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EXPERIMENTAL STUDY & PERFORMANCE ANALYSIS OF SOLAR AIR HEATER

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ABSTRACT

Solar air collector is a specific type of heat exchanger that transfers heat to air, which is obtained from absorbing solar radiation by absorber. In solar air collector heat transfer occurs from an energy source which spreads radiation to the air. It consists of an absorber plate, supportive walls, ducts or channels of fluid flow, glazing, air blower or fans (if forced convection), and insulation to minimize heat losses. Almost parts of solar air collector or heaters are thermally well insulated to reduce thermal heat losses.

KEYWORDS: Aluminum Pipe ,Temperature.

INTRODUCTION

Solar air heaters are systems that collect solar energy and transfers the heat to passing air, which is either stored or used for space heating. The collectors are often black to absorb more of the sun's energy and a conductive material, often metal, acts as a heat exchanger. There are many different designs and systems may include fans to increase the flow rate of air. Alternatively, a passive collector can be built such that when the hot air rises it draws fresh air through the bottom. Fans can often increase the performance of the system, but require additional parts and adds complexity. Solar air heaters can compliment traditional indoor heating systems by providing a free and clean source of heat (after initial costs).

OPTIMAL LOCATIONS AND ANGLES

- Meteonorm - Provides a visual reference to understand how much energy your geographic location receives from the sun.
- Solar Path Finder - Helps determine which angle the collector should be positioned, based on your location.
- Weatherbase - Has a large database of temperature and weather data that could be helpful in learning more about your heating and cooling demands .
- Report on Efficiency - An investigation into the efficiency of solar air heaters in cold climates .

DESIGN

Natural convection during a sunny day will allow the heater to pull cool air from your room, heat it and expel it back into the room as warm air. At night and on dark cloudy days the opposite is true. The heater will pull air from your room into the “heater” it will cool it and it will fall back into your room. A solar heater needs to include the ability to completely seal off airflow. To make this heater truly useable for people that are not at home 100% of the time, the heater needs to have the ability to open the sealed vent when the temperatures reach a higher temperature than the room, with no human interaction. The same should be done with heaters equipped with a fan. The fan needs to come on and shut off automatically. Until these issues are solved in an economic way solar heaters will not find wide spread use.

To address the possibility of reverse air flow, first consider that the hot air would need to rise through the cooler air of the heater, yet if the air were cooled on its way up to be colder than that of the room, the air would not flow up.

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To consider downward air flow, yes it is true that cold air settles when displaced by warmer air. The heater will not have cooler air because we assume the heater is completely inside the room and so there can be no "loss" of heat by the heater in relation to the room because if it gives up heat it will be giving it up to the room. If the heater were to share its plastic surface with an outside window, then there could be a current at night as the heat inside the heater is exchanged to the outside via the window acting as heat exchanger.

EXPERIMENTAL SET UP

One solar air heaters of same specific dimensions have been designed and fabricated to supply hot air for drying and space heating. Both air heaters were experimentally tested individually for their thermal performance on different configurations. The maximum amount of solar energy for SAH To reduce the heat losses, a 2 cm thick layer of glass-wool was placed between the absorber tray and outer cabinet. The single glazing has been considered especially for the maintenance of the SAHS. The efficiency effecting elements of the system like as halogen lights, inside wall of ducts for good reflection, and mainly the absorber tray are required to be very clean while performing (a float glass, beneath which the granular carbon is spread of heat storing for long hours) and for efficient working in good and poor ambient conditions.

Dusty transparent glass over storage media and dusty reflective walls will be resulted in lower efficiency of the system. Double glazing makes the system a little bit complicated in comparison of discussing system and more maintenance and attention will be required. The distance between glazing and absorber tray was 10 cm for both heaters.

This vessel was fabricated of an Al bucket with two ‘‘Ends’’ in which round shaped end was fixed with fans while rectangular end was fixed to the inlet duct of SAH. Other two ducts (inlet and outlet) of same dimensions were fitted to the SAH (fabricated with the same grade of Al) for air supply and for exhausting. Both ducts were also painted dull black.

RESULT AND DISCUSSION

Table . 1 Airflow rate are 2.0 m3 / minute

Sr.No.	Time	Temperature in Degree at inlet	Temperature in Degree at outlet
1	11:00	30	38
2	12:00	32	40
3	13:00	40	50
4	14:00	40	48
5	15:00	38	44

Efficiency at time 11:00
Temperature at inlet =30 °C
Temperature at outlet =38°C
ή= (Temperature at outlet -Temperature at inlet) / Temperature at inlet
= (38-30)/30 =26.66%

Efficiency at time 12:00
Temperature at inlet =32 °C
Temperature at outlet =40°C
ή= (Temperature at outlet -Temperature at inlet) / Temperature at inlet
= (40-32)/32 =25.00%

Efficiency at time 13:00

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Temperature at inlet =40 °C
Temperature at outlet =50°C
ή= (Temperature at outlet -Temperature at inlet) / Temperature at inlet
= (50-40)/40 =25.00%

Efficiency at time 14:00
Temperature at inlet =40 °C
Temperature at outlet =48°C
ή= (Temperature at outlet -Temperature at inlet) / Temperature at inlet
= (48-40)/40 =20%

Efficiency at time 15:00
Temperature at inlet =38 °C
Temperature at outlet =44°C
ή= (Temperature at outlet -Temperature at inlet) / Temperature at inlet
= (44-38)/38 =15.78%

Table . 2. Airflow rate are 3.0 m^3 / minute

Sr.No.	Time	Temperature in Degree at inlet	Temperature in Degree at outlet
1	11:00	31	39
2	12:00	34	44
3	13:00	42	53
4	14:00	38	49
5	15:00	37	46

Efficiency at time 11:00
Temperature at inlet =31 °C
Temperature at outlet =39°C
ή= (Temperature at outlet -Temperature at inlet) / Temperature at inlet
= (31-39)/31 =25.80%

Efficiency at time 12:00
Temperature at inlet =34 °C
Temperature at outlet =44°C
ή= (Temperature at outlet -Temperature at inlet) / Temperature at inlet
= (44-34)/34 =29.41%

Efficiency at time 13:00
Temperature at inlet =42 °C
Temperature at outlet =53°C

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ή= (Temperature at outlet -Temperature at inlet) / Temperature at inlet
= (53-42)/42 =26.19%

Efficiency at time 14:00
Temperature at inlet =38 °C
Temperature at outlet =49°C
ή= (Temperature at outlet -Temperature at inlet) / Temperature at inlet
= (49-38)/38 =28.94%

Efficiency at time 15:00
Temperature at inlet =37 °C
Temperature at outlet =46°C
ή= (Temperature at outlet -Temperature at inlet) / Temperature at inlet
= (46-37)/37 =24.32%

CONCLUSION

collector the double glazing gives lower thermal performance than the triple glazing this is due to the heat losses towards the surroundings..The air stream reduces sensibly the temperature of the absorber and in same time the heat losses are reduced. With the offset fin collector the double glazing gives lower thermal performance than the triple glazing this is due to the heat losses towards the surroundings.

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