UNIVERSITI TEKNIKAL MALAYSIA MELAKA

MULTIPLE VALVE SPRING COMPRESSOR (MVC)

This report submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the
Bachelor Degree in Mechanical Engineering Technology
(Automotive Technology) (Hons.)

By

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DECLARATION

I hereby, declared this report entitled " Multiple Valve Spring Compressor" is the results of my own research except as cited in the references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as one of the requirements for the award of Bachelor's Degree Mechanical Engineering Technology (Automotive Technology) with honors. The following are the members of the supervisory committee:

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(MR. ADNAN BIN KATIJAN)

ABSTRAK

"Multiple Valve Spring Compressor" (MVC) merupakan projek yang dilaksanakan dengan mengubah "Valve-Clamp". Projek "MVC" ini berfungsi untuk membuka dan memasang semula "spring injap" ke dalam lapan injap secara serentak di "kepala silinder" yang dikuasai oleh "jack hidraulik". Selalunya mekanik perlu meluangkan banyak masa dan tenaga apabila menggunakan "Valve-Clamp". Di samping itu, mekanik juga terdedah kepada risiko kecederaan dan kehilangan "penahan pin" apabila terbuka "spring injap" dengan menggunakan kaedah lama iaitu menggunakan tukul besi. Tujuan kajian ini adalah untuk meningkatkan produktiviti, kerana keupayaan reka bentuk untuk memampatkan lebih daripada satu spring injap pada satu masa. Reka bentuk dan faktor ergonomik diberi keutamaan bagi proses reka bentuk. Dengan mengaplikasikan cara "MVC", ia mengambil masa yang kurang dan juga boleh digunakan untuk semua jenis enjin kereta. Tambahan lagi , ia tidak akan merosakkan injap serta bahagian-bahagian enjin yang lain. Projek ini juga akan mencegah kerosakan kerana terdapat banyak langkah keselamatan. Pelbagai kaedah dan reka bentuk telah digunakan untuk menyiapkan keseluruhan projek ini dan didapati projek ini berjaya apabila percubaan dilaksanakan. Dapatan data menunjukkan bahawa kedudukan "MVC" untuk sebelah kiri dan kanan kebanyakannya 1 hingga 5 dan analisa pandangan mata "MVC" adalah jelas dan lebih tepat. Dengan menggunakan "MVC" projek adalah kurang memakan masa dan juga boleh digunakan untuk semua jenis enjin kereta. Selain itu, ia tidak akan merosakkan meterai injap serta banyak bahagian-bahagian enjin lain. Projek ini akan menghalang sebarang kerosakan kerana terdapat pelbagai langkah keselamatan. Keseluruhan projek berjaya dan objektif tercapai.

ABSTRACT

"Multiple valve spring compressor" (MVC) is a project implemented by modifying the "Valve-Clamp" is used to open and reinstall "valve spring". This serves to open and reinstall "valve spring" in eight valves simultaneously at the "cylinder head" powered by "hydraulic jack". Often mechanics need to use a lot of time and energy when using the "Valve-Clamp". In addition, the mechanics are also exposed to the risk of injury and loss "retainer pin" when open "valve spring" using the old method of using a hammer. The aim of this study was to increase the productivity, due to the designs ability to compress more than one valve spring at a time. Ergonomic design and safety factor were given consideration for the design flows. Results show that the "MVC" rating for left and right hand side are mostly 1 until 5 and the eye view of the "MVC" is clear and more precise. By using "MVC" project is less time consuming and also applicable to all types of car engine. Besides, it won't damage the valve seal as well as many other engine parts. But this project will prevent this damages as there are more safety measures applied. The entire project is successful when we try to complete this project with a variety of methods and design within a few months and has been successful when run an experiment on this project.

DEDICATION

There are a number of people without whom this thesis might not have been written, and to whom I am greatly indebted. I owe my gratitude to all those people who have made this project possible and because of whom my graduate experience has been one that I will cherish forever. I dedicate my dissertation work to my family and many friends. A special feeling of gratitude to my loving parents, Isweran Choory and Devika Mayan, whose have been my constant source of inspiration. They have given me the drive and discipline to tackle any task with enthusiasm and determination. Without their love and support this project would not have been made possible. My sisters Ugeswary Isweran have never left my side and are very special. My deepest gratitude is to my advisor, Mr. Adnan Bin Katijan. I have been amazingly fortunate to have an advisor who gave me the freedom to explore on my own and at the same time the guidance to recover when my steps faltered. He taught me how to question thoughts and express ideas. His patience and support helped me overcome many crisis situations and finish this project. I hope that one day I would become as good an advisor to my students as he has been to me. Many friends have helped me through these difficult years. Their support and care helped me overcome setbacks and stay focused on my graduate study. I greatly value their friendship and I deeply appreciate their belief in me. Particularly, I would like to acknowledge Rooben for helping me develop my drawing skills and, Nishanti Tharuma Rethinam for the many hours of proofreading. Besides, I am also thankful to lecturers for numerous discussions on related topics that helped me improve my knowledge in the research area better. All of them have been my best cheerleaders.

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LIST OF ABBREVATIONS, SYMBOLS AND NOMENCLATURES

MVC	-	Multiple Valve Spring Compressor
ADA	-	Americans Disabilities Act
P	-	Piston
W	-	Work
BJ	-	Bottle Jack
OHV	-	Over Head Valve
OHC	-	Over Head, Camshaft
A	-	Area
R	-	Radius
F	-	Force
K	-	Spring Constant
N	-	Newton
VIKOR	-	Multi Criteria Decision Making (MCDM)
MADM	-	Multi Attribute Decision Making
ASM	-	American Society for Metals
KNOVEL	-	For Material or Property Search
TOPSIS	-	Method To Solve Decision Making Problems With Interval Data
UTeM	-	Universiti Teknikal Malaysia Melaka
CATIA	-	Computer Aided Three-dimensional Interactive Application
RULA	-	Rapid Upper Limb Assessment
MSD	-	Musculoskeletal Disorder

CHAPTER 1
INTRODUCTION

1.1 Background of the study

In modern producing firms, mechanical engineers play a key role within the “realization" of merchandise, operating closely with alternative engineers and specialists in company management, finance, marketing, and packaging. Small maintenance field or in the field of improvement of the existing equipment is still operating conventional, and without any improvement. At present there are a variety of special tools that are created for the purpose of simplifying and accelerating the opening, installation and modification of components of the vehicle.

Current designs of valve spring compressors have a work force applied by either a hand operated lever or by a pneumatic piston, operated by hand and powered through an air compressor system or use a portable hydraulic system. Common to these designs are a clamp fixture that fits over the cylinder head, usually made of flat steel or round tubing and are designed to compress one valve spring at a time.

Among the special tools that are created is the valve spring compressor. Multiple Valve Spring Compressor is the special equipment used to enable and facilitate the valve spring is compressed to manufacture valves and valve seals to be changed. This spring compressor is usually supplied with the compressor different sizes for different valve according to engine sizes. Multiple valve spring compressors can provide a number of benefits, such as two or more compressors can be arranged in series providing two or more stages of compression.

This project covered in the design of a mechanical engineering device which can be used efficiently to open and reinstall valve spring in eight valves simultaneously at the cylinder head powered by hydraulic jack where the main idea is to relieve the worker from undue stress and fatigue, but also increases profitability for a workshop are to a decrease in wasted time.

1.2 Problem Statement

In modern times now, most of the mechanical workshop or automobile service centers still using the hammer and "socket box" to open "valve spring". The installation will damage the "socket box" if not carefully use a hammer, hammer arms will be exposed. These will not only results in mechanic face the risk of injury and also harm the surrounding people. In addition, during the installation of the valve spring .Mechanics needs to take a relatively long time. This is because the mechanics need to install "valve spring" one by one. Excessive work and fatigue placed upon the worker by having to lift and hold the clamp fixture while compressing each individual valve spring in order to assemble or disassemble a cylinder head for repair.

Moreover mechanic has to use his full energy and it will take long time to finish the work. Some more when using the valve-clamp to clamp the "valve spring" and to open the "retainer pin" the working environment must be clean and safety if not it can cause mishaps. Loss of time and profit by having a worker perform the repetitive act of compressing each individual valve spring. Most accidents are caused by operator carelessness or misjudgment. Thus we must watch for poorly maintained equipment and hazardous situations and correct them.

1.3 Objectives of the study

Objective of this project:

- To design and analyze the Multiple Valve Spring Compressor (MVC).
- To fabricate the Multiple Valve Spring Compressor (MVC).

Specific Objectives:

- To Increase in productivity, due to the design's ability to compress more than one valve spring at a time.
- To eliminate of strain a worker must endure when using common valve spring compressors, by having to continuously lift and hold the valve-clamp fixture.

1.4 Scope of the study

This project covers the design of the "MVC" using computer CATIA design. Moreover the design developed should be optimized for providing a healthy and safe workplace. The design of the Multiple Valve Spring compressor is mainly focuses on the base of rectangular shape having a means for and is attached at each end to an upper frame member, said upper frame member being positioned vertically, comprising a rectangular u-shape and having a means for connection of an expandable device at its centre, which is used as a means of supplying force to compress multiple valve springs, Beside, this project also covers the fabrication of the newly designed "MVC" that suitable for all types of engines and people. Finally, product development should be analyzed and the data gained is used to make discussion and conclusion.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

To produce a quality project, all aspects should take into consideration in order all the criteria can be used to solve problems that have been identified. Every aspect should be studied in depth for each instrument used for essential uses in the production of the project.

In producing a project, a literature review is an important aspect that should be considered in the production of the project. Literature study is one aspect which various methods used to select and specify materials or materials suitable for producing the project. The choice of material is much focused because it will determine the quality of a project. Selections of appropriate materials can produce a quality project and meet customer requirement. Therefore, the literature review should be done before a project is designed to determine the appropriate material for the project.

2.2 Introduction on major criteria ergonomic

2.2.1 Ergonomics

Figure 2.1 : Ergonomic

Ergonomics may be a natural rule, which suggests the science of labor and a person's engagement to work. It is the research of anthropoid match, and minimized dullness and distress through product style. Biotechnology implemented to article on appliance style needs that we tend to take into thought, however the product we tend to style match the people who square measure victimization them. A lot of comfort, higher productivity, and fewer stress are the result of the user activity.

Ergonomics is often an associate degree integral a part of style and producing. However the stronger comprehend feeling of biotechnology is mainly about the study of posture, repetitive motion, and space style affects as they relate to the final - user. Refer Figure half-dozen for the application of biotechnology in product style. [1] Domains existence of specialization at intervals the discipline that corresponds to deeper competencies in specific human attributes or characteristics of human communication.

2.2.2 Physical Ergonomics

Figure 2.2 : Body Physical

Human anatomical, measure, physiological and bio mechanical characteristics are called are related to physical activity. The relevant topics embrace in operation postures, handling, repetitive movements, work-related system disorders, work layout, safety and health. Physical technology is in addition attached, but the physical setting around you'd probably have an impression on your performance. 'Physical' here suggests that the styles of things physicists apprehend and low - heat, light, noise, dusts, chemicals, and so on. Physical technology is related to understanding the implications of these aspects of the setting for people, and specifically, the harmful effects. Then you will be ready to vogue environments for folks that won't harm them, which they'd probably even get pleasure from the experience. [2]

2.2.3 Cognitive Ergonomics

Figure 2.3 : Brain Work

Cognitive Technology cares with mental processes ('brain work'), like perception, memory, reasoning, and motor response, as they need a sway for communications among humans and completely different components of a system. The relevant topics embody the brain work, judgement-making, skilled appearance, human-computer interaction, human duty, work stress and practices as these may relate to human-system vogue. [2]

2.3 Importance of Ergonomics

Figure 2.4 : People suffer because their conditions

Many people suffer as a result of their conditions at work and residential square measure incompatible with their desires, skills and limitations. This example, affects their safety and welfare, as well as, that of organizations and societies. Technology will create our lives a lot of economical and excitement. However, fascination with technology and excessively formidable business expectation will cause to consider human factors risks. Neglecting these risks will have serious effects on makers, suppliers and repair enterprises. Therefore, engineering, science and human factors are a lot of vitality in a genre, era than once it had been initially introduced within the nineteenth century. [3]

2.4 Anthropometric Measurements in Ergonomics

Anthropometry is that the science that measures the variation of body sizes in an exceedingly very population. Once planning, merchandise it's vital to recollect that folks are available in several sizes and shapes. Measuring knowledge varies significantly between regional community. For instance, Scandinavian populations tend to be taller, whereas Asian and Italian populations tend to be shorter. Once folks are available in several forms, thus the planning, product should be created to suit every individual. [1]

2.4.1 Percentile Humans

Anthropometric dimensions for each community area unit gradable by size and delineate as percentiles. It's common follow to vogue for the fifth score (5th %) female to the ninety fifth score (95th %) male. The fifth female value for a particular dimension (e.g. Sitting height) typically represents the tiniest live in vogue in Associate in nursing passing population. Conversely, a ninety fifth male value may stand for the most important angle that one is bobbing up with. The fifth to ninety fifth vary accommodates roughly ninetieth of the community. To vogue for a much bigger segment of the community, one could use the variables from the first step female to the 99th% male. These criteria need to be thought of among the design technique as results of they are every female and male users of "MVC". [1]. These criteria ought to be thought of within the style method as a result of their each feminine and male users of "MVC". [1]

2.4.2 Global Design Considerations

Many people become familiar to some extent of physical limitation at some purpose in life, like broken bones, sprained wrists, pregnancy, or aging. Others may digest a restriction or impairment on every day. Once considering product vogue, designers can acknowledge the special needs of assorted others, in conjunction with individuals with disabilities. Matters relating to accommodations for individuals with affliction became lots of rife, associate degree an leader is additionally required to form the accommodations for these individuals at worksites and in numerous public areas. The Americans with Disabilities Act (ADA) does not specify any desires for furnishings to accommodate independent with disabilities. Therefore, it's incorrect to category that furnishings product unit “ADA compliant.” designing with all people in mind is also a standard that is aforesaid as Global vogue, and is important to have faith in in result vogue. This can be necessary to contemplate the disabled individuals in coming up with the sweeper so they will additionally use the merchandise while not moving their health. [1]