CHAPTER I
INTRODUCTION

A. Background

One of the most significant component for on-road vehicle especially car and motorcycle is tire. The car and motorcycle are always equipped with some wheels which consist of the mounting between rims and pneumatic tires. This component is not only allows vehicle to move easily, but also became the vibration absorbers from the inhomogeneous road conditions so drivers feel the comforts even as they riding. “A tire is composed of the body ply cords which are made on of rubber-coated textile (rayon, nylon, polyester), and/or steel wire strands (the plies), and the inner lines.” (Schulz 1982:141). The first company who produced pneumatic tire is Dunlop in 1888 and it is used for bicycles, then succeeded the tire for automobiles. It is followed by Continental which started to produce their tire in the next year. They claimed their tires are capable to travel at higher speed. Continental is also developed the tread pattern for the tire outer surface. From that point, many companies are competing in the tire production fighting. In 1950s the radial tire is found and become popular for passenger car due to its handling performance. The technology in the tire development is always increasing until today. Up to now, there are many kinds of tire which can be found in this world, but the major kind for the rubber tire detected from rubber materials are solid rubber and pneumatic rubber tire. Based on the pneumatic instrument, there are two kinds of pneumatic tire, the tube-type tire which uses an inner tire and tubeless tire which not. Tube-type tire is assembled by inner and outer tire that’s mounted on a rim. The outer tire is as same as general tire, consists of the synthetic polymer plies
combined by some steel plies as a stabilizer belt. Inner tire on tube-
type usually made from natural rubber or latex that more elastics and
become the cover of the air pressure. While, the tubeless tire is not
uses inner tire. The mounting of tire and rim allows the air pressure
does not go out from the wheel, because the tire generally equipped
by a toe strip or rim chamfer to protect the air pressure in it. Both of
them are suitable for their properties and vehicle specifications.

The uses of tire on light vehicles are often to gain some
problems that the most general problem occurred is a flat tire. A flat
tire could be triggered by bad conditions of roads, stuck of a sharp
material, the air pressure of the tire that didn’t in standard demand, the
carried load that’s too large, or the tire itself that became thinner
during the long usage. When the flat tire was occurring, it surely will
disturb the trip and trigger the other problems for drivers. To solve that
problem, car and other automobile vehicles are always equipped with
extra wheels that can change into the flat tire. But for two wheeled
vehicles, especially motorcycle when the tire is flat, the riders have to
go to the service station to fix it before they continue their trip. This
thing is a basic reason why many researchers interested to develop
the performance of the tire. The vehicles that formerly use the tube-
type tire, during the round of time changed into the tubeless tire,
because when the tube-type tire is flat the new inner tube is required
to replace the old one. By using the tubeless, that thing can be
avoided because a flat tire can be fixed by a certain adhesive
substance to paste the hole which occurs when the tire is flat. The
lifetime of the tire is becoming longer than before. Because of that, the
usage of tube-type in many countries as long as depart on time. But it
is different in Indonesia, the tubular tire is still becoming a popular
choice. The cause is not only Indonesia as a big producer of natural
rubber country, but also Indonesian people have found a creative
solution to solve the tube-type tire flat problems. On the roadside we
will easily meet the tire service stations. The conditions of the vehicle in Indonesia that generally used tube-type tire also support the success on tire patching station business field.

On tubeless tire, to patch the puncture hole we only need the coating of rubber cement that placed on the flatted area which self-dried until it is slightly. For the tube typed wheels, the tire patching tool basically combines a heating and pressing components. After the puncture hole located, the marked patch will be pasted with thin rubber scrap. Then it shall be pressed on the tool while in other side, it will be heated to paste the patch. This way can generate a longer life of the tire and lower cost if it compared to the repair by directly changing the inner tire with the new one.

The conventional tire patching tool which recently known in Indonesia is uses the cylindrical component that is acquired from the lapsed motorcycle piston which assembled on a threaded lever, used as a pressing part on the top side. Even as the heating part of the bottom side uses the squared-metal plate heated by combusting the rubbing alcohol. This model has disadvantage that is no measurement standard in the pressing process. The operators only use their feeling and push the tool maximally without knowing how many the pressing limit of natural rubber meanwhile the other side of tire is heated. Sometimes, when the process was not done carefully the pressure could be too big and it can be unsafe for tire. At the end of the process the tire can be stabbed on the presser and difficult to take. Rubbing Alcohol is assumed as the fuel which has lowest cost than others. But if we observe its maximum temperature is relatively lower than other liquid fuel. If that temperature is used to warm up the heater plane which generally has about 5mm thickness, it will spare may time. It is directly proportional when it needs more time, the consumption of fuel is increase. This thing will decrease the efficiencies of the heat
transfer process on tool, and in other hand it will generate the higher cost due to the wasteful of heat source. Based on that cause people are motivated to improve the performance of tire patching tools, recent is a group of automotive engineering students in Universitas Muhammadiyah Surakarta. In the end of 2015, a group of automotive engineering students designed a tire patching tool structure. The structure of patching presser modified is uses the grip pliers.

The tool uses the grip pliers as a base of clamping which aimed to ease tire placing and releasing when they are patched. The heater that usually generated from combustion of rubbing alcohol as the heat source changed into the electrical heater. Based on this structure, the time and cost for one patching relatively less than a general patching because for one patch is only 5 minutes required. But there are some deficiencies on this tools observed from it’s structural design. The structure of the grip pliers is lengthened with a welded joint steel bar on its jaw. This design provides the heater can be assembled on system, but to many reduce the distribution of loads so the quantity of force and pressure is reduced. To maximize the performance of the tool, the design should be repaired with an optimization process. “Optimization is the act of obtaining the best result under given circumstances. The ultimate goal of all such decisions is either to minimize the effort required or to maximize the desired benefit.” (Rao 2009:1)

This pushed the writer to do a further research to maximize the performance of this electrical tire patching tool. Through this research the writer hopes it can provide a knowledge improvements and being useful for people in automotive world.
B. Problem Statement

After knowing the backgrounds that motivate the writer arranges this project, several problems can be formulated, such as:

1. How is the performance of former tire patching design so it triggers deficiencies on the tool?
2. How to optimize the design so the tool capable to generates a greater performance?
3. How to test the tool when it is successfully designed and made?
4. If the test is gaining a satisfying result, is that possible if the tool mass produced?

C. Problem Limitations

To maximize the concentration during research this project need to be limited. The problem limitations for this research are:

1. The structure of presser that uses Grip Pliers will be evaluated on the static load profile using Solidworks 2013 software.
2. The early Tire Patching Tool will be called UMS-001 and the new design of the tool called UMS-002.
3. The heat transfer which discussed is conduction heat transfer of the heater.
4. The tire is an inner tire for tube-type wheel for motorcycle.
5. We won’t discuss about electronic automatic control.
6. We won’t discuss about chemical reaction on rubber heating.

D. Objectives of Research

Some main goals can be shown of this research that are:
1. To redesign the better tire patching tool for tube-type tires to maximize its benefits.

2. To test and explain how is the performance of the optimized design, calculate how much its cost, and examine how if the tool mass produced.

E. Benefits of Research

This research hopefully done with clear and it can give at least two major benefits that are:

1. For educations and researches
   Contribute the utilization of automotive tools which are simple yet but result a promising performance. Give the up to date data to gain an improvement in automotive tools.

2. For people
   Ease the tire patching operator with the rapid-used tool also gives a new opportunity of new business field.

F. Writing Systematics

To serve what is the main goal, so the readers can be guided into the same understanding of the writer, this papers has systematically shown in a structure below:

1. CHAPTER I INTRODUCTION

Consists of background that trigger the writer take this research, problem statement and its limitations, also the main objectives of the writer do the research until the benefits of this research.
2. CHAPTER II LITERATURE REVIEW
   Derived into the mentioned several relevant researches and the explanation of the basic theories that will used in this research.

3. CHAPTER III RESEARCH METHODOLOGY
   Explain how the writer done the research and collecting data with particular tools and materials.

4. CHAPTER IV RESULT AND DISCUSSION
   It will show us the research representations, and explain the advantages and disadvantages during the research.

5. CHAPTER V CONCLUSION AND FUTURE WORK
   This last chapter performs the conclusions of this research and also gives some recommendations for further works.