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A REVIEW ON AUTOMOBILE AC BY UTILIZING WASTE HEAT AND GASES

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ABSTRACT

With the quickly changing environmental and atmospheric consequence, the air conditioning of the moving vehicle has become a necessity. In the same time customers are incapable to bear the increasing operating cost of the vehicles due to continuously increase in fuel prices, component expenses and maintenance costs associated with vehicles. More recently, several fresh philosophies for manufacturing Progress have been developed and implemented in various sectors, be it manufacturing, service or another. Keep in spirit in this paper, an exploration has been done to research the possibility of waste heat recovery and it's subsequently utilization in air conditioning system of a vehicle without increasing the component expenditure, weight, number of component and brings improvement in vehicle by making luxurious.

Keywords: Waste Engine heat, Air conditioning System, VCRS, VARS

I. INTRODUCTION

Industries are vying for various tools and techniques for competitive advantage over the competitors in an ever-changing global market by combining factors like quality, cost, flexibility, responsiveness, and innovation. In today's global market, there is constantly increasing pressure to make products more quickly, with more variety, at the lowest possible cost. In the end, those companies that meet and exceed customers' demands will succeed by remaining competitive. Then, the question is, how do companies become competitive and retain their competitiveness? This question may not be easy to answer because manufacturing systems are complex, and simple solutions to manufacturing problems may not exist. Therefore, companies must choose from available techniques to develop their own solutions in the existing products to attract the customers in their fold without adding extra cost.With the rapid changing environment and atmospheric effect, the air conditioning of the moving vehicle has become a necessity. Air conditioning of a vehicle can be done by Vapour Compression Refrigeration System (hereinafter VCRS) and Vapour Absorption Refrigeration System (hereinafter VARS).Presently, in the vehicles VCRS is in use in most of the cases. In lieu of VCRS, if, VARS is used in vehicles the refrigeration system could be operable in a vehicle without adding running cost for air conditioning. There is a great impact on the running cost of a vehicle due to increasing cost of fuel. The A/C system adds nearly 35 % extra cost in fuel expenses. Alternately, it is a matter of investigation that waste recovery of an engine for application in A/C can reduce the fuel economy of vehicles to what maximum extent? It has been revealed that there is great potential to reduce A/C fuel consumption because A/C systems have traditionally

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been designed to maximize capacity, not efficiency. From the reviews of various literatures there is an indication that reducing the A/C load decreases A/C fuel consumption. In the same line, an automobile engine utilizes only about 35% of available energy and rests are lost to cooling and exhaust system. If one is adding conventional air conditioning system to automobile, it further utilizes about 5% of the total energy. Therefore automobile becomes costlier, uneconomical and less efficient. Additional of conventional air conditioner in car also decreases the life of engine and increases the fuel consumption. For very small cars compressor needs 3 to 4 bhp, a significant ratio of the power output. Keeping these problems in mind, a car air conditioning system is proposed from recovery of engine waste heat using radiator water as source / generator for VARS.

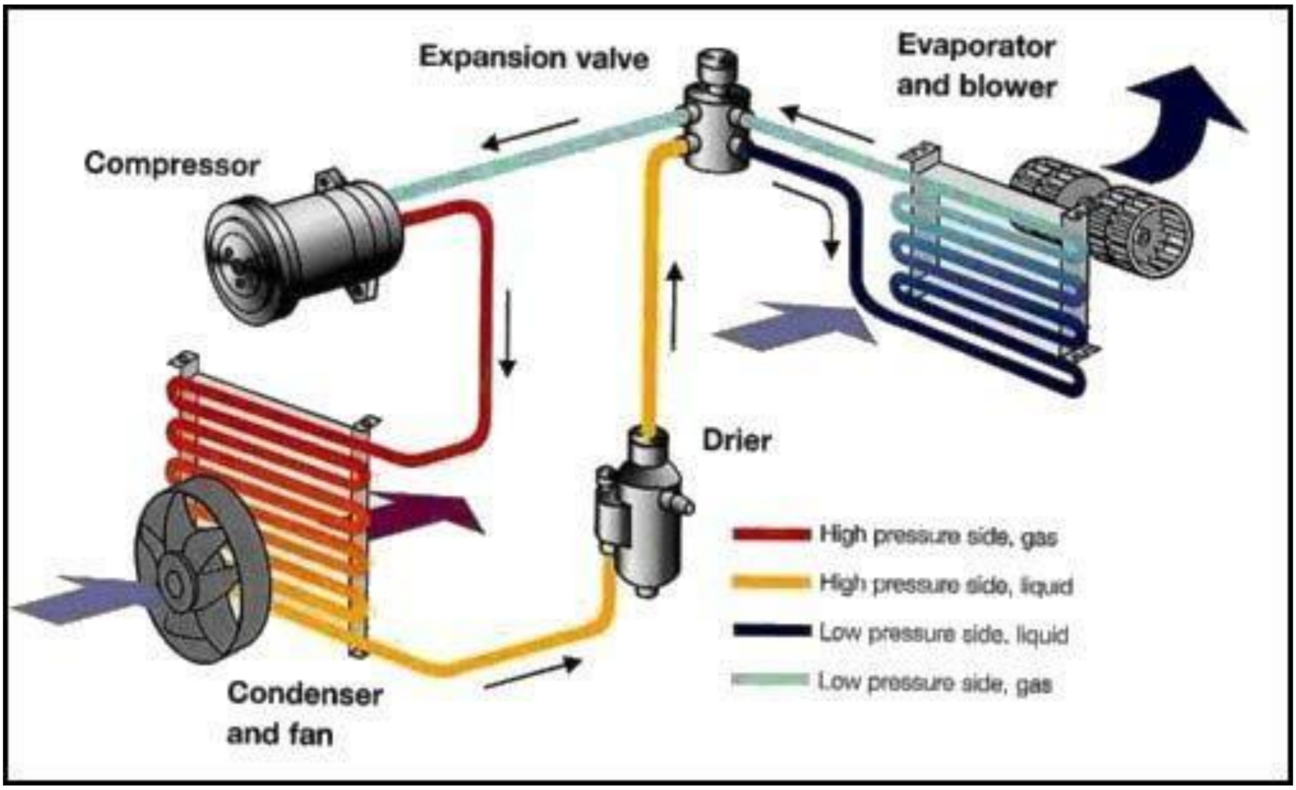

Fig. 1.1: Existing Refrigeration system in automobiles.

II. LITERATURE REVIEW

In the past years, E.F. Gorzelnik [1] indulged in the recovery of energy in the heat of compression from air conditioning, refrigeration, or heat-pump equipment in 1977 itself. Kaushik and Singh [2] confabulated about 40 percent of heat is recovered using Canopus heat exchanger in 1995. Hung etal [3] discussed in a review of Organic Rankine Cycle for the feasibility of recovery of low grade industrial waste heat in 2000. M.Bojic [4] studied and explained the heat rise in environment due to heat rejected from Air Conditioners in 2001. T.T. Chow [5] explained about the heat dissipation of split type Air Conditioning system in 2002. Soylemez [6] studied on the thermo economical optimization of Heat Pipe Heat Exchanger for waste heat Recovery system in 2003. M.M. Rahman [7] studied and confabulated about heat utilization from Split Air Conditioners in 2004. Then Tugural ogulata [8] discussed about utilization of heat in textile drying process in 2004. In

ASHRAE Handbook [9] energy consumption of Air Conditioners and energy efficient buildings and plans are discussed in detail in 2008.

III. OBJECTIVES OF THE STUDY

The objectives of the study on the subject "Recovery of engine waste heat for reutilization in air conditioning system in an automobile: An investigation" are as follows

1. Identify the form of "muda" (waste) in traditional VCRS.
2. Compare the key characteristics of traditional VCRS and proposed VARS
3. Differentiate between existing refrigeration cost and proposed target cost
4. Identify data and tools useful for planning and assessing strategies for leadership in refrigeration quality in vehicle by use of SWOT analysis.

IV. SCOPE OF THE WORK

Our scope of work is confined and limited to the study of VARS in lieu of VCRS through recovery of engine waste heat using radiator water as source / generator for VARS. The arrangement of various components of air conditioning system is also a challenge because of the fix size of cars. However, the designing aspects will be given due consideration after initial experimentation. In the proposed model condenser and evaporator will be arranged same as the conventional unit.

V. METHODOLOGY

The proposed model is based on three fluid vapour absorption systems. It will contain basic components needed for vapour absorption system as shown in Fig.

- The three fluid used in this system will be ammonia, water and hydrogen.

○ The use of water is to absorb ammonia readily.

The use of hydrogen gas is to increase the rate of evaporation of the liquid ammonia passing through the system.

- Even though ammonia is toxic, but due to absence of moving part, there will be little chance for the leakage.
- The hot radiator water will be used to heat the ammonia solution in the generator. To remove water from ammonia vapor, a rectifier will be used before condenser. The ammonia vapor is condensed and flows under gravity to the evaporator, where, it meets the hydrogen gas. The hydrogen of gas, which is being feed to the evaporator, permits the liquid ammonia to evaporate at low pressure and temperature.

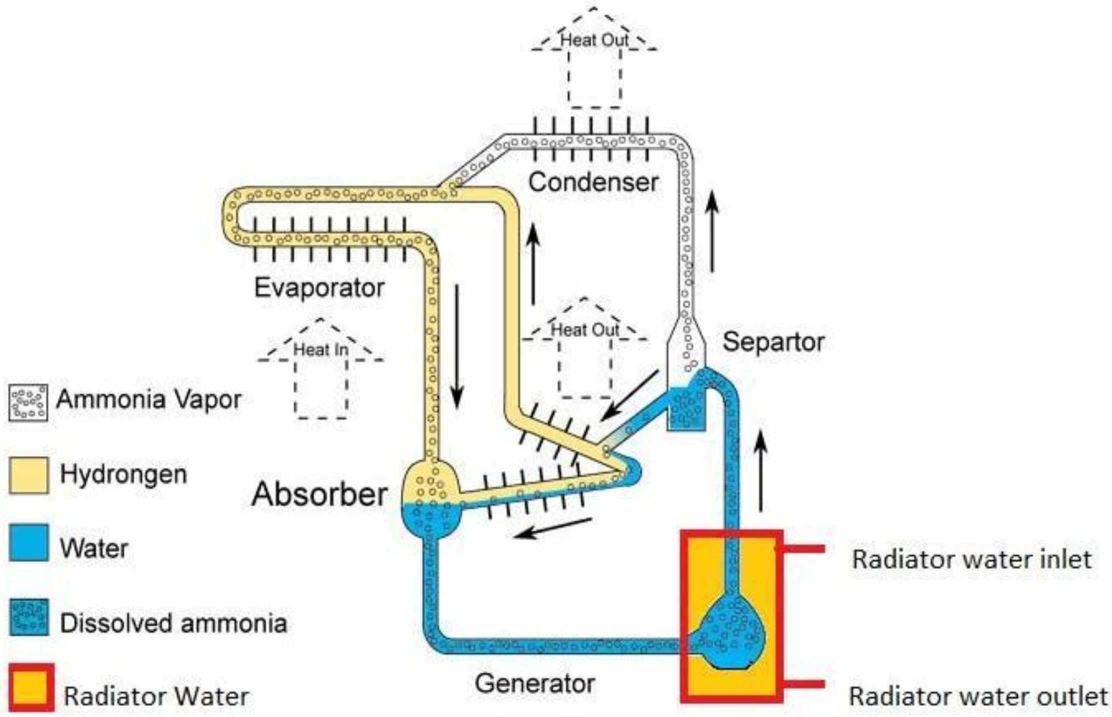

Fig.5.1: Schematic of a triple fluid vapors absorption refrigeration system

- During the process of evaporation, the ammonia will absorb the latent heat from refrigerated space and produces cooling effect. The mixture of ammonia vapor and hydrogen will be passed to the absorber where ammonia will be absorbed while hydrogen raises the top and flows back to the evaporator.

a) Development of a Mathematical Model

The mathematical model will be developed considering the following elements

- Thermodynamic properties
- Absorption equation
- Conservation of energy
- Absorption process, and
- The coefficient of performance

The relation will be developed through mathematical model that what is the extent of heat generated in the engine and what quantity could be transferred for utilizing at the A/C system by recovery of waste engine heat.

VI. CONCLUSION

The study of dissipate heat cooling method analyzed in this article will be experimentally investigated and the data will be captured for additional analysis. This will be supported by a suitable mathematical model and a simulation tool. The study reveals that it contain four heat exchanges, namely, an air finned forced convection condenser, an air finned forced convection evaporator, and a couple of shell and tube type absorbers, plus four one-way refrigerant valves, an expansion valve, and an interchange valve. For a refrigerant system the following things are needed

- Specific Cooling Power (SCP)

• Coefficient of Waste Heat Recovery (CWHR)

• Coefficient of Waste Heat Cooling (CWHC)

At present, for an automobile waste heat absorption cooling system, the demand for CWHC can be easily met, but for SCP, further research is needed, which will be in next research.

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