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"A Review on Experimental Analysis of Single Pass Solar Air Heater Fitted with Conical Copper Screw as Obstacle and Artificial Roughness"

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ABSTRACT:

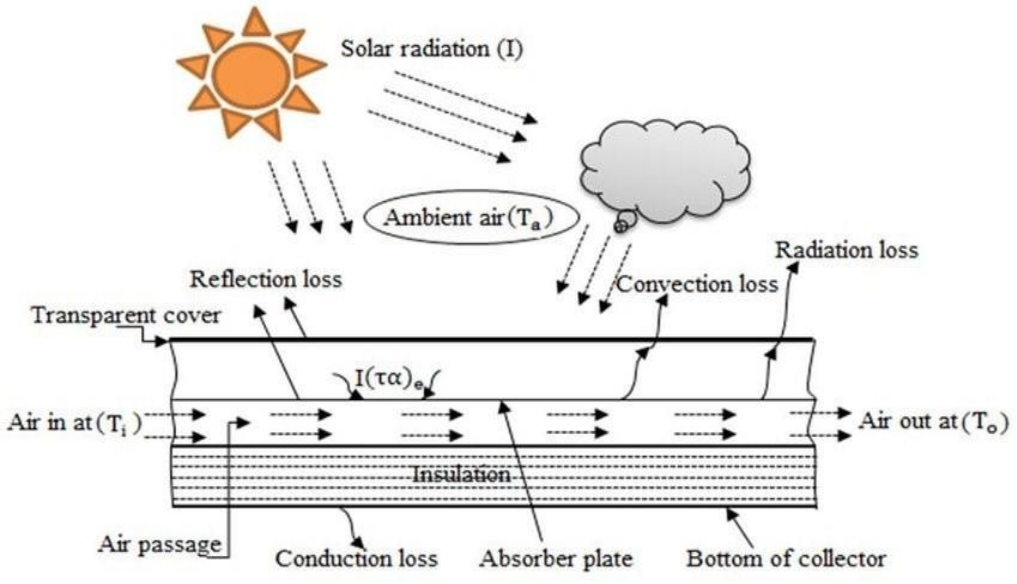
This paper presents a review of the current literature on solar air heaters. The review is conducted to facilitate the discussion and evaluation of the findings by the researchers. It mainly covers the solar air heater technology Fitted with Conical Copper Screw as Obstacle and Artificial Roughness. The conical screw allows the maximum absorption of solar energy. Its fine channel obstructs the air to hold for some time and swirl around. Artificial roughness is also been provided to the surface for better utilization of solar energy and its absorption by the flowing air.

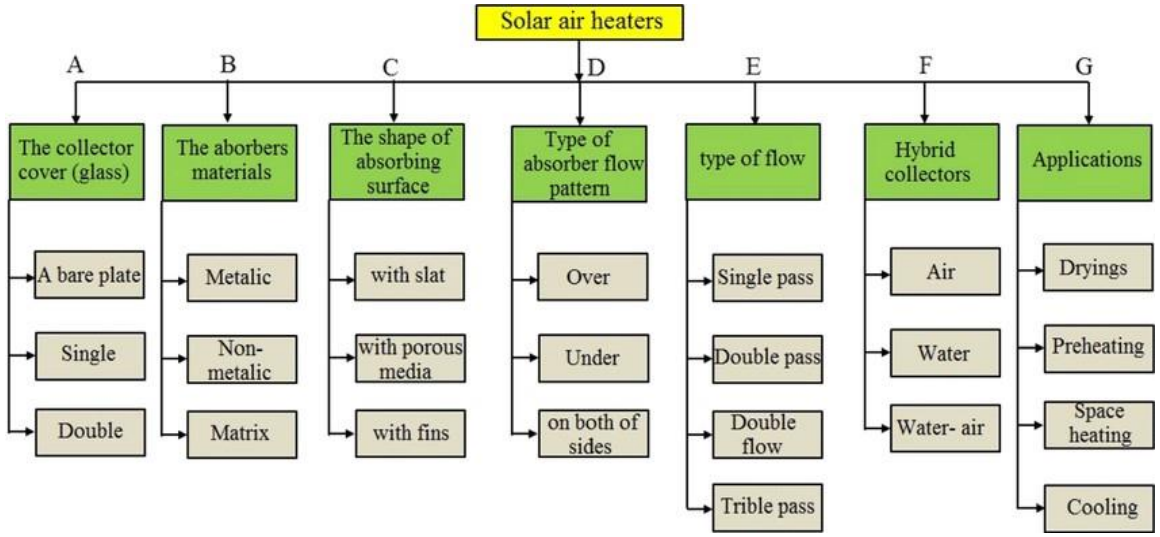
Keywords: Solar air heater, Conical copper screw obstacle, artificial roughness.

Introduction of Solar Air Heater:

All energy originates from solar radiation. The increasing importance of energy in our society is necessary to maintain the standard of living and to keep the other sectors of our economy operating smoothly. In the twenty-first century, a number of renewable energy technologies are being used, but many are still in the research and development stage. Solar air heaters (SAHs) were widely employed as heat exchangers in solar energy applications. One of the main uses for solar thermal energy is air heating, which is employed in desalination, crop drying, laundry, and other drying operations as well as space heating. Using conventional energy for this operation will raise the cost of the procedure and pollute the environment. Using solar energy for air heating reduces the system's operational costs and conventional energy use. This study intends to combine the efforts of researchers working on SAH and identify methods to provide it through robust applications to use, thereby improving the performance for consideration in design and development in the current setting. Due of the large number of shapes and empirical constructions, classifying solar air heaters is quite difficult.

Classification of Solar Air Heater:





Literature Review:

Jurinak and Abdel-Khalik investigated the physical properties of phase-change energy storage materials for solar air-heating systems. They employed simulation approaches to assess system performance over the course of the heating season. Different heating loads are applied to different areas of the house. They explored the transient behavior of phase-change energy storage (PCES) units and developed simulation tools to be used in conjunction with these models to estimate the performance of PCES-based solar heating systems. They estimated optimum ranges of storage sizes, the variation of the solar supplied fraction of demand with storage size, and collector area for systems using sodium sulfate decabydrate and paraffin wax as storage medium for air heating systems.

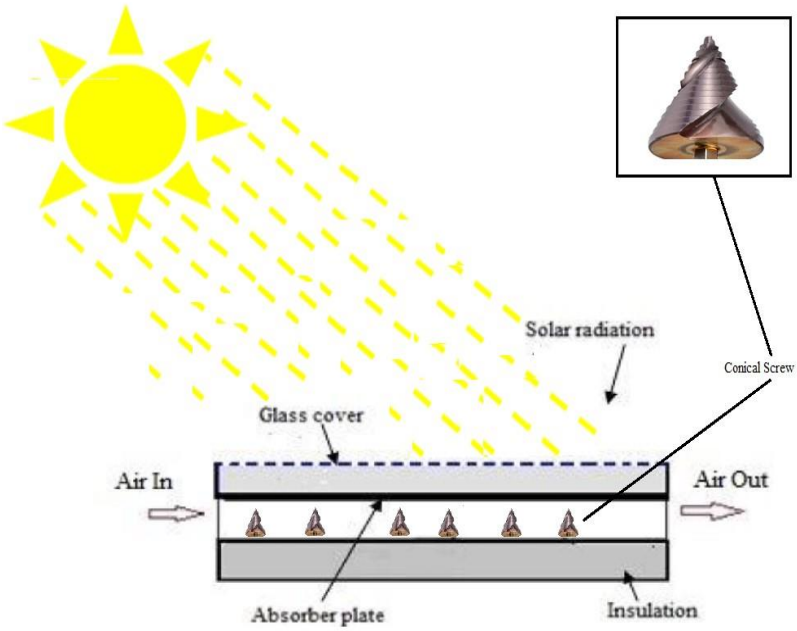
Hammou and Lacroix suggested a hybrid thermal energy storage system (HTESS) that uses phase change materials to manage the simultaneous storage of heat from solar and electric energy. They captured solar heat on sunny days and released it later. Electric energy is saved during off-peak periods and later used during peak periods to smooth power demands at night or on cloudy days. According to the findings of this study, utilizing an HTESS reduces power consumption for space heating by 32%. Furthermore, more than 90% of electricity is consumed during off-peak hours. For power markets with time-of-use tariff systems, the return on investment in such a storage system is particularly appealing.

Kaygusuz have investigated experimentally and theoretically the performance studies of a solar heating system with a heat pump. Experimental studies show that the parallel heat pump system saved more energy than the series heat pump system, because it uses both air and solar as a heat source for the evaporator while the series system uses only solar energy stored in the storage tank. In this experimental study, they used CaCl2·6H2O as a PCM and concluded that it is technically preferable as a storage material in this region. The experimental results of this study indicate that high collector efficiencies ranging from 62 to 70% can be realized with 30 m2 flat-plate water cooled collectors over the heating period for the solar assisted series heat pump with energy storage as illustrated in Fig 14, while the collector efficiency of the parallel heat pump system ranged from 54 to 60%. However, energy storage efficiencies were less than the collector efficiencies. The average net storage efficiency is 63% for both systems. In this study, a thermodynamic model has been developed for a solar assisted series heat pump system with latent heat energy storage. The system parameters were determined from experimental data. It was found that the model agreed well with the experimental results.

Saman et al. studied the thermal performance of a phase change thermal storage unit based solar roof integrated heating system. The storage unit was a component of a roof integrated solar heating system being developed for space heating of a home as shown in Fig17.The storage unit consists of several layers of phase change material (PCM) slabs with a melting temperature of 29 ◦ C. The warm air was circulated in a roof integrated collector and passed through the spaces between the PCM layers to charge the storage unit. The stored energy Ravish Kumar Srivastava and Ajeet Kumar Rai http://www.iaeme.com/IJMET/index.asp 1128 editor@iaeme.com in form of heat was utilized to heat ambient air before being admitted to a living space. They concluded some useful remarks for this study.

Proposed Methodology:

Solar air heating systems absorb thermal energy from direct sunlight to heat air; this heated air can then be circulated through buildings to provide heat. The air within the collector is heated by the plate, which is heated by solar radiation. Air is drawn from the room through the collector and blown back into it by an electric fan or blower. Main working principle of this solar heater is same of traditional solar air heater, the main modification is the assembly of conical screw obstacle and artificial roughness for the improvement of thermal efficiency of solar air heater.



Conclusion:

A basic gadget that harnesses solar energy is the solar air warmer. One renewable energy heating method for processing heat generation for space heating is the use of solar air heaters to produce hot air. These kinds of devices generate heat for free. minimal upkeep, such as cleaning. It is necessary to use collectors solely. Energy storage is crucial for energy conservation, but it also enhances performance and dependability in a variety of energy systems and is especially crucial in situations when the energy source is sporadic, like solar energy. The fact is that assembly of Conical Copper Screw as Obstacle and Artificial Roughness will definitely increase the thermal efficiency of solar air heater. Adding artificial roughness to the channel's surface promotes heat transfer to the fluid passing through it. Under the same conditions, a synthetic course solar air heater outperforms a smooth solar air heater in terms of heat transfer rate.

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