DESIGN AND FABRICATE GAS STOVE STAND AND EXTRACTOR HOOD STAND

MUHAMAD FADHLI BIN OTHMAN

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

Faculty of Mechanical Engineering
UNIVERSITI MALAYSIA PAHANG

DECEMBER 2012
ABSTRACT

This final year project is about to design and fabricate the gas stove stand with extractor hood rack that suit to be used in kitchen. The objective of the project is to design and fabricate gas stove stand with extractor hood rack. This project also describes the review of products which are available in the market following to the title of the project. Design generation is showed and solid three dimensional structure modelling of the gas stove stand and extractor hood stand design was developed with solid work software. This report also explain the fabrication process that carrying in this project. Descriptions of material also show on this report in order to design this projek. As the conclusion, this project has achieved its goal through the succesful product making.
ABSTRAK

# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUPERVISOR’S DECLARATION</td>
<td>ii</td>
</tr>
<tr>
<td>STUDENT’S DECLARATION</td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>iv</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>v</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF CONTENTS</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF TABLE</td>
<td>x</td>
</tr>
<tr>
<td>LIST OF FIGURE</td>
<td>xi</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>xiii</td>
</tr>
</tbody>
</table>

## CHAPTER 1 INTRODUCTION

1.1 Introduction 1
1.2 Project Synopsis 1
1.3 Problem Statement 1
1.4 Objective 1
1.5 Project Scope 2
1.6 Report overview 2

## CHAPTER 2 LITERATURE REVIEW

2.1 Introduction 4
2.2 Extractor Hood Review 4
2.3 Gas Stove 5
   2.3.1 Portable Stove 5
2.4 Type of Stove 5
   2.4.1 Charcoal Stove 6
   2.4.2 Electric Stove 7
2.5 Review of Gas Stove Stand 7
2.6 Reviews Selected Material 8
  2.6.1 Mild steel 8
  2.6.2 Aluminium 9
  2.6.3 Zinc aluminium 10
  2.6.4 Rubber 10
2.7 Welding 11
  2.7.1 Arc welding 12
  2.7.2 TIG welding 12
2.8 Drilling 13
  2.8.1 Drill press 13
2.9 Grinding Process 14

CHAPTER 3  METHODOLOGY

3.1 Introduction 16
3.2 Overall Research Methodology 16
3.3 Design 17
  3.3.2 Concept generation and evaluation 20
  3.3.3 Finalize design 21
3.4 Fabrication Process 21
3.5 Process Involve 21
  3.5.1 Measuring process 22
  3.5.2 Marking process 22
  3.5.3 Cutting process 23
  3.5.4 Drilling process 23
  3.5.5 Joining process 24
  3.5.6 Grinding process 24

CHAPTER 4  RESULT AND DISCUSSION

4.1 Introduction 25
4.2 Final Product 25
4.3 Complete Product 27
4.4 Product Advantages 28
  4.4.2 Adjustable height 28
  4.4.2 Rubber liner on stand 29
4.4.3 Oil trap
4.4 Product Testing
4.5 Discussion

CHAPTER 5 CONCLUSION AND RECOMMENDATION

5.1 Conclusion
5.2 Recommendation

REFERENCES
APPENDICES
## LIST OF TABLE

<table>
<thead>
<tr>
<th>Table no.</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Concept selection criteria</td>
<td>20</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure No.</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Charcoal stove stand</td>
<td>6</td>
</tr>
<tr>
<td>2.2</td>
<td>Electric stove stand</td>
<td>7</td>
</tr>
<tr>
<td>2.3</td>
<td>Two burner gas stove stand</td>
<td>8</td>
</tr>
<tr>
<td>2.4</td>
<td>Welding process</td>
<td>11</td>
</tr>
<tr>
<td>2.5</td>
<td>TIG welding</td>
<td>13</td>
</tr>
<tr>
<td>2.6</td>
<td>Drilling press machine</td>
<td>14</td>
</tr>
<tr>
<td>2.7</td>
<td>Hand grinder</td>
<td>15</td>
</tr>
<tr>
<td>3.1</td>
<td>Concept A</td>
<td>17</td>
</tr>
<tr>
<td>3.2</td>
<td>Concept B</td>
<td>18</td>
</tr>
<tr>
<td>3.3</td>
<td>Concept C</td>
<td>19</td>
</tr>
<tr>
<td>3.4</td>
<td>Final design</td>
<td>21</td>
</tr>
<tr>
<td>3.5</td>
<td>Measuring process</td>
<td>22</td>
</tr>
<tr>
<td>3.6</td>
<td>Marking process</td>
<td>22</td>
</tr>
<tr>
<td>3.7</td>
<td>Cutting process</td>
<td>23</td>
</tr>
<tr>
<td>3.8</td>
<td>Drilling process</td>
<td>23</td>
</tr>
<tr>
<td>3.9</td>
<td>Joining process</td>
<td>24</td>
</tr>
<tr>
<td>3.10</td>
<td>Grinding process</td>
<td>24</td>
</tr>
<tr>
<td>4.1</td>
<td>Gas stove stands</td>
<td>26</td>
</tr>
<tr>
<td>Section</td>
<td>Description</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>4.2</td>
<td>Extractor hood stands</td>
<td>26</td>
</tr>
<tr>
<td>4.3</td>
<td>Product front view</td>
<td>27</td>
</tr>
<tr>
<td>4.4</td>
<td>Product side view</td>
<td>27</td>
</tr>
<tr>
<td>4.5</td>
<td>Product rear view</td>
<td>27</td>
</tr>
<tr>
<td>4.6</td>
<td>Before adjust stands</td>
<td>28</td>
</tr>
<tr>
<td>4.7</td>
<td>After adjust stands</td>
<td>28</td>
</tr>
<tr>
<td>4.8</td>
<td>Stands with rubber liner</td>
<td>29</td>
</tr>
<tr>
<td>4.9</td>
<td>Oil trap</td>
<td>29</td>
</tr>
<tr>
<td>4.10</td>
<td>Product testing</td>
<td>33</td>
</tr>
</tbody>
</table>
# LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL</td>
<td>Aluminium</td>
</tr>
<tr>
<td>ZA</td>
<td>Zinc aluminium</td>
</tr>
<tr>
<td>SMAW</td>
<td>Shield metal arc welding</td>
</tr>
<tr>
<td>MMA</td>
<td>Manual metal arc welding</td>
</tr>
<tr>
<td>TIG</td>
<td>Tungsten inert gas</td>
</tr>
<tr>
<td>GTAW</td>
<td>Gas tungsten arc welding</td>
</tr>
<tr>
<td>UMP</td>
<td>Universiti Malaysia Pahang</td>
</tr>
</tbody>
</table>
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 PROJECT SYNOPSIS

Final year project is one subjects of this semester. This subject carries four hour credits. In this subject, a project needs to fulfill by the student. The current project is to design and fabricate kitchen gas stove with cooker hoods. Final year project. The student must have hardworking and high discipline attitude. This project involves a few process in other to fabricate it. This project were testing with a real gas stove and cooker hoods dimensions.

1.3 PROBLEM STATEMENT

1) To avoid the stove from slip when use
2) To prevent smoke from regrouping in the kitchen
3) To avoid floor from oil that produce when cooking

1.4 OBJECTIVE

To design and fabricate gas stove stand with extractor hood stand
1.5 PROJECT SCOPE

1) Focused for two burner gas stove
2) Focused on table top
3) Focused on extractor hood that has weight less than 12 kg

1.6 REPORT OVERVIEW

1.6.1 Chapter 1

In this chapter discussed about the problem statement, project objective and project scope. This chapter explain the main thing to why to design design this product.

1.6.2 Chapter 2

The purpose of this chapter is to provide a review of past research efforts related to gas stove stand and extractor hood. A review of other relevant research studies is also provided. Substantial literature has been studied on history, types of lamp and material needed.

1.6.3 Chapter 3

This chapter discusses about all the information and data that required and fabrication process for this project. Firstly, to designing the gas stove stand and extractor hood skill in drawing and. This kind of data is required to design the concept of tree lamp.
1.6.4 Chapter 4

In this chapter explain and review about the final result of the product. This chapter also explain about the result of product testing, the advantages of product and a discuss about the product.

1.6.5 Chapter 5

This chapter briefly explain the conclude of overall of this project. The experience we gather and all the skills that we learn during fabricate this product. It also review about the little recommendation in order to make this product function more efficiently.
CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In a small kitchen needed the furnishings that could accommodate but do not to make kitchen became visible narrow especially for cooking. For example, gas stove stand and extractor hood rack. I have design a gas stove stand together with place to put the extractor hood. This invention ia a two-in one use. Here’s the example gas stove stand. It’s a gas stove stand which design together with extractor hood. As we know, gas stoves are often moving ang slipping when used on the table. It also often leaves stains such as oil and other substances. In order to solve the problems, the stand that I design is considering all the current weakness.

2.2 EXTRACTOR HOOD REVIEW

An extractor hood consists of three main components that is a skirt or capture panel to contain the raising gases, one or more grease filters, and a fan tangential blower for force ventilation. There are two major configurations of extractor hoods, ducted (or vented) application, and ductless (or recirculating) application. In a ducted application, the output collar of the extractor hood's blower motor is attached to a duct system, which terminates outside the building. In a ductless application, a filter, often containing activated charcoal, removes odor and smoke particles from the air before releasing the cleaned air back into the kitchen. A ducted system allows for removal of all forms of airborne contamination, while a ductless one recirculates heat and moisture into the kitchen. In addition, a ducted application eliminates the
need for regular replacement of the filters, and avoids the airflow restriction (and resultant loss of power) caused by them.

However, ducted application can be impractical, due to lack of space or ability to install a duct system, make-up air requirements, or the additional cost of heating/cooling the make-up air. Some range hood designs allow for both types of applications. Exhaust hoods almost always include built-in lighting (incandescent, fluorescent, or halogen) to illuminate the cooking surface. In addition, some manufacturers offer matching accessories, such as backsplash panels, pot racks, shelf units, or dish racks. Extractor hoods controls are typically electronic, though some low-end models use electromechanical controls. Extractor hoods with electronic controls can offer remote control, motorized height adjustment, thermal sensor, overheat protection, boost mode, delayed shut-off, filter cleaning reminder, active noise cancellation, temperature display, user presets (memory), and so on.

2.3 GAS STOVE

2.3.1 Portable stove

A portable stove is a cooking stove specially designed to be portable and lightweight, as in camping, picnicking, backpacking, or other use in remote locations where an easily transportable means of cooking or heating is needed. Portable stove can be used in diverse situations, such as for outdoor food service or catering and also in field hospitals. Since the invention of the portable stove in the 19th century, a wide variety of designs and models have seen use in a number of different applications. Portable stoves can be broken down into several broad categories based on the type of fuel used and stove design: unpressurized stoves that use solid or liquid fuel placed in the burner before ignition, stoves that use a volatile liquid fuel in a pressurized burner, bottled gas stoves, and gravity-fed “spirit” stoves.

2.4 TYPE OF STOVE

A kitchen stove, usually called a stove, range, or cooker, or oven is a kitchen appliance designed for the purpose of cooking food. Kitchen stoves rely on the
application of direct heat for the cooking process and may also contain an oven, used for baking. Modern kitchen stoves have burner on the top. A cooktop can refer to the top of a stove or burners built into a countertop. Many cooktops are made from glass-ceramic. A drop-in range has both burners on the top and an oven and hangs from a cutout in the countertop (that is, it cannot be installed free-standing on its own). Most modern stoves come in together with built-in extractor hoods.

2.4.1 charcoal stoves

Stove continued to evolve and charcoal began to replace wood as the burning material in stoves. These stoves had flat tops and the heat was concentrated on one side of the stoves top so that cooks could cook things at different temperatures based on where the pot or pan was located.

Figure 2.1: Charcoal stoves stand
2.4.2 electric stoves

Once electric power was widely and economically available, electric stoves became a popular alternative to fuel-burning appliances. The first electric stoves use heating elements made of high-resistance metal to produce heat. The cooktop (range) surface had one or more circular heating elements, insulated with compressed magnesia and sheathed in a spiral metal tube. Heating elements for the oven are of similar construction but an elongated loop to distribute heat. Elements were made as plug-in consumer-replaceable parts and could also be easily removed for cleaning. Temperature of cooking elements was regulated by adjusting a bimetal thermostat control switch, which switched power on and off to control the average heating effect of the elements.

![Electric stoves](image)

Figure 2.2: Electric stoves stand

2.5 REVIEW OF GAS STOVE STAND

The stand of gas stove are design based on the dimensional size of the stove. Portable stove stand make the user become more easier to handle when want to replace it in room kitchen. Safety factor are analyse during the testing with the stove. To make it more safe to be put on the table top, rubber liner are put on each stand to avoid it easily to slip on table top. It also come in together with built-in extractor...
hoods rack. Stainless steel is suitable material made a stand. With a high stand from stainless, it can make the stand more long-lasting.

![Stainless steel stand](image)

**Figure 2.3:** 2 burner gas stoves stand

### 2.6 RIVIEWS ON SELECTED MATERIAL

#### 2.6.1 Mild Steel

Mild steel, also called plain-carbon steel, is the most common form of steel because its price is relatively low while it provides material properties that are acceptable for many applications. Low carbon steel contains approximately 0.05–0.15% carbon and mild steel contains 0.16–0.29% carbon; making it malleable and ductile, but it cannot be hardened by heat treatment. Mild steel has a relatively low
tensile strength, but it is cheap and malleable; surface hardness can be increased through carburizing.

It is often used when large quantities of steel are needed, for example as structural steel. The density of mild steel is approximately 7.85 g/cm$^3$ (7850 kg/m$^3$ or 0.284 lb/in$^3$) and the Young's modulus is 210 GPa (30,000,000 psi).

Low carbon steels suffer from yield-point runout where the material has two yield points. The first yield point (or upper yield point) is higher than the second and the yield drops dramatically after the upper yield point. If a low carbon steel is only stressed to some point between the upper and lower yield point then the surface may develop Luder bands. Low carbon steels contain less carbon than other steels and are easier to cold-form, making them easier to handle.

### 2.6.2 Aluminium

Aluminium (or aluminum) is a chemical element in the boron group with symbol Al and atomic number 13. It is silvery white, and it is not soluble in water under normal circumstances.

Aluminium is the third most abundant element (after oxygen and silicon), and the most abundant metal, in the Earth's crust. It makes up about 8% by weight of the Earth's solid surface. Aluminium metal is so chemically reactive that native specimens are rare and limited to extreme reducing environments. Instead, it is found combined in over 270 different minerals. The chief ore of aluminium is bauxite.

Aluminium is remarkable for the metal's low density and for its ability to resist corrosion due to the phenomenon of passivation. The most useful compounds of aluminium, at least on a weight basis, are the oxides and sulfates.

Despite its prevalence in the environment, aluminium salts are not known to be used by any form of life. In keeping with its pervasiveness, aluminium is well
tolerated by plants and animals. Owing to their prevalence, potential beneficial (or otherwise) biological roles of aluminium compounds are of continuing interest.

### 2.6.3 Zinc Aluminium

Zinc-aluminium (ZA) alloys are alloys whose main constituents are zinc and aluminium. Other alloying elements include magnesium and copper. This type of alloy was originally developed for gravity casting. They were designed to compete with bronze, cast iron and aluminium using sand and permanent mold casting methods. Distinguishing features of ZA alloys include high as-cast strength, excellent bearing properties, as well as low energy requirements (for melting).

ZA alloys make good bearings because their final composition includes hard eutectic zinc-aluminium-copper particles embedded in a softer zinc-aluminium matrix. The hard particles provide a low-friction bearing surface, while the softer material wears back to provide space for lubricant to flow, similar to Babbitt metal.[citation needed]

The numbers associated with the name represent the amount of aluminium in the alloy (i.e. ZA8 has 8% aluminium).

### 2.6.4 Rubber

Natural rubber, also called India rubber or caoutchouc, as initially produced, consists of suitable polymers of the organic compound isoprene with minor impurities of other organic compounds plus water. Forms of polyisoprene that are useful as natural rubbers are classified as elastomers. Currently the rubber is harvested mainly in the form of the latex from certain trees. The latex is a sticky, milky colloid drawn off by making incisions into the bark and collecting the fluid in vessels. This process is called "tapping". The latex then is refined into rubber ready for commercial processing. Natural rubber is used extensively in many applications and products, either alone or in combination with other materials. In most of its useful forms it has a large stretch ratio, high resilience, and is extremely waterproof.
2.7  WELDING

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the work pieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. This is in contrast with soldering and brazing, which involve melting a lower-melting-point material between the work pieces to form a bond between them, without melting the work pieces.

Many different energy sources can be used for welding, including a gas flame, an electric arc, a laser, an electron beam, friction, and ultrasound. While often an industrial process, welding can be done in many different environments, including open air, under water and in outer space. Regardless of location, however, welding remains dangerous, and precautions must be taken to avoid burns, electric shock, eye damage, poisonous fumes, and overexposure to ultraviolet light.

**Figure 2.4:** Welding process
2.7.1 Arc Welding

One of the most common types of arc welding is shielded metal arc welding (SMAW), which is also known as manual metal arc welding (MMA) or stick welding. Electric current is used to strike an arc between the base material and consumable electrode rod, which is made of steel and is covered with a flux that protects the weld area from oxidation and contamination by producing CO₂ gas during the welding process. The electrode core itself acts as filler material, making separate filler unnecessary.

The process is versatile and can be performed with relatively inexpensive equipment, making it well suited to shop jobs and field work. An operator can become reasonably proficient with a modest amount of training and can achieve mastery with experience. Weld times are rather slow, since the consumable electrodes must be frequently replaced and because slag, the residue from the flux, must be chipped away after welding. Furthermore, the process is generally limited to welding ferrous materials, though special electrodes have made possible the welding of cast iron, nickel, aluminum, copper, and other metals. Inexperienced operators may find it difficult to make good out-of-position welds with this process.

2.7.2 TIG Welding

TIG (Tungsten Inert Gas) or even as it called GTAW (Gas Tungsten Arc Welding) uses non-consumable tungsten electrode and inert gas for shielding. It also can be implemented with or without filler metal. Tungsten is used due to its high melting point (3410°C). GTAW is most used for aluminium stainless steel.

Advantages of GTAW is can produce high quality welds, no weld spatter, little or no cleaning required after welding since no flux is used. The level of heat input also affects weld quality. Low heat input, caused by low welding current or high welding speed, can limit penetration and cause the weld bead to lift away from the surface being welded. If there is too much heat input, however, the weld bead grows in width while the likelihood of excessive penetration and spatter increase.
Additionally, if the welding torch is too far from the workpiece the shielding gas becomes ineffective causing porosity within the weld. This results in a weld with pinholes, which is weaker than a typical weld.

![Figure 2.5: Schematic of Tungsten Inert Gas (TIG) Welding](image)

**2.8 DRILLING**

Drilling is easily the most common machining process. One estimate is that 75% of all metal-cutting material removed comes from drilling operations. Drilling involves the creation of holes that are right circular cylinders. This is accomplished most typically by using a twist drill, something most readers will have seen before. The chips must exit through the flutes to the outside of the tool. As can be seen in the figure, the cutting front is embedded within the work piece, making cooling difficult. The cutting area can be flooded, coolant spray mist can be applied, or coolant can be delivered through the drill bit shaft.

**2.8.1 Drill Press**

A typical manual drill press is shown in the figure below. Compared to other powered metal cutting tools, a drill press is fairly simple, but it has evolved into a versatile necessity for every machine shop.
2.9 GRINDING PROCESS

Grinding is a finishing process used to improve surface finish, abrade hard materials, and tighten the tolerance on flat and cylindrical surfaces by removing a small amount of material. Information in this section is organized according to the subcategory links in the menu bar to the left.

In grinding, an abrasive material rubs against the metal part and removes tiny pieces of material. The abrasive material is typically on the surface of a wheel or belt and abrades material in a way similar to sanding. On a microscopic scale, the chip formation in grinding is the same as that found in other machining processes. The abrasive action of grinding generates excessive heat so that flooding of the cutting area with fluid is necessary.