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ACTUAL PROBLEMS OF RENEWABLE POWER ENGINEERING, CONSTRUCTION AND ENVIRONMENTAL ENGINEERING

Book of abstracts

Part II

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Participation without presentation

DEVELOPMENT OF SUN AIR HEATERS FOR MODERNIZATION OF GRAIN DRYERS

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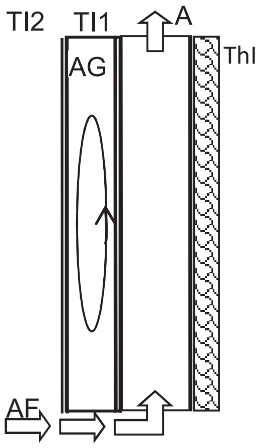
The current state of organization of grain drying requires the transition to new energy-saving, environmentally friendly and accelerated technologies that allow to obtain high quality products. Innovative ways of drying and upgrading chamber dryers are used to reduce energy consumption, reducing fuel consumption by 25-50%.

The purpose of the work is to develop solar air heaters for the modernization of grain dryers. Currently, there are existing developments of solar collectors for heating the air. Their samples are shown in fig. 1.



a)

b)

Fig. 1. Flat air solar collector (SC). a – scheme, b – photo (from internet)
A - absorber (heat sink); TI - transparent insulation; ThI - thermal insulation; AF - air flow; AG - air gap.

The paper proposes a number of solutions for solar air heater. They differ in materials and design of the absorber and insulating transparent coating. A fundamentally new element of the solar air heater is the two-sided washing of the absorber by the flow of air. This increases the efficiency of heat removal from the absorber and lowers the temperature on the silo wall. The method of calculation of heat exchange processes in the solar air of the heater is developed. Design calculations were performed and the surface area of the solar collector was determined.

For the incident solar radiation density E = 630 W / m^2, ambient temperature t = 20 ºC, collector tilt angle φ = 90%, for collector width δ = 0.25 m, wind speed w = 5 m/s, obtained: heat loss from 1 m^2 of collector surface Q_{loss}= 143.9 W, useful heat flow value Q_u = 454.7 W, heat flux absorbed by the plate Q_{abs} = 598.6 W.

The modernized grain dryer is capable of saving gas costs and ensuring the quality of the finished product. A solar air heater for grain drying is created. Directing the heated air directly into the furnace creates the possibility of additional savings (up to 50% or more) of natural gas. When choosing methods and modes of grain drying, it is necessary to take into account its thermo - and moisture resistance, structural and mechanical properties, on which the quality of the obtained products depends.

THERMAL CONDUCTIVITY OF THE WET POLLUTION LAYER ON CONDENSING HEATING SURFACES OF EXHAUST GAS BOILERS

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Additional energy saving by utilizing the exhaust heat in internal combustion engines (ICE) of the thermal power plants (TPP) allows to save fuel. Using of condensing low-temperature heating surfaces (LTHS) in exhaust gas boilers (EGB) allows to increase the economic efficiency and environmental performance of boilers and TPP in the whole. When fuel oils are burnt the intensity of low-temperature corrosion (LTC) increases to 1.2 mm/year at wall temperatures above 130 °C. In the case of water-fuel emulsions (WFE) combusted with water content of $W^{\mathrm{r}} = 30$ % there is a significant decrease of LTC intensity to the level 0.25 mm/year. That makes it possible to apply condensing LTHS at a wall temperature t_{w} below the dew point temperature of sulfuric acid vapors $t_{\mathrm{H_2SO_4}}$ within high working reliability of these condensing LTHS. With this a pollution intensity of LTHS increases, but the condensing heating surface is covered with a layer of wet pollution which is easier to remove.

Experimental researches of pollution intensity at wall temperature values below dew point temperature of sulpfuric acid vapors were carried out at the experimental setup with combustion of fuel oil and WFE (Fig.1).

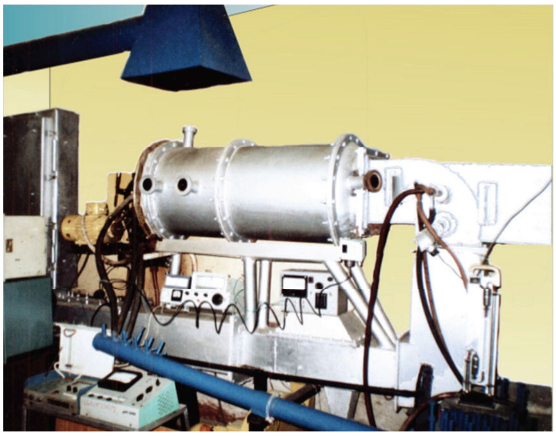

Fig. 1. General view of experimental setup

Fig. 2 shows flushing pollutions during combustion of fuel oil and WFE. When WFE is burnt with $W^{\mathrm{r}} = 30$ % the pollution consists mainly of membrane of sulfates with soot and ash. When fuel oil is burnt with $W^{\mathrm{r}} = 2$ % the pollution consists of soot and ash deposits. Determination of specific mass on pollution external surface of sample tubes was carried out by gravitation method.