Increasing efficiency of radiant heating systems' work

Volodymyr Shepitchak[1], Vasyl Zhelyh[2]

[1]Department of Labor Protection, National University Lviv Polytechnik, UKRAINE, Lviv, S. Bandery street 12, E-mail: shepitchak@gmail.com

[2]Department of Heat and Gas Supply, and Ventilation, National University Lviv Polytechnik, UKRAINE, Lviv, S. Bandery street 12, E-mail: v_zhelykh@msn.com

Abstract – The possibility of the application of energy efficient heating systems based on infrared light for heating industrial premises has been analyzed in the article. The experimental studies of temperature condition exposure zone of the rotary infrared heaters. The rotary radiation heater represents the distribution of the exposure intensity depending on the height disposition. The results are presented in graphical interpretation.

Key words: heat, energy-efficient systems, heating, infrared heaters, radiant energy.

I. Introduction

Nowadays one of the most important problem of Ukrainian's industrial system is energy-efficiency. It is vital question of energy saving in the country with limited fuel and energy resources. A large amount of energy expends on creating an artificial microclimate in the premises. The heating of these premises is not an easy task. The large geometric dimensions are typical for industrial premises. In order to create a sense of comfort in these buildings it is important to ensure proper thermal conditions in the work area. Infrared heaters systems are the most economical way to heat these premises. As a result of the radiation only the particular surface of objects are heated. Thus, it becomes possible for purposeful partial heating of different areas of premises or separate workplaces. Besides, after switching on infrared heaters quickly reach rated power level and by that to reduce the time of going into operating duty in comparison with traditional heating systems.

II. The radiant heating system

The necessity of saving and reducing heat consumption leads to an intensive searching of new ways of heating industrial premises. One of such types is heating by infrared heating devices [1].

Radiant heating is one of the types of heating system, in which infrared heaters use as heating source. It can be used as independent or subsidiary type of heat supply.

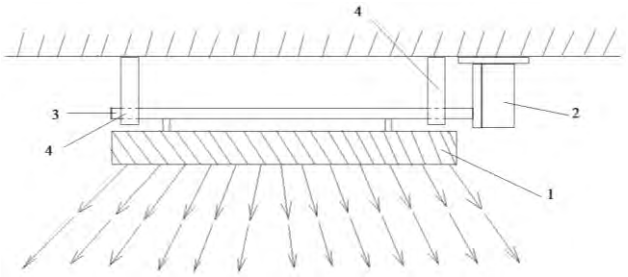
The meanings of the radiancy and the uniformity of the radiant energy's field in work area are important for the use of infrared heating. During radiant heating the area distribution of radiancy of the heat energy isn't uniform [2].

During the use of infrared heating the reducing radiancy depends on the enlarging distance from radiation source. As a result of the calculation of heating with infrared sources it is important to find the point of maximum and minimum radiation intensity in order to ensure proper thermal conditions.

Among all the microclimate supply systems much attention is paid to the highly efficient and energy-efficient technologies. Therefore, the purpose of our investigation is creating the infrared heating system with new structural components and new use of existing heating system which ensure effective and uniform heating that will increase efficiency of work and reduce energy consumption of infrared heaters.

The task is achieved by the infrared heater, which is usually used to heat a specific area of the premises, and that is equipped with electromotor and reducer that is in line with heater. [3]

It provides some rotation around the axis of the radiator, so the efficient and uniform heating of the work area is larger than usually and the result is a reduction of energy consumption.



1 – infrared radiator; 2 – electromotor with reducer; 3 – rotation axis and attachment of radiator; 4 – bearing assembly.

Fig. 1. The infrared heating system of premises with rotary radiator

Fig.1 illustrates the general view of infrared heating system.

Facility consists of the infrared radiator 1, the electromotor with reducer 2, the rotation axis and attachment of radiator 3, the bearing assembly 4.

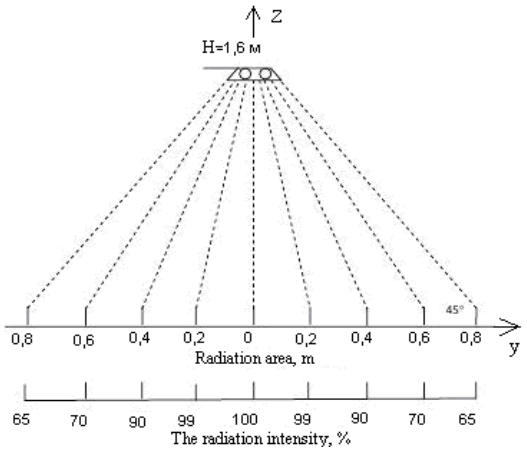
The electromotor with reducer 2 is situated in horizontal line of rotation with the source of infrared radiation which provides uniform and gradual rotation of radiator. In such way the radiant heater effectuates uniform heating of larger work area. By means of bearing assembly all system is attached to the inner surface of premises.

In the experimental facility that consisted of a rotation radiator located at some distance from the floor on stand with changing height, the investigation on the determining the area and distribution of the radiation intensity, depending on the height of the disposition had been done[4].

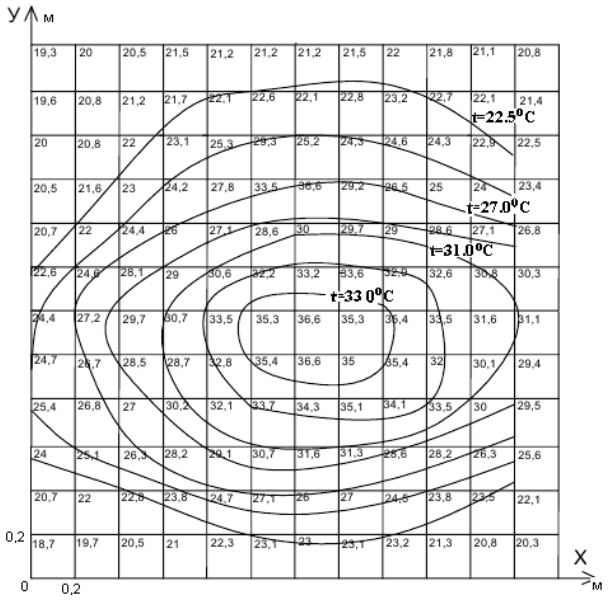
Experimental results are presented graphically and shown in Fig. 2 and Fig. 3.

Experimentally, the heating area is determined with the source of radiant energy that is in a stationary position (Fig. 3a), and the source that rotates in the plane of 90 degree (Fig. 4a). During the experiment the heater was located at a height of 1.6 m.

As shown in figure 2a and 3a the distribution of radiant energy is more uniform during the work of rotary radiator.

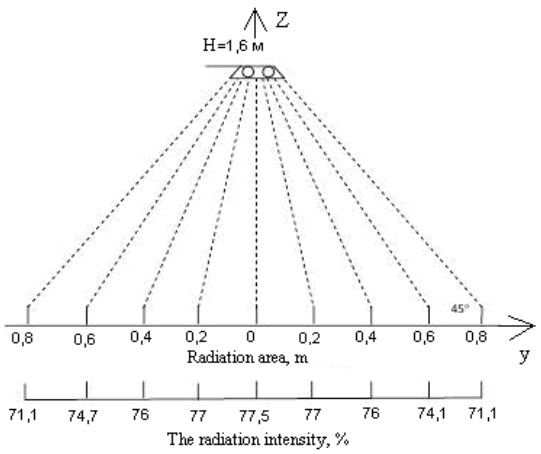


a). The distribution of the radiation intensity

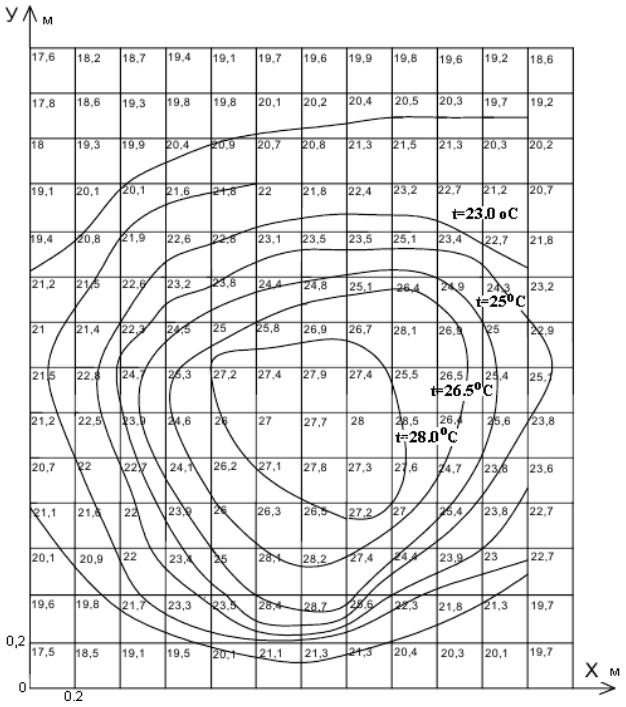


b). Temperature's fields of heating surface

Fig. 2 (a,b) The results of experimental investingations with stationary radiant heater at a height of 1.6 m



a). The distribution of the radiation intensity



b). Temperature's fields of heating surface

Fig. 3(a,b) The results of experimental investigations with rotary radiant heater at a height of 1.6 m

Conclusion

The use of such system provides the increasing of efficiency and uniformity of the radiation energy's field in the work area (Fig. 3),enlarging of the heating's area and reducing energy consumption.

References

[1] A. Khydenko, Radiatsiine opalennia i okholodzenia. [Radiation heating and cooling]. Kyiv: KNUBA Publ., 2004.

[2] K. Bakovski Merezhi i hazove obladnannia [Systems and gas equipment].Vudavnytstvo Naukovo-tekhnichne Publ., 2002.

[3] . Shepitchak, N. Spodyniuk, V. Zhelykh "Infrared heater", UA Patent 81275, Jun 25, 2013.

[4] V. Shepitchak, V. Zhelykh "Eksperementalni doslidzhennia temperaturnoho rezhymu zony oprominennia povorotnymy infrachervonymy obihrivachamy" ["The experimental investigations of temperature condition exposure of the rotary infrared heaters "] -The collection of proceeding Kiev National University of Building and Architecture "Energy-efficiency in civil engineering and architecture, no.4, pp.119-123, 2013.