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B2F
Selected US specifications from IPC sub-class B05B

(54) Electrostatic sprayer

(57) An electrostatic sprayer, which may be trailer-mounted for crop spraying, comprises two spray heads (13) incorporating nozzles (23), and electrodes placed on either side of each nozzle and completely embedded in an electrically insulating material whereby no part of the electrode is exposed. The insulating material is a polyester resin of high dielectric constant, and in particular a tetrahydropthalic anhydride based polyester resin, with an additive in the form of tri (β - chloroethyl) phosphate to increase the dielectric properties of the resin. The electrodes (17) of each head are of petal-shape and are connected to a bus-bar 18. The insulating coating covers the electrodes, bus-bars and connections (22).

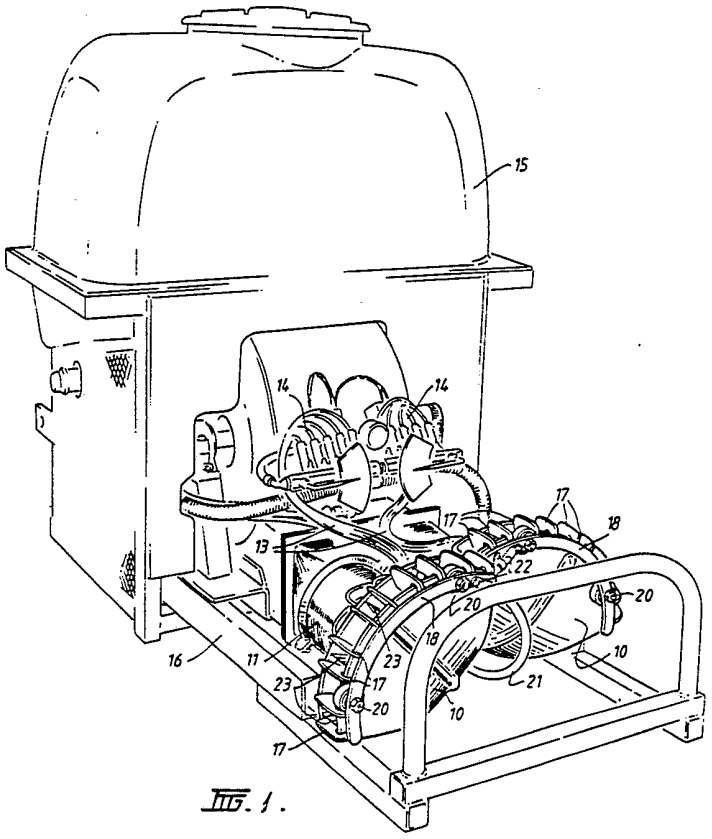

FIG. 1.

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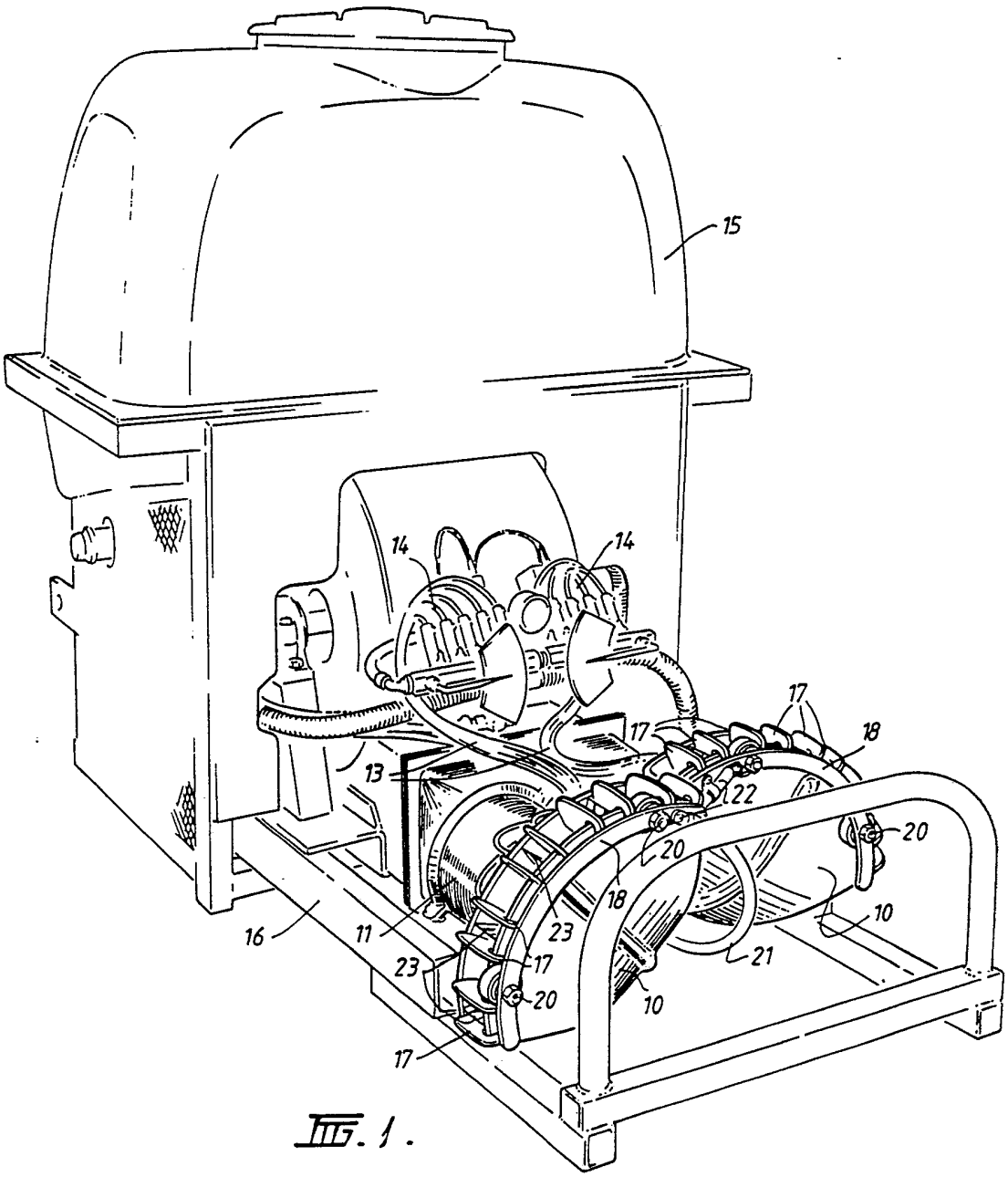
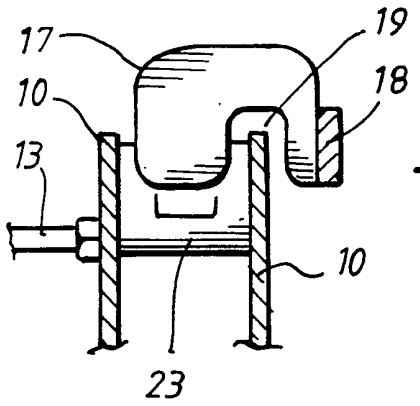
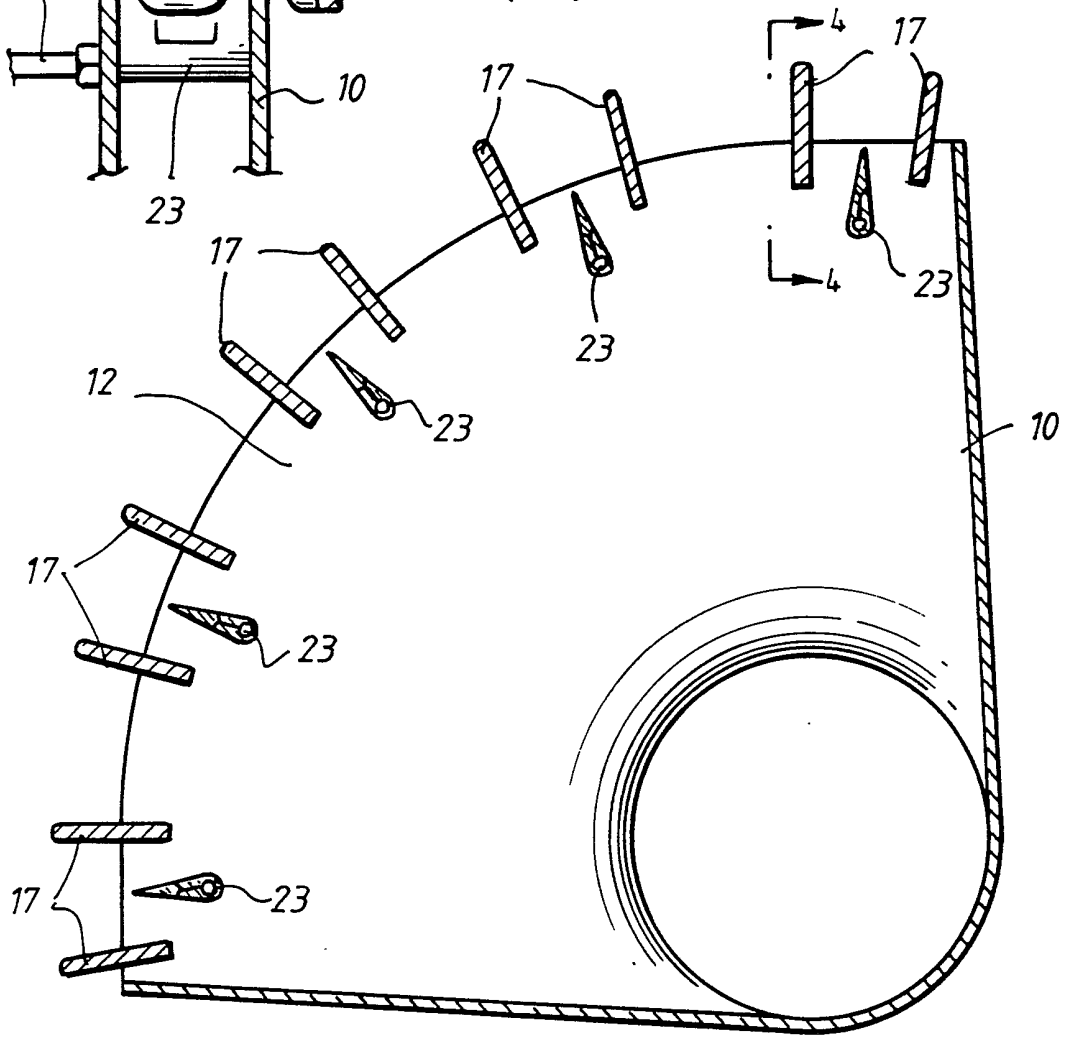


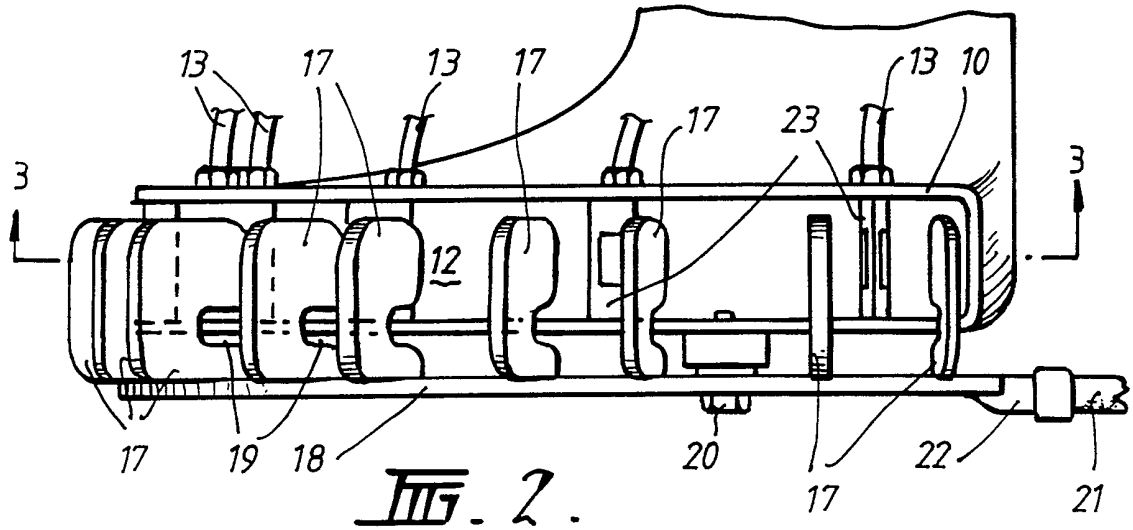
Fig. 1.



ФИГ. 4.



ФИГ. 3.



ФИГ. 2.

ELECTROSTATIC SPRAYER

Technical Field

This invention relates to electrostatic sprayers and more particularly, but not exclusively, to electrostatic sprayers mounted together with a supply tank on a trailer to be drawn behind a tractor or other prime mover through crop to be sprayed, such as an orchard. Alternatively the electrostatic sprayer may be a static installation or mounted, together with supply tank, directly on the prime mover. Throughout the remainder of this specification reference will be made to

the spraying of liquids, although it will be appreciated that the invention is also applicable to the spraying of dusts from a hopper.

Background Art

Conventional electrostatic sprayers of this type, one example of which is described in the specification of Canadian Patent No. 1114427, comprise delivery heads or shrouds in the form of tubes each flared at one end and made of electrically insulating material. The delivery heads are connected to an air supply from a blower such that in operation a high velocity air stream issues from the flared end of the delivery head. Air shear nozzles are mounted inside the delivery heads adjacent their flared ends, and liquid to be sprayed is pumped to the shear nozzles from a liquid supply tank, whereby liquid issuing from the nozzles is atomised by the high velocity air flow passing over the nozzles. The nozzles are maintained at ground electrical potential, and high voltage metal electrodes are positioned inside the flared end of the delivery head in space relation to the nozzles, and are supplied with high voltage positive potential which acts to charge the liquid particles or droplets of the atomised liquid with a negative potential. The effect of the electrostatic charging of the liquid droplets is that, apart from the fact that the blower and the direction of the delivery head is such as to direct the droplets towards and into the crop to be sprayed, the crop being at ground or positive potential attracts the droplets to its surface, such as, in the case of fruit trees, the surfaces of the fruit, leaves and branches, to ensure that as many of the droplets as possible contact the crop rather than drifting into the surrounding environment where their effect is wasted. Electrostatic spraying is therefore an efficient spraying technique not only from the point of

view of crop contact but also reduces wastage and keeps the volume of spray used, and therefore its cost, to a minimum.

The above described electrostatic sprayers represent one type presently in use, although there are other types to which the present invention can be applied, but all have in common the positioning of electrodes adjacent the spray nozzles.

One problem with electrostatic sprayers of all types known to us rests with the fact that liquid or dusts being sprayed accummulate on and coat the surfaces of the insulators on which the electrodes are mounted and other associated surfaces, whereby the charge of the electrode leaks through such electrically conductive coatings and across the insulator surfaces to earth rather than being conveyed to the liquid droplets or dust particles and thus the electrostatic affect required is reduced.

Disclosure of the Invention

It is therefore an object of the present invention to overcome this problem with electrostatic sprayers.

In accordance with the invention there is envisaged an electrostatic sprayer comprising a delivery head incorporating at least one nozzle and at least one electrode positioned adjacent, including surrounding, said nozzle, wherein said electrode is completely embedded in an electrically insulating material whereby no part of the electrode is exposed.

It has been found that, with such complete embedding of the electrodes, the leakage referred to above is avoided, and the electrostatic inductive effect on the droplets or particles is still achieved, and in fact it has been found that in some situations the effect is enhanced as compared with an exposed electrode.

Preferably said insulating material is a plastics material of high dielectric constant insofar as we have found a relationship between the dielectric properties and the amount of charge induced in the spray.

Preferably said insulating material is a polyester resin.

Preferably said insulating material is tetrahydropthalic anhydride based polyester resin.

Preferably an additive in the form of tri(β -chloroethyl) phosphate is added to the polyester resin to increase the dielectric properties of the resin.

Preferably 5% by volume of the additive is used, together with 2% of a catalyst such as MEKP.

Brief Description of the Drawings

One preferred embodiment of the invention will now be described with reference to the accompanying drawings, in which;

Figure 1 is a perspective view of one form of electrostatic sprayer incorporating the invention;

Figure 2 is a plan view from above of one of the spraying heads of the sprayer of Figure 1;

Figure 3 is a cross-sectional view taken along line 3-3 of Figure 2; and

Figure 4 is a cross-sectional view along line 4-4 of Figure 3.

Best Mode for Carrying out the Invention

In this preferred embodiment two electrostatic spraying heads 10 are provided each mounted on the end of the supply duct 11 from a turbine fan (not shown) which draws a large volume of air and delivers it to the spraying heads at in the order of 320 kmh. The fan may be driven by a gear box and pulley drive to increase fan speed from a standard 540 rpm input drive.

Each spraying head 10 consist of a flared tube of fibreglass, and as shown provides an arcuate radially outwardly directed discharge passage 12 through which the air is blown. Positioned at spaced apart intervals along the arcuate length of the discharge passage are a plurality of nozzles 23 of a conventional type to which liquid to be sprayed is pumped by a turbine pump (not shown) through supply hoses 13. The pump may have a capacity of 300 litres/min., and also may have provision to bypass liquid back to the supply tank to assist in agitating the liquid in the tank, which is useful when the liquid is a mixture of spray compositions which needs to be kept homogeneous. In the case of a supply tank of 1,150 litre capacity, the bypass function of the pump may allow for recirculation of the tank volume over a period of 4 minutes. The liquid is pumped from a supply tank 15 through vernier metering controls 14 which allows for adjustment of the desired volume of liquid from the pump to each spraying head, and which are controlled by an operator from a control seat (not shown) mounted, together with a supply tank 15 and the spraying equipment, on a chassis 16. The chassis 16 may form part of a trailer to be towed by a tractor or other prime mover, with a power take-off being used to drive the liquid pump and the air blower. Alternatively, the controls may be mounted on the tractor and controlled by the driver. In another example of the invention, the equipment may have its own engine driving the pump and blower, and may be a static installation or mounted on the prime mover itself.

In this embodiment, the electrodes are formed from steel and consist of a plurality of petal shaped plates 17 on either side of each nozzle 23 and coupled to a common electrically conducting bus bar 18. The electrode plates 17 have notches 19 formed adjacent their connections to the bus bar 18 whereby the edge of the

associated spraying head at the opening from the discharge passage 12 is received within the notches. The electrode assemblies are further coupled to the spraying heads by bolts 20. The electrodes 17 are charged with positive charge through an electrical cable 21 and connector 22 from an electrical power source such as the 12-volt electrical system of the prime mover and may operate at 18000 volts.

In accordance with the present invention, the entire electrode arrangement of plates 17, bus bar 18 and cable connection 22, are completely embedded in a coating of electrically insulating material. We have found that plastics materials of high dielectric constant are particularly suitable as insulating materials, and in particular polyester resins. One group of polyester resins which have proved effective are the tetrahydropthalic anhydride based polyester resins, one of which is marketed under the name "Stypol". A still further improvement has been achieved by adding 5% by volume of tri(β -chloroethyl) phosphate to the polyester resin, together with 2% of a suitable catalyst such as MEKP. The resin, catalyst and additive are mixed together and may be applied to the electrode assembly by dipping, or coating by brushing, but preferably by spraying.

By completely embedding the electrode assembly in the insulating material, electrical charge, cannot, as is the case with known exposed electrodes, leak through any layer of liquid or other conductive coating accumulating on the surfaces of the spraying heads, and in fact with some insulating materials, such as that described above, it has been found that the electrostatic induction effect on the liquid droplets in the liquid spray issuing from the nozzles, and atomised by the air flow, has been enhanced.

It will of course be understood that the present invention has been described above purely by way of example, and modifications of detail can be made within the scope of the invention.

CLAIMS

1. An electrostatic sprayer comprising a delivery head incorporating at least one nozzle and at least one electrode positioned adjacent, including surrounding, said nozzle, wherein said electrode is completely embedded in an electrically insulating material whereby no part of the electrode is exposed.

2. A sprayer as claimed in Claim 1, wherein said insulating material is a plastics material of high dielectric constant.

3. A sprayer as claimed in Claim 2, wherein said insulating material is a polyester resin.

4. A sprayer as claimed in Claim 3, wherein said insulating material is tetrahydropthalic anhydride based polyester resin.

5. A sprayer as claimed in Claim 3 or 4, wherein an additive in the form of tri(β -chloroethyl) phosphate is added to the polyester resin to increase the dielectric properties of the resin.

6. A sprayer as claimed in Claim 5, wherein 5% by volume of the additive is used, together with 2% of a catalyst.

7. An electrostatic sprayer, substantially as hereinbefore described with reference to the accompanying drawings.

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