

DESIGN AND FABRICATION OF WHEEL OPERATED PESTICIDE SPRAYER

A PROJECT REPORT

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IN

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**M.KUMARASAMY COLLEGE OF ENGINEERING,
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BONAFIDE CERTIFICATE

Certified that this project report “**DESIGN AND FABRICATION OF WHEEL OPERATED PESTICIDE SPRAYER**” is the bonafide work of “**KARAN S (927622BME034), KARUNAKARAN S (927622BME035), LIVIN KUMAR M (927622BME307)**” who carried out the project work during the academic year 2023 – 2024 under my supervision. Certified further, that to the best of my knowledge the work reported here in does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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EXTERNAL EXAMINER

DECLARATION

We affirm that the Project titled “**DESIGN AND FABRICATION OF WHEEL OPERATED PESTICIDE SPRAYER**” being submitted in partial fulfillment of for the award of Bachelor of Engineering in Mechanical Engineering, is the original work carried out by us. It has not formed the part of any other project or dissertation on the basis of which a degree or award was conferred on an earlier occasion on any other candidate.

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INSTITUTION VISION & MISSION

Vision

- ❖ To emerge as a leader among the top institutions in the field of technical education.

Mission

- ❖ Produce smart technocrats with empirical knowledge who can surmount the global challenges.
- ❖ Create a diverse, fully-engaged, learner-centric campus environment to provide quality education to the students.
- ❖ Maintain mutually beneficial partnerships with our alumni, industry and professional associations.

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Vision

- ❖ To create globally recognized competent Mechanical engineers to work in multicultural environment.

Mission

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- ❖ To establish a learner-centric atmosphere along with state-of-the-art research facility.
- ❖ To make collaboration with industries, distinguished research institution and to become a centre of excellence.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

The graduates of Mechanical Engineering will be able to

- ❖ PEO1: Graduates of the program will accommodate in high full information of engineering principles necessary for the applications of engineering.
- ❖ PEO2: Graduates of the program will acquire knowledge of recent trends in technology and solve problem in industry.
- ❖ PEO3: Graduates of the program will have practical experience and interpersonal skills to work both in local and international environments.
- ❖ PEO4: Graduates of the program will possess creative professionalism, understand their ethical responsibility and committed towards society.

PROGRAM OUTCOME

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid the conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques ,resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work :** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large , such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life- long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

The following are the Program Specific Outcomes of Engineering

Graduates: The students will demonstrate the abilities

1. **Real world application:** To comprehend, analyze, design and develop innovative products and provide solutions for the real-life problems.
2. **Multi-disciplinary areas:** To work collaboratively on multi-disciplinary areas and make quality projects.

Research oriented innovative ideas and methods: To adopt modern tools, mathematical, scientific and engineering fundamentals required to solve industrial and societal problems.

Course Outcome	At the end of this course, learners will be able to:	Knowledge level
CO-1	Identify the issues and challenges related to industry, society and environment.	Apply
CO-2	Describe the identified problem and formulate the possible solutions	Apply
CO-3	Design/ Fabricate new experimental setup/devices to provide solutions for the identified problems	Analyse
CO-4	Prepare a detailed report describing the project outcome	Apply
CO-5	Communicate outcome of the project and defend by making an effective oral presentation.	Apply

MAPPING OF PO& PSO WITH THE PROJECT OUTCOME

Course Outcome	Program												Program Specific Outcome		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO - 1	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 2	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 3	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 4	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 5	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3

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ABSTRACT

The project is intended to help the farmers as India being an Agriculture based country. It is a water Sprayer mounted on a movable frame which is operated mechanically without any external source of energy. The aim of developing such a concept is primarily because of preventing the three major drawbacks of the pump being used currently.

Firstly, the farmer has to carry the entire weight of the spraying pump on his shoulder; secondly, he has to continuously use his one hand to pump using the handle; thirdly, the farmers don't take enough precaution while handling chemicals which results in fatal diseases because of its direct contact..

All these factors have been taken care of in this project along with being cost effective, light in weight and good in strength. The pump already available with the farmer can be directly used in this mechanism. The handle of the sprayer will be mechanically operated through the rotating crank. This will result into the reciprocating motion of the piston and hence pumping will be done in user friendly manner. Power Sprayer, a modified model has been designed and introduced for effective operation without fossil fuel and minimum physical inputs of operator. In this modified model the tank with compression chamber is placed on the trolley and with the help of some suitable driving assembly and mechanism piston is oscillated to create pressure in cylinder of sprayer

CHAPTER 1

INTRODUCTION

India is a land of agriculture which comprises of small, marginal and rich farmers. Small scale farmers are interested in manually lever operated knapsack sprayer because of its versatility, cost and design. As the pests and insects nowadays have been growing up in abundance throughout the vegetation and also having developed their immunity towards the surrounding environment, it becomes compulsory for the farmers across the globe to spray pesticides and insecticides frequently in order to protect their crops from getting rotten and consumed by insects.

Protection from parasites is an important factor in all the agricultural operations, and calls for continual monitoring and prompt action when needed. In many cases, different equipment, pesticides and manpower are required for this purpose which accounts for the majority of production expenses. This would ultimately affect the economy of the farmer, hence it needs serious consideration.

Two general types of sprayers are available for greenhouse application of pesticides: hydraulic and low-volume. There are many variations of these that fit particular crops or growing methods. The outlet of sprayer is attached with four nozzles which is placed at the front end portion of chassis. The hand lever is provided at the rear end portion which helps user to handle the equipment.

CHAPTER 2

LITERATURE REVIEW

Agricultural fertilizer and pesticide sprayer

Day by day the population of India is increasing and to fulfill the need of food modernization of agricultural sectors are important. Due to chemical fertilizers the fertility of soil is decreasing. Hence farmers are attracted towards organic farming. By mechanization in spraying devices fertilizers and pesticides are distributed equally on the farm and reduce the quantity of waste, which results in prevention of losses and wastage of input applied to farm. It will reduce the cost of production. It will reduce the cost of production. Mechanization gives higher productivity in minimum input. Farmers are using same traditional methods for spraying fertilizers and pesticides. Equipment is also the same for ages. In India there is a large development in industrial sectors compared to agricultural sectors. Conventionally the spraying is done by labors carrying backpack sprayer and fertilizers are sprayed manually. The efforts required are more and beneficial by farmers having small farming land

Agriculture sprayer vehicle with router weeder and seed sower-

The spraying is traditionally done by labour carrying backpack type sprayer which requires more human effort. The weeding is the generally done with the help of Bulls becomes for small land farmers. Similarly the seed sowing

application is also done with the help of bulls, which in the present age is time consuming and laborious. So to overcome these above problems a machine is developed which will be beneficial to the farmer for the spraying and weeding operation along with the seed sowing application. A multifunction device will come in handy that can be put to use in different stages of farming as per requirement.

Development of multi agricultural sprayer

Automation for spraying in the field of agriculture has increased the productive output of the farms. Owing to this, labor problem has been solved. But the scenario in the country like India is different. The agriculture field being small, automation in such places are a difficult task also the economic condition of majority of Indian farmers is not well to do.

Therefore, the manually operated sprayer finds wide application in such condition. In Indian farms two types of sprays are used: Hand operated and Fuel operated pump. The main drawback of hand operated spray pump is that the user cannot use it for more than 5-6 hours continuously as he gets tired whereas fuel operated spray pump requires fuel which is expensive and availability of fuel. Sprayer is a device used to spray liquid. In agriculture, sprayer is a piece of equipment that is used to apply pesticides on agricultural crops. Mainly, the general spraying technique uses hand operated and power sprayers with backpack. By using existing pesticide sprayers very less area is covered while spraying and hence more time is required to spray the entire land and also some existing sprayers are required petrol or diesel as a fuel so that the labour cost of the sprayer is also high. Some series sprayers the pipe line is not rotated in 360 degrees.

CHAPTER 3

METHODOLOGY

The base frame which acts as a chassis is fabricated with the help of square tubes and channels by metal cutting and metal joining process called welding. A wheel is attached to the chassis for its displacement at the front end portion of frame. A hand lever operated sprayer can is mounted on the rear end portion of chassis. The crank wheel is mounted with the main wheel shaft which gets coupled with sprocket wheel which is fixed at the mid portion of chassis with bearing supported end. A chain drive is used to connect this crank wheel and sprocket, this sprocket has an eccentric pin on its surface which is linked with hand lever of pump with the help of coupler link. The outlet of sprayer is attached with four nozzles which are placed at the front end portion of chassis. The hand lever is provided at the rear end portion which helps user to handle the equipment.

The tank in this sprayer holds about four gallons of material. A hand-operated pump pressurizes the spray material as the operator walks along, and the wand with nozzle directs the spray to the target. Its use is limited to small areas that can be reached from a walkway.

CHAPTER 4

FABRICATION AND MATERIALS

1. CHAIN DRIVE
2. NOZZLE
3. BEARING
4. FRAME
5. SHAFT
6. METAL STRIP
7. AGRICULTURAL SPRAYER
8. WHEEL
9. DISC

4.1 CHAIN DRIVE:

It is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicle

Most often, the power is conveyed by a roller chain known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system.



Fig: 4.1

4.2 NOZZLE:

To control the direction or characteristics of fluid flow.

Diameter: 0.5mm to 1mm

Pressure: 1-3 bar to 3-6 bar

It is often a pipe or tube of varying cross sectional area, and it can be used to direct or modify the flow of a fluid (liquid or gas).

Nozzles are frequently used to control the rate of flow, speed, direction, mass, shape, and/or the pressure of the stream that emerges from them.

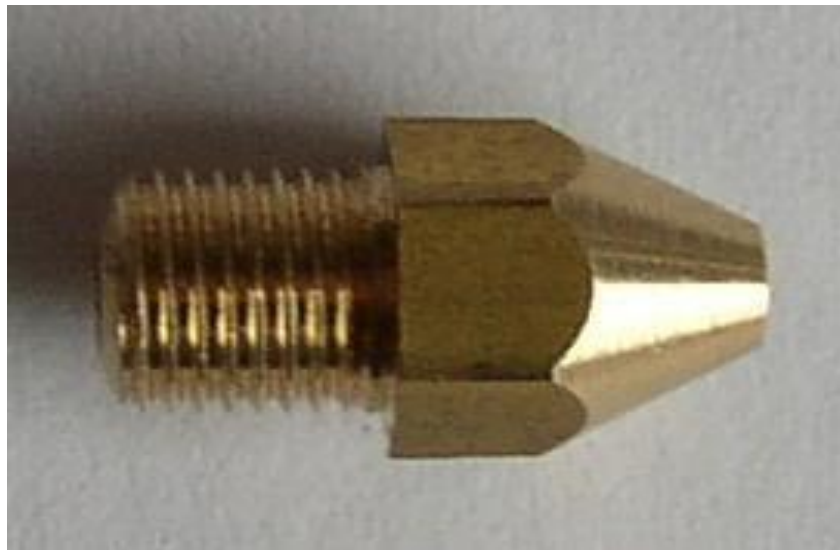


Fig : 4.2

4.3 BEARING:

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races.

Specifications:

Inner diameter: 12mm

Outer diameter: 37mm

The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least three races to contain the balls and transmit the loads through the balls. In most applications, one race is stationary and the other is attached to the rotating assembly (e.g: a hub or shaft).

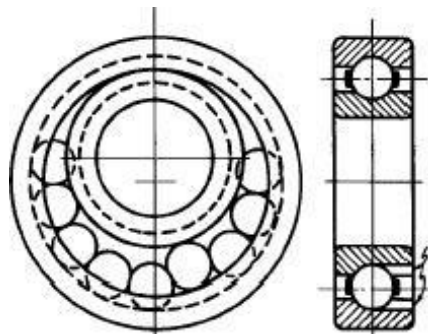


Fig : 4.3

4.4 FRAME:

The metal frame is generally made of **mild steel** bars for machining, suitable for lightly stressed components including studs, bolts, gears and shafts. It can be case-hardened to improve wear resistance. They are available in bright rounds, squares and flats, and hot rolled rounds.



Fig 4.4

4.5 SHAFT:

Shaft is a common and important machine element. It is a rotating member, in general, has a circular cross-section and is used to transmit power

Specifications:

Shaft diameter: 12mm

Material: mild steel

Length: 26 inch



Fig : 4.5

4.6 METAL STRIP:

Metal strip is narrow, thin stock that is usually $\frac{3}{16}$ in. (4.76 mm) or less in thickness and under 24 in. (609.6 mm) in width. Metal strips are formed to precise thicknesses and/or width requirements.

Specifications:

Length: 50 mm

Width : 5cm

Thickness : 4 mm

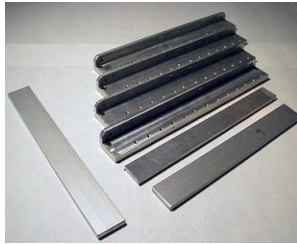


Fig: 4.6

4.7 AGRICULTURAL SPRAYER:

A sprayer is a device used to spray a liquid. In agriculture, a sprayer is a piece of equipment that is used to apply herbicides, pesticides and fertilizers on agricultural field. Filter is being placed inside the agricultural pesticide sprayer.



Fig :4.7

4.8 WHEEL:

The materials of modern pneumatic tires are synthetic rubber,

natural rubber, fabric and wire, along with carbon black and other chemical compounds. They consist of a tread and a body.

Hub material: steel, Tire : Rubber



Fig: 4.8

4.9 DISC:

Disc is the region in a plane bounded by a circle. A disk is said to be closed if it contains the circle that constitutes its boundary. It has circular symmetry.

Specifications:

Material: Mild steel

Outer diameter: 250mm

Thickness: 5mm



Fig: 4.9

4.10. MATERIALS & COST ESTIMATION

S.NO	DESCRIPTION	QTY	MATERIAL	COST
1	CHAIN DRIVE	1	STAINLESS STEEL	900
2	NOZZLE	1	STAINLESS STEEL	400
3	BEARING	4	STAINLESS STEEL	350
4	SHAFT	AS PER REQUIREMENT	MILD STEEL	350
5	METAL STRIP	AS PER REQUIREMENT	MILD STEEL	350
6	AGRICULTURAL SPRAYER	1	PLASTIC	550
7	WHEEL	1	RUBBER	450
8	DISC	1	MILD STEEL	650
9	FRAME	AS PER REQUIREMENT	MILD STEEL	750
10	LABOUR COST	–	–	1200
11	TOTAL	–	–	6000

Table 4.10.1

CHAPTER 5

WORKING

5.1 WORKING PRINCIPLE

Initially water or fertilizer which has to be sprayed is loaded inside the sprayer can and the setup is placed on the field where the spraying operation to be conducted. A manual effort is applied on the chassis which allows the wheel mounted with it to rotate about its axis, this rotation allows the crank wheel attached with it to rotate. This rotation tends to rotate sprocket gear and this makes hand lever of pump to activate linearly. This activation pressurizes the fluid stored inside tank and makes it to exhaust through outlet. This pressurized fluid from outlet is transferred to the nozzles from there the fluid is sprayed on the field. . A chain drive is used to connect this crank wheel and sprocket, this sprocket has an eccentric pin on its surface which is linked with hand lever of pump with the help of coupler link.. The outlet of sprayer is attached with four nozzles which is placed at the front end portion of chassis. The hand lever is provided at the rear end portion which helps user to handle the equipment. The base frame which acts a chassis is fabricated with the help of square tubes and channels by metal cutting and metal joining process called welding. A wheel is attached to the chassis for its displacement at the front end portion of frame. A hand lever operated sprayer can is mounted on the rear end portion of chassis.

5.1.ADVANTAGES

- Less Initial and Maintenance cost
- Does not require any External Source of Energy
- Safe for Operation
- No Fatigue to Operator
- Does not require to buy any Specially Designed Pump
(conventionalbackpack pump can be directly used here)
- Can work efficiently during all Seasons
- Uniform Spraying
- Portable & Economic
- No Running cost

5.2. APPLICATION

- This setup can be used for small and medium fields and by increasing thenumber of nozzles and specification of pump this setup can also be used for large fields also.

5.3. MANUFACTURING PROCESS

Manufacturing processes are the steps through which raw materials are transformed into a final product. The manufacturing process begins with the creation of the materials from which the design is made. These materials are then modified through manufacturing processes to become the required part. Manufacturing processes can include treating (such as heat treating or coating), machining, or reshaping the material. The manufacturing process also includes tests and checks for quality assurance during or after the manufacturing, and planning the production process prior to manufacturing.

5.4.1 SAWING:

Cold saws are saws that make use of a circular saw blade to cut through various types of metal, including sheet metal. The name of the saw has to do with the action that takes place during the cutting process, which manages to keep both the metal and the blade from becoming too hot. A cold saw is powered with electricity and is usually a stationary type of saw machine rather than a portable type of saw.

The circular saw blades used with a cold saw are often constructed of high speed steel. Steel blades of this type are resistant to wear even under daily usage. The end result is that it is possible to complete a

number of cutting projects before there is a need to replace the blade. High speed steel blades are especially useful when the saws are used for cutting through thicker sections of metal.

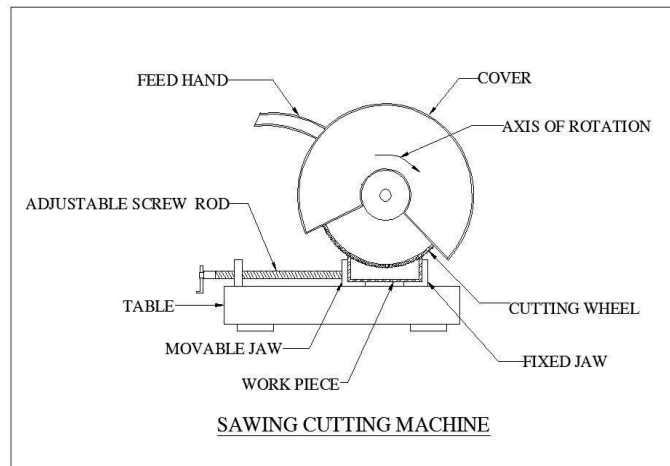


Fig 5.4.1

5.4.2 WELDING:

Welding is a process for joining similar metals. Welding joins metals by melting and fusing 1, the base metals being joined and 2, the filler metal applied. Welding employs pinpointed, localized heat input. Most welding involves ferrous-based metals such as steel and stainless steel. Weld joints are usually stronger than or as strong as the base metals being joined. Welding is used for making permanent joints. It is used in the manufacture of automobile bodies, aircraft frames, railway wagons, machine frames, structural works, tanks, furniture, boilers, general repair work and ship building.

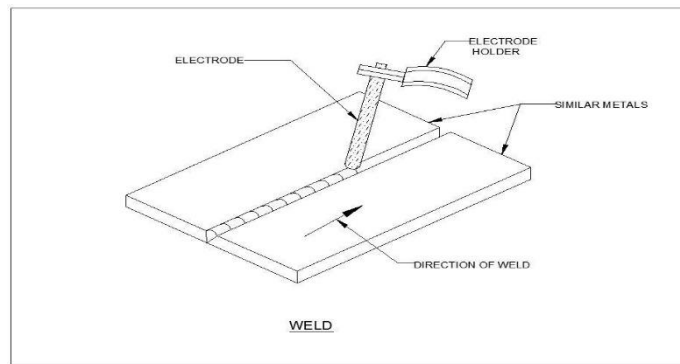
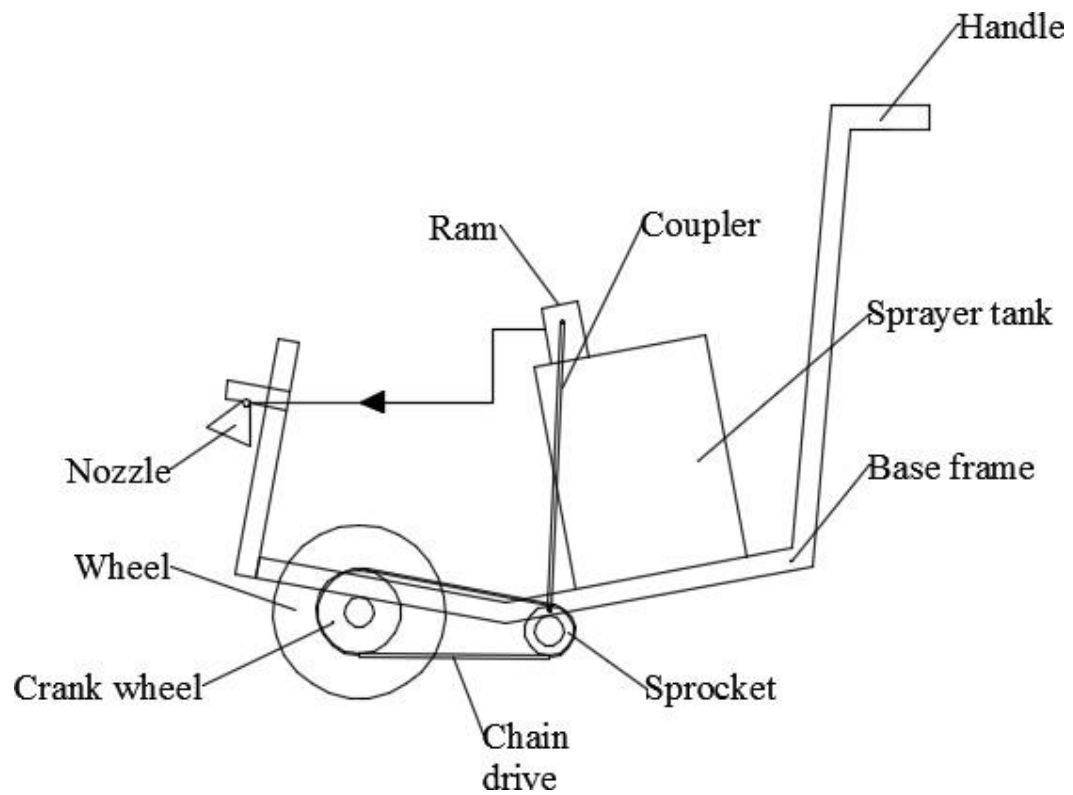


Fig : 5.4

5.5. DESIGN OF PROJECT



[WOPS - WHEEL OPERATED PESTICIDE SPRAYER]

CHAPTER 6

GLIMPSE OF PROJECT



Fig : 6.1

Photography of Wheel Operated Pesticide Sprayer



Fig: 6.2.

Top view of the Wheel operated Pesticide Sprayer

CHAPTER 7

CONCLUSION

Sprayers are commonly used on farms to spray pesticides, herbicides, fungicides, and defoliants as a means of crop quality control. To produce more output from the farm mechanization in the industrial sector is needed. It gives more productivity in less input. By mechanization we can reduce the efforts of labors and uniformly spray the fertilizers and pesticides all over the farm. So there is a need for mechanization in industrial areas in India

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