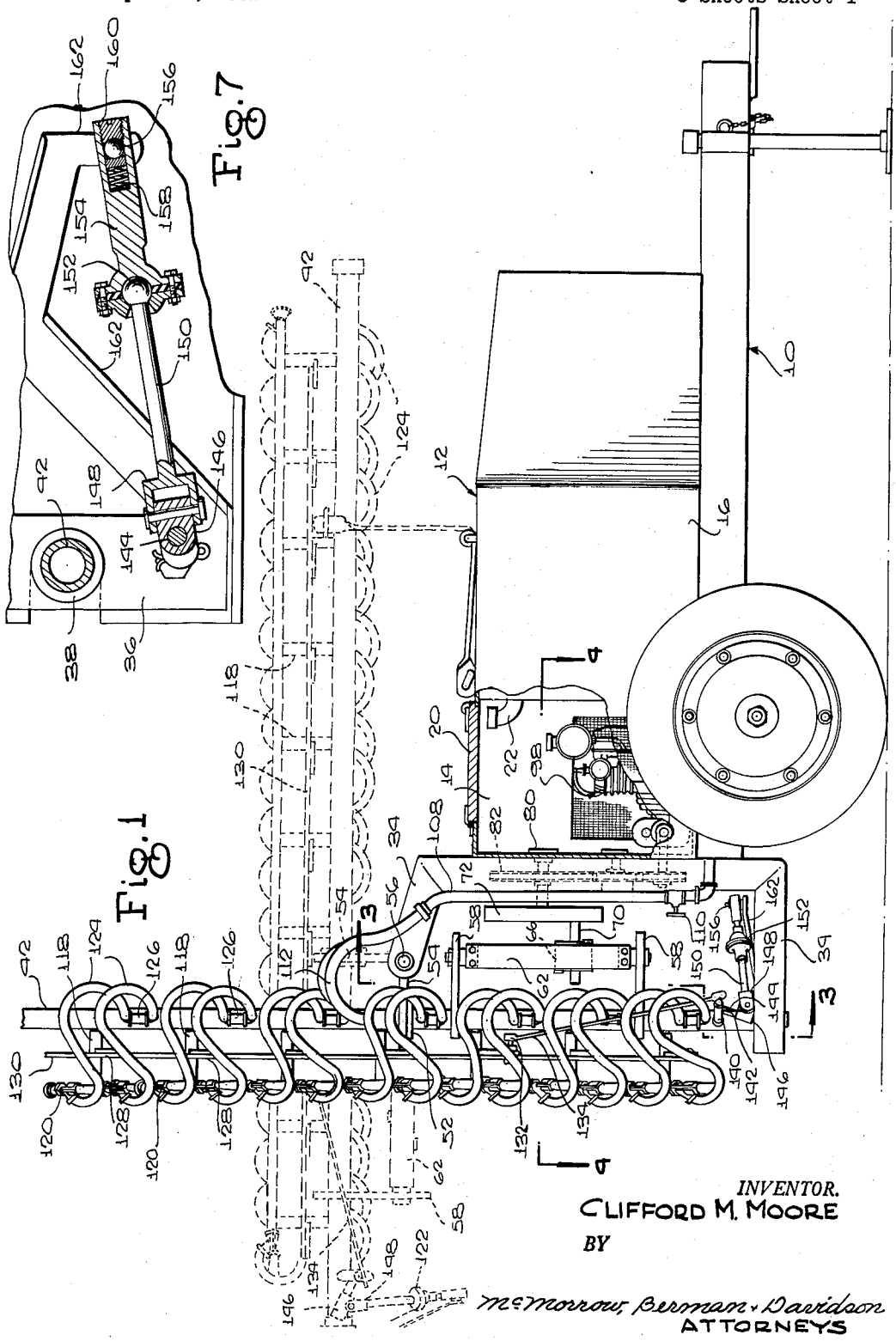

Fig. 1

Fig. 7

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Fig. 2

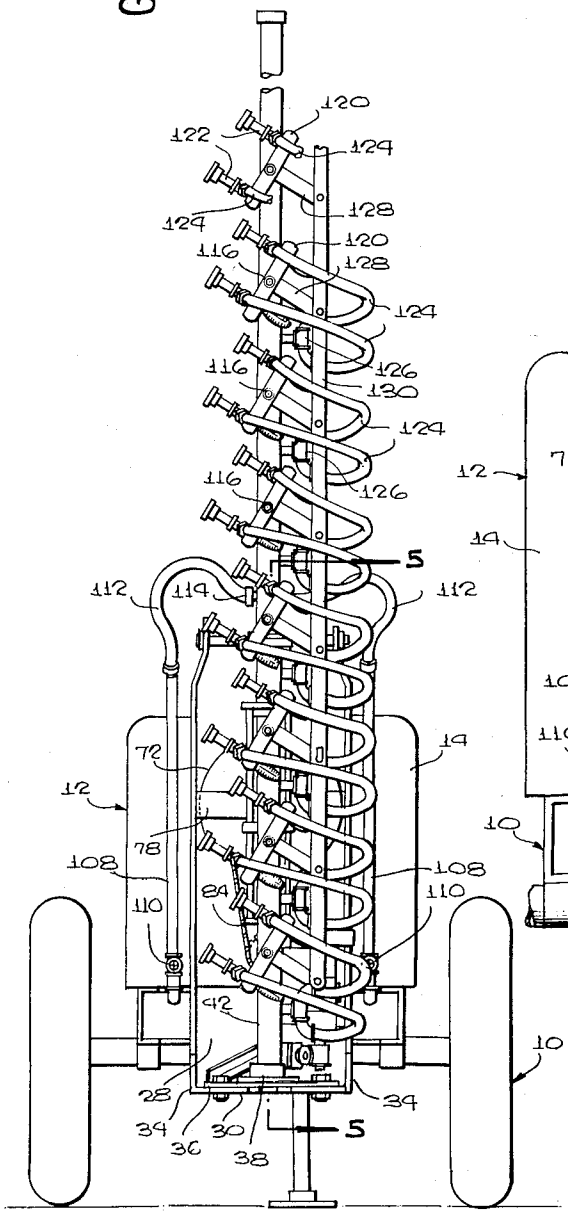

Fig. 3

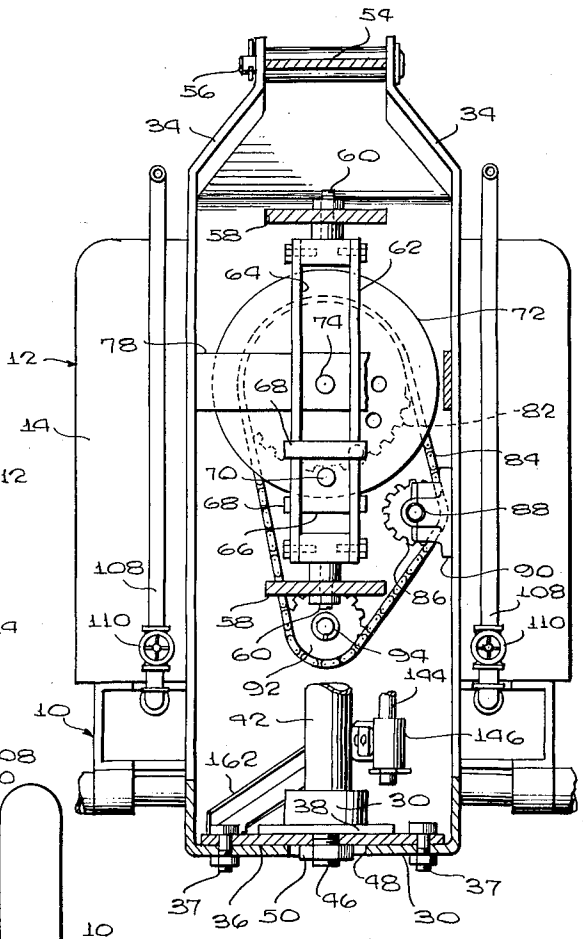

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Fig. 4

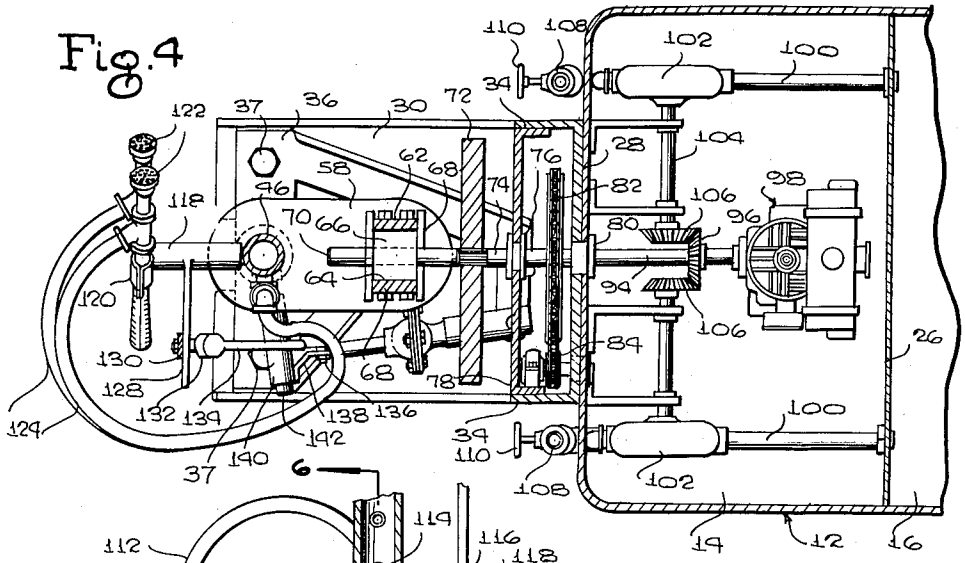


Fig. 5

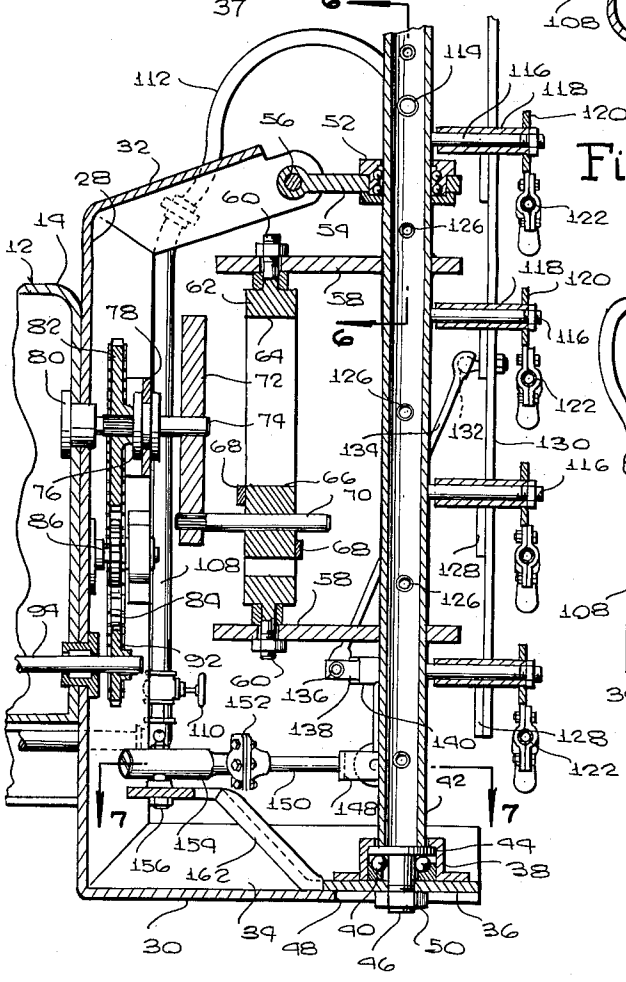
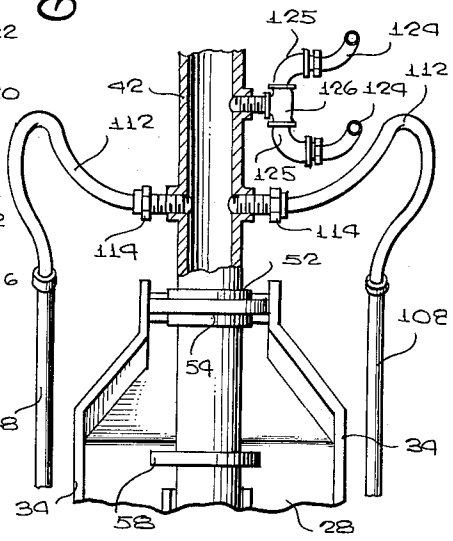


Fig. 6



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OSCILLATING SPRAY RIG PIPE

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Application September 12, 1952, Serial No. 309,293

4 Claims. (Cl. 299—37)

This invention relates to spraying devices, and more particularly, has reference to a device of the character referred to that can be mounted upon a trailer, and used with particular effectiveness in spraying citrus groves and the like, wherein the object to be sprayed is of substantial size, and must be sprayed from top to bottom thereof.

In large scale spraying operations of the character referred to, it will be appreciated that it is a difficult problem in the art to provide for large scale spraying operations, that can be carried out in a minimum of time, and wherein the large objects, such as citrus trees, will still be uniformly and completely sprayed from top to bottom and from side to side thereof. Heretofore, spray rigs have been devised, for the purpose of carrying out these operations, but to my knowledge, there has not been conceived, so far, a spray rig adapted to be mounted upon a truck, trailer, or the like, which will be so designed as to direct sprays of insecticide or the like toward areas of the objects being sprayed, in a manner to completely and uniformly cover said areas, and with the jets or sprays of liquid being shifted through a predetermined spray pattern, by means of an automatically operating mechanism incapable of being affected by human error.

The main object of the present invention is to provide a spray rig which will so operate, and in carrying out the invention, I provide a rig wherein an elongated, vertically disposed, bank or series of spray nozzles will be caused to oscillate about a vertical axis, with the individual nozzles that make up said series oscillating about horizontal axes radiating from said vertical, main axis.

It is a further important object of the present invention to provide a rig of the character referred to wherein a drive means embodied in the structure for the purpose of imparting the joint and individual oscillatory movement to the nozzles will be effectively linked with pumping means, to provide a continuous supply of liquid under pressure to the nozzles.

Yet another object of the present invention is to provide, in a rig of the character referred to, means for bodily tilting the entire rig about a horizontal axis, for the purpose of disposing said rig horizontally during movement thereof from place to place.

Still another object of importance is to provide, in a rig as stated, an arrangement wherein a plurality of different liquids can be comingled directly within the rig, during the spraying operation.

Yet another object of importance is to provide a spray rig as stated which will be designed to spray large objects of the character stated in a minimum time, from top to bottom and from side to side thereof, while still being confined in a relatively narrow area, thus to permit travel of the rig between closely spaced rows of trees.

Other objects will appear from the following description, the claims appended thereto, and from the annexed

drawing, in which like reference characters designate like parts throughout the several views, and wherein:

Figure 1 is a side elevational view of an oscillating spray rig formed in accordance with the present invention, the dotted lines indicating a position to which a portion of the structure is adjusted during movement thereof from place to place;

Figure 2 is a rear end elevational view;

Figure 3 is an enlarged vertical section taken substantially on line 3—3 of Figure 1;

Figure 4 is an enlarged horizontal section taken substantially on line 4—4 of Figure 1;

Figure 5 is a vertical section taken at right angles to the cutting plane of Figure 3, taken on line 5—5 of Figure 2, the scale being the same as that of Figure 3;

Figure 6 is a sectional view through a portion of the tubular boom through which liquid is supplied to the nozzles, taken on line 6—6 of Figure 5; and

Figure 7 is a detail sectional view, the scale being enlarged still further, taken on line 7—7 of Figure 5.

Referring to the drawings in detail, I have designated generally by the reference numeral 10, a trailer, which can be attached to a suitable traction vehicle, not shown. Alternatively, the spray rig constituting the present invention can be mounted directly upon a self-propelled vehicle, such as a truck or the like.

In any event, there is mounted upon the body of the trailer 10 a housing designated generally by the reference numeral 12, said housing being divided into a plurality of compartments including, at the rear end of the housing, a drive machinery casing 14, and a tank 16 extending from the intermediate portion of the housing to the front end thereof. An access door 20 is provided in the top wall of the machinery casing 14, to provide access to the power means disposed therein, and also to permit filling of the tank through fill pipe 22.

In use of the invention, the tank 16 is filled with insecticides comprising concentrates, liquids, and powders mixed with water in specified proportions.

Welded or otherwise fixedly secured to the rear end wall of the casing 14 is an elongated, vertically disposed main support plate 28, said plate being disposed transversely of the structure and having its upper end projecting above the top wall of the housing 12. The lower end of the main support plate 28 projects below the bottom wall of the housing 12, and is integrally formed with a rearwardly directed, horizontally disposed bottom support plate 30. Integral with the upper end of the main support plate 28 is an inclined support plate 32, said top support plate also being extended rearwardly from the housing 12.

For the purpose of rigidifying the construction of the plates 28, 30, 32, there are provided reinforcing flanges 34, said flanges extending continuously along the opposite sides of the several plates.

Referring to Figures 3 and 5, there is fixedly but separably connected to the bottom plate 30 a boom support plate 36, said boom support plate overlying the bottom plate 30, and extending substantially from one side edge to the other side edge of said bottom plate, at the rear or free end of the bottom plate.

At its opposite ends, the boom support plate 36 is fixedly connected to the bottom plate 30 by means of bolts 37 or equivalent fasteners. At such time as the boom support plate 36 is to be detached from the bottom plate, the bolts 37 are removed.

Welded or otherwise fixedly connected to the top surface of the boom support plate 36, medially between the opposite side edges of the support structure defined by the plates 28, 30, 32, is a bearing cup 38, containing anti-friction elements 40 (Figure 5). An elongated, tubular boom 42 has its lower end extended into

the bearing cup 38, said lower end of the boom being provided with a collar 44 engaged within the bearing cup, and overlying the anti-friction elements 40. Integral or otherwise made rigid with the collar 44, and depending therefrom, is an axial, reduced, threaded extension 46 of the boom 42, said extension extending downwardly through a center opening formed in the boom support plate and projecting into a recess 48 formed in the free or rear edge of the bottom plate 30. A nut 50 is threaded upon the extension 46, for the purpose of holding the boom 42 in a properly assembled relationship to the bearing cup 38 and anti-friction elements 40.

Medially between the opposite ends of the boom 42, I provide a bearing 52 extending about the intermediate boom portion, the boom being journaled rotatably in said bearing and in the bearing cup 38. A bearing support plate 54 has one end circumposed about and engaged with the intermediate bearing 52 of the boom, the other end of said bearing support plate being hingedly connected, by means of a hinge pin 56, to the free end of the flanged, top support plate 32 of the main support structure.

As will be noted, the axis of hinged movement of the bearing support plate 54 is horizontal, and thus, when the bolts 37 are removed in a manner effective to detach the boom support plate 36 from the bottom plate of the support structure, the boom and all the parts carried thereby can be tilted about a horizontal axis defined by the hinge pin 56 to the dotted line position shown in Figure 1, in which position the boom is horizontally disposed and may be readily transported from place to place for spraying operations.

Means is embodied in the invention for automatically effecting rotatable movement of the boom 42 during the spraying operation, with said means being arranged to cause the rotation of the boom about its longitudinal axis first in one direction and then in an opposite direction, so that a plurality of spray nozzles carried by the boom will be given oscillative movement about the boom axis and will thereby cause spray jets to be directed from side to side of the objects being sprayed.

To this end, there is rigidly secured to the boom 42 a pair of radial arms 58 of plate-like formation, said arms being respectively made rigid with the boom at locations spaced longitudinally of the boom, and being disposed normally to the axis of rotatable movement of the boom. The arms 58 extend in the direction of the main support plate 28, as best shown in Figures 1 and 5, and in those ends of the arms disposed nearer the plate 28, I form aligned openings in which studs or trunnions 60 are loosely and rotatably engaged. The trunnions 60 extend in opposite directions from the opposite ends of an elongated guide block 62, said block being disposed in parallelism with the boom 42, and being formed with a longitudinal slot 64 closed at its opposite ends.

Mounted for sliding movement within the slot 64, between the opposite ends of said slot, is a slide 66, said slide being held assembled with its associated guide block by means of ears 68 secured to the opposite walls of said slide and extending laterally of the slot 64, said ears extending in opposite directions and being slidably engaged with opposite walls of the guide block 62.

The slide 66 is formed with a centrally disposed, transverse bore in which is rotatably mounted an eccentric pin 70 projecting outwardly from the marginal portion of a driven wheel 72 secured to one end of a horizontally disposed shaft 74 for rotation with said shaft. The shaft 74 is journaled, intermediate its ends, in a flanged bearing collar 76, mounted upon a bearing plate 78, that is rigidly secured at its opposite ends to the side flanges of the main support plate 28, intermediate the opposite ends of said main support plate.

The other end of the shaft 74 is journaled in a bearing 80, mounted in the rear end wall of the casing 14 and in the main support plate 28.

For the purpose of driving the shaft 74, I secure, to the intermediate portion of the shaft, a drive sprocket 82 around which is passed a chain 84, said chain being extended about an idler sprocket 86 (Figure 3) carried by a shaft 88 journaled in a bearing 90 secured to one side flange of the main support plate 28. The shaft 88 of the idler sprocket 86 can be adjustably positioned, in a manner well known to those skilled in the art, for adjusting the tension of the chain 84.

The chain 84 is also passed about a drive sprocket 92 keyed or otherwise secured to a drive shaft 94 journaled in the main support plate 28, said drive shaft having intermediate its opposite ends a bevel gear 96 and being driven from an engine designated generally by the reference numeral 98 and mounted within the casing 14.

From the construction which has so far been described, it will be apparent that on operation of the engine, the wheel 72 will be rotated, and as a result, the slide 66 will be given up and down movement within the slot 64, the guide block 62 being reciprocated bodily in a horizontal path, thus to transmit rotatable movement to the vertically disposed boom 42, with the direction of rotation of the boom being continuously changed.

Means is also embodied in the invention for supplying liquid continuously to the hollow boom 42, during the spraying operation, and to this end, a pair of supply pipes 100 (Figure 4) are mounted within the casing 14, one end of each pipe communicating with the tank 16 and the other end of said pipe extending to a pump 102. In the illustrated embodiment of the invention, a pair of pumps 102 is provided, said pumps being spaced transversely of and within the casing 14, but I believe that it is well within the spirit of the invention to provide a single pump for the purpose of forcing a liquid under pressure to the hollow boom 42.

The pumps 102 are driven by pump drive shafts 104 disposed normally to and extending in opposite directions from the main drive shaft 94, the pump drive shafts 104 being provided with bevel gears 106 that are in mesh with main bevel gear 96 so that the bevel gear 96 constitutes a motion-transmitting member imparting rotation to the shafts 104 by meshing with the gears 106 to drive the pumps 102 from the drive shaft 94 driven by the motor 98.

The liquid pumped is directed into upstanding boom supply pipes 108, disposed exteriorly of the housing 12, and extending upwardly along the rear end wall of said housing. Manually operated valves 110 can be utilized to close the flow of liquid through either or both of said boom supply pipes.

At their upper ends, the pipes 108 are in communication with supply hoses 112, said hoses being of a flexible nature and extending into communication with the intermediate portion of the boom 42. Connecting fittings 114 are employed for the purpose of connecting the hoses 112 to the boom.

The boom 42 supports a series or bank of spray nozzles, the nozzles of said series being arranged in pairs, and said pairs being disposed in a line parallel to and spaced from the boom. To provide a support for the nozzles, the boom 42 has a plurality of laterally projecting spindles 116, said spindles being welded or otherwise fixedly secured to the boom, at locations spaced longitudinally of the boom. The spindles 116 have rotatably mounted thereupon sleeves 118, said sleeves being rigid with nozzle support arms 120 disposed transversely of the sleeves, at the outer ends thereof. The nozzle support arms 120 have clamps at their opposite ends, each clamp engaging a nozzle 122. Thus, it is observed that each pair of nozzles is mounted rotatably upon the boom, for movement about an axis normal to the longitudinal axis of said boom.

To supply liquid under pressure to the spray nozzles **122**, I provide flexible connecting hoses **124**, said hoses being connected at one end to the respective nozzles of each pair of nozzles, and being connected at their other end, by means of L's **125** to T's **126**, said T's being secured to the boom **42** (Figure 6).

I provide means for imparting oscillative movement to each pair of nozzles, about the axis defined by the spindle **116** associated with each of said pairs, during oscillative movement of the complete bank of nozzles about the axis of rotation of the boom **42**. To this end, there is made rigid with each sleeve **118** a radial arm **128**, said arms being pivotally connected, at their outer ends, to an elongated, reciprocating, connecting rod **130**. The rod **130** extends for substantially the full length of and is in parallelism with the boom **42**, and for the purpose of imparting reciprocating movement to said rod along a line parallel to the boom axis, the rod is provided, intermediate its ends, with a ball joint **132** (Figures 1 and 5), whereby the rod is attached to a rod-actuating link **134**. The link **134** is inclined relative to the rod **130**, as best shown in Figure 5, and at its lower end, is pivotally connected at **136** to an ear **138** rigid with a sleeve **140** disposed radially of the boom **42**, and rotatably mounted upon a spindle **142**, said spindle being made rigid at its inner end with the boom.

Integral or otherwise made rigid with the sleeve **140**, and depending from the sleeve in parallelism with the boom axis, is a stub shaft **144**, on the lower end of which is rotatably mounted a block **146** pivotally connected to a yoke **148**, said yoke being rigid with a substantially horizontally disposed shaft member **150** coupled by a ball joint **152** to a swingable arm **154** mounted to swing about a vertical axis defined by an upstanding spindle **156** (Figure 7). The spindle **156** is connected to the arm **154**, by extension of said spindle through a transverse bore formed in the arm **154**, said bore communicating with a socket of the arm in which is provided a spring **158** exerting pressure against one side of the spindle, the other side of the spindle being engaged by a plug **160** threaded into said socket.

The spindle is fixedly connected to the outer end of a support arm **162**, said arm being rigid with the boom support plate **36**.

It is to be noted that when the spray rig is to be tilted to the horizontal position shown in dotted lines in Figure 1, the slide **66** will be withdrawn from the eccentric pin **70**, the pin **70** being fitted loosely in the opening provided therefor in the slide. Additionally, when the spray rig is to be adjusted to said horizontal position thereof, the bolts **37** would be removed, and the boom and the several parts connected therewith will be tiltable bodily to the desired horizontal position.

I believe it is apparent, from the description which has been provided, that during operation of the spray rig, spray jets will be directed from top to bottom of the large objects, such as trees, that are being sprayed, and will at the same time be directed from side to side of said objects, thus to cause the entire object to be sprayed uniformly and completely, in a minimum amount of time. In this way, an entire line of trees in a grove can be quickly and effectively sprayed, in a short time, by a spray rig formed in accordance with the present invention and moving along said line.

The effective spraying action referred to is obtained, in the first instance, by oscillation of the vertically disposed series of spray nozzles as a unit, about a vertical axis, with said spraying action being further obtained by joint oscillation of the several pairs of spray nozzles about horizontal axes, the last named oscillative movement of the spray nozzles being provided for during the oscillative movement of the bank of nozzles about said vertical axis.

All this is achieved automatically, and the drive means used in bringing about the oscillating action is, at the same time, adapted to drive pumps whereby fluid is supplied under pressure to the several pairs of spray nozzles.

It is believed apparent that the invention is not necessarily confined to the specific use or uses thereof described above, since it may be utilized for any purpose to which it may be suited. Nor is the invention to be necessarily limited to the specific construction illustrated and described, since such construction is only intended to be illustrative of the principles of operation and the means presently devised to carry out said principles, it being considered that the invention comprehends any minor change in construction that may be permitted within the scope of the appended claims.

What is claimed is:

1. A spray rig comprising a boom, a plurality of pairs of spray nozzles arranged in superimposed spaced relation and connected to said boom for reciprocating movement in unison, each of said pairs of nozzles being also connected to said boom for transverse rocking movement about the longitudinal axis of the boom upon reciprocatory movement of said nozzles, means operatively connected to said pairs of nozzles for imparting reciprocatory movement to the pairs of nozzles, and means for supplying fluid under pressure to said pairs of nozzles, last mentioned fluid supplying means including a pair of pumps, a pump drive shaft for each of said pumps, gear means carried by each pump drive shaft, and complemental gear means carried by said main drive shaft operatively connected to said gear means on each of said pump drive shafts.

2. A spray rig comprising a support structure, a boom rotatably mounted thereon, a longitudinal series of laterally projecting spindles carried by said boom, a sleeve rotatably carried by and longitudinally surrounding each of said spindles, a nozzle support pivotally carried centrally on said sleeve and disposed transversely thereof, a pair of clamps carried by said nozzle support, one clamp adjacent each end thereof, a pair of spray nozzles, one nozzle held in each of said clamps, means for imparting rotatable movement to the boom to swing the nozzles about the axis of the boom, and means for supplying liquid to be sprayed under pressure to said nozzles.

3. A spray rig comprising a support structure, a boom rotatably mounted thereon, a longitudinal series of laterally projecting spindles carried by said boom, a sleeve rotatably carried by and extending longitudinally of each of said spindles, a nozzle support pivotally carried centrally on said sleeve and disposed transversely thereof, a pair of clamps carried by said nozzle support, one clamp adjacent each end thereof, a pair of spray nozzles, one nozzle held in each of said clamps, means for imparting rotatable movement to the boom to swing the nozzles about the axis of the boom, said means including a main drive shaft, and means for supplying liquid to be sprayed under pressure to said nozzles including a pump operatively connected to said main drive shaft to be driven thereby and flexible means between said pump and said nozzles.

4. A spray rig comprising a support structure including a vertical main support plate adapted to be supported on a vehicle, and top and bottom plates extending laterally from the respective ends of the main support plate, reinforcing flanges extending along opposite sides of said main, top and bottom plates, a boom support plate removably secured on said bottom plate, and bearing means on said support plate; an upstanding tubular boom having one end rotatably mounted in the bearing means on said boom support plate, a bearing extending about an intermediate boom portion, a bearing support plate rigidly engaged at one end with said bearing and hingedly connected to one of said reinforcing flanges on the top plate at its other end permitting hinged movement of said bearing support plate, so that when the boom support plate is detached, said boom thereby being tiltable from an up-

standing to a horizontal position to facilitate transport from one place to another; a longitudinal series of spray nozzles carried by said boom, means for imparting rotatable movement to the boom to swing the nozzles about the axis of boom rotation; and means for supplying fluid to be sprayed under pressure to said nozzles.

References Cited in the file of this patent

UNITED STATES PATENTS

2,365,755	Griffith	Dec. 26, 1944
2,369,950	Daly	Feb. 20, 1945
2,554,702	Heuser	May 29, 1951
2,574,206	Browning	Nov. 6, 1951
2,610,088	Randell	Sept. 9, 1952