IV International Scientific-Technical Conference

6–8 February 2020, Kielce
(Poland, Ukraine, Croatia, Slovakia, Sweden, USA)

ACTUAL PROBLEMS OF RENEWABLE POWER ENGINEERING, CONSTRUCTION AND ENVIRONMENTAL ENGINEERING

Book of abstracts

Part I

KIELCE 2020

6-8 February 2020, Kielce (Poland, Ukraine, Croatia, Slovakia, Sweden, USA)
Under the general editorship Prof. doctor of science Anatoliy Pavlenko

The organizers:
- Kielce University of Technology, Faculty of Environmental, Geomatic and Energy Engineering (Poland)
- Koszalin University of Technology, Faculty of Civil Engineering, Environment and Geodetic Sciences (Poland)
- Ivano-Frankivsk National Technical University of Oil and Gas (Ukraine)
- The European Academy of Education and Science (Ukraine - Poland)
- KTH Royal Institute of Technology, Department of Chemical Engineering (Sweden)
- University of Zagreb Faculty of Metallurgy (Croatia)
- National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" (Ukraine)
- Smart Heat Corporation, Skokie, Illinois (USA)
- University of Žilina Departament of Power Engineering (Slovakia)

Scientific and organizing committee of the conference:
Co-organizers:
- Prof. PŚk doctor of science LIDIA DĄBEK – Faculty of Geomatic and Energy Engineering, Kielce University of Technology (Poland)
- Prof. doctor of science ANATOLIY PAVLENKO – Department of Building Physics and Renewable Energy, Kielce University of Technology (Poland)
- Prof. PK doctor of science WIESŁAWA GŁODKOWSKA – Department of Concrete Structures and Concrete Technology, Koszalin University of Technology (Poland)
- Prof. doctor of science ALEKSANDER SZKAROWSKI – Department of Construction Networks and Systems, Koszalin University of Technology (Poland)
- Prof. doctor of science HANNA KOSHLAK – Department of Building Physics and Renewable Energy, Kielce University of Technology (Poland)
- Prof. doctor of science ENGVALL KLAS – Department of Chemical Engineering (Sweden)
- Prof. doctor of science LADISLAV LAZIĆ – Faculty of Metallurgy University of Zagreb (Croatia)
- Prof. doctor of science MILAN MALCHO – Department of Power Engineering (Slovakia)
- Doctor of science ANDREJ KAPJOR – Department of Power Engineering (Slovakia)
- Prof. doctor of science OLEG MANDRYK – Ivano-Frankivsk National Technical University of Oil and Gas (Ukraine)
- Doctor of science HELEN SKOP – Smart Heat Corporation (USA)
- Prof. doctor of science VALERII DESHKO – National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" (Ukraine)

ISBN 978-83-65719-84-3

Wydawnictwo Politechniki Świętokrzyskiej
25-314 Kielce, al. Tysiąclecia Państwa Polskiego 7
tel./fax 41 34 24 581
e-mail: wydawca@tu.kielce.pl
www.wydawnictwo.tu.kielce.pl

DEVELOPMENT OF HOUSEHOLD COMBINED DEVICES – ABSORPTION REFRIGERATORS WITH HEAT CHAMBERS

T. HRATII, O. TITLOV

Odessa National Academy of Food Technologies
1/3 Dvoryanska Str. Odesa, 65082, Ukraine
e-mail: titlov1959@gmail.com

A promising energy-saving direction for modern household appliances is the creation of devices that combine the functions of refrigerated storage and heat treatment of food products, semi-finished products and agricultural raw materials.

During most household technological processes, the temperature does not exceed 70°C. Only a dephlegmator and a rectifier – elements of the absorption refrigeration unit (ARU) – have such a temperature potential, of all types of modern household refrigeration equipment.

Various schemes of household refrigeration devices with heat chambers have been developed. They differ in: a method of heat transfer; a location of the heat chamber; a constructive design of the heat chamber (single-chamber, two-chambers); a source of waste heat.

The simplest in design is the scheme with an intermediate heat transfer device, which involves minimum design changes in the household combined device and ARU.

Two types of such household combined devices have been developed and researched – with air and liquid heat chambers (HC).

Calculation of the design parameters of HC was carried out at a thermal load of 19-22 W. The thermal insulation thicknesses of the side walls, bottom and top cover were determined as a result of mathematical modeling of unsteady temperature fields. At the same time the following was taken into account: orientation of the camera surfaces and its thermal connection with the refrigeration chamber; design features of HC; the working time coefficient of the serial model of the single-chamber absorption refrigerator "Crystal-408" (refrigerated volume 150 dm^3).

The experimental designs were produced at the Vasil'kovsky Refrigerator Plant (VRP) in Kyiv region.

Geometric parameters of the internal volume of HC were as follows: height – 0.420 m; depth – 0.540 m; width – 0.570 m; volume – 35 dm^3. Thermal insulation thicknesses were as follows: of side walls – 0.080 m; of a bottom – 0.075 m; of a cover, back and front walls – 0.10 m.

To ensure the thermal connection of the lifting section of the ARU dephlegmator with HC, a two-phase thermosiphon (TPTS) was used, 1.2 m long and 0.010×0.001 m in diameter. TPTS body material is stainless steel. The heat carrier is ethanol.

The study of HC thermal conditions was carried out both in stationary and in transient modes of ARU operation. As a result of the research, the optimal length of the TPTS evaporation section was determined – 0.15 m. At the exit of this section, the dephlegmator temperature is 73-76°C. The most favorable conditions for HC were the regimes with increased ambient temperatures – when the heat losses are reduced, and the ARU working time coefficient, as well as the period of heat load supply, increase.

Experimental researches of household combined absorption-type devices created on the basis of the serial model "Crystal-408" of VRP showed that adding the additional heat chamber, which is connected thermally with the lifting section of the ARU dephlegmator, does not lead to growth energy consumption and does not impair the performance of cooling chambers to the design of household absorption refrigerators, which is connected thermally with the lifting section of the ARU reflux condenser, does not lead to increased energy consumption and does not impair the performance of refrigeration chambers.