ENERGY SAVINGS FOR HEATING SYSTEMS FOR INDUSTRIAL BUILDINGS

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Annotation: *This article presents a contribution to the need and relevance of using solar energy. Furthermore, recommendations were made to improve the efficiency of the operation of solar collectors with a flat surface. The methods of operation of a new type of solar collectors are investigated. The issues of accelerating heat transfer processes due to the return of the upward movement of the air flow in the working chamber of the solar air collector are considered.*

Keywords: *Solar air collector, absorber, temperature, convective heat flux, hollow pipe, air duct.*

I.INTRODUCTION

At present, the problems of energy conservation in the use of fuel and energy resources remain especially relevant due to the reduction of traditional reserves of fuel and energy resources and increased environmental negative impact on the environment. Currently, 20% of the energy consumed in the world is extracted from on-conventional energy sources, and 30% from the fossil fuels.

Nowadays, many researchers and scientists are conducting research on the introduction of advanced technologies and equipment into the heat supply system that can efficiently and economically use energy, fuel and energy resources. It is known that at present, the reserves of natural fuels and energy resources used on an industry are declining sharply, so the use of renewable energy sources allows preserving natural resources and the ecological situation at the current level. Because in the XXI century the world faced two serious problems in the energy sector: ensuring a reliable energy supply and combating climate change. Developing environmental problems, on the one hand, are extremely unstable market of energy resources, on the other hand, the risks of the energy supply system, if it is to be built only on the basis of the use of fuel, given the resource depletion of any type of resources, this can lead to serious problems associated with energy reserves in the future. Collectors have factors affecting the acceleration of heat transfer processes, one of the main types of which is the requirement to install special hollow pipes on the absorption surface of the solar heater. Solar air heaters have low heat transfer properties due to the low thermal conductivity when air passes over a flat surface. [1]

II. LITERATURE SURVEY

The main problem of using air as a heat carrier is its low heat capacity and thermal conductivity, as well as the low cost of the thermal conductivity coefficient between the absorber and air. When using air as a heat carrier, the main task is to increase the heat transfer coefficient. Therefore, using a suitable method of increasing thermal conductivity, they increase the thermal efficiency of solar air purifiers. [2] The heat transfer efficiency of these types of solar air heaters with a flat surface is 14-18% higher than that of collectors with a flat surface

III. RECOMMENDED SOLAR AIR HEATER

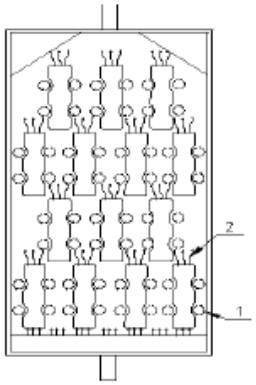

Fig 1: *The movement of air flow in ducts in the air heater with pipelines*

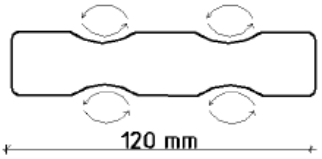

Fig 2: *Air duct*

In solar air heaters with pipelines, the process of heat exchange mainly occurs over a wide range. A boundary layer is formed on the opposite surface of the solar heater pipe, the thickness of which increases in the direction of flow. At some points, a breakdown of the boundary layer from the surface is observed, and two symmetric bends occur behind the pipe. [3]

The case of heating systems for industrial buildings is slightly more complicated than that of heating systems for non-industrial buildings. In residential commercial or process heat applications, the airflow rate through the collector is constant. In heating systems for industrial buildings on the other hand, a recirculation damper system incorporated into the fan compartment mixes warm indoor air with cooler solar collector air to maintain a constant delivered air temperature. The ratio of indoor air to solar air heating system (outdoor) air varies continuously with changes in the solar collector outlet air temperature.[3]

IV. METHOD OF THEORETICAL ANALYSIS

As a consequence, the flow rate of air through the collector varies, and so do the collector efficiency and the temperature rise through the collector. Since it is impossible

to calculate one of the quantities without knowing the other, an iterative algorithm becomes necessary to find the operating point on the curve of *Figure 3.*

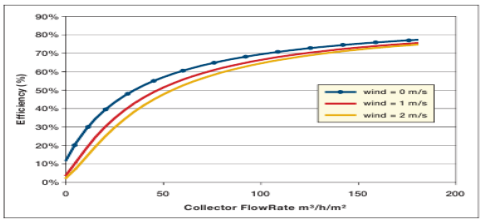

Fig 3: *Solar collector efficiency vs. FlowRate*

For simplicity the RETS screen software program iterates three times. First a suitable estimate is made for the starting collector flow rate $Q_{coll}^{(1)}$. The following equation provides the suitable estimate:

$$\dot{Q}_{coll}^{(1)} = \min\left(1, \frac{7.5}{\max\left(0,\ \left(T_{del} - T_{amb}\right)\right)}\right) \dot{Q}_{design} \quad (1)$$

where

Q_{design} is the design airflow rate through the collector, T_{del} is the desired delivered air temperature for the supply air, and T_{amb} is the outdoor ambient air temperature for the given month.[4]

V. EXPERIMENTAL RESULTS

Table 1. 14.08.2019 15^{00}-15^{30} t=33 °C

№	V_1 m/s	V_2 m/s	$t_{(hot\ air)}$ °C	$t_{(absorber)}$ °C	$t_{(air\ duct)}$ °C
	0.86	0.7	69	79	79
	1.2	0.85	68	78	78
	1.4	0.9	67	77	77
	1.88	1.4	66	76	76
	2.2	1.71	65	75	75

Table 1. 14.08.2019 16^{00}-16^{30} t=32 °C

№	V_1 m/s	V_2 m/s	$t_{(hot\ air)}$ °C	$t_{(absorber)}$ °C	$t_{(air\ duct)}$ °C
	0.86	0.7	69	77	77
	1.2	0.85	68	76	76
	1.4	0.9	66	75	75
	1.88	1.4	65	74	74
	2.2	1.71	64	74	74

VI. CONCLUSION

With the help of a newly developed solar air heater, experiments are required in all periods of the year and based on the results obtained and a mathematical model of the device is developed.

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