

FUEL-SAVING PLATE-ELECTRODE BASE DEVICE ON GASOLINE FUEL
ENGINE

MOHAMAD SAZMAN BIN SAZALI

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

Faculty of Mechanical Engineering

Universiti Malaysia Pahang

NOVEMBER 2010

SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project report and in my opinion this project is satisfactory in terms of scope and quality for the award of Diploma in Mechanical Engineering.

Signature:

Name of Supervisor: DR.GIGIH PRIYANDOKO

Position: LECTURER

Date:25 NOVEMBER 2010

STUDENT 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 degree and is not concurrently submitted for award of other degree.

Signature:

Name: MOHAMAD SAZMAN BIN SAZALI

ID Number: MB 08088

Date: 25 NOVEMBER 2010

ACKNOWLEDGEMENT

Praise to God for His help and guidance that I am able to complete the task of the Final Year Project. I am thankful and grateful to my supervisor, Dr.Gigih Priyandoko for his advice and knowledge that he shared in the completion of the project. I appreciate his help for me while I am doing the Final Year Project from week 1 to the day I finished my Final Year Project.

I also would like to thank all my friends who have been really helpful during the course of the conducting the Final Year Project. I also would like to thank laboratory assistants who have help me in sharing knowledge in conjunction with the project that I am conducting.

My grateful also goes to my parent for their love and sacrifice that they had given to me throughout my life and their support for me in my activities that I have done. I also wanted to thank the other people who have directly or indirectly help in the completion of my Final Year Project. I sincerely appreciate all your help.

ABSTRACT

This report shows the design and fabrication of the fuel-saving plate-electrode device on gasoline fuel engine. The objective of the report is to develop the procedures to design and fabricate the fuel-saving plate-electrode base device on gasoline fuel engine. Design generation is showed and solid three dimensional structures modelling of the test rig was developed with the solid work software. Material selection and the reason behind the selection are shown based on criteria predetermined. Based on the selection, plastic and steel are selected. This project is difficult to make because it is hard to find the references and information of similar project. As the conclusion, this project has achieved its goal through the successful of the product making.

ABSTRAK

Laporan ini menunjukkan rekaan dan pembuatan alat penjimat minyak menggunakan kepingan besi sebagai elektrod untuk enjin yang menggunakan gasoline sebagai bahan bakar. Objektif laporan ini adalah untuk menghasilkan prosedur-prosedur dalam pembuatan alat penjimat minyak menggunakan kepingan besi sebagai elektrod untuk enjin yang menggunakan gasoline sebagai bahan bakar. Generasi rekaan ditunjukkan dan struktur model tiga dimensi alat penjimat minyak dibangunkan melalui perisian solid work. Pemilihan bahan dan sebab-sebab pemilihan ditunjukkan berdasarkan bahan yang telah dipilih. Plastik dan besi telah dipilih untuk pembangunan projek ini. Penghasilan projek ini sukar kerana rujukan dan maklumat tentang projek ini sukar ditemui dan terhad. Sebagai kesimpulan, misi projek ini telah tercapai melalui penghasilan alat penjimat minyak yang telah dilakukan.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	TITLE	i
	SUPERVISOR DECLARATION	ii
	STUDENT DECLARATION	iii
	ACKNOWLEDGEMENTS	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	x
	LIST OF APPENDICES	x
	LIST OF FIGURES	xi

CHAPTER 1 INTRODUCTION

1.1	Project Synopsis	1
1.2	Problem Statement	2
1.3	Project Objective	2
1.4	Project Scope	2

CHAPTER 2 LITERATURE REVIEW

2.1	Introduction	3
2.2	Type of Fuel Saving Device	4
2.3	Function	7
2.4	Joining Method	7
2.5	Fasteners	7
2.5.1	Bolts	7
2.5.2	Nuts	8
2.5.3	Washer	8
2.6	Electrolysis of Water	8
2.6.1	Principle	8
2.6.2	Hydrogen and Oxygen	9
2.7	Fuel	9
2.7.1	Gasoline	10
2.8	Dynamometer	10
2.8.1	Eddy Current Type Absorber	10

CHAPTER 3 METHODOLOGY

3.1	Introduction	12
3.2	Design	15
3.3	Drawing	15
3.4	Sketching Drawing Selection	15
3.4.1	First Design	16

3.4.2	Second Design	17
3.4.3	Third Design	18
3.5	Concept Generation and Evaluation	19
3.5.1	Finalize Design	20
3.6	Fabrication Process	21
3.7	Process Involved	21
3.7.1	Measuring	21
3.7.2	Marking	22
3.7.3	Joining	23
3.7.4	Drilling	23
 CHAPTER 4 RESULTS AND DISCUSSION		
4.1	Introduction	24
4.2	Result	24
4.3	Analysis	25
4.4	Discussion	27
 CHAPTER 5 CONCLUSION AND RECOMMENDATIONS		
5.1	Conclusion	28
5.2	Recommendation	28
 REFERENCES		30
 APPENDICES		31

LIST OF TABLES

TABLE NO.		PAGE
2.1	Hydrogen and Oxygen Characteristic	9
3.1	Pugh Selection Method	19
4.1	Result of the Analysis	26

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Gantt Chart-Planning Work	31
B	Gantt Chart-Actual Work	32
C	Electrolyzer	32
D	Filter	32

LIST OF FIGURES

FIGURE NO.		PAGE
2.1	Voltage Stabilizer	4
2.2	Gas Saving Gadget	4
2.3	Prozone	4
2.4	Tezkar Fuel Saver	5
2.5	Hydro-Octane Booster	5
2.6	NoxGen Fuel Saving Device	5
2.7	Force Flow Turbine	6
2.8	FueLEX Fuelsaver	6
2.9	Air Compressor Fuel Saver	6
2.10	Dynamometer's Engine	10
2.11	Dynamometer 100kW	11
3.1	Flow Chart	14
3.2	Concept A	16
3.3	Concept B	17

3.4	Concept C	18
3.5	Final Design	20
3.6	Measuring Process	21
3.7	Marking Process	22
3.8	Joining Process	23
3.9	Drilling Process	23
4.1	Overall Project View	24
4.2	View of the Electrode of Electrolysis	25

CHAPTER 1

INTRODUCTION

1.1 PROJECT SYNOPSIS

This project involves in designing and fabricating the fuel saving device. The basic system used to generate the device was the electrolysis. Basically, the working session could be divided into three stages, which were the concept review and development, designing, and fabrication.

The device was invented by using the fasteners like washers, bolts and nuts that were used to build the structure of electrode for the electrolysis system. Then, the pair of electrodes were hanged inside of a plastic container that act as the container of the electrolyte for the electrolysis process.

Electrical connection were also required for generating the device in order to run the electrolysis.

Lastly, a small plastic container used in order to accumulate the gas that were produced by the electrolysis process before being flowed into the intake manifold.

1.2 PROBLEM STATEMENT

Nowadays, most people find it is difficult when the fuel for their vehicle runs out before the allocated time. If this problem continues, consequently it will raise up their spending or budget for the fuel for example budget for the fuel for a week. It also can affect to the individual's working quality and efficiency. For example, getting scolded by the boss because of getting late to work caused by the running out of the fuel. Moreover, people stated that in the past, the fuel was hard to run out within a period of time, although the spending remains the same as present. Meaning that the price is still the same, but the volume is decrease due to the global economy rate.

1.3 PROJECT OBJECTIVE

The objective of this project are :

- To design and fabricate a fuel saving device systemized with the electrolysis system by using the plate electrode base.
- To investigate that the usage of the device can decrease the usage of gasoline fuel or not.

1.4 PROJECT SCOPE

The specific scopes of this project is to design and fabricate a fuel saving device. Its purpose is to minimize the fuel usage on a vehicle by supplying the hydrogen gas produced by the device which is done through the electrolysis process, then channeled into the intake manifold to be used for the combustion of the engine.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

There are many forms of fuel saving device that are available in the market. Some are invented in the form of gadget, and some other are in the form of additional substances for the fuel that used for the internal combustion of engine. Back of the time, there was a Canadian inventor, Charles Nelson Pogue, who had invented the 200 mpg carburetor, used as a fuel saving gadget for vehicles. But, the invention were claims difficult to justify because the invention did not undergoes any testing or demonstration that proves the carburetor can saved up the fuel usage.

Nowadays, people had invented the fuel saving device in many ways especially in the form of fuel additives. Materials such as tin, magnesium and platinum compound are used for the additives. Generally, these usage of additives purposely to improve the energy density of the fuel by virtue of the material added. But some of the other additives also can cause harmful for the internal plastic parts in the fuel system such acetone.

For my project, the device were invented in the form of gadget. The body of the device is mainly about plastic. The electrode was built by using the fasteners that made of steel that have the characteristic of the electrical conductivity. And the system of my was also based on the electrolysis system in order to generate the device for producing the hydrogen gas that later used for the combustion.

2.2 TYPE OF FUEL SAVING DEVICE



Figure 2.1 : Voltage Stabilizer



Figure 2.2 : Gas Saving Gadget



Figure 2.3 : Prozone

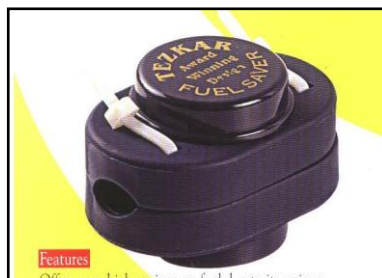


Figure 2.4 : Tezkar Fuel Saver



Figure 2.5 : Hydro-Octane Booster



Figure 2.6 : NoxGen Fuel Saving Device



Figure 2.7 : Force Flow Turbine Fuel



Figure 2.8 : FuelEX Fuelsaver



Figure 2.9 : Air Compressor Fuel Saver

2.3 FUNCTION

The main function of the device is to decrease the fuel usage on a vehicle. This can be done by the device that operates the electrolysis system that then produces hydrogen gas. Then, it will be channeled into the intake manifold and get along with the gasoline and used for the combustion of the engine. Thus, this can reduce the amount of gasoline that enters into the combustion chamber by supplying along it with the hydrogen gas produced by the device. Meaning that amount of fuel that inserted into the engine after attaching the device is lower than before we attaching the device.

2.4 JOINING METHOD

Joining method that were used in this project is fasteners. This joining method are used when build-up the electrode for the electrolysis system.

2.5 FASTENERS

Generally, fastener is a hardware tool that mechanically joins two or more objects together.

2.5.1 BOLTS

A round cylindrical tool that were wrapped by the thread along its body. Bolts are also same as screws, but different about the head.

2.5.2 NUTS

A fastener that contains inner thread hole. Usually, it is paired along with the screws and bolts in order to fasten or stack parts together.

2.5.3 WASHER

A round thin plate with hole at the center that were commonly used to reduce the load of the bolts and nut from damages.

2.6 ELECTROLYSIS OF WATER

Is the decomposition of water to produce oxygen and hydrogen gas by letting electrical current passed through the water.

2.6.1 PRINCIPLE

- Electrical source is connected to the two electrodes, the positive and negative terminal which are then placed in the electrolyte.
- When current passes through the electrolyte which is the water for example, the electrolyte then breaks into hydrogen and hydroxide ions that are then will be attracted to the both terminal depend on the opposition of the polarities and then undergoes chemical reaction.
 - Reduction at cathode or negative terminal : $2\text{H}^+(\text{aq}) + 2\text{e}^- \longrightarrow \text{H}_2(\text{g})$
 - Oxidation at anode or positive terminal : $2\text{H}_2\text{O}(\text{l}) \longrightarrow \text{O}_2(\text{g}) + 4\text{H}^+(\text{aq}) + 4\text{e}^-$

Thus, in this project, we used the hydrogen gas produced by the fuel saving device as the addition in the combustion chamber in order to reduce the fuel usage that are inserted for the combustion.

2.6.2 HYDROGEN AND OXYGEN

Table 2.1 : Hydrogen and Oxygen Characteristic

Hydrogen(H₂)	Oxygen(O₂)
○ Element with the atomic number of one.	○ Element with the atomic number of eight.
○ Represented by the symbol of "H".	○ Represented by the symbol of "O".
○ Lightest and most abundant chemical elements	○ Can cause combustion when it is highly concentrated.
○ Highly flammable.	○ Act as oxidant.
○ Burn in air at very wide range of volume concentration.	

2.7 FUEL

Material that are usable in generating energy to produce work. In other words, fuel are a substance that produce energy mostly generated by usable heat. Common type of fuels are used nowadays are hydrocarbons.

2.7.1 GASOLINE

A petroleum derived liquid mixture used for internal combustion engine. Obtained from the fractional distillation, it is then enhanced with the iso-octane and benzene to increase the octane rate.

2.8 DYNAMOMETER

A device that used to measure force, moment of force (torque) and power. For example, the power produced by an engine, motor or other rotating primer mover can be evaluated by simultaneously measuring the torque and rotational speed. Dynamometer also used to provide simulated road loading of either engine or full powertrain.

2.8.1 EDDY CURRENT TYPE ABSORBER

Is an electromagnetic load device. The engine being tested spins the disc in the dynamometer. Electrical current passes through coils surrounding the disc, and induce a magnetic resistance to the motion of the disc. Varying the current varies the load of the engine.



Figure 2.10 : Dynamometer's Engine



Figure 2.11 : Dynamometer 100kW

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

For the diagram in **Figure 3.1** below, the project was starts with the literature review and research about the title.This is consist about the review of the concept of the fuel saving device, type of the fuel saving device, and the features of the fuel saving devices used in various fields.These tasks have been done through the research based on the internet, books, and other sources.

After gathering all the relevent informations, the project undergoes the designation process.In this step, the knowledge gathered are used to make several sketches or designs that may be fit for this project.After that, design consideration have been made in order to chose the best design so later on it can be build-up.The selected design's sketch is then transfered into the solid modelling generated by the solidwork program.The materials and the measurements needed for the device were listed down and calculated in order to give an ergonomic shape of the device.

After listing up the materials needed, acquisition step take place.There are only few materials that are needed to be bought such as wires,tubes and other additional accessories for the production of the product.

The next step is the fabrication process.The design and the drawing are used as the references in order to build the device.

The fabrication process that involved in this project are drilling, assembling and fastening. After each of these processes are finished, the product undergoes the inspection session so that the product obeys the design and drawing that have been made earlier.

The product is then being tested in order to get the result as stated in the project objective. During the testing session, if any problems occurs such as malfunction and others, the device will step back to the previous process where all the mistakes and errors will be fixed.

After fixing up the errors, the testing session will be done again in order to get the expected result. If the testing goes well, then it will proceed to the last stage, the discussion. In the discussions data, the draft report and all the related things are gathered and hand over to the supervisor to be checked in order to ensure that there is no mistake done for both the project and report.

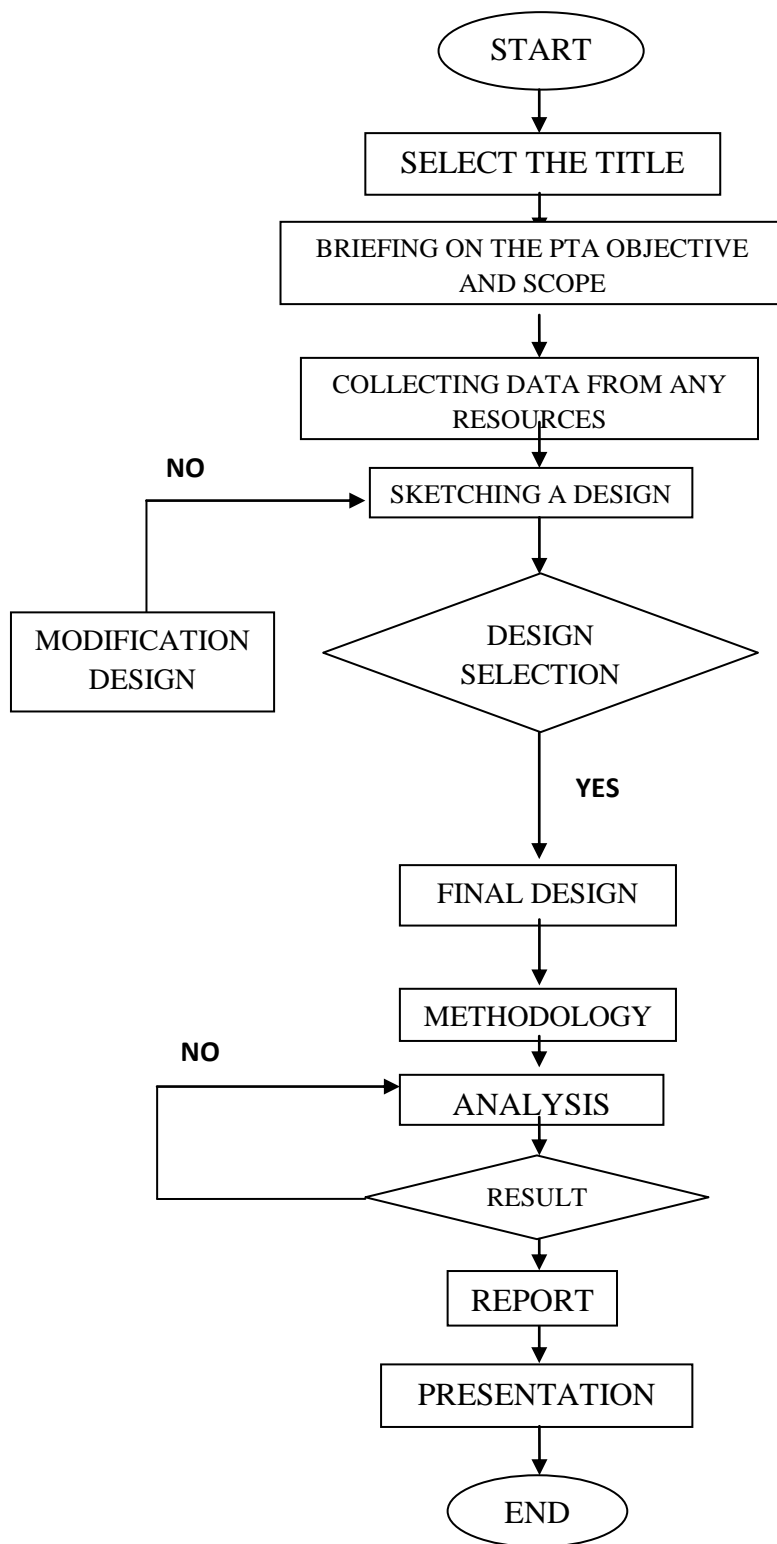


Figure 3.1: Flow Chart

3.2 DESIGN

The design of the device must be compliance to several aspect.The design consideration must be done carefully so the design can be fabricated and functioned well.The aspect that must be considered in designing the device are:

3.2.1 Ergonomic factors : The fuel saving device must be user friendly as easy to use and convenience.

3.2.2 Safety : The fuel saving device must have teh characteristic of electrical insulator since it is generated by the electricity source.

3.2.3 Size of the plate electrode : The larger the surface of the palte electrode,the higher the rate of electrolysis.So,the gas production also is high.

3.3 DRAWING

The drawing are devided into two categories which are :

3.3.1 Sketching : All the ideas for the device's fabrication are sketched first so that the idea selection can be made.

3.3.2 Solid modelling : The selected design or concept sketched are transfered to solid modelling using Solidwork software.

3.4 SKETCHING DRAWING SELECTION

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

3.4.1 First Design

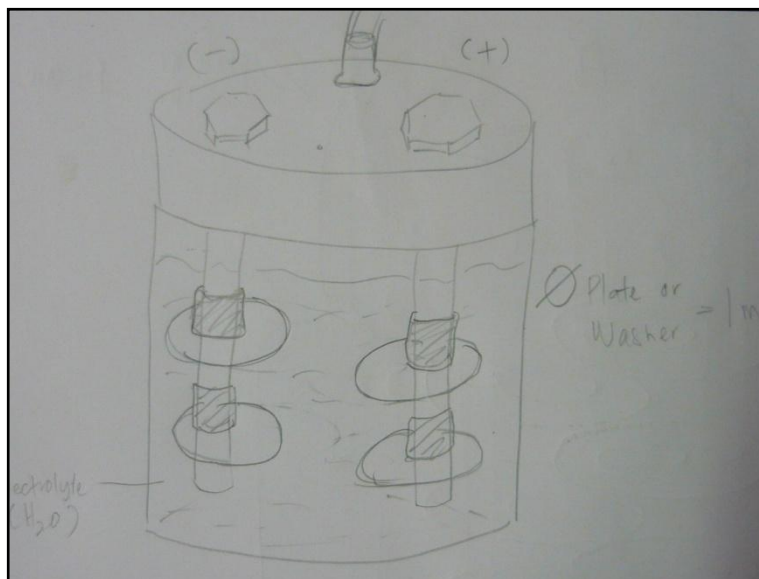


Figure 3.2 : Concept A

Advantage

- Can be built up easily
- Easy to use
- Portable

Disadvantage

- Gas production is low due to the size of the plate
- No safety measure applied to protect the engine since the water can be directly sucked into the engine.

3.4.2 Second Design

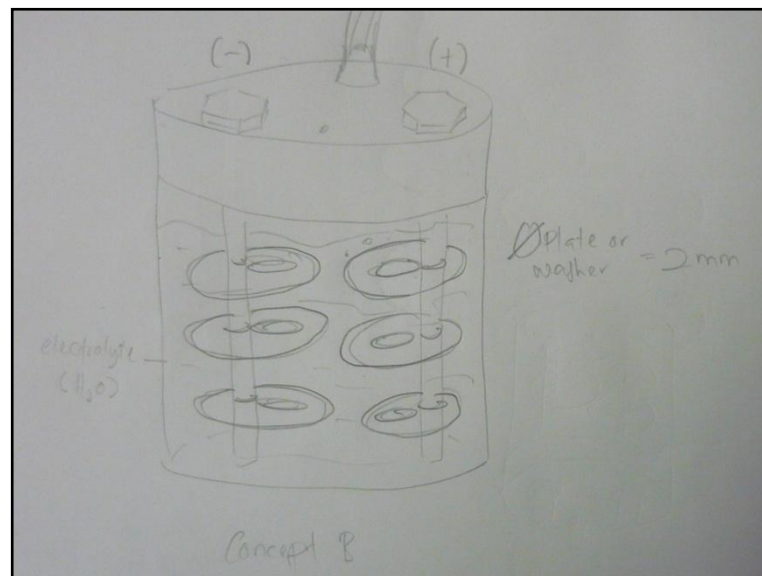


Figure 3.3 : Concept B

Advantage

- Easy to build
- Easy to use
- Gas production is high than before due to the larger area of the electrode plate.

Disadvantage

- No safety measure applied since the water can directly beeing sucked into the engine.

3.4.3 Third Design

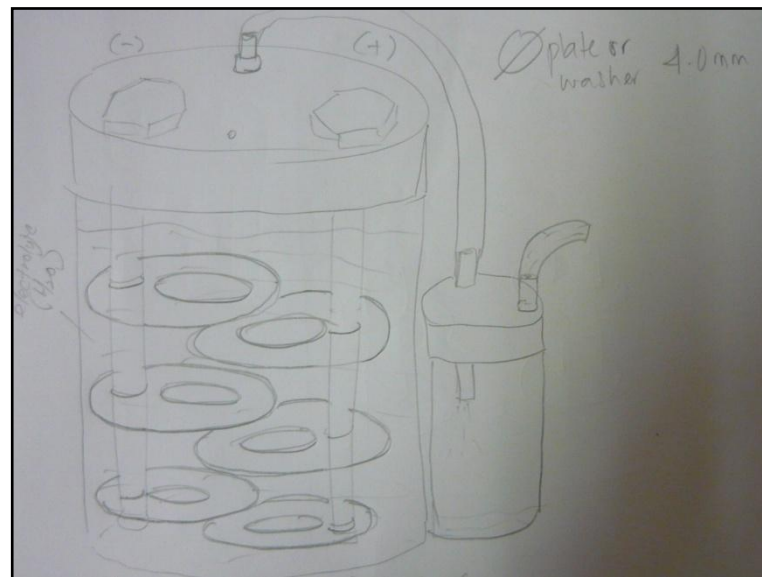


Figure 3.4 : Concept C

Advantage

- Easy to use
- Portable
- Easy to build
- Gas production is higher due to the size of the plate.
- Safety measure applied

Disadvantage

- Need more space to install

3.5 CONCEPT GENERATION AND EVALUATION

Four concepts for the fuel saving device were developed then evaluated against the datum of the device using the Pugh concept selection. The comparison between each concept is shown in **Table 3.1**.

Table 3.1 : Pugh's Selection Method

Selection Criteria	Concept			
	X(Datum)	A	B	C
Easy to manufacture	0	+	+	+
Easy of use	0	+	+	+
Portability	0	+	+	+
Function	0	0	0	0
Efficiency	0	-	+	+
Safety	0	-	-	+
Σ^+	0	3	4	5
$\Sigma 0$	6	1	1	1
Σ^-	0	2	1	0
Net score	0	1	3	5
Ranking	4	3	2	1

“0” : Same as **“-“** : Worse than **“+”** : Better than

According to the Table 3.1, Concept C was chosen because it is simple but yet convenience. It is because the device is portable, easy to use, easy to manufacture, and also can functioned effectively. Besides that, the Concept C is equipped with a small container which helps in collecting the gas effectively and then channeled into the manifold without containing the water because the container also act as the filter. Thus, it's a safety features that used for the device preventing the engine from damage.

3.5.1 FINALIZE DESIGN



Figure 3.5 : Final Design

3.6 FABRICATION PROCESS

This process is about to fabricate the device using the materials selected and make it based on the design by following the dimension stated. Many methods can be used to fabricate the product like fastening, drilling, fastening, and also many other method. Fabrication process is difference to the manufacturing process. Fabrication involves in making a product only while manufacturing involves in producing the products in a large batch.

3.7 PROCESS INVOLVED

In order to make the design comes to reality, fabrication process needs to be done first. The fabrication process starts from dimensioning the materials unit until it is finish as a desired product. The process that involved in this project are :

3.7.1 Measuring : Materials are measured to desired dimension or locations as shown in **Figure 3.6**.



Figure 3.6 : Measuring Process

3.7.2 Marking : All measured materials needed to be marked in order to give precise dimension as shown in **Figure 3.7**.

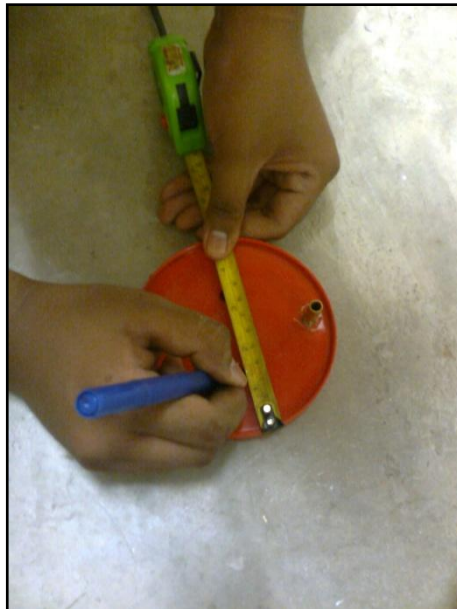


Figure 3.7 : Marking Process

3.7.3 Joining : Materials joined by using bolts,nut,and washers as shown in **Figure 3.8**.



Figure 3.8 : Joining Process

3.7.4 Drilling : Marked holes are then drilled to make holes for the bolts as shown in **Figure 3.9**.



Figure 3.9 : Drilling Process