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Basics of control system material in iron foundry

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Abstract

The article is taking into account problems of preparing the production of cast-iron casts with reference to correctnesses functioning of processes supplementing, containing elements the system of supply necessary materials and the tool used in order processing production. Methods and chosen models realization elements of production process and their influence on the efficiency process were characterized.

Keywords: Planning, Foundry, Moulding Sand, Cast-Iron Scrap

1. Introduction. Characteristics of the supplying process

Casting plants irrespective the assortment of production are buying indispensable materials on the market for producing products in accordance with orders of customers and requirements system of quality assurance. Often, depending on the kind and the quantity output, number of items selected is very big. Therefore supply decisions must be taken very carefully, including their significant effect to economics, and especially to the level of costs and reached profits.

Planning and steering material stores in the iron foundry, he constitutes combining such scopes into one comprehensive system as predicting and add determining sizes of orders dates of materials, determining the size of batch, determining moments start-up and size of supplies in magazines and process of producing. Planning material needs is playing the significant significance particularly in case of the demand for materials, raw materials, parts to productions, to which the demand depends from the demand for an determined end product. Planning and steering material stores in iron foundry, from a point of view production companies and service the planning includes:

- materials directly applied for the completion of planned production or the service in foundry, like e.g.: casting instrumentation, moulding sand, casting salad, cast-iron scrap,
- auxiliary materials needed for correct holding a production cycle, like e.g. modifiers, protective covers to forms, the spare parts for machines and devices, etc.

2. Chosen methods of planning material needs in iron foundry

At the choice method of planning material needs in foundry general various factors, particularly a type of production are being taken into account (mass, serial or individual) and length associated with it of the cycle of the production [1]. They are also playing an important role:

- scope of consuming materials applied for the direct production (casting salad, moulding sand) and of auxiliary materials, coal dust,
- add the source of purchase materials and conditions associated with it.

Exchanged factors indeed affect character of planning and accuracy of arrangements of the plan of supply. Material needs (Pm) appoint three basic components: planned consuming materials – Pż, set safety stock – Z_B, real supply for the start of the period embraced with plan – Z_P.

Between these elements the following relation is occurring:

$$P_m = P_{\dot{z}} + Z_B - Z_P \tag{1}$$

Planning consuming materials is a base planning material needs. Depending on character of consuming materials (basic or support materials) various methods and techniques of planning are being exploited. Consuming the basic materials essential for planned production is determined on the basis of production programs and the structural structure of products and consumption standards [4].

Of building blocks in case of installation processes understood as linking (e.g. of details, sub-assemblies or teams) into the product a material list constitutes the ground for estimating consuming materials. It is the description of the complexity selected by developing his structural, and then adding elements repeating itself up and single putting them in the description [4]. The material list is appearing in two varieties: analytical, where materials are being sorted according to sub-assemblies in which they are appearing and synthetic which all materials being included in a ready cast are included.

Consumption standard, being an important factor influencing developing directly sizes of consuming materials, should be based on technical premises. On that account for calculating individual consumption standards appropriate formulae taking into account of property materials and technological processes are applied. Every norm is based on the same principle: a matching size of justified losses and technological waste needs to add the sum of extras to amount material a product contains which.

A safety stock is a next element the plan of material needs. He determines the amount of given type material essential to provide with the continuity of production in the period between two next supplies. In case of regulating the supplies it is supply of specific material accepted as the norm for the given period. The need of keeping the determined level of supply results from the instability of provoked e.g. activity conditions enterprise with the changeability demand for materials, the unevenness and the nonrhythmicality of supplies. From here many enterprises are keeping the certain size of the supply as the buffer or the safety stock in the case of appearance disruptions in the completion supplies or mistakes made at forecasting the demand.

And so establishing the level safety stock is becoming the substantial matter. To this purpose it is possible to use the following resources:

- based on the length of delivery time for reconstructing the state of supply,
- based on using the theory of statistics.

In the first case on basis of data from past an average demand for material is settling accounts in period between two supplies as well a maximum demand for products is being estimated [5].

The level of the safety stock must be in addition so big as to cover the difference between the average and maximum demand. This way so it is possible to describe level of safety stock as the function of the time new delivery:

$$Z_B = (P_{\max} - P_0) \cdot T \tag{2}$$

Z_B – level of safety stock,
P_{max} – maximum demand per unit of time,
P_0 – expected demand per unit of time,
T – delivery time.

For them the shorter, all the smaller delivery time of materials can be level of the safety stock. In the second case he is betting that the level of safety stock depends on the size of mistake, forecasting and the plausibility of his address [6, 7]. Add the probability that the magnitude of the demand will exceed the given level of supplies during the given cycle, he is settling with the help of the normal distribution. In practice industrial is abiding increasing simplified ways of estimating level of the safety stock about sure about the per cent size delivery, e.g. for strategic materials 10, 20%, remaining materials about 5%. With source and the formation for determining real supplies is feeling report the state of materials drawn up on the basis conducted control the state of materials.

Being characteristic different ways and methods the planning it isn't possible to forget MRP about the method of planning material needs on the basis forecast demand or orders of customers called method. elements of this method are leaning against forecasting to which exclusively a demand for finished articles is reporting (independent demand). However material needs (dependent demand) are being calculated directly on the basis structure in product. A division into needs is an important component of proceedings gross and net. Gross needs are needs of products within the scope of materials and elements resulting from the efficient production plan and different standards; they determine the kind and the quantity of materials and the elements needed for the course of a production process.

Setting material needs gross and net constitutes the sure synchronization in setting lengths of time the demand for the given assortment, with simultaneous agreeing on dates this demand and dates of placing an order. Knowing the cycle of order processing from outside suppliers or cycle of in-house order processings (length of a production cycle) it is possible very much precisely to determine the date of ordering materials. This method allows for very precise establishing the moment of the appearance of the demand for the given element, but also he lets describe the magnitude of this demand. A minimization of supplies is an element this method [5].

3. Models of controlling material supplies

Hoarding supplies material at the smelting unit requires considering the following problems:

- assortment of materials supplies to productions, for which they should be held currently and perspective in the foundry,

- add sizes of part,
- add the cycle in foundry,
- to skip determining situations, in which it is possible from carrying inventory.

One should also consider the fact, that every supply, which holding generally speaking is justified, he can consist of three parts: rotating supply, safety stock and the exaggerated supply [7].

Rotating supply – his determined size is a size of Q supplies and the current wear and tear:

$$Z_R = 0{,}5 \cdot Q \tag{3}$$

Safety stock – the following factors determine his size [5]:

- length of cycle delivery for reconstructing inventory,
- the probability of exceeding delivery time and sizes of delivery,
- number of magazines.

An exaggerated supply is a supply adding costs (mainly variable costs carrying inventory), rather than carrying none added to the whole process [7].

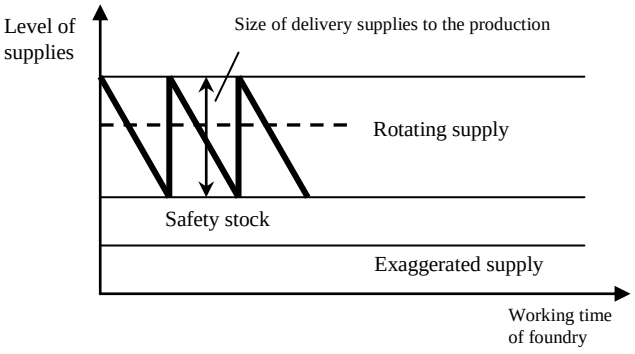

Fig. 1. Basic notions of steering supplies [6]

Shaping the level used supply in the production of casts will depend on the applied method of steering the supply.

It is possible to single out two basic groups of methods of controlling the supplies in the area of the supply:

- methods based on statistical forecasting,
- method of planning material needs MRP.

In the process of steering supplies plans of material needs must be replaced with plans of supplies. It requires determining two basic parameters of steering:

- add sizes (sizes of the Q order) – quantitative aspect,
- of cycle of supplies (of lead time essential to determine the date of placing an order – T) temporal aspect.

The model based on the level of the supply setting the moment of ordering

This model is characterized by a fixed amount of ordered materials in the moment, when the level of the supply lowers to the paragraph of the reorder. Paragraph of the reorder (of Oils) it is level of the supply sufficing for meeting the need to the time of the next delivery. The cycle of the delivery is a changeable size. This model requires establishing two sizes:

- sizes of the delivery,
- of level of the supply announcing the need of placing an order.

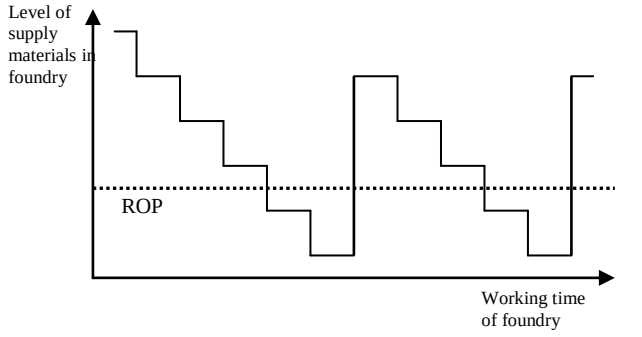

Fig. 2. Model steering leaned for ROP point [2]

According to principles model placing an order is taking place in the moment, when actual supply in magazine (increased by the possible delivery in transit) will lower to the level of oils. next the ordered size is fixed and he results from the optiumum size of supplies.

Model the permanent cycle of ordering

In this method supplies are controlled in set moments of the time, and order is being placed in the determined cycle about the permanent period. The size of order is changeable and appointed with difference between the level of supply, called the maximum supply from t_{max} and the actual state of the foundry. The model requires calculating two sizes:

- level of maximum supply Z_{tmax},
- cycle of inspection T_c, that is lengths of the time between next inspections.

The level of maximum supply is calculated out from the model:

$$Z_{t\max} = y_t(T_c + T_{śr}) + k \cdot \delta\sqrt{(T_c + T_{śr})} \tag{4}$$

y_t – forecast of size needs in the individual period,
T_c – cycle of inspection,
$T_{śr}$ – average observed lead time,
k – size resulting from the accepted risk factor,
δ - standard deviation.

Cycle of inspection T_c they appoint from the model:

$$T_c = \frac{t \cdot Q_{opt}}{R} \tag{5}$$

t – time expressed in appropriate units (e.g. 52 weeks),
Q_{opt} – optimum size of delivery,

R – annual volume of the demand.

Compared with the essential conception based on Q_{opt} this model doesn't require precise observation of level osupplies, what lower costs of monitoring supplies are an effect [3].

4. Conclusions

Smooth functioning with system of supplying the foundry with the basic and supplementing materials necessary for the accomplishment of production processes, requires taking strategic decisions, allowing to adapt abilities of plant to a given production cycle in the developing market economy. Making plans for the material demand in casting industry is based on three basic kinds demand: primitive, secondary and supplementing. For planning material needs of the enterprise a conventional method or a MRP method are being used. Both methods require dense connecting the size of material needs with production programs of foundry. MRP method compared with conventional lets for very precise establishing the moment appearance of demand to given material and magnitudes demand what lets the determined part of casts the minimization supplies necessary for the accomplishment.

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