

Design and Analysis of Food Warmer

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Abstract— This project is focused to use the heat rejected from the engine through cooling system for a useful accessory during long distance travel of vehicle and also by using solar water heater. In this project, a system of water heater/food warmer has been designed and fabricated using the principle of waste heat recovery. The heat energy required to heat food, mostly water is extracted from the heat in the engine coolant which otherwise will be rejected to the atmosphere by radiator and solar water heater circulates the warm water to maintain the warm temperature of the oven. Coolant from engine jacket is circulated in the radiator in automotive engines. In this project, a branch line is added to coolant circuit. This branch line bypasses some amount of coolant and feed to the heater chamber. Heater chamber is a doubled walled container. Coolant is fed to the jacket of heater chamber. The warm water from the solar water heater is passed into the oven to maintain the warm temperature of the food. The food material, liquid or solid, mostly water is kept in the chamber. Heat is transferred from the coolant / warm water circulated in the jacket of heater chamber to the food material. Water was taken for testing food warmer and was found to effective. The maximum heat transfer temperature from coolant / warm water was observed as 85°C/50°C. The inner and outer wall temperature of heater chamber was found almost same for both theoretical and practical cases.

Index Terms—Heat, solar heater, engine, design, warmer, ANOFW, fabrication

I. INTRODUCTION

One of the emerging fields found in widespread disciplines of mechanical engineering is the field of advance study in automobile engineering. Particularly the interest in heat recovery systems is growing rapidly as a substitute to extra power usage from battery due to its ease of use, saving of power, cost effectiveness, advanced concept etc... Further the application of heat from engine has been in various theories such as foot warmer, heat storage devices etc.. Many heat usage processes have been unused. So in this work, interest lies in the usage or bypass of engine heat which is naturally available without any external source.

The main aim of this project is to use the engine heat / solar heater in a new way of approach and to develop it as a useful accessory in vehicles and solar heater. In this project work, engine heat and the heat water from the solar heater are bypassed into a small Heater Chamber through a heat jacket hose and use this heat in an efficient way to boil water, prepare milk etc...

The heat from engine is continuously passed to radiator for cooling purpose. This is a cyclic process. More amount of heat from

engine is wasted during the operation of vehicle. This wasted heat is passed through heat jacket hose pipe and connected to the heat exchanger inlet and piped back to engine through outlet and also the heat water from the solar heater is passed into the heat chamber. A small passage is present between the outer and inner layer of the Heater Chamber for flow of hot water. The inlet and outlet are welded to the outer layer of Heater Chamber. Hot water along with coolant is passed through the inlet. Water to be boiled or milk to be prepared is poured into the inner layer of Heater Chamber from top section. Heat from hot coolant is transferred and exchanged to inner layer of Heater Chamber. This heat is used for domestic heat processing applications.

II. LITERATURE REVIEW

Paper by Yutaka Ando, Field on Mar 31, 1987, on topic of Foot Warmer for Use in Car, concept of A device for warming passenger's feet using waste engine heat was introduced. It is proposed to be located at the base of car. It comprises of a concave groove formed in a meandering form on one surface of a heat insulating material. A heat radiating sheet is connected to the surface on which the groove is formed. A tube is disposed in the groove for heat transfer of water flowing to heat radiating sheet.

Robert M Uyeki, field on Apr 18, 1985, on topic of Solar water circulation by domestic food equipment, concept of it has heat storage devices which employ a rechargeable latent heat storage device. This provides rapid warm up of engine of motor vehicle. Heat storage battery is capable of storing and releasing substantial quantity of heat energy upon demand. This gives an auxiliary source of heat to the cabin interior.

III. PROBLEM STATEMENT

Every project starts with a problem statement. The introduction of food warmer in this project can overcome various customer needs. The first and foremost problem identified is that heat from engine is wasted under operating conditions of vehicle. Food warmer used in this project utilizes the engine waste heat. Many accessories for various needs have been developed, especially in four wheelers. But no inventions on food accessories are developed up to date. Customers who travel long distance journeys demand hot water. This may be very useful during winter season. Warm water and milk would be useful to feed baby infants during travel and also food can be kept warm at a steady temperature.

Thus the problem statement can be summarized as,

Heat from engine is wasted under operating conditions of vehicle.

No invention has been focused on food accessories up to date.

Also, people demand hot water during long journeys especially during winter seasons.

Food should be kept warm for a long period.

Baby infants need warm water.

IV. EXPERIMENTAL PROCEDURE

When the vehicle is started, coolant gets circulated between the engine and radiator. Coolant that is passed between the engine and the radiator gets heated within few minutes. This heated coolant along with hot water passes to the radiator and gets cooled down. Thus a nominal temperature is maintained inside the engine.

Heater is an accessory connected from engine. A parallel connection is taken from the heat jacket hose. Hot water flows through this heat jacket hose when the flow control valve is regulated. Heat from hot coolant is the source given to Heater Chamber (accessory in vehicle) where heating takes place. A

temperature of 75-1200⁰C is obtained.

Warm water is circulated from solar heater into warmer.

A temperature of 50⁰C

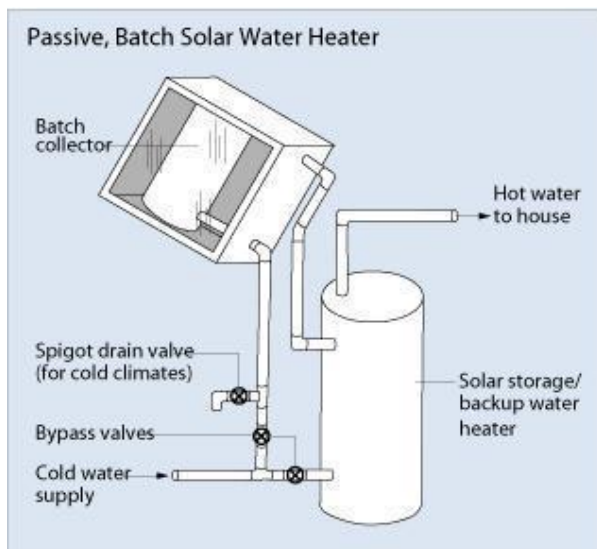


Fig1 Convection process

V. ANALYSIS OF FOOD WARMER (ANOFW)

ANSYS software is used to analysis the temperature transfer between inlet and outlet surface walls then temperature keep on maintain constant is to be used by stainless steel material 304.

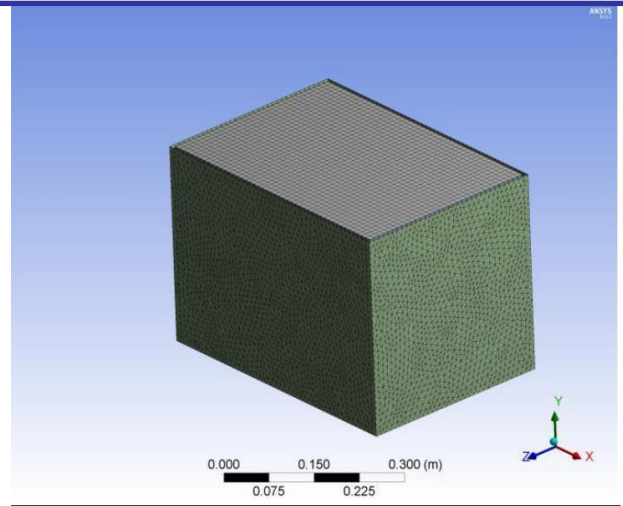


Fig 2 Mesh analysis

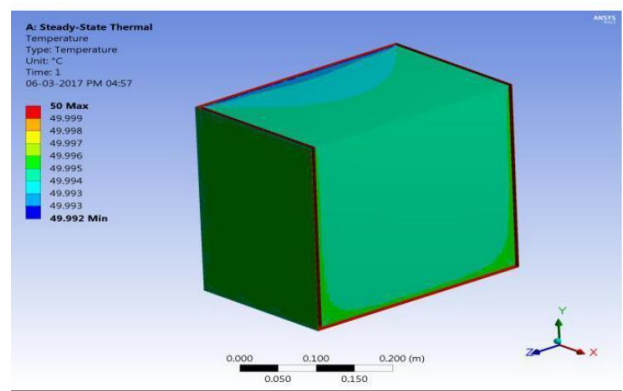


Fig 3 Temperature analysis

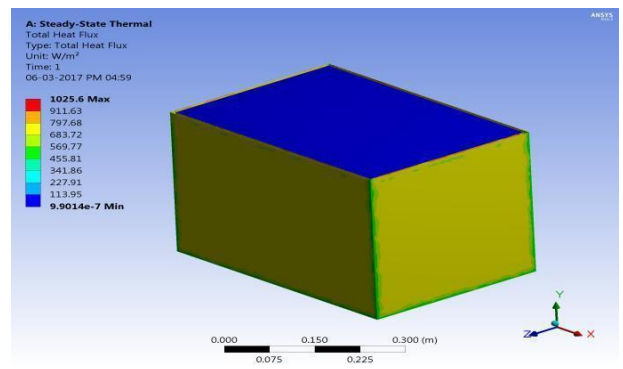


Fig 4 Heat flux analysis

VI. GRAPHICAL ANALYSIS

A graph was plotted by taking time in X axis and temperature in Y axis. A gradual increase in temperature was observed as time delay increases. The graph obtained is a straight linear line. A nominal temperature of 49oC was obtained in 16 minutes. The Time vs Temperature graph is shown below:

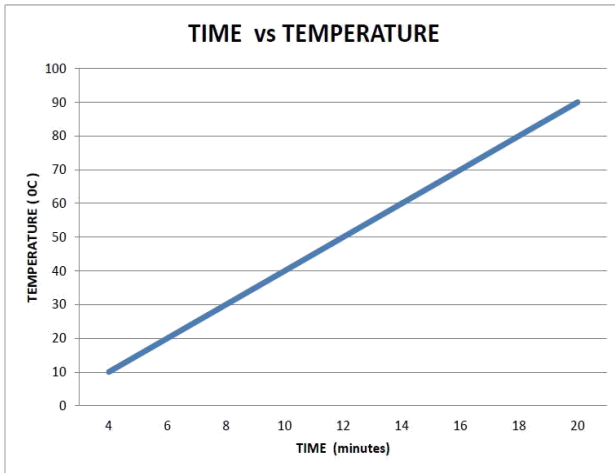


Fig 5 Time Vs Temperature graph

VII. CONCLUSION

Our project can be summarized as follows:

Useful accessory in vehicles ,User friendly accessory ,Uses the heat present in the hot coolant for heating process ,No damage to engine ,No external power supply

The wasted heat from engine is converted into various useful forms. Many inventions based on engine heat recovery and engine heat usage are still under serious research in many automobile sectors. Our paper comes under the category of one such research. A number of accessories are being invented every day. Thus the Heater

Chamber that we have experimented can become a useful accessory in vehicles such as cars, buses, Lorries etc...

This can create a new revolution in the history of engine heat usage systems in the near future

VIII. REFERENCE

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