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THE STUDY OF TEMPERATURE FIELDS IN EXPOSURE ZONE OF THE ROTARY INFRARED HEATERS

The experimental studies of temperature condition exposure zone of the rotary and non rotational infrared heaters have been done. The energy-efficient nature of rotary infrared radiator has been established. In the case of use rotary heaters temperature gradient of the heating surface is lower but the area of exposure is greater than in the case of non rotational heater at the same capacity has been established. This confirms the energy-efficient nature of heating systems that bases on rotary infrared radiators.

Keywords: service area, infrared heater, thermal capacity, microclimate parameters

INTRODUCTION

Industrial heating is a complicated task. In most great height, insufficient heat insulation of external protections, significant replacement of air are typical for such premises. Using traditional water, steam or air systems is technically difficult and economically unprofitable. In large premises work area, where it's necessary to create a microclimate, usually has a height of 2 m. It is about 20÷30% of the total volume. The results of the domestic and foreign scholars' recent research suggest that the most effective way of industrial heating is the use of infrared systems. The principle of work is based on local heating by radiation. The radiant heating is heated only that area where the heating is required. As a result, due to radiation it's heated only individual objects. Thus, we can achieve different heating zones of premises or separate working positions.

1. THE AIM AND TASKS OF RESEARCH

The experimental studies of temperature condition exposure zone of the rotary infrared heaters at different heights of its installation.

2. EXPERIMENTAL RESEARCH AND ITS ANALYSIS

Radiant heating is one of the variety of the heating system, where the infrared radiator isused as a source of heat. It can be used as an independent or complementary kind of heating.

During the use of infrared heater is important the density and uniformityof the field of radiant energy in the work area. So, during radiant heating the distribution density of the heating energyin area the surface of exposure is not uniform. The density of radiant energy is the largest on the vertical axis under the source of exposure and decreases towards the border of the irradiated surface.With increasing height of the radiator disposition the density of radiant energy at the surface decreases. By that means, the calculation of heating with infrared sources it is necessary to find the point of maximum and minimum intensity of radiation in order to ensure proper temperature regime [1].

Even distribution of radiant energy at the area can be achieved by the disposition of radiation devices and the distances between them. In order to achieve greater economic impact and a better distribution of energy during the use of infrared heating, series of experiments have been done with the use a rotary radiant heater (Fig. 1) [2].

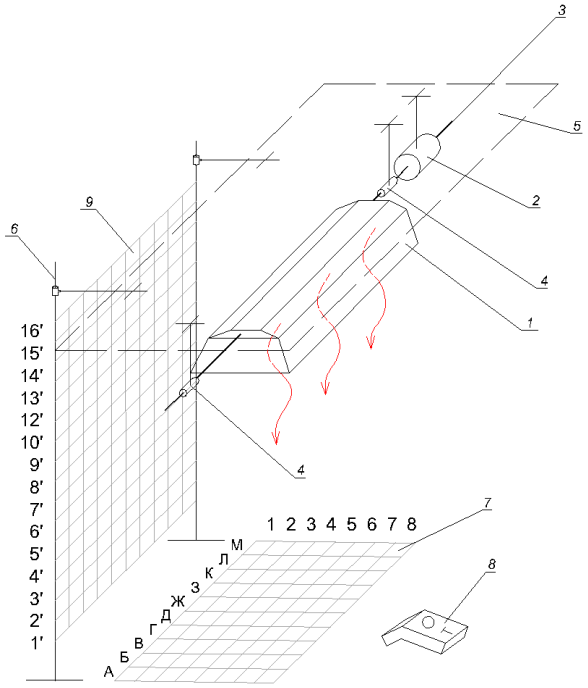

Fig. 1. Experimental facility for determining the temperature fields exposure zone:
1 - the source of infrared radiation; 2 - electromotor with reducer; 3 - rotation axis; 4 - bearing assembly; 5 - fastening surface of infrared radiator; 6 - stand; 7 - surface of exposure; 8 - pyrometer; 9 - coordinate grid

The research was done in the experimental facility, it consists of the rotary radiator, which is located at some distance from the floor on a stand 6, to determine the temperature fields exposure zone 8, depending on the height of the disposition. [3]. There was used infrared source power 2 kW, which heated surface with a certain degree of blackness. Heater was located at two different heights - 1,9 m, 2,8 m.

The facility (Fig. 1) consists of the infrared radiator 1, the electromotor with reducer 2, the horizontal axis of rotation 3, rotation of the bearing assembly and fastening system 4. The electromotor with reducer 2 is situated in horizontal line of rotation with the source of infrared radiation which provides uniform and gradual fluctuation 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 base 5.

Thus, it was determined the temperature fields radiaion source of the radiant energy which is fixed Figures 2a, 3a and the source which turns in the plane of 90° Figures 2b, 3b.

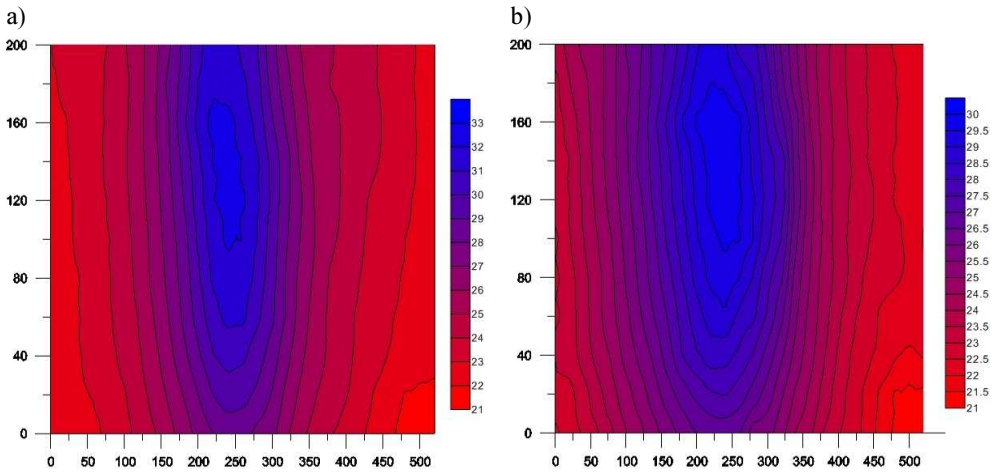

Fig. 2. The distribution of the radiation intensity radiant heater at a height of 1,9 m:
a) the temprature field of heating suface in the non-rotary regime,
b) the temprature field of heating suface in the rotary regime

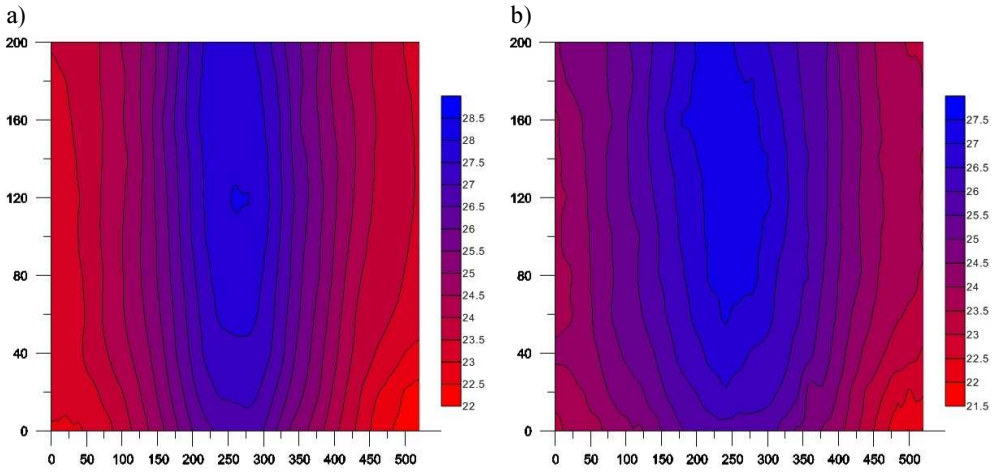

Fig. 3. The distribution of the radiation intensity radiant heater at a height of 2,8 m:
a) the temprature field of heating suface in the non-rotary regime, b) the temprature field of heating suface in the rotary regime

As shown in Figure 2a, the radiation plane using fixed infrared source maximum temperature difference in the surface of exposure is about 12°C and the distribution of the density of radiant energy is uneven. In the same conditions, but the rotary regime - the maximum temperature difference is around 9°C, and as it is shown in Figure 2 b the distribution of the radiation intensity is more uniform.

With the increasing height of the radiator heating area increases too. Decreasing temperature gradient in horizontal plane and the radiation intensity becomes more uniform (Figs. 2 and 3).

Thus, the use of such kind of source of infrared radiation permits to increase the heating plane and to achieve more uniform distribution of thermal energy. Rotary heater permits. Rotary heaters permit to set more energy-efficient nature maintaining the temperature regime of working areas.

CONCLUSION

The experimental studies of temperature condition exposure zone of the rotary and non rotational infrared heaters have been done. The energy-efficient nature of of rotary infrared radiator has been established. The temperature fields in cases of setting the infrared radiator at a height the 1.9 m and 2.8 m from the surface of exposure have been received. In the case of use rotary heaters temperature gradient of the heating surface is lower but the area of exposure is greater than in the case of non rotational heater at the same capacity has been established. This confirms the energy-efficient nature of heating systems that bases on rotary infrared radiators.

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STUDIUM PÓL TEMPERATURY W STREFIE EKSPOZYCJI OBROTOWEGO GRZEJNIKA

Wykonano badania eksperymentalne stanu temperatury w strefach ekspozycji obrotowych i nieobrotowych promienników podczerwieni. Wykazano energooszczędny charakter obrotowego promiennika podczerwieni. W przypadku użycia grzejników obrotowych gradient temperatury powierzchni grzewczej jest mniejszy, ale obszar oddziaływania jest większy niż w przypadku grzejnika nieobrotowego przy tej samej wydajności grzejnika. Potwierdza to istotę systemu energooszczędnego grzewczego, która opiera się na obrotowych promiennikach podczerwieni.

Słowa kluczowe: obszar usług, promiennik podczerwieni, moc grzewcza, parametry mikroklimatu