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THE STUDY OF THE INTENSITY OF INFRARED HEATING SYSTEMS RADIATION

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Summary: The effective heating systems of high industial premises are systems based on the use of electric infrared heaters. The main advantage of them is that they heat only the areas where heating is required.
The purpose of the publication was development of research setting based on the infrared heater for the study of the intensity of radiation surfaces, which was designed the graphics dependence on the results of study.
The results of experimental studies were done concerning the determination of the intensity of radiation surface by the infrared heaters depending on the power and height of their installation.
The researches of the radiation intensity of the infrared heater in non-rotary work mode have been done. The distribution of intensity of radiation by the infrared heater in its rotary and non-rotary work modes was shown.

Keywords: Heating, energy-saving systems, heating systems, infrared heaters, the intensity of radiation.

1. INTRODUCTION

Nowadays the energy-saving systems occupy a key position in the development and the economy of consumer markets and materials. In terms of Ukraine's dependence on natural gas supplies from the Russian Federation there is a need to use alternative energy sources, including the choice of heating systems. The heating systems of the industrial premises are one of the largest consumers of heat energy. The improvement of such systems has the most important meaning for the increasing the energy efficiency of buildings and decreasing the energy consumption to create comfortable microclimate there.
The effective heating systems of high production premises are systems based on the use of electric infrared heaters. The main advantage of them consists in the heating only the areas where it is required. As a result, the use of such heating systems warms only the certain surfaces and objects. Thus, we can achieve the desired thermal condition in different areas or in individual workplaces [1-3]. However, the use of radiation heating system the meaning of radiant energy distribution on the surface is uniform. Therefore, the task is to ensure uniform distribution of heating system on all area of workplace.
The purpose of the publication was development of research setting based on the infrared heater for the study of the intensity of radiation surfaces, which was designed the graphics dependence on the results of study.

2. EXPERIMENTAL SETUP

The construction of heating device was developed for the effective use of the infrared heating system which provides the uniform distribution of radiation intensity and makes the necessary results of infrared heaters [4-5]. The scheme of the device is shown in Figure 1. The device of infrared heating works in following way.
The radiation source is turned on 1, which provides the radiation of electromagnetic waves. The reflector 2 directs the heat rays in the heating zone. The source of radiation 1 with the reflector 2 is fixed immovably to the rotation axis 4. With help of the bearing assembly 6 and elements of fastening 5 the rotation axis is fixed to the ceiling. The electromotor with reducer 3, which are connected with the rotation axis 4, do a uniform and gradual rotation of the radiation source 1, which is set in the reflector 2 at 30-45°.

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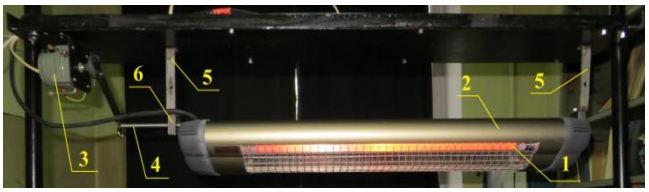


Fig. 1. Device of infrared heating of premises:

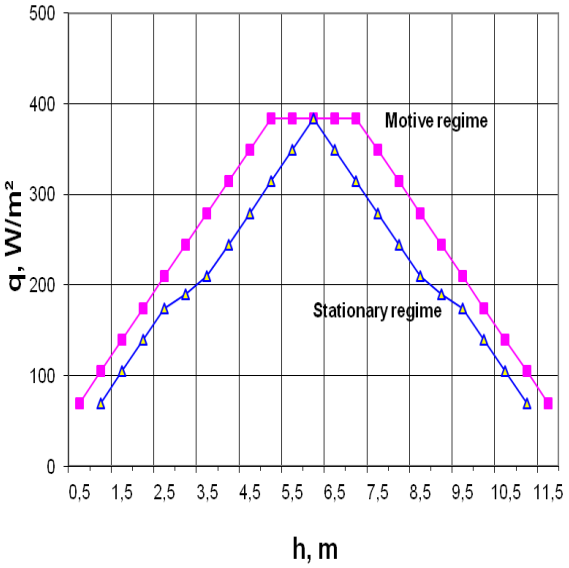
1 - radiation source,
2 - reflector,
3 - electromotor with reducer,
4 - rotation axis,
5 - elements of fastening,
6 - bearing assembly.

Rys. 1. Promiennik podczerwieni do ogrzewania pomieszczeń:

1 - źródło promieniowania,
2 - reflektor,
3 - silnik elektryczny z reduktorem,
4 - oś obrotu,
5 - elementy mocowania,
6 - zespół łożyskowy.

3. RESULTS AND DISCUSSION

The experiments have been done by using an infrared heater power Q = 2 kW. The height of the installation of the heater was variable and was: H = 1,6 m; H = 2,2 m; H = 2,8 m; H = 3,4 m; H = 4 m; H = 5 m. The heating of the surface was done in rotary and non-rotary regime of heating device which was installed in the middle of the room. The Fig. 2 presents the graphical distribution of the radiation intensity on the floor surface, where h represents width of the room.



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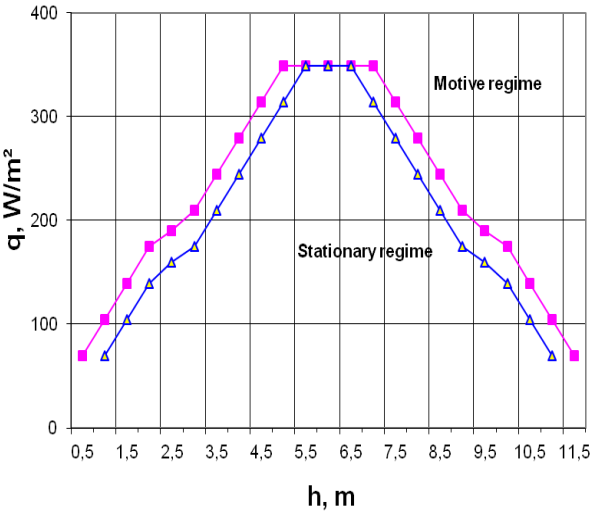

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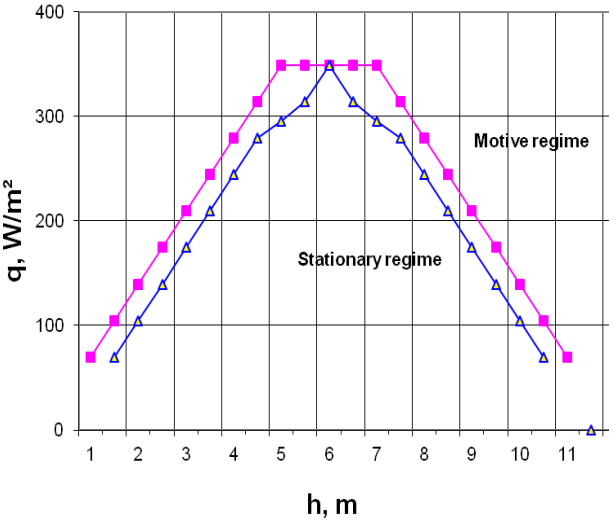

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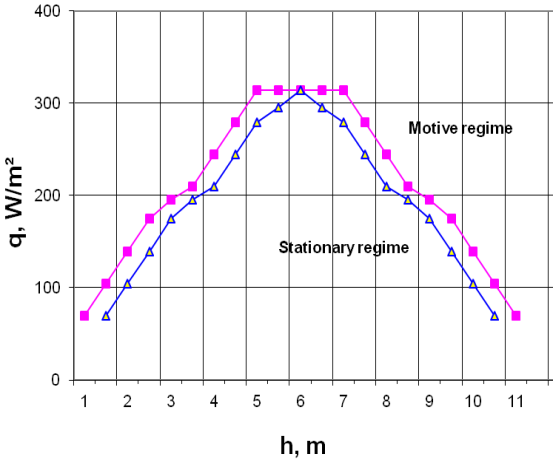

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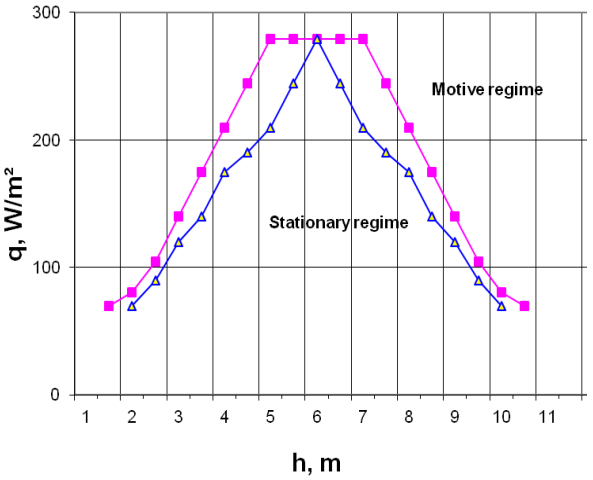

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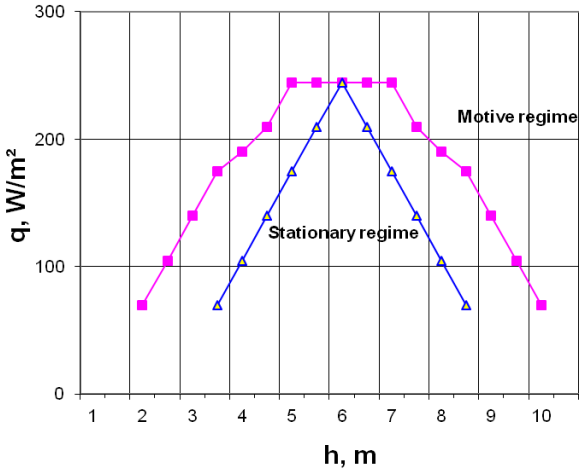

(f)

Fig. 2. The graphical distribution of the radiation intensity of the infrared heater (q, W/m²) in rotary and non-rotary work modes in the height of installation: (a) H = 1,6 m; (b) H = 2,2 m; (c) H = 2,8 m; (d) H = 3,4 m; (e) H = 4 m; (f) H = 5 m

Rys. 2. Wykresy rozkładu natężenia promieniowania (q, W/m²) promiennika podczerwieni, w ruchomym i stacjonarnym trybie pracy na wysokości ustawienia: (a) H = 1,6 m; (b) H = 2,2 m; (c) H = 2,8 m; (d) H = 3,4 m; (e) H = 4 m; (f) H = 5 m

As seen in the graphs, in rotary work mode of the infrared heater radiation area is greater than in non-rotary work mode. The radiation intensity and radiation zone decrease by increasing the height of installation of the infrared heater.

The study of the changing of the radiation intensity of non-rotary infrared heater was implemented. The graphs of the radiation intensity q, W/m², depending on the distance h, in the horizontal axis from the centre of the radiator at its thermal power Q = 1.4 kW and Q = 2.5 kW were drawn (Figure 3).

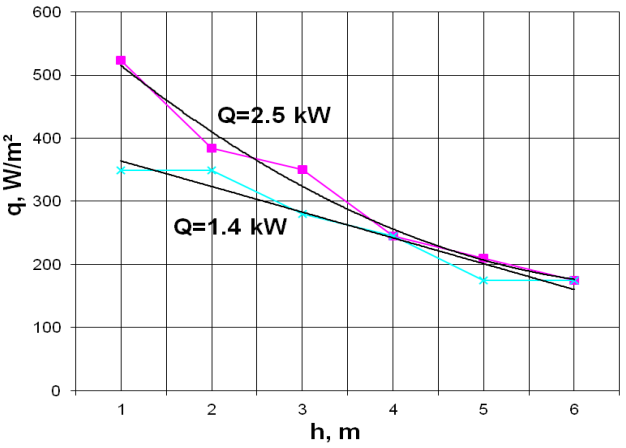

Fig. 3. The graphs of the radiation intensity (q, W / m²), depending on the distance (h, m), in the horizontal axis from the center of the radiator at its thermal power: Q = 1.4 kW and Q = 2.5 kW

Rys. 3. Wykres zmian natężenia promieniowania (q, W/m²), stacjonarnego promiennika podczerwieni w zależności od odległości (h, m), i mocy grzejnika: Q = 1.4 kW i Q = 2.5 kW

As shown in graph the radiation intensity of the non-rotary infrared heater extends to a distance of 6 meters from the centre of radiation. In the extreme point of radiation zone the meaning of intensity is normalized [6-7].

4. CONCLUSIONS

As the result, the device of infrared heating was developed for the effective heating of industrial premises, which ensures uniform distribution of the radiation intensity that increases the efficiency of infrared heaters.

The researches of the radiation intensity of the infrared heater in non-rotary work mode have been done. The radiation intensity of non-rotary infrared heater extends to a distance of 6 meters from the centre of radiation.

The distribution of intensity of radiation by the infrared heater in its rotary and non-rotary work modes was shown and the radiation zone of rotary infrared heater is increased.

BADANIE NATĘŻENIA PROMIENIOWANIA SYSTEMU OGRZEWANIA NA PODCZERWIEŃ

Streszczenie: Efektywnymi systemami ogrzewania wysokich pomieszczeń w budynkach przemysłowych są systemy oparte na zastosowaniu elektrycznych promienników podczerwieni. Główną ich zaletą jest to, że ogrzewa się tylko te obszary, których ogrzewanie jest wymagane.

Celem badań było poszerzenie wiedzy o promiennikach podczerwieni odnośnie natężenia ich promieniowania. Rezultatem badań było opracowanie zależności graficznych. Przedstawiono wpływ wysokości zamontowania oraz mocy promiennika na

natężenie jego promieniowania na daną powierzchnię. Badania te przeprowadzono dla promienników stacjonarnych bez możliwości obrotu. Zaprezentowano również rozkład natężenia promieniowania stacjonarnego promiennika podczerwieni oraz promiennika pracującego w trybie obrotowym.

Słowa kluczowe: Ogrzewanie, systemy energooszczędne, systemy ogrzewania, promienniki podczerwieni, natężenie promieniowania.

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