

DESIGN AND FABRICATION OF PESTICIDE PUMP SPRAYER CART

AHMAD SHAWAL BIN MOHD AMIN

Report submitted in partial fulfillment of the requirements
for the award of
Diploma in Mechanical Engineering

Faculty of Mechanical Engineering
UNIVERSITI MALAYSIA PAHANG

DECEMBER 2012

SUPERVISOR'S DECLARATION

We hereby declare that we have checked this project and in our opinion this project is satisfactory in terms of scope and quality for the award of the degree of Diploma of Mechanical Engineering

Signature :

Name of Supervisor : MR. ROSMAZI BIN ROSLI

Position : LECTURER

Date : 31 December 2012

STUDENT'S DECLARATION

I hereby declare that the work in this report is my own except for quotations and summaries which have been duly acknowledged. The report has not been accepted for any diploma and is not concurrently submitted for award of other diploma.

Signature :

Name : AHMAD SHAWAL BIN MOHD AMIN

ID Number : MB10049

Date : 31 December 2012

ACKNOWLEDGEMENTS

Alhamdulillah, I am grateful and would like to express my sincere thanks to my supervisor Mr. Rosmazi bin Rosli for his germinal ideas, invaluable guidance, continuous encouragement and constant support in completing this project. He has always impressed me with his outstanding professional conduct, his strong creativity, and his belief that this project will be success. I appreciate his consistent support from the first day of our briefing until end of this project.

My profound thanks go to all classmates, especially to my friends for spending their time in helping and giving support whenever I need it in fabricating my project. Not least that thanks to instructor labs of Mechanical Engineering who gave me a permission to use the mechanical equipment and giving a permission to use all the necessary tools in the laboratory.

I also would like to acknowledge my sincere indebtedness and gratitude to my family and parents for their sacrifice, patience, and understanding that were inevitable to make this work possible. I cannot find the appropriate words that could properly describe my appreciation for their devotion, support and faith in my ability to attain my goals. Special thanks should be given to my committee members. I would like to acknowledge their comments and suggestions, which was crucial for the successful completion of this study.

ABSTRACT

This final year project presented about pesticide pump sprayer cart that can carry about 36 litres of pesticide and water mixture. The objective of this project is to design and fabricate of a pesticide pump sprayer cart. This cart is suitable for a small garden area, boundary plant, or shrubs plant. This trolley use a pump to spray out the poison however how the pump work will differentiate this trolley with existing products in the market. The pump will work when the trolley is moved. Pesticides are sprayed out through two nozzles on the left and right with a sprayer shut off valve controlled. Therefore, this cart will ease the burden and ease of use for the work of poison plants.

ABSTRAK

Projek tahun akhir ini membentangkan tentang troli penyembur racun perosak yang boleh membawa muatan kira-kira 36 liter campuran racun dan air. Objektif projek ini adalah mereka bentuk dan membentuk sebuah troli penyembur racun perosak. Troli ini sesuai untuk diguna di kawasan kebun kecil, tanaman berbatas, atau kebun tumbuhan renek. Troli ini mngunakan pam untuk menyembur racun bagaimanapun cara racun itu dipam akan membezakan troli ini dengan produk yang sedia ada di pasaran. Pam tersebut akan berfungsi apabila troli ini digerakkan. Racun akan disembur keluar melalui dua muncung di sebelah kiri dan kanan dengan dikawal oleh injap penyembur. Oleh itu, troli ini akan meringankan beban dan memudahkan pengguna bagi kerja-kerja meracun tanaman.

TABLE OF CONTENTS

		Page
SUPERVISOR’S DECLARATION		ii
STUDENT’S DECLARATION		iii
ACKNOWLEDGEMENTS		iv
ABSTRACT		v
ABSTRAK		vi
TABLE OF CONTENTS		vii
LIST OF TABLES		x
LIST OF FIGURES		xi
LIST OF SYMBOLS		xiii
LIST OF ABBREVIATION		xiii
CHAPTER 1	INTRODUCTION	
1.1	Introduction	1
1.2	Background	1
1.3	Problem Statement	2
1.4	Objective	2
1.5	Scope	2
1.6	Overview of the Report	3

CHAPTER 2 LITERATURE REVIEW

2.1	Introduction	4
2.2	Types of Sprayer	4
	2.2.1 Hand Operated Back-pack Sprayer	4
	2.2.2 Motorized Sprayer	5
	2.2.3 Boomless Sprayer	6
	2.2.4 Boomless Sprayer	6
	2.2.5 Boom Sprayer	7
	2.2.6 Airblast Sprayer	8
2.3	Reviews on Selected Material	9
	2.3.1 Mild Steel	9
	2.3.2 Plastic	10

CHAPTER 3 METHODOLOGY

3.1	Introduction	11
3.2	Design	12
3.3	Drawing	12
3.4	Design Selection	12
	3.4.1 First Concept	13
	3.4.2 Second Concept	14
	3.4.3 Third Concept	15
	3.4.4 Fourth Concept	16
	3.4.5 Concept Generation and Evaluation	17
	3.4.6 Finalize Design	18
3.5	Fabrication Process	19
3.6	Process Involve	19
	3.6.1 Measuring and Marking	19
	3.6.2 Cutting	20
	3.6.3 Drilling	20
	3.6.4 Welding	21
	3.6.5 Finishing	22
	3.6.6 Painting	22
	3.6.7 Assembling	23

CHAPTER 4 RESULT AND DISCUSSION

4.1	Introduction	24
4.2	Final Product	24
4.3	Product Advantages and Function	26
	4.3.1 Large Tank Container	26
	4.3.2 Mechanisms of the Pump System	26
	4.3.3 Mechanically Pump Move	28
	4.3.4 Double Nozzles	28
	4.3.5 Controller Valve	29
4.4	Result	30
4.5	Discussion	31

CHAPTER 5 CONCLUSION AND RECOMMENDATION

5.1	Conclusion	33
5.2	Recommendation	34

REFFERENCES	35
--------------------	----

APPENDICES	36
-------------------	----

Project Flow	37
Gantt Chart of Project	38
Drawing	39

LIST OF TABLES

Table No.	Title	Page
3.1	Detail of First Concept Design	13
3.2	Detail of Second Concept Design	14
3.3	Detail of Third Concept Design	15
3.4	Detail of Fourth Concept Design	16
3.5	Pugh's Selection Method	17

LIST OF FIGURES

Figure No.	Title	Page
2.1	Hand Operate Back-pack Sprayer	5
2.2	Boomless Sprayer	6
2.3	Boomless Nozzles	7
2.4	Boom Sprayer	8
2.5	Airblast Sprayer	9
3.1	Concept Design A	13
3.2	Concept Design B	14
3.3	Concept Design C	15
3.4	Concept Design D	16
3.5	Final Design	18
3.6	Measuring Material	19
3.7	Cutting Process by using Cut-Off Saw	20
3.8	Drilling Process	21
3.9	Welding Process	21
3.10	Grinding Process	22
3.11	Painting Process	23

3.12	Assembling Process	23
4.1	Chassis	25
4.2	Product Complete with Tank and Sprayer	25
4.3	Tank with 36 Liters Capacity	26
4.4	Gears and Chain	27
4.5	Bearing	27
4.6	Mechanically Pumping Process	38
4.7	T-joint Socket	29
4.8	Double Nozzles	29
4.9	Sprayer Shut-off Valve	30
4.10	Pressurized Pesticide Released	31
4.11	Cable tight is used to hold pipes sprayer	32
4.12	Bracket is used to hold pump	32

LIST OF SYMBOLS

m Meter

Σ Sum

LIST OF ABBREVIATIONS

PSI Pound per Square Inch

UMP Universiti Malaysia Pahang

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This chapter explained about the project objectives, project background, project scope, and problem statement that been conducted.

1.2 BACKGROUND

Spraying pesticide is an important process in farming. Nowadays, there are many types of pesticide sprayer already in market. For the different types of pesticide sprayer there are have a different shapes, sizes, method to carry it but the function are same. For example small pesticide sprayer uses by small area or little quantity of plant such as for flower surround home or in vase compare to pesticide pump cart sprayer use for quite large area and it suitable for boundary plant because it was consist of two nozzles.

1.3 PROBLEM STATEMENT

- 1) Pesticide pumps already in market having limited capacity. So user need to refill the pesticide for many times. It will cause of wasting time to user.
- 2) For the back-pack type pesticide sprayer, user needs to carry the heavy tank at the back. As we know, this is the most type of pesticide pump sprayer that user use in farming.
- 3) User need to hold the nozzle when spraying out the pesticide.
- 4) Some of pesticide sprayer, user need to pump in the mixture of pesticide before spraying out the pesticide manually. So, huge force is needed to pump the pesticide.

1.4 OBJECTIVE

To design and fabricate pesticide pump sprayer cart

1.5 SCOPE

- 1) Use for small scale farmer that have plant area around 4/3 acres.
- 2) Suitable for boundary plant such as chilies, cabbage, and etc.
- 3) Plant that have space not less than 0.7m and not more than 1.5m gap between each.
- 4) Suitable use for shrub type plant.
- 5) Carrying 36 Liter tank container of mixture pesticide.

1.6 OVERVIEW OF REPORT

1.6.1 CHAPTER 1- Introduction

This chapter discussed about the background, objective, problem statement, and the scope regarding to this project. The main purposes of this project are stated in this chapter.

1.6.2 CHAPTER 2- Literature Review

This chapter discussed about the literature review of this project. The examples of products that already have in market are shown in this chapter. The previous products will be the reference point in producing of this project.

1.6.3 CHAPTER 3- Methodology

This chapter discussed about the process for the producing of this project. It is starting by designing until the fabricating process of this project.

1.6.4 CHAPTER 4- Result and Discussion

The results of this project are shown in this chapter although this project success or not. The function of this project also discussed in this chapter.

1.6.5 CHAPTER 5- Conclusion and Recommendation

This chapter discussed about the overall of the project included recommendation. The recommendation is to make the improvement of the project for the future.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of this chapter is to provide a review of past research efforts related to pesticide sprayer pump cart. A review of other relevant research studies is also provided. Substantial literature has been studied on history, types of sprayer and material use.

2.2 TYPE OF SPRAYER

2.2.1 Hand Operated Back-pack Sprayer

Hand operated back-pack sprayer applicators are generally used to apply small quantities of pesticides both inside structures such as greenhouses or for small jobs outdoors such as on small farms or spot treatment on larger farms. This sprayer consist a nozzle to spray out the pesticide. Hand operated back-pack sprayers usually have an air pump which compresses air into the tanks and pressurizes the spray mixture. When the pressure gets too low, the nozzle spray pattern is poor. These sprayers operate at low pressures of 90 psi or less and have small tanks of 4-Gallon.



Figure 2.1: Hand Operate Back-pack Sprayer

Source: northerntool.com

2.2.2 Motorized Sprayers

Motor powered sprayers offer many advantages over hand operated sprayers. Powered sprayers can provide high pressure sprays and the power can be used to drive agitation systems, fans for air-assisted or air blast spraying, and transporting large volumes of spray mix. These systems commonly can be mounted on tractors, trucks, or trailers. Some backpack sprayers are also motorized.

2.2.3 Boomless Sprayers

With this equipment, the spray uniformity will be similar to a hand operated sprayer. However, the sprayer pressure may be constant and the operator is able to cover larger areas or targets than with a hand operated sprayer. Hand guns are useful for spot treatments and treating small areas.



Figure 2.2: Boomless Sprayers

Source: logictoday.co.uk

2.2.4 Boomless Nozzles

Boomless nozzles are also used to broadcast pesticides in areas not easily accessed by a boom sprayer. With this equipment good distribution of spray is obtained but the uniformity is not as good as with a properly operated boom sprayer. Boomless nozzles may be suitable for use in rough areas, and along fence lines and roadsides.



Figure 2.3: Boomless Nozzles

Source: b-btech.com

2.2.5 Boom Sprayers

Most sprayers distribute pesticides using a boom with spray nozzles spaced at regular intervals. The most common example would be wide horizontal booms used on field sprayers to spray field crops. Depending on how the motorized sprayer is equipped, these sprayers can be used for a wide variety of tasks. A high degree of spray coverage uniformity is possible with constant spray pressure through uniformly spaced nozzles traveling at constant speeds. High pressure sprayers require pumps, hoses, nozzles and other components that can develop and withstand the higher pressures, resulting in sprayers that are more expensive.



Figure 2.4: Boom Sprayer

Source: daltonagproducts.com

2.2.6 Airblast Sprayer

Airblast sprayers direct the spray mixture from the nozzles into an air stream which transports the spray droplets to the target. Airblast sprayers have a powered fan which forces air through an opening to generate high air speeds. Often the opening or manifold can be adjusted to ensure that the air stream is directed at the target. These sprayers are also used in other commodities such as grapes, blueberries and nursery crops among others.

In conventional airblast sprayers most of the air movement is upward into the trees or target. Tower air manifolds are also available for airblast sprayers which direct the air horizontally or even downwards towards the target. The horizontal or downwards air movement minimizes drift from airblast sprayers.



Figure 2.5: Airblast Sprayer

Source: jpkc.jluhp.edu.cn

2.3 REVIEW ON SELECTED MATERIAL

2.3.1 Mild Steel

Mild steel is a carbon steel typically with a maximum of 0.25% Carbon and 0.4%-0.7% manganese, 0.1%-0.5% Silicon and some + traces of other elements such as phosphorous, it may also contain lead (free cutting mild steel) or sulphur (again free cutting steel called re-sulphurised mild steel).

Mild steel (a so-called carbon steel) is a general term for a range of low carbon (a maximum of about 0.3%) steels that have good strength and can be bent, worked or can be welded into an endless variety of shapes for uses from vehicles (like cars and ships) to building materials.

The shapes of mild steel that commonly use are angle (L-shaped cross-section), Channel or(C section), bar, rod, and sheet.

2.3.2 Plastic

A plastic material is any of a wide range of synthetic or semi-synthetic organic solids used in the manufacture of industrial products. Plastics are typically polymers of high molecular mass, and may contain other substances to improve performance and/or reduce costs. Monomers of plastic are either natural or synthetic organic compounds.

The word plastic is derived from the Greek (plastikos) meaning capable of being shaped or molded. It refers to their malleability, or plasticity during manufacture, that allows them to be cast, pressed, or extruded into a variety of shapes-such as films, fibers, plates, tubes, bottles, boxes, and much more. The physical properties of plastics are transparency, flexibility, elasticity, permeability, water resistant, electrical resistance and specific gravity.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter discusses about all the information and data that required and fabrication process of this project. Overall this project is following the flow chart from take the title from the supervisor, then the second task from taking the title is finding the related literature review for the project given. Then, sketch some design before turn to concept screening method. After that, draw the final design that had selected. To design the pesticide pump sprayer cart, skill in drawing is required. To make the design more prominent and clear, Solid Work software was used. After the fabrication is finish, the product will be test. This kind of data is required to design the concept of pesticide pump sprayer cart.

3.2 DESIGN

The design of the project must be compliance to several aspects such as ergonomic and safety. The design consideration must be done carefully so to the design can be fabricated and functioned well. The design must be considered in designing to fulfill the scope of this project.

3.3 DRAWING

The drawing is divided into two processes. Firstly, the idea must be sketch before become a design. Improvement is needed to improve the quality of the design. After choosing the final concept design, the selected design is transfer to solid modeling by using Solid Work software.

3.4 DESIGN SELECTION

From the exist ideas, only four sketches that had been chosen to be consideration as the final ideas which are:

3.4.1 First Concept

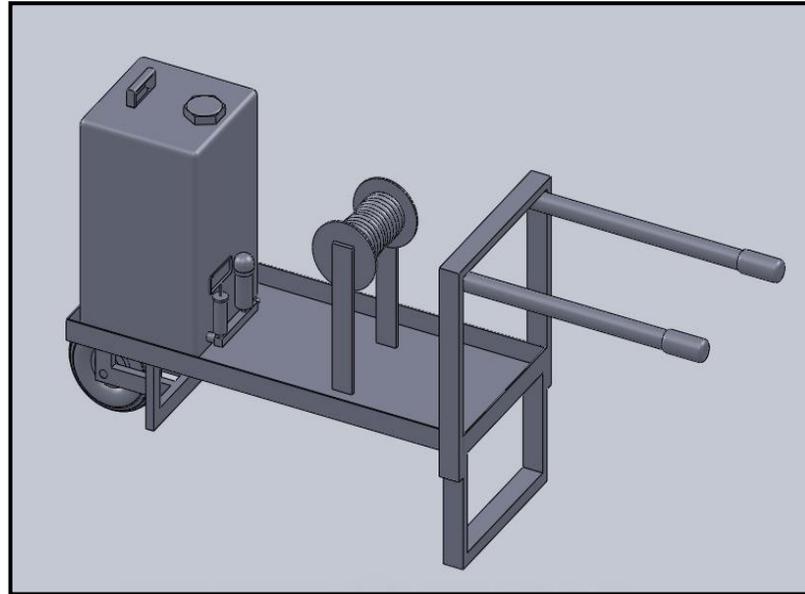


Figure 3.1: Concept Design A

Table 3.1 Detail of First Concept Design

Material Used	<ul style="list-style-type: none"> • Mild steel
Advantages	<ul style="list-style-type: none"> • Easy to control the cart
Disadvantages	<ul style="list-style-type: none"> • Need to hold the nozzle • Consist only a nozzle • Need to lift when move • Very heavy

3.4.2 Second Concept



Figure 3.2: Concept Design B

Table 3.2 Detail of Second Concept Design

Material Used	<ul style="list-style-type: none"> • Mild steel
Advantages	<ul style="list-style-type: none"> • Light weight • Simple design • Easy to control
Disadvantages	<ul style="list-style-type: none"> • Difficult to move • Difficult to pump the pesticide • Only a nozzle to spray out the pesticide

3.4.3 Third Concept

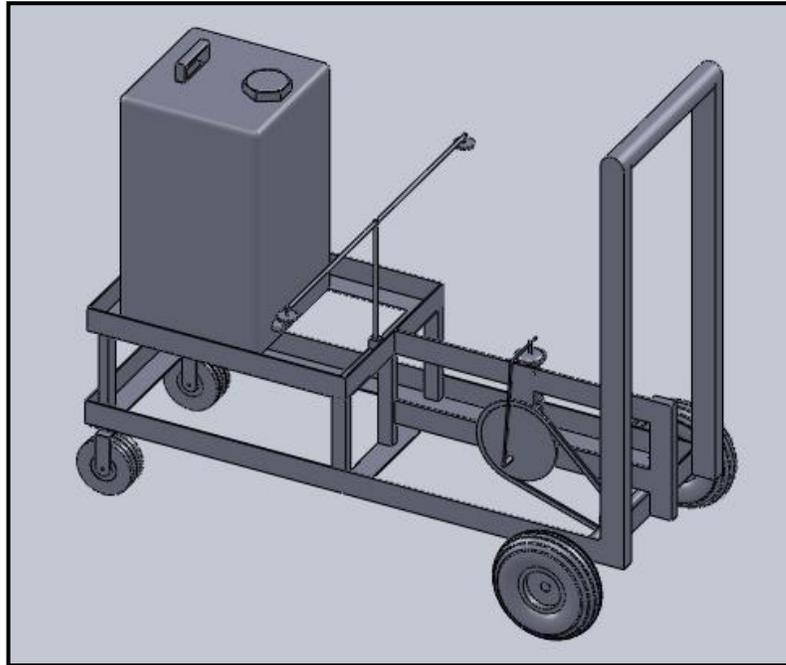


Figure 3.3: Concept C

Table 3.3 Detail of Third Concept Design

Material Used	<ul style="list-style-type: none"> • Mild steel
Advantages	<ul style="list-style-type: none"> • Automatically pump the pesticide • Have two nozzle to spray out the pesticide
Disadvantages	<ul style="list-style-type: none"> • Too large design • Not attractive design • Low stability of tank to stand

3.4.4 Fourth Concept

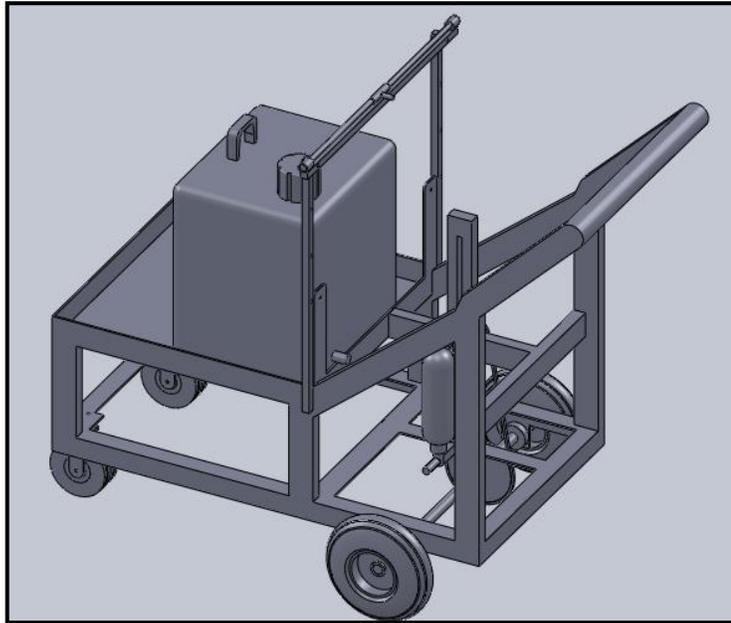


Figure 3.4: Concept D

Table 3.4 Detail of Fourth Concept Design

Material Used	<ul style="list-style-type: none"> • Mild steel
Advantages	<ul style="list-style-type: none"> • Automatically pump the pesticide • Easy to move and control • Consist of two nozzles • Attractive design • High stability to carry the heavy tank • Adjustable height of nozzles
Disadvantages	<ul style="list-style-type: none"> • Complex design

3.4.5 Concept Generation and Evaluation

Four design of pesticide pump sprayer cart were develop. The evaluation of each design is shown in **table 3.5** below.

Table 3.5: Pugh's Selection Method

Criteria	Design A	Design B	Design C	Design D
Easy to use	-	-	+	+
Easy to manufacture	0	+	-	-
Safety	0	0	0	+
Efficiency	-	0	+	+
Stability	-	0	0	0
$\Sigma+$	0	1	2	3
$\Sigma 0$	2	3	2	1
$\Sigma-$	3	1	1	1
Net score	-1	0	1	2
Rank	4	3	2	1

“0”: same as

“-”: worse than

“+”: better than.

3.4.6 Finalize Design

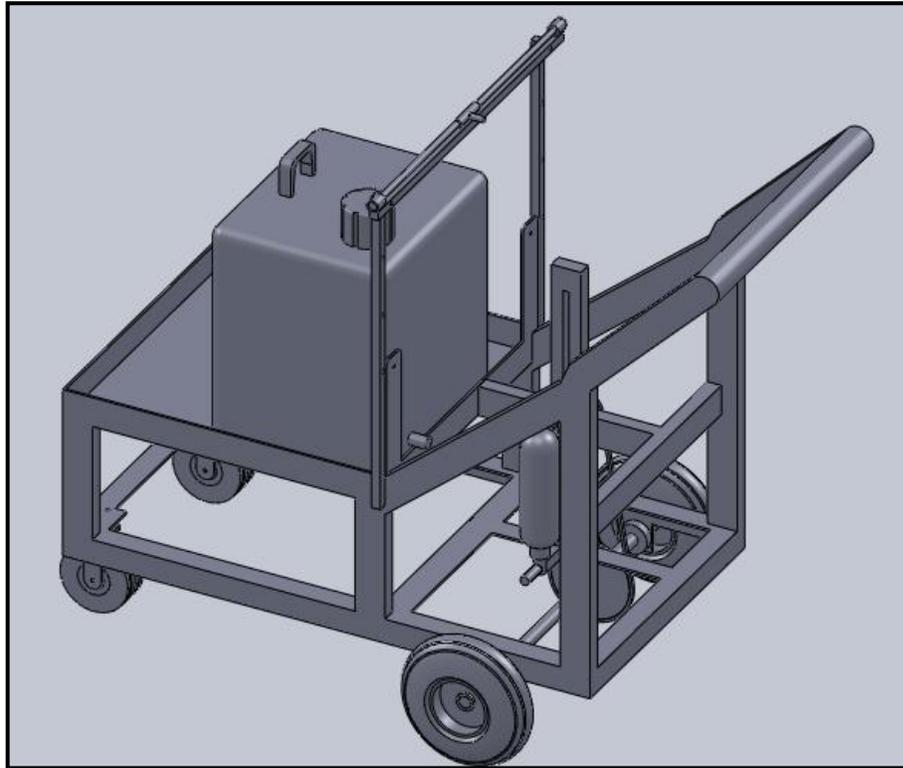


Figure 3.5: Final Design

Study of the concept selection table shows that concept D score the highest positive signs. Concept D was selected as final design because the design approximately fulfills the criteria. It will be easy to use, high of safety and efficiency. Therefore, concept D is the best concept to be produce.

3.5 FABRICATION PROCESS

After designing phase, now is about the fabrication process of pesticide pump sprayer cart. It is starting from selecting material until finished. The dimension of this project is based on the final design that has been selected. Many methods can be used to fabricate a product, like welding, fastening, cutting, drilling and many more method. Fabrication process is difference from manufacturing process in term of production quantity. Fabrication process is a process to make only one product rather than manufacturing process that focus to large scale production. Fabrication process was used at the whole system production. This was include part by part fabrication until assembly to others component.

3.6 PROCESS INVOLVE

3.6.1 Measuring and Marking

Materials need to be measure and mark the dimension based on design specification. All the measuring process is done by using measuring tape as shown in **figure 3.6**



Figure 3.6: Measuring Material

3.6.2 Cutting

Marked materials were cut into several parts. There are many types of cutter that can use to do the process, depend on types and hardness of the material. For the hard material, it is easier to be cut by using cut off saw as shown in **figure 3.8** below.



Figure 3.7: Cutting Process by using Cut-Off Saw

3.6.3 Drilling

Some parts of this pesticide pump sprayer cart are joining by using nuts and bolts. So, drilling process is needed to make holes for placing the bolts and nuts as shown in **figure 3.8**



Figure 3.8: Drilling Process

3.6.4 Welding

To build the main body part of the pesticide pump sprayer cart, welding process is needed. By using this type of joining process, it is stronger joint between each.



Figure 3.9: Welding Process

3.6.5 Finishing

Rough surface will be produced after welding process is done cause of welding spark. The rough surface can be smooth back by using grinding machine. The safety feature of this project can be improve by removed the sharp edge of the body.



Figure 3.10: Grinding Process

3.6.6 Painting

Painting is an important process of this product. The paint will be avoiding the corrosion happen to the body. So, the body strength will last longer once appear more beautiful. **Figure 3.11** show the painting process of the chassis.



Figure 3.11: Painting Process

3.6.7 Assembling

After painting process finished, there are some of parts need to be assembled before become as a finished product. The other parts that need to be installed at the body such as tires, connecting chain, pump, tank, and some of tube as shown in **figure 3.13**



Figure 3.12: Assembling Process

CHAPTER 4

RESULT AND DISCUSSION

4.1 INTRODUCTION

The purpose of this chapter is to discuss the result after fabrication of the product. Some of problem and improvement about this product will be discuss in this chapter.

4.2 FINAL PRODUCT

There are several view of the chassis and complete product as shown in figure below.



Figure 4.1: Chassis



Figure 4.2: Product Complete With Tank and Sprayer

4.3 PRODUCT ADVANTAGES AND FUNCTION

4.3.1 Large Tank Container

The purpose of this product is reducing burden on user but not the capacity of the pesticide. This product can be carrying about 37 liters of mixture of pesticide. A bracket will hold the tank to the body as shown **figure 4.3**



Figure 4.3: Tank with 36 Liters Capacity

4.3.2 Mechanism of the Pump System

This mechanism consists of two gears that is gear A and gear B. Gear A consists of 16 teeth and gear B consist of 32 teeth, so the ratio of the both gear are 1:2. Gear A and B will work together and double outcome will be produced cause of the ratio. Gear B is placed fix on the wheel shaft while the gear A is placed on parallel to the gear B. A connecting chain is used to contact the both gear. A bar shaft is attached together to the gear A, so it will rotate together at the same speed. The small gear A is connected to

bearing before placed to the body to allow the gear can be rotate smoothly. **Figure 4.4** and **figure 4.5** showing clear view of the bearing and the gears.

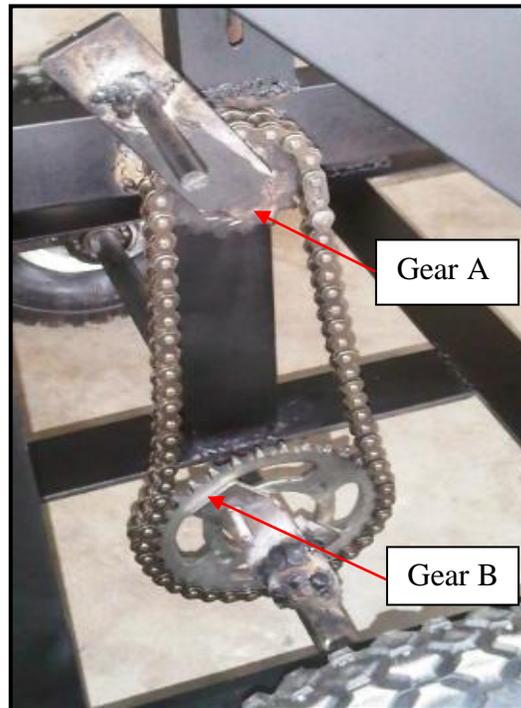


Figure 4.4: Gears and Chain



Figure 4.5: Bearing

4.3.3 Mechanically Pump Move

The pump is located at the body next to the gear and chain. A connecting rod will connect the piston of the pump and the bar shaft. The wheel shaft that has been fixed with the gear B will rotate as well as the rear wheel rotating. So, the pump will be pumping automatically when the pesticide pump sprayer cart is moved as shown in **figure 4.5**

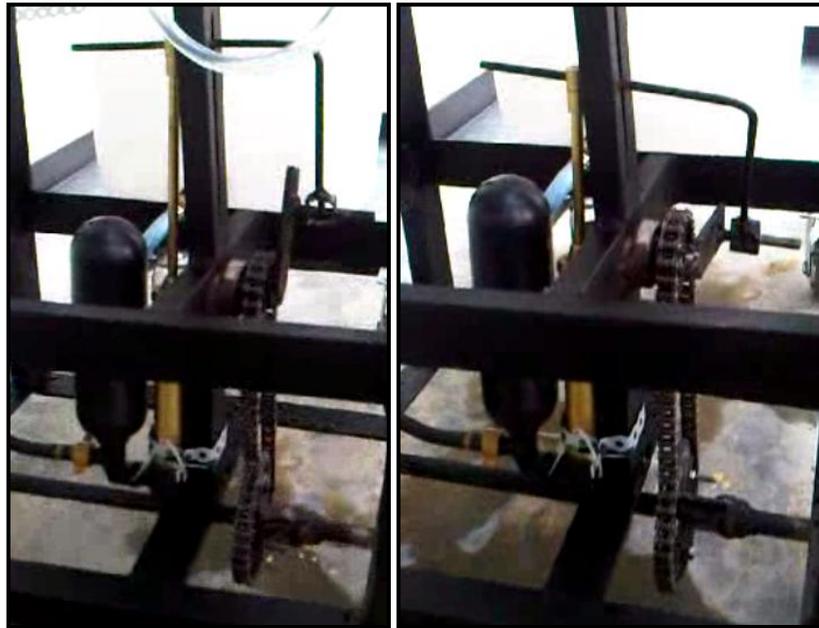


Figure 4.6: Mechanically Pumping Process

4.3.4 Double Nozzles

By using T-joint socket that consist one input, the pressurized pesticide can be spray out with double output. The nozzles will spray out the pesticide at the both side left and right. The pressure to spray out pesticide is enough if the cart is move continuously. The height of the nozzle can be adjustable based on situation.



Figure 4.7: T-joint Socket



Figure 4.8: Double Nozzles

4.3.5 Controller Valve

A sprayer shut-off valve is used to control the pesticide spray out. The valve also can be lock-on and lock off by clicking on the click.



Figure 4.9: Sprayer Shut-Off Valve

4.4 RESULT

The pesticide pump sprayer carts are successfully spraying out the pressurized pesticide at the both sides when the cart is moving as shown in **figure 4.10**. A rotation of the rear wheel will produce twice of pumping of the piston at the pump cause of the gear ratio. The sprayer shut-off valve is placed on the handle, so it is need to be pressed to release the pressurized pesticide once spray out to the plant. The pump can hold the pressurized pesticide to be release after being pumped at maximum of six times.



Figure 4.10: Pressurized Pesticide Released

4.5 DISCUSSION

In this project, several observations have been done with respect to the fabrication of pesticide pump sprayer cart. The outcome pesticide pump sprayer cart was achieved the objective of this project. All the components or parts of this project can function in good condition for example the pump can be pumped when the cart is moved and the pressurized pesticide can be spray out at the both sides.

However, this pesticide pump sprayer cart was too heavy according to the unsuitable material used in the fabrication process. Flat and angle bar steel was perfect in strengthness, but the weight of this material makes this metal not suitable. Besides that, this material can be corrosion if it surface exposed with oxygen and water. The painting method can be used to prevent this problem.

Some of components need to be assembling by using bracket and cable tight as shown in **figure 4.11** and **figure 4.12** cause of different type of material.



Figure 4.11: Cable Tie is used to hold Pipes Sprayer



Figure 4.12: Bracket is used to hold pump

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

As a conclusion, this project has practice and gives more knowledge about many mechanical properties such as machining and many others material during the fabrication process. Besides that, we also can gain knowledge about the material type, structure and others else. This product also has produces to make an improvement compare to other pesticide sprayer that had been exist in the market. It also is the suitable use for small scale farmer that have medium space of boundary plant such as chilies or other shrub plant. The final year project is very important because it can make our self more discipline and punctual. Finally, the objectives of this project that to design and fabricates pesticide pump sprayer cart has been achieved.

5.2 RECOMMENDATION

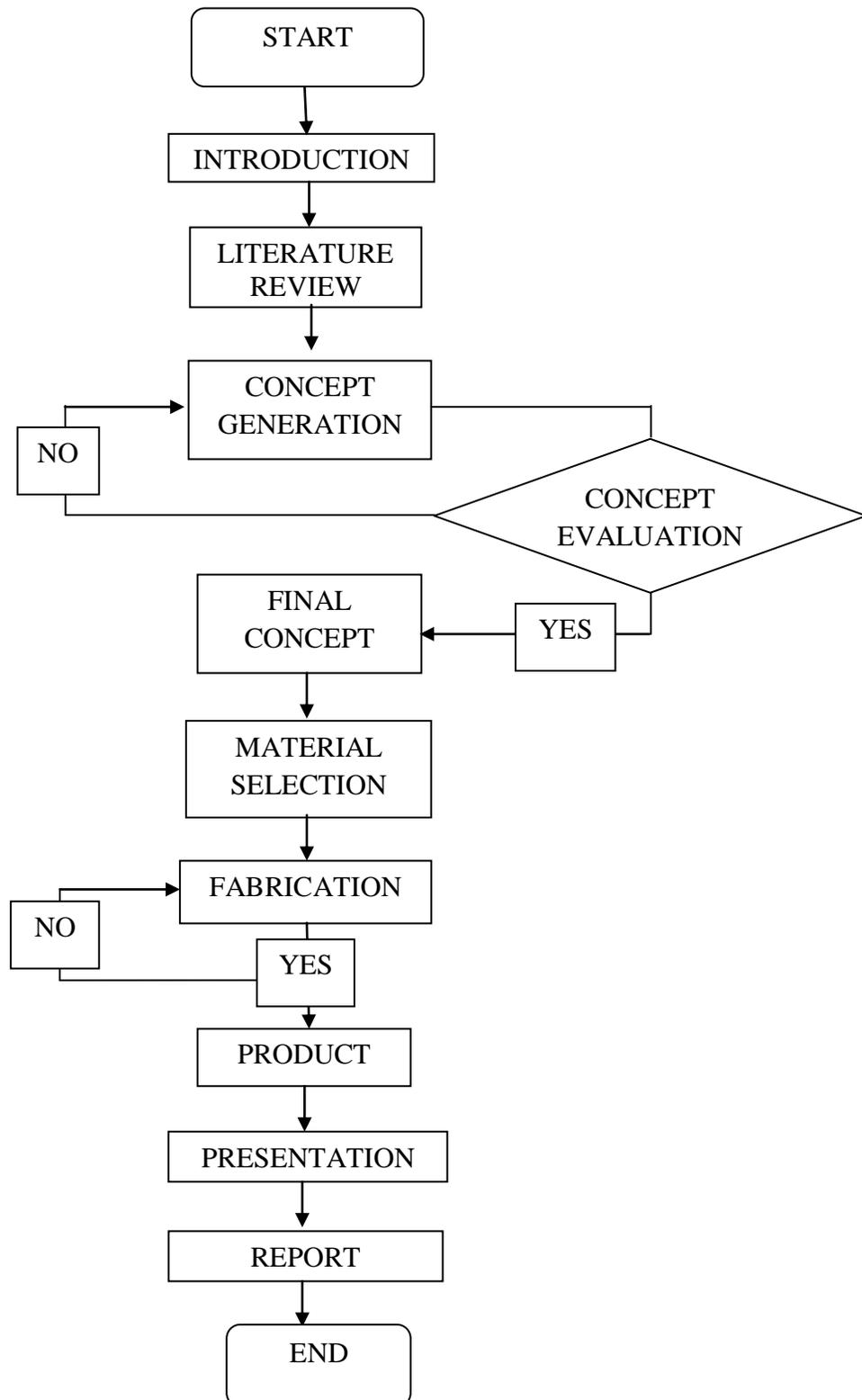
These recommendations can be improving this product in the future:

- 1) Material at the main body should be lightweight and hardness. So, the cart will be easier to move.
- 2) The tank should be bigger because there are huge spaces for placed the tank. The capacity of the tank can be bigger once increase the total space area for spraying.
- 3) The nozzle should be adjustable their angle for spraying.

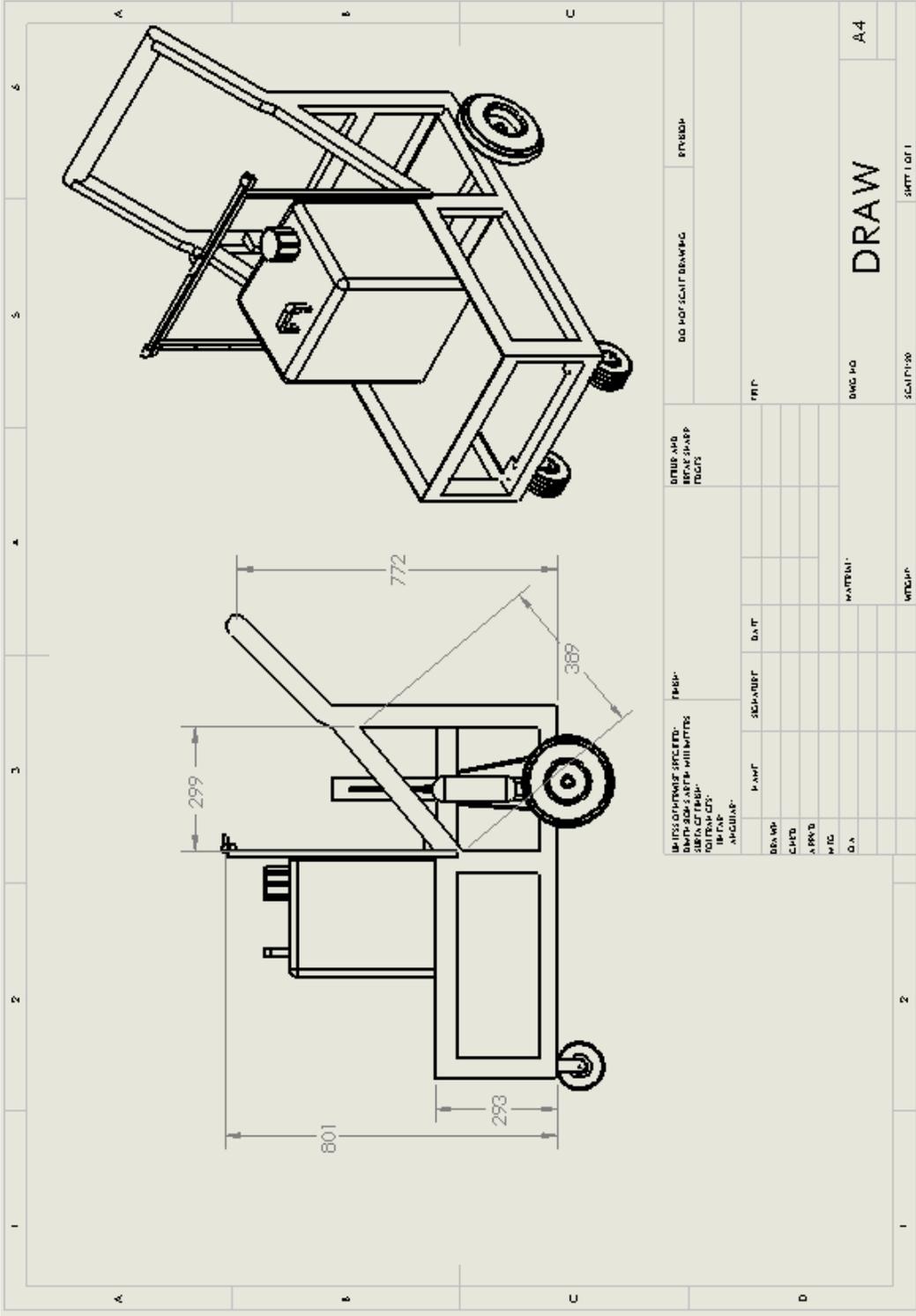
REFERENCES

- 1) http://www.al.gov.bc.ca/pesticides/f_2.htm, dated on Dec 31st,2012
- 2) <http://en.wikipedia.org/wiki/Welding>, dated on Dec 31st,2012
- 3) <http://en.wikipedia.org/wiki/Plastic>, dated on Dec 31st,2012
- 4) http://en.wikipedia.org/wiki/Structural_steel, dated on Dec 31st,2012
- 5) http://wiki.answers.com/Q/What_is_mild_steel, dated on Dec 31st,2012

APPENDICES

PROJECT FLOW

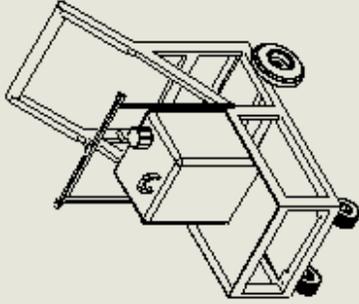
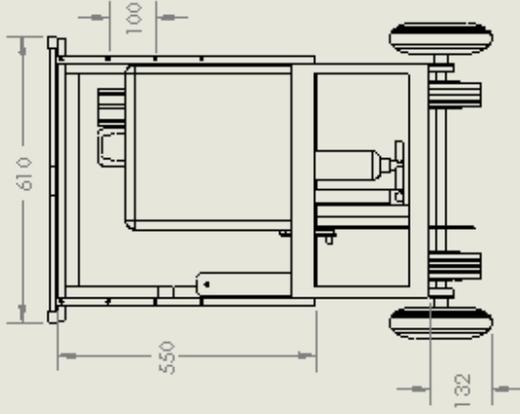
DRAWING



DRAW

A4

SETT 1 OF 1



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILLIMETERS
SURFACE FINISH:
TO FINISHES:
REF. FINISH
ANODIZED

TP-504
PART NUMBER DATE
REV. NO. DATE
CHK'D DATE
APP'D DATE
MFG DATE
Q.A.

DATE AND TIME OF SHIP PLANT

DO NOT SCALE DRAWING

ENGR'S

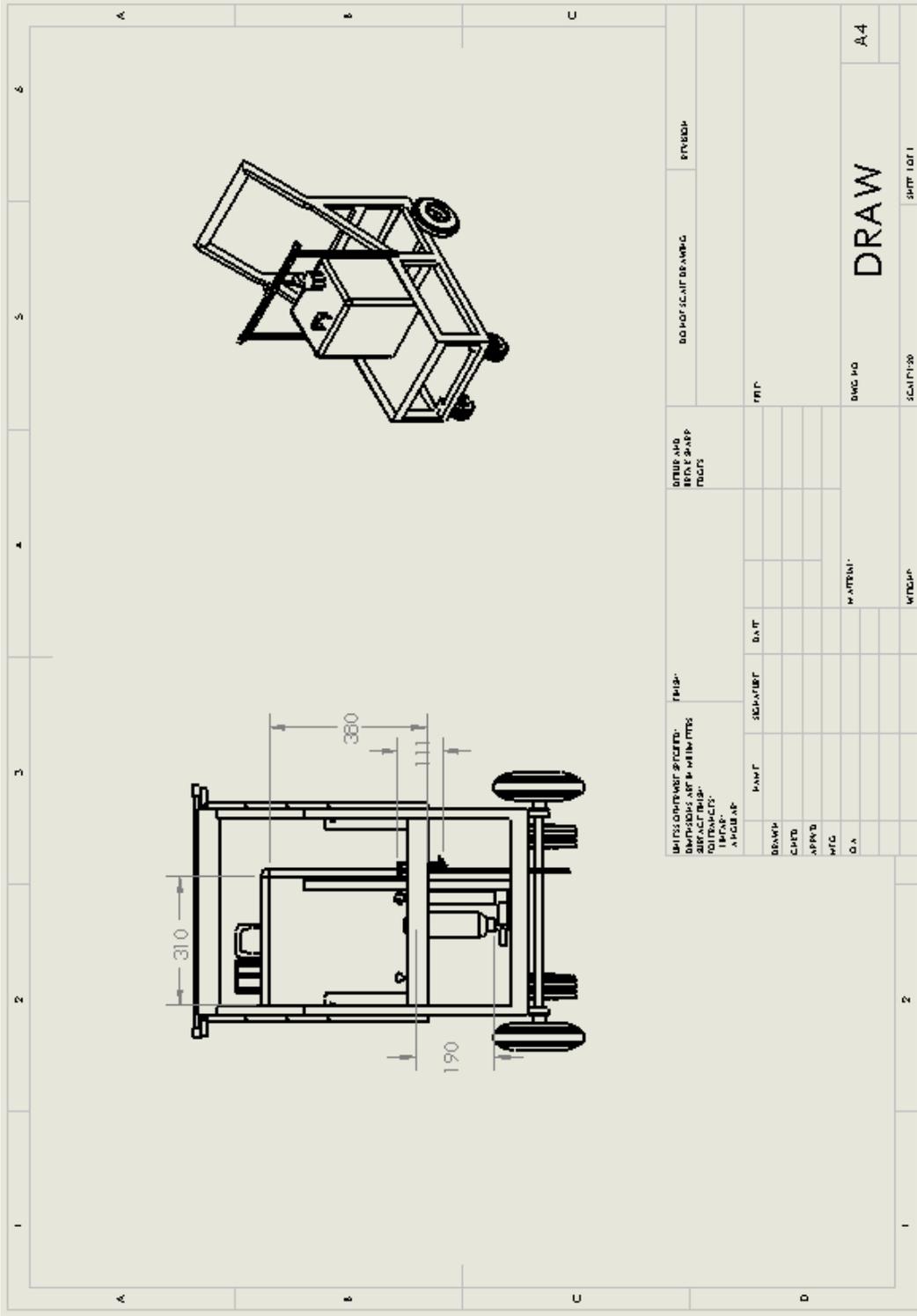
DWG NO

SCALE 1:50

DATE 10/1

A4

DRAW



ИЗДЕЛИЕ ИЛИ СБОРКА		ФИЗ.		ДИАГ. ИЛИ ДРУГОЕ ПОЯСНЕНИЕ		КОД ИЛИ НАИМЕНОВАНИЕ	
НАИМЕНОВАНИЕ	КОЛИЧЕСТВО	МАТЕРИАЛ	ДИМ.	МАТЕРИАЛ	МАТЕРИАЛ	МАТЕРИАЛ	МАТЕРИАЛ
ДВИЖ.							
СЕР.							
ПРИБ.							
МТЗ							
Д.А.							

DRAW

A4

Лист 1 из 1