

ABSTRACT

Renewable energy RE technologies are considered as clean sources of energy, and optimal use of these resources minimize environmental impacts, produce minimum secondary wastes, and are sustainable based on social, current and future economic. Solar energy is one of the renewable energy sources, and it is an important part of our clean energy future. The radiation from the Sun which is capable of producing heat, causing chemical reactions, or generating electricity. Solar air heater SAH is a renewable energy application that can be utilized to reduce energy consumption. SAH considers a heat exchanger device which is one of the sources to absorb the heat from the sun and increases the ambient temperature by sun radiation. In this project, a literature review about the SAH system was conducted. Furthermore, we design the mixing promoters to the absorber plate and also design the collector of SAH using SOLIDWORKS software.

Keywords: Renewable energy (RE) , Solar Air Heater (SAH)

OBJECTIVES

- ❖ Reviewing the literature related to the solar air heater
- ❖ Performing the mathematical model
- ❖ Drawing the detailed prototype using SOLIDWORKS

DESCRIPTION

The SAH system which consists of absorber, glass at the top, inlet channel and outlet channel is shown in figure 1 and figure 2. The geometry design of the absorber plate which is a metal plate with a black color to absorb radiation of the sun with special shape to increase the efficiency of the system . The purpose of glass at the top is to collect the highest amount of radiation, and the insulator is used to prevent the heat losses. The blower device provides the air flow from surrounding (ambient air) above the absorber to generate hot air by convection heat transfer. The inlet and outlet channels have a trapezoidal shape.

MAIN APPLICATIONS

- Heating rooms and cold areas.
- Drying food .

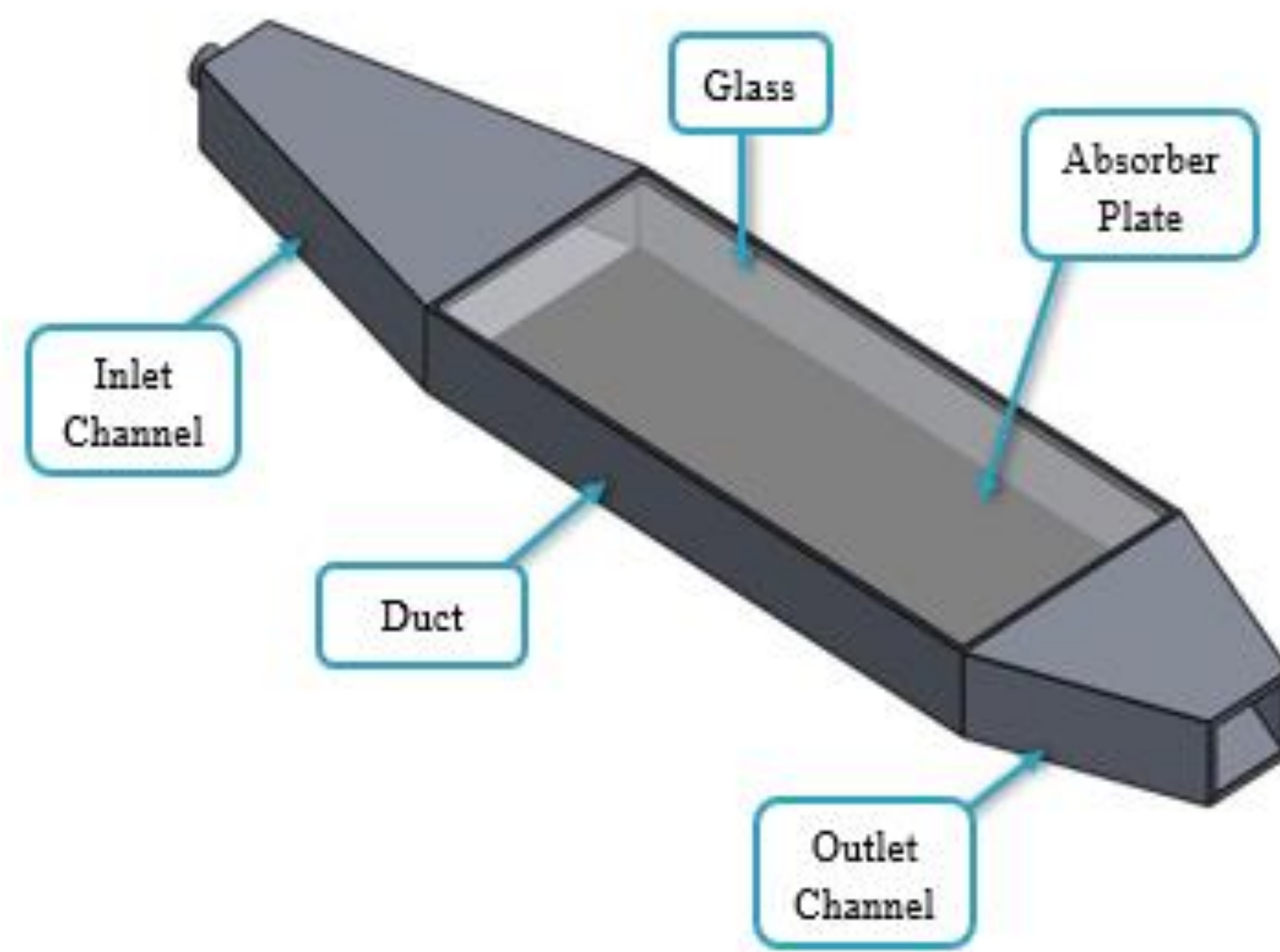


Figure 1. 3D view of the SAH.

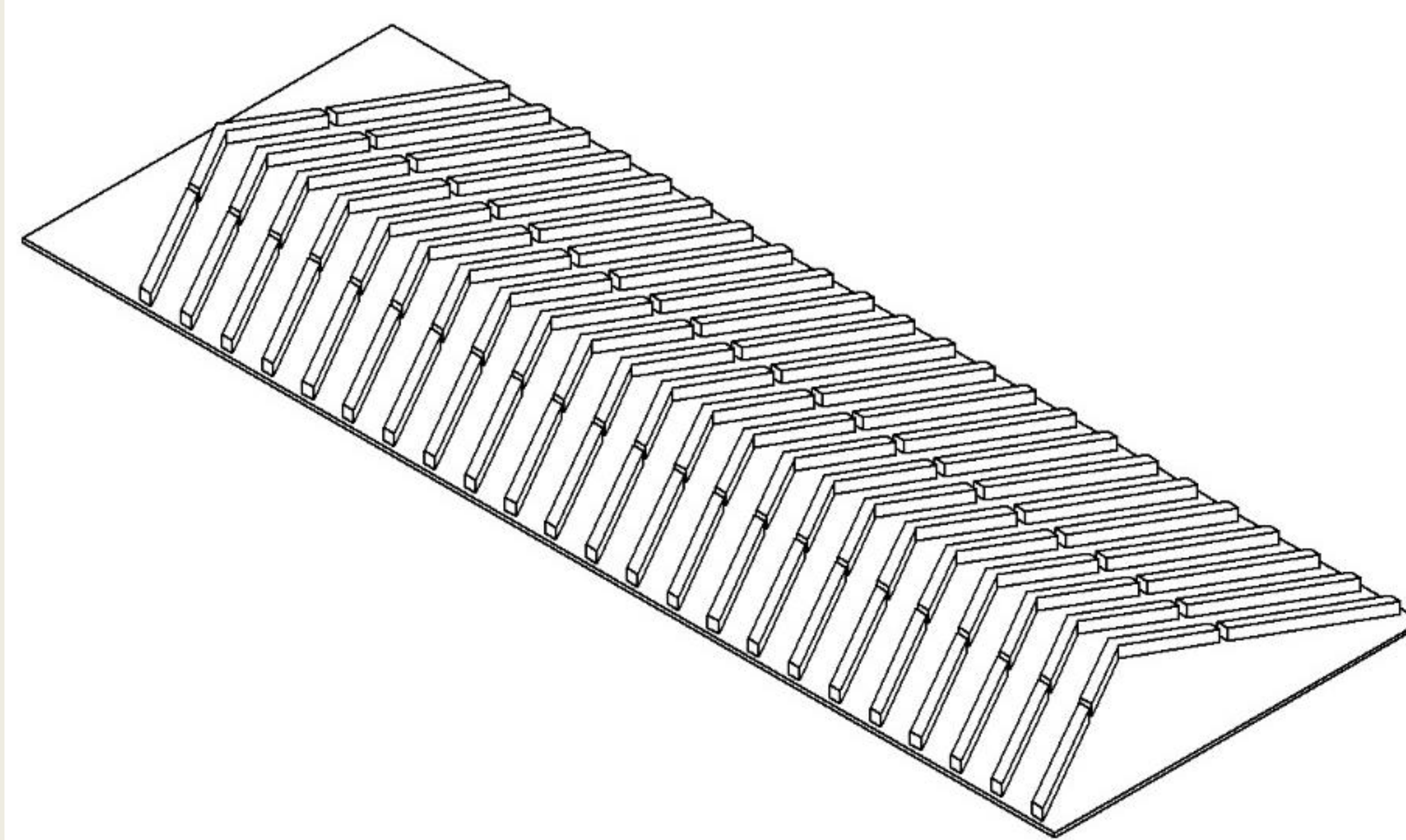


Figure 2. 3D view of the Absorber plate

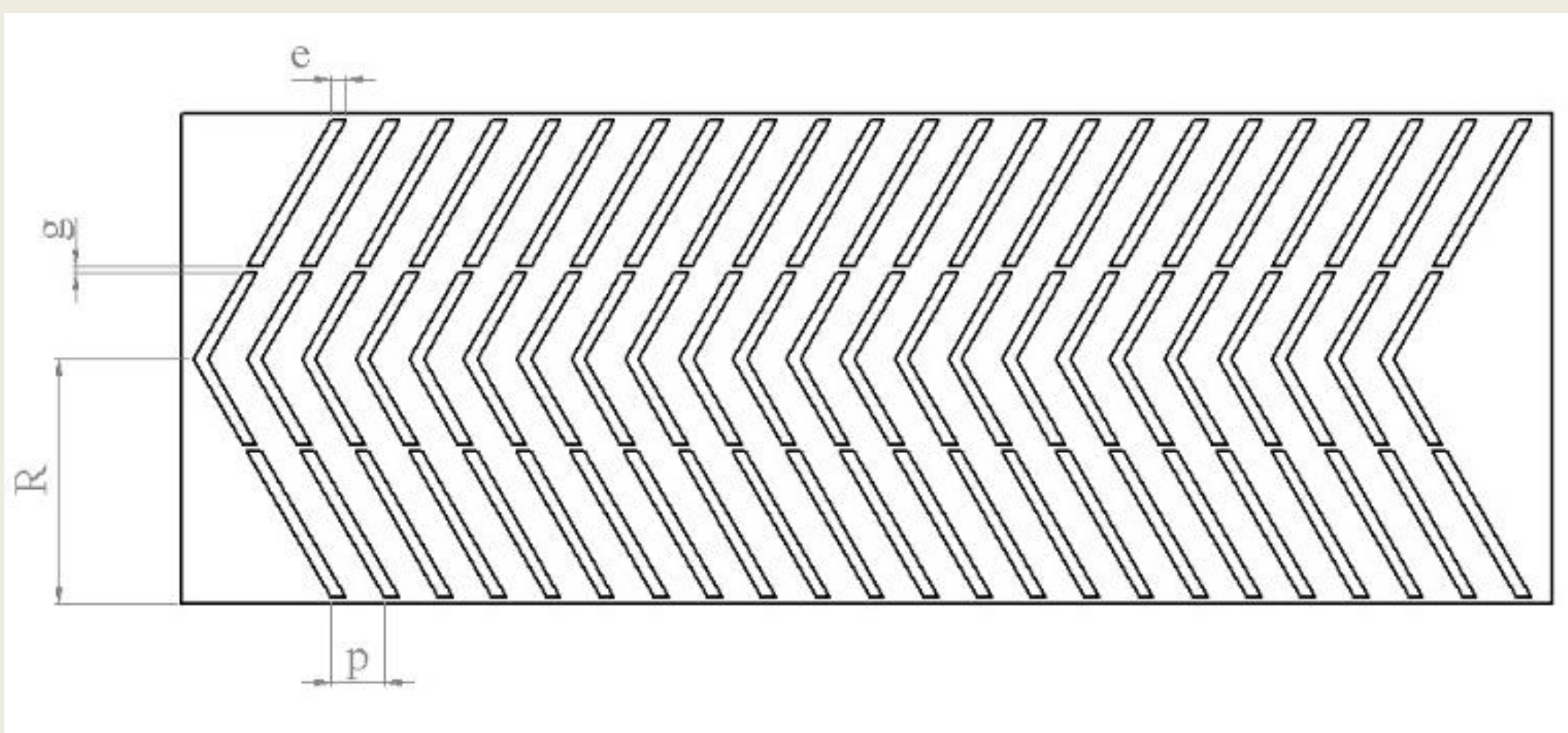


Figure 3. Top view of the Absorber plate



Figure 4. Side view of the Absorber plate

MATERIALS SELECTION

Part	Material
Inlet channel	Steel
Duct	Steel
Insulation	Mineral wool
Glass	Single glass
Absorber Plate	Aluminum
Outlet channel	Steel

MATHEMATICAL MODEL

- Reynolds number:

$$Re = \frac{\rho u D_h}{\mu}$$

- Nusselt number for roughened duct:

$$Nu_r = \frac{h D}{K}$$

- Friction factor for roughened duct:

$$f_r = \frac{(\frac{\Delta P}{L}) D}{2 \rho u^2}$$

- Useful energy:

$$Q_u = \dot{m} C_p (T_{a,out} - T_{a,in})$$

- SAH efficiency:

$$\eta = \frac{Q_u}{I_R A_h}$$

COMPONENTS OF SYSTEM

1. Inlet channel
2. Blower
3. Duct
4. Glass
5. Insulation
6. Absorber Plate
7. Outlet channel

CONCLUSION

In this graduation project 1, a detailed literature review was conducted on renewable energy, solar energy, and solar air heating SAH system. We design SAH with consideration of ASHRAE standards. We select some materials to manufacture SAH. The construction and experiment based on the proposals will be developed in project 2.

FUTURE WORK

- ❖ Collect the required materials for the experimental work
- ❖ Fabricate SAH system
- ❖ Perform the experiment and validate it with the mathematical model