UNIVERSITI TEKNIKAL MALAYSIA MELAKA

MECHANICAL COFFEE MACHINE (TRAVELER'S PORTABLE COFFEE MACHINE)

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Refrigeration and Air Conditioning System) with Honours.

by

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Tajuk: MECHANICAL COFFEE MACHINE (Traveler's portable coffee machine)

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Refrigeration and Air Conditioning System) with Honours. The member of the supervisory is as follow:

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ABSTRACT

The coffee machine is a very useful kitchen tool from ancient times. It is designed to facilitate coffee making. The more modern the more sophisticated coffee machines are designed but the coffee machine is difficult to bring together because it has a large size and weight. This will lead some problem to coffee lover especially traveler. Therefore, this product is designed to solve the problem so that the coffee machine is easy to carry anywhere. The size of this product is the same as the size of 250 ml bottle of mineral water. This product is designed based on three types of coffee machine which are Moka Pot, French Press and Vacuum Coffee Maker. Then, some morphological chart is carried out to choose the best design for this coffee machine. The design of this coffee machine is drawn using the "Solidwork" software. Once this machine is ready or created, it will be tested and ensured to function as it should. In addition, this coffee machine has a unique mechanism in which it uses the infusion mechanism. This mechanism responds by heating the water at the bottom of the machine coating until it shrivels. The boiling water will be pushed to the top by a small tube by the water vapor pressure. The small tube connects the hot water course from the bottom of the coffee machine to the middle containing coffee powder and then to the top of the coffee machine. The coffee machine has been studied in terms of the time required to produce coffee water and the temperature of coffee produced by using three different types of heat sources namely small bunsen burner, spirit lamp and candle. The result that is obtained after trying and analyzing this product is recorded and tabulated. Small bunsen recorded the least amount of time in producing coffee water of 6.31 minutes and produced the highest temperature water temperature of 92.2°c compared with spirit lamps and candles. In conclusion, the objective of this project has been achieved. The personal compact coffee machine for traveler is successfully designed and developed based on the requirements. This coffee machine has been named a Traveler's Portable Coffee Machine.

ABSTRAK

Mesin kopi adalah alat dapur yang sangat berguna dari zaman dahulu. Ia direka untuk memudahkan pembuatan kopi. Semakin moden mesin kopi yang lebih canggih direka bentuk tetapi mesin kopi sukar dikumpulkan kerana ia mempunyai saiz dan berat yang besar. Ini akan membawa masalah kepada pencinta kopi terutamanya pengembara. Oleh itu, produk ini direka untuk menyelesaikan masalah supaya mesin kopi mudah dibawa ke mana saja. Saiz produk ini sama dengan saiz 250 ml botol air mineral. Produk ini direka berdasarkan tiga jenis mesin kopi iaitu “Moka Pot”, “French Press’ dan “Vacuum Coffee Maker”. Kemudian, beberapa carta morfologi dijalankan untuk memilih reka bentuk terbaik untuk mesin kopi ini. Reka bentuk mesin kopi ini digambar menggunakan perisian "Solidwork". Setelah mesin ini siap atau diciptakan, ia akan diuji dan dipastikan berfungsi sebagaimana mestinya. Di samping itu, mesin kopi ini mempunyai mekanisme yang unik di mana ia menggunakan mekanisme infusi. Mekanisme ini bertindak balas dengan memanaskan air di bahagian bawah salutan mesin sehingga ia menghancurkan. Air mendidih akan ditolak ke atas oleh tiub kecil oleh tekanan wap air. Tiub kecil menghubungkan jalan air panas dari bahagian bawah mesin kopi ke tengah yang mengandungi serbuk kopi dan kemudian ke bahagian atas mesin kopi. Mesin kopi telah dikaji dari segi masa yang diperlukan untuk menghasilkan air kopi dan suhu kopi yang dihasilkan dengan menggunakan tiga jenis sumber haba yang berbeza iaitu pembakar bunsen kecil, pelita dan lilin. Keputusan yang diperolehi setelah mencuba dan menganalisis produk ini direkodkan dan ditabulasi.Bunsen kecil mencatatkan sedikit masa dalam menghasilkan air kopi sebanyak 6.31 minit dan menghasilkan suhu air suhu tertinggi 92.2˚c berbanding dengan pelita dan lilin. Kesimpulannya, matlamat projek ini telah dicapai. Mesin kopi kompak peribadi untuk pengembara berjaya direka dan dibangunkan berdasarkan keperluan. Mesin kopi ini telah dinamakan “Traveler Portable Coffee Machine”.

DEDICATION

I dedicate my degree work to my beloved family and friends. A special thank for my loving parents, Igai Anak Suka and Jawai Anthony Nibong because giving me much moral support to complete this project. Besides that, I also dedicate to my housemate and classmate that always give me support and encouragement doing my project. Last but not least, I would like to give a lot thanks to my Final Year Project supervisor Madam Norain binti Idris who had given me advices, knowledge and guide me doing this project. I will always appreciate all they have done for helping me in achieving my goal.

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AL2O3	-	Aluminum Oxide
B2O3	-	Boron Trioxide
CO2	-	Carbon Dioxide
GMAW	-	Gas Metal Arc Welding
K2O	-	Potassium Oxide
MAG	-	Metal Active Gas
MIG	-	Metal Inert Gas
Na2O	-	Sodium Oxide
RM	-	Ringgit Malaysia
SiO2	-	Silicon Dioxide
US	-	United States
3D	-	Three Dimensional

LIST OF SYMBOLS

cm	-	Centimeter
cm^3	-	Centimeter cube
D,d	-	Diameter
g/cm3	-	Gram Per Centimeter Cubed
h	-	Height
L	-	Long
ml	-	Millimeter
min	-	Minute
r	-	Radius
t	-	Time
w	-	Wide
v	-	Volume
Π	-	Pi
˚c	-	Celsius
%	-	Percentage
$	-	Dollar

CHAPTER 1

INTRODUCTION

This chapter will describe the coffee machine background. Problem statement is obtained by doing some research of coffee machine. The objective of this project is made by referring to the problem statement which the main objective is to make some improvement to coffee machine. After that, the scope of this project will be mention in this chapter.

1.1 Background

Coffee is a brewed drink prepared from roasted coffee bean (Maurin, O. ,2007). Coffee has its own distinctive features. In addition, coffee is the most popular beverage in the world because it tastes good and calms someone (Oder, Tom, 2015). Besides, coffee is a standout among the most mainstream and generally expended drinks on the planet. The business is purportedly worth during the many (US$) billions every year and it is the second most exchanged product after oil (Andrew Trafford King, 2013).

There are various ways to present coffee, such as espresso, French press, cafe latte, cappuccino and more (Poole et al,2017). Although this coffee has a lot of benefits but it also has a disadvantage if it is taken incorrectly. Often this coffee is provided or serve hot although ice coffee is a popular alternative. Therefore, coffee should be made or brewed in the right way to produce good and tasty coffee.

To produce good coffee is not easy for someone because it needs the help of a suitable coffee machine. If the coffee machine is good then the coffee made from the machine will also be good. That's why coffee machines play an important role in coffee making.

The coffee machine is a kitchen tool and has been made from the old days. In the past, most coffee machines were more mechanical than today's coffee machines. Now, many coffee machines are made of electric appliances and depend entirely on electric power. Electricity is a major source for today's coffee machines to function.

There are many types of coffee machines that have been made from ancient times to present, including "vacuum brewers", "percolators", "moka pot", "and electric drip coffee maker “,” French press “,” espresso machine “and” single- serve coffee maker ". Most coffee machines in the past used infusion concepts.

The basic infusion that is occurred in old coffee machine is when water is forced by steam pressure from pot then enter a coffee container from which the liquid return to the pot (Jepson Ivar and Bylund Eric, 1937). Today, the coffee machine does not use the infusion concept as it takes time to make coffee. If compared with the first coffee machine, today's coffee machine is more beneficial.

In conclusion coffee machine is an important tool in producing good coffee. Therefore, a coffee machine should be well-crafted as a good coffee machine can bring many benefits to the community.

1.2 Problem Statement

Nowadays, most coffee machines have been made to lighten the work of making coffee but it is expensive. Today's coffee machine is made by using electric appliances, of course it's good but it still has the disadvantage where the coffee machine relies entirely on electricity. If there is no electricity then the coffee machine cannot be used. Additionally, electrical coffee machines will be damaged if their wires or electronic equipment are exposed to water.

Coffee machine is also a kitchen tool that is not durable and easily damaged if it falls. Therefore, the coffee machine should be well maintained. On the other hand, most modern coffee machines are made with large and heavy sizes. It was very difficult to carry. In fact, most coffee machines today do not focus on traveler, it only focuses on the use of only kitchen.

Although there are many portable coffee makers that use mechanical systems in the market at the moment but they are sold at unreasonable prices. Most of which are sold in the market are not tough. Additionally, the portable coffee maker marketed does not use features such as bottles. It was unable to directly drink through the coffee maker and it had to be poured into the cup first to be drunk. Thus, a cheaper, durable and suitable size portable mechanical coffee machine is needed to solve these problems.

1.3 Objective

The project has two main objectives in to modify the use of coffee machines to bring benefits to everyday life especially to coffee lover. The two objectives are:

1) To design and develop a personal compact coffee machine for traveler.

2) To analyze the duration and temperature of the coffee produced by using different heat source namely candles, kerosene and bunsen burner.

1.4 Scope

This project will explore the background of coffee machines where two types of coffee machines will be compared to the concept and design of the coffee machine. This project will produce a good, portable and durable coffee machine for travelers. Two types of coffee machines are vacuum coffee makers and moka pot. After being compared, this project will go through several processes such as benchmarking, scoring and more before going into the process of detail designing of the coffee machine. As the model of this coffee machine is produced, the coffee machine will be tested and analyzed in terms of several aspects. Thus, the scopes of this research process include:

a) Benchmarking of some products.

b) Concept of developing.

c) Concept of scoring.

d) Concept of sketching.

e) Calculation of dimension.

f) Design of portable traveler coffee machine.

The coffee machine will be test and analyze in terms of coffee production duration and temperature of the coffee produced by using different heat source namely candles, kerosene and bunsen burner.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This literature review will show the background of the product. This chapter will provide literature review of brew coffee machine which it will related with previous and similar brew coffee machine that are already in market. Hence, this will review about the background, system, mechanism and materials to make the mechanical brew coffee machine.

2.2 Product Review

2.2.1 Moka Pot

Moka Pot is a mechanical coffee machine that was created in the past. The Moka pot is intended for simple convey ability and open to stacking (Lind, Maarja, 2017). It is a coffee machine that uses steam pressure to make coffee water (Kevin Kilburn, 2018). Moka Pot requires less than 5 minutes to produce coffee. The production of coffee is depending on type of heat source. Water vapor resulting from the boiling process will produce pressure. The steam pressure will force the water from the bottom pot into the middle of the pot containing a coffee bean. The coffee powder will mix with hot water and will move into the top of the pot. This is how the Moka Pot makes coffee. Moka Pot was created by Luigi De Ponti and was patented for the first time in Italy by Alfonso Bialetti in 1993 (Bialetti,2015) .Moka Pot is made of aluminum because aluminum is a cheap, strong and good heat conductor material. Moka Pot has been popular and widely used in Europe. Figure 2.1 below shows a picture of Moka Pot.

Figure 2.1: Moka Pot

(Bialetti, 2015).