THE EVOLUTION OF ALUMINIUM INGOTS
FROM CONVENTIONAL INGOTS TO THE PROPERZI INGOTS

Some 40 years ago, the vast majority of industrial processes required intense manual labor making the operational conditions of the workers unsafe and often debilitating. Also, the very simple process of transforming liquid metal into ingots did not escape from this general situation: the ingots produced where manually piled up one by one. The first photo on the right is a vivid example of such a situation. We should also emphasize that the low production output of the conventional ingot casting chain did not spark the creativity of the designers to invent any sort of automatic stacking system. In this general context the weight of 50 lb (22.7 kg) ingots became more and more commonplace among the various smelters.

Manual stacking operation during 1960s (by courtesy of J. A. Taylor, I. F. Bainbridge and J. F. Grandfield)

At the onset of industrial production of aluminium ingots, automatic stacking systems were not even in the fantasy of the most farsighted designers. Therefore, the size and weight of the ingots were compatible with the manual handling operations, i.e. de-moulding and stacking. The above considerations have pushed the designers of these systems (mould and chain) to find the best compromise between the weight of each ingot and the maximization of the production output.
It is quite interesting to analyze the equation that determines the output of any conventional ingot casting machine in order to understand the background of such weight.

The hourly output of a mould chain depends on the weight of the ingots and the length of the mould chain according to the equation:

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

Where :
>> **P** is the hourly output of the line
>> **W** is the ingot mass
>> **L** is the line length
>> $\mathbf{I_s}$ is the spacing between moulds
>> $\mathbf{t_s}$ is the solidification time
>> **K** is a coefficient to homogenize the various units

Continuus-Properzi Chairman Giulio Properzi near Track & Belt casting machine

From this equation it appears that, once the length of the chain conveyor has been determined (i.e. the CAPEX), somehow, the greater the ingot weight the higher the output ……. and 50 lb is a nice round number. We see no other technical reasons.
The ingots so produced were characterized by:
>> Weights and dimensions not repeatable
>> Cavities and cracks in the top surface
>> Unstable bundles

The required manual operation for de-moulding, skimming and stacking of the ingots completed this unpleasant picture. In the most advanced countries a dramatic change was required with the introduction of new rules governing worker health and safety.

What is the difference between “improvement” and “invention”? Well, it is written somewhere that human beings tend to optimize and improve what they know and see every day thereby making a contribution to the development of technology. On the contrary, the Inventor has the capability of imagining completely new solutions and sketching the input received by his creativity and imagination on the blackboard. The new ingot concept, well-known worldwide as “Properzi Ingots”, has been generated not by improvement but by creativity and invention.
The globally renowned Properzi ingots are characterized by:
>> Constant and repeatable geometry
>> Flat and smooth surfaces
>> Absence of dross
>> Absence of surface cavity
>> Compact bundles for better transportation

The Track & Belt ingot casting machine (see photo) produces 2,000 plus ingots per operating hour, in the standard format of 8 kg (17.6 lb), 10 kg (22 lb) and 13.6 kg (30 lb), serving both the needs of primary smelters or secondary ingot producers. In the sector of primary ingot producers, Alba and Dubal have been producing Properzi ingots since 2005 with growing success and competitiveness, achieving the highest standard in terms of safety and repeatability of quality.

by Alberto Ghisetti & Michelangelo Nidasio

Properzi ingots during the unloading operation after strapping