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MODELING OF WORK FOR TECHNOLOGICAL EQUIPMENT AT OVERLOAD OF DRY MATERIALS ON OPEN STACKER

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There is made the modeling of working process technical equipment for transshipment of bulk materials in the ore yard of metallurgical enterprises. The conclusions derived of concerning the rational arrangement of ore-bucket-transfer in the warehouse during the issue of domain supply of raw materials on the blast furnaces and the sinter workshop. On the basis of the developed model can be carry out researches of the changes in production capacity effect and technological features of the equipment on its workload.

Key words: charge, stack, ore-bucket-transfer, operating mode, performance, modeling.

One of factors, which influence on quality of preparation processes for raw material to pelictizing or redistribution there are processes, related with organization of technological equipment works depending on its characteristics and operating parameters.

At the supply of raw material on a metallurgical plant by the first stage of it preparation are processes of overload, averaging and presentation to the receiving bunkers of sintering and blast-furnace workshops. These processes are executed on stackers (ore courts) of open or closed type with application of the special mechanisms of continuous and cyclic action [1].

The features for application of mathematical description of processes of overload and supply of raw material from sracker to the basic metallurgical work-shops on the basis of balance approaches will be conditioned by the type of technological equipment which is used for the decision of concrete tasks of production.

The basic task of stacker work is providing of production the given quantity of charge materials:

$$\sum_{j=0}^{nk} \int_{0}^{t_{w2}} q_j dt \Rightarrow \sum_{i=1}^{nm} \int_{0}^{t_{w1}} q_i dt \ , \qquad (1)$$

where q_i is a requirement of workshop in i component of charge, tons/hours; q_j is the productivity of *j* ore-grab transfer (OGT), tons/hours; t_{w1} is time of the use of materials of charge in a production, hours; t_{w2} is burn-time of OGT, hours; i is an quantity of materials types ($i = 1…nm$); j is an quantity of simultaneously working unloaders ($j = 0…nk$).

From equation (1) evidently, if $\sum_{j=0}^{nk} \int_{0}^{t_{w2}} q_j dt < \sum_{i=1}^{nm} \int_{0}^{t_{w1}} q_i dt$, then for a 100 % loading of technological equipment, production does not provide the necessary quantity of mate-

rials. For terms $\sum_{j=0}^{nk}\int_{0}^{t_{w2}} q_j dt > \sum_{i=1}^{nm}\int_{0}^{t_{w1}} q_i dt$ a production is provided by the necessary quantity of materials, but a technological equipment is not used on complete power.

For determining the quantity of material ($\sum_{n=1}^{nb} Q_n^{á\_use}$) which is in the bunkers of domain and sintering workshop used a formula:

$$\sum_{n=1}^{nb} Q_n^{á\_use} = \sum_{n=1}^{nb} Q_n^{á\_rest} + \sum_{j=0}^{nk}\int_{0}^{t_{p2}} q_j dt \ , \qquad (2)$$

where $\sum_{n=1}^{nb} Q_n^{á\_rest}$ is a quantity of materials, which remained in bunkers at the moment of time $t = t_{w2}$.

During the overload for materials from stacks they have a several ($Q_m^{st\_rest}$) quantity which is determined with use a formula:

$$Q_m^{st\_rest} = Q_{ò}^{st\_use} - \sum_{j=0}^{nk}\int_{0}^{t_{p2}} q_j dt \ . \qquad (3)$$

At the modeling of process of overload of materials it is necessary to take into account also next limitations:

- a presence in stacks of the least of material $Q_m^{st\_use} > Q_m^{st\_min}$, which is determined by the parameters of stack, and also in high layer which can take a clamshell after the effective use of his volume is by the condition of permission to carry out unloading of materials from its;

- at implementation of overload for materials of OGT can occupy certain the next condition of position in relation to stacks:

$$K_j = {}^{3}, \text{ if } K_{j+1} \neq {}^{3} \text{ or } K_{j+2} \neq {}^{3}, \text{ or, } \ldots \text{or } K_{j=nm} \neq {}^{3} \ , \qquad (5)$$

where K_j is position of *j* OGT relatively *i* stack;

- the technological operations of OGT execute during time, that determine as a difference between time of change-out and sometimes, that it is necessary for the crossing of unloaders and them technological service during a change-out:

$$t_w = t_{sh} - t_{c.m.} - t_{ï} \ , \qquad (6)$$

where t_{sh} is general time of change-out, hours; $t_{c.m.}$ is time, necessary on technical maintenance of equipment, by hours; $t_{ï}$ is time, necessary OGT on crossing, hours.

In the software environment of «MatLab» applience of «Simulink» executed development of model for overload process of charge materials by OGT and control system by work of OGT, which allowed depending on initial values to investigate work of technological equipment and execute conclusions in relation to efficiency of its use. Data-ins in a model are: the state of OGT (worker or not worker), their productivity and initial position in relation to stacks, initial and minimum quantity of dry materials in stacks, which an overload is settled; a requirement of production is in every type of materials. For introduction to the system of running time and for count-

ing out of time intervals in a model used the blocks of «Clock» and pulse of generator. As a result of model work running positions of faucets (the overload of materials is carried out from stack) and changes of quantity of dry materials in a stack at their overload, and also running value of task for production are represented.

For description of logic for work of OGT it is worked out «Stateflow-diagram», in which due to support of parallelness of implementation of operations executed by modeling of overload of materials three simultaneously working OGT and control system by the location of unloaders in relation to stacks. In a model there were certainly the states: forming of task on the overload of materials, definition of initial data, work OGT and calculation for outages of equipment.

If all conditions of passing to the second stack are executed, then to off-load the transfer begin to upload material from it after an algorithm, analogical to work on the first stack. After work on the second stack of OGT it is possible to move to the first or on the third stack, here check up conditions, described before. Other OGT work after analogical algorithms.

Conclusions. As a result of construction of overload model of dry materials on open stacker of metallurgical plant influence is investigated on the work-load of OGT for tasks of production. For providing of running productive necessities it is necessary to use technological equipment the productivity of which not less than put in a task. To that it is not enough to provide total accordance of quantities of material, but necessary, that a task after every independent stack did not exceed the productivity of OGT, which overloads material from it.

Thus, the worked out approach allows to estimate the work-loads of OGT during planning of stacker sector, and also to determine rational distribution of technological equipment on operating stacker.

LIST OF LITERATURE

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