Modern Systems for Processing of Brasses and Bronzes with Gas Filtration

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Abstract: The technological process of obtaining raw copper, brass and bronze is process in which the basic operation, smelting nonferrous alloys melting is done in rotary kiln. Other machines are used for cooling the gas flow technology and retention of zinc oxide powder and tin in the oven resulting from oxidation reactions of zinc and tin that are part of the raw material supply of the oven. By using filter bags to obtain a clean technology, environmental clean emissions.

Key-Words: brass and bronzes melting furnace, air pollution, bags filters.

1. Introduction

The present work describes the technology for obtaining the blister copper from brasses and bronzes as an alternative for obtaining the necessary of copper to thermal refining and obtaining copper anode. The recovery technology of copper from brasses and bronzes is one of the technologies for recycling materials.

The recovered copper as secondary raw materials and returned to the circuit without losing productive qualities decrease consumption of raw materials and energy consumption.

2.The description of technological process of processing brasses and bronzes

2.1. Description of the melting process

The process have place in a tilting furnace, Pierce-Smith type converter to 15 tons capacity per batch. The converter is equipped with a gas burner which provides smelting of brass and bronze waste. Over the oxidation and elimination of impurities is obtaining a raw copper which content of approx. 98% copper.

The process is based on oxidation reactions of copper, zinc and tin:

$$2\,Cu + 1/2\,O_2 = Cu_2O \quad (1)$$

$$2\,Zn + O_2 = 2\,ZnO \quad (2)$$

$$Sn + O_2 = SnO_2 \quad (3)$$

The technological gases which results are treated in a dedusting system consist of the expansion chamber, plate coolers and bags filters. Exhaust gases to funnel have a maximum concentration of 5 mg/Nm^3 volatile dust.

2.2. Functional description

Technological process of obtaining the raw copper from brasses and bronzes is a simple process in which the basic operation to nonferrous alloys melting is made in rotary furnace. In brass and bronze smelting process there are a several distinct phases:

Loading the melting furnace phase. This operation involves melting furnace tilting forward, until the furnace mouth is out of hood. The furnace loading is made by special device made for this purpose.

Melting phase. The melting of brasses and bronzes is using methane gas burner of 300 Nm^3/h. After their melting and slag formation, the slag is removed from the metal bath surface. Then proceed to the next stage of oxidation.

Oxidation phase. Held here the oxidation reactions of Zn, Sn and other impurities. This process is carried out by introducing the technological air through the wind-bleeding and injection pipes mounted in the furnace.

Casting phase. To the end of impurities oxidation phase, pass on to the next stage, the casting of copper. The blister coppers that result is empty in the melting pots, which will be transported to the

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bridge from the melting hall until the thermal refining furnace.

The cooling of gases starts in the suction hood, made of steel. The hood is cooled with water, where there is the first dilution of gases that leaving the furnace through an air flow aspiration from the hall. Gas cooled to approx. 550 °C passes through a plate coolers connected in series, where it retains a large amount of dust (dust retention efficiency is 30-50% in coolers). The temperature of gases to the exit is about 120-150 °C, temperature required for operation of bags filters (cloth). Temperature control of gases is automatic throughout the route. Thus partially cooled and dedusting, the gases go to the bags filters (filtration area of 1800 square meters, filtration efficiency of approx. 99%), which retains very fine dust which has not been deposit in other machines, so that the exhaust gases to the funnel will contain between 1-5 mg/m^3, situated below the permitted concentration of national standards (50 mg/m^3 according Order 462/93).

2.3. Description of technological equipment

The technological flow presents the main phases of the technological process of obtaining copper from brasses and bronzes scrap. The manufacturing process is conducted in the following equipments:

Melting furnace, which has a melting capacity of 15 tons/batch. The furnace is a cylindrical shape with a diameter of 2460 mm and 4930 mm length. Zinc and tin oxides (predominantly) are volatilizing from the melt as steam and leaves the furnace with flue gas is solidifying with gas cooling (as fine dust). The fine dust is retained in the equipment provided for gas purification.

All equipment described below is used to process dedusting (cleaning) of gas from the melting process.

The suction hood of technological gases, is a double-walled metal-downs, water cooled. The hood serves for the technological gases suction which leaving from the melting furnace during the process. To collect the gases that are not captured by the gas suction hood is mounted that a secondary hood which can exhaust the escaping gases from the hood during furnace operation and supply gas escaping during furnace.

The Expansion chamber is made of bricks (blocks) held by a confection of metal sections, linked by ties. The expansion chamber is designed to retain the dust trained to gases from the furnace. The deposited dust in the chamber is mechanically collected by door, mounted on side. The dusting degrees of the chamber are 30-50% of gas dust under the action takes place due weight and relaxation gas particles.

The plate coolers are designed for cooling of technological gases at about 550 °C at about 120 °C - the required temperature for entry gas in to the bags filters. The coolers are four numbers; each has a cooling surface of 235 sqm (940 sqm totally). In the coolers takes place and a dedusting of gases, dust is collected in bunkers equipped with screw conveyors and metering cell. Bunker emptying are made in bags or containers. In Figure 1 are shown the overview of plate coolers.

Bags filters are used in advanced gas purification. For a good cleaning is provided a battery bags filters consists of four filters, each with 10 compartments, each with 35 bags (each filter filtration area is 450 m^2, totally 1800 m^2). Caught with bags and necklaces are suspended at both the top and the bottom. Bag cleaning is done by compressed air injection (pulse) in reverse to gases circulation. Distribution and air insufflations pressure is automated. Blast air moving in purified circulating gases. The dust gather mounted bunkers to the bottom of them. Each bunker is equipped with screw conveyors and metering cells. The empty of bunkers is made from the canvas bags.

Final ventilator serves oven gases aspiration by suction hood and their exhaust from the funnel. The ventilator is dimensioned to take all the gases can be added to the technological gases route, cooling them to temperatures of 1200 °C to 120 °C. The ventilator takes the blast air too from the shake of bags and to overcome all resistance in its route.

In Figure 2 are shown the brasses and bronzes processing plant.

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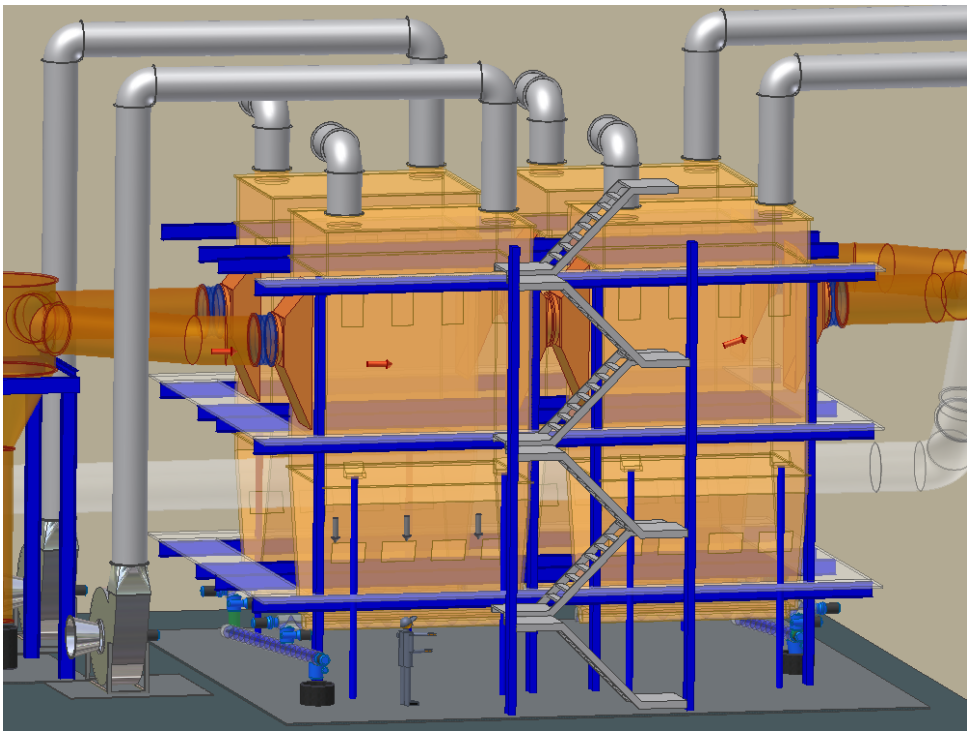

Fig.1. Overview of plate coolers

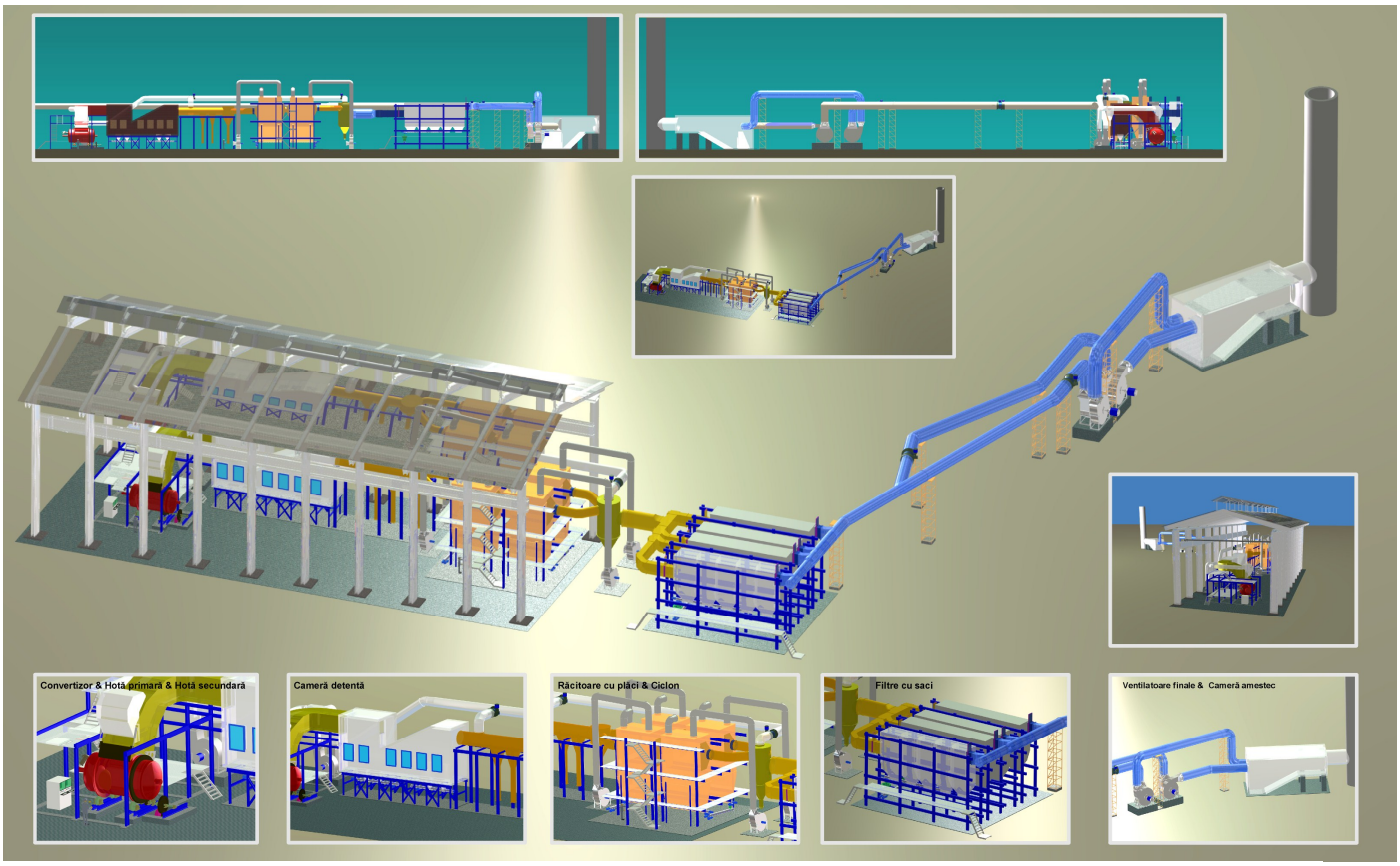

Fig.2. Brasses and bronzes processing plant

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3. Considerations regarding the emissions

Final dedusting system of technological gases which results in process (bags filters battery) are placed after dedusting rooms and after the cooling system, to allow the major dedusting and heat recovery from flue gases.

The basic principle of using membrane filters bags is woven, permeable to gas, but will retain dust. The bags are usually mounted on frame and each bag has a way of sealing the chamber structure bags. Initially, dust is deposited both on the surface of the fabric fibers and in depth, but as the surface layer is formed, the filter medium itself becomes dominant. As the dust thickness increases, increases resistance to gas flow. Regular cleaning of filter medium is indicated by lower gas pressure to pass through the filter. Cleaning methods are the most common air insufflations in the reverse direction, mechanical shaking, vibrating or pulsating air as is the case with the filters used in this technology.

4. Environmental legislation regarding the air pollution

As for the local environmental laws the following are in force and have to be respected:

- Minister Decision 462/1993 for approval of technical conditions on the atmosphere and protect the Methodological Norms on the emission of air pollutants produced by stationary sources[1].
- Emergency Ordinance 195/2005 regarding the environmental protection, with the further modification.
- Minister Decision M.A.P.M. nr.1144/2002, establishing the Registry polluters discharged from activities covered by Article 3) paragraph 1) g) h) of the Emergency Ordinance no. 34/2002 on the prevention, reduction and control of pollution and the reporting thereof.
- Emergency Ordinance 34/2002, on the prevention, reduction and control of pollution[3].
- Minister Decision no.592/2002, the norm for determining the limit values, threshold values and criteria and methods for assessment of sulfur dioxide, nitrogen dioxide and nitrogen oxides, suspended particulate, lead, benzene, carbon monoxide and ozone in ambient air.

5. Conclusion

Characteristics for the purification of waste gases and dust retention, collection and dispersion of gases in the atmosphere, used in this technology includes: ***suction hood of technological gases, the expansion chambers, plate coolers, bags filters and final ventilator.***

All these equipments give the gases filtration with a efficiency of approx. 99.9%, which meets the standards of B.A.T. (Best Available Techniques).

References:

[1] Order 462/1993 for approval of technical conditions on the atmosphere and protect the Methodological Norms on the emission of air pollutants produced by stationary sources.

[2] Emergency Ordinante no 195/2005 regarding the environmental protection.

[3] Emergency Ordinance 34/2002, to prevent, reduce and control pollution.

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