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MATHEMATICAL MODELING OF THE RAPE GRAIN THERMAL PROCESSING IN A DENSE LAYER USING INDUCTION HEATING

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Recently there was a clear trend of pre-heating oil raw material before it is fed to the compression. Providing the recommended temperature increases the yield of oil and extends the life of the processing equipment. The advantage of this technology is the uniformity of heating the disperse material in the layer under continuous stirring. But the technical realization and hardware implementation of the conductive heating method on the disc heating surface reduces the energy efficiency of the process because of the heat loss of natural convection and radiation into the environment and the vessel wall. In addition all drawbacks of element electrical heating of working surfaces are presented.

The heat balance in the dynamics for an infinitesimal element of the heater filled with disperse material moving along the heaters (while stirring) for each of the following dynamic elements: the rod, the grain material, the air (the space between the grains), the body of the unit, inductor winding, we can write (for height *dx* of the elementary volume in the direction of material movement).

Thus, the modeled object is represented by four dynamic elements – thermal capacitances.

Before opening the components of heat balance equations we take the usual one-dimensional case simplifying assumptions:

- temperature gradient over the cross section (radius) of the material flow, rods, the frame and inductor walls has a very small (minor) value and it can be neglected, i.e. contribution of the thermal conductivity to the calculations will be negligible compared to the effective heat transfer, thereby we accept a uniform temperature field along the radius of the chamber, which reduces the dynamic problem to one-dimensional case;

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- heat transfer by conduction in the direction of material flow is negligible and can be neglected;

- thermal parameters of all elements of the object does not depend on the temperature and time;

- heat generation in the first approximation is assumed to be constant;

- given the intense heat supply and mixing of the material by heated rods, the temperature of the individual grains to be the same on the surface and in the center;

- the effects of radiation, conduction in the space between the rods and the convective heat transfer are taken into account due to the heat transfer coefficient:

Using the resulting mathematical model to identify the rape grain temperature in a channel with a ferromagnetic rods, which are heated by the induction method. Experimental data are given in.

We substitute the thermal characteristics of rape grain from the source to the obtained mathematical models. For the preliminary calculation we take the assumption that the material moves only under the influence of gravitational forces, and the ferromagnetic rods do not move. The result is the dependence of rape grain temperature change along the length of the unit frame and the dependence of rape grain temperature change of grain *tz* and the heater temperature Θc in time

It is developed improved mathematical models of the dynamics of disperse material heating in a moving layer with uniformly placed heat-generating elements with not previously taken into account factors (types of heat transfer, evaporation), which link the design and operational parameters of installation and allow us to determine the static and dynamic characteristics of the object.

The resulting mathematical model describes the process of rape grain heating with sufficient adequacy and allows you to determine the theoretical values of the grain temperature and the temperature of ferromagnetic rods for various technological modes of thermal processing installation operating.