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TOOWOOMBA PLOT SPRAYER

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SUMMARY

The design and the construction of a self-propelled sprayer for experimental plots are described. This machine allows accurate spraying of plots with all commonly available spraying materials. Three travel speeds are available and flexibility in boom height and position is provided.

I. INTRODUCTION

The success of experimental work involving the use of sprays rests heavily on the accuracy of application. Many types of experimental sprayer giving accurate application have been developed, principally in Europe and North America. Nordby (1968) gives a resumé of the advantages and points of interest for the various models.

The self-propelled type allows an even speed to be maintained over uneven or wet ground conditions. The IAMFE Handbook (International Association on the Mechanization of Field Experiments 1968) lists most of the experimental sprayers commercially available. Unfortunately only one of these is self-propelled and its landed cost in this country would be high. Hergert (1968) also lists sprayers that are readily available. Again only one of these is self-propelled and it suffers from the disadvantages of no differential and no rear supporting wheels.

II. REQUIREMENTS AND SPECIFICATIONS

To meet the needs of the Queensland Department of Primary Industries, local design and construction of a sprayer seemed the best solution. The requirements were for:

- (1) A self-propelled sprayer capable of spraying up to 13 litres per filling of the tank.
- (2) A sprayer capable of handling all sprays, including wettable powders, at different application rates.
- (3) A sprayer to handle booms up to 4 m long offset to one side of the machine, or 8 m booms symmetrically mounted.
- (4) A sprayer of a size easily transported by normal utility vehicle.

To fulfil the second requirement it was decided to use two independent spraying systems, the first of the gas pressurized type and the second using a conventional piston pump, tank and agitator.

Figures 1, 2 and 3 show general views of the machine, the important components being numbered as below.

- (1) 2.3 kW petrol engine with 6:1 reduction ratio.
- (2) 3-speed and reverse transmission and differential ("Kirby Peerless" Model 1200 Transaxle).
- (3) Piston pump ("Rega" model 1 twin piston) with regulator (Model PP43).
- (4) Spray tank, capacity 16 litres, aluminium construction. Features removable top and fittings for pump bypass, agitation and outlet. A drain tap is incorporated with the outlet.
- (5) Propane pressure container, 4.5 kg fitted with 0-410 kPa regulator.
- (6) Solution tank for gas pressurized spraying system. Capacity, 10 litres, fitted with removable top bung.
- (7) Slide and adjustable stops for varying boom height.
- (8) Chain drive to driving wheels from transaxle output shafts.
- (9) Cone clutch for pump drive.

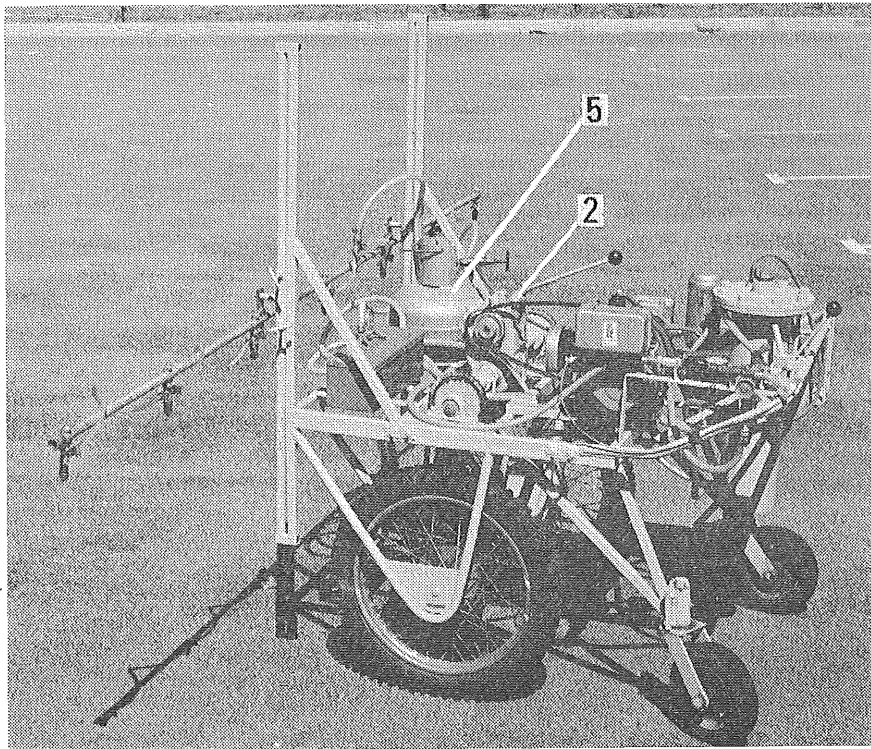


Fig. 1.—General view of machine. 2 = 3-speed and reverse transmission and differential.
5 = Propane pressure container and regulator.

The sprayer is driven by two 8 cm x 48 cm motor cycle wheels and supported at the rear by 6.5 cm x 15 cm wheels and tyres. Castor mounting of the rear wheels allows swivelling when steering. High clearance under the machine, as seen in Figure 2, is a useful feature and plants to a height of 1 m can safely be driven over. Higher crops can be treated by using an offset boom. Wheel spacing on the present machine is 89 cm, enabling five 17.8 cm rows to be straddled. Damage to crops in 17.8 cm rows has not been a problem with crops up to 1 m high. Different wheel spacings could be provided with little change to the machine described here.

Construction of the machine frame is from 1.9 cm black pipe and 2.5 cm x 2.5 cm and 2.5 cm x 5.1 cm rectangular hollow section tube. Brackets attached to this frame are used to attach such items as tanks, gas cylinders and controls. The slide for the boom allows the boom height to be varied from 0.5 m to 2 m. The boom consists of 1.25 cm galvanized water pipe to which the nozzles are attached with Rega adjustable nozzle clamps to allow easy changes in nozzle spacing.

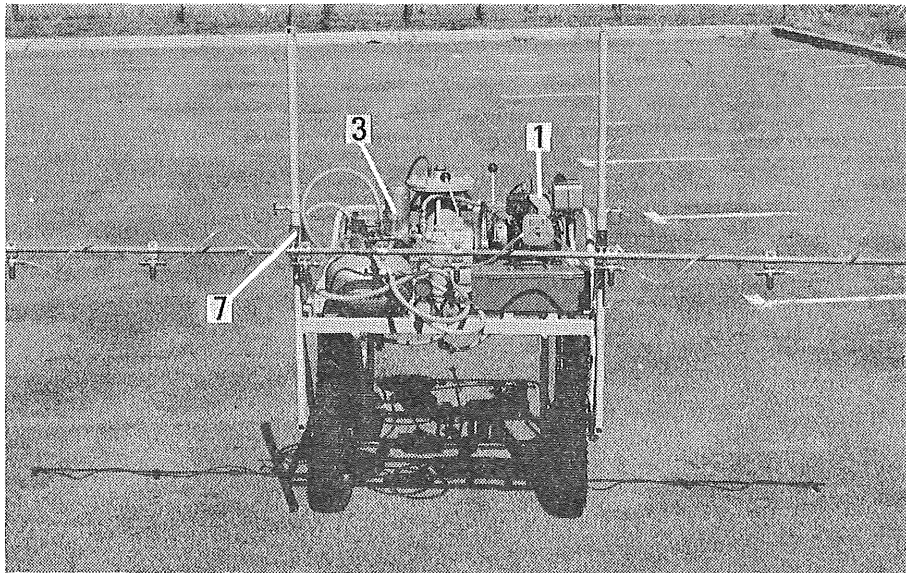


Fig. 2.—General view of machine. 1 = Petrol engine. 3 = Piston pump with regulator.
7 = Slide and adjustable stops for varying boom height.

A belt-tightening clutch is used to couple the engine with the transmission and a cone clutch to connect the pump. Both the pump and the transmission can be operated independently of one another. The transmission gives three forward speeds and one reverse. Figure 4 shows the range of speeds available in each gear and the corresponding pump outputs.

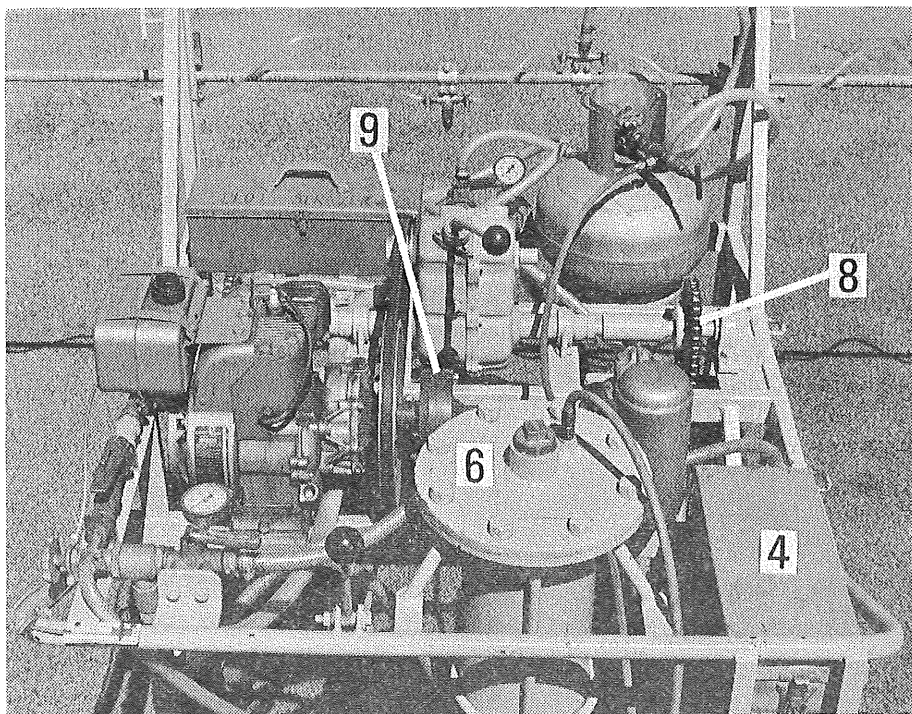


Fig. 3.—General view of machine. 4 = Spray tank. 6 = Solution tank for pressurized spraying system. 8 = Chain drive to driving wheels from transaxle output shafts. 9 = Cone clutch for pump drive.

The spray container for the pressure system is mounted at the rear of the frame. Flexible hoses connect this container with the gas cylinder and the spray boom. A shut-off valve in the line from the tank to the boom is used to control spraying. Control of the pump system is by shut-off valve contained as part of the pump regulator. Agitation of the spray solution in the tank is achieved by directing the regulator by-pass into the solution through a small nozzle. The size of the pump is such that a large volume is always by-passed; hence agitation is always assured. In-line filters are used with both systems. Spraying pressure is monitored by a gauge mounted near the input to the boom.

Total cost of the machine including spray booms, nozzles, and labour was \$810 (1971 Government prices). Labour costs amounted to about \$200. Plans and full details of components are available from the Queensland Department of Primary Industries.

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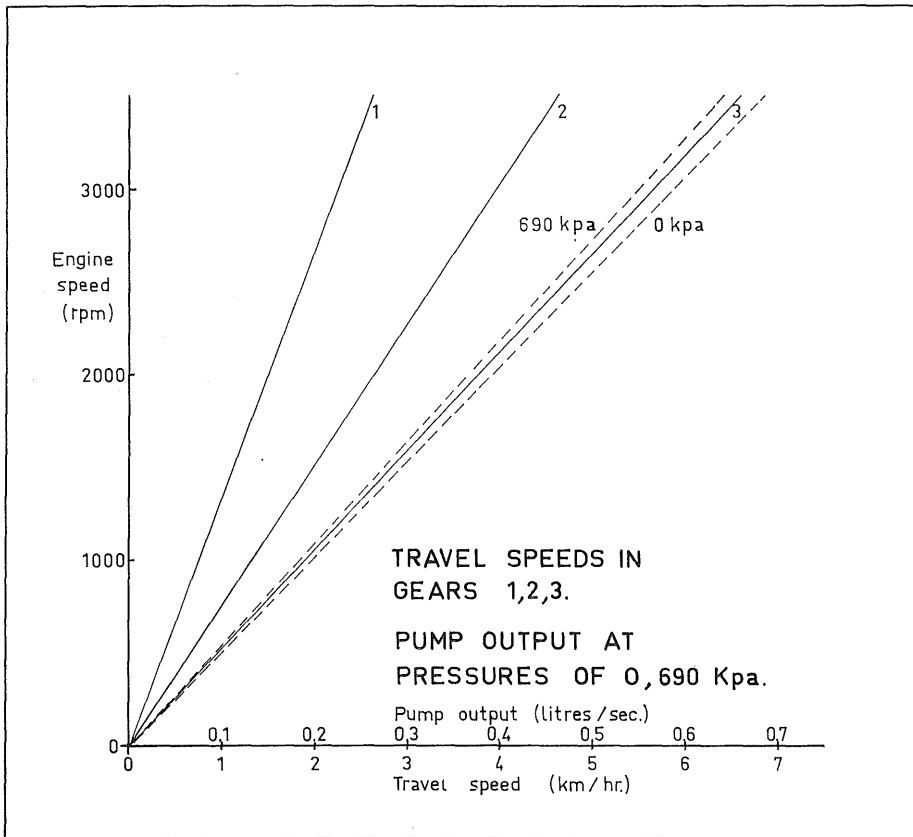


Fig. 4.—Range of speeds available in each gear and corresponding pump outputs.

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