ANALYSIS OF A DEVICE THAT INFLATES THE INFLATABLE ITEMS

Thesis submitted in accordance with the requirements of the Universiti Teknikal Malaysia Melaka for the Degree of Bachelor of Engineering Manufacturing (Robotic and Automation)

By

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JUDUL: DESIGN IMPROVEMENT ON A METHOD OF INFLATING THE INFLATABLE ARTICLES

SESi PENGAJIAN: 2006-2007

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I hereby, declare this thesis entitled “Analysis of A Device That Inflates the Inflatable Items” is the results of my own research except as cited in the reference.

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Date : 29 MEI 2007
ABSTRACT

Air Pressure Plug is the new innovation functioned as a tire pump for motorcycles. This is made to substitute the ordinary pump in the market. Concept of this pump is different where the source of air comes from the mechanism of internal combustion of engine strokes. From the testing done before showed this pump gave more physical advantage than other pumps such as less energy usage, take a short time to inflate the tire, lightweight and small size. But in terms of compounds of air there are several experiments should be doing to see the chemical properties of the air. Theoretically the air consisted five gases when combustion happened. These gases were hydrocarbon, carbon oxide, carbon monoxide, nitrogen and oxygen, which measured in ppm. This kind of gases were not a clean air but full of impurities and consist of particles of petrol. So at this stage some laboratory test need to perform to proof that the gases may give effect to the physical properties of inner tube. So this experiment will be called ‘Analysis of A Device That Inflates The Inflatable Items’. There are two stages of experiment will be doing, the first stages called pre-experiment including endurance test and performance speed test. For the second stages is the final experiment that is tensile test to measure the tensile strength (break point) and elasticity (modulus young). From the Trapezium software several value will show up automatically including yield strength, maximum stress, max strain and maximum force. This value will be discuss and try to find the answer of the problem such as life cycle and effect of physical properties changing impact to the safety of the motorcyclist and come up with the solution.
DEDICATION

To my beloved
Father, Mother
And
The Whole Families
ACKNOWLEDGEMENT

Alhamdulillah, a lot of grateful to the almighty, ALLAH S.W.T because gave me a time with better health to finished this Projek Sarjana Muda. Thank you to my mom and dad in giving me fully support. For my supervisor and lecturers you are the best and keep up your performance. To all my friends whether in UteM or at the outside highest solute to all of you and hopefully our ‘families’ always keep in tight. To the management person in Manufacturing Engineering Faculty, University Industry Center and the PSM committees, perfect job from yours and boost your step further in the future. Lastly, from the deep of my heart hopefully one day this prototype will become a product and sold over the world, InsyALLAH.
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<tr>
<td>DOE</td>
<td>Design of Experiment</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society of for Testing and Materials</td>
</tr>
<tr>
<td>CO</td>
<td>Carbon oxide</td>
</tr>
<tr>
<td>CO2</td>
<td>Carbon monoxide</td>
</tr>
<tr>
<td>NO</td>
<td>Nitrogen</td>
</tr>
<tr>
<td>HC</td>
<td>Hydrocarbon</td>
</tr>
<tr>
<td>O2</td>
<td>Oxygen</td>
</tr>
<tr>
<td>C-H</td>
<td>Chemical bonding between carbon and hydrogen</td>
</tr>
<tr>
<td>TR</td>
<td>Temperature Range</td>
</tr>
<tr>
<td>APP</td>
<td>Air Pressure Plug</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer Aided Design</td>
</tr>
<tr>
<td>OHNS</td>
<td>Oil Hardening Non-Shrinking Tool Steel</td>
</tr>
<tr>
<td>E</td>
<td>Modulus of elasticity</td>
</tr>
<tr>
<td>%</td>
<td>Percent</td>
</tr>
<tr>
<td>Mpa</td>
<td>Mega Pascal (Unit of Pressure)</td>
</tr>
<tr>
<td>psi</td>
<td>Unit of Pressure</td>
</tr>
<tr>
<td>rev</td>
<td>Revolution</td>
</tr>
<tr>
<td>rpm</td>
<td>Rotation per Minutes</td>
</tr>
<tr>
<td>hp</td>
<td>Horse Power (Unit of Power)</td>
</tr>
<tr>
<td>mm</td>
<td>Millimeter</td>
</tr>
<tr>
<td>kW</td>
<td>Kilowatt</td>
</tr>
<tr>
<td>kN</td>
<td>Kilo Newton</td>
</tr>
<tr>
<td>RM</td>
<td>Malaysian Ringgit</td>
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<tr>
<td>PHA</td>
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CHAPTER 1
INTRODUCTION

1.1 Introduction

The source of air comes from the reciprocating movement of piston in internal combustion engine in which fuels are being burnt generates compressed air in the engine. The compressed air in the engine is channeled out through a modified spark plug. The modified spark plug acts as a medium of delivery from the engine to any inflatable items. Inflatable item here is the type of rubber, which in general called elastomer. This is because it may elongate and have a bigger young modulus compare to the metal. For this project it may focus on the inner tube where in the rubber industry called butyl.
1.2 Problem Statement

There is an analysis conducted to the Air Pressure Plug is:

a) Effect of the product to the tire tube.

1.3 Objectives of The Research

a) How to identify the effect of the product to the tire tube.

1.4 Scope of Project

![Flow Chart]

Figure 1.0: Project's Flow Chart
1.5 Summary

In this introduction stage, only to give the main idea what the project is. So now the idea is to develop the experiment of tensile test to looking for the complete data and analyze the physical properties of inner tube or in the scientific name called butyl. With the value measured such as tensile stress, yield strength, elongation and modulus of elasticity, is it the source of air from internal combustion engines give side effect to the inner tube.
CHAPTER 2
LITERATURE REVIEW

2.1 Introduction to Internal Combustion Engine

Before explaining the operation of the two-stroke and four-stroke engine, some of the internal parts must be identified. Refer to the drawing of the basic internal combustion engine. Throughout the presentation, these parts are mentioned, so an understanding of what they do should be helpful. The Intake Valve opens at a precise time to allow the air/fuel mixture to enter the cylinder. The Exhaust Valve opens at a precise time to allow the burned gases to leave the cylinder. The Spark Plug ignites the air/fuel mixture in the cylinder, which creates an explosion. The force of the explosion is transferred to the Piston. The piston travels up and down in a Reciprocation Motion. The force from the piston is then transferred to the Crankshaft through the Piston Rod (connecting rod). The piston rod converts the reciprocating motion of the piston, to the Rotating Motion of the crankshaft.
2.2 Types of Stroke

2.2.1 Two Stroke Engine

Engine is the heart of the vehicles. It is the part that moves the vehicle. It acts as a small power plant that generates the energy. The ignition of the spark plug triggers the combustion in the engine cause the vehicle to move. There are two strokes in each cycle operation in the two strokes internal combustion engine. For every one revolution of the flywheel, there is one power stroke. The followings are the two different stroke of the engine (Srivivasan 2001):

i) Suction and compression stroke

This is the first stroke of the two-stroke cycle of the engine. As the piston moves up from the bottom dead center, it close all the three ports, which are the inlet, transfer, and exhaust port. As illustrated in Figure 2.1(a), the piston compresses the mixture of fuel and air inside the cylinder. The piston is fully compressed when the piston is closed to the top dead center. Then, fuel and air mixtures are ignited by the spark plug. With the burning of the mixtures, power is generated that is transmitted to the crankshaft through the connecting rod. Partial vacuum is produced inside the crankcase at this stage. As the inlet port opens, the fuel mixtures enter through it into the crankcase as indicated in Figure 2.1(b).

ii) Power and exhaust stroke

In the second stroke of the cycle, the piston moves down from the top dead center and the inlet port is closed. The bottom of the piston and the crankcase compress the fuel mixtures. Then, the fuel mixtures are pushed into the cylinder through the transfer port as illustrated in Figure 2.1(c). The exhaust gas leaves the cylinder through the opened exhaust port. However, some of the exhaust gas may remain inside the cylinder. The special shape of the piston head deflects the new fuel mixtures into the cylinder. Then the fuel mixtures flow down and push the exhaust gas through the exhaust port. This
process is known as scavenging. The cycle of operation will be repeated once the flywheel has completed one revolution.

![Compression stroke](image)  ![Power stroke](image)

(a) Compression stroke  (b) Power stroke

Figure 2.1: Operation of two strokes cycle petrol engines (Srivivasan 2001)

### 2.2.2 Four-stroke Engine

Four-stroke engine has four different strokes cycle for each complete operation. Most of the automobiles use this type of engine because it is more efficient and environmental friendly than the two-stroke engine. The four strokes in each cycle of the engine are (Srivivasan 2001):

i) Suction stroke

The inlet valve is opened and the exhaust valve is closed during this stroke. This is indicated in Figure 2.2(a). As the piston moves down from the top dead center, a partial vacuum is developed inside the cylinder. This causes the fuel and air mixtures suck into the cylinder. The inlet valve closes when the piston reaches the bottom dead center. The flywheel makes a half revolution.
ii) Compression stroke

In this stroke, the inlet and the exhaust valves are closed as illustrated in Figure 2.2(b). As the piston rises from the bottom dead center to the top dead center, the flywheel makes another half revolution. The mixture, which was sucked earlier into the cylinder, is compressed in the combustion chamber. During compression, heat is produced that vaporize the mixtures. Spark plug generates a spark that ignites the mixtures when the piston reaches the top dead center.

iii) Power stroke

In this stroke the inlet and exhaust valves remain closed as illustrated in Figure 2.2(c). The charge is ignited by the spark plug and the power is generated at the end of the compression stroke. The burning gas expands and pushes the piston down to the bottom dead center. The exhaust valve opens when the piston reaches close to the bottom dead center. Now the flywheel turns by another half-revolution.

iv) Exhaust stroke

At this stage, the inlet valve is closed and the exhaust valve is opened, which is indicated in Figure 2.2(d). The piston rises up from the bottom top center to the top dead center. As soon as the burnt gas is pushed out of cylinder, the exhaust valve closes and the inlet valve opens with the flywheel making another half-revolution. The piston moves down again and the fresh mixtures of fuel and air are drawn into the cylinder again. All these cycles of suction, compression, power and exhaust strokes is then repeated in which the flywheel rotates twice for each cycle of operation.
Figure 2.2: Operation of four strokes cycle petrol engines (Srivivasan 2001)