THE ISSUE RESEARCH RELIABLE OPERATION OF THE WITH MAGNETIC LIQUEFACTION LAYER

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The article presents the results of studies of thermal modes of vehicles with magnetic liquefaction layer mehanoaktivatory The electromagnetic (EMMA). The results of experimental studies of thermal modes of vehicles representing the subject inventions. It is proved that the high power EMMA require forced cooling. For heavy thermal modes of EMMA, a system of forced cooling with coolant circulation by means of built-in or having an independent fan drive. It was found that the product temperature at the exit of the device (when operated at rated speed and steady thermal state) does not exceed the permissible values of the respective technological requirements dispersion of semi-finished chocolate production.

Keywords: reliability, thermal conditions, magnetic liquefaction layer.

Introduction

Requirements for reliable operation of the apparatus with a layer of magnetic liquefaction requires a determination of the thermal regime of the field winding and aggregate working volume in the design [1] Also, as in electric machines and other electromagnetic mechanisms to secure for such calculations require the experimental determination of the temperature of the individual elements of devices, both stationary and non-stationary modes in. Using a simplified model of the temperature field can analytically determine the temperature of the most important elements. Based on the experimental results can then be determined coefficients in the analytical solution that allows to produce heat sufficient accuracy calculation devices of the same type, but having other dimensions.

The aim of the study it is to increase the reliability of the EMMA by providing predetermined conditions for the production of thermal modes.

Material and research methods. The object of the study are thermal conditions EMMA work.

Results and discussion.

During experimental studies starred characteristic $\theta = \varphi(t)$, by which determines the maximum steady-state temperature θ_m housing and the heating time constant T analyzed device. Electrical test bed EMMA scheme is shown in figure.1[2]. In determining the values of T to use the basic property of exhibitors, according to which an arbitrary point on the line subtangent $\theta = \theta_m$ for the time constant (Figure 2).

It was found that for the nominal mode EMMA-1 [3,4] (B=0,37 Тл, n_1=23,5 с$^{-1}$) steady thermal state reached at $\theta_{\delta 1} = 48\ °C$ through time T_1=60 minute. The corresponding values for the EMMA-2 in operation (B=0,3 Тл, n_1=22 с$^{-1}$) up: $\theta_{\delta 2} = 46\ °C$, T_2=50 minute. The error, which is characterized by the difference between the established and the current values of the temperature rise is approximately 4% at t=3T, 1,8% at t=4T, 0.7% at t=5T.

It was found that the product temperature $\theta_{ПР}$ the output of the devices during their operation at rated speed and steady thermal condition does not exceed the permissible values corresponding to the technological requirements of the dispersion of semi-finished chocolate production and is as follows: for ЭММА-1 $\theta_{ПР}$ =65°C, for ЭММА-2 $\theta_{ÏÐ}$ =61°C.

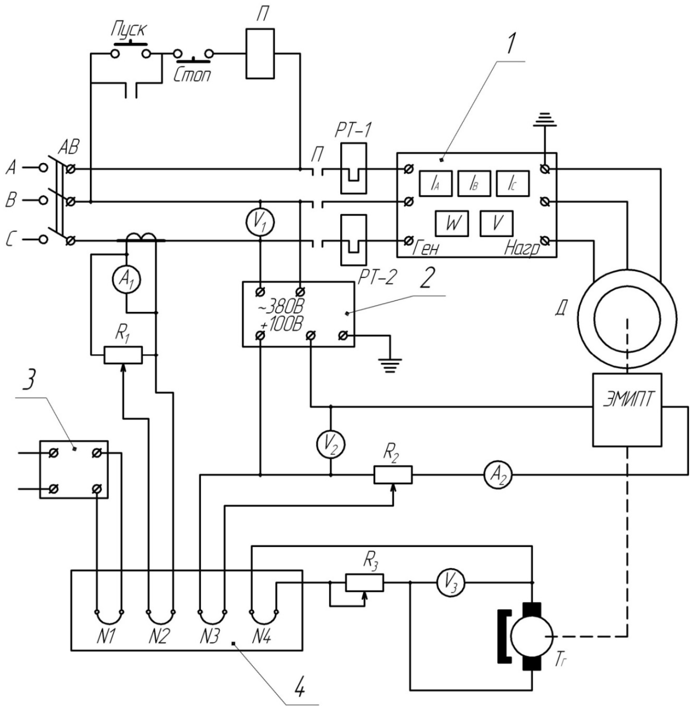

Figure 1-Schematic diagram of the test stand EMMA [2]

Comparative analysis of experimental and theoretical data conducted for the whole range of research of temperature modes of EMMA different structural modifications has shown that the underlying heat calculation formula

$$\theta = \theta_{ð}\left[1-\exp\left(-\frac{t}{T}\right)+\theta_0\exp\left(-\frac{t}{T}\right)\right]` \tag{1}$$

$$\theta_{PO} = \theta + \sum_{i=1}^{n}\Delta\theta\ ,$$

$$\theta_{PO} = \frac{P_{УТ}+P_{2T}}{S_n h_K}\left(1-e^{-\frac{t}{T}}\right)+\sum_{i=1}^{n}\frac{b_n\left(I_y^2 R_{y0}\frac{\rho_H}{\rho_0}+\frac{1}{2}K_M P_\tau S_P h n_1\right)}{\lambda_n S_n}+\theta_0 \tag{2}$$

(здесь $\theta_{Ðî}$ - the temperature in the working volume shredders; S_n и h_K - respectively external surface area of the chopper housing and the heat transfer coefficient (h_K =16…20 Вт/м^2); λ_n, S_n, b_n - respectively the thermal conductivity of the material, thickness and surface area of the n-th portion) give a maximum relative error of not more than 14% for the operating temperature ranges of 25 ... 110 ° C, which does not exceed the accuracy of such measurements conducted.

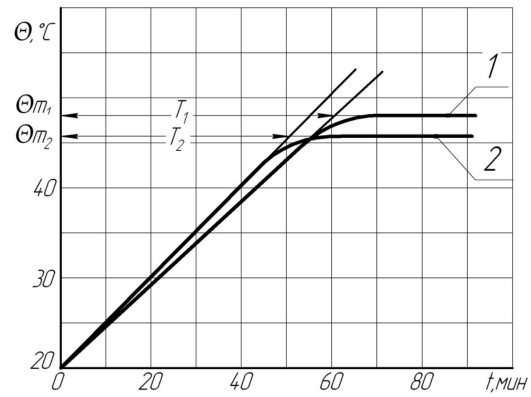

Figure 2 - The character of Emma heating processes

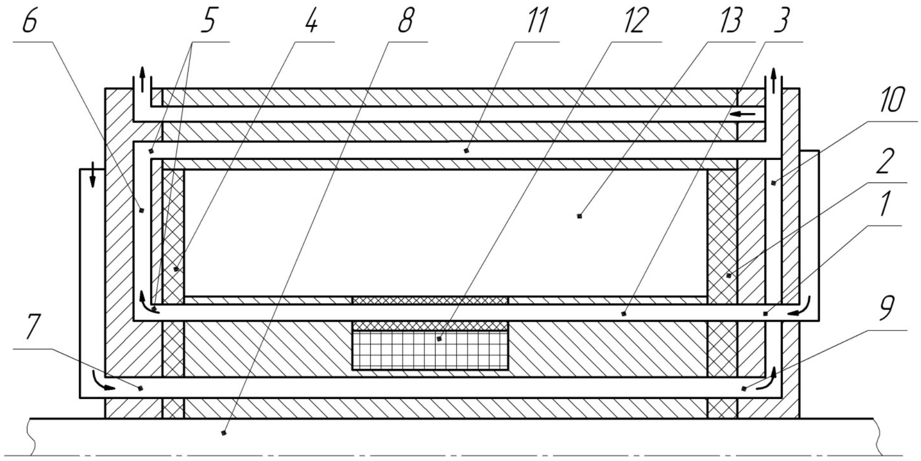

Figure 3-Schematic diagram of the forced cooling system EMMA

EMMA high power require forced cooling, circulation of the cooling agent in the built-in or having an independent fan drive. For heavy thermal modes of EMMA, a system of forced cooling, the concept of which is shown in Figure 3. At the end faces of the outer casing of the EMMA placed special pipes, lead-in air from outside the fan to the axial channels of the two systems the duct device. From the fan and the first nozzle special air system flows through axial ducts in the one end cap sealing the space 2. Hence, through the axial channels inside the rotating part 3 enters the space in the seal 4 the filler. From this space 5 along the axial and radial channels 6 in the outer cylindrical body EMMA air out into the surrounding space. In another system the air duct from the fan and pipe connected thereto enters the axial channels 7, which through a space between the seal end face of the outer shell and the inner cylinder device through axial ducts 6 goes into the space in the seal opposite portion EMMA. It is found that air is passed through the channels it provides sufficient cooling performance and the working volume of the filler, and the control winding current streamlined.

Conclusion

The research results of thermal conditions allowed EMMA design reliably working for the needs of confectionery production [2].

Literature

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