NOVEL TYPE SOLAR HEATING SYSTEM

Kataria Mahendra B.[1]., Khunt Hardik A.[2]
[1]Assistant Professor, Mechanical Engineering Department, V.V.P Engineering College Rajkot, Gujarat, India
[2]Assistant Professor, Mechanical Engineering Department, V.V.P Engineering College Rajkot, Gujarat, India

Abstract— *the increased awareness that the world's energy resources are limited has caused many countries to reexamine their energy policies the box type and parabolic solar cookers are commonly used for cooking of food in the noon. Among them, box type solar cooker is more popular due to its simplicity of handling and operation. The cooking applications of Novel type solar heating system with evacuated tube have their applications in increasing the rate of evaporation of water, in food processing. It produces a high temperature around and the food gets cooked in less time also use like solar cooking stove and Cooker is that it has not yet been tested in all the seasons. However, realigned with the orbiting sun for maximum effectiveness. Novel type larger surface, so it is slightly more tolerant for marginal errors of alignm*

Keywords- Energy *analysis, Thermal Power Plant, Second law of ther*

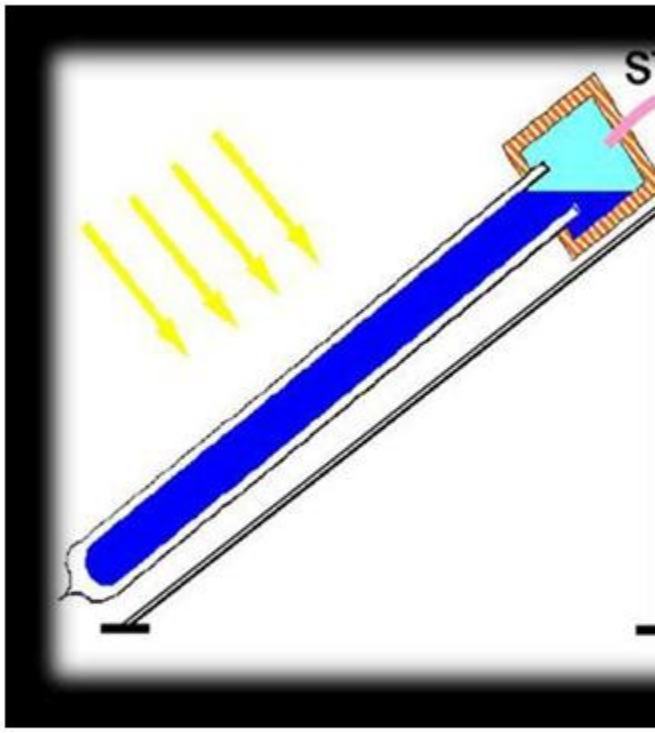
1 INTRODUCTION

1.1 Introduction of project

 All good engineering design starts with a clear understanding of the project's needs, goals, budgetary constraints, material constraints, performance tolerances, and criteria for judging the effectiveness and success of the final product.

 One possible approach to producing a solar heating would be to build an actual Solar heating, within the limits of all criteria. We would then test the Solar heating and measure the Performance Index that we achieved.

 Another approach would be to use Design of Experiments (DOE). Using DOE, we could (hopefully) identify the most important factors in a solar heating, and then make good decisions about the levels to test them at. Once these values are chosen, we could build the entire heating device needed to test a full-factorial combination of these factors and levels. Then, using the resulting DOE predictive model, we could build additional heating device and test them, until we achieve the desired Efficiency. Again this could take a very long time.



1.2 Problem summary

 For the developing countries especially, cooking is one of the basic and dominant end use of energy.

 It is very desirable to develop alternative, convenient and affordable methods of cooking, based upon the renewable energy sources.

 Solar cookers of various designs are being used in many parts of the world since a long time as environmental friendly and cost effective devices to partially fulfil the cooking needs.

 Though, the conventional design has been modified by many authors using several combinations of booster mirrors, etc. it is still not quite user friendly.

 We are make novel solar heating system used for cooking and heating water.

 The system is work on simple principal of solar energy is converted in to heat energy.

 Also in this we are using solar evacuated tube and glass plate for achieving this heat energy.

 In May 2008, John Grandinetti publicized his version of an indirect solar cooker through an interview with television

station. The interview was picked up by Affiliate stations and eventually broadcasted. Details of John Grandinetti's design are limited; however it appears to be an improved version of the Whiller Indirect cooker design.

 The primary innovation over the Whiller design is the use of an evacuated tube solar collector as the collecting element of the cooker. Evacuated tubes have been used in solar hot water systems, and are considered a mature, efficient technology. By replacing the copper pipe and fin in the Whiller design, John Grandinetti claims during his media interview that his indirect cooker design can reach temperatures of 400°F in direct sunlight. The Grandinetti design replaces water with oil for the heat transport mechanism in order to sustain these temperatures.

 Mr. Grandinetti is working through his non-profit organization Developing World Solar, to have his and distribution of the cookers will be permitted based on supporting Developing design placed into production. A fact-finding trip to China is planned for July 2008 to locate a manufacturer and finalize pricing.

2.1 MODES OF HEAT TRANSFER

(a) Conduction
(b) Convection
(c) Radiation

2.1.1 Conduction

 Conduction is one of heat transfer mode. It is work by microscopic impact of particles and movement of electrons within a body.

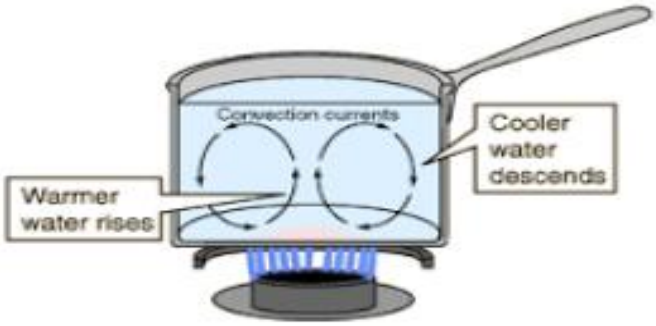
Fig.2.1 Conduction

 The microscopically impacting objects, that include molecules, atoms, and electrons, transfer disorganized microscopic kinetic and potential energy.

 The rate at which energy is conducted as heat between two bodies is a function of the temperature difference between the two bodies and the properties of the conductive medium through which the heat is transferred. Thermal conduction is also called diffusion.

2.1.2 Convection

 Convection is one of heattransfer mode is heat transfer. It is work by mass motion of a fluid such as air or water when the heated fluid is caused to move away from the source of heat, carrying energy with it.



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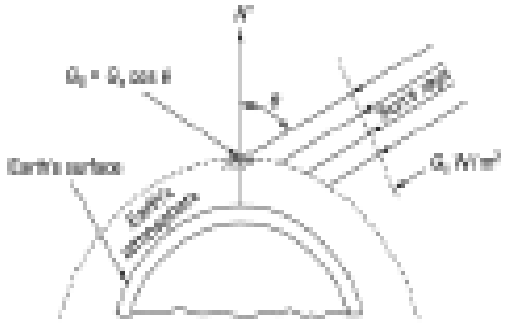
place in solids.

 Convection can be demonstrated by placing a heat source at the side of a glass full of a liquid, and observing the changes in temperature in the glass caused by the hot fluid moving into cooler areas.

2.1.3 Solar radiation

 Our primary source of energy is sun. Solar energy emanating from the sun reaches us in the form of electromagnetic waves after experiencing considerable interaction with the atmosphere.



 The radiation energy emitted or reflected by the constituents of the atmosphere form the atmospheric radiation.

 The energy of the sun is due to continuous fusion reaction during which two hydrogen atoms fuse to from one atom of helium.

 The solar energy reaching the earth's atmosphere, called the solar constant, is given by

$G_s = 1353\ W/m^2$

3. Implementation

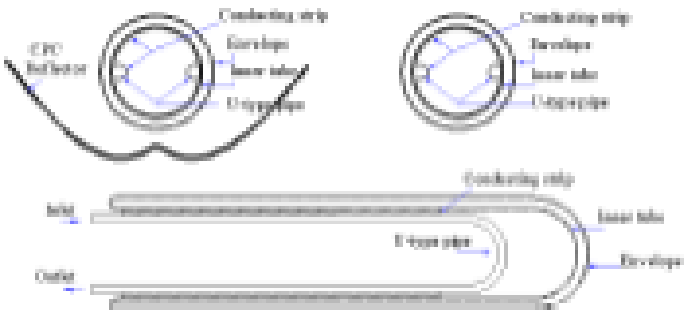
3.1. 3.1 VARIOUS COMPONENTS:
3.2. Following component and material are use in this system.
3.3.
3.4. 1.Evacuated tubes
3.5. 2.Wooden strip
3.6. 3. Metal sheet
3.7. 4. Rubber bush
3.8. 5. Safety valve
3.9. 6. Pipes and its joints
3.10. 7. Glass wool
3.11. 8. Rubber strip
3.12. 9. M/Seal (Bond material)
3.13. 10. Insulation Box
3.14. 11. Plane glass plates
3.15. 12. Stand
3.16. 13. Coting color and Brush
3.17. 14. Rubber Rings
3.18. 15. On/off water valve
3.19. 16. Aluminum cooking box
3.20. 17. Thermometer etc.

3.1 Evacuated tube

 Solar water heating systems using vacuum tubes made of borosilicate glass with special coating to absorb the solar energy are called as Evacuated.

 Evacuated tubes solar heating systems are widely used due to their advantages include their high thermal efficiency, simple construction requirements and low manufacturing costs.

 Vacuum tube as shown in the sketch is the main component, which absorbs solar energy.

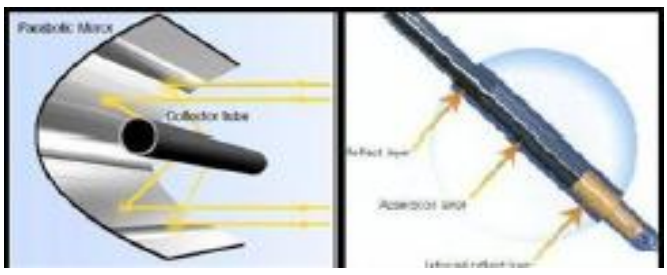


 The vacuum tube is an assembly of two concentric, borosilicate glass tubes.
 The ends of the tubes connected to the copper header are fused together and a vacuum is created between them.
 This process is called as evacuation, as by definition, it means that the air is pumped out from the cavity.
 It results in high level of vacuum, which acts as the best insulation to minimize the heat loss from inner tube.
 The black coating on the inner tube absorbs the solar energy and transfers it to the water.
 The water on upper side of Vacuum Tube becomes hot and thus lighter, so it starts moving upwards in the tank.
 At the same time cold water, which is heavy, comes downward from the tank and is stored at the bottom.
 The phenomenon is called as natural thermo syphon circulation, which occurs in every tube.

Sr. No.		Tube Specifications
1	Length	1800mm
2	Mean diameter	58mm
3	Weight	4KG
4	Material	Borosilicate glass
5	Coating	Aluminum nitride coating
6	Glass thickness	1.6mm
7	Absorptivity	0.04
8	Transmitivity	0.92
9	Refractive index	1.474

3.1.2 Reflector

 A parabolic reflector is reflective surface used to collect or project energy. Parabolic reflectors are used to collect energy from a distant source and bring it to a common focal point.



 The reflector can made from Glass mirror and aluminum foil .one disadvantage of a parabolic

reflector is that the solar energy is concentrated in a very small area, which may be too small for a particular purpose.

3.1.3 Tube holder

The tube holder is a piece of laboratory equipment that is used to hold tubes. They are made out of metal and are used by squeezing the handles to open the other end, and inserting the test tube.
 Test tube holders are typically used when heating the test tube is necessary, or for when caustic materials are being handled. Tube holders are a staple in most commercial and student.

3.1.4 Insulation box

 Insulation is most importance in this device foe decreases the maximum heat losses. In novel type solar heating system, we are use the glass wool material for insulation and wood also.
 Many types of insulation are available in the market but glass wool is best for the solar heating system, technically and cost wise also.

3.1.5 Safety valve
Fig

 Safety valve use for the safety of the glass material of the system. Because the top side of insulation box is made with plane glass plate and also insulation box is assembled with the evacuated tubes. At a time pressure of the insulation box is increasing the more then pressure limit.

3.3 MATHEMATIC CALCULATION
3.31 Latitude and longitude incident on a horizontal collectors for **'**Rajkot city**'.**

Sr.no.	Month	**Latitude & Longitude**
1	January	6.5-7.0
2	February	7.0-7.5
3	March	7.0-7.5
4	April	7.0-7.5
5	May	7.5-8.0
6	June	4.5-5.0
7	July	2.0-2.5
8	August	2.0-2.5
9	Septembe r	5.5-6.0
10	October	6.5-7.0

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3.3 MATHEMATIC CALCULATION

Latitude and longitude incident on a horizontal collectors for 'Rajkot city'.

 Now, As solar radiation is incident on the outer layer of the borosilicate glass tube, a part of it is absorbed, part reflected back into the atmosphere and most of the radiation is transmitted to the next layer of glass tube. Since,
Transmisitivity = 0.92 ,
Absorptivity = (1- 0.92 - 0.04) =0.04
 From the empirical relations, the insolation at Rajkot's latitude and longitude incident on a horizontal collectors is measured to be **7.5 KWh/m2 day.**

 To obtain the peak value of insolation, it is required that this value is divided with an approximate number of bright sunshine hours.

 Assuming that May 15 is a dear day with no clouds and 8 h of bright sunshine, the radiation received/m2 at every incident would be = **7.5 /8 = 940 W/m2.**

 The further calculations are based on this value of incidence solar radiation flux.

 It is further assume that the total incident energy available on the surface is G x Aperture area.

Total incident energy = 940 x 0.1366 = 128.45 W.
  The temperatureof the outer tube is determined and it is therefore required to calculate the temperature of the inner glass tube. As the two tubes are separated by a vacuum and we have assumed that no convection and only transmission takes place from the top layer.
Energytrans = t x Energy Incident.
Energytrans = 0.92 x 128.45 W.
= 118.182 W.
Using the aforementioned equation:

1. 118.182 x 0.12 = 3.14 x (0.058) x 1.5 x 0.04 x 5.669 x 10-8 x (T4 – 3084)

T = 1500 C.

4. CONCLUSION

Merits

- Heat absorption capacity of this system is more than compared to a 60 cm * 60 cm conventional box type solar cooker.
- The greatest advantage of this system is that it offers fast cooking and does not require frequent manual solar tracking.
- The greatly enhanced heat collecting capacity due to relatively large collector area allows frequent interaction with the food during the cooking process without fear of losing performance.
- Evacuated tube absorbs heat very efficiently from all directions supported by reflector to absorb maximum of solar heat.
- This solar system is therefore ready for wide scale global dissemination, this device is eco-friendly and they required little maintenance.
- Simple to handle and transport, lifespan is good and heating from all directions leading to fast preheating.
- Efficiency (η) is more than all previous models and maximum temperature is very high.

- Initial Installation cost and volume occupied are minimum and cooking is quick.

Demerits

- Evacuated tube is made from glass. So, handling is carefully.
- For this device, availability of sun is must require.
- In this device, heating is not constantly.

Application

- For the cooking.

For water heating.

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