AN APPROACH TO DETERMINE THE NECESSARY EQUIPMENT IN A FOUNDRY WORKSHOP

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Abstract: The processes to obtain the casts imply many complex operations starting from the sand storehouse to the fettling shop. The mechanization and the automation of the technological flux are realized by using advanced equipment. A very important problem is to establish the type and the number of technological installations. In this paper are presented some ways to calculate the number of technological installation in the melting and alloying shop.

Keywords: melting and alloying shop, pig breaker, guillotine, cupola forehearth receiver, electric induction furnace.

1. INTRODUCTION

The furnaces in which is elaborated the alloys for cooling in moulds in order to obtain the casts are characterized by a large gamut of capacities from 20 kg till 100 t at a charge. These furnaces may be heated by solid, liquid or gaseous fuels, or by electric power. The foundry furnaces treat metals which are already elaborated coming from the treatment of ores (Fig.1).

The desire for obtaining casts with optimal cooling and mechanical characteristics implies rigorous melting and alloying. So, these installations have to:
-reduce at maximum the risks of oxygenation and gas including;
-permit the metallurgical treatment of alloys by a precise regulation of the temperature and a optimal homogenization of this temperature in the furnace;
-consume minimum of energy;
-present the highest productivity.

Electrical furnaces may be divided into crucible type and arc type. Electrical crucible furnaces operate on the induction principle, on the induction principle, and this system of melting is widely used for the production of high-quality metals and alloys. The high frequency furnace is suitable for the melting of metals of low electrical conductivity. The crucible is placed in a water-cooled coil. When the coil is energized, the secondary eddy currents are induced within the metal charge. The heating effect of the induced currents is sufficient to raise the temperature of the charge to the melting range. The circular path of the eddy currents cause the swirling of the metal and ensure a high mixture.

All the alloys undergo a diminution of temperature during their transport from the fusion furnace till the moulds to cool. The reduction of the temperature is made at different stages of transport of the liquid alloy:
-from the exit of the melting furnace;
-at the recipient which receive the alloy;

-during the transfer of the recipient to the working area;
-during the cooling of the alloy in the mould.

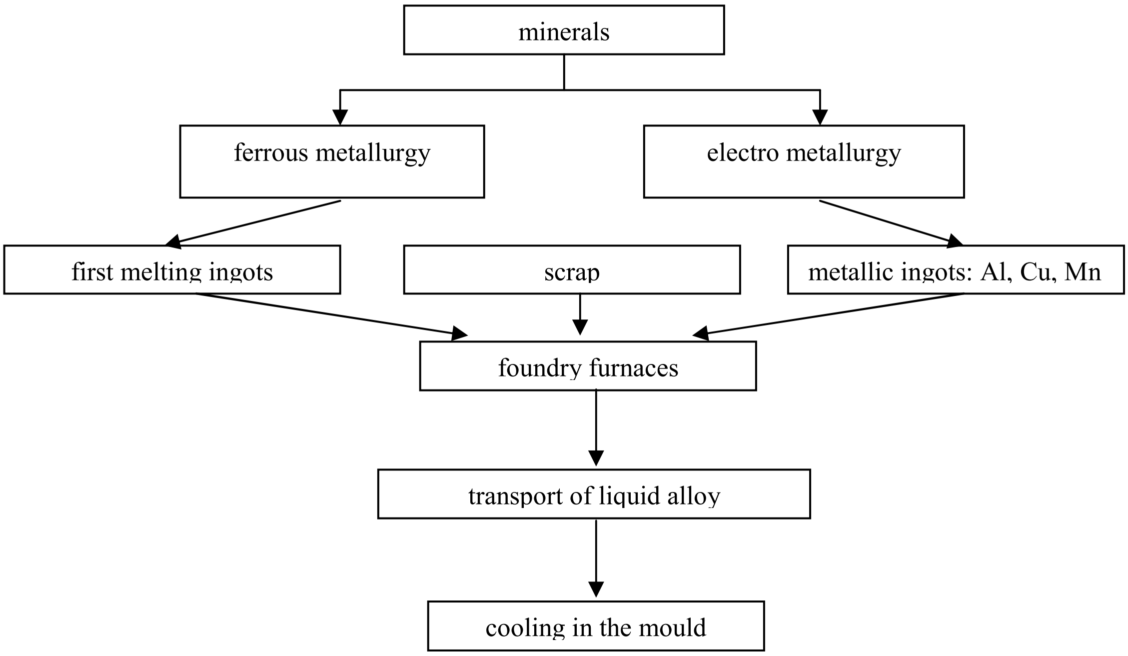

Fig. 1.
The position of the furnaces in the elaboration of metallic liquids

2. THE CALCULATION OF NECESSARY EQUIPMENT

2.1. The calculation of necessary electrical crucible furnaces

The minimal capacity of the crucible (Gmf) of the electrical crucible furnaces for cast iron may be adopted conforming with the table 1.

Table 1.

Type	Capacity of the crucible (t)	Installed power (kW)	Specific energy consumption (kWh/t)	Productivity (t/h)	Consumption of cooling water (m^3/h)
B1	3	880	350	1,8	3-4

The number of furnaces (n_{cf}) is determined by the relation:

$$n_{cf} = \frac{Q}{a\,F_{a.e.}\,A}\,k_i \tag{1}$$

where: Q is the annual necessary production of metallic liquid;
$F_{a.e}$ – the effective annual fund of time;
A – the productivity of the electrical crucible furnace;
k_i – the coefficient of irregularity;
a – the coefficient of filling.

For example, if:
Q = 15000 t;

$F_{a.e} = 3407$ h;
A = 1,8 t/h;
$k_i = 1,1$;
a = 0,63,

it is resulting:
$n_c = 4,27$ (2)
The adopted number of furnaces (n_{af}) is determined by the relation:

$$n_{af} = \frac{n_{cf}}{i_{uf}} \quad (3)$$

where: i_{uf} is the coefficient of usage.

In the example given above ($i_{uf} = 0,8$), the adopted number of furnaces is:

$n_{af} = 5,3 = 6$ (4)

2.2. The calculation of necessary guillotines

The minimal capacity of the guillotines (Gmg) may be adopted conforming with the table 2.

Table 2.

Type	Installed power (kW)	Productivity (t/h)
alligator	20	12-20

The number of guillotines (n_{cg}) is determined by the relation:

$$n_{cg} = \frac{Q\ q}{a\ F_{a.e.}\ A}\ k_i \quad (5)$$

where: Q is the annual necessary production of metallic liquid;
$F_{a.e}$ – the effective annual fund of time;
A – the productivity of the guillotine;
k_i – the coefficient of irregularity;
a – the coefficient of filling;
q – the weight of charge submitted to be prepared by guillotine .

For example, if:
Q = 15000 t;
$F_{a.e} = 3407$ h;
A = 1,8 t/h;
$k_i = 1,1$;
a = 0,63;
q = 0,3

it is resulting:

$n_g = 0,192$ (6)

The adopted number of guillotines (n_{ag}) is determined by the relation:

$$n_{ag} = \frac{n_{cg}}{i_u} \quad (7)$$

where: i_u is the coefficient of usage.
In the example given above (i_{ug}= 0,8), the adopted number of guillotines is:

n_{ag} = 0,24 =1 (8)

2.3. The calculation of necessary pig breakers

The minimal capacity of the pig breaker (Gmp) may be adopted conforming with the table 3.

Table 3.

Type	Installed power (kW)	Productivity (t/h)
S1	15	7-20

The number of pig breaker (n_{cp}) is determined by the relation:

$$n_{cg} = \frac{Q\,q}{a\,F_{a.e.}\,A}\,k_i \tag{9}$$

where: Q is the annual necessary production of metallic liquid;
$F_{a.e}$ – the effective annual fund of time;
A – the productivity of the pig breaker;
k_i – the coefficient of irregularity;
a – the coefficient of filling;
q – the weight of charge submitted to be prepared by pig breaker .

For example, if:
Q = 15000 t;
$F_{a.e}$ = 3407 h;
A = 1,8 t/h;
k_i = 1,1;
a = 0,63;
q = 0,4

it is resulting:
n_p = 0,27 (10)

The adopted number of pig breakers (n_{ag}) is determined by the relation:

$$n_{ag} = \frac{n_{cp}}{i_{up}} \tag{11}$$

where: i_u is the coefficient of usage.

In the example given above (i_{up} = 0,8), the adopted number of pig breakers is:
n_{ap} = 0,33 =1 (12)

3. CONCLUSIONS

The calculation of necessary equipment in the melting and alloying shop is affected by numerous coefficients which are determined by experience. This situation was emphasized by the some examples. One of the principle in calculation is to round off in plus.

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