RADIATOR CLEANING EQUIPMENT

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"I hereby declare that I have read this thesis and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Thermal-Fluids)."

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This report is presented in
partial fulfilment of the requirement for the
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DECLARATION

"I hereby declare that the work in this report is my own expect for summaries and quotations which have been duly acknowledged."

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Specially dedicated to my beloved father Mohamed Amin Bin Mat Nor and beloved mother Halimah Binti Muhammad, brothers and sister, to all family members, lecturers and friends.

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ABSTRACT

Radiator Cleaning Equipment is an equipment to clean impurities out of the car radiator. Conventionally, radiator cleaning process was carried out by overhauling each part at a time in which it is time consuming. Therefore, this project main purpose is to fabricate portable cleaning equipment that can reduce labour cost while decreasing time for cleaning process. This equipment operates by connecting the equipment outlet hose to inlet of car radiator and the equipment inlet hose connected to car outlet upper hose from engine. The flushing process runs for about 15 minutes until the working fluid is clean. The effectiveness of equipment were analysed by observing the colour of water sample become clearer and corrosion impurities weight decreasing. As a conclusion, the radiator cleaning equipment was successfully fabricated and this project has the potential to be commercialized and marketed.

ABSTRAK

Peralatan Pembersihan Radiator merupakan alat untuk membersihkan kotoran daripada radiator kereta. Kebiasaannya, proses pembersihan radiator dijalankan dengan meleraikan satu demi satu bahagian dalam satu masa dimana ianya memerlukan banyak masa. Oleh itu, tujuan utama projek ini adalah untuk mereka peralatan pembersihan mudah alih yang boleh mengurangkan kos buruh disamping itu turut mengurangkan masa bagi proses pembersihan. Peralatan ini beroperasi dengan menghubungkan hos keluaran daripada peralatan kepada bahagian masukan radiator kereta dan hos masukan peralatan disambungkan kepada hos keluaran air dari enjin. Proses pembersihan dijalankan kira-kira 15 minit sehingga air yang keluar daripada radiator menjadi bersih. Keberkesanan peralatan dianalisis dengan memerhatikan warna sampel air menjadi lebih jernih dan berat kotoran berkurangan. Kesimpulannya, Peralatan Pembersihan Radiator telah berjaya direka dan mempunyai potensi untuk dikomersial dan dipasarkan.

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LIST OF SYMBOL

m	=	Meter, m
hp	=	Horse power, hp
ml	=	Millilitre, ml
g	=	Gram, g
min	=	Minute, min

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Almost all automobiles in the market today have a type of heat exchanger called radiator. Radiator is commonly used in automobiles, buildings, and electronics system. It is purpose to use for heating the environment, cooling the fluid and also as a coolant supplied system that specifically for engine cooling process.

The radiator is one of the components that can be categorising in the complex cooling system of the engine. It is acts as heat exchangers which are used to transfer thermal energy from one medium to another for the purpose of cooling and heating process especially in car water system.

Basically, heat exchanger functions by flowing fluids through a system of tubes and takes heat from a hotter fluid and carries it away. Essentially it is exchanging heat from the hotter fluid to the cooler fluid. Figure 1.1 shows simple explanations of the radiator cleaning process background study.

Figure 1.1: Radiator cleaning equipment

1.2 PROBLEM STATEMENT

The radiator performance will be affected by ineffective heat transfer caused by corrosion, scaling or sludge. It will cause the engine to overheat hence radiator cleaning is essential. Based on Figure 1.2, this problem usually occurred when the water temperature in system increase and this normally occur at the highway.

The common cause is the radiator tube becomes clogged due to lack of maintenance for cleaning. However, the conventional cleaning process required the radiator system to be overhaul. Overhaul process takes a lot of time and need at least two people to do maintenance at one time. Besides, this is intricate and unsuitable for on-site repair.

Therefore, a portable machine with water cleaning system to remove and clean up radiator system was proposed. Usually, the conventional system focused on radiator part only. But, by using this equipment, it can be used to clean up the whole car water system without overhauling process that can affect another part in the system. So, it will solve the radiator cleaning process easily and simple.

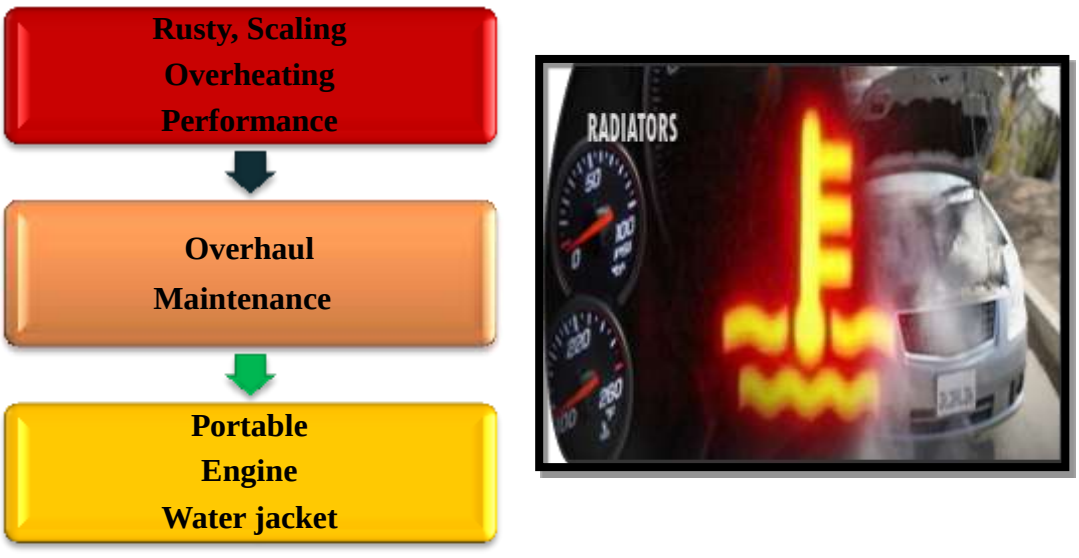

Figure 1.2: Simplify of Problem Statement

(Source: Valencia Auto Performance and Air Conditioning)

1.3 OBJECTIVE OF STUDY

The objective of this study is to fabricate a portable radiator cleaning equipment which functions to flush clean water throughout car engine water system.

1.4 SCOPE OF STUDY

In order to accomplish this project objective, following are the scope of study to fulfill this final year project:

1. To conduct a research on current radiator cleaning method and improvise by design the equipment.
2. To fabricate a portable radiator cleaning equipment and analyze the water flow system from radiator cleaning equipment to the car

CHAPTER 2

LITERATURE REVIEW

2.1 OVERVIEW

Radiator Cleaning Equipment is a tool that used to clean the car water system by flushing the clean water into the system. Radiator functions as cooling system for the engine. The water system must be maintained to ensure the system operates well for the best performance of the engine. Therefore, the system needs to be clean up which prevent clogging occurrence in radiator tube and avoid leakage due to corrosion.

Portable feature is implemented on equipment for easy movement. The criteria such as material used, process flow of water and design of equipment must be considered in the process of fabricating the equipment. So, before making decision the research must be done to get the best equipment design.

2.2 PREVIOUS STUDY

There are a few studies in the literature review based on the source collection from magazine, book, and journal that have been read in the course of this project. It was divided into several parts that are essential to include in this study which is used to design a Radiator Cleaning Equipment. It have been categorise into five sections which are consists of a material used, method of process, fluid flow system, design of equipment and cleaning system.

2.3 MATERIAL USED

Pneumatically Controlled Wide Heat Load Space Radiator stated about spacecraft and employment of thermal radiators in the form of heat conductive panels for the rejection of waste heat. It is more particularly to control system for thermally coupling and decoupling thermal radiator tubes from radiator panel (Hightower 1979). This journal is about the material used of tube radiators that is explain about type of fluid flow in tube line and the chemical reaction that happened when using unsuitable of cleaning agent which can give some leakage.

Study about Water Filter Cartridge End-of-Life Mechanism, the journal state about the water treatment devices like gravity-fed devices that need to use the filter cartridge as a device. The invention also related with a fill-counting cartridge and assembly to removes water treatment particles to treated water (Tanner 1999). From the journal of Potable Water Filter, explain about type of filter for inlet and outlet specifically focused on tabs water as domestic use. The carbon filters use as element for water flowing (Solomon 1987). So, by researching the journal regarding filter, it improves knowledge and aids in the process of selecting materials.

Moreover, according to the journal of Corrosion Resistant Filter Unit, it explained about creation of multi-bank. The transportable filter unit applied to all connection of mechanical parts then isolated from the fluid being filtered (Gentry 1992). Therefore, the water flushing by using filter of project equipment has been referring to this journal. Method and device for eliminating corrosion at connection ends of heating installations particularly aluminium panel radiators discuss about the higher rate of corrosion based on types of material used for radiator tube (Garcia 2005). Thus, to create a radiator cleaning system, consideration should be given priority in the study of corrosion and analyse.

2.4 METHOD OF PROCESS

Refer to the Automotive Radiator Flush System and Methods of Use, the invention explain about flush system by using an automated or manually operated system with controls for switching to various modes of operation (Awad 2003). From the journal of Hydronic Pump Type Heat Radiator, the explanation process of cleaning method of radiator fluid is replacing by using two gas containers. The fluid conducting hose with a gas nozzle fitted into a radiator fill pipe nipple to cleaning the radiator though inlet and outlet (Wang 2004).

Through of a read from Cleaning Apparatus and Method journal, it is related with the method and apparatus for emptying, flushing and filling automobile cooling systems. The prior art in this literature is replete with diverse method and apparatus for use in removing spent or vintage antifreeze or coolant (Creeron 1992). In the journal of Auxiliary Water-Supply System for an Internal Combustion Engine stated that, the flushing of radiator with flush liquid and filling with new anti-freeze or coolant by combining the hose and radiator containing of liquid. The modification of radiator cap is used to fluid flow directly (Hsu 1997). However, this journal is more on filling of coolant refilling process.

2.5 FLUID FLOW SYSTEM

Based on the journal of Central Heating Radiator, the invention is related to connection of a central heating radiator to its liquid flow and return pipes. The invention is explained about adjacent to wall by hanging them from brackets secured to wall. The flow and return pipes are connected to apertures located at opposite ends of lower edge of radiator (Davidson 2003). In the journal of the Water circulation system, the dirt and dust tend build up in the space between the radiator and the wall. As a result, it can be soil the decoration on the wall around radiator because it is unsightly and unhygienic. So, to remove a radiator to gain access to the wall, the flow and return pipes have to be disconnected that requiring the services of plumber (Reld 1971).

Through the read a journal of Compact Radiator-Based Heat Exchanger, it explained about a compact heat exchanger for use in a mobile cleaning apparatus. The heat exchanger in compact size used to utilizes a water jacket that has annular space between concentrically arranged between internal and external housing (Barrios 2011). By referring the journal of Method of Water Admixing to Fuel Oil, the radiator enclosed within the internal housing which is a super-heated exhaust is supplied. So, based on this journal, the concept that in radiator can be understand more clearly about the fluid flow of process used (Sugimoto 1977).

2.6 DESIGN OF EQUIPMENT

The Radiator Assembly is an important thing need to investigate before design of equipment because to join the machine with the car's water system. In this journal, it is explain about the improvement in the design and method of manufacturing heat exchangers and particularly function when using cross flow radiators (Knowlton 1986). There are some of best mode for carrying out the invention that explains detail about the design, comparison, function and fluid flow (Lang 1987). Based on the invention, the pretinned with solder is following the Table 2.6 as below:

Table 2.6: The component of radiator tube used based on pretinned area (Source: Knowlton, 1986)

COMPONENT	PRETINNED AREA
Radiator tube 11b	Entire tube
First support member 18	Inside of circular clamp 18a and circular clamp bracket 18b
Second support member 20	Inside of circular clamp 20a and circular clamp bracket 20b

By reading the journal of Radiator Header and Tube Connection, it is related to a water-tight connection between radiator tube and header. It is formed automatically within the interior of the header by process of assembling the tube in the header. The invention provide for radiator tube connection with no part projecting when the end of header will be hermetically sealed without use solder or coupling (Anderson 1929). Through the journal of Engine Cleaning Process, the explanation about the process of radiator connection between header and tube assist to understand the method of connected for cleaning equipment and engine water system (Suratt 1993).

2.7 CLEANING SYSTEM

Based on the journal of Radiator Cleaning Composition and Method of Manufacture Thereof, it is explain about the cleaning composition that used as cleaning solution in radiator tube which is used a strong acid-based to clean the compositions. The invention of devises used pH value of less than 1.0. It is nonreactive and non-irritating to human skin tissue (Garcia 1990). The chemical reaction will give some effect to material that can rust or erode the surface of material. Radiator tube material commonly used is copper and aluminium (Numazawa 1996). So, based on material to design the cleaning equipment also need to know about this.

In design the radiator cleaning equipment, this equipment used water flow which use water base as cleaning agent for cleaning process of radiator. However, from the study of Ultrasonic Radiator Cleaning for radiator, it can be transducer a mounted on a carriage and also movable above sludge pit. The design of a rack is provide to movable transducer for holding or supporting radiator. It controlled according to the width of radiator being cleaned (Field 1987). But, in term of the cost, it is more expensive. This is because the ultrasonic system is more complex based on the process and method used for cleaning car radiator system.