ANNALS of the ORADEA UNIVERSITY.

Fascicle of Management and Technological Engineering, Volume VII (XVII), 2008

THE SIMPLE CONSTRUCTION OF A SOLAR PLANE THERMIC PICK-UP FUNCTIONING BY GREENHOUSE EFFECT

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Keywords: solar energy, thermic pick-up, black body, plane surfaces, glass, tube, primary thermic fluid, sera effect.

ABSTRACT

Nowadays there are new sources of alternative energy with less pollution or without any pollution regarding the nature, with the purpose to reduce the production costs and to be used in house heating greenhouses etc., or of potable waters.

In the project it is presented the simple construction of a solar thermic trap whit the solar heat absorption from a black material and with the functioning through the greenhouse effect.

Comparatively to other sources of energy, the solar traps have lost of advantages: they are self generators, without other mobile elements, they are usable. The biggest disadvantage is that their functioning is influenced by the nature conditions.

The solar thermic trap introduced in the heating circuit will surely offer the potable water, with a minimum price and with a fast decadency of the investment.

1. INTRODUCTION

Because of the enormous price of the conventional energy of the high degree of pollution in the nature, we are looking for new sources of energy.

For the fulfillment of the necessities in the individual household, at least for the potable water heating, are introduced new plumbing with thermic traps.

The collection of the solar energy radiation with the purpose of heating the potable water it is made through greenhouse effect with the help of the solar thermic taps in the creation of water plumbing having in view the insurance of the primary thermic energy in the plumbing.

This can be easily produced if it is assured and absorption of the solar radiation as much as possible the energy produced by the trap through heating.

An easiest construction of a solar thermic trap presented by the students from IMT College, to the University from Oradea, has all this conditions. The reduction of the loss of heat through radiation in the solar thermic trap presented it is made through the greenhouse effect, the absorption of solar energy necessary from the plumbing of heating water is made in trap on the base of the black material proprieties, with selective transmission of radiations to this through dimmed glass.

2. BASIC PRINCIPLES

A simple solar thermic trap, with the primary agent carrier of heating, water, glycerin or oil, is a plan trap. The way of functioning of the plane trap is based on the utilization of the black material effect as thermic energy absorbent, conjugated with the green house effect or vacuum effect.

Basically, the construction of the plane traps consist on a metallic plaque painted with black on the opposite side of the sunrays absorptive and thermicly isolated. On top of the plaque is the vitrage from one or more than one glass plaques.

The absorptive heat is transmitted to a work flow called heat carrier and it is in a thermic contact with the absorptive plaque. The work flow ensures the heat transport to the user.

At the exit, the temperature of the carrier flow of heat can be between 50-100℃. The solar traps are made with wire and trap with receiver from pipes.

The basic element of a trap is the absorbent plaque which is heating under the solar radiations, increasing the intern energy of this. The receiver transmits radiations in the nature.

The physical elements which exist in these traps are: light absorption, reflexion and light refraction.

a .light absorption

The passage of a lighting wave through substance goes to the oscillation existence of atomic electrons, of elementary dipoles, under the electromagnetic actions of the wave being accompanied by a loss of energy of this wave where, consumed for the electronic oscillations usage. On one hand, this energy is returned under the form of the radiation emitted by poles, and another part goes under the form of thermic energy.

The biggest parts of absorption of the atoms correspond to the proper frequencies of resonance of elementary dipoles from atom. The general law which describes the phenomenon of absorption given by Bouger is:

$$I=I_0 e^{-kd} \qquad (1)$$

Where: I is the intensity of the plane wave that suffers a decrease;

I_0 - the intensity of the parallel fascicle of waves which fall on the surface of a plan material;

d - the thickness of the substance stratum traversed by light;

k – absorption coefficient that depends on the wave length of the light.

For the plane surface it will be chose as material the glass of the Plexiglas. The both being transparent and colorless, absorbing very little from the visible radiations.

The absorbent material (black material) is chose depending the k absorption coefficient being proportional with absorbent molecules on the road unity traversed by the light wave and also with the absorptive molecules number in the volume unity. The k coefficient of light absorption is:

$$K=A \cdot c$$

where A is a constant that depends on the nature of the absorptive substances.

Thought experimental observations the biggest light absorption coefficient is given by the black material. A material that has a high light absorption coefficient is the colloidal (graphite), black painting. As much as the d thickness of a glass or plexiglas blade is shortest as much it permit to traverse a lighting flux of big intensity.

b. light reflection

In the solar thermic trap practice it is utilized the glass, the plexiglas and other materials, these materials with plane surface permit the light reflection or refraction at the crossing of this through a surface in which two invisibles mediums are separated. The light reflection consists in the partially return in the nature medium when it meets the separating surface of a medium.

The light reflection on glowing surfaces can be: a) regular; b) diffuse.

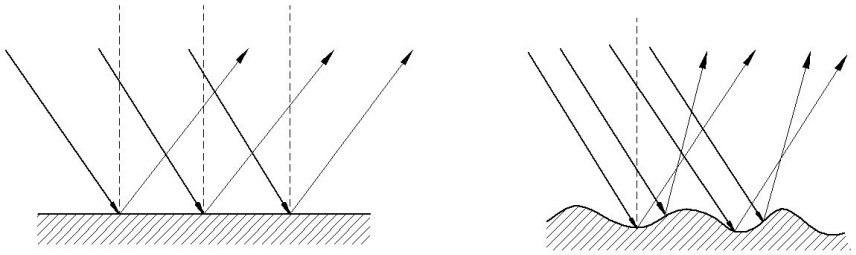

Fig.1 The light reflection on glowing surfaces

c *.light refraction*

The light refraction consists in the elimination of one of the light part that falls on the separation surface of two invisible medium in the second medium changing the direction of propagation

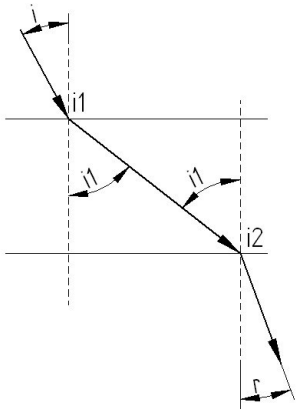

Fig.2 The absolute and relative refraction indicator

The refraction's law at the separation surface of two invisible medium is:

$$n_1 \sin i = n_2 \sin \tau$$

or

$$\sin i / \sin \tau = n_2 / n_1$$

where: n_1 is the absolute refraction indicator, the light going from l_2 to l_1;
n_2 –is the absolute refraction indicator of medium 2.
$n_2/n_1 = n_2$ –is the relative refraction indicator of two medium being the absolute refraction indicators of these two medium.

For the practical realization of a solar trap is indicated as the indicator n_2, to be very high in the second medium chose than the first. In our case we chose for the second medium the colloidal graphite. In the case of opaque materials the light is absorbed.

d. the totally reflection

Always the light's reflexion is followed by refraction even in the case of opaque materials when the refracted light is absorbed.

If the light passes from a denser optic medium into another less dense ($n_2 < n_1$) from the refraction's law (3) results:

$$n_2 < n_1$$

$$\sin \tau > \sin I \qquad (5)$$

In this case, for a certain value of the incident angle i= *I*, the refraction angle can obtain the value $\tau = \pi/2$. For the biggest incident angles than I, the refractant radians don't pass into the second medium because of the totally reflection phenomenon.

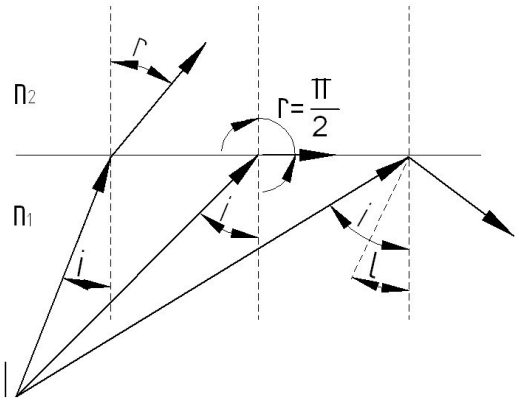

Fig.3 The totally reflection

The minimum incident angle from which this phenomenon came is the limit angle:

$$\sin i = n_2 / n_1$$

for $\tau = \pi/2$.

The limit angle depends only on the refraction indicators of the two substances. A plan surface with totally reflection can be easily obtained by painting a reflectant plaque with paint used to the road indicators.

The specific feature of some glass spheres or invisible perimeters

Another phenomenon which appears in the solar traps is the green house effect.

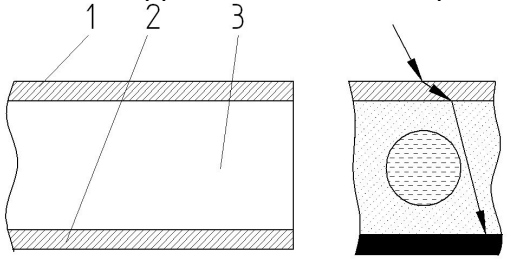

Fig. 4 The greenhouse effect

In the fourth figure were made the next observations: 1-glass plaque or plastic material; 2-glass plaque or plastic material; 3-green house effect.

3. The simple construction of one solar thermic plan trap

The phenomenon presented previous and also the geometric optic is at the base of the solar thermic plan traps construction.

It is difficult to realize ideal optic systems having in view the economical limited possibilities of the team's students participants to the making-up of a simple solar thermic traps, it was chose to realize a simple optic system to whom to use homogeneous mediums in which the light can be propagated in right line with parallel and divergent points of light.

a) ***b)***

Fig.5 Point of light
a) parallel; b) divergent

Such a solar thermic trap which takes into consideration the phenomena a presented it is schematically presented in figure number 6.

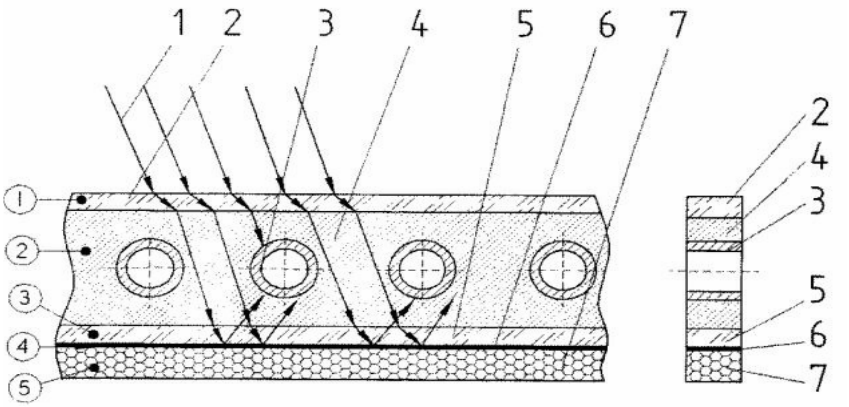

Fig. 6 The figure of a solar thermic plan trap

In figure 6 was noted: 1-point of liht; 2-glass or Plexiglas; 3-copper capillary pipes; 4-coloidal graphite; 5-glass or Plexiglas; 6-aluminium plaque; 7-encreased polyester.

Through capillary copper pipes goes-through hydraulic or thermic pressure-primary their agent(the water or glycerin).This type of traps under the form of a modern glass can be easy obtained and can be insert into the hydraulic circuit of a heating plumbing.

In the figure 6 it is noticed that to the trap´s construction are presented the phenomena's applications, known as elementary optic:

1-light and reflection phenomena;
2-absorption and refraction light phenomena;
3-reflection and refraction phenomena;
4-total reflection phenomenon;
5-thermo isolated medium;

Between the glass plaque 2 and 5 the green house effect is manifested.

The termic absorbed energy under the shape of heat from the absorbent medium is transported into a network of capillary copper pipes through which the primary thermic agent passing which takes the heat from the absorbent medium.

4. CONCLUSIONS

1. The solar thermic plane trap is presented in the project as a simple construction and easily to reproduce.

2. For trap's creation is necessary the understanding of the simple phenomena regarding the entrance of light through different medium.

3.The construction of the solar thermic plane trap is based are phenomena of: reflection, refraction and total light reflection light absorption,greenhouse effect, black material property and heat transportation phenomena.

4. The trap presented is the project can be easily used in any possition and it is ecological.

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