KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN MALAYSIA

DESIGN, SIMULATION AND ANALYSIS THE PRESSURE LIMITING VALVE FOR AUTOMOBILE TUBES OR TUBELESS TYRE

Thesis submitted in accordance with the requirements of the
National Technical University College of Malaysia for the Degree of
Bachelor of Manufacturing Engineering (Honours) (Manufacturing Process)

By

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KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN MALAYSIA

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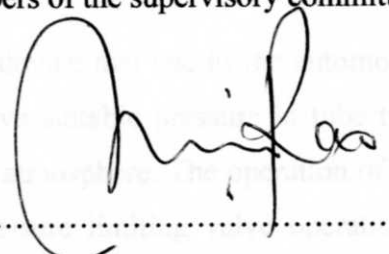
APPROVAL

This thesis submitted to the senate of KUTKM and has been accepted as fulfillment of the requirement for the degree of Bachelor of Engineering (Honours) Manufacturing (Process). The members of the supervisory committee are as follows:



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ABSTRACT

Pressure limiting valve is the device that use in the automotive tube or tubeless tyres. The function of this valve is to give suitable pressure in tube tyre's and release the excessive pressure (if happen) in tube to atmosphere. The operation of pressure limiting valve as same like pressure relief valve. Pressure limiting valve operation is based on a selection and analysis of pressure springs. A spring is important element in pressure limiting valve where spring will be compress to release the excessive pressure in tube. Equipment needed such as lathe machine and drilling machine in developed this valve. Material selection from aluminum 1060 types is selected to replace the previous material used. The designs of this valve begin with conceptual design. Simulation the valve motion and the analysis are indicates by applying the pressure using the Cosmosxpress provided by Solidwork software.

ABSTRAK

Injap penghad tekanan, adalah satu peralatan yang digunakan pada tiub kenderaan. Fungsi injap ini adalah untuk memberi tekanan yang sesuai di dalam tiub dan juga melepaskan tekanan yang berlebihan didalam tiub kepada udara kasa sekiranya berlaku. Injap penghad tekanan ini, beroperasi bergantung kepada pemilihan dan analisa spring. Spring merupakan unsur yang penting didalam injap penghad tekanan ini, dimana spring akan termampat untuk melepaskan tekanan yang berlebihan didalam tiub. Pemilihan bahan mentah adalah daripada aluminium untuk menggantikan bahan mentah yang telah digunakan oleh injap-injap tekanan yang lain. Simulasi untuk pergerakan injap dilakukan dengan meletakkan tekanan sebagai beban menggunakan perisian COSMOSXpress Solidwork .

DEDICATION

Specially dedicated to My beloved Father, Mohd Rashid bin Abdul Razak and My Mother, Norlizam binti Mohd Yassin who are very concern, understanding, patient and supporting. Thanks for everything to My supervisor Mr P. S. Sivarao for his constructive guidance, encouragement and patience in fulfilling our aspiration in completing this project. To My partner Zaimi bin Sahak, My Sisters, Brothers and All My Friends, I also would like to say thanks. The Work and Success will never be achieved without all of you.

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

PDP	-	Personal design portfolio
KM/H	-	Kilometer per hour
MPH	-	Mile per hour
KG	-	Kilogram
DIN	-	Deutsche Industries Normal
RTV	-	Room Temperature Vulcanizing
PTFE	-	Polytetrafluoroethylene
PSI	-	Pound force per square inch
ASTM	-	American Standard Testing Machine

CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION OF PROJECT

Generally the scope of manufacturing engineering (process and system) course is to design a process or a system or to solve manufacturing related problems in industry. The graduates from this course need to know the process of producing components and products. Usually some components or products have specific process, usage function and made of specific material. In manufacturing engineering characteristics and properties of the materials are vary important because these determine the advantages and limitations of product application and also the cost of the product.

This thesis will highlight about the design, simulation and analysis of pressure limiting tube valves for automobile tyre's. This is the new project to design and develop with new functions. This project is related with the tyre's valve. A tyres valve basically, does three jobs that are it retains air (up to 250 psi), it allows air in during inflation and also allows air out during deflation and pressure testing. Objective of this project is to make easier the vehicle users to pumped air pressure to tube or tubeless tyre's without pay attention the air pressure that will be set on the pressure gauge at kiosk

Usually, the basic pneumatic valve is a mechanical device consisting of a body and a moving part, which connects and disconnects passages within the body. The flow passages in pneumatic valves carry air under pressure. The action of the moving part may control system pressure, direction of flow, and rate of flow. Pressure in a pneumatic system, must be controlled at several points at the compressor and after the air receiver tank as well as the point of usage. Control of pressure at the point of air usage is necessary for functional safety and so that actuators receive the proper pressure.

In pressure limiting valve the operation is based on a selection and analysis of pressure springs. Spring will be compress and release the excessive pressure in tube tyre's to atmosphere. The design of pressure limiting valve begin with construct the product features first provided by Catia and Solidwork software. The simulation of valve motion is applied and to be analyze using the Cosmosexpress program.

1.2 OBJECTIVES OF THE PROJECT

The objective of this project is to make easier the vehicle users to pump air pressure to tube or tubeless tyre without have to pay attention of the pressure set on the kiosk gauge. As example, if the certain vehicle users is not learned of tyre pressure that need to decide for fill in the suitable air pressure on tyre, this valve can helped them fill in the suitable tyre pressure on their vehicle tyre with make the adjustment on anything pressure reading although the pressure that already set is too high or too low. So the function of valve is allow the excessive pressure exit when the pressure in tyre already sufficient.

Besides that, this valve also can lengthen the life span of tyre because this valve allow pressure tyre always in suitable pressure condition and indirectly that can prevent the side wear and mid wear occur on tyre. So, indirectly that can reduce the maintenance cost of tyre, where the user not to change a new tyre in the short terms.

1.3 SCOPE OF PROJECT

a) To conduct the design process of pressure limiting valve
b) To simulate the motion of pressure limiting valve
c) To analyze the capability at the valve to relief the excessive pressure from the tyre in case over inflation

1.4 THE IMPORTANT OF PROJECT

This project is very important because it can solve the user problem about the pressure in tube tyre's according from the problem statements. In this way, significant benefits from the project is obtained to prevent the under inflation and over inflation in tube tyre's. Under inflation has caused the tyre's to wear on the outer edges of the tread, leaving the central tread area far less worn. Over inflation has resulted in the central tread area being forced into contact with the road causing rapid centre and worn shoulders.

Further more, this project can help the students to understand the design process and the applications in the real world and also will the enhance knowledge and confidence in design, create and develop new things.

1.5 PROBLEM STATEMENTS

Most of the vehicle users are not sure the value of pressure is to be set for their tube or tyre. Their compelled refer to the table that sticks on at the kiosk by the car manufacturer or have to presume the pressure without get to know the effect cause from the air pressure is too high or too low.

Besides that, a certain vehicle user's is confused with the proper pressure of the tube especially when their vehicle is loaded with the capacity and the tyre it seems like deflated. The tyre deflated is always regarding with perception that the tyre pressure is too low or the reading pressure gauge at kiosk is not accurate. So that, the users make the adjustment with set the high pressure on the kiosk. This action can cause the dangerous and damage on the tyre.

CHAPTER 2
LITERATURE REVIEW

2.1 TYRE VALVE

The tire valve is really an air check that opens under air pressure and closes when pressure is removed. The inner valve or "valve core," acts as a check valve for the air. Positive sealing is provided by the "valve cap," which contains a soft rubber washer or gasket that shown at figure 2.1 and 2.2 below. It is this gasket, pressed against the end of the "valve stem," that seals the air in the tire. The careless practice of operating tires without the valve cap should not be followed, because, without the valve cap in place, there is usually a slow leak of air from the tire, causing the tire to run in an under inflated condition. If air should leak out around the base of the valve, it will be necessary to install a new tire valve assembly. This is easily accomplished with a special lever-type tool. (Autoswalk 2000)

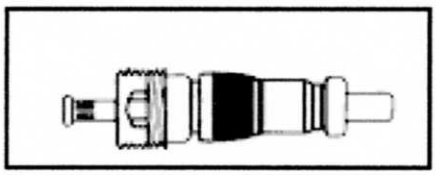

Figure 2.1: Short core valve

Figure 2.2: Long core valve

2.2 TUBELESS VALVE

Tubeless valves are generally made from rubber with a central core of metal containing the components required for inflating or deflating the tyre and providing the air seal. The valve core provides the primary air seal in a tubeless valve, a secondary seal is provided by the valve cap that also acts as a seal to prevent the ingress of dust and moisture into the valve itself.

Different types of tubeless valves are available for different applications or requirements. Usually available in two standard lengths the shorter one is generally used for alloy wheels and the longer one for steel wheels fitted with a plastic wheel trim - longer length allows for the valve to be accessible without removing the trim.

Another type of valve that is mainly constructed from steel also will find. These steel valves are bolted into the wheel and are usually found on high performance wheel or tyre assemblies.

A rubber tubeless valve will, over a period of time deteriorate. It is therefore recommended that whenever new tyres are fitted a new tubeless valve be fitted. Also whenever a tyre is removed from the rim (puncture repair etc) it is again recommended that a new valve be fitted. This is due to the fact that the base of the valve may be damaged during the removal of the tyre from the rim. (Litchfield P. W, 1903)