



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF PORTABLE AIR COMPRESSOR BY
USING A BATTERY**

This report is submitted in accordance with the requirement of Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Power) with Honours.

by

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This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

.....
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ABSTRAK

Di zaman ini, industri pengeluar kenderaan sedang membangunkan hari demi hari. Dimana sahaja kita dapat melihat kenderaan bergerak. Kenderaan akan bergerak jika tayar diisi dengan angin yang mencukupi. Kebanyakan pemampat angin untuk mengepam tayar adalah dalam saiz yang besar dan kebanyakannya memerlukan tenaga besar iaitu AC dan susah untuk bawa kemana sahaja. Dengan masalah ini, kita boleh mengatakan bahawa terdapat keperluan pemampat udara yang mudah yang sepatutnya menjadi daya hidup produktif iaitu dalam saiz yang kecil dan juga dengan tenaga yang serba boleh (DC). Selain itu di sini dicadangkan satu garis rangka kerja yang akan memberi tenaga (DC) dan akan mempunyai keupayaan untuk terus berfungsi pada alat, sebagai contoh, bateri. Pemampat udara mudah alih menggabungkan kotak dan unit pemampat sesuai dalam projek ini. Unit pemampat menggabungkan sarung utama, ombok dipasang dengan badan silinder, motor dan komponen penghantaran. Motor tersebut memacu instrumen penghantaran untuk menggerakkan badan silinder untuk mewujudkan udara. Lubang keluar bergabung dengan ruang masuk daripadanya diperbuat daripada logam dan dirangka pada silinder. Tekanan angin dalam logam silinder akan keluar melalui lubang yang telah ada. Pam udara mudah alih ini menggabungkan semua alat penghantaran yang digunakan didalam satu tempat.

Kata kunci – Pemampat Udara, Bateri, Piston, Pam Angin, Motor DC

ABSTRACT

In today's period, vehicles industry is developing day by day. There is not a solitary spot where you can't get the chance to see autos. The Automobiles keep running on the tires that are filled with the packed air. Till in this way, the framework that gives packed air is extremely gigantic in size, devours substantial measure of power (AC) and is not achievable to convey with. Considering these viewpoints, we can say that there is an extraordinary need of an air compressor that ought to be vitality productive (DC), little in size what's more, versatile to convey with. Subsequently here we propose an outline of a framework that will give the ideal compacted air by using least measure of force (DC) and will have the capacity to keep running on gadget, for example, batteries. A portable air compressor incorporates a box and a compressor unit suited in the case. The compressor unit incorporates a primary casing, a piston fitted with cylinder body, a motor and a transmission component. The motor drives the transmission instrument to have the cylinder body conduct responding movement in the barrel to create packed air. The barrel characterizes a way out gap speaking with an inward space thereof. A metal seat is vitally framed at the piston cylinder. The focal gap of the metal seat speaks with the way out gap of the piston cylinder. The air pump apparatus incorporates a force gadget and a transmission gadget associated together through the interfacing piece.

Keyword – Air Compressor, Battery, Piston, Air Pump, DC Motor

DEDICATION

To my beloved parents,

Mr. Amzah and Mdm. Siti Saedah,

Who was raised me,

Feed me,

Accompany me,

Cheer me,

I love you both

ACKNOWLEDGEMENT

All praise belongs to ALLAH (SWT). Without the health, strength and perseverance He gave, I would not be able to complete this project thesis. In preparing this report, I was in contact with many people and friends. However, it would have not been possible without the kind support and help of many individuals. They have contributed towards my understanding and thoughts. In particular, I wish to express my sincere appreciation to my project supervisor, Encik Mohd Firdaus Bin Mohd Ab. Halim for encouragement guidance, critics, ideas and advices. Without his guidance and persistent help this project thesis would not complete successfully. My sincere appreciation also extends to all my colleagues and others who have provided assistance at various situations. Their views and tips are useful indeed. Finally, the most important, my project would not be carried out smoothly without the continuing support and encouragement given by my parent. They give their kind motivation to go through all the hard works and they gave me their supports and positive vibes while carrying out this project. I would like to express my sincere gratitude to them especially for their helping during the time in need. I am grateful to all my family members and my big appreciations also go to the people who are directly or indirectly helped me in developing this project thesis.

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CHAPTER 1

INTRODUCTION

1.0 Background

In today's time, vehicles industry is developing day by day. The Automobiles keep running on the tires that are filled with the compacted air. Till in this way, the framework that gives compacted air is exceptionally gigantic in size, devours expansive measure of power (AC) and is not practical to convey with. Considering these viewpoints, we can say that there is an extraordinary need of an air compressor that ought to be vitality productive (DC), little in size, compact to convey with. Thus here we propose a configuration of a framework that will give the ideal compacted air by using least measure of force (DC) and will have the capacity to keep running on gadget, for example, batteries (Nerlikar et al. 2015) .

The historical backdrop of air compressor frameworks is as old as the age of the interest for packed and pressurized air. Pressurized air has been utilized as a part of numerous businesses for various applications for a long time. The requirement for compacted air came about to development of air compressor frameworks. The frameworks are without further ado mainstream in assembling and development commercial ventures where pneumatic parts are utilized to cool packed air for mechanical purposes.

The air compressor that had a history of several hundred years since it was successfully produced in 1640 in Germany (Xuemei & Changchun 2011) . Several years later, in 1762, an engineer called Smeaton could plan propelled air compressors

that were controlled utilizing water wheels. This was a noteworthy stride in the historical backdrop of air compressor frameworks.

In spite of the fact that Smeaton air compressor was powerful, it was later supplanted by the impacting machine air compressor planned in 1776 by Wilkinson. This was best in class that the past adaptations and it is accepted to be the paradigm of later air compressor frameworks. It is significant that air compressors were utilized for some reasons as a part of the past days extending from, metalworking, underground ventilation, mining and creation of metals among others. Case in point, air compressor frameworks assumed an extraordinary part amid the development of the France-Italy rail framework in 1857. Later on, interest for compacted air expanded and more progressed pneumatic parts were imagined to build the generation of packed air.

As person created better approaches to utilize compacted air, interest for air compressor frameworks expanded and the innovation spread to numerous parts of the world. In the 1800, man was utilizing air compressors for vitality transmission. Engineer Viktor made an exceptionally positive move after he outlined an air compressor in Paris that delivered 18000Kw. This was trailed by various advancements in the mid twentieth century, and more enhanced pneumatic segments were similarly intended to meet the expanding requests for air compressor frameworks (Rubanova 1982) .

Mini type air compressor is made to apply as a power in daily life every day. Mini type air compressor is drive by inductive 12v DC motor. To design mini type air compressor, drive motor volume and weight must be little and its efficiency must be high (Zhong 2012) . The portable air compressor is a device that converts power (usually from an electric motor) into potential energy by forcing air into a smaller volume and thus increasing its pressure by connecting rod from DC motor transforms the rotary motion of the crankshaft into the reciprocating motion of piston in the cylinder and compress the air (Patil et al. 2015) .

1.1 Problem Statement

Now, each and every field is in influence with the technological advancements. We cannot find a single field without technological aspects. Among all innovations, revolution in the field of automobiles has made our life exciting and easier (Nerlikar et al. 2015) .

Today car industry is at its top. Tremendous measure of improvement has been done till so far to support the business requests. Consistently we see various vehicles running all over. For a human, vehicles assume an imperative part. Car vehicles constitute a few sections that run productively.

Wheels are the base for a vehicle. Wheels are the running base of the automobiles. These wheels include tires that are loaded with the packed air. All around we get the opportunity to see compacted air filling focuses. It might be at the carport then again might be close to the petrol/diesel or gas filling stations. Today, the way packed air is picked up is excessively dreary and complex system. Each time there is need of packed air for our vehicles, we have to hurry to the closest air filling point, which is a migraine for us particularly at the point when time imperative matters. Regardless of the fact that we hurry to the air filling point, we may get packed air.

These focuses to a need of a well enhanced choice for giving compacted air at our place, wherever we need and with least assets, for example, power and so forth. Another framework can be produced to give such functionalities.

1.2 Objectives

- i. To find the alternative to the conventional way of pumping the tire.
- ii. To build a low power air compressor that use battery as a power source to made it portable.
- iii. To show the air compressor pump functioning correctly when using the battery.

1.3 Scope

The aim of this project is to focus about portable tire pump which is this device is very important to everyone life to make sure that can help to easy to pump the tire everywhere. This portable air pump tire can compress about 220 psi air to full fill the flat tire and it's about five minutes above 30 psi. That is suitable for pump car tire, motorcycle tire and bike tire. Besides that, it also has the nozzle to pump the ball other than tire. This device develops from the most sustainable materials and processes available. In order to create this air compressor as portable air compressor pump tire, its use a battery 12v as a supply to powered up the DC motor 12v. Dc Motor will be the fundamental part of this proposed system. It is expected that DC Motor will be functional at 12 volt power that rotary motion of the crankshaft into the reciprocating motion of piston in the cylinder and compress the air. Based on with the cylinder type, this part can be used to generating the compressed air. It replaced the valve that is used by hand from normal pump. To make the portable air compressor, it must have pressure gauge to measure the air that compress out and also to know how many air full fill to the suitable capacity of tire. This device can make people and cultures about being easier with the use the portable pump.

CHAPTER 2

LITERATURE REVIEW

2.0 INTRODUCTION

This chapter reviews existing project created to get an idea about the project design, conception, specification and any information that related to improve the project. In later of this chapter, some review about air compressor that proposed to fulfill this project will also be reported. This chapter also discusses about the equipment such as DC motor, cylinder type of piston and battery. It highlights some previous case studies that are related to this project from reference books, thesis, conference papers and journal.

The portable air compressor can be made as portable tire pump. This portable pump tire is made to user get easier and comfortable when use. As we know, pump tire is use manually. This system that want to make is portable and automatic compress the air into the tire. In this final project need to build a portable air compressor for tire pump and it is mean that have to develop the portable tire pump and compress the air without be controlled by human.

In this project we are using a piston as a valve. This cylinder piston can use the gear to assembly as a bridge in between DC Motor It can be used for transmitting torque from one shaft to another shaft generating the compressed air automatically (Nerlikar et al. 2015) .

As needs be, it is a general object of the present development to give a compact pneumatic machine that conquers the simply portrayed issues by having an independent force supply that renders the pump truly versatile [6].

2.1 HARDWARE BACKGROUND

This topic discusses the equipment that want to use either electrical or the housing hardware based on what has been find with literature study.

2.1.1 DC MOTOR

The DC motor takes the electrical energy from the battery 12v and converts it to the mechanical work necessary to drive the cylinder type of piston to replace the valve to compress the air. This DC Motor is electric motor which uses direct current (DC – Direct Current). This DC Motor has two terminals only. Motor will be turning when two terminals given voltage according to the need for example 12V. The direction of the rotation of the motor depends on polarity supply. The gear must have at motor's shaft to rotate the shaft of the piston (James et al. 2007) .

DC Motor broadly utilized as a part of industry. DC Motor are additionally broadly utilized as a part of mechanical frameworks, for example, automated controllers, since their control is generally straight forward and they are solid for an extensive variety of working conditions. Flaw finding of DC Motor are quality control have gotten developing in the consideration of architects. DC Motor also give the advantage compare to AC electric motor example of electrical system such as cost are expensive and can be dangerous (Iorgulescu & Beloiu 2012) .

2.1.2 Type of DC Motor

2.1.2.1 Brushed Motor

A Brushed Motor has a turning set of wound wire curls called an armature which goes about as an electromagnet with two posts. A mechanical rotational switch called a commutator inverts the course of the electric current twice every cycle, to move through the armature so that the shafts of the electromagnet push and draw against the perpetual magnets on the outside of the motor. As the posts of the armature electromagnet pass the shafts of the changeless magnets, the commutator inverts the extremity of the armature electromagnet. Amid the moment of exchanging extremity, dormancy keeps the established engine going in the best possible heading. Figure 2.1 show the example of brushed DC motor.

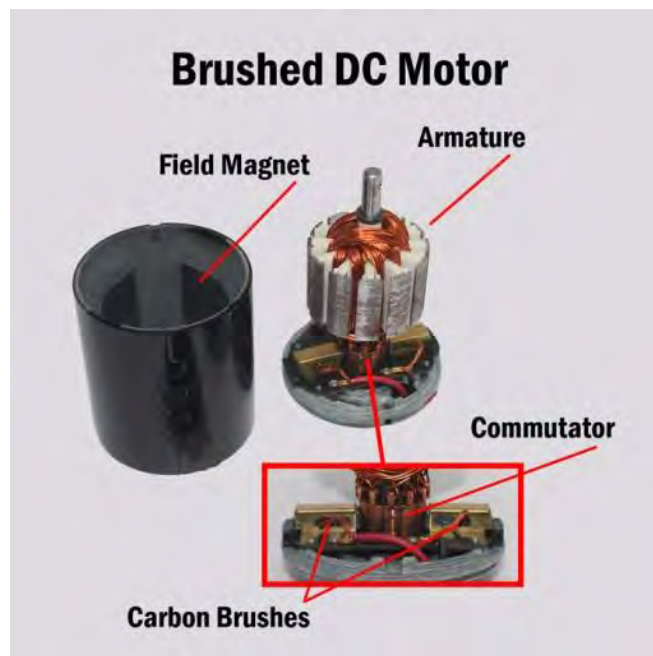


Figure 2.1: Brushed DC Motor

Despite the fact that DC brushed motor are extremely efficient and cheap, issues connected with the brushed DC motor is that starting happens under heavy load conditions between the two surfaces of the commutator and carbon brushes bringing about self-creating heat, short life range and electrical noise because of sparking.

2.1.2.2 Brushless Motor

A DC Brushless Motor that show in Figure 2.2 has uses a perpetual magnet outside rotor, three periods of driving curls, one or more Hall impact gadgets to sense the position of the rotor, and the related drive hardware. The curls are enacted, one stage after the other, by the drive gadgets as prompted by the signs from the Hall impact sensors, and they go about as three-stage synchronous motor containing their own particular variable recurrence drive hardware.

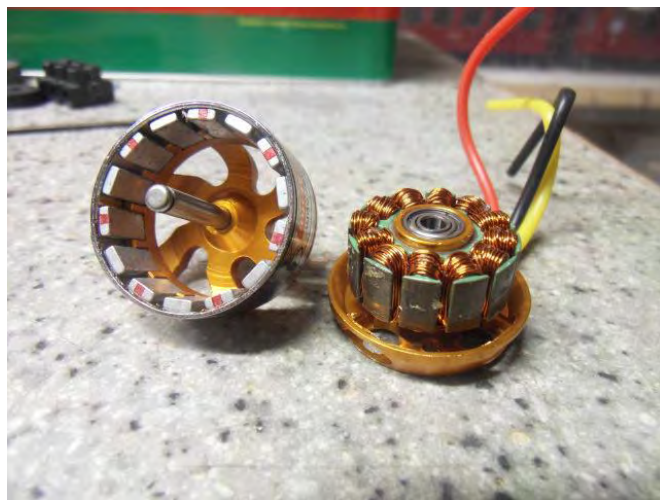


Figure 2.2: Brushless Motor

Advantages of the Brushless DC Motor is higher efficiencies, high unwavering quality, low electrical commotion, great pace control and all the more significantly, no brushes or commutator to destroy delivering a much higher velocity. However their impediment is that they are more costly and more convoluted to control.

2.1.3 BATTERY

The battery selection is very important to relate with the system and must have the suitability with the system. A wide range of electronic equipment uses uninterruptible power system units in order to continue operating in case there is loss of power supply and the battery must be available to charge to regulate that supplies the load with DC voltage (Kokkosis et al. 2012).

The battery is recharged following the recovery to the fully charged state. Battery power, energy capacity and service life are the main factors in the design of a standby system (Wong et al. 2008).

The first important thing to figure out is what voltage the motor is going to use. The motor may come with specifications. Motor controllers are designed to run from 5V to 12V. The second thing to figure out is how much current the motor will need. These criteria are very important to select the suitable battery for driving the 12V DC motor.

2.1.3.1 Lead-Acid Battery

Lead-Acid batteries include two 6-volt batteries in series arrangement, or a solitary 12-volt battery. These batteries are built of a few single cells associated in series arrangement every cell delivers around 2.1 volts. A six-volt battery has three single cells, which when completely charged produce an output voltage of 6.3 volts. Figure 2.3(a) shows the example of a single Lead-Acid Separator.

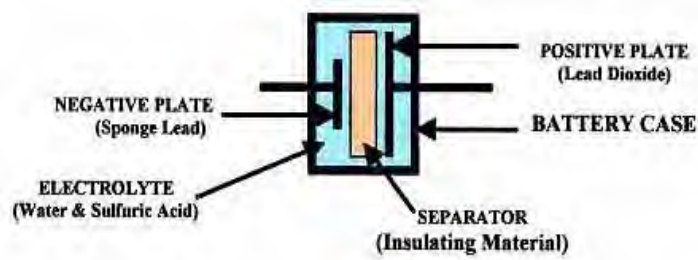


Figure 2.3(a): Lead-Acid Battery Separator

A twelve-volt battery has six single cells in arrangement creating a completely charged output voltage of 12.6 volts. The example showed on Figure 2.3(b).

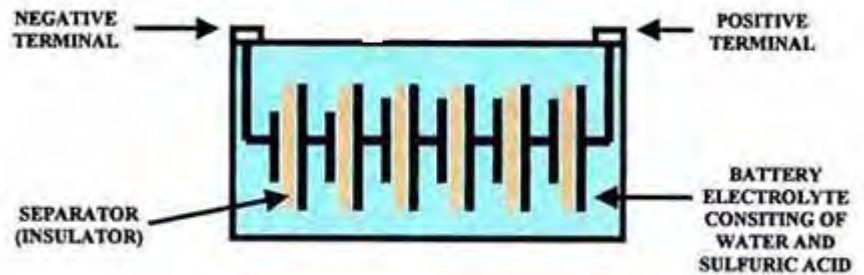


Figure 2.3(b): The design of Lead-Acid Battery

Refer to (Dr. Dieter Kunze 2009) book title the Principles of Function, Construction and Application of Valve Regulated Lead-Acid Batteries, the key process in the VRLAB is the high rate of reaction of oxygen with lead at the lead electrode by finally forming water. Oxygen is formed during charge at the lead-dioxide electrode by electrolytic decomposition of water. The charging efficiency of this electrode is less than that of the lead electrode. Therefore, oxygen is produced much earlier than hydrogen at the lead electrode. Hydrogen is formed mainly when this electrode is very near to a fully charged state. (Kunze et al. 2009)