Production of Primary Ingots with Track & Belt System

More and more, the Cast House of any Aluminium Smelter is the place where the added value is given to the molten metal produced in the pot lines when transformed into solid forms. These solid forms are classified in two main categories: the Semis (Rod, Billets and Slabs) and the Re-melt products (T-bars, Sows and Ingots).

Solid Forms from Molten Aluminium

Semis **Re-Melt**

Rods

Ingots

Slabs

Billets

Sows

T-bars

These products are identified as “commodities” and they have a reference price worldwide and standardized shapes and characteristics. In general, weight and shape of each product have been optimized with the aim of minimizing the production costs and the transportation costs while maximizing the safety aspects.

Ingot geometry and weight have varied in the past, but eventually the 50 lb (22.7 kg) ingot, with a design that varies just in small details from producer to producer, has become the worldwide preference and the most common ingot on the market, though not the only one. These ingots are produced by the so-called “open top ingot caster” or “chain conveyor ingot caster”. The ingots are packed in bundles having a nominal weight of 1 ton before being delivered to the end users. As we know, the Industry prefers the ingots as raw material, versus T-bars and Sows, when the size of the furnace or the particular re-melting process requires manual handling of the ingots. A question quickly comes to mind: why are the “light” ingots so heavy? The answer is quite simple. The only way for the open top system to achieve a production rate of 25 tph is to produce heavy ingots. With those systems, the heavier the ingot, the higher the output.

The above concept stems from the general equation, shown below, that governs the production rate of the open top systems.

$$P = \frac{W \times L}{I_s \times t_s} \times k$$

Where:

- P is the hourly output of the line
- W is the ingot mass
- L is the line length
- I_s is the spacing between moulds
- t_s is the solidification time
- k is a coefficient to homogenize the various units

From this equation it appears that once the length of the chain conveyor has been determined (i.e. the equipment cost), the higher the weight the higher the output… and 50 lb is a nice round number. We do not see other technical reasons to select this weight.

Despite some recent over-refinements of casting star wheels and the use of robotized skimming devices, the dross-free ingots are still not a reality with these traditional systems. The complex shape of the traditional ingot comes from the need to obtain a larger surface area for thermal exchange in order to reduce the length of the mould chain, but still requires about 1.3 - 1.4 meters in length per ton/h produced. Moreover, such geometry is necessary to facilitate the de-moulding and to “interlock” the layers within each bundle to improve their stability. The 50 lb (22.7 kg) open top Aluminium ingots are used worldwide and the technique to produce such commodities is well proven and well established. Although it does not represent the latest state-of-the-art technology, it has become an industry-accepted tradition. However, even the most well-established traditions must be abandoned when new process techniques are developed which offer an improvement in quality with lower or equal costs (equipment and transformation).

Properzi Ingot Bundles / By courtesy of Vedani Carlo Metalli

Taking the above into consideration, Properzi focused their attention towards a system able to produce lighter ingots at a higher rate using the experience accumulated with secondary ingot producers like Raffmetal, Vedani and Sacal and with primary smelters like Dubal and Alba where, with the Properzi Wheel Caster, hourly production rates up to 2,000 Properzi ingots of 10 kg each are produced.

The Track & Belt Properzi casting machine, sized for producing up to 2,060 ingots per hour, can reach an output of 28 tph when the ingots have a weight of 30Lbs lb (13.6 kg) each. We believe these ingots will give, besides all the advantages coming from the continuous casting method into a closed mould, better working conditions to the operators of the ingot users. An additional advantage is the expected yearly output when using Properzi systems. Considering 330 working days per year the expected output, under good working conditions, will not be less then 180,000 t!

The photo shows one Properzi Track & Belt Ingot Caster (by courtesy of Vedani Carlo Metalli) that has been designed to produce more than 2,000 ingots per operating hour. The ingots are characterized by:

- >> **Compact shape and high stability** so that one can stack three / four bundles one upon the other
- >> **Repeatable dimensions**
- >> **No ingot rejection due to weight variation**
- >> **No cavities** and therefore no risks of explosion inside the furnaces due to water retention
- >> **No Dross skimming of the ingots is required**

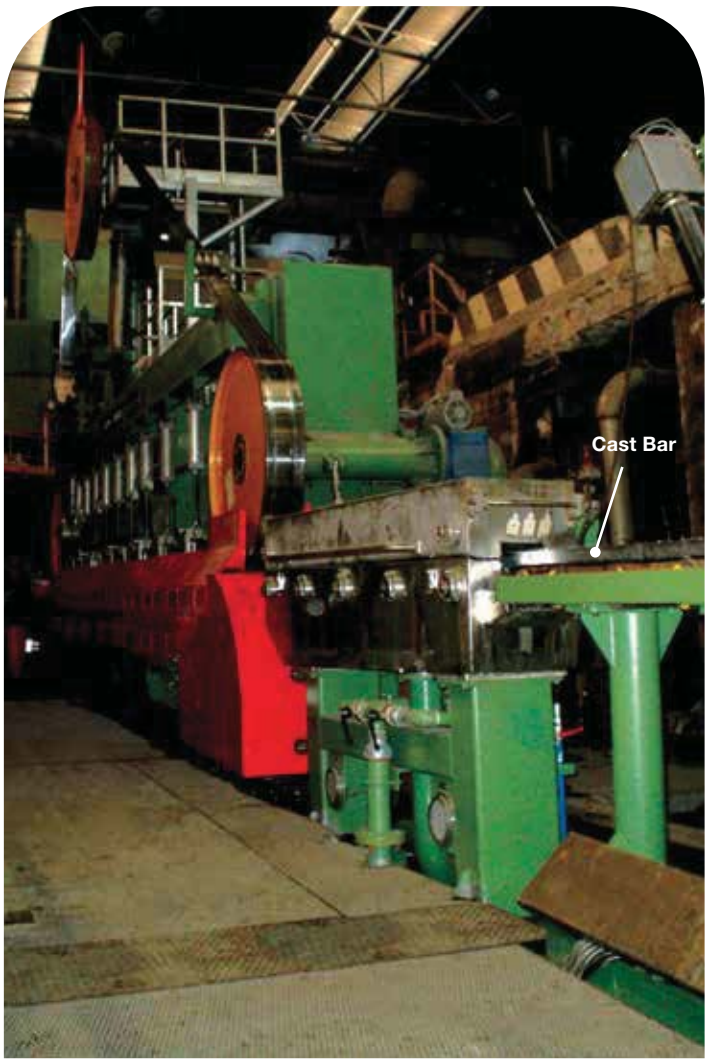
Before concluding this short article, we would like to highlight the savings gained by producing ingots that do not require skimming.

The skimming action necessary when producing traditional ingots causes a loss of material of approximately 0.3% in weight.

Each ingot has a weight of 22.7 kg and therefore the loss is 0.06 - 0.07 kg per ingot. At first glance it seems like nothing, but if we calculate this weight loss over a production of 100,000 t it becomes apparent this “nothing” is 300 t per annum. Considering the LME at $ 2,000 USD / t this “nothing” becomes $ 600,000 USD / year!

Surely, it is the right time to look for a Properzi Ingot Caster!

by Carmelo Maria Brocato



View of the Track & Belt Caster in Operation