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Research Paper

Wheel Operated Agriculture Spray Machine

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ABSTRACT *India is a rural country with minor, sporadic, and large agriculture. For development, our country's ranchers are employing age-old methods, techniques, and gear. Aside from that, when compared to agribusiness, there has been significant progress in the technological and administrative areas. Modernization of agribusiness is unavoidable in order to meet the food needs of a growing population and to speed up industrialisation. Many manures, synthetic compounds, pesticides, herbicides, and other chemicals are used to manage illnesses, bugs, and weeds in order to produce a high yield from the crop. Throughout history, several inventive ways involving automation in this industry have been developed. For the most part, synthetic substances are applied with dusters and sprayers. Sprayers come in a variety of shapes and sizes. In this present work targets fostering another strategy for showering method called as "WHEEL OPERATED AGRICULTURE SPRAY MACHINE" which will perform splashing at most extreme rate in least time. The hardware is wheel worked thusly working the siphon and splashing of the fluid at the rear of the specialist thus keeps away from Contact with the Fluid and Diminishes Wellbeing Risks.*

Key Words: *Crank shaft, Connecting rod, Wheel operated spray machine, Discharge, Angular velocity*

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I. INTRODUCTION

India is destined to be an agrarian society; approximately 75% of India's population is reliant on cultivating crops either directly or indirectly. Over 70% of ranchers are sharing space with small and insignificant landowners. Automation of small ranches is generally regarded as problematic. Despite the fact that Japan has a typical land holding, even though it is less than ours, farming in Japan has reached remarkable heights thanks to proper automation. To lessen the drudgery of small ranchers, increase their proficiency, and provide farmers with the ideal possibility to engage in extra/strengthening producing activities, the use of current time-saving machines and the implementation of right size equipment should be adequately advanced. Limit concerns are a problem in the agribusiness sector. gear's should be appropriately advanced. Agribusiness area is dealing with issues with limit issues like incomes are declining, there are labour shortages, and shopper requests are increasing. For centuries, our ranchers have used comparable tactics and equipment. For example, seed planting, showering, weeding, and so on, which is one of the primary reasons for low efficiency and poor cultivation, there is a need for the creation of effective hardware to increase efficiency. Furthermore, most industrialists are desperately hunting for new techniques to improve equipment quality while lowering immediate escalating expenses (labour) and capital. As a result, understanding the effect of a pesticide sprayer in an agriculture field is a vital open door. Ordinary sprayers have challenges such as (more work to push the liver all over the place to make the strain to shower, non-uniform splashing, health risks, and so on.)

1.1 LITERATURE REVIEW

- Ms.Ashwini Kambar, Ms.Nootan S. Kankanawadi, Ms. Pooja B. Nerli, Ms. Shwetha S. Patil worked on "Design and Development of Dual Controlled, Solar Powered, Smart Pesticide & Fertilizer Spraying Robot.
- Vishakha Bodke , Mahesh Gaikwad, Pratibha Patil , Karan Pawar , Prof. Firdos J. Khan worked on "Multipurpose Manually Operated Automatic Spraying and Fertilizer Throwing Machine"

- Shivaraja kumar. A , Parameswaramurthy. D worked on "Design And Development Of Wheel And Pedal Operated Sprayer"
- Varikuti Vasantha Rao , Sharanakumar Mathapati , Dr. Basavaraj Amarapur worked on "Multiple Power Supplied Fertilizer Sprayer"
- Dhiraj N. Kumbhare, Vishal Singh , Prashik Waghmare , Altaf Ansari , Vikas Tiwari , Prof. R.D. Gorle worked on "Fabrication of Automatic Pesticides Spraying Machine"

1.2 COMMENTS-

Literature survey shows that every author has tried to reduce the efforts while spraying the fertilizer on the crops. To reduce the efforts they have used various options to achieve the function of spraying. It can be by achieved using robotics or it can also be achieved by using pedal operated vehicle. No any author has incorporated use of slider crank mechanism using chain drive. So we have gone for the use of slider crank mechanism and chain drive to achieve the goal of fertilizer spraying with ease and maximum efficiency.

II. OBJECTIVE-

- Decrease the operational costs by using new mechanisms.
- Work reliably as under different working condition.
- Decrease the costs of machine.
- Decrease labour costs by advancing the spraying methods.
- Machine should be operated in small farming land with the standard spacing.

Table -1: DIMENSIONAL ANALYSIS IN THIS PROJECT

S.NO	NAME OF COMPONENT	MEASURING DIMENSIONS	MATERIAL USED
1	Handle rod	29 inches	Mild Steel
2	Diameter of handle rod	3 inches	Mild Steel
3	Support rod	14 inches	Mild Steel
4	Length of rod	51 inches	Mild Steel
5	Volume of tank	26.6744 liters	Plastic tank
6	Wheel		Steel
7	Large & small wheel size	12 inches, 9 inches	Steel
8	Large & small gear size	5 inches, 3 inches	Mild steel
9	Chain	56 inches	Steel
10	Bearing length & bearing diameter	7 inches, 10 inches	Steel
11	Diameter of spray fixed support	2.5 inches	Plastic

Chart -1: DIMENSIONAL ANALYSIS IN THIS PROJECT

III. CONSTRUCTION

The main components of agricultural reciprocating multi sprayer are as follows:

- **SPROCKETS**

The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth. We use freewheel and chain wheel for chain and sprocket arrangement.

Figure.1

- **CHAIN**

The chain is made of steel which is used to transmit power from gear sprocket to pinion sprocket, and it has a no sleep.

Figure.2

- **CRANK**

The function of crank is to transfer motion from prime mover to the connecting rod for further operation. Here the circular disc having eccentricity at which rotary motion of crank is converted into reciprocating/linear motion of connecting rod.

- **CONNECTING ROD**

The main function of connecting rod is to convert rotary motion into reciprocating/linear motion. Here connecting rod convert rotary motion of crank to reciprocating motion of pump and extension rod.

- **PUMP**

It consists of piston and cylinder arrangement, it has a lever to operate the motion of piston in reciprocating dierction. It is a device which converts the pressure energy of fluid into kinetic energy; spray nozzle is a precision device that facilitates dispersion of liquid into a spray. Nozzle is used for purpose to distribute a liquid over an area.

Figure.3

- **WHEEL**

Wheel is used to carry the whole assembly and move machine from one place to another by rotary motion of it. A bicycle wheel is a wheel, most commonly a wire wheel, designed for a bicycle. Bicycle wheel is designed to fit into the frame and fork via drop outs, and hold bicycle tyre. A typical modern wheel has a metal hub, wire tension spokes and a metal or carbon fiber rim which holds a pneumatic rubber tire. We use a tubeless tire wheel.

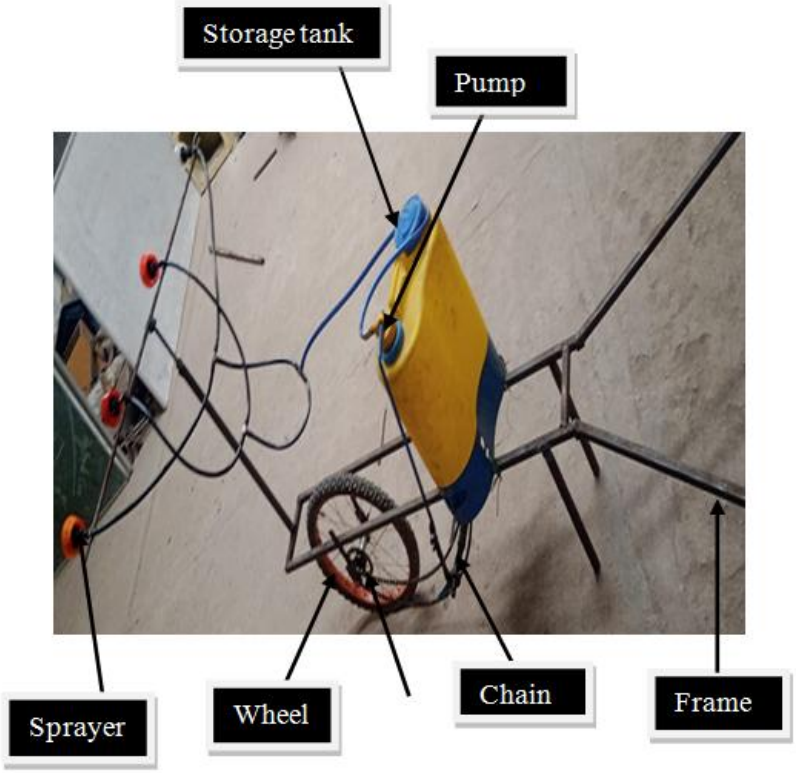
- **FRAME**

The main function of frame is to carry whole assembly on it so it has to be strong enough to hold it. The frame is made of square pipe and it is formed out of mild steel.

- **TANK**

We want our tank to carry as much fluid as it can be along with its self weight as less as possible. We have taken a tank which is almost 26.6744 liter capacity. A material for tank used is plastic fiber. Plastic fiber is very low in weight as compared to other materials. It also has very low cost.

IV. METHODOLOGY



The assembly of the agricultural reciprocating multi sprayer is shown in the diagram above. The operator holds the handle and pulls the cycle forward. The wheel rotates as the cycle travels forward. When the wheel revolves, the gear sprocket attached to the wheel turns at the same rate. The motion of the gear sprocket is transferred to the pinion sprocket via the chain drive. The pinion sprocket and crank are located on opposite sides of the same shaft, and the shaft's rotating motion is turned into reciprocating motion by the crank and connecting rod mechanism. The lever is also attached to the connecting rod, and the lever oscillates at the fulcrum. The piston attached at the fulcrum causes reciprocating motion in the cylinder, resulting in the appropriate pressure. The pesticide was driven to nozzle through the pipe by sucking in the cylinder and piston; a number of nozzles were linked to spray the pesticide. With the use of a particular arrangement, we may alter the pressure required for spraying by changing the length of the crank by putting a slot on the crank. It is possible to achieve free rotation of the crank or neutral state by making some adjustments at the connecting rod and lever joint. When you use these changes, the pumping stops and the wheel rotates freely, so you don't have to spray pesticide. The nozzle's height, location, and angle can all be adjusted.

V. DESIGN & CALCULATIONS

Rotation of the wheel in 6 sec =1 rotation

Rotation of wheel in 60 sec= $60\times\frac{1}{6}$ sec

Rotation of wheel per minutes= 10 rpm

The rotation is provided by manual force, then angular velocity of the wheel

$$\dot{\omega} = 2\pi N/60$$

$= 2\times\pi\times10/360 = \pi/3 = 1.04$ rad/sec

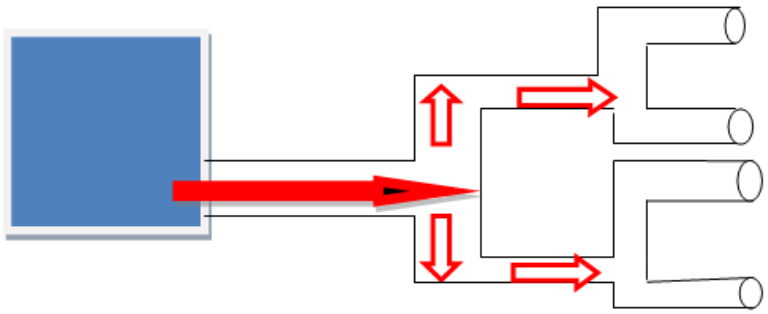
Linear velocity of wheel (V) = $r.\dot{\omega}$

Here, r is radius of crank & ώ is angular velocity of the wheel.

- Linear velocity is the sliding velocity of the piston on agriculture spray machine.

$$V_s = r.\ \omega$$
$$V_s = 0.077 \times 1.04$$
$$V_s = 0.08 \text{ mt/sec}$$

- Mass flow rate of water by spray machine = discharge of water for main pipe of spray.
- Velocity of water coming out from the spray = $V_s/2$ = .08/2 = .04 mt/sec
- Q = mass flow rate = $q \times A \times V = 1000 \times \frac{\pi}{4}(0.010)^2 \times 0.04 = 0.00314$ mt^3/sec
- **Total discharge Q = $Q_1 + Q_2 + Q_3 + Q_4$**



All diameter of the nozzle are same = $d_1 = d_2 = d_3 = d_4$= 12 mm
$Q_1 = Q_2 = Q_3 = Q_4 = Q/4 = 0.000785$
Flow velocity through the nozzle = $V_1 = Q_1/A_1 = 0.000785/\frac{\pi}{4} \times (0.012)^2$

$$V_1 = 6.7 \text{ mt/sec}$$

COST ESTIMATION

S.NO	Name of Component Used	Quantity	Cost of Component
1	Storage Tank	1 Piece	700 Rs
2	Nozzle	4 Piece	600 Rs
3	Bearing	2 Piece	400 Rs
4	Iron	8 kg	600 Rs
5	Chain	1 Piece	150 Rs
6	Pump	1 Piece	400 Rs
7	Wheels	2 Piece	500 Rs

Total cost of the components = 3350 Rs

VI. RESULT & DISCUSSION

- This machine diminishes exertion of man via programmed siphoning by revolution of wheel.
- The model can be effectively worked by a solitary client/administrator.
- The model can be effectively manufactured.
- The model requires less actual contribution from the client.
- It is eco-accommodating as no fuel is expected for working it.

- It diminishes work and working expense actually.
- It is less expensive than siphoning by utilizing power from work vehicle or engine since it doesn't need outer electrical or mechanical power.
- The model is appropriate for treating little regions like nurseries, nurseries and vegetable nurseries.

VII. CONCLUSION

Many splashing gadgets are available in market today. Be that as it may, the back mounted siphon expands the difficult work. The expense of work vehicle sprayer is high, which can't be managed by limited scope ranchers. The plan and model made concentrations on diminishing human endeavors. This arrangement isn't so costly too. Dissimilar to farm vehicle compost there is no wastage of compost and pesticides. There is no reduction in usefulness of land. Similar investigation of old and made model shows that this arrangement is productive and covers more land than back mounted sprayer.

VIII. FUTURE SCOPE

Push type spraying machine is fabricated and operated successfully. Still there is a scope to do some modifications which will make it more effective. In the current model we have used shaft in driving assembly therefore the ground clearance we getting is less. If we use shaft less assembly then we can get higher ground clearance. Also in such assembly we can provide arrangement for adjustment of width of machine according to requirement. This will reduce damage to crops.

Now days the spraying of crop is done by operator taking pump on back, but we were developing this conventional spraying for reducing efforts and time by using slider crank mechanism and motion transmission by chain and sprocket arrangement principles.

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