Review Paper on Design and Development of Solar Air Heater by using Evacuated Tube

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Abstract:
A solar air heater including a housing having a transparent front wall and an inlet and outlet for establishing a flow path for a gas such as air to be heated and a porous radiation absorbent collector plate positioned across the path and arranged to accept incident solar radiation passing through the front wall wherein a radiation trap is placed inside the housing either adjacent to the front wall, directly on top of the collector plate or between the collector plate and the front wall. The radiation trap has a cellular structure such as honeycomb and is made from a material which is light-transmitting but wall and preferably the trap is actually bonded to the opaque to infrared radiation emitted from the collector front wall, plate in a direction toward the front wall. When the Radiation trap is placed adjacent to the front wall the Trap can additionally serve as an air buffer layer.

Keywords: Parabolic collector plate, Evacuated tube, Thermocouple, Air motor.

1. INTRODUCTION

1.1 Problem statement

Concentrating solar power (CSP) has been used for more than 100 years. Initially, CSP was used for small-scale solar thermal-mechanical applications, with outputs to 100 kW, mainly for water pumping. Only after the energy crises of 1973 did the idea of large-scale solar power plants took hold. Starting in the late 1980s, nine solar electric generating systems (SEGSs) have been built and operated in the Mojave Desert of southern California.

1.2 Objectives of the Design:

1. To Design and fabricate parabolic solar trough collector for energy concentration.
2. To manufacture cost effective solar trough collectors, so that it’s affordable to common people.
3. To bring up a system that constantly works with intended mechanism and reduces human work considerably.

1.3 Basic Principle:

The basic principle adopted in the construction of the parabolic solar air heater is that when parallel rays of light from the Sun close to and parallel to the principal axis are incident on a concave or parabolic shaped mirror, they converge or come together after reflection to a point F on the principal axis called the principal focus as shown in figure 4.
The electric exhaust fan and the temperature indicator are connected to the power supply. The electric fan sucks atmospheric air and passes it to the evacuated tube. This evacuated tube acts as an absorber and absorbs all the solar radiations falling on it. As this tube is placed at the focal line of the designed parabolic collector, it absorbs all the reflected radiations too. This increases the temperature of the air. Two thermocouple wires are used to measure the temperature of inlet and outlet air. These thermocouple wires are connected to digital temperature indicator that indicates the temperature sensed. The readings were noted on a clear sunny day at 9 a.m. and were finished at 5 p.m. in the evening. The parabolic frame was designed so as to track the Sun. Manual tracking mechanism was used for this purpose.

II. LITERATURE REVIEW

Comparing Evacuated Tubes with Flat plate collectors
Both the Flat plate and Evacuated tube collectors play a major role in heating operations using solar energy. However, many researchers have proved that evacuated tube solar collector is a better substitute to flat plate collectors when high temperature is concerned. Ayompe et al monitored year round energy performance of solar water heaters with 4 m² flat plate and 3 m² 2 heat pipe evacuated tube collectors under same operating conditions. The annual collector efficiency observed were 46.1% and 60.7% for the flat plate collector and evacuated tube collector respectively with system efficiencies of 37.9% and 50.3% for the same systems. Economic analysis showed that both solar water heating systems were not economically viable because of their very low net present worth and their simple payback periods varied between 13 years and 48.5 years of flat plate collector and evacuated pipe collector respectively.

III. CONCLUSION

In morning, when the sun rises, the radiations are low and hence the output so obtained is not satisfactory. As the Sun rises and comes at the top, large amount of solar radiations fall on the parabolic plate and most of them are absorbed. This gives the expected efficiency. The efficiency is maximum at 1 pm and the it begins to decrease as the Sun moves to the west. Use of this setup gives a high temperature increase, very higher than the ambient temperature and hence it can be concluded that the design, manufacturing and the assembly of the setup is satisfactory and the project is successful.

IV. REFERENCES


