United States Patent

Crimmins et al.

[15] **3,666,178**

[45] **May 30, 1972**

[54] FIELD-TREATING DEVICE

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[73] Assignee: **All American Industries, Inc.**, Wilmington, Del.

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[52] **U.S. Cl.** **239/77**, 239/172

[51] **Int. Cl.** **A01n 17/08**

[58] **Field of Search** 239/77, 78, 150, 151, 172

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Primary Examiner—M. Henson Wood, Jr.
Assistant Examiner—Edwin D. Grant
Attorney—Connolly and Hutz

[57] **ABSTRACT**

An elongated canopy approximately 50 feet long and about 10 feet wide is driven widthwise over a field on wheels of adjustable height. Air circulating fans are mounted under the canopy along its longitudinal axis pointing in the direction of movement of the canopy. Crop-treating substances, such as wet or dry chemicals, are ejected under the canopy and intermixed with the circulating air currents. The canopy substantially confines the circulating mixture and applied substance to the portion of the field substantially under it. Adjustable auxiliary lift surfaces and air inlet means may be provided on the canopy to help support its weight above the ground or to responsively control the footprint pressure and attitude of the device. A dual canopy may thus be joined by an auxiliary lift surface. A control console is mounted on a longitudinal center of the canopy. It is rotatable for driving in both directions without turning the entire device around. A pair of tandem driving wheels are mounted in the center of the canopy and freely rotatable castered outrigger wheels are spaced on both sides of the center driving wheels.

26 Claims, 16 Drawing Figures

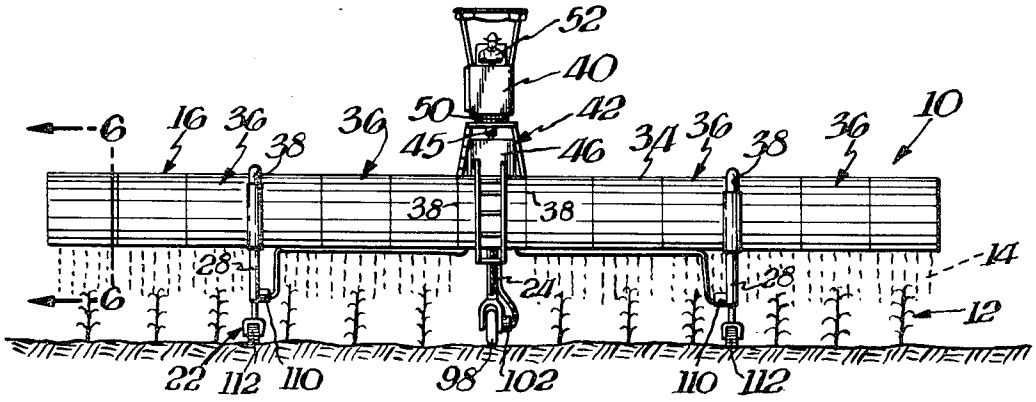


Fig. 3.

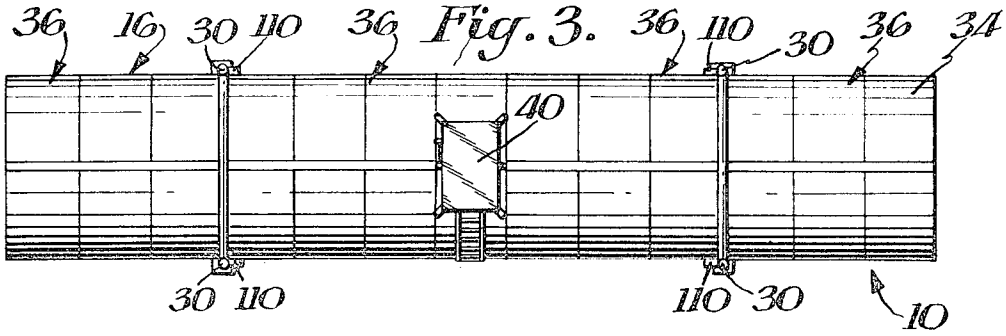


Fig. 2.

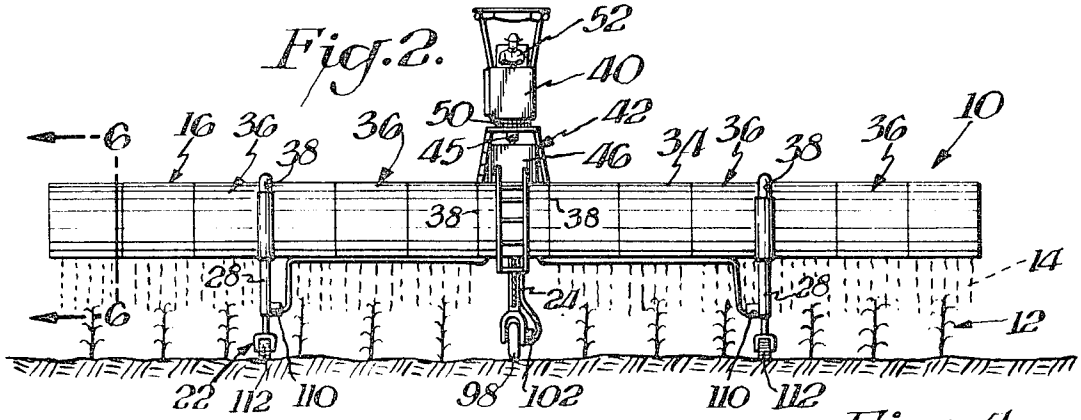


Fig. 1.

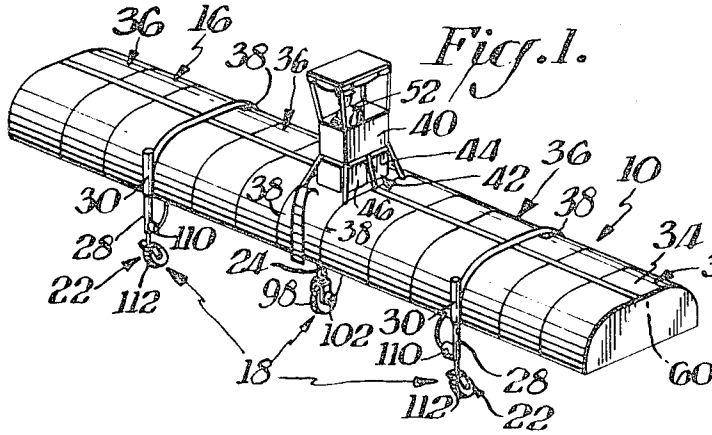


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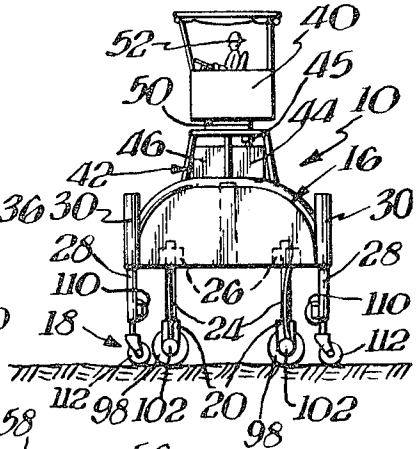
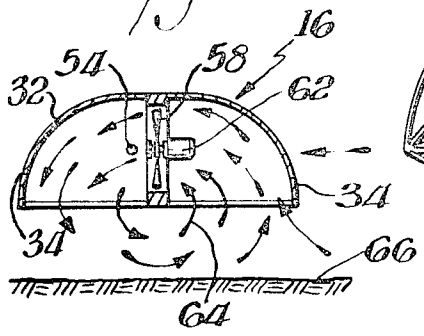


Fig. 6.



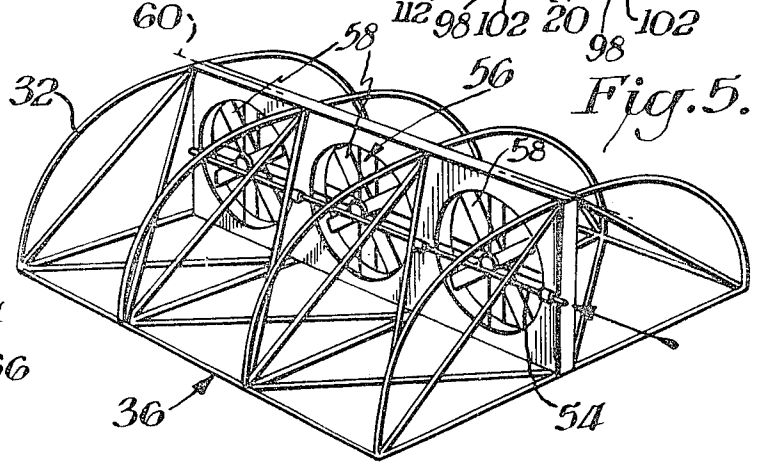


Fig. 5.

Fig. 8.

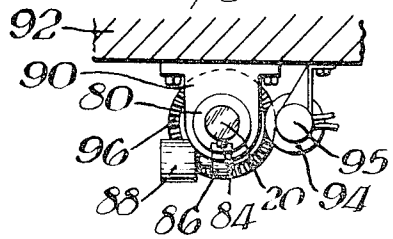


Fig. 7.

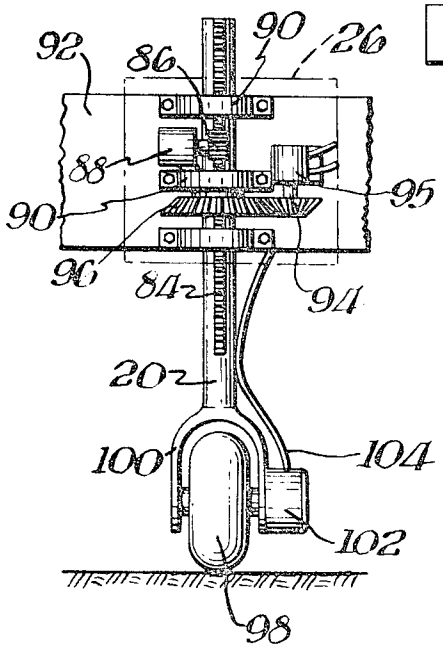
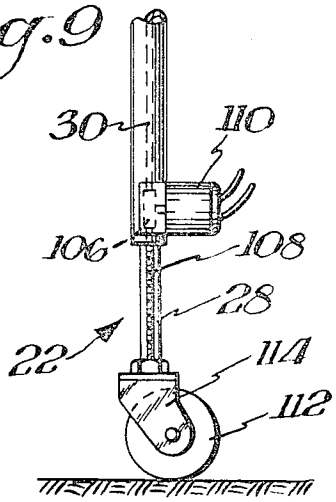


Fig. 9



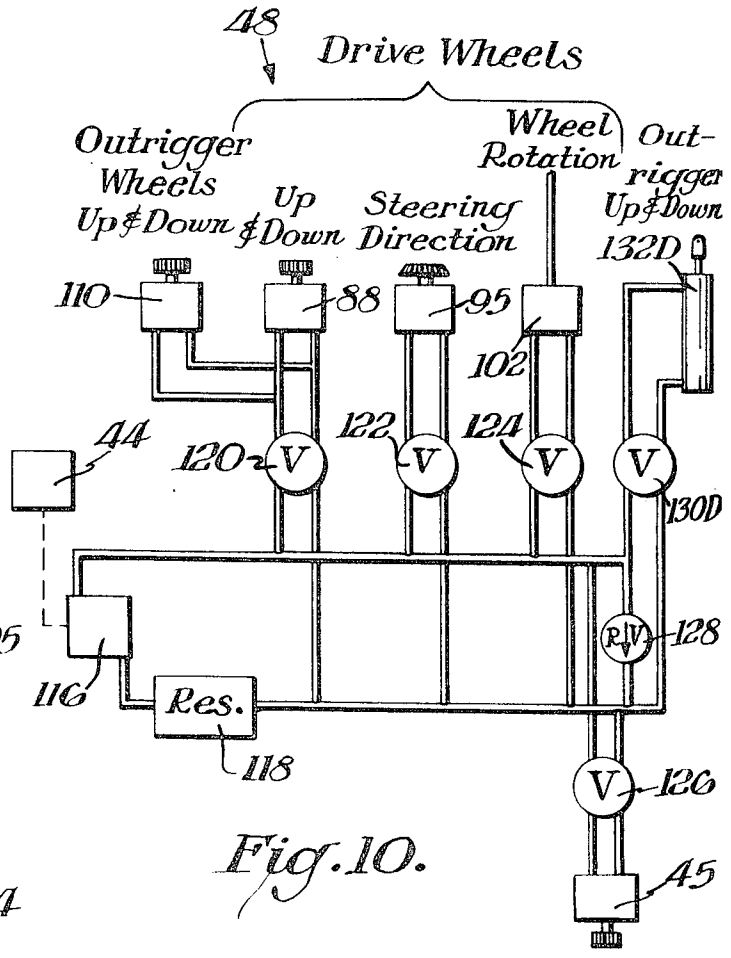


Fig. 10.

Turret Drive

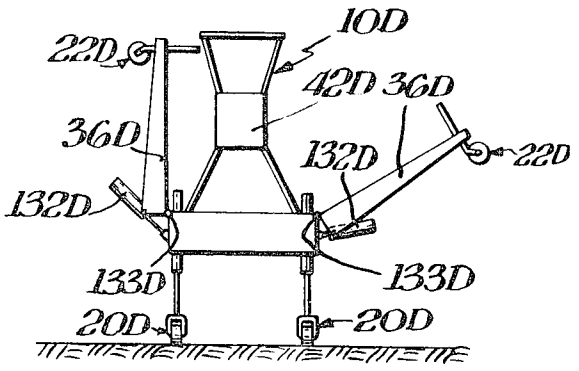


Fig. 16.

Fig. 11.

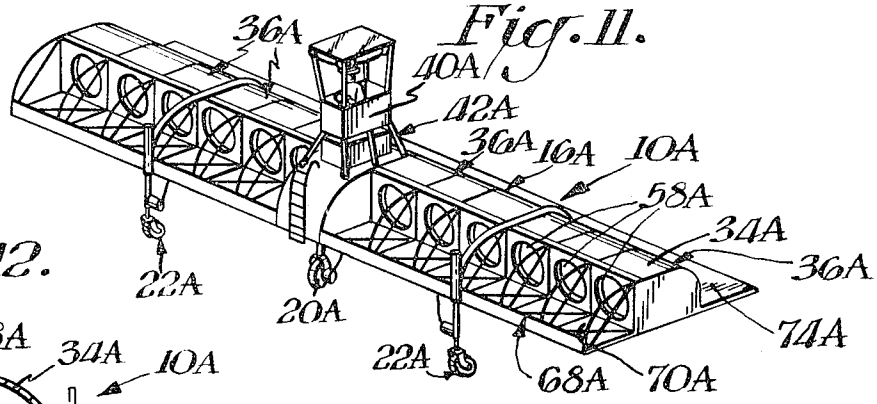


Fig. 12.

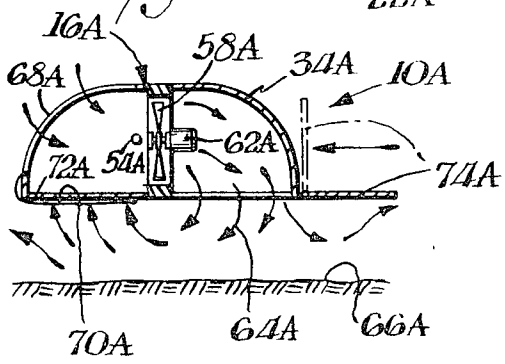


Fig. 13.

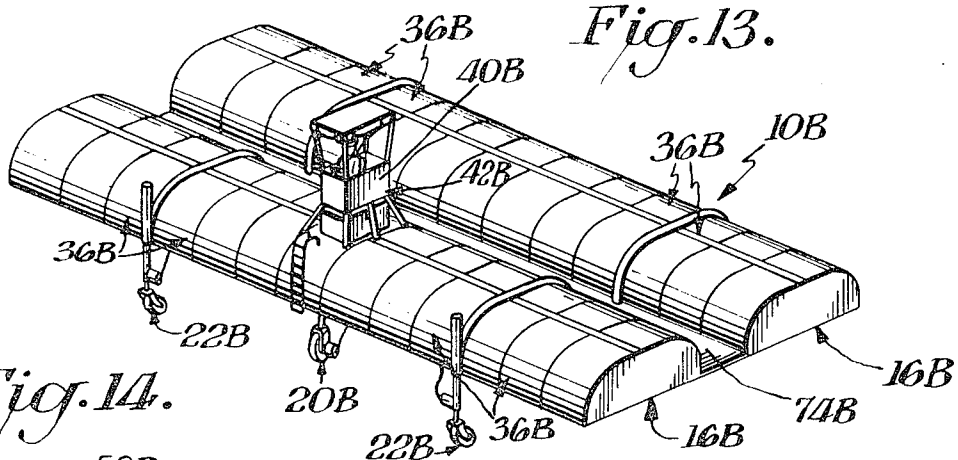


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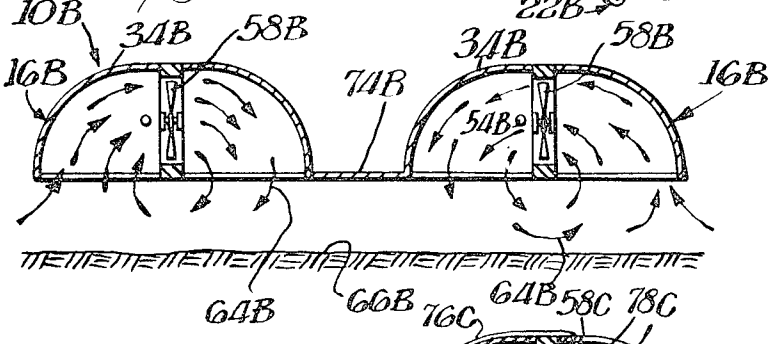
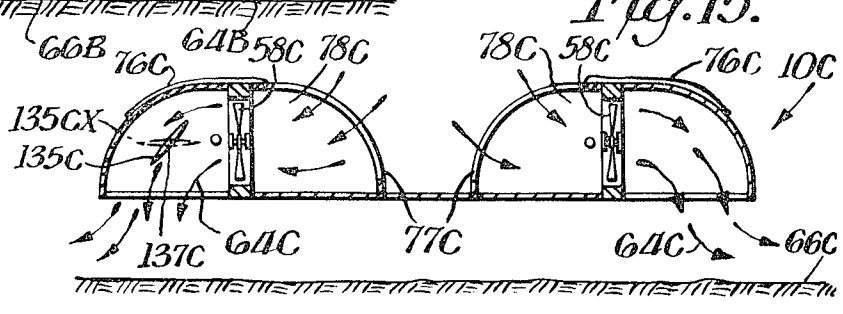


Fig. 15.



FIELD-TREATING DEVICE

BACKGROUND OF THE INVENTION

This invention relates to a device for treating an agricultural field with chemical substances and more particularly relates to such a device with air circulating means. Various airborne devices have been proposed for treating fields and crops with chemical substances, such as pesticides and insecticides. Airplanes, helicopters and ground effect vehicles have been accordingly used. These airborne devices spread chemicals quite rapidly but generate strong air current which disperse the chemicals widely throughout the surrounding area. These airborne devices are also relatively expensive to buy and operate and require licensed pilots. An object of this invention is to provide a device for treating fields and crops which is relatively inexpensive in structure and operation and which confines the treating substances to a predetermined area. Another object is to provide such a device which does not require a licensed operator.

SUMMARY

An elongated canopy having a length extending over several rows of crops and a width of at least several feet is driven widthwise over a field of crops. A control unit (central for example) controls the direction and speed of movement of vertically adjustable wheels. Air circulators are mounted under the canopy for generating air currents which entrain the crop-treating substance ejected under it and which are confined upon the portion of the field directly under the canopy. The canopy may be arranged to react against the air currents for generating lift to help support its weight or to responsively control the footprint pressure and attitude of the device. Alternative auxiliary lift surfaces and air inlets may thus be provided. A pair of tandem elongated canopies connected by a lift suface can generate substantial lift for soft fields. A bidirectional control console can drive the device in opposite directions without turning it around. The canopy may include several detachable sections to facilitate transportation from one location to another.

BRIEF DESCRIPTION OF THE DRAWINGS

Novel features and advantages of the present invention will become apparent to one skilled in the art from a reading of the following description in conjunction with the accompanying drawings wherein similar reference characters refer to similar parts and in which:

FIG. 1 is a three-dimensional pictorial view of one embodiment of this invention;

FIG. 2 is a front view in elevation of the embodiment shown in FIG. 1 in conjunction with a field of crops being treated thereby;

FIG. 3 is a top plan view of the embodiment shown in FIGS. 1 and 2;

FIG. 4 is a right-hand end view of the embodiment shown in FIGS. 1—3;

FIG. 5 is a three-dimensional pictorial view of one portion of the embodiment shown in FIG. 1 with outer covering material removed;

FIG. 6 is a cross-sectional view taken through FIG. 2 along the line 6—6;

FIG. 7 is a front view in elevation of an adjustable driving wheel of the embodiment shown in FIG. 1;

FIG. 8 is a top plan view of the adjustably driving wheel shown in FIG. 7;

FIG. 9 is a front view in elevation of a portion of an adjustable outrigger wheel of the embodiment shown in FIG. 1;

FIG. 10 is a schematic diagram of the steering and driving hydraulic system for the embodiment shown in FIG. 1;

FIG. 11 is a three-dimensional pictorial view of another embodiment of this invention;

FIG. 12 is a cross-sectional view taken through a canopy portion of the embodiment shown in FIG. 11;

FIG. 13 is a three-dimensional pictorial view of a further embodiment of this invention;

FIG. 14 is a cross-sectional view taken through a canopy portion of the embodiment shown in FIG. 13;

FIG. 15 is a cross-sectional view of a modified canopy portion of the embodiment shown in FIG. 13; and

FIG. 16 is a schematic front view in elevation of a still further embodiment of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIGS. 1–4 is shown field-treating device **10** for applying to a field **12** of crops (such as corn shown in FIG. 2) a mixture **14** of air and chemicals such as insecticide. Device **10** includes an elongated canopy **16** about **50** feet long extending over several rows of crops **12** and a width of about 4 feet.

Device **10** includes mobile traction means **18** incorporating a pair of tandem steering and driving wheels **20** and two pairs of tandem free swivelling outrigger wheels **22**. Wheels **20** are mounted on rotatable and vertically adjustable legs **24** in bearing assemblies **26**, later described in detail in conjunction with FIGS. **7** and **8**. Full castering outrigger wheels **22** are mounted on legs **28** which are vertically adjustable in support tubes **30** as later described in detail in conjunction with FIG. **9**.

Canopy **16** includes an elongated frame **32** covered by an air-resistant sheet material **34**, which is for example tightly woven canvas. Canopy **16** includes for example several sections **36** as shown in FIG. **5**. Device **10** shown in FIG. **1** has four of such sections connected to each other at joints **38**, which are detachable from each other to facilitate transportation of device **10** from one location to another. Sections **36** are for example connected to each other by suitable connectors such as nuts and bolts or quick coupling devices (not shown). Central sections **36** may fold upwardly for transportation as later described in conjunction with FIG. **16**.

Control console **40** is mounted on a center portion of device **10** on top of control unit **42**. Canopy sections **36** are connected on both sides of control unit **42**. Control unit **42** includes a power unit **44** and a chemical storage tank **46**. Power unit **44** includes an internal combustion engine and an electric generator (both not shown) and a hydraulic system **48** described in detail in FIG. **10**. Control console **40** is bidirectional by virtue of turret **50** to permit device **10** to be driven back and forth without turning it completely around. An operator **52** can thus remain seated in control console **40**, and alternately drive unit **10** in opposite directions without leaving his seat.

Distributing tube **54** is connected to storage tank **46** and it extends under canopy **16** as shown in FIGS. **5** and **6**. Distributing tube **54** is mounted in front of air circulator **56** which includes fans **58** mounted along the longitudinal axis **60** of canopy **16**. Fans **58** are disposed in a direction normal to axis **60** or in the widthwise direction of movement of device **10**. Fans **58** are rotated by electrical motors **62**, which may be connected to the generator and power unit **44** in a conventional manner (not shown).

FIG. **6** shows the circulation of air currents in the direction of arrows **64** in response to rotation fans **58** under canopy **16**. Air currents symbolized by arrows **64** are substantially confined within the portion of field **66** substantially under canopy **16** to accordingly confine the chemicals applied under canopy **16**.

FIGS. **7** and **8** show the details of control drive and steering leg **20** within bearing support **26**. Leg **20** passes through bearing sleeves **80** having a slot **82** for receiving rack **84**. Pinion **86** driven by hydraulic motor **88** moves rack **84** and leg **20** up and down through bearing sleeves **80** to adjust the vertical disposition of leg **20**. Motor **88** rotates together with one of bearing sleeves **80**. Bearings sleeves **80** are mounted in fixed bearings supports **90** connected to frame **92** of control unit **42**. The angular orientation of leg **20** is controlled by pinion **94** driven by hydraulic motor **95**. Pinion **94** engages bevel gear **96** concentrically mounted on leg **20**. Rotation of wheel **98** mounted in yoke **100** at the bottom of leg **20** is accomplished by hydraulic motor **102** connected by tubes **104** to hydraulic system **48** shown in FIG. **10**.

FIG. 9 shows outrigger wheel assembly 22 including leg 28 mounted in support tube 30. Leg 28 is vertically adjustable relative to support tube 30 by movement of pinion 106 against rack 108 in response to rotation of hydraulic motor 110. Wheel 112 is mounted in full swivelling castered yoke 114 at the bottom of leg 28.

FIG. 10 shows hydraulic system 48 which includes a positive pressure pump 116 of a type suitable for hydraulic control operation, such as a gear pump. Pump 116 is driven by internal combustion engine 44 to supply hydraulic pressure to reservoir 118. Reservoir 118 supplies hydraulic fluid under pressure to motors 45, 110, 88, 95 and 102 for controlling the hydraulic motors for the various steering and adjustment functions indicated in legends on FIG. 10. Actuation of these hydraulic motors, is controlled by suitable valves 120, 122, 124 and 126. Valve 128 is relief valve. The one remaining valve 130D controls cylinder 132D (shown in FIG. 16) which helps fold the center canopy sections 36D upwardly on hinges 133D about center control section 42D to facilitate road transportation.

FIGS. 11 and 12 show a modified device 10A which differs from device 10 in that a portion of sheet material 34A is removed from front section 68A of canopy 16A to provide an air inlet means. Section 68A is uncovered by moving flap 70A from over it to cover lower section 72A of canopy 16A in front of fan 58A. Trailing flap 74A is also provided by folding it down from its retracted position shown in phantom outline against the rear section of canopy 16A. Flaps 70A and 74A provide auxiliary lift surfaces or planes which react against air currents 64A to help support the weight of device 10A. This is particularly advantageous in a muddy field, which might not even support the weight of a person.

FIG. 13 shows another type 10B of crop-treating device including a tandem pair of canopy sections 16B connected by an auxiliary lifting flap 74B. Device 10B is similar to device 10 in all other respects.

FIG. 14 shows the path of air currents 64B which react upwardly against auxiliary lifting surface or plane 74B to help support the weight of device 10B.

FIG. 15 shows a modified device 10C similar to that shown in FIGS. 13 and 14 with the exception that inner canopy sections 76C are removed and folded over the front canopy sections to thus provide open air inlets 78C into the adjacent canopy sections of the tandem pair. Arrows 64C illustrate the air currents directed against the adjacent portion of ground 66C, which help support device 10C. The magnitude of these lifting forces will be later described in detail.

FIG. 16 is a schematic front elevational view of a still further form of this device 10D having hydraulic cylinder 132D for folding center canopy sections 36D upwardly about control section 42D on hinges 133D for transportation.

OPERATION

Devices 10, 10A, 10B, 10C and 10D all are similar to device 10 with respect to application of a chemical to a field of crops 12 and such operation is thus described for all in conjunction with device 10 shown in FIGS. 1–10. A chemical such as an insecticide is distributed under canopy 16 through distributing tubing 54 from storage container 46. The chemical is mixed with air by fans 58 which generate circulating air currents 64. Air currents 64, shown in FIG. 6, are confined substantially between canopy 16 and the portion 66 of field 12 under it. The normal downdraft provided by air currents 64 is approximately 20 miles per hour (30 feet per second) or even less. This is slow enough to avoid the likelihood of damage to the crops.

This confinement of the air currents increases the efficiency of the application and thus lowers the cost of chemical needed per acre and also reduces dispersion to the surrounding area to practically nothing. Environmental pollution is therefore greatly minimized. This reduces the cost of operation of this device to approximately 30 cents per acre in comparison to the cost of 90 cents and one dollar per acre for conventional ground application equipment and fixed wing aircraft.

Device 10 is extremely rapid in operation because it covers a swath as long as the canopy, for example 50 feet. It can travel at speeds up to 20 miles per hour in the illustrated 4 feet wide configuration. Unit 10 is fully ground supported and is thus stable even under windy conditions.

Unit 10A shown in FIGS. 11 and 12 is modified to provide some lift to help support the device over soft fields such as under muddy conditions. Its air velocity is increased over device 10, but is still effective at air velocities of less than 30 feet per second (20 miles per hour). The configuration of FIG. 11 is achieved from FIG. 1 by folding forward canopy flap 70A down under the front end of canopy 16 while the rear flap 74A is extended by folding it down from its retracted phantom position against the rear of canopy 16A shown in FIG. 12.

Device 10B (shown in FIGS. 13 and 14) is a tandem unit providing substantial lift for very poor field conditions. The air velocity ranges up to 30 feet per second (20 miles per hour) similarly to unit 10A. A comparison of aerodynamic horsepower and footprint pressures for device 10 is shown in following Table A. The footprint area is the area of wheel contact.

Device 10C shown in FIG. 15 is formed from device 10B to augment its lift characteristics by folding flaps 76C from adjacent canopy portions 77C to provide air inlets 78C, which direct circulating currents 64C against the ground 66C under device 10C and outwardly therefrom.

Device 10D shown in FIG. 16 folds central canopy sections 36D upwardly about centrol control unit 42D to facilitate rotability of the folded center unit. Outer canopy sections 36D (not shown) are previously detached and are, for example transported on flat bed truck.

For purposes of Table A: Velocity $= \sqrt{(2S/0.002378}$; and $Hp = V \times \text{Perimeter} \times \text{Height} \times S/550)$.

TABLE A

V (velocity) feet per sec.	M.p.h.	S wing loading (lbs. per sq. ft.)	Total lift (lbs.)	Horse-power required	Footprint (lbs. per sq. in.)
10	6.8	0.119	214	1.56	5.70
20	13.6	0.476	857	12.46	4.59
30	20.5	1,070	1,926	42.02	2.73
40	27.2	1,902	3,424	99.60	0.13

The above table is based on the conservative assumption that the 3,500 pound vehicle is operating at a 4 foot height over bare ground. This provides maximum horsepower requirement because the considerable resistance to the flow of air offered by the crops being treated is disregarded.

Because of the lift inherent in the design of the invention, device 10B can travel in fields that a man could only traverse with considerable difficulty. The footprint pressure with a downdraft of 20 mph is roughly half that of a walking may and about 75 percent of the average crawler type farm tractor. With application of full power, device 10B can reduce its footprint pressure to near zero for travel over particularly bad spots or ditches.

All controls, steering, drive and brakes are applied through the supporting wheels. No special talent other than the ability to drive a tractor is required. The quantity of chemical desired per acre is preset into the dispensing system prior to actual spreading. This adjustment is theoretically the same as adjusting the orifice of a common lawn spreader.

The actual metering and control system for chemical application may incorporate a small, very inexpensive analog computer (not shown) that will compute actual ground covered (as measured by wheel rotation) against the operator's control (set for the desired amount of chemical per acre). Thus, the only action then required of the operator is the setting of a knob to a number corresponding to the desired coverage per acre, and this amount of chemical will be automatically dispersed regardless of speed of the vehicle.

The illustrated design is completely modular. The basic machine consists of a power and control module, and two or more "wing" sections. A single wing module is shown in FIG. 5. FIGS. 11 through 15 show various possible configurations to illustrate some of the ways the basic design can be assembled by the user to allow for changing conditions of operation.

When arranged as shown in FIGS. 1–6, the maximum chemical application efficiency is obtained. When firm, dry field conditions exist permitting a footprint pressure of a normal tractor, this configuration re-ingests practically all of the chemical-laden air with a major increase in the efficiency of application. Estimated savings range up to 50 percent of the cost of chemicals as compared to current practices.

As shown in FIGS. 11 and 12, a slight modification to the basic module provides a moderate lift, reducing the footprint pressure considerably for softer field conditions.

FIGS. 13 and 14 illustrate a double system, truly bi-directional, that provides considerable lift with the re-ingestion features of FIGS. 1–6. This design will allow a low footprint pressure for use in very poor field conditions. This design represents perhaps the best compromise.

The FIG. 15 configuration provides the most lift, but there is relatively little re-ingestion, so the application confinement will be lower than FIGS. 1–6, 11–12. The FIG. 15 configuration also does not attempt to control ground dust generation. The primary feature of FIG. 15 of benefit, is the added lift. This requirement might be needed over very muddy fields (where ground dust would not exist) and would permit use of the machine where even a walking man would find his progress painfully slow. It is certainly conceivable that the mechanical system could be arranged so that the operator could change from FIG. 14 to FIG. 15 while in full operation over the field as previously described. Thus, FIG. 14 would be normal, with FIG. 15 used only over ditches, muddy spots, or other cases where high lift and virtually zero footprint pressure would be required.

Under unstable conditions, such as in a high or gusty wind or on uneven terrain, it is advantageous to generate a negative lift to control the attitude of the device to hold it in position relative to the ground. This is easily accomplished by rotating air circulator 56 in reverse, which would reverse the direction of fans 58 and illustrated air currents 64. A negative lift or any desired degree of negative or positive lift can also be obtained by an adjustable attitude airfoil, such as airfoil 135C shown in solid outline in FIG. 15, rotatably mounted on pivot 137C in the path of air currents 64C. The illustrated solid outline position of airfoil 135C is neutral and does not generate any lift because it is substantially aligned with air currents 64C.

The phantom disposition of airfoil 135CX reacts with air currents 64C to generate a negative lift which urges canopy 16C towards the ground and thus helps control the attitude of device 10C. Quick operating controls, such as a stick control, can be provided to enable an operator to rapidly adjust airfoil 135C to counteract the effects of gusts of wind.

The general construction would combine rugged and familiar tractor systems with lightweight, easily repairable (or inexpensively replaceable) modules and fabric, with an estimated gross weight of 3,500 lbs. or slightly less.

Since this is a ground surface machine, 24-hour operations are possible. Its use at night would take maximum advantage of low wind conditions, the existence of dew on plants for even more effective chemical application efficiency, more comfortable operating temperature and greatly decreased overall costs of operation.

General performance conditions would be approximately as follows:

Application Ground Speed	20 mph maximum 10 mph normal
Coverage Width	50' (100% effective)
Payload (Liquid Pesticide)	80 gallons
Maximum Operational Height	6 feet

Application Control—Linked to drive system for direct area measurement.

What is claimed is:

1. A device for applying to a field mixtures of treating substances and air comprising a canopy extending over several rows of crops, mobile traction means connected below said canopy for traversing it over the ground, drive means connected to said device for causing it to move over the ground, a control unit connected to said drive means for guiding the direction and speed of movement of said device, distributing means for said treating substance connected to said device for ejecting said substance under said canopy, air propelling means on said device for generating air currents under said canopy and towards the portion of said field under said canopy for mixing and entraining said treating substance with said air for distribution and substantial confinement to the portion of said field substantially under said canopy, said mobile traction means being elongated to hold said canopy a substantial height above the ground, and said canopy and air propelling means being constructed and arranged for generating a substantial flow of air within and out of said canopy for causing a substantial force reaction by said canopy at said height on said mobile traction means whereby the footprint pressure and attitude of said canopy are responsively controlled.

2. A device as set forth in claim 1 wherein said canopy comprises an elongated frame and a substantially air resistant sheet material upon an upper portion of said frame.

3. A device as set forth in claim 1 wherein said canopy comprises an elongated frame, a substantially air resistant sheet material upon an upper portion of said frame, air inlet openings through portions of said sheet material whereby currents of air are directed relative to said canopy whereby a substantial force reaction is generated to help control the footprint pressure and attitude of said device.

4. A device as set forth in claim 1 wherein said control unit is connected to said canopy, and driving controls in said control unit whereby the speed and direction of movement of said device is controlled.

5. A device as set forth in claim 1 wherein said mobile traction means comprises wheels connected below said canopy on adjustable supports for holding said canopy an adjustable distance above said field.

6. A device as set forth in claim 5 wherein said supports comprise telescopic rods.

7. A device as set forth in claim 1 wherein said control unit is disposed substantially in the longitudinal center of said canopy with said canopy extending laterally on each side of said control unit, a pair of tandem outrigger wheels spaced below said canopy a distance on each side of said control unit to prevent lateral rocking of said device, and a pair of tandem driving wheels mounted beneath said control unit.

8. A device as set forth in claim 7 wherein said control means includes driving controls, swivelling means connected to said wheels and said driving controls being connected to said swivelling means by a control linkage.

9. A device as set forth in claim 8 wherein said control linkage is of the hydraulic type.

10. A device as set forth in claim 1 wherein said canopy includes several detachable sections whereby transportation from one location to another is facilitated.

11. A device as set forth in claim 1 wherein a control console is included in said control unit, a storage means for said crop-treating substance is mounted on said device, and a discharge control means on said storage means and operable from said control console.

12. A device as set forth in claim 1 wherein said control unit includes a control console, and said control console being two-directional to permit said device to be driven in opposite directions without turning it around.

13. A device as set forth in claim 1 wherein said canopy is elongated having a length extending over several rows of crops and a width of at least several feet.

14. A device as set forth in claim 13 wherein said drive means causes said device to move widthwise over the ground in a direction substantially perpendicular to its length.

15. A device as set forth in claim 1 wherein said air propelling means comprises air circulating means.

16. A device as set forth in claim 15 wherein said air circulating means and said canopy means are constructed and arranged to recirculate a substantial amount of said mixtures.

17. A device for applying to a field mixtures of treating substances and air comprising a canopy extending over several rows of crops, mobile traction means connected below said canopy for traversing it over the ground, drive means connected to said device for causing it to move over the ground, a control unit connected to said drive means for guiding the direction and speed of movement of said device, distributing means for said treating substance connected to said device for ejecting said substance under said canopy, air propelling means on said device for generating air currents under said canopy and towards the portion of said field under said canopy for mixing and entraining said treating substance with said air for distribution and substantial confinement to the portion of said field substantially under said canopy, and said air propelling means comprises a number of fans vertically mounted within said canopy along its longitudinal axis, and the axes of said fans being disposed normal to said longitudinal axis of said canopy.

18. A device for applying to a field mixtures of treating substances and air comprising a canopy extending over several rows of crops, mobile traction means connected below said canopy for traversing it over the ground, drive means connected to said device for causing it to move over the ground, a control unit connected to said drive means for guiding the direction and speed of movement of said device, distributing means for said treating substance connected to said device for ejecting said substance under said canopy, air propelling means on said device for generating air currents under said canopy and towards the portion of said field under said canopy for mixing and entraining said treating substance with said air for distribution and substantial confinement to the portion of said field substantially under said canopy, and an auxiliary lift surface is connected to said canopy which is constructed and arranged for reacting with said air propelling means to generate a force reaction for helping control the footprint pressure and attitude of said device.

19. A device as set forth in claim 18, wherein said auxiliary lift surface comprises plane means upon a lower portion of said canopy.

20. A device as set forth in claim 19, wherein air inlet means is disposed in a portion of said canopy for causing a current of air to react against said plane means.

21. A device as set forth in claim 20 wherein said canopy includes movable sections which are constructed and arranged to form said air inlet and said plane means.

22. A device as set forth in claim 18 wherein a pair of said elongated canopies are disposed one behind the other in a direction substantially normal to said canopy, and said auxiliary lift means is disposed between said canopies.

23. A device as set forth in claim 22 wherein air inlet means is disposed in said canopy for reacting against said auxiliary lift surface.

24. A device for applying to a field mixtures of treating substances and air comprising a canopy extending over several rows of crops, mobile traction means connected below said canopy for traversing it over the ground, drive means connected to said device for causing it to move over the ground, a control unit connected to said drive means for guiding the direction and speed of movement of said device, distributing means for said treating substance connected to said device for ejecting said substance under said canopy, air propelling means on said device for generating air currents under said canopy and towards the portion of said field under said canopy for mixing entraining said treating substance with said air for distribution and substantial confinement to the portion of said field substantially under said canopy, and said canopy and said air propelling means are constructed and arranged for generating a negative lifting reaction on said device to help control its attitude.

25. A device for applying to a field mixtures of treating substances and air comprising a canopy extending over several rows of crops, mobile traction means connected below said canopy for tranversing it over the ground, drive means connected to said device for causing it to move over the ground, a control unit connected to said drive means for guiding the direction and speed of movement of said device, distributing means for said treating substance connected to said device for ejecting said substance under said canopy, air propelling means on said device for generating air currents under said canopy and towards the portion of said field under said canopy for mixing and entraining said treating substance with said air for distribution and substantial confinement to the portion of said field substantially under said canopy, and an auxiliary airfoil is mounted on said device relative to said air propelling means for helping control the attitude of said device by reaction with said air currents.

26. A device as set forth in claim 25 wherein said auxiliary airfoil is adjustable for varying its lift characteristics.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,666,178 Dated May 30, 1972

Inventor(s) Crimmins, Arthur G., et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 11, "current" should be -- currents --

line 64, "adjustably" should be -- adjustable --

Col. 4, line 50, "requirement" should be -- requirements --

line 55, "may" should be -- man --

Col. 5, line 50, after "phantom" insert -- outline --

Signed and sealed this 30th day of January 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents