The Technical Solution for a Laminated

Coating on a Rounded Surfaces

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Abstract

Posed the problem of producing a multilayer coating on the surface of the spherical form. Suggested solution to this problem. A mathematical model describing the process of work and the optimal values of the significant factors.

Keywords: coating, device, applying

Introduction

Introduction of intensive industrial technologies in construction, mechanical engineering, medicine, agriculture, the food industry provides sharp increase of requirements to quality of drawing multilayered coverings on bodies of a spherical

form. The uniformity of drawing a mantle without damage of initial object and compliance of a form and the sizes to the given parameters are regulated as quality indicators. In this regard it is possible to formulate the problem, facing science and equipment – creation of devices providing technological process of coverings drawing with the given quality.

Methodology of the research

Authors developed and theoretically proved the device (figure 1) allowing to receive during the work to 98% of qualitatively processed material [2].
The device works as follows: powder for a covering is loaded into the batcher bunker 4, located on a frame 1. From where it comes to the drum 8 through a bore 6 in a drum cap. Supply of powder is regulated by means of the gate 5 and a vibrotray 3, and its frequency − by means of station launcher 2. Previously prepared material is loaded into the drum 8 via the top closed hatch. The fan 9 is turned on, and then the drum 8 is rotated. The glue solution is given from measured capacity through a bore in a cap of a drum, alternating giving the glue and powder before obtaining the size conforming to requirements of the standard. Then unload via the hatch 7 [1].
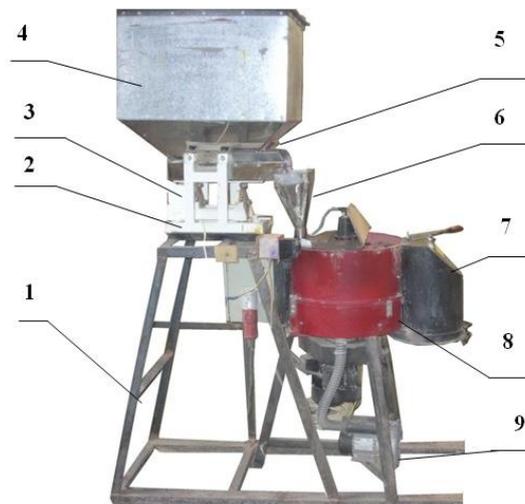

Figure 1 – A general view of the offered device:
1 - frame; 2 - station launcher; 3 - vibrotray; 4 - bunker; 5 - valve; 6 - a bore in a drum cap; 7 - unloading hatch; 8 - drum; 9 – fan

For the purpose of determination of optimum parameters of the developed device the matrix was made and the eliminating experiment was made, three most significant parameters were allocated: n (h1) – rotary speed (a drum bottom),

mines-1; V (h2) − loading of a drum, %; t (h3) − operating time, min. Further authors made multi factorial experiment with criterion of process optimality − % of high-quality processing.

The optimum amount of the working liquid given on material has great importance for receiving a qualitative covering. For definition of this optimum ratio λ one-factorial experiment was made.

The research results

After computer processing of multiple-factor experiment results in the Excel 2003 and Statistica v.6.0 programs adequate mathematical model of the second order in the decoded look was received:

$$Y = 11{,}72197 + 0{,}15922n − 1{,}86435V − 0{,}58422t − 0{,}00007n2 − 0{,}51977V2 + \\ + 0{,}01823t2 + 0{,}00421nV − 0{,}00051n\,t + 0{,}06465V\,t.$$

On the basis of the model analysis factors optimum values were defined. So for the parameter of optimization of 98% it is necessary to reach the following values of factors: to rotary speed of a bottom of the n=1181,46 mines-1 reel, t operating time = 14,53 min. and extents of loading of the reel V = 5,19%.

As a result of processing of results of experiment by definition of optimum working liquid amount λ dependence of high-quality processing number P on a solution ratio was received.

$$P = − 1.3988\,λ\,2+13{,}256\,λ +84{,}4583$$

Apparently from dependence an optimum ratio of working liquid will be 1,2 … 1,3 at which 98% of material will be processed. With reduction of working liquid ratio all material will not be processed, with increase λ the quantity of deviations in sizes increases (material sticks together).

Conclusion

As a result of the conducted researches by authors optimum parameters of the developed device were proved. Observance of recommendations given by authors will allow to receive quality of drawing coverings on spherical form bodies within 98%. All this testifies to expediency of this device use.

References

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[2] Pat. №97238 RU U1MPK A01S 1/00. Apparatus for pelleting seed; 25.05.2009 stated. Publ. 10.09.2010, Bull. №25. - 3.