A PUMP FOR RESEARCH STUDIES WITH ULTRA-LOW VOLUME SPRAYERS[1]

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Application of ultra-low volume (ULV) sprays requires coverage of the target area with droplets 500 microns in size and smaller. Various styles of drop generators are available to break up liquids into droplets of the desired size. A common method is the use of a spinning shape with small holes drilled at the maximum periphery to produce drops in the 100 to 500 micron region. As spray coverage is dependent on many small drops reaching the foliage rather than having the liquid flooding the foliage to the point of runoff as is the case with conventional high-volume sprays, equipment used for ULV application for research purposes must be such that repeatable accurate coverage over a row length can be made. A pump and three wheel cart has been developed to assure even coverage by producing plunger movement of a hypodermic syringe pump relative to any given row length through the use of a land driven wheel (Fig. 3).

Application

The equipment, as described, was used at the C.D.A. Research Station, Charlottetown, P.E.I. to apply technically pure malathion, Cidial and phosphamidon to potatoes for the control of Colorado potato beetle, potato aphid and flea beetle. The potatoes were grown in field plots 15.24m long and 1m apart. Five applications were applied per season and comparisons were made with conventional spray methods.

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Description

The pump is mounted on a hand pushed cart with a drop generator and a blower (Fig. 3A). The drop generator was obtained from Chemagro Corporation[1] and consists of a bell shaped spinner with small holes drilled at the maximum periphery. The bell was originally attached to the shaft of a small 6 volt motor. Liquid was forced to the interior base of the bell by a hand-held hypodermic syringe and a small tube bent around the profile of the bell. The assembly was modified by attaching the bell to a hollow shaft mounted in ball bearings. A 12 volt miniature motor was attached outside of the bearing housing and turned the hollow shaft via nylon gears. The feed tube was placed in the hollow shaft and bent to place the liquid at the interior base of the bell (Fig. 1).

A propeller fan was added to direct the spray pattern to the plants. As spray material was required on the underside of the leaves, the fan was mounted below the drop generator to blow the small droplets up into the foliage. The fan is powered by the motor originally used to power the bell shaped drop generator. Both the fan and drop generator are attached to the cart with swivel and slide attachments to provide unlimited adjustment of anle and level of application (Fig. 3C).

The pump makes use of hypodermic syringes for accurate and repeatable applications (Fig. 2). Various sizes of syringes (A) fit into holders (B) which are clamped to the pump frame. A screw (C) with .635mm per revolution lead (40 threads per inch) is the driving member. A quick release clamp nut (D) with threaded jaws fits over the threaded lead screw and applies pressure to the syringe plunger when the lead screw is

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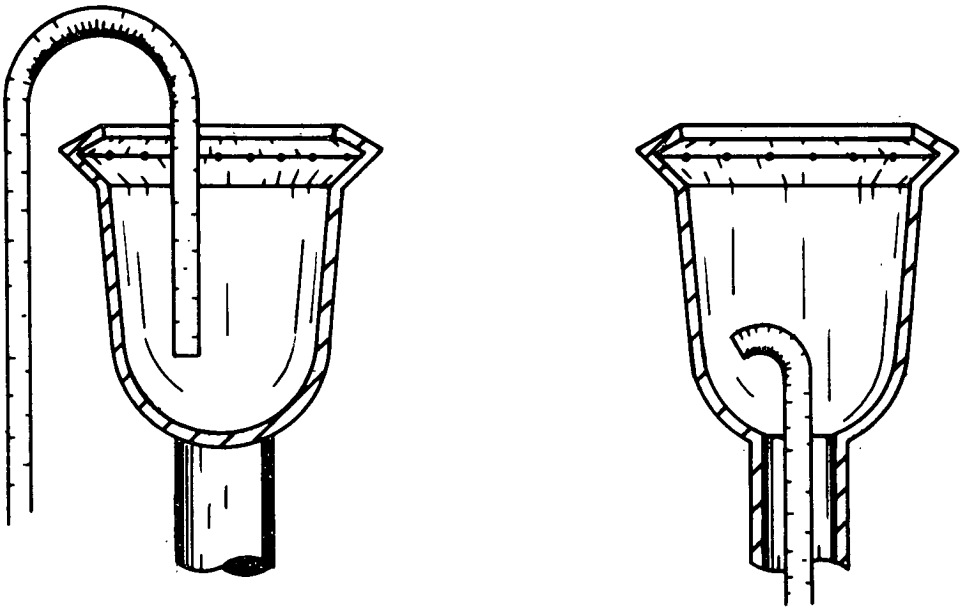
[1]Chemagro Corp., Box 4913, Kansas City, Mo., U.S.A. 64120.

turned. Positioning of the clamp nut at any position on the lead screw is possible. A safety release (E) opens the clamp nut as the plunger reaches the bottom of the syringe. The safety release fits into a slot at the bottom of the pump frame and can be adjusted to suit different types of syringes. The device is reset with a knob at the bottom of the pump (F). The amount of liquid pumped is dependent on the size of syringe used and the speed of rotation of the lead screw. Liquid is transferred from the pump to the drop generator by a small diameter catheter tube (G). The lead screw is turned by a ground driven wheel on the cart through a chain drive and a flexible shaft (H). The chain drive has interchangeable sprockets and a chain tightening device to alter gear ratios and thus the ratio of ground driven speed to lead screw speed. Provision is made to reverse the direction of rotation of the lead screw drive which permitted the cart to be pushed or pulled through the plot (Fig. 3D).

In addition to the land wheel drive, the pump is equipped with an electric motor to permit use of the drop generator and fan without use of the cart. A miniature geared head motor is mounted to drive the lead screw through a worm gear drive (Fig. 2-J). A clutch arrangement permits changing the drive from motor to land wheel. The motor operates from a 12 volt battery and is controlled with a switch and rheostat.

The cart was designed to carry the application equipment plus a battery through narrow rows. The rear wheels can be adjusted to suit the Vee trench left after hilling the plots. The handle bars were made removable and could be folded flat for transport (Fig. 3B).

LIQUID PLACEMENT IN SPINNER



ORIGINAL MODIFIED

FIG. 1

Conclusion

The pump and sprayer were used for three years to compare ULV spraying with conventional spraying. Both methods directed the pesticide to the underside of the leaves. Application of the ULV spray at 420 gm per ha was comparable to conventional application at 240 L per ha. Repeatability of spray per row per application with the ULV pump was satisfactory. Pulling of the cart was preferable as the spray could be directed away from the operator and the dirction he was facing. A similar pump with electric motor drive is now available[2] and may be adaptable to a ground-wheel drive as described here.

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[2]Sage Instruments Inc., 2 Spring, White Plains, New York 10601, U.S.A.

Acknowlegement is given to Mr. W. J. Mundy for shop assistance in constructing the pump.

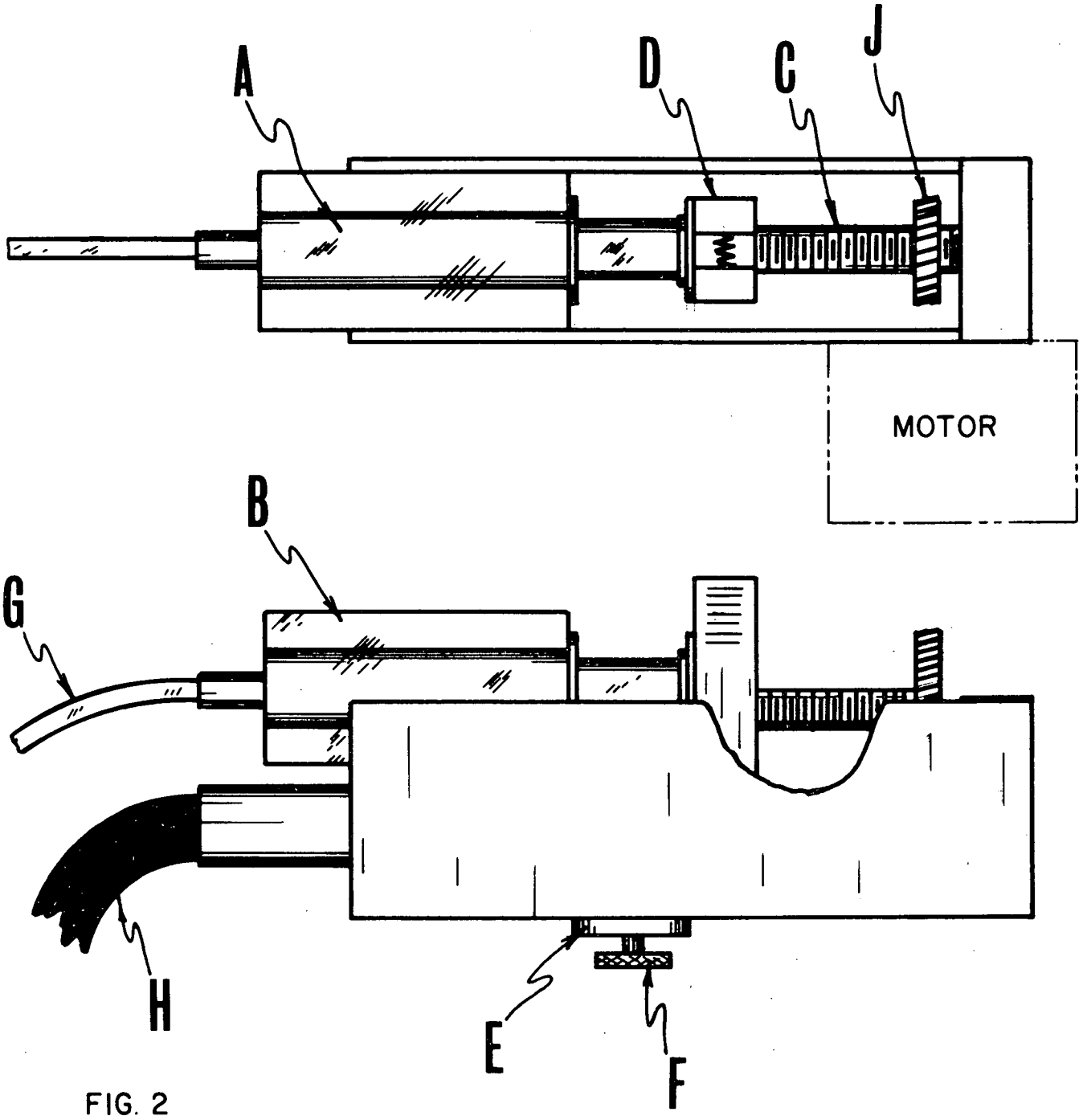

FIG. 2